O’zbekiston Respublikasi
Oliy va O’rta maxsus ta`lim vazirligi

Namangan muhandislik-pedagogika instituti

«Axborotlar texnologiyasi»
kafedrasi

«LOYIXALASH JARAYONLARINI AVTOMATLASHTIRISH ASOSLARI» FANIDAN TAJRIBA ISHLARNI BAJARISH BO’YICHA YUTTUE yo`nalishlari uchun

USLUBIY KO’RSATMA

Namangan-2016

talabasi_____ning "LJAA" fanidan joriy va oraliq baholashlarini qayd etuvchi reyting varaqasi (bahorgi semestr)

Baholash turi	*Tajriba ishi uchun topshiriq mazmuni*	Maksimall ball	Bajarish muddati	Olingan ball	2-Muddat (-1) ball	(so'nggi imkoniyat) (-2) ball	Natijaviy ball
1-JN	1-tajriba. *Berilgan ob`ekt (buyum)ni loyixalash jarayoni strukturasini ishlab chiqish. Berilgan ob`ekt ALTi strukturasini ishlab chiqish (Matematik modelga algoritm ishlab chiqish).*	4					
	2-tajriba. *Amaliy dasturlar paketi yordamida turi matematik ifodalarni yechish va funksiyalar grafiklarin qurishni tashkil etish.*	4					
	3-tajriba. *Berilgan ob`ekt ALTi matematik modelini amali dasturlar paketi yordamida yechishni tashkil etish.*	5					
	Mustaqil ish topshiriqlarini bajarganligi uchun	4					
	Talabaning mashg'ulotlardagi ishtiroki, faolligi, ijodiy fikrlashi, mustaqil qarorlar qabul qila olishi, mantiqiy xulosalar chiqara olganligi uchun	3					
	Jami: 1-joriy	*20 ball*					
1-ON	Mavzular bo'yicha yozma ish.	8					
	Mustaqil ish topshiriqlarini bajarganligi uchun	4					
	Talabaning mashg'ulotlardagi muntazam ishtiroki, faolligi, ijodiy fikrlashi, mustaqil qarorlar qabul qila olishi, mantiqiy xulosalar chiqara olganligi uchun.	3					
	Jami: 1-oraliq	*15 ball*					
1-JN	4-tajriba. *ALTning texnikaviy, umumtizimli va lingvisti ta`minotini tanlash. Berilgan ob`ekt ALTi amaliy taminotin loyixalash*	4					
	5-tajriba. *ALT tnformatsion ta`minoti (berilganlar bazasi) ni tanlash va loyixalash. AutoCAD dasturida Ob`ektlarini qurish; chizmalarni shakllantirish komandalari; chizmalarni taxrirlash;*	4					
	6-tajriba. *AutoCAD dasturidan foydalanib, uch o`lchamli ob`ektlarni shakllantirish.*	5					
	Mustaqil ish topshiriqlarini bajarganligi uchun	4					
	Talabaning mashg'ulotlardagi ishtiroki, faolligi, ijodiy fikrlashi, mustaqil qarorlar qabul qila olishi, mantiqiy xulosalar chiqara olganligi uchun	3					
	Jami: 2-joriy	*20 ball*					
2-ON	Mavzular bo'yicha TEST topshiriqlari	8					
	Mustaqil ish topshiriqlarini bajarganligi uchun	4					
	Talabaning mashg'ulotlardagi muntazam ishtiroki, faolligi, ijodiy fikrlashi, mustaqil qarorlar qabul qila olishi, mantiqiy xulosalar chiqara olganligi uchun.	3					
	Jami: 2-oraliq	*15 ball*					

Izoh: Har bir olingan ball o'qituvchi imzosi bilan tasdiqlanadi. Ushbu varaqa magistrning qo'lida semestr yakunlanguncha turishi shart. Reyting varaqasi yo'qotilsa, Uni qayta to'ldirilmaydi.

O'qituvchi_____(Imzo)_____ Talaba _____

So’z boshi

“Jahon tsivilizatsiyasiga dahldor bo’lgan eng zamonaviy ilmlarni egallamay turib, mamlakat taraqqiyotini ta`minlash qiyin”,-degan edilar I.Karimov. O’zbekistonning iqtisodiy va ijtimoiy sohalarda yuqori natijalarga erishishi, jahon iqtisodiy tizimida to’laqonli natijalarga to’laqonli sheriklik o’rnini egallay borishi, inson faoliyatining barcha jabhalarida zamonaviy axborot texnologiyalaridan yuqori darajada foydalanishning ko’lamlari qanday bo’lishiga hamda bu texnoliyalar ijtimoiy mehnat samaradorligining oshishida qanday ro’l o’ynashiga bog’liq. Demak, zamonaviy komp’yuterlardan amalda keng foydalana oladigan yetuk kadrlar tayyorlash kechiktirib bo’lmaydigan vazifadir.

Talabalar axborot texnologiyalarini va yo’nalish bo’yicha maxsus fanlarni o’rganish natijasida loyixalovchi muhandis darajasiga yetishadi. Lekin, ular olgan nazariy va amaliy bilimlarini amaliy masalalarni loyixalash va yechishda ko’pgina qiyinchiliklarga duch kelishadi. Chunki ularda tipik, taqribiy masalalarni yechishda oliy matematika kursidan olgan bilimlargina mavjud. Shuning uchun, muxandislik masalalarning matematik va sxematik modellarini tushuna olishlari, ularni yechishning sonli-taqribiy,taqribiy-analitik va grafik usullarini o’rganishlari uchun “Loyixalash jarayonlarini avtomatlashtirish asoslari” fanining ahamiyati katta hisoblanadi.

Tajriba mashg’ulotlarni bajarish uchun belgilangan tartiblar:

1. Tajriba ishini bajarish uchun zarur bo’lgan nazariy ma`lumotlarni ko’rsatilgan adabiyotlardan to’plash;
2. Belgilangan variant bo’yicha shaxsiy topshiriqlarni o’z vaqtida olish;
3. Ish rejasida belgilangan masalalarning qo’yilishi, uning mohiyati va xalq ho’jaligidagi masalalarni yechishdagi ahamiyati haqida to’liq ma`lumotga ega bo’lish;
4. Masalani yechish usullarining ishchi algoritmlarini ishlab chiqish.
5. Ishlab chiqilgan algoritmlar bo’yicha masalaga mos holda dastur yaratish.
6. To’zilgan dasturni tekshirib ko’rish va olinayotgan natijalarning to’g’riligiga ishonch bildirish;
7. Qo’yilgan masala (shaxsiy topshiriq)ning dasturdan olingan natijalarini zarur formada chop etishni tashkillash;
8. Bajarilgan ishlarni, belgilangan reja asosida rasmiylashtirish va uni o’qituvchi huzurida himoya qilish (tajriba darsi mobaynida);
9. Himoya qilingan, o’qituvchi tomonidan baholangan tajriba ishi hisobotini o’qituvchiga topshirish;
10. Tajriba ishini o’z vaqtida bajarmagan talaba o’qituvchi belgilagan vaqtda (dars mashg’ulotlaridan bo’sh vaqtda) kafedraga kelib ishni bajaradi va belgilangan tartibda uni himoya qiladi;
11. Agar talaba dars mobaynida va qo’shimcha belgilangan vaqtda ham tajriba ishini bajarmasa shu mavzu uchun reyting ballarini ololmaydi va fandan o’zlashtirmagan hisoblanadi.

1-TAJRIBA IShI

MAVZU: Berilgan ob`ekt (buyum)ni loyixalash jarayoni strukturasini ishlab chiqish. Berilgan ob`ekt ALTi strukturasini ishlab chiqish, matematik modelini tuzish. (Chiziqli tenglamalar tuzish, differentsial tenglamasini ishlab chiqish).

Ishdan maqsad: Mathcad da chiziqli tenglamalar sistemasini yechishni o`zlashtirish,

REJA:

1. Chiziqli tenglamalar haqida umumiy ma`lumotlar.
2. Berilgan ob`ekt (buyum)ni loyixalash jarayoni strukturasini ishlab chiqish.
3. Berilgan ob`ekt ALTi strukturasini ishlab chiqish, matematik modelini tuzish

Chiziqli tenglamalar haqida umumiy ma`lumotlar

Chiziqli algebraik tenglamalar sistemasini yechish usullari muhandislik masalalarida muhim o`rin tutadi. Buning asosiy sababi xalq ho`jaligining juda ko`p masalalari bunday sistemalarni

yechish bilan bog`liqdir.

Ushbu n-tartibli n ta chiziqli algebraik tenglamalar sistemasi berilgan bo`lsin:

$$\begin{cases} a_{11}x_1 + a_{12}x_2 + ... + a_{1n}x_n = b_1 \\ a_{21}x_1 + a_{22}x_2 + ... + a_{2n}x_n = b_2 \\ ..... \\ a_{n1}x_1 + a_{n2}x_2 + ... + a_{nn}x_n = b_n \end{cases} \qquad (1.1)$$

Bu yerda a_{ij} (i,jq1,n) lar ma`lum sonlardan iborat bo`lib, noma`lumlarning k o e f f i ts i ye n t l a r i deyiladi, $x_1,x_2,...,x_n$ - noma`lumlar, b_1, b_2,..., b_n- sistema tenglamalarining ozod hadlari, ular ham ma`lum sonlardan iborat.

Quyidagi belgilashlarni kiritamiz:

$$A = \begin{pmatrix} a_{11}a_{12}...a_{1n} \\ a_{21}a_{22}...a_{2n} \\ ..... \\ a_{n1}a_{n2}...a_{nn} \end{pmatrix}, X = \begin{pmatrix} x_1 \\ x_2 \\ . \\ . \\ . \\ x_n \end{pmatrix}, B = \begin{pmatrix} b_1 \\ b_2 \\ . \\ . \\ . \\ b_n \end{pmatrix}. \qquad (1.2)$$

Bunda A-n ta satr va n ta ustundan iborat kvadrat matritsa, a_{ij} elementlarning soni n^2 ta, X V-n ta elementlardan iborat vektor ustunlar.

Matritsalarni bir-biriga ko`paytirish xossasidan foydalanib, belgilashlarni hisobga olgan holda sistemani matritsa ko`rinishda yozamiz:

A*XqV. (1.3)

Chiziqli algebraik tenglamalar sistemasini yechish deb (1.1) yoki (1.3) sistemalardan $x_1,x_2,x_3,...,x_n$ noma`lumlarni topishga aytiladi. Topilgan $x_1,x_2,x_3,...,x_n$ qiymatlar (1.1) yoki (1.3) sistemalarga qo`yilganda tenglamalarni ayniyatga aylantirsa, ular sistemaning yechimi deyiladi.

Sistemaning yagona yechimi mavjudligining zaruriy va yetarli sharti A matritsa determinantining noldan farqli bo`lishidir, ya`ni

$$D = \det A = \begin{vmatrix} a_{11}a_{12}...a_{1n} \\ a_{21}a_{22}...a_{2n} \\ ..... \\ a_{n1}a_{n2}...a_{nn} \end{vmatrix} \neq 0. \qquad (1.3)$$

Agar Dq0 bo`lsa, sistemalar maxsus sistemalar deyiladi va ularning yechimi yoki mavjud emas, yoki cheksiz ko`p bo`ladi (bunday sistemalarni aynigan sistemalar deb ataladi).

Chiziqli algebraik tenglamalar sistemasini yechish usullari ikkita guruhga bo`linadi: to`g`ri (aniq) va iteratsion (taqribiy) usullar.

To`g`ri usullar yordamida sistemaning yechimi chekli sondagi aniq arifmetik amallar bajarish orqali hisoblanadi. Bu usullar keng sinfdagi sistemalarni yechish imkoniyatiga ega. Lekin, shu bilan birga, ular ayrim kamchiliklardan ham holi emas. Masalan, ular EHMda ishlatilganda hotira qurilmasida sistema koeffitsentlari va ozod hadlarning barchasi saqlanishi kerak. Sistema koeffitsentlari matritsasi A ning elementlari siyrak bo`lsa, ya`ni 0 ga teng elementlari ham bo`lsa, ularni xotira qurilmasiga yozish ko`p joyni egallaydi. Bundan tashqari, usullar asosida yotuvchi algoritmlar aniq bo`lishiga qaramasdan yechim ma`lum darajada taqribiy topiladi. Chunki yahlitlash xatoliklari ketma-ket bajariluvchi hisoblash bosqichlarida doimo jamlanib boradi. Ayniqsa yuqori tartibli va yomon shartlangan sistemalar uchun bu butunlay yaroqsiz yechim olinishiga sabab bo`lishi mumkin. Shuning uchun to`g`ri usullar yaxshi shartlangan, past tartibli, elementlari siyrak bo`lmagan matritsali sistemalarni yechishda ishlatiladi.

Kramer formulasi.

