GEOMETRIYA

10

O‘QITUVCHILAR UCHUN
METODIK QO‘LLANMA

O‘zbekiston Respublikasi Xalq ta’limi
vazirligi nashrga tavsiya etgan

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SO‘ZBOSHI

Muhtaram ustozlar!

Respublikamizning yangi taraqqiyoti davrida malakali mutaxassislarga bo‘lgan ehtiyoj tobora dolzarb muammo bo‘lib bormoqda. Hozirda vujudga kelgan iqtisodiy sharoit yangicha tafakkurga ega bo‘lgan, dunyoga yangicha ko‘z bilan qaraydigan, yangicha fikrlaydigan yangi avlodning ishtirokini taqozo etmoqda. Bu ish qanchalik tez amalga oshirilsa, mamlakatimizning iqtisodiy salohiyati shunchalik tez yuksaladi. Bu o‘rinda yoshlarning matematik tayyorgarligiga qo‘yiladigan talablar ham juda muhim masala hisoblanadi.

Matematika fani bo‘yicha Milliy o‘quv dasturiga belgilangan yangi davlat ta’lim standartlari va o‘quv dasturi matematika ta’limini sifat va mazmun jihatidan yangi darajaga ko‘tarish vazifasini qo‘yadi. Bu esa o‘z navbatida yangi O‘zbekiston kelajagini yaratuvchi barkamol avlodni, yangi zamon, yangi jamiyat kishisini tarbiyalashdek o‘ta mashaqqatli va ayni zamonda sharafli ish shu kunning eng muhim vazifalaridan biri bo‘lib qoldi. Uni amalga oshirish sizdek fidoyi o‘qituvchilar zimmasiga yuklanadi.

Shu vazifalarni amalga oshirish maqsadida 10-sinf “Geometriya” darsligi va o‘qituvchilar uchun mo‘ljallangan uslubiy qo‘llanma yaratildi. Darslikda keltirilgan mavzular sodda, tushunarli tilda, hayotiy masalalar yordamida qisqacha yoritilgan va rasmlar bilan bezatilgan. Mashg‘ulotlar har bir mavzu bo‘yicha turli xil kichik savollar, testlar, amaliy mashqlar, topshiriqlardan tashkil topgan bo‘lib, ular bir-biri bilan uzviy bogliq va o‘quvchidan ijodiy yondashuvni talab qiladi. Darslik asosida qay yo‘sinda dars olib borish yo‘l-yo‘riqlari uslubiy qo‘llanmada keltirilgan.

Darslikni yaratishda rivojlangan mamlakatlarda to‘plangan ilg‘or tajriba namunalaridan ham foydalanilgan. Shu bilan birga, yurtimizga xos sharqona umrboqiy qadriyatlarimizga darslikda katta e’tibor berilgan. Darslik asosan o‘quvchiga qaratilgan bo‘lib, uning imkoniyatlarini, yoshini, individualligini, mustaqil fikrlovchi, o‘z qarash va tushunchalariga ega bo‘lgan erkin shaxs ekanligini hisobga olgan holda yozilgan. Bu darslik asosida o‘qituvchi darsda, mashg‘ulotlarda o‘quvchining faol ishtirokini ta’minlashi, o‘quvchiga qaratilgan o‘quv uslublarini (interfaol usuli) keng qo‘llashi, joriy qilishi mumkin. Mavzular hayot va turmush bilan bog‘liq holda konkret masalalar, amaliy topshiriqlar bilan to‘ldirilgan va o‘quvchilarning darsda va darsdan keyin ham o‘quv jarayonining faol ishtirokchisiga aylanishiga xizmat qiladi. O‘rni kelganda tarixiy ma’lumotlar ham berilib, o‘quvchilar bu fanning abstrakt, tushunarsiz, qiyin fan emasligini, balki insonlarning ehtiyojlari, sivilizatsiyaning taraqqiyoti sababli bu fanning paydo bo‘lgani va insoniyatga xizmat qilib kelayotgani haqida, qolaversa bu fanning rivojiga buyuk vatandoshlarimizning qo‘shgan bebaho, ulkan hissalari to‘g‘risida zarur tushuncha va ma’lumotlarga ega bo‘ladilar.

O‘quvchilarning yosh xususiyatlari hisobga olingan holda darslikda o‘quv materiali aksiomatik yondashuv bilan uyg‘unlashgan holda va shu bilan birga, o‘quvchiga buni qat’iy ta’kidlamasdan imkon qadar sodda,

tushunarli, yaqqollikka e'tibor qaratgan holda berilgan. Jumladan, mavzularning ixcham holda berilishiga, iloji boricha kamroq so'z ishlatishga, o'quvchi uchun zarur bo'lmagan yoki faqat o'qituvchiga taalluqli bo'lgan materiallarni darslikka kiritmaslikka harakat qilingan. Bunda albatta, chizmalarning, rasmlarning roli juda muhimdir. Chizmalardan nafaqat masala yoki teoremaning shartini ifodalovchi rasm, illyustratsiya sifatida, balki geometrik intuitsiyani, tasavvurni rivojlantiruvchi, shakllantiruvchi vosita sifatida ham foydalanish mumkin. Qadimgi Hindistonda matematikaga oid ilmiy asarlarda teoremaning isbotida ko'pincha chizma keltirilgan va yonida faqat "Qara!" degan yozuv bo'lgan. Teoremaning yoki masalaning butun mazmuni va mohiyati shu chizmada o'z aksini topgan.

Darslik bilan ishlashda, umuman, geometriyani o'rganishda masalalarni yechish juda muhim rol o'ynaydi. Darslikda ham, mazkur qo'llanmada ham eng asosiy e'tibor shunga qaratilgan. Yangi tushunchalar, shakllar, ularning xossalari, oldindan tanish bo'lgan tushunchalar, faktlarning yangicha talqini, kengaytirilishi, yuritilgan mulohazalarning mohiyati masalalar yechish mobaynida puxta o'zlashtirilishi mumkin.

O'qituvchilar uchun uslubiy qo'llanmada yangi davlat ta'lim standartlari talablaridan kelib chiqqan holda, darslik asosida o'qitish bo'yicha metodik ko'rsatmalar, har bir mavzu bo'yicha dars ishlanmalari, ba'zi masalalarning yechimlari va ko'rsatmalar, mavzularni mustahkamlash uchun qo'shimcha masalalar va ularning yechimlari berilgan. Bundan tashqari, darslik bo'yicha tuzilgan yillik mavzuviy rejalashtirish, oraliq nazoratlar uchun yozma ish variantlari, har yarim yillikka mo'ljallangan test topshiriqlari, qobiliyatli o'quvchilar bilan ishlash va sinfdan tashqari ishlar uchun materiallar berilgan.

Mazkur qo'llanma matematika fani bo'yicha dars olib borayotgan barcha maktab o'qituvchilari va uni o'qitish uslubiyati masalalari bilan shug'ullanayotgan mutaxassislarga mo'ljallangan bo'lib, unda keltirilgan tavsiyalar bu fanni o'qitishni takomillashtirishda yordam beradi degan umiddamiz.

Mualliflar

1. MATEMATIKA FANIDAN MILLIY O‘QUV DASTURI

Matematika fanini o‘qitishdan ko‘zlangan maqsadlar quyidagilardan iborat:

– o‘quvchilar tomonidan matematik tushunchalar, xossalar, geometrik shakllar, usullar va algoritmlar haqidagi bilim, ko‘nikmalar egallanishini ta’minlash;

– inson kamoloti va jamiyat taraqqiyotida matematikaning ahamiyatini anglatish, ijtimoiy-iqtisodiy munosabatlar, kundalik hayotda matematik bilim va ko‘nikmalarni muvaffaqiyatli qo‘llashga o‘rgatish;

– o‘quvchilarning individual xususiyatlarini rivojlantirgan holda mustaqil ta’lim olish, kreativ, tanqidiy fikrlash va mantiqiy tahlil, qiziquvchanlik, muammolarni hal qilish, yangiliklar yaratishga bo‘lgan ko‘nikmalarini namoyon qilish va rivojlantirish;

– fanlar integratsiyasini inobatga olgan holda o‘quvchilarda milliy va umuminsoniy qadriyatlarni shakllantirish.hamda ongli ravishda kasb tanlashga yo‘naltirish;

– kelgusida matematikadan bilim va ko‘nikmalar talab qilinadigan boshqa fanlarni o‘rganish uchun zarur bo‘lgan matematik mazmunni shakllantirish.va rivojlantirish.

Matematika fanidan o‘quvchilarda rivojlantiriladigan tayanch kompetensiyalar

Umumiy o‘rta ta’lim tizimida o‘quvchilarda fanga oid kompetensiyalar bilan birgalikda tayanch kompetensiyalar shakllantirilishi belgilab berilgan. Turli fanlarni o‘rganish orqali o‘quvchilarda tayanch kompetensiyalarni shakllantirish.- o‘zlashtirgan bilim va ko‘nikmalarini turli hayotiy vaziyatlarda qo‘llay olishga qaratilishi maqsadga muvofiq.

1. Kommunikativ kompetensiya

Kommunikativ kompetensiyalarni shakllantirishda davlat tili, xorijiy tillarni o‘zlashtirishda mustaqil, ijodiy fikrlash, yozma va og‘zaki ravon bayon etish, to‘g‘ri talaffuz qilish, izohlab berish hamda erkin muloqot qilishga o‘rgatish zarur. Xususan, matematika fanining o‘z ilmiy tili, o‘z tushunchalari, belgi va timsollari ham mavjud bo‘lib, bu tilda muloqot qilish kommunikativ kompetensiyalarni shakllantirish.omili sifatida qaralishi lozim bo‘ladi.

2. Axborot bilan ishlash kompetensiyasi

Fanlarni o‘qitishda axborot bilan ishlash kompetensiyasini samarali rivojlantirish imkoniyatlarini kengaytiruvchi zamonaviy axborot-telekommunikatsiya vositalaridan muntazam foydalanish zarur. Bunda o‘quvchilarni darslik, elektron resurslar va turli o‘quv manbalari bilan ishlash, matematika faniga oid axborotlarni turli manbalardan izlash, tahlil qilish va axborot xavfsizligiga rioya qilgan holda axborot vositalari bilan ishlash ko‘nikmalarini shakllantirishda turli amaliy dasturiy paket va ta’minotlardan, mobil qurilma (telefon, planshet va boshqa gadjetlar) lardan foydalanish tavsiya etiladi.

3. O‘z-o‘zini rivojlantirish kompetensiyasi

O‘z-o‘zini rivojlantirish kompetensiyasini shakllantirishda umuminsoniy qadriyatlar asosiga qurilgan fazilatlarga ega bo‘lish, Vatanni sevish, jamiyat va tabiat haqidagi bilimlarga ega bo‘lish, yangiliklarga intilish va o‘zlashtirgan nazariy bilimlari asosida mustaqil qaror qabul qilishga, jamiyatda ro‘y berayotgan progressiv va innovatsion o‘zgarishlardan xabardor va daxldor bo‘lish, doimo zamonaviy bilim va ko‘nikmalarni egallashga intilish, hamda ulardan kundalik hayotda foydalana olishga o‘rgatish zarur. Shu o‘rinda matematika fanini puxta o‘rganish orqali o‘quvchilar tartib-intizomga o‘rganadilar, har bir muammoga matematik masala sifatida qarab, uni yechishda qat’iyatli bo‘ladilar.

4. Ijtimoiy-emotsional va fuqarolik kompetensiyasi

Ijtimoiy-emotsional va fuqarolik kompetensiyasini shakllantirishda fuqarolik burchi, ijtimoiy va siyosiy rivojlanish, favqulodda vaziyatlar, ekologik muammolar haqida bilimlarga ega bo‘lish hamda badiiy va san’at asarlarini tushunish hamda ularni asrashda tashkilotchilik xislatlarini rivojlantirishdan iborat. Shuningdek, matematika ularni haqgo‘y, nohaqlikka befarq bo‘lmaslik va vatanga sadoqatli bo‘lish ruhida tarbiyalaydi. Matematika fanini puxta o‘rgatish orqali o‘quvchilarni jamiyatning faol fuqarosi sifatida rivojlantirib borishga zamin yaratiladi.

Matematika fani bo‘yicha “Al-jabr” ta’lim standartlari (bitiruvchilarning o‘zlashtirgan bilim va ko‘nikmalariga qo‘yilgan talablar)

Matematika fani bo‘yicha ta’lim standartlari matematika faniga umumta’lim maktablari (11-sinf) bitiruvchilarining fan bo‘yicha bilim, ko‘nikma va kompetensiyalariga qo‘yilgan umumlashgan talablardan iborat bo‘lib, ular matematik mazmun va amaliy faoliyat standartlariga bo‘linadi.

Matematik mazmun standartlari (bilim va ko‘nikmalar)

Qisqacha tavsifi: asosiy matematik tushunchalar va munosabatlar mohiyatini tushunish va ulardan tipik o‘quv topshiriqlarini bajarishda foydalanish.

Ushbu standartlar o‘quvchilar matematikani o‘rganish orqali nimani tushunishi va nimalarni bajarishga qodir bo‘lish kerakligini belgilab beradi. Matematikada tushunishning o‘ziga xos belgilaridan biri – bu o‘quvchining matematik o‘zlashtirish darajasidan kelib chiqqan holda muayyan matematik ifodaning to‘g‘ri yoki noto‘g‘ri ekani yoki muayyan matematik qoidaning qayerdan kelib chiqishini asoslab berish qobiliyatidir. Matematik tushuncha mohiyatini tushunish va tipik amallarni bajarish ko‘nikmasi bir xilda muhim bo‘lib, ular muayyan murakkablik darajasidagi standart topshiriqlar yordamida baholanadi.

Matematik mazmun standartlari umumlashgan talablar ko‘rinishida ifodalanib, ular matematikaning quyidagi mazmun sohalari va bo‘limlarini qamrab oladi (kelgusida ishlatish qulay bo‘lsin uchun mazmun sohalari va bo‘limlar nomi bosh harfi bilan kodlanadi):

- sonlar va amallar (SA);
- algebra va funksiyalar (AF):
- geometriya va o‘lchashlar (GO‘);
- statistika va ehtimollik (SE);
- matematik analiz (MA)

Mazmun sohasi	Mazmun sohasi bo‘limlari	Bo‘lim bo‘yicha standartning qisqacha tavsifi va kodi
Sonlar va amallar (SA)	Son tushunchasi	Sonlar va miqdorlar (kattaliklar) haqida tushunchaga ega bo‘lish, ularni tasvirlash usullarini va sanoq sistemalarini bilish (SA.ST);
	Amallar va hisoblashlar	Matematik amallar mohiyatini bilish, sonlar va kattaliklar o‘rtasida munosabatlarni o‘rnatish va tushunish hamda masalalarni yechishda qo‘llash. Sonlar va kattaliklar ustida hisoblashlarni qiyinchiliklarsiz bajarish, natijaga tegishli baho berish va ularni chamalash va yaxlitlash (SA.AH);

Algebra va funksiyalar (AF)	Algebraik ifodalar va almashtirishlar	Matematik belgi va timsollar yordamida hayotiy vaziyatlar va tabiatdagi hodisalarni, miqdoriy munosabatlarni matematik tilda ifodalash, tushunish va tahlil qilish, asosiy algebraik almashtirishlarni bilish va ulardan masalalar yechishda foydalanish (AF.AA);
	Munosabatlar va funksiyalar	Tabiat va jamiyatdagi qonuniyatlar, munosabatlar mohiyatini funksiya sifatida tushunish, bu jarayonlardagi o‘zgaruvchilar orasidagi munosabatlarni matematik nuqtayi nazardan talqin qilish (AF.MF);
	Tenglama va tengsizliklar	Chiziqli, kvadratik, ratsional, irratsional, ko‘rsatkichli (eksponensial), logarifmik, darajali va trigonometrik tenglamalar, tengsizliklar va ularning sistemalarini yechishda standart yechish metodlarini qo‘llay olish hamda yechimlarni ko‘rgazmali ifodalash (AF.TT).
Geometriya va o‘lchashlar (GO‘)	Geometrik shakllar	Yassi va fazoviy geometrik shakllarni chizma, model va real voqelikda taniy oladi, ularning asosiy xossalarini bilish (GO‘.GSh);
	Geometrik mushohada va masala yechish	Geometrik shakllarning xossalari haqida geometrik va mantiqiy fikrni rivojlantirish, geometrik isbot qilish metodlari va masalalarni yechish algoritmlaridan foydalanish, asosli matematik mulohazalar yuritish (GO‘.MM);
	Geometrik yasashlar	Koordinatalar sistemasi va boshqa tasvirlash tizimlarida geometrik munosabatlarni tasvirlash va ularning geometrik o‘rnini aniqlash, sodda geometrik yasashlarni amalga oshirish, simmetriya va geometrik shakl almashtirishlardan foydalanish (GO‘.GY);
	O‘lchashlar va o‘lchash usullari	Turli obyektlarning o‘lchanadigan elementlarini, o‘lchov birliklarini bilish, o‘lchov tizimlari va jarayonlarining mohiyatini tushunish, o‘lchash jarayonida mos o‘lchov usullari, formulalar, o‘quv qurollari, multimediali interaktiv ilovalar, kalkulyator va o‘lchov asboblaridan foydalanish (GO‘.O‘U).
Statistika va ehtimollik (SE)	To‘plamlar va mantiq elementlari	To‘plamlar ustida amallar mohiyatini bilish va bajara olish, sodda mantiqiy xulosalarni chiqara olish (SE.TM);
	Ma’lumotlarni statistik tahlil qilish	Kerakli ma’lumotlarni topish, aniqlash, yig‘ish va ularga ishlov berish hamda natijalarni talqin qilish va turli vositalar yordamida taqdim qilish; ma’lumotlarni tahlil qilish uchun mos statistik ishlov berish usullarini tanlash va qo‘llash, ma’lumotlar asosida tegishli xulosa qilish va bashoratlarni ishlab chiqish va ularni baholash (SE.ST);
	Kombinatorika asoslari	Kombinatorika masalalari mohiyatini tushunish va ularni yechish algoritmidan hayotiy masalalarni yechishda foydalanish (SE.KA);

	Ehtimollik nazariyasi asoslari	Tasodifiy, statistik hodisa va jarayonlar haqida tasavvurga ega bo‘lish, ularni tadqiq qilish, ehtimollik modellarini ishlab chiqish, ularni talqin qilish, baholash va ulardan foydalanish (SE.EN).
Matematik analiz (MA)	Funksiya va uning tatbiqlari	Funksiyaga oid asosiy tushunchalarini, uning umumiy xossalari va turlarini bilish, aniqlay olish, shuningdek, asosiy elementar funksiyalarni taniy oladi, ularning asosiy xossalarini bilish, ularni tenglama va tengsizliklarni hamda amaliy masalalarni yechishda qo‘llay olish (MA.FT);
	Hosila va uning tatbiqlari	Funksiyaning uzluksizligi va hosilasi tushunchalarining mohiyatini bilish, hosilaning geometrik va fizik ma’nolarini tushunish hamda funksiyalarni hosila yordamida tekshirish algoritmini bilish, ularni funksiyalarning xossalarini aniqlashda, shuningdek, amaliy, ekstremumga doir masalalarni yechishda qo‘llay olish (MA.HT);
	Boshlang‘ich funksiya, aniq integral va uning tatbiqlari	Boshlang‘ich funksiya va aniq integral tushunchalarining mohiyatini bilish va ulardan turli amaliy (yuz va hajmlarni hisoblash va bajarilgan ishni topish) masalalarni yechishda foydalana olish (MA.IT).

Amaliy faoliyat standartlari (kompetensiyalar)

Qisqacha tavsifi: o‘zlashtirilgan bilim va ko‘nikmalarini amaliy masalalarni yechishda va notanish vaziyatlarda qo‘llay olish (kompetensiyalar).

Mazkur standartlar ham umumlashgan mazmunda bo‘lib, ular o‘quvchilarning quyidagi amaliy faoliyati sohalarini qamrab oladi (kelgusida ishlatish qulay bo‘lsin uchun bu sohalar mos harflar bilan kodlanadi):

– mulohaza yuritish (MY);
– matematik modellashtirish (MM);
– muammoni hal qilish (MH);
– muloqot qilish (MQ).

Amaliy faoliyat turi	Amaliy faoliyatning qisqacha tavsifi	Amaliy faoliyat standartining qisqacha tavsifi va kodi
Mulohaza yuritish (MY)	Matematikaga oid fikrni asoslash, isbotlash yoki o‘zgalar fikriga munosabat bildirish uchun mantiqan asosli va tushunarli dalillar keltirish	Aqliy faoliyatga asoslangan mantiqiy fukrlash, taxmin qilish, xulosa chiqarish, dalillar keltirish, asoslash, xulosalash, asoslov va sabablar ustida fikrlash (MY.AF);

		Qo‘llanadigan ta’riflar, qoidalar, tushunchalar, algoritm va usullar, matematik yechimlar va xatolar ustida fikr yuritish (MY.AU);
		Matematik tushunchalar orasidagi aloqalarni tanish va ulardan foydalanish (MY.AT);
		Yaxlit matematik tushunchani hosil qilish uchun matematik tushunchalarni birlashtirish yoki birini ikkinchisining ustiga qurish (MY.TB).
Matematik modellashti-rish (MM):	O‘quv va hayotiy muammolarni matematika tilida ifodalash, ularning matematik modelini qurish	Muammoli vaziyatlar mohiyatini o‘qib tushunish, tahlil qilish va unda keltirilgan muammoni aniqlash (MM.VT);
		Tabiat, jamiyatdagi hodisa va jarayonlarni tushuntirish va modellashtirish uchun turli matematik talqin usullaridan foydalanish (MM.MT);
		Muammoni matematik masala ko‘rinishda ifodalash, matematik modelini tuzish (MM.MT).
Muammoni hal qilish (MH):	Matemati-kani qo‘llab muammoni hal qilish	Hayotiy muammo va amaliy matematik masalalarni yechish uchun o‘rganilgan matematik tushunchalar, faktlar, g‘oyalar, qonuniyatlar, algoritmlar va metod-laridan foydalanish (MH.MF);
		Muammo (masala)ni yechishda mantiqiy, kreativ fikrlash, matematik mushohada yuritish va ilmiy izlanish usullari: kuzatish, o‘lchash, tajriba o‘tkazish, analiz va sintez, induksiya va deduksiya, taqqoslash va analogiyalardan foydalanish (MH.MY);
		Muammo (masala)ni yechishning muqobil usullari va algoritmlarini tahlil qilish, tanlash va asoslash (MH.MU);
		Muammo (masala)ni) yechish jarayonida yangi matematik bilimlarni hosil qilish va ularni o‘zlashtirish (MH.BO‘);
		Matematik taxminlarni ifodalash va tadqiq qilish, matematik asoslash, taqqoslash va baholash (MH.TT).
		Matematik yechimni real muammo mazmuniga ko‘chirish va matematik masalada tasvirlangan real muammoga nisbatan uni talqin qilish va topilgan yechimning muammo haqiqiy yechimiga mosligini, yaqinligini baholash (MH.TB);

		Muammoni hal qilish algoritmlarini hayotiy vaziyatlar asosiga qurilgan kichik tadqiqot, loyiha ishini bajarish jarayonida namoyish qilish va taqdimot qilishda AKT imkoniyatlaridan foydalanish (MH.TQ).
Muloqot qilish (MQ)	Matematik tushuncha, belgi va timsollar asosida matematika tilida o‘zaro muloqot qilish	Matematik fikrni og‘zaki va yozma yetkazish, o‘zgalar bilan o‘zaro muloqot qilish uchun matematika tilidan, belgi va timsollardan o‘rnida foydalanish (MQ.BT);
		Boshqalarning matematikaga oid fikrlarini tushunish, tahlil qilish, baholash va ularga munosabat bildirish (MQ.TB).

Matematika fanidan amaliy faoliyat standartlari har bir sinf kesimida mazmun standartlari bilan uzviy bog‘liq bo‘lib, tegishli mazmun standartlarida o‘z aksini topgan. Amaliy faoliyat standartlari mazmun standartlarining mazmuniga mos bo‘lgan, tegishli yosh fiziologik imkoniyatlari, aqliy va amaliy faoliyat sohalaridan kelib chiqib singdirilgan.

2. 10-SINF UCHUN GEOMETRIYA FANIDAN STANDARTLARNING ANIQLASHTIRILGAN ELEMENTLARI

Mazmun sohasi	Mazmun sohasi bo‘limi	Standartning qisqacha tavsifi va kodi	Standartning aniqlashtirilgan elementlari va kodi
Geometriya va o‘lchashlar (GO‘)	Geometrik shakllar	Yassi va fazoviy geometrik shakllarni chizma, model va real voqelikda taniy oladi, ularning asosiy xossalarini bilish (GO‘.GSh)	M10.GO‘.GSH.01. Stereometriya aksiomalarini biladi va isbotlashlarda ulardan foydalana oladi; M10.GO‘.GSH.02. Fazoda ayqash, parallel va kesishuvchi to‘g‘ri chiziqlar ta’rifini biladi va chizmada tasvirlay oladi; M10.GO‘.GSH.03. To‘g‘ri chiziqning tekislikka parallelligi ta’rifini biladi; M10.GO‘.GSH.04. Kesishuvchi va parallel tekisliklar haqida tushunchaga ega bo‘ladi; M10.GO‘.GSH.05. Tekislikka parallel to‘g‘ri chiziq ta’rifini biladi; M10.GO‘.GSH.06. Parallel va kesishuvchi tekisliklar ta’rifini biladi; M10.GO‘.GSH.07. Ko‘pyoqlar: prizma, parallelepiped, kub, piramida haqida boshlang‘ich tushunchalarga ega bo‘ladi;

			M10.GO‘.GSH.08. Ko‘pyoqlar: prizma, parallelepiped, kub, piramida elementlarini chizmada ko‘rsata oladi; M10.GO‘.GSH.09. Ikki tekislikning parallelligi alomatini biladi va undan foydalana oladi; M10.GO‘.GSH.10. Tekislikka perpendikulyar to‘g‘ri chiziqlarni tasavvur qila oladi; M10.GO‘.GSH.11. Fazoda tekislikka tushirilgan perpendikulyar va og‘ma haqida tushunchaga ega bo‘ladi; M10.GO‘.GSH.12. Uch perpendikulyarlar haqidagi teorema haqida ma’lumotga ega bo‘ladi; M10.GO‘.GSH.13. Ortogonal proyeksiya haqida tushunchaga ega bo‘ladi.
Geometriya va o‘lchashlar (GO‘)	Geometrik mushohada va masala yechish	Geometrik shakllarning xossalari haqida geometrik va mantiqiy fikrni rivojlantirish, geometrik isbot qilish metodlari va masalalarni yechish algoritmlaridan foydalanish, asosli matematik mulohazalar yuritish (GO‘.MM)	M10.GO‘.MM.01. Stereometriya aksiomalaridan kelib chiquvchi natijalarni biladi va ularni qo‘llay oladi; M10.GO‘.MM.02. Prizma, parallelepiped, kub, piramida sirtini topishga doir masalalarni yecha oladi; M10.GO‘.MM.03. Tekislikka parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi; M10.GO‘.MM.04. Parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi; M10.GO‘.MM.05. Parallelepipedning xossalarini biladi va ularni masalalar yechishda qo‘llay oladi; M10.GO‘.MM.06. To‘g‘ri chiziqlarning ayqashlik alomatini biladi va uni masalalar yechishda qo‘llay oladi; M10.GO‘.MM.07. Parallel tekisliklarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi; M10.GO‘.MM.08. Parallel proyeksiyaning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi; M10.GO‘.MM.09. To‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini biladi va uni masalalar yechishda qo‘llay oladi; M10.GO‘.MM.10. Tekislikka perpendikulyar to‘g‘ri chiziqlarning xossalarini amaliy masalalar yechishda qo‘llay oladi; M10.GO‘.MM.11. Umumlashgan Pifagor teoremasini biladi va uni tatbiq qila oladi; M10.GO‘.MM.12. Fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni amaliy masalalar yechishda qo‘llay oladi;

			M10.GO‘.MM.13. Uch perpendikulyarlar haqidagi teorema va unga teskari teoremani masalalar yechishda qo‘llay oladi; M10.GO‘.MM.14. Fazoda tekisliklarning perpendikulyarligi haqidagi teoremani qo‘llay oladi; M10.GO‘.MM.15. Ikki yoqli burchakning chiziqli burchagini chizmada tasvirlay oladi va masalalar yechishda hisoblay oladi; M10.GO‘.MM.16. Tekisliklar orasidagi burchakni chizmada tasvirlay oladi va hisoblay oladi; M10.GO‘.MM.17. Fazoda perpendikulyar tekisliklar haqidagi teoremani masalalar yechishda qo‘llay oladi; M10.GO‘.MM.18. Tekisliklarning perpendikulyarlik alomati va undan kelib chiqadigan natijalarni masalalar yechishda qo‘llay oladi; M10.GO‘.MM.19. Ko‘pburchakning ortogonal proyeksiyasining yuzini topa oladi.
Geometriya va o‘lchashlar (GO‘)	Geometrik yasashlar va munosabat-larni tasvirlash	Koordinatalar sistemasi va boshqa tasvirlash tizimlarida geometrik munosabatlarni tasvirlash va ularning geometrik o‘rnini aniqlash, sodda geometrik yasashlarni amalga oshirish, simmetriya va geometrik shakl almashtirishlardan foydalanish (GO‘.YM)	M10.GO‘.YM.01. Sodda fazoviy jismlarning yoyilmasi yordamida ularning modellarini yasay oladi va chizmasini tekislikda tasvirlay oladi; M10.GO‘.YM.02. Ko‘pyoqlarni tekislikda tasvirlay oladi; M10.GO‘.YM.03. Parallel to‘g‘ri chiziqlarni tasavvur qila oladi; M10.GO‘.YM.04. Ayqash to‘g‘ri chiziqlarni tasavvur qila oladi; M10.GO‘.YM.05. Perpendikulyar to‘g‘ri chiziqlarni tasavvur qila oladi; M10.GO‘.YM.06. Nuqtadan to‘g‘ri chiziqqacha va tekislikkacha bo‘lgan masofani aniqlay oladi va hisoblay oladi; M10.GO‘.YM.07. Ikki yoqli burchak yasay oladi va uning elementlarini chizmada ko‘rsata oladi; M10.GO‘.YM.08. Sodda fazoviy jismlar ortogonal proyeksiyalarni chizmada tasvirlay oladi.

3. GEOMETRIYA FANIDAN 10-SINF UCHUN O‘QUV DASTURI VA TAVSIYAVIY SOATLAR TAQSIMOTI

(haftasiga 2 soatdan, jami 68 soat)

Bo‘lim va ajratilgan soat	Mavzular	O‘quv maqsadlari (standart elementlari)
I BOB. TAKRORLASH (6 soat)	**Planimetriyaning mantiqiy tuzilishi (1 soat).** Geometrik masalalar va ularni yechish usullari (3 soat). Bobni takrorlashga doir amaliy mashqlar (2 soat).	
II BOB. STEREOMETRIYAGA KIRISH (14 soat)	**Stereometriyaning asosiy tushunchalari (2 soat).** Stereometriya aksiomalari. Stereometriya aksiomalaridan kelib chiquvchi natijalar.	M10.GO‘.GSH.01. Stereometriya aksiomalarini biladi va isbotlashlarda ulardan foydalana oladi; M10.GO‘.MM.01. Stereometriya aksiomalaridan kelib chiquvchi natijalarni biladi va ularni qo‘llay oladi;
	Fazoda to‘g‘ri chiziqlar va tekisliklar (2 soat). Fazoda kesishuvchi, ayqash va parallel to‘g‘ri chiziqlar. Fazoda tekislikni kesuvchi va unga parallel to‘g‘ri chiziqlar. Fazoda kesishuvchi va parallel tekisliklar.	M10.GO‘.GSH.02. Fazoda ayqash, parallel va kesishuvchi to‘g‘ri chiziqlar ta’rifini biladi va chizmada tasvirlay oladi; M10.GO‘.GSH.03. To‘g‘ri chiziqning tekislikka parallelligi ta’rifini biladi; M10.GO‘.GSH.03. Kesishuvchi va parallel tekisliklar haqida tushunchaga ega bo‘ladi; M10.GO‘.GSH.05. Tekislikka parallel to‘g‘ri chiziq ta’rifini biladi; M10.GO‘.GSH.06. Parallel va kesishuvchi tekisliklar ta’rifini biladi; M10.GO‘.MM.03. Tekislikka parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi;
	Fazoviy geometrik shakllar. Ko‘pyoqlar (2 soat). Fazoviy jismlar. Ko‘pyoqlar va ularning elementlari. Prizma va piramidalar hamda ularning turlari. Muntazam piramida va uning xossalari. Muntazam piramida yon sirtini hisoblash formulasi.	M10.GO‘.GSH.07. Ko‘pyoqlar: prizma, parallelepiped, kub, piramida haqida boshlang‘ich tushunchalarga ega bo‘ladi; M10.GO‘.GSH.08. Ko‘pyoqlar: prizma, parallelepiped, kub, piramida elementlarini chizmada ko‘rsata oladi; M10.GO‘.MM.02. Prizma, parallelepiped, kub, piramida sirtini topishga doir masalalarni yecha oladi;

	Ko‘pyoqlarni tasvirlash va modelini yasash (2 soat). Ko‘pyoqlarni tekislikda tasvirlash. Ko‘pyoqlar yoyilmasi va unga ko‘ra uning modelini yasash	M10.GO‘.YM.01. Sodda fazoviy jismlarning yoyilmasi yordamida ularning modellarini yasay oladi va chizmasini tekislikda tasvirlay oladi; M10.GO‘.YM.02. Ko‘pyoqlarni tekislikda tasvirlay oladi;
	Ko‘pyoqlarning sodda kesimlarini yasash (3 soat). Kesim tushunchasi. Ko‘pyoqlarning sodda kesimlarini yasash usullari.	
	Loyiha ishi bo‘yicha mashg‘ulot (1 soat).	
	Summativ baholash. 1-nazorat ishi (2 soat).	
III BOB. FAZODA TO‘G‘RI CHIZIQLAR VA TEKISLIKLARNING PARALLELLIGI (18 soat)	**Fazoda to‘g‘ri chiziqlarning o‘zaro joylashuvi (2 soat).** Parallel to‘g‘ri chiziqlar va ularning xossalari..	M10.GO‘.YM.03. Parallel to‘g‘ri chiziqlarni tasavvur qila oladi; M10.GO‘.MM.04. Parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi; M10.GO‘.MM.05. Parallelepipedning xossalarini biladi va ularni masalalar yechishda qo‘llay oladi;
	Ayqash to'g'ri chiziqlar (2 soat). To‘g‘ri chiziqlarning ayqashlik alomati. Ayqash to‘g‘ri chiziqlar orasidagi burchak.	M10.GO‘.GSH.04. Fazoda ayqash, parallel va kesishuvchi to‘g‘ri chiziqlar ta’rifini biladi va chizmada tasvirlay oladi; M10.GO‘.YM.04. Ayqash to‘g‘ri chiziqlarni tasavvur qila oladi; M10.GO‘.MM.06.To‘g‘ri chiziqlarning ayqashlik alomatini biladi va uni masalalar yechishda qo‘llay oladi; M10.GO‘.GSH.05. To‘g‘ri chiziqning tekislikka parallelligi ta’rifini biladi; M10.GO‘.GSH.06. Kesishuvchi va parallel tekisliklar haqida tushunchaga ega bo‘ladi;
	Fazoda to‘g‘ri chiziqlar va tekisliklarning o‘zaro joylashuvi (4 soat). Tekislik bilan parallel to‘g‘ri chiziqlar va ularning xossalari. Tekislikka parallel to‘g‘ri chiziqlar va ularning xossalari.	M10.GO‘.MM.06. Tekislikka parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi;

	Fazoda tekisliklarning o‘zaro joylashuvi (2 soat). Parallel tekisliklar va ularning xossalari. Fazoviy shakllarning tekislikda tasvirlanishi.	M10.GO‘.GSH.09. Ikki tekislikning parallelligi alomatini biladi va undan foydalana oladi; M10.GO‘.MM.07. Parallel tekisliklarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi;
	Fazoda parallel proyeksiyalash (2 soat).	M10.GO‘.MM.07. Parallel tekisliklarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi; M10.GO‘.MM.08. Parallel proyeksiyaning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi;
	Bobni takrorlashga doir amaliy mashqlar (4 soat).	
	Summativ baholash. 2-nazorat ishi (2 soat).	
IV BOB. Fazoda to‘g‘ri chiziq va tekislikning perpendikulyarligi (19 soat)	**Fazoda perpendikulyar to‘g‘ri chiziqlar va tekisliklar (3 soat).** Fazodagi perpendikulyar to‘g‘ri chiziqlarning xossalari. To‘g‘ri chiziqlarning perpendikulyarlik alomati. Umumlashgan Pifagor teoremasi.	M10.GO‘.GSH.10. Tekislikka perpendikulyar to‘g‘ri chiziqlarni tasavvur qila oladi; M10.GO‘.MM.09. To‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini biladi va uni masalalar yechishda qo‘llay oladi; M10.GO‘.MM.10. Tekislikka perpendikulyar to‘g‘ri chiziqlarning xossalarini amaliy masalalar yechishda qo‘llay oladi; M10.GO‘.MM.11. Umumlashgan Pifagor teoremasini biladi va uni tatbiq qila oladi; M10.GO‘.YM.05. Perpendikulyar to‘g‘ri chiziqlarni tasavvur qila oladi;
	Fazoda perpendikulyar, og‘ma va masofa (3 soat). Fazoda tekislikka tushirilgan perpendikulyar va og‘ma. Nuqtadan tekislikkacha bo‘lgan masofa. To‘g‘ri chiziqdan unga parallel bo‘lgan tekislikkacha bo‘lgan masofa. Parallel tekisliklar orasidagi masofa. Ayqash to‘g‘ri chiziqlar orasidagi masofa.	M10.GO‘.GSH.11. Fazoda tekislikka tushirilgan perpendikulyar va og‘ma haqida tushunchaga ega bo‘ladi; M10.GO‘.MM.12.Fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni amaliy masalalar yechishda qo‘llay oladi; M10.GO‘.YM.06. Nuqtadan to‘g‘ri chiziqqacha va tekislikkacha bo‘lgan masofani aniqlay oladi va hisoblay oladi;
	Uch perpendikulyar haqidagi teorema (2 soat). Uch perpendikulyarlar haqidagi teorema va unga teskari teorema	M10.GO‘.GSH.12. Uch perpendikulyarlar haqidagi teorema haqida ma’lumotga ega bo‘ladi; M10.GO‘.MM.13. Uch perpendikulyarlar haqidagi teorema va unga teskari teoremani masalalar yechishda qo‘llay oladi;

	Fazoda tekisliklarning perpendikulyarligi (3 soat). Ikki yoqli burchak va uning elementlari. Ikki yoqli burchakning chiziqli burchagi. Tekisliklar orasidagi burchak. Fazoda perpendikulyar tekisliklar. Tekisliklarning perpendikulyarlik alomati va undan kelib chiqadigan natijalar.	M10.GO‘.MM.14. Fazoda tekisliklarning perpendikulyarligi haqidagi teoremani qo‘llay oladi; M10.GO‘.MM.14. Fazoda tekisliklarning perpendikulyarligi haqidagi teoremani qo‘llay oladi; M10.GO‘.MM.15. Ikki yoqli burchakning chiziqli burchagini chizmada tasvirlay oladi va masalalar yechishda hisoblay oladi; M10.GO‘.MM.16. Tekisliklar orasidagi burchakni chizmada tasvirlay oladi va hisoblay oladi; M10.GO‘.MM.17. Fazoda perpendikulyar tekisliklar haqidagi teoremani masalalar yechishda qo‘llay oladi; M10.GO‘.MM.18. Tekisliklarning perpendikulyarlik alomati va undan kelib chiqadigan natijalarni masalalar yechishda qo‘llay oladi; M10.GO‘.YM.07. Ikki yoqli burchak yasay oladi va uning elementlarini chizmada ko‘rsata oladi;
	Fazoda ortogonal proyeksiya va undan texnikada foydalanish (2 soat). Ko‘pburchakning ortogonal proyeksiyasining yuzi. Ortogonal proyeksiyadan texnikada foydalanish	M10.GO‘.GSH.13. Ortogonal proyeksiya haqida tushunchaga ega bo‘ladi; M10.GO‘.YM.08. Sodda fazoviy jismlar ortogonal proyeksiyalarni chizmada tasvirlay oladi. M10.GO‘.MM.19. Ko‘pburchakning ortogonal proyeksiyasining yuzini topa oladi.
	Bobni takrorlashga doir amaliy mashqlar (4 soat).	
	Summativ baholash. 3-nazorat ishi (2 soat).	
TAKRORLASH (11 soat)	**Takrorlashga doir masalalar (7 soat).**	
	Loyiha ishi taqdimoti (2 soat).	M10.SE.ST.07 O‘zlashtirilgan bilim va ko‘nikmalar asosida, berilgan muammoli vaziyat bo‘yicha kichik o‘quv-tadqiqot mavzusi bo‘yicha loyiha ishini bajarish jarayonida amaliy faoliyat standartlari talablariga mos kompetensiyalarni shakllantirib boradi.
	Summativ baholash. 4-nazorat ishi (2 soat).	

MATEMATIKA FANINI O‘QITISH JARAYONINI TASHKIL QILISH

1. MATEMATIKA FANINI O‘QITISHGA METODIK YONDASHUVLAR

Matematika fanini o‘qitishga metodik tavsiyalar

Mamlakatimiz rivojlanishining hozirgi davrida jahon tajribasi asosida ta’limning yangi ustuvor yo‘nalishlari belgilandi. Maktab ta’lim sifatini yaxshilashning asosiy yo‘naltiruvchi nuqtasi sifatida maktab o‘quvchilari funktsional savodxonligini rivojlantirish, ularning jamiyatda faol ishlash, o‘z taqdirini o‘zi belgilash, o‘z-o‘zini takomillashtirish hamda o‘zini-o‘zi ro‘yobga chiqarish qobiliyatlarini o‘stirish talab qilinadi.

Ilg‘or xalqaro tajribalar tahlillaridan kelib chiqib, o‘quvchilarning matematika bo‘yicha funksional savodxonligini rivojlantirish amaliy faoliyat standartlarining quyidagi yo‘nalishlarini qamrab oladi:

- matematikaga oid ta’riflar, formulalar va boshqa faktlarni o‘quv va ma’lumotnomalardan qidirish va foydalanish;
- turli hayotiy vaziyatlarda algebraga doir bilim, ko‘nikma va grafik malakalarini qo‘llash;
- ma’lumotlarni to‘plash, tahlil qilish, qayta ishlash, sintez qilish;
- matematik formuladan foydalanish, muayyan xususiy hollarni umumlashtirish asosida miqdorlar orasidagi bog‘liqlikni ifodalovchi formulalarini mustaqil ravishda tuzish;
- o‘zlashtirilgan algebraik almashtirishlarni va funksional grafik tasvir va tasavvurlarni tevarak-atrofdagi yoki boshqa fanlardagi tegishli obyektlarni ifodalash va tahlil qilishda qo‘llash;
- o‘z nuqtayi nazarini asoslay olish, uning muhokamasida ishtirok etish va mantiqiy jihatdan to‘g‘ri xulosa chiqarish;
- matematik matn bilan ishlash (tahlil qilish va kerakli ma’lumotlarni chiqarib olish), o‘z fikrini matematik atamalar, timsollar va ramzlar yordamida aniq va to‘g‘ri yozish hamda og‘zaki va yozma izhor qila olish;
- amaliy xarakterdagi hayotiy masalalarni yechish, zarur hollarda ularni yechishda kerakli ma’lumotnomalar va hisoblash vositalarini qo‘llay olish;
- jadvallar, diagrammalar, grafik ko‘rinishdagi real raqamli ma’lumotlarni hamda statistik xarakterdagi ma’lumotlarni tahlil qilish;
- amaliy xarakterdagi matematik muammolarni hal qilish vositasi sifatida zamonaviy axborot texnologiyalaridan foydalanish.

Buning uchun matematika fanini o‘qitishda quyidagilarga e’tibor berish tavsiya etiladi:

- an’anaviy va zamonaviy o‘qitish usullarini uyg‘unlashtirib olib borish;
- puxta tanlangan topshiriqlar va mashg‘ulotlar orqali o‘quvchilarni rag‘batlantirish va rivojlantirish;
- o‘rganishni baholash orqali o‘quvchilarning bilim olishini qo‘llab-quvvatlash;
- o‘quvchilarning kichik o‘quv kashfiyotlari asosida faol o‘rganishni rag‘batlantirish;
- o‘quvchilarning kreativ va tanqidiy fikrlash qobiliyatlarini rivojlantirish;
- butun sinf ishini, individual va guruh faoliyatini tashkil etish orqali o‘quvchilarning hamkorlikda ishlash ko‘nikmalarini rivojlantirish;

– matematik nutqni to‘g‘ri va aniq shakllantirish;

– matnli masalalarini yechishda matematik mazmun va usullarni ajratib ko‘rsatish va yangi holatga qo‘llash;

– masala shartlarini matnli ko‘rinishdan matematik tilga o‘girish va bu shakl almashtirishlarning mazmun va mohiyatini ochib borish;

– o‘quvchilarga mavzuni chuqurroq o‘rganish imkonini beradigan tabaqalashtirilgan yondashuv asosida o‘quvchilarda ijodiy ishlash ko‘nikmalarini shakllantirish va faol aqliy harakatlarni amalga oshirishlari uchun muammoli vaziyatlarni yaratish;

– ta’lim jarayonida o‘quvchilarning tabaqalashtirilgan individual shug‘ullanish trayektoriyalarini yaratish;

– darsda interfaol va faol ta’lim texnologiyalari: loyiha, tadqiqot, evristik, keys, muammoli o‘qitish kabi metodlardan o‘rnida foydalanish.

Yuqoridagilardan kelib chiqib, matematika fanini o‘qitishda quyidagi metodik jihatlarga e’tibor qaratish tavsiya etiladi:

1. Ta’lim jarayonining mohiyati katta hajmdagi o‘quv materialini o‘rganishga emas, balki kiritilayotgan matematik atama va faktlarni o‘quvchilarning tushunishi chuqurligiga e’tibor berish lozim. Odatdagi, xususan, bizning maktab matematika fani o‘quv dasturlarimizda buning aksi: dasturlarimiz o‘quv yuklamasi juda katta, o‘rganilishi kerak bo‘lgan mavzular juda ko‘p, vaqtimiz esa cheklangan. Buning oqibatida bu mavzularni chuqur o‘rganish imkoniyatlari cheklanib qoladi. Har bir mavzu chuqurroq o‘rganilishi lozim. O‘quvchilar oldin o‘rganilgan mavzuga uni takrorlash uchun emas, balki chuqurroq o‘rganish maqsadida qayta-qayta murojaat qilishi kerak, ya’ni mavzuga uni jiddiyroq darajada chuqurroq o‘rganish uchun yana qaytish lozim. O‘quvchilar o‘zlashtirish darajasining yuqori bo‘lishini darsdan keyingi mashg‘ulotlar evaziga ushlab turish lozim. Sinfda mavzularni o‘zlashtirmagan qoloq o‘quvchi bo‘lmasligi lozim. Hamma e’tiborni barcha o‘quvchilar tomonidan mavzuning ma’lum darajada o‘zlashtirilishiga qaratish kerak bo‘ladi. Bu darajani oldinroq o‘zlashtirgan o‘quvchilar, boshqalar ham bu darajaga yetishgunga qadar, mavzuni chuqurrroq o‘rganishga o‘tishadi.

2. Ta’lim jarayonini muayyan amaliy tajribadan boshlab abstrakt tushunchalarga tomon borish lozim. Tushunchalarni o‘rganish uch bosqichda olib boriladi.

Birinchi bosqichda o‘quvchilar kiritilayotgan tushunchaga doir turli amaliy faoliyat bilan shug‘ullanadilar, tushunchaga doir turli moddiy narsalarni qo‘llari bilan ushlab ko‘radilar yoki ulardan turli modellarni yasaydilar.

Ikkinchi bosqichda yangi tushunchani timsollar yordamida ifodalaydilar. Ularni turli rasmlarda, diagramma yoki chizmalarda tasvirlaydilar.

Shundan keyingina uchinchi bosqichga, yangi tushunchaga oid abstrakt ta’rif, matematik timsol va belgilashlarga o‘tiladi. Boshqacha qilib aytganda, matematik tushunchalar bilan tanishish ko‘rgazmali misoldan boshlanadi, uning asosida abstrakt tushunchani “ushlash” va “ko‘rish” imkoniyati beriladi.

Ta’limning amaliy tajribadan abstrakt tushunchalarga tomon borishi o‘quvchilarda har bir mavzu bo‘yicha muayyan assotsiatsiyalar (yorqin, xotirada chuqur va mustahkam o‘rnashuvchi taassurotlar) hosil qilinadi. Bu taassurotlar eslanganda mavzuning turli jihatlari yodga tushishi ta’minlanadi.

Ta’lim jarayonining boshidan amaliy ishga yo‘naltirilganligi u yoki bu matematik tushunchaning nima sababdan o‘rganilayotgan va uning hayotiy vaziyatlarda qachon va qayerda kerak bo‘lishini oldindan bilishga va ta’lim olishga bo‘lgan motivatsiyani (qiziqishni) oshiradi. Bu esa matematika fani hayotda kerakli va foydali bo‘lishi bilan birga, uning

jozibador fan ekanligini ham ta’minlaydi.

3. Matematik modellashtirishga alohida e’tibor qaratish lozim. Bu bilan berilgan masala sharti ko‘rgazmali qilib vizuallashtiriladi. Masala modellashtiriladi va berilganlardan qulay ravishda foydalanish tashkil qilinadi va bosqichma-bosqich masalani yechishga kirishiladi.

4. Hamkorlikda o‘rganish va o‘zaro muloqotga katta e’tibor berish lozim. Masalalarni yechishda o‘quvchilarga matematik tushunchalarni va masalalar bo‘yicha o‘z fikrlarini bildirishi, ularni birgalikda muhokama qilish va boshqalar fikrini ham tinglash imkoniyati yaratiladi. Natijada o‘quvchilar tushunchani yaxshiroq o‘zlashtirishadi, matematika tilidan to‘g‘ri foydalanishga o‘rganishadi, ba’zi hollarda u yoki bu masalaning bir necha yechimi bo‘lishi mumkinligini tushunib yetishadi. O‘quvchilarni har safar masala yechayotganda masala sharti, uni yechish usullari va yechimi haqida sinfdoshlariga ovoz chiqarib so‘zlab berishga undash lozim. Bu esa o‘z navbatida mavzuni, masalani yechish yo‘llarini yaxshiroq eslab qolishlarini ta’minlaydi. Shuningdek, o‘quvchilar bir necha kishilik kichik guruhlarda masalani jamoa bo‘lib yechish, mavzuni qanday tushunganlarini bir-birlariga aytib berish, yechimlarini muhokama qilish hamda jamoaviy ishlarni bajarish kabi interfaol ishlar bilan shug‘ullanshlarnini tashkil qilish lozim.

5. O‘quvchilarni eslab qolishga emas, masala (muammo) ni yechishga o‘rgatish lozim. Odatda dars yangi turdagi masalani yechish qoidasidan emas, balki bevosita notanish masalani yechishdan boshlash tavsiya qilinadi. O‘quvchilar oldingi bilim va ko‘nikmalari asosida intuitiv ravishda masalani yechishga urinib ko‘radilar. Ular birgalikda “urinish, xato qilish va uni tuzatish” orqali mulohaza yuritadilar, xatolar qiladilar hamda bu xatolar ustida ishlashadi, shu asosida to‘g‘ri yechimga bosqichma-bosqich yaqinlashib borishadi. Bu o‘rinda o‘quvchilar xato qilish unchalik yomon ish emasligini, aynan turli xato yechimlarni tahlil qilish va tekshirish (kichik tadqiqot) jarayoni bora-bora ularni to‘g‘ri yechimga olib borishini o‘z tajribalari asosida tushunib yetishadi.

Matematika ta’limiga kompetensiyaviy yondashuv

Matematika ta’limiga kompetensiyaviy yondashuv kasbiy, shaxsiy faoliyatga doir kundalik hayotda uchraydigan holatlarda samarali harakat qilishga imkon beradigan turli ko‘rinishdagi malakalarni o‘quvchilar tomonidan egallashni nazarda tutadi. Shunga ko‘ra, kompetensiyaviy yondashuvda matematik ta’limning amaliy va tatbiqiy yo‘nalishlarini kuchaytirishga qaratiladi.

Matematika darslarini tashkil qilishda nazariyadan ko‘ra ko‘proq amaliyotga e’tibor berish hamda o‘quvchilarga tayyor o‘quv materiallarini berishga asoslangan yondashuvdan ma’lum darajada voz kechish talab qilinadi. Matematika darslarida ko‘proq keys, tadqiqot, loyiha, kichik o‘quv kashfiyotlari kabi interaktiv metodlardan foydalanish tavsiya etiladi. O‘quvchilarda kichik tadqiqotchilik ko‘nikmalarini shakllantirishda kuzatish, tajriba, o‘lchashlar, analiz (tahlil) va sintez, induksiya va deduksiya, taqqoslash va analogiya kabi ilmiy izlanish metodlaridan o‘rnida foydalanish talab etiladi. O‘quvchilarda bilim va ko‘nikmalarni shunchaki shakllantirib qolmasdan, ularni hayotiy vaziyatlarda qo‘llay olish kompetensiyalarini ham tarkib toptirish muhim ahamiyat kasb etadi.

STEAM – ijodkorlik texnologiyasi

STEAM (S – science – tabiiy fanlar, T – technology – texnologiya, E – engineering – muhandislik, A – art – san’at, M – mathematics – matematika) ta’lim texnologiyasi aniq fanlar blok-modulida o‘quvchilarning egallagan bilim, ko‘nikma va malakalarini kundalik hayot bilan bog‘liqligini ko‘rsatishda dars va sinfdan tashqari mashg‘ulotlarda o‘quv tadqiqotla-

rini o‘tkazish, tajribalarni bajarish, loyihalashtirishga yo‘naltirilgan ijodkorligini tarbiyalash, yangiliklar yaratishga bo‘lgan qiziqishlarini rivojlantirishga qaratilgan. Bu texnologiyani amalga oshirishda o‘quvchilar tomonidan turli texnik qurilmalarni yasash uchun loyihalar yaratish, loyiha asosida qurilmaning maketini yaratish va uni amaliyotda ishlatib ko‘rish, kamchiliklarini topish hamda uni bartaraf etish kabi vazifalar bajariladi.

Loyiha ishi – amaliy faoliyat ko‘zgusi

O‘quvchilarda tayanch va fan bo‘yicha amaliy faoliyat kompetensiyalarini shakllantirish, kichik o‘quv tadqiqotlarni bajarish orqali umumta’lim fanlarini o‘rganishga qiziqishni kuchaytirish maqsadida fan o‘quv dasturlariga loyiha ishi kiritildi. Bu holat nafaqat muayyan o‘quv fani bo‘yicha o‘zlashtirish sifatini yaxshilaydi, balki fanlararo va fanning kundalik turmush bilan bog‘lanish imkoniyatlarini ochadi va ta’lim samaradorligini oshiradi.

O‘quv loyihasi – bu uzoq vaqtga mo‘ljallangan, o‘rganilgan mavzu yoki bo‘limni yanada, chuqurroq o‘rganishga yo‘naltirilgan, ta’lim jarayoniga tajriba, amaliy faoliyat asosida yondashuvga imkon beruvchi, tadqiqotchilik va izlanishga doir metodlardan foydalanishni talab etuvchi ta’limni tashkil etish shakli.

Loyihalashtirish – bu real natijaga olib keluvchi, qat’iy tartibga solingan harakatlar izchilligini o‘z ichiga oluvchi muammoni o‘zgartiruvchi faoliyat.

Hozirgi vaqtda ta’lim amaliyotida o‘quv loyihasining xilma-xil turlaridan foydalaniladi. Yetakchi faoliyat turiga ko‘ra loyihalar: axborotli, amaliy yo‘naltirilgan va tadqiqot turlarga bo‘linadi.

Masalan, agar o‘qituvchi o‘quvchida axborotlar bilan ishlash malakalarini, matnni tahlil etish, turli manbalardagi ma’lumotlarni tasniflash va tekshirish ko‘nikmalarini rivojlantirishni o‘z oldiga maqsad qilib qo‘ysa, u holda axborotli tavsifdagi o‘quv loyihasidan foydalanishi maqsadga muvofiq. Axborotli tavsifdagi loyihaning maqsadi aynan ma’lumotlarni to‘plash, axborotlarni rasmiylashtirish va taqdim etishdan iborat. Albatta, o‘quv loyihasining istalgan turida axborot to‘plash bosqichi bor, biroq bu yerda u o‘quv ishi vositasi bo‘lib xizmat qiladi, axboriy tavsifdagi loyihada esa, asosiy maqsad sifatida belgilanadi. Mazkur holatda o‘quvchi faoliyati aynan axborotlar bilan ishlashga yo‘naltiriladi. Shu bilan birgalikda o‘quvchida ma’lumotlar bilan ishlash kompetentligini rivojlantirish asosiy vazifa sifatida belgilanadi.

Ma’lum bir fan yoki fanlarga doir amaliy ko‘nikma va malakalarni rivojlantirish zaruriyati paydo bo‘lganda amaliy yo‘naltirilgan loyihalardan foydalanish yaxshi samara beradi. Eng oddiy holatda, o‘qituvchi o‘quvchilardan muayyan muammoning matematik modelini tuzish va uni yechish, fanga doir o‘quv va tarqatma materiallarni yoki glossariy yaratish topshirig‘ini buyurishi mumkin. Amaliy yo‘naltirilgan loyihalar bilan ishlash jarayonida o‘quvchilarda nafaqat fanga doir bilim, ko‘nikma va malakalar rivojlanibgina qolmay, balki matematik modellashtirish, muammoni hal qilish kabi amaliy faoliyatga doir kompetentlik ham qaror topadi. O‘quvchilarning analitik, tanqidiy fikrlash qobiliyatini rivojlantirish, idrok etishning mantiqiy usullarini o‘zlashtirish va katta hajmdagi axborotlarni qayta ishlash maqsad qilib qo‘yilsa, tadqiqotchilikka doir o‘quv loyihasidan foydalanish maqsadga muvofiq. Mazkur o‘quv loyihasining maqsadi loyiha farazini asoslab berishdan iborat. Ushbu maqsadga erishish uchun tajriba-sinov ishlari o‘tkazish, olingan natijalarni tahlil etish, umumlashtirish, taqqoslash, rivojlanish qonuniyatlarini aniqlash, bundan tashqari xulosalar chiqarish, o‘z nuqtayi nazarini asoslash zarur. Ana shu tarzda tadqiqotchilikka doir o‘quv loyihasida asosiy e’tibor mulohaza yurutish kompetentligini rivojlantirishga qaratiladi.

O‘quv loyihasida eng katta e’tibor o‘quvchilarda ijodiy qobiliyatlarini rivojlantirishga qaratiladi. Aynan loyihalar o‘quvchilarga o‘zini namoyon eta olish, istalgan janrdagi asarni

yaratish imkonini beradi. Shuningdek, loyihalar o‘quvchilarni guruhdagi maqomining oshishi, o‘z-o‘zini baholashga imkon berishi orqali ularning ijodiy qobiliyatlarini rivojlantiradi. Har qanday ijodiy ish uni taqdim etish va sinf jamoasi bilan qayta aloqani taqozo etadi.

Shu sababli loyihalar o‘quvchilarda ma’lumotlar bilan ishlash, matematik modellashtirish, muammoni hal qilish, mulohaza yuritish, muloqot qilish kabi amaliy faoliyat kompetenisyalarni rivojlantirishga katta ta’sir ko‘rsatadi.

Loyiha ishi bo‘yicha o‘quvchilar faoliyatini tashkil qilish

O‘quvchilar bir o‘quv yilida o‘zlari qiziqqan fani yoki ta’lim sohasidan faqat bitta loyiha ishini bajarishlari tavsiya etiladi. Loyiha ishi mavzulari o‘qituvchilar tomonidan bitta yoki bir necha o‘quv fanlari doirasida muammoli vaziyat yoki keys sifatida tanlanadi. Loyiha ishi mavzusi ustida o‘quvchilar alohida-alohida yoki qiziqishlariga qarab 3-4 kishilik guruh bo‘lib ishlashlari ham mumkin. Loyiha ishi o‘quv yili oxirida o‘tkaziladigan himoya bilan tugaydi. Himoya bitta yoki bir necha o‘quv fanlari doirasida konferensiya tarzida o‘tkazilishi mumkin.

Loyiha ishi ustida o‘quvchilarning individual yoki guruhiy ishi quyidagi o‘quv faoliyatlarni o‘z ichiga olgan ishlab chiqish bosqichlaridan iborat bo‘lishi mumkin:

- *tayyorgarlik bosqichi*: o‘z izlanish faoliyatlarini rejalashtirish, motivatsiya, muammoli vaziyatni aniqlash, tadqiqot mavzusini tanlash;
- *loyihalash bosqichi*: loyihaning maqsadini belgilash, faoliyatni amalga oshirishning aniq rejasini tuzish, vazifalarni o‘zaro taqsimlab olish,
- *amaliy bosqich:* muammoni tadqiq etish, kerakli ma’lumotlarni to‘plash va qayta ishlash, muammoning matematik modelini yaratish, matematikani qo‘llash, muqobil yechimlarini aniqlash va ulardan eng maqbulini tanlash hamda uni asoslash,
- *tahlil va talqin bosqichi*: zarur hollarda so‘rovlar yoki tajribalar o‘tkazish, rejalashtirilgan ishlar va olingan natijalarni taqqoslash, tahlil qilish, real muammoga nisbatan talqin qilish, umumlashtirish va xulosalash;
- *nazorat va baholash bosqichi*: o‘z faoliyatlarini tahlil qilish va baholash, ijobiy natijalarni va yo‘l qo‘yilgan xatolarni tahlil etish, xatolarni to‘g‘rilash yo‘llarini izlash, real holat bilan bog‘liqlikda loyihaga o‘zgartirishlar kiritish;
- *natijalarni rasmiylashtirish bosqichi*: loyiha ishi natijalari bo‘yicha hisobot tayyorlash,
- *yakuniy bosqich*: loyiha ishi himoyasi uchun taqdimot tayyorlash va uni himoya qilish.

O‘quvchilar loyiha ishi bo‘yicha izlanishlarini odatda darsdan tashqari mustaqil mashg‘ulotlarda olib borishadi. Dasturda belgilangan dars soatlarida esa, turli loyiha ishlaridan namunalarni muhokama qiladilar, birgalikda muayyan loyiha ishi bo‘yicha guruhlarda ishlashadi, shu bilan birga o‘z loyiha ishlari mavzusi bo‘yicha maslahatlar oladilar.

Yuqoridagilarda ko‘rinib turibdiki, loyiha ishi bo‘yicha o‘quvchilar faoliyati an’anaviy ta’limdan tubdan farq qiladi. Zero bunda, birinchidan, o‘quvchilarga bilimlar tayyor holda uzatilmaydi, balki muammo tarzida qo‘yiladi, o‘quvchilar qo‘yilgan muammoni mustaqil yechadilar. Bilimlar o‘qitishning maqsadi bo‘lmay, muammoni yechish vositasiga aylanadi. O‘quvchilar yangi bilimlarni o‘zlashtirishning o‘zlari uchun qanchalik zarur ekanini his qiladilar, bu esa ularda motivatsiyaning sezilarli darajada o‘sishiga olib keladi. Ularning o‘quv-amaliy faolligi kuchayadi. Avvalo, mustaqil ishlash darajalari ortadi. O‘quvchilar kichik guruhlarga bo‘linib, muammoni aniqlab oladilar,uni hal qilish uchun qanday manba va bilimlar kerakligini belgilaydilar, mazkur manbalar bilan ishlaydilar, muammoni hal etishning olingan variantini umumlashtiradilar. Bunda o‘qituvchi shunchaki jimgina kuzatib turuvchi bo‘lmay, zarur paytda o‘quvchilarga kerakli maslahat va yordamini berib turadi.

2. MATEMATIKA FANINING BOSHQA FANLAR BILAN INTEGRATSIYASI

Matematika fanini o‘qitishda nafaqat uning bo‘limlar orasidagi o‘zaro ichki, balki tashqi, ya’ni STEAM yoki turdosh blok-modullar tarkibiga kiruvchi fanlar bilan integratsiyasi ham katta ahamiyatga ega.

Jumladan, matematikaning quyidagi fan yo‘nalishlari bilan o‘zaro chambarchas aloqalari muhim hisoblanadi:

Matematika va tabiiy fanlar

Matematika va tabiiy fanlar orasidagi bog‘liqlik – modellashtirish, o‘lchashlar, tajriba, tadqiqotlar, tajribaga asoslangan (empirik) mulohazalarga quriladi. Tabiiy fanlar va matematikada o‘quvchilar miqdorlar va munosabatlar, tabiat qonunlari ifodalovchi modellarini ishlab chiqadilar. Ular avval turli noan’anaviy birliklar yordamida, keyin rasmiy birliklar yordamida o‘lchash bilan tanishadilar. Keyinchalik o‘lchashda noaniqlik va ishonchlilik masalalarini ko‘rib chiqadilar. O‘quvchilar sifat va miqdoriy ma’lumotlarni yig‘adilar, ular tahlil qiladilar va turli ko‘rinishlarda ifodalaydilar. O‘quvchilar sonli ma’lumotlar va grafiklar asosida ma’lumotlarni tahlil qilish, turli qonuniyatlarni aniqlash ko‘nikmalarini egallaydilar.

Fizika fanini o‘qitishda o‘quvchilar tabiat hodisalarini va asosiy fizik jarayonlarni anglash bilan birga, texnika va texnologiyalarni rivojlantirishda matematik formulalarni qo‘llashni o‘rganadilar. Ko‘pgina fizik masalalar tenglama yoki tenglamalar sistemasini tuzish va ular bilan ishlash ko‘nikmasining shakllangan bo‘lishini taqozo etadi. Fizika fanini o‘qitishda matematika fani nafaqat hisoblash apparati sifatida, balki matematik mulohazalar yordamida voqelik, hodisaning xarakteri haqida fizik xulosalar chiqarishga hamda mazkur jarayonlarni tadqiq qilish, matematik tenglamalarni yechish orqali fizik hodisalar haqida fikr yuritish imkonini beradi. Fizik masalalarni matematika darslarida tahlil qilsh jarayonida o‘quvchilarning mantiqiy fikrlash qobiliyati, aqliy rivojlanishi va umuminsoniy qadriyatlarni shakllantirish barobarida olamning yagona manzarasiga oid tafakkurlarini rivojlantirish hamda egallangan bilimlardan hayotiy muammolarni hal qiliish, kundalik faoliyatlarida foydalanish ko‘nikmasini shakllantirishni ko‘zda tutadi.

Biologiya fani o‘quvchilarda jonli tabiatning obyekti hamda tizimini his etishni, jonli va jonsiz tabiat o‘rtasidagi aloqalarni shakllantiradi. Bir vaqtning o‘zida atrofimizni o‘rab turgan jonli tabiatga ijobiy munosabat, tabiiy rang-baranglikni saqlab qolish, shuningdek, javobgarlikni his qilgan holda mustahkam hayotiy faoliyat shakllanadi. Matematika darslarida jonli tabiatning biologik qonuniyatlari va modellari haqidagi hayotiy masalalarni tahlil qilish orqali bu ikki fan orasidagi integratsiya ta’minlanadi.

Kimyo fani o‘quvchilarda organik va anorganik moddalar hamda tuzilmalarni tabiatning obyekti sifatida his etish ko‘nikmalarini shakllantiradi. Matematika darslarida moddalar va tuzilmalarning tuzilishiga oid geometrik, sifat va miqdoriy kattaliklarni tahlil qilish orqali ularning kimyoviy xususiyatlarini o‘rganish, tadqiq qilish hamda xulosa chiqarish orqali bu ikki fan orasidagi uzviy aloqadorlik ta’minlanadi.

Geografiya fani o‘quvchilarda tabiat in’omlari va insonning iqtisodiy faoliyati natijasida yaratilgan obyektlarni tizimli ravishda, birgalikda his etishni shakllantiradi. Matematika darslarida geografik obyektlarga doir hayotiy masalalar yechish va tahlil qilish orqali bu ikki fan orasidagi aloqadorliklar aniqlanadi.

Matematika va raqamli texnologiyalar

Matematika va raqamli texnologiyalar orasidagi aloqadorlik ma’lumotlar, hisoblash va

algoritmik fikrlashga quriladi. Axborot kommunikatsiya texnologiyalaridan (AKT) foydalanish kompetensiyasi ta'lim olish va kundalik turmushda mazkur texnologiyalarni mohirona va ijodiy qo'llashni o'z ichiga oladi. Informatika va axborot texnologiyalari fani matematika fanini o'qitish jarayonining samaradorligini turli ko'rinishdagi axborot-kommunikatsiya texnologiyalari va kompyuter texnikasidan foydalanish orqali oshirishga ulkan imkoniyatlarni yaratadi. O'quvchilar ta'lim olish jarayonida axborotni izlash, yaratish va qayta ishlash, ma'lumot va g'oyalar bilan hamkorlik qilish va almashish, multimediali kompyuter texnikasi, dasturiy ta'minotlar va ilovalar yordamida o'z faoliyatlarini baholash va takomillashtirish orqali AKT ko'nikmalarini rivojlantiradilar. Matematikada algoritmlarni yaratish va loyihalash, loyihani amalga oshirish ta'limda hisoblashga qurilgan yondashuvini hamda matematikada tajribalar o'tkazishning ajralmas qismini tashkil etadi. Matematika fanidan bajariladigan loyihalar doirasida tajribalar o'tkazish asosida o'rganishni raqamli texnologiyalar to'ldiradi, hisoblash va algoritmik fikrlash ko'nikmalarini rivojlantirishni qo'llab-quvvatlaydi.

AKT quyidagi amaliy faoliyat yo'nalishlari bo'yicha ko'nikmalarni shakllantirishga xizmat qiladi:

– o'quvchilarda axborot qidirish, uni saralash, faktlar va hodisalar o'rtasidagi bog'liqlik va farqlarni solishtirish hamda o'rnatish bilan bog'liq mustaqil ishlash ko'nikmalarini rivojlantirish;

– matematikani mustaqil o'rganish imkoniyatini baradigan turli ta'lim platformalarida (masalan, ixl.com, uz.khanakademu.org va hokazolarda) ishlash;

– matematikaning turli bo'limlarini o'rganishda ko'rgazmalilikni ta'minlash (masalan, geometriyada GeoGebra dasturi yordamida);

– o'quvchilarning turli dasturiy muhitlardan foydalangan holda matematik modellashtirish ko'nikmalarini oshirish;

– o'quvchilarda turli xil dasturiy muhitlar yordamida farazlarni ilgari surish va ularni sinab ko'rish qobiliyatini rivojlantirish (masalan, ehtimollikka doir masalalarni yechishda Excel ilovasidan foydalanish);

– o'quvchlarni loyihalar, tadqiqotlarni bajarishda katta hajmdagi hisoblash topshiriqlarni bajarishda vaqtni tejash maqsadida muhandislik kalkulyatori bilan ishlash ko'nikmalarini shakllantirib borish;

– o'z-o'zini nazorat qilish ko'nikmalarini rivojlantirishga yordam beradigan elektron darsliklardan foydalangan holda o'quvchilarga ta'lim berish;

– internet-olimpiadalarda va olimpiadaning saralash bosqichi bo'lgan masofaviy fan olimpiadalarida ishtirok etish orqali matematik qobiliyat va ijodiy faollikni rivojlantirish (masalan, IMO xalqaro matematika olimpiadasi, IMC xalqaro matematika musobaqasi, "Kenguru" xalqaro olimpiadasining onlayn turlarida);

– ta'lim olishga yo'naltirilgan onlayn ijtimoiy tarmoqlarda, portallarda, videokonferensiyalarda yoki forumlarda ishtirok etish orqali matematik ko'nikmalar va matematik tilni rivojlantirish.

– maxsus dasturlar yordamida kichik o'quv saytlari, multimedia ilovalari, videoroliklarni yaratish, baholash bo'yicha dasturiy ta'minotlardan foydalanish ko'nikmalarini shakllantirish.

Matematika, dizayn va texnologiyalar

Dizayn va texnologiyalar o'quvchilarga matematik bilim va ko'nikmalarni bir qator hayotiy vaziyatlarda talqin qilish va ulardan foydalanish imkoniyatlarini beradi. O'quvchilar sondan miqdoriy baholash va o'lchash, statistikadan olgan natijalarini sharhlash va xulosa chiqarish uchun foydalanadilar. G'oyalarni ishlab chiqarish jarayonida o'lchaydilar

va sonlar yordamida qayd etadilar. G‘oyalarni ishlab chiqish, takomillashtirish va sinash hamda loyihalarni boshqarishda sonlardan foydalanadilar. Ular uch o‘lchamli modellardan foydalanadilar, aniq texnik chizmalar yaratadilar, raqamli modellar bilan ishlaydilar va eng yaxshi yechimlarni ishlab chiqishda va yaratishda qaror qabul qilish jarayonlarida miqdoriy mulohaza yuritishdan foydalanadilar. Texnologiya fani orqali tarkib toptirilgan kompetensiyalar matematika fanini o‘qitish jarayonida o‘quvchilarni kasb-hunarga yo‘naltirish, ularning texnik ijodkorlik qobiliyatlarini rivojlantirish hamda ijodiy loyiha tayyorlash malakalari hosil bo‘lishida muhim ahamiyatga ega hisoblanadi

Matematika va san’at

Matematika va san’at uyg‘unligi qonuniyatlarni tushunish, o‘lchash, fazoviy tasavvur va fikrlash ustiga quriladi. Matematikada o‘quvchilar bu bilimlardan masalalar yechishda va modellashtirishda foydalanadilar. San’atda badiiy asarlarni yaratish, talqin qilish, tahlil qilish va o‘rganishga doir bilimlar qo‘llanadi. Matematika va san’at ham o‘quvchilarga tabiiy va sun’iy muhitlarni o‘rganish hamda ularni kuzatish imkoniyatini beradi. O‘quvchilar matematik bilimlarini tasviriy, ovozli va kinestetik kabi san’at shakllari orqali uzatishlari mumkin. O‘quvchilarga muayyan san’at jarayonlari yoki amaliyotlaridan foydalanganda matematik tushunishni qo‘llash imkoniyati beriladi. Masalan, musiqada o‘quvchilar kompozitsiya tuzishda naqsh va algoritmlarida haqidagi bilimlarni qo‘llashlari mumkin.

Matematika va ijtimoiy fanlar

Matematika va ijtimoiy fanlar uyg‘unligi moliyaviy savodxonlik va tadqiqot ma’lumotlarini tahlil qilishga e’tibor beriladi. Bu moliyaviy va biznes qarorlarini qabul qilish uchun moliyaviy menejment tamoyillarini tushunish talab etiladi.

Ona tili va adabiyot, xorijiy tillar orqali shakllantiriladigan kompetensiyalar matematikani o‘qitishda o‘quvchilarning ijodiy fikrlashini rivojlantirishda, yozma va og‘zaki ravishda o‘z qarashlarini ravon bayon etish malakalarini hosil qilishda, ilmiy atamalarni to‘g‘ri qo‘llash hamda bahs-munozaralar jarayonida erkin muloqot qilishga o‘rgatishda muhim o‘rin tutadi.

Iqtisodiy bilim asoslari fanini o‘rganish jarayonida iqtisodiyotni yanada rivojlantirish va liberallashtirishga yo‘naltirilgan makroiqtisodiy barqarorlikni mustahkamlash va yuqori iqtisodiy o‘sish sur’atlarini saqlab qolish, ijtimoiy-iqtisodiy faoliyat bilan bog‘liq bo‘lgan muayyan hayotiy vaziyatlarda eng maqbul yechim topa olish va to‘g‘ri qaror qabul qilishga o‘rgatishdan iborat. O‘quvchilarda iqtisodiy masalalarning matematik modelini qurish va matematika fani yordamida iqtisodiy jarayonlarni tahlil qilishda u asosida bashoratlar qilish ko‘nikmalarini rivojlantirish muhim ahamiyat kasb etadi.

Tadbirkorlik asoslari fanini o‘rganish o‘quvchilarning kelajakdagi hayotiy tadbirkorlik ko‘nikmalarini shakllantirishni ko‘zda tutadi. Tadbirkorlik faoliyatini rejalashtirishda matematikaning o‘rni beqiyos bo‘lib, tadbirkor mablag‘lari va sarmoyasini iqtisodiyotga jalb qilish maqsadida ishlab chiqiladigan biznes-reja matematik hisob-kitoblar yordamida asoslab berilishi lozim bo‘ladi. Tadbirkor faoliyatida foyda, zarar va daromad hamda tavakkalchilik kabi muhim omillar borki, ular ham oldindan matematik hisob-kitoblar yordamida asoslanishi tadbirkorlik faoliyatining samaradorligini kafolatlashda muhim o‘rin tutadi. Matematika darslarida iqtisodiy muammo va masalalarni yechish, matematika fani mazmunini hayotiy masalalar bilan boyitadi va o‘quvchilarning fanlarga bo‘lgan qiziqishi oshishiga olib keladi.

Tarix fani matematika fani bilan ham bevosita bog‘langan. Ilm-fan yutuqlarining ishlab chiqarish sohalari, iqtisodiy-ijtimoiy munosabatlarining rivojlanishi va atrof-muhit holatiga ta’sirini ko‘rsatishda tarixiy ma’lumotlarning ahamiyati kattadir. O‘quvchilar tarixiy va fuqarolik voqealari hamda rivojlanish haqidagi ma’lumotlarni o‘tmish va hozirgi kunning ma’nosini anglatish uchun raqamli va grafik shaklda o‘rganish, izohlash, tahlil qilish va

taqdim etishni o‘rganadilar. Xaritalarni tuzish va izohlashda o‘quvchilar kataklar, masshtab, masofa, maydon va proyeksiyalar bilan bog‘liq sonli tushunchalar bilan ishlaydilar.

3. MATEMATIKADAN O‘QUVCHILAR YUTUQLARINI BAHOLASH ASOSLARI

Baholash

Baholash o‘quv jarayonining muhim va zaruriy tarkibiy qismi bo‘lib, u ta’limning joriy va yakuniy bosqichlarida o‘quvchilar faoliyati to‘g‘risidagi ma’lumotlarni to‘plash va tahlil qilish jarayonidan iborat.

Baholashning maqsadi, vazifalari, predmeti, obyekti, tamoyillari, usullari, shakllari va vositalari ta’lim jarayonining barcha subyektlari – maktab ma’muriyati, o‘qituvchilar, ota-onalar va o‘quvchilar uchun tushunarli bo‘lishi kerak.

Baholash tizimi – bu yutuqlarni o‘lchash va o‘quv muammolarini diagnostika qilishning asosiy vositasidir. U ta’lim sifatini, uning jahon standartlariga muvofiqligini aniqlashga, o‘qitish strategiyasi va taktikasi hamda ta’lim sohasidagi zamonaviy vazifalar, ta’lim mazmunini va ta’limning kutilayotgan natijalarini baholovchi shakllarini takomillashtirish bo‘yicha asosiy qarorlarni qabul qilishga imkon beradi.

Baholash olingan natijalar va rejalashtirilgan maqsadlarni o‘zaro bog‘lash jarayonidan iborat.

Baholash tizimi:

– o‘quvchining o‘quv materialini qay darajada muvaffaqiyatli egallaganini yoki amaliy ko‘nikmalarni shakllantirganini aniqlashga imkon berishi;

– kognitiv (o‘rganish) faoliyatning turli sohalarida o‘quvchilar muvaffaqiyatining dinamikasini (o‘zgarishini) ko‘rsatishi;

– o‘quvchilarni rag‘batlantiruvchi, rivojlantiruvchi, o‘z-o‘zini baholashga yordam beradigan mexanizmga asoslangan bo‘lishi;

– “o‘qituvchi – o‘quvchi”, “ota-ona – sinf rahbari”, “maktab ma’muriyat – o‘qituvchilar jamoasi” aloqalarini ta’minlashi lozim.

O‘quv maqsadlari – baholash asosi

Maktab amaliyotida, darsning ta’limiy, tarbiyaviy va rivojlantiruvchi maqsadlari ajratib ko‘rsatiladi. Tarbiyaviy va rivojlantiruvchi maqsadlarini bitta darsda amalga oshirish mumkin emas, ularni diagnostik jihatdan erishilganini (hech bo‘lmaganda amaliyotda) aniqlash qiyin. Shuning uchun bugungi kunda ularni har bir dars uchun emas, balki darslar tizimi uchun rejalashtirish, ko‘p haftalarga mo‘ljallangan tematik rejada shakllantirish.tavsiya qilinadi. Shu bois ular har bir darsda yo‘naltiruvchi vazifani bajaradi.

Tarbiyaviy va rivojlantiruvchi o‘quv maqsadlarini ta’lim standartlarida o‘quvchining amaliy faoliyati uchun mezon (etalon)lar shaklida ifodalashning imkoni yo‘qligi sababli, kelgusida mezonga asoslangan baholashda faqat o‘quv maqsadlari haqida fikr yuritiladi.

Dars maqsadlarni belgilash bo‘yicha yo‘riqlar

Dars maqsadlari o‘rganish jarayoni natijalarining o‘quvchilar faoliyatiga nisbatan ifodasida namoyon bo‘ladi. Maqsadlar aniq (konkret), korrekt va erishib bo‘ladigan tarzda ifodalanishi zarur.

Maqsadning aniqligi deganda umumiy tarzda ifodalashdan qochib, o‘quv maqsadini aniq va ravshan tavsiflash tushuniladi. Dars maqsadini aniqlashtirib kirgan o‘qituvchi, unga erishish uchun maqsadli o‘quv jarayonini tashkil qilib ko‘p narsaga erishadi. Mavhum,

umumiy tavsiflangan maqsadlar esa o‘qituvchining dars davomidagi xatti-harakatlariga yo‘naltiruvchi kuch bermaydi. Natijada dars natijasi kutilgandek bo‘lmasligi mumkin.

Maqsadning korrektligi deganda maqsadning ifodasi haqiqatdan ham kutilayotgan natijaga qaratilganini, ya’ni uning to‘g‘ri ifodalanganini tushuniladi.

Maqsadlar vaqt, qanday o‘quv materialini qamrab olgani va o‘quvchilarning o‘zlashtirish imkoniyatlari hamda shart-sharoitlardan kelib chiqib, erishib bo‘ladigan qilib belgilanishi muhim ahamiyat kasb etadi. Yuqorida ta’kidlanganidek, maqsadlar o‘quvchilar faoliyatiga nisbatan ifodalanishi kerak. Maqsadning bunday aniqlashtirilishi o‘quv natijalari haqidagi umumiy tasavvurdan ma’lum bir etalonga, o‘quvchi tomonidan erishilishi lozim bo‘lgan mezonga o‘tishga yordam beradi.

O‘zlashtirish darajalari

O‘zlashtirishning uchta darajasini ajratish mumkin.

1-daraja – bilish va tushunish (tanib olish faoliyati). O‘quvchilar uni obyektlar, jarayonlar yoki harakatlar haqida ilgari o‘zlashtirilgan ma’lumotlarni qayta idrok etgandagina amalga oshirishi mumkin.

2-daraja – qo‘llash (algoritm). Ilgari o‘rganilgan, reproduktiv, algoritmik harakatlarni qo‘llash. O‘quvchilar mazkur amalni bajarish bo‘yicha oldin o‘zlashtirgan ma’lumotlari asosida mustaqil ravishda uni qayta bajara oladilar.

3-daraja – mulohaza yuritish (ijodiy). Nostandart muammolarni hal qilish uchun ilgari olingan bilim va ko‘nikmalarni qo‘llash. Bu fikrlash uchun samarali harakatdir. Bu jarayon natijasida o‘quvchilar subyektiv (faqat o‘zlari uchun) yangi ma’lumotlarni o‘zlashtirishadi, ya’ni evristik faoliyatni amalga oshirishadi. Shuningdek, ular yangi ma’lumotlarni o‘zlashtirishadi. Bunda ular tadqiqotchilik faoliyatini amalga oshirib, o‘zlariga ma’lum bo‘lgan sohada “qoidalarsiz” harakat qilib, yangi qoidalarni yaratishadi.

Maqsadni belgilash faoliyati jarayonida o‘qituvchi ushbu darsning o‘rganish obyekti bo‘lgan mazmun elementlarini aniqlaydi, har bir element uchun standart talablari, vaqt miqdori, o‘quvchilarning xususiyatlarini hisobga olgan holda uni o‘zlashtirish darajasi va aniqlashtirilgan maqsadlarni belgilaydi hamda o‘quv maqsadlarini shakllantiradi, ularga erishish uchun zarur bo‘lgan harakat usullari va shakllarini tanlaydi.

Baholashning o‘quv maqsadlariga muvofiqligi

Ta’lim natijalarini tekshirish va baholash o‘quv maqsadlariga yo‘naltirilgan bo‘lishi kerak. Shuni aytish joizki, baholash mezonlari aynan ta’lim standartlari talablarining elementlaridan iborat bo‘lgan o‘quv maqsadlaridan kelib chiqib tuzilishi, baholash topshiriqlari esa maqsadga erishganlikni aniqlaydigan bo‘lishi lozim.

Baholashga mezonga asoslangan yangicha yondashuv

Mezonga yo‘naltirilgan ta’lim texnologiyasining asosiy jihati bu belgilangan standart va dastur talablariga muvofiq to‘liq o‘zlashtirishning belgilarini aniqlash va uning muayyan etaloni (mezonini) ifodalashdan iborat.

Mezonga yo‘naltirilgan ta’lim texnologiyasining asosi – ilmiy asoslangan ta’lim maqsadlaridan iborat. O‘quvchilar tomonidan ongli qabul qilingan va anglangan ilmiy asoslangan o‘quv maqsadlari o‘qituvchi va o‘quvchilar faoliyati ma’nolarining yaqinlashishiga olib keladi, ta’limning shaxsga yo‘naltirilganligini ta’minlaydi.

Mezon (kriteriy)ga baholashning o‘lchov vositasi, baholash nima asosida amalga oshirilayotganligini ko‘rsatuvchi belgi sifatida qarash mumkin.

Mezonlarga asoslangan baholash – o‘quvchilarning turli sohalarda o‘qib o‘rganish

kompetensiyalarini rivojlantirish bo‘yicha erishgan yutuqlarini aks ettiruvchi tarkibiy qismlardan (mezonlardan) iborat baho.

Mezonlarga asoslangan baholash – bu baholash va o‘zini o‘zi baholashning har xil turlari, shakllari va usullaridan foydalanadigan yondashuvdir.

Mezonlarga asoslangan baholash tamoyillari

Ta’lim va tarbiya jarayoni bilan bog‘liqlik – o‘lchov parametrlari ta’lim va tarbiya natijalariga qo‘yiladigan Davlat ta’lim standarti va o‘quv dasturlari talablari bilan belgilanadi;

dolzarblik – eng muhim ta’lim va o‘quvning faoliyatining natijalarini baholashga urg‘u berish.

xolislik va adolat – bosim vositasi (yoki natijasi) bo‘lmagan aniq baholash mezonlarini sinchkovlik bilan tanlashni amalga oshirish.

adekvatlik (muvofiqlik) – bilimlarni, qobiliyatlarni, ko‘nikmalarni, qadriyatlarni, malakalarni baholashning maqsadlari va ta’lim natijalariga muvofiqligi.

integratsiya – baholash o‘quv jarayonining ajralmas qismi bo‘lib, unda baholash mezonlari va strategiyalari ochiqligi va shaffofligi o‘quvchilarga oldindan yetkaziladi; o‘quvchilar baholash mezonlarini ishlab chiqishda qatnashadilar.

ishonchlilik – darajasi ishonchlilik koeffitsiyenti (korrelyatsiya koeffitsiyenti) bilan belgilanadi, bu bir xil sharoitda o‘tkazilgan baholash natijalari qay darajada bir-biriga mos kelishini ko‘rsatadi.

samaradorlik – maqsadlar va rejalarni ma’lum talablar: vaqt, xarajatlar, maqsadga erishish darajasi asosida amalga oshirish imkoniyati.

asoslilik (validlik) – o‘rganilayotgan pedagogik hodisaning haqiqatan ham talab qilinadigan mezonlarini (kriteriylarni) o‘lchashga imkon berishi.

tizimlilik va izchillik – baholash amaliyotlari izchil va davriy ravishda amalga oshiriladi. Vaqti-vaqti bilan amalga oshiriladigan o‘lchovlar birgalikda ayrim bo‘limlar uchun ham, butun mazmun uchun ham nazorat choralaridan iborat yaxlit tizimni ifodalashi kerak.

keng qamrovlilik (komplekslik) – funksional savodxonlikni shakllantirish.vazifasi, mavzu mazmunini o‘zlashtirish natijalarini o‘lchashni, asosiy vakolatlarni shakllantirishni talab qiladi.

xayrixohlik – o‘qituvchi va o‘quvchi o‘rtasida sheriklik holatini yaratish, yutuqlarning o‘sishini rag‘batlantirish; o‘quvchilarni rivojlantirish va qo‘llab-quvvatlashga e’tibor qaratish.

Mezonga asoslangan baholashda o‘qituvchi uchun yo‘riqlar ham o‘zgaradi:

− o‘quvchining shaxsiyati emas, faqat uning ishi baholanishi kerak;

− o‘quvchining ishi – sinfda vazifani yaxshi bajargan o‘quvchilarning ishlari bilan emas, balki oldindan belgilangan va o‘quvchiga oldindan ma’lum bo‘lgan etalon (standart) bilan taqqoslanadi;

− aniq vazifalarning turli shakllaridan foydalaniladi va risoladagidek bajarilgan vazifalarning aniq va aniq tavsiflari mavjud;

− baholashning (baho chiqarishning) aniq algoritmi ishlab chiqiladi, unga ko‘ra o‘quvchi o‘zi erishgan darajasi va tegishli bahoni o‘zi aniqlashi mumkin;

− o‘quvchilar o‘zlarini baholashga o‘tishga intilib, baholash jarayonida qatnashadilar;

− faqat o‘qitiladigan narsa baholanadi, shuning uchun baholash mezonlari ta’lim maqsadlarining o‘ziga xos ifodasidir;

− fan bo‘yicha umumiy ta’lim maqsadlari o‘quvchilarning ushbu fan bo‘yicha erishgan yutuqlarini baholash mezonlari bo‘lib, o‘quvchilarning individual ishlari bilan aniqlangan

natijalarni umumlashtirishga imkon beradi.

Formativ va summativ baholash

Mezonga asoslangan baholash tizimi formativ (shakllanuvchi) baholash yoki joriy baholash va summativ (jamlanuvchi) yoki oraliq (yakuniy) baholashni o‘z ichiga oladi. Summativ baholashga o‘quv dasturi bo‘limlari tugaganda, chorak va yil oxirida o‘tkaziladigan oraliq va yakuniy baholashlar kiradi.

Formativ baholash sinfda yoki uydagi ta’lim olish jarayonida bilim va ko‘nikmalarni o‘zlashtirish darajasini aniqlashga mo‘ljallangan. U har xil shakllarda olib boriladi va o‘qituvchi va o‘quvchiga o‘z faoliyatlarini tuzatishga, yuzaga kelishi mumkin bo‘lgan muammo va kamchiliklarni bartaraf etishga imkon beradi. Fotmativ baholar summativ, choraklik va yakuniy baholarni chiqarishda hisobga olinmaydi.

Summativ baholash fanning yaxlit o‘quv bo‘limi mavzularini o‘rganish tugaganidan so‘ng shakllanishi lozim bo‘lgan bilim va ko‘nikmalarining o‘zlashtirish darajasini aniqlash uchun mo‘ljallangan.

Summativ baholash testlar, nazorat ishi, loyiha ishi kabi baholash ishlarini bajarish natijalari bo‘yicha amalga oshiriladi. Summativ baholash uchun qo‘yilgan baholar fan bo‘yicha choraklik, yillik yakuniy baholarini belgilash uchun asos bo‘ladi.

Summativ baholash mezon asosida amalga oshiriladi. Baholash mezonlari haqida o‘quv jarayonining barcha ishtirokchilari: o‘quvchilar, o‘qituvchilar, ota-onalarning oldindan xabarlari bo‘lishi lozim. Baholash mezonlari formativ baholashning ham ajralmas qismidir. Formativ baholashda baholash mezonlari o‘quv materialining (mavzu yoki bo‘limning) ma’lum bir qismiga yo‘naltirilgan bo‘lsa, summativ baholashda ular keng miqyosda qaraladi.