Faraz qilaylik birinchi darajali, ikki noma`lumli ikkita algeybraik tenglamalar sistemasi berilgan bo`lsin:

$$\begin{cases} a_{11}x_1 + a_{12}x_2 = b_1 \\ a_{21}x_1 + a_{22}x_2 = b_2 \end{cases} \qquad (1)$$

(1) sistemaning 1-tenglamasini a_{22} ga, 2-tenglamasini $-a_{12}$ ga ko`paytirib qo`shsak

$$(a_{11}a_{22}-a_{12}a_{21})x_1 = b_1a_{22}-b_2a_{12} \qquad x_1 = \frac{b_1a_{22} - b_2a_{12}}{a_{11}a_{22} - a_{12}a_{21}} \quad (2)$$

Agar (1) sistemaning 1-sistemasini $-a_{21}$ ga 2-tenglamasini a_{11} ga ko`paytirib qo`shsak

$$(a_{11}a_{22}-a_{12}a_{21})x_2 = b_2a_{11}-b_1a_{21} \qquad x_2 = \frac{b_2a_{11} - b_1a_{21}}{a_{11}a_{22} - a_{12}a_{21}} \quad (3)$$

(2) va (3) Larga etibor bersak ikkinchi tarbibli determinatining ta`rifiga ko`ra

$$x_1 = \frac{\begin{vmatrix} b_1 & a_{12} \\ b_2 & a_{22} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}} = \frac{\Delta_1}{\Delta}; \qquad x_2 = \frac{\begin{vmatrix} a_{11} & b_1 \\ a_{21} & b_2 \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}} = \frac{\Delta_2}{\Delta}; \qquad (4)$$

(4) ga Krammer formulasi deyiladi

2-TAJRIBA ISh

MAVZU: Amaliy dasturlar paketi yordamida turli matematik ifodalarni yechish va funksiyalar grafiklarini qurishni tashkil etish.

REJA:

1. Mathcad strukturasi va uni ishga tushirish
2. Matematik ifodalarni qurish va hisoblash
3. Mathcad menyusi va uskinalar paneli.

Mathcad strukturasi va uni ishga tushirish.

Mathcad xilma-xil matematik masalalarni yechish uchun muljallangan integrallashgan muxitdir. Mathcad quyidagi funkfional komponentlardan iborat:

· Yaxshi uylangan, kordinatsiyalashgan menyular sistemasi, konteks menyu;

· Qurollar paneli majmuasi;

· Matn muxarriri;

· Formulalar redaktori;

· Grafiklar redaktori, jumladan uch o'lchovli grafiklar yaratish imkoniyatini beradi;

· Xisoblash sistemasi, bu sistema sonli va simvolli xisoblashlar imkoniyatini beradi;

· Shablonlar majmuasi, ular yordamida formulalar, indekslar, integral, xosila, matritsa, determinant va xokazo belgilarni kulay kiritish mumkin;

· Matematik ifodalarni to'g'ri yozilishini nazorat qiluvchi va notug'riligi xaqida, uni tuzatish xakida kursatma beruvchi yordam sistemasi;

· Natijalarni chiqarish sistemasi;

· Alfavitli, indeksli yordam sistemasi, tayyor shpargalkalar, bo'limlarga ajratilgan yordam sistemasi.

Mathcad menyusi ierarxik tuzilishga ega: bosh menyu (gorizontal menyu), gorizontal menyu punktlariga bog'langan osiluvchi vertikal menyu va uning qo'shimcha menyulari, qalqib chikuvchi menyu, kontekst menyu.

Mathcad Matematik amaliy dasturlar dastasi Math Soft Inc. firmasi tomonidan kompakt disklarda chikariladi. Uni standart usullar bilan installyatsiya kilinadi. Mathcad installyatsiya kilingach Windows OS ning bosh menyusida qayd etiladi. Mathcad ni ishga tushirish xam Windows OS ning standart usullari bilan ishga tushiriladi:

1-usul. Bosh menyu orqali pusk «programmo'» Math Soft Apps Mathcad;

2-usul. Ixtiyoriy papkada, jumladan ish stolidagi Mathcad yorligida sichqoncha chap tugmasida ko'sh chertki (SChTQCh);

3-usul. Ixtiyoriy, mcd qo'shimchali fayl ustida SChTQCh;

4-usul. Bo'stro'y zapusk panelida tugmada SChTQCh bilan.

Bistro zapusk panelida Mathcad (M) tugmasi quyidagicha yaratiladi:

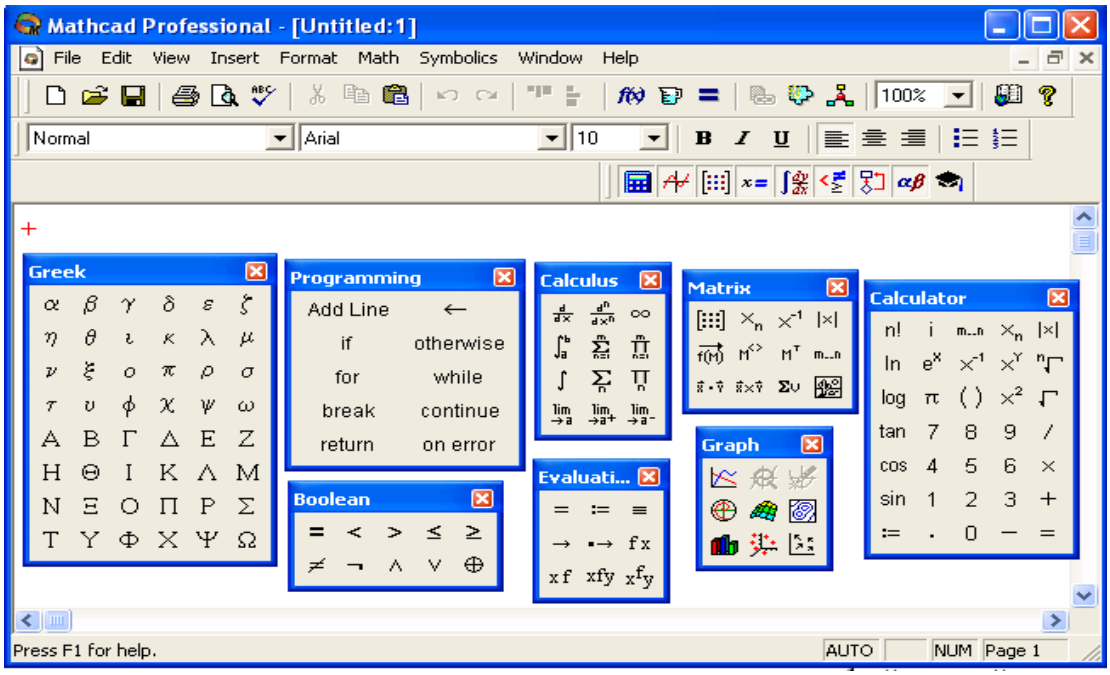
A) Windows OS masalalar panelida sichqoncha o'ng tugmasini bosish;

B) kontekst menyudan Panel instrumentov (Toolbars) ni tanlash;

V) kalkib chikuvchi menyudan Bo'stro'y zapusk punktini tanlash, uning oldida v belgisi paydo buladi, ish stoli pastida Bo'stro'y zapusk paneli paydo buladi;

G) ish stolidagi Mathcad yorligin sichqoncha chap tugmasi yordamida Bo'stro'y zapusk paneliga sudrab utish. Bo'stro'y zapusk panelida belgisi paydo buladi.

Mathcad interfeysi Windowsning barcha dasturlari intefeysiga o'xshash. Mathcad ishga tushurilgandan so'ng uning oynasida bosh menyu va uchta panel vositasi chiqadi: Standart (Standart), Formatting (Formatlash) va Math (Matematika). Mathcad ishga tushganda avtomatik ravishda uning ishchi hujjat fayli Untitled 1 nom bilan ochiladi va unga Workshet (Ish vararі) deyiladi. Standart (Standart) vositalar paneli bir necha fayllar bilan ishlash uchun buyruqlar to'plamini o'z ichiga oladi. Formatting (Formatlash) formula va matnlarni formatlash bo'yicha bir necha buyruqlarni o'z ichiga oladi. Math (Matematika) matematik vositalarini o'z ichiga olgan bo'lib, ular yordamida simvollar va operatorlarni hujjat fayli oynasiga joylashtirish uchun qo'llaniladi. quyidagi rasmda Mathcadning oynasi va uning matematik panel vositalari ko'rsatilgan (2.1-rasm):



2.1-rasm. Mathcad paketi oynasi va uning matematik panel vositalari.

Mathcad bosh menyusi va uning tarkibi. Mathcad bosh menyusi quyidagi punktlardan iborat:

fayl (file), **pravka** (edit), **vid** (view), **vstavka** (insert), **format** (format), **matematika** (math), **simvolno'e vo'rajeniya** (symbolics), **okno** (window), **pomosh** (help).

Colculator (Kol kulyator) – asosiy matematik operatsiyalar shabloni;

Graph (Grafik) – grafiklar shabloni;

Matrix (Matritsa) – matritsa va matritsa operatsiyalarini bajarish shabloni; **Evluation** (Baholash) – qiymatlarni yuborish operatori va natijalarni chiqarish operatori;

Colculus (Ҳisoblash) – differentsiallash, integrallash, summani hisoblash shabloni;

Boolean (Mantiqiy operatorlar) – mantiqiy operatorlar;

Programming (Dasturlashirish) – dastur tuzish uchun kerakli modullar yaratish opreatorlari;

Greek (Grek harflari) - Symbolik belgililar ustida ishlash uchun operatorlar.

2.Matematik ifodalarni qurish va hisoblash

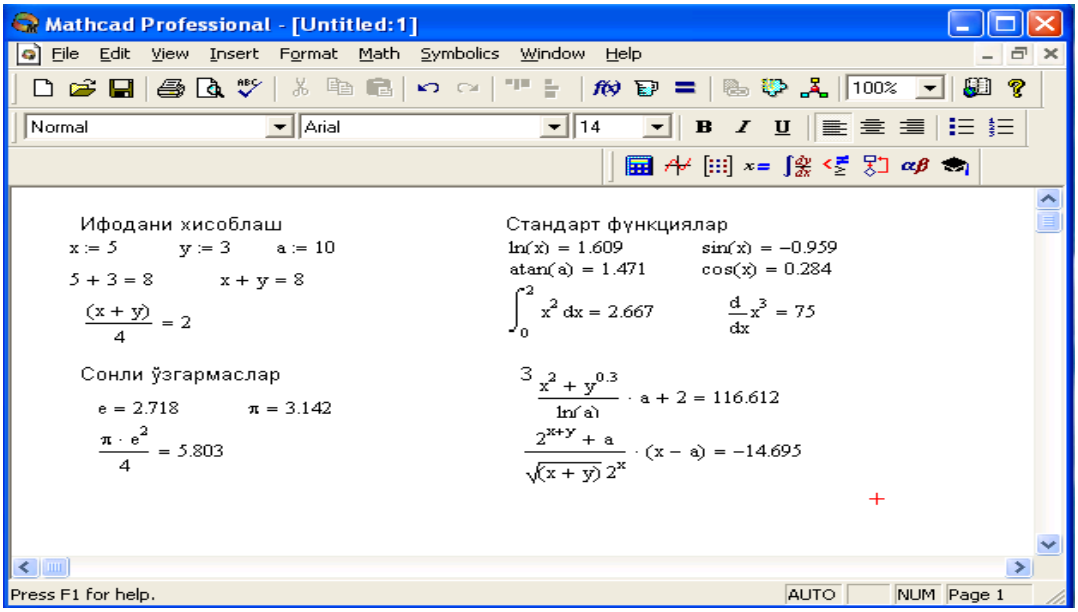
Boshlanғich holatda ekranda kursor krestik ko'rinishda bo'ladi. Ifodani kiritishda u kiritilayotgan ifodani egallab olgan ko'k burchakli holatga o'tadi. Mathcadning har qanday operatorini kiritishni uchta usulda bajarish mumkin:

- menyu buyruғidan foydalanib;
- klaviatura tugmalaridan foydalanib;
- matematik paneldan foydalanib.

Ўzgauvchilarga qiymat berish uchun yuborish operatori ":=" ishlatiladi. Hisoblashlarni amalga oshirish uchun oldin formuladagi o'zgaruvchi qiymatlari kiritiladi, keyin matematik ifoda yozilib tenglik "=" belgisi kiritiladi, natijada ifoda qiymati hosil bo'ladi (2-rasm).

Oddiy va matematik ifodalarni tahrirlashda menyu standart buyruqlaridan foydalaniladi. Tahrirlashda klaviaturadan ham foydalanish mumkin, masalan

- kesib olish – Ctrl+x;
- nusxa olish – Ctrl+c;
- qo'yish – Ctrl+v;
- bajarishni bekor qilish – Ctrl+z.

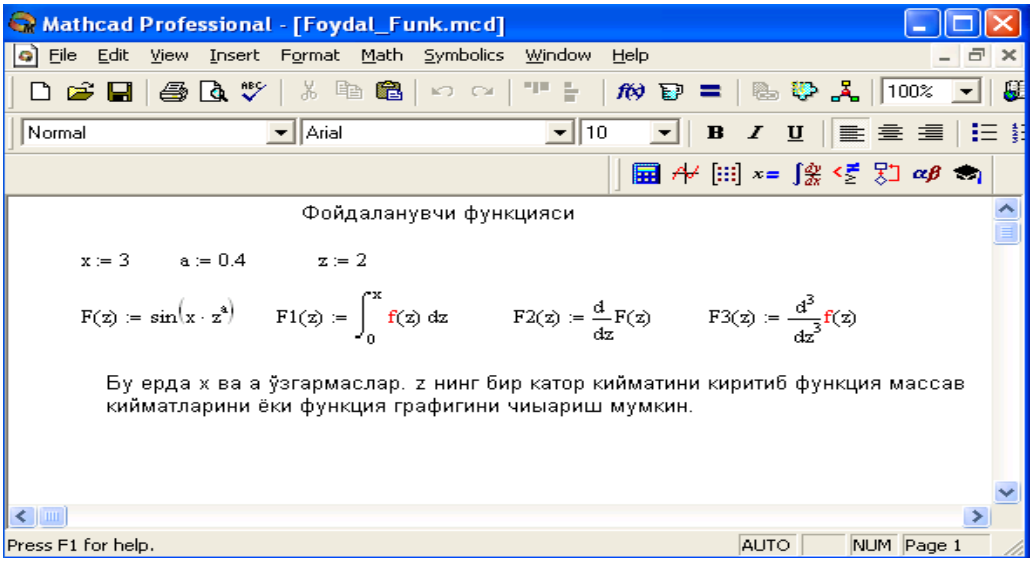


2.2-rasm. Oddiy matematik ifodalarni hisoblash.

Mathcad 200 dan ortiq o'zida qurilgan funktsiyalariga ega bo'lib, ularni matematik ifodalarda ishlatish uchun standart panel vositasidagi Insert Function (Funktsiyani qo'yish) tugmasiga boғlangan muloqot oynasidan foydalaniladi.

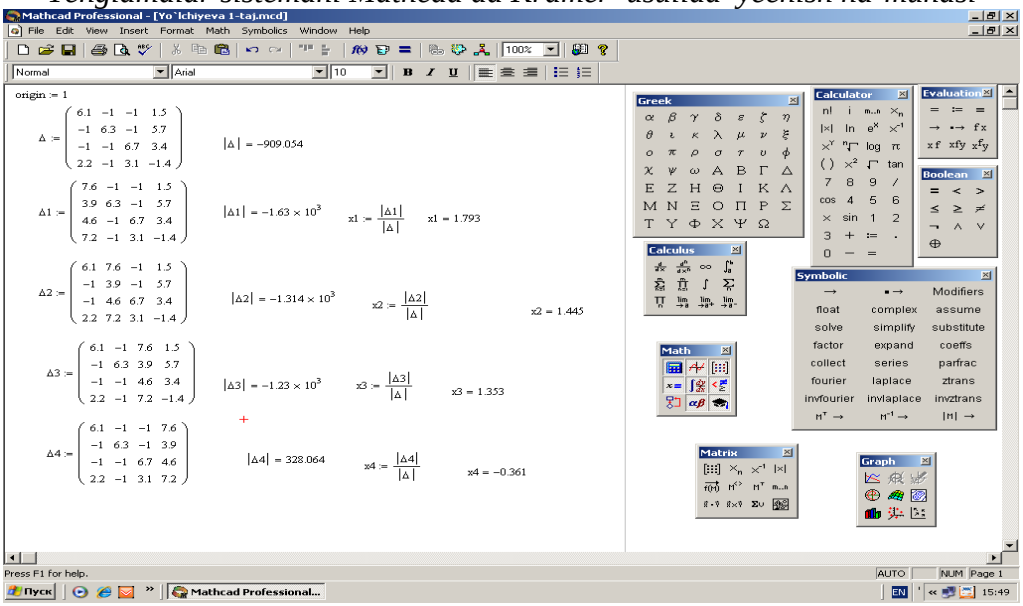
Mathcad hujjatiga matn kiritish uchun bosh menyudan Insert→Text Region (qo'yish→Matn maydoni) buyruғini berish yoki yaxshisi klaviaturadan ikkitali kavichka (") belgisini kiritish kerak. Bunda matn ma`lumotini kiritish uchun ekranda matn kiritish maydoni paydo bo'ladi. Matn kiritish maydoniga matematik ifodani yozish uchun matematik maydonni ham qo'yish mumkin. Buning uchun shu matn maydonida turib Insert→Math Region (qo'yish→Matematik maydoni) buyruғini berish kifoya. Bu maydondagi kiritilgan matematik ifodalar ham oddiy kiritilgan matematik maydon kabi hisoblashni bajaradi.

Mathcadda foydalanuvchi funktsiyasini tuzish hisoblashlarda qulaylikni va uning effektivligini oshiradi. Funktsiya chap tomonda ko'rsatilib, undan keyin yuborish operatori (:=) va hisoblanadigan ifoda yoziladi. Ifodada ishlatiladigan o'zgaruvchi kattaliklari funktsiya parametri qilib funktsiya nomidan keyin qavs ichida yoziladi (2.3-rasm).



2.3-rasm. Hisoblashlarda foydalanuvchi funktsiyasini tuzish.

Tenglamalar sistemani Mathcad da Kramer usulida yechish na`munasi



Topshiriqlar

Quyida berilgan ratsional koeffitsientli tenglamalar sistemasini Gauss yoki Kramer usulida yeching.

1. $$\begin{cases} 6{,}5x_1 + 3{,}8x_2 - 4{,}1x_3 + 1{,}2x_4 = 9{,}9, \\ 7{,}1x_1 + 2{,}7x_2 - 1{,}4x_3 + 1{,}4x_4 = 6{,}9, \\ -1{,}8x_1 - x_2 + 4{,}3x_3 + 1{,}3x_4 = 7{,}9, \\ 1{,}5x_1 - 3{,}4x_2 + 7{,}8x_3 - 1{,}8x_4 = 15{,}1. \end{cases}$$

2. $$\begin{cases} 1{,}3x_1 + 3{,}2x_2 + 2{,}1x_3 + 3{,}3x_4 = 1{,}9, \\ 3{,}5x_1 - 4{,}1x_2 - 5{,}3x_3 - 2{,}5x_4 = -4{,}7, \\ 2{,}8x_1 + 3{,}5x_2 - 7{,}6x_3 - 4{,}9x_4 = -6{,}7, \\ 1{,}4x_1 + 2{,}8x_2 + 3{,}9x_3 - 1{,}8x_4 = -4{,}8. \end{cases}$$

3. $$\begin{cases} 0{,}6x_1 + 1{,}1x_2 + 0{,}7x_3 + 0{,}03x_4 = 2{,}0, \\ 1{,}8x_1 + 0{,}9x_2 - 0{,}6x_3 + 0{,}7x_4 = 0{,}2, \\ 2{,}7x_1 - 0{,}8x_2 + 1{,}2x_3 - 2{,}4x_4 = 1{,}3, \\ 3{,}6x_1 + 0{,}2x_2 - 3{,}4x_3 - 1{,}2x_4 = 0{,}1. \end{cases}$$

4. $$\begin{cases} 2{,}6x_1 - 3{,}1x_2 + 3{,}4x_3 + 2{,}5x_4 = 3{,}5, \\ 6{,}6x_1 + 9{,}9x_2 - 2{,}3x_3 - 0{,}1x_4 = -4{,}3, \\ 10{,}1x_1 + 3{,}2x_2 - 3{,}7x_3 - 2{,}8x_4 = 3{,}8, \\ 8{,}9x_1 + 6{,}4x_2 + 1{,}1x_3 + 3{,}9x_4 = -7{,}8. \end{cases}$$

5. $\left.\begin{array}{l} 1{,}1x_1 + 2{,}3x_2 + 3{,}4x_3 - 2{,}0x_4 = 6{,}5, \\ 2{,}8x_1 - 1{,}2x_2 - 2{,}3x_3 - 3{,}9x_4 = 8{,}8, \\ 3{,}9x_1 + 2{,}8x_2 - 1{,}3x_3 + 2{,}8x_4 = 4{,}1, \\ 2{,}7x_1 - 3{,}6x_2 + 2{,}6x_3 + 1{,}7x_4 = -8{,}7. \end{array}\right\}$

6. $\left.\begin{array}{l} 1{,}4x_1 + 0{,}3x_2 - 0{,}4x_3 + 0{,}9x_4 = 1{,}3, \\ 0{,}6x_1 - 0{,}4x_2 + 1{,}3x_3 - 0{,}6x_4 = -0{,}4, \\ 0{,}8x_1 - 2{,}2x_2 - 0{,}5x_3 + 0{,}5x_4 = 0{,}6, \\ 0{,}3x_1 + 1{,}4x_2 + 0{,}6x_3 - 1{,}3x_4 = 0{,}9. \end{array}\right\}$

7. $\left.\begin{array}{l} 3{,}5x_1 + 0{,}2x_2 + 3{,}8x_3 - 0{,}3x_4 = 0{,}8, \\ 4{,}5x_1 + 2{,}1x_2 - 0{,}1x_3 - 0{,}2x_4 = 1{,}1, \\ -2{,}1x_1 + 3{,}2x_2 + 0{,}2x_3 - 0{,}2x_4 = 0{,}2, \\ 3{,}2x_1 + 1{,}8x_2 - 3{,}2x_3 + 0{,}2x_4 = 0{,}1.. \end{array}\right\}$

8. $\left.\begin{array}{l} 1{,}1x_1 + 2{,}3x_2 + 5{,}5x_3 + 2{,}3x_4 = 7{,}9, \\ 3{,}3x_1 + 1{,}3x_2 + 1{,}8x_3 + 3{,}1x_4 = 2{,}6, \\ 2{,}6x_1 + 4{,}3x_2 + 1{,}1x_3 + 1{,}7x_4 = 10{,}6, \\ 1{,}1x_1 + 3{,}8x_2 + 2{,}9x_3 + 2{,}7x_4 = 9{,}3. \end{array}\right\}$

9. $\left.\begin{array}{l} -3{,}1x_1 + 2x_2 - 4x_3 + 5x_4 = 4{,}9, \\ 2x_1 - x_2 + x_3 + 1{,}2x_4 = -9{,}7, \\ x_1 - 3x_2 - 2x_3 + 2{,}7x_4 = 13{,}1, \\ 5x_1 - x_2 + 3x_3 + 7{,}8x_4 = 10{,}6. \end{array}\right\}$

10. $\left.\begin{array}{l} x_1 + 2{,}3x_2 + 3{,}4x_3 + 4{,}6x_4 = 5{,}6, \\ 2{,}7x_1 + 1{,}1x_2 + 2{,}7x_3 - 3{,}7x_4 = 1{,}9, \\ -3{,}8x_1 + 2{,}8x_2 + 1{,}4x_3 + 2{,}8x_4 = 1{,}7, \\ 4{,}5x_1 + 3{,}9x_2 + 2{,}5x_3 + 1{,}6x_4 = -5{,}3. \end{array}\right\}$

11. $\left.\begin{array}{l} 0{,}2x_1 + 0{,}8x_2 - 0{,}1x_3 + 0{,}2x_4 = 0{,}1, \\ 0{,}8x_1 + 1{,}1x_2 + 0{,}1x_3 + 1{,}1x_4 = 2{,}3, \\ -0{,}3x_1 + 0{,}1x_2 + 3{,}0x_3 - 2{,}0x_4 = 0{,}1, \\ 0{,}1x_1 + 1{,}1x_2 + 1{,}1x_3 - 1{,}3x_4 = 0{,}2. \end{array}\right\}$

12. $\left.\begin{array}{l} 1{,}1x_1 + 1{,}3x_2 - 6{,}3x_3 - 4{,}5x_4 = 6{,}3, \\ 3{,}9x_1 - 0{,}7x_2 - 6{,}8x_3 - 4{,}7x_4 = 2{,}7, \\ 2{,}8x_1 + 3{,}3x_2 + 9{,}1x_3 + 2{,}8x_4 = 6{,}9, \\ 3{,}1x_1 + 2{,}7x_2 + 3{,}4x_3 - 8{,}1x_4 = -7{,}1. \end{array}\right\}$

13. $\left.\begin{array}{l} 6{,}1x_1 - x_2 - x_3 + 1{,}5x_4 = 7{,}6, \\ -x_1 + 6{,}3x_2 - x_3 + 5{,}7x_4 = 3{,}9, \\ -x_1 - x_2 + 6{,}7x_3 + 3{,}4x_4 = 4{,}6, \\ 2{,}2x_1 - x_2 + 3{,}1x_3 - 1{,}4x_4 = 7{,}2. \end{array}\right\}$