Mezonga asoslangan baholash mexanizmi

O‘qituvchi bajarilgan joriy ish uchun olingan bahoni sinf jurnaliga va o‘quvchining kundaligiga qo‘yadi. Ushbu baho, yuqorida aytib o‘tilganidek, o‘qituvchi uchun ham, o‘quvchi uchun kam ma’lumot beradi. Sinfda formatriv baholashdan foydalanganda o‘qituvchi o‘zining shaxsiy daftariga o‘quvchilar yutuqlarini turli qulay belgilar, piktogramma, ranglar, sharhlar shaklida qayd etib borishi ham mumkin. Bu bilan o‘qituvchi har bir o‘quvchining kamchiliklari va ularni tuzatish yo‘llari, shuningdek, belgilangan o‘quv maqsadlari bilan bog‘liq holda ular rivojlanishining o‘zgarish dinamikasini kuzatib boradi.

Baholashning turli shakllari mavzuviy rejalashtirishda aks ettirilishi kerak. O‘qituvchi chorak boshlanishidan oldin chorak davomida o‘tkazilishi lozim bo‘lgan baholashni rejalashtirishi kerak.

O‘qituvchi baholashni tashkil qilish uchun:

- baholash turlarini belgilaydi;
- baholash shakllarini ishlab chiqadi;
- baholash mezonlarini tuzadi;
- nazorat ishlari vaqtini belgilaydi.

O‘quvchilarning o‘quv-o‘rganish faoliyatini baholash bo‘yicha barcha ma’lumotlarni to‘plash va saqlash, olingan ma’lumotlarni tahlil qilish zarur. Tahlillar har bir o‘quvchining o‘rganish faoliyati va butun sinfning o‘zlashtirishi dinamikasini o‘rganish maqsadida o‘tkazilishi shart.

Formativ baholashda ishning mazmuni va to‘g‘riligi to‘g‘risida yozma yoki og‘zaki qayd qilib boriladi. Natijalar dastlab jurnalga qo‘yilmasligi mumkin. Bu holatda ular o‘quvchi bilan muhokama qilinadi va o‘qituvchining alohida tutgan daftariga qo‘yiladi. O‘quvchilar

o‘qituvchining bu sharhlari asosida ishlarini qayta ko‘rib chiqadilar va xatolarini tuzatadilar. Shundan so‘nggina aniqlashtirilgan baholar jurnalga qo‘yilishi mumkin.

Mavzular blogi yoki bobni o‘rganish tugagandan so‘ng o‘qituvchi summativ baholashni amalga oshiradi. Bunday ish endi baholash mezonlari yordamida amalga oshirilishi lozim bo‘ladi. Chorak davomida o‘qituvchi nazorat ishlari sonini rejalashtirishi kerak bo‘ladi. Summativ baholashlar soni chorak davomida kamida ikkita bo‘lishi maqsadga muvofiq. Ushbu nazorat ishlari o‘quvchilarning berilgan mavzular blogi bo‘yicha bilim va ko‘nikmalarini baholash bo‘yicha tuzilgan topshiriqlardan iborat bo‘ladi. Nazorat ishlari, standart talablari asosida o‘rganilgan bob mavzularining mazmunini iloji boricha to‘liq qamrab olishi shart. O‘qituvchi topshiriqlarni shunday tanlashi kerakki, ular faqat nazariy materialni o‘zlashtirish, ya’ni bilim darajasini emas, balki o‘quvchining o‘zlashtirgan bilimlarini qo‘llash darajasini ham tekshirishi lozim. Shuningdek, o‘quvchilar uchun mulohaza yuritishga doir uchinchi darajali topshiriqlar taklif etilishi lozim bo‘ladi. Nazorat ishlari natijasida olingan baholar, keyingi darsda xatolar ustida ishlagandan so‘ng tuzatishlar bilan jurnalga qo‘yiladi.

Choraklik yakuniy baho o‘rtacha formativ baho va summativ baholar o‘rta arifmetigi sifatida chiqariladi. Yillik yakuniy baho esa 4 ta choraklik baholar va loyiha ishi bahosi o‘rtachasi sifatida olinadi. Agar yil oxirida fan bo‘yicha imtihon (yoki yakuniy nazorat) ham ko‘zda tutilgan bo‘lsa, yillik baho choraklik baholar, loyiha ishi bahosi o‘rtachasi va imtihon (yoki yakuniy nazorat) bahosining o‘rta arifmetigi sifatida olinadi.

Summativ baholash topshiriqlari

Summativ baholash ta’lim muassasasi ma’muriyati tomonidan tuzilgan komissiya tomonidan xolisona o‘tkazish tavsiya etiladi. Baholash muddatlari, mezonlari, topshiriqlar namunalari va baholash bo‘yicha yo‘riqlar oldindan tuzilib, o‘quvchilar va ularning ota-onalariga hamda dars beruvchi o‘qituvchilarga o‘quv yili boshida e’lon qilinishi lozim.

Summativ baholash ikki qismdan iborat bo‘lishi mumkin:

- *test topshirig‘i;*
- *yozma ish.*

Summativ baholashda 100 balli tizim qo‘llanadi va tarkibiy qismlari bo‘yicha ballar quyidagicha taqsimlanadi:

- *test topshirig‘i – 30 ball;*
- *yozma ish – 70 ball.*

Test topshirig‘i 45 minutga mo‘ljallangan bo‘lib, 15-25 ta testdan iborat qilib tuziladi.

Topshiriq quyidagi test turlaridan iborat bo‘lishi mumkin:

– to‘rtta javob variantli, bitta to‘g‘ri javobli yopiq test;

– to‘rttadan ko‘p javob variantli, bir nechta to‘g‘ri javobli yopiq test;

– to‘rtta savolga to‘rtta to‘g‘ri javobni mos qo‘yadigan yopiq test;

– har biriga “To‘g‘ri” yoki “Noto‘g‘ri” deb javob beriladigan, to‘rtta savoldan iborat yopiq test;

– qisqa javobli ochiq test (faqat javobini yozish so‘raladigan masala yoki savol). Test topshirig‘i odatda o‘quvchilarning 1- va 2- darajadagi o‘zlashtirish darajasiga erishganini aniqlash uchun o‘tkaziladi. Shunga mos ravishda har bir test savoli 1 yoki 2 ball bilan baholanadi.

Yozma ish batafsil javobli ochiq test, ya’ni batafsil yechishga mo‘ljallangan to‘laqonli matematika masalalaridan iborat qilib tuziladi. Yozma ish odatda 45 minutga mo‘ljallangan bo‘lib, u quyidagi mazmundagi 3 ta masaladan iborat qilib tuzilishi tavsiya etiladi:

- algebraga doir algoritm asosida yechiladigan masala yoki geometriyadan hisob-

lashga doir masala;

− algebraik mulohaza yuritish yoki geometriyadan isbotlashga doir masala;

− hayotiy vaziyatga doir muammoning matematik modelini tuzish va uni yechishga doir masala.

Yozma ish odatda o‘quvchilarning 2- va 3- darajadagi o‘zlashtirish darajasiga erishganini aniqlash uchun o‘tkaziladi. Yozma ishni baholash mezonlari uning har bir masalasi uchun alohida tuziladi va ballar masalalarning murakkablik darajasidan kelib chiqib o‘zaro taqsimlanadi.

Ballarni bahoga o‘tkazish shkalasi

0 dan – 50 ballgacha – “2” baho,

51 dan – 70 ballgacha – “3” baho,

71 dan – 85 ballgacha – “4” baho,

86 dan – 100 ballgacha – “5” baho.

Loyiha ishini baholash mezonlari

Loyiha ishi haqida yuqorida batafsil ma’lumot berildi. O‘quvchilarning loyiha ishi bo‘yicha faoliyati birgalikda baholanadi. Loyiha ishi ham 100 balli tizimda baholanadi va yuqoridagi shkala yordamida baholarga o‘tkaziladi. Har bir o‘quvchiga loyiha ishi uchun olgan umumiy bahosi qo‘yiladi. Quyida loyiha ishini baholash mezonlari va ularga mos maksimal ballar keltirilgan:

№	Baholash mezonlari	Ballar
1.	Loyiha ishida o‘rganilgan muammolarning ahamiyatliligi va dolzarbligi hamda o‘rganilayotgan mavzuga mosligi	5
2.	Tuzilgan matematik modelning o‘rganilayotgan muammoga mosligi	10
3.	Foydalanilgan tadqiqot usullari va olingan natijalarni qayta ishlash usullarining muammoni o‘rganishga muvofiqligi	20
4.	Muammoga zaruriy va yetarlicha chuqur kirish, boshqa sohalardan bilimlarni jalb etish imkoniyatlaridan foydalanganlik	20
5.	Oraliq va yakuniy xulosalarning asoslanganligi, natijalarning muammo yechimiga yaqinligi	10
6.	Loyiha ishtirokchilarining hamkorlikdagi faolligi	10
7.	Bajarilgan loyiha natijalarini rasmiylashtirish sifati	5
8.	Taqdimot sifati, taqrizchilar savollariga javob bera olish, guruhning har bir ishtirokchisi javoblarining asoslangani	20
	Jami	100

4. GEOMETRIYA DARSLARIDA TARIXIY ILMIY MEROSNING O‘RNI

Respublikamizning kelajagini barpo qiluvchi yosh avlodga hozirgi zamon fanining yangiliklarini, uning murakkab qirralarini o‘rgatish bilan bir qatorda o‘tmish merosimizni o‘rganishga imkoniyat tug‘dirilishi lozim.

Al-Xorazmiy, Abu Nasir Farobiy, Ahmad al-Farg‘oniy, Abu Ali ibn Sino, Abu Rayhon Beruniy, Abul Vafo Buzjoniy, G‘iyosiddin al-Koshiy, Umar Xayyom, Nosiruddin at-Tusiy, Mirzo Ulug‘bek va hozirgi zamon mashhur o‘zbek matematiklarining matematika faniga qo‘shgan hissalari haqida tushuncha berish maqsadga muvofiqdir.

Matematika darslarida tarixiy malumotlardan foydalanish matematika darslarini qiziqarli qiladi, o‘quvchilarning o‘rganilayotgan materiallarga qiziqishini orttiradi, bilimlarni mustahkam egallashlariga yordam beradi.

Tarixiy materiallardan foydalanishning ikki asosiy usuli mavjud: tarixiy materiallardan dars jarayonida foydalanish va ulardan darsdan tashqari ishlarni tashkil etishda foydalanish. Geometrik faktlarni hozirgi zamon faktlari bilan taqqoslash yoki tarixiy masalalar yechish geometriyaning har bir darsida to‘g‘ri kelavermaydi, ammo dars jarayonida tarixiy faktlarga tez-tez murojaat qilib turish lozim. Ammo bularning hammasi o‘quvchilarni o‘rganilayotgan asosiy mavzudan chalg‘itmasligi kerak.Tarixiy masalalardan darsning boshi yoki oxirida foydalangan ma‘qul. Agar o‘qituvchi o‘z sinfiga ishonsa, unda dars davomida ham foydalansa bo‘ladi.

O‘quvchilardan hamma aytilgan tarixiy faktlar, ismlar va yillarni esda saqlashni talab etish shart emas. Darsda ular muammo yoki masalaning qisqacha tarixi bilan tanishishlari, biror kashfiyot ro‘y bergan davrni esga olishlari, yangilik qilgan matematikning ismi va sharifini eshitishlari, agar bo‘lsa, portretini ko‘rishlari kifoya. Bu aytilganlarning hammasi bo‘lmasa-da, bir qismi ularning esida qoladi va o‘qituvchi u o‘qitadigan “fanning quruqligi” haqidagi da’vodan qutuladi, darsning esa anchagina qiziqarli bo‘lishiga erishadi.

Geometriyaning kelib chiqishi. Geometriya dastlab Qadimgi Misr va Bobilda shakllanib, keyinchalik Qadimgi Gretsiyada (Yunonistonda) rivojlandi. Umuman geometriyaning paydo bo‘lishi va rivojlanishi insoniyat taraqqiyoti bilan chambarchas bog‘liqdir. Uning aynan yuksak tsivilizatsiyaga ega bo‘lgan davlatlarda shakllanishi va rivojlanishi ham fikrimizni tasdiqlaydi. Mashhur grek tarixchisi Gerodot (miloddan avvalgi V asr) geometriyaning paydo bo‘lishi haqida bunday deydi: “Misr shohi Seotros har bir misrlikka qur’a bo‘yicha yer maydoni ajratib berar va yer egasidan shu yerga mos soliq undirar edi. Agar Nil daryosi toshib biror kishining yerini yuvib ketsa, u shohga xabar berar va shoh tanobchilar yuborib, u kishining yeri qanchaga kamayganini aniqlatar hamda unga mos ravishda soliqni ham kamaytirar edi. Geometriya mana shunday paydo bo‘lgan va so‘ngra Gretsiyaga o‘tgan”.

Bu haqda grek olimlaridan Yevdem (miloddan avvalgi IV asr) bunday yozadi:”Geometriyani misrliklar kashf etgan, u yer o‘lchash natijasida vujudga kelgan. Bu o‘lchashlar doim yerlarning chegarasini yuvib ketadigan Nil daryosining toshqinlari tufayli hosil bo‘lgan. Bu fan ham boshqa fanlar singari kishilarning ehtiyoji tufayli vujudga kelgan”.

Demak, geometriyani insoniyatning ehtiyoji vujudga keltirgan, ya’ni ular to‘g‘ri chiziqlar o‘tkazishlari, maydonlarning yuzini hisoblashlari, buyumlarning hajmini aniqlashlari zarur bo‘lgan.

Qadimgi misrliklar bir necha yillar davomida asta-sekin turli sohalarda ilmiy ma’lumotlar to‘play boshlagan. Ular ba’zi bir figuralarning yuzlarini, ba’zi jismlarning hajmlarini juda aniq hisoblay olar, ba’zi masalalarning yechish usullarini ham bilishar edi. Biroq fan sifatidagi

geometriya hali ularda mavjud emas edi. Ularda o‘zaro bog‘lanmagan, tartibsiz holdagi juda ko‘p qoidalar mavjud edi.

Miloddan avvalgi VII asr o‘rtalarida Kichik Osiyoning g‘arbiy chegaralari Gretsiyaga qarar edi. Uning o‘rta qismi Ioniya deb atalar, Ioniyada boshqa mamlakatlar bilan savdo-sotiq ishlarini olib boruvchi katta-katta shaharlar juda ko‘p edi. Shunday shaharlardan biri Miletda Fales (miloddan avvalgi 640–548-y.y.) yashagan. U Misrga sayohat qilgan va u yerda turli fanlar bilan tanishgan. Falesni ko‘proq geometriya qiziqtirgan. U Ioniya maktabining asoschisi hisoblanadi. Fales geometriyaga tegishli juda ko‘p kashfiyotlar qilgan. Shuning uchun ham Fales fan tarixida birinchi geometrik olim sifatida tan olinadi.

Misr va Yunoniston o‘rtasida savdo-sotiq ishlari rivojlangan bo‘lib, savdogarlar bilan birga yunon olimlari ham Misrga safar qilib turishgan va misrliklarning turli fanlar sohasida erishgan yutuqlarini o‘rganib qaytishgan. Ular misrliklarning matematika va boshqa fanlardagi bilimlarini faqat o‘rganish bilan chegaralanmasdan, ulardagi kamchiliklarni tuzatib, tartibga solib, nazariy jihatdan to‘ldirib, yaxlit holga keltirishdi. Natijada bundan taxminan 2500 yillar ilgari Yunonistonda geometriya fan sifatida shakllandi.

Shunday qilib, o‘sha davrda Yunonistonda geometriya rivojlana boshladi. Miloddan avvalgi V asrda Gippokrat geometriyadan to‘plangan barcha bilimlarni bitta kitobda sistemali ravishda bayon etishga urinib ko‘rdi. Uning bu asari bizgacha yetib kelmagan.

Miloddan oldingi III asrda Yevklid bu ishni muvaffaqiyatli amalga oshirdi va geometriyaning mustaqil matematik fan sifatida shakllanishiga ulkan va beqiyos hissa qo‘shdi. U o‘zining mashhur “Negizlar” asarida boshlang‘ich tushunchalar va asos sifatida ba’zi aksiomalar va postulatlarni oldi va ulardan mantiqiy yo‘l bilan teoremalarni keltirib chiqardi.

V–VI sinflarda o‘quvchilar geometriyaning ba’zi elementlari bilan tanishgan bo‘lsalar, VII sinfda bu fanni sistemali ravishda o‘rganishni boshlaydilar.

Geometriyaning eng sodda tushunchalari, son tushunchasi singari, kishilarning ehtiyoji tufayli vujudga kelgan. Dastlabki geometrik o‘lchov birliklari inson tanasining biror a’zosi bilan bog‘liq bo‘lgan (masalan, “qarich”, “qadam”, “tirsak” va hokazo).

Mamlakatimiz hududida olib borilgan arxeologik qazish ishlari geometriyaning dastlabki rivojlanishi dehqonchilik, kulolchilik, tikuvchilik ishlari, qurilish va uning texnikasi bilan bog‘liq ekanini ko‘rsatadi. Qazish paytida topilgan turli sopol idishlar, ularga solingan turli-tuman figuralar qadimgi avlod va ajdodlarimiz geometriyadan ancha boxabar ekanligidan dalolat beradi. Ular o‘z turar joylarini turli xil geometrik figuralar – uchburchaklar, ko‘pburchaklar, va spirallar bilan bezaganlarini ko‘ramiz. O‘sha bezaklarda figuralarning tengligi, o‘xshashligi, simmetriyasi va hokazolar uchraydi. Albatta, qadimgi xalqlarda uchraydigan bunday shakllar bevosita tabiatdan olingan.

O‘rta asrlarga kelib, Sharqda ilm-fan yuksak taraqqiyotga erishdi. Xususan, geometriya fani ham yangi kashfiyotlar bilan boyitilib, rivojlana boshladi. Bunda, albatta, O‘rta Osiyodan yetishib chiqqan buyuk olimlarimizning xizmatlari juda kattadir. Al-Xorazmiy, Ahmad al-Farg‘oniy, Abu Nasr Farobiy, Abul Vafo Buzjoniy, Abu Rayhon Beruniy, Abu Ali ibn Sino, G‘iyosiddin Jamshid al-Koshiy, Mirzo Ulug‘bek va boshqa olimlarning ilmiy merosi, hayot yo‘llari haqida, jumladan, geometriyaning rivojiga qo‘shgan hissalari haqida o‘quvchilarimiz zarur ma’lumotlarga ega bo‘lishlari kerak. Bu haqda bilim berish, tushuntirish ma’naviy yetuk, bilimdon, buyuk ajdodlari bilan faxrlanuvchi va ularga munosib voris bo‘lishga intilayotgan barkamol yosh avlodni tarbiyalashda muhim ahamiyatga ega.

I BOB. PLANIMETRIYANI TIZIMLI TAKRORLASH

1-DARS. GEOMETRIYANING MANTIQIY TUZILISHI

I. Standartlar:

– yassi va fazoviy geometrik shakllarni chizma, model va real voqelikda taniy oladi, ularning asosiy xossalarini biladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– geometriya fanining mantiqiy tuzilishini bilish;

Ko‘nikmalar:

– geometriyaga doir misollar keltira olish;

III. Dars mazmunining qisqacha tavsifi:

– geometriya fanining mantiqiy tuzilishi. Planimetriyaning asosini tashkil qilgan aksiomalar tizimi.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	“Geometriya” fani nimani o‘rganadi?	Aqliy hujum	Mavzu bo‘yicha savollar: 1; 2
Bilimlarni boyitish va mustahkamlash	Yevklid geometriyasi deganda nimani tushunasiz?	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3; 4 Amaliy mashq va tatbiq: 1.1; 1.2
	Geometriyaning mantiqiy tuzilishi	Teorema va aksioma bir-biridan nimasi bilan farq qiladi?	Mavzu bo‘yicha savollar: 3; 4 Amaliy mashq va tatbiq: 1.3;
	Geometriyaning aksiomatik tuzilishi	Darslik bilan ishlash	Yevklid va noyevklid geometriyasi bir-biridan nimasi bilan farq qiladi? Mavzu bo‘yicha savollar: 5 Amaliy mashq va tatbiq: 1.4
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	
Uyga vazifa	1. Mavzu bo‘yicha savollar: 6 2. Amaliy mashq va tatbiq: 1.5; 1.6		

1.1. Maktab geometriya kursida quyidagi geometrik shakllarning qaysilari ta’rifsiz qabul qilingan (asosiy) va qaysilariga ta’rif berilgan?

a) nuqta b) burchak c) tekislik d) kesma

e) nur f) to‘g‘ri chiziq g) uchburchak h) o‘tkir burchak

Javob: *a, c, f.*

1.2. Maktab geometriya kursida geometrik shakllarning quyidagi xossalaridan qaysilari aksioma (ya’ni isbotsiz qabul qilingan) va qaysilari teorema (ya’ni ularning to‘g‘riligi isbotlab ko‘rsatilishi shart) sifatida keltirilgan?

a) Har qanday ikki nuqtadan faqat bitta to‘g‘ri chiziq o‘tadi.

b) Qo‘shni burchaklar yig‘indisi 180^o ga teng.

c) Uchburchak ichki burchaklari yig‘indisi 180^o ga teng.

d) Parallelogrammning diagonallari kesishish nuqtasida teng ikkiga bo‘linadi.

e) Bir to‘g‘ri chiziqda olingan istalgan uchta nuqtaning faqat bittasi qolgan ikkitasining orasida yotadi.

f) Tekislikda to‘g‘ri chiziqdan tashqarida olingan nuqtadan bu to‘g‘ri chiziqqa faqat bitta parallel to‘g‘ri chiziq o‘tkazish mumkin.

Javob: Aksioma: *a, e, f;* Teorema: *b, c, d.*

1.3. Quyidagi jumlalarni o‘qing. Jumla to‘g‘ri bo‘lsa “+”, noto‘g‘ri bo‘lsa “–“ belgisini yonidagi katakka qo‘ying.

1	Planimetriya tekislikdagi, stereometriya esa fazodagi geometrik shakllarning xossalarini o‘rganadi.	+
2	Boshlang‘ich (asosiy) geometrik shakllar ta’rifsiz qabul qilinadi.	+
3	Tekislikda to‘g‘ri chiziqdan tashqarida olingan nuqtadan bu to‘g‘ri chiziqqa istalgancha parallel to‘g‘ri chiziq o‘tkazish mumkin.	–
4	Yevklid o‘zining “Negizlar” asarida geometriyaga oid barcha yutuqlarini jamlab, uning rivojiga ulkan hissa qo‘shgan.	–

1.4. Geometriya fani rivojiga kimlar qanday hissa qo‘shishgan? Quyidagi jadvalning birinchi ustunida keltirilgan olimlar nomlariga ikkinchi ustundagi ular amalga oshirgan ishlarni moslab qo‘ying.

1	Umar Hayyom	A	Noyevklid geometriyasini yaratgan.
2	N.I.Lobachevskiy	B	Yevklidning V postulatiga aniqlik kiritish bo‘yicha tadqiqotlar olib borgan.
3	Bernxard Riman	C	Geometriyani fan sifatida tavsiflagan.
4	Yevklid	D	Noyevklid geometriyasini tavsiflashda katta ishlar qilgan.

Javob: 1 – B, 2 – A, 3 – D, 4 – C,

1.5. Quyidagi tasdiqlarning qaysi birini V postulat sifatida Evklid tavsiflagan? Ularning qaysilari bu postulatga teng kuchli hisoblanadi?

A) Bir tekislikda yotgan ikki to‘g‘ri chiziqni uchinchi to‘g‘ri chiziq kesib, bir tomonli ichki burchaklar hosil qilsa va burchaklar yig‘indisi ikki to‘g‘ri burchakdan kichik bo‘lsa, mazkur to‘g‘ri chiziqlar davom ettirilganda, ular yig‘indisi ikki to‘g‘ri burchakdan kichik burchaklar tomonida kesishadi.

B) a va b to‘g‘ri chiziqlarni kesuvchi kesib o‘tganda hosil bo‘lgan ichki bir tomonli a va b burchaklar uchun $a + b$ bo‘lsa, u holda berilgan to‘g‘ri chiziqlar shu burchaklar yotgan tomonda kesishadi.

C) Tekislikda to‘g‘ri chiziqdan tashqarida olingan nuqtadan bu to‘g‘ri chiziqqa faqat bitta parallel to‘g‘ri chiziq o‘tkazish mumkin.

D) Har qanday ikki nuqtadan faqat bitta to‘g‘ri chiziq o‘tkazish mumkin.

Javob: A, D.

2-DARS. GEOMETRIK MASALALAR VA ULARNI YECHISH USULLARI

I. Standartlar:

– yassi va fazoviy geometrik shakllarni chizma, model va real voqelikda taniy oladi, ularning asosiy xossalarini biladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– geometrik masalalar yechishning analitik va sintetik usullarini bilish.

Ko‘nikmalar:

– masalalar yechishda analitik va sintetik usullarini qo‘llay olish.

III. Dars mazmunining qisqacha tavsifi:

– geometrik masalalar yechishning turli usullari.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– chizg‘ich, qalam.

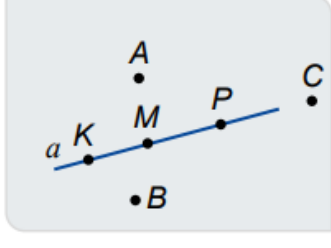
V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Geometrik masalalarni yechishning qanday usullarini bilasiz?	Aqliy hujum	Mavzu bo‘yicha savollar: 1

Bilimlarni boyitish va mustahkam-lash	Geometrik masalalar turlari	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 2.1, 2.2
	Geometrik masalalarni yechishning turli usullari	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 2.3-2.5
	masalalarni yechishning sintetik va analitik usuli	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 2.6-2.8
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	
Uyga vazifa	Amaliy mashq va tatbiq: 2.9-2.11		

2.1. Rasmdan foydalanib to‘g‘ri matematik tasdiqni tanlang.

A) $A \in a$ B) $K \notin a$ C) $C \in a$ D) $M \notin a$



a to‘g‘ri chiziqni davom ettirish orqali C nuqta a to‘g‘ri chiziqqa tegishli ekanligini ko‘rishimiz mumkin.

Javob: C.

2.2. Bitta to‘g‘ri chiziqda A, B, C nuqtalar shunday tanlanganki, $AB = 2{,}7$ dm, $BC = 1{,}3$ dm, $AC = 1{,}3$ dm. Bitta nuqtaning qolgan ikkitasi orasida yotishi haqidagi to‘g‘ri tasdiqni aniqlang.

A) $A \in BC$ B) $B \in AC$ C) $C \in AB$ D) $C \notin AB$

$AC + BC = AB$ $1{,}3 \text{ dm} + 1{,}3 \text{ dm} = 2{,}7 \text{ dm}$ $2{,}6 \text{ dm} \neq 2{,}7 \text{ dm}$

Javob: D.

2.3. AC kesma BC kesmadan 3 marta uzun. Bu munosabat ko‘rsatilgan ikkita bandni aniqlang.

A) $AC = 3 \cdot BC$; B) $3 \cdot AC = BC$; C) $AC + BC = 4 \cdot AC$; D) $BM = \frac{1}{3} AM$.

$BC = 3 \cdot AC$; $AC + BC = 4 \cdot AC$; $BC = 4 \cdot AC - AC = 3 \cdot AC$.

Javob: B, C.

2.4. AC kesma BC kesmadan 2 cm ga qisqa. Bu munosabat ko‘rsatilgan ikkita bandni aniqlang.

A) $AC - BC = 3$ cm B) $BC - AC = 2$ cm

C) $AC - 2$ cm $= BC$ D) $AC + 2$ cm $= BC$

A) $AC - BC = 3$ cm; $AC = BC + 3$ cm. AC kesma BC kesmadan 3 cm uzun.

B) $BC - AC = 2$ cm; $AC = BC - 2$ cm. AC kesma BC kesmadan 2 cm qisqa.

C) $AC - 2$ cm $= BC$; $AC = BC + 2$ cm. AC kesma BC kesmadan 2 cm uzun.

D) $AC + 2\ cm = BC;\quad AC = BC - 2\ cm.$ *AC kesma BC kesmadan 2 cm qisqa.*

Javob: *B, D.*

2.5. *A, B, C* nuqtalarning qaysi biri qolgan ikkitasining orasida yotganligini aniqlang.

1) $AC = 3,\quad AB = 8,\quad BC = 5.$

$AC + BC = AB;\quad 3 + 5 = 8;\quad 8 = 8.$

Javob: *C nuqta A va B nuqtalar orasida yotadi.*

2) $AC = 7,\quad BC = 12,\quad AB = 19.$

$AC + BC = AB;\ 7 + 12 = 19;\quad 19 = 19.$

Javob: *C nuqta A va B nuqtalar orasida yotadi.*

3) $AC = 27\ m,\quad BC = 5\ m,\quad AB = 22\ m;$

$AB + BC = AC;\ 22\ m + 5\ m = 27\ m;\ 27\ m = 27\ m.$

Javob: *B nuqta A va C nuqtalar orasida yotadi.*

4) $AC = 9\ mm,\quad BC = 21\ mm,\quad AB = 12\ mm;$

$AB + AC = BC;\quad 12\ mm + 9\ mm = 21\ mm;\quad 21\ mm = 21\ mm.$

Javob: *A nuqta B va C nuqtalar orasida yotadi.*

5) $AC = 21\ m,\quad BC = 37\ m,\quad AB = 16\ m;$

$AB + AC = BC;\quad 16\ m + 21\ m = 37\ m;\quad 37\ m = 37\ m.$

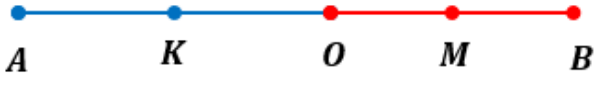
Javob: *A nuqta B va C nuqtalar orasida yotadi.*

6) $BC = 18\ dm,\quad AC = 33\ dm,\quad AB = 15\ dm;$

$AB + BC = AC;\quad 15\ dm + 18\ dm = 33\ dm;\quad 33\ dm = 33\ dm.$

Javob: *B nuqta A va C nuqtalar orasida yotadi.*

2.6. *AB* kesmani *O* nuqta uzunligi 18 *cm* va 14 *cm* bo‘lgan bo‘laklarga bo‘ladi. Agar *K* va *M* nuqtalar *AO* va *BO* kesmalarning o‘rtasi bo‘lsa, *KM* kesma uzunligini toping.



$AO = 18\ cm;\quad OB = 14\ cm.$

$AK = KO;\quad OM = MB;\quad KM = ?$

$$AK = KO = \frac{AO}{2} = \frac{18\ cm}{2} = 9\ cm;$$

$$OM = MB = \frac{OB}{2} = \frac{14\ cm}{2} = 7\ cm;$$

$$KM = KO + OM = 9\ cm + 7\ cm = 16\ cm.$$

$$= 16\ cm.$$

Javob: KM

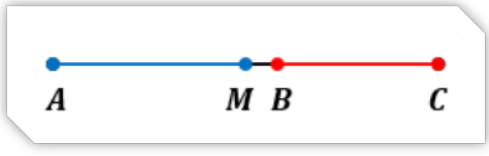
2.7. Uzunligi 48 *dm* bo‘lgan kesmada *O* nuqta belgilangan. Agar *AO*:*BO* – 3:5 bo‘lsa, *AO* va *BO* kesmalarning uzunliklarini toping.



$AB = 48\ dm;\ AO = 3x;\ BO = 5x;$
Topish kerak: $AO = ?;\ BO = ?$

Yechish: $AO + BO = AB;\ \ 3x + 5x = 48\ dm;\ \ 8x = 48;\ \ \ x = 6\ dm;$
$AO = 3x = 3 \cdot 6\ dm = 18\ dm;\ \ BO = 5x = 5 \cdot 6\ dm = 30\ dm.$
Javob: $AO = 18\ dm;\ \ BO = 30\ dm;$

2.8. *A, B, C, M* nuqtalar bitta to‘g‘ri chiziqda yotadi va *AC* = 12 *m*, *CB* = 5 *m*, *M* esa *AC* kesmaning o‘rtasi. *MB* kesma uzunligini toping.

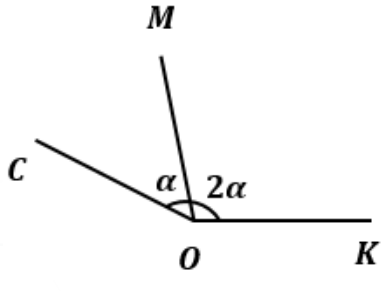


$$AM = MC = \frac{AC}{2} = \frac{12\ cm}{2} = 6\ cm;$$

$MB = MC - CB = 6\ cm - 5\ cm = 1\ cm.$
Javob: $MB = 1\ cm.$

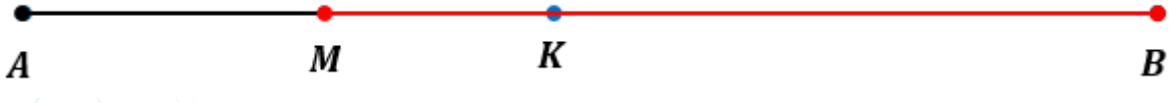
Uy vazifasi

2.9. $\angle KOC = 153°$. *OM* nur burchak tomonlari orasidan o‘tadi. Agar $\angle KOM = 2 \cdot \angle MOC$ bo‘lsa, *KOM* va *MOC* burchaklarni toping.



Berilgan: $\angle KOC = 153°;\ \ \angle KOM = 2 \cdot \angle MOC.$
Topish kerak: $\angle KOM = ?,\ \angle MOC = ?$
$\angle KOM + \angle MOC = \angle KOC;\ \ 2\alpha + \alpha = 153°;$
$3\alpha = 153°;\ \ \alpha = 51°.\ \ \angle MOC = \alpha = 51°;$
$\angle KOM = 2\alpha = 2 \cdot 51° = 102°$

2.10*. Uzunligi 75 *cm* bo‘lgan *AB* kesmada *M* va *K* nuqtalar belgilangan. Bunda *M* ∈ *AK*, *K* ∈ *MB*. Shuningdek, *AM* kesma *MK* kesmadan 5 *cm* uzun, *KB* esa *AM* dan 2 marta uzun. Hosil bo‘lgan 5 ta kesma uzunliklarini toping.



Berilgan: $AM = MK + 5;\ \ KB = 2 \cdot AM;\ \ AM + MK + KB = 75;$
Topish kerak: $AM, MK, KB, AK, MB - ?$

$MK = AM - 5;\ AM = x;\ \ x + x-5 + 2x = 75;\ \ 4x = 80;\ \ x = 20;$
$AM = 20;\ \ MK = AM - 5 = 20-5 = 15;\ \ KB = 2 \cdot AM = 2 \cdot 20 = 40;$
$AK = AM + MK = 20 + 15 = 35;\ \ \ MB = MK + KB = 15 + 40 = 55.$
Javob: $AM = 20\ cm;\ MK = 15\ cm;\ \ KB = 40\ cm;\ AK = 35\ cm;\ MB = 55\ cm.$

3-DARS. GEOMETRIK MASALALAR VA ULARNI YECHISH USULLARI

I. Standartlar:

– yassi va fazoviy geometrik shakllarni chizma, model va real voqelikda taniy oladi, ularning asosiy xossalarini biladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– geometrik masalalar yechishning to‘g‘ri va teskari, algebraik usullarini bilish;

Ko‘nikmalar:

– masalalar yechishda to‘g‘ri va teskari, algebraik usullarini qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– geometrik masalalar yechishning turli usullari.

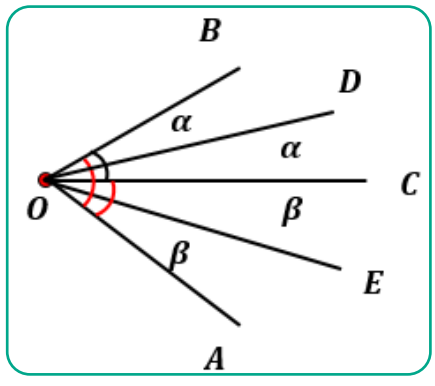
IV. Dars ashyolari va ko‘rgazmali qurollar:

– chizg‘ich, qalam.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Masalalarni yechishda eng maqbul usul qaysi deb hisoblaysiz?	Aqliy hujum	Mavzu bo‘yicha savollar: 5
Bilimlarni boyitish va mustahkam-lash	Geometrik masalalarni yechishning to‘g‘ri va teskari usullari	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 6 Amaliy mashq va tatbiq: 2.12; 2.13
	teskarisini faraz qilib isbotlash usuli	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 7 Amaliy mashq va tatbiq: 2.14-2.15
	Geometrik masalani algebraik usul bilan yechish algoritmi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 8 Amaliy mashq va tatbiq: 2.16-2.18
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	
Uyga vazifa	Amaliy mashq va tatbiq: 2.19-2.23		

2.11*. Burchak tomonlari orasidan o‘tgan nur uni ikkita burchakka ajratadi. Bu burchaklar bissektrisalari orasidagi burchak berilgan burchakdan 2 marta kichik ekanligini isbotlang.

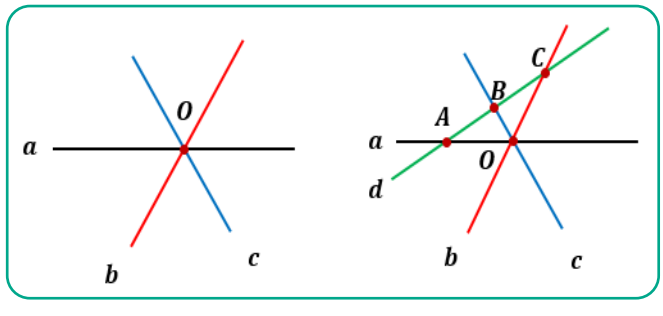


$\angle BOD = \angle DOC = \alpha;\ \angle AOE = \angle EOC = \beta;$
$\angle BOC = \angle BOD + \angle DOC = \alpha + \alpha = 2\alpha;$
$\angle AOC = \angle AOE + \angle EOC = \beta + \beta = 2\beta$
$\angle AOB = \angle AOC + \angle BOC = 2\beta + 2\alpha = 2\alpha + 2\beta;$
$\angle AOB = 2(\alpha + \beta).$

$$\angle DOE = \angle DOC + \angle EOC = \alpha + \beta = \frac{\angle AOB}{2}$$

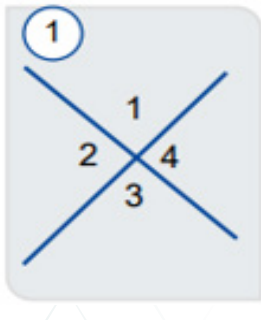
Demak, $\angle DOE = \frac{\angle AOB}{2}$ isbot bo‘ldi.

2.12*. *a, b, c* va *d* to‘g‘ri chiziqlar berilgan. Ularning har uchtasi bitta nuqtada kesishadi. Barcha to‘g‘ri chiziqlarning bitta nuqtadan o‘tishini isbotlang.



a, b, c to‘g‘ri chiziqlar O nuqtada kesishsin. Agar d to‘g‘ri chiziq O dan boshqa nuqtadan o‘tsa, A, B, C nuqtalardan hech birida uchta to‘g‘ri chiziq kesishmagan. Ya’ni masala shartiga zid. Demak, d to‘g‘ri chiziq ham O nuqtadan o‘tadi.

2.13. Ikki to‘g‘ri chiziqning kesishishidan to‘rtta burchak hosil bo‘ldi. Quyida keltirilgan jadvalda har bir shart (*A–E*)ga undan kelib chiquvchi xulosa *(1–5)*ni moslab qo‘ying.



A) $\angle 1 = \angle 3$
B) $\angle 2 + \angle 3 = 180°$
C) $\angle 1 = \angle 2 = 90°$
D) $\angle 2 + \angle 4 = 260°$
E) $\angle 3 = 90°$

1) $\angle 3 = \angle 4 = 90°$
2) $\angle 1 = \angle 2 = \angle 4 = 90°$
3) $\angle 1$ va $\angle 4$ - qo‘shni
4) $\angle 1$ va $\angle 3$ - o‘tkir
5) $\angle 2$ va $\angle 4$ - vertikal

Javob:

A	B	C	D	E
4	3	2	5	1

2.14. Quyida ba'zi burchaklarning gradus o'lchovlari (1–7) berilgan. Ulardan qaysi juftlari qo'shni bo'lishi mumkinligini aniqlang.

1) $18°$ 2) $72°$ 3) $128°$ 4) $62°$ 5) $28°$ 6) $108°$; 7) $38°$.

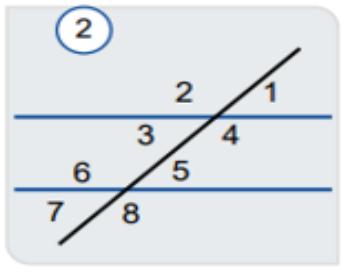
A) 1 va 2 B) 2 va 6 C) 3 va 4 D) 1 va 7 E) 2 va 5.

Qo'shni bo'lishi uchun ularning yig'indisi 180^o ga teng bo'lishi kerak.

Javob: B.

2.15. Agar 2 – rasmda $\angle 1 = \angle 7$ bo'lsa, to'g'ri tasdiqni toping.

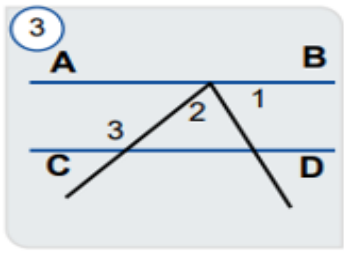
A) $a \parallel b$ *B)* $a \perp b$ *C)* a va b kesishmaydi.



Vertikal burchaklar teng. $\angle 1 = \angle 3 = \angle 5 = \angle 7$,
$\angle 2 = \angle 4 = \angle 6 = \angle 8$,
Mos burchaklar teng. $\angle 1 = \angle 5$, $\angle 2 = \angle 6$,
$\angle 4 = \angle 8$, $\angle 3 = \angle 7$.
Demak, $a \parallel b$ va a va b kesishmaydi.
Javob: A va C.

2.16. Agar quyidagi rasmda $CD = AB$, $\angle 1 = \angle 2$ va $\angle 2 = 72°$ bo'lsa, $\angle 3 = ?$

A) 72^o *B)* 144^o *C)* 108^o *D)* 36^o *E)* 124^o.



Berilgan: $CD \parallel AB$; $\angle 1 = \angle 2$; $\angle = 72°$. $\angle 3 = ?$
$\angle 3 = \angle 1 + \angle 2 = 72° + 72° = 144°$.
$\angle 3 = 144°$. **Javob:** B.

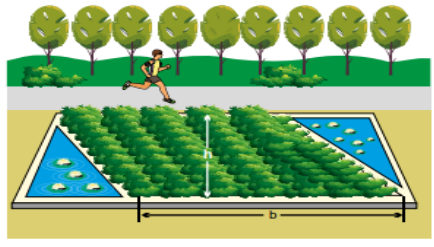
Uy vazifasi

2.22. Doira shaklidagi stol sirtining yuzini toping *(1 fut = 30,48 cm)*.



Berilgan: $r = 2,7$ *fut*; $(1$ *fut* $= 30,48$ *cm*$)$.
Topish kerak: $S = ?$
$r = 2,7$ *fut* $= 2,7 \cdot 1$ *fut* $= 2,7 \cdot 30,48$ *cm* $= 82,296$ *cm*.
$S = \pi r^2 = \pi \cdot (82,296\ cm)^2 = 6772,631616\pi\ cm^2$.
Javob: $S = 6772,631616\pi\ cm^2$.

2.23. Agar $h = 3\ m$ va $b = 6\ m$ bo‘lsa, rasmdagi gulzor yuzini toping.



Berilgan: $h = 3\ m;\ b = 6\ m.$
Topish kerak: $S = ?$
$S = b \cdot h = 3\ m \cdot 6\ m = 18\ m^2.$

4-DARS. GEOMETRIK MASALALAR VA ULARNI YECHISH USULLARI

I. Standartlar:

Yassi va fazoviy geometrik shakllarni chizma, model va real voqelikda taniy oladi, ularning asosiy xossalarini biladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

— geometrik masalalar yechishning yuzlar, vektorlar, koordinatalar hamda geometrik almashtirishlar usullarini bilish;

Ko‘nikmalar:

— masalalar yechishda yuzlar, vektorlar, koordinatalar hamda geometrik almashtirishlar usullarini qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

— geometrik masalalar yechishning turli usullari.

— IV. Dars ashyolari va ko‘rgazmali qurollar:

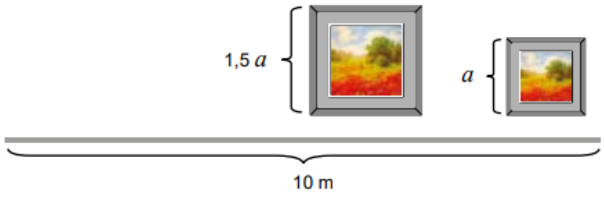
— chizg‘ich, qalam.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Masalalarni yechish usuli qanday tanlanadi?	Aqliy hujum	Mavzu bo‘yicha savollar: 9
Bilimlarni boyitish va mustahkamlash	Geometrik masalalarni yechishda yuzlarni hisoblash formulalaridan foydalanish	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 10 Amaliy mashq va tatbiq: 2.24, 2.25
	Geometrik masalani vektorlar usuli bilan yechish	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 11 Amaliy mashq va tatbiq: 2.26, 2.27

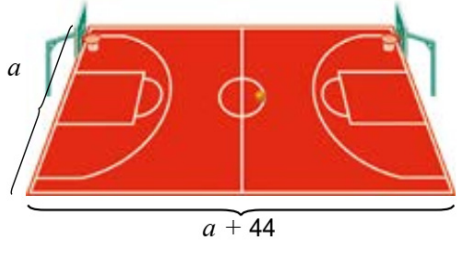
	geometrik masalani koordinatalar usuli bilan yechish; geometrik almashtirishlar usuli	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 12 Amaliy mashq va tatbiq: 2.28
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 2.29
Uyga vazifa	Amaliy mashq va tatbiq: 2.30 – 2.33		

2.24. Kvadrat shaklidagi romlar uchun 10 *m* reyka ishlatilgan bo‘lsa, har bir rom o‘lchamlarini toping.



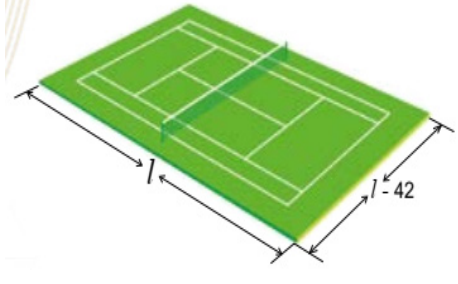
Berilgan: $P = 10\ m.$
1-rom: $P_1 = 4 \cdot 1{,}5a = 6a;$
2-rom: $P_2 = 4 \cdot a = 4a;$
Javob: $P_1 + P_2 = P;\quad 6a + 4a = 10\ m.$

2.25. Basketbol maydonining perimetri *288 fut*, bo‘yi esa enidan *44 fut* uzun bo‘lsa, maydon o‘lchamlarini metrlarda toping *(1 fut = 30,48 cm)*.



Berilgan: $P = 288\ fut;\ b = a + 44\ fut;$
$1\ fut = 30{,}48\ m.$ Topish kerak: $a = ?,\ b = ?$
$2(a + b) = P;\quad 2(a + a + 44) = 288;$
$2(2a + 44) = 288;\quad 4a + 88 = 288;$
$4a = 288 - 88;\quad 4a = 200;\quad a = 50;$
$b = a + 44 = 50 + 44 = 94;$
$a = 50\ fut = 50 \cdot 1\ fut = 50 \cdot 30{,}48\ cm = 1524\ cm = 15{,}24\ m;$
$b = 94\ fut = 94 \cdot 1\ fut = 94 \cdot 30{,}48\ cm = 2865{,}12\ cm = 28{,}6512\ m.$
Javob: $a = 15{,}24\ m;\ b = 28{,}6512\ m.$

2.26. Tennis kortining perimetri *288 fut*, bo‘yi esa enidan *42 fut* uzun bo‘lsa, maydon o‘lchamlarini metrlarda toping *(1 fut = 30,48 cm)*.



Berilgan: $P = 288\ fut;\ b = a\text{-}42\ fut;$
$1\ fut = 30{,}48\ m.$ Topish kerak: $a=?,\ b = ?$
$2(a + b) = P;\quad 2(a + a\text{-}42) = 288;$
$2(2a - 42) = 288;\quad 4a\text{-}84 = 288;$
$4a = 288 + 84;\quad 4a = 372;\quad a = 93;$

$b = a-42 = 93 - 42 = 51;$

$b = 51\ fut = 51 \cdot 1\ fut = 51 \cdot 30{,}48\ cm = 1554{,}48\ cm = 15{,}5448\ m;$

$a = 93\ fut = 93 \cdot 1\ fut = 93 \cdot 30{,}48\ cm = 2834{,}64\ cm = 28{,}3464\ m.$

Javob: $a = 28{,}3454\ m;\quad b = 15{,}5448\ m.$

2.27. Avtomobillar to‘xtash joyidagi teng yonli uchburchak shaklidagi maydonchaning yuzi *288 fut²* va asosi *16 fut* bo‘lsa, uning balandligini toping (*1 fut – 30,48 cm*).



Berilgan: $S = 288\ fut^2;\ a = 16\ fut;$ $1\ fut = 30{,}48\ cm.$ **Topish kerak:** $h = ?$

$$h = \frac{S}{a} = \frac{288\ fut^2}{16\ fut} = 18\ fut$$

$h = 18\ fut = 18 \cdot 1\ fut = 18 \cdot 30{,}48\ cm = 548{,}64\ cm.$

Javob: $h = 548{,}64\ cm.$

2.28. Rasmdagi HD televizori ekranining bo‘yi va eni uzunliklari nisbati 16:9 kabi bo‘ladi. Diagonali 70 dyuym bo‘lgan HD televizori o‘lchamlarini cm larda toping *(1 dyuym = 2,54 cm)*.



Berilgan: $a = 16x;\ b = 9x;\ d = 70\ dyuym;$

$(1\ dyuym = 2{,}54\ cm)$. Topish kerak: $a = ?,\quad b = ?$

$a^2 + b^2 = d^2;\quad (16x)^2 + (9x)^2 = 702;$

$256x^2 + 81x^2 = 4900;\qquad 337x^2 = 4900;$

$$x^2 = \frac{4900}{337};\ x = \sqrt{\frac{4900}{337}} \approx \frac{70}{18{,}36} \approx 3{,}81 \approx 4.$$

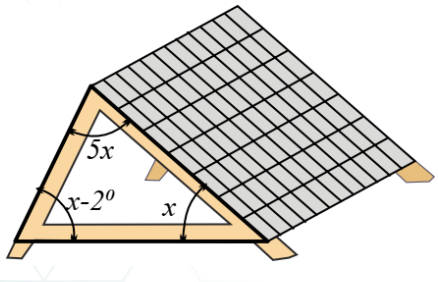
$a = 16x = 16 \cdot 4\ dyuym = 64 \cdot 1\ dyuym = 64 \cdot 2{,}54\ cm = 162{,}56\ cm;$

$b = 9x = 9 \cdot 4\ dyuym = 36 \cdot 1\ dyuym = 36 \cdot 2{,}54\ cm = 91{,}44\ cm.$

Javob: $a = 162{,}56\ cm;\ b = 91{,}44\ cm.$

2.29. Rasmlardagi tomlar burchaklarini toping.

a)



$\angle A = x - 2°;\ \angle B = x;\ \angle C = 5x.$

$\angle A + \angle B + \angle C = 180°;$

$x - 2° + x + 5x = 180°;\ 7x - 2° = 180°;$

$7x = 180° + 2°;\ 7x = 182°;\ x = 26°;$

$\angle B = 26°;\ \angle A = x - 2° = 26° - 2° = 24°;$

$\angle C = 5x = 5 \cdot 26° = 130°.$

Javob: $24°;\ 26°;\ 130°.$

b)



$\angle A = x;\quad \angle B = x + 20°;\quad \angle C = 2x.$

$\angle A + \angle B + \angle C = 180°;$

$x + x + 20° + 2x = 180°;\quad 4x + 20° = 180°;$

$4x = 180° - 20°;\quad 4x = 160°;\quad x = 40°;$

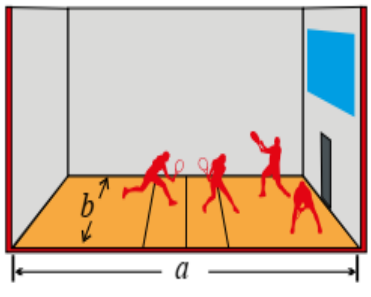
$\angle A = 40°;\quad \angle B = x + 20° = 40° + 20° = 60°;$

$\angle C = 2x = 2 \cdot 40° = 80°.$

Javob: $40°;\ 60°;\ 80°.$

Uy vazifasi

2.30. Yopiq sport maydonining perimetri *120 fut*, bo‘yi esa enidan ikki marta uzun bo‘lsa, maydon o‘lchamlarini metrlarda toping *(1 fut = 30,48 cm)*



Berilgan: $P = 120\ fut;\ b = 2a;\ 1\ fut = 30{,}48\ cm.$

Topish kerak: $a = ?,\ b = ?$

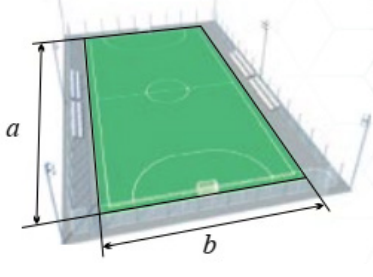
$2(a + b) = P;\ 2 \cdot (a + 2a) = 120;\ 3a = 60;$

$a = 20\ fut = 20 \cdot 30{,}48\ cm = 609{,}6\ cm = 6{,}096\ m;$

$b = 2a = 2 \cdot 20\ fut = 40\ fut = 40 \cdot 30{,}48 = 1219{,}2\ cm = 12{,}192\ m.$

Javob: $a = 6{,}096\ m;\ b = 12{,}192\ m.$

2.31. Futbol maydonining perimetri *340 m*, bo‘yi esa enidan *50 m* uzun bo‘lsa, maydon o‘lchamlarini toping.



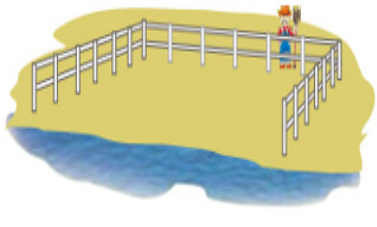
Berilgan: $P = 340\ m;\ b = a + 50\ m.$

Topish kerak: $a = ?,\ b = ?$

$2(a+b) = P;\ a+b=\frac{P}{2};\ a+a+50=\frac{340}{2};$

$2a+50 = 170;\quad 2a = 170-50;\quad 2a = 120;$

2.32. Fermer daryo bo‘yida to‘g‘ri to‘rtburchak shaklidagi maydonni panjara bilan o‘rab olmoqchi. 100 m uzunlikdagi panjara bilan qanday o‘lchamdagi eng katta yuzli maydonni o‘rab olish mumkin?



Berilgan: $P = 100\ m.$ Topish kerak: $S = ?$

$$\begin{cases} 2a + b = P \\ a \cdot b = -S \end{cases} \rightarrow \begin{cases} 2a + b = 100 \\ a \cdot b = S \end{cases}$$

5-DARS. BOBNI TAKRORLASHGA DOIR AMALIY MASHQLAR

I. Standartlar:

– yassi va fazoviy geometrik shakllarni chizma, model va real voqelikda taniy oladi, ularning asosiy xossalarini biladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– geometrik masalalar yechishning turli usullarini bilish;

Ko‘nikmalar:

– masalalar yechishda turli usullarini qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– geometrik masalalar yechishning turli usullari.

IV. Dars ashyolari va ko‘rgazmali qurollar:

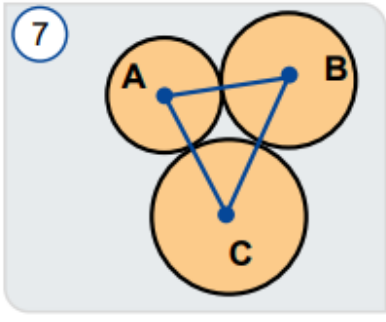
– chizg‘ich, qalam.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Masalalarni yechish qanday usullardan foydalangan ma’qul?	Aqliy hujum	Amaliy mashq va tatbiq: 3.1–3.5
Bilimlarni boyitish va mustahkam-lash	Qanday turdagi masalalarni yechishda yuzlarni hisoblash formulalaridan foydalaniladi?	Darslik bilan ishlash	Mavzu bo‘yicha savollar: masalalarni yechishning qulay usulini tanlang va tushuntiring. Amaliy mashq va tatbiq: 3.6 – 3.8
	Vektorlar usulidan qaysi turdagi masalalarni yechishda foydalanish mumkin?	Darslik bilan ishlash	Amaliy mashq va tatbiq: 3.9 – 3.10
	Geometrik almashtirishlar usuli	Darslik bilan ishlash	Amaliy mashq va tatbiq: 3.11–3.12
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 3.13
Uyga vazifa	Amaliy mashq va tatbiq: 3.14 – 3.17		

3.1. **Uchburchakning uchlari radiuslari *6 cm*, *7 cm* va *8 cm* bo‘lgan va jufti-jufti bilan urinadigan uchta aylana markazlarida yotibdi. Bu uchburchakning perimetrni toping.**

A) 28 cm ***B) 29 cm*** ***C) 27 cm*** ***D) 42 cm***



Berilgan: $r_1 = 6\ cm;\ \ r_2 = 7\ cm;\ \ r_3 = 8\ cm.$

Topish kerak: $P_{ABC} = ?$

$AB = r_1 + r_2 = 6\ cm + 7\ cm = 13\ cm;$

$BC = r_2 + r_3 = 7\ cm + 8\ cm = 15\ cm;$

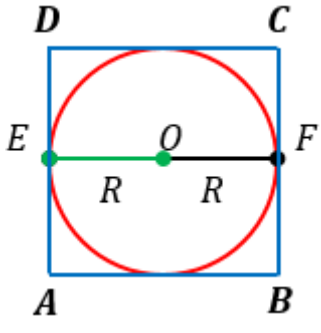
$AC = r_1 + r_3 = 6\ cm + 8\ cm = 14\ cm.$

$P_{ABC} = AB + BC + AC = 13\ cm + 15\ cm + 14\ cm = 42\ cm.$

$P = 42\ cm.$ **Javob:** $D.$

3.2. **Kvadratning tomoni $20\sqrt{2}$ ga teng. Bu kvadratga ichki chizilgan aylana radiusini toping.**

A) 20; ***B)*** $10\sqrt{2}$; ***C)*** 10; ***D)*** $5\sqrt{2}$;



Berilgan: $a = AB = BC = CD = AD = 20\sqrt{2};$

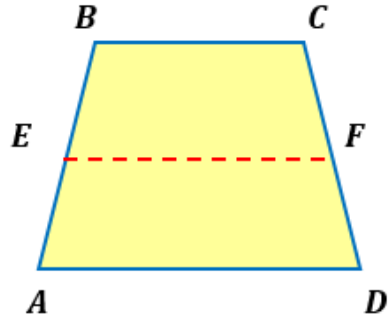
$R = EO = OF;$ $\qquad R = \frac{EF}{2} = \frac{20\sqrt{2}}{2} = 10\sqrt{2}.$

$R = 10\sqrt{2}.$

Javob: $A.$

3.3. **Trapetsiyaning bitta asosi ikkinchisidan *8 cm* ga uzun, o‘rta chizig‘i esa *10 cm* ga teng. Trapetsiyaning kichik asosini toping.**

A) 2 cm *B) 4 cm* *C) 6 cm* *D) 8 cm*



Berilgan: $BC = x\ cm;\ \ AD = x + 8\ cm;$

$EF = 10\ cm.$ Topish kerak: $BC = ?$

$\frac{BC + AD}{2} = EF;$ $\qquad \frac{x + x + 8}{2} = 10;$ $\qquad \frac{2x + 8}{2} = 10;$

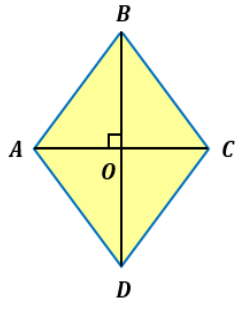
$x + 4 = 10;\ \ x = 10 - 4;\ \ \ x = 6\ cm.$

$BC = 6\ cm.\ \ AD = x + 8 = 6 + 8 = 14\ cm.$

Javob: $C.$

3.4. **Diagonallari *10 m* va *36 m* bo‘lgan rombning yuzini toping.**

A) 90 m^2 B) *92 m^2* C) *180 m^2* D) *184 m^2*



Berilgan: $d_1 = 10\ m;\quad d_2 = 36\ m.$

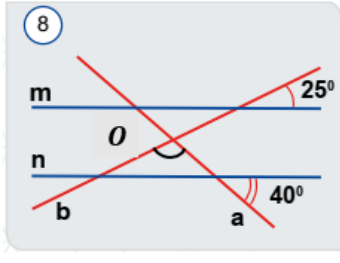
Topish kerak: $S = ?$

$$S = \frac{1}{2} d_1 \cdot d_2 = \frac{1}{2} \cdot 10 \cdot 36 = \frac{360}{2} = 180\ cm^2.$$

$S = 180\ cm^2.$ **Javob:** $C.$

3.5. **Rasmdagi m va n to‘g‘ri chiziqlar o‘zaro parallel bo‘lsa, a va b to‘g‘ri chiziqlar orasidagi burchakni toping.**

A) $50^o;$ B) $80^o;$ C) $100^o;$ D) $115^o.$



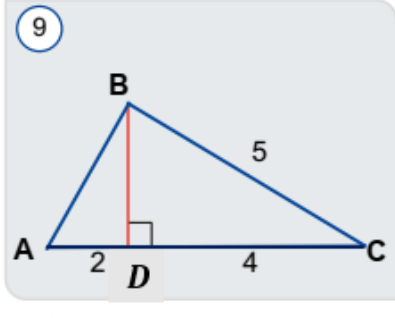
Yechilishi:

$\angle aOb = 180° - (25° + 40°) = 180° - 65° = 115°.$

Javob: E

3.6. **Rasmdagi uchburchak yuzini toping.**

A) 6 **B)** 9 **C)** 12 **D)** 24



Berilgan: $AD = 2;\ CD = 4;\ BC = 5.$

Topish kerak: $S_{ABC} = ?$

$$BD = \sqrt{BC^2 - CD^2} = \sqrt{5^2 - 4^2} =$$

$$= \sqrt{25 - 16} = \sqrt{9} = 3.$$

$$AC = AD + CD = 2 + 4 = 6.$$

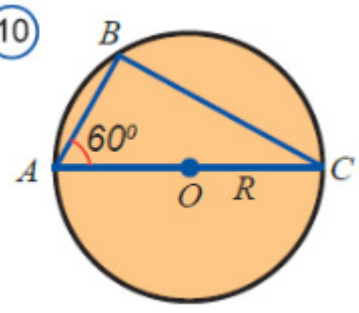
$$S_{ABC} = \frac{AC \cdot BD}{2} = \frac{6 \cdot 3}{2} = \frac{18}{2} = 9.$$ **Javob:** $B.$

3.7. **10-rasmdagi R radiusli aylanaga ichki chizilgan ABC uchburchakning BC tomonini toping.**

A) $R;$ **B)** $R\frac{\sqrt{2}}{2};$ **C)** $R\sqrt{2};$ **D)** $R\sqrt{3};$

$\angle A = 60°;\ \angle C = 90° - \angle A = 90° - 60° = 30°.$

10



$AC = AO + OC = R + R = 2R;$

$AB = \frac{1}{2} \cdot AC = \frac{1}{2} \cdot 2R = \frac{2R}{2} = R.$

$BC = \sqrt{AC^2 - AB^2} = \sqrt{(2R)^2 - R^2} =$

$= \sqrt{(4R^2 - R^2} = \sqrt{3R^2} = R\sqrt{3}.$ **Javob:** D

3.8. **Yuzi $9\pi\ cm^2$ bo‘lgan doirani o‘rab turgan aylana uzunligini toping.**

A) $3\pi\ cm$ **B)** $9\pi\ cm$ **C)** $18\pi\ cm$ **D)** $6\pi\ cm$

Yechilishi: $S = 9\pi\ cm^2;$ $\pi R^2 = S;$ $\pi R^2 = 9\pi\ cm^2;$ $R^2 = \frac{9\pi\ cm^2}{\pi};$

$R = \sqrt{9\ cm^2};$ $R = 3\ cm;$ $C = 2\pi R = 2\pi \cdot 3\ cm = 6\pi\ cm.$ **Javob:** $D.$

3.9. **Tomoni $6\ cm$ ga teng bo‘lgan kvadratga ichki chizilgan doira yuzini toping.**

A) $9\pi\ cm^2;$ B) $144\pi\ cm^2;$ C) $36\pi\ cm^2;$ D) $72\pi\ cm^2.$

Yechilishi: $a = 6\ cm;$ $r = \frac{a}{2} = \frac{6\ sm}{2} = 3\ cm;$

$S = \pi r^2 - \pi \cdot (3\ cm)^2 = 9\pi\ cm^2$ **Javob:** A

3.10. **Kvadratga ichki chizilgan aylana radiusi $5\ cm$. Kvadrat diagonalini toping.**

A) $\frac{5\sqrt{2}}{2};$ **B)** $5\sqrt{2};$ **C)** $\frac{5\sqrt{2}}{4};$ **D)** $10\sqrt{2};$

Yechilishi: $r - 5\ cm;$ $a - 2r - 2 \cdot 5\ cm - 10\ cm;$

$d = \sqrt{2a^2} = \sqrt{2 \cdot (10\ cm)^2} = \sqrt{2 \cdot 100\ cm^2} = 10\sqrt{2}\ cm.$ **Javob:** D.

3.11. **Ichki burchaklari yig‘indisi 1600^o bo‘lgan muntazam ko‘pburchakning tomonlari sonini toping.**

A) 12 B) 14 C) 16 D) 10

Yechilishi: $1600^o - 8 \cdot 180^o + 160^o;$ $180^o(n - 2) = 8 \cdot 180^o;$

$n - 2 - 8;$ $n - 8 + 2;$ $n - 10.$ **Javob:** D

3.12. **Diagonallari $24\ cm$ va $18\ cm$ bo‘lgan rombning perimetrini toping.**

A) $120\ cm$ B) $60\ cm$ C) $84\ cm$ D) $108\ cm$

Berilgan: $AC = 24\ cm;$ $BD = 18\ cm.$ Topish kerak: $P = ?$

$AO = \frac{AC}{2} = \frac{24}{2} cm = 12\ cm;$ $BO = \frac{BD}{2} = \frac{18}{2}\ cm = 9\ cm;$

$AB = \sqrt{AO^2 + BO^2} = \sqrt{(12\ cm)^2 + (9\ cm)^2} = \sqrt{144\ cm^2 + 81\ cm^2} =$
$= \sqrt{225\ cm^2} = 15\ cm;$

$P = 4AB = 4 \cdot 15\ cm = 60\ cm.$ **Javob:** $B.$

3.13. Parallelogrammning perimetri $48\ dm$ bo‘lib, bir tomoni ikkinchisidan $8\ dm$ ga uzun. Parallelogrammning kichik tomonini toping.

A) $8\ dm$; B) $16\ dm$; C) $6\ dm$; D) $12\ dm$;

Berilgan: $P = 48\ dm;$ $AB = x\ dm;$ $BC = AB + 8\ dm = x + 8\ dm.$

Topish kerak: $AB = ?$

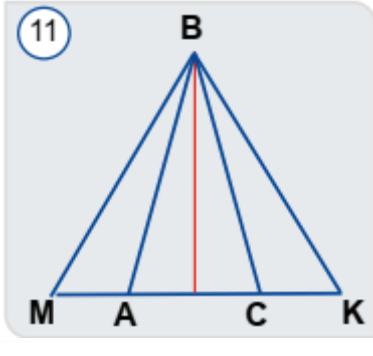
$2 \cdot (AB + BC) = P;$ $2 \cdot (x + x + 8) = 48;$ $2x + 8 = \frac{48}{2};$ $2x + 8 = 24;$

$2x = 24\text{-}8;$ $2x = 16;$ $x = \frac{16}{2};$ $x = 8\ dm.$ $AB = 8\ dm.$

Javob: A

Uy vazifasi

3.14. Rasmdagi ABC teng yonli uchburchak tashqarisida ikkita teng ABM va CBK burchaklar qurildi. Bu burchaklar tomonlari AC tomonni, mos ravishda M va K nuqtalarda kesib o‘tdi. MBC va KBA uchburchaklar tengligini isbotlang.



ABC teng yonli uchburchak. $AB=BC;$

$\angle CAB = \angle ACB = \alpha;$ $\angle ABM = \angle CBK = \beta;$

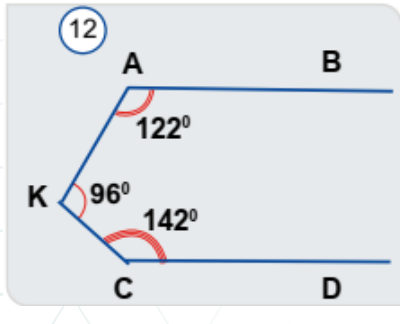
$\angle ABC = 180°\text{-}(\angle CAB + \angle ACB) = 180°\text{-}2\alpha;$

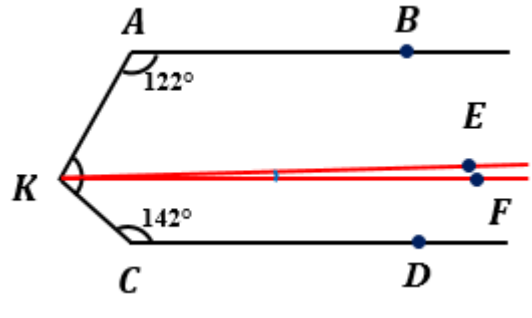
$\angle MBC = \angle MBA + \angle ABC = \beta + 180°\text{-}2\alpha;$

$\angle ABK = \angle ABC + \angle CBK = 180°\text{-}2\alpha + \beta;$

$\angle MBC = \angle ABK.$ Isbot bo‘ldi.

3.15. Rasmda tasvirlangan AB va CD to‘g‘ri chiziqlarning o‘zaro joylashuvini aniqlang. Javobingizni asoslang.





$\angle KAB = 122°;$ $\angle AKC = 96°;$ $\angle KCD = 142°;$

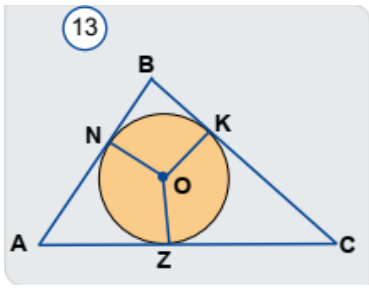
$\angle AKE = \alpha;$ $\angle EKF = \beta;$ $\angle FKC = \gamma;$ $\angle AKC = \alpha+\beta+\gamma = 96°;$

$$\begin{cases} AB \parallel KE \\ CD \parallel KF \end{cases} \rightarrow \begin{cases} \alpha + 122° = 180° \\ \gamma + 142° = 180° \end{cases} \rightarrow \begin{cases} \alpha = 180° - 122° = 58° \\ \gamma = 180° - 142° = 38° \end{cases}$$

$\alpha + \beta + \gamma = 96°;$ $58° + \beta + 38° = 96°;$ $\beta = 96° - 96°;$ $\beta = 0°.$

Demak, KE va KF ustma-ust tushadi. Bundan AB // CD ekanligi kelib chiqadi.

3.16. Rasmdagi ABC uchburchakka ichki aylana chizilgan. Aylananing N va Z urinish nuqtalari uchburchakning AB va AC tomonlarini ayirmasiga mos ravishda $3\ cm$ va $4\ cm$ bo‘lgan kesmalarga ajratadi ($AN > NB, AZ > ZC$). Agar uchburchakning perimetri $28\ cm$ bo‘lsa, uning tomonlarini toping.



$AN = x;$ $NB = x - 3;$ $AZ = x;$ $ZC = x - 4;$

$AN > NB;$ $AZ > ZC;$ $\begin{cases} AN - MB = 3 \\ AZ - ZC = 4 \end{cases};$

$P_{ABC} = 28\ cm;$ $\begin{cases} ZC = CK = x - 4 \\ NB = BK = x - 3 \end{cases};$

$AB = AN + NB = x + x - 3 = 2x - 3;$ $AC = AZ + ZC = x + x - 4 = 2x - 4;$

$BC = BK + KC = x - 3 + x - 4 = 2x - 7;$ $AB + BC + AC = P_{ABC};$

$2x - 3 + 2x - 7 + 2x - 4 = 28;$ $6x - 14 = 28;$ $6x = 28 + 14;$

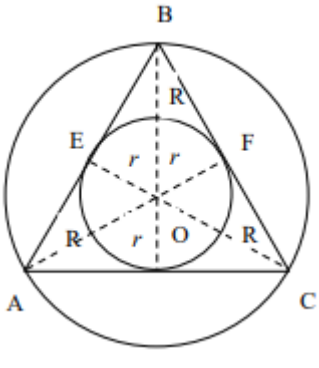
$6x = 42;$ $x = 7\ cm.$ $AB = 2x - 3 = 2 \cdot 7 - 3 = 14 - 3 = 11\ cm;$

$BC = 2x - 7 = 2 \cdot 7 - 7 = 14 - 7 = 7\ cm;$

$AC = 2x - 4 = 2 \cdot 7 - 4 = 14 - 4 = 10\ cm.$

Javob: *11 cm, 7 cm, 10 cm.*

3.17. Teng tomonli uchburchakka radiusi $3\sqrt{3}$ bo‘lgan aylana tashqi chizilgan. Ichki chizilgan aylana radiusini toping.



Berilgan: $AB = BC = AC = a;$ $R = 3\sqrt{3}.$

$\angle A = \angle B = \angle C = 60°.$ Topish kerak: $r = ?$

$\angle CAO = \angle BAO = \alpha;$

$\angle A = \angle CAO + \angle BAO = \alpha + \alpha = 2\alpha;$ $2\alpha = 60°;$

$\alpha = \frac{60°}{2};$ $\alpha = 30°;$ $\sin 30° = \frac{r}{R};$ $\frac{1}{2} = \frac{r}{R};$

$r = \frac{R}{2} = \frac{3\sqrt{3}}{2}.$ *Javob:* $r = \frac{3\sqrt{3}}{2}.$

6-DARS. BOBNI TAKRORLASHGA DOIR AMALIY MASHQLAR

I. Standartlar:

– yassi va fazoviy geometrik shakllarni chizma, model va real voqelikda taniy oladi, ularning asosiy xossalarini biladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish*:*

Bilim:

– geometrik masalalar yechishning turli usullarini bilish;

Ko‘nikmalar:

– masalalar yechishda turli usullarini qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– geometrik masalalar yechishning turli usullari.

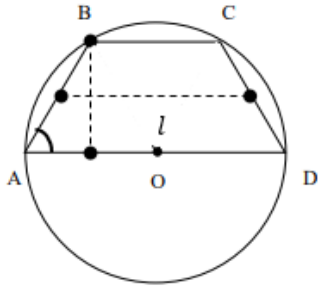
IV. Dars ashyolari va ko‘rgazmali qurollar:

– chizg‘ich, qalam.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan asalalar
Motivatsiya	Masalalarni yechish qanday usullardan foydalangan ma’qul?	Aqliy hujum	Amaliy mashq va tatbiq: 3.18 – 3.19
Bilimlarni boyitish va mustahkamlash	Qanday turdagi masalalarni yechishda yuzlarni hisoblash formulalaridan foydalaniladi?	Darslik bilan ishlash	Amaliy mashq va tatbiq: 3.20 – 3.21
	Vektorlar usulidan qaysi turdagi masalalarni yechishda foydalanish mumkin?	Darslik bilan ishlash	Amaliy mashq va tatbiq: 3.22
	Geometrik almashtirishlar usuli	Darslik bilan ishlash	Amaliy mashq va tatbiq: 3.23
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 3.24
Uyga vazifa	Amaliy mashq va tatbiq: 3.25 – 3.28		

3.18. Asosidagi burchagi 30° bo‘lgan, teng yonli trapetsiyaga aylana tashqi chizilgan. Trapetsiyaning balandligi *7 cm* ga teng bo‘lsa, uning o‘rta chizig‘ini toping.



Berilgan: $x = AB = CD;\ \alpha = \angle A = \angle D = 30°;$

$h = BK = 7\ cm.$ Topish kerak: $l = \frac{a+b}{2} = ?$

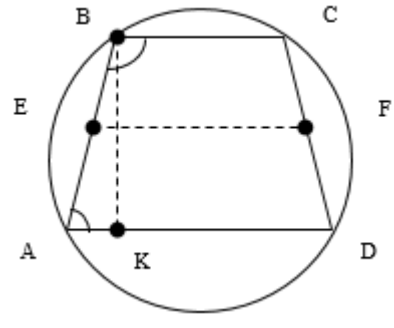
$\sin\alpha = \frac{h}{x};\quad \sin 30° = \frac{7}{x};\quad \frac{1}{2} = \frac{7}{x};\quad x = 14\ cm;$

$a = AD;\quad b = BC;\quad AD + BC = AB + CD;$

$a + b = x + x;\quad a + b = 2x;\quad \frac{a+b}{2} = x;\quad \frac{a+b}{2} = 14\ cm;\quad l = 14\ cm.$

Javob: *trapetsiyaning o‘rta chizig‘i 14 cm ga teng.*

3.19 Asosidagi burchagi *150°* bo‘lgan teng yonli trapetsiya aylanaga tashqi chizilgan. Trapetsiyaning o‘rta chizig‘i $16\sqrt{3}$ ga teng bo‘lsa, uning balandligini toping.



$x = AB = CD;\quad AD = a;\quad BC = b;$

$\angle B = 150°;\quad EF = 16\sqrt{3};\quad h = BK;$

$\angle ABK = \alpha;\quad \angle A = \angle D;\quad \angle B + \angle D = 180°;$

$\angle D = 180° - 150° = 30°;\quad \angle A = 30°;$

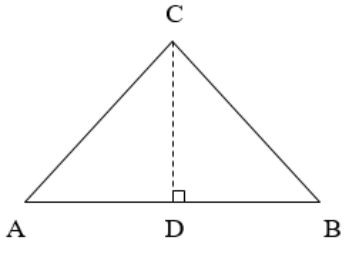
$AD + BC = AB + CD;\quad a + b = x + x;$

$a + b = 2x;\quad x = \frac{a+b}{2};\quad x = EF = 16\sqrt{3};\quad \sin\alpha = \frac{h}{x};$

$\sin 30° = \frac{h}{16\sqrt{3}};\quad \frac{1}{2} = \frac{h}{16\sqrt{3}};\quad h = \frac{16\sqrt{3}}{2};\quad h = 8\sqrt{3}.$

Javob: *trapetsiyaning balandligi $8\sqrt{3}$ cm ga teng.*

3.20. Asosi *16 cm* va bu asosga tushirilgan balandligi *15 cm* bo‘lgan teng yonli uchburchakning yon tomonini toping.



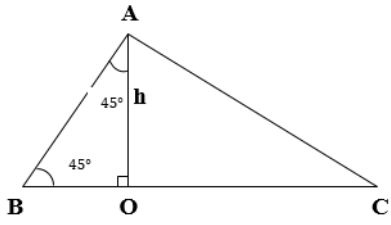
Berilgan: $a = AB = 16\ cm;\quad h = CD = 15\ cm.$

Topish kerak: $b = AC = BC = ?$

$b = \sqrt{\left(\frac{a}{2}\right)^2 + h^2} = \sqrt{\left(\frac{16}{2}\right)^2 + 15^2} = \sqrt{8^2 + 15^2} =$

$= \sqrt{64 + 225} = \sqrt{289} = 17\ cm.$ **Javob:** uchburchakning yon tomoni 17 cm.

3.21. ABC **uchburchakning** AO **balandligi uning** BC **tomonini** BO **va** OC **kesmalarga ajratadi. Agar** $AB = 10\sqrt{2}\ cm$, $AC = 26\ cm$ **va** $B = 45°$ **bo‘lsa,** OC **kesma uzunligini toping.**



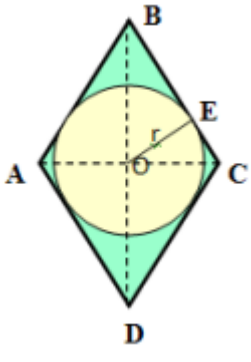
$$\sin B = \frac{h}{AB};\quad h = AB \cdot \sin B = 10\sqrt{2} \cdot \sin 45° =$$

$$= 10\sqrt{2} \cdot \frac{\sqrt{2}}{2} = \frac{10 \cdot \sqrt{4}}{2} = 5 \cdot 2 = 10\ cm;$$

$$OC = \sqrt{AC^2 - h^2} = \sqrt{26^2 - 10^2} = \sqrt{676 - 100} = \sqrt{576} = 24\ cm.$$

Javob: OC kesmaning uzunligi 24 cm ga teng.

3.22. Rombning tomoni $10\ cm$**, diagonallaridan biri** $12\ cm$**. Rombga ichki chizilgan aylana radiusini toping.**



Berilgan: $a = AB = BC = CD = AD = 10\ cm;\ \ d_1 = AC = 12\ cm.$

Topish kerak: $r = ?$

$$d_2 = \sqrt{4a^2 - d_1^2} = \sqrt{4 \cdot 10^2 - 12^2} = \sqrt{4 \cdot 100 - 144} =$$

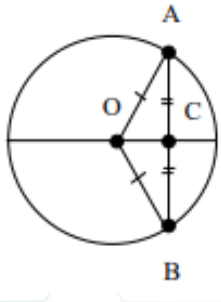
$$= \sqrt{400 - 144} = \sqrt{256} = 16\ cm;$$

$$S = \frac{1}{2} \cdot d_1 \cdot d_2 = \frac{1}{2} \cdot 12 \cdot 16 = 6 \cdot 16 = 96\ cm^2;$$

$$S = a \cdot h;\quad h = \frac{S}{a} = \frac{96}{10} = 9{,}6\ cm;\quad h = 2r;\quad r = \frac{h}{2} = \frac{9{,}6}{2} = 4{,}8\ cm.$$

Javob: Rombga ichki chizilgan aylana radiusi $4{,}8\ cm$ ga teng.

3.23. Radiusi $15\ cm$ **bo‘lgan aylanada uning markazidan** $12\ cm$ **uzoqlikda bo‘lgan vatar o‘tkazilgan. Vatar uzunligini toping.**



Berilgan: $x = AO_1 = O_1B;\quad CO_1 = 5\ cm;\quad O_1D = 20\ cm.$

Topish kerak: $AB = ?,\quad CD = ?$

$CD = CO_1 + O_1D = 5\ cm + 20\ cm = 25\ cm;$

$AO_1 \cdot O_1B = CO_1 \cdot O_1D \ \rightarrow\ \ x \cdot x = 5 \cdot 20;$

$x^2 = 100;\quad x = \sqrt{100};\quad x = 10\ cm.$

$$AB = AO_1 + O_1B = x + x = 2x;\quad AB = 2x = 2 \cdot 10\ cm = 20\ cm.$$

Javob: $AB = 20\ cm,\ CD = 25\ cm.$

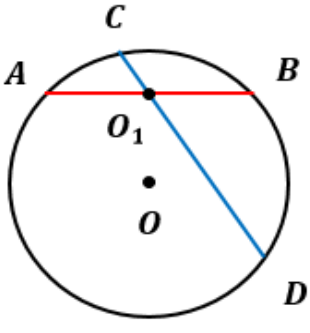
$x = \sqrt{R^2 - OC^2} = \sqrt{15^2 - 12^2} = \sqrt{225 - 144} = \sqrt{81} = 9\ cm;$

$AB = 2x = 2 \cdot 9\ cm = 18\ cm.$

Javob: vatarning uzunligi $18\ cm$ ga teng.

Uy vazifasi

3.24. Aylanada ikkita kesishuvchi vatarlar o‘tkazilgan. Ulardan biri kesishish nuqtasi bilan teng ikkiga, ikkinchisi esa uzunliklari $5\ cm$ va $20\ cm$ bo‘lgan kesmalarga bo‘linadi. Har bir vatar uzunligini toping.



Berilgan: $x = AO_1 = O_1B;\ CO_1 = 5\ cm;\ O_1D = 20\ cm.$

Topish kerak: $AB = ?,\ \ CD = ?$

$CD = CO_1 + O_1D = 5\ cm + 20\ cm = 25\ cm;$

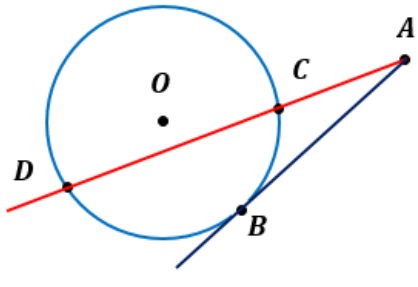
$AO_1 \cdot O_1B = CO_1 \cdot O_1D \rightarrow x \cdot x = 5 \cdot 20;$

$x^2 = 100;\ \ x = \sqrt{100};\ \ x = 10\ cm.$

$AB = AO_1 + O_1B = x + x = 2x;\ AB = 2x = 2 \cdot 10\ cm = 20\ cm.$

Javob: $AB = 20\ cm,\ CD = 25\ cm.$

3.25. Aylanadan tashqarida yotgan nuqtadan unga urinma va kesuvchi o‘tkazilgan. Agar urinma o‘zining tashqi bo‘lagidan $5\ cm$ uzun, kesuvchining ichki bo‘lagidan $5\ cm$ qisqa bo‘lsa, uning uzunligini toping.



Berilgan: $AB = AC + 5\ cm;\ AB = CD - 5\ cm.$

Topish kerak: $AB = ?$

$AC = AB - 5\ cm;\ \ CD = AB + 5\ cm;$

$AD = AC + CD = AB - 5 + AB + 5 = 2 \cdot AB;$

$(AB)^2 = AC \cdot AD;\ \ (AB)^2 = (AB - 5) \cdot 2 \cdot AB;\ \ AB = 2 \cdot (AB - 5);$

$AB = 2AB - 10;\ \ 2AB - AB = 10;\ \ AB = 10\ cm.$

Javob: $AB = 10\ cm.$

II BOB. STEREOMETRIYAGA KIRISH

1-DARS. STEREOMETRIYANING ASOSIY TUSHUNCHALARI

I. Standartlar:

– M10.GO‘.GSH.01. Stereometriya aksiomalarini biladi va isbotlashlarda ulardan foydalana oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– stereometriya haqida tushunchaga ega bo‘lish;

– stereometriya aksiomalarini bilish.

Ko‘nikmalar:

– stereometriya aksiomalaridan foydalana olish;

III. Dars mazmunining qisqacha tavsifi:

– stereometriya aksiomalari va ulardan isbotlashlarda foydalanish.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

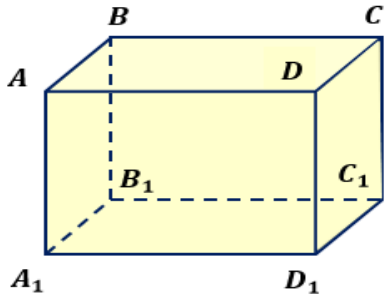
V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Stereometriya nimani o‘rganadi?	Aqliy hujum	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 4.1 – 4.2
Bilimlarni boyitish va mustahkamlash	Yassi va fazoviy shakllarga misollar keltiring	Darslik bilan ishlash 1-2-rasm	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 4.3
	Stereometriyada ishlatiladigan ba’zi belgilashlar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 4.4
	Stereometriya aksiomalari	Darslik bilan ishlash	Amaliy mashq va tatbiq: 4.5 – 4.6
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 4.7 – 4.9
Uyga vazifa	Amaliy mashq va tatbiq: 4.10 – 4.11		

4.2. Quyidagi tasdiqlarga mos belgili ifodalarni mos qo‘ying.

Tasdiq		Ifoda
1. M nuqta α tekislikka tegishli.		$\alpha \cap \beta = \varnothing$
2. M nuqta α tekislikka tegishli emas.		$M \in \alpha$
3. a to‘g‘ri chiziq α tekislikda yotadi.		$M \notin \alpha$
4. a to‘g‘ri chiziq α tekislikda yotmaydi.		$a \subset \alpha$
5. α va β tekisliklar a to‘g‘ri chiziq bo‘ylab kesishadi.		$\alpha \cap \beta = a$
6. α va β tekisliklar o‘zaro kesishmaydi.		$a \not\subset \alpha$

4.3. Sinfxona devorlarini tekisliklarning bo‘laklari deb faraz qiling va quyidagilarni ko‘rsating:



a) ikkita kesishuvchi to‘g‘ri chiziq;
b) ikkita kesishuvchi tekislik;
c) bir nuqtada kesishuvchi uchta to‘g‘ri chiziq;
d) ikkita kesishmaydigan tekislik;
e) ikkita kesishmaydigan to‘g‘ri chiziq;
f) uchta kesishadigan tekislik.

a) ikkita kesishuvchi to‘g‘ri chiziqlar:
AB va BC; BC va CD; CD va DA; DA va AB;
A_1B_1 va B_1C_1; B_1C_1 va C_1D_1; C_1D_1 va D_1A_1; D_1A_1 va A_1B_1;
AA_1 va AB; AA_1 va A_1B_1; AA_1 va AD; AA_1 va A_1D_1
BB_1 va AB; BB_1 va A_1B_1; BB_1 va BC; BB_1 va B_1C_1
CC_1 va BC; CC_1 va B_1C_1; CC_1 va CD; CC_1 va C_1D_1
DD_1 va AD; DD_1 va A_1D_1; DD_1 va CD; DD_1 va C_1D_1
b) ikkita kesishuvchi tekisliklar:
$ABCD \cap ABA_1B_1 = AB$; $ABCD \cap BCC_1B_1 = BC$;
$ABCD \cap CDD_1C_1 = CD$; $ABCD \cap ADD_1A_1 = AD$;
$A_1B_1C_1D_1 \cap ABB_1A_1 = A_1B_1$; $A_1B_1C_1D_1 \cap BCC_1B_1 = B_1C_1$;
$A_1B_1C_1D_1 \cap CDD_1C_1 = C_1D_1$; $A_1B_1C_1D_1 \cap ADD_1A_1 = D_1A_1$;
c) bir nuqtada kesishuvchi uchta to‘g‘ri chiziqlar:
$AB \cap BC \cap BB_1 = \{B\}$; $BC \cap CD \cap CC_1 = \{C\}$; $CD \cap DA \cap DD_1 = \{D\}$;
$DA \cap AB \cap AA_1 = \{A\}$; $A_1B_1 \cap B_1C_1 \cap BB_1 = \{B_1\}$;
$B_1C_1 \cap C_1D_1 \cap C_1C = \{C_1\}$; $C_1D_1 \cap D_1A_1 \cap DD_1 = \{D_1\}$;
$D_1A_1 \cap A_1B_1 \cap AA_1 = \{A_1\}$;
d) ikkita kesishmaydigan tekisliklar:
$ABCD \cap A_1B_1C_1D_1 = \varnothing$; $ABA_1B_1 \cap CDD_1C_1 = \varnothing$; $BCC_1B_1 \cap ADD_1A_1 = \varnothing$;
e) ikkita kesishmaydigan to‘g‘ri chiziqlar:
$AB \cap CD = \varnothing$; $AB \cap A_1B_1 = \varnothing$; $AB \cap C_1D_1 = \varnothing$; $AB \cap A_1D_1 = \varnothing$;

$AB \cap B_1C_1 = \varnothing$; $AB \cap CC_1 = \varnothing$; $AB \cap DD_1 = \varnothing$.
$BC \cap B_1C_1 = \varnothing$; $BC \cap AD = \varnothing$; $BC \cap A_1D_1 = \varnothing$; $BC \cap AA_1 = \varnothing$;
$BC \cap DD_1 = \varnothing$; $BC \cap D_1C_1 = \varnothing$; $BC \cap A_1B_1 = \varnothing$.