14. $\left.\begin{array}{l} 2{,}3x_1 - 1{,}1x_2 + 3{,}4x_3 + 2{,}6x_4 = 4{,}3, \\ 3{,}4x_1 + 3{,}8x_2 + 3{,}6x_3 - 2{,}1x_4 = 6{,}5, \\ 3{,}9x_1 - 0{,}3x_2 - 0{,}1x_3 + 2{,}3x_4 = 6{,}3, \\ 3{,}1x_1 - 0{,}7x_2 + 3{,}8x_3 - 1{,}1x_4 = 5{,}1. \end{array}\right\}$

15. $\left.\begin{array}{l} -x_1 + 0{,}1x_2 - 2{,}1x_3 - 0{,}1x_4 = 0{,}2, \\ 0{,}8x_1 + 0{,}2x_2 - 0{,}2x_3 - 0{,}8x_4 = 1{,}4, \\ 0{,}3x_1 - 0{,}2x_2 + 0{,}4x_3 + 0{,}5x_4 = 2{,}1, \\ 1{,}1x_1 + 3{,}1x_2 + 0{,}2x_3 - 1{,}1x_4 = -0{,}1. \end{array}\right\}$

16. $\left.\begin{array}{l} 2{,}1x_1 + 3{,}3x_2 - 0{,}7x_3 + 0{,}1x_4 = 1{,}1, \\ 8{,}3x_1 + 12{,}1x_2 - 9{,}3x_3 + 8{,}7x_4 = 3{,}3, \\ 4{,}8x_1 + 6{,}2x_2 + 3{,}4x_3 - 2{,}5x_4 = 3{,}5, \\ 2{,}6x_1 + 3{,}7x_2 + 9{,}8x_3 - 7{,}6x_4 = 3{,}4. \end{array}\right\}$

17. $\left.\begin{array}{l} 0{,}7x_1 - x_2 + 3{,}2x_3 + 4{,}1x_4 = 0{,}1, \\ x_1 + x_2 - 8{,}3x_3 + 2{,}4x_4 = 10{,}2, \\ 3{,}8x_1 - 0{,}5x_2 - 2{,}4x_3 + 8{,}8x_4 = 1{,}1, \\ 8{,}3x_1 + 7{,}3x_2 - 0{,}7x_3 + 10{,}1x_4 = 9{,}2. \end{array}\right\}$

18. $\left.\begin{array}{l} 0{,}1x_1 + 0{,}3x_2 + 0{,}4x_3 + 0{,}2x_4 = 0{,}1, \\ 0{,}3x_1 + 2{,}1x_2 + 3{,}4x_3 + 4{,}6x_4 = 6{,}2, \\ 0{,}5x_1 + 3{,}3x_2 + 6{,}4x_3 + 10{,}1x_4 = 8{,}3, \\ 0{,}2x_1 + 4{,}1x_2 + 10{,}3x_3 + 2{,}9x_4 = 9{,}2. \end{array}\right\}$

19. $\left.\begin{array}{l} 3{,}1x_1 - 0{,}1x_2 + 1{,}1x_3 - 0{,}2x_4 = 1{,}1, \\ -1{,}8x_1 + 1{,}1x_2 + 0{,}1x_3 - 0{,}8x_4 = 0{,}1, \\ 0{,}2x_1 - 2{,}1x_2 + 0{,}7x_3 - 1{,}7x_4 = 1{,}2, \\ 0{,}2x_1 + 0{,}2x_2 + 0{,}4x_3 + 0{,}3x_4 = 0{,}2. \end{array}\right\}$

20. $\left.\begin{array}{l} x_1 - 6{,}3x_2 + 1{,}2x_3 - 5{,}9x_4 = 7{,}1, \\ -3{,}8x_1 - 7{,}2x_2 + 2{,}4x_3 - x_4 = 7{,}9, \\ 6{,}1x_1 - 5{,}6x_2 - 4{,}1x_3 + x_4 = 9{,}4, \\ x_1 + 2{,}3x_2 - 0{,}7x_3 + 9{,}1x_4 = 11{,}2. \end{array}\right\}$

21. $\left.\begin{array}{l} 2{,}2x_1 - 3{,}2x_2 + 1{,}2x_3 - 0{,}9x_4 = 0{,}5, \\ 1{,}5x_1 + 2{,}1x_2 - 0{,}5x_3 + 1{,}4x_4 = 1{,}5, \\ 0{,}9x_1 - 1{,}4x_2 + 0{,}6x_3 + 0{,}3x_4 = -0{,}1, \\ 0{,}5x_1 + 1{,}3x_2 - 0{,}6x_3 - 0{,}9x_4 = 0{,}4. \end{array}\right\}$

22. $\left.\begin{array}{l} 4{,}1x_1 - 3{,}3x_2 + 2{,}4x_3 - 0{,}7x_4 = 8{,}1, \\ 3{,}2x_1 - 2{,}1x_2 + 0{,}5x_3 - 3{,}2x_4 = 7{,}2, \\ 2{,}4x_1 - 0{,}2x_2 + 0{,}1x_3 - 5{,}1x_4 = 6{,}3, \\ 5{,}3x_1 - 3{,}1x_2 + 0{,}3x_3 + 8{,}2x_4 = 1{,}1. \end{array}\right\}$

23. $\left.\begin{array}{l} 0,6x_1 + 0,8x_2 + 4,1x_3 + 5,2x_4 = 7,9, \\ -3,2x_1 + 2,1x_2 - x_3 + 3,4x_4 = 1,9, \\ -2,5x_1 + 3,9x_2 + 2,2x_3 - 1,3x_4 = 3,9, \\ 1,4x_1 - x_2 - 3,4x_3 - 1,6x_4 = 5,6. \end{array}\right\}$

24. $\left.\begin{array}{l} 0,8x_1 + 0,7x_2 - 0,8x_3 + 4,2x_4 = 2,2, \\ 0,6x_1 - 0,8x_2 + 1,4x_3 - 0,6x_4 = 1,7, \\ 0,9x_1 + 0,8x_2 - 1,8x_3 + 0,9x_4 = -0,5, \\ 1,3x_1 - 0,5x_2 - 0,7x_3 + 1,2x_4 = 0,7. \end{array}\right\}$

25. $\left.\begin{array}{l} 2,1x_1 - 0,1x_2 + 0,3x_3 - 0,3x_4 = 3,1, \\ 4,3x_1 - 2,3x_2 - 2,4x_3 + 3,3x_4 = 2,7, \\ 2,4x_1 - 0,1x_2 + 5,3x_3 - 6,1x_4 = 1,1, \\ 2,3x_1 - 0,4x_2 - 3,3x_3 + 4,3x_4 = 5,4. \end{array}\right\}$

26. $\left.\begin{array}{l} 0,6x_1 - 2,1x_2 + 3,4x_3 + 3,5x_4 = 1,5, \\ 1,6x_1 + 3,9x_2 - 1,3x_3 - 2,1x_4 = 2,3, \\ 8,1x_1 + 1,2x_2 - 3,1x_3 - 1,8x_4 = 2,3, \\ 2,9x_1 + 0,4x_2 + 2,1x_3 + 4,9x_4 = -8,8. \end{array}\right\}$

27. $\left.\begin{array}{l} 1,1x_1 - 6,3x_2 + 2,4x_3 - 0,7x_4 = 2,1, \\ 1,5x_1 - 1,1x_2 + 0,5x_3 - 3,2x_4 = 2,2, \\ 2,4x_1 - 5,2x_2 + 0,1x_3 - 5,1x_4 = 2,3, \\ 5,8x_1 - 2,1x_2 + 0,3x_3 + 8,2x_4 = 5,1. \end{array}\right\}$

28. $\left.\begin{array}{l} 1,1x_1 - 2x_2 - x_3 + 2,5x_4 = 3,2 \\ -2x_1 + 1,3x_2 - 0,4x_3 + 0,7x_4 = 0,2, \\ -5x_1 - 2x_2 + 0,7x_3 + 0,4x_4 = 4,1, \\ 0,2x_1 - 4,2x_2 + 1,1x_3 - 0,4x_4 = 1,2. \end{array}\right\}$

29.. $\left.\begin{array}{l} 0,5x_1 + 1,2x_2 + 2,8x_3 - 3,3x_4 = 1,1, \\ 2,5x_1 + 1,1x_2 - 5,1x_3 - 1,2x_4 = 2,3, \\ -1,1x_1 + 2,2x_2 + 1,2x_3 - 4,2x_4 = 5,2, \\ 1,2x_1 + 1,1x_2 - 1,2x_3 + 5,2x_4 = 4,2.. \end{array}\right\}$

30. $\left.\begin{array}{l} 1,1x_1 + 1,1x_2 - 2x_3 + 5x_4 = 0,9, \\ 2x_1 - 1,1x_2 + 2,1x_3 + 0,2x_4 = +1,7, \\ 5x_1 - 3,2x_2 - 1,1x_3 + 0,7x_4 = 1,1, \\ 2x_1 + 2x_2 + 2,5x_3 + 1,8x_4 = 9,6. \end{array}\right\}$

Mustaqil topshiriq:.

1. a) $\int_{0,8}^{1,6} \frac{dx}{\sqrt{2x^2+1}}$ b) $\int_{1,2}^{2} \frac{\lg(x+2)}{x}dx$
2. a) $\int_{1,2}^{2,7} \frac{1}{\sqrt{x^2+3,2}}dx$ b) $\int_{1,6}^{2,4} (x+1)\sin x dx$
3. a) $\int_{1,2}^{2} \frac{dx}{\sqrt{2x^2+1,3}}$ b) $\int_{0,2}^{1} \frac{tg(x^{2;})}{x^2+1}dx$
4. a) $\int_{0,2}^{1,2} \frac{dx}{\sqrt{x^2+1}}$ b) $\int_{0,6}^{1,4} \frac{\cos x}{x+1}dx$
5. a) $\int_{0,8}^{1,4} \frac{dx}{\sqrt{2x^2+3}}$ b) $\int_{0,4}^{12} \sqrt{x}\cdot\cos(x^2)dx$
6. a) $\int_{0,,4}^{1,2} \frac{dx}{\sqrt{2+0,5x^2}}$ b) $\int_{0,8}^{1,2} \frac{\sin(2x)}{x^2}dx$
7. a) $\int_{1,4}^{2,1} \frac{dx}{\sqrt{3x^2+1}}$ b) $\int_{1,2}^{8,9} \frac{\sin^2 x}{\sqrt{1+\sin^2 x}}dx, h = 0,77.$
8. a) $\int_{1,2}^{2,4} \frac{dx}{\sqrt{0,5+x^2}}$ b) $\int_{0}^{3,4} \frac{\cos^2 x}{\sqrt{1+\sin^2 x}}dx, h = 0,17.$

9 a) $\int_{0,4}^{1,2} \frac{dx}{\sqrt{3+x^2}}$ b) $\int_{1}^{11} x\sqrt{1+2xdx}, h=1.$

10 a) $\int_{0,6}^{1,5} \frac{dx}{\sqrt{1+2x^2}}$ b) $\int_{0,4}^{0,8} \frac{\lg(x^2+0,5)}{1+2x^2}dx$

11. a) $\int_{0,8}^{1,6} \frac{dx}{\sqrt{2x^2+x+1}}$ b) $\int_{1,2}^{2} \frac{x^2 ctg(x+2)}{x+3}dx$

12. a) $\int_{0,8}^{1,6} \frac{x\sin x dx}{\sqrt{2x^2+1}}$ b) $\int_{1,2}^{2} \frac{\lg(x-1)}{\sin x}dx$

13. a) $\int_{0,8}^{1,8} \frac{x^4 dx}{\sqrt{x\lg x}}$ b) $\int_{1,4}^{2,2} \frac{x+5}{tgx-2}dx$

14. a) $\int_{0,8}^{1,6} \frac{x\cos x dx}{\sqrt{x+5}}$ b) $\int_{1,6}^{2} \frac{tg(x-3)}{x-\sin x}dx$

15. a) $\int_{0,8}^{1,6} \frac{(2+\ln x)dx}{x\sin(x+1)}$ b) $\int_{1,2}^{2} \frac{\lg(x-5)}{x^2-1}dx$

16. a) $\int_{0,4}^{1,2} \frac{\sin x dx}{x\sqrt[3]{x+2}}$ b) $\int_{1,2}^{2} \frac{\lg(x+2)}{x}dx$

17. a) $\int_{0,5}^{1,6} \frac{(x-5)dx}{\sqrt{x+\lg x}}$ b) $\int_{1,2}^{2} \frac{2\lg x}{xtg(x-1)}dx$

18. a) $\int_{2,4}^{3,6} \frac{(x+\ln x)dx}{\sin(x+1)}$ b) $\int_{1,2}^{2} \frac{\sin(x+1)}{x\sqrt{x+1}}dx$

19. a) $\int_{0,8}^{1,6} \frac{x^2 dx}{\sqrt{2x+\lg x}}$ b) $\int_{1,2}^{2,2} \frac{x\lg(x+1)}{\cos x}dx$

20. a) $\int_{1,2}^{1,8} \frac{x\sqrt{x+6}dx}{\sin x}$ b) $\int_{1,2}^{2,4} \frac{tg(x+2)}{x\ln x}dx$