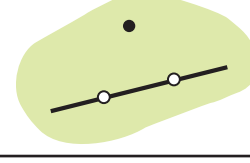
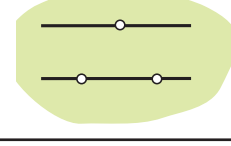
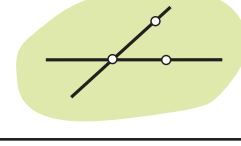
f) uchta kesishadigan tekislik:

$ABB_1A_1 \cap BCC_1B_1 \cap ABCD = \{B\}$; $BCC_1B_1 \cap CDD_1C_1 \cap ABCD = \{C\}$;
$CDD_1C_1 \cap ADD_1A_1 \cap ABCD = \{D\}$; $ADD_1A_1 \cap ABB_1A_1 \cap ABCD = \{A\}$;
$ABB_1A_1 \cap BCC_1B_1 \cap A_1B_1C_1D_1 = \{B_1\}$; $BCC_1B_1 \cap CDD_1C_1 \cap A_1B_1C_1D_1 = \{C_1\}$;
$CDD_1C_1 \cap ADD_1A_1 \cap A_1B_1C_1D_1 = \{D_1\}$; $ADD_1A_1 \cap ABB_1A_1 \cap A_1B_1C_1D_1 = \{A_1\}$.

4.4. Quyidagi jumlalarni o‘qing. Jumla to‘g‘ri bo‘lsa “+”, noto‘g‘ri bo‘lsa “–” belgisini yonidagi katakka qo‘ying.

1	Ikki tekislik faqat bitta umumiy nuqtaga ega bo‘lishi mumkin.	–
2	Ikki tekislik faqat ikkita umumiy nuqtaga ega bo‘lishi mumkin.	–
3	Ikki tekislik ikkita umumiy to‘g‘ri chiziqqa ega bo‘lishi mumkin.	–
4	Berilgan kesishuvchi ikkita to‘g‘ri chiziq orqali yagona tekislik o‘tkazish mumkin.	+
5	To‘g‘ri chiziq va unda yotmaydigan nuqta orqali bitta va faqat bitta tekislik o‘tkazish mumkin.	+
6	Agar uchta nuqta bir to‘g‘ri chiziqda yotmasa, u holda ular orqali yagona tekislik o‘tkazish mumkin.	+
7	Agar to‘g‘ri chiziqning ikki nuqtasi bitta tekislikda yotsa, u holda uning barcha nuqtalari shu tekislikda yotadi.	+
8	Agar ikki tekislik umumiy nuqtaga ega bo‘lsa, u holda bu tekisliklar shu nuqtadan o‘tuvchi umumiy to‘g‘ri chiziqqa ham ega bo‘ladi.	+

4.5. Quyidagi fazoviy shakllar xossalariga tegishli rasmni mos qo‘ying.

Xossalar		Rasmlar
To‘g‘ri chiziq va unda yotmagan nuqta orqali bitta va faqat bitta tekislik o‘tkazish mumkin.		
Kesishuvchi ikki to‘g‘ri chiziq orqali bitta va faqat bitta tekislik o‘tkazish mumkin.		
Parallel ikki to‘g‘ri chiziq orqali bitta va faqat bitta tekislik o‘tkazish mumkin.		

4.6. Fazoda ikki nuqtadan nechta to‘g‘ri chiziq o‘tishi mumkin?

Javob: Fazoda ikki nuqtadan bitta va faqat bitta to‘g‘ri chiziq o‘tishi mumkin.

4.7. Fazoda uchta nuqtadan nechta tekislik o‘tkazish mumkin?

Javob: a) Fazoda uchta nuqta bir to‘g‘ri chiziqda yotsa, ular orqali cheksiz ko‘p tekislik o‘tkazish mumkin.

b) Fazoda uchta nuqta bir to‘g‘ri chiziqda yotmasa, ular orqali bitta tekislik o‘tkazish mumkin.

4.8. Fazoda bitta to‘g‘ri chiziqdan nechta tekislik o‘tkazish mumkin?

Javob. Fazoda bitta to‘g‘ri chiziqdan cheksiz ko‘p tekislik o‘tkazish mumkin.

4.9. Fazoda uchta nuqta qanday joylashganda ulardan cheksiz ko‘p tekislik o‘tkazish mumkin?

Javob. Agar uchta nuqta bitta to‘g‘ri chiziqda yotsa ular orqali cheksiz ko‘p tekislik o‘tkazish mumkin.

Uy vazifasi

4.10. Fazoda: a) ikki to‘g‘ri chiziq; b) to‘g‘ri chiziq va tekislik; c) ikki tekislik nechta umumiy nuqtaga ega bo‘lishi mumkin?

Javoblar:

a) Fazoda ikki to‘g‘ri chiziq nechta umumiy nuqtaga ega bo‘lishi mumkin?

1. Fazoda ikki to‘g‘ri chiziq parallel bo‘lsa, umumiy nuqtaga ega emas.
2. Fazoda ikki to‘g‘ri chiziq bir-birini kesib o‘tsa, bitta umumiy nuqtaga ega.
3. Fazoda ikki to‘g‘ri chiziq ustma-ust tushsa, cheksiz ko‘p umumiy nuqtaga ega.

b) Fazoda to‘g‘ri chiziq va tekislik nechta umumiy nuqtaga ega bo‘lishi mumkin?

1. Fazoda to‘g‘ri chiziq va tekislik parallel bo‘lsa, umumiy nuqtaga ega emas.
2. Fazoda to‘g‘ri chiziq va tekislik kesishgan bo‘lsa, bitta umumiy nuqtaga ega.
3. Fazoda to‘g‘ri chiziq va tekislik ustma-ust tushsa, cheksiz ko‘p umumiy nuqtaga ega.

c) Fazoda ikki tekislik nechta umumiy nuqtaga ega bo‘lishi mumkin?

1. Fazoda ikki tekislik parallel bo‘lsa, umumiy nuqtaga ega emas.
2. Fazoda ikki tekislik kesishgan bo‘lsa, cheksiz ko‘p umumiy nuqtaga ega.
3. Fazoda ikki tekislik ustma-ust tushsa, cheksiz ko‘p umumiy nuqtaga ega.

4.11. Fazoda: a) ikki to‘g‘ri chiziq; b) to‘g‘ri chiziq va tekislik; c) ikki tekislik; d) uchta tekislik yagona umumiy nuqtaga ega bo‘lishi mumkinmi?

a) Fazoda ikki to‘g‘ri chiziq yagona umumiy nuqtaga ega bo‘lishi mumkinmi?

Javob: Fazoda ikki to‘g‘ri chiziq parallel bo‘lmasa, yagona umumiy nuqtaga ega bo‘ladi.

b) Fazoda to‘g‘ri chiziq va tekislik yagona umumiy nuqtaga ega bo‘lishi mumkinmi?

Javob: Fazoda to‘g‘ri chiziq va tekislik parallel bo‘lmasa, yagona umumiy nuqtaga ega bo‘lishi mumkin.

c) Fazoda ikki tekislik yagona umumiy nuqtaga ega bo‘lishi mumkinmi?

Javob: Fazoda ikki tekislik yagona umumiy nuqtaga ega bo‘lishi mumkin emas. Cheksiz ko‘p umumiy nuqtalarga ega bo‘ladi.

2-DARS. STEREOMETRIYANING ASOSIY TUSHUNCHALARI

I. Standartlar:

– M10.GO‘.MM.01. Stereometriya aksiomalaridan kelib chiquvchi natijalarni biladi va ularni qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– stereometriya aksiomalaridan kelib chiquvchi natijalarni bilish;

Ko‘nikmalar:

– stereometriya aksiomalaridan kelib chiquvchi natijalarni qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– stereometriya aksiomalaridan kelib chiquvchi natijalar va ularni qo‘llash.

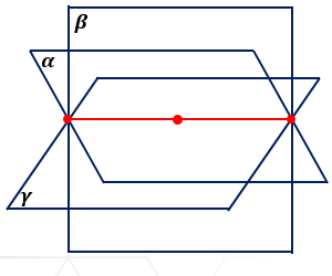
IV. Dars ashyolari va ko‘rgazmali qurollar:

– chizg‘ich, qalam.

V. Darsning qisqa texnologik xaritasi:

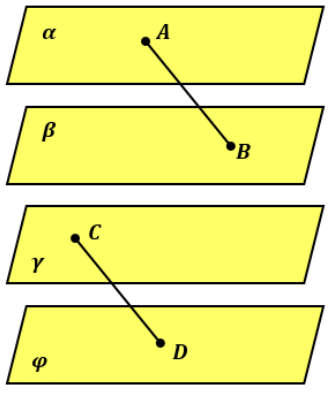
Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Stereometriya aksiomalarining planimetriya aksiomalaridan farqi nimada?	Aqliy hujum	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 4.12 – 4.13
Bilimlarni boyitish va mustahkam-lash	Stereometriya aksiomalaridan kelib chiquvchi natijalar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 5 Amaliy mashq va tatbiq: 4.14 – 4.15
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 4.16 – 4.17
Uyga vazifa	Amaliy mashq va tatbiq: 4.18 – 4.21		

4.12. Bir to‘g‘ri chiziqda yotuvchi uchta nuqtadan tekislik o‘tkazish mumkinligini isbotlang. Bunday tekisliklar soni nechta bo‘ladi?



Javob: Bir to‘g‘ri chiziqda yotuvchi uchta nuqtadan $\alpha, \beta, \gamma, \ldots$ cheksiz ko‘p tekisliklar o‘tishi mumkin.

4.13. A, B, C va D nuqtalar bitta tekislikda yotmaydi. AB va CD to‘g‘ri chiziqlarning kesishmasligini isbotlang.



$A \in \alpha;\ A \notin \beta;\ A \notin \gamma;\ A \notin \varphi;\ \alpha \cap AB = \{A\}$

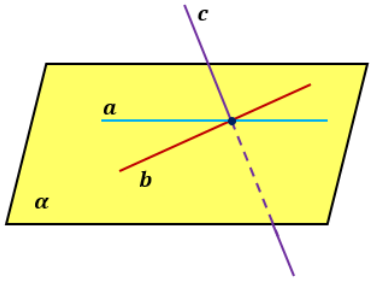
$B \notin \alpha;\ B \in \beta;\ B \notin \gamma;\ B \notin \varphi;\ \beta \cap AB = \{B\}$

$C \notin \alpha;\ C \notin \beta;\ C \in \gamma;\ C \notin \varphi;\ \gamma \cap CD = \{C\}$

$D \notin \alpha;\ D \notin \beta;\ D \notin \gamma;\ D \in \varphi;\ \varphi \cap CD = \{D\}$

$AB // CD;\ AB \cap CD = \varnothing.$

4.14. Berilgan ikki to‘g‘ri chiziqning kesishgan nuqtasidan bu to‘g‘ri chiziqlar bilan bir tekislikda yotmaydigan to‘g‘ri chiziq o‘tkazish mumkinmi? Javobingizni asoslang.



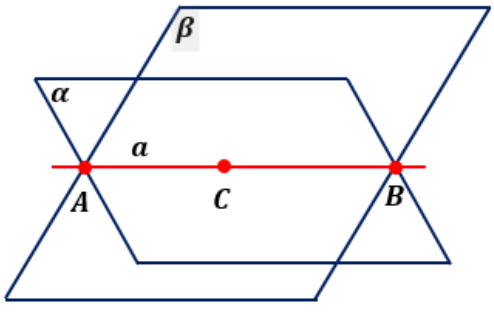
$a \in \alpha;\ b \in \alpha;$

$a \cap b = O;\ c \notin \alpha;$

$c \cap \alpha = O.$

c to‘g‘ri chiziq α tekislikni O nuqtada kesib o‘tadi.

4.15. A, B, C **nuqtalar ikkita turli tekislikning har birida yotadi. Bu nuqtalarning bir to‘g‘ri chiziqda yotishini isbotlang.**

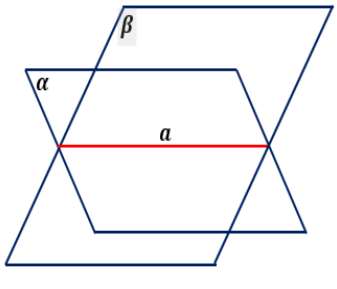


$\begin{cases} A \in \alpha \\ A \in \beta \end{cases} \rightarrow A \in a;$

$\begin{cases} B \in \alpha \\ B \in \beta \end{cases} \rightarrow B \in a;$

$\begin{cases} C \in \alpha \\ C \in \beta \end{cases} \rightarrow C \in a.$

4.16. To‘g‘ri chiziq orqali ikkita turli tekislik o‘tishini isbotlang.



$\alpha \nparallel \beta \rightarrow \begin{cases} a \subset \alpha \\ a \subset \beta \end{cases} \rightarrow \alpha \cap \beta = a.$

α tekislik β tekislikka parallel emas.

α tekislik a to‘g‘ri chizig‘i orqali o‘tadi.

β tekislik a to‘g‘ri chizig‘i orqali o‘tadi.

a to‘g‘ri chiziq α va β tekisliklar kesishmasi.

4.17. Turli: a) uchta; b) to‘rtta; c) beshta; d) n ta nuqtalar juftlaridan eng ko‘pi bilan nechta to‘g‘ri chiziq o‘tkazish mumkin?

Qoida. n ta nuqtadan ko‘pi bilan to‘g‘ri chiziqlar o‘tkazish uchun ixtiyoriy 3 tasi bir to‘g‘ri chiziqda yotmasligi kerak.

Demak, 2 ta nuqtadan bitta to‘g‘ri chiziq o‘tkazish mumkin bo‘lgani uchun n tadan ko‘pi bilan $C\frac{2}{n}$ ta to‘g‘ri chiziq o‘tkazish mumkin. Bu yerda:

$$C_n^2 = \frac{n!}{2!\cdot(n-2)!} = \frac{n\cdot(n-1)}{2}$$ ga teng.

$a)\ n=3 \rightarrow \frac{n\cdot(n-1)}{2} = \frac{3\cdot(3-1)}{2} = \frac{3\cdot 2}{2} = \frac{6}{2} = 3$ ta;

$b)\ n=4 \rightarrow \frac{n\cdot(n-1)}{2} = \frac{4\cdot(4-1)}{2} = \frac{4\cdot 3}{2} = \frac{12}{2} = 6$ ta;

$c)\ n=5 \rightarrow \frac{n\cdot(n-1)}{2} = \frac{5\cdot(5-1)}{2} = \frac{5\cdot 4}{2} = \frac{20}{2} = 10$ ta;

$d)\ n=n \rightarrow \frac{n\cdot(n-1)}{2}$ ta.

Uy vazifasi

4.18. Turli: a) uchta; b) to‘rtta; c) beshta; d) n ta nuqtalar juftlaridan eng ko‘pi bilan nechta tekislik o‘tkazish mumkin?

Qoida. n ta nuqtadan ko‘pi bilan tekislik o‘tkazish uchun ixtiyoriy 3 tasi bir to‘g‘ri chiziqda yotmasligi kerak.

Demak, 3 ta nuqtadan bitta tekislik o‘tkazish mumkin bo‘lgani uchun n tadan ko‘pi bilan $C\frac{3}{n}$ ta tekislik o‘tkazish mumkin. Bu yerda:

$$C_n^3 = \frac{n!}{3!\cdot(n-3)!} = \frac{n\cdot(n-1)\cdot(n-2)}{6}$$ ga teng.

$a)\ n=3 \rightarrow \frac{n\cdot(n-1)\cdot(n-2)}{6} = \frac{3\cdot(3-1)\cdot(3-2)}{6} = \frac{3\cdot 2\cdot 1}{6} = \frac{6}{6} = 1$ ta;

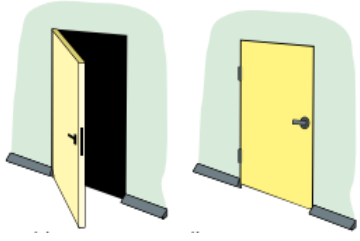
$b)\ n=4 \rightarrow \frac{n\cdot(n-1)\cdot(n-2)}{6} = \frac{4\cdot(4-1)\cdot(4-2)}{6} = \frac{4\cdot 3\cdot 2}{6} = \frac{24}{6} = 4$ ta;

$c)\ n=5 \rightarrow \frac{n\cdot(n-1)\cdot(n-2)}{6} = \frac{5\cdot(5-1)\cdot(5-2)}{6} = \frac{5\cdot 4\cdot 3}{6} = \frac{60}{6} = 10$ ta;

$d)\ n=n \rightarrow \frac{n\cdot(n-1)\cdot(n-2)}{6}$ ta.

4.19. Quyidagi 15-rasmlardagi holatlarni tushuntirishda qaysi aksiomalarga tayanish mumkin? 1) Nega eshik ochiq holatda yelvizak paytida ochilib – yopilib harakatda bo‘ladi? Nega qulfga ilinganda bunday harakat kuzatilmaydi? 2) Kamera

oyoqlari nega uchta bo‘ladi? 3) Stul yerda mahkam turishi uchun uning oyoqlari qanday tekshiriladi? 4) Chizg‘ichning tekisligi qanday tekshiriladi? 5) Ikkita devor stereometriya aksiomalaridan kelib chiqadigan qaysi natijani tushuntirishda qo‘l keladi?



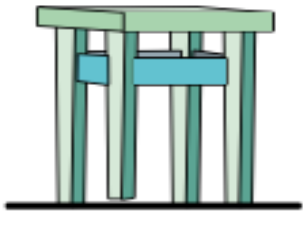
S_1 aksioma. ***Agar uchta nuqta bir to‘g‘ri chiziqda yotmasa, u holda ular orqali yagona tekislik o‘tkazish mumkin.***

Javob. To‘g‘ri chiziq va unda yotmagan nuqtadan faqat bitta tekislik o‘tkazish mumkin.



S_1 aksioma. ***Agar uchta nuqta bir to‘g‘ri chiziqda yotmasa, u holda ular orqali yagona tekislik o‘tkazish mumkin.***

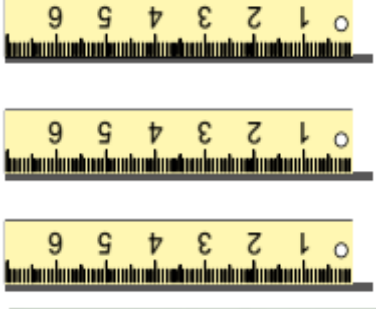
Javob. Bir to‘g‘ri chiziqda yotmagan uchta nuqtadan faqat bitta tekislik o‘tadi.



S_1 aksioma. ***Agar uchta nuqta bir to‘g‘ri chiziqda yotmasa, u holda ular orqali yagona tekislik o‘tkazish mumkin.***

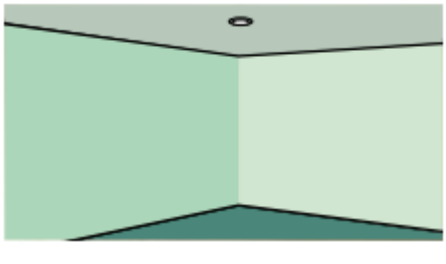
S_2 aksioma. ***Agar to‘g‘ri chiziqning ikki nuqtasi bitta tekislikda yotsa, u holda uning barcha nuqtalari shu tekislikda yotadi.***

Javob. Yasalgan stulning oyoqlari bir tekislikda yotganini tekshirish uchun duradgorlar stulning qarama-qarshi oyoqlariga ip tortib tekshiradi. Ikki kesishuvchi chiziq yagona tekislikni aniqlaydi.



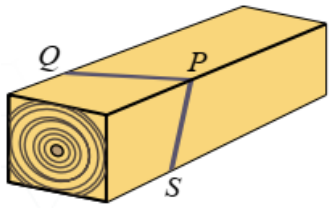
S_2 aksioma. ***Agar to‘g‘ri chiziqning ikki nuqtasi bitta tekislikda yotsa, u holda uning barcha nuqtalari shu tekislikda yotadi.***

Javob. Agar to‘g‘ri chiziqning ikki nuqtasi tekislikda yotsa, uning o‘zi ham butunligicha shu tekislikda yotadi.



1-natija. To‘g‘ri chiziq va unda yotmaydigan nuqta orqali bitta va faqat bitta tekislik o‘tkazish mumkin.

4.20. Rasmda duradgorning taxtani arralashdan oldin chizgan chiziqlari tasvirlangan. Uning bu ishini stereometriya aksiomalaridan kelib chiqadigan qaysi natija bilan izohlash mumkin?



2-natija. ***Berilgan kesishuvchi ikkita to‘g‘ri chiziq orqali yagona tekislik o‘tkazish mumkin.***

Javob: yog‘och taxtaning ikki qo‘shni yoqlariga AB va AC kesmalarni chizadi va arrani imkoni boricha shu kesmalardan o‘tadigan qilib qo‘yib, arralashni bajaradi. Natijada ikki kesishuvchi to‘g‘ri chiziqdan o‘tuvchi tekislik yagona bo‘lgani uchun arralash sirti tekis chiqadi.

4.21. Rasmda temirchining egri temirni tekislash jarayoni tasvirlangan. Temir oldin tekis joyga qo‘yilib, bolg‘a bilan urib tekislanadi. So‘ng temir aylantirilib yana urib tekislanadi. Uning bu ikki bosqichdan iborat ishini stereometriya aksiomalaridan kelib chiqadigan qaysi natija bilan izohlash mumkin?



1-natija. ***To‘g‘ri chiziq va unda yotmaydigan nuqta orqali bitta va faqat bitta tekislik o‘tkazish mumkin.***

3-DARS. FAZODA TO‘G‘RI CHIZIQLAR VA TEKISLIKLAR

I. Standartlar:

– M10.GO‘.GSH.02. Fazoda ayqash, parallel va kesishuvchi to‘g‘ri chiziqlar ta’rifini biladi va chizmada tasvirlay oladi;

– M10.GO‘.GSH.03. To‘g‘ri chiziqning tekislikka parallelligi ta’rifini biladi;

– M10.GO‘.GSH.03. Kesishuvchi va parallel tekisliklar haqida tushunchaga ega bo‘ladi;

– M10.GO‘.GSH.05. Tekislikka parallel to‘g‘ri chiziq ta’rifini biladi;

– M10.GO‘.GSH.06. Parallel va kesishuvchi tekisliklar ta’rifini biladi;

– M10.GO‘.MM.03. Tekislikka parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– fazoda ayqash, parallel va kesishuvchi to‘g‘ri chiziqlar ta’rifini bilish;

– to‘g‘ri chiziqning tekislikka parallelligi ta’rifini bilish;

– tekislikka parallel to‘g‘ri chiziq ta’rifini bilish.

Ko‘nikmalar:

– tekislikka parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– fazoda ayqash, parallel va kesishuvchi to‘g‘ri chiziqlar. To‘g‘ri chiziqning tekislikka

parallelligi. Tekislikka parallel to‘g‘ri chiziqlarning xossalari.

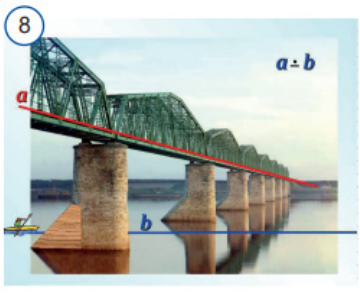
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

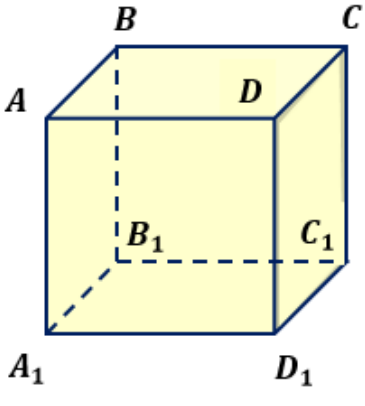
Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Yon-atrofingizdan fazoda to‘g‘ri chiziq va tekikislikka oid misollar keltiring	Aqliy hujum	Mavzu bo‘yicha savollar: 1-2
Bilimlarni boyitish va mustahkam-lash	Fazoda to‘g‘ri chiziqlar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 5.1-5.2
	Fazoda to‘g‘ri chiziq va tekislik	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 5.3-5.4
	Fazoda tekisliklar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 5 Amaliy mashq va tatbiq: 5.5-5.6
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 5.7-5.8
Uyga vazifa	1. Mavzu bo‘yicha savollar: 6-7 2. Amaliy mashq va tatbiq: 5.9-5.14		

5.2. Rasmda fazoda ayqash to‘g‘ri chiziqlarning nimalar tasvirlayotganligini aniqlang.



Rasmda fazoda ayqash to‘g‘ri chiziqlar sifatida a to‘g‘ri chiziq mashina yuradigan yo‘lni ko‘rsatmoqda, b to‘g‘ri chiziq qayiq suzadigan yo‘nalishni tasvirlangan. a to‘g‘ri chiziq b to‘g‘ri chiziqqa ayqashligi $a \dotplus b$ kabi belgilanishi ko‘rsatilgan.

5.3. Kub modelida uning quyidagi elementlari juftlarini ko‘rsating:



1) bitta umumiy nuqtaga ega ikkita qirra;
2) umumiy nuqtaga ega bo‘lmagan ikkita qirra;
3) bitta tekislikda yotmaydigan ikkita qirra;
4) bitta umumiy nuqtaga ega qirra va yoq;
5) umumiy nuqtaga ega bo‘lmagan qirra va yoq;
6) yoq va unda yotgan qirra;
7) kesishmaydigan ikkita yoq;
8) kesishadigan ikkita yoq.

1) bitta umumiy nuqtaga ega ikkita qirra;

AB va BC; BC va CD; CD va DA; DA va AB;
A_1B_1 va B_1C_1; B_1C_1 va C_1D_1; C_1D_1 va D_1A_1; D_1A_1 va A_1B_1;
AA_1 va AB; AA_1 va A_1B_1; AA_1 va AD; AA_1 va A_1D_1;
BB_1 va AB; BB_1 va A_1B_1; BB_1 va BC; BB_1 va B_1C_1;
CC_1 va BC; CC_1 va B_1C_1; CC_1 va CD; CC_1 va C_1D_1;
DD_1 va AD; DD_1 va A_1D_1; DD_1 va CD; DD_1 va C_1D_1.

2) umumiy nuqtaga ega bo‘lmagan ikkita qirra:

AA_1 va C_1D_1; AA_1 va B_1C_1; AA_1 va CC_1; AA_1 va BC;
AA_1 va CD; AA_1 va BB_1; AA_1 va DD_1.

DD_1 va AA_1; DD_1 va BB_1; DD_1 va CC_1; DD_1 va A_1B_1;
DD_1 va B_1C_1; DD_1 va AB; DD_1 va BC.

CC_1 va DD_1; CC_1 va AA_1; CC_1 va BB_1; CC_1 va A_1D_1;
CC_1 va AD; CC_1 va A_1B_1; CC_1 va AB.

BB_1 va AA_1; BB_1 va CC_1; BB_1 va DD_1; BB_1 va A_1D_1;
BB_1 va AD; BB_1 va C_1D_1; BB_1 va CD.

A_1B_1 va C_1D_1; A_1B_1 va CD; A_1B_1 va AB; A_1B_1 va CC_1;
A_1B_1 va DD_1; A_1B_1 va AD; A_1B_1 va BC.

B_1C_1 va A_1D_1; B_1C_1 va AD; B_1C_1 va BC; B_1C_1 va AB;
B_1C_1 va CD; B_1C_1 va AA_1; B_1C_1 va DD_1.

C_1D_1 va A_1B_1; C_1D_1 va AB; C_1D_1 va DC; C_1D_1 va AA_1;
C_1D_1 va BB_1; C_1D_1 va BC; C_1D_1 va AD.
A_1D_1 va B_1C_1; A_1D_1 va BC; A_1D_1 va AD; A_1D_1 va BB_1;
A_1D_1 va CC_1; A_1D_1 va AB; A_1D_1 va DC.

AB va A_1B_1; AB va D_1C_1; AB va DC; AB va CC_1;
AB va DD_1; AB va A_1D_1; AB va B_1C_1.

BC va B_1C_1; BC va A_1D_1; BC va AD; BC va AA_1;
BC va DD_1; BC va A_1B_1; BC va D_1C_1.

CD va C_1D_1; CD va A_1B_1; CD va AB; CD va BB_1;
CD va AA_1; CD va B_1C_1; CD va A_1D_1.

AD va A_1D_1; AD va B_1C_1; AD va BC; AD va A_1B_1;
AD va D_1C_1; AD va BB_1; AD va CC_1.

3) bitta tekislikda yotmaydigan ikkita qirra:

AB va A_1D_1; AB va B_1C_1; AB va C_1D_1; AB va CC_1; AB va DD_1.

BC va D_1C_1; BC va A_1B_1; BC va A_1D_1; BC va AA_1; BC va DD_1.

CD va A_1D_1; CD va B_1C_1; CD va A_1B_1; CD va AA_1; CD va BB_1.

AD va A_1B_1; AD va D_1C_1; AD va B_1C_1; AD va BB_1; AD va CC_1.

A_1B_1 va AD; A_1B_1 va BC; A_1B_1 va DC; A_1B_1 va DD_1; A_1B_1 va CC_1.

B_1C_1 va AB; B_1C_1 va DC; B_1C_1 va AD; B_1C_1 va AA_1; B_1C_1 va DD_1.

C_1D_1 va CB; C_1D_1 va AB; C_1D_1 va AD; C_1D_1 va AA_1; C_1D_1 va BB_1.

A_1D_1 va AB; A_1D_1 va BC; A_1D_1 va DC; A_1D_1 va BB_1; A_1D_1 va CC_1.

AA_1 va D_1C_1; AA_1 va C_1B_1; AA_1 va CC_1; AA_1 va BC; AA_1

BB_1 va A_1D_1; BB_1 va D_1C_1; BB_1 va AD; BB_1 va DC; BB_1 va DD_1.

CC_1 va A_1D_1; CC va A_1B_1; CC_1 va AD; CC_1 va AB; CC_1 va AA_1.

DD_1 va A_1B_1; DD_1 va B_1C_1; DD_1 va AB; DD_1 va BC; DD_1 va BB_1.

4) bitta umumiy nuqtaga ega qirra va yoq:

$$A \to \begin{cases} AB \\ AD \\ AA_1 \end{cases}; \quad B \to \begin{cases} BA \\ BC \\ BB_1 \end{cases}; \quad C \to \begin{cases} CB \\ CD \\ CC_1 \end{cases}; \quad D \to \begin{cases} DA \\ DC \\ DD_1 \end{cases}$$

$$A_1 \to \begin{cases} A_1B_1 \\ A_1D_1 \\ AA_1 \end{cases}; \quad B_1 \to \begin{cases} B_1A_1 \\ B_1C_1 \\ BB_1 \end{cases}; \quad C_1 \to \begin{cases} C_1B_1 \\ C_1D_1 \\ CC_1 \end{cases}; \quad D_1 \to \begin{cases} D_1A_1 \\ D_1C_1 \\ DD_1 \end{cases}$$

$$A \to \begin{cases} ABCD \\ ABB_1A_1 \\ ADD_1A_1 \end{cases}; \quad B \to \begin{cases} ABCD \\ ABB_1A_1 \\ BCC_1B_1 \end{cases}; \quad C \to \begin{cases} ABCD \\ BCC_1B_1 \\ CDD_1C_1 \end{cases}; \quad D \to \begin{cases} ABCD \\ ADD_1A_1 \\ DCC_1D_1 \end{cases}$$

$$A_1 \to \begin{cases} A_1B_1C_1D_1 \\ A_1D_1DA \\ A_1B_1BA \end{cases}; \quad B_1 \to \begin{cases} A_1B_1C_1D_1 \\ A_1B_1BA \\ B_1C_1CB \end{cases}; \quad C_1 \to \begin{cases} A_1B_1C_1D_1 \\ B_1C_1CB \\ D_1C_1CD \end{cases}; \quad D_1 \to \begin{cases} A_1B_1C_1D_1 \\ D_1C_1CD \\ A_1D_1DA \end{cases}$$

5.4. Quyidagi jadvaldagi ikki to‘g‘ri chiziqlarning xossalariga ko‘ra ularning o‘zaro joylashishini mos qo‘ying.

To‘g‘ri chiziqlarning xossalari	O‘zaro joylashuvi
Bitta tekislikda yotadi va umumiy nuqtaga ega emas.	Ayqash
Bitta tekislikda yotadi va umumiy nuqtaga ega.	Parallel
Bitta tekislikda yotmaydi.	Kesishuvchi

Javob:

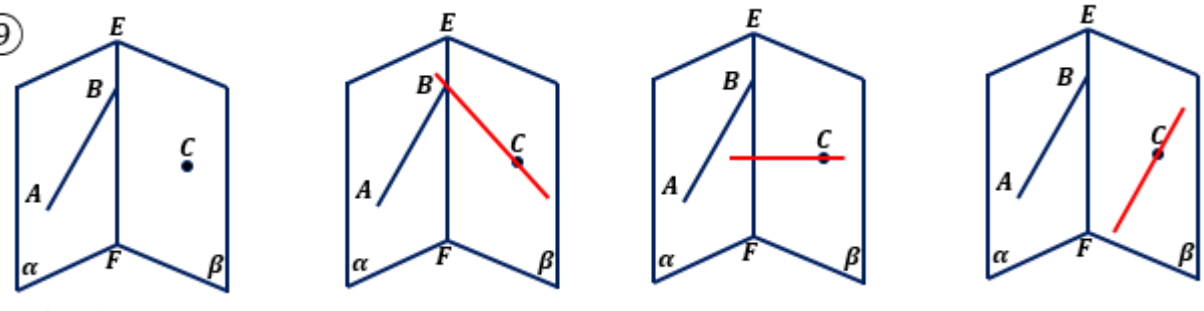
To‘g‘ri chiziqlarning xossalari	O‘zaro joylashuvi
Bitta tekislikda yotadi va umumiy nuqtaga ega emas.	Parallel
Bitta tekislikda yotadi va umumiy nuqtaga ega.	Kesishuvchi
Bitta tekislikda yotmaydi.	Ayqash

5.5. Rasmdagi α va β tekisliklar EF to‘g‘ri chiziq bo‘ylab kesishadi. AB to‘g‘ri chiziq α tekislikda yotadi. β tekislikda yotgan C nuqtadan shunday to‘g‘ri chiziq o‘tkazingki, u:

a) AB to‘g‘ri chiziqni kesib o‘tsin; **b) AB to‘g‘ri chiziq bilan ayqash;**

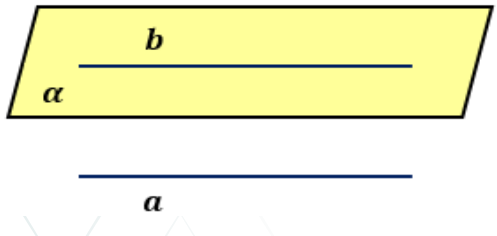
d) AB to‘g‘ri chiziq bilan parallel bo‘lsin.

⑨

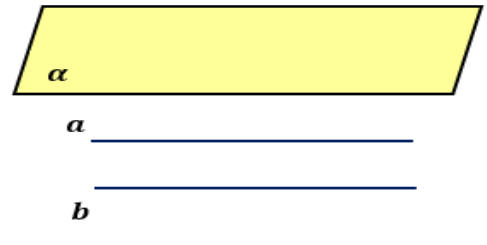


5.6. $a \parallel b$ va $a \parallel \alpha$ ekani ma’lum. b to‘g‘ri chiziq va α tekislik o‘zaro qanday joylashgan bo‘lishi mumkin?

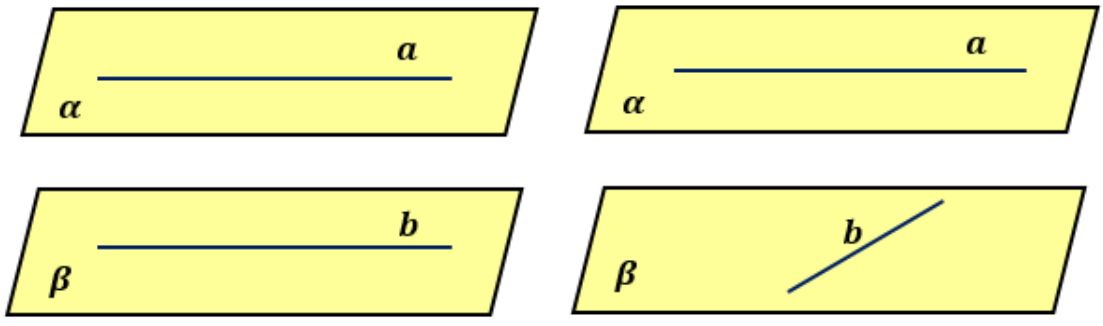
1-hol. $a \parallel b$; $a \parallel \alpha$; $b \parallel \alpha$.



2-hol. $a \parallel b$; $a \parallel \alpha$; $\alpha \parallel b$.



5.7. $\alpha \parallel \beta$, $a \subset \alpha$ va $b \subset \beta$ ekani ma'lum. a va b to'g'ri chiziqlar o'zaro qanday joylashgan bo'lishi mumkin?

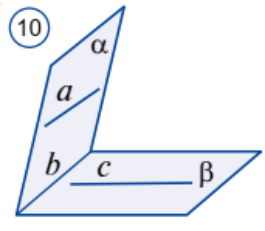


1) $\alpha \parallel \beta;\ a \subset \alpha;\ b \subset \beta;\ a \parallel b.$ 2) $\alpha \parallel \beta;\ a \subset \alpha;\ b \subset \beta;\ a \div b.$

a va b to'g'ri chiziqlar parallel yoki ayqash holatda bo'lishi mumkin.

Javob: $a \parallel b;\ a \div b.$

5.8. 10-rasmda α va β tekisliklar b to'g'ri chiziq bo'ylab kesishadi. Agar $a \parallel b$, c va b to'g'ri chiziqlar parallel bo'lmasa, a va c to'g'ri chiziqlar o'zaro qanday joylashishishi mumkin?



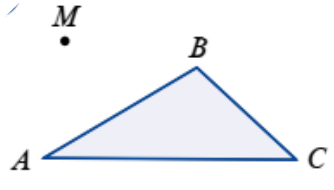
$\alpha \cap \beta = b;\ \ a \parallel b;\ \ c \nparallel b.$

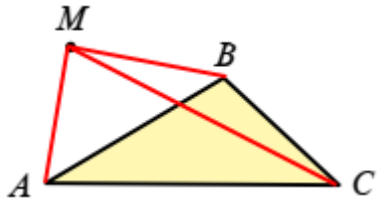
a va c to'g'ri chiziqlar o'zaro ayqash bo'ladi.

Javob: $a \div c.$

Uy vazifasi

5.9. Rasmda M nuqta ABC uchburchak tashqi sohasida yotibdi. MA, MC, MB to'g'ri chiziqlarga ayqash to'g'ri chiziqlarni aniqlang.

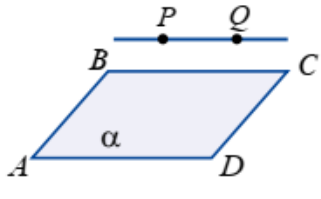




$MA \div BC;$
$MB \div AC;$
$MC \div AB.$

$\begin{cases} MA \text{ va } BC \\ MB \text{ va } AC \\ MC \text{ va } AB \end{cases}$ to'g'ri chiziqlar ayqash.

5.10. Rasmda PQ to'g'ri chiziq $ABCD$ to'rtburchakning tashqi sohasida yotadi va BC ga parallel. a) PQ va AB; b) PQ va CD; c) PQ va AD qanday to'g'ri chiziqlar?

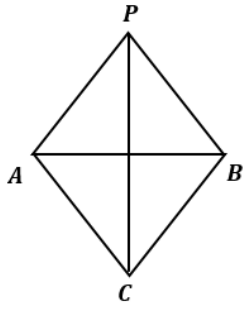


a) PQ va AB ayqash. $PQ \div AB.$

b) PQ va CD ayqash. $PQ \div CD.$

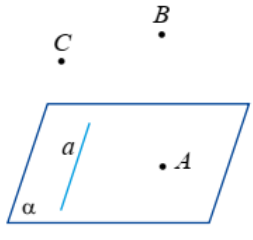
c) PQ va AD parallel. $PQ \parallel AD.$

5.11. $ABCP$ **uchburchakli piramida (tetraedr) berilgan. Quyidagi jadvalda keltirilgan to‘g‘ri chiziqlar o‘zaro qanday joylashadi? Mos katakka tegishli belgi (⊗ – kesishadi, ∸ – ayqash, // – parallel)ni qo‘ying.**



	AB	BC	AC	PA	PB	PC
AB		⊗	⊗	⊗	⊗	∸
BC	⊗		⊗	∸	⊗	⊗
AC	⊗	⊗		⊗	∸	⊗
PA	⊗	∸	⊗		⊗	⊗
PB	⊗	⊗	∸	⊗		⊗
PC	∸	⊗	⊗	⊗	⊗	

5.12. Rasmda a **to‘g‘ri chiziq va** A **nuqta** α **tekislikka tegishli.** C **va** B **nuqtalar esa bu tekislikka tegishli emas. Quyidagilardan o‘tuvchi tekislik berilgan** α **tekislikdan farqli bo‘ladimi?**



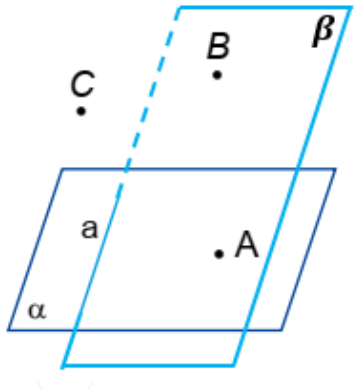
a) a to‘g‘ri chiziq va B nuqtadan;

b) a to‘g‘ri chiziq va C nuqtadan;

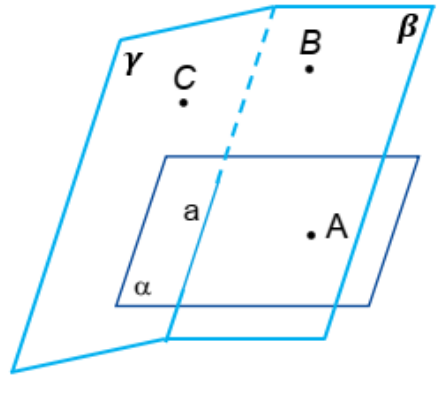
c) AB va CD to‘g‘ri chiziqdan;

d) AB va BC to‘g‘ri chiziqdan.

a) a **to‘g‘ri chiziq va** B **nuqtadan** β **tekislik o‘tkazish mumkin.**

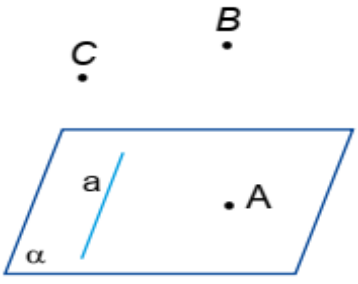


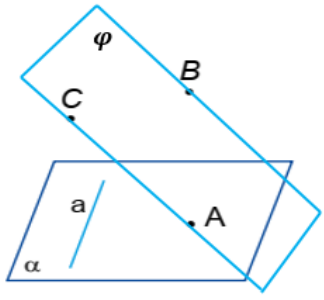
b) a **to‘g‘ri chiziq va** C **nuqtadan** γ **tekislik o‘tkazish mumkin.**



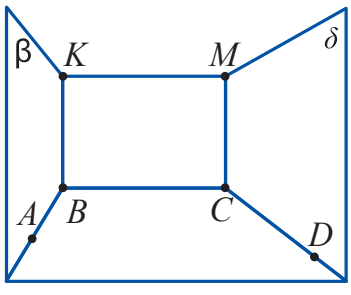
c) AB **va** CD **to‘g‘ri chiziqdan Chizmada** D **nuqta yo‘q.**

d) AB **va** BC **to‘g‘ri chiziqdan** φ **tekislik o‘tkazish mumkin.**





5.13. Rasmdagi ma’lumotlardan foydalanib, namunaga ko‘ra jadvalni to‘ldiring:



Tekisliklar	α va β	α va γ	α va δ	β va γ	γ va δ
Umumiy nuqtalari	A va B				
Umumiy to‘g‘ri chiziq	AB				

Tekisliklar	α va β	α va γ	α va δ	β va γ	γ va δ
Umumiy nuqtalari	A va B	B va C	C va D	B va K	C va M
Umumiy to‘g‘ri chiziq	AB	BC	CD	BK	CM

4-DARS. FAZOVIY GEOMETRIK SHAKLLAR. KO‘PYOQLAR

I. Standartlar:

– M10.GO‘.GSH.07. Ko‘pyoqlar: prizma, parallelepiped, kub, piramida haqida boshlang‘ich tushunchalarga ega bo‘ladi;

– M10.GO‘.GSH.08. Ko‘pyoqlar: prizma, parallelepiped, kub, piramida elementlarini chizmada ko‘rsata oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ko‘pyoqlar: prizma, parallelepiped, kub, piramidani bilish;

Ko‘nikmalar:

– ko‘pyoqlar: prizma, parallelepiped, kub, piramida elementlarini chizmada ko‘rsata olish;

III. Dars mazmunining qisqacha tavsifi:

– ko‘pyoqlar: prizma, parallelepiped, kub, piramida.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Ko‘pyoqlarga misol keltiring?	Aqliy hujum	Mavzu bo‘yicha savollar: 1
Bilimlarni boyitish va mustahkamlash	Fazoviy jismlar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 6.1-6.2
	Prizma va uning turlari	Chizma va maketlar	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 6.3-6.4
	Piramida va uning turlari	Darslik bilan ishlash. Chizma va maketlar	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 6.5-6.6
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 6.7-6.12
Uyga vazifa	1. Mavzu bo‘yicha savollar: 5 2. Amaliy mashq va tatbiq: 6.13-6.17		

6.1. Jadvalda 5-bandning asosiy tayanch ma’lumotlari keltirilgan. Ularni sinchiklab o‘rganib chiqing va izohlang.

1) Prizma. Asoslari: ABC va $A_1\ B_1\ C_1$ uchburchaklar, yon yoqlari Parallelogramm: ABB_1A_1; BCC_1B_1; ACC_1A_1. Prizmada yoqlari soni $n+2$ ta, yon yoqlari soni n ta, asosi yoqlari soni 2 ta bo‘ladi. Prizma uchlari soni $U = 2n$, yoqlari soni $Y = n+2$, qirralari soni $Q = 3n$ dan iborat bo‘ladi.

2) To‘g‘ri burchakli parallelepiped. Asoslari $ABCD$, $A_1B_1C_1D_1$ to‘g‘ri to‘rtburchak, yon

yoqlari ABB_1A_1, BCC_1B_1, CDD_1C_1, ADD_1A_1 to‘g‘ri to‘rtburchak.

To‘g‘ri burchakli parallelepipedning yoqlari soni 6 ta, yon yoqlari soni 4 ta, asosilari soni 2 ta, qirralari soni 12 ta, uchlari soni 8 ta.

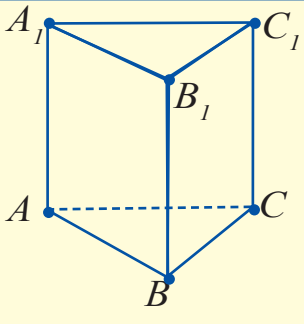
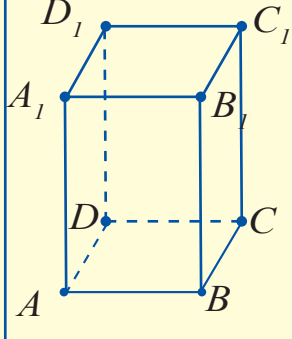
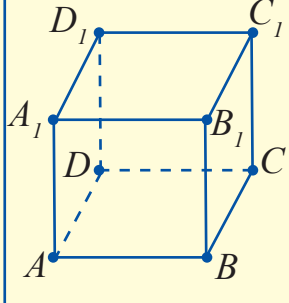
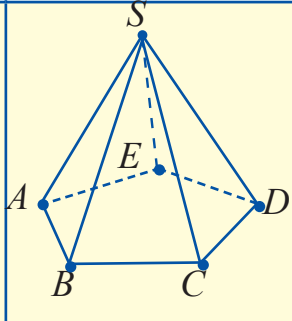
3) Kub. Asoslari $ABCD$, $A_1B_1C_1D_1$ kvadrat, yon yoqlari ABB_1A_1, BCC_1B_1, CDD_1C_1, ADD_1A_1 kvadrat. $S_{asos} = a^2$; $S_{yon} = 4a^2$; $S_{to‘la} = 6a^2$.

Kubning yoqlari soni 6 ta, yon yoqlari soni 4 ta, asosilari soni 2 ta, qirralari soni 12 ta, uchlari soni 8 ta.

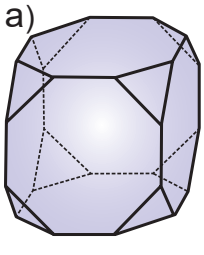
4) Piramida. Asosi $ABCDE$ ko‘pburchak, yon yoqlari ABS, BCS, CDS, DES, AES uchburchaklardan iborat.

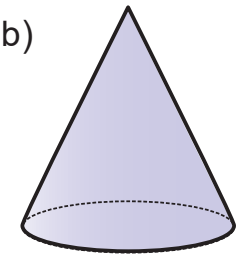
Piramidaning asosi qirralari AB, BC, CD, DE, AE. Yon qirralari AS, BS, CS, DS, ES.

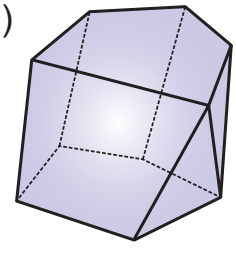
Piramidaning asoslari soni n ta bo‘lsa: uchlari soni $n+1$ ta, qirralari soni $2n$ ta, yoqlari soni $n+1$ ta.

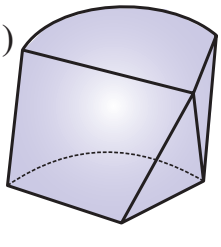
Ko‘pyoqlar			
Prizma	**To‘g‘ri burchakli parallelepiped**	**Kub**	**Piramida**
			
Asoslari – ko‘pburchak, yoqlari – Parallelogrammlar.	Asoslari – to‘g‘ri to‘rtburchak, yoqlari – to‘g‘ri to‘rtburchaklar.	Asoslari – kvadrat, yoqlari – kvadrat.	Asosi – ko‘pburchak, yoqlari – uchburchak.

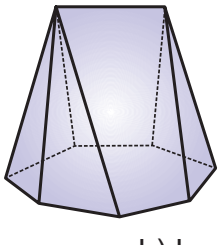
6.2. Rasmdagi jismlarning qaysilari ko‘pyoq bo‘ladi?

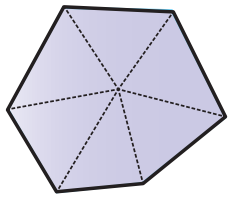
a) 

b) 

c) 

d) 

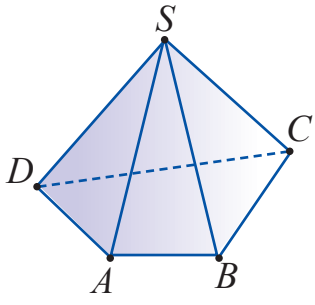
e) 

f) 

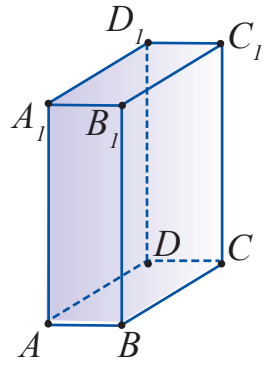
Javob: a) ko‘pyoq; b) konus; c) ko‘pyoq;
d) ko‘pyoq emas; e) ko‘pyoq; f) ko‘pyoq.

6.3. Rasmdagi fazoviy jismlarning qaysi biri: 1) kub; 2) piramida; 3) prizma?

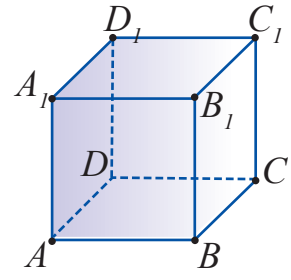
1)



2)



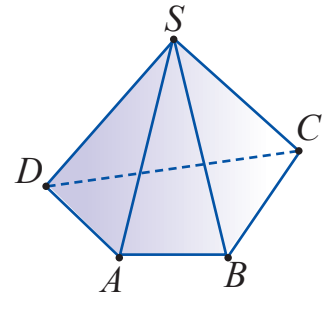
3)



Javob: 1) *Kub – c;* 2) *piramida – a;* 3) *prizma – b.*

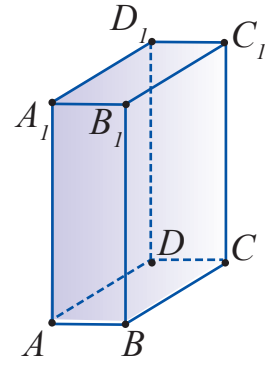
6.4. Rasmdagi piramidaning nechta uchi, qirrasi va yog‘i bor? Asosi qanday ko‘pburchakdan iborat? Yon yoqlarichi?

Piramida uchi $U = 5$ ta, ya’ni A, B, C, D, S.
Piramida qirralari $Q = 8$ ta, ya’ni $AB, BC, CD, AD, AS, BS, CS, DS$.
Piramida yoqlari: $Y = 5$ ta, ya’ni $ASB, BSC, CSD, DSA, ABCD$.
Asosi to‘rtburchakdan iborat, ya’ni $ABCD$.



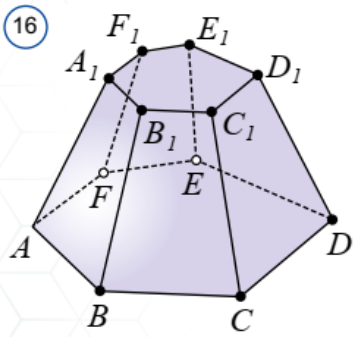
6.5. Rasmdagi prizmaning nechta uchi, qirrasi va yog‘i bor? Asoslari qanday ko‘pburchaklardan iborat? Yon yoqlari-chi?

Prizma uchi: $U = 8$ ta, ya’ni $A, B, C, D, A_1, B_1, C_1, D_1$.
Prizma qirrasi $Q = 12$ ta, ya’ni $AB, BC, CD, AD, AA_1, BB_1, CC_1, DD_1, A_1B_1, B_1C_1, C_1D_1, D_1A_1$.
Prizma yoqlari: $Y = 6$ ta, ya’ni $ABCD, A_1B_1C_1D_1; ABB_1A_1, BCC_1B_1, CDD_1C_1, ADD_1A_1$.
Asosi to‘g‘ri to‘rtburchakdan iborat, ya’ni $ABCD, A_1B_1C_1D_1$.
Yon yoqlari to‘g‘ri to‘rtburchakdan iborat, ya’ni ABB_1A_1, $BCC_1B_1, CDD_1C_1, ADD_1A_1$.



6.6. Rasmda $ABCDEFA_1B_1C_1D_1E_1F_1$ ko‘pyoq tasvirlangan. Undagi:

16



a) CD qirra umumiy bo‘lgan yoqlarni;
b) DD_1 qirra umumiy bo‘lgan yoqlarni;
c) E uch umumiy bo‘lgan yoqlarni;
d) C_1 uch umumiy bo‘lgan yoqlarni;
e) A uch umumiy bo‘lgan qirralarni;
f) F_1 uch umumiy bo‘lgan qirralarni ayting.

Javob: *a)* CD *qirra umumiy bo‘lgan yoqlari:* CDD_1C_1 *va* $ABCDEF$;
b) DD_1 *qirra umumiy bo‘lgan yoqlari:* CDD_1C_1 *va* DD_1E_1E;
c) E *uch umumiy bo‘lgan yoqlari:* EDD_1E_1, EFF_1E_1, $ABCDEF$;
d) C_1 *uch umumiy bo‘lgan yoqlari:* C_1CBB_1, C_1D_1DC, $C_1D_1E_1F_1A_1B_1$;
e) A *uch umumiy bo‘lgan qirralari:* AB, AF, AA_1.
f) F_1 *uch umumiy bo‘lgan qirralari:* F_1A_1, F_1E_1, F_1F.

6.7. Prizmaning: a) 9 ta; b) 16 ta uchi bo‘lishi mumkinmi?

Prizmaning uchlari soni: $U = 2 \cdot n$ ta (bu yerda n–prizma asosi soni).
a) $U = 9;\quad 2 \cdot n = U;\quad 2 \cdot n = 9;\quad n = 4{,}5;\quad 4{,}5 \notin N.$
b) $U = 16;\quad 2 \cdot n = U;\quad 2 \cdot n = 16;\quad n = 8.\quad 8 \in N.$
Javob: a) mumkin emas; b) mumkin.

6.8. Ixtiyoriy prizmaning uchlari soni juft bo‘lishini asoslang.

Prizmaning asoslari 2 ta bo‘lgani uchun uning uchlari soni $2n$ ta. Demak, uchlari soni juft bo‘lishi mumkin.
Javob: mumkin.

6.9. Prizmaning a) 14 ta; b) 15 ta qirrasi bo‘lishi mumkinmi?

Prizmaning qirralari soni: $Q = 3n$ ta.
a) $Q = 14;\quad 3n = 14;\quad n = \frac{14}{3};\quad \frac{14}{3} \notin N.$
b) $Q - 15;\quad 3n = 15;\quad n = 5;\quad 5 \in N.$
Javob: a) mumkin emas; b) mumkin.

6.10. Ixtiyoriy prizmaning qirralari soni 3 ga karrali bo‘lishini asoslang.

Prizmaning birinchi asosidagi qirralari soni n ta; ikkinchi asosidagi qirralari soni n ta; yon yoqlaridagi qirralari soni n tadan iborat. Demak, $n + n + n = 3n$ ta.

6.11. Prizmaning: a) 10 ta uchi; b) 18 ta qirrasi; c) 8 ta yog‘i bor bo‘lsa, uning turini aniqlang.

Prizmaning asoslaridagi burchaklari soni n ta bo‘lsa: prizma uchlari soni: $U = 2n$; yoqlari soni $Y = n + 2$; qirralari soni $Q = 3n$ dan iborat bo‘ladi.
a) $U = 10$ ta; $\quad U = 2n;\quad 2n = 10;\quad n = 5;$
b) $Q = 18$ ta; $\quad Q = 3n;\quad 3n = 18;\quad n = 6;$
c) $Y = 8$ ta; $\quad Y = n + 2;\quad n + 2 = 8;\quad n = 8 - 2 = 6.$
Javob: a) beshburchakli prizma. b) oltiburchakli prizma. c) oltiburchakli prizma.

6.12. Ixtiyoriy *n*–burchakli prizmaning: a) uchlari; b) qirralari; c) yoqlari sonini hisoblash formulasini keltirib chiqaring.

a) Ixtiyoriy n–burchakli prizmaning pastki asosida n ta uchi, yuqori asosida ham n ta uchi bor. Demak, jami uchlar soni: $U = n + n = 2n$ ta.
Javob: $U = 2n$.

b) Ixtiyoriy n–burchakli prizmaning pastki asosida n ta qirrasi, yuqori asosida ham n ta qirrasi, yon tomonida n ta qirrasi bor. Demak, prizmaning jami qirralari soni:
$Q = n + n + n = 3n$ ta.
Javob: $Q = 3n$.

c) Ixtiyoriy n–burchakli prizmaning n ta yon yoqlari soni, 2 ta asos yoqlari bor. Demak,

prizmaning jami yoqlari soni: $Y = n + 2$ ta.

Javob: $Y = n + 2$.

Uy vazifasi

6.13. Piramidaning: a) 3 ta; b) 7 ta uchi bo‘lishi mumkinmi?

Piramidaning asosi n burchakli ko‘pburchak bo‘lsa, asosida n ta uchi va piramida uchida 1 ta uchi bor. $n \geq 3$, jami: $U = n + 1$ ta uchi bor.

$n=3;\quad U = n + 1 = 3 + 1 = 4;\quad n+1 \geq 4.$

a) $n+1 = 3;\quad 3<4.$ **Javob:** $\varnothing$.

b) $n+1 = 7;\quad 7>4.$ **Javob:** bo‘lishi mumkin.

6.14. Piramidaning: a) 20 ta; b) 21 ta qirrasi bo‘lishi mumkinmi?

Piramidaning asosi n burchakli bo‘lsa, asosidagi qirralari soni n ta, yon qirralari soni n ta. Demak piramidaning qirralari soni $Q = n + n = 2n$ ta, $Q = 2n$.

a) $Q = 20$ ta; $2n = Q;\quad 2n = 20;\quad n = 10;\quad 10 \in N.$

b) $Q = 21$ ta; $2n = Q;\quad 2n = 21;\quad n = 10{,}5;\quad 10{,}5 \notin N.$

Javob: a) mumkin; b) mumkin emas.

6.15. Ixtiyoriy piramidaning qirralari soni juft bo‘lishini asoslang.

Ixtiyoriy piramidaning asosi n burchakli bo‘lsa, asosidagi qirralari soni n ta, yon qirralari soni n ta. Demak piramidaning qirralari soni $Q = n + n = 2n$ ta, $Q = 2n$.

Javob: juft bo‘lishi mumkin.

6.16. Piramidaning: a) 6 ta uchi; b) 22 ta qirrasi; c) 10 ta yog‘i bor bo‘lsa, uning turini aniqlang.

Piramidaning asosi n burchakli bo‘lsa, yonida n ta, asosida 1 ta yog‘i bo‘ladi. Demak, piramidada yoqlar soni $n + 1$ ta ekan. Piramidada uchlar soni: $U = n + 1$, yoqlar soni $Y = n + 1$, qirralari soni $Q = 2n$:

a) $U = 6;\quad U = n + 1;\quad n + 1 = 6;\quad n = 6 - 1;\quad n = 5.$

Javob: beshburchakli piramida.

b) $Q = 22;\quad Q = 2n;\quad 2n = 22;\quad n = 11.$

Javob: o‘nbirburchakli piramida.

c) $Y = 10;\quad Y = n + 1;\quad n + 1 = 10;\quad n = 10 - 1;\quad n = 9.$

Javob: to‘qqizburchakli piramida.

6.17. Prizmaning: a) 9 ta; b) 16 ta yog‘i bo‘lishi mumkinmi?

Prizmada: $U = 2n;\quad Y = n + 2;\quad Q = 3n.$

a) $Y = 9;\quad n + 2 = 9;\quad n = 9 - 2;\quad n = 7;\quad 7 \in N.$

Javob: mumkin .

b) $Y = 16;\quad n + 2 = 16;\quad n = 16-2;\quad n = 14;\quad 14 \in N.$

Javob. mumkin.

5-DARS. FAZOVIY GEOMETRIK SHAKLLAR. KO‘PYOQLAR

I. Standartlar:

– M10.GO‘.MM.02. Prizma, parallelepiped, kub, piramida sirtini topishga doir masalalarni yecha oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– prizma, parallelepiped, kub, piramida sirtini hisoblash formulasini bilish;

Ko‘nikmalar:

– prizma, parallelepiped, kub, piramida sirtini hisoblay olish;

III. Dars mazmunining qisqacha tavsifi:

– prizma, parallelepiped, kub, piramida sirti formulasi.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Ko‘pyoqlarning yon sirtiga misol keltiring?	Aqliy hujum	Mavzu bo‘yicha savollar: 6
Bilimlarni boyitish va mustahkamlash	Fazoviy jismlar sirti	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 7 Amaliy mashq va tatbiq: 6.20 – 6.21
	Muntazam piramida	Chizma va maketlar	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 6.22
	Muntazam piramida yon sirti	Darslik bilan ishlash. Chizma va maketlar	Mavzu bo‘yicha savollar: 8 Amaliy mashq va tatbiq: 6.29
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 6.30
Uyga vazifa	1. Mavzu bo‘yicha savollar: 9 2. Amaliy mashq va tatbiq: 6.31 – 6.32		

6.20. Ixtiyoriy n-burchakli piramidaning: a) uchlari; b) qirralari; c) yoqlari sonini hisoblash formulasini keltirib chiqaring.

n burchakli piramida asosi n burchakli ko‘pburchak bo‘lgani uchun asosida n ta qirra va n ta uchi bor, yonida n ta yoq va n ta qirrasi bor. Uchida 1 ta uchi bor.

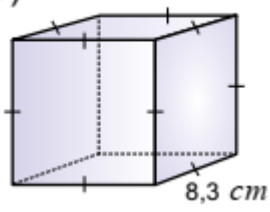
a) Ixtiyoriy n burchakli piramidaning uchlari: $U = n + 1$.

b) Ixtiyoriy n burchakli piramidaning qirralari: $Q = n + n = 2n;$ $Q = 2n$.

c) Ixtiyoriy n burchakli piramidaning yoqlari: $Y = 1 + n = n + 1;$ $Y = n + 1$.

6.21. 17-rasmdagi ma’lumotlardan foydalanib, ko‘pyoqlarning to‘la sirtini toping.

a)

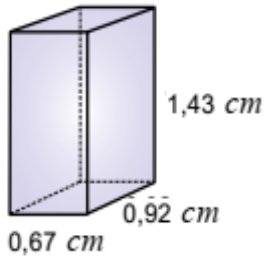


$a = 8{,}3$ cm.

$S_{to'la} = 6a^2 = 6 \cdot (8{,}3\ cm)^2 = 6 \cdot 68{,}89\ cm^2 = 413{,}34 cm^2.$

Javob: $S_{to'la} = 413{,}34\ cm^2.$

b)



$a = 0{,}67$ cm; $b = 0{,}92$ cm; $c = 1{,}43$ cm.

$S_{to'la} = 2(ab + ac + bc) =$

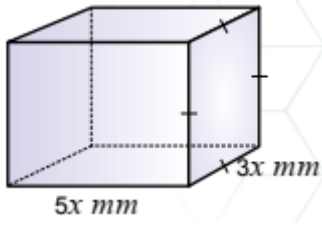
$= 2 \cdot (0{,}67 \cdot 0{,}92 + 0{,}67 \cdot 1{,}43 + 0{,}92 \cdot 1{,}43) =$

$= 2 \cdot (0{,}6164 + 0{,}9581 + 1{,}3156) = 2 \cdot 2{,}8901 =$

$= 5{,}7802\ cm^2.$

Javob: $S_{to'la} = 5{,}7802\ cm^2$

c)



$a = 5x$ mm; $b = 3x$ mm; $c = 3x$ mm.

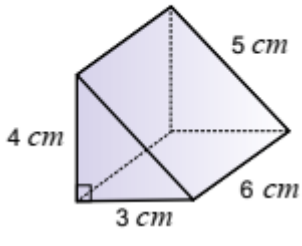
$S_{to'la} = 2 \cdot (a \cdot b + a \cdot c + b \cdot c) =$

$= 2 \cdot (5x \cdot 3x + 5x \cdot 3x + 5x \cdot 3x) =$

$= 2 \cdot (15x^2 + 15x^2 + 9x^2) = 2 \cdot 39\ x^2 = 78\ x^2.$

Javob: $S_{to'la} = 78x^2\ mm^2$

d)



$a = 3$ cm; $b = 4$ cm; $c = 6$ cm; $d = 5$ cm.

$$S_{\Delta} = \frac{a \cdot b}{2} = \frac{3\ cm \cdot 4\ cm}{2} = \frac{12\ cm^2}{2} = 6\ cm^2;$$

$S_{ac} = a \cdot c = 3\ cm \cdot 6\ cm = 18\ cm^2;$

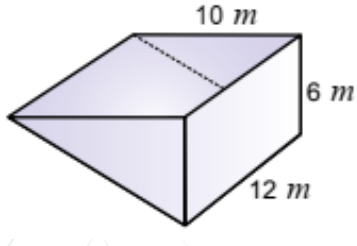
$S_{bc} = b \cdot c = 4\ cm \cdot 6\ cm = 24\ cm^2;$

$S_{cd} = c \cdot d = 6\ cm \cdot 5\ cm = 30\ cm^2;$

$S_{to'la} = 2 \cdot S_{\Delta} + S_{ac} + S_{bc} + S_{cd} = 2 \cdot 6\ cm^2 + 18\ cm^2 + 24\ cm^2 + 30\ cm^2 = 12\ cm^2 + 72\ cm^2 = 84\ cm^2.$

Javob: $S_{to'la} = 84\ cm^2.$

e)



$a = 6$ cm; $c = 10$ cm; $d = 12$ cm.

$$b = \sqrt{c^2 - a^2} = \sqrt{10^2 - 6^2} = \sqrt{64} = 8\ cm;$$

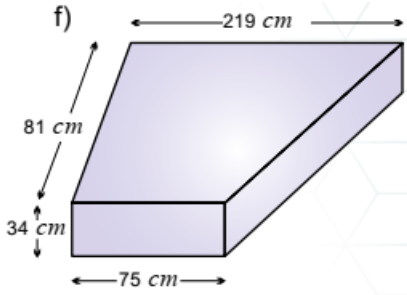
$$S_{ab} = \frac{ab}{2} = \frac{6\ cm \cdot 8\ cm}{2} = \frac{48\ cm^2}{2} = 24\ cm^2;$$

$S_{ad} = ad = 6\ cm \cdot 12\ cm = 72\ cm^2;$

$S_{bd} = b \cdot d = 8\ cm \cdot 12\ cm = 96\ cm^2;$ $S_{cd} = c \cdot d = 10\ cm \cdot 12\ cm = 120\ cm^2;$

$S_{to'la} = 2 \cdot S_{ab} + S_{ad} + S_{bd} + S_{cd} = 2 \cdot 24\ cm^2 + 72\ cm^2 + 96\ cm^2 + 120\ cm^2 =$

$= 48\ cm^2 + 288\ cm^2 = 336\ cm^2.$ **Javob:** $S_{to'la} = 336\ cm^2.$



$a = 75\ cm;\ b = 219\ cm;\ c = 81\ cm;\ d = 34\ cm.$

$$e = \sqrt{c^2 + (b-a)^2} = \sqrt{81^2 + (219-75)^2} =$$

$$= \sqrt{81^2 + 144^2} = \sqrt{9^2 \cdot (9^2 + 12^2)} =$$

$$= 9 \cdot \sqrt{81 + 144} = 9 \cdot \sqrt{225} = 9 \cdot 15 = 135\ cm.$$

$$S_{abce} = \frac{a+b}{2} \cdot c = \frac{75+219}{2} \cdot 81 = \frac{294}{2} \cdot 81 = 147 \cdot 81 = 11907\ cm^2;$$

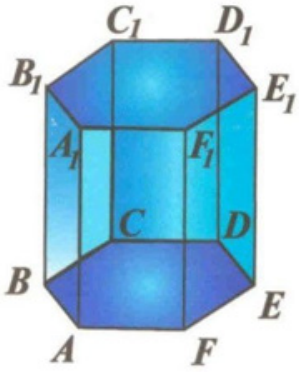
$S_{cd} = c \cdot d = 81 \cdot 34 = 2754\ cm^2;$ $S_{bd} = b \cdot d = 219 \cdot 34 = 7446\ cm^2;$

$S_{ed} = e \cdot d = 135 \cdot 34 = 4590\ cm^2;$ $S_{ad} = a \cdot d = 75 \cdot 34 = 2550\ cm^2;$

$S_{to'la} = 2 \cdot S_{abce} + S_{cd} + S_{bd} + S_{ed} + S_{ad} = 2 \cdot 11907\ cm^2 + 2754\ cm^2 + 7446\ cm^2 + 4590\ cm^2 + 2550\ cm^2 = 23814\ cm^2 + 17340\ cm^2 = 41154\ cm^2.$

Javob: $S_{to'la} = 41154\ cm^2.$

6.22. To‘g‘ri prizmaning yon yoqlari to‘g‘ri to‘rtburchak ekanligini isbotlang.



$ABCDEF \parallel A_1\ B_1\ C_1\ D_1\ E_1\ F_1.$

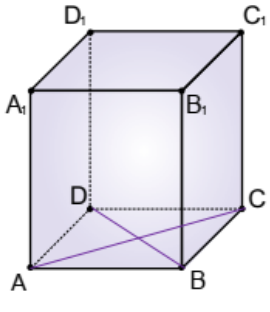
To‘g‘ri prizmada yon qirralari asosiga perpendikulyar bo‘lgani uchun yon yoqlari to‘g‘ri to‘rtburchakdir.

ABB_1A_1 – to‘g‘ri to‘rtburchak. Isbotlandi.

6.23. To‘g‘ri prizma yon sirti asosining perimetri va yon qirrasining ko‘paytmasiga teng ekanligini isbotlang.

Isboti. To‘g‘ri prizma yon yoqlari to‘g‘ri to‘rtburchaklardir. Bu to‘g‘ri to‘rtburchaklarning asoslari prizmaning asosida yotgan ko‘pburchakning tomonlari bo‘ladi, balandliklari esa yon qirralarining uzunliklariga teng. Bundan prizmaning yon sirti $S = a^1\ l + a^2\ l + \cdots + a_n\ l = (a_1 + a_2 + \cdots + a_n) \cdot l = pl$ ga teng degan natija chiqadi: bu yerda $a1 \ldots a_n$ – *asos* qirralarining uzunliklari, p – prizma asosining perimetri, l – yon qirralarining uzunligi.

6.24. To‘g‘ri parallelepipedning asosi diagonallari 10 m va 24 m bo‘lgan rombdan iborat. Agar parallelepipedning yon qirrasi 8 m bo‘lsa, uning to‘la sirtini toping.



$BD = 10\ m;\ AC = 24\ m;\ h = AA_1 = 8\ m.$

$BD^2 + AC^2 = 4a^2;\ 4a^2 = 10^2 + 24^2;$

$4a^2 = 100 + 576;\ 4a^2 = 676;$

$(2a)^2 = 26^2;\ 2a = 26;\ a = 13\ m.$

$$S_{ABCD} = S_{A_1B_1C_1D_1} = \frac{AC \cdot BD}{2} = \frac{10 \cdot 24}{2} = 120\ m^2;$$

$S_{yon} = 4a \cdot h = 4 \cdot 13\ m \cdot 8\ m = 416\ m^2;$

$S_{to'la} = 2 \cdot S_{asos} + S_{yon} = 2 \cdot 120\ m^2 + 416\ m^2 = 240\ m^2 + 416\ m^2 = 656\ m^2.$

Javob: $S_{to'la} = 656\ m^2.$

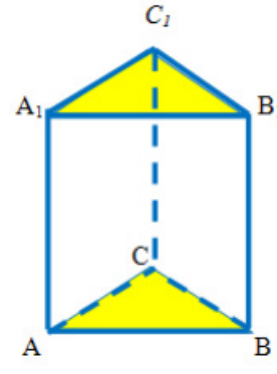
6.25. To‘g‘ri burchakli parallelepipedning barcha yoqlari to‘g‘ri to‘rtburchak ekanligini isbotlang.

To‘g‘ri burchakli parallelepipedda asosi to‘g‘ri to‘rtburchak va yon qirralari asosiga perpendikulyar bo‘lgani uchun barcha yoqlari to‘g‘ri to‘rtburchak bo‘ladi.

6.26. Muntazam uchburchakli prizma asosining tomoni 6 cm, yon qirrasi esa 11 cm ga teng. Prizmaning to‘la sirtini toping.

Berilgan: $a = AB = BC = AC = 6\ cm;$

$h = AA_1 = BB_1 = CC_1 = 11\ cm.$ Topish kerak: $S_{to'la} = ?$



$$S_{ABC} = \frac{a^2\sqrt{3}}{4} = \frac{6^2\sqrt{3}}{4} = \frac{36\sqrt{3}}{4} = 9\sqrt{3}\ cm^2;$$

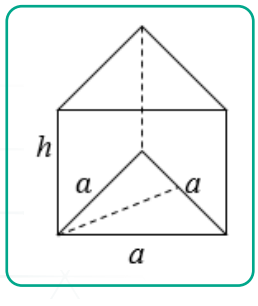
$$S_{asos} = 2 \cdot S_{ABC} = 2 \cdot 9\sqrt{3} = 18\sqrt{3}\ cm^2;$$

$$S_{yon} = 3 \cdot a \cdot h = 3 \cdot 6 \cdot 11 = 198\ cm^2;$$

$$S_{to'la} = S_{asos} + S_{yon} = 18\sqrt{3} + 198 = 18\left(\sqrt{3} + 11\right)cm^2.$$

Javob: $S_{to'la} = 18\left(\sqrt{3} + 11\right)cm^2.$

6.27. Muntazam *n* burchakli prizma asosining tomoni *a*, yon qirrasi *h* ga teng. Agar: a) $n = 3,\ a = 5,\ h = 10;$ b) $n = 4,\ a = 10,\ h = 30;$ c) $n = 6,\ a = 18,\ h = 32;$ d) $n = 5,\ a = 16,\ h = 25$ bo‘lsa, prizmaning yon sirti va to‘la sirtini toping.



Yechilishi: a) $n = 3,\ a = 5,\ h = 10.$

$S_{yon} = p \cdot h = n \cdot a \cdot h = 3 \cdot 5 \cdot 10 = 15 \cdot 10 = 150;$

$$S_{asos} = \frac{1}{2} \cdot a \cdot h_1 \cdot \sin\alpha,\ n = 3\ bo'lgani\ uchun$$

$$\alpha = \frac{180^\circ}{3} = 60^\circ\ ga\ teng\ bo'ladi.$$

$$h_1 = \sqrt{a^2 - \left(\frac{a}{2}\right)^2} = \sqrt{5^2 - \left(\frac{5}{2}\right)^2} = \sqrt{25 - \frac{25}{4}} = \sqrt{\frac{100 - 25}{4}} = \sqrt{\frac{75}{4}} = \frac{5\sqrt{3}}{2};$$

$$S_{asos} = \frac{1}{2} \cdot a \cdot h_1 = \frac{1}{2} \cdot 5 \cdot \frac{5\sqrt{3}}{2} = \frac{5}{2} \cdot \frac{5\sqrt{3}}{2} = \frac{25 \cdot \sqrt{3}}{4};$$

$$S_{to'la} = S_{yon} + 2S_{asos} = 150 + 2 \cdot \frac{25 \cdot \sqrt{3}}{4} = 150 + \frac{25 \cdot \sqrt{3}}{2}.$$

Javob: $S_{yon} = 150$; $S_{to'la} = 150 + \frac{25 \cdot \sqrt{3}}{2}$.

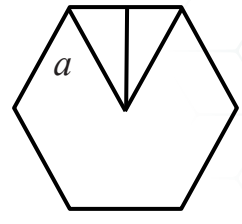
Yechilishi: b) $n = 4;\ a = 10;\ h = 30.$

$S_{yon} = p \cdot h = n \cdot a \cdot h = 4 \cdot 10 \cdot 30 = 40 \cdot 30 = 1200;$

$n = 4$ bo'lgani uchun $\alpha = \frac{360^\circ}{4} = 90^\circ$ ga teng bo'ladi. Demak prizmaning asosi kvadratdan iborat $S_{asos} = a \cdot a = 10 \cdot 10 = 100$

$S_{to'la} = S_{yon} + 2S_{asos} = 1200 + 2 \cdot 100 = 1200 + 200 = 1400.$

Javob: $S_{yon} = 1200;$ $S_{to'la} = 1400.$



Yechilishi: c) $n = 6;\ a = 18;\ h = 32.$

$S_{yon} = p \cdot h = n \cdot a \cdot h = 6 \cdot 18 \cdot 32 = 108 \cdot 32 = 3456;$

$$h_1 = \sqrt{a^2 - \left(\frac{a}{2}\right)^2} = \sqrt{18^2 - \left(\frac{18}{2}\right)^2} = \sqrt{324 - \frac{324}{4}} = \sqrt{243} = 9\sqrt{3}$$

$$S_\Delta = \frac{1}{2} a \cdot h_1 = \frac{1}{2} \cdot 18 \cdot 9\sqrt{3} = 9 \cdot 9\sqrt{3} = 81\sqrt{3};$$

$S_{asos} = n \cdot S_\Delta = 6 \cdot 81\sqrt{3} = 486\sqrt{3};$

$S_{to'la} = S_{yon} + 2S_{asos} = 3456 + 2 \cdot 486\sqrt{3} = 3456 + 972\sqrt{3} = 108(32 + 9\sqrt{3}).$

Javob: $S_{yon} = 3456;$ $S_{to'la} = 108(32 + 9\sqrt{3}).$

$$\alpha = \frac{180^\circ}{5} = 36^\circ; \quad tg\,36^\circ = \frac{\frac{a}{2}}{y} = \frac{\frac{16}{2}}{y} = \frac{8}{y}; \quad tg\,36^\circ = \frac{8}{y}; \quad y = 8 \cdot ctg\,36^\circ;$$

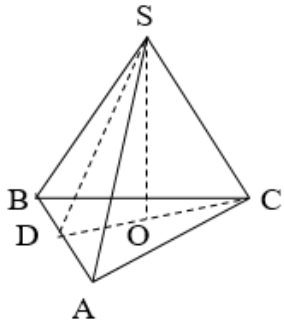
$$S_{asos} = S_5 = n \cdot \frac{ay}{2} = 5 \cdot \frac{16 \cdot 8 \cdot ctg\,36^\circ}{2} = 5 \cdot 8 \cdot 8 \cdot ctg\,36^\circ = 320 \cdot ctg\,36^\circ;$$

$S_{yon} = p \cdot h = n \cdot a \cdot h = 5 \cdot 16 \cdot 25 = 80 \cdot 25 = 2000;$

$S_{to'la} = S_{yon} + 2S_{asos} = 2000 + 2 \cdot 320 \cdot ctg\,36^\circ = 2000 + 640 \cdot ctg\,36^\circ.$

Javob: $S_{yon} = 2000;$ $S_{to'la} = 2000 + 640 \cdot ctg\,36^\circ.$

6.28. Muntazam uchburchakli piramida apofemasi 15 ga, piramida uchini asos markazi bilan tutashtiruvchi kesma uzunligi 12 ga teng. a) piramida yon qirrasi va asosining tomonini; b) piramida yon sirtini; c) piramida to‘la sirtini toping.



$SD = 15;\quad SO = 12.$

$a)\ AS = BS = CS = ?;\quad AB = BC = AC = ?$

$OD = \sqrt{SD^2 - SO^2} = \sqrt{15^2 - 12^2} = \sqrt{225 - 144} = 9;$

$AB = 2 \cdot OD \cdot tg\frac{180^\circ}{2} = 2 \cdot 9 \cdot tg60^\circ = 18\sqrt{3};$

$AD = \frac{AB}{2} = \frac{18\sqrt{3}}{2} = 9\sqrt{3};$

$AS = \sqrt{SD^2 + AD^2} = \sqrt{15^2 + (9\sqrt{3})^2} = \sqrt{225 + 81 \cdot 3} = \sqrt{225 + 243} =$

$= \sqrt{468} = 6\sqrt{13}.$

Javob: $AS = 6\sqrt{13};\quad AB = 18\sqrt{3}.$

$b)\ CD = \sqrt{AC^2 - AD^2} = \sqrt{(18\sqrt{3})^2 - (9\sqrt{3})^2} = \sqrt{324 \cdot 3 - 81 \cdot 3} =$

$= \sqrt{972 - 243} = \sqrt{729} = 27;$

$S_{asos} = \frac{1}{2} \cdot CD \cdot AB = \frac{1}{2} \cdot 27 \cdot 18\sqrt{3} = 27 \cdot 9\sqrt{3} = 243\sqrt{3};$

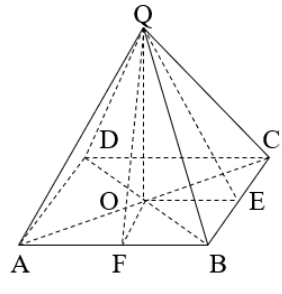
$S_{yon} = \frac{1}{2} \cdot n \cdot AB \cdot SD = \frac{1}{2} \cdot 3 \cdot 18\sqrt{3} \cdot 15 = 45 \cdot 9\sqrt{3} = 405\sqrt{3}.$

Javob: $S_{yon} = 405\sqrt{3}$

$c)\ S_{to'la} = S_{yon} + S_{asos} = 405\sqrt{3} + 243\sqrt{3} = (405 + 243)\sqrt{3} = 648\sqrt{3}.$

Javob: $S_{to'la} = 648\sqrt{3}.$

6.29*. Piramida asosi tomonlari 8 va 10 bo‘lgan va kichik diagonali 6 ga teng bo‘lgan Parallelogrammdan iborat. Piramida uchini asos diagonallari kesishish nuqtasi bilan tutashtiruvchi kesma uzunligi 4 ga teng. a) piramida yon qirralarini; b) piramida yon sirtini; c) piramida to‘la sirtini toping.



$a = AD = BC = 8;\quad b = AB = CD = 10;$

$d_1 = BD = 6;\quad h = QO = 4.$

a) $l_1 = QB = QD = ?;\quad l_2 = QA = QC = ?$

b) $S_{yon} = ?$ c) $S_{to'la} = ?$

$a)\ d_1^2 + d_2^2 = 2(a^2 + b^2);\quad 6^2 + d_2^2 = 2(8^2 + 10^2);\quad 36 + d_2^2 = 2(64 + 100);$

$36 + d_2^2 = 2 \cdot 164;$ $36 + d_2^2 = 328;$ $d_2^2 = 328 - 36;$ $d_2^2 = 292;$

$36 + d_2^2 = 2 \cdot 164;$ $36 + d_2^2 = 328;$ $d_2^2 = 328\text{-}36;$ $d_2^2 = 292;$

$d_2 = \sqrt{292};$ $d_2 = 2\sqrt{73};$ $d_2 = AC = 2\sqrt{73};$

$$l_1 = \sqrt{h^2 + \left(\frac{d_1}{2}\right)^2} = \sqrt{4^2 + \left(\frac{6}{2}\right)^2} = \sqrt{16 + 3^2} = \sqrt{16 + 9} = \sqrt{25} = 5;$$

$$l_2 = \sqrt{h^2 + \left(\frac{d_2}{2}\right)^2} = \sqrt{4^2 + \left(\frac{2\sqrt{73}}{2}\right)^2} = \sqrt{16 + 73} = \sqrt{89};$$

Javob: $l_1 = 5;$ $l_2 = \sqrt{89}.$

b) $a = AD = BC = 8;$ $b = AB = CD = 10;$ $d_1 = BD = 6;$ $h = QO = 4.$

$AC = 2\sqrt{73};$ $\angle BOC = \alpha;$ $BO = \frac{d_1}{2} = \frac{6}{2} = 3;$ $CO = \frac{d_2}{2} = \frac{2\sqrt{73}}{2} = \sqrt{73};$

$BC^2 = BO^2 + CO^2 - 2 \cdot BO \cdot CO \cdot \cos\alpha;$ $8^2 = 3^2 + \left(\sqrt{73}\right)^2 - 2 \cdot 3 \cdot \sqrt{73} \cdot \cos\alpha;$

$64 = 9 + 73 - 6\sqrt{73} \cdot \cos\alpha;$ $64 = 82 - 6\sqrt{73} \cdot \cos\alpha;$

$6\sqrt{73} \cdot \cos\alpha = 82 - 64;$ $6\sqrt{73} \cdot \cos\alpha = 18;$ $\sqrt{73} \cdot \cos\alpha = 3;$

$$\cos\alpha = \frac{3}{\sqrt{73}}; \quad \sin\alpha = \sqrt{1 - \left(\frac{3}{\sqrt{73}}\right)^2} = \sqrt{1 - \frac{9}{73}} = \sqrt{\frac{73 - 9}{73}} = \sqrt{\frac{64}{73}} = \frac{8}{\sqrt{73}};$$

$$S_{ABCD} = \frac{BD \cdot AC}{2} \cdot \sin\alpha = \frac{6 \cdot 2\sqrt{73}}{2} \cdot \frac{8}{\sqrt{73}} = 48; \quad a \cdot h_a = S_{ABCD};$$

$$h_a = \frac{S_{ABCD}}{a} = \frac{48}{8} = 6; \quad b \cdot h_b = S_{ABCD}; \quad h_b = \frac{S_{ABCD}}{b} = \frac{48}{10} = 4{,}8;$$

$$f_a = QE = \sqrt{h^2 + BO^2} = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} = \sqrt{25} = 5;$$

$$f_b = QF = \sqrt{h^2 + \left(\frac{h_b}{2}\right)^2} = \sqrt{4^2 + \left(\frac{4{,}8}{2}\right)^2} = \sqrt{4^2 + (2{,}4)^2} = \sqrt{16 + \frac{144}{25}} =$$

$$= 4\sqrt{1 + \frac{9}{25}} = 4\sqrt{\frac{34}{25}} = \frac{4\sqrt{34}}{5}; \qquad S_{BCQ} = S_{ADQ} = \frac{a \cdot f_a}{2} = \frac{8 \cdot 5}{2} = \frac{40}{2} = 20;$$

$$S_{ABQ} = S_{DCQ} = \frac{b \cdot f_b}{2} = \frac{10 \cdot \frac{4\sqrt{34}}{5}}{2} = \frac{2 \cdot 4\sqrt{34}}{2} = 4\sqrt{34};$$

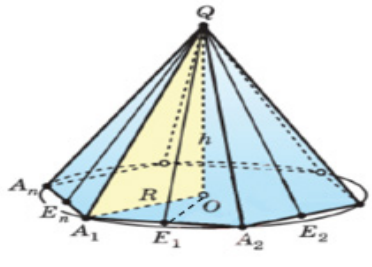
$$S_{yon} = 2 \cdot \left(S_{BCQ} + S_{ABQ}\right) = 2 \cdot (20 + 4\sqrt{34} = 40 + 8\sqrt{34}.$$

Javob: $S_{yon} = 40 + 8\sqrt{34}$.

$c)$ $S_{to'la} = S_{asos} + S_{yon} = 48 + 40 + 8\sqrt{34} = 88 + 8\sqrt{34}$.

Javob: $S_{to'la} = 88 + 8\sqrt{34}$.

6.30*. Muntazam oltiburchakli piramida asosining tomoni 10 *cm* ga teng. Piramida uchini asos markazi bilan tutashtiruvchi kesma uzunligi √69 ga teng. a) piramida yon qirrasi va apofemasini; b) piramida yon sirtini; c) piramida to‘la sirtini toping.



Berilgan: $n = 6;\ a = A_1A_2 = \ldots = A_5A_6 = 10\ cm;$
$h = QO = \sqrt{69}.\ R = OA_1;\ r = OE_1.$
Topish kerak: a) $l = QA_1 = ?,\ f = QE_1 = ?$
b) $S_{yon} = ?,$ c) $S_{to'la} = ?$

$$l = \sqrt{R^2 + h^2} = \sqrt{10^2 + \left(\sqrt{69}\right)^2} = \sqrt{100 + 69} = \sqrt{169} = 13\ cm.$$

$$r = \frac{a\sqrt{3}}{2} = \frac{10\ cm \cdot \sqrt{3}}{2} = 5\sqrt{3}\ cm;$$

$$f = \sqrt{r^2 + h^2} = \sqrt{\left(5\sqrt{3}\right)^2 + \left(\sqrt{69}\right)^2} = \sqrt{75 + 69} = \sqrt{144} = 12\ cm.$$

Javob: l – 13 cm; f – 12 cm.

$b)$ $S_{yon} = \frac{n \cdot a \cdot f}{2} = \frac{6 \cdot 10 \cdot 12}{2} = 3 \cdot 120 = 360\ cm^2;$

Javob: $S_{yon} = 360\ cm^2;$

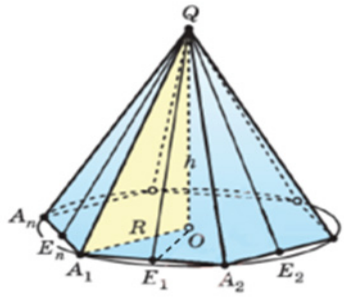
$c)\ S_{asos} = \frac{3a^2\sqrt{3}}{2} = \frac{3\cdot 10^2\cdot\sqrt{3}}{2} = \frac{3\cdot 100\cdot\sqrt{3}}{2} = 3\cdot 50\cdot\sqrt{3} = 150\sqrt{3}\ cm^2;$

$S_{to'la} = S_{asos} + S_{yon} = 150\sqrt{3}\ cm^2 + 360\ cm^2 = 30\left(5\sqrt{3}+12\right)\ cm^2.$

Javob: $S_{to'la} = 30\left(5\sqrt{3}+12\right)\ cm^2.$

Uy vazifasi

6.31. Muntazam oltiburchakli piramida yon sirtining yuzi $150\ m^2$ ga, yon qirrasi esa $10\ m$ ga teng. Piramida asosining yuzini toping.



$n = 6; \qquad S_{yon} = 150\ m^2; \qquad l = QA_1 = 10\ m.$

$a = A_1O = OA_2 = A_1A_2; \qquad a = R; \qquad r = \frac{a\sqrt{3}}{2};$

$P = 6a; \qquad \frac{1}{2}\cdot P\cdot f = S_{yon}; \qquad \frac{1}{2}\cdot 6a\cdot f = 150;$

$3a\cdot f = 150; \qquad a = \frac{150}{3\cdot f}; \qquad a = \frac{50}{f};$

$\begin{cases} R^2 + h^2 = l^2 \\ r^2 + h^2 = f^2 \end{cases} \rightarrow \begin{cases} h^2 = l^2 - R^2 \\ h^2 = f^2 - r^2 \end{cases} \rightarrow l^2 - R^2 = f^2 - r^2;$

$l^2 - a^2 = f^2 - \left(\frac{a\sqrt{3}}{2}\right)^2; \qquad 10^2 - \left(\frac{50}{f}\right)^2 = f^2 - \left(\frac{\frac{50}{f}\cdot\sqrt{3}}{2}\right)^2;$

$100 - \frac{2500}{f^2} = f^2 - \frac{2500\cdot 3}{4\cdot f^2}; \qquad \frac{100\cdot f^2 - 2500}{f^2} = f^2 - \frac{625\cdot 3}{f^2};$

$\frac{100\cdot f^2 - 2500}{f^2} = \frac{f^4 - 1875}{f^2}; \qquad 100\cdot f^2 - 2500 = f^4 - 1875;$

$f^4 - 100\cdot f^2 - 1875 + 2500 = 0; \qquad f^4 - 100\cdot f^2 + 625 = 0;$

$$f^2 = \frac{100 \pm \sqrt{10\,000 - 2\,500}}{2} = 50 \pm 25\sqrt{3}\,; \qquad f^2 = 50 \pm 25\sqrt{3}\,;$$

$$f = \sqrt{50 \pm 25\sqrt{3}} = \sqrt{25(2 \pm \sqrt{3})} = 5\sqrt{2 \pm \sqrt{3}}\,;$$

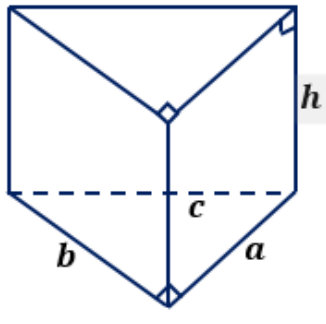
$$a = \frac{50}{f} = \frac{50}{5\sqrt{2 \pm \sqrt{3}}} = \frac{10}{\sqrt{2 \pm \sqrt{3}}} = 10 \cdot \sqrt{2 \mp \sqrt{3}};$$

$$S_{asos} = \frac{3a^2\sqrt{3}}{2} = \frac{3 \cdot \left(10 \cdot \sqrt{2 \mp \sqrt{3}}\right)^2 \cdot \sqrt{3}}{2} = \frac{3 \cdot 100 \cdot (2 \mp \sqrt{3}) \cdot \sqrt{3}}{2} =$$

$$= 150\left(2\sqrt{3} \mp \sqrt{3}\right).$$

Javob: $S_{asos} = 150\left(2\sqrt{3} \mp \sqrt{3}\right)\ m^2.$

6.32. To‘g‘ri prizmaning asosi gipotenuzasi 5 *cm*, kateti 4 *cm* bo‘lgan to‘g‘ri burchakli uchburchakdir. Agar eng kichik katet yotgan yoq kvadrat bo‘lsa, prizmaning yon sirti yuzini toping.



Berilgan: $c = 5\ cm;\ \ b = 4\ cm.$

Topish kerak: $S_{to‘la} = ?$

$$a = \sqrt{c^2 - b^2} = \sqrt{5^2 - 4^2} = \sqrt{25 - 16} = \sqrt{9} = 3\ cm.$$

$$a = h = 3\ cm\,; \qquad S_{asos} = \frac{ab}{2} = \frac{3 \cdot 4}{2} = \frac{12}{2} = 6\ cm^2\,;$$

$S_{yon} = (a+b+c) \cdot h = (3\ cm + 4\ cm + 5\ cm) \cdot 3\ cm = 12\ cm \cdot 3\ cm = 36\ cm^2.$

$S_{to‘la} = 2 \cdot S_{asos} + S_{yon} = 2 \cdot 6\ cm^2 + 36\ cm^2 = 12\ cm^2 + 36\ cm^2 = 48\ cm^2.$

Javob: $S_{to‘la} = 48\ cm^2.$

6-DARS. KO‘PYOQLARNI TASVIRLASH VA MODELINI YASHASH

I. Standartlar:

– M10.GO‘.YM.01. Sodda fazoviy jismlarning yoyilmasi yordamida ularning modellarini yasay oladi va chizmasini tekislikda tasvirlay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ko‘pyoqlarni tekislikda tasvirlashni bilish;

– ko‘pyoqlar yoyilmasi va unga ko‘ra uning modelini yasashni bilish.

Ko‘nikmalar:

– sodda fazoviy jismlarning yoyilmasi yordamida ularning modellarini yasay olish va chizmasini tekislikda tasvirlay olish.

III. Dars mazmunining qisqacha tavsifi

– ko‘pyoqlarni tekislikda tasvirlash. Ko‘pyoqlar yoyilmasi va unga ko‘ra uning modelini yasash.

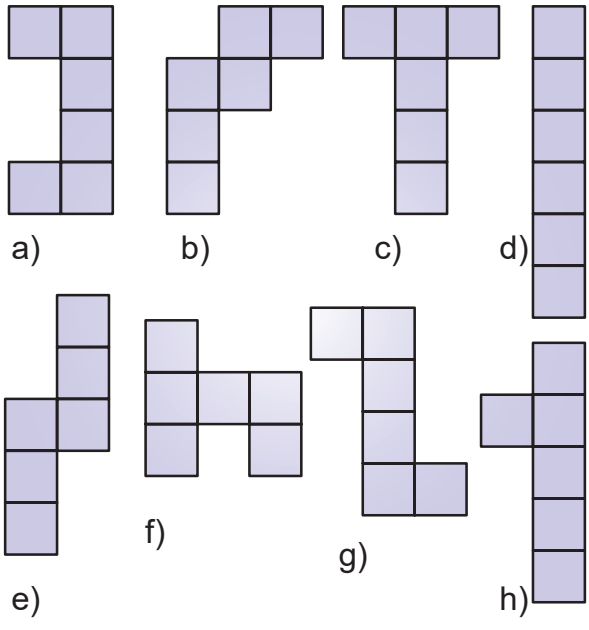
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Qanday fazoviy jismlarning yoyilmasini bilasiz?	Aqliy hujum	Mavzu bo‘yicha savollar: Ko‘pyoqlar yoyilmasi deganda nimani tushunasiz?
Bilimlarni boyitish va mustahkam-lash	Prizamaning yoyilmasi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: Prizama yoyilmasi qanday yasaladi? Amaliy mashq va tatbiq: 7.1
	Piramidaning yoyilmasi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: Piramida yoyilmasi qanday yasaladi? Amaliy mashq va tatbiq: 7.2
	Turli ko‘pyoqlarning yoyilmasi	Misollar keltirish, maketlardan foydalanish	Mavzu bo‘yicha savollar: Ko‘pyoq maketi qanday yasaladi? Amaliy mashq va tatbiq: 7.3 – 7.4
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	
Uyga vazifa	1. Amaliy mashq va tatbiq: 7.5		

7.4. Rasmdagi yoyilmalarning qaysilari kubning yoyilmasi bo‘ladi?

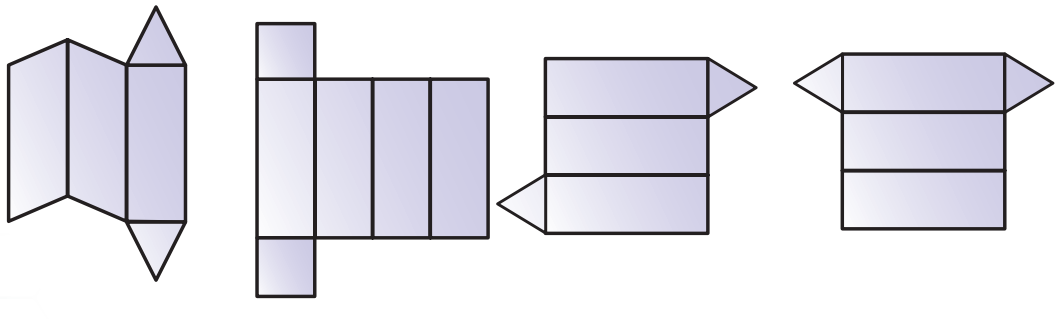


Javob: c), e), g).

Uy vazifasi

7.5. Rasmdagi yoyilmalarning qaysilari prizmalarning yoyilmasi bo‘ladi? Prizmalarning turini aniqlang.

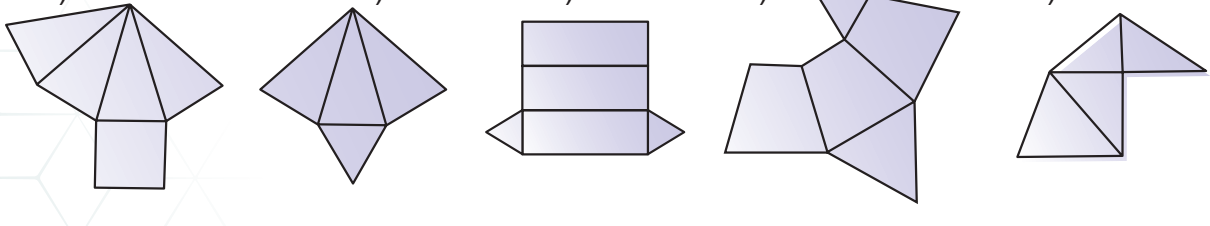
a) b) c) d)



Javob: a), b), d)

7.6. 8-rasmdagi yoyilmalarning qaysilari piramidalarning yoyilmasi bo‘ladi? Piramidalarning turini aniqlang.

a) b) c) d) e)



Javob: a rasmda asosi to‘rtburchakli muntazam piramida, b rasmda asosi muntazam uchburchakli piramida.

7-DARS. KO‘PYOQLARNI TASVIRLASH VA MODELINI YASHASH

I. Standartlar:

– M10.GO‘.YM.01. Sodda fazoviy jismlarning yoyilmasi yordamida ularning modellarini yasay oladi va chizmasini tekislikda tasvirlay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ko‘pyoqlarni tekislikda tasvirlashni bilish;

– ko‘pyoqlar yoyilmasi va unga ko‘ra uning modelini yasashni bilish;

Ko‘nikmalar:

– sodda fazoviy jismlarning yoyilmasi yordamida ularning modellarini yasay olish va chizmasini tekislikda tasvirlay olish;

III. Dars mazmunining qisqacha tavsifi:

– ko‘pyoqlarni tekislikda tasvirlash. Ko‘pyoqlar yoyilmasi va unga ko‘ra uning modelini yasash

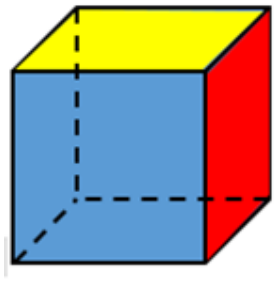
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Ko‘pyoqning yoyilmasini chizganda nimalarga e’tibor berish lozim?	Aqliy hujum	Mavzu bo‘yicha savollar: Prizma va piramida yoyilmasi bir-biridan nimasi bilan farq qiladi?
Bilimlarni boyitish va mustahkamlash	Piramidaning yoyilmasi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: Yoyilmaga qarab piramidaning turini aniqlash mumkinmi? Amaliy mashq va tatbiq: 7.6
	Prizamaning yoyilmasi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: Yoyilmaga qarab prizmaning turini aniqlash mumkinmi? Amaliy mashq va tatbiq: 7.7
	Turli ko‘pyoqlarning yoyilmasi	Misollar keltirish, maketlardan foydalanish	Mavzu bo‘yicha savollar: Kubning nech xil yoyilmasi bor? Amaliy mashq va tatbiq: 7.8 – 7.9
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	
Uyga vazifa	Amaliy mashq va tatbiq: 7.10 – 7.11		

7.7. Uch xil rang bilan kubni uning qo‘shni yoqlari har xil rangda bo‘yaladigan qilib bo‘yash mumkinmi? Kub modelini yasang va mos rangga bo‘yang.

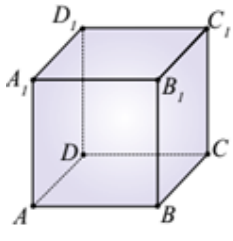


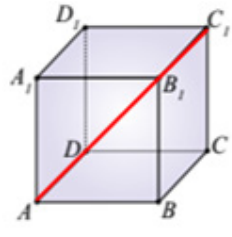
Javob: Kubning parallel tomonlarini bir xil rangga, old va orqa tomonlarini ko‘k rangga, ikki yon tomonlarini qizil rangga, osti va ustini sariq rangga bo‘yash kerak.

7.8. 9 ta gugurt cho‘pidan 7 ta teng uchburchak yasang.



7.9. $ABCDA_1B_1C_1D_1$ **kubning sirtida** A **uchidan** C_1 **uchga boradigan eng qisqa yo‘lni toping.**





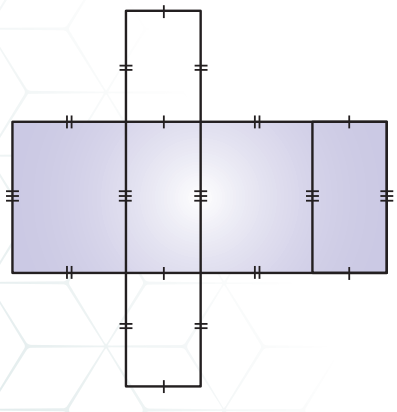
$$a = AB = BC = CD = AD = A_1B_1 = B_1C_1 = C_1D_1 = D_1A_1 = AA_1 = BB_1 = CC_1 = DD_1;$$

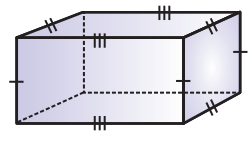
$$AC_1 = \sqrt{(AB)^2 + (BC)^2 + (CC_1)^2} = \sqrt{a^2 + a^2 + a^2} = \sqrt{3a^2} = a\sqrt{3}.$$

Javob: $AC_1 = a\sqrt{3}.$

Uy vazifasi

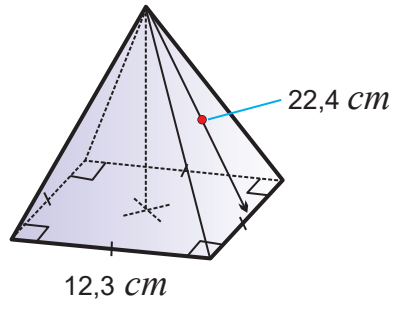
7.10. Rasmda tasvirlangan to‘g‘ri burchakli parallelepiped yoyilmasiga ko‘ra uning to‘la sirti formulasini toping.

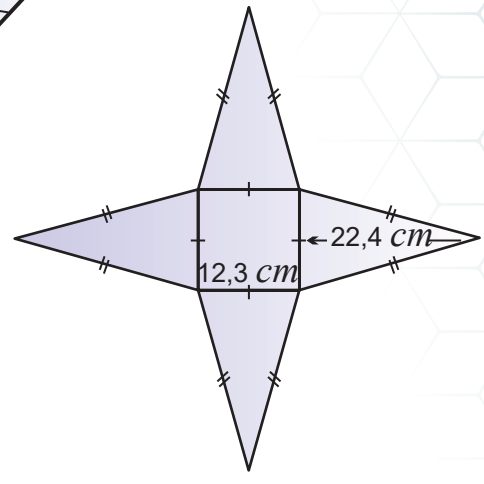




Javob: $S_{to'la} = 2(ab + bc + ac).$

7.11. Rasmda tasvirlangan to‘rtburchakli muntazam piramida yoyilmasiga ko‘ra uning to‘la sirti formulasini toping va berilgan ma’lumotlarga ko‘ra hisoblang.





$a = 12{,}3\ cm;\ f = 22{,}4\ cm.$

$S_{asos} = a^2;\qquad P_{asos} = 4a;$

$S_{yon} = \frac{1}{2} \cdot P \cdot f;$

$S_{to'la} = S_{asos} + S_{yon};$

$$S_{asos} = a^2 = (12{,}3\ cm)^2 = 151{,}29\ cm^2\ ; \quad P_{asos} = 4a = 4 \cdot 12{,}3\ cm = 49{,}2\ cm\ ;$$

$$S_{yon} = \frac{1}{2} \cdot P \cdot f = \frac{1}{2} \cdot 49{,}2\ cm \cdot 22{,}4\ cm = 49{,}2\ cm \cdot 11{,}2\ cm = 551{,}04\ cm^2\ ;$$

$$S_{to'la} = S_{asos} + S_{yon} = 151{,}29\ cm^2 + 551{,}04\ cm^2 = 702{,}33\ cm^2$$

Javob: $S_{to'la} = 702{,}33\ cm^2.$

8-DARS. KO‘PYOQLARNING SODDA KESIMLARINI YASASH

I. Standartlar:

– M10.GO‘.YM.01. Sodda fazoviy jismlarning yoyilmasi yordamida ularning modellarini yasay oladi va chizmasini tekislikda tasvirlay oladi;

– M10.GO‘.YM.02. Ko‘pyoqlarni tekislikda tasvirlay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– kesim tushunchasini bilish;

– ko‘pyoqlarning sodda kesimlarini yasash usullarini bilish.

Ko‘nikmalar:

– ko‘pyoqlarning sodda kesimlarini yasay olish;

III. Dars mazmunining qisqacha tavsifi:

– kesim tushunchasi. Ko‘pyoqlarning sodda kesimlari.

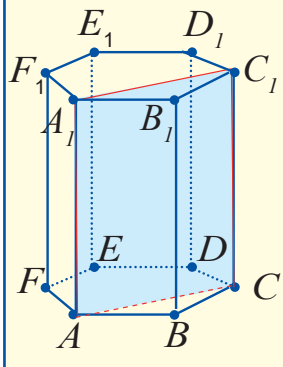
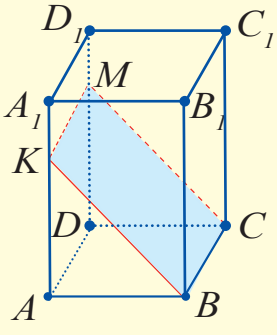
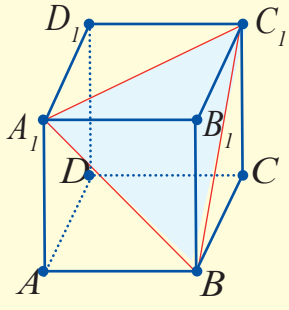
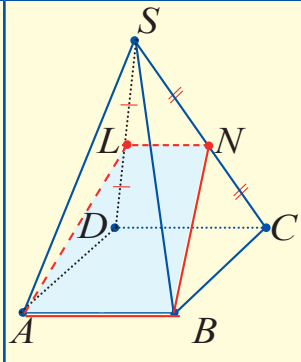
IV. Dars ashyolari va ko‘rgazmali qurollar:

– fazoviy geometrik shakllar modellari va yoyilmalari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Kub shaklidagi taxta bo‘lagini diagonali bo‘ylab arralaganda kesimda qanday shakl hosil bo‘ladi?	Aqliy hujum	Mavzu bo‘yicha savollar: Kub, piramida va prizma shaklidagi jismni asosiga parallel qilib kesganda kesimda qanday shakl hosil bo‘ladi?
Bilimlarni boyitish va mustahkam-lash	Kesim tushunchasi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 8.1 – 8.2
	Ko‘pyoqlarning sodda kesimlari	Kesimning tomonlari ko‘pi bilan nechta bo‘lishi mumkin? Amaliy mashg‘ulot o‘tkazish	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 8.3 – 8.4
	Izlar usuli	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 8.5 – 8.6
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 8.7
Uyga vazifa	Amaliy mashq va tatbiq: 8.8 – 8.10		

8.1. Jadvalda 5-bandning asosiy tayanch ma'lumotlari keltirilgan. Ularni sinchiklab o'rganib chiqing va izohlang.

Ko'pyoqlarning sodda kesimlari			
Ko'pburchakli prizma	**To'g'ri burchakli parallelepiped**	**Kub**	**Piramida**
			
ACC_1 – A, C, C_1 nuqtalardan o'tuvchi, kesuvchi tekislik. ACC_1A_1 – kesim.	CBK – K nuqta va CB to'g'ri chiziqdan o'tuvchi, kesuvchi tekislik. $CBKM$ – kesim.	A_1BC_1 – BC_1 va BA_1 to'g'ri chiziqlardan o'tuvchi, kesuvchi tekislik. A_1C_1B – kesim.	ABN – AB va LN parallel to'g'ri chiziqlardan o'tuvchi, kesuvchi tekislik. $ABNL$ – kesim.

Ko'pburchakli prizma.

Asosi n-burchakli bo'lsin: 1) qirralari soni: $3 \cdot n$ ta; 2) yoqlari soni: $n+2$ ta; 3) uchlari soni: $2 \cdot n$ ta; 4) diagonallari soni: $n \cdot (n-3)$ ta; 5) diagonal kesimlar soni: $\frac{n \cdot (n-3)}{2}$ ta.

Chizmada ACC_1A_1 kesim diagonal kesim to'g'ri to'rtburchakdir. Bu to'rtburchakning AA_1 va CC_1 tomoni prizmaning yon qirrasi, AC va A_1C_1 esa prizma asosining diagonalidir.

To'g'ri burchakli parallelepiped. Chizmada kesim BC asosi tomoni va ADD_1A_1-tomonni kesib o'tgan kesim $BCMK$ to'g'ri to'rtburchakdir. Chunki, $BC \| AD \| KM$; $\begin{cases} BC \| KM \\ BC = KM \end{cases}$; $KB \perp BC \perp MC, KB \| MC$.

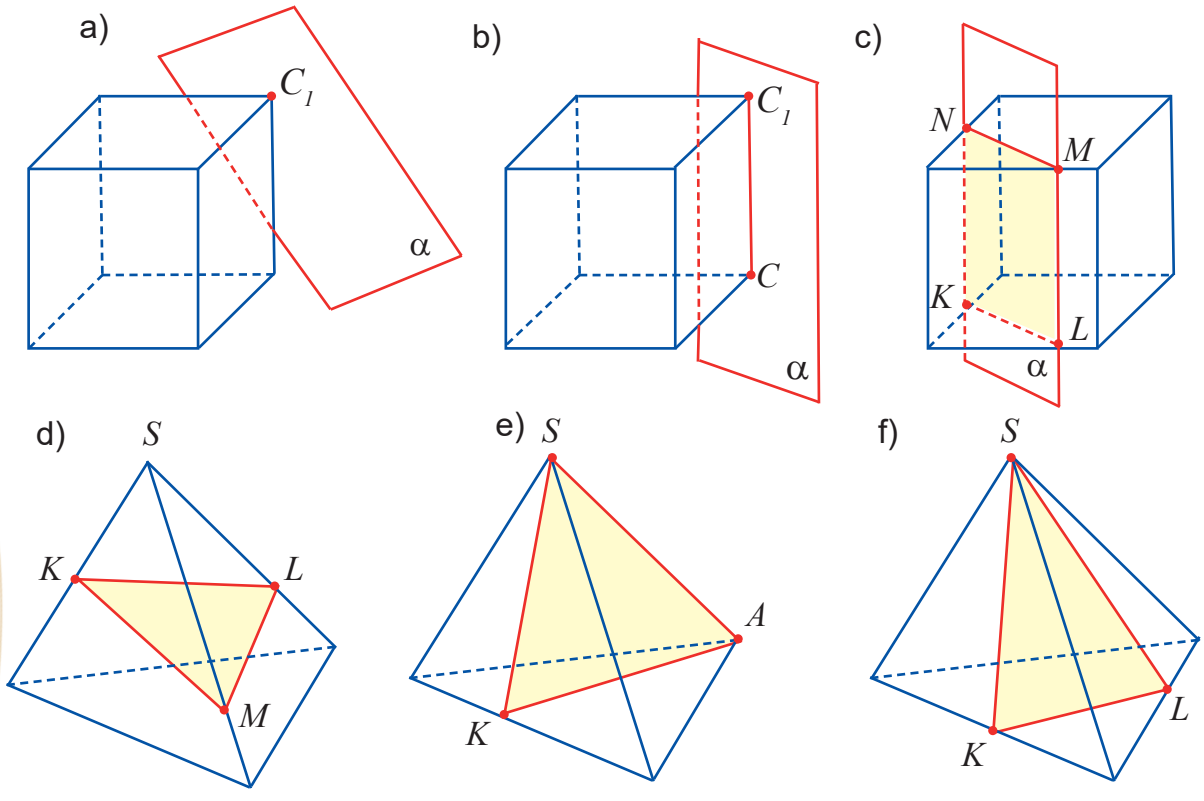
Kub. Kubdagi kesim A_1C_1B – muntazam uchburchak, chunki $BA_1 = a\sqrt{2}$; $BC_1 = a\sqrt{2}$; $A_1C_1 = a\sqrt{2}$; $A_1B = BC_1 = A_1C_1 = a\sqrt{2}$.

Piramida. Piramidada $ABNL$ kesim trapetsiyadir:

$$\begin{cases} SN = NC \\ SL = LD \end{cases} \rightarrow LN = \frac{DC}{2}; \quad \begin{cases} AB = 2 \cdot LN \\ AL = BN \end{cases}$$

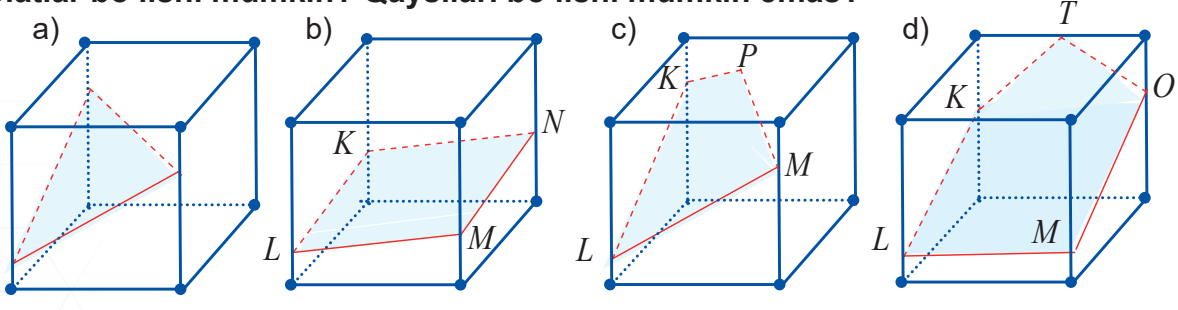
Katta asosi kichik asosdan ikki marta katta teng yonli trapetsiya.

8.2. Rasmda keltirilgan holatlarda fazoviy shakllarning qanday kesimi tasvirlanganligini izohlang.



1. *a*-rasmda fazoviy shakllarning kesimi bo‘lgan C_1 nuqta tasvirlangan.
2. *b*-rasmda fazoviy shakllarning kesimi bo‘lgan CC_1 kesma tasvirlangan.
3. *c*-rasmda fazoviy shakllarning kesimi bo‘lgan $KLMN$ tekislik tasvirlangan.
4. *d*-rasmda fazoviy shakllarning kesimi bo‘lgan KLM uchburchak tasvirlangan.
5. *e*-rasmda fazoviy shakllarning kesimi bo‘lgan SKA uchburchak tasvirlangan.
6. *f*-rasmda fazoviy shakllarning kesimi bo‘lgan SKL uchburchak tasvirlangan.

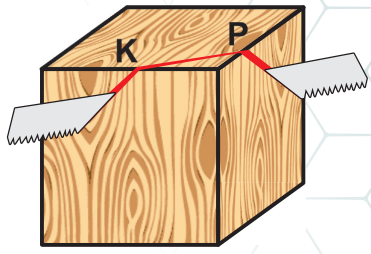
8.3. Kubni tekislik bilan kesganda kesimda quyidagi rasmda tasvirlangan qaysi holatlar bo‘lishi mumkin? Qaysilari bo‘lishi mumkin emas?



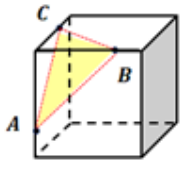
Javob: *b)* holat bo‘lishi mumkin. *a-c-d*-rasmlardagi holatlar bo‘lishi mumkin emas.

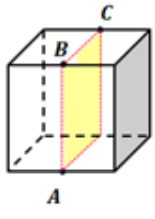
8.4. Rasmda tasvirlangan yog‘och kub arralanganda *K*, *P* va *T* nuqtalardan o‘tuvchi kesim hosil bo‘ladi. To‘liq kesim qanday shakldan iborat bo‘ladi?

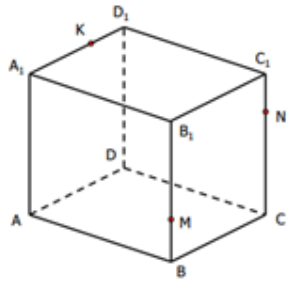
Javob: To‘liq kesim olti burchakdan iborat bo‘ladi.

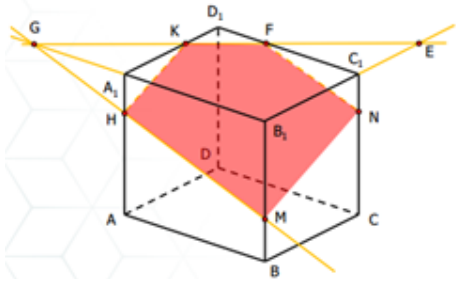


8.5. Kub chizing. Uning qirralarida shunday uchta nuqtani belgilangki, bu nuqtalardan o‘tuvchi tekislik kesimda: a) uchburchak; b) to‘rtburchak; d) bechburchak hosil qilsin.



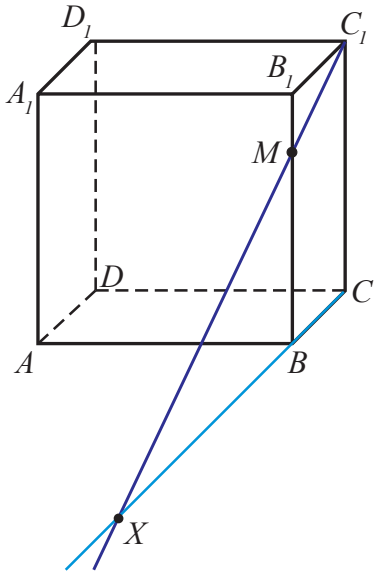






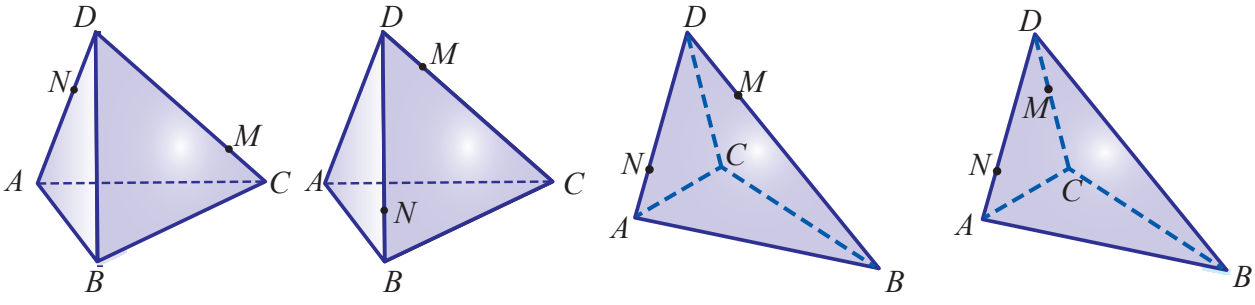
8.6. Quyidagi algoritm asosida yasashni bajaring va yasash jarayonini izohlang. $ABCDA_1B_1C_1D_1$ **kub va** $M \in BB_1$ **nuqta berilgan.** C_1M **to‘g‘ri chiziq bilan kubning** $ABCD$ **yog‘i kesishish nuqtasini topish algoritmi** C_1M **va** BC **kesmalarni davom ettirib, ularning kesishish nuqtasini** X **bilan belgilaymiz.**

X **– Izlangan nuqta bo‘ladi.**



CB dan va C_1M dan o‘tuvchi to‘g‘ri chiziqlarni davom ettirsak X nuqtani (kesishish nuqtasini) topamiz.

8.7. Rasmda tasvirlangan $ABCD$ **tetraedrning qirralarida** M **va** N **nuqtalar belgilangan.** MN **to‘g‘ri chiziqning** ABC **tekislik bilan kesishish nuqtasi qaysi to‘g‘ri chiziqda yotishini aniqlang.**



1. NM va AC larning davomi kesishish nuqtasi. **Javob:** AC to‘g‘ri chiziqda.
2. MN va CB larning davomi kesishish nuqtasi. **Javob:** CB to‘g‘ri chiziqda.
3. MN va BA larning davomi kesishish nuqtasi. **Javob:** BA to‘g‘ri chiziqda.
4. MN va CA larning davomi kesishish nuqtasi. **Javob:** CA to‘g‘ri chiziqda.

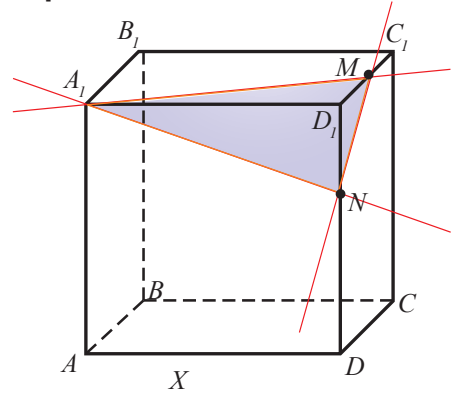
Uy vazifasi

8.8. Quyidagi algoritm asosida kubning berilgan nuqtalardan o‘tuvchi kesimini yasang va izohlang.

$ABCDA_1B_1C_1D_1$ kubning A_1, $M \in D_1C_1$ va $N \in DD_1$ nuqtalaridan o‘tuvchi kesimini yasash algoritmi.

1) A_1 nuqtani M nuqta bilan tutashtiramiz;
2) A_1 nuqtani N nuqta bilan tutashtiramiz;
3) M nuqtani N nuqta bilan tutashtiramiz;

A_1MN uchburchak izlanayotgan kesim bo‘ladi.



8.9. Quyidagi algoritm asosida kubning berilgan nuqtalardan o‘tuvchi kesimini yasang va yasash jarayonini izohlang.

$ABCDA_1B_1C_1D_1$ kubning M, Q va P nuqtalaridan o‘tuvchi kesimini yasash algoritmi.

1. A_1 va M nuqtalardan o‘tuvchi to‘g‘ri chiziq o‘tkazamiz. A_1M va D_1C_1 to‘g‘ri chiziqlar kesishish nuqtasini X bilan belgilaymiz.

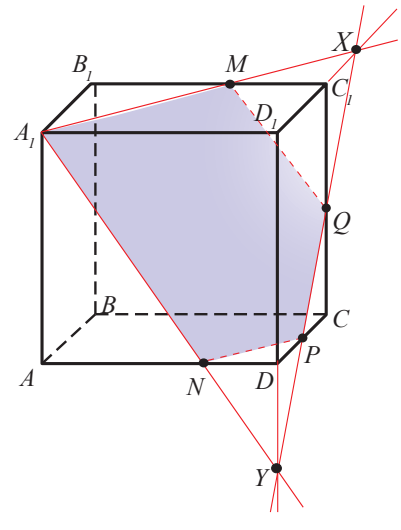
2. A_1 va N nuqtalardan to‘g‘ri chiziq o‘tkazamiz. A_1N va DD_1 to‘g‘ri chiziqlar kesishish nuqtasini Y bilan belgilaymiz.

3. X nuqtani Y nuqta bilan tutashtiramiz. XY va CC_1 to‘g‘ri chiziqlar kesishish nuqtasini Q bilan belgilaymiz.

4. XY va DC to‘g‘ri chiziqlar kesishish nuqtasini P bilan belgilaymiz.

5. M va Q nuqtalardan o‘tuvchi to‘g‘ri chiziq o‘tkazamiz. N va P nuqtalardan o‘tuvchi to‘g‘ri chiziq o‘tkazamiz.

6. A_1MQPN beshburchak izlanayotgan kesim bo‘ladi.



9-DARS. KO‘PYOQLARNING SODDA KESIMLARINI YASASH

I. Standartlar:

– M10.GO‘.YM.01. Sodda fazoviy jismlarning yoyilmasi yordamida ularning modellarini yasay oladi va chizmasini tekislikda tasvirlay oladi;

– M10.GO‘.YM.02. Ko‘pyoqlarni tekislikda tasvirlay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– kesim tushunchasini bilish;

– ko‘pyoqlarning sodda kesimlarini yasash usullarini bilish.

Ko‘nikmalar:

– ko‘pyoqlarning sodda kesimlarini yasay olish;

III. Dars mazmunining qisqacha tavsifi:

– kesim tushunchasi. Ko‘pyoqlarning sodda kesimlari.

IV. Dars ashyolari va ko‘rgazmali qurollar:

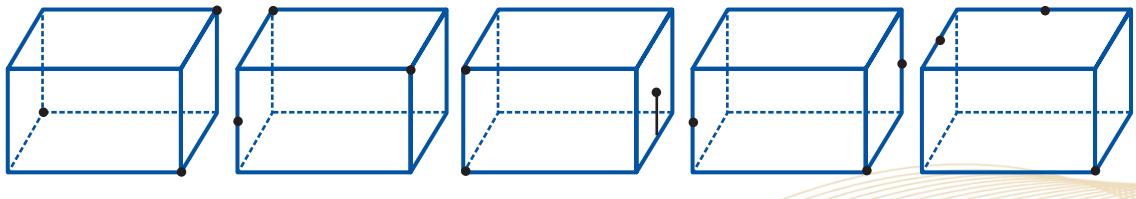
– fazoviy geometrik shakllar modellari va yoyilmalari.

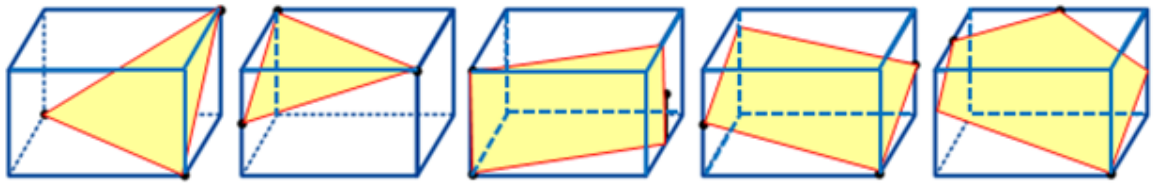
V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Hayotda ko‘pyoqning kesimidan qayerlarda foydalanish mumkin?	Aqliy hujum	Mavzu bo‘yicha savollar: 4
Bilimlarni boyitish va mustahkam-lash	Ko‘pyoqlarning kesimini yasash	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 5 Amaliy mashq va tatbiq: 8.11 – 8.12
	Izlar usuli	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 6 Amaliy mashq va tatbiq: 8.13 – 8.14
	Parallel ko‘chirish usuli	Darslik bilan ishlash	Amaliy mashq va tatbiq: 8.15 – 8.16
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 8.17
Uyga vazifa	Amaliy mashq va tatbiq: 8.18 – 8.20		

8.10. Rasmda tasvirlangan to‘g‘ri burchakli parallelepipedning berilgan uchta nuqtasidan o‘tuvchi kesimini quring.

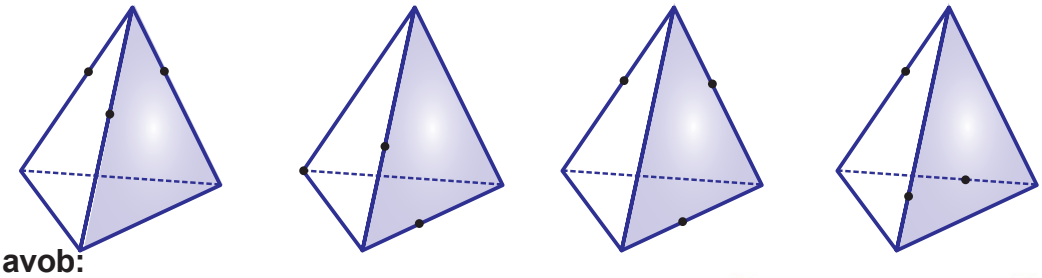
a) b) c) d) e)





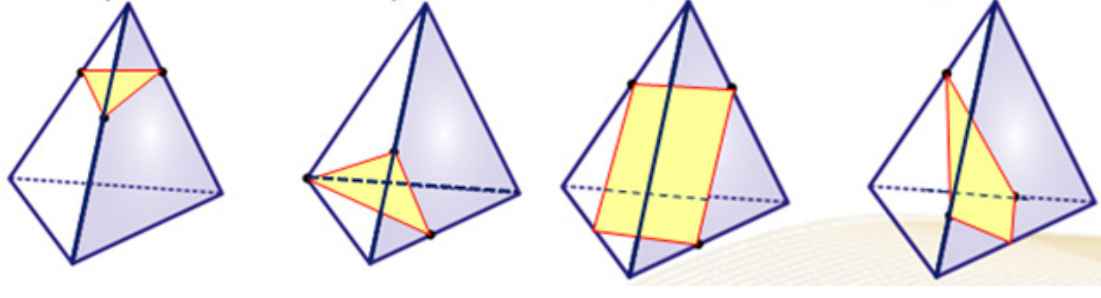
8.11. Rasmda tasvirlangan piramidalarning berilgan uchta nuqtasidan o‘tuvchi kesimini quring.

a) b) c) d)

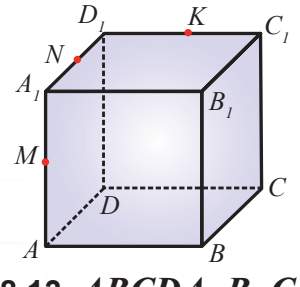


Javob:

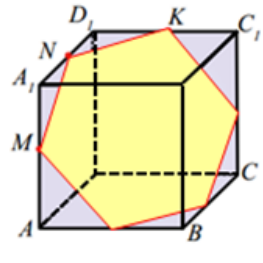
a) b) c) d)



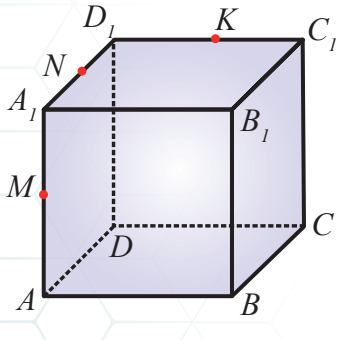
8.12. Kubning M, N va K nuqtalardan o‘tuvchi tekislik bilan kesimini parallel ko‘chirish usuli bilan yasang.



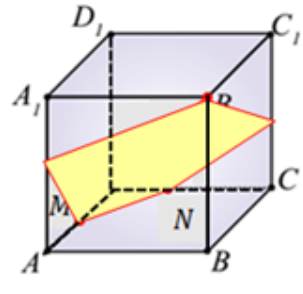
Javob:



8.13. $ABCDA_1B_1C_1D_1$ kubning AD va CD qirralarida M va N nuqtalar berilgan. Kubni MNB_1 tekislik bilan kesganda hosil bo‘ladigan kesimni yasang.



Javob:

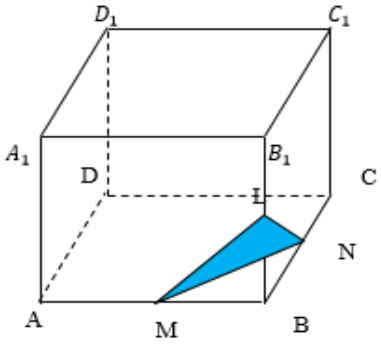


8.14. $ABCDA_1B_1C_1D_1$ **kubni chizing va** AB, BC **va** BB_1 **qirralari o‘rtalari bo‘lgan** M, N **va** L **nuqtalarni belgilang:**

a) kubni MNL **tekislik bilan kesganda hosil bo‘ladigan kesimni yasang;**

b) MNL **uchburchakning muntazam ekanligini isbotlang;**

c) kubning qirrasi $1\ cm$ **bo‘lsa,** MNL **uchburchak yuzini toping.**



$$b)\ BM = BN = BL = \frac{a}{2}$$

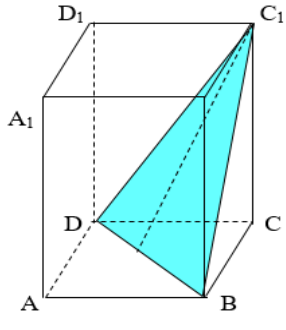
$$ML = LN = MN = \frac{a}{2}\cdot\sqrt{2} = \frac{a\sqrt{2}}{2};$$

Demak, MNL uchburchak muntazam.

$$c)\ a = 1\ cm;\quad ML = LN = MN = \frac{1\cdot\sqrt{2}}{2} = \frac{\sqrt{2}}{2}\ cm;$$

$$S_{MNL} = \frac{a^2\sqrt{3}}{4} = \frac{\left(\frac{\sqrt{2}}{2}\right)^2\cdot\sqrt{3}}{4} = \frac{\frac{1}{2}\cdot\sqrt{3}}{4} = \frac{\sqrt{3}}{8}\ cm^2.$$

8.15. $ABCDA_1B_1C_1D_1$ **to‘g‘ri burchakli parallelepipedning qirralari** $AB = 6\ cm$, $AD = 6\ cm$ **va** $AA_1 = 8\ cm$. **Parallelepipedning** BC_1D **tekislik bilan kesimi teng yonli uchburchak ekanligini isbotlang va bu uchburchak balandligini toping.**



$AB = 6\ cm,\quad AD = 6\ cm,\quad AA_1 = 8\ cm.\quad h = OC_1 = ?$

$$BD = \sqrt{AD^2 + AB^2} = \sqrt{6^2 + 6^2} = \sqrt{36 + 36} = 6\sqrt{2}\ cm;$$

$$AA_1 = CC_1 = 8\ cm;\quad AD = BC = 6\ cm;$$

$$BC_1 = \sqrt{BC^2 + {CC_1}^2} = \sqrt{6^2 + 8^2} = \sqrt{36 + 64} = 10\ cm;$$

$$AA_1 = DD_1 = 8\ cm;\qquad AB = D_1C_1 = 6\ cm;$$

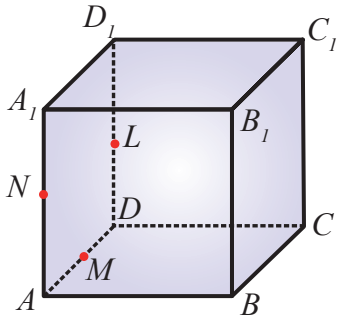
$$DC_1 = \sqrt{{DD_1}^2 + {D_1C_1}^2} = \sqrt{8^2 + 6^2} = \sqrt{64 + 36} = \sqrt{100} = 10\ cm;$$

$BC_1 = DC_1 = 10\ cm$. Demak BC_1D tekislik bilan kesimi teng yonli uchburchak ekanligi kelib chiqadi.

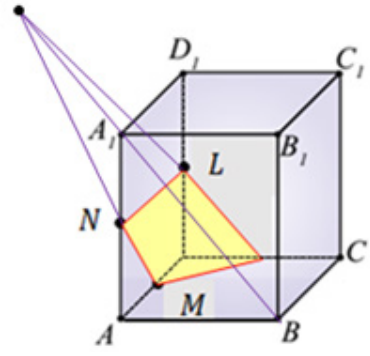
$$h = OC_1 = \sqrt{{DC_1}^2 - \left(\frac{BD}{2}\right)^2} = \sqrt{10^2 - \left(\frac{6\sqrt{2}}{2}\right)^2} = \sqrt{100 - \frac{36\cdot 2}{4}} = \sqrt{82}\ cm.$$

Javob: $h = \sqrt{82}\ cm$.

8.16. $ABCDA_1B_1C_1D_1$ prizmani chizing. Prizmaning AD, AA_1 va DD_1 qirralari o‘rtalari bo‘lgan M, N va L nuqtalardan o‘tuvchi tekislik bilan kesimini yasang.

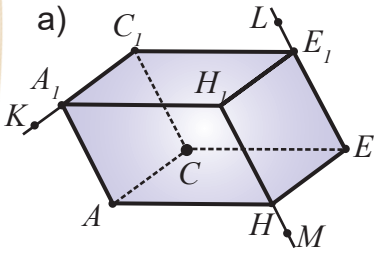


Javob:

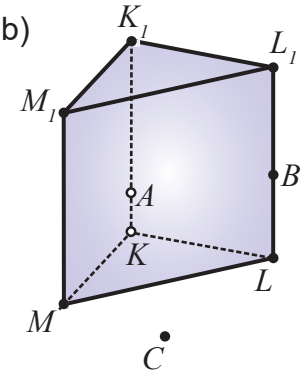


8.17. Rasmda berilgan ma’lumotlar asosida a) K, L va M; b) A, B va C; c) A, B va C nuqtalardan o‘tuvchi fazoviy shakllarning tegishli kesimlarini yasang.

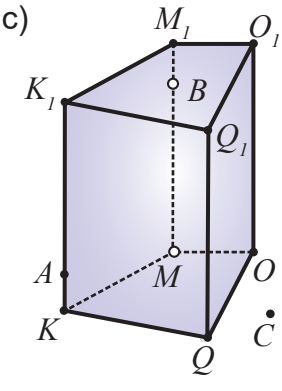
a)



b)

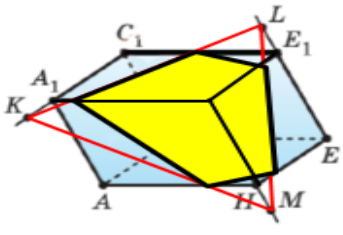


c)

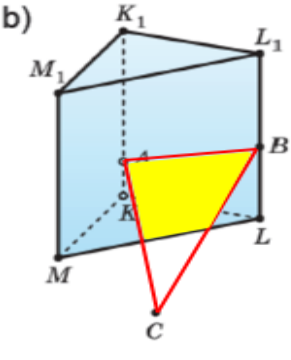


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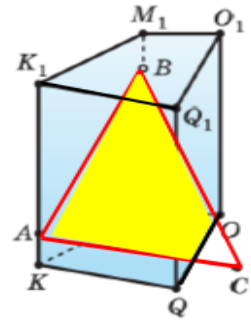
a)



b)

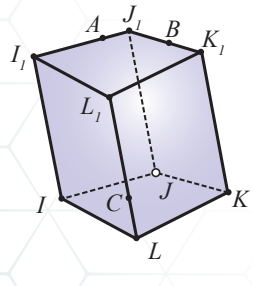


c)

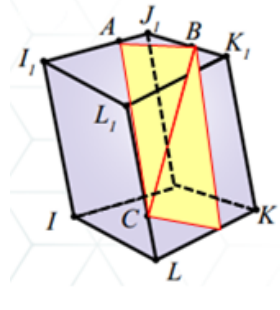


Uy vazifasi

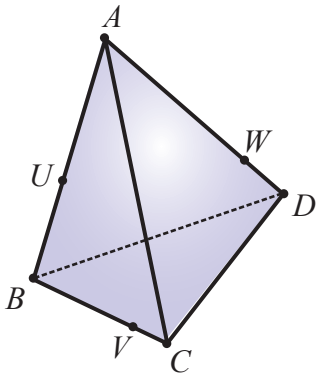
8.18. $IJKLI_1J_1K_1L_1$ prizmaning JI_1, J_1K_1 va LL_1 qirralarida yotgan A, B, va C nuqtalar olingan. Prizmaning ABC tekislik bilan kesimini yasang.



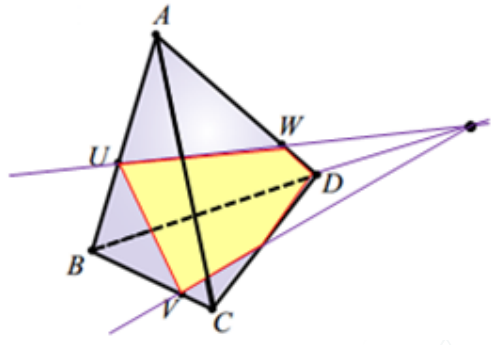
Javob:



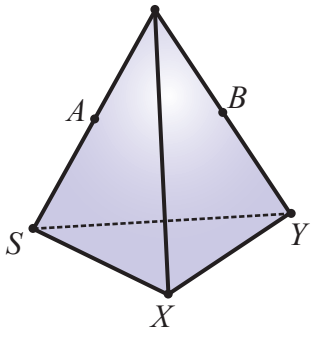
8.19. Berilgan ma'lumotlar asosida rasmdagi fazoviy shaklning U, V va W nuqtalardan o'tuvchi tekislik bilan kesganda hosil bo'lgan kesimini yasang.



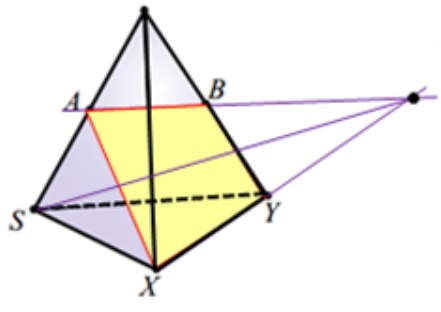
Javob:



8.20. Berilgan ma'lumotlar asosida rasmdagi fazoviy shaklning A, B va X nuqtalardan o'tuvchi tekislik bilan kesganda hosil bo'lgan kesimini yasang.



Javob:



10-DARS. BOBNI TAKRORLASHGA DOIR AMALIY TOPSHIRIQLAR

I. Standartlar:

– fazoviy jismlar, ko‘pyoqlar – prizma, parallelepiped, kub, piramida haqida boshlang‘ich tushunchalarga ega bo‘lish, tekislikda tasvirlay olish, ularni chizmada ko‘rsatish va sirtini topishga doir masalalarni yechish.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ko‘pyoqlarga oid tushunchalarni bilish;
– ko‘pyoqlarning sirtini topa olish.

Ko‘nikmalar:

– ko‘pyoqlar sirtini topishga doir masalalarni yechish;

III. Dars mazmunining qisqacha tavsifi:

– ko‘pyoqlar va ularning sirti.

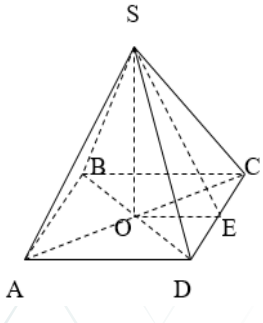
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Yassi va fazoviy siniq chiziqlar bir-biridan nimasi bilan farq qiladi?	Aqliy hujum	Mavzu bo‘yicha savollar: Yassi va fazoviy siniq chiziqlarga misollar keltiring
Bilimlarni boyitish va mustahkam-lash	piramida yon sirti;	Darslik bilan ishlash	Amaliy mashq va tatbiq: 10.1
	piramida to‘la sirti;	Darslik bilan ishlash	Amaliy mashq va tatbiq: 10.2
	Ko‘pyoq kesimi	Darslik bilan ishlash	Amaliy mashq va tatbiq: 10.3
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 10.4
Uyga vazifa	Amaliy mashq va tatbiq: 10.5 – 10.6		

10.2. Muntazam to‘rtburchakli piramida asosi $12\ cm$ ga, piramida uchini asos markazi bilan tutashtiruvchi kesma uzunligi $16\ cm$ ga teng. a) piramida yon qirrasi va apofemasini; b) piramida yon sirtini; c) piramida to‘la sirtini toping.



$AB = BC = CD = AD = 12\ cm;\ \ SO = 16\ cm.$

a) $SA = SB = SC = SD = ?;\ \ SE = ?;$ b) $S_{yon} = ?$ c) $S_{to'la} = ?$

a) $BD = \sqrt{AB^2 + AD^2} = \sqrt{12^2 + 12^2} = \sqrt{144 + 144} =$

$= \sqrt{144 \cdot 2} = 12\sqrt{2}\ cm;$ $\qquad BD = 12\sqrt{2}\ cm.$

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$$OD = \frac{BD}{2} = \frac{12\sqrt{2}}{2} = 6\sqrt{2}\ cm;$$

$$SD = \sqrt{SO^2 + OD^2} = \sqrt{16^2 + \left(6\sqrt{2}\right)^2} = \sqrt{256 + 72} = \sqrt{328} = 2\sqrt{82}\ cm.$$

Javob: $SD = 2\sqrt{82}\ cm;$

$$b)\quad OE = \frac{AD}{2} = \frac{12}{2} = 6;$$

$$SE = \sqrt{SO^2 + OE^2} = \sqrt{16^2 + 6^2} = \sqrt{256 + 36} = \sqrt{292} = 2\sqrt{73}\ cm;$$

$$S_{CDS} = \frac{1}{2} \cdot CD \cdot SE = \frac{1}{2} \cdot 12 \cdot 2\sqrt{73} = 12\sqrt{73}\ cm^2;$$

$$S_{yon} = 4 \cdot S_{CDS} = 4 \cdot 12\sqrt{73} = 48\sqrt{73}\ cm^2;$$

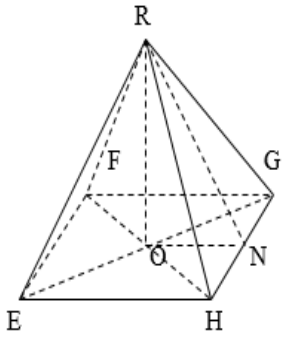
Javob: $SE - 2\sqrt{73}\ cm^2;$

c) $S_{asos} = AD^2 = 12^2 = 144\ cm^2;$

$S_{to'la} = S_{asos} + S_{yon} = 144 + 48\sqrt{73}\ cm^2.$

Javob: $S_{to'la} = 144 + 48\sqrt{73}\ cm^2.$

10.3. ***REFGH*** **piramida asosi tomonlari** ***10 cm*** **va** ***18 cm*** **bo‘lgan va yuzi** ***90 cm²*** **ga teng bo‘lgan** ***EFGH*** **Parallelogrammdan iborat. Piramida uchi R ni asos diagonallari kesishish nuqtasi** ***O*** **bilan tutashtiruvchi kesma uzunligi** ***6 cm*** **ga teng va u bu diagonallarga perpendikulyar. Piramida: a) yon qirralarini; b) yon sirtini; c) to‘la sirtini toping.**



$a = EF = GH = 10\ cm;\ b = FG = EH = 18\ cm;$

$S_{EFGH} = 90\ cm^2;\ h = RO = 6\ cm;$

Topish kerak: a) $RE = RF = RG = RH = ?$

b) $S_{yon} = ?;$ c) $S_{to'la} = ?$

$a \cdot b \cdot \sin\alpha = S_{EFGH};\quad 10 \cdot 18 \cdot \sin\alpha = 90;$

$$180 \cdot \sin\alpha = 90; \qquad \sin\alpha = \frac{90}{180}; \qquad \sin\alpha = \frac{1}{2}; \qquad \sin^2\alpha + \cos^2\alpha = 1;$$

$$\cos\alpha = \sqrt{1 - \sin^2\alpha} = \sqrt{1 - \left(\frac{1}{2}\right)^2} = \sqrt{1 - \frac{1}{4}} = \sqrt{\frac{4-1}{4}} = \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2};$$

$$HF = \sqrt{a^2 + b^2 - 2 \cdot a \cdot b \cdot \cos\alpha} = \sqrt{10^2 + 18^2 - 2 \cdot 10 \cdot 18 \cdot \frac{\sqrt{3}}{2}} =$$

$$= \sqrt{100 + 324 - 180\sqrt{3}} = \sqrt{424 - 180\sqrt{3}} = 2\sqrt{106 - 45\sqrt{3}}\ cm;$$

$$EG = HF = \sqrt{a^2 + b^2 + 2 \cdot a \cdot b \cdot \cos\alpha} = \sqrt{10^2 + 18^2 + 2 \cdot 10 \cdot 18 \cdot \frac{\sqrt{3}}{2}} =$$

$$a)\ \ RH = HF = \sqrt{(HO)^2 + h^2} = \sqrt{\left(\frac{HF}{2}\right)^2 + h^2} = \sqrt{\left(\frac{2\sqrt{106 - 45\sqrt{3}}}{2}\right)^2 + 6^2} =$$

$$= \sqrt{106 - 45\sqrt{3} + 36} = \sqrt{142 - 45\sqrt{3}}\ cm\,;$$

$$RE = RG = \sqrt{(EG)^2 + h^2} = \sqrt{\left(\frac{EG}{2}\right)^2 + h^2} = \sqrt{\left(\frac{2\sqrt{106 + 45\sqrt{3}}}{2}\right)^2 + 6^2} =$$

$$= \sqrt{106 + 45\sqrt{3} + 36} = \sqrt{142 + 45\sqrt{3}}\ cm;$$

Javob: $RH = \sqrt{142 - 45\sqrt{3}}\ cm\,;\quad RE = \sqrt{142 + 45\sqrt{3}}\ cm\,.$

$$b)\ \ S_{asos} = a \cdot b \cdot \sin\alpha = 10 \cdot 18 \cdot \frac{1}{2} = \frac{180}{2} = 90\ cm^2;\qquad a \cdot h_a = S_{asos}\,;$$

$$h_a = \frac{S_{asos}}{a} = \frac{90}{10} = 9\ cm;\qquad h_b = \frac{S_{asos}}{b} = \frac{90}{18} = 5\ cm;$$

$$f_a = \sqrt{h^2 + \left(\frac{h_a}{2}\right)^2} = \sqrt{6^2 + \left(\frac{9}{2}\right)^2} = \sqrt{36 + \frac{81}{4}} = 3\sqrt{4 + \frac{9}{4}} = 3\sqrt{\frac{16 + 9}{4}} =$$

$$= 3\sqrt{\frac{25}{4}} = 3 \cdot \frac{5}{2} = \frac{15}{2} = 7{,}5\ cm;$$

$$f_b = \sqrt{h^2 + \left(\frac{h_b}{2}\right)^2} = \sqrt{6^2 + \left(\frac{5}{2}\right)^2} = \sqrt{36 + \frac{25}{4}} = \sqrt{\frac{144 + 25}{4}} = \sqrt{\frac{169}{4}} =$$

$$= \frac{13}{2} = 6{,}5\ cm;$$

$$S_{yon} = 2\left(\frac{a \cdot f_a}{2} + \frac{b \cdot f_b}{2}\right) = 2\left(\frac{a \cdot f_a + b \cdot f_b}{2}\right) = a \cdot f_a + b \cdot f_b =$$

$$= 10 \cdot 7{,}5 + 18 \cdot 6{,}5 = 75 + 117 = 192\ cm^2.$$

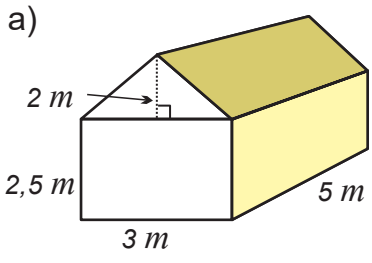
Javob: $S_{yon} - 192\ cm^2$.

$c)\quad S_{to'la} = S_{asos} + S_{yon} = 90\ cm^2 + 192\ cm^2 = 282\ cm^2.$

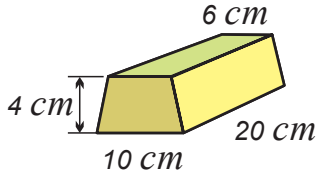
Javob: $S_{to'la} = 282\ cm^2$.

10.4. Rasmda tasvirlangan jismlarning to‘la sirtini toping.

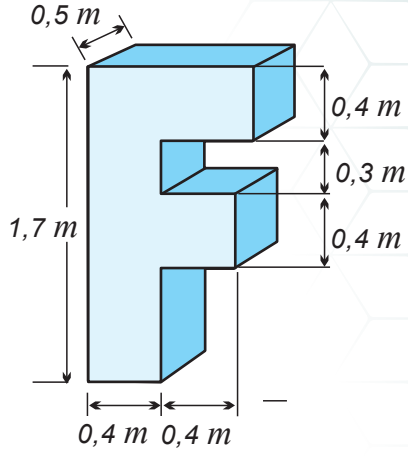
a)



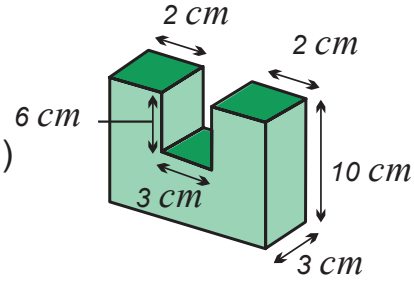
b)



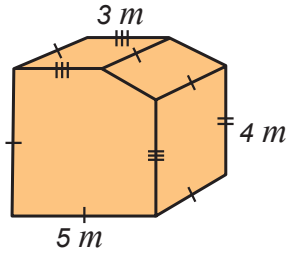
c)



d)



e)



$\boldsymbol{a)}\ \boldsymbol{h_1 = 2\ m;\ \ h_2 = 2{,}5\ m;\ \ a = 3\ m;\ \ b = 5\ m.}\quad \boldsymbol{S_{to'la}} = ?$

$$a_1 = \frac{a}{2} = \frac{3}{2} = 1{,}5\ m;$$

$$c = \sqrt{(a_1)^2 + (h_1)^2} = \sqrt{(1{,}5)^2 + 2^2} = \sqrt{2{,}25 + 4} = \sqrt{6{,}25} = 2{,}5\ m;$$

$$S_1 = S_2 = \frac{a_1 \cdot h_1}{2} = \frac{1{,}5\ m \cdot 2\ m}{2} = 1{,}5\ m^2;\quad S_2 = S_3 = a \cdot h_1 = 3 \cdot 2{,}5 = 7{,}5\ m^2;$$

$$S_3 = S_4 = h_2 \cdot b = 2{,}5 \cdot 5 = 12{,}5\ m^2;\qquad S_5 = S_6 = c \cdot b = 2{,}5 \cdot 5 = 12{,}5\ m^2;$$

$$S_{to'la} = 2(S_1 + S_2 + S_3 + S_4) = 2 \cdot (1{,}5 + 7{,}5 + 12{,}5 + 12{,}5) = 2 \cdot 34 = 68\ m^2.$$

Javob: $S_{to'la} = 68\ cm^2$.

$\boldsymbol{b)\ a = 10\ cm;\ \ b = 6\ cm;\ \ h = 4\ cm;\ \ c = 20\ cm;}\qquad \boldsymbol{S_{to'la}} = ?$

$$S_1 = \frac{a+b}{2} \cdot h = \frac{10+6}{2} \cdot 4 = \frac{16}{2} \cdot 4 = 8 \cdot 4 = 32\ cm^2;$$

$$l = \sqrt{(a-b)^2 + h^2} = \sqrt{(10-6)^2 + 4^2} = \sqrt{4^2 + 4^2} = \sqrt{32} = 4\sqrt{2}\ cm;$$

$S_2 = c \cdot l = 20\,cm \cdot 4\sqrt{2}\,cm = 80\sqrt{2}\,cm^2$; $S_3 = a \cdot c = 10 \cdot 20 = 200\,cm^2$;
$S_4 = b \cdot c = 6\,cm \cdot 20\,cm = 120\,cm^2$;
$S_{to'la} = 2S_1 + 2S_2 + S_3 + S_4 = 2 \cdot 32 + 2 \cdot 80\sqrt{2} + 200 + 120 =$

$= 64 + 160\sqrt{2} + 320 = (384 + 160\sqrt{2})\,cm^2.$

Javob: $S_{to'la} - (384 + 160\sqrt{2})cm^2.$

c) $\boldsymbol{a = 1{,}7\ m;}$ $\boldsymbol{a_1 = a_3 = 0{,}4\ m;}$ $\boldsymbol{a_2 = 0{,}3\ m;}$
$\boldsymbol{b_1 = b_2 = 0{,}4\ m;}$ $\boldsymbol{b_3 = 0{,}3\ m;}$ $\boldsymbol{c = 0{,}5\ m.}$ $\boldsymbol{S_{to'la} = ?}$

$a_4 = a-(2a_1+a_2) = 1{,}7-(2 \cdot 0{,}4+0{,}3) = 1{,}7-(0{,}8+0{,}3) = 1{,}7-1{,}1 = 0{,}6\ m;$

$b = 2b_1+b_2 = 2 \cdot 0{,}4+0{,}3 = 0{,}8+0{,}3 = 1{,}1\ m;$

Yon yoqlari: $S_1 = S_2 = a \cdot c = 1{,}7\ m \cdot 0{,}5\ m = 0{,}85\ m^2;$

Oldi va orqa yoqlari: $S_3 = S_4 = a \cdot b_1 + a_3 \cdot b_2 + a_1 \cdot (b_2 + b_3) =$

$= 1{,}7 \cdot 0{,}4 + 0{,}4 \cdot 0{,}4 + 0{,}4 \cdot (0{,}4 + 0{,}1) = 0{,}68 + 0{,}16 + 0{,}4 \cdot 0{,}5 =$

$= 0{,}84 + 0{,}2 = 1{,}04\ m^2;$

Asoslari: $S_5 = b \cdot c + 2 \cdot b_2 \cdot c + b_1 \cdot c = (b + 2 \cdot b_2 + b_1) \cdot c =$

$= (1{,}1 + 2 \cdot 0{,}4 + 0{,}4) \cdot 0{,}5 = (1{,}1 + 0{,}8 + 0{,}4) \cdot 0{,}5 = 2{,}3 \cdot 0{,}5 = 1{,}15\ m^2;$

$S_{to'la} = 2S_1 + 2S_3 + S_5 = 2 \cdot 0{,}85 + 2 \cdot 1{,}04 + 1{,}15 = 1{,}7 + 2{,}08 + 1{,}15 = 4{,}93\ m^2.$

Javob: $S_{to'la} = 4{,}93\ m^2.$

d) Berilgan: $a = 5\ m;$ $b = 5\ m;$ $c = 5\ m;$ $a_1 = 3\ m;$ $b_1 = 4\ m.$

Topish kerak: $S_{to'la} = ?$

$$d = \sqrt{(a - a_1)^2 + (b - b_1)^2} = \sqrt{(5-3)^2 + (5-4)^2} =$$

$$= \sqrt{2^2 + 1^2} = \sqrt{4+1} = \sqrt{5};$$

$$S_1 = S_2 = \frac{a + a_1}{2} \cdot b = \frac{5+3}{2} \cdot 5 = \frac{8}{2} \cdot 5 = 4 \cdot 5 = 20\ m^2;$$

$$S_3 = S_4 = a \cdot c = 5\ m \cdot 5\ m = 25\ m^2;$$

$$S_5 = c \cdot b_1 = 5\ m \cdot 4\ m = 20\ m^2;$$

$$S_6 = a_1 \cdot c = 3\ m \cdot 5\ m = 15\ m^2; \qquad S_7 = c \cdot d = 5\ m \cdot \sqrt{5}\ m = 5\sqrt{5}\ m^2;$$

$$S_{to'la} = 2 \cdot S_1 + 2 \cdot S_3 + S_5 + S_6 + S_7 = (2 \cdot 20 + 2 \cdot 25 + 20 + 15 + 5\sqrt{5})m^2 =$$

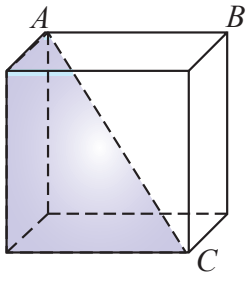
$$= (40 + 50 + 35 + 5\sqrt{5})m^2 = (125 + 5\sqrt{5})m^2 = 5(25 + \sqrt{5})\ m^2.$$

Javob: $S_{to'la} - 5(25 + \sqrt{5})m^2.$

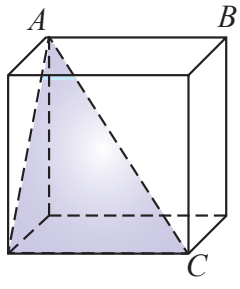
Uy vazifasi

10.5. Kubni tekislik bilan kesganda kesimda rasmda tasvirlangan qaysi holatlar bo‘lishi mumkin? Qaysilari bo‘lishi mumkin emas?

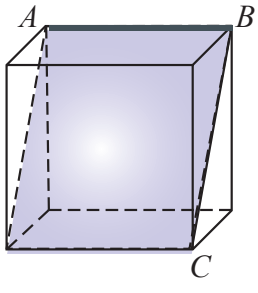
a)



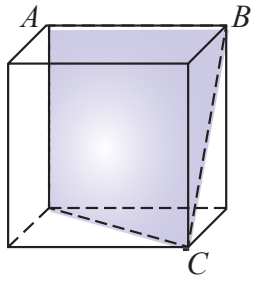
b)



c)



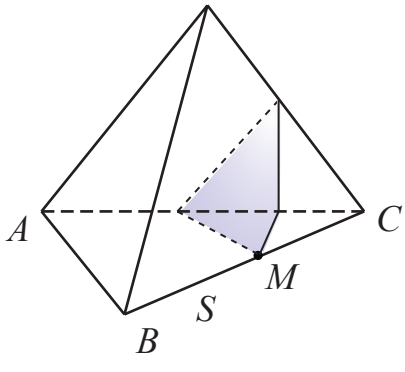
d)



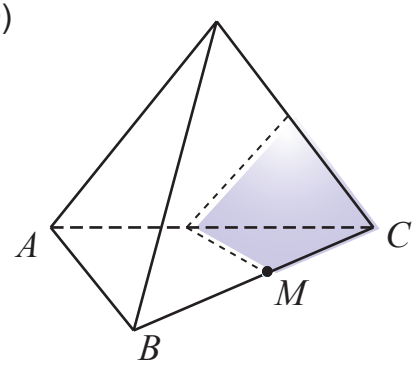
Javob: *a) mumkin emas; b) mumkin; c) mumkin; d) mumkin.*

10.6. Qaysi rasmda M nuqtadan o‘tuvchi va tetraedrning SAB yog‘iga parallel bo‘lgan kesim tasvirlangan?

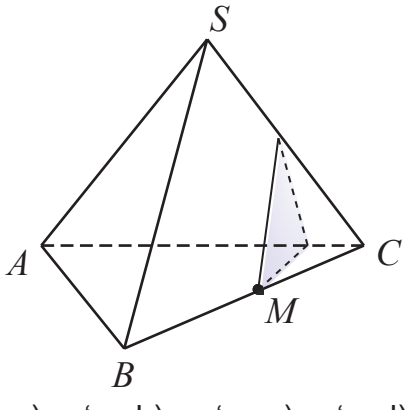
a)



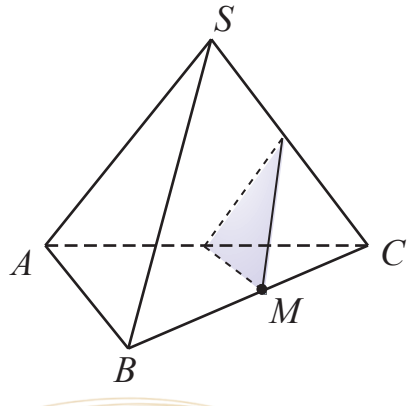
b)



c)



d)



Javob: a) yo‘q; b) yo‘q; c) yo‘q; d) ha.

11-DARS. BOBNI TAKRORLASHGA DOIR AMALIY TOPSHIRIQLAR

I. Standartlar:

– fazoviy jismlar, ko‘pyoqlar – prizma, parallelepiped, kub, piramida haqida boshlang‘ich tushunchalarga ega bo‘lish, tekislikda tasvirlay olish, ularni chizmada ko‘rsatish va sirtini topishga doir masalalarni yechish.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ko‘pyoqlarga oid tushunchalarni bilish;

– ko‘pyoqlarning sirtini topa olish.

Ko‘nikmalar:

– ko‘pyoqlar sirtini topishga doir masalalarni yechish.

III. Dars mazmunining qisqacha tavsifi:

– ko‘pyoqlar va ularning sirti.

IV. Dars ashyolari va ko‘rgazmali qurollar:

turli fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Yassi va fazoviy siniq chiziqlar bir-biridan nimasi bilan farq qiladi?	Aqliy hujum	Mavzu bo‘yicha savollar: Yassi va fazoviy siniq chiziqlarga misollar keltiring
Bilimlarni boyitish va mustahkam-lash	piramida yon sirti; piramida to‘la sirti;	Darslik bilan ishlash	Amaliy mashq va tatbiq: 10.7
	Ko‘pyoq kesimi	Darslik bilan ishlash	Amaliy mashq va tatbiq: 10.8
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 10.9
Uyga vazifa	Amaliy mashq va tatbiq: 1–2		

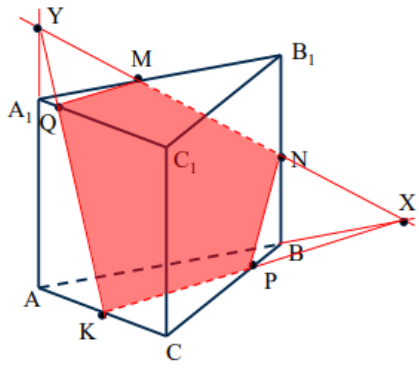
10.7. Quyidagi algoritm asosida prizmaning berilgan nuqtalardan o‘tuvchi kesimini yasang va yasash jarayonini izohlang.

$ABCA_1B_1C_1$ prizmaning M, N, P va Q nuqtalaridan o‘tuvchi kesimini yasash algoritmi:

1) $M \longleftrightarrow N,\ MN \cap AB = X;$ 2) $X \longleftrightarrow K,\ XK \cap BC = P;$ 3) $MN \cap AA_1 = Y$

4) $Y \longleftrightarrow K,\ YK \cap A_1C_1 = Q;$ 5) $P \longleftrightarrow N,\ Q \longleftrightarrow M;$

6. $MNKPQ$ – izlanayotgan kesim bo‘ladi.



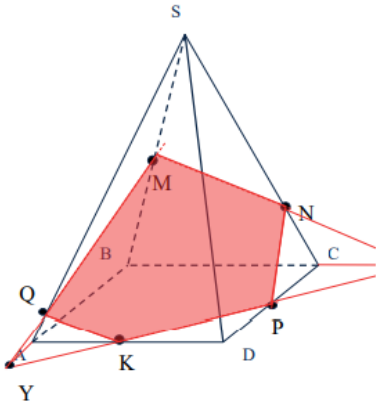
Bu yerda, $"M \longleftrightarrow N"$ belgilash – M va N nuqtalardan o‘tuvchi to‘g‘ri chiziqni o‘tkazamiz, $"MN \cap AB = X"$ belgilash esa – MN va AB to‘g‘ri chiziqlar kesishish nuqtasini X bilan belgilaymiz, degan ma’noni anglatadi.

10.8. Quyidagi algoritm asosida kubning berilgan nuqtalardan o‘tuvchi kesimini yasang va yasash jarayonini izohlang.

$ABCDA_1B_1C_1D_1$ kubning $M \in A_1B_1$, $N \in B_1C_1$ va $K \in CC_1$ nuqtalaridan o‘tuvchi kesimini yasash algoritmi:

1) $M \longleftrightarrow N;$
2) $MN \cap D_1C_1 = X;$
3) $N \longleftrightarrow K,\ X \longleftrightarrow K;$
4) $XK \cap DC = P;$
5) $KP \cap DD1 = Y;$
6) $MN \cap A1D1 = Z;$
7) $Y \longleftrightarrow Z;$
8) $YZ \cap AD = Q;$
9) $YZ \cap AA1 = R;$
10) $Q \longleftrightarrow P,\ R \longleftrightarrow M;$
11) $MNKPQR$ izlanayotgan kesim bo‘ladi.

10.9. Quyidagi algoritm asosida piramidaning berilgan nuqtalardan o‘tuvchi kesimini yasang va yasash jarayonini izohlang. $SABCD$ piramidaning $M \in SB$, $N \in SC$ va $K \in AD$ nuqtalaridan o‘tuvchi kesimini yasash algoritmi:



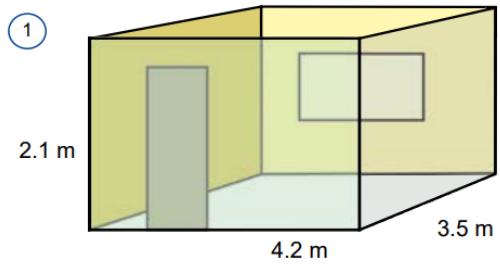
1) $M \longleftrightarrow N;$
2) $MN \cap BC = X;$
3) $X \longleftrightarrow K;$
4) $XK \cap DC = P;$
5) $XK \cap AB = Y;$
6) $Y \longleftrightarrow M;$
7) $YM \cap SA = Q;$
8) $P \longleftrightarrow N,\ K \longleftrightarrow Q;$
9) $MNPKQ$ izlanayotgan kesim bo‘ladi.

Uy vazifasi

2. Rasmda tasvirlangan xonani ta’mirlash kerak. Xonada o‘lchamlari $0,8\ m$ va $2,2\ m$ bo‘lgan eshik va o‘lchamlari $183\ cm$ va $91\ cm$ bo‘lgan deraza bor. Eshikning

ikki tomoni ham bo‘yalishi lozim. Jadvalda ikki xil bo‘yoqning narxlari berilgan. Bu ma’lumotlardan foydalanib, tejamli ta’mirlash uchun qancha mablag‘ kerakligini hisoblang.

Bo‘yoq turi	Hajmi	Bo‘yash yuzi	Narxi (so‘mda)
Devor uchun	4 l	16 m^2	32450
	2 l	8 m^2	20800
Eshik uchun	2 l	10 m^2	23600
	1 l	5 m^2	15400



1) $a = 4{,}2\ m;\ b = 3{,}5\ m;\ c = 2{,}1\ m.$

$S_{yon} = 2\,(ac+bc) = 2c(a+b) = 2 \cdot 2{,}1 \cdot (4{,}2 + 3{,}5) = 4{,}2 \cdot 7{,}7 = 32{,}34\ m^2;$

2) $a = 0{,}8\ m;\ b = 2{,}2\ m.$

$S_{eshik} = a \cdot b = 0{,}8\ m \cdot 2{,}2\ m = 1{,}76\ m^2;$

3) $a = 183\ cm = 1{,}83\ m;\ \ b = 91\ cm = 0{,}91\ m;$

$S_{deraza} = a \cdot b = 1{,}83\ m \cdot 0{,}91\ m = 1{,}6653\ m^2;$

$S_{devor} = S_{yon} - S_{eshik} - S_{deraza} = 32{,}34\ m^2 - 1{,}76\ m^2 - 1{,}6653\ m^2 = 28{,}9147\ m^2;$

$S_{devor\ ichi\ va\ sirti} = 2 \cdot S_{devor} = 2 \cdot 28{,}9147\ m^2 = 57{,}8294\ m^2;$

Devor uchun bo‘yoqlar:

$$4\ litrlikdan:\ \ n_1 = \frac{S_{devor\ ichi\ va\ sirti}}{S_{bo'yash\ yuzasi}} = \frac{57{,}8294\ m^2}{16\ m^2} = 3{,}6143375 \approx 4\ ta;$$

$$m_1 = n_1 \cdot k_1 = 4 \cdot 32450\ so'm = 129800\ so'm;$$

$$2\ litrlikdan:\ \ n_2 = \frac{S_{devor\ ichi\ va\ sirti}}{S_{bo'yash\ yuzasi}} = \frac{57{,}8294\ m^2}{8\ m^2} = 7{,}228675 \approx 8\ ta;$$

$m_2 = n_2 \cdot k_2 = 8 \cdot 20800\ so'm = 166400\ so'm;$

Eshik uchun bo'yoqlar:

$2\ litrlikdan:\ \ n_1 = \dfrac{S_{eshik}}{S_{bo'yash\ yuzasi}} = \dfrac{1{,}76\ m^2}{10\ m^2} = 0{,}176 \approx 1\ ta;$

$1\ litrlikdan:\ \ n_1 = \dfrac{S_{eshik}}{S_{bo'yash\ yuzasi}} = \dfrac{1{,}76\ m^2}{5\ m^2} = 0{,}352 \approx 1\ ta;$

$m_4 = n_4 \cdot k_4 = 1 \cdot 15400\ so'm = 15400\ so'm;$

Tejash uchun: $m_1 + m_4 = 129800\ so'm + 15400\ so'm = 145200\ so'm.$

Javob: 145200 so'm.

III BOB. FAZODA TO‘G‘RI CHIZIQLAR VA TEKISLIKLARNING PARALLELLIGI

1-DARS. FAZODA TO‘G‘RI CHIZIQLARNING O‘ZARO JOYLASHUVI

I. Standartlar:

– M10.GO‘.YM.03. Parallel to‘g‘ri chiziqlarni tasavvur qila oladi;

– M10.GO‘.MM.04. Parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– parallel to‘g‘ri chiziqlarning xossalarini bilish;

Ko‘nikmalar:

– parallel to‘g‘ri chiziqlarning xossalarini amaliy masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– parallel to‘g‘ri chiziqlarning xossalari.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

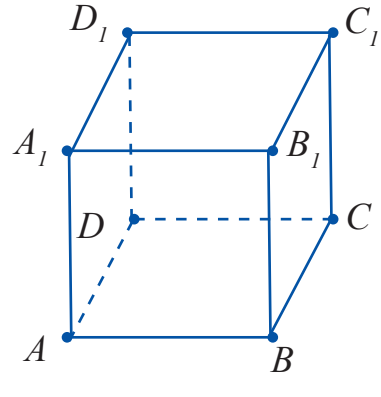
Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Parallellik deganda nimani tushunasiz?	Aqliy hujum	Mavzu bo‘yicha savollar: Parallellikka misollar keltiring
Bilimlarni boyitish va mustahkamlash	Fazoda parallel to‘g‘ri chiziqlar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 11.1
	Parallellik alomati	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 11.2–11.3
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 11.4–11.5
Uyga vazifa	1. Mavzu bo‘yicha savollar: 3 2. Amaliy mashq va tatbiq: 11.6–11.8		

11.3. Rasmda tasvirlangan a) $ABCDA_1B_1C_1D_1$ parallelepipeddagi parallel qirralar juftlarini aniqlang.

$ABCDA_1B_1C_1D_1$ parallelepipeddagi parallel qirralar juftlari:

1) $AB \parallel DC$; 2) $AB \parallel A_1B_1$; 3) $AB \parallel D_1C_1$;

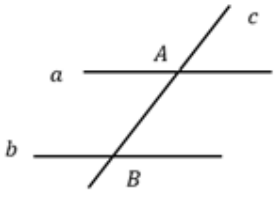
4) $DC \parallel D_1C_1$; 5) $DC \parallel A_1B_1$; 6) $D_1C_1 \parallel A_1B_1$;



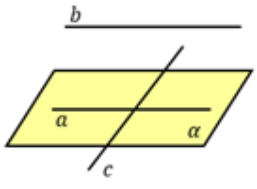
7) $AA_1 \parallel DD_1$; 8) $AA_1 \parallel CC_1$; 9) $AA_1 \parallel BB_1$;

10) $BB_1 \parallel CC_1$; 11) $BB_1 \parallel DD_1$; 12) $CC_1 \parallel DD_1$.

11.5. Ma'lumki, tekislikda to'g'ri chiziq parallel to'g'ri chiziqlardan birini kesib o'tsa, ikkinchisini ham kesib o'tadi. Bu xossa fazoda ham o'rinli bo'ladimi?



Tekislikda $\begin{cases} a \parallel b \\ a \nparallel c \end{cases} \rightarrow \quad b \nparallel c$.



Fazoda $a \parallel b, \quad c \div b.$

Javob: O'rinli emas.

Uy vazifasi

11.6. a va b to'g'ri chiziqlar c to'g'ri chiziqqa parallel. a va b to'g'ri chiziqlar o'zaro qanday joylashishishi mumkin? ?

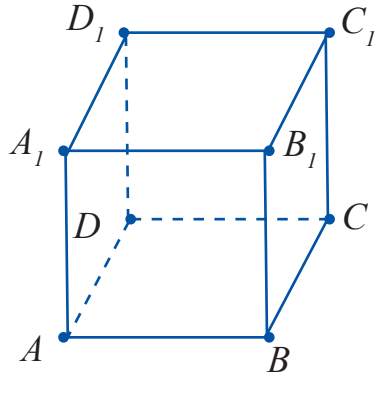
a _____

b _____

c _____

$\begin{cases} a \parallel c \\ b \parallel c \end{cases} \rightarrow \quad a \parallel b$.

11.7. Rasmda tasvirlangan $ABCDA_1B_1C_1D_1$ parallelepipedda BC_1 va AD_1 diagonallar o'zaro teng va parallel ekanligini isbotlang.



$BCC_1B_1 \parallel ADD_1A_1$; $BC = AD$;

$\begin{cases} BC_1 = BC \cdot \sqrt{2} \\ AD_1 = AD \cdot \sqrt{2} \end{cases} \rightarrow \quad AD_1 = BC_1$.

ABC_1D_1 -to'g'ri to'rtburchak bo'lgani uchun

$AD_1 \parallel BC_1$.

2-DARS.FAZODA TO‘G‘RI CHIZIQLARNING O‘ZARO JOYLASHUVI

I. Standartlar:

– M10.GO‘.MM.05. Parallelepipedning xossalarini biladi va ularni masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– parallel to‘g‘ri chiziqlarning xossalarini bilish;

Ko‘nikmalar:

– parallel to‘g‘ri chiziqlarning xossalarini amaliy masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– parallel to‘g‘ri chiziqlarning xossalari.

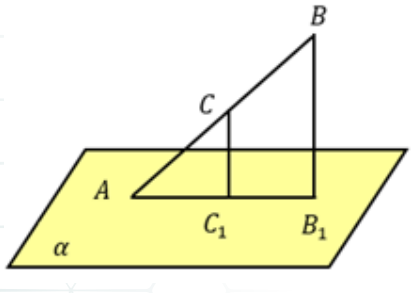
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Parallellik deganda nimani tushunasiz?	Aqliy hujum	Mavzu bo‘yicha savollar: Parallellikka misollar keltiring
Bilimlarni boyitish va mustahkam-lash	Fazoda parallel to‘g‘ri chiziqlar	Darslik bilan ishlash	Amaliy mashq va tatbiq: 11.9
	Parallellik alomati	Darslik bilan ishlash	Amaliy mashq va tatbiq: 11.10-11.11
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 11.12-11.13
Uyga vazifa	Amaliy mashq va tatbiq: 11.14–11.15		

11.8. A **uchi** α **tekislikda yotgan** AB **kesmadan** C **nuqta tanlangan.** B **va** C **nuqtalardan o‘tkazilgan parallel to‘g‘ri chiziqlar** α **tekislikni mos ravishda** B_1 **va** C_1 **nuqtalarda kesib o‘tadi. Agar a)** C **nuqta** B **kesmaning o‘rtasi, va** $BB_1 = 14\ cm$**; b)** $AC : CB = 3 : 2$ **va** $BB_1 = 50\ cm$ **bo‘lsa,** CC_1 **kesmaning uzunligini toping.**



a) $AC = CB;\quad BB_1 = 14\ cm.\quad CC_1 = ?$

$\Delta ACC_1 \sim \Delta ABB_1;\qquad AB = 2 \cdot AC;$

$$\frac{AC}{AB} = \frac{CC_1}{BB_1};\qquad \frac{AC}{2 \cdot AC} = \frac{CC_1}{14};\qquad \frac{1}{2} = \frac{CC_1}{14};$$

$$CC_1 = \frac{14}{2} = 7\ cm;\qquad Javob:\ CC_1 = 7\ cm.$$

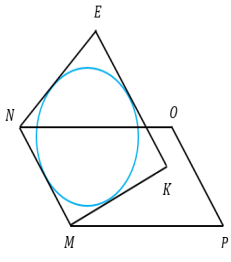
$b)\ AC : CB = 3 : 2;\qquad BB_1 = 50\ cm.\qquad CC_1 = ?$

$AB = AC + CB = 3 + 2 = 5;\qquad \frac{AC}{CB} = \frac{3}{2};\qquad \frac{AC}{AB} = \frac{CC_1}{BB_1};\qquad \frac{3}{5} = \frac{CC_1}{50};$

$CC_1 = \frac{3 \cdot 50}{5} = 3 \cdot 10 = 30\ cm.$

Javob: $CC_1 = 30\ cm.$

11.9. Bitta tekislikda yotmaydigan *MNOP* Parallelogramm va *EK* asosli *MNEK* trapetsiya berilgan. a) *PO* va *EK* to‘g‘ri chiziqlarning o‘zaro joylashishini aniqlang; b) trapetsiyaning asosiari *MN = 45 cm, EK = 55 cm* ga teng bo‘lib, unga ichki aylana chizish mumkin, trapetsiyaning perimetrini toping.