21. a) $\int_{0,8}^{1,6} \frac{dx}{\sqrt{2x^2+1}}$ b) $\int_{1,2}^{2} \frac{\lg(x+2)}{x}dx$

22. a) $\int_{0,8}^{1,6} \frac{\sin dx}{\sqrt{2ctgx+1}}$ b) $\int_{1,2}^{2} \frac{tg(x+1)}{x\sin x}dx$

23. a) $\int_{1,2}^{1,8} \frac{\sqrt{x+5}dx}{\sin(x+2)}$ b) $\int_{1,8}^{2,6} \sqrt{\frac{x\sin x}{x+2\lg x}}dx$

24. a) $\int_{0,8}^{1,6} \frac{ctgx dx}{\sqrt{4x^3-x}}$ b) $\int_{1,2}^{2} \frac{\sin(x+2)x}{3x}dx$

25. a) $\int_{1,8}^{2,8} \frac{x^3-2\sin x dx}{\sqrt{x+1}}$ b) $\int_{1,2}^{2} \frac{\cos(x+2)}{x^3 tgx}dx$

26. a) $\int_{1,3}^{3} \frac{dx}{\sqrt{2x^3+2,3}}$ b) $\int_{1,2}^{2} \frac{tg(x^{3;})}{x^2+0,1}dx$

27. a) $\int_{1,2}^{3,2} \frac{dx}{\sqrt{2x^3+1}}$ b) $\int_{0,6}^{1,4} \frac{\sin x}{x+2}dx$

28. a) $\int_{1,8}^{2,4} \frac{dx}{\sqrt{x^3+5}}$ b) $\int_{5,4}^{12} \sqrt{x}\cdot\sin(x^2)dx$

29. a) $\int_{1,,4}^{3,2} \frac{dx}{\sqrt{2+5x^2}}$ b) $\int_{0,8}^{1,2} \frac{\sin(2x)}{x^2}dx$

30. a) $\int_{1,4}^{2,1} \frac{dx}{\sqrt{3x^2+1}}$ **b)** $\int_{1,2}^{8,9} \frac{\cos^2 x}{\sqrt{1+\cos^2 x}}dx,.$

3-*TAJRIBA ISHI*

Mavzu: **Berilgan ob`ekt ALTi matematik modelini amaliy dasturlar paketi yordamida yechishni tashkil etish.**

Ishdan maqsad: ***Talabalarni amaliy masalalarni yechishda ko'p ishlatiladigan differentsial tenglamalar, Koshi masalasini yechishning Eyler va Runge-Kutta usullari, usullarga oid nazariy ma`lumotlar va dasturlar bilan tanishtirish.***

Reja:

1. ***Oddiy differentsial tenglamalarga oid nazariy ma`lumotlar.***
2. ***Koshe masalasini Eyler usuli yordamida Mathcad da dasturini tuzish va natijalar va ularnig tahlili..***
3. ***Tajriba ishiga doir topshiriqlar ro'yhati.***

Oddiy differentsial tenglamalarga oid nazariy ma`lumotlar.

Ma`lumki, ko'pincha amaliy masalalarni yechishda, dastlab uning matematik modeli fizik, mexanik, kimyoviy va boshqa qonuniyatlar asosida tuziladi. Matematik model asosan algebraik, differentsial, integral va boshqa tenglamalardan iborat bo'ladi. *Oddiy differentsial* tenglamalar esa juda ko'p muhandislik masalalarini yechishda uchraydi. Demak, differentsial tenglamalarning ma`lum shartlarni qanoatlantiruvchi yechimlarini topish katta ahamiyatga ega.

Differentsial tenglamalar ikkita asosiy sinfga bo'linadi: *oddiy differentsial* tenglamalar va *xususiy hosilali differentsial* tenglamalar.

Xususiy hosilali differentsial tenlamalarga keyinroq batafsil to'xtalamiz.

Oddiy differentsial tenglamalarda faqat bir o'zgaruvchiga bog'liq funktsiya va uning hosilalari qatnashadi, ya`ni

$$f(x,y,y',...,y^{(n)})q0 \qquad (1)$$

(1) tenglamada qatnashuvchi hosilalarning eng yuqori tartibi differentsial tenglamalarning tartibi deyiladi. Agar tenglama izlanuvchi funktsiya va uning hosilalariga nisbatan chiziqli bo'lsa, unga *chiziqli differentsial* tenglama deyiladi.

Differentsial tenglamaning *umumiy yechimi* deb, uni ayniyatga aylantiruvchi x va *n* ta $c_1,c_2,...,c_n$ o'zgarmaslarga bog'liq ixtiyoriy funktsiyaga aytiladi. Masalan (1) tenglamaning umumiy yechimi $y=\varphi(x,c_1,c_2,...,c_n)$ ko'rinishdagi funktsiyalardan iborat. Agar $c_1,c_2,...,c_n$ o'zgarmaslarga muayyan qiymatlar berilsa, umumiy yechimdan xususiy yechim hosil qilinadi. Xususiy yechimni topish uchun $c_1,c_2,...,c_n$ o'zgarmaslarning mos qiymatlarini aniqlash lozim. Buning uchun esa yechimni qanoatlantiruvchi qo'shimcha shartlarga ega bo'lishimiz kerak. Agar differentsial tenglama *n*-tartibli bo'lsa, yagona xususiy yechimni topish uchun xuddi shuncha qo'shimcha shartlar kerak. Xususan, *1*-tartibli tenglama *f(x,y,y')q0* ning umumiy yechimi $y=\varphi(x,c)$ dagi *s* o'zgarmasni topish uchun *1* ta qo'shimcha shartning berilishi kifoya.

Qo'shimcha shartlar berilishiga ko'ra differentsial tenglamalar uchun 2 xil masala qo'yiladi:

1) *Koshi masalasi*
2) *Chegaraviy masala.*

Agar qo'shimcha shartlar bitta $x=x_0$ nuqtada berilsa, differentsial tenglamani yechish uchun qo'yilgan masala *Koshi masalasi* deyiladi. Koshi masalasidagi qo'shimcha shartlar *boshlang'ich shartlar*, $x=x_0$ nuqta esa *boshlang'ich nuqta* deb ataladi. Oddiy differentsial tenglamalarni yechishning chizma, analitik, taqribiy va sonli yechish usullari mavjud.

*Analitik usullar*da differentsial tenglamaning yechimlari aniq formulalar orqali aniqlanadi.

Eyler usuliinng ishchi algoritmi

Bizga quyidagi birinchi tartibli differentsial tenglama (Koshi masalasi)ni

$$y'=f(x,y) \quad (2)$$

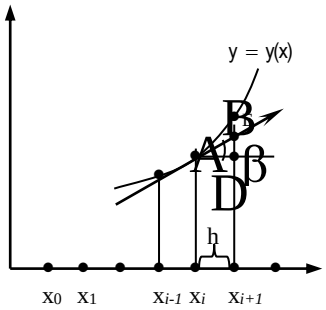
[a,b] oraliqdagi $y_0=y(x_0)$ boshlang'ich shartni qanoatlantiruvchi yechimini topish lozim bo'lsin.

Koshi masalasini Eyler usuli yordamida yechish uchun, dastlab differentsial tenglamaning yechimi qidiriladigan [a,b] kesmani $x_1,x_2,...x_n$ tugun nuqtalar bilan bo'laklarga bo'lamiz. Tugun nuqtalarning koordinatalari $x_{i+1}=a+(i+1)h$ (i=0..n-1) formula orqali aniqlanadi. Har bir tugunda $y(x_i)$ yechimning qiymatlarini chekli ayirmalar yordamida taqribiy y_i qiymatlar bilan almashtiriladi.

Ma`lumki, y=f(x) funktsiyaning $x=x_0$ nuqta atrofidagi Teylor qatoriga yoyilmasini quyidagicha yozish mumkin:

Ushbu cheksiz qatorning boshidagi ikkita had bilan chegaralanib, birinchi tartibli hosila qatnashgan hadni aniqlash natijasida quyidagi chekli ayirmali formulani hosil qilamiz:

$$y'(x_i) \approx \frac{y(x_{i+1}) - y(x_i)}{h} \quad (3)$$



Ushbu almashtirishning geometrik ma`nosi quyidagicha:

Xosilaning geometrik ma`nosiga ko'ra

$$y'(x_i) = tg\beta = \frac{ED}{AD} = \frac{ED}{h}$$

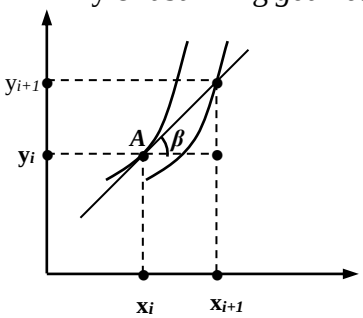
(3) dan

$$y'(x_i) \approx \frac{y_{i+1} - y_i}{h} = \frac{BD}{h} = \frac{ED}{h} + \frac{BE}{h} = y'(x_i) + \frac{BE}{h}$$ Demak, chekli ayirmalar formulasi hosilaning asl qiymatidan BE/h ga farq qiladi, ya`ni BE qancha kichik bo'lsa, chekli ayirma y' hosilaga shuncha yaqin bo'ladi. Rasmdan $h \to 0$ da $BE \to 0$ ekanini ko'rish mumkin. (2) va (3) dan $y'_i = f(x_i, y_i)$ ekanini hisobga olib, quyidagini hosil qilamiz:

$$y'_{i+1} \approx y_{i+1} + h \cdot f(x_i, y_i) \quad (4)$$

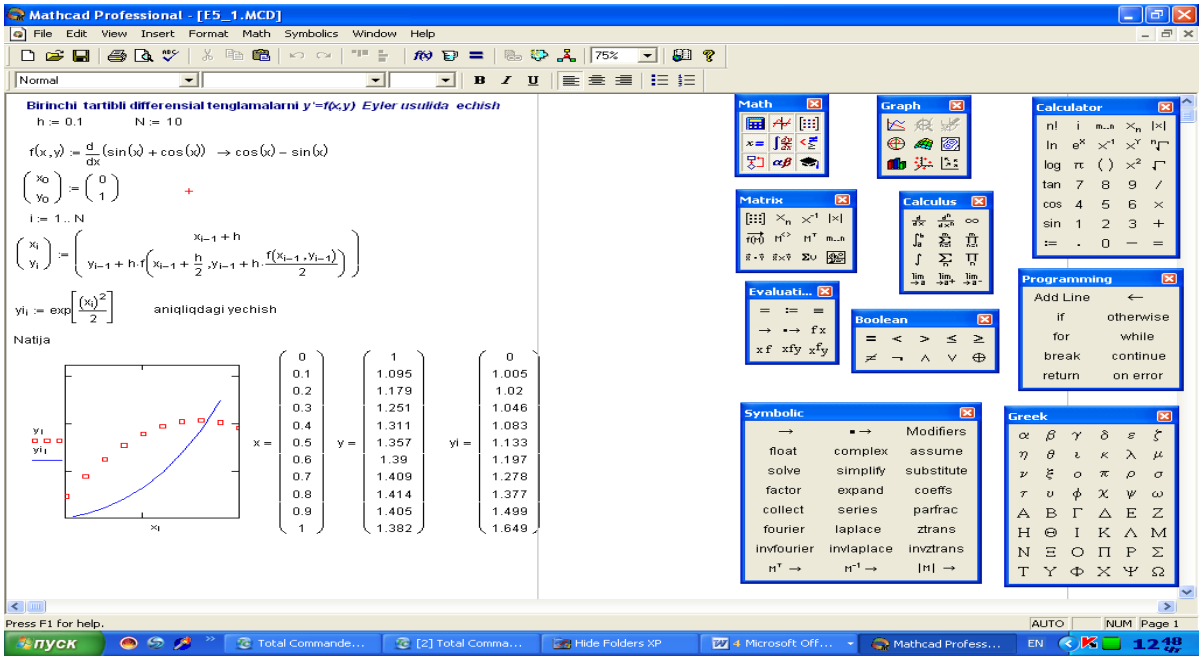
Hosil qilingan (4) formula Eyler usulining asosiy ishchi formulasi bo'lib, uning yordamida tugun nuqtalarga mos bo'lgan differentsial tenglamaning y_i xususiy yechimlarini topish mumkin. Yuqoridagi formuladan ko'rinib turibdiki, y_{i+1} yechimni topish uchun y_i yechimnigina bilish kifoya. Demak, Eyler usuli bir qadamli usullar jumlasiga kiradi.

Eyler usulining *geometrik ma`nosi* quyidagicha:



A nuqta $x=x_i$ nuqtaga mos keluvchi yechim bo'lsin. Bu nuqtadan integral chiziqqa o'tkazilgan urinma x_{i+1} nuqtada boshqa integral chizig'ida y_{i+1} yechimni aniqlaydi.