$a)\ \begin{cases} EK \| MN \\ PO \| MN \end{cases} \rightarrow\ PO \| EK.$

b) $MN = 45\ cm;\ EK = 55\ cm.$

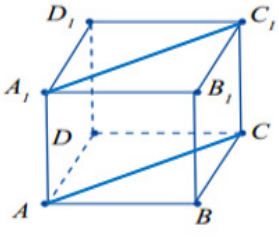
$NE + MK = MN + EK;$

$MN + EK = 45\ cm + 55\ cm = 100\ cm;$

$P_{PNEK} = NE + MK + MN + EK = 100\ cm + 100\ cm = 200\ cm.$

Javob: $P_{PNEK} = 200\ cm.$

11.10. Quyidagi xossalarning qaysilari parallelepipedga tegishli? To‘g‘ri javoblarni belgilang.



D) Barcha diagonallari bitta nuqtada kesishadi va bu nuqtada teng ikkiga bo‘linadi.

E) Qarama-qarshi qirralari o‘zaro parallel.

F) Hamma yoqlari to‘g‘ri to‘rtburchakdan iborat.

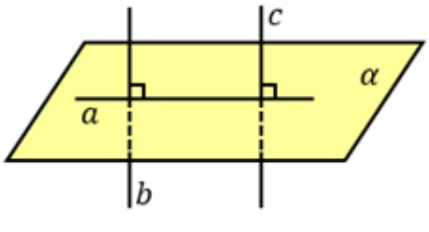
G) Qarama-qarshi yoqlari o‘zaro teng.

H) Qirralari o‘zaro ayqash.

I) Qirralari orasida o‘zaro ayqashlari ham bor.

ACC_1A_1 Parallelogramm bo‘ladi. **Javob:** *A, B, D, E, F, G, J.*

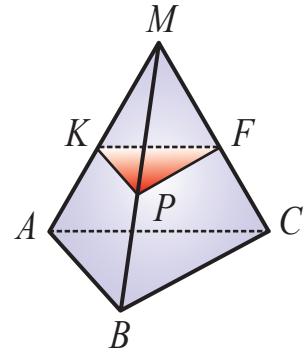
11.11. Fazoda bitta to‘g‘ri chiziqqa perpendikulyar bo‘lgan to‘g‘ri chiziqlar o‘zaro parallel bo‘ladimi?



$\begin{cases} a \subset \alpha \\ b \subset \alpha \\ \begin{cases} a \perp b \\ c \perp a \\ c \perp \alpha \end{cases} \end{cases} \rightarrow\ b \nparallel c$ ayqash bo‘ladi.

Har doim parallel bo‘lmaydi. Qachonki $\begin{cases} a, b, c \subset \alpha \\ a \perp b \\ a \perp c \end{cases} \rightarrow b \| c$ bo‘ladi.

11.12. Rasmda M nuqta ABC uchburchak tashqi sohasida yotibdi. MA, MB, MC kesmalarning o‘rtalari mos ravishda K, F, P nuqtalar bilan belgilangan. KP, PF, KF, KM, PM, FM, AB, BC, AC to‘g‘ri chiziqlardan qaysilari o‘zaro papallel?



Javob: $AB \parallel KP$;

$AC \parallel KF$;

$BC \parallel PF$.

11.13. Quyidagi jumlalarni o‘qing. Jumla to‘g‘ri bo‘lsa “+”, noto‘g‘ri bo‘lsa “–” belgisini yonidagi katakka qo‘ying.

1	Fazoda to‘g‘ri chiziqqa unda yotmagan nuqtadan unga parallel ko‘plab to‘g‘ri chiziqlarni o‘tkazish mumkin.	–
2	Uchinchi to‘g‘ri chiziqqa parallel ikki to‘g‘ri chiziq o‘zaro kesishadi.	–
3	Agar ikki to‘g‘ri chiziq tekislikda yotsa, ular kesishadi.	–
4	To‘g‘ri chiziq va unda yotmagan nuqtadan o‘tuvchi ikkita tekislik o‘tkazish mumkin.	–
5	Fazoning tekislikda yotmagan nuqtasidan bu tekislikni kesadigan ko‘plab to‘g‘ri chiziqlarni o‘tkazish mumkin.	+

Uy vazifasi

11.14. M, N, U, V nuqtalar $ABCD$ piramidaning mos ravishda AC, AD, BD va BC qirralarining o‘rtalari. Agar $AB = 20$ cm, $CD = 30$ cm bo‘lsa, $MNUV$ to‘rtburchakning perimetrini toping.

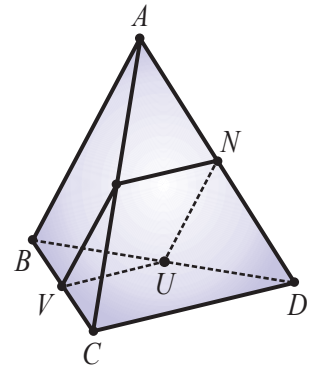
$AB = 20$ cm, $CD = 30$ cm.

$P_{MNUV} = ?$

ΔACD da MN-o‘rta chiziq.

ΔBCD da $MN = \frac{CD}{2} = \frac{30}{2} = 15$ cm;

ΔABC da $MV = \frac{AB}{2} = \frac{20}{2} = 10$ cm;



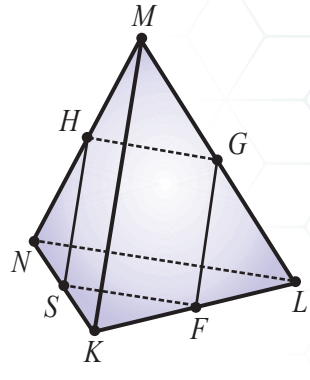
ΔABD da $\quad NU = \frac{AB}{2} = \frac{20}{2} = 10\ cm;$

$P_{MNUV} = MN + NU + UV + VM = 2(MN + MV) = 2 \cdot (15 + 10) = 50\ cm.$

Javob: $P_{MNUV} = 50\ cm.$

11.15. ***H, G, F, S*** **nuqtalar** ***KLMN*** **uchburchakli piramidaning mos ravishda** ***MN, ML, LK*** **va** ***KN*** **qirralarining o‘rtalari. Agar** ***LK = 18 mm, MN = 22 mm*** **bo‘lsa,** ***HGFS*** **to‘rtburchakning perimetrini toping.**

$LK = 18\ mm, \quad MN = 22\ mm. \qquad P_{NGFS} = ?$



$LK = ML = 18\ mm; \quad MN = MK = 22\ mm;$

ΔMNK da $\quad HS = \frac{MK}{2} = \frac{22\ mm}{2} = 11\ mm;$

ΔMKL da $\quad GF = \frac{MK}{2} = \frac{22\ mm}{2} = 11\ mm;$

ΔNKL da $\quad SF = \frac{NL}{2} = \frac{18\ mm}{2} = 9\ mm;$

ΔNLM da $\quad HG = \frac{NL}{2} = \frac{18\ mm}{2} = 9\ mm;$

$P_{NGFS} = 2(HS + GF) = 2 \cdot (11\ mm + 9\ mm) = 2 \cdot 20\ mm = 40\ mm.$

Javob: $P_{NGFS} = 40\ mm.$

3-DARS. AYQASH TO‘G‘RI CHIZIQLAR

I. Standartlar:

– M10.GO‘.GSH.04. Fazoda ayqash, parallel va kesishuvchi to‘g‘ri chiziqlar ta’rifini biladi va chizmada tasvirlay oladi;

– M10.GO‘.YM.04. Ayqash to‘g‘ri chiziqlarni tasavvur qila oladi;

– M10.GO‘.MM.06.To‘g‘ri chiziqlarning ayqashlik alomatini biladi va uni masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– fazoda ayqash, parallel va kesishuvchi to‘g‘ri chiziqlar ta’rifini bilish;

– to‘g‘ri chiziqlarning ayqashlik alomatini bilish.

Ko‘nikmalar:

– to‘g‘ri chiziqlarning ayqashlik alomatini biladi va uni masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– fazoda ayqash, parallel va kesishuvchi to‘g‘ri chiziqlar. To‘g‘ri chiziqlarning ayqashlik alomati.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

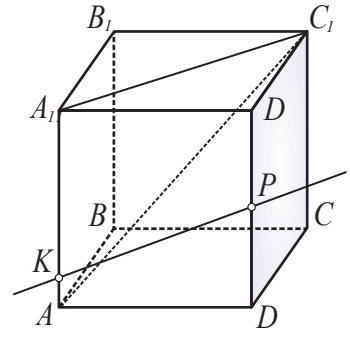
V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Qanday to‘g‘ri chiziqlar parallel va kesishuvchi to‘g‘ri chiziqlar deyiladi?	Aqliy hujum	Mavzu bo‘yicha savollar: Parallel va kesishuvchi to‘g‘ri chiziqlarga misollar keltiring
Bilimlarni boyitish va mustahkam-lash	Fazoda parallel va kesishuvchi to‘g‘ri chiziqlar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 12.1
	Fazoda ayqash to‘g‘ri chiziqlar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 12.2
	Ayqash to‘g‘ri chiziqlar orasidagi burchak	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 12.3
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 12.4
Uyga vazifa	Amaliy mashq va tatbiq: 12.5–12.6		

12.2. Rasmda $ABCDA_1B_1C_1D_1$ to‘g‘ri burchakli parallelepiped va uning AA_1 va DD_1 qirralaridagi mos ravishda K va P nuqtalar tasvirlangan. Jadvalda keltirilgan to‘g‘ri chiziqlarning o‘zaro joylashuvidan kelib chiqib, jadvalning mos kataklariga tegishli belgi ($\otimes$ – kesishish va $\div$ – ayqashlik) qo‘yilgan. Jadvaldagi xatoliklarni toping.

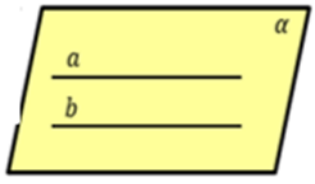
	AB	BB_1	A_1D_1
KP	$\otimes$	$\div$	$\otimes$
C_1A_1	$\div$	$\div$	$\otimes$
C_1B	$\otimes$	$\otimes$	$\div$

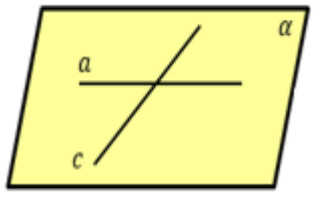
	AB	BB_1	A_1D_1
KP	$\div$	$\div$	$\otimes$
C_1A_1	$\div$	$\div$	$\otimes$
C_1B	$\otimes$	$\otimes$	$\div$

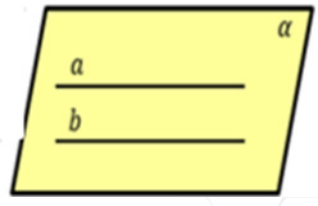


12.3. a va b to‘g‘ri chiziqlar bitta tekislikda yotadi. Bu to‘g‘ri chiziqlarning mumkin bo‘lgan o‘zaro joylashishini ko‘rsating.

A) a va b parallel; B) a va b kesishadi; C) a va b kesishmaydi;

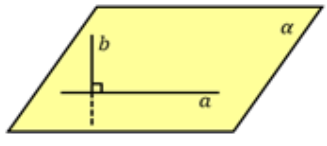






D) a va b ayqash; **E) perpendikulyar**

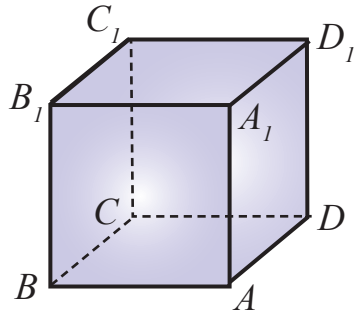
Bitta tekislikda ayqash bo‘lmaydi.



12.4. a) $ABCDA_1B_1C_1D_1$ parallelepiped; b) $ABCA_1B_1C_1$ prizma; c) $ABCD$ tetraedr; d) $SABCD$ piramidani chizing va undagi ayqash qirralar juftlarini aniqlang.

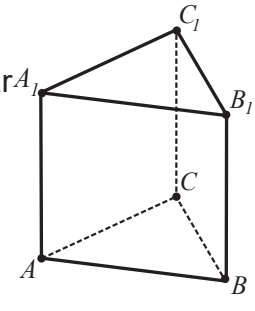
a) $ABCDA_1B_1C_1D_1$ parallelepipedni chizing va undagi ayqash qirralar juftlarini aniqlang:

1) $AB \div A_1D_1$; 2) $AB \div B_1C_1$; 3) $AB \div DD_1$;
4) $AB \div CC_1$; 5) $BC \div AA_1$; 6) $BC \div DD_1$;
7) $BC \div A_1B_1$; 8) $BC \div C_1D_1$; 9) $CD \div C_1B_1$;
10) $CD \div A_1D_1$; 11) $CD \div AA_1$; 12) $CD \div BB_1$;
13) $AD \div BB_1$; 14) $AD \div CC_1$; 15) $AD \div A_1B_1$;
16) $AD \div C_1D_1$; 17) $A_1B_1 \div AD$; 18) $A_1B_1 \div BC$;
19) $A_1B_1 \div DD_1$; 20) $A_1B_1 \div CC_1$; 21) $B_1C_1 \div AA_1$;
22) $B_1C_1 \div DD_1$; 23) $B_1C_1 \div AB$; 24) $B_1C_1 \div CD$;
25) $C_1D_1 \div AA_1$; 26) $C_1D_1 \div BB_1$; 27) $C_1D_1 \div BB_1$; 28) $C_1D_1 \div BC$;
29) $A_1D_1 \div BB_1$; 30) $A_1D_1 \div CC_1$; 31) $A_1D_1 \div AB$; 32) $A_1D_1 \div DC$.



b) $ABCA_1B_1C_1$ prizmani chizing va undagi ayqash qirralar juftlarini aniqlang.

1) $AB \div A_1C_1$; 2) $AB \div B_1C_1$; 3) $AB \div CC_1$;
4) $BC \div AA_1$; 5) $BC \div A_1C_1$; 6) $BC \div A_1B_1$;
7) $AC \div BB_1$; 8) $AC \div B_1C_1$; 9) $AC \div A_1B_1$;
10) $A_1C_1 \div BB_1$; 11) $A_1B_1 \div CC_1$; 12) $B_1C_1 \div AA_1$.

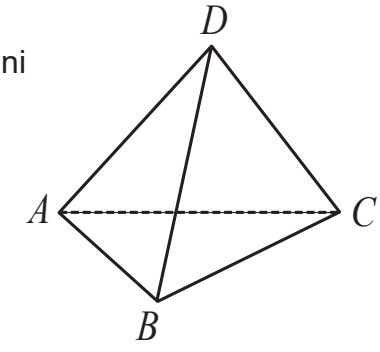


c) $ABCD$ tetraedrni chizing va undagi ayqash qirralar juftlarini aniqlang.

1) $AB \div DC$;

2) $BC \div AD$;

3) $AC \div BD$.

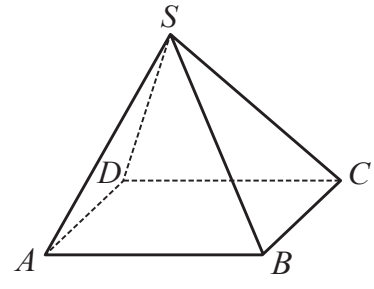


d) $SABCD$ piramidani chizing va undagi ayqash qirralar juftlarini aniqlang.

1) $SA \div DC$; 2) $SA \div BC$; 3) $SB \div AD$;

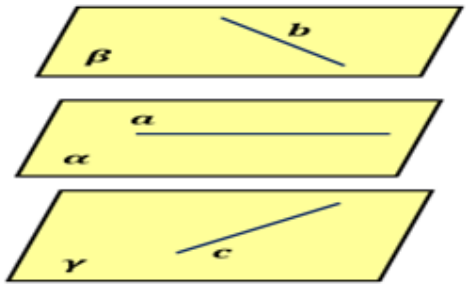
4) $SB \div DC$; 5) $SC \div AD$; 6) $SC \div AB$;

7) $SD \div AB$; 8) $SD \div BC$.



Uy vazifasi

12.5. a to‘g‘ri chiziq b to‘g‘ri chiziqqa, b to‘g‘ri chiziq esa c to‘g‘ri chiziqqa ayqash bo‘lsa, a to‘g‘ri chiziq c to‘g‘ri chiziqqa ayqash bo‘ladimi?

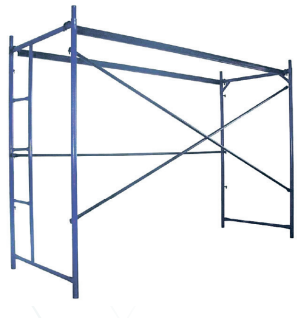


$\begin{cases} a \div b \\ b \div c \end{cases} \rightarrow a \| c$ yoki $a \div c$ bo‘ladi.

Javob: a to‘g‘ri chiziq c to‘g‘ri chiziqqa ayqash bo‘ladi.

12.6. Rasmdagi ayqash to‘g‘ri chiziqlar timsollarini toping.

a)



b)



Ikkita X holatdagi to‘g‘ri chiziqlarning birortasi bilan bu to‘g‘ri chiziqlar tekisligidan boshqa temir trubalar bilan ayqashdir.

Poyezd yo‘li bilan avtomabil yuradigan ko‘prik yo‘llari ayqashdir.

4-DARS. AYQASH TO‘G‘RI CHIZIQLAR

I. Standartlar:

– M10.GO‘.MM.06.To‘g‘ri chiziqlarning ayqashlik alomatini biladi va uni masalalar yechishda qo‘llay oladi;

– M10.GO‘.GSH.05. To‘g‘ri chiziqning tekislikka parallelligi ta’rifini biladi;

– M10.GO‘.GSH.06. Kesishuvchi va parallel tekisliklar haqida tushunchaga ega bo‘ladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– to‘g‘ri chiziqlarning ayqashlik alomatini bilish;

– to‘g‘ri chiziqning tekislikka parallelligi ta’rifini bilish;

– kesishuvchi va parallel tekisliklar haqida tushunchaga ega bo‘lish.

Ko‘nikmalar:

– to‘g‘ri chiziqlarning ayqashlik alomatini bilish va uni masalalar yechishda qo‘llay olish.

III. Dars mazmunining qisqacha tavsifi:

– to‘g‘ri chiziqning tekislikka parallelligi. Kesishuvchi va parallel tekisliklar.

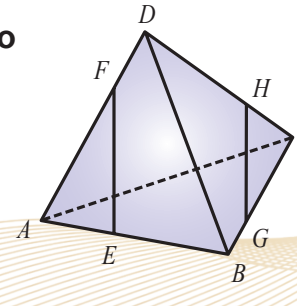
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	To‘g‘ri chiziqlar qachon tekislikka parallel bo‘ladi deyiladi?	Aqliy hujum	Mavzu bo‘yicha savollar: Kesishuvchi tekisliklarga misollar keltiring
Bilimlarni boyitish va mustahkamlash	To‘g‘ri chiziqlarning ayqashlik alomati	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 12.7
	To‘g‘ri chiziqning tekislikka parallelligi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 5 Amaliy mashq va tatbiq: 12.8
	Kesishuvchi va parallel tekisliklar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 6 Amaliy mashq va tatbiq: 12.9
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 12.10
Uyga vazifa	Amaliy mashq va tatbiq: 12.11–12.12		

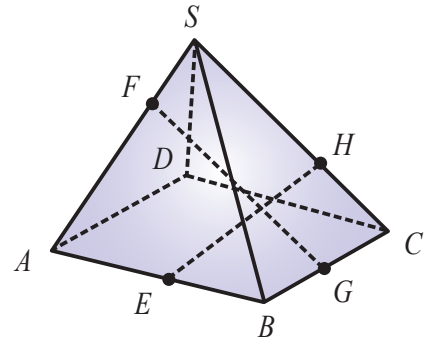
12.7. Rasmda tasvirlangan EF va GH kesmalarning o‘zaro joylashuvi qanday?



$EF \div GH$.

Javob: EF va GH kesmalar o‘zaro ayqash.

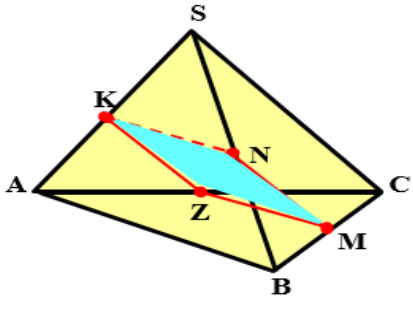
12.8. Rasmda tasvirlangan EH va FG kesmalar o‘zaro kesishadimi?



Agar E, H, G, F nuqtalar bir tekislikda bo‘lsa, EH va GF kesmalar kesishadi.

Agar E va H nuqtalar bir tekislikda, G va F nuqtalar boshqa tekislikda bo‘lsa, EH va GF kesmalar ayqash bo‘ladi.

12.9. K, Z, M, N nuqtalar $SABC$ uchburchakli piramidaning mos ravishda SA, AC, BC, SB kesmalarining o‘rtalari. Agar piramidaning yon qirralari b, asosining tomoni a ga teng bo‘lsa, $KZMN$ to‘rtburchakning perimetrini toping.



$AB = AC = BC = a; \quad SA = SB = SC = b;$

$$\Delta ACS \text{ da } KZ = \frac{SC}{2} = \frac{b}{2};$$

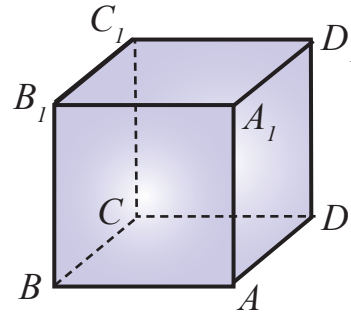
$$\Delta BCS \text{ da } NM = \frac{SC}{2} = \frac{b}{2};$$

$$\Delta ABC \text{ da } ZM = \frac{AB}{2} = \frac{a}{2}; \qquad \Delta ABS \text{ da } KN = \frac{AB}{2} = \frac{a}{2};$$

$$P_{KZMN} = 2(ZM + KZ) = 2\left(\frac{a}{2} + \frac{b}{2}\right) = 2 \cdot \frac{a+b}{2} = a + b.$$

Javob: $P_{KZMN} = a + b.$

12.10. Rasmdagi $ABCDA_1B_1C_1D_1$ kubda quyidagi to‘g‘ri chiziqlar orasidagi burchaklarni toping: a) DC va BC; b) AB va BB_1; c) AA_1 va D_1C; d) AA_1 va D_1C_1; e) A_1C_1 va AC; f) AB va B_1D_1.



a) $DC \perp BC; \quad \angle BCD = 90°;$

b) $AB \perp BB_1; \quad \angle ABB_1 = 90°;$

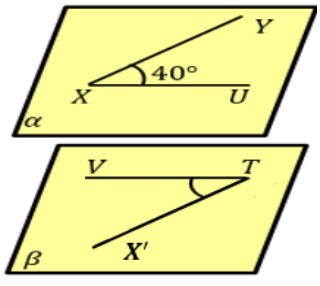
c) $\begin{cases} AA_1 \parallel DD_1 \\ \angle DD_1C = 45° \end{cases} \rightarrow 45°;$

d) $\begin{cases} AA_1 \parallel DD_1 \\ DD_1 \perp C_1D_1 \end{cases} \rightarrow 90°;$

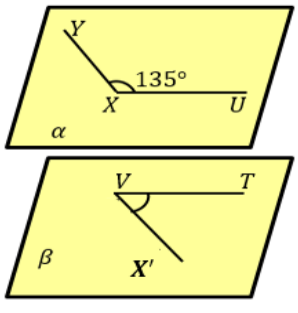
e) $A_1C_1 \parallel AC \rightarrow 0°;$ f) $\begin{cases} AB \parallel A_1B_1 \\ \angle A_1B_1D_1 = 45° \end{cases} \rightarrow 45°.$

Uy vazifasi

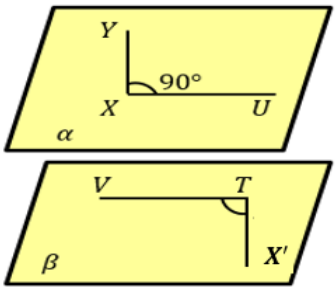
12.11. XU va VT to‘g‘ri chiziqlar parallel, XY va VT to‘g‘ri chiziqlar esa ayqash. Agar: a) $\angle YXU = 40°$; b) $\angle YXU = 135°$; c) $\angle YXU = 90°$ bo‘lsa, XY va VT to‘g‘ri chiziqlar orasidagi burchakni toping.



a) $\alpha \parallel \beta$; $XU \parallel VT$; $XY \div VT$; $\angle YXU = 40°$.
$\angle X'TV = ?$
$XU \parallel VT$; $X'T \div XU$; $X'T \parallel XY$;
$\angle YXU = \angle X'TV$; **Javob:** $\angle X'TV = 40°$.

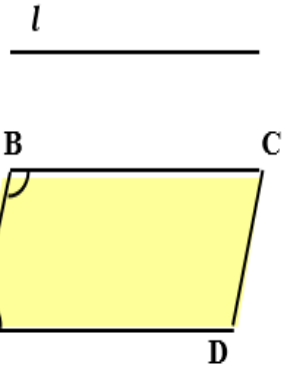


b) $\alpha \parallel \beta$; $XU \parallel VT$; $XY \div VT$; $\angle YXU = 135°$.
$\angle X'VT = ?$
$XU \parallel VT$; $X'V \div XU$; $X'V \parallel XY$;
$\angle YXU = \angle X'TV$;
$\angle X'VT = 180° - \angle YXU = 180° - 135° = 45°$.
Javob: $\angle X'VT = 45°$



c) $\alpha \parallel \beta$; $XU \parallel VT$; $XY \div VT$; $\angle YXU = 90°$.
$\angle X'TV = ?$
$XU \parallel VT$; $X'T \div XU$; $X'T \parallel XY$;
$\angle YXU = \angle X'TV$;
Javob: $\angle X'TV = 90°$.

12.12. l to‘g‘ri chiziq $ABCD$ Parallelogrammning BC tomoniga parallel va uning tekisigida yotmaydi. l va CD to‘g‘ri chiziqlar ayqash ekanligini isbotlang. Agar Parallelogrammning burchaklaridan biri a) 58°; b) 133° bo‘lsa, l va CD to‘g‘ri chiziqlar orasidagi burchakni toping.



$l \parallel BC$; $CD \nparallel BC$; $l \notin ABCD$, demak, $l \div CD$.
a) $\angle A = 58°$; $l \parallel BC$, $BC \parallel AD$, $l \div CD$.
$\angle B = 180° - \angle A = 180° - 58° = 122°$;
$(l, CD) = 180° - \angle B = 180° - 122° = 58°$.
Javob: $(l, CD) = 58°$.
b) $\angle B = 133°$; $l \parallel BC$, $l \div CD$.
$(l, CD) = 180° - \angle B = 180° - 133° = 47°$.
Javob: $(l, CD) = 47°$.

5-DARS. FAZODA TO‘G‘RI CHIZIQ VA TEKISLIKLARNING O‘ZARO JOYLASHUVI

I. Standartlar:

– M10.GO‘.MM.06. Tekislikka parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– tekislikka parallel to‘g‘ri chiziqlarning xossalarini bilish;

Ko‘nikmalar:

– tekislikka parallel to‘g‘ri chiziqlarning xossalarini bilish va amaliy masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– tekislik bilan parallel to‘g‘ri chiziqlar va ularning xossalari. Tekislikka parallel to‘g‘ri chiziqlar va ularning xossalari.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlar	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	To‘g‘ri chiziq va tekislik fazoda o‘zaro qanday joylashishi mumkin? Misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: To‘g‘ri chiziq qachon tekislikka parallel bo‘ladi?
Bilimlarni boyitish va mustahkamlash	Tekislik bilan parallel to‘g‘ri chiziqlar va ularning xossalari.	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 13.1
	Tekislikka parallel to‘g‘ri chiziqlar va ularning xossalari.	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 13.2
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 13.3 – 13.4
Uyga vazifa	Amaliy mashq va tatbiq: 13.5		

13.2. a) $ABCDA_1B_1C_1D_1$ kubning; b) $ABCDEFA_1B_1C_1D_1E_1F_1$ oltiburchakli muntazam prizmaning bir-biriga parallel bo‘lgan qirra va yoqlarini aniqlang.

a) $ABCDA_1B_1C_1D_1$ kubning bir-biriga parallel bo‘lgan qirralari va yoqlarini aniqlang.

Parallel bo‘lgan qirralari:

1) $AB,\ CD,\ A_1B_1,\ C_1D_1;$

Parallel bo‘lgan yoqlari:

1) $ABCD,\ A_1B_1C_1D_1;$

2) $AD,\ BC,\ B_1C_1,\ A_1D_1$; 2) $ADD_1A_1,\ BCC_1B_1$;

3) $AA_1,\ BB_1,\ CC_1,\ DD_1$. 3) $ABB_1A_1,\ CDD_1C_1$.

b) $ABCDEFA_1B_1C_1D_1E_1F_1$ oltiburchakli muntazam prizmaning bir-biriga parallel bo‘lgan qirralari va yoqlarini aniqlang.

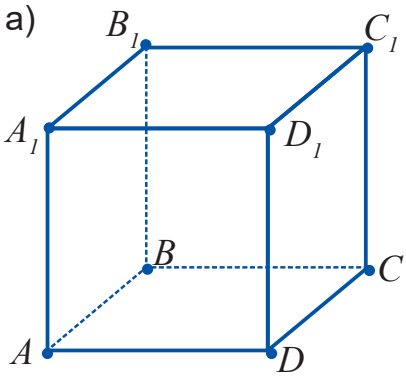
b) Parallel bo‘lgan qirralari: Parallel bo‘lgan yoqlari:

1) $AB,\ A_1B_1,\ DE,\ D_1E_1$; 1) $ABB_1A_1,\ DEE_1D_1$;

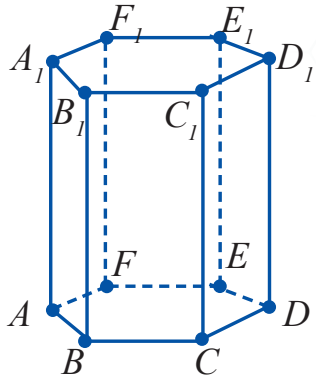
2) $BC,\ B_1C_1,\ FE,\ F_1E_1$; 2) $BCC_1B_1,\ EFF_1E_1$;

3) $CD,\ C_1D_1,\ AF,\ A_1F_1$. 3) $CDD_1C_1,\ AFF_1A_1$.

a)



b)



Uy vazifasi

13.5. Quyidagi jumlalarni o‘qing. Jumla to‘g‘ri bo‘lsa “+”, noto‘g‘ri bo‘lsa, “–” belgisini yonidagi katakka qo‘ying.

1	Agar tekislikda yotmagan to‘g‘ri chiziq shu tekislikdagi biror to‘g‘ri chiziqqa parallel bo‘lsa, bu to‘g‘ri chiziq tekislikning o‘ziga ham parallel bo‘ladi.	+
2	Bitta tekislikka parallel to‘g‘ri chiziqlar o‘zaro parallel bo‘ladi.	–
3	Tekislikka parallel to‘g‘ri chiziq bu tekislikda yotgan ixtiyoriy to‘g‘ri chiziqqa ham parallel bo‘ladi.	–
4	Agar bir tekislik ikkinchi tekislikka parallel bo‘lgan to‘g‘ri chiziqdan o‘tsa, bu tekisliklarning kesishish to‘g‘ri chizig‘i ham berilgan to‘g‘ri chiziqqa parallel bo‘ladi.	+
5	Agar to‘g‘ri chiziq bilan tekislik kesishmasa, to‘g‘ri chiziq va tekislik parallel deyiladi.	+
6	Orasidagi burchak 90° ga teng to‘g‘ri chiziqlar perpendikulyar to‘g‘ri chiziqlar deb ataladi.	+
7	Ayqash to‘g‘ri chiziqlar orasidagi burchak deb bu to‘g‘ri chiziqlarga parallel bo‘lgan kesishuvchi to‘g‘ri chiziqlar orasidagi burchakka aytiladi.	+

6-DARS. FAZODA TO‘G‘RI CHIZIQ VA TEKISLIKLARNING O‘ZARO JOYLASHUVI

I. Standartlar:

– M10.GO‘.MM.06. Tekislikka parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– tekislikka parallel to‘g‘ri chiziqlarning xossalarini bilish;

Ko‘nikmalar:

– tekislikka parallel to‘g‘ri chiziqlarning xossalarini bilish va amaliy masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– tekislik bilan parallel to‘g‘ri chiziqlar va ularning xossalari. Tekislikka parallel to‘g‘ri chiziqlar va ularning xossalari.

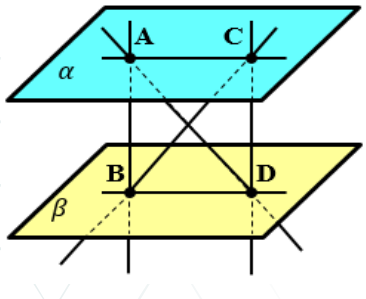
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	To‘g‘ri chiziq qachon tekislikka parallel bo‘ladi? Misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: To‘g‘ri chiziqning tekislikka parallellik alomatlarini ayting
Bilimlarni boyitish va mustahkamlash	Tekislik bilan parallel to‘g‘ri chiziqlar va ularning xossalari.	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 13.6
	Tekislikka parallel to‘g‘ri chiziqlar va ularning xossalari.	G‘ishtning nechta uchi, yog‘i va qirrasi bor?	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 13.7
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 13.8-13.9
Uyga vazifa	Amaliy mashq va tatbiq: 13.10–13.11		

13.6. A **va** C **nuqtalar** α **tekislikda yotadi.** B **va** D **nuqtalar** β **tekislikda yotadi.** AC, CD, BD, AB, BC **va** AD **to‘g‘ri chiziqlardan qaysilari** β **tekislikni kesib o‘tadi?**



$a \in A,\ a \in c,\ AC \in \alpha;$

$b \in B,\ b \in D,\ BD \in \beta;$

$\alpha \parallel \beta,\ AC \parallel BD,\ AB \parallel CD.$

AB, BC, CD, AD to‘g‘ri chiziqlar β tekislikni kesib o‘tadi.

13.7. ABC uchburchak α tekislikni B_1 va C_1 nuqtalarda kesib o‘tadi. Agar $AB_1 : BB_1 = 2 : 3$ $BC = 15$ cm $BC \parallel B_1C_1$ bo‘lsa, B_1C_1 kesmaning uzunligini toping.

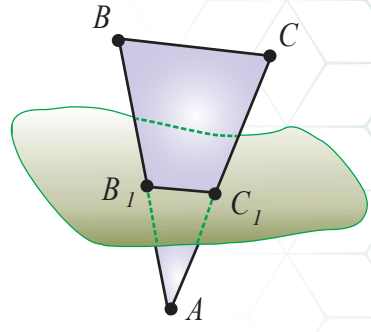
$AB_1 : BB_1 = 2:3$, $BC = 15$ cm, $BC \parallel B_1C_1$.

$B_1C_1 = ?$ $AB_1 = 2x$; $BB_1 = 3x$;

$AB = AB_1 + BB_1 = 2x + 3x = 5x$;

$$\frac{AB_1}{AB} = \frac{B_1C_1}{BC}; \qquad \frac{2}{5} = \frac{B_1C_1}{15\ cm};$$

$$B_1C_1 = \frac{2 \cdot 15\ cm}{5} = 2 \cdot 3\ cm = 6\ cm.$$



Javob: $B_1C_1 = 6$ cm.

13.8. α tekislik ABC uchburchakning AB va AC tomonlarini B_1 va C_1 nuqtalarda kesib o‘tadi. Agar $AB1 : BB1 = 3:1$, $B_1C_1 = 12$ cm, $BC \parallel \alpha$ bo‘lsa, BC kesmaning uzunligini toping.

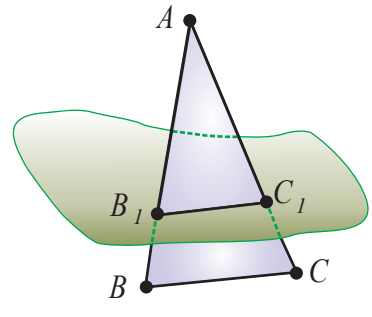
$AB_1 : BB_1 = 3:1$, $B_1C_1 = 12$ cm, $BC \parallel \alpha$.

$BC = ?$ $AB_1 = 3x$; $BB_1 = x$;

$AB = AB_1 + BB_1 = 3x + x = 4x$;

$$\frac{AB_1}{AB} = \frac{B_1C_1}{BC}; \qquad \frac{3}{4} = \frac{12\ cm}{BC}; \qquad BC = \frac{4 \cdot 12\ cm}{3} =$$

$= 4 \cdot 4\ cm = 16\ cm.$



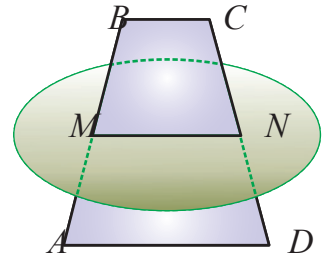
Javob: $BC = 36$ cm.

13.9. α tekislik $ABCD$ trapetsiyaning AD asosiga parallel va yon tomonlari o‘rtalarini M va N nuqtalarda kesib o‘tadi. Agar $AD = 17$ cm, $BC = 9$ cm bo‘lsa, MN kesmaning uzunligini toping.

$AD = 17$ cm, $BC = 9$ cm. $MN = ?$

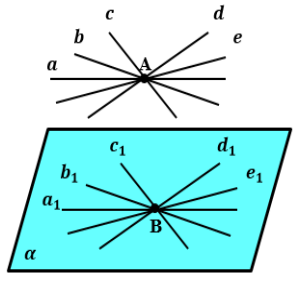
$$MN = \frac{AD + BC}{2} = \frac{17\ cm + 9\ cm}{2} = 13\ cm.$$

Javob: $MN = 13$ cm.



Uy vazifasi

13.10. Tekislikka unda yotmagan nuqtadan nechta parallel to‘g‘ri chiziq o‘tkazish mumkin?

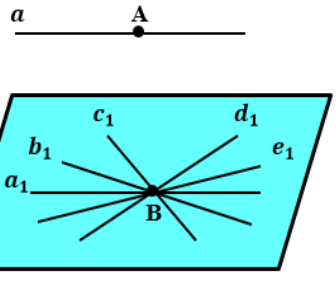


$\alpha \not\ni A$. $A \in a$, $A \in b$, $A \in c$, $A \in d$, $A \in e$;
$B \in a_1$, $B \in b_1$, $B \in c_1$, $B \in d_1$, $B \in e_1$;
$B \in \alpha$. $a \parallel a_1$, $b \parallel b_1$, $c \parallel c_1$, $d \parallel d_1$, $e \parallel e_1$.
$\alpha \parallel a$, $\alpha \parallel b$, $\alpha \parallel c$, $\alpha \parallel d$, $\alpha \parallel e$.

Javob: tekislikka unda yotmagan nuqtadan cheksiz ko‘p parallel to‘g‘ri chiziq o‘tkazish mumkin.

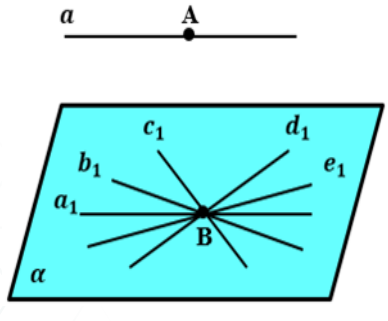
13.11. a to‘g‘ri chiziq α tekislikka parallel. To‘g‘ri tasdiqni toping.

a) a to‘g‘ri chiziq α tekislikning faqat bitta to‘g‘ri chizig‘iga parallel bo‘ladi.



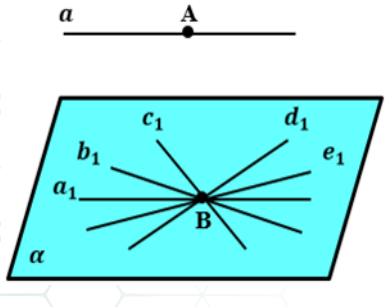
Javob: tasdiq to‘g‘ri. a to‘g‘ri chiziq α tekislikka parallel. a to‘g‘ri chiziq α tekislikning faqat bitta a_1 to‘g‘ri chizig‘iga parallel bo‘ladi.

b) a to‘g‘ri chiziq a tekislikning bitta to‘g‘ri chizig‘idan boshqa barcha to‘g‘ri chiziqlariga ayqash bo‘ladi.



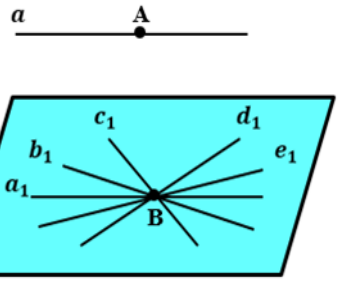
Javob: tasdiq to‘g‘ri. a to‘g‘ri chiziq α tekislikka parallel. a to‘g‘ri chiziq α tekislikning bitta a_1 to‘g‘ri chizig‘idan boshqa barcha to‘g‘ri chiziqlariga ayqash bo‘ladi.

c) a tekislikda a to‘g‘ri chiziqqa parallel va ayqash bo‘lgan ko‘plab to‘g‘ri chiziqlar topiladi.



Javob: tasdiq to‘g‘ri. a to‘g‘ri chiziq α tekislikka parallel. α tekislikda a to‘g‘ri chiziqqa parallel a_1 va ayqash bo‘lgan ko‘plab to‘g‘ri chiziqlar topiladi.

d) a tekislikda faqat bitta a to‘g‘ri chiziqqa parallel va bu tekislikning ixtiyoriy nuqtasidan o‘tuvchi to‘g‘ri chiziq mavjud.



Javob: tasdiq to‘g‘ri. a to‘g‘ri chiziq α tekislikka parallel. α tekislikda faqat bitta – a to‘g‘ri chiziqqa parallel a_1 va bu tekislikning ixtiyoriy nuqtasidan o‘tuvchi a_1 to‘g‘ri chiziq mavjud emas.

7-DARS. FAZODA TO‘G‘RI CHIZIQ VA TEKISLIKLARNING O‘ZARO JOYLASHUVI

I. Standartlar:

– M10.GO‘.MM.06. Tekislikka parallel to‘g‘ri chiziqlarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– tekislikka parallel to‘g‘ri chiziqlarning xossalarini bilish;

Ko‘nikmalar:

– tekislikka parallel to‘g‘ri chiziqlarning xossalarini bilish va amaliy masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– tekislik bilan parallel to‘g‘ri chiziqlar va ularning xossalari. Tekislikka parallel to‘g‘ri chiziqlar va ularning xossalari.

IV. Dars ashyolari va ko‘rgazmali qurollar:

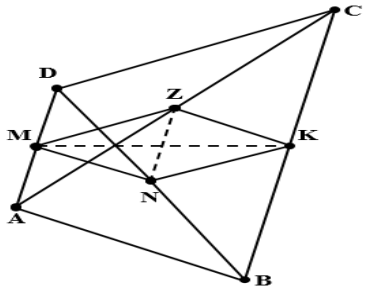
– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	To‘g‘ri chiziq qachon tekislikka parallel bo‘ladi? Misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: To‘g‘ri chiziqning tekislikka parallellik alomatlarini ayting
Bilimlarni boyitish va mustahkam-lash	Tekislik bilan paral-lel to‘g‘ri chiziqlar va ularning xossalari.	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 13.12
	Tekislikka parallel to‘g‘ri chiziqlar va ularning xossalari.	G‘ishtning nechta uchi, yog‘i va qirrasi bor?	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 13.13

Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 13.14–13.15
Uyga vazifa	Amaliy mashq va tatbiq: 13.16–13.17		

13.12. A, B, C, D **nuqtalar bitta tekislikda yotmaydi.** M, N, K, Z **nuqtalar – mos ravishda** AD, BD, BC, AC **kesmalarning o‘rtalari. Agar** $CD = AB$ **bo‘lsa,** MK **va** NZ **to‘g‘ri chiziqlarning perpendikulyarligini isbotlang.**



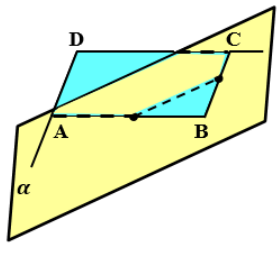
$$AB = CD = a; \qquad \begin{cases} MN \parallel AB \\ ZK \parallel AB \end{cases} \rightarrow MN \parallel ZK;$$

$$MN = ZK = \frac{AB}{2} = \frac{a}{2}; \qquad \begin{cases} MZ \parallel CD \\ MK \parallel CD \end{cases} \rightarrow MZ \parallel NK;$$

$$MZ = NK = \frac{CD}{2} = \frac{a}{2}.$$

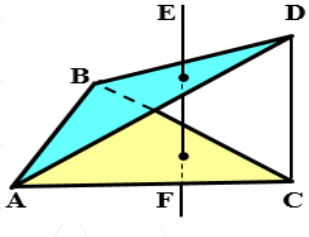
Demak, $MNKZ$ – romb ekan. Rombning diagonallari $MK \perp NZ$ bo‘ladi.

13.13. $ABCD$ **Parallelogrammning** AB **va** BC **tomonlari α tekislikni kesib o‘tadi.** AD **va** DC **to‘g‘ri chiziqlar ham** α **tekislikni kesib o‘tishini isbotlang.**



$AB \parallel CD;\ AB \nparallel \alpha.$ Demak, CD to‘g‘ri chiziq α ni kesib o‘tadi.
$BC \parallel AD;\ BC \nparallel \alpha.$ Demak, CD to‘g‘ri chiziq α ni kesib o‘tadi.

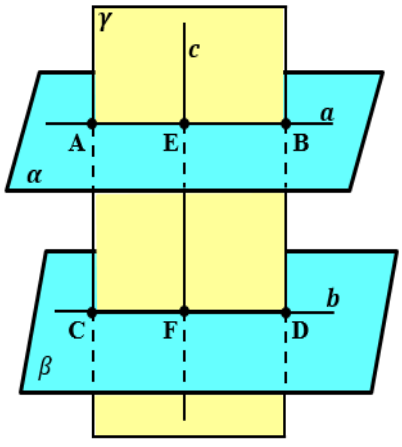
13.14. ABC **va** ABD **uchburchaklar bitta tekislikda yotmaydi.** CD **to‘g‘ri chiziqqa parallel bo‘lgan ixtiyoriy to‘g‘ri chiziqning bu uchburchaklar tekisligini kesib o‘tishini isbotlang.**



$$\begin{cases} CD \nparallel \Delta ABC \\ CD \nparallel \Delta ABD \\ EF \parallel CD \end{cases} \rightarrow \begin{cases} EF \nparallel \Delta ABC \\ EF \nparallel \Delta ABD \end{cases} \rightarrow$$

Demak, EF to‘g‘ri chiziq ABC va ABD uchburchak tekisliklarini kesib o‘tadi.

13.15. Berilgan ikki to‘g‘ri chiziqni kesib o‘tuvchi to‘g‘ri chiziqlarning bir tekislikda yotishini isbotlang.



$A \in a;\ B \in a;\ a \in \alpha;$

$C \in b;\ D \in b;\ b \in \beta;\ a \parallel b,\ \alpha \parallel \beta;$

$E \in c;\ a \cap c = E;\ a \perp c;\ \alpha \perp \gamma;$

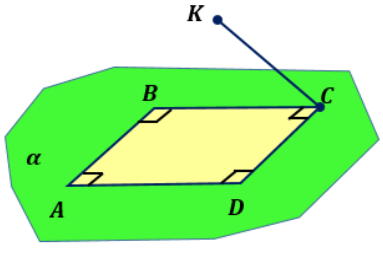
$F \in b;\ b \cap c = F;\ b \perp c;\ \beta \perp \gamma;$

$c \in \gamma.$

Uy vazifasi

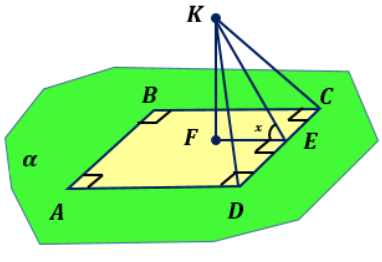
13.16. $ABCD$ **kvadratning** C **uchi orqali kvadrat tekisligida yotmagan** CK **to‘g‘ri chiziq o‘tadi.**

a) CK **va** AD **ayqash ekanligini isbotlang.**



$$\begin{cases} ABCD \subset \alpha \\ AD \parallel BC \\ K \notin \alpha \end{cases} \rightarrow \quad CK \div AD\,.$$

b) CK **va** AD **orasidagi burchakni toping.**



$$\begin{cases} CD \perp KE \\ KF \perp \alpha \end{cases} \rightarrow \quad FE \perp CD \quad \rightarrow FE \parallel AD.$$

ΔKFE da $\angle KEF = x.$

$x = \angle KEF$ burchak – AD va KC ayqash to‘g‘ri chiziqlar orasidagi burchak.

13.17 Tadbirkor alyuminiydan rasmda tasvirlangan narvonni ishlab chiqarmoqchi. Narvon har birida 7 ta zina bo‘lgan, bir-biriga mahkamlangan ikkita qismdan iborat.

a) narvonning qaysi bo‘laklari o‘zaro parallel va qaysilari o‘zaro ayqash ekanligini aniqlang;

b) agar narvonning kengligi 0,5 m, balandligi esa kengligidan 3,5 marta uzun ekani ma’lum bo‘lsa, bitta narvonni tayyorlash uchun necha m quvur kerak bo‘ladi?

c) 1 m alyuminiy quvurining narxi 20 000 so‘m bo‘lsa, bitta narvonni ishlab chiqarish uchun necha so‘m alyuminiy quvuri kerak bo‘ladi.

a) 1) narvonning zinalari o‘zaro parallel;

2) bir-biriga mahkamlangan 2 ta qismi ham parallel;

3) 2 ta narvonning kesishmagan ustunlari o‘zaro ayqash;

4) narvon ixtiyoriy zinasi bilan mahkamlangan qismi ayqash.



b) Narvon zinasi uzunligi 0,5 m ustuni esa 0,5 m · 3,5 = 1,75 m. Bitta narvon uchun

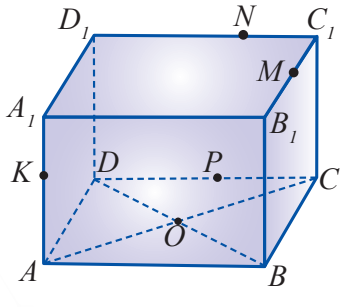
7·0,5 m + 2·3,5 m = 3,5 m + 7 m = 10,5 m quvur kerak bo‘ladi.

c) 10,5 m · 20 000 so‘m = 210 000 so‘mlik alyuminiy quvur kerak bo‘ladi.

Javob: b) 1,75 m; 10,5 m; c) 210 000 so‘m.

O‘ZINGIZNI SINAB KO‘RING (2-nazorat ishi)

1. Rasmda $ABCDA_1B_1C_1D_1$ to‘g‘ri burchakli parallelepiped va uning B_1C_1, C_1D_1, CD va AA_1 qirralarining o‘rtalari mos ravishda M, N, P, K nuqtalar tasvirlangan. O nuqta $ABCD$ asos markazi. Jadvalda keltirilgan to‘g‘ri chiziqlarning o‘zaro joylashuvini rasmdan aniqlab, jadvalning mos katagiga tegishli belgi ($\otimes$ – keshishish, $\parallel$ – parallelllik va $\div$ – ayqashlik)ni yozing.



To‘g‘ri chiziqlar	MN	NP	C_1O	NO
AA_1	$\div$	$\div$	$\div$	$\div$
BC_1	$\div$	$\div$	$\otimes$	$\div$
BD	$\parallel$	$\div$	$\otimes$	$\otimes$
AC	$\div$	$\div$	$\otimes$	$\otimes$

2. A, B, C, D nuqtalar bir tekislikda yotadi. AB va CD to‘g‘ri chiziqlar haqida nima deyish mumkin?

A) parallel bo‘ladi **B) kesishadi** **C) ayqash bo‘ladi.**

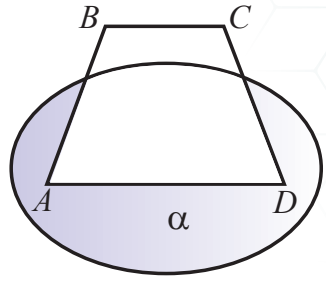
Bitta tekislikda yotgan A, B, C, D nuqtalardan o‘tuvchi AB va CD to‘g‘ri chiziqlar parallel va kesishishi mumkin, lekin ayqash bo‘lmaydi.

Javob: A va B.

3. $ABCD$ to‘rtburchakning AD tomoni orqali tekislik o‘tkazilgan. Agar $\angle BCA = \angle CAD$ bo‘lsa, BC tomon a tekislikka parallel ekanini isbotlang.

$$\angle BAC = \angle CAD \rightarrow BC \parallel AD;$$

$$\begin{cases} AD \subset \alpha \\ BC \| AD \end{cases} \rightarrow \quad BC \| \alpha$$



4. $ABCD$ **kvadrat va** $BEFC$ **trapetsiya bir tekislikda yotmaydi.** M **va** N **nuqtalar – mos ravishda** BE **va** FC **kesmalarning o‘rtasi: a)** MN **ning** AD **ga parallel ekanini isbotlang. b) agar** $AD = 10\ cm$, $EF = 6\ cm$ **bo‘lsa,** MN **ni toping.**

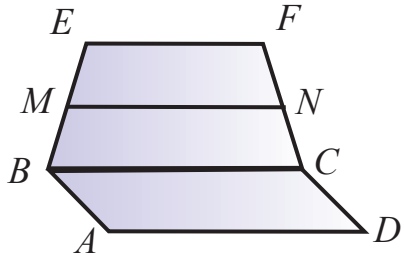
a) $BM = ME$; $FN = NC$.

$$\begin{cases} MN \| EF \\ MN \| BC \\ BC \| AD \end{cases} \rightarrow \quad MN \| AD$$ ekani kelib chiqadi.

b) $BM = ME$; $FN = NC$; $AD = 10\ cm$; $EF = 6\ cm$. $MN = ?$

$$BC = AD = 10\ cm; \qquad MN = \frac{BC + EF}{2} = \frac{10\ cm + 6\ cm}{2} = \frac{16\ cm}{2} = 8\ cm.$$

Javob: $MN = 8\ cm$.



5. $ABCD$ **parallelogrammning** AD **tomonida** A_1 **nuqta shunday tanlanadiki,** $DA_1 = 4\ cm$. AC **diagonalga parallel tekislik** A_1 **nuqtadan o‘tadi va** CD **tomonini** C_1 **nuqtada kesib o‘tadi.**

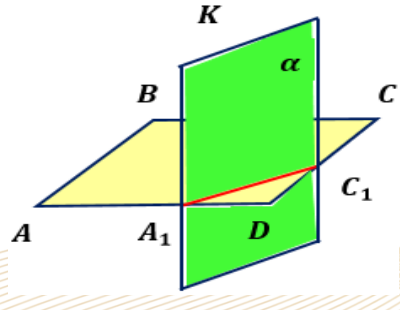
1) $C_1 DA_1$ **va** ABC **uchburchaklarning o‘xshashligini isbotlang.**

2) Agar $BC = 10\ cm$, $A_1 C_1 = 6\ cm$ **bo‘lsa,** AC **ni toping.**

$DA_1 = 4\ cm$; 1) $\begin{cases} A_1C_1 \subset \alpha \\ \alpha \| AC \end{cases} \rightarrow AC \| A_1C_1$;

$$\begin{cases} \angle CAD = \angle C_1A_1D \\ \angle ACD = \angle A_1C_1D \\ \angle D - umumiy \end{cases} \rightarrow \Delta ACD \sim \Delta A_1C_1D\ ;$$

$\Delta ACD = \Delta ACB$; $\Delta C_1DA_1 \sim \Delta ACB$.



2) $BC = 10\,cm$; $A_1C_1 = 6\,cm$; $BC = AD = 10\,cm$; $\Delta ACD \sim \Delta A_1C_1D$;

$$\frac{AC}{A_1C_1} = \frac{AD}{A_1D}; \qquad \frac{AC}{6} = \frac{10}{4}; \qquad AC = \frac{6\cdot 10}{4} = \frac{60}{4} = 15\,cm.$$

Javob: $AC = 15\,cm$.

6. α tekislik BAC burchak tomonlarini A_1 va B_1 nuqtalarda, unga parallel b tekislik esa A_2 va B_2 nuqtalarda kesadi. $A_1B_1 = 18$, $AA_1 = 24$, $AA_2 = \frac{1}{2}A_1A_2$ bo‘lsa, A_2B_2 va AA_2 ni toping.

$\alpha \| \beta$; $A_1B_1 \| A_2B_2$; $\Delta AA_1B_1 \sim \Delta AA_2B_2$;

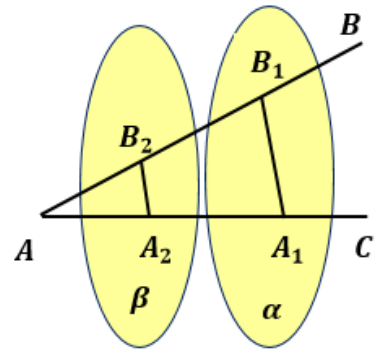
$AA_1 = AA_2 + A_1A_2 = AA_2 + 2\cdot AA_2 = 3\cdot AA_2$;

$3\cdot AA_2 = AA_1$; $3\cdot AA_2 = 24$; $AA_2 = 8$;

$$\frac{AA_2}{AA_1} = \frac{A_2B_2}{A_1B_1}; \qquad \frac{8}{24} = \frac{A_2B_2}{18};$$

$$A_2B_2 = \frac{8\cdot 18}{24} = \frac{8\cdot 18}{8\cdot 3} = \frac{18}{3} = 6.$$

Javob: $A_2B_2 = 6$; $AA_2 = 8$.

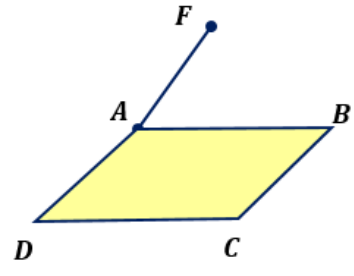


7. FA to‘g‘ri chiziq $ABCD$ parallelogrammning uchidan o‘tadi va parallelogramm tekisligida yotmaydi: 1) FA va CD ayqash ekanini isbotlang.

2) FAB burchagi 30° bo‘lsa, FA va CD to‘g‘ri chiziqlar orasidagi burchakni toping.

1) $FA \not\subset ABCD$; $\begin{cases} AB \| DC \\ AB \otimes AF \end{cases} \rightarrow AF \div CD$.

2) $\begin{cases} CD \| AB \\ \angle FAB = 30° \end{cases} \rightarrow$ CD va FA orasidagi burchak ham 30° ga teng bo‘ladi.



8-DARS. FAZODA TEKISLIKLARNING O‘ZARO JOYLASHUVI

I. Standartlar:

– M10.GO‘.GSH.09. Ikki tekislikning parallelligi alomatini biladi va undan foydalana oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ikki tekislikning parallelligi alomatini bilish;

Ko‘nikmalar:

– ikki tekislikning parallelligi alomatidan foydalana olish;

III. Dars mazmunining qisqacha tavsifi:

– parallel tekisliklar va ularning xossalari. Fazoviy shakllarning tekislikda tasvirlanishi.

IV. Dars ashyolari va ko‘rgazmali qurollar:

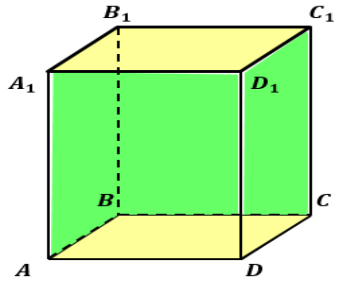
– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Tekisliklarning fazoda joylashuviga oid misollar keltiring?	Aqliy hujum	Mavzu bo‘yicha savollar: yon atrofingizdan tekisliklarning o‘zaro joylashuviga misollar keltiring.
Bilimlarni boyitish va mustahkamlash	Parallel tekisliklar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 14.1–14.2
	Ikki tekislikning parallelligi alomati	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 14.3–14.4
	Fazoviy shakllarning tekislikda tasvirlanishi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 14.5
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 14.6
Uyga vazifa	Amaliy mashq va tatbiq: 14.7–14.8		

14.3. a) $ABCDA_1B_1C_1D_1$ parallelepipedning; b) $ABCA_1B_1C_1$ prizmaning parallel yoqlarini aniqlang.

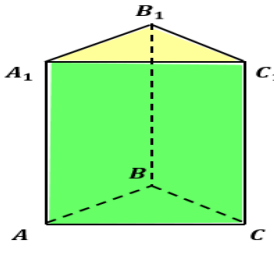
a) $ABCDA_1B_1C_1D_1$ parallelepipedning parallel yoqlarini aniqlang.



$ABCDA_1B_1C_1D_1$ parallelepipedning asoslaridagi qirralari o‘zaro $AB \parallel A_1B_1$, $BC \parallel B_1C_1$, $CD \parallel C_1D_1$, $AD \parallel A_1D_1$ bo‘lganligi uchun $ABCD$ va $A_1B_1C_1D_1$ asoslari parallel‌dir. Asos qirralariga perpedikulyar

AA_1, BB_1, CC_1, DD_1 yon qirralari bir-biriga o‘zaro

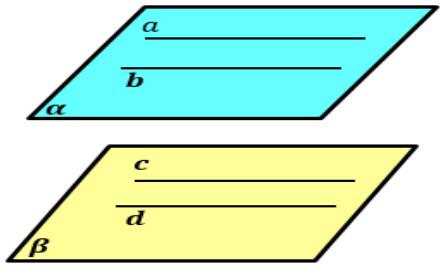
b) Prizmaning parallel yoqlarini aniqlang.



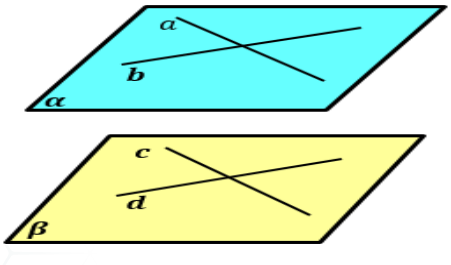
$ABCA_1B_1C_1$ prizmaning asoslaridagi AB va A_1B_1, BC va B_1C_1, AC va A_1C_1 qirralari parallel bo‘lgani uchun, ABC va $A_1B_1C_1$ prizma asoslarining parallelligi kelib chiqadi. Demak, $\Delta ABC \parallel \Delta A_1B_1C_1$ – ikkita asos o‘zaro parallel.

14.5. α va β tekisliklar parallel. a va b to‘g‘ri chiziqlar α tekislikda yotadi, c va d to‘g‘ri chiziqlar esa β tekislikda yotadi. Quyidagi tasdiqlardan qaysilari to‘g‘ri:

A); B); C); D); E); F); G) H);

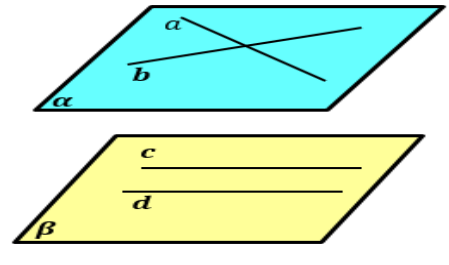


1-hol. α tekislikda a va b, β tekislikda c va d to‘g‘ri chiziqlar parallel bo‘lganligi uchun ular orqali o‘tkazilgan α va β tekisliklar paralleldir. Tasdiqlardan: α va β tekisliklarda yotuvchi – A, B, D, E, F, H tasdiqlar to‘g‘ri.



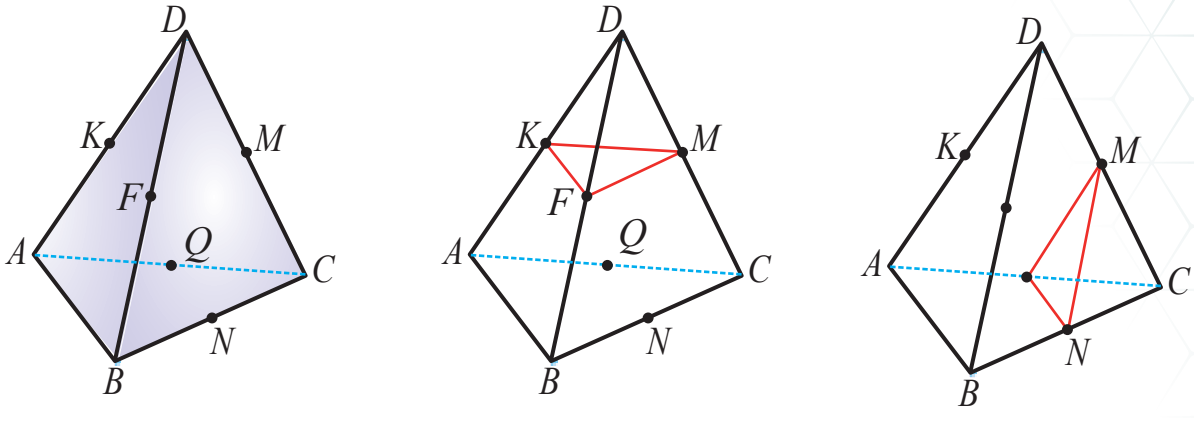
2-hol. α tekislikda a va b to‘g‘ri chiziqlar kesishuvchi, β tekislikda c va d to‘g‘ri chiziqlar parallel bo‘lganligi uchun ular orqali o‘tkazilgan α va β tekisliklar paralleldir. Tasdiqlar orasida α va β tekisliklarda yotuvchi tasdiq mavjud emas.

3-hol. α tekislikda a va b , β tekislikda c va d to‘g‘ri chiziqlar kesishuvchi bo‘lganligi uchun ular orqali o‘tkazilgan α va β tekisliklar paralleldir. Tasdiqlardan: α va β tekisliklarda yotuvchi 5), 6) tasdiqlar to‘g‘ri.



Uy vazifasi

14.7. K, F, M, N, Q nuqtalar rasmda tasvirlangan $ABCD$ tetraedr mos qirralarining o‘rtalari bo‘lsa: a) K nuqtadan o‘tuvchi va ABC tekislikka parallel; b) BD to‘g‘ri chiziqdan o‘tuvchi va MNQ tekislikka parallel bo‘lgan tekislikni aniqlang.



a) $AK = KD;$ $BF = FD;$ $CM = MD;$

$$KF \| AB \rightarrow KF = \frac{AB}{2}; \quad KM \| AC \rightarrow \frac{AC}{2}; \quad FM \| BC \rightarrow FM = \frac{BC}{2}.$$

Demak, $KFM \parallel ABC$ ekan.

b) $AQ = QC;$ $DM = MC;$ $BN = NC;$ $MNQ \| BD.$

Bundan $ADB \parallel MNQ$ kelib chiqadi.

9-DARS. FAZODA TEKISLIKLARNING O‘ZARO JOYLASHUVI

I. Standartlar:

– M10.GO‘.GSH.09. Ikki tekislikning parallelligi alomatini biladi va undan foydalana oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ikki tekislikning parallelligi alomatini bilish;

Ko‘nikmalar:

– ikki tekislikning parallelligi alomatidan foydalana olish;

III. Dars mazmunining qisqacha tavsifi:

– parallel tekisliklar va ularning xossalari. Fazoviy shakllarning tekislikda tasvirlanishi.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

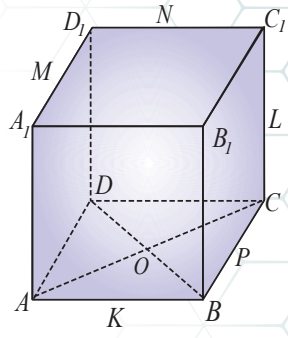
V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Tekisliklarning fazoda joylashuviga oid misollar keltiring?	Aqliy hujum	Mavzu bo‘yicha savollar: yon atrofingizdan tekisliklarning o‘zaro joylashuviga misollar keltiring.
Bilimlarni boyitish va mustahkamlash	Parallel tekisliklar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 14.9–14.10
	Ikki tekislikning parallelligi alomati	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 14.11–14.12
	Fazoviy shakllarning tekislikda tasvirlanishi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 14.13
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 14.14
Uyga vazifa	Amaliy mashq va tatbiq: 14.18, 14.20		

14.9. Rasmda $ABCDA_1B_1C_1D_1$ kub va uning ba’zi qirralarining o‘rtalari – M, N, P, K va L nuqtalar tasvirlangan. O nuqta – $ABCD$ asos markazi. Jadvalda keltirilgan tekisliklarning o‘zaro joylashuvini rasmdan aniqlab, jadvalning mos katagiga tegishli belgi ($\otimes$ – kesishish, $\parallel$ - parallellik va $\div$ – ayqashlik)ni yozing.

Tekisliklar	ADC	PLN	MNP	A_1C_1C
$A_1B_1C_1$	$\parallel$	$\div$	$\div$	$\otimes$
MNK	$\div$	$\otimes$	$\otimes$	$\otimes$

MKP	÷	⊗	⊗	⊗
A_1DC_1	⊗	⊗	⊗	⊗



14.10. α va β tekisliklar parallel. Ularning hech biriga tegishli bo‘lmagan nuqtadan γ tekislik o‘tkazilgan. To‘g‘ri tasdiqlarni ko‘rsating.

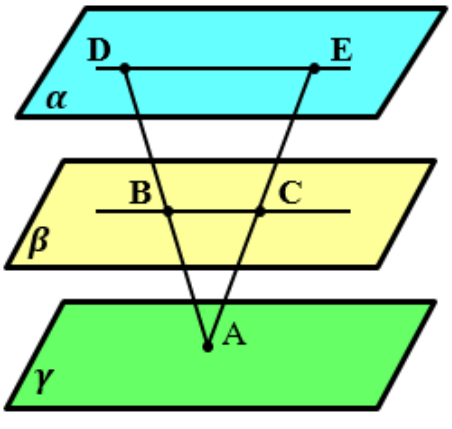
A) γ tekislik α tekislikka parallel bo‘lgan yagona tekislik.

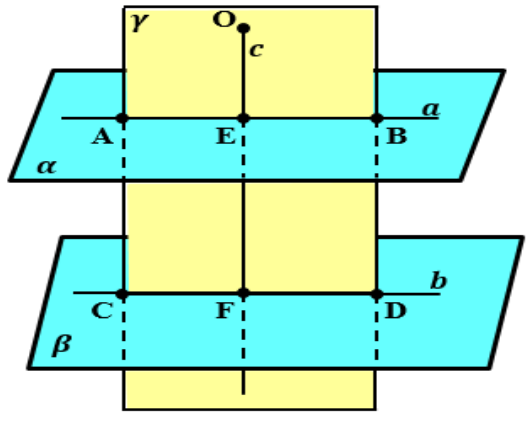
B) γ tekislik β tekislikni kesib o‘tuvchi yagona tekislik.

C) γ tekislik β tekislikka parallel bo‘lgan yagona tekislik.

D) γ tekislik α tekislikni kesib o‘tuvchi yagona tekislik.

E) γ tekislik α tekislikka ham, β tekislikka ham parallel bo‘lgan yagona tekislik.





a) Tasdiq to‘g‘ri emas. $\alpha \parallel \beta,\ \gamma \parallel \alpha,\ \gamma \parallel \beta;$

b) Tasdiq to‘g‘ri emas. $\alpha \parallel \beta,\ \gamma \cap \beta = b,\ \gamma \cap \alpha = a;$

c) Tasdiq to‘g‘ri emas. $\alpha \parallel \beta,\ \gamma \parallel \beta,\ \gamma \parallel \alpha;$

d) Tasdiq to‘g‘ri emas. $\alpha \parallel \beta,\ \gamma \cap \alpha = a,\ \gamma \cap \beta = b;$

e) Tasdiq to‘g‘ri . $\alpha \parallel \beta,\ \gamma \parallel \alpha,\ \gamma \parallel \beta;$

Javob: $E.$

14.11. Rasmda $ABCDA_1B_1C_1D_1$ to‘g‘ri burchakli parallelepiped tasvirlangan.

a) $A_1B_1C_1D_1$ va B_1A_1AB; b) ADD_1A_1 va $ABCD$; c) ABB_1A_1 va C_1D_1DC; d) $BADC$ va ABB_1A_1; e) CC_1B_1B va ADD_1A_1 tekisliklarning o‘zaro joylashuvini aniqlang.

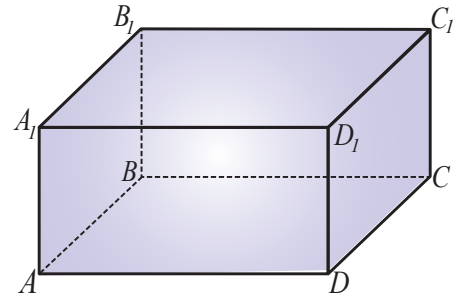
a) $A_1B_1C_1D_1 \perp B_1A_1AB.$

b) $ADD_1A_1 \perp ABCD.$

c) $ABB_1A_1 \parallel C_1D_1DC$.

d) $BADC \perp ABB_1A_1$.

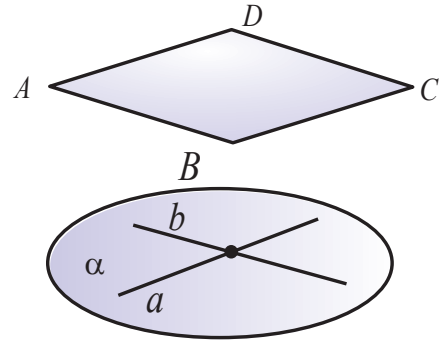
e) $CC_1B_1B \parallel ADD_1A_1$.



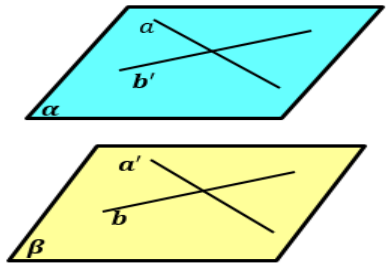
14.12. AB, BC kesmalar $ABCD$ Parallelogrammning tomonlari bo‘lib, ular mos ravishda a va b to‘g‘ri chiziqlarga parallel. a va b to‘g‘ri chiziqlar o‘zaro kesishadi va α tekislikka tegishli. $ABCD$ va α tekisliklarning fazoda o‘zaro joylashuvini aniqlang.

$BC \parallel a$; $AB \parallel b$; $a \in \alpha$; $b \in \alpha$; $a \cap b = O$;

$AB \parallel CD$; $BC \parallel AD$, bundan $a \parallel AD$ va $b \parallel CD$ ekanligi kelib chiqadi. Demak, $ABCD$ va α tekisliklar o‘zaro parallel ekan.



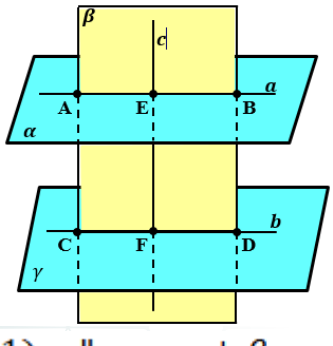
14.13. a va b ayqash to‘g‘ri chiziqlar berilgan. a to‘g‘ri chiziqdan o‘tuvchi va β tekislikka parallel bo‘lgan nechta tekislik o‘tkazish mumkin?



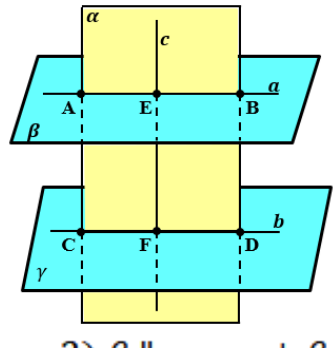
$a \div b$. a to‘g‘ri chiziqqa parallel a' to‘g‘ri chiziq, b to‘g‘ri chiziqqa parallel b' to‘g‘ri chiziq o‘tkazamiz. Kesishuvchi a va b' to‘g‘ri chiziq orqali bitta va faqat bitta α tekislik o‘tkazish mumkin.

14.14. Ikkita α va β tekisliklarning kesishish chizig‘i uchinchi γ tekislikka parallel. va tekisliklarning fazoda o‘zaro joylashuvini aniqlang.

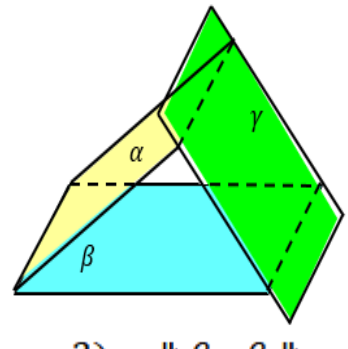
1-hol. 2-hol. 3-hol.



1) $\alpha \parallel \gamma$; $\alpha \perp \beta$;



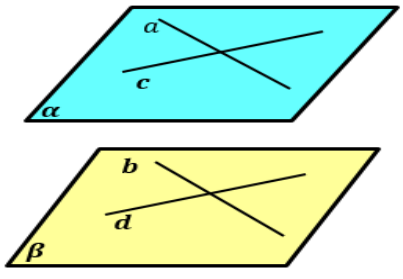
2) $\beta \parallel \gamma$; $\alpha \perp \beta$;



3) $\alpha \nparallel \beta$; $\beta \nparallel \gamma$; $\alpha \nparallel \gamma$.

Uy vazifasi

14.18. α **va** β **tekisliklar parallel.** α **tekislikda yotuvchi ixtiyoriy to‘g‘ri chiziq** β **tekislikka parallel bo‘lishini isbotlang.**

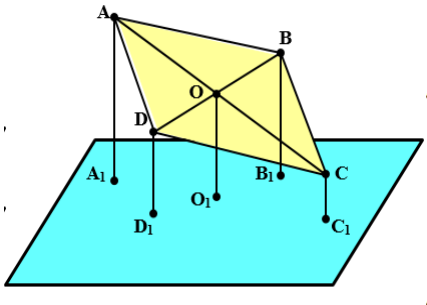


$\alpha \ni a$, $\alpha \parallel \beta$ bo‘lgani uchun β tekislikdan a to‘g‘ri chizig‘iga ayqash b to‘g‘ri chiziqni o‘tkazamiz. α tekislikda yotuvchi a to‘g‘ri chiziqni kesuvchi c to‘g‘ri chiziqni o‘tkazamiz.

β tekislikda yotuvchi b to‘g‘ri chiziqni kesuvchi d to‘g‘ri chiziqni o‘tkazamiz.

Natijada $a \parallel b$, $c \parallel d$ hosil bo‘ladi. Bundan ixtiyoriy a to‘g‘ri chiziq α tekisligiga parallel ekanligi kelib chiqadi.

14.20. $ABCD$ **Parallelogramm va uni kesmaydigan tekislik berilgan. Parallelogrammning** A, B, C, D **uchlaridan tekislikni mos ravishda** A_1, B_1, C_1, D_1 **nuqtalarda kesib o‘tadigan parallel to‘g‘ri chiziqlar o‘tkazilgan. Agar** $AA_1 = 4\ m$, $BB_1 = 3\ m$ **va** $CC_1 = 1\ m$ **bo‘lsa,** DD_1 **kesma uzunligini toping.**



$$AA_1 = 4\ m,\ BB_1 = 3\ m,\ CC_1 = 1\ m. \quad DD_1 = ?$$

$$OO_1 = \frac{AA_1 + CC_1}{2}; \qquad OO_1 = \frac{DD_1 + BB_1}{2};$$

$$\frac{AA_1 + CC_1}{2} = \frac{DD_1 + BB_1}{2};$$

$$AA_1 + CC_1 = DD_1 + BB_1;$$

$$DD_1 = AA_1 + CC_1 - BB_1 = 4 + 1 - 3 = 2\ m.$$

Javob: $DD_1 = 2m$.

10-DARS. FAZODA TEKISLIKLARNING O‘ZARO JOYLASHUVI

I. Standartlar:

– M10.GO‘.GSH.09. Ikki tekislikning parallelligi alomatini biladi va undan foydalana oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ikki tekislikning parallelligi alomatini bilish;

Ko‘nikmalar:

– ikki tekislikning parallelligi alomatidan foydalana olish;

III. Dars mazmunining qisqacha tavsifi:

– parallel tekisliklar va ularning xossalari. Fazoviy shakllarning tekislikda tasvirlanishi.

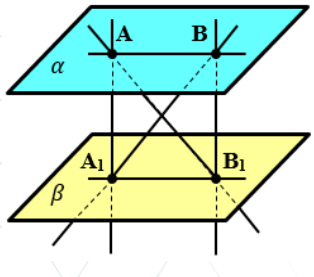
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Tekisliklarning fazoda joylashuviga oid misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: yon atrofingizdan tekisliklarning o‘zaro joylashuviga misollar keltiring.
Bilimlarni boyitish va mustahkamlash	Parallel tekisliklar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 14.22
	Ikki tekislikning parallelligi alomati. Fazoviy shakllarning tekislikda tasvirlanish	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 14.23
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 14.24
Uyga vazifa	Amaliy mashq va tatbiq: 14.25, 14.26		

14.21. Ikkita parallel tekislik berilgan. Bir tekislikning A va B nuqtalaridan ikkinchi tekislikni A_1 va B_1 nuqtalarda kesib o‘tuvchi parallel to‘g‘ri chiziqlar o‘tkazilgan. Agar $AB = a$ bo‘lsa, AA_1 kesma uzunligini toping.



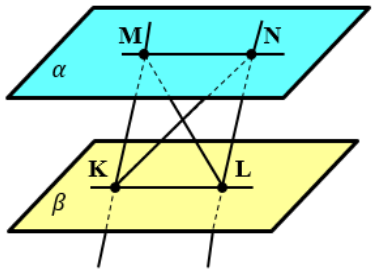
$\alpha \parallel \beta;\ A \in \alpha,\ B \in \alpha;\ A_1 \in \beta,\ B_1 \in \beta.$

$AB = a;\ AA_1 = b;\ A_1B = c.$

$a^2 + b^2 = c^2;\ b^2 = c^2 - a^2;\ b = \sqrt{c^2 - a^2}.$

Demak, $AA_1 = \sqrt{c^2 - a^2}$ ekanligi kelib chiqadi.

14.22. ***α*** **va** ***β*** **tekisliklar parallel. α tekislikning** ***M*** **va** ***N*** **nuqtalaridan** ***β*** **tekislikni** ***K*** **va** ***L*** **nuqtalarda kesib o‘tuvchi parallel to‘g‘ri chiziqlar o‘tkazilgan.** ***MNLK*** **Parallelogramm ekanligini isbotlang. Agar** $ML = 14$ **cm,** $NK = 8$ *cm* **va** $MK:MN = 9:7$ **bo‘lsa,** ***MNLK*** **to‘rtburchak perimetrini toping.**



$\alpha \parallel \beta;\ \alpha \in M,\ \alpha \in N,\ a = MN$ bo‘lgani uchun,

$\alpha \in a$ ekanligi kelib chiqadi.

$\beta \in K,\ \beta \in L,\ b = KL$ bo‘lgani uchun $\beta \in b$ ekanligi kelib chiqadi.

Bundan M, K va N, L nuqtalardan o‘tuvchi MK va NL to‘g‘ri chiziqlar parallel ekanligi kelib chiqadi.

$MNKL$ to‘rtburchakda $MN = KL$ va $MK = NL$.

Demak, $MNKL$ – Parallelogramm.

Berilgan: $ML = 14\ cm,\ NK = 8\ cm,\ MK : MN = 9 : 7.$ Topish kerak: $P_{MNKL} = ?$

$MK = 9x;\ MN = 7x;\ ML^2 + NK^2 = 2 \cdot (MK^2 + MN^2);$

$14^2 + 8^2 = 2 \cdot ((9x)^2 + (7x)^2);\ 196 + 64 = 2 \cdot (81x^2 + 49x^2);$

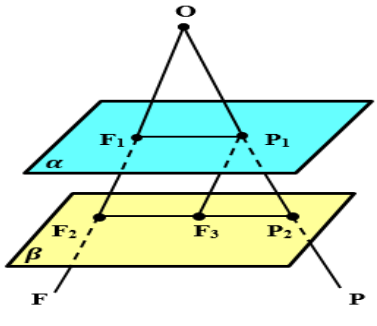
$260 = 2 \cdot 130x^2;\quad 260 = 260x^2;\quad x^2 = \frac{260}{260};\quad x^2 = 1;\quad x = 1\ cm;$

$MK = 9x = 9 \cdot 1\ cm = 9\ cm;\qquad MN = 7x = 7 \cdot 1\ cm = 7\ cm;$

$P_{MNKL} = 2 \cdot (MK + MN) = 2 \cdot (9\ cm + 7\ cm = 2 \cdot 16\ cm = 32\ cm.$

Javob: 32 cm.

14.23. ***OF*** **va** ***OP*** **nurlar** ***α*** **va** ***β*** **parallel tekisliklarni, mos ravishda** F_1, P_1, F_2, P_2 **nuqtalarda kesib o‘tadi. Agar** $F_1P_1 = 3$ *cm,* $F_2P_2 = 5$ *cm* **va** $P_1P_2 = 4$ *cm* **bo‘lsa,** OP_1 **kesma uzunligini toping.**



$F_1P_1 = 3\ cm,\ F_2P_2 = 5\ cm,\ P_1P_2 = 4\ cm.\quad OP_1 = ?$

$F_3P_2 = F_2P_2 - F_1P_1 = 5\ cm - 3\ cm = 2\ cm;$

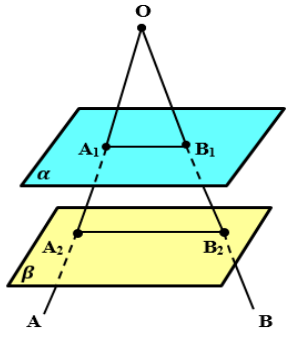
$\frac{F_3P_2}{F_1P_1} = \frac{P_1P_2}{OP_1};\qquad \frac{2\ cm}{3\ cm} = \frac{4\ cm}{OP_1};$

$OP_1 = \frac{3\ cm \cdot 4\ cm}{2\ cm} = \frac{12\ cm^2}{2\ cm} = 6\ cm.$

Javob: $OP_1 = 6\ cm.$

14.24. ***OA*** **va** ***OB*** **nurlar α va β parallel tekisliklarni, mos ravishda** A_1, B_1, A_2, B_2

nuqtalarda kesib o‘tadi. Agar $OA_1 = 16\ cm$, $A_1A_2 = 24\ cm$ va $A_2B_2 = 50\ cm$ bo‘lsa, A_1B_1 kesma uzunligini toping.



$OA_1 = 16\ cm,\ A_1A_2 = 24\ cm,\ A_2B_2 = 50\ cm.\ A_1B_1 = ?$

$OA_2 = OA_1 + A_1A_2 = 16\ cm + 24\ cm = 40\ cm;$

$$\frac{OA_1}{OA_2} = \frac{A_1B_1}{A_2B_2}; \qquad \frac{16\ cm}{40\ cm} = \frac{A_1B_1}{50\ cm};$$

$$A_1B_1 = \frac{16\ cm \cdot 50\ cm}{40\ cm} = \frac{80\ cm^2}{4\ cm} = 20\ cm.$$

Javob: $A_1B_1 = 20\ cm.$

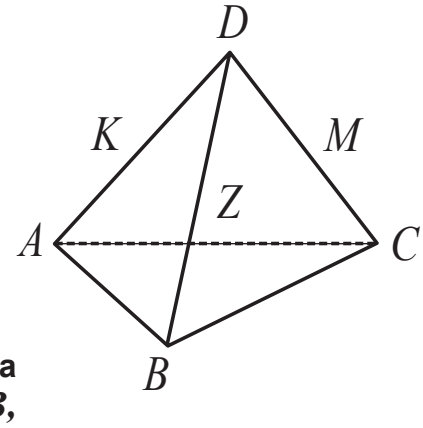
Uy vazifasi

14.25. D nuqta ABC uchburchak tekisligiga tegishli emas. K, M, Z nuqtalar mos ravishda DA, DB va DC kesmalarning o‘rtasi. ABC va KZM tekisliklarning o‘zaro joylashuvini aniqlang.

$$AK = \frac{AD}{2};\ BZ = \frac{BD}{2};\ CM = \frac{CD}{2};$$

$$S_{KZM} = \frac{1}{2} \cdot S_{ABC}.$$

Bundan, $\Delta ABC \parallel \Delta KZM$ ravishda joylashgan.

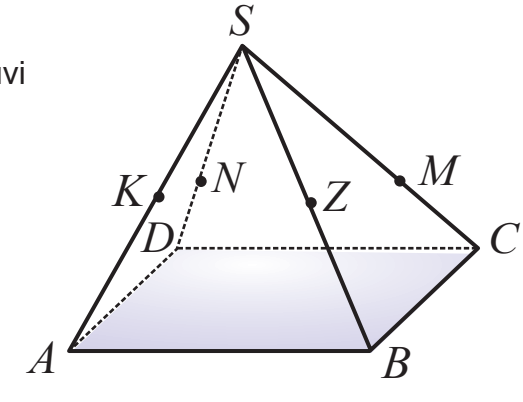


14.26. S nuqta $ABCD$ parallelogramm tekisligiga tegishli emas. K, M, Z, N nuqtalar mos ravishda SA, SB, SC va SD kesmalarga tegishli. Agar $SK = AK$, $SZ = BZ$, $SM : MC = 2 : 1$, $SN : ND = 2 : 1$ bo‘lsa, $ABCD$ va $KZMN$ tekisliklarning o‘zaro joylashuvini aniqlang.

$SK = AK,\ SZ = BZ,\ SM : MC = 2 : 1,$

$SN:ND = 2:1$ bo‘lsa,

$ABCD$ va $KZMN$ tekisliklarning o‘zaro joylashuvi parallel emas.



11-DARS. FAZODA TEKISLIKLARNING O‘ZARO JOYLASHUVI

I. Standartlar:

– M10.GO‘.MM.07. Parallel tekisliklarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi;

– M10.GO‘.MM.08. Parallel proyeksiyaning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– parallel proyeksiyaning xossalarini bilish;

Ko‘nikmalar:

– parallel proyeksiyaning xossalarini bilish va amaliy masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– fazodagi shaklni tekislikka proyeksiyalash. Parallel proyeksiyaning xossalari.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– 0 fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Proyeksiyalashdan qayerlarda foydalanish mumkin? Proyeksiyaga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: fazoviy geometrik shaklning tekislikda proyeksiyasidan qayerlarda foydalanish mumkin?
Bilimlarni boyitish va mustahkamlash	Fazodagi shaklni tekislikka proyeksiyalash	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 15.1
	Parallel proyeksiyaning xossalari	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 15.2
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 15.3–15.4
Uyga vazifa	Amaliy mashq va tatbiq: 15.5		

15.2. Parallel proyeksiyalashda kesmaning proyeksiyasi: a) kesma; b) nuqta; c) ikki nuqta; d) nur; e) to‘g‘ri chiziq bo‘lishi mumkinmi?

a) Parallel proyeksiyalashda kesmaning proyeksiyasi kesma bo‘lishi mumkin.

b) Parallel proyeksiyalashda kesmaning proyeksiyasi nuqta bo‘lishi mumkin emas.

c) Parallel proyeksiyalashda kesmaning proyeksiyasi ikki nuqta bo‘lishi mumkin emas.

d) Parallel proyeksiyalashda kesmaning proyeksiyasi nur bo‘lishi mumkin emas.

e) Parallel proyeksiyalashda kesmaning proyeksiyasi to‘g‘ri chiziq bo‘lishi mumkin emas.

15.3. Parallel proyeksiyalashda kvadratning proyeksiyasi: a) kvadrat; b) parallelogramm; c) romb; d) to‘g‘ri to‘rtburchak; e) trapetsiya; f) kesma bo‘lishi mumkinmi?

a) Parallel proyeksiyalashda kvadratning proyeksiyasi kvadrat bo‘lishi mumkin.

b) Parallel proyeksiyalashda kvadratning proyeksiyasi parallelogramm bo‘lishi mumkin emas.