Urinmaning og'maligi $\beta \cdot y_i^{'} = f(x_i, y_i)$ hosila bilan aniqlanadi. Demak, Eyler usulidagi yo'l qo'yilgan asosiy xatolik yechimni bir integral chizig'idan boshqasiga o'tkazib yuborishi bilan xarakterlanadi.



Tajriba ishiga doir topshiriqlar:

Eyler va Runge-Kutta usullari yordamida berilgan differentsial tenglama uchun Koshi masalasini h=0.1 qadam bilan [0;1] oraliqda yechimini topish algoritmi va dasturini tuzing.

№	*Tenglama*	*Boshlang'ich shart*
1	$y' = (x+1)^{1/2} y - 0{,}5x^2$	$y(0) = 1{,}2$
2	$y' = (x^2+1)^{1/2} y + 4{,}5x$	$y(0) = 1{,}4$
3	$y' = 3{,}4x^2 y - 2{,}8x^2$	$y(0) = 0{,}6$
4	$y' = (x+1)^{1/2} y - 0{,}5x^2$	$y(0) = 1{,}6$
5	$y' = 2{,}8x^2 y - 1{,}4x$	$y(0) = 4{,}2$
6	$y' = 4{,}8x^2 y + 4{,}8x$	$y(0) = 4{,}6$
7	$y' = 4{,}5x^3 y + 4{,}5x^2$	$y(0) = 2{,}8$
8	$y' = 4{,}8xy - 3{,}5x^3$	$y(0) = 4{,}2$
9	$y' = 4{,}2xy + 3{,}5x^2$	$y(0) = 4{,}8$
10	$y' = 4{,}8xy + 2{,}5x^2$	$y(0) = 2{,}6$
11	$y' = 2{,}6x^3 y - 3{,}4x^2$	$y(0) = 4{,}2$
12	$y' = (3{,}5x+1)y + x^2 + 1{,}6$	$y(0) = 2{,}6$
13	$y' = (x+1)^{1/2} y + 2{,}5x^2$	$y(0) = 2{,}4$
14	$y' = (x^2+1)^{1/2} y + 2{,}6x^2$	$y(0) = 1{,}2$
15	$y' = (x+1)^{1/2} y - 2{,}4x^2 + 1{,}2$	$y(0) = 1{,}2$
16	$y' = (3x^2+1)y - 3{,}4x^2 + 1{,}4$	$y(0) = 1{,}5$
17	$y' = (4x^2+1)y - 3{,}5x^2 + 1{,}2$	$y(0) = 1{,}6$
18	$y' = (3x^2+1)y - 2{,}6x^2 + 1$	$y(0) = 1{,}2$
19	$y' = x^{1/2} + 2x^3 y - x^2$	$y(0) = 3{,}2$
20	$y' = 0{,}6x^3 - 3x^2$	$y(0) = 2{,}9$
21	$y' = 4{,}2x^3 y - 2{,}6x^2$	$y(0) = 4{,}7$
22	$y' = 2x + 0{,}1y^2$	$y(0) = 0{,}2$
23	$y' = x^2 + xy$	$y(0) = 0{,}2$
24	$y' = x^2 + y$	$y(0) = 0{,}4$
25	$y' = xy + y^2$	$y(0) = 0{,}6$
26	$y' = 0{,}1x + 0{,}2y^2$	$y(0) = 0{,}2$

27	$y' = 2x^2 + xy$	$y(0) = 0,5$
28	$y' = x^2 + 0,2xy$	$y(0) = 0,6$
29	$y' = x^2 + 3xy$	$y(0) = 0,3$
30	$y' = 2x^2 + 3y^2$	$y(0) = 0,2$

4-TAJRIBA IShI

Mavzu: ALTning texnikaviy, umumtizimli va lingvistik ta`minotini tanlash. Berilgan ob`ekt ALTi amaliy taminotini loyihalash

Reja:

1. **ALTning texnikaviy, umumtizimli va lingvistik ta`minotini**
2. **AutoCAD tizimi ishi bilan tanishish**
3. **Menyu tarkibini o'rganish va interfeys bilan ishlash tartibi bilan tanishish**
4. **AutoCAD tizimini boshqarishning asosiy prinsiplari bilan tanishish**

ALTning texnikaviy ta'minoti

ALTning texnikaviy ta'minoti – avtomatlashtirilgan loyihalashni bajarish uchun mo'ljallangan o'zaro bog'langan va o'zaro ta'sir qiluvchi texnikaviy vositalar majmuidir.

ALTning istalgan hisoblash komplektlari quyidagilarni yetarli miqdorda o'z ichiga olishi kerak: informatsiyani kiritish va chiqarish periferiya qurilmalari, grafik klanshetali va elektron peroli grafikli va alfavitli-raqamli displeylar (GD va ARD), har xil formatli yuqori aniqli rulonli va planshetali grafquruvchilar, grafik informatsiyani kodlovchilar, skanerlar, printerlar, magnitli disklarda to'plovchi (nakopitel)lar (MDT), lazerli disklarda to'plovchilar, 200...500 Gbayt hajmli «Vinchester» tipidagi disklardagi to'plovchilar (2003 yilgi holat), funktsional klaviaturalar, informatsiyani mikrofilm va mikrofishlarga chiqaruvchi qurilmalar, yuqori darajadagi EHM bilan bog'lanish qurilmalari.

ALTning dasturiy ta'minoti (DT)

ALTning dasturaviy ta'minoti avtomatlashtirilgan loyihalashni bajarish uchun zarur bo'lgan hamma dasturlar va ekspluatatsion hujjatlaridan iborat. Dasturaviy ta'minot umumtizimiy va maxsus (amaliy)larga bo'linadi.

Umumtizimiy DT texnikaviy vositalar funktsiyalarini tashkil qilish uchun, ya'ni hisoblash jarayonini rejalashtirish va boshqarish, mavjud resurslarni taqsimlash uchun mo'ljallangan va EHM hamda hisoblash komplekslari (HK)ning operatsion tizimlari ko'rinishida namoyon bo'ladi. Umumtizimiy DT odatda ko'p ilovalar uchun yaratiladi va ALT spetsifikasini aks ettirmaydi.

Maxsus (amaliy) DT da loyihalash protseduralarini bevosita bajaradigan matematik ta'minot realizatsiya qilinadi. Maxsus DT odatda amaliy dasturlar paketi (ADI) ko'rinishida bo'ladi; ulardan har biri loyihalash jarayonining ma'lum bosqichini yohud turli bosqichlar ichidagi bir turdagi masalalar guruhini boshqaradi.

ALTning lingvistik ta'minoti

ALT lingvistik ta'minoti asosini maxsus til vositalari (loyihalash tillari) tashkil qiladi; ular avtomatlashtirilgan loyihalash protseduralarini va loyihaviy yechimlarni bayon qilish uchun mo'ljallangan. Lingvistik ta'minotning asosiy qismi – insonning EHM bilan muloqot qilish tillari. Loyihalashning muammoli-yo'nalgan tillari (MYT) loyihalashning algoritmik tillariga (*Visual Basic, Visual C++, Delphi, Java, Visual Fox Pro* va sh.k.) o'xshash. Ba'zi masalani yechish topshirig'i asosan fizikaviy va funktsional mazmundagi original atamalarni o'z ichiga oladi. Masalaning fizikaviy va funktsional bayonidani EHM uchun dasturlarga o'tish so'ngra translyator yordamida avtomatik ravishda amalga oshadi. Boshqa hollarda masalan, muhandislik tipidagi masalalarni yechishda, DT o'zida hisobiy matematik masalalarni yechish uchun yuqori darajali algoritmik til vositalarini va geometrik ob'yektlarni modellashning maxsus til vositalarini birlashtiradi. Yuqori darajali algoritmik til translyatori zarur bo'lgan maxsus dasturlar bilan to'ldiriladi.

Amaliy vositalar paketlari

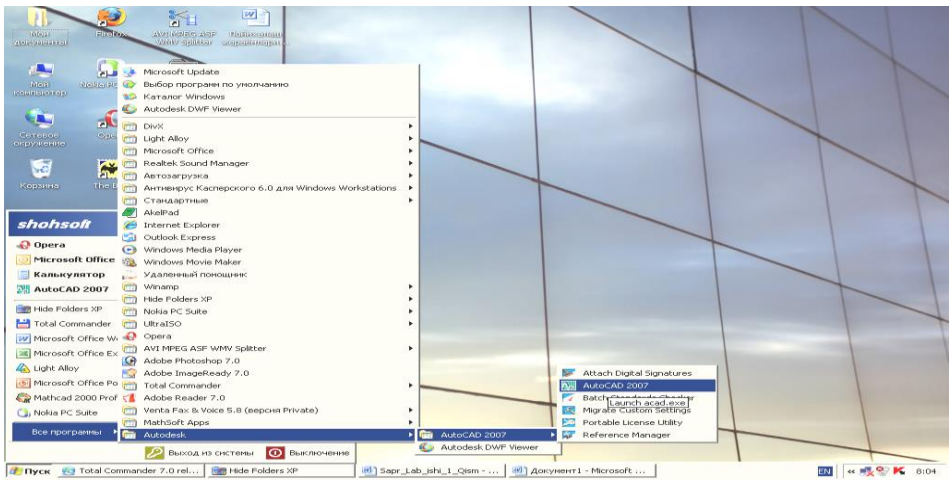
Bu paketlar foydalanuvchi uchun kerakli bo`lgan barcha ishni yoki ishning asosiy kerakli qismini bajarish imkonini beradi: muammoni tadqiq qilish (analitik shaklida ham); ma`lumotlarning tahlili; yechim mavjudligini tekshirish; madellashtirish; optimallash; grafiklarni qurish; natijalarni hujjatlashtirish va shakillantirish; taqdimotlarni yaratish.

Hozirgi kunda kampyuter algebrasining nisbatan imkoniyatli paketlari bu - *Mathematica, Maple, Matlab, MathCAD, Derive* va *Scientific WorkPlace*. Bulardan birinchi ikkitasi professional matematiklar uchun mo`ljallangan bo`lib imkoniyatlarning boyligi, ishlatishda murakkabligi bilan ajralib turadi. Grafik loyihalarni yaratish uchun hozirgi kunda zamonaviy amaliy dasturlar mavjud- AutoCad, Compas, 3D Max, CorelDraw,Adobe FreeHand.

AutoCAD tizimini ishga tushirish.

AutoCAD 2007 tizimini ishga tushirishning standart usulida quyidagi amallar ketma – ket bajariladi:

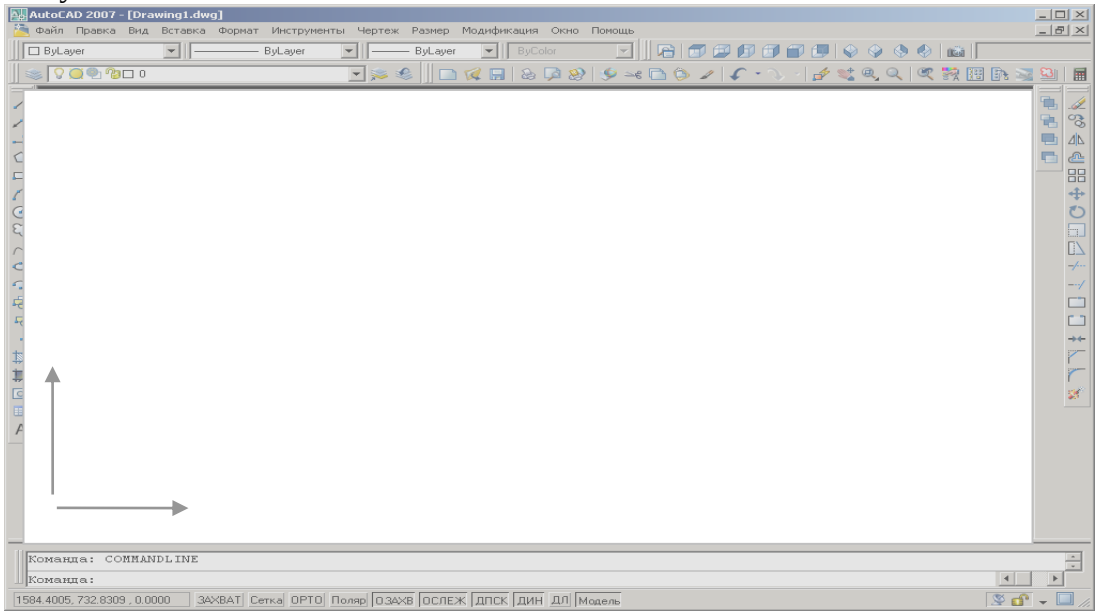
1. Start (Pusk) tugmasi bosiladi (4.1-rasm).
2. All Programs (Programmi) bo'limiga kiriladi.
3. Autodesk bo'limiga kiriladi.
4. AutoCAD 2007 dasturi tanlanadi.