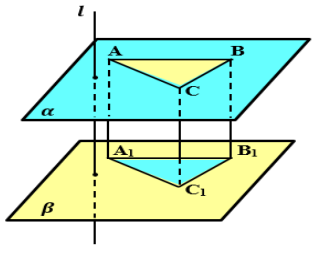
c) Parallel proyeksiyalashda kvadratning proyeksiyasi romb bo‘lishi mumkin emas.

d) Parallel proyeksiyalashda kvadratning proyeksiyasi to‘g‘ri to‘rtburchak bo‘lishi mumkin emas.

e) Parallel proyeksiyalashda kvadratning proyeksiyasi trapetsiya bo‘lishi mumkin emas.

f) Parallel proyeksiyalashda kvadratning proyeksiyasi kesma bo‘lishi mumkin emas.

15.4. Parallel tekisliklardan birida yotgan uchburchak ikkinchi tekislikka parallel proyeksiyalansa, uning yuzi o‘zgarmasligini isbotlang.



$\alpha \parallel \beta,\ l \perp \alpha,\ l \perp \beta.\ l \parallel AA_1,\ l \parallel BB_1,\ l \parallel CC_1.$

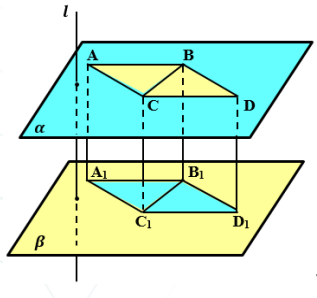
Bundan, $AB \parallel A_1B_1,\ BC \parallel B_1C_1,\ AC \parallel A_1B_1.$

$AB = A_1B_1,\ BC = B_1C_1,\ AC = A_1B_1.$

$\Delta ABC = \Delta A_1B_1C_1$ parallel proyeksiyalashda uchburchak yuzi o‘zgarmasligi kelib chiqadi.

Uy vazifasi

15.5. Parallelogrammning parallel proyeksiyasi trapetsiya bo‘lishi mumkinmi? Javobingizni asoslang.



$\alpha \parallel \beta,\ l \perp \alpha,\ l \perp \beta.$

$l \parallel AA_1,\ l \parallel BB_1,\ l \parallel CC_1,\ l \parallel DD_1.$ Bundan,

$AB \parallel A_1B_1,\ BD \parallel B_1D_1,\ DC \parallel D_1C_1,\ AC \parallel A_1C_1.$

$AB = A_1B_1,\ BD = B_1D_1,\ DC = D_1C_1,\ AC = A_1C_1.$

$ABCD = A_1B_1C_1D_1$ parallel proyeksiyalashda Parallelogramm trapetsiya bo‘lishi mumkin emas.

12-DARS. FAZODA TEKISLIKLARNING O‘ZARO JOYLASHUVI

I. Standartlar:

– M10.GO‘.MM.07. Parallel tekisliklarning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi;

– M10.GO‘.MM.08. Parallel proyeksiyaning xossalarini biladi va amaliy masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– parallel proyeksiyaning xossalarini bilish;

Ko‘nikmalar:

– parallel proyeksiyaning xossalarini bilish va amaliy masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– fazodagi shaklni tekislikka proyeksiyalash. Parallel proyeksiyaning xossalari.

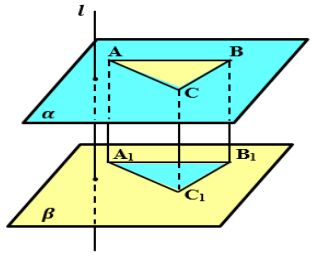
IV. Dars ashyolari va ko‘rgazmali qurollar:

– 0 fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Proyeksiyalashdan qayerlarda foydalanish mumkin? Proyeksiyaga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: fazoviy geometrik shaklning tekislikda proyeksiyasidan qayerlarda foydalanish mumkin?
Bilimlarni boyitish va mustahkamlash	Fazodagi shaklni tekislikka proyeksiyalash	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 15.6
	Parallel proyeksiyaning xossalari	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 15.7
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 15.8–15.9
Uyga vazifa	Amaliy mashq va tatbiq: 15.10		

15.6. Muntazam uchburchakning parallel proyeksiyasi muntazam uchburchak bo‘ladimi?



$\Delta ABC,\ AB = BC = AC,\ \alpha \parallel \beta,\ l \perp \alpha,\ l \perp \beta.$

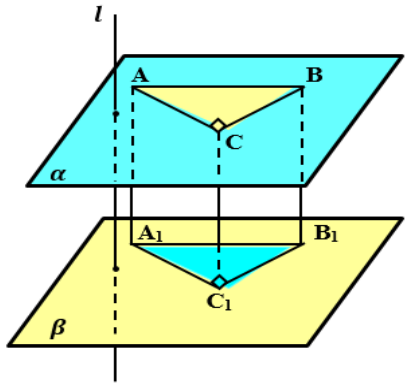
$l \parallel AA_1,\ l \parallel BB_1,\ l \parallel CC_1.$

$AB \parallel A_1B_1,\quad BC \parallel B_1C_1,\quad AC \parallel A_1B_1.$

$AB = A_1B_1,\quad BC = B_1C_1,\quad AC = A_1B_1.$

$\Delta ABC = \Delta A_1B_1C_1$ muntazam uchburchak parallel proyeksiyalashda muntazam uchburchak bo‘ladi.

15.7. To‘g‘ri burchakli uchburchakning parallel proyeksiyasi to‘g‘ri burchakli uchburchak bo‘ladimi?



$\Delta ABC,\ AB \perp BC,\ \alpha \| \beta,\ l \perp \alpha,\ l \perp \beta.$

$l \| AA_1,\ l \| BB_1,\ l \| CC_1.$

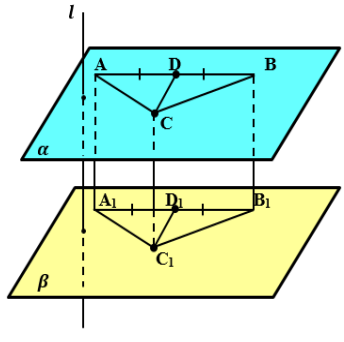
$AB \| A_1B_1,\quad BC \| B_1C_1,\quad AC \| A_1B_1.$

$AB = A_1B_1,\quad BC = B_1C_1,\quad AC = A_1B_1.$

$A_1B_1 \perp B_1C_1.$

$\Delta ACB = \Delta A_1C_1B_1$ – To‘g‘ri burchakli uchburchak parallel proyeksiyalashda to‘g‘ri burchakli uchburchak bo‘ladi.

15.8. ABC uchburchakning parallel proyeksiyasi $A_1B_1C_1$ uchburchakdan iborat. Bu proyeksiyalashda ABC uchburchakning: a) medianasi; b) balandligi; c) bissektrisasi. $A_1B_1C_1$ uchburchakning mos: a) medianasi; b) balandligi; c) bissektrisasiga o‘tadimi?



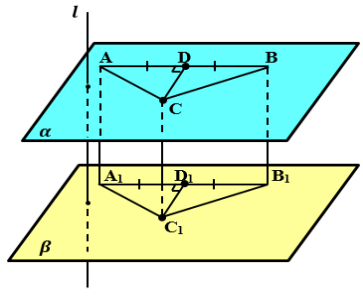
a) $\Delta ABC,\ \alpha \| \beta,\ l \perp \alpha,\ l \perp \beta.$

$l \| AA_1,\ l \| BB_1,\ l \| CC_1.$

$AB \| A_1B_1,\ BC \| B_1C_1,\ AC \| A_1B_1,\ CD \| C_1D_1.$

$AB = A_1B_1,\ BC = B_1C_1,\ AC = A_1B_1,\ CD = C_1D_1.$

$\Delta ACB = \Delta A_1C_1B_1$ uchburchak parallel proyeksiyalashda CD mediana C_1D_1 medianaga o‘tadi.



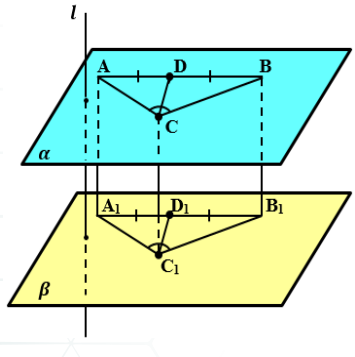
b) $\Delta ABC,\ \alpha \| \beta,\ l \perp \alpha,\ l \perp \beta.$

$l \| AA_1,\ l \| BB_1,\ l \| CC_1.$

$AB \| A_1B_1,\ BC \| B_1C_1,\ AC \| A_1B_1,\ CD \| C_1D_1.$

$AB = A_1B_1,\ BC = B_1C_1,\ AC = A_1B_1,\ CD = C_1D_1.$

$\Delta ACB = \Delta A_1C_1B_1$ uchburchak parallel proyeksiyalashda CD balandligi C_1D_1 balandligiga o‘tadi.



b) $\Delta ABC,\ \alpha \| \beta,\ l \perp \alpha,\ l \perp \beta.$

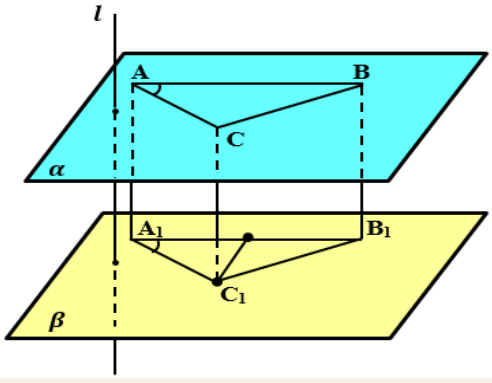
$l \| AA_1,\ l \| BB_1,\ l \| CC_1.$

$AB \| A_1B_1,\ BC \| B_1C_1,\ AC \| A_1B_1,\ CD \| C_1D_1.$

$AB = A_1B_1,\ BC = B_1C_1,\ AC = A_1B_1,$

$CD = C_1D_1.$ $\Delta ACB = \Delta A_1C_1B_1$ uchburchak parallel proyeksiyalashda CD bissektrisasi C_1D_1 bissektrisasiga o‘tadi.

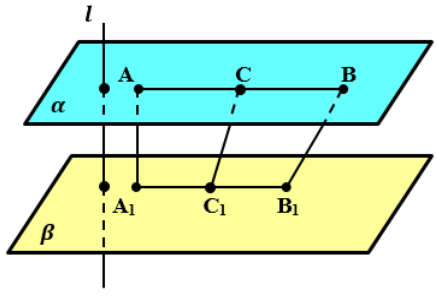
15.9. ABC uchburchakning parallel proyeksiyasi $A_1B_1C_1$ uchburchakdan iborat. Agar $\angle A = 30°,\ BC = 20\ cm$ bo‘lsa, $\angle A_1 = 30°,\ B1\ C_1 = 20\ cm$ bo‘ladimi?



ABC uchburchakning parallel proyeksiyasi $A_1B_1C_1$ uchburchakdan iborat bo‘lsa, $\angle A = 30°$, $BC = 20\ cm$, proyeksiyasi ham $\angle A_1 = 30°$, $B_1C_1 = 20\ cm$ bo‘ladi.

Uy vazifasi

15.10. AB kesmaning parallel proyeksiyasi A_1B_1 kesmadan iborat. AB kesmadan olingan C nuqtaning proyeksiyasi esa C_1 nuqta. $AB = 48\ cm$, $A_1B_1 = 36\ cm$. Agar AC kesmaning uzunligi: a) 24 cm; b) 12 cm; c) 8 cm; d) 32 cm; e) 36 cm bo‘lsa, A_1C_1 kesmaning uzunligini toping.



a) $AC = 24\ cm$, $AB = 48\ cm$, $A_1B_1 = 36\ cm$.

Topish kerak: $A_1C_1 = ?$ $\quad \frac{A_1B_1}{AB} = \frac{A_1C_1}{AC}$

$$A_1C_1 = \frac{A_1B_1 \cdot AC}{AB} = \frac{36 \cdot 24}{48} = \frac{36}{2} = 18\ cm.$$

Javob: $A_1C_1 = 18\ cm$.

b) $AC = 12\ cm$, $AB = 48\ cm$, $A_1B_1 = 36\ cm$. Topish kerak: $A_1C_1 = ?$

$$\frac{A_1B_1}{AB} = \frac{A_1C_1}{AC};\quad A_1C_1 = \frac{A_1B_1 \cdot AC}{AB} = \frac{36 \cdot 12}{48} = \frac{36}{4} = 9\ cm.$$ **Javob:** $A_1C_1 = 9\ cm$

c) $AC = 8\ cm$, $AB = 48\ cm$, $A_1B_1 = 36\ cm$. Topish kerak: $A_1C_1 = ?$

$$\frac{A_1B_1}{AB} = \frac{A_1C_1}{AC};\quad A_1C_1 = \frac{A_1B_1 \cdot AC}{AB} = \frac{36 \cdot 8}{48} = \frac{36}{6} = 6\ cm.$$ **Javob:** $A_1C_1 = 6\ cm$

d) $AC = 32\ cm$, $AB = 48\ cm$, $A_1B_1 = 36\ cm$. Topish kerak: $A_1C_1 = ?$

$$\frac{A_1B_1}{AB} = \frac{A_1C_1}{AC};\quad A_1C_1 = \frac{A_1B_1 \cdot AC}{AB} = \frac{36 \cdot 32}{48} = \frac{36 \cdot 2}{3} = 12 \cdot 2 = 24\ cm.$$

Javob: $A_1C_1 = 24\ cm$.

e) $AC = 36\ cm$, $AB = 48\ cm$, $A_1B_1 = 36\ cm$. Topish kerak: $A_1C_1 = ?$

$$\frac{A_1B_1}{AB} = \frac{A_1C_1}{AC};\quad A_1C_1 = \frac{A_1B_1 \cdot AC}{AB} = \frac{36 \cdot 36}{48} = \frac{36 \cdot 3}{4} = 9 \cdot 3 = 27\ cm.$$

Javob: $A_1C_1 = 27\ cm$.

13-DARS. BOBNI TAKRORLASHGA DOIR AMALIY MASHQLAR

I. Standartlar:

– o‘rganilgan tushunchalar, faktlar va metodlarni notanish yoki hayotiy vaziyatlarda qo‘llay olish.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ikki tekislikning parallelligi alomatini bilish;

– parallel tekisliklarning xossalarini bilish;

– parallel proyeksiyaning xossalarini bilish.

Ko‘nikmalar:

– o‘rganilgan tushunchalar, faktlar va metodlarni notanish yoki hayotiy vaziyatlarda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– ikki tekislikning parallelligi alomati;

– parallel tekisliklarning xossalari;

– parallel proyeksiyaning xossalari.

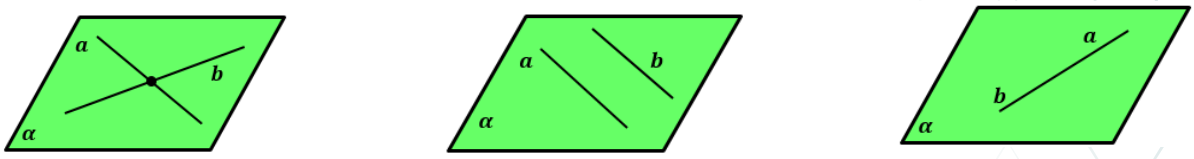
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

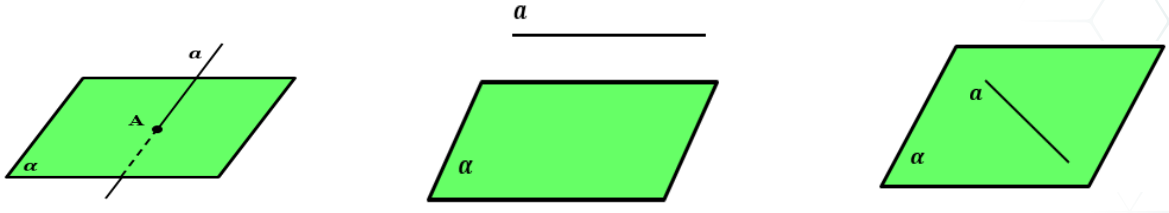
V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	fazoda to‘g‘ri chiziq va tekisliklarning parallеligiga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: ayqash to‘g‘ri chiziqlarga misollar keltiring
Bilimlarni boyitish va mustahkamlash	fazoda to‘g‘ri chiziq va tekisliklarning parallеligi	Darslik bilan ishlash	Amaliy mashq va tatbiq: 16.1
	Tekislikka parallel to‘g‘ri chiziqlar va ularning xossalari	Darslik bilan ishlash	Amaliy mashq va tatbiq: 16.2
	Parallel tekisliklar va ularning xossalari	Darslik bilan ishlash	Amaliy mashq va tatbiq: 16.3
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 16.4, 16.4, 16.5
Uyga vazifa	Amaliy mashq va tatbiq: 16.6, 16.7		

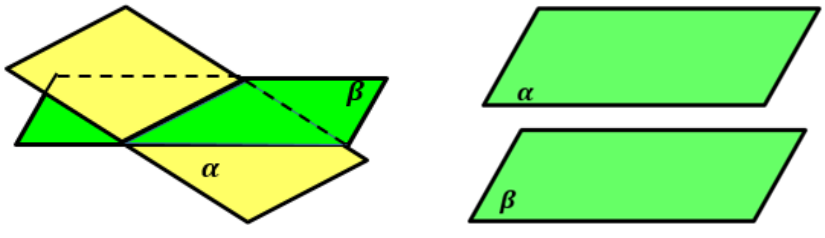
16.1. a) ikki to‘g‘ri chiziq; b) to‘g‘ri chiziq va tekislik; c) ikki tekislik nechta umumiy nuqtaga ega bo‘lishi mumkin?



Javob: a) ikki to‘g‘ri chiziq kesishsa, faqat bitta umumiy nuqtaga ega; agar ikki to‘g‘ri chiziq parallel bo‘lsa, umumiy nuqtaga ega emas; agar ikki to‘g‘ri chiziq ustma-ust tushsa, cheksiz umumiy nuqtaga ega.



Javob: b) to‘g‘ri chiziq va tekislik kesishsa, faqat bitta umumiy nuqtaga ega. Agar to‘g‘ri chiziq va tekislik parallel bo‘lsa, umumiy nuqtaga ega emas. Agar to‘g‘ri chiziq va tekislik ustma-ust tushsa, cheksiz umumiy nuqtaga ega.



Javob: c) ikkita tekislik kesishsa, cheksiz umumiy nuqtaga ega. Agar ikki tekislik parallel bo‘lsa, umumiy nuqtaga ega emas.

16.2. a) ikki to‘g‘ri chiziq; b) to‘g‘ri chiziq va tekislik; c) ikki tekislik; d) uchta tekislik yagona umumiy nuqtaga ega bo‘lishi mumkin.

Javob: a) ikki to‘g‘ri chiziq kesishsa, yagona umumiy nuqtaga ega bo‘lishi mumkin.

Javob: b) to‘g‘ri chiziq va tekislik kesishsa, yagona umumiy nuqtaga ega bo‘lishi mumkin.

Javob: c) ikki tekislik yagona umumiy nuqtaga ega bo‘lishi mumkin emas.

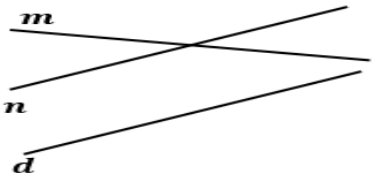
Javob: d) uchta tekislik yagona umumiy nuqtaga ega bo‘lishi mumkin emas.

16.3. To‘rtta nuqta bitta tekislikda yotmaydi. a) ulardan uchtasi bitta to‘g‘ri chiziqda yotishi mumkinmi? b) ular orqali nechta tekislik o‘tkazish mumkin?

a) To‘rtta nuqta bitta tekislikda yotmaydi. Ulardan uchtasi bitta to‘g‘ri chiziqda yotishi mumkin emas.

b) To‘rtta nuqta bitta tekislikda yotmaydi. Ulardan uchtasi bir to‘g‘ri chiziqda yotmasa, yagona tekislik o‘tkazish mumkin.

16.4. m **va** n **to‘g‘ri chiziqlar kesishadi,** d **to‘g‘ri chiziq esa** n **to‘g‘ri chiziqqa parallel.** m **va** d **to‘g‘ri chiziqlar o‘zaro qanday joylashishi mumkin?**



m va d to‘g‘ri chiziqlar o‘zaro ayqash joylashishi mumkin.

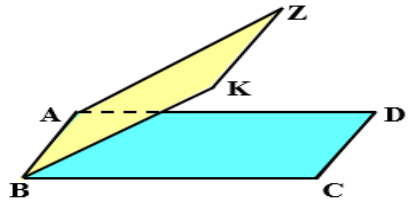
16.5. ABC **uchburchakning** C **uchidan o‘tuvchi va** AB **tomoniga parallel bo‘lgan nechta tekislik o‘tkazish mumkin?**

Javob: ABC uchburchakning C uchidan o‘tuvchi va AB tomoniga parallel bo‘lgan bitta tekislik o‘tkazish mumkin.

Uy vazifasi

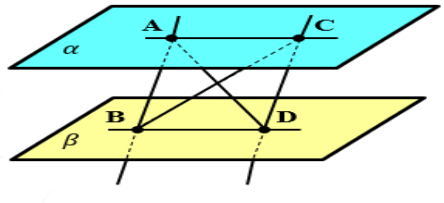
16.6. $ABCD$ **va** $ABKZ$ **Parallelogrammlar turli tekisliklarda yotadi parallel to‘g‘ri chiziqlarni ko‘rsating:**

A) DA **va** KB; **B)** CD **va** KZ; **C)** BC **va** AZ; **D)** DA **va** ZA; ***E) CB va KB.***



Javob: B) $CD \parallel KZ$.

16.7. A **va** C **nuqtalar** α **tekislikka,** B **va** D **nuqtalar** β **tekislikka tegishli.** AC, CD, BD, AB, BC, AD **to‘g‘ri chiziqlardan qaysilari** β **tekislikni kesib o‘tadi?**



$A \in \alpha$, $C \in \alpha$, $B \in \beta$, $D \in \beta$.

CD, AB, BC, AD to‘g‘ri chiziqlar β tekislikni kesib o‘tadi.

14-DARS. BOBNI TAKRORLASHGA DOIR AMALIY MASHQLAR

I. Standartlar:

– o‘rganilgan tushunchalar, faktlar va metodlarni notanish yoki hayotiy vaziyatlarda qo‘llay olish.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ikki tekislikning parallelligi alomatini bilish;

– parallel tekisliklarning xossalarini bilish;

– parallel proyeksiyaning xossalarini bilish.

Ko‘nikmalar:

– o‘rganilgan tushunchalar, faktlar va metodlarni notanish yoki hayotiy vaziyatlarda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– ikki tekislikning parallelligi alomati;

– parallel tekisliklarning xossalari;

– parallel proyeksiyaning xossalari.

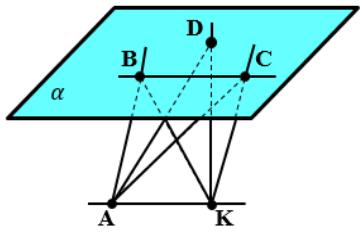
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	fazoda to‘g‘ri chiziq va tekisliklarning parallеligiga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar, ayqash to‘g‘ri chiziqlarga misollar keltirish
Bilimlarni boyitish va mustahkamlash	fazoda to‘g‘ri chiziq va tekisliklarning parallеligi	Darslik bilan ishlash	Amaliy mashq va tatbiq: 16.8
	Tekislikka parallel to‘g‘ri chiziqlar va ularning xossalari.	Darslik bilan ishlash	Amaliy mashq va tatbiq: 16.9
	Parallel tekisliklar va ularning xossalari	Darslik bilan ishlash	Amaliy mashq va tatbiq: 16.10
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 16.11, 16.12, 16.13
Uyga vazifa	Amaliy mashq va tatbiq: 16.14, 16.15		

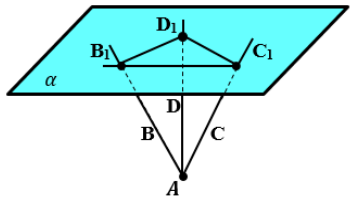
16.8. AB, AC, KB, KD **kesmalar** α **tekislikni kesib o‘tadi.** AK, AD, BD, KC, CD **to‘g‘ri chiziqlardan qaysilari** α **tekislikni kesib o‘tadi?**



$B \in \alpha,\ C \in \alpha,\ D \in \alpha.$

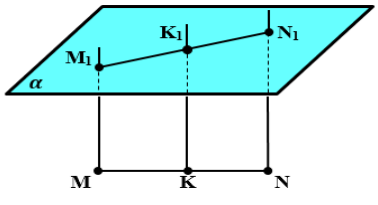
$AB,\ AC,\ KB,\ KD$ to‘g‘ri chiziqlar α tekislikni kesib o‘tadi. $AD,\ KC$ to‘g‘ri chiziqlar ham α tekislikni kesib o‘tadi.

16.9. Bir tekislikda yotmagan AB, AC va AD to‘g‘ri chiziqlar α tekislikni, B_1,C_1 va D_1 nuqtalarda kesib o‘tadi. B_1, C_1 va D_1 nuqtalar ketma-ket tutashtirilsa, qanday shakl hosil bo‘ladi?



B_1,C_1 va D_1 nuqtalar ketma-ket tutashtirilsa, uchburchak shakli hosil bo‘ladi.

16.10. α tekislikni kesib o‘tamaydigan MN kesma uchlaridan va o‘rtasidan to‘g‘ri chiziqlar o‘tkazilgan. Agar bu to‘g‘ri chiziqlar α tekislikni, mos ravishda M_1, N_1 va K_1 nuqtalarda kesib o‘tsa va $KK_1 = 9\ cm$, $NN_1 = 15\ cm$ bo‘lsa, MM_1 kesma uzunligini toping.

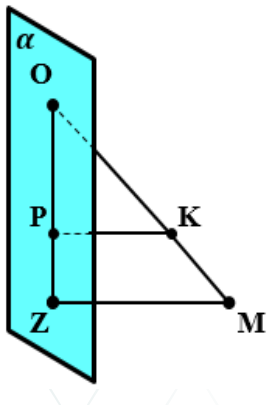


$KK_1 = 9\ cm, \quad NN_1 = 15\ cm. \quad MM_1 = ?$

$$\frac{KK_1}{NN_1} = \frac{MM_1}{KK_1}; \qquad \frac{9\ cm}{15\ cm} = \frac{MM_1}{9\ cm};$$

$$MM_1 = \frac{9\ cm \cdot 9\ cm}{15\ cm} = \frac{3\ cm \cdot 9\ cm}{5\ cm} = \frac{27\ cm^2}{5\ cm} = 5{,}4\ cm.$$ **Javob:** $MM_1 = 5{,}4\ cm.$

16.11. α tekislikning P va Z nuqtalaridan undan tashqarida uzunliklari $PK = 6\ cm$ va $ZM = 9\ cm$ bo‘lgan parallel kesmalar tushirilgan. MK to‘g‘ri chiziq α tekislikni O nuqtada kesib o‘tadi. Agar $MK = 6\ cm$ bo‘lsa, MO kesma uzunligini toping.



$PK = 6\ cm,\ ZM = 9\ cm,\ MK = 6\ cm.\ MO = ?$

$$MO = MK + KO = 6 + x; \qquad \frac{PK}{KO} = \frac{ZM}{MO}; \qquad \frac{6}{x} = \frac{9}{6+x};$$

$9x = 6 \cdot (6 + x);\ 9x = 36 + 6x;\ 9x - 6x = 36;$

$3x = 36;\ x = 36 : 3;\ x = 12;\ KO = 12\ cm;$

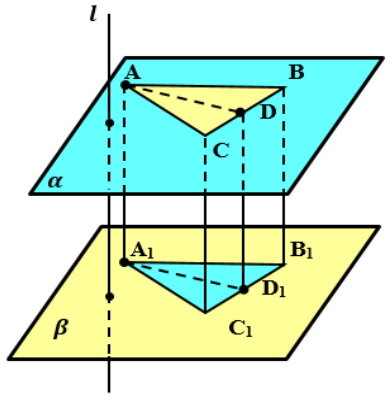
$MO = MK + KO = 6\ cm + 12\ cm = 18\ cm.$

Javob: $MO = 18\ cm.$

16.12. Parallelogrammni parallel proyeksiyalashda kvadrat hosil bo‘lishi mumkinmi?

Parallelogrammni parallel proyeksiyalashda kvadrat hosil bo‘lishi mumkin emas.

16.13. Uchburchakning parallel proyeksiyasi berilgan. Bu uchburchak medianalarining proyeksiyalari qanday yasaladi?

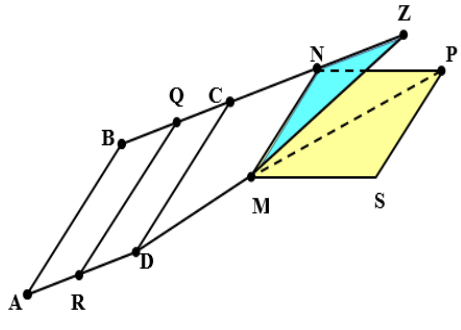


$\alpha \| \beta,\ l \perp \alpha,\ l \perp \beta,\ \alpha \in AB,\ \alpha \in BC,\ \alpha \in AC,$ $\beta \in A_1B_1,\ \beta \in B_1C_1,\ \beta \in A_1C_1$. Parallel proyeksiyalashda nuqta nuqtaga, kesma kesmaga o‘tadi. Bundan ABC uchburchak proyeksiyasi $A_1B_1C_1$ uchburchakka o‘tadi.

Demak, $\Delta ABC = \Delta A_1B_1C_1$ va AD mediana A_1D_1 medianaga l to‘g‘ri chiziqqa nisbatan parallel proyeksiyalanadi: $AD = A_1D_1$.

Uy vazifasi

16.14. MNZ uchburchak va $MNPS$ (BC – asos) parallelogramm bitta tekislikda yotmaydi. Q va R nuqtalar CB va DA kesmalarning o‘rtasi, M va N esa DP va CZ kesmalarning o‘rtasi. MN va QR to‘g‘ri chiziqlarning parallel ekanligini isbotlang.



$MNZ \cap MNPS = MN, \qquad DM = \frac{1}{2}DP,$

$CN = \frac{1}{2}CZ; \quad BQ = \frac{1}{2}BC; \quad AR = \frac{1}{2}AD;$

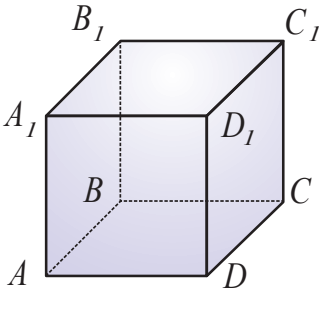
$AB \| QR;\ QR \| CD;\ CD \| MN$ bundan, $MN \| QR$.

16.15. $ABCDA_1B_1C_1D_1$ kubning. a) AA_1D_1D; b) BB_1C_1C; c) $ABCD$; d) DD_1C_1C; e) $B_1C_1D_1A_1$; f) ADD_1A_1 yoqlaridan qaysilari A_1B_1 to‘g‘ri chiziqqa parallel bo‘ladi?

a) AA_1D_1D yoqlaridan A_1B_1 to‘g‘ri chiziqqa parallel qirralari mavjud emas.

b) BB_1C_1C yoqlaridan A_1B_1 to‘g‘ri chiziqqa parallel qirralari mavjud emas.

c) $ABCD$ yoqlaridan A_1B_1 to‘g‘ri chiziqqa parallel qirralari $A_1B_1 \| AB,\ A_1B_1 \| CD$.



d) DD_1C_1C yoqlaridan A_1B_1 to‘g‘ri chiziqqa parallel qirralari $A_1B_1 \| CD,\ A_1B_1 \| C_1D_1$.

e) $B_1C_1D_1A_1$ yoqlaridan A_1B_1 to‘g‘ri chiziqqa parallel qirralari $A_1B_1 \| C_1D_1$.

f) ADD_1A_1 yoqlaridan A_1B_1 to‘g‘ri chiziqqa parallel qirralari mavjud emas.

15-DARS. BOBNI TAKRORLASHGA DOIR AMALIY MASHQLAR

I. Standartlar:

– o‘rganilgan tushunchalar, faktlar va metodlarni notanish yoki hayotiy vaziyatlarda qo‘llay olish.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ikki tekislikning parallelligi alomatini bilish;

– parallel tekisliklarning xossalarini bilish;

– parallel proyeksiyaning xossalarini bilish.

Ko‘nikmalar:

– o‘rganilgan tushunchalar, faktlar va metodlarni notanish yoki hayotiy vaziyatlarda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– ikki tekislikning parallelligi alomati;

– parallel tekisliklarning xossalari;

– parallel proyeksiyaning xossalari.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

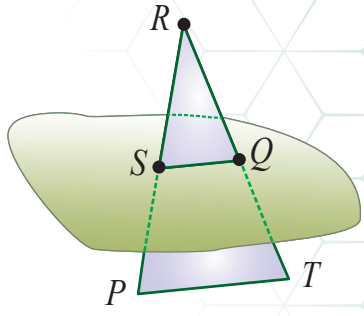
V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	fazoda to‘g‘ri chiziq va tekisliklarning parallеligiga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: ayqash to‘g‘ri chiziqlarga misollar keltiring.
Bilimlarni boyitish va mustahkamlash	fazoda to‘g‘ri chiziq va tekisliklarning parallеligi	Darslik bilan ishlash	Amaliy mashq va tatbiq: 16.16
	Tekislikka parallel to‘g‘ri chiziqlar va ularning xossalari	Darslik bilan ishlash	Amaliy mashq va tatbiq: 16.17
	Parallel tekisliklar va ularning xossalari	Darslik bilan ishlash	Amaliy mashq va tatbiq: 16.18
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 16.19
Uyga vazifa	Amaliy mashq va tatbiq: 16.20, 16.21		

16.16. PRT **uchburchak berilgan.** PT **to‘g‘ri chiziqqa parallel** α **tekislik** PR **tomonni** S **nuqtada,** RT **tomonni** Q **nuqtada kesib o‘tadi. Agar** $SR = 7\ cm, SQ = 3\ cm$ **va** $SP = 35\ cm$ **bo‘lsa,** PT **tomonni toping.**

$PT \parallel \alpha$; $SR = 7\ cm$; $SQ = 3\ cm$; $SP = 35\ cm$. $PT = ?$

$\Delta RSQ \sim \Delta RPT$; $PR = SR + SP = 7+35 = 42\ cm$;

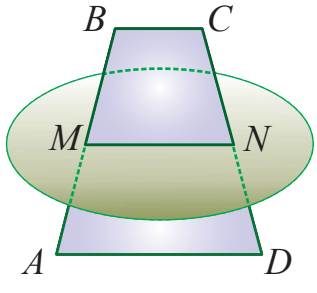


$$\frac{SR}{PR} = \frac{SQ}{PT}; \qquad \frac{7\ cm}{42\ cm} = \frac{3\ cm}{PT};$$

$$PT = \frac{42\ cm \cdot 3\ cm}{7\ cm} = 6 \cdot 3\ cm = 18\ cm.$$

Javob: $PT = 18\ cm$.

16.17. α **tekislik** $ABCD$ **trapetsiya asosi** AD **ga parallel hamda** AB **va** CD **tomonlarini** M **va** N **nuqtalarda kesib o‘tadi.** $AD = 20\ cm$, $MN = 16\ cm$. **Agar** M **nuqta** AB **kesma o‘rtasi va** $AB = 8\ cm$ **bo‘lsa, trapetsiya perimetrini toping.**



$\alpha \parallel AD$; $AD = 20\ cm$; $MN = 16\ cm$; $AM = MB$; $AB = 8\ cm$. $AB = CD$; $P_{ABCD} = ?$

$$AM = \frac{1}{2}AB = \frac{1}{2} \cdot 8\ cm = 4\ cm; \qquad \frac{AD + BC}{2} = MN;$$

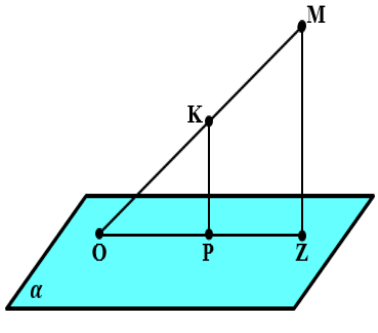
$$AD + BC = 2 \cdot MN;$$

$$BC = 2 \cdot MN - AD = 2 \cdot 16\ cm - 20\ cm = 32\ cm - 20\ cm = 12\ cm;$$

$$P_{ABCD} = AB + BC + CD + AD = 8\ cm + 12\ cm + 8\ cm + 20\ cm = 48\ cm.$$

Javob: $P_{ABCD} = 48\ cm$.

16.18. α **tekislikning** P **va** Z **nuqtalariga undan tashqarida** $PK = 6\ cm$ **va** $ZM = 9\ cm$ **kesmalar o‘tkazilgan.** MK **to‘g‘ri chiziq tekislikni** O **nuqtada kesib o‘tadi. Agar** $MK = 6\ cm$ **bo‘lsa,** MO **masofani toping.**



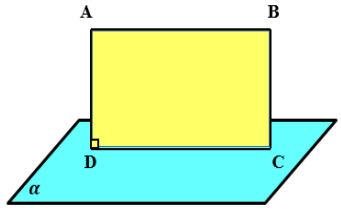
Berilgan: $\alpha \in P$, $\alpha \in Z$, $\alpha \in O$, $PK = 6\ cm$, $ZM = 9\ cm$, $MK = 6\ cm$. Topish kerak: $MO = ?$

$$\Delta MOZ \sim \Delta KOP; \qquad \frac{PK}{ZM} = \frac{MK}{MO}; \qquad \frac{6\ cm}{9\ cm} = \frac{6\ cm}{MO};$$

$$MO = \frac{6\ cm \cdot 9\ cm}{6\ cm} = \frac{54\ cm^2}{6\ cm} = 9\ cm.$$

Javob: $MO = 9\ cm$.

16.19. $ABCD$ **to‘g‘ri to‘rtburchakning** AB **tomoni** α **tekislikka parallel,** AD **tomoni esa bu tekislikka parallel emas.** $ABCD$ **va** α **tekisliklarning fazoda o‘zaro joylashuvini aniqlang.**



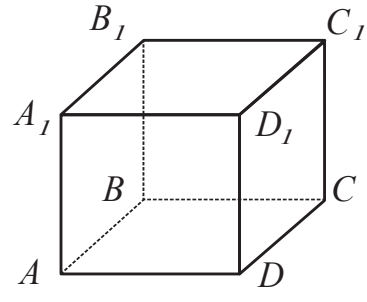
$AB \parallel \alpha$, $AD \nparallel \alpha$. $AB \parallel CD$, $AD \parallel BC$, $AB \parallel BC$, $AB \perp CD$, $ABCD$ va α tekisliklar fazoda o‘zaro perpendikulyar joylashgan.

Uy vazifasi

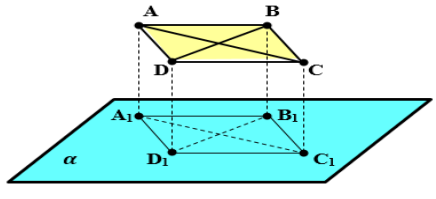
16.20. $ABCDA_1B_1C_1D_1$ **to‘g‘ri burchakli parallelepipedning quyida berilgan yoqlaridan qaysilari** A **uchi va** $ABCD$ **yog‘iga parallel bo‘ladi:**

A) D_1A_1AD; B) $D_1A_1B_1C_1$; C) ABB_1A_1; D) D_1C_1CD?

$ABCDA_1B_1C_1D_1$ to‘g‘ri burchakli parallelepipedning berilgan yoqlaridan A uchi va $ABCD$ yog‘iga $D_1A_1B_1C_1$ yog‘i parallel bo‘ladi.



16.21. Rombning ikki diagonali a **tekislikka parallel. Romb tekisligi va** a **tekislikning fazoda o‘zaro joylashuvini aniqlang.**



$AC \parallel \alpha$, $BD \parallel \alpha$, $AC \parallel A_1C_1$, $BD \parallel B_1D_1$.

$AC = A_1C_1$, $BD = B_1D_1$. Bundan,

$ABCD$ romb α tekislikka parallel bo‘ladi.

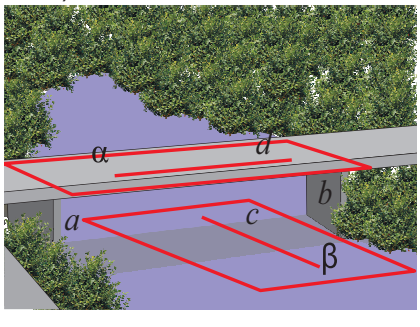
O‘ZINGIZNI SINAB KO‘RING (3-nazorat ishi)

1. Quyidagi ta’riflarni o‘qing. Jumlalar ma’nosidan kelib chiqib ularning har doim, ba’zida to‘g‘ri bo‘lishi yoki hech qachon to‘g‘ri bo‘lmasligini aniqlang va “+” belgisini tegishli ustunga qo‘ying. Javobingizni izohlang.

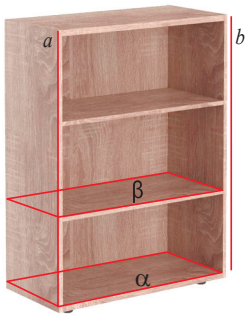
	Ta’riflar	Har doim	Ba’zida	Hech qachon
1	Fazoda ikki to‘g‘ri chiziq kesishmaydi.		+	
2	Fazoda ikki tekislik kesishmaydi.		+	
3	Fazoda to‘g‘ri chiziq bilan tekislik kesishadi.		+	
4	Fazoda to‘g‘ri chiziqlar ayqash bo‘ladi.		+	
6	Tekislikda to‘g‘ri chiziqlar ayqash bo‘ladi.			+
7	Tekislikni kesuvchi to‘g‘ri chiziqlar kesishadi.		+	
8	Tekislikka parallel to‘g‘ri chiziqlar kesishadi.		+	

2. Rasmlarda ba’zi obyektlar fazoviy geometrik shakllar timsoli sifatida chizib ko‘rsatilgan. Qanday fazoviy geometrik shakllarni ko‘ryapsiz? Ular o‘zaro qanday joylashganligini aniqlab yozing.

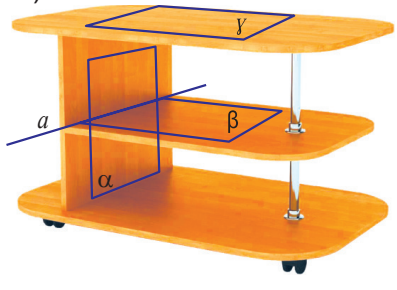
a)



b)



c)



a) $\alpha \parallel \beta$; $d \div c$; $d \parallel \beta$; $d \subset \alpha$; $c \parallel \alpha$; $c \subset \beta$;

b) $a \parallel b$; $\alpha \parallel \beta$; $a \perp \beta$; $a \perp \alpha$; $b \perp \beta$; $b \perp \alpha$;

c) $\alpha \perp \beta$; $\alpha \perp \gamma$; $\beta \parallel \gamma$; $\alpha \cap \beta = a$; $a \parallel \gamma$.

3. Bitta tekislikda yotib, bitta umumiy nuqtaga ega bo‘lgan to‘g‘ri chiziqlar qanday nomlanadi?

A) ayqash B) kesishuvchi D) parallel

Bitta tekislikda yotib, bitta umumiy nuqtaga ega bo‘lgan to‘g‘ri chiziqlar kesishuvchi deb nomlanadi.

Javob: B.

4. Ayqash to‘g‘ri chiziqlar nechta umumiy nuqtaga ega bo‘lishi mumkin?

A) 1 ta B) 0 ta D) 2 ta

Ayqash to‘g‘ri chiziqlar umumiy nuqtaga ega bo‘lmaydi.

Javob: B.

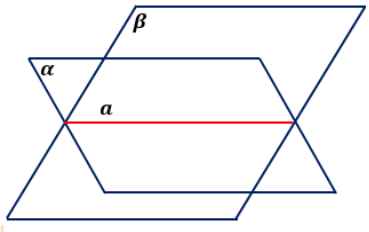
5. Bitta tekislikda yotib, umumiy nuqtaga ega bo‘lmagan to‘g‘ri chiziqlar qanday nomlanadi?

A) ayqash B) kesishuvchi D) parallel

Bitta tekislikda yotib, umumiy nuqtaga ega bo‘lmagan to‘g‘ri chiziqlar, parallel to‘g‘ri chiziqlar deb nomlanadi.

Javob: D.

6. To‘g‘ri chiziqdan turli ikkita tekislik o‘tkazish mumkinligini isbotlang.



$\begin{cases} \alpha \nparallel \beta \\ a \subset \alpha \\ a \subset \beta \end{cases}$ → a to‘g‘ri chiziq α va β tekisliklarning kesishish to‘g‘ri chizig‘i.

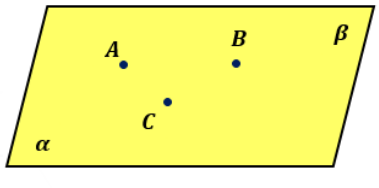
7. Bitta tekislikda yotmagan to‘rtta nuqta berilgan. Ularning uchtasidan o‘tuvchi nechta tekislik o‘tkazish mumkin?

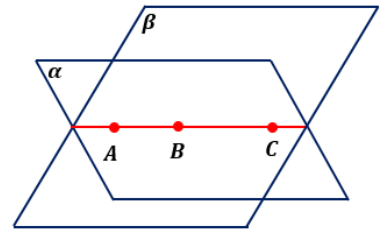
Aniq bir tekislik o‘tkazish uchun 3 ta nuqta kerak.

$$C_4^3 = \frac{4!}{3! \cdot (4-3)!} = \frac{4!}{3! \cdot 1!} = \frac{1 \cdot 2 \cdot 3 \cdot 4}{1 \cdot 2 \cdot 3 \cdot 1} = \frac{4}{1} = 4.$$ **Javob:** 4 ta.

8. A, B, C nuqtalar berilgan ikkita tekislikning har birida yotadi. Bu nuqtalarning bitta tekislikda yotishini isbotlang.

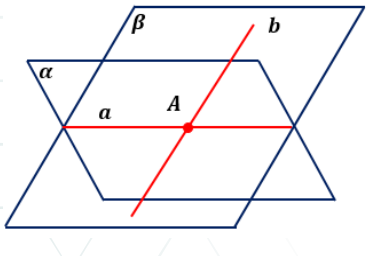
$A \in \alpha;$ $B \in \alpha;$ $C \in \alpha;$ $A \in \beta;$ $B \in \beta;$ $C \in \beta.$





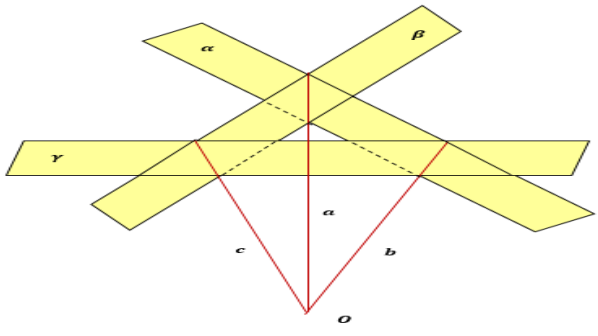
1-hol. α va β ustma-ust tushadi. **2-hol.** α va β tekisliklar kesishadi.

9. a to‘g‘ri chiziq bo‘ylab kesishuvchi ikkita tekislik berilgan. b to‘g‘ri chiziq ulardan birida yotadi va ikkinchisini kesib o‘tadi. a va b to‘g‘ri chiziqlarning kesishishini isbotlang.



$\begin{cases} \alpha \cap \beta = a \\ b \subset \alpha \\ \beta \cap b = A \end{cases}$ → $a \cap b = A$.

10. Uchta tekislikning har ikkitasi o‘zaro kesishadi. Tekisliklarning kesishish to‘g‘ri chiziqlaridan ikkitasi biror nuqtada kesishsa, uchinchi kesishish chizig‘i ham bu nuqtadan o‘tishini isbotlang.



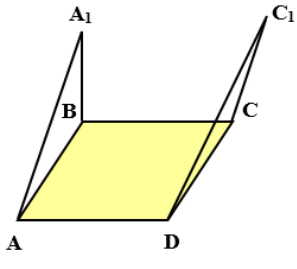
$\alpha \cap \beta = a;$
$\alpha \cap \gamma = b;$
$\beta \cap \gamma = c;$
$a \cap b = O;$
$a \cap c = O;$
$b \cap c = O.$

11. Agar fazodagi to‘rtbuchakning diagonallari kesishsa, unda uning uchlari bitta tekislikda yotishini isbotlang. Rasmda tasvirlangan to‘g‘ri chiziqlar qanday nomlanadi?

A) ayqash B) kesishuvchi C) to‘rtburchak D) parallel

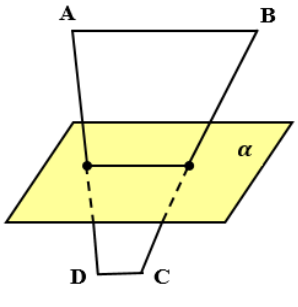
Javob: *C*.

12. $ABCD$ parallelogrammning A va C uchlari orqali Parallelogramm tekisligida yotmaydigan A_1 A va C_1 C parallel to‘g‘ri chiziqlar o‘tkazildi. A_1 AB va C_1 CD tekisliklarining parallelligini isbotlang.



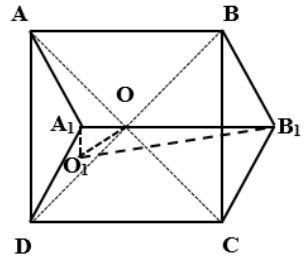
$$\begin{cases} AB \parallel CD \\ AA_1 \parallel CC_1 \end{cases} \rightarrow A_1AB \parallel C_1CD$$

13. Trapetsiyaning asoslari qandaydir tekislikka parallel. Trapetsiyaning tomonlari ham shu tekislikka parallel bo‘lishi mumkinmi? Javobingizni asoslang.



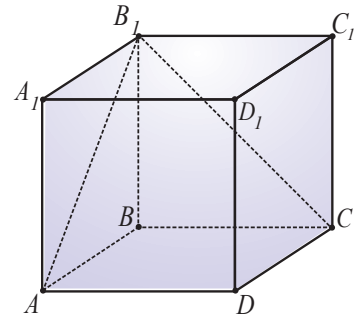
$$\begin{cases} AB \parallel \alpha \\ CD \parallel \alpha \\ BC \nparallel AB \\ AD \parallel CD \end{cases} \rightarrow BC \nparallel \alpha \ ; \quad AD \nparallel \alpha$$

14. Kvadratning A va B uchlari va diagonallari kesishish nuqtasi O ning proyeksiyalari A_1, B_1 va O_1 nuqtalardan iborat ekanligi ma’lum. $ABCD$ kvadratining proyeksiyasini yasang.



15. Rasmga ko‘ra berilgan to‘g‘ri chiziq va tekislikning o‘zaro qanday joylashganini aniqlang va jadvaldagi tegishli kataklarga mos (⊗ – kesishish, // – parallellik, ÷ – ayqashlik va ⊂ – tegishli) belgilarni qo‘ying.

To‘g‘ri chiziqlar/ tekisliklar	AA_1	BC_1	CC_1	CB_1	AB_1
ADD_1	⊗	∥	∥	∥	⊗
AA_1B_1	⊗	÷	∥	⊗	⊗
ABD	⊗	⊗	÷	÷	⊗
AA_1D	⊗	∥	∥	∥	⊗
BCD	÷	⊗	⊗	⊗	÷

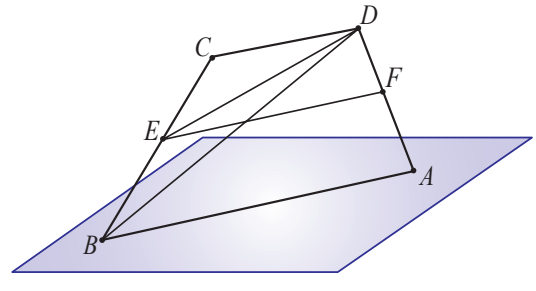


16. Rasmdagi $ABCD$ trapetsiyaning AB asosi α tekislikda yotadi, CD asosi esa α tekislikda yotmaydi. Berilgan to‘g‘ri chiziqlar va α tekislikning o‘zaro joylashishini ifodalaydigan jumlalarni to‘ldiring.

Javob:

A) DB to‘g‘ri chiziq berilgan tekislik bilan umumiy nuqtaga ega bo‘lganligi uchun u α tekislik bilan kesishadi.

B) Trapetsiyaning EF o‘rta chizig‘i uning asoslariga parallel bo‘lganligi uchun α tekislikka parallel bo‘ladi.



17. Rasmdagi ABC uchburchakning AB va AC tomonlarida D va E nuqtalar shunday belgilanganki, $DE = 5\ cm$ va $AD : BD = 3 : 4$. B va C nuqtalardan DE kesmaga parallel α tekislik o‘tkazilgan. BC tomon uzunligini toping.

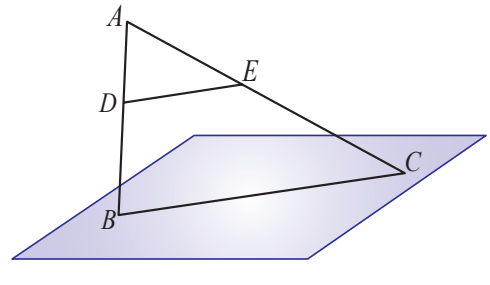
$DE = 5\ cm;\ DE \parallel \alpha;\ DE \parallel BC;\ AD : BD = 3 : 4;$

$\Delta ADE \sim \Delta ABC;\ AD = 3x;\quad AB = 7x;$

$$\frac{AD}{AB} = \frac{DE}{BC};\quad \frac{3}{7} = \frac{5}{BC};$$

$$BC = \frac{7 \cdot 5}{3} = \frac{35}{3} = 11\frac{2}{3}$$

Javob: $BC = 11\frac{2}{3}\ cm.$



IV BOB. FAZODA TO‘G‘RI CHIZIQLAR VA TEKISLIKLARNING PERPENDIKULYARLIGI

1-DARS. FAZODA PERPENDIKULYAR TO‘G‘RI CHIZIQLAR VA TEKISLIKLAR

I. Standartlar:

– M10.GO‘.GSH.10. Tekislikka perpendikulyar to‘g‘ri chiziqlarni tasavvur qila oladi;

– M10.GO‘.MM.09.To‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini biladi va uni masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– to‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini bilish;

Ko‘nikmalar:

– to‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini bilish va uni masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– fazodagi perpendikulyar to‘g‘ri chiziqlarning xossalari. To‘g‘ri chiziqlarning perpendikulyarlik alomati. Umumlashgan Pifagor teoremasi.

IV. Dars ashyolari va ko‘rgazmali qurollar:

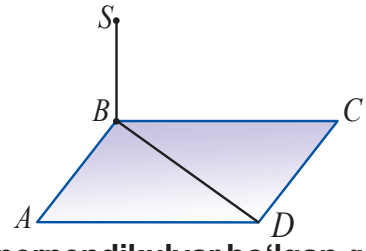
– fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Fazoda qanday to‘g‘ri chiziqlar o‘zaro perpendikulyar bo‘ladi? Misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: 1, 2
Bilimlarni boyitish va mustahkamlash	Fazodagi perpendikulyar to‘g‘ri chiziqlarning xossalari	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 17.1
	To‘g‘ri chiziqlarning perpendikulyarlik alomati	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 17.2
	Umumlashgan Pifagor teoremasi.	Darslik bilan ishlash	Amaliy mashq va tatbiq: 17.3, 17.4
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 17.5, 17.6, 17.7, 17.8
Uyga vazifa	Amaliy mashq va tatbiq: 17.9-17.12		

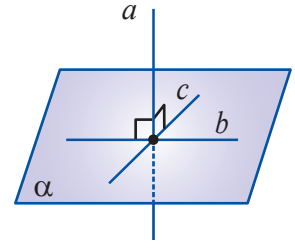
17.2. SB **kesma** $ABCD$ **Parallelogramm tekisligiga perpendikulyar.** SB **perpendikulyar bo‘lgan to‘g‘ri chiziqlarni ayting.**

$SB \perp BD;$ $SB \perp AB;$ $SB \perp BC.$



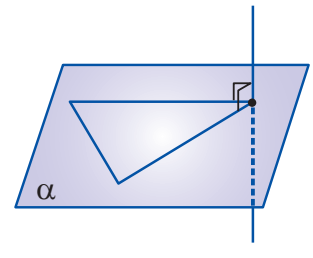
17.3. Rasmda α **tekislikda yotgan** b **va** c **to‘g‘ri chiziqlarga perpendikulyar bo‘lgan** a **to‘g‘ri chiziq tasvirlangan.** $a \perp \alpha$ **to‘g‘ri chiziq tasvirlangan.** $a \perp \alpha$ **ekanligini asoslang.**

$$\begin{cases} b \subset \alpha \\ c \subset \alpha \\ a \perp b \\ a \mid c \end{cases} \rightarrow \quad a \perp \alpha .$$



17.4. Rasmdagi to‘g‘ri chiziq uchburchakning ikki tomoniga perpendikulyar. Uning uchburchak tekisligiga perpendikulyar ekanligini asoslang.

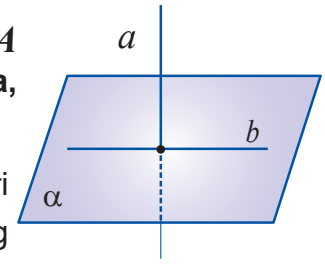
Burchak α tekislikka tegishli hamda boshqa to‘g‘ri chiziq burchak uchidan o‘tadi va burchak tomonlariga perpendikulyar. To‘g‘ri chiziq tekislikka perpendikulyar bo‘lishi uchun to‘g‘ri chiziq tekislikni kesgan nuqtasidan o‘tuvchi kesishuvchi ikkita to‘g‘ri chiziqqa perpendikulyar bo‘lishi yetarli. Shuning uchun rasmdagi to‘g‘ri chiziq uchburchak tekisligiga perpendikulyar bo‘ladi.



17.5. Rasmda $a \perp \alpha$. a **to‘g‘ri chiziqning** α **tekislikda yotgan** b **to‘g‘ri chiziqqa ham perpendikulyar bo‘lishini asoslang.**

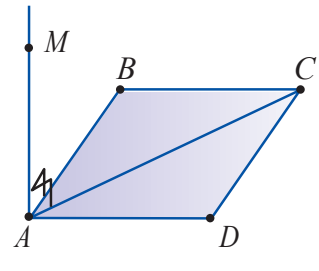
$a \perp \alpha$. a to‘g‘ri chiziq α tekislikni kesib o‘tgan nuqtada o‘tuvchi ixtiyoriy to‘g‘ri chiziqqa perpendikulyar bo‘ladi. Shuning uchun $a \perp b$ bo‘ladi.

17.6. Rasmda $ABCD$ **to‘g‘ri to‘rtburchakning** A **uchiga** MA **perpendikulyar tushirilgan. Agar** $MA \perp AB$ **va** $MA \perp AC$ **bo‘lsa,** $MA \perp AD$ **bo‘lishini asoslang.**



$\begin{cases} NA \perp AB \\ NA \perp AF \end{cases} \rightarrow$ A nuqtadan o‘tuvchi tekislikdagi ixtiyoriy to‘g‘ri chiziq MA ga perpendikulyar bo‘ladi. Shuning uchun $MA \perp AD$ bo‘ladi.

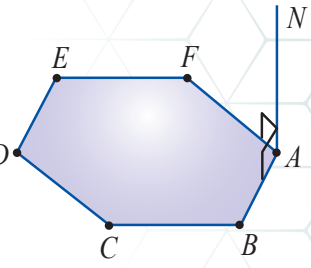
17.7. Rasmda $ABCDEF$ **oltiburchakning** A **uchiga** NA **perpendikulyar tushirilgan. Agar** $NA \perp AB$ **va** $NA \perp AF$ **bo‘lsa, a)** $NA \perp AC$**; b)** $NA \perp AD$**; c)** $NA \perp AE$ **bo‘lishini asoslang.**

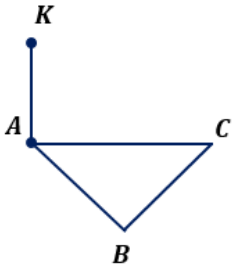


$\begin{cases} MA \perp AB \\ MA \perp AC \end{cases} \rightarrow$ A nuqtadan o‘tuvchi tekislikdagi ixtiyoriy to‘g‘ri chiziqqa NA perpendikulyardir. Demak,

a) $NA \perp AC$. b) $NA \perp AD$. c) $NA \perp AE$ bo‘ladi.

17.8. ABC uchburchakning A uchidan uning AB va AC tomonlariga perpendikulyar bo‘lgan AK to‘g‘ri chiziq o‘tkazilgan. Bu to‘g‘ri chiziqning uchburchakning A nuqtasidan tushirilgan balandligi, medianasi va bissektrisasiga perpendikulyar bo‘lishini asoslang.





$\begin{cases} AK \perp AC \\ AK \perp AB \end{cases}$ A uchidan o‘tuvchi uchburchak tekisligida yotuvchi ixtiyoriy to‘g‘ri chiziqqa perpendikulyardir. Shuning uchun A nuqtadan chiqqan balandlik, mediana va bissektrisalari AK ga perpendikulyar bo‘ladi.

Uy vazifasi

17.9. l to‘g‘ri chiziq ABC uchburchakning AB va AC tomonlariga perpendikulyar. l to‘g‘ri chiziq va ABC uchburchak tekisligining o‘zaro joylashuvini aniqlang.

a) l to‘g‘ri chiziq ABC tekislikni kesib o‘tadi, lekin unga perpendikulyar emas.

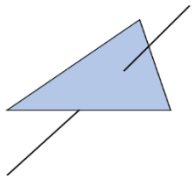
b) l to‘g‘ri chiziq ABC tekislikka tegishli.

c) l to‘g‘ri chiziq ABC tekislikka perpendikulyar.

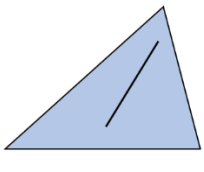
d) l to‘g‘ri chiziq ABC tekislikka parallel.

Yechish: $l \perp AB;\ l \perp AC$.

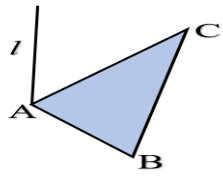
A) l to‘g‘ri chiziq ABC tekislikni kesib o‘tadi, lekin unga perpendikulyar emas.



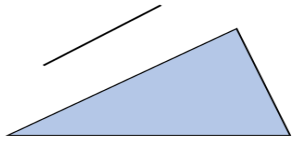
B) l to‘g‘ri chiziq ABC tekislikka tegishli.



C) l to‘g‘ri chiziq ABC tekislikka perpendikulyar.

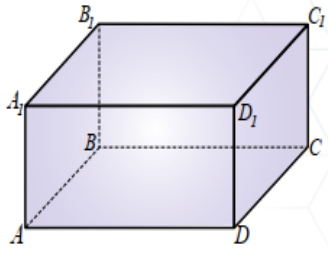


D) l to‘g‘ri chiziq ABC tekislikka parallel.



Javob: c)

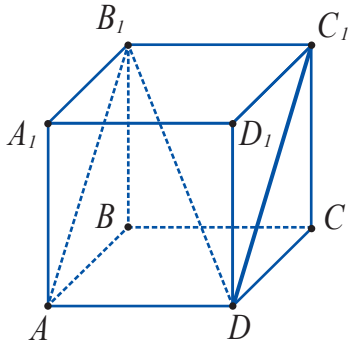
17.10. $ABCDA_1B_1C_1D_1$ **to‘g‘ri burchakli parallelepiped berilgan. a)** DD_1 **to‘g‘ri chiziq** $ABCD$ **yoqqa; b)** AD **to‘g‘ri chiziq esa** DD_1CC_1 **yoqqa perpendikulyar bo‘lishini asoslang.**



a) parallelepipedda yon qirralari asoslariga perpendikulyar. Demak, $DD_1 \perp ABCD$.

b) parallelepipedda asosidagi to‘rtburchak to‘g‘ri to‘rtburchak bo‘lgani uchun $AD \perp DC$ bundan esa $AD \perp DCC_1D_1$ kelib chiqadi.

17.11. Rasmda $ABCDA_1B_1C_1D_1$ **kub berilgan. a)** AB_1D **– to‘g‘ri burchakli uchburchak; b)** AB_1C_1D **– to‘g‘ri to‘rtburchak ekanligini asoslang.**



Kubda barcha tutashgan qirralari o‘zaro teng va perpendikulyar bo‘lgani uchun

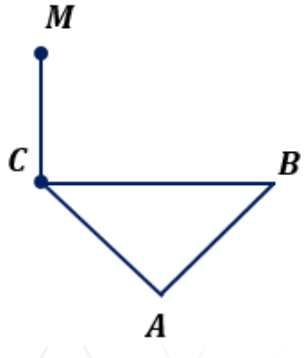
a) A_1BD da $AD \perp AA_1B_1B$ bundan, $AB_1 \perp AD$ bo‘ladi.

b) $\begin{cases} AB_1 \perp AD \\ AB_1 \perp B_1C_1 \\ DC_1 \perp AD \\ DC_1 \perp B_1C_1 \end{cases} \rightarrow AB_1C_1D$ – to‘g‘ri to‘rtburchak.

17.12. CM **to‘g‘ri chiziq** ABC **uchburchak tekisligiga perpendikulyar** $(\angle C = 90°)$**.**

a) BC **to‘g‘ri chiziq** AC **va** CM **to‘g‘ri chiziqlar yotgan tekislikka perpendikulyar;**

b) AC **to‘g‘ri chiziq** BC **va** CM **to‘g‘ri chiziqlar yotgan tekislikka perpendikulyar ekanligini isbotlang.**



a) $\begin{cases} BC \perp CM \\ BC \perp AC \end{cases} \rightarrow CM$ va AC dan o‘tuvchi tekislikka ham perpendikulyardir.

b) $\begin{cases} AC \perp CM \\ AC \perp BC \end{cases} \rightarrow CM$ va BC dan o‘tuvchi tekislikka ham perpendikulyardir.

2-DARS. FAZODA PERPENDIKULYAR TO‘G‘RI CHIZIQLAR VA TEKISLIKLAR

I. Standartlar:

– M10.GO‘.GSH.10. Tekislikka perpendikulyar to‘g‘ri chiziqlarni tasavvur qila oladi;

– M10.GO‘.MM.09.To‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini biladi va uni masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– to‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini bilish;

Ko‘nikmalar:

– to‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini bilish va uni masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– fazodagi perpendikulyar to‘g‘ri chiziqlarning xossalari. To‘g‘ri chiziqlarning perpendikulyarlik alomati. Umumlashgan Pifagor teoremasi.

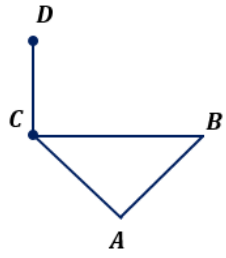
IV. Dars ashyolari va ko‘rgazmali qurollar:

– fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Fazoda qanday to‘g‘ri chiziqlar o‘zaro perpendikulyar bo‘ladi? Misollar keltiring	Aqliy hujum	Mavzu bo‘yicha savollar: 4
Bilimlarni boyitish va mustahkamlash	Fazodagi perpendikulyar to‘g‘ri chiziqlarning xossalari.	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 5 Amaliy mashq va tatbiq: 17.13
	To‘g‘ri chiziqlarning perpendikulyarlik alomati.	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 6 Amaliy mashq va tatbiq: 17.14
	Umumlashgan Pifagor teoremasi.	Darslik bilan ishlash	Amaliy mashq va tatbiq: 17.15, 17.16
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 17.17, 17.18, 17.20
Uyga vazifa	Amaliy mashq va tatbiq: 17.21–17.24		

17.13. CD **to‘g‘ri chiziq** ABC **uchburchakning** BC **tomoniga perpendikulyar** $(\angle C = 90°)$**. O‘zaro perpendikulyar to‘g‘ri chiziq va tekisliklarni aniqlang va izohlang.**



$\begin{cases} BC \perp CD \\ AC \perp BC \end{cases} \rightarrow$ qirralar perpendikulyardir.

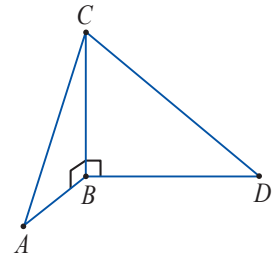
AC va CD dan o‘tuvchi tekislik ABC ga perpendikulyardir.

17.14. Rasmdagi ABC va DBC to‘g‘ri burchakli uchburchaklar turli tekisliklarda yotibdi va BC tomon bo‘yicha kesishadi. Qaysi to‘g‘ri chiziq va tekisliklar o‘zaro perpendikulyar bo‘ladi? Javobingizni asoslang.

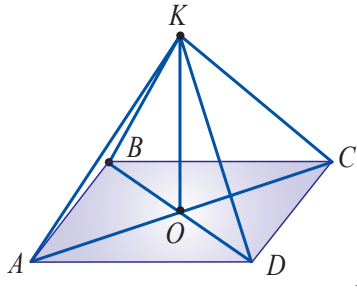
$AB \perp BC.$

$BD \perp BC.$

$ABD \perp BC.$



17.15. KO to‘g‘ri chiziq $ABCD$ Parallelogramm tekisligiga perpendikulyar. KO to‘g‘ri chiziqqa perpendikulyar to‘g‘ri chiziqni aniqlang.

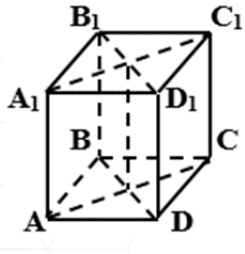


$KO \perp ABCD;\ KO \perp AC,\ KO \perp BD\ .$

17.16. MB to‘g‘ri chiziq ABC uchburchakning AB va BC tomonlariga perpendikulyar. X nuqta AC tomonning ixtiyoriy nuqtasi bo‘lsa, MBX uchburchak turini aniqlang.

$MB \perp AB,\ MB \perp BC$ bo‘lgani uchun $\Delta ABC \perp MB$. ΔMBX ning B burchagi 90° li bo‘ladi. Demak, MBX uchburchak to‘g‘ri burchakli uchburchak.

17.17. $ABCD$ to‘rtburchakning tomonlari $A_1\ B_1\ C_1\ D_1$ to‘g‘ri to‘rtburchakning tomonlariga mos ravishda parallel. $ABCD$ to‘g‘ri to‘rtburchak ekanligini isbotlang.



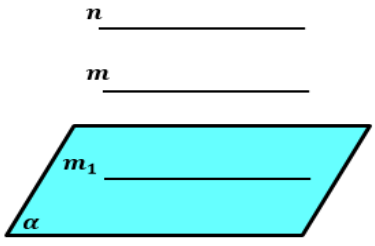
$AB \parallel A_1B_1,\ BC \parallel B_1C_1,\ CD \parallel C_1D_1,\ AD \parallel A_1D_1,$

$A_1B_1 \perp B_1C_1,\ B_1C_1 \perp C_1D_1,\ C_1D_1 \perp A_1D_1,\ A_1D_1 \perp A_1B_1.$

demak, $AB \perp BC,\ BC \perp CD,\ CD \perp AD,\ AD \perp AB.$

$ABCD \parallel A_1B_1C_1D_1$ bundan $ABCD$ to‘g‘ri to‘rtburchak ekanligi kelib chiqadi.

17.18. α tekislik m to‘g‘ri chiziqqa, m to‘g‘ri chiziq n to‘g‘ri chiziqqa parallel. Tekislikning n to‘g‘ri chiziqqa parallel bo‘lishini isbotlang.

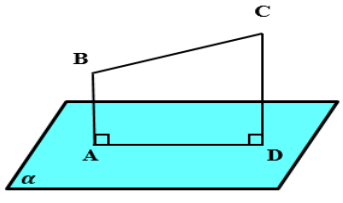


$\alpha \| m, \quad m \| n. \quad \alpha \notin m, \quad \alpha \notin n.$

$\alpha \in m_1, \; m \| m_1, \; n \| m_1.$

Bundan, $n \| \alpha$ ekanligi kelib chiqadi.

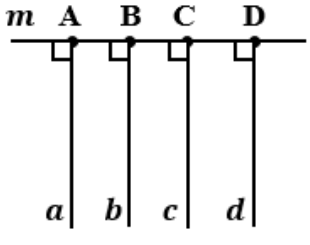
17.19. $ABCD$ **trapetsiyaning** AB **asosi yotgan to‘g‘ri chiziq** α **tekislikka perpendikulyar. Bu trapetsiyaning** CD **asosi yotgan to‘g‘ri chiziq ham** α **tekislikka perpendikulyar bo‘lishini isbotlang.**



$AB \| CD, \alpha \in AD, \; AB \nparallel BC, CD \nparallel BC, AB \perp AD, CD \perp AD.$

Bundan, $AB \perp \alpha, \; CD \perp \alpha$ ekanligi kelib chiqadi.

17.20. Fazodagi to‘g‘ri chiziqning istalgan nuqtasidan unga perpendikulyar to‘g‘ri chiziq o‘tkazish mumkinligini isbotlang.



$m \in A, \quad m \in B, \quad m \in C, \quad m \in D.$

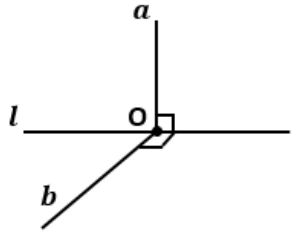
$a \cap m = A, \quad b \cap m = B, \quad c \cap m = C, \quad d \cap m = D.$

$a \| b, \quad b \| c, \quad c \| d, \quad a \| c, \quad a \| d, \quad b \| d.$

$m \perp a, \quad m \perp b, \quad m \perp c, \quad m \perp d.$

Uy vazifasi

17.21. Fazodagi to‘g‘ri chiziqning istalgan nuqtasidan unga ikkita turli perpendikulyar to‘g‘ri chiziq o‘tkazish mumkinligini isbotlang.



$l \in O, \quad l \perp a, \quad l \perp b, \quad a \perp b.$

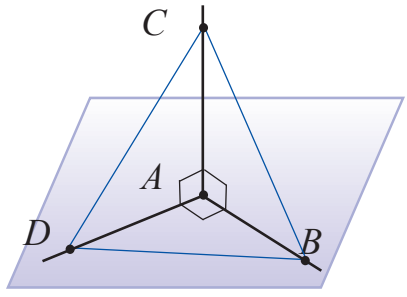
17.22 AB, AC, AD **to‘g‘ri chiziqlar juft-jufti bilan o‘zaro perpendikulyar. Agar**

a) $AB = 3$ *cm*, $BC = 7$ *cm*, $AD = 1{,}5$ *cm*;

b) $BD = 9$ *cm*, $BC = 16$ *cm*, $AD = 5$ *cm*;

c) $AB = b$ *cm*, $BC = a$ *cm*, $AD = d$ *cm*;

d) $BD = c$ *cm*, $BC = a$ *cm*, $AD = d$ *cm* **bo‘lsa,** CD **kesma uzunligini toping.**



Berilgan: a) $AB = 3\ cm,\ BC=7\ cm,\ AD = 1{,}5\ cm;$

Topish kerak: $CD=?$

$AC^2 = BC^2 - AB^2 = 7^2 - 3^2 = 49 - 9 = 40\ cm;$

$AC = \sqrt{40}\ cm;$

$CD^2 = AD^2 + AC^2 = (1{,}5\ cm)^2 + (\sqrt{40}\ cm)^2 = 2{,}25\ cm^2 + 40\ cm^2 =$

$= 42{,}25\ cm^2.\ CD = \sqrt{(42{,}25\ cm^2)} = 6{,}5\ cm.$

Javob: $CD=6{,}5\ cm.$

Berilgan: b) $BD = 9\ cm,\ BC = 16\ cm,\ AD = 5\ cm.$ Topish kerak: $CD = ?$

$AB^2 = BD^2 - AD^2 = (9\ cm)^2 - (5\ cm)^2 = 81\ cm^2 - 25\ cm^2 = 56\ cm^2;$

$AB = \sqrt{(56\ cm^2)} = 2\sqrt{14}\ cm;$

$AC^2 = BC^2 - AB^2 = (16\ cm)^2 - (\sqrt{56}cm)^2 = 256\ cm^2 - 56\ cm^2 = 200\ cm^2;$

$AC = \sqrt{(200\ cm^2)} = 10\sqrt{2}\ cm;$

$CD^2 = AC^2 - AD^2 = (10\sqrt{2}\ cm)^2 + (5\ cm)^2 = 200\ cm^2 + 25\ cm^2 = 225\ cm^2;$

$CD = \sqrt{(225\ cm^2)} = 15\ cm.$

Javob: $CD = 15\ cm.$

Berilgan: c) $AB = b\ cm,\ BC = a\ cm,\ AD = d\ cm.$

Topish kerak: $CD = ?$

$AC^2 = a^2 - b^2;\quad CD^2 = AC^2 + AD^2 = a^2 - b^2 + d^2;\quad CD = \sqrt{(a^2 - b^2 + d^2)}$

Javob: $\sqrt{(a^2 - b^2 + d^2)}.$

Berilgan: d) $BD = C\ cm,\ BC=a\ cm,\ AD = d\ cm.$ Topish kerak: $CD = ?$

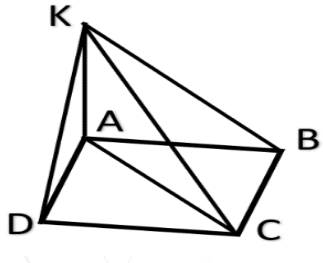
$AB^2 = BD^2 - AD^2 = c^2 - d^2;\quad AC^2 = BC^2 - AB^2 = a^2 - c^2 + d^2;$

$CD^2 = AC^2 + AD^2 = a^2 - c^2 + d^2 + d^2 = a^2 - c^2 + 2d^2;$

$CD = \sqrt{(a^2 - c^2 + 2d^2)}.$

Javob: $CD = \sqrt{(a^2 - c^2 + 2d^2)}.$

17.23. $ABCD$ **to‘g‘ri to‘rtburchakning** A **uchida uning tekisligiga perpendikulyar** AK **to‘g‘ri chiziq o‘tkazilgan.** K **nuqtadan to‘g‘ri to‘rtburchakning boshqa uchlarigacha masofa** $6\ m,\ 7\ m,\ 9\ m.$ AK **masofani toping.**



Berilgan: $AK \perp ABCD;$

$KD=6\ m;\ KB=7\ m;\ KC = 9\ m;$

$KD=6\ m;\ KB=7\ m;\ KC = 9\ m.$

Topish kerak: $AK=?$

$AC^2 = AB^2 + AD^2;$

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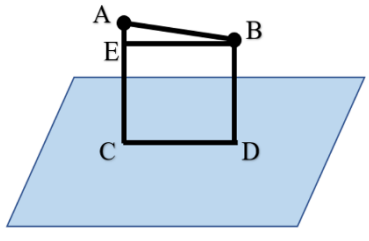
$$\begin{cases} AK^2 = KD^2 - AD^2 \\ AK^2 = KB^2 - AB^2 \\ AK^2 = KC^2 - (AB^2 + AD^2) \end{cases} \rightarrow \begin{cases} AK^2 = 6^2 - AD^2 \\ AK^2 = 7^2 - AB^2 \\ AK^2 = 9^2 - (AB^2 + AD^2) \end{cases} \rightarrow$$

$$\rightarrow \begin{cases} 6^2 - AD^2 = 7^2 - AB^2 \\ 6^2 - AD^2 = 9^2 - AB^2 - AD^2 \end{cases} \rightarrow \begin{cases} AB^2 - AD^2 = 13 \\ AB^2 = 45 \end{cases}$$

$AK^2 = 49\text{-}45;\quad AK^2 = 4;\quad AK = 2.$

Javob: $AK=2$ *m.*

17.24. ***A*** **va** ***B*** **nuqtalar α tekislikka perpendikulyar va uni mos ravishda** ***C*** **va** ***D*** **nuqtalarda kesib o‘tuvchi to‘g‘ri chiziq o‘tkazilgan. Agar** $AC = 3$ *m*, $BD = 2$ *m* **va** $CD = 2{,}4$ *m* **bo‘lsa va** AB **kesma α tekislikni kesib o‘tmasa,** A **va** B **nuqtalar orasidagi masofani toping.**



Berilgan: $AC=3$ *m;* $BD = 2$ *m;* $CD = 2{,}4$ *m;*

Topish kerak: $AB = ?$

$AE = AC\text{-}EC = AC\text{-}BD = 3$ *m*$\text{-}2$ *m* $= 1$ *m;*

$$AB = \sqrt{CD^2 + AE^2};$$

$$AB = \sqrt{2{,}4^2 + 1^2} = \sqrt{6{,}76} = 2{,}6\ m.$$

Javob: $AB = 2{,}6$ *m.*

3-DARS. FAZODA PERPENDIKULYAR TO‘G‘RI CHIZIQLAR VA TEKISLIKLAR

I. Standartlar:

– M10.GO‘.GSH.10. Tekislikka perpendikulyar to‘g‘ri chiziqlarni tasavvur qila oladi;

– M10.GO‘.MM.09.To‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini biladi va uni masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– to‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini bilish;

Ko‘nikmalar:

– to‘g‘ri chiziqning tekislikka perpendikulyarlik alomatini bilish va uni masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– fazodagi perpendikulyar to‘g‘ri chiziqlarning xossalari. To‘g‘ri chiziqlarning perpendikulyarlik alomati. Umumlashgan Pifagor teoremasi.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

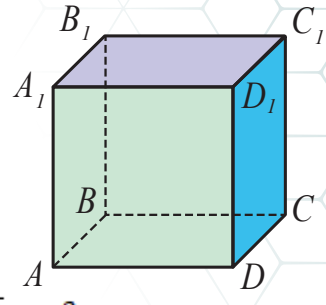
Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Fazoda qanday to‘g‘ri chiziqlar o‘zaro perpendikulyar bo‘ladi? Misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: 4
Bilimlarni boyitish va mustahkamlash	Fazodagi perpendikulyar to‘g‘ri chiziqlarning xossalari.	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 5 Amaliy mashq va tatbiq: 17.25, 17,26
	To‘g‘ri chiziqlarning perpendikulyarlik alomati	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 6 Amaliy mashq va tatbiq: 17.27, 17.28
	Umumlashgan Pifagor teoremasi	Darslik bilan ishlash	Amaliy mashq va tatbiq: 17.29, 17.30
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 17.31
Uyga vazifa	Amaliy mashq va tatbiq: 17.32–17.34		

17.25. Rasmda tasvirlangan kubning qirrasi: a) $4\ cm$; b) $8\ cm$ bo‘lsa, AB_1C uchburchak perimetrini va DAC_1 uchburchak yuzini toping.

a) Berilgan: $AB = 4\ cm;$

Topish kerak: $P_{AB_1C} = ?\quad S_{DAC_1} = ?$

$$AB_1 = \sqrt{AA_1^2 + A_1B_1^2} = \sqrt{4^2 + 4^2} = \sqrt{32} = 4\sqrt{2};$$



Uchburchak AB_1C da $AB_1 = B_1C = AC;$

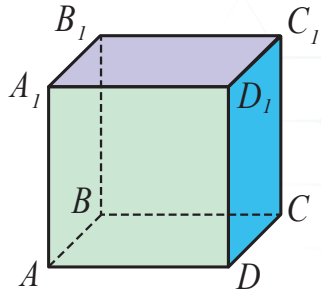
$$P_{AB_1C} = 3 \cdot 4\sqrt{2} = 12\sqrt{2}\ cm; \qquad S_{DAC_1} = \frac{4 \cdot 4\sqrt{2}}{2} = 8\sqrt{2}\ cm^2.$$

Javob: $P_{AB_1C} = 12\sqrt{2}\ cm;\ \ S_{DAC_1} = 8\sqrt{2}\ cm^2.$

b) Berilgan: $AB = 8\ cm;$

Topish kerak: $P_{AB_1C} = ?\qquad S_{DAC_1} = ?$

$$AB_1 = \sqrt{AA_1^2 + A_1B_1^2} = \sqrt{8^2 + 8^2} = \sqrt{128} = 8\sqrt{2};$$



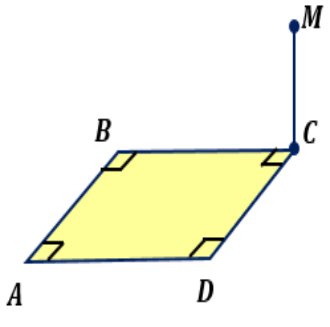
Uchburchak AB_1C da $AB_1 = B_1C = AC;$

$$P_{AB_1C} = 3 \cdot 8\sqrt{2}\ cm = 24\sqrt{2}\ cm;$$

$$S_{DAC_1} = \frac{AB \cdot AB_1}{2} = \frac{8\ cm \cdot 8\sqrt{2}\ cm}{2} = 4\ cm \cdot 8\sqrt{2}\ cm = 32\sqrt{2}\ cm^2;$$

Javob: $P_{AB_1C} = 24\sqrt{2}\ cm; \qquad S_{DAC_1} = 32\sqrt{2}\ cm^2;$

17.26. CM **to‘g‘ri chiziq tomoni** a **ga teng bo‘lgan** $ABCD$ **kvadrat tekisligiga perpendikulyar va** $CM = b$**. Agar: a)** $a = 2\ cm, b = 1\ cm;$ **b)** $a = 3\ cm, b = 4\ cm$ **bo‘lsa,** M **nuqtadan kvadrat uchlarigacha bo‘lgan masofalarni toping.**



$CM = b;\ \ ABCD \perp CM;\ \ CA = a\sqrt{2}\ cm;$

a) $a = 2\ cm;\ \ b = 1\ cm.$

$$MB = \sqrt{a^2 + b^2} = \sqrt{2^2 + 1^2} = \sqrt{4 + 1} = \sqrt{5}\ cm;$$

$$MD = \sqrt{a^2 + b^2} = \sqrt{2^2 + 1^2} = \sqrt{4 + 1} = \sqrt{5}\ cm;$$

$$MA = \sqrt{AC^2 + b^2} = \sqrt{\left(a\sqrt{2}\right)^2 + b^2} = \sqrt{\left(2\sqrt{2}\right)^2 + 1^2} = \sqrt{8 + 1} = \sqrt{9} = 3\ cm.$$

Javob: $MB = \sqrt{5}\ cm;\ \ MD = \sqrt{5}\ cm;\ \ MA = 3\ cm.$

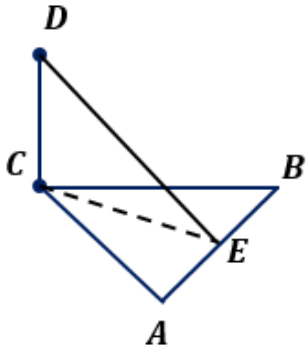
b) $a = 3\ cm;\ \ b = 4\ cm;$

$$MB = MD = \sqrt{a^2 + b^2} = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5\ cm;$$

$$MA = \sqrt{AC^2 + b^2} = \sqrt{\left(a\sqrt{2}\right)^2 + b^2} = \sqrt{\left(3\sqrt{2}\right)^2 + 4^2} = \sqrt{18 + 16} = \sqrt{34}\ cm.$$

Javob: $MB = 5\ cm;\quad MD = 5\ cm;\quad MA = \sqrt{34}\ cm.$

17.27. ABC **to‘g‘ri burchakli uchburchakning** C **uchi orqali uning tekisligiga** CD **perpendikulyar tushirilgan. Agar: a)** $AC = 6\ cm,\ BC = 8\ cm,\ CD = 12\ cm;$ **b)** $AC = 12\ cm,\ BC = 16\ cm,\ CD = 24\ cm$ **bo‘lsa,** D **nuqtadan uchburchakning gipotenuzasi o‘rtasigacha bo‘lgan masofani toping.**



$$AE = EB = \frac{AB}{2};$$

$a)\ AC = 6\ cm;\ BC = 8\ cm;\ CD = 12\ cm.\ DE = ?$

$$AB = \sqrt{AC^2 + BC^2} = \sqrt{6^2 + 8^2} = \sqrt{100} = 10\ cm;$$

$$AE = EB = CE = \frac{AB}{2} = \frac{10}{2} = 5\ cm;$$

$$DE = \sqrt{CD^2 + CE^2} = \sqrt{12^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = 13\ cm;$$

$Javob:\ \ DE = 13\ cm.$

$b)\ \ AC = 12\ cm;\quad BC = 16\ cm;\quad CD = 24\ cm.\quad DE = ?$

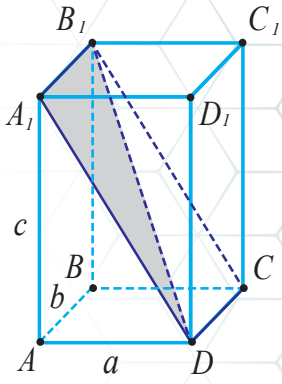
$$AB = \sqrt{AC^2 + BC^2} = \sqrt{12^2 + 16^2} = \sqrt{144 + 256} = \sqrt{400} = 20\ cm;$$

$$AE = EB = CE = \frac{AB}{2} = \frac{20}{2} = 10\ cm;$$

$$DE = \sqrt{CD^2 + CE^2} = \sqrt{24^2 + 10^2} = \sqrt{576 + 100} = \sqrt{676} = 26\ cm;$$

Javob: $DE = 26\ cm.$

17.28. Rasmdagi $ABCDA_1B_1C_1D_1$ **to‘g‘ri burchakli parallelepipedning o‘lchamlari a)** $a = 12\ cm,\ b = 8\ cm,\ c = 16\ cm,$ **b)** $a = 5\ cm,\ b = 10\ cm,\ c = 12\ cm$ **bo‘lsa,** A_1B_1D **uchburchak va** A_1B_1CD **to‘rtburchak yuzini toping.**



a) $a = 12\ cm;\quad b = 8\ cm;\quad c = 16\ cm.$

$A_1D = \sqrt{a^2 + c^2} = \sqrt{12^2 + 16^2} = \sqrt{144 + 256} = 20\ cm;$

$A_1B_1 = b = 8\ cm;\ \angle B_1A_1D = 90°;$

$S_{A_1B_1D} = \frac{A_1B_1 \cdot A_1D}{2} = \frac{8\ cm \cdot 20\ cm}{2} = \frac{160\ cm^2}{2} = 80\ cm^2;$

$S_{A_1B_1CD} = 2 \cdot S_{A_1B_1D} = 2 \cdot 80\ cm^2 = 160\ cm^2.$ *Javob:* $80\ cm^2;\ 160\ cm^2.$

b) $a = 5\ cm;\quad b = 10\ cm;\quad c = 12\ cm.$

$A_1D = \sqrt{a^2 + c^2} = \sqrt{5^2 + 12^2} = \sqrt{25 + 144} = \sqrt{169} = 13\ cm;$

$A_1B_1 = b = 10\ cm;\quad \angle B_1A_1D = 90°;$

$S_{A_1B_1D} = \frac{A_1B_1 \cdot A_1D}{2} = \frac{10\ cm \cdot 13\ cm}{2} = \frac{130\ cm^2}{2} = 65\ cm^2;$

$S_{A_1B_1CD} = 2 \cdot S_{A_1B_1D} = 2 \cdot 65\ cm^2 = 130\ cm^2.$

Javob: $65\ cm^2;\ 130\ cm^2.$

17.29. $ABCDA_1B_1C_1D_1$ **to‘g‘ri burchakli parallelepipedning o‘lchamlari: a)** $a = 12\ cm, b = 8\ cm, c = 16\ cm;$ **b)** $a = 5\ cm, b = 10\ cm, c = 12\ cm;$ **d)** $a = 2\ m, b = 12\ m, c = 6\ m$ **bo‘lsa, uning diagonalini toping.**

a) $a = 12\ cm;\quad b = 8\ cm;\quad c = 16\ cm.\quad d = ?$

$d = \sqrt{a^2 + b^2 + c^2} = \sqrt{12^2 + 8^2 + 16^2} = \sqrt{144 + 64 + 256} = \sqrt{464}$
$= 4\sqrt{29}\ cm.$

Javob: $d = 4\sqrt{29}\ cm.$

b) $a = 5\ cm;\quad b = 10\ cm;\quad c = 12\ cm.\quad d = ?$

$d = \sqrt{a^2 + b^2 + c^2} = \sqrt{5^2 + 10^2 + 12^2} = \sqrt{25 + 100 + 144} = \sqrt{269}\ cm.$

Javob: $d = 4\sqrt{269}\ cm.$

d) $a = 2\ m;\quad b = 12\ m;\quad c = 6\ m.\quad d = ?$

$d = \sqrt{a^2 + b^2 + c^2} = \sqrt{2^2 + 12^2 + 6^2} = \sqrt{4 + 144 + 36} = \sqrt{184} = 2\sqrt{46}\ m.$

Javob: $d = 2\sqrt{46}\ cm.$

17.30. Muntazam to‘g‘ri burchakli parallelepiped asosining tomoni $4\ cm$ **va balandligi** $5\ cm$ **bo‘lsa, uning diagonalini toping.**

$a = 4\ cm;\quad b = 4\ cm;\quad h = 5\ m.\quad d = ?$

$$d = \sqrt{a^2 + b^2 + h^2} = \sqrt{4^2 + 4^2 + 5^2} = \sqrt{16 + 16 + 25} = \sqrt{57}\ cm.$$

Javob: $d = \sqrt{57}\ cm.$

Uy vazifasi

17.31. To‘g‘ri burchakli parallelepiped asosining tomonlari *12 cm* va *8 cm* hamda diagonali *16 cm* bo‘lsa, uning balandligini toping.