4.1-rasm

AutoCAD 2007 tizimini yorlig`i

AutoCAD 2007 tizimini yorliq yordamida ham ishga tushirish mumkin. Buning uchun Rabochiy stol menyusidagi AutoCAD 2007 tizimi yorlig'i ustida "Sichqon"cha chap tugmasi ikki marotaba tez-tez bosib yuklanadi. Natijada AutoCAD 2007 dasturning grafik interfeysi (4.2-rasm) namoyon bo'ladi.



4.2-rasm. Dasturning bosh oynasi ya'ni loyihalash muhiti.

Ushbu loyihalash muhitining tarkibiga quyidagi asosiy elementlar kiradi:

1. Muharrirlanayotgan chizma (fayl) nomi ko'rsatilgan sarlavha;
2. Asosiy menyu;
3. Asboblarning standart paneli;
4. "Ob'yektning xususiyati" paneli;
5. "Chizish" paneli;
6. "O'zgartirish" paneli;
7. Muloqotlar paneli (buyruqlar satri);
8. Holatlar satri;
9. Asosiy ishchi maydon;
10. Chizmadagi joriy holatni ko'rsatuvchi kursor(sichqoncha) holati.

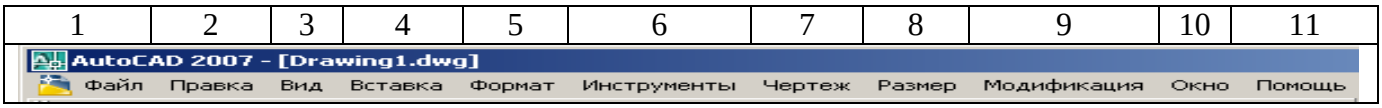
AutoCAD 2007 tiziminini interfeysi rostlanuvchan bo'lib, uning ko'rinish 4.2-rasmdagidan farq qilishi mumkin.

AutoCAD ning asosiy menyusiga quyidagilar kiradi:

AutoCAD 2007 tizimi interfeysining birinchi satrida 

sarlavha chiqariladi, bu yerda 'Drawing1' muharrirlanayotgan chizma (fayl) nomi, '.dwg' esa fayl kengaytmasidir.

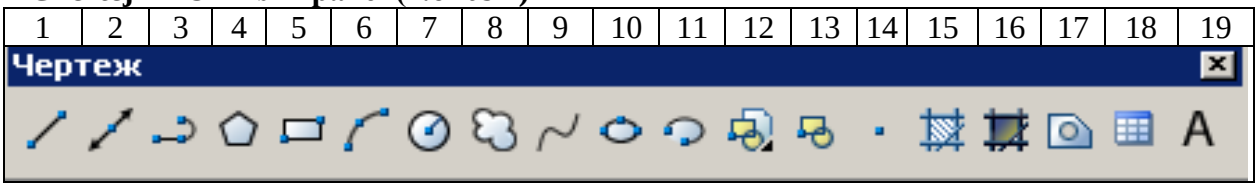
AutoCAD 2007 tizimi interfeysining ikkinchi satrida iyerarxik menyu satri joylashgan (4.3-rasm) u quyidagi bo'limlardan tashkil topgan:



4.3-rasm.

1. "Fayl" – fayllar bilan ishlash menyusi;
2. "Pravka" – Windows stolidagi grafik maydon qismlarini taxrir qilish menyusi;
3. "Vid" – Ekran ko'rsatgichlarini boshqarishda kerakli asboblar paneli va boshqa buyruqlarni o'rnatadi;
4. "Vstavka" – ilovadagi va tashqi obektlarni bloklarga qo'yishni ta'minlash;
5. "Format" – rang va chiziq turlari, matn holatini va o'lchamini boshaqarish, o'lchamlar birligini o'rnatish, chizma chegaralarini aniqlash kabi buyruqlar menyusi;
6. "Instrumento'" – ekranda foydalanishda tizimlarni boshqarish buyruqlari menyusi. Ular yordamida muloqot darchasidan foydalanib, chizma ko'rsatgichini o'rnatish kabi buyruqlar bajariladi;
7. "Chertyoj" – turli shakllar chizish va hajmini o'zgartirish kabi buyruqlarni bajaradi;
8. "Razmer" – o'lcham ko'rsatgichlarini boshqarish va ularni qo'yish buyruqlari ochiladi;
9. "Modifikatsiya" – chizma elementlarini o'zgartirish – chizmani va undagi yozuvlarni tarir qilish buyruqlari ochiladi;
10. "Okno" - bir vaqtda foydalanishda bo'lgan axborotlarni fayldan faylga o'tib ularni ochadi;
11. "Spravka" – AutoCAD 2007 dasturi haqida yangi foydalanuvchilar uchun to'liq ma'lumot berilgan.

"Chertej"- "Chizish" paneli(4.6-rasm**)**



4.6-rasm.

1. "Liniya"- chiziq (kesma) chizish tugmasi;
2. "Liniya konstruktsii"- to'g'ri chziq chizish tugmasi;

3. “Poliliniya”- ko’p chiziq chizish tugmasi;
4. “Poligon”- ko’p burchak chizish tugmasi;
5. “Pryamougol nik”- to’rtburchak chizish tugmasi;
6. “Duga”- yoy chizish tugmasi;
7. “Okrujnost ”- doira chizish tugmasi;
8. “Region”- soha chizish tugmasi;
9. “Splayn”- egri chiziq chizish tugmasi;
10. “Ellips”- ellips chizish tugmasi;
11. “Ellipsoidnaya duga”- ellipsoid yoy chizish tugmasi;
12. “Vstavit blok”- blokni qo’yish tugmasi;
13. “Sdelat blok”- blok yaratish tugmasi;
14. “Tochka”- nuqta qo’yish tugmasi;
15. “Shtrix”- kesim va qirqim yuzalarini shtrixlash tugmasi;
16 “Gradient” -
17. “Oblast ”- 3D ob’ektiga soha ochish tugmasi;
18 “Tablits ” - Jadvallar tashkil etish;
19. “Mnogostrokovo’y tekst”- ko’p satrli yozuvlar bajarish tugmasi.

5-TAJRIBA IShI

Mavzu: AutoCAD dasturida ob`ektlarni qurish, chizmalarni shakillantirish komandalari, chizmalarni taxrirlash, fazo va chizma kampanovkasi.

Ishdan maqsad: AutoCAD dasturida oddiy chizmalarni chizishni o’rgatish.

REJA:

1. AutoCAD dasturi haqida.
2. AutoCAD dasturi buyruqlar paneli.
3. «Chertyoj» uskunalar paneli.

Ushbu tajriba ishini bajarish uchun AutoCAD dasturi haqida, AutoCAD dasturining buyruqlar panelidagi «Chertyoj» <Privyazka>, <Izmenit >, Izmenit II>, <Telo>, <Ten > va <Standart> kabi uskunalar panellaridan foydalinishga doir ma`lumotlar tanishib chiqish zarur bo’ladi.

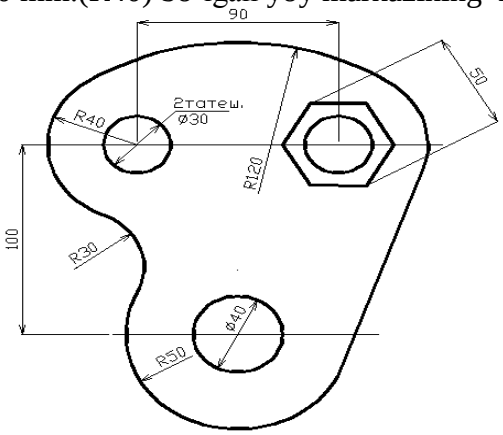
TAJRIBA ISHINING BAJARISH.

Berilgan variant topshiriq (5.1-rasm) chizmasidagi aylana va yoylarning(x,y,z) o’qlari bo’yicha koordinatalarini aniqlaymiz:

1.1. Ostki tomondagi Radiusi 50 mm. (R50) bo’lgan yoy markazining koordinatalari (0,0,0);

1.2. Chap tomondagi radiusi 40 mm.(R40) bo’lgan yoy markazining koordinatalari (-45,90,0);

1.3.O’ng tomondagi radiusi 40 mm.(R40) bo’lgan yoy markazining koordinatalari (45,90,0).



5.1-rasm

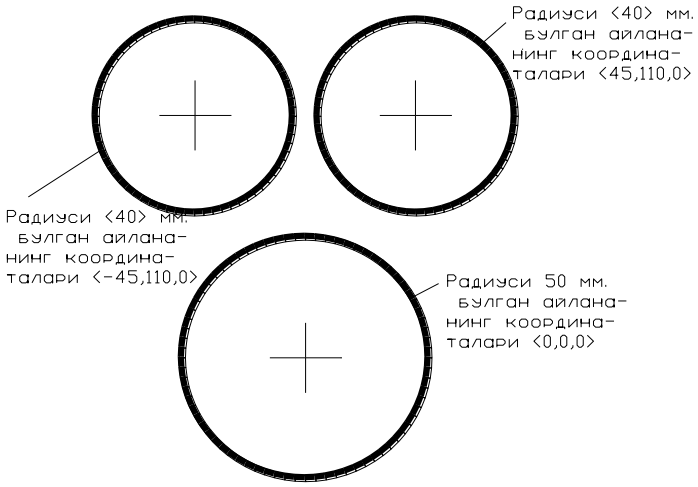
2. AYLANA VA YOYLARNI KOMP’YUTER YORDAMIDA CHIZISH.

2.1. «Chertyoj» uskunalar panelidan «Okrujnost » tugmasi tanlanadi

Muloqot oynasiga birinchi yoyning koordinatalari «0,0,0» kiritiladi va «Enter» bosiladi.

Muloqot oynasiga birinchi yoyning radiusi «50» kiritiladi va «Enter» bosiladi. Natijada Diametri 100mm. li aylana hosil bo’ladi.

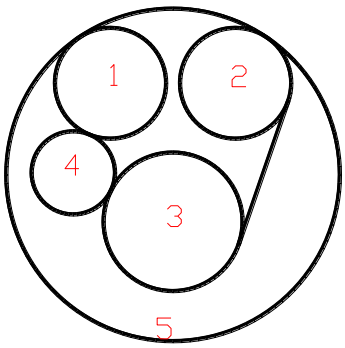
O’ng va chap tomonlaridagi yoylarning o’rniga yuqoridagi kabi aylanalar quriladi (5.2 – rasm).



5.2-rasm

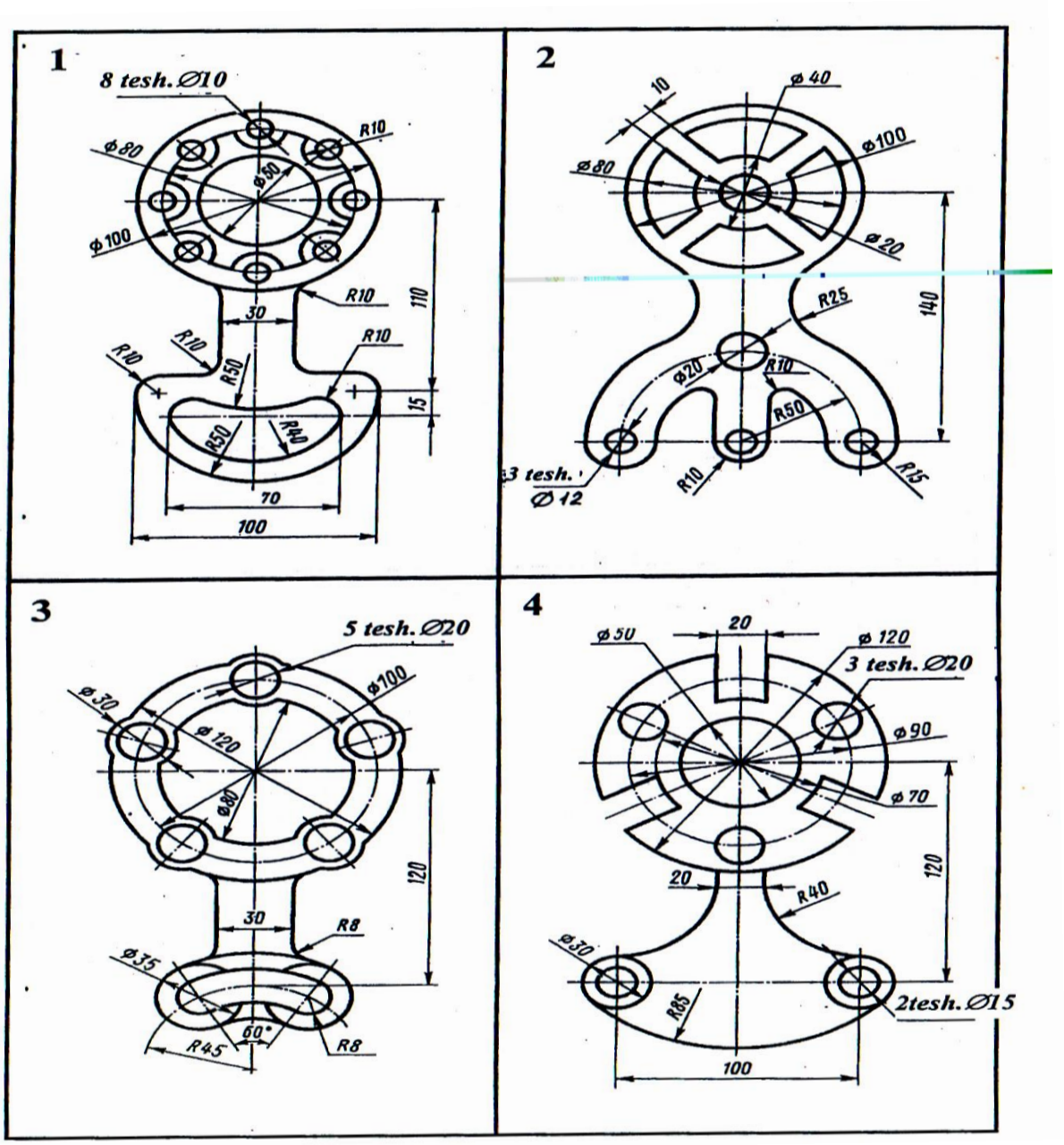
3.1. CHIZILGAN AYLANALARGA URINGAN AYLANA O’TKAZISH.