$a = 12\ cm;\quad b = 8\ cm;\quad d = 16\ cm.\quad h = ?$

$$h = \sqrt{d^2 - a^2 - b^2} = \sqrt{16^2 - 12^2 - 8^2} = \sqrt{256 - 144 - 64} = \sqrt{48} = 4\sqrt{3}\ cm.$$

Javob: $h = 4\sqrt{3}\ cm.$

17.32. *ABC* to‘g‘ri burchakli uchburchak tekisligiga uning *C* to‘g‘ri burchagi uchi orqali perpendikulyar tushirilgan. *AD=a, BD=b, CD=c bo‘lsa, ABC* uchburchakning *CM* medianasini toping.

$AD = a;\ BD = b;\ CD = c.\ \angle ACD = \angle BCD = \angle ACB = 90°;$

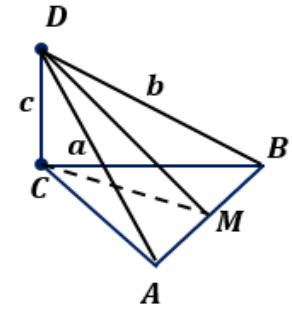
$AC = \sqrt{AD^2 - DC^2} = \sqrt{a^2 - c^2};$

$BC = \sqrt{BD^2 - DC^2} = \sqrt{b^2 - c^2};$

$$AB = \sqrt{AC^2 + BC^2} = \sqrt{(a^2 - c^2) + (b^2 - c^2)} = \sqrt{a^2 + b^2 - 2c^2};$$

$MA = MB;\quad CM = \frac{AB}{2} = \frac{\sqrt{a^2 + b^2 - 2c^2}}{2}.$

$$= \frac{\sqrt{a^2 + b^2 - 2c^2}}{2}.$$



Javob: $CM.$

4-DARS. FAZODA PERPENDIKULYAR, OG‘MA VA MASOFA

I. Standartlar:

– M10.GO‘.GSH.11. Fazoda tekislikka tushirilgan perpendikulyar va og‘ma haqida tushunchaga ega bo‘ladi;

– M10.GO‘.MM.12. Fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni amaliy masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma haqida tushunchaga ega bo‘lish;

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni bilish.

Ko‘nikmalar:

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni bilish va amaliy masalalar yechishda qo‘llay olish.

III. Dars mazmunining qisqacha tavsifi:

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma. Nuqtadan tekislikkacha bo‘lgan masofa. To‘g‘ri chiziqdan unga parallel bo‘lgan tekislikkacha bo‘lgan masofa. Parallel tekisliklar orasidagi masofa. Ayqash to‘g‘ri chiziqlar orasidagi masofa.

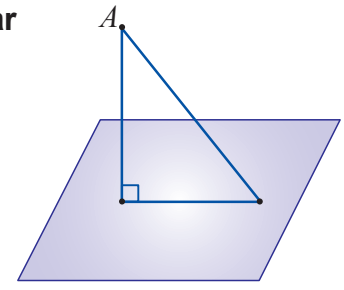
IV. Dars ashyolari va ko‘rgazmali qurollar:

– g‘isht – 1 dona; turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Tekislikka tushirilgan perpendikulyarga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: 1
Bilimlarni boyitish va mustahkamlash	Fazoda tekislikka tushirilgan perpendikulyar va og‘ma	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 18.1
	Nuqtadan tekislikkacha bo‘lgan masofa. To‘g‘ri chiziqdan unga parallel bo‘lgan tekislikkacha bo‘lgan masofa	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 18.2
	Parallel tekisliklar orasidagi masofa. Ayqash to‘g‘ri chiziqlar orasidagi masofa	Darslik bilan ishlash	Amaliy mashq va tatbiq: 18.3
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 18.4, 18.5
Uyga vazifa	Amaliy mashq va tatbiq: 18.6, 18.7		

18.2. Rasmdan a) perpendikulyar; b) og‘ma: c) perpendikulyar asosi; d) og‘ma proyeksiyasini aniqlang va yozing.



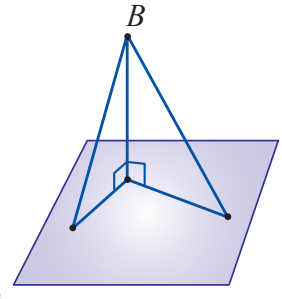
a) AB – perpendikulyar;

b) AC – og‘ma;

c) B – nuqta AB perpendikulyarning asosi;

d) BC – og‘ma proyeksiyasi.

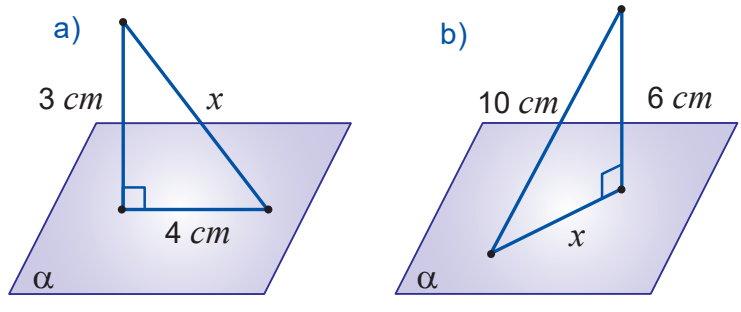
18.3. Rasmdan AD va DC kesmalar AB va BC og‘malarning proyeksiyasi: a) Agar $AD > DC$ bo‘lsa, og‘malar haqida nima deyish mumkin; b) Agar $AB = BC$ bo‘lsa, proyeksiyalar haqida nima deyish mumkin?



a) $AD > DC$ bo‘lsa, $AB > BC$ bo‘ladi.

b) $AB = BC$ bo‘lsa, $AD = DC$ bo‘ladi.

18.4. Rasmdagi noma’lum kesmalarning uzunligini toping.



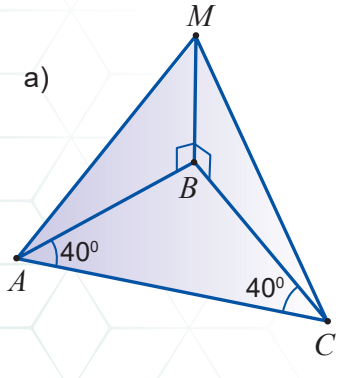
$a)\ x = \sqrt{a^2 + b^2} = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5\ cm.$

Javob: $x = 5\ cm.$

$b)\ x = \sqrt{c^2 - a^2} = \sqrt{10^2 - 6^2} = \sqrt{100 - 36} = \sqrt{64} = 8\ cm.$

Javob: $x = 8\ cm.$

18.5. Rasmda berilganlardan foydalanib, MA va MC og‘malar uzunliklarini o‘zaro solishtiring.

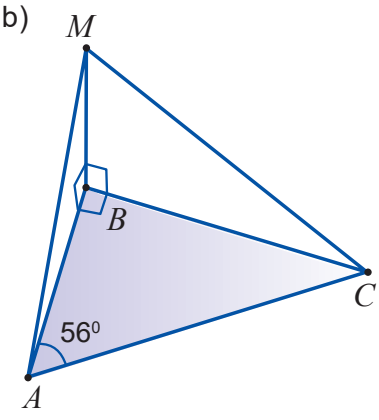


ΔABC da $\angle BAC = \angle BCA = 40°$. Demak,

$$\begin{cases} AB = BC \\ MB - umumiy \\ \angle ABM = \angle CBM = 90° \end{cases}$$ *TBT alomatiga ko‘ra,*

$\Delta ABM = \Delta CBM$ bundan $MA = MC$ kelib chiqadi.

b)



$\angle ABC = 90°;\quad \angle BAC = 56°;$

$\angle ACB = \angle ABC - \angle BAC = 90° - 56° = 34°;$

$\angle BAC > \angle ACB \rightarrow BC > AB;$

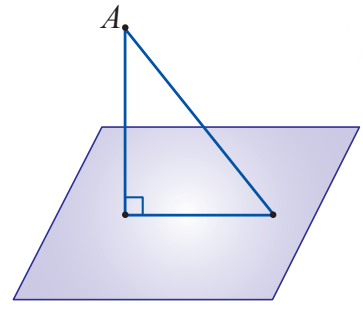
$MA = \sqrt{MB^2 + MA^2};\quad MC = \sqrt{MB^2 + BC^2};$

Demak, $MC > MA$ bo‘ladi.

Uy vazifasi

18.6. AB perpendikulyar, AC og‘ma va BC og‘ma proyeksiya bo‘lsa, jadvalni berilganlardan foydalanib to‘ldiring.

AB	24	15	**10**	**$3a$**	12
BC	7	**20**	24	$4a$	**5**
AC	**25**	25	26	$5a$	13



$AB^2 + BC^2 = AC^2;$

1) $AC = \sqrt{AB^2 + BC^2} = \sqrt{24^2 + 7^2} = \sqrt{576 + 49} = \sqrt{625} = 25;$

2) $BC = \sqrt{AC^2 - AB^2} = \sqrt{25^2 - 15^2} = \sqrt{625 - 225} = \sqrt{400} = 20;$

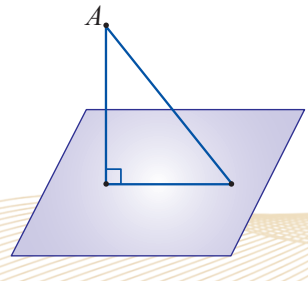
3) $AB = \sqrt{AC^2 - BC^2} = \sqrt{26^2 - 24^2} = \sqrt{676 - 576} = \sqrt{100} = 10;$

4) $AB = \sqrt{AC^2 - BC^2} = \sqrt{(5a)^2 - (4a)^2} = \sqrt{25a^2 - 16a^2} = \sqrt{9a^2} = 3a;$

5) $BC = \sqrt{AC^2 - AB^2} = \sqrt{13^2 - 12^2} = \sqrt{169 - 144} = \sqrt{25} = 5;$

18.7. AB perpendikulyar, AC og‘ma, BC og‘ma proyeksiyasi, α perpendikulyar va og‘ma orasidagi burchak bo‘lsa, jadvalni berilganlardan foydalanib to‘ldiring.

AB	$3\sqrt{3}$	$4\sqrt{3}$	5	6	14
BC	3	4	5	12	14
AC	6	8	$5\sqrt{2}$	12	$14\sqrt{2}$
α	30°	30°	45°	60°	45°



$AB^2 + BC^2 = AC^2$;

$\sin\alpha = \frac{BC}{AC}$; $\cos\alpha = \frac{AB}{AC}$; $tg\alpha = \frac{BC}{AB}$; $ctg\alpha = \frac{AB}{BC}$;

1) $AC = 6$; $\alpha = 30°$; $\sin 30° = \frac{BC}{AC}$; $\frac{1}{2} = \frac{BC}{6}$; $BC = 3$;

$\cos 30° = \frac{AB}{AC}$; $\frac{\sqrt{3}}{2} = \frac{AB}{6}$; $AB = \frac{6\sqrt{3}}{2} = 3\sqrt{3}$.

2) $BC = 4$; $AC = 8$;

$AB = \sqrt{AC^2 - BC^2} = \sqrt{8^2 - 4^2} = \sqrt{64 - 16} = \sqrt{48} = 4\sqrt{3}$;

$\sin\alpha = \frac{BC}{AC}$; $\sin\alpha = \frac{4}{8}$; $\sin\alpha = \frac{1}{2}$; $\alpha = 30°$.

3) $AB = 5$; $\alpha = 45°$; $tg\alpha = \frac{BC}{AB}$; $tg45° = \frac{BC}{5}$; $1 = \frac{BC}{5}$; $BC = 5$;

$AC = \sqrt{AB^2 + BC^2} = \sqrt{5^2 + 5^2} = \sqrt{2 \cdot 5^2} = 5\sqrt{2}$.

4) $AB = 6$; $AC = 12$;

$BC = \sqrt{AC^2 - AB^2} = \sqrt{12^2 - 6^2} = \sqrt{144 - 36} = \sqrt{108} = \sqrt{36 \cdot 3} = 6\sqrt{3}$;

$\sin\alpha = \frac{BC}{AC}$; $\sin\alpha = \frac{6\sqrt{3}}{12}$; $\sin\alpha = \frac{\sqrt{3}}{2}$; $\alpha = 60°$.

5) $AB = 14$; $BC = 14$;

$AC = \sqrt{AB^2 + BC^2} = \sqrt{14^2 + 14^2} = \sqrt{2 \cdot 14^2} = 14\sqrt{2}$;

$tg\alpha = \frac{BC}{AB}$; $tg\alpha = \frac{14}{14}$; $tg\alpha = 1$; $\alpha = 45°$.

5-DARS. FAZODA PERPENDIKULYAR, OG‘MA VA MASOFA

I. Standartlar:

– M10.GO‘.GSH.11. Fazoda tekislikka tushirilgan perpendikulyar va og‘ma haqida tushunchaga ega bo‘ladi;

– M10.GO‘.MM.12. Fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni amaliy masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma haqida tushunchaga ega bo‘lish;

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni bilish.

Ko‘nikmalar:

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni bilish va amaliy masalalar yechishda qo‘llay olish.

III. Dars mazmunining qisqacha tavsifi:

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma. Nuqtadan tekislikkacha bo‘lgan masofa. To‘g‘ri chiziqdan unga parallel bo‘lgan tekislikkacha bo‘lgan masofa. Parallel tekisliklar orasidagi masofa. Ayqash to‘g‘ri chiziqlar orasidagi masofa.

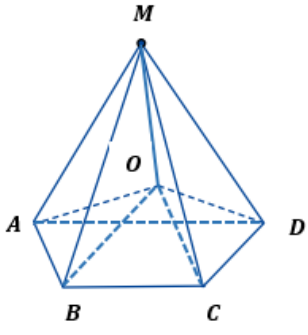
IV. Dars ashyolari va ko‘rgazmali qurollar:

– g‘isht – 1 dona; Turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Tekislikka tushirilgan perpendikulyarga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: 4
Bilimlarni boyitish va mustahkamlash	Fazoda tekislikka tushirilgan perpendikulyar va og‘ma.	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 5 Amaliy mashq va tatbiq: 18.8
	Nuqtadan tekislikkacha bo‘lgan masofa. To‘g‘ri chiziqdan unga parallel bo‘lgan tekislikkacha bo‘lgan masofa	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 6 Amaliy mashq va tatbiq: 18.9
	Parallel tekisliklar orasidagi masofa. Ayqash to‘g‘ri chiziqlar orasidagi masofa	Darslik bilan ishlash	Amaliy mashq va tatbiq: 18.10
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 18.11, 18.12
Uyga vazifa	Amaliy mashq va tatbiq: 18.13, 18.14		

18.8. M **nuqtadan tekislikga o‘zaro teng** MA, MB, MC, MD **og‘malar o‘tkazilgan.** $ABCD$ **to‘rtburchak turi quyidagilardan qaysi biri bo‘ladi: a) kvadrat; b) Parallelogramm; c) to‘g‘ri to‘rtburchak. Javobingizni asoslang.**



$x = MA = MB = MC = MD;$

$AO = BO = CO = DO = \sqrt{x^2 - MO^2}.$

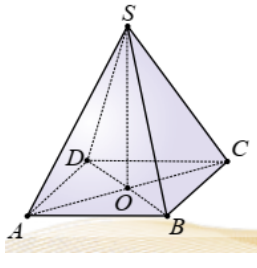
$ABCD$ to‘rtburchakka markazi O nuqtada bo‘lgan tashqi aylana chizish mumkin.

a) Kvadrat mumkin, chunki tashqi aylana chizish mumkin.

b) Parallelogramm mumkin emas, chunki unga tashqi aylana chizib bo‘lmaydi.

c) To‘g‘ri to‘rtburchak mumkin, chunki tashqi aylana chizish mumkin.

18.9. Agar Parallelogrammning uchlaridan baravar uzoqlikda yotgan nuqta mavjud bo‘lsa, bu Parallelogramm to‘g‘ri to‘rtburchak ekanini isbotlang.

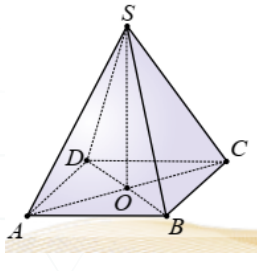


$SA=SB=SC=SD=x;$

$AO = BO = CO = DO = \sqrt{x2 - SO2}.$

$ABCD$ ga markazi O nuqtada bo‘lgan aylana chizish mumkin. Demak, $ABCD$ to‘g‘ri to‘rtburchak.

18.10. Agar rombning uchlaridan baravar uzoqlikda yotgan nuqta mavjud bo‘lsa, bu romb kvardat ekanligini isbotlang.



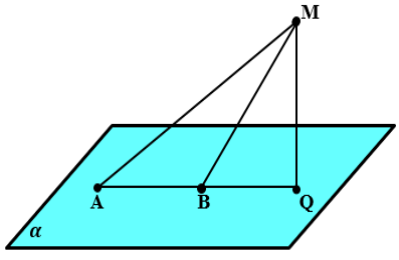
$SA = SB = SC = SD = x;$

$AO = BO = CO = DO = \sqrt{x2 - SO2}.$

$ABCD$ ga markazi O nuqtada bo‘lgan aylana chizish mumkin. Demak, $ABCD$ to‘g‘ri to‘rtburchak.

$ABCD$ – shartda romb edi, ya’ni $AB = BC = CAD$ bundan, $ABCD$ kvadrat ekanligi kelib chiqadi.

18.11. A, B, Q **nuqtalar** α **tekislikka tegishli,** M **nuqta esa unga tegishli emas va** $MQ \perp \alpha$. MA, AQ, MQ, BQ, MB **kesmalarning qaysi biri a) perpendikulyar; b) og‘ma; c) og‘ma proyeksiyasi ekanini aniqlang.**



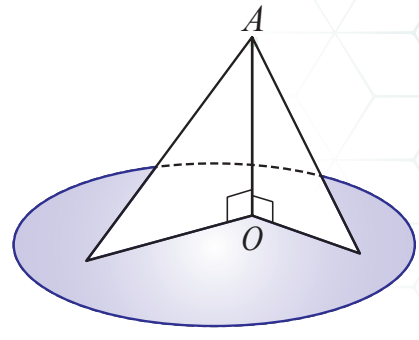
$A \in \alpha,\ B \in \alpha,\ Q \in \alpha,\ M \notin \alpha,\ MQ \perp \alpha.$

a) perpendikulyar: $AQ \perp MQ,\ BQ \perp MQ.$

b) og‘ma: $MA,\ MB.$

c) og‘ma proyeksiyasi: $AQ,\ BQ.$

18.12. A **nuqtadan α tekislikka** AB **va** AC **og‘malar va** AO **perpendikulyar o‘tkazilgan. Agar** $AB = 2{,}5\ cm,\ AC = 3\ cm$ **bo‘lsa, og‘malarning proyeksiyalarini o‘zaro taqqoslang.**



Berilgan: $AB = 2{,}5\ cm;\ AC = 3\ cm.$

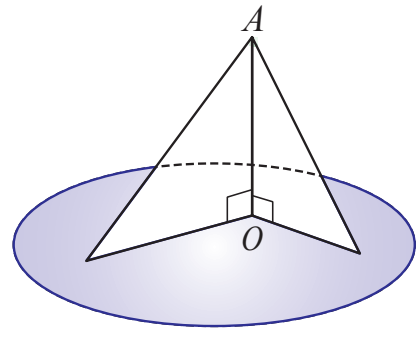
Taqqoslash kerak CO va OB ni $3^2 - AO^2 > 2{,}5^2 - AO^2;$

$CO^2 = AC^2 - AO^2;\quad 9^2 - AO^2 > 6{,}25^2 - AO^2;$

$OB^2 = AB^2 - AO^2;\quad CO^2 > OB^2.$

Uy vazifasi

18.13. Nuqtadan tekislikka ikkita og‘ma tushirilgan. Agar og‘malarning biri ikkinchisidan $26\ cm$ **uzun, proyeksiyalari esa** $12\ cm$ **va** $40\ cm$ **bo‘lsa, bu og‘malarning uzunliklarini toping.**



Berilgan: $AC = x + 26;\ AB = x;\ CO = 40\ cm;$

$OB = 12\ cm;$ Topish kerak: $AC,\ AB - ?$

$(x + 26)^2 - 40^2 = AO^2;\quad x^2 - 122 = AO^2;$

$(x + 26)^2 - 40^2 = x^2 - 122;$

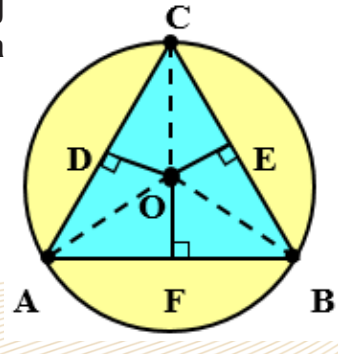
$x^2 + 52x + 676 - 1600 = x^2 - 144;$

$52x - 924 = -144;\qquad 52x = -144 + 924;$

$52x = 780;\quad x = 780 : 52;\quad x = 15;\quad AB = 15\ cm;\quad AC = 15 + 26 = 41.$

Javob: $15\ cm;\ 41\ cm.$

18.14. Uchburchakka tashqi chizilgan aylana markazidan uchburchak tekisligiga perpendikulyar to‘g‘ri chiziq o‘tkazilgan. Bu to‘g‘ri chiziqning har bir nuqtasi uchburchak uchlaridan baravar uzoqlikda yotishini isbotlang.



$OD \perp AC,\ OE \perp BC,\ OF \perp AB.$

$r = OD = OE = OF,\quad R = AO = BO = CO.$

$AD = AF,\ BF = BE,\ CE = CD.$

$AF = FB,\ BE = EC,\ AD = DC.$

6-DARS. FAZODA PERPENDIKULYAR, OG‘MA VA MASOFA

I. Standartlar:

– M10.GO‘.GSH.11. Fazoda tekislikka tushirilgan perpendikulyar va og‘ma haqida tushunchaga ega bo‘ladi;

– M10.GO‘.MM.12.Fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni amaliy masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma haqida tushunchaga ega bo‘lish;

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni bilish.

Ko‘nikmalar:

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma orasidagi bog‘liqlikni bilish va amaliy masalalar yechishda qo‘llay olish.

III. Dars mazmunining qisqacha tavsifi:

– fazoda tekislikka tushirilgan perpendikulyar va og‘ma. Nuqtadan tekislikkacha bo‘lgan masofa. To‘g‘ri chiziqdan unga parallel bo‘lgan tekislikkacha bo‘lgan masofa. Parallel tekisliklar orasidagi masofa. Ayqash to‘g‘ri chiziqlar orasidagi masofa.

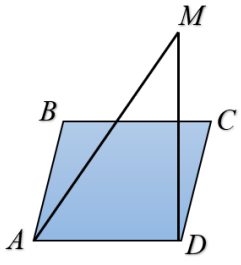
IV. Dars ashyolari va ko‘rgazmali qurollar:

– g‘isht – 1 dona; Turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Tekislikka tushirilgan perpendikulyarga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: 7
Bilimlarni boyitish va mustahkamlash	Fazoda tekislikka tushirilgan perpendikulyar va og‘ma	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 7 Amaliy mashq va tatbiq: 18.15
	Nuqtadan tekislikkacha bo‘lgan masofa. To‘g‘ri chiziqdan unga parallel bo‘lgan tekislikkacha masofa	Darslik bilan ishlash	Amaliy mashq va tatbiq: 18.16
	Parallel tekisliklar orasidagi masofa. Ayqash to‘g‘ri chiziqlar orasidagi masofa	Darslik bilan ishlash	Amaliy mashq va tatbiq: 18.17
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 18.18
Uyga vazifa	Amaliy mashq va tatbiq: 18.17, 18.18		

18.15. Yuzi: a) $21\ cm^2$; b) $96\ cm^2$; c) $44\ cm^2$; d) $69\ cm^2$; e) $156\ cm^2$ bo‘lgan $ABCD$ kvadrat tekisligiga uzunligi $10\ cm$ bo‘lgan DM perpendikulyar tushurilgan. MA og‘maning uzunligini toping.



Berilgan: a) $S = a^2 = 21\ cm^2;\ DM = 10\ cm.$

Topish kerak: $MA=?$

$MA^2 = AD^2 + MD^2;\quad MA = \sqrt{21 + 100} = 11\ cm.$

Javob: $MA = 11\ cm.$

b) Berilgan: $S = a^2 = 96\ cm^2;\quad DM = 10\ cm.$

Topish kerak: $MA = ?$

$MA^2 = AD^2 + MD^2;\quad MA = \sqrt{96 + 100} = 14\ cm.$

Javob: $MA = 14\ cm.$

c) Berilgan: $S = a^2 = 44\ cm^2;\quad DM = 10\ cm.$ Topish kerak: $MA = ?$

$MA^2 = AD^2 + MD^2;\quad MA = \sqrt{44+100}=12\ cm.$

Javob: $MA = 12\ cm.$

d) Berilgan: $S = a^2 = 69\ cm^2;\quad DM = 10\ cm.$ Topish kerak: $MA = ?$

$MA^2 = AD^2 + MD^2;\quad MA = \sqrt{69 + 100} = 13\ cm.$

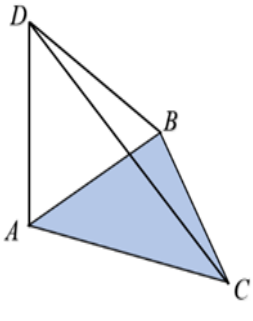
Javob: $MA = 13\ cm.$

e) Berilgan: $S = a^2 = 156\ cm^2;\ DM = 10\ cm.$ Topish kerak: $MA = ?$

$MA^2 = AD^2 + MD^2;\quad MA = \sqrt{(156 + 100)} = 16\ cm.$

Javob: $MA = 16\ cm.$

18.16. To‘g‘ri burchagi C bo‘lgan ABC uchburchakning o‘tkir burchagi uchidan uchburchak tekisligiga perpendikulyar AD to‘g‘ri chiziq o‘tkazilgan. Agar $AC = c$, $BC = b$ va $AD = c$ bo‘lsa, D nuqtadan B va C uchlargacha bo‘lgan masofalarni toping.



Berilgan: $AC = c,\quad BC = b,\quad AD = c.$

Topish kerak: $BD = ?\quad CD = ?$

$CD^2 = AC^2 + AD^2 = c^2 + c^2 = 2c^2;\qquad CD = \sqrt{2}\,c.$

$AB^2 = BC^2 + AC^2 = b^2 + c^2;$

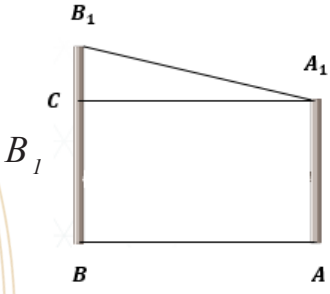
$BD^2 = AD^2 + AB^2 = c^2 + b^2 + c^2 = b^2 + 2c^2;$

$BD = \sqrt{b^2 + 2c^2}.$

Javob: $CD = \sqrt{2}c;\quad BD = \sqrt{b^2 + 2c^2}.$

Uy vazifasi

18.17. Bir-biridan 4,2 m uzoqlikda bo‘lgan vertikal ustunlarning yuqori uchlari to‘sin bilan tutashtirilgan. Ustunlarning balandliklari 5,8 m va 4,1 m bo‘lsa, to‘sin uzunligini toping.



$AB = 4{,}2\ m;\ AA_1 = 4{,}1\ m;\ BB_1 = 5{,}8\ m.\ A_1B_1 = ?$

$AA_1 = BC = 4{,}1\ m;\quad A_1C = AB = 4{,}2\ m;$

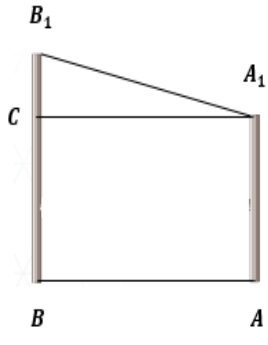
$C = BB_1 - BC = 5{,}8\ m - 4{,}1\ m = 1{,}7\ m;$

$$A_1B_1 = \sqrt{A_1C^2 + B_1C^2} = \sqrt{(4{,}2)^2 + (1{,}7)^2} =$$

$$= \sqrt{17{,}64 + 2{,}89} = \sqrt{20{,}53}\ m.$$

Javob: $\sqrt{20{,}53}\ m.$

18.18. 20 m uzunlikdagi telefon simi simyog‘ochga yer sathidan 8 m balandlikda mahkamlangan va undan balandligi 18 m bo‘lgan ko‘pqavatli uy tomiga tarang tortilgan. Uy bilan ustun orasidagi masofani toping.



$A_1B_1 = 20\ m;\ AA_1 = 8\ m;\ BB_1 = 18\ m.\ A_1C = ?$

$AA_1 = BC = 8\ m;\quad A_1C = AB = 4{,}2\ m;$

$B_1C = BB_1 - BC = 18\ m - 8\ m = 10\ m;$

$$A_1C = AB = \sqrt{A_1B_1^{\,2} - B_1C^2} = \sqrt{20^2 - 10^2} =$$

$$= \sqrt{400 - 100} = \sqrt{300} = 10\sqrt{3}\ m.$$

Javob: $10\sqrt{3}\ m$

7-DARS. UCH PERPENDIKULYAR HAQIDAGI TEOREMA

I. Standartlar:

– M10.GO‘.GSH.12. Uch perpendikulyarlar haqidagi teorema haqida ma’lumotga ega bo‘ladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– uch perpendikulyarlar haqidagi teoremani bilish;

Ko‘nikmalar:

– uch perpendikulyarlar haqidagi teoremani amaliy masalar yechishda qo‘llay olish.

III. Dars mazmunining qisqacha tavsifi:

– uch perpendikulyarlar haqidagi teorema va unga teskari teorema.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Perpendikulyar chiziqlarga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: 1
Bilimlarni boyitish va mustahkamlash	Uch perpendikulyarlar haqidagi teorema	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 19.1, 19.2
	Uch perpendikulyarlar teoremasiga teskari teorema	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 19.3, 19.4
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 19.5, 19.6
Uyga vazifa	Amaliy mashq va tatbiq: 19.7, 19.8		

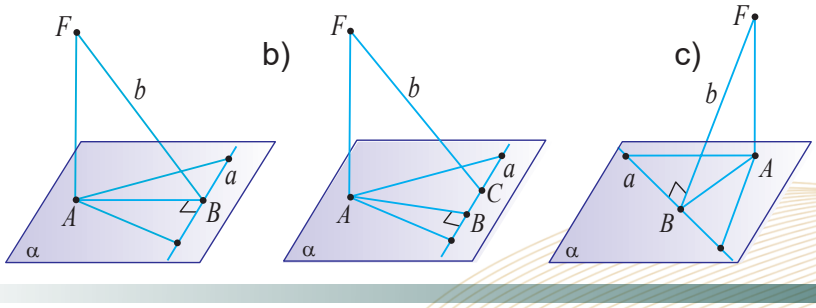
19.2. Rasmda $AF \perp \alpha$. a va b to‘g‘ri chiziqlarning o‘zaro joylashuvini aniqlang.

a) $\begin{cases} AF \perp \alpha \\ AB \perp a \end{cases} \rightarrow b \perp a$ uch perpendikulyarga ko‘ra.

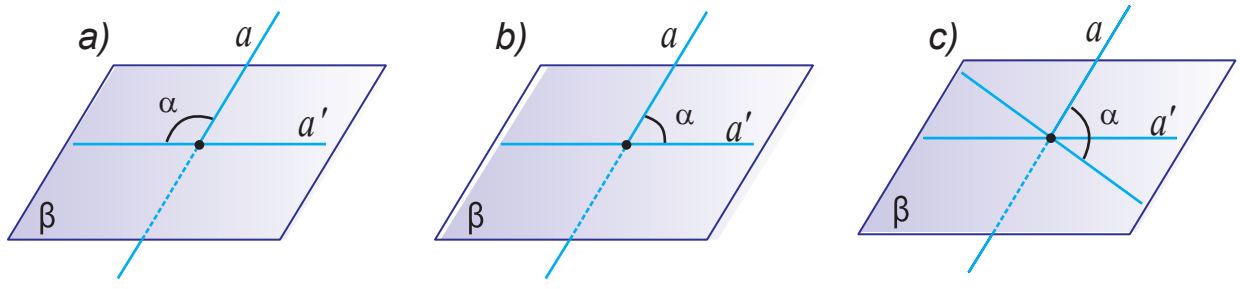
b) $\begin{cases} AF \perp \alpha \\ AB \perp a \end{cases} \rightarrow FB \perp a; \quad FC = b \otimes a.$

c) $\begin{cases} AF \perp \alpha \\ AB \perp a \end{cases} \rightarrow AB = b; \quad AB \perp a; \quad b \perp a.$

a) b) c)



19.3. Rasmda a' to‘g‘ri chiziq – a to‘g‘ri chiziqning β tekislikdagi proyeksiyasi. Rasmlarning qaysi birida a to‘g‘ri chiziq va β tekislik orasidagi α burchak to‘g‘ri ko‘rsatilgan?



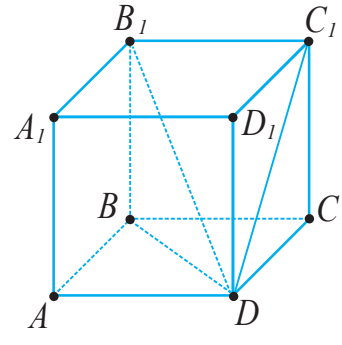
a) to‘g‘ri ; b) to‘g‘ri ; c) noto‘g‘ri.

19.4. Rasmda $ABCDA_1B_1C_1D_1$ kub berilgan. a) DD_1C_1C yoqning DC_1 diagonali va $ABCD$ asos tekisligi orasidagi; b) kubning B_1D diagonali va $ABCD$ asos tekisligi orasidagi; c) kubning B_1D diagonali va DD_1C_1C yoq tekisligi orasidagi burchakni aniqlang.

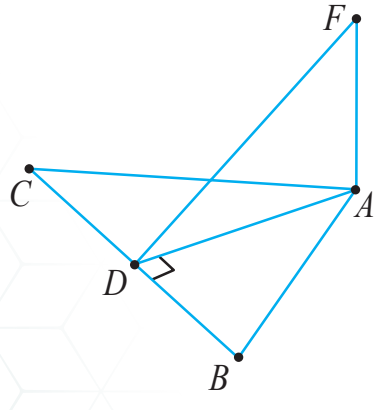
a) DD_1C_1C yoqning DC_1 diagonali va $ABCD$ asos tekisligi orasidagi burchagi $\alpha = \angle CDC_1$;

b) kubning B_1D diagonali va $ABCD$ asos tekisligi orasidagi burchagi $\alpha = \angle BDB_1$;

c) kubning B_1D diagonali va DD_1C_1C yoq tekisligi orasidagi burchagi $\alpha = \angle B_1DC_1$.



19.5. Rasmlarga doir masalalar tuzing va ularni yeching.



Masala: rasmda $AD \perp BC$ va $FA \perp \Delta ABC$ bo‘lsa, FD va BC o‘zaro joylashuvi qanday?

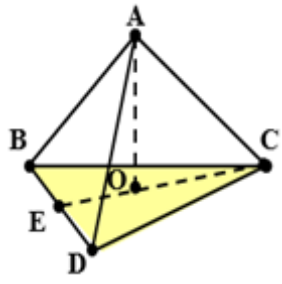
Javob: $FD \perp BC$.

Masala: rasmda $ABCD$ romb $MD \perp ABCD$ bo‘lsa, hamda O-$ABCD$ romb diagonallari kesishish nuqtasi bo‘lsin MO va AC ning o‘zaro joylashuvi qanday?

Javob: $MO \perp AC$.

Uy vazifasi

19.8. A nuqta tomoni a ga teng bo‘lgan teng tomonli uchburchakning uchlaridan a masofada yotadi. A nuqtadan uchburchak tekisligigacha bo‘lgan masofani toping.



$AB = AC = AD = a;\quad BC = CD = BD = a;\quad AO = ?$

$CE = \sqrt{3}/2 \cdot a;\quad OC = 2/3 \cdot CE = 2/3 \cdot \sqrt{3}/2 \cdot a = a/\sqrt{3};$

$AO = \sqrt{(AC^2 - OC^2)} = \sqrt{(a^2 - a2/3)} = a\sqrt{(2/3)}.$

Javob: $AO = a \cdot \sqrt{2}/3.$

8-DARS. UCH PERPENDIKULYAR HAQIDAGI TEOREMA

I. Standartlar:

– M10.GO‘.GSH.12. Uch perpendikulyarlar haqidagi teorema haqida ma’lumotga ega bo‘ladi;

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– uch perpendikulyarlar haqidagi teoremani bilish;

Ko‘nikmalar:

– uch perpendikulyarlar haqidagi teoremani amaliy masalalar yechishda qo‘llay olish;

III. Dars mazmunining qisqacha tavsifi:

– uch perpendikulyarlar haqidagi teorema va unga teskari teorema.

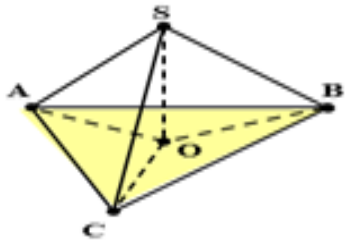
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Perpendikulyar chiziqlarga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: 3
Bilimlarni boyitish va mustahkamlash	Uch perpendikulyarlar haqidagi teorema	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 19.9, 19.10
	Uch perpendikulyarlar teoremasiga teskari teorema	Darslik bilan ishlash	Amaliy mashq va tatbiq: 19.11, 19.12
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 19.13, 19.14, 19.15
Uyga vazifa	Amaliy mashq va tatbiq: 19.16, 19.17		

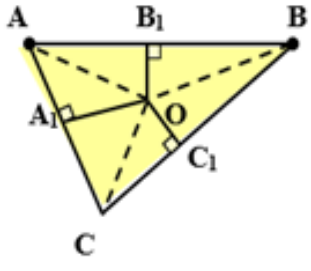
19.9. a **tekislikning tashqarisidagi** S **nuqtadan unga uchta teng** SA, SB, SC **og‘malar va** SO **perpendikulyar o‘tkazilgan. Perpendikulyarning** O **asosi** ABC **uchburchakka tashqi chizilgan aylananing markazi bo‘lishini isbotlang.**



$SA = SB = SC = l;$

$SO \perp AO, \quad SO \perp BO, \quad SO \perp CO;$

$SO = h; \quad AO = OB = OC = \sqrt{l^2 - h^2}.$



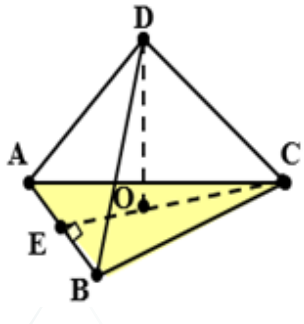
$OA_1 \perp AC, \quad OB_1 \perp AB, \quad OC_1 \perp BC;$

ΔAOB da $AO = OB$ bo‘lgani uchun $A_1 = B_1 B$ bundan

B_1 nuqta AB ning o‘rtasi ekanligi kelib chiqadi.

Huddi shunday, A_1 nuqta AC tomon, C_1 nuqta BC tomonning o‘rtasi ekani kelib chiqadi. Demak, $B_1 O;\ C_1 O;\ A_1 O$ lar ΔABC ning o‘rta perpendikulyarlari ekan va O nuqta o‘rta perpendikulyarlar kesishgan nuqta. Bundan, O nuqta ABC uchburchakka tashqi chizilgan aylana markazi ekani kelib chiqadi.

19.10. Teng tomonli uchburchakning tomonlari 3 m ga teng. Uchburchak har bir uchidan 2 m masofada bo‘lgan nuqtadan uchburchak tekisligigacha bo‘lgan masofani toping.



Berilgan: ABC muntazam uchburchak.

$AB = BC = AC = 3\ m; \quad AD = BD = CD = 2\ m.$

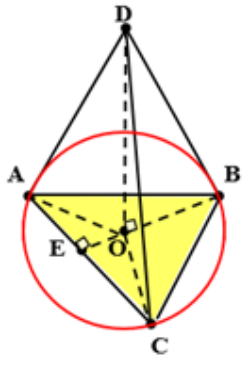
Topish kerak: $DO = ? \quad CE = (a\sqrt{3})/2 = (3\sqrt{3})/2;$

$OC = 2/3 \cdot CE = 2/3 \cdot (3\sqrt{3})/2 = (6\sqrt{3})/6 = \sqrt{3};$

$DO = \sqrt{CD^2 - OC^2} = \sqrt{2^2 - \sqrt{3}^2} = \sqrt{4 - 3} = \sqrt{1} = 1\ m.$

Javob: $DO = 1\ m.$

19.11. Teng yonli uchburchak asosi va balandligi 4 m ga teng. Berilgan nuqta uchburchak tekisligidan 6 m masofada va uning uchlaridan bir xil masofada yotadi. Shu masofani toping.



Berilgan: $AC = BE = 4\ m;\quad AD = BD = CD = 6\ m;$

Topish kerak: $DO = ?$

$S_{ABC} = 1/2 \cdot AC \cdot BE = 1/2 \cdot 4\ m \cdot 4\ m = (16\ m^2)/2 = 8\ m^2;$

$R = OA = OB = OC;\quad AE = EC = AC/2 = (4\ m)/2 = 2\ m;$

$EO = EB - OB = 4 - R;\quad \Delta CEO$ dan $EC^2 + EO^2 = CO^2;$

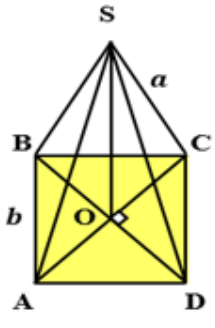
$2^2 + 4 - R^2 = R^2;\quad 4 + 16 - 8R + R^2 = R^2;\quad 20 - 8R = 0;$

$8R = 20;\quad R = 20/8 = 5/2\ m;\quad R = OA = OB = OC = 5/2\ m;$

$DO = \sqrt{(BD^2 - OB^2)} = \sqrt{(6^2 - (5/2)^2)} = \sqrt{(36 - 25/4)} = \sqrt{(144 - 25)/4)} = \sqrt{119}/2\ m.$

Javob: $DO = \sqrt{119}/2\ m.$

19.12. A nuqtadan kvadratning uchlarigacha bo‘lgan masofa a ga teng. Kvadratning tomoni b ga teng bo‘lsa, A nuqtadan kvadrat tekisligigacha bo‘lgan masofani toping.



Berilgan: $SA = SB = SC = SD = a;$

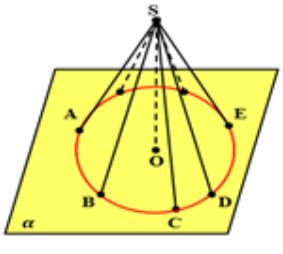
$AB = BC = CD = AD = b.\qquad SO = ?$

$AO = AC/2 = (b\sqrt{2})/2;\ SO = \sqrt{AS^2 - AO^2} = \sqrt{a^2 - ((b\sqrt{2})/2)^2} =$

$= \sqrt{a^2 - b^2/2)} = \sqrt{2a^2 - b^2)}/2.$

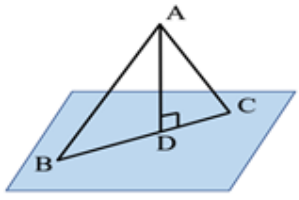
Javob: $AO = \sqrt{2a^2 - b^2)}/2).$

19.13. Berilgan nuqtadan tekislikka o‘tkazilgan berilgan uzunlikdagi og‘malar asoslarining geometrik o‘rnini toping.



Berilgan S nuqtadan tekislikka o‘tkazilgan berilgan uzunlikdagi og‘malar asoslarining geometrik o‘rni aylanadagi nuqtalardir.

19.14. Berilgan nuqtadan tekislikka uzunliklari 10 *cm* va 17 *cm* bo‘lgan ikkita og‘ma o‘tkazilgan. Bu og‘malar proyeksiyasining ayirmasi 9 cm ga teng. Og‘malar proyeksiyalarini toping.



Berilgan: $AB = 17\ cm;\ AC = 10\ cm;$

$BD - CD = 9\ cm;$ Topish kerak: $BD,\ DC - ?$

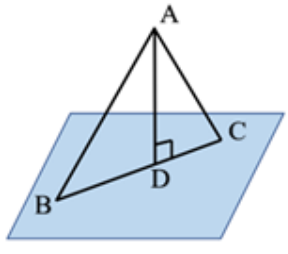
$AB^2 - BD^2 = AC^2 - CD^2;$

$17^2 - BD^2 = 10^2 - (BD - 9)^2;$

$289 - BD^2 = 100 - BD^2 + 18BD - 81;$ $18BD = 289 - 100 + 81$

$18BD = 270;$ $BD = 15\ cm;$ $DC = 6\ cm.$ **Javob:** $15\ cm;\ 6\ cm.$

19.15. Nuqtadan tekislikka ikkita og‘ma o‘tkazilgan. Agar: a) ulardan biri ikkinchisidan 26 cm uzun, og‘malarning proyeksiyalari 12 cm va 40 cm bo‘lsa; b) og‘malar uzunliklari 1 : 2 nisbatda bo‘lib, ularning proyeksiyalari 1 cm va 7 cm ga teng bo‘lsa, og‘malarning uzunliklarini toping.



1) Berilgan: $AB = AC+26\ cm;$ $BD = 40\ cm;$

$CD = 12\ cm.$ Topish kerak: $AB,\ AC$ - ?

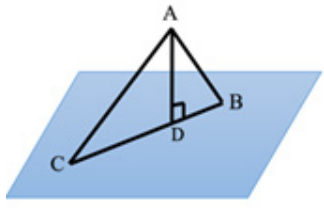
$AB^2 - BD^2 = AC^2 - CD^2;$

$(AC+26)^2 - 40^2 = AC^2 - 12^2;$

$AC^2 + 52AC + 676 - 1600 = AC^2 - 144;$

$52AC = 780;$ $AC=15;$ $AB=15+26=41.$

Javob: $15\ cm;\ 41\ cm.$



2) Berilgan: $AB : AC = 1 : 2;$ $AC = 2AB;$

$BD = 1\ cm;$ $CD = 7\ cm.$

Topish kerak: AB,AC - ?

$\begin{cases} CD^2 + AD^2 = AC^2 \\ BD^2 + AD^2 = AB^2 \end{cases} \rightarrow CD^2 - BD^2 = AC^2 - AB^2;$

$7^2 - 1^2 = (2AB)^2 - AB^2;$ $49 - 1 = 4AB^2 - AB^2;$ $3AB^2 = 48;$

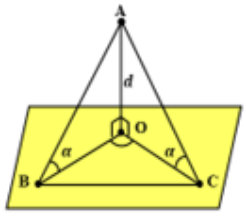
$AB^2 = 48/3;$ $AB^2 = 16;$ $AB = \sqrt{16};$ $AB = 4\ cm;$

$AC = 2 \cdot AB = 2 \cdot 4\ cm = 8\ cm.$

Javob: $AB = 4\ cm;\ AC = 8\ cm.$

Uy vazifasi

19.16. a tekislikdan d masofada yotgan A nuqtaga tekislik bilan $30°$ burchak tashkil qiluvchi AB va AC og‘malar o‘tkazilgan. Ularning a tekislikka proyeksiyalari o‘zaro 120° li burchak tashkil qiladi. BC kesma uzunligini toping.



$d = AO;\quad AB = AC;\quad \alpha = 30°;\quad \angle BOC = 120°;$

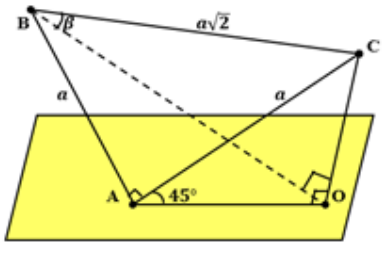
$\angle AOB = \angle AOC = 90°;\quad BC = ?$

$BO = OC;\quad tg\alpha = d/BO;\quad tg30° = d/BO;\quad 1/\sqrt{3} = d/BO;$

$BO = d \cdot \sqrt{3};\quad BC = BO\cdot\sqrt{3} = d \cdot \sqrt{3} \cdot \sqrt{3} = 3d.$

Javob: $BC=3d.$

19.17. Agar to‘g‘ri burchakli va teng yonli uchburchakning katetlaridan biri tekislikka tegishli, ikkinchisi esa u bilan 45° li burchak tashkil qilsa, gipotenuza bu tekislik bilan 30° li burchak tashkil qilishini isbotlang.



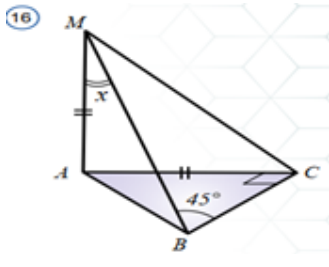
$AB = AC = a;\quad BC = a\sqrt{2};\quad AO = OC=a/\sqrt{2};$

$sin\beta = OC/BC = (a/\sqrt{2})/(a\sqrt{2}) = a/(a\sqrt{2}\cdot\sqrt{2}) = 1/2;$

$sin\beta = 1/2;\quad \beta = 30°.$

Javob: $\beta=30°.$

19.18. ABC uchburchak tekisligiga MA perpendikulyar tushirilgan. $\angle MBC = 45°$. $\angle ACB = 90°$. $MA = AC$. $\angle AMB$ ni toping.



$\Delta ABC \perp MA;\quad \angle MBC = 45°;\quad \angle ACB = 90°;$

$MA = AC = a.\quad x = \angle AMB = ?$

$\begin{cases} MA \perp \Delta ABC \\ AC = BC \end{cases} \rightarrow\quad MC \perp BC;$

Uch perpendikulyarga ko‘ra, $MA = AC$

$MC = \sqrt{MA2 + MC^2} = \sqrt{a^2 + a^2} = \sqrt{(2a^2)} = a\sqrt{2}\quad MC = a\sqrt{2};$

$\angle MBC = 45°;\quad \angle MCB = 90° \rightarrow \angle BMC = 45°;$ demak, $MC=BC=a\sqrt{2};$

$AB = \sqrt{AC^2+BC^2} = \sqrt{a^2 + 2a^2} = \sqrt{3a^2} = a\sqrt{3};\quad tg\angle AMB = tg\, x;$

$tgx = AB/MA=(a\sqrt{3})/a = \sqrt{3};\quad tgx = \sqrt{3};\quad x = 60°;\quad \angle AMB = 60°.$

Javob: $\angle AMB = 60°.$

9-DARS. FAZODA TEKISLIKLANING PERPENDIKULYARLIGI

I. Standartlar:

– M10.GO‘.MM.14. Fazoda tekisliklarning perpendikulyarligi haqidagi teoremani qo‘llay oladi;

– M10.GO‘.MM.15. Ikki yoqli burchakning chiziqli burchagini chizmada tasvirlay oladi va masalalar yechishda hisoblay oladi;

– M10.GO‘.MM.16. Tekisliklar orasidagi burchakni chizmada tasvirlay oladi va hisoblay oladi;

– M10.GO‘.MM.17.Fazoda perpendikulyar tekisliklar haqidagi teoremani masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– fazoda tekisliklarning perpendikulyarligi haqidagi teoremani bilish;

– ikki yoqli burchakning chiziqli burchagini chizmada tasvirlashni bilish.

Ko‘nikmalar:

– fazoda tekisliklarning perpendikulyarligi haqidagi teoremani masalalar yechishda qo‘llay olish;

– tekisliklar orasidagi burchakni chizmada tasvirlash va hisoblay olish.

III. Dars mazmunining qisqacha tavsifi:

– ikki yoqli burchak va uning elementlari. Ikki yoqli burchakning chiziqli burchagi. Tekisliklar orasidagi burchak. Fazoda perpendikulyar tekisliklar.

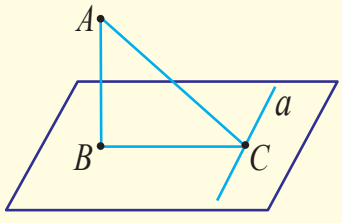
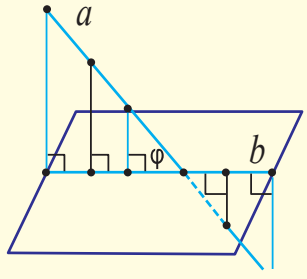
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

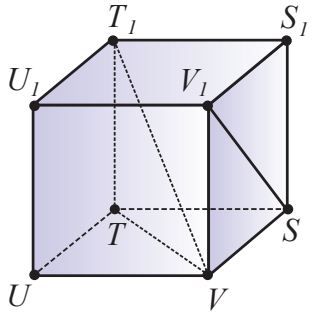
V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Fazoda tekisliklarning perpendikulyarligiga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: Qanday tekisliklar perpendikulyar deyiladi?
Bilimlarni boyitish va mustahkamlash	Ikki yoqli burchak va uning elementlari	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 20.1
	Ikki yoqli burchakning chiziqli burchagi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 20.3
	Tekisliklar orasidagi burchak. Fazoda perpendikulyar tekisliklar	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 20.4
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 20.5. 20.6
Uyga vazifa	Amaliy mashq va tatbiq: 20.7		

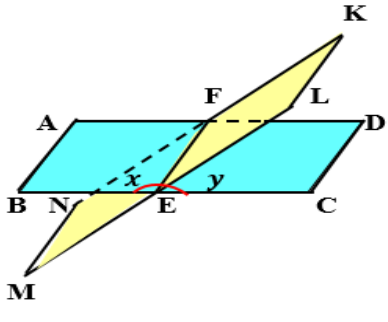
20.1. Jadvalda mavzuning asosiy tayanch ma'lumotlari keltirilgan. Ularni sinchiklab o'rganib chiqing va izohlang.

Uch perpendikulyar haqidagi teorema	To'g'ri chiziq va tekislik orasidagi burchak
	
$AB \perp \alpha$ Agar $a \perp BC$ bo'lsa, $a \perp AC$ bo'ladi. Agar $a \perp AC$ bo'lsa, $a \perp BC$ bo'ladi.	b – a ning α tekislikdagi proyeksiyasi. φ – a va α tekislik orasidagi burchak.

20.3. $STUVS_1T_1U_1V_1$ kubda: a) TVT_1 burchak; b) T_1ST burchak T_1SVT ikki yoqli burchakning chiziqli burchagi bo'ladimi? V_1UTS ikki yoqli burchakning qiymatini toping.



20.4. Ikkita ikki yoqli burchakning bittadan yog'i umumiy, qolgan yoqlari birgalikda tekislikni tashkil qiladi. Bu ikki yoqli burchaklarning yig'indisi 180° ga teng ekanligini isbotlang.



$\angle BEL = x;\ \angle CEL = y;\ \angle BEC = 180°.$

Vertikal burchaklar o'zaro teng.

$\angle BEK = \angle CEM;\ \angle BEM = \angle CEK.$

Qo'shni burchaklar yig'indisi 180° ga teng.

$\angle BEL + \angle CEL = \angle BEC.$

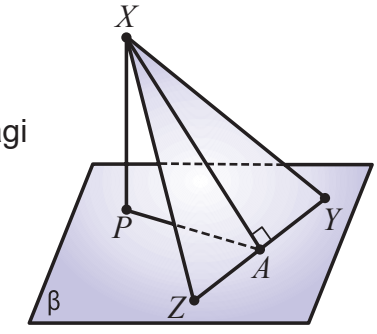
$x + y = 180°.$

20.5. XYZ uchburchakning YZ tomoni β tekislikda yotadi. Uning X uchidan XA balandlik va β tekislikka XP perpendikulyar tushirilgan. XAP burchak $XYZP$ ikki yoqli burchakning chiziqli burchagi ekanligini isbotlang.

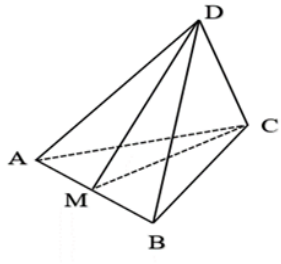
$YZ \in \beta$; $XA \perp YZ$; $XP \perp \beta$.

$AP \in \beta$; $YA = AZ$; $PY = PZ$;

XAP burchak $XYZP$ ikki yoqli burchakning chiziqli burchagi bo‘ladi.



20.6. Uchburchakli $ABCD$ piramidaning CD qirrasi ABC tekislikka perpendikulyar. $AB = BC = AC = 6$ va $BD = 3\sqrt{7}$ bo‘lsa, $DACB$, $DABC$, $BDCA$ ikki yoqli burchakni toping.



$ABCD$ - tetraedr, $CD \perp ABC$, $AB = BC = AC = 6$, $BD = 3\sqrt{7}$. $DACB$ ikki yoqli burchakning chiziqli burchagini aniqlaymiz. ADC va ABC tekisliklar perpendikulyar, u holda $DABC$ ikki yoqli burchak va unga mos chiziqli burchak 90° ga teng.

Endi $DABC$ – ikki yoqli burchakning chiziqli burchagini aniqlaymiz. AB ga perpendikulyar bo‘lgan CM to‘g‘ri chiziq o‘tkazamiz. M va D nuqtalarni tutashtiramiz.

$CD \perp AB$, $CM \perp AB \rightarrow AB \perp DM$

$\angle DMC - DABC$ ikki yoqli burchakning chiziqli burchagi.

$CM = AC \cdot \sin 60^o = 3\sqrt{3}$; $MB = MA = \frac{1}{2} \cdot 6 = 3$.

Pifagor teoremasiga ko‘ra, $DC = \sqrt{BD^2 - BC^2}$;

$$DC = \sqrt{(3\sqrt{7})^2 - 6^2} = \sqrt{63 - 36} = \sqrt{27} = 3\sqrt{3};$$

U holda $tg\angle DMC = \frac{DC}{CM} = \frac{3\sqrt{3}}{3\sqrt{3}} = 1$. $tg\angle DMC = 1$, $\angle DMC = 45^0$.

Endi $BDCA$ ikki yoqli burchakning chiziqli burchagini aniqlaymiz.

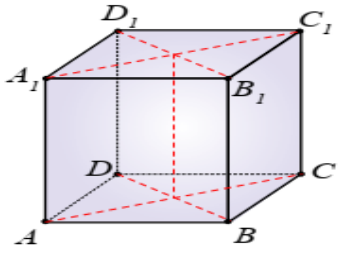
$$BC \perp DC,\ AC \perp DC.$$

U holda, $\angle ABC - BDCA$ ikki yoqli burchakning chiziqli burchagi $\angle ABC = 60^o$.

Javob: $90°$, $45°$, $60°$.

Uy vazifasi

20.7. $ABCDA_1B_1C_1D_1$ **muntazam parallelepipedning** AA_1C_1C **va** BB_1D_1D **diagonal kesimlari o‘zaro perpendikulyar ekanligi isbotlang.**



$$\begin{cases} AC \perp BD \\ A_1C_1 \perp B_1D_1 \end{cases} \rightarrow AA_1C_1C \perp BB_1D_1D.$$

10-DARS. FAZODA TEKISLIKLANING PERPENDIKULYARLIGI

I. Standartlar:

– M10.GO‘.MM.14. Fazoda tekisliklarning perpendikulyarligi haqidagi teoremani qo‘llay oladi;

– M10.GO‘.MM.15. Ikki yoqli burchakning chiziqli burchagini chizmada tasvirlay oladi va masalalar yechishda hisoblay oladi;

– M10.GO‘.MM.16. Tekisliklar orasidagi burchakni chizmada tasvirlay oladi va hisoblay oladi;

– M10.GO‘.MM.17. Fazoda perpendikulyar tekisliklar haqidagi teoremani masalalar yechishda qo‘llay oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– fazoda tekisliklarning perpendikulyarligi haqidagi teoremani bilish;

– ikki yoqli burchakning chiziqli burchagini chizmada tasvirlashni bilish.

Ko‘nikmalar:

– fazoda tekisliklarning perpendikulyarligi haqidagi teoremani masalalar yechishda qo‘llay olish;

– tekisliklar orasidagi burchakni chizmada tasvirlash va hisoblay olish.

III. Dars mazmunining qisqacha tavsifi:

– ikki yoqli burchak va uning elementlari. Ikki yoqli burchakning chiziqli burchagi. Tekisliklar orasidagi burchak. Fazoda perpendikulyar tekisliklar.

IV. Dars ashyolari va ko‘rgazmali qurollar:

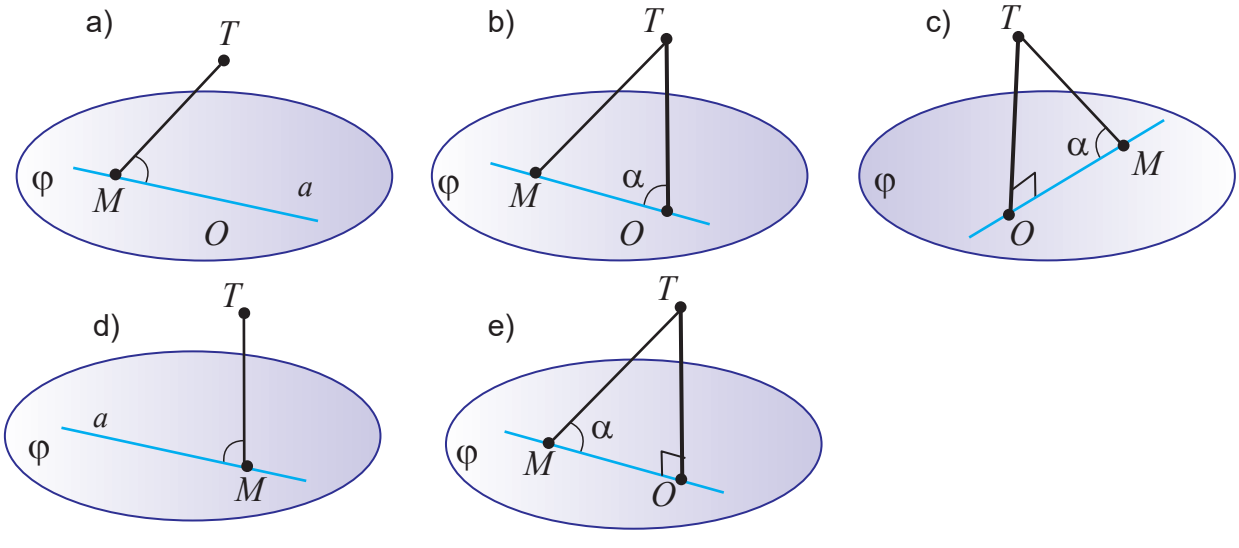
– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar

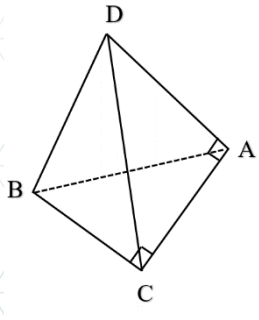
Motivatsiya	Fazoda tekisliklarning perpendikulyarligiga misollar keltiring	Aqliy hujum	Mavzu bo‘yicha savollar: Qanday tekisliklar perpendikulyar deyiladi?
Bilimlarni boyitish va mustahkamlash	Tekisliklarning perpendikulyarlik alomati.	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 20.8
	Tekisliklarning perpendikulyarlik alomatidan kelib chiqadigan natijalar	Darslik bilan ishlash	Amaliy mashq va tatbiq: 20.9, 20.10
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 20.11, 20.12
Uyga vazifa	Amaliy mashq va tatbiq: 20.13, 20.14		

20.8. T **nuqtadan** φ **tekislikka og‘ma tushirilgan** ***(15-rasm)*****. Quyidagi rasmlarning qaysilarida tekislik va og‘ma orasidagi** α ***burchak to‘g‘ri belgilangan?***



Javob: *b)*

20.9. Uchburchakli $ABCD$ **piramidada** DAB, DAC, ACB **burchaklar to‘g‘ri,** $AC = CB = 5$ **va** $DB = 5\sqrt{5}$ **bo‘lsa,** $ABCD$ **ikki yoqli burchagini toping.**



Yechish: *Shartga ko‘ra* DAB, DAC *va* ACB *burchaklar to‘g‘ri burchaklar. U holda Pifagor teoremasiga ko‘ra,*

$$AB = \sqrt{AC^2 + CB^2} = \sqrt{5^2 + 5^2} = \sqrt{50} = 5\sqrt{2};$$

$$AD = \sqrt{DB^2 - AB^2} = \sqrt{(5\sqrt{5})^2 - (5\sqrt{5})^2} = \sqrt{75} = 5\sqrt{3};$$

$$DB = \sqrt{AD^2 + AB^2} = \sqrt{(5\sqrt{3})^2 - (5\sqrt{2})^2} = \sqrt{125} = 5\sqrt{5};$$

$$DC = \sqrt{AC^2 + DA^2} = \sqrt{5^2 - (5\sqrt{3})^2} = \sqrt{100} = 10;$$

$\triangle DBC$: $DB^2 = DC^2 + BC^2 \rightarrow \angle DBC = 90°$;

$BC \perp AC$, $BC \perp DC$.

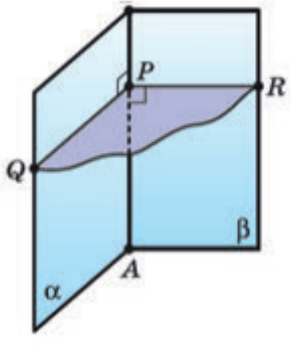
U holda, $BC \perp ADC$ tekislikka perpendikulyar.

Demak, $\angle ACD - ABCD$ ikki yoqli burchakning chiziqli burchagi bo‘ladi.

$$cos\angle ACD = \frac{AC}{DC} = \frac{5}{10} = \frac{1}{2}; \quad \angle ACD = 60°.$$

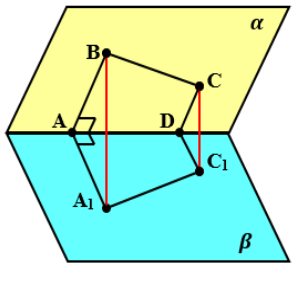
Javob: $ABCD$ ikki yoqli burchakning qiymati $60°$ ga teng.

20.10. Ikki yoqli burchak chiziqli burchagining tekisligi uning har bir yog‘ida perpendikulyar ekanligini isbotlang.



Ikki yoqli burchak qirrasining ixtiyoriy P nuqtasidan uning yoqlarida yotuvchi va bu qirraga perpendikulyar bo‘lgan PQ va PR nurlar chiqaramiz. Bu nurlar hosil qilgan QPR burchak ikki yoqli α va β burchaklarning chiziqli burchagi bo‘ladi.
$PQ \perp PR$ bo‘lgani uchun $\alpha \perp \beta$ ekanligi kelib chiqadi.

20.11. Ikki yoqli burchakning bitta yog‘ida yotgan ikkita nuqta uning qirrasidan, mos ravishda, 51 cm va 34 cm uzoqlikda yotibdi. Bu nuqtalarning birinchisi boshqa yog‘idan 15 cm uzoqlikda yotganligi ma’lum bo‘lsa, shu yoqdan ikkinchi nuqtagacha bo‘lgan masofani toping.



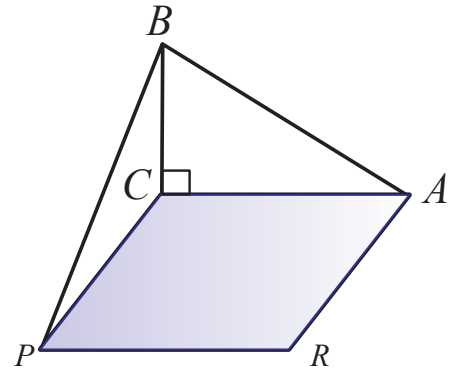
$AB = 51\ cm$; $CD = 34\ cm$; $CC_1 = 15\ cm$. $BA_1 = ?$

$$\Delta ABA_1 \sim \Delta DCC_1; \quad \frac{CC_1}{CD} = \frac{BA_1}{AB}; \quad \frac{15}{34} = \frac{BA_1}{51};$$

$$BA_1 = \frac{15 \cdot 51}{34} = \frac{15 \cdot 3}{2} = \frac{45}{2} = 22{,}5\ cm.$$

Javob: $BA_1 = 22{,}5\ cm$.

20.12. ABC **to‘g‘ri burchakli uchburchak** $(\angle C = 90°)$ **va** $ACPR$ **kvadrat tekisliklari o‘zaro perpendikulyar. Kvadrat tomoni 6 cm, uchburchak gipotenuzasi 10 cm.** BP **kesma uzunligini toping.**



$\triangle ABC \perp ACPR;$ $AC = AR = CP = PR = 6$ cm;

$AB = 10$ cm. $BP = ?$

$BC^2 = AB^2 - AC^2 = 10^2 - 6^2 = 100 - 36 = 64;$

$BC = \sqrt{64} = 8$ cm;

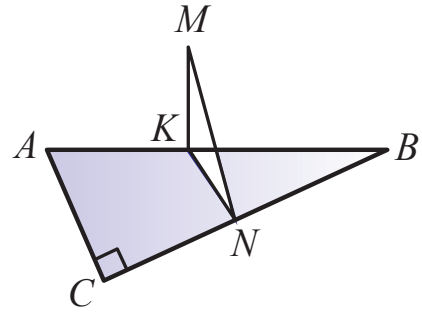
$BP^2 = CP^2 + BC^2 = 6^2 + 8^2 = 36 + 64 = 100;$

$BP = \sqrt{100} = 10$ cm;

Javob: $BP = 10$ cm.

Uy vazifasi

20.13. MK **kesma to‘g‘ri burchakli** ABC **uchburchak** $(\angle C = 90°)$ **tekisligiga perpendikulyar.** $KN \parallel AC$, $AK = KB$, $AC = 12$ cm, $MK = 8$ cm **bo‘lsa,** MN **kesma uzunligini toping.**



$KN \parallel AC$, $AK = KB$, $AC = 12$ cm, $MK = 8$ cm. $MN = ?$

$KN \parallel AC$ va $AK = KB$ ekanidan $KN \triangle ABC$ ning o‘rta chizig‘i ekanligi kelib chiqadi.

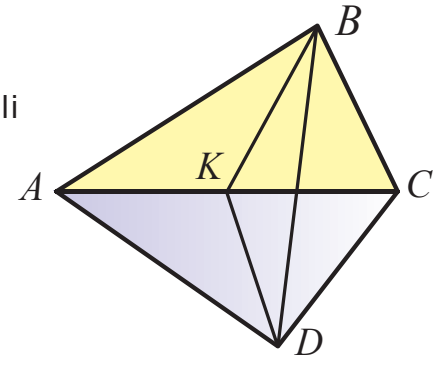
Demak, $KN = \frac{1}{2} AC;$ $KN = \frac{12}{2} = 6;$

$\triangle MKN$ to‘g‘ri burchakli uchburchak. Demak, $MN^2 = MK^2 + KN^2;$

$$MN = \sqrt{8^2 + 6^2} = \sqrt{64 + 36} = \sqrt{100} = 10;$$ $MN = 10$ cm.

Javob: 10 cm.

20.14. ABC **va** ADC **teng yonli uchburchaklar tekisliklari perpendikulyar.** AC **ularning umumiy asosi.** BK **kesma** ABC **uchburchak medianasi.** $BK = 8$ cm, $DK = 15$ cm **bo‘lsa,** BD **kesma uzunligini toping.**



$BK = 8$ cm, $DK = 15$ cm. $BD = ?$

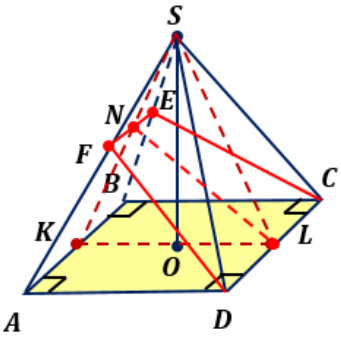
$\triangle ABC \perp \triangle ADC$ dan $\triangle BKD$ to‘g‘ri burchakli uchburchak ekanligi kelib chiqadi. Demak,

$BD^2 = BK^2 + DK^2 = 8^2 + 15^2 = 64 + 225 = 289;$

$BD = \sqrt{289} = 17$ cm.

Javob: $BD = 17$ cm.

20.15. Muntazam to‘rtburchakli piramida asosining tomoni orqali uning qarshisidagi yon yoqqa perpendikulyar tekislik o‘tkazilgan. Asosining tomoni $a = 30\ cm$, piramidaning balandligi $h = 20\ cm$. Hosil bo‘lgan kesimning yuzini aniqlang.



$EN = NF;$ $KL = BC;$ $CDFE \perp ABS;$

$a = AB = BC = CD = DA = 30\ cm;$

$h = SO = 20\ cm;$ $KO = OL = \frac{a}{2} = \frac{30}{2} = 15\ cm;$

$SK = SL = \sqrt{\left(\frac{a}{2}\right)^2 + h^2} = \sqrt{15^2 + 20^2} =$

$= \sqrt{225 + 400} = \sqrt{625} = 25\ cm;$ $\angle SNL = 90°;$ ΔSKL da

$KL^2 = SL^2 + SK^2 - 2 \cdot SL \cdot SK \cdot \cos\angle KSL;$

$30^2 = 25^2 + 25^2 - 2 \cdot 25 \cdot 25 \cdot \cos\angle KSL;$

$900 = 625 + 625 - 1250 \cdot \cos\angle KSL;$ $1250 \cdot \cos\angle KSL = 1250 - 900;$

$1250 \cdot \cos\angle KSL = 350;$ $\cos\angle KSL = \frac{350}{1250};$ $\cos\angle KSL = \frac{7}{25};$

$\sin\angle KSL = \sqrt{1 - \cos^2\angle KSL} = \sqrt{1 - \left(\frac{7}{25}\right)^2} = \sqrt{1 - \frac{49}{625}} = \sqrt{\frac{576}{625}} = \frac{24}{25};$

$\sin\angle SNL = \frac{NL}{SL};$ $\frac{24}{25} = \frac{NL}{25};$ $NL = 24\ cm;$

$SN = \sqrt{SL^2 - NL^2} = \sqrt{25^2 - 24^2} = \sqrt{625 - 576} = \sqrt{49} = 7\ cm;$

$\Delta SEF \sim \Delta SAB;$ $\frac{AB}{EF} = \frac{SK}{SN};$ $\frac{30}{EF} = \frac{25}{7};$

$EF = \frac{30 \cdot 7}{25} = \frac{6 \cdot 7}{5} = \frac{42}{5} = 8{,}4\ cm;$

$S_{CDFE} = \frac{CD + FE}{2} \cdot NL = \frac{30 + 8{,}4}{2} \cdot 24 = 38{,}4 \cdot 12 = 460{,}8\ cm^2.$

$S_{CDFE} = 460{,}8\ cm^2.$

11-DARS. FAZODA ORTOGONAL PROYEKSIYA VA UNDAN TEXNIKADA FOYDALANISH

I. Standartlar:

– M10.GO‘.GSH.13. Ortogonal proyeksiya haqida tushunchaga ega bo‘ladi;

– M10.GO‘.YM.08. Sodda fazoviy jismlar ortogonal proyeksiyalarni chizmada tasvirlay oladi;

– M10.GO‘.MM.19. Ko‘pburchakning ortogonal proyeksiyasining yuzini topa oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ortogonal proyeksiya haqida bilish;

– sodda fazoviy jismlar ortogonal proyeksiyalarni chizmada tasvirlashni bilish.

Ko‘nikmalar:

– sodda fazoviy jismlar ortogonal proyeksiyalarni chizmada tasvirlay olish;

III. Dars mazmunining qisqacha tavsifi:

– ko‘pburchakning ortogonal proyeksiyasining yuzi. Ortogonal proyeksiyadan texnikada foydalanish.

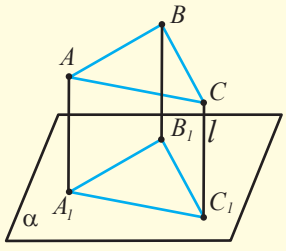
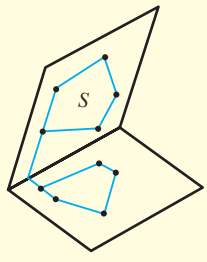
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

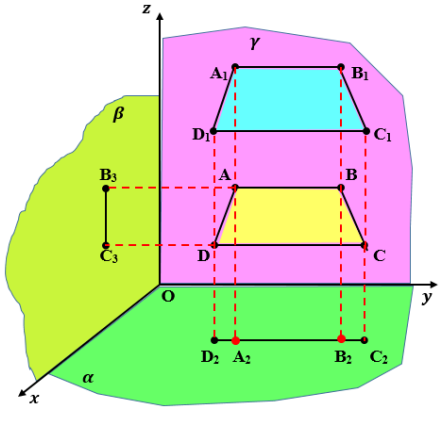
V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Proyeksiyadan texnikada foydalanishga oid misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: Proyeksiyalashga oid misollar keltiring.
Bilimlarni boyitish va mustahkamlash	Ko‘pburchakning ortogonal proyeksiyasining yuzi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 1 Amaliy mashq va tatbiq: 21.1
	Ortogonal proyeksiyadan texnikada foydalanish	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 2 Amaliy mashq va tatbiq: 21.2, 21.3
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 21.4, 21.5
Uyga vazifa	Amaliy mashq va tatbiq: 21.6, 21.7		

21.1. Jadvalda 21-mavzuning asosiy tayanch ma’lumotlari keltirilgan. Ularni sinchiklab o‘rganib chiqing va izohlang.

Fazoda ortogonal proyeksiya	Ko‘pburchak proyeksiyasining yuzi
	 $S_1 = S \cdot cos\varphi$
Ortogonal proyeksiyada: $l \perp \alpha$. l – proyeksiyalash yo‘nalishi; α – proyeksiyalash tekisligi.	S – ko‘pburchak yuzi; S_1 – ko‘pburchak ortogonal proyeksiyasining yuzi; φ – ko‘pburchak va proyeksiya tekisliklari orasidagi burchak.

21.2. Trapetsiyaning ortogonal proyeksiyasi: a) kvadrat; b) kesma; c) to‘g‘ri to‘rtburchak; d) parallelogramm; e) trapetsiya bo‘lishi mumkinmi?



Trapetsiyaning ortogonal proyeksiyasi:

a) kvadrat bo‘lishi mumkin emas.

b) kesma bo‘lishi mumkin.

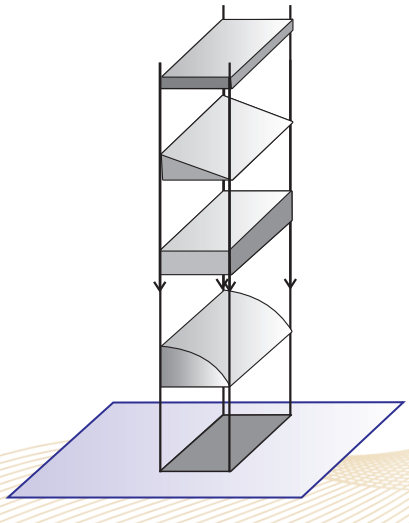
c) to‘g‘ri to‘rtburchak bo‘lishi mumkin emas.

d) parallelogramm bo‘lishi mumkin emas.

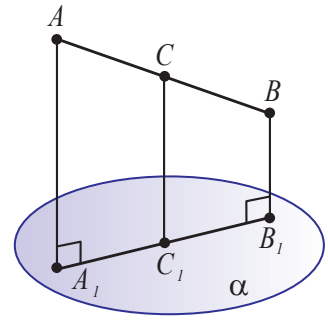
e) trapetsiya bo‘lishi mumkin.

21.3. Rasmga qarab ortogonal proyeksiyasi to‘g‘ri to‘rtburchak bo‘lgan shakllarni ayting.

Javob: barchasining ortogonal proyeksiyasi to‘g‘ri to‘rtburchakdan iborat.



21.4. A_1B_1 kesma AB kesmaning α tekislikka ortogonal proyeksiyasi *(8-rasm)*. Agar $AB = 20\ cm$, $AC = 10\ cm$, $A_1B_1 = 12\ cm$ bo'lsa, B_1C_1 kesma uzunligini toping.



$AB = 20\ cm,\ AC = 10\ cm,\ A_1B_1 = 12\ cm.$

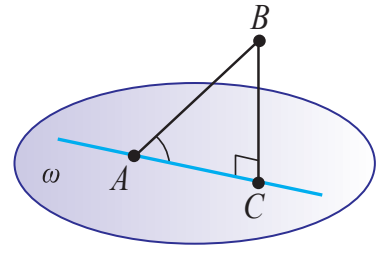
$B_1C_1 = ?\ \ BC = AB - AC = 20 - 10 = 10\ cm.$

$$\frac{AB}{A_1B_1} = \frac{BC}{B_1C_1}; \qquad \frac{20}{12} = \frac{10}{B_1C_1};$$

$$B_1C_1 = \frac{10 \cdot 12}{20} = 6\ cm.$$

Javob: $B_1C_1 = 6\ cm.$

21.5. Uzunligi 5 *cm* bo'lgan AB kesmaning ω tekislikka ortogonal proyeksiyasi uzunligi 3 *cm* bo'lgan AC kesmadan iborat. AB kesmaning ω tekislikka og'ish burchagi kosinusini toping.



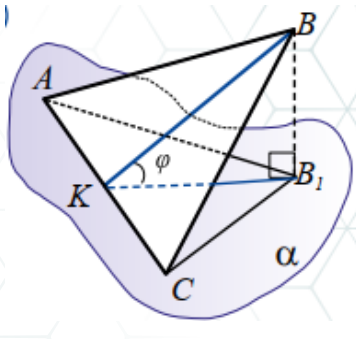
Yechish: $AB = 5\ cm,\ AC = 3\ cm.\ \ cosA = ?$

$$\cos A = \frac{AC}{AB}; \qquad cosA = \frac{3}{5}; \qquad \cos A = 0{,}6.$$

Javob: *0,6.*

Uy vazifasi

21.6. Tomoni a ga teng bo'lgan muntazam uchburchak berilgan. Uchburchak tekisligi bilan a) 30°; b) 45°; c) 60° li burchak tashkil qiluvchi tekislikka uning ortogonal proyeksiyasi yuzini toping.



a) $BB_1 = a;\ \angle BKB_1 = 30°;\ AB = BC = AC = a;$

$$BK = \frac{a\sqrt{3}}{2}; \quad \cos\angle BKB_1 = \frac{KB_1}{KB}; \quad \cos 30° = \frac{KB_1}{\frac{a\sqrt{3}}{2}};$$

$$\frac{\sqrt{3}}{2} = \frac{KB_1}{\frac{a\sqrt{3}}{2}}; \qquad \frac{\sqrt{3}}{2} = \frac{2 \cdot KB_1}{a\sqrt{3}}; \qquad 4 \cdot KB_1 = 3a;$$

$$KB_1 = \frac{3a}{4}; \quad S_{AB_1C} = \frac{AC \cdot KB_1}{2} = \frac{a \cdot \frac{3a}{4}}{2} = \frac{\frac{3a^2}{4}}{2} = \frac{3a^2}{8}.$$

Javob: $S_{AB_1C} = \frac{3a^2}{8}$

b) $BB_1 = a$; $\angle BKB_1 = 45°$; $AB = BC = AC = a$;

$BK = \frac{a\sqrt{3}}{2}$; $\cos\angle BKB_1 = \frac{KB_1}{KB}$; $\cos 45° = \frac{KB_1}{\frac{a\sqrt{3}}{2}}$; $\frac{\sqrt{2}}{2} = \frac{KB_1}{\frac{a\sqrt{3}}{2}}$

$\frac{\sqrt{2}}{2} = \frac{2 \cdot KB_1}{a\sqrt{3}}$; $4 \cdot KB_1 = a\sqrt{6}$; $KB_1 = \frac{a\sqrt{6}}{4}$;

$S_{AB_1C} = \frac{AC \cdot KB_1}{2} = \frac{a \cdot \frac{a\sqrt{6}}{4}}{2} = \frac{\frac{a^2 \cdot \sqrt{6}}{4}}{2} = \frac{a^2\sqrt{6}}{8}$. **Javob:** $S_{AB_1C} = \frac{a^2\sqrt{6}}{8}$

$BK = \frac{a\sqrt{3}}{2}$; $\cos\angle BKB_1 = \frac{KB_1}{KB}$; $\cos 60° = \frac{KB_1}{\frac{a\sqrt{3}}{2}}$; $\frac{1}{2} = \frac{KB_1}{\frac{a\sqrt{3}}{2}}$

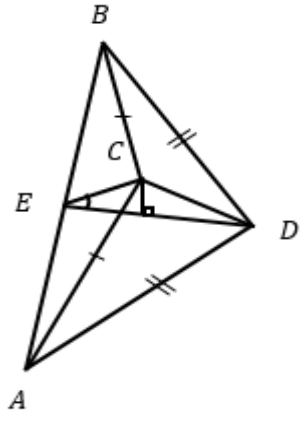
$\frac{1}{2} = \frac{2 \cdot KB_1}{a\sqrt{3}}$; $4 \cdot KB_1 = a\sqrt{3}$; $KB_1 = \frac{a\sqrt{3}}{4}$;

$S_{AB_1C} = \frac{AC \cdot KB_1}{2} = \frac{a \cdot \frac{a\sqrt{3}}{4}}{2} = \frac{\frac{a^2 \cdot \sqrt{3}}{4}}{2} = \frac{a^2\sqrt{3}}{8}$. **Javob:** $S_{AB_1C} = \frac{a^2\sqrt{3}}{8}$

21.7. Umumiy AB tomonga ega bo‘lgan ABC va ABD teng yonli uchburchaklar turli tekisliklarda yotadi. Agar: a) $AB = 24$ cm, $AC = 13$ cm, $AD = 37$ cm, $CD = 35$ cm; b) $AB = 32$ cm, $AC = 65$ cm, $AD = 20$ cm, $CD = 63$ cm bo‘lsa, ABC uchburchakning ABD uchburchakka ortogonal proyeksiyasi yuzini toping. Shunigdek, ABD uchburchakning ABC uchburchakka ortogonal proyeksiyasi yuzini ham toping.

a) $AB = 24$ cm; $AC = 13$ cm; $AD = 37$ cm;

$CD = 35$ cm; $AC = BC$; $AD = BD$. $S_{ABD} = ?$



$AE = EB = \frac{AB}{2} = \frac{24}{2} = 12$ cm;

$EC = \sqrt{AC^2 - AE^2} = \sqrt{13^2 - 12^2} = \sqrt{25} = 5$ cm;

$ED = \sqrt{AD^2 - AE^2} = \sqrt{37^2 - 12^2} = \sqrt{1369 - 144} =$

$35^2 = 5^2 + 35^2 - 2 \cdot 5 \cdot 35 \cdot \cos\angle CED$; $1225 = 25 + 1225 - 350 \cdot \cos\angle CED$;

$1225 = 1250 - 350 \cdot \cos\angle CED$; $350 \cdot \cos\angle CED = 1250 - 1225$;

$350 \cdot \cos\angle CED = 25$; $\cos\angle CED = \frac{25}{350} = \frac{1}{14}$;

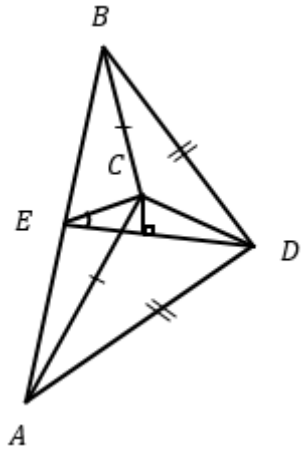
$S_{ABC} = \frac{1}{2} \cdot AB \cdot EC = \frac{1}{2} \cdot 24 \cdot 5 = 12 \cdot 5 = 60$ cm^2;

$S_{ABD} = S_{ABC} \cdot \cos \angle CED = 60 \cdot \frac{1}{14} = \frac{30}{7} = 4\frac{2}{7}\ cm^2$.

Javob: $S_{ABD} = 4\frac{2}{7}\ cm^2$.

b) $AB = 32\ cm$; $AC = 65\ cm$; $AD = 65\ cm$; $CD = 63\ cm$. $S_{proyeksiya} = ?$

$S_{proyeksiya} = S_{ABC} \cdot \cos\alpha$; $AE = \frac{AB}{2} = \frac{32}{2} = 16\ cm$;



$p = \frac{AB + AC + AD}{2} = \frac{32 + 65 + 65}{2} = \frac{162}{2} = 81\ cm$;

$S_{ABC} = \sqrt{p \cdot (p - AB) \cdot (p - AC) \cdot (p - AD)} =$

$= \sqrt{81 \cdot 49 \cdot 16 \cdot 16} = 9 \cdot 7 \cdot 4 \cdot 4 = 1008\ cm^2$;

$ED = \sqrt{AD^2 - AE^2} = \sqrt{20^2 - 16^2} = \sqrt{400 - 256} =$

$= \sqrt{144} = 12\ cm$;

$EC = \sqrt{AC^2 - AE^2} = \sqrt{65^2 - 16^2} = \sqrt{4225 - 256} = \sqrt{3969} = 63\ cm$;

$CD^2 = EC^2 + ED^2 - 2 \cdot EC \cdot ED \cdot \cos\alpha$; $63^2 = 63^2 + 12^2 - 2 \cdot 63 \cdot 12 \cdot \cos\alpha$;

$-144 = -2 \cdot 63 \cdot 12 \cdot \cos\alpha$; $2 = 21 \cdot \cos\alpha$; $\cos\alpha = \frac{2}{21}$;

$S_{proyeksiya} = S_{ABC} \cdot \cos\alpha = 1008 \cdot \frac{2}{21} = 48 \cdot 2 = 96\ cm^2$.

Javob: $S_{proyeksiya} - 96\ cm^2$.

12-DARS. FAZODA ORTOGONAL PROYEKSIYA VA UNDAN TEXNIKADA FOYDALANISH

I. Standartlar:

– M10.GO‘.GSH.13. Ortogonal proyeksiya haqida tushunchaga ega bo‘ladi;

– M10.GO‘.YM.08. Sodda fazoviy jismlar ortogonal proyeksiyalarni chizmada tasvirlay oladi;

– M10.GO‘.MM.19. Ko‘pburchakning ortogonal proyeksiyasining yuzini topa oladi.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– ortogonal proyeksiya haqida bilish;

– sodda fazoviy jismlar ortogonal proyeksiyalarni chizmada tasvirlashni bilish;

Ko‘nikmalar:

– sodda fazoviy jismlar ortogonal proyeksiyalarni chizmada tasvirlay olish.

III. Dars mazmunining qisqacha tavsifi:

– ko‘pburchakning ortogonal proyeksiyasining yuzi. Ortogonal proyeksiyadan texnikada foydalanish.

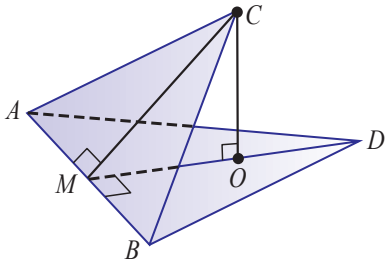
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Ko‘pburchakning ortogonal proyeksiyasiga oid misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: Ko‘pburchakning ortogonal proyeksiyasidan qayerlarda foydalanish mumkin?
Bilimlarni boyitish va mustahkamlash	Ko‘pburchakning ortogonal proyeksiyasining yuzi	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 3 Amaliy mashq va tatbiq: 21.8
	Ortogonal proyeksiyadan texnikada foydalanish	Darslik bilan ishlash	Mavzu bo‘yicha savollar: 4 Amaliy mashq va tatbiq: 21.9, 21.10
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	Amaliy mashq va tatbiq: 21.11, 21.12
Uyga vazifa	Amaliy mashq va tatbiq: 21.13, 21.14		

21.8. Agar AB to‘g‘ri chiziqdan C nuqtagacha bo‘lgan masofa C nuqtadan ABD tekislikkacha bo‘lgan masofadan ikki marta katta bo‘lsa, ABC va ABD tekisliklar orasidagi burchakni toping.

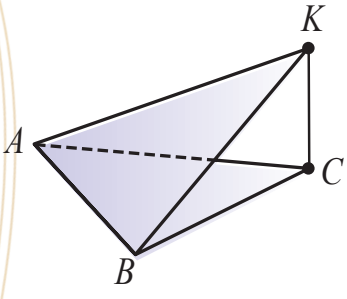


$CM = 2 \cdot CO; \quad \angle CMD = ?$

$$\frac{CO}{\sin M} = \frac{CM}{\sin 90°}; \qquad \sin \widehat{CMD} = \frac{CO \cdot \sin 90°}{2 \cdot CO} = \frac{1}{2};$$

$\angle CMD = 30°.$ **Javob:** $\angle CMD = 30°.$

21.9. ABC **uchburchakning yuzi** $18\ cm^2$ **ga teng.** $KC \perp \Delta ABC$. **Agar** ABK **va** ABC **uchburchaklar tekisliklari orasidagi burchak: a)** α**=30°; b)** α **= 45°; c)** α **= 60° bo‘lsa,** ABK **uchburchak yuzini toping.**



$S_{ABC} = 18\ cm^2; \quad KC \perp \Delta ABC. \quad S_{ABK} = ?$

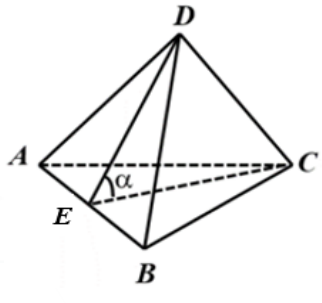
$$\alpha = 30°; \quad S_{ABK} = S_{ABC} \cdot \cos 30° = 18 \cdot \frac{\sqrt{3}}{2} = 9\sqrt{3}\ cm^2;$$

$$\alpha = 45°; \quad S_{ABK} = S_{ABC} \cdot \cos 45° = 18 \cdot \frac{\sqrt{2}}{2} = 9\sqrt{2}\ cm^2;$$

$$\alpha = 60°; \qquad S_{ABK} = S_{ABC} \cdot \cos 60° = 18 \cdot \frac{1}{2} = 9\ cm^2;$$

Javob: a) $9\sqrt{3}\ cm^2; 9\sqrt{2}\ cm^2; 9\ cm^2.$

21.10. ABC **va** ABD **muntazam uchburchaklar tekisliklari orasidagi burchak 60° ga teng. Agar** $AB = 4\sqrt{3}$ **bo‘lsa,** CD **masofani toping.**



$\alpha = \angle E = 60°; \quad AB = 4\sqrt{3}. \quad CD = ?$

$\alpha = \angle E = \angle C = \angle D = 60°;$

$$DE = EC = CD = \frac{AB\sqrt{3}}{2} = 6.$$

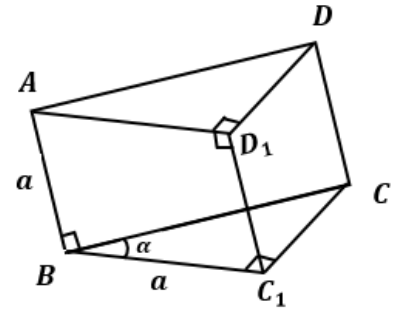
Javob: $CD = 6.$

21.11. To‘g‘ri to‘rtburchakning yuzi 72 ga teng. Uning tekislikdagi ortogonal proyeksiyasi kvadratdan iborat. Tekislik va to‘g‘ri to‘rtburchak yotgan tekislik orasidagi burchak 60° ga teng. Kvadratning perimetrini toping.

$\alpha = 60°; \quad S_{ABCD} = 72. \quad P_{ABC_1D_1} = ?$

$a = AB = BC_1; \quad b = AD = BC;$

$a \cdot b = S_{ABCD}; \qquad a \cdot b = 72; \qquad \cos 60° = \frac{a}{b};$



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$\frac{1}{2}=\frac{a}{b}$; $b=2a$; $a\cdot 2a=72$; $a^2=36$;

$a=\sqrt{36}$; $a=6$; $P_{ABC_1D_1}=4a=4\cdot 6=24$.

Javob: $P_{ABC_1D_1}=24$.

Uy vazifasi

21.12. Yuzi 48 cm² ga teng bo‘lgan uchburchakning ortogonal proyeksiyasi tomonlari 14 cm, 16 cm va 6 cm bo‘lgan uchburchakdan iborat. Bu uchburchak tekisligi va uning proyeksiyasi orasidagi burchakni hisoblang.

$S_{ABC}=48\ cm^2$; $AB=14\ cm$; $AD=16\ cm$;

$BD=6\ cm$. $\alpha=CED=?$

$$S_{ABD}=\sqrt{18\cdot(18-14)\cdot(18-16)\cdot(18-6)}=24\sqrt{3};$$

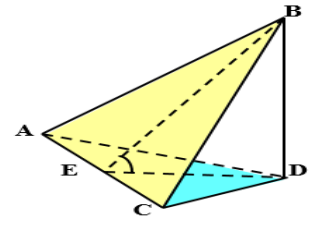
$$cos\alpha=\frac{S_{ABD}}{S_{ABC}}=\frac{24\sqrt{3}}{48}=\frac{\sqrt{3}}{2};\qquad \cos\alpha=\frac{\sqrt{3}}{2};$$

$\alpha=30°$. **Javob:** $\alpha=30°$.

21.13. Yuzi 12 cm^2 ga teng bo‘lgan uchburchakning ortogonal proyeksiyasi tomonlari 13 cm, 14 cm va 15 cm bo‘lgan uchburchakdan iborat. Bu uchburchak tekisligi va uning proyeksiyasi orasidagi burchakni hisoblang.

$S_{ABC}=12\ cm^2$; $AC=13\ cm$; $CD=14\ cm$;

$AD=15\ cm$. $\alpha=\angle BED=?$



$$p=\frac{AC+CD+AD}{2}=\frac{13+14+15}{2}=\frac{42}{2}=21\ cm;$$

$$S_{ACD}=\sqrt{p\cdot(p-AC)\cdot(p-CD)\cdot(p-AD)}=$$

$$=\sqrt{21\cdot(21-13)\cdot(21-14)\cdot(21-15)}=\sqrt{21\cdot 8\cdot 7\cdot 6}=\sqrt{7056}=84\ cm^2;$$

$$\cos\alpha=\frac{S_{ABC}}{S_{ACD}};\qquad \cos\alpha=\frac{12}{84};\qquad \cos\alpha=\frac{1}{7};\qquad \alpha=\arccos\frac{1}{7}.$$

Javob: $\alpha=arccos\frac{1}{7}$.

13-DARS. BOBNI TAKRORLASHGA DOIR AMALIY MASHQLAR

I. Standartlar:

– o‘rganilgan tushunchalar, faktlar va metodlarni notanish yoki hayotiy vaziyatlarda qo‘llay olish.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– umumlashgan Pifagor teoremasini bilish;

– uch perpendikulyarlar haqidagi teoremani bilish.

Ko‘nikmalar:

– fazoda perpendikulyar tekisliklar haqidagi teoremalarni va tekisliklarning perpendikulyarlik alomatlarini masalalar yechishda qo‘llay olish;

– o‘rganilgan tushunchalar, faktlar va metodlarni masalalar yechishda qo‘llay olish.

III. Dars mazmunining qisqacha tavsifi:

– fazoda to‘g‘ri chiziqlar va tekisliklarning perpendikulyarligi.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Fazoda to‘g‘ri chiziqlar va tekisliklarning perpendikulyarligiga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: fazoda tekislikka tushirilgan perpendikulyar va og‘maga misollar keltiring.
Bilimlarni boyitish va mustahkamlash	Fazodagi perpendikulyar to‘g‘ri chiziqlarning xossalari. Fazoda perpendikulyar, og‘ma va masofa. Uch perpendikulyar haqidagi teorema	Darslik bilan ishlash	Amaliy mashq va tatbiq: 22.1, 22.2, 22.3, 22.4
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	22.5
Uyga vazifa	Amaliy mashq va tatbiq: 22.6		

22.1. Quyidagi mulohazalarning qaysi biri noto‘g‘ri?

A) Agar bir tekislikda yotgan ikki to‘g‘ri chiziq ikkinchi tekislikda yotgan ikki to‘g‘ri chiziqqa mos ravishda parallel bo‘lsa, bu tekisliklar paralleldir.

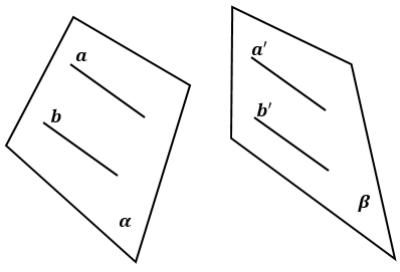
B) Agar ikki to‘g‘ri chiziq uchinchi to‘g‘ri chiziqqa parallel bo‘lsa, ular o‘zaro paralleldir.

C) Tekislikda yotgan to‘g‘ri chiziq og‘maning proyeksiyasiga perpendikulyar bo‘lsa,

og‘maning o‘ziga ham perpendikulyar bo‘ladi.

D) To‘g‘ri chiziq tekislikda yotgan ikki kesishuvchi to‘g‘ri chiziqqa perpendikulyar bo‘lsa, bu to‘g‘ri chiziq tekislikka ham perpendikulyar bo‘ladi.

E) Og‘ma va uning tekislikdagi proyeksiyasi orasidagi burchaklardan eng kichigiga og‘ma va tekisliklar orasidagi burchak deyiladi.



$$\begin{cases} a \parallel a' \\ b \parallel b' \end{cases} \rightarrow \quad \alpha \nparallel \beta .$$

Javob: A.

22.2. Quyidagi mulohazalarning qaysi biri noto‘g‘ri?

A) Agar fazoda ikki to‘g‘ri chiziq uchinchi to‘g‘ri chiziqqa parallel bo‘lsa, ular o‘zaro paralleldir.

B) Tekislikda og‘maning asosidan uning proyeksiyasiga perpendikulyar qilib o‘tkazilgan to‘g‘ri chiziq og‘maning o‘ziga ham perpendikulyar bo‘ladi.

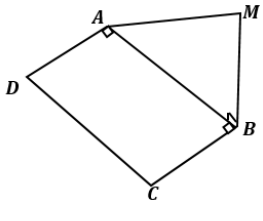
C) Fazodagi uchta nuqta orqali faqat bitta tekislik o‘tkazish mumkin.

D) To‘g‘ri chiziq yoki parallel to‘g‘ri chiziqlar kesmalarining nisbati parallel proyeksiyalashda o‘zgarmaydi (proyeksiyalanadigan kesmalar proyeksiyalash yo‘nalishiga parallel emas).

E) Tekislikdan tashqarida yotgan to‘g‘ri chiziq bu tekislikdagi biror to‘g‘ri chiziqqa parallel bo‘lsa, bu to‘g‘ri chiziq va tekislik o‘zaro paralleldir.

Javob: D

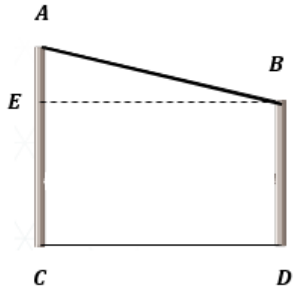
22.3. $ABCD$ to‘g‘ri to‘rtburchak tekisligiga uning B uchi orqali BM perpendikulyar tushirilgan. a) AD to‘g‘ri chiziq AB va BM to‘g‘ri chiziqlar yotgan tekislikka; b) CD to‘g‘ri chiziq BC va BM to‘g‘ri chiziqlar yotgan tekislikka perpendikulyar bo‘lishini isbotlang.



a) $\begin{cases} AB \perp AD \\ MB \perp AB \end{cases} \rightarrow MA \perp AD$. Demak, $AD \perp ABD$.

b) $\begin{cases} CD \perp BC \\ BM \perp BC \end{cases} \rightarrow MC \perp CD$. Demak, $CD \perp BMC$.

22.4. A va B nuqtalardan α tekislikka perpendikulyar va uni mos ravishda C va D nuqtalarda kesib o‘tuvchi to‘g‘ri chiziq o‘tkazilgan. Agar $AC = 3\ m$, $BD = 2\ m$ va $CD = 2{,}4\ m$ bo‘lsa hamda AB to‘g‘ri chiziq α tekislikni kesmasa, A va B nuqtalar orasidagi masofani toping.



$AC = 3\ m;\ BD = 2\ m;\ CD = 2{,}4\ m.\ AB = ?$

$BE \parallel CD \rightarrow BE = CD = 2{,}4\ m;\ CE = BD = 2\ m;$

$AE = AC - CE = 3\ m - 2\ m = 1\ m;$

$$AB = \sqrt{AE^2 + EB^2} = \sqrt{1^2 + (2{,}4)^2} = \sqrt{1 + 5{,}76} = \sqrt{6{,}76} = 2{,}6\ m.$$

Javob: $AB = 2{,}6\ m.$

22.5. To‘g‘ri burchakli parallelepipedning uchta o‘lchamlariga ko‘ra uning diagonali uzunligini toping. a) 1, 2, 2; b) 2, 3, 6; c) 6, 6, 7.

$a)\ a = 1;\ b = 2;\ c = 2.\ d = ?$

$$d = \sqrt{a^2 + b^2 + c^2} = \sqrt{1^2 + 2^2 + 2^2} = \sqrt{1 + 4 + 4} = \sqrt{9} = 3.$$ *Javob:* $d = 3.$

$b)\ a = 2;\ b = 3;\ c = 6.\ d = ?$

$$d = \sqrt{a^2 + b^2 + c^2} = \sqrt{2^2 + 3^2 + 6^2} = \sqrt{4 + 9 + 36} = \sqrt{49} = 7.$$ *Javob:* $d = 7.$

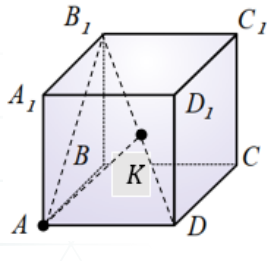
$c)\ a = 6;\ b = 6;\ c = 7.\ d = ?$

$$d = \sqrt{a^2 + b^2 + c^2} = \sqrt{6^2 + 6^2 + 7^2} = \sqrt{36 + 36 + 49} = \sqrt{121} = 11.$$

Javob: $d = 11.$

Uy vazifasi

22.6. Kubning qirrasi a ga teng. Kubning uchidan uning boshqa ikki uchini tutashtiruvchi diagonali orasidagi masofani toping.



$$AB_1 = \sqrt{{AA_1}^2 + {A_1B_1}^2} = \sqrt{a^2 + a^2} = \sqrt{2a^2} = a\sqrt{2};$$

$$DB_1 = \sqrt{AD^2 + {AA_1}^2 + {A_1B_1}^2} = \sqrt{a^2 + a^2 + a^2} = \sqrt{3a^2} = a\sqrt{3};$$ ΔDAB_1 da

$$\frac{AD \cdot AB_1}{2} = \frac{DB_1 \cdot AK}{2};$$

$$AK = \frac{AD \cdot AB_1}{DB_1} = \frac{a \cdot a\sqrt{2}}{a\sqrt{3}} = \frac{a\sqrt{2}}{\sqrt{3}} = \frac{a\sqrt{6}}{3}.$$

Javob: $AK = \frac{a\sqrt{6}}{3}.$

14-DARS. BOBNI TAKRORLASHGA DOIR AMALIY MASHQLAR

I. Standartlar:

– o‘rganilgan tushunchalar, faktlar va metodlarni notanish yoki hayotiy vaziyatlarda qo‘llay olish.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– umumlashgan Pifagor teoremasini bilish;

– uch perpendikulyarlar haqidagi teoremani bilish.

Ko‘nikmalar:

– fazoda perpendikulyar tekisliklar haqidagi teoremalarni va tekisliklarning perpendikulyarlik alomatlarini masalalar yechishda qo‘llay olish;

– o‘rganilgan tushunchalar, faktlar va metodlarni masalalar yechishda qo‘llay olish.

III. Dars mazmunining qisqacha tavsifi:

– fazoda to‘g‘ri chiziqlar va tekisliklarning perpendikulyarligi.

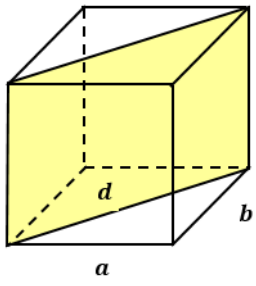
IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Fazoda to‘g‘ri chiziqlar va tekisliklarning perpendikulyarligiga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: fazoda tekislikka tushirilgan perpendikulyar va og‘maga misollar keltiring.
Bilimlarni boyitish va mustahkamlash	Fazodagi perpendikulyar to‘g‘ri chiziqlarning xossalari. Fazoda perpendikulyar, og‘ma va masofa. Uch perpendikulyar haqidagi teorema	Darslik bilan ishlash	Amaliy mashq va tatbiq: 22.7, 22.8, 22.9
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	22.10
Uyga vazifa	Amaliy mashq va tatbiq: 22.11-22.12		

22.7. To‘g‘ri burchakli parallelepiped asosining tomonlari *7 cm* va *24 cm*, balandligi *8 cm*. Parallelepiped diagonal kesimining yuzini toping.



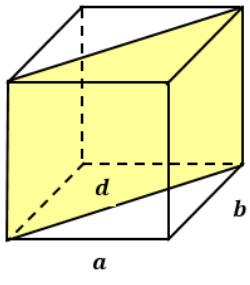
$a = 7\ cm;\quad b = 24\ cm;\quad c = 8\ cm.\quad S_{kesim} = ?$

$d = \sqrt{a^2 + b^2} = \sqrt{7^2 + 24^2} = \sqrt{(49 + 576)} = \sqrt{625} = 25\ cm;$

$S_{kesim} = d \cdot c = 25\ cm \cdot 8\ cm = 200\ cm^2.$

Javob: $S_{kesim} = 200\ cm^2.$

22.8. To‘g‘ri burchakli parallelepipedning uchta o‘lchamlariga ko‘ra uning to‘la sirti yuzini toping: *10 cm, 22 cm, 16 cm.*



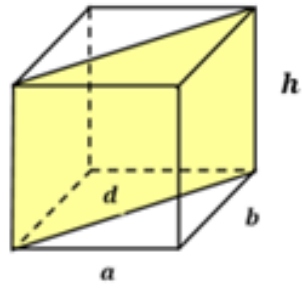
$a = 10\ cm;\ b=22\ cm;\ c = 16\ cm.\ S_{to'la} = ?$

$S_{to'la} = 2 \cdot (a \cdot b + b \cdot c + a \cdot c) =$

$= 2 \cdot 10 \cdot 22 + 22 \cdot 16 + 10 \cdot 16 = 2 \cdot 220 + 160 + 352 =$

$= 2 \cdot 732 = 1464\ cm^2.$ **Javob:** $S_{to'la} = 1464\ cm^2.$

22.9. To‘g‘ri burchakli parallelepipedning balandligi h, asosining yuzi Q, diagonal kesimining yuzi M bo‘lsa, uning yon sirtining yuzini toping.



$S_{asos} = a \cdot b = Q;\quad d = \sqrt{a^2 + b^2};\quad d \cdot h = M;$

$$\begin{cases} a^2 + b^2 = \left(\frac{M}{h}\right)^2 \\ a \cdot b = Q \quad |\cdot 2 \end{cases} \rightarrow \begin{cases} a^2 + b^2 = \left(\frac{M}{h}\right)^2 \\ 2ab = 2Q \end{cases}$$

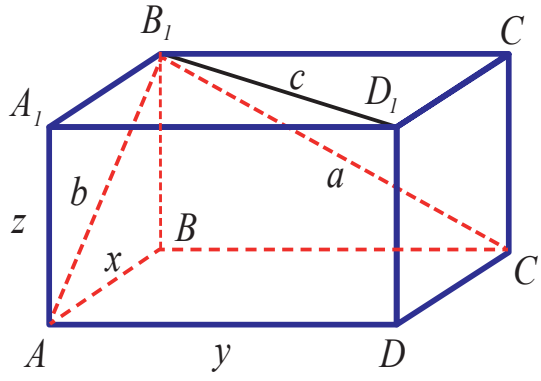
$$a^2 + b^2 + 2ab = \left(\frac{M}{h}\right)^2 + 2Q;\quad (a+b)^2 = \left(\frac{M}{h}\right)^2 + 2Q;\quad a + b = \sqrt{\left(\frac{M}{h}\right)^2 + 2Q};$$

$$S_{yon} = 2(a+b) \cdot h = 2 \cdot \sqrt{\left(\frac{M}{h}\right)^2 + 2Q} \cdot h = 2 \cdot \sqrt{\left(\left(\frac{M}{h}\right)^2 + 2Q\right) \cdot h^2} =$$

$$= 2 \cdot \sqrt{M^2 + 2h^2 \cdot Q}.$$

Javob: $S_{yon} = 2 \cdot \sqrt{M^2 + 2h^2 \cdot Q}.$

22.10. To‘g‘ri burchakli parallelepipedning bitta uchida uchrashuvchi yoqlarining diagonallari: *a*, *b*, *c* ga teng. Parallelepipedning uchta o‘lchamlari uzunliklarini toping.



$$\begin{cases} x^2+z^2=b^2 \\ y^2+z^2=a^2 \\ x^2+y^2=c^2 \end{cases} \rightarrow \quad 2(x^2+y^2+z^2)=a^2+b^2+c^2\,;$$

$$x^2+y^2+z^2=\frac{a^2+b^2+c^2}{2}\,; \quad c^2+z^2=\frac{a^2+b^2+c^2}{2}\,;$$

$$z^2=\frac{a^2+b^2+c^2}{2}-c^2=\frac{a^2+b^2+c^2-2c^2}{2}=\frac{a^2+b^2-c^2}{2}\,;$$

$$z^2=\frac{a^2+b^2-c^2}{2}\,; \qquad z=\sqrt{\frac{a^2+b^2-c^2}{2}}\,; \quad x^2+a^2=\frac{a^2+b^2+c^2}{2}\,;$$

$$x^2=\frac{a^2+b^2+c^2}{2}-a^2\,; \quad x^2=\frac{a^2+b^2+c^2-2a^2}{2}=\frac{b^2+c^2-a^2}{2}\,;$$

$$x^2=\frac{b^2+c^2-a^2}{2}\,; \qquad x=\sqrt{\frac{b^2+c^2-a^2}{2}}\,; \qquad y^2+b^2=\frac{a^2+b^2+c^2}{2}\,;$$

$$y^2=\frac{a^2+b^2+c^2}{2}-b^2\,; \quad y^2=\frac{a^2+b^2+c^2-2b^2}{2}=\frac{a^2-b^2+c^2}{2}\,;$$

$$y^2=\frac{a^2-b^2+c^2}{2}\,; \qquad y=\sqrt{\frac{a^2-b^2+c^2}{2}}\,;$$

Javob: $x=\sqrt{\frac{b^2+c^2-a^2}{2}}\,; \qquad y=\sqrt{\frac{a^2-b^2+c^2}{2}}\,; \qquad z=\sqrt{\frac{a^2+b^2-c^2}{2}}\,.$

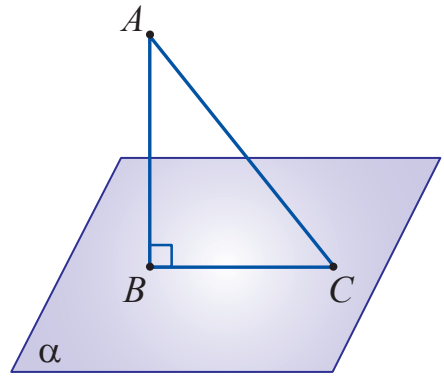
Uy vazifasi

22.11. Perpendikulyar bilan og‘ma orasidagi burchak 60^o ga teng. Perpendikulyarning uzunligi 20 ga teng. Og‘maning uzunligini toping.

Berilgan: $\angle BAC = 60°;\quad AB = 20.\quad AC = ?$

$$\cos\angle BAC = \frac{BA}{AC};\qquad \cos 60° = \frac{20}{AC};\qquad \frac{1}{2} = \frac{20}{AC};$$

$AC = 2\cdot 20 = 40.$ **Javob:** $AC = 40.$

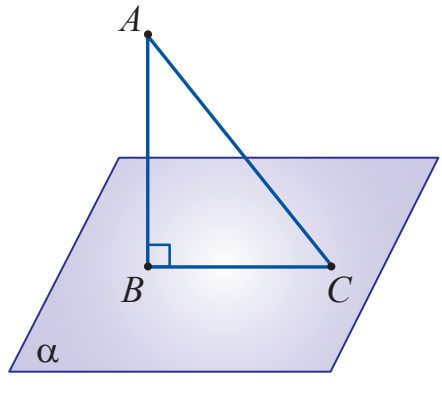


22.12. Tekislikka tushirilgan og‘ma bilan perpendikulyar orasidagi burchak 30°, og‘maning uzunligi $20\sqrt{3}$. Perpendikulyarning uzunligini toping.

Berilgan: $\angle BAC = 30°;\quad AB = 10.\quad AC = ?$

$$\cos\angle BAC = \frac{AB}{AC};\qquad \cos 60° = \frac{AB}{20\sqrt{3}};\qquad \frac{1}{2} = \frac{AB}{20\sqrt{3}};$$

$$AB = \frac{20\sqrt{3}}{2} = 10\sqrt{3}.\qquad \textit{Javob:}\quad AB = 10\sqrt{3}.$$



15-DARS. BOBNI TAKRORLASHGA DOIR AMALIY MASHQLAR

I. Standartlar:

– o‘rganilgan tushunchalar, faktlar va metodlarni notanish yoki hayotiy vaziyatlarda qo‘llay olish.

II. Dars maqsadi: o‘quvchilarda quyidagi bilim va ko‘nikmalarni shakllantirish:

Bilim:

– umumlashgan Pifagor teoremasini bilish;

– uch perpendikulyarlar haqidagi teoremani bilish.

Ko‘nikmalar:

– fazoda perpendikulyar tekisliklar haqidagi teoremalarni va tekisliklarning perpendikulyarlik alomatlarini masalalar yechishda qo‘llay olish;

– o‘rganilgan tushunchalar, faktlar va metodlarni masalalar yechishda qo‘llay olish.

III. Dars mazmunining qisqacha tavsifi:

– fazoda to‘g‘ri chiziqlar va tekisliklarning perpendikulyarligi.

IV. Dars ashyolari va ko‘rgazmali qurollar:

– turli yassi va fazoviy geometrik shakllar modellari.

V. Darsning qisqa texnologik xaritasi:

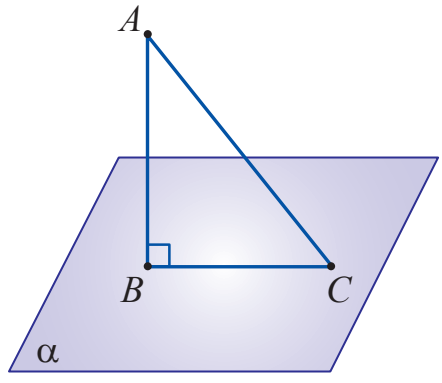
Dars bosqichlari	Tafsilotlari	Uslubiy tavsiyalar	Savollar va yechiladigan masalalar
Motivatsiya	Fazoda to‘g‘ri chiziqlar va tekisliklarning perpendikulyarligiga misollar keltiring.	Aqliy hujum	Mavzu bo‘yicha savollar: fazoda tekislikka tushirilgan perpendikulyar va og‘maga misollar keltiring.
Bilimlarni boyitish va mustahkamlash	Fazodagi perpendikulyar to‘g‘ri chiziqlarning xossalari. Fazoda perpendikulyar, og‘ma va masofa. Uch perpendikulyar haqidagi teorema	Darslik bilan ishlash	Amaliy mashq va tatbiq: 22.13, 22.14, 22.15
Darsga yakun yasash	Bugun nimani o‘rgandik?	Savol-javob	22.16
Uyga vazifa	Amaliy mashq va tatbiq: 22.17		

22.13. Tekislikka o‘tkazilgan perpendikulyar bilan og‘ma orasidagi burchak °, perpendikulyarning uzunligi esa 10 ga teng. Og‘maning uzunligini toping.

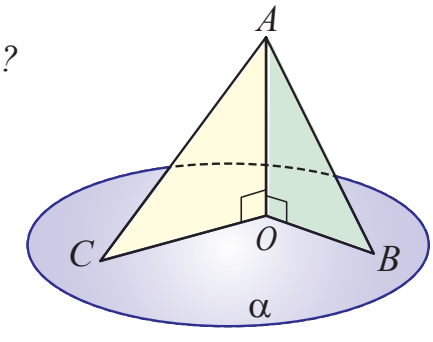
Berilgan: $\angle BAC = 30°;\quad AB = 10.\quad AC = ?$

$$\cos\angle BAC = \frac{AB}{AC};\qquad \cos 60° = \frac{10}{AC};\qquad \frac{\sqrt{3}}{2} = \frac{10}{AC};$$

$$AC = \frac{2 \cdot 10}{\sqrt{3}} = \frac{20}{\sqrt{3}} = \frac{20\sqrt{3}}{3}. \quad Javob: \quad AC = \frac{20\sqrt{3}}{3}.$$



22.14. Nuqtadan tekislikka ikkita og‘ma o‘tkazilgan. Agar og‘malar *1:2* ga teng nisbatda bo‘lib, ularning proyeksiyalari *1* va *7* ga teng bo‘lsa, og‘malarning uzunligini toping.



$AB:AC = 1:2; \quad OB = 1; \quad OC = 7. \quad AB = ?, AC = ?$

$$AB = x; \quad AC = 2x; \quad \begin{cases} AO^2 + OC^2 = AC^2 \\ AO^2 + OB^2 = AB^2 \end{cases} \rightarrow$$

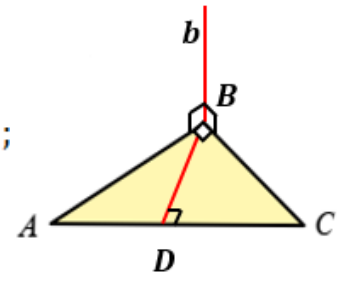
$$\rightarrow \begin{cases} AO^2 + 7^2 = (2x)^2 \\ AO^2 + 1^2 = x^2 \end{cases} \rightarrow \begin{cases} AO^2 + 49 = 4x^2 \\ AO^2 + 1 = x^2 \end{cases}$$

$49 - 1 = 4x^2 - x^2; \quad 48 = 3x^2; \quad x^2 = 16; \quad x = 4; \quad AB = 4;$

$AD = 2x = 2 \cdot 4 = 8; \quad AD = 8.$

Javob: $AB = 4; \quad AD = 8.$

22.15. ABC uchburchakning to‘g‘ri burchakli B uchidan uchburchak tekisligiga perpendikulyar to‘g‘ri chiziq b o‘tkazilgan. $AB = 3$, $BC = 4$. b va AC to‘g‘ri chiziqlar orasidagi masofani toping.



Berilgan: $AB = 3; \quad BC = 4.$ Topish kerak: $BD = ?$

$$AC = \sqrt{AB^2 + BC^2} = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5;$$

$AB \cdot BC = AC \cdot BD;$

$$BD = \frac{AB \cdot BC}{AC} = \frac{3 \cdot 4}{5} = \frac{12}{5} = 2{,}4.$$

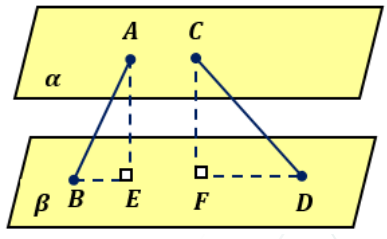
Javob: $BD = 2{,}4.$

22.16. Uzunliklari *10 cm* va *15 cm* bo‘lgan ikki kesmaning uchlari o‘zaro parallel

tekisliklarda yotadi. Birinchi kesmaning tekislikdagi proyeksiyasi $\sqrt{19}$ *cm* bo‘lsa, ikkinchi kesmaning proyeksiyasi necha *cm* bo‘ladi?

$AE = CF = h;\ AB = 10\ cm;\quad CD = 15\ cm;$

$BE = \sqrt{19}\ cm.\ \ FD = ?$



$$AE = \sqrt{AB^2 - BE^2} = \sqrt{10^2 - \left(\sqrt{19}\right)^2} =$$

$$= \sqrt{(100 - 19)} = \sqrt{81} = 9\ cm;\ \ CF = AE = 9\ cm;$$

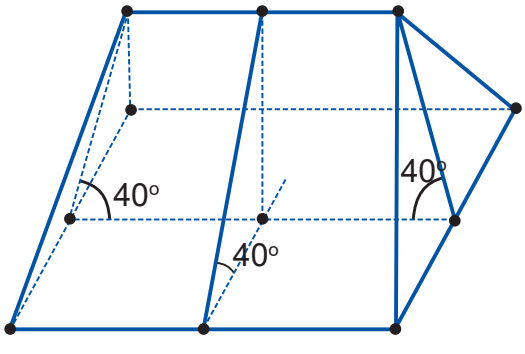
$$FD = \sqrt{CD^2 - CF^2} = \sqrt{(15^2 - 9^2)} = \sqrt{225 - 81} = \sqrt{144} = 12\ cm.$$

Javob: *12 cm.*

Uy vazifasi

22.17. O‘lchamlari *12,5 m* va *7,2 m* bo‘lgan uy tomi to‘rtta qiya yoqlar bilan rasmda ko‘rsatilgandek qilib yopilgan. Har bir yoq tom tekisligi bilan 40° li burchak tashkil qiladi. a) Har bir qiya yoq yuzini toping. b) Tomning jami qiya yoqlari yuzini toping. c) Agar tomni tunuka bilan yopganda uning 6 foizi isrof bo‘lishi ma’lum bo‘lsa, tomni yopishga qancha tunuka kerak bo‘ladi?

a)



b)



$$a)\ GH = AB = 12{,}5\ m;\quad BC = 7{,}2\ m;\quad IJ = \frac{BC}{2} = \frac{7{,}2}{2} = 3{,}6\ m;\quad tg40° = \frac{EJ}{IJ};$$

$$tg40° = \frac{EJ}{3{,}6};\qquad EJ = 3{,}6 \cdot tg40°;\qquad EJ = FK = 3{,}6 \cdot tg40°;$$

$$tg40° = \frac{EJ}{GJ};\qquad tg40° = \frac{3{,}6 \cdot tg40°}{GJ};\qquad GJ = \frac{3{,}6 \cdot tg40°}{tg40°} = 3{,}6\ m;$$

$$\cos 40^\circ = \frac{IJ}{IE} = \frac{GJ}{EG}\ ; \qquad IE = EG = \frac{3{,}6}{\cos 40^\circ}\ ; \qquad GJ = KH\ ;$$

$$EF = GH - 2 \cdot GJ = 12{,}5 - 2 \cdot 3{,}6 = 12{,}5 - 7{,}2 = 5{,}3\ m\ ;$$

$$S_{ABFE} = S_{DCFE} = \frac{AB + EF}{2} \cdot EI = \frac{12{,}5 + 5{,}3}{2} \cdot \frac{3{,}6}{\cos 40^\circ} = \frac{17{,}8 \cdot 1{,}8}{0{,}8} = 40\ m^2\ ;$$

$$S_{ADE} = S_{BCF} = \frac{AD \cdot GE}{2} = \frac{7{,}2 \cdot 3{,}6}{2 \cdot \cos 40^\circ} = \frac{12{,}96}{2 \cdot 0{,}8} = \frac{12{,}96}{1{,}6} = 8\ m^2\ ;$$

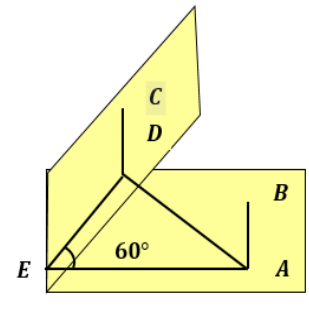
$$b)\ \ S_{tom} = S_{ADE} + S_{BCF} + S_{ABFE} + S_{DCFE} = 2 \cdot (S_{ADE} + S_{ABFE}) =$$

$$= 2 \cdot (8 + 40) = 2 \cdot 48 = 96\ m^2\ ;$$

$$c)\ \ S_{tom} = 0{,}94 \cdot S_{tunuka}\ ; \qquad S_{tunuka} = \frac{S_{tom}}{0{,}94} = \frac{96}{0{,}94} = \frac{9600}{94} = 102\ m^2\ .$$

Javob: a) $S_{ADE} = S_{BCF} = 8\ m^2$; b) $S_{tom} = 96\ m^2$; c) $S_{tunuka} = 102\ m^2$.

22.18. ***AB* va *CD* – o‘zaro *60°* li burchak hosil qilib kesishuvchi ikki tekislikda yotgan parallel to‘g‘ri chiziqlar. *A* va *D* nuqtalar tekisliklarning kesishish chizig‘idan *8 cm* va *6,3 cm* uzoqlikda. *AB* va *CD* orasidagi masofani toping.**



$AB \parallel CD;\quad AE = 8\ cm;\quad DE = 6{,}3\ cm.\quad AD = ?$

$\angle AED = 60°;$

$$AD = \sqrt{AE^2 + DE^2 - 2 \cdot AE \cdot DE \cdot \cos 60^\circ} =$$

$$= \sqrt{8^2 + 6{,}3^2 - 2 \cdot 8 \cdot 6{,}3 \cdot \frac{1}{2}} = \sqrt{64 + 39{,}69 - 50{,}4} =$$

$$= \sqrt{53{,}29} = 7{,}3\ cm.$$

Javob: $AD = 7{,}3\ cm.$

O‘ZINGIZNI SINAB KO‘RING (5-nazorat ishi)

1. Qaysi mulohaza to‘g‘ri?

A) Agar ikkita to‘g‘ri chiziqdan biri uchinchi to‘g‘ri chiziqqa perpendikulyar bo‘lsa, ikkinchi to‘g‘ri chiziq ham shu to‘g‘ri chiziqqa perpendikulyar bo‘ladi.

B) Agar ikkita to‘g‘ri chiziq uchinchi to‘g‘ri chiziqqa perpendikulyar bo‘lsa, ular parallel.

D) Agar ikkita to‘g‘ri chiziq tekislikka perpendikulyar bo‘lsa, ular parallel.

Javob: D

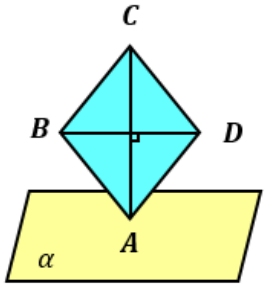
2. m to‘g‘ri chiziq α tekislikda yotgan a va b to‘g‘ri chiziqlarga perpendikulyar, lekin m to‘g‘ri chiziq α tekislikka perpendikulyar emas. a va b to‘g‘ri chiziqlar haqida nima deyish mumkin?

A) parallel; B) kesishadi; D) ayqash.

Javob: A.

3. α tekislik $ABCD$ rombning A uchidan o‘tadi va AC diagonaliga perpendikulyar. U holda BD diagonal...

A) α tekislikka perpendikulyar B) α tekislikka parallel D) α tekislikda yotadi



$$\begin{cases} \alpha \perp AC \\ AC \perp BD \end{cases} \rightarrow \quad BD \parallel \alpha .$$

α tekislik $ABCD$ rombning A uchidan o‘tadi va AC diagonaliga perpendikulyar. U holda BD diagonal α tekislikka parallel.

4. $a \parallel \alpha$, $b \perp \alpha$. Bu holda a va b to‘g‘ri chiziqlar qanday bo‘lishi mumkin emas?

A) kesishuvchi B) perpendikulyar D) parallel

Javob: B.

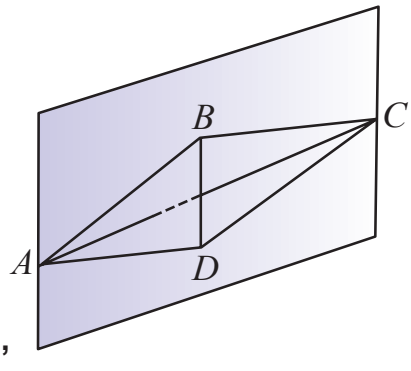
5. $ABCD$ – Parallelogramm, $BD \perp \alpha$, $AC \perp \alpha$. U holda $ABCD$ nima bo‘la olmaydi?

A) to‘g‘ri to‘rtburchak

B) kvadrat

D) romb

Javob: A.



6. To‘g‘ri chiziq doira tekisligiga perpendikulyar bo‘ladi, agar u...

A) ikkita radiusga perpendikulyar bo‘lsa

B) ikkita diametrga perpendikulyar bo‘lsa

D) ikkita vatarga perpendikulyar bo‘lsa

Javob: B

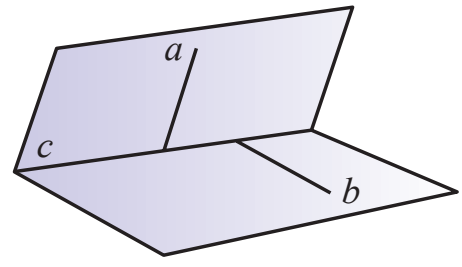
7. $\cap b = c$, $a \in \alpha$, $b \in \beta$. **Qaysi shart bajarilganda,** $\angle(ab)$-α **va** β **tekisliklar orasidagi ikki yoqli burchakning chiziqli burchagi bo‘ladi?**

A) $b \perp \alpha$ bo‘lsa

B) $a \perp c$ bo‘lsa

C) $a \perp c,\ b \perp c$ bo‘lsa

Javob: C.



8. Qaysi mulohaza to‘g‘ri?

A) ikki yoqli burchakning qirrasi uning chiziqli burchagi tekisligiga perpendikulyar bo‘lishi mumkin emas.

B) Bir tekislikka perpendikulyar bo‘lgan ikkita tekislik parallel bo‘lishi mumkin emas.

C) Bitta to‘g‘ri chiziqqa perpendikulyar bo‘lgan ikkita tekislik parallel bo‘lolmaydi.

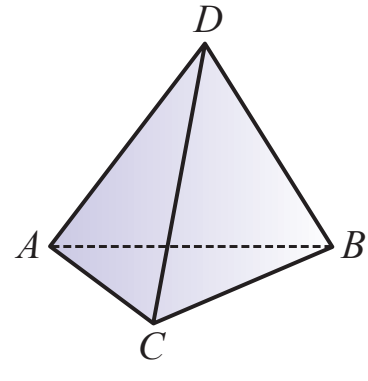
9. $ABC \perp ABD$. D **nuqtadan** ABC **tekislikka tushirilgan perpendikulyarning asosi...**

A) ABC uchburchakdan tashqarida yotadi.

B) AB tomonida yotadi.

C) ABC uchburchak ichida yotadi.

Javob: B.



10. Qaysi mulohaza noto‘g‘ri?

A) Agar ikkita tekislikdan biri ikkinchi tekislikka perpendikulyar bo‘lgan chiziqdan o‘tsa, bunday tekisliklar perpendikulyar bo‘ladi.

B) Agar tekisliklar perpendikulyar bo‘lsa, u holda ularning kesishish chizig‘i shu tekisliklarning birida yotgan har qanday to‘g‘ri chiziqqa perpendikulyar bo‘ladi.

C) Berilgan ikkita tekislikning kesishish chizig‘iga perpendikulyar bo‘lgan tekislik shu tekisliklarning har biriga perpendikulyar.

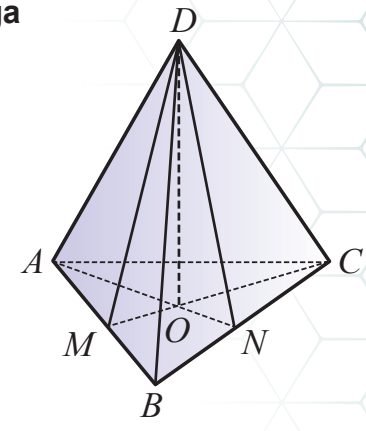
Javob: B)

11. Parallelepipedning ikki yoqli burchaklari soni nechta?

A) 18 ta B) 12 ta C) 24 ta

Javob: B

12. ABC uchburchakda AN va CM balandliklar. $DO \perp ABC$. $ABCD$ ikki yoqli burchakning gradus o‘lchovi qaysi burchak gradus o‘lchoviga teng?



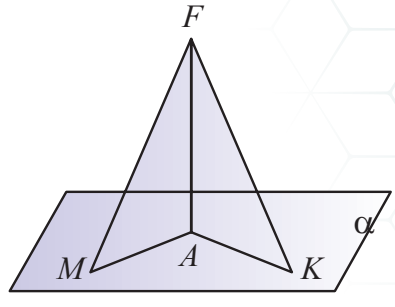
A) ABD

B) AND

C) ACD

Javob: B.

13. $AF \perp \alpha$. Qaysi tengsizlik o‘rinli emas?



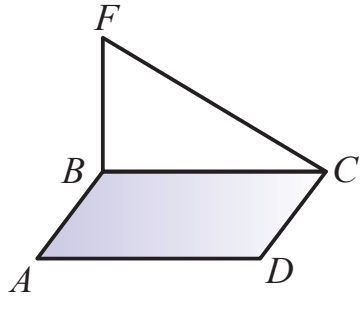
A) $FM > AF$

B) $FA > FK$

C) $AK < FK$

Javob: B.

14. $BF \perp ABC$. $ABCD$ qanday bo‘lsa, CD va CF to‘g‘ri chiziqlar perpendikulyar bo‘ladi?



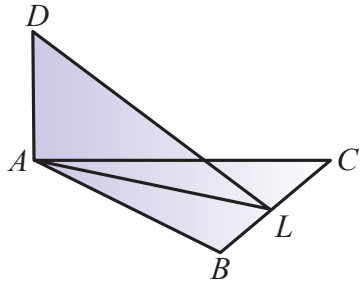
A) to‘rtburchak

B) romb

D) kvadrat

Javob: D.

15. $AD \perp ABC$. LA nima bo‘lsa, DL va BC to‘g‘ri chiziqlar perpendikulyar bo‘ladi?



A) bissektrisa

B) mediana

D) balandlik

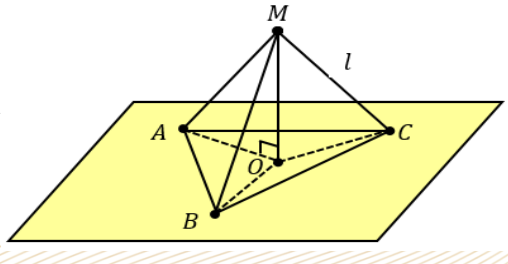
Javob: D.

16. M nuqta ABC uchburchak uchlaridan teng masofada joylashgan. M nuqtaning ABC tekislikdagi proyeksiyasi qaysi kesmalar kesishish nuqtasidan iborat bo‘ladi?

A) uchburchak balandliklarining;

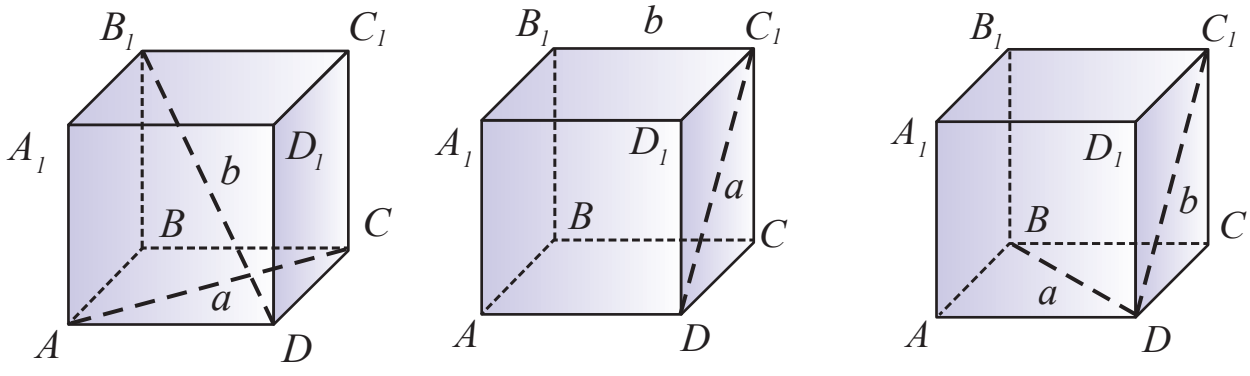
B) uchburchak bissektrisalarining;

C) uchburchak tomonlariga tushirilgan o‘rta perpendikulyarlarining.



Javob: C.

17. Rasmlarda $ABCDA_1B_1C_1D_1$ kub tasvirlangan. a va b to‘g‘ri chiziqlar qaysi rasmda perpendikulyar emas?



Javob: 3-rasmda.

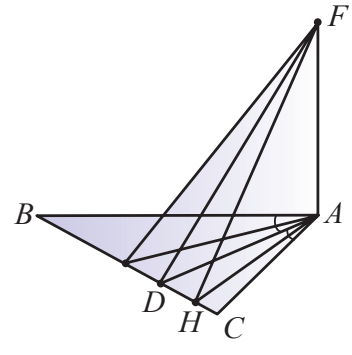
18. ABC uchburchakda AL – mediana, AD – bissektrisa, AH – balandlik. $AF \perp ABC$. F nuqtadan BC to‘g‘ri chiziqqacha bo‘lgan masofa qaysi kesma uzunligiga teng bo‘ladi?

A) FL

B) FD

C) FH

Javob: C.



19. $ABCD$ tetraedrda $\angle BCD = \angle ACD = 90°$. CD ga perpendikulyar bo‘lgan barcha qirralarni ko‘rsating.

A) AB, CB, CA

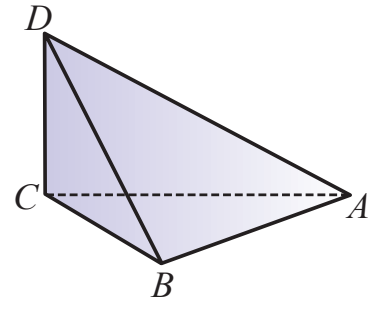
B) AB, BD, AD

C) CB, CA

D) AB

$CD \perp BC$; $CD \perp AC$.

Javob: C. BC va AC.



20. α tekislikka A nuqtadan AB – perpendikulyar, AC va AD og‘malar tushirilgan. $\angle ACB = 45°$, $AC = 8\sqrt{2}$, $BD = 6$. AD ni toping.

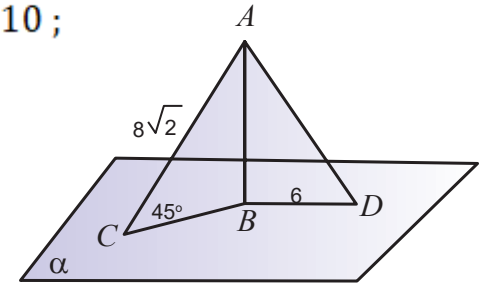
A) $2\sqrt{13}$; B) 10; C) 14; D) 4.

$$\sin \angle ACB = \frac{AB}{AC}; \qquad \sin 45° = \frac{AB}{8\sqrt{2}}; \qquad \frac{AB}{8\sqrt{2}} = \frac{1}{\sqrt{2}};$$

$$AB = \frac{8\sqrt{2}}{\sqrt{2}} = 8\,; \quad AD = \sqrt{AB^2 + BD^2} = \sqrt{8^2 + 6^2} =$$

$$= \sqrt{64+36} = \sqrt{100} = 10\,;$$

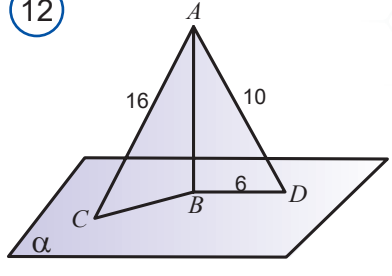
Javob: $AD = 10$.



21. α **tekislikka** AB **perpendikulyar,** AD **va** AC **og'malar tushirilgan.** $BD = 6$, $AD = 10$, $AC = 16$. $\angle ACB$ **ni toping.**

A) 45°; B) 30°; C) 60°; D) 90°

12



$$AB = \sqrt{AD^2 - BD^2} = \sqrt{10^2 - 6^2} = \sqrt{100 - 36} =$$

$$= \sqrt{64} = 8\,; \qquad \sin\angle ACB = \frac{AB}{AC} = \frac{8}{16} = \frac{1}{2}\,;$$

$$\sin\angle ACB = \frac{1}{2}\,; \qquad \angle ACB = 30^\circ\,.$$

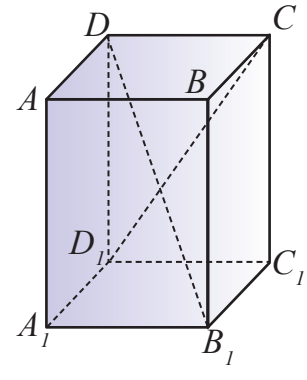
Javob: $\angle ACB = 30°$

V BOB. TAKRORLASH

TAKRORLASHGA DOIR MASALALAR

1. Tekislikka perpendikulyar va og‘malar

1. Rasmda to‘g‘ri burchakli parallelepiped tasvirlangan. 1) DB_1 va D_1C to‘g‘ri chiziqlar kesishadimi? BB_1 va D_1C to‘g‘ri chiziqlar-chi? 2) AO va B_1C_1 to‘g‘ri chiziqlar orqali tekislik o‘tkazish mumkinmi? DC va DB_1 orqali-chi? BC va AA_1 orqali-chi?



Javob: 1) DB_1 va D_1C to‘g‘ri chiziqlar kesishmaydi. BB_1 va D_1C to‘g‘ri chiziqlar kesishmaydi.

2) $\begin{cases} AO \subset \mathrm{ADC_1B_1} \\ B_1C_1 \subset ADC_1B_1 \end{cases}$ Demak, AO va B_1C_1 to‘g‘ri chiziqlar orqali tekislik o‘tkazish mumkin.

$\begin{cases} DC \subset CDB_1 \\ DB_1 \subset DCB_1 \end{cases}$ Demak, DC va DB_1 to‘g‘ri chiziqlar orqali tekislik o‘tkazish mumkin.

BC va AA_1 ayqash, shuning uchun bu to‘g‘ri chiziqlar orqali tekislik o‘tkazish mumkin emas.

2. To‘g‘ri burchakli parallelepipedning qirralari $3\ cm$, $4\ cm$ va $7\ cm$. Bir uchidan chiqqan uchta qirra uchlari orqali o‘tkazilgan kesimning yuzini toping.

C uchidan $CD = 3\ cm$, $CB = 4\ cm$, $CC_1 = 7\ cm$ qirralari uchlari orqali BDC_1 tekislik o‘tkazilgan.

$$BD = \sqrt{CB^2 + CD^2} = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} =$$

$$= \sqrt{25} = 5\ cm;$$

$$\begin{cases} CE \perp BD \\ CC_1 \perp CE \end{cases} \rightarrow \quad C_1E \perp BD \quad \text{uch perpendikulyar .}$$

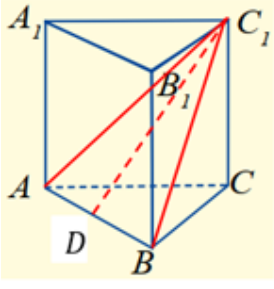
$$\frac{BD \cdot CE}{2} = \frac{DC \cdot BC}{2} = S_{BCD};$$

$$CE = \sqrt{CE^2 + {CC_1}^2} = \sqrt{\left(\frac{12}{5}\right)^2 + 7^2} = \sqrt{\frac{144}{25} + 49} = \sqrt{\frac{1369}{25}} = \frac{37}{5}\ cm;$$

$$S_{BDC_1} = \frac{BD \cdot C_1E}{2} = \frac{5 \cdot \frac{37}{5}}{2} = \frac{37}{2} = 18{,}5\ cm^2\ .$$

Javob: $S_{ABC_1} = 18{,}5\ cm^2$.

3. Muntazam prizmaning asosi tomoni a ga teng bo‘lgan uchburchakdan iborat. Prizmaning balandligi b ga teng. Ostki asosi tomonlarining biri va ustki asosining shu tomon qarshisida yotgan uchi orqali tekislik o‘tkazing. Hosil bo‘lgan kesimning yuzini hisoblang.



$AB = BC = AC = a; \quad BB_1 = CC_1 = AA_1 = b;$

$BC_1 = \sqrt{a^2 + b^2}; \quad AD = DB = a/2;$

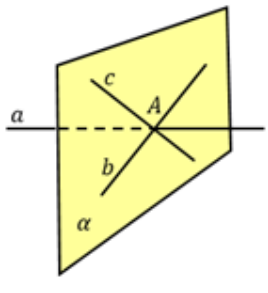
$DC_1 = \sqrt{BC_1^2 - DB^2} = \sqrt{(\sqrt{a^2+b^2})^2 - (a/2)^2} =$

$= \sqrt{a^2 + b^2 - \frac{a^2}{4}} = \sqrt{4a^2 + b^2 - \frac{a^2}{4}} = \frac{\sqrt{3a^2 + b^2}}{4};$

$$S_{ABC_1} = \frac{AB \cdot DC_1}{2} = a \cdot \sqrt{\left(\frac{3a^2}{4} + b2\right)^2} = \frac{(a \cdot \sqrt{(3a^2 + b^2)}2}{2} = (a \cdot \sqrt{\left(\frac{3a^2}{4} + \frac{b^2}{4}\right)}.$$

Javob: $S_{ABC_1} = (a \cdot \sqrt{(3a^2 + b^2)})/4$.

4. To‘g‘ri chiziqda olingan nuqtadan shu to‘g‘ri chiziqqa perpendikulyar tekislik o‘tkazing.

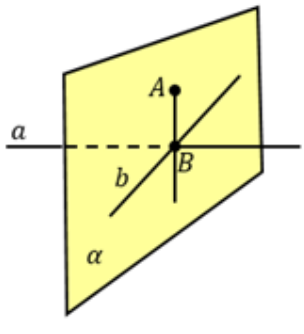


$a \cap b \cap c = A; \qquad b \perp a; \qquad c \perp a.$

b va c to‘g‘ri chiziqlar orqali α tekislik o‘tkazish mumkin.

$$\begin{cases} A \in a \\ A \in \alpha \end{cases} \rightarrow \qquad a \perp \alpha.$$

5. To‘g‘ri chiziq tashqarisida olingan nuqtadan shu to‘g‘ri chiziqqa perpendikulyar tekislik o‘tkazing.



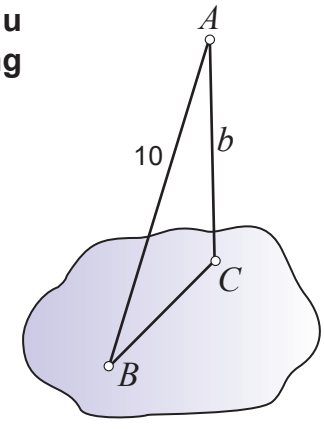
$AB \perp a;$

$b \perp a;$

$a \cap b = B.$

AB va b to‘g‘ri chiziq orqali α tekislik o‘tkazamiz.

6. Tekislikdan $b\ cm$ masofada turgan A nuqtadan, shu tekislikka uzunligi $10\ cm$ bo‘lgan AB og‘ma o‘tkazilgan. Uning shu tekislikka tushirilgan BC proyeksiyasini toping.



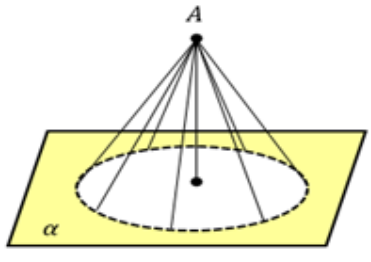
$AC = b\ cm;\quad AB = 10\ cm.\quad BC = ?$

$AB^2 = BC^2 + AC^2;\qquad BC^2 = AB^2 - AC^2;$

$BC = \sqrt{AB^2 - AC^2} = \sqrt{10^2 - b^2} = \sqrt{100 - b^2}.$

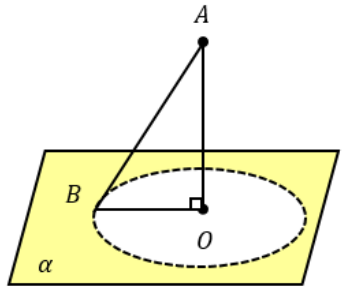
Javob: $BC = \sqrt{100 - b^2}.$

7. Tekislikdan tashqarida yotgan nuqtadan berilgan masofada turgan nuqtalarning berilgan tekislikdagi geometrik o‘rnini toping.



Javob: Tekislikdan tashqarida yotgan nuqtadan berilgan masofada turgan nuqtalarning berilgan tekislikdagi geometrik o‘rni aylanadan iborat.

8. Doira markazidan uning tekisligiga perpendikulyar o‘tkazilgan. Agar perpendikulyarning uzunligi a ga, doiraning yuzi Q ga teng bo‘lsa, perpendikulyarning ustki uchidan aylanadagi nuqtagacha bo‘lgan masofani aniqlang.



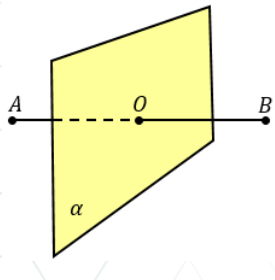
$OB = R;\qquad AO = a;\qquad S_{doira} = Q.\qquad AB = ?$

$\pi R^2 = S_{doira};\qquad \pi R^2 = Q;\qquad R^2 = \frac{Q}{\pi};$

$AB = \sqrt{BO^2 + AO^2} = \sqrt{R^2 + a^2} = \sqrt{\frac{Q}{\pi} + a^2}.$

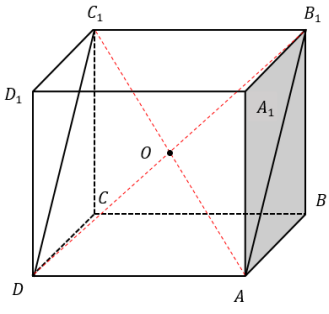
Javob: $AB = \sqrt{\frac{Q}{\pi} + a^2}.$

9. Berilgan ikki nuqtadan teng uzoqlikdagi nuqtalarning geometrik o‘rnini toping.



Javob: A va B nuqtalardan teng uzoqlikdagi nuqtalarning geometrik o‘rni α tekislikdan iborat.

10. $ABCDA_1B_1C_1D_1$ **to‘g‘ri burchakli parallelepipedning yon qirrasi** $AA_1 = 56$ *cm*, **asosining tomonlari:** $AB = 33$ *cm* **va** $AO = 40$ *cm*. AD **va** B_1C_1 **qirralaridan o‘tkazilgan kesimning yuzini aniqlang.**



$AA_1 = 56\ cm;\quad AB = 33\ cm;\quad AO = 40\ cm.$

$S_{ADC_1B_1} = ?\quad AC_1 = 2 \cdot AO = 2 \cdot 40\ cm = 80\ cm;$

$AA_1 = BB_1 = 56\ cm;\quad AC_1^2 = AD^2 + AA_1^2 + AB^2;$

$80^2 = AD^2 + 56^2 + 33^2;\quad 6400 = AD^2 + 3136 + 1089;$

$$AD = \sqrt{6400 - 3136 - 1089} = \sqrt{2175} = 5\sqrt{87}\ cm;$$

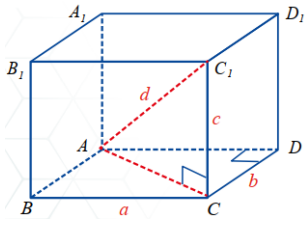
$$AB_1 = \sqrt{AB^2 + BB_1^{\,2}} = \sqrt{33^2 + 56^2} = \sqrt{1089 + 3136} = \sqrt{4225} = 65\ cm;$$

$$S_{ADC_1B_1} = AD \cdot AB_1 = 5\sqrt{87}\ cm \cdot 65\ cm = 325\sqrt{87}\ cm^2.$$

Javob: $S_{ADC_1B_1} = 325\sqrt{87}\ cm^2$.

2. To‘g‘ri chiziq bilan tekislik orasidagi burchak

1. To‘g‘ri burchakli parallelepiped asosining qirralari 4 *cm* **va 3** *cm*, **parallelepipedning balandligi 5** *cm*. **Uning diagonalini va diagonalning asos tekisligi bilan hosil qilgan burchagini toping.**



$a = BC = 4\ cm;\quad b = CD = 3\ cm;\quad c = CC_1 = 5\ cm;$

$AC_1 = ?;\quad \angle CAC_1 = ?.$

$AB = CD;\quad BC = AD;\quad AC^2 = AB^2 + BC^2;$

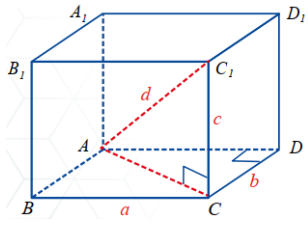
$$AC = \sqrt{AB^2 + BC^2} = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5\ cm;\qquad AC = 5\ cm;$$

$$AC_1 = \sqrt{AC^2 + CC_1^{\,2}} = \sqrt{5^2 + 5^2} = \sqrt{2 \cdot 5^2} = 5\sqrt{2}\ cm;\ \sin\angle CAC_1 = \frac{CC_1}{AC_1};$$

$$\sin\angle CAC_1 = \frac{5}{5\sqrt{2}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2};\qquad \sin\angle CAC_1 = \frac{\sqrt{2}}{2};\qquad \angle CAC_1 = 45°.$$

Javob: $AC_1 = 5\sqrt{2}\ cm;\qquad \angle CAC_1 = 45°$.

2. To‘g‘ri burchakli parallelepipedning diagonali parallelepiped asosining tekisligi bilan 45° li burchak hosil qiladi. Asosining tomonlari 120 *cm* va 209 *cm*. Parallelepipedning balandligini aniqlang.



$a = BC = 4\ cm;\ \ b = CD = 3\ cm;\ \ c = CC_1 = 5\ cm;$

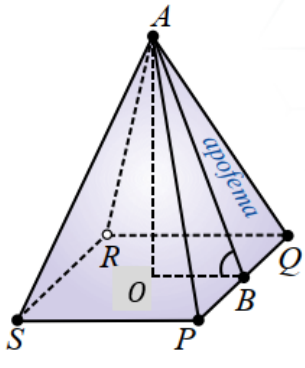
$AC_1 = ?;\ \ \angle CAC_1 = ?.$

$AB = CD;\ \ BC = AD;\ \ AC^2 = AB^2 + BC^2;$

$AC = \sqrt{AB^2 + BC^2} = \sqrt{209^2 + 120^2} = \sqrt{43681 + 14400} = \sqrt{58081} = 241\ cm;$

$AC = 241\ cm;\ \ CC_1 = AC = 241\ cm.$ Javob: $CC_1 = 241\ cm.$

3. Muntazam to‘rtburchakli piramidaning balandligi h, apofemaning asos tekisligiga og‘ish burchagi 60°. Piramidaning yon qirralarini toping.



Berilgan: $h = OA;\ \ \angle OBA = 60°.\ \ AS = ?$

$SP = PQ = QR = SR;\ \ AS = AP = AQ = AR;$

$\sin\angle OBA = \frac{OA}{AB} = \frac{h}{AB};\ \ \sin 60° = \frac{h}{AB};\ \ \frac{\sqrt{3}}{2} = \frac{h}{AB};$

$AB = \frac{2h}{\sqrt{3}} = \frac{2\sqrt{3}\cdot h}{3};\ \ \cos\angle OBA = \frac{OB}{AB};$

$\cos 60° = \frac{OB}{\frac{2\sqrt{3}\cdot h}{3}};\ \ \frac{1}{2} = \frac{3\cdot OB}{2\sqrt{3}\cdot h};\ \ 6\cdot OB = 2\sqrt{3}\cdot h;\ \ OB = \frac{2\sqrt{3}\cdot h}{6};$

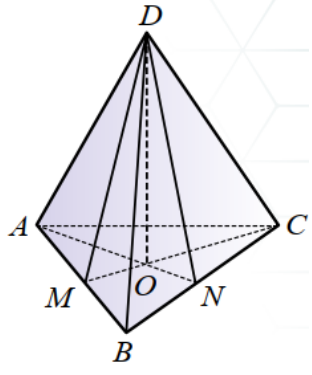
$OB = \frac{\sqrt{3}\cdot h}{3};\ \ OB = PB;\ \ PQ = 2\cdot PB = 2\cdot\frac{\sqrt{3}\cdot h}{3}$

$PQ = \frac{2\sqrt{3}\cdot h}{3};\ \ AP = \sqrt{PB^2 + AB^2} = \sqrt{\left(\frac{\sqrt{3}\cdot h}{3}\right)^2 + \left(\frac{2\sqrt{3}\cdot h}{3}\right)^2}$

$= \sqrt{\frac{3h^2}{9} + \frac{12h^2}{9}} = \sqrt{\frac{15h^2}{9}} = \frac{h\sqrt{15}}{3};\ \ AS = AQ = AR = AP = \frac{h\sqrt{15}}{3}.$

Javob: $AS = \frac{h\sqrt{15}}{3}$.

4. Muntazam uchburchakli piramidaning yon qirrasi b ga teng bo‘lib, piramida asosi bilan 30° li burchak hosil qiladi. Piramida asosining tomonini toping.



Berilgan: $\angle DAO = 30°;\quad AD = b.\quad AB = ?$

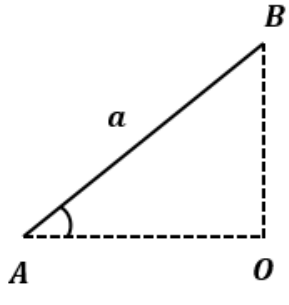
$\cos\angle DAO = \frac{AO}{AD};\quad \cos 30° = \frac{AO}{b};\quad \frac{\sqrt{3}}{2} = \frac{AO}{b};$

$AO = \frac{\sqrt{3}\cdot b}{2};\quad AO = \frac{\sqrt{3}}{2}\cdot\frac{2}{3}\cdot AB;\quad \frac{\sqrt{3}\cdot b}{2} = \frac{\sqrt{3}}{3}\cdot AB;$

$2\sqrt{3}\cdot AB = 3\sqrt{3}\cdot b;\qquad AB = \frac{3\sqrt{3}\cdot b}{2\sqrt{3}} = \frac{3b}{2} = 1{,}5b.$

Javob: $AB = 1{,}5b.$

5. Og‘ma *a* ga teng. Agar og‘ma proyeksiyalar tekisligi bilan: 1) 45°; 2) 60°; 3) 30° li burchak hosil qilsa, bu og‘maning tekislikdagi proyeksiyasi uzunligini toping.



1) Berilgan: $AB = a;\quad \angle A = 45°.\quad AO = ?$

$\cos\angle A = \frac{AO}{AB};\qquad \cos 45° = \frac{AO}{a};\qquad \frac{\sqrt{2}}{2} = \frac{AO}{a};$

$AO = \frac{a\cdot\sqrt{2}}{2}.\qquad Javob:\quad AO = \frac{a\cdot\sqrt{2}}{2}.$

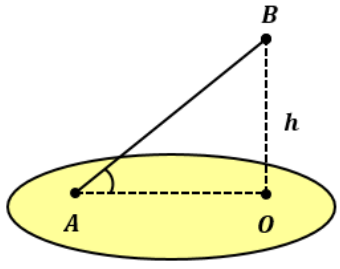
2) *Berilgan:* $AB = a;\quad \angle A = 60°.\quad$ *Topish kerak:* $AO = ?$

$\cos\angle A = \frac{AO}{AB};\quad \cos 60° = \frac{AO}{a};\quad \frac{1}{2} = \frac{AO}{a};\quad AO = \frac{a}{2}.\quad Javob:\quad AO = \frac{a}{2}.$

3) *Berilgan:* $AB = a;\quad \angle A = 30°.\quad$ *Topish kerak:* $AO = ?$

$\cos\angle A = \frac{AO}{AB};\quad \cos 30° = \frac{AO}{a};\quad \frac{\sqrt{3}}{2} = \frac{AO}{a};\quad AO = \frac{a\sqrt{3}}{2}.\quad Javob:\ AO = \frac{a\sqrt{3}}{2}.$

6. Nuqta tekislikdan *h* uzoqlikda yotibdi. Shu nuqtadan tekislikka o‘tkazilgan va u bilan: a) 30°; b), 45°; c) 60° li burchaklar hosil qilgan og‘maning uzunligini toping.



a) Berilgan: $\angle A = 30°;\ \ OB = h.\ \ AB = ?$

$\sin\angle A = \frac{OB}{AB}$; $\sin 30° = \frac{h}{AB}$; $\frac{1}{2} = \frac{h}{AB}$;

$AB = 2h.$

Javob: $AB = 2h.$

b) Berilgan: $\angle A = 45°;\ \ OB = h.$ Topish kerak: $AB=?$

$\sin\angle A = \frac{OB}{AB}$; $\sin 45° = \frac{h}{AB}$; $\frac{\sqrt{2}}{2} = \frac{h}{AB}$; $AB = \frac{2h}{\sqrt{2}} = \sqrt{2}h.$

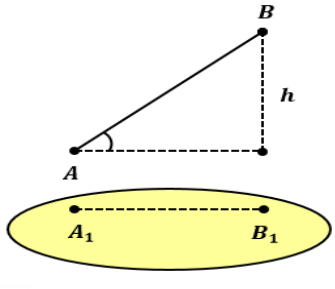
Javob: $AB = \sqrt{2}\,h.$

b) Berilgan: $\angle A = 60°;\ \ OB = h.$ Topish kerak: $AB = ?$

$\sin\angle A = \frac{OB}{AB}$; $\sin 60° = \frac{h}{AB}$; $\frac{\sqrt{3}}{2} = \frac{h}{AB}$; $AB = \frac{2h}{\sqrt{3}} = \frac{2\sqrt{3}h}{3}.$

Javob: $AB = \frac{2\sqrt{3}h}{3}.$

7. Kesmaning tekislikka tushirilgan proyeksiyasi uning o‘zidan ikki marta kichik bo‘lishi uchun kesmani tekislikka qanday burchak ostida og‘ma qilib o‘tkazish kerak?

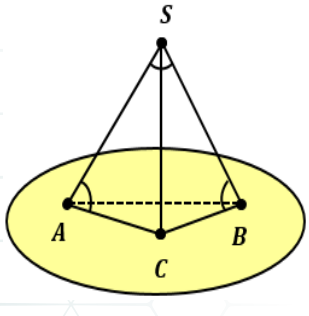


$AB = 2\cdot A_1B_1$; $\cos\angle A = \frac{A_1B_1}{AB}$;

$\cos\angle A = \frac{A_1B_1}{2\cdot A_1B_1}$; $\cos\angle A = \frac{1}{2}$; $\angle A = 60°.$

Javob: $\angle A = 60°.$

8. Tekislikdan *a* masofada turgan nuqtadan unga ikkita og‘ma o‘tkazilgan. Bu og‘malar tekislik bilan 45° li burchak, o‘zaro esa 60° li burchak hosil qiladi. Og‘malarning uchlari orasidagi masofani aniqlang.



Berilgan: $CS = a;\ \angle SAC = \angle SBC = 45°;$

$ASB = 60°.$ Topish kerak: $AB = ?$

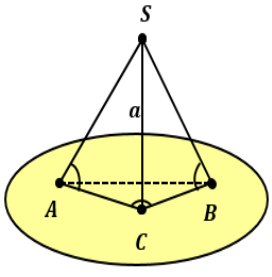
$\angle SAB = \angle SBA = \angle ASB = 60°;\ \ CB = CS = AC = a;$

$SB^2 = CB^2 + CS^2;\ \ SB = \sqrt{CB^2 + CS^2} = \sqrt{a^2 + a^2} =$

$= \sqrt{2a^2} = a\sqrt{2}.$

Javob: $AB = SB = SA = a\sqrt{2}.$

9. Tekislikdan *a* uzoqlikda turgan nuqtadan tekislik bilan 30° li burchak yasovchi ikki og‘ma o‘tkazilgan. Ularning tekislikdagi proyeksiyalari o‘zaro 120° li burchak hosil qiladi. Og‘malarning uchlari orasidagi masofani aniqlang.



$CS = a;\ \angle SAC = \angle SBC = 30°;\ \angle ACB = 120°.\ AB = ?$

$$tg\angle CBS = \frac{CS}{CB};\quad tg30° = \frac{a}{CB};\quad \frac{1}{\sqrt{3}} = \frac{a}{CB};\quad AC = CB;$$

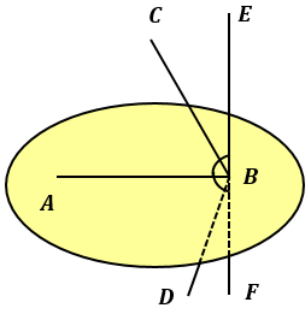
$$CB = a\sqrt{3};\quad AB^2 = AC^2 + CB^2 - 2\cdot AC\cdot CB\cdot\cos\angle ACB;$$

$$AB = \sqrt{(a\sqrt{3})^2 + (a\sqrt{3})^2 - 2\cdot a\sqrt{3}\cdot a\sqrt{3}\cdot\cos\angle 120°} =$$

$$= \sqrt{3a^2 + 3a^2 - 6a^2\cdot\left(-\frac{1}{2}\right)} = \sqrt{6a^2 + 3a^2} = \sqrt{9a^2} = 3a.$$

Javob: $AB = 3a$

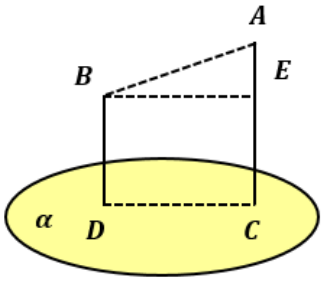
10. *AB* to‘g‘ri chiziq α tekislikda yotadi. *B* nuqtadan *AB* ga perpendikulyar *BC* va *BD* to‘g‘ri chiziqlar o‘tkazilgan. Ular *α* tekislikning bir tomonida bo‘lib, unga 50° va 15° ga og‘gan. *CBD* burchakni toping.



$AB \in \alpha;\ AB \perp BC;\quad AB \perp BD;\quad \angle CBE = 50°;$
$\angle DBF = 15°.$ Topish kerak: $\angle CBD = ?$
$\angle CBD = 180° - (\angle CBE + \angle DEF) =$
$= 80° - (50° + 15°) = 180° - 65° = 115°.$
Javob: $\angle CBD = 115°.$

3. Parallel to‘g‘ri chiziqlar va tekisliklar

1. *A* va *B* nuqtalar α tekislikning tashqarisida yotibdi. *AC* va *BD* shu tekislikka perpendikulyar. *AC = 3 m, BD = 2 m, CD = 24 dm. A* va *B* nuqtalar orasidagi masofani aniqlang.



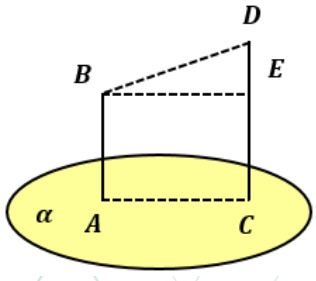
Berilgan: $AC \perp \alpha;\quad BD \perp \alpha;\quad A \notin \alpha;\quad B \notin \alpha;$
$AC = 3\ m = 30\ dm;\quad BD = EC = 2\ m = 20\ dm;$
$CD = 24\ dm.$ Topish kerak: $AB = ?$
$BE = CD = 24\ dm;$
$AE = AC - EC = 30\ dm - 20\ dm = 10\ dm;$

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$$AB = \sqrt{AE^2 + BE^2} = \sqrt{10^2 + 24^2} = \sqrt{100 + 576} = \sqrt{676} = 26\ dm\,.$$

Javob: $AB = 26\ dm.$

2. *125 cm* uzunlikdagi kesmaning uchlari tekislikdan *100 cm* va *56 cm* uzoqlikda. Kesma proyeksiyasining uzunligini toping.



Berilgan: $AB=56\ cm\ ;\ CD=100\ cm\ ;\ BD = 125\ cm;$

Topish kerak: $AC = ?\quad AB = EC\ ;$

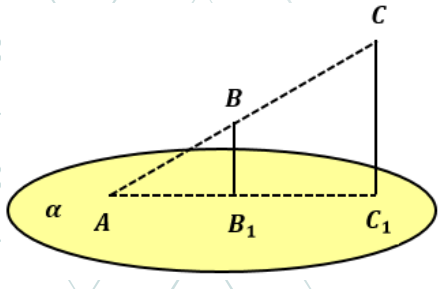
$DE = CD\text{-}EC = 100\ cm\text{-}56\ cm=44\ cm\ ;$

$AC = BE=\sqrt{BD^2} - DE^2 = \sqrt{125^2 - 44^2} =$

$= \sqrt{15625 - 1936} = \sqrt{13689} = 117\ cm.$

Javob: $AC = 117\ cm.$

3. *α* tekislikning *A* nuqtasidan og‘ma to‘g‘ri chiziq o‘tkazilgan va unda *B* hamda a nuqtalar olingan. *AB = 8 cm* va *AC = 14 cm. B* nuqta α tekislikdan *6 cm* uzoqlikda. *α* tekislikdan *C* nuqtagacha bo‘lgan masofani toping.



Berilgan: $AB = 8\ cm;\ AC = 14\ cm;$

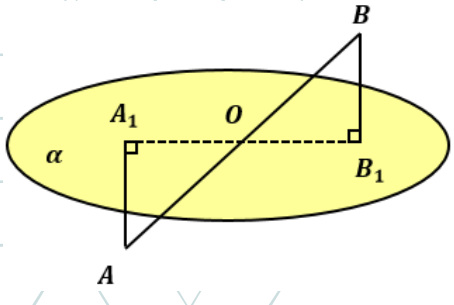
$BB_1 = 6\ cm.$ Topish kerak: $CC_1 = ?$

$\Delta ABB_1 \sim \Delta ACC_1\ ;\quad \frac{AB}{AC} = \frac{BB_1}{CC_1}\ ;\quad \frac{8}{14} = \frac{6}{CC_1}\ ;$

$$CC_1 = \frac{6 \cdot 14}{8} = \frac{3 \cdot 7}{2} = \frac{21}{2} = 10{,}5\ cm\,.$$

Javob: $CC_1.$

4. *10 cm* uzunlikdagi kesma tekislikni kesadi. Uning uchlari tekislikdan *5 cm* va *3 cm* uzoqlikda. Kesmaning tekislikdagi proyeksiyasining uzunligini toping.



Berilgan: $AB = 10\ cm;\quad AA_1 = 5\ cm;$

$BB_1 = 3\ cm$ .Topish kerak: $A_1B_1 = ?$

$\Delta AA_1O \sim \Delta BB_1O\ ;\quad \frac{AA_1}{BB_1} = \frac{AO}{BO}\ ;\quad \frac{AO}{BO} = \frac{5}{3}\ ;$

$AO = 5x;\ BO = 3\ x;\quad AO + OB = AB;$

$$5x + 3x = 10\ ;\quad 8x = 10\ ;\quad 4x = 5\ ;\quad x = \frac{5}{4}\ ;\quad AO = 5x = 5 \cdot \frac{5}{4} = \frac{25}{4}\ cm\ ;$$

$$A_1O=\sqrt{AO^2-AA_1{}^2}=\sqrt{\left(\frac{25}{4}\right)^2-5^2}=\sqrt{\left(\frac{25}{4}-5\right)\cdot\left(\frac{25}{4}+5\right)}=\sqrt{\frac{5}{4}\cdot\frac{45}{4}}=$$

$$=\sqrt{\frac{5\cdot5\cdot9}{4\cdot4}}=\frac{5\cdot3}{4}=\frac{15}{4}\ cm;\qquad BO=3x=3\cdot\frac{5}{4}$$

$$=\frac{15}{4}\ cm;$$

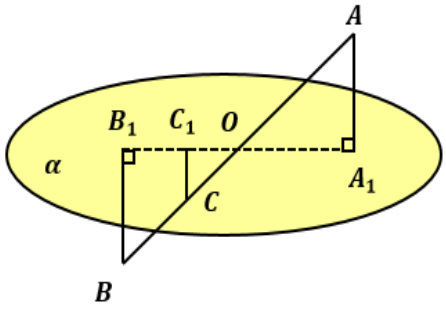
$$B_1O=\sqrt{OB^2-BB_1{}^2}=\sqrt{\left(\frac{15}{4}\right)^2-3^2}=\sqrt{\left(\frac{15}{4}-3\right)\cdot\left(\frac{15}{4}+3\right)}=\sqrt{\frac{3}{4}\cdot\frac{27}{4}}=$$

$$=\sqrt{\frac{81}{16}}=\frac{9}{4}\ cm;\qquad A_1B_1=A_1O+B_1O=\frac{15}{4}\ cm+\frac{9}{4}\ cm=\frac{24}{4}\ cm=6\ cm.$$

Javob: $A_1B_1=6\ cm.$

5. Kesma tekislikni kesadi. Uning uchlari tekislikdan *8 cm* va *2 cm* uzoqlikda. Kesmaning o‘rtasidan tekislikkacha bo‘lgan masofani toping.

Berilgan: $AA_1=2\ cm;\quad BB_1=8\ cm.\quad CC_1=?$



$$\Delta BB_1O\sim\Delta AA_1O;\quad \frac{BB_1}{AA_1}=\frac{BO}{AO};\quad \frac{BO}{AO}=\frac{8}{2}=4;$$

$$\frac{BO}{AO}=4;\qquad BO=4\cdot AO;\qquad AB=BO+AO;$$

$$AB=4\cdot AO+AO=5\cdot AO;\qquad BC=CA=\frac{AB}{2}=\frac{5\cdot AO}{2};$$

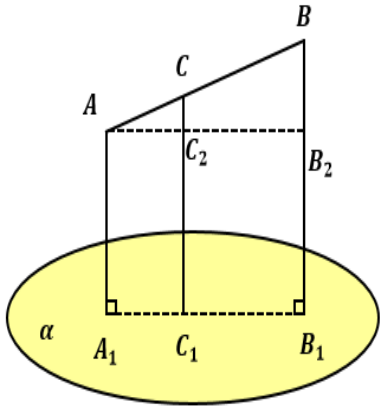
$$CO=AC-AO=\frac{5\cdot AO}{2}-AO=\frac{5\cdot AO-2AO}{2}=\frac{3\cdot AO}{2};$$

$$\frac{CC_1}{AA_1}=\frac{CO}{AO};\qquad \frac{CC_1}{2}=\frac{\frac{3\cdot AO}{2}}{AO};\qquad \frac{CC_1}{2}=\frac{3\cdot AO}{2\cdot AO};\qquad \frac{CC_1}{2}=\frac{3}{2};$$

$$CC_1=\frac{2\cdot3}{2}=\frac{6}{2}=3\ cm.$$

Javob: $CC_1=3\ cm.$

6. Tekislik bilan kesishmaydigan kesmaning uchlari tekislikdan *30 cm* va *50 cm* uzoqlikda. Shu kesmani *3:7* nisbatda bo‘luvchi nuqta tekislikdan qancha uzoqlikda bo‘ladi?



1-hol. Berilgan: $AA_1 = 30\ cm;\ BB_1 = 50\ cm;$

$AC:CB = 3:7;\quad AC = 3x;\quad CB = 7x;$

$$AB = AC + CB = 3x + 7x = 10x;\qquad \frac{AC}{AB} = \frac{3x}{10x};$$

$$\frac{AC}{AB} = \frac{3}{10};\qquad AA_1 = C_1C_2 = B_1B_2 = 30\ cm;$$

$$BB_2 = BB_1 - B_1B_2 = 50\ cm - 30\ cm = 20\ cm;\qquad \Delta ACC_2 \sim \Delta ABB_2;$$

$$\frac{AC}{AB} = \frac{CC_2}{BB_2};\quad \frac{3}{10} = \frac{CC_2}{20};\qquad CC_2 = \frac{3\cdot 20}{10} = 3\cdot 2 = 6\ cm;$$

$$CC_1 = CC_2 + C_1C_2 = 6\ cm + 30\ cm = 36\ cm.$$

Javob: $CC_1 = 36\ cm.$

2-hol. *Berilgan:* $AA_1 = 30\ cm;\ BB_1 = 50\ cm;$

$$BC : AC = 3 : 7;\quad BC = 3x;\quad AC = 7x;\quad AB = AC + CB = 3x + 7x = 10x;$$

$$\frac{BC}{AC} = \frac{3x}{10x};\qquad \frac{BC}{AC} = \frac{3}{10};\qquad AA_1 = C_1C_2 = B_1B_2 = 30\ cm;$$

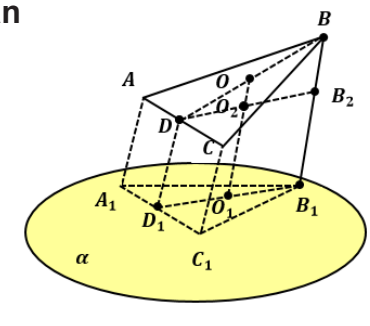
$$BB_2 = BB_1 - B_1B_2 = 50\ cm - 30\ cm = 20\ cm;\qquad \Delta ACC_2 \sim \Delta ABB_2;$$

$$\frac{AC}{AB} = \frac{CC_2}{BB_2};\qquad \frac{7}{10} = \frac{CC_2}{20};\qquad CC_2 = \frac{7\cdot 20}{10} = 7\cdot 2 = 14\ cm;$$

$$CC_1 = CC_2 + C_1C_2 = 14\ cm + 30\ cm = 44\ cm.$$

Javob: $CC_1 = 44\ cm$

7. Muntazam uchburchak tekislikka proyeksiyalangan. Uning uchlari tekislikdan *10 dm, 15 dm* va *17 dm* uzoqlikda. Uchburchakning markazidan proyeksiyalar tekisligigacha bo‘lgan masofani toping.



Berilgan: $CC_1 = 10\ dm;\quad AA_1 = 15\ dm;$

$BB_1 = 17\ dm.$ Topish kerak: $OO_1 = ?$

$$AD = DC;\quad DD_1 = \frac{AA_1 + CC_2}{2} = \frac{15 + 10}{2} = \frac{25}{2}\ dm;$$

$DD_1 = B_2B_1 = O_1O_2 = \frac{25}{2}\ dm;$

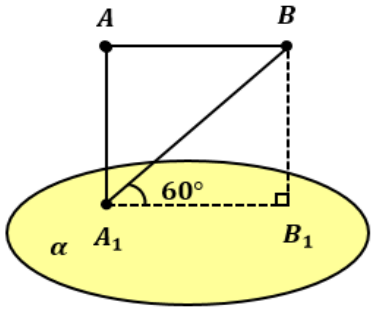
$BB_2 = BB_1 - B_2B_1 = 17 - \frac{25}{2} = \frac{34-25}{2} = \frac{9}{2}\ dm;$ $\Delta DOO_2 \sim \Delta DBB_2;$

$DO : OB = 1 : 2;$ $DO : DB = 1 : 3;$ $\frac{DO}{DB} = \frac{OO_2}{BB_2};$ $\frac{1}{3} = \frac{OO_2}{\frac{9}{2}};$

$OO_2 = \frac{\frac{9}{2}}{3} = \frac{9}{2\cdot 3} = \frac{3}{2}\ dm;$ $OO_1 = OO_2 + O_2O_1 = \frac{3}{2} + \frac{25}{2} = \frac{28}{2} = 14\ dm.$

Javob: $OO_1 = 14\ dm$.

8. Tekislikka parallel AB kesma berilgan, uning uzunligi a ga teng. B uchi bilan ikkinchi uchining A_1 proyeksiyasini tutashtiruvchi BA_1 kesma tekislik bilan $60°$ li burchak hosil qiladi. BA_1 kesmaning uzunligini aniqlang.



Berilgan: $AB \parallel \alpha;\ AB = a;\ \angle BA_1B_1 = 60°.$

Topish kerak: $BA_1 = ?$

$A_1B_1 = AB = a;$ $\cos\angle BA_1B_1 = \frac{A_1B_1}{A_1B};$

$\cos 60° = \frac{a}{BA_1};$ $\frac{1}{2} = \frac{a}{BA_1};$ $BA_1 = 2a.$

Javob: $BA_1 = 2a.$

O‘quv nashri

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