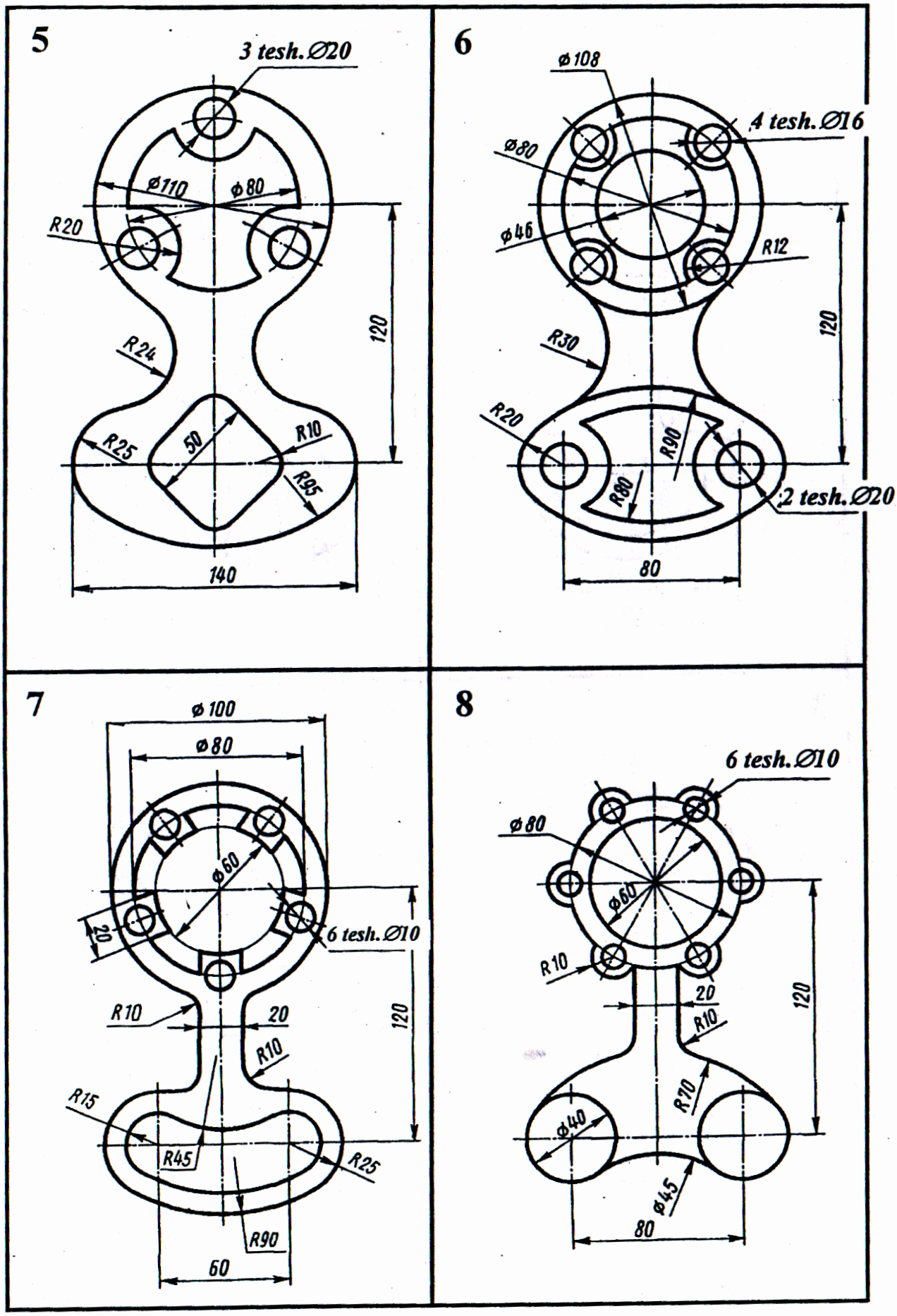
<Privyazka ob yektov> xolatlar tugmasi(ekran ostidagi) bosib yoqilgan xolda, «Chertyoj» uskunalar panelidan «Okrujnost » tugmasi tanlanib, sichqonchani o’ng tugmachasi bosiladi va <Ttr (tan, tan, radius)> bandi tanlanadi. Keyin 5 – aylanani (radiusi – 100 mm.) qurish uchun kursorni 1 – 2 – aylanalarga (taxminiy) urinishi mumkin bo’lgan nuqtalari ketma ket belgilanadi va aylananing radiusi - <100> soni kiritilib, <Enter> tugmasi bosiladi (5.3-rasm). 1 – va 3 - aylanalarga uringan 4 - aylanani ham yuqoridagi usul bilan quriladi.

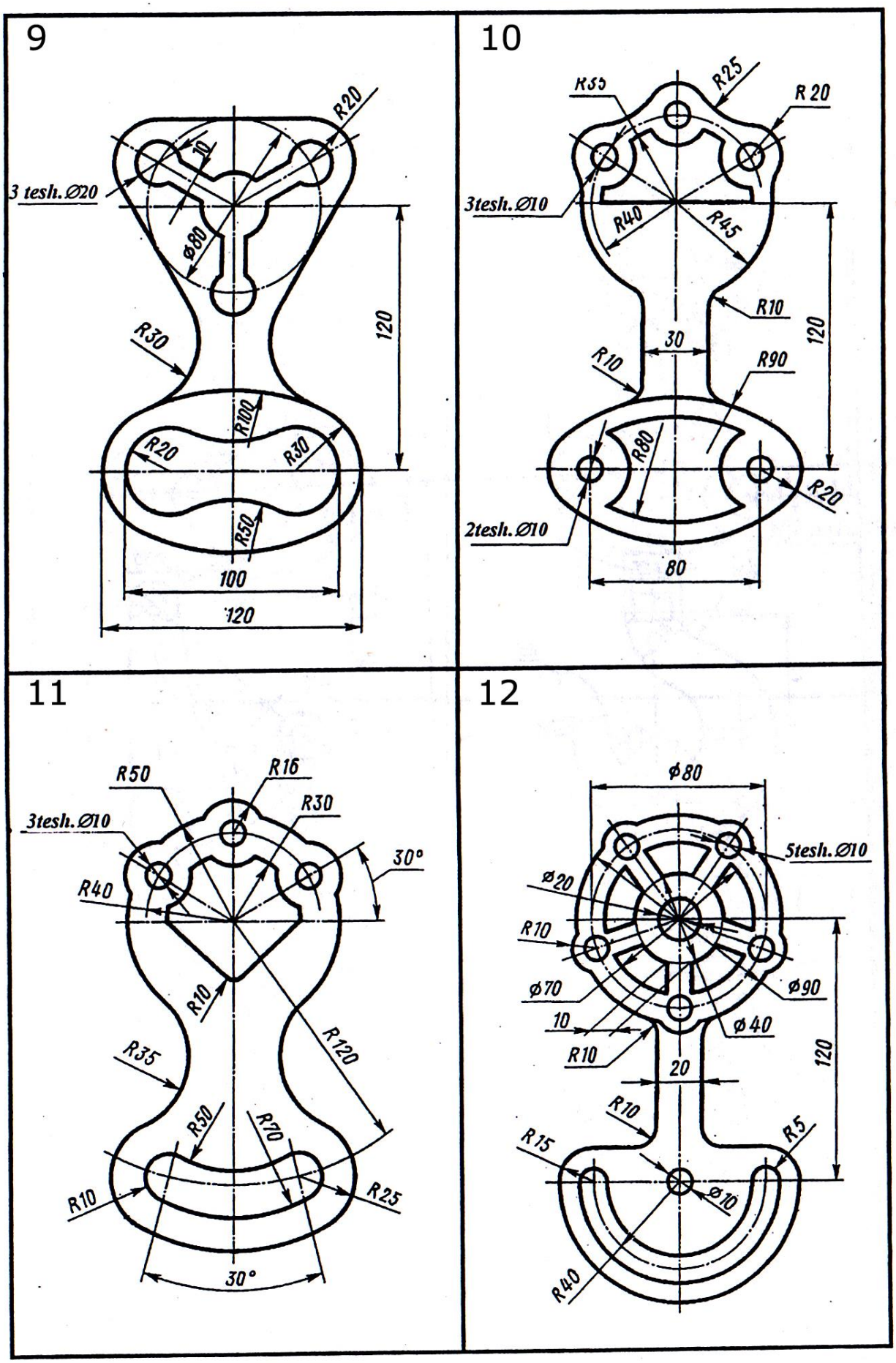


5.3-rasm

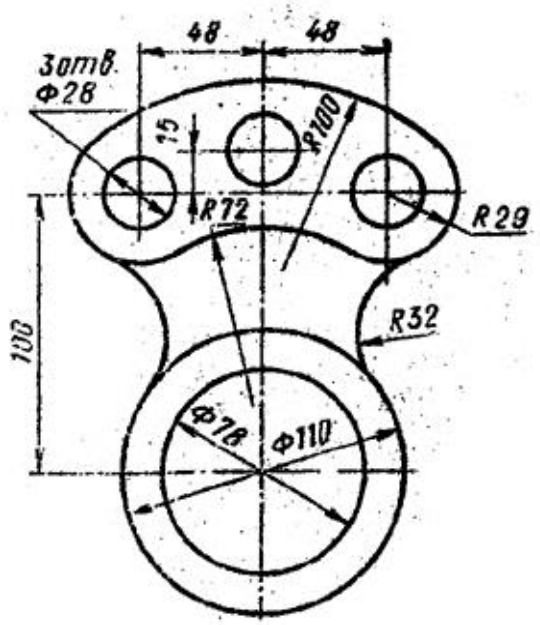
TOPSHIRIQ VARIANTLARI



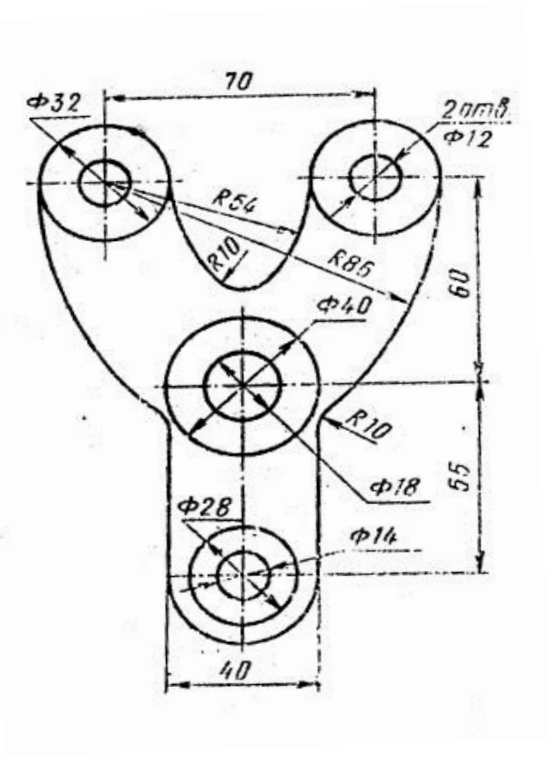

5
3 tesh.∅20
ø110
ø80
R20
120
R24
R25
50
R10
R95
140
6
ø108
4 tesh.∅16
ø80
ø46
R12
120
R30
R20
R90
R80
2 tesh.∅20
80
7
ø100
ø80
ø60
20
6 tesh.∅10
R10
20
120
R10
R15
R45
R25
R90
60
8
6 tesh.∅10
ø80
ø60
R10
20
120
R10
R70
ø40
ø45
80


9
R20
3 tesh.Ø20
10
Ø80
120
R30
R100
R20
R30
R50
100
120
10
R55
R25
R 20
3tesh.Ø10
R40
R45
R10
120
30
R10
R90
R80
R20
2tesh.Ø10
80
11
R50
R16
R30
3tesh.Ø10
30°
R40
R10
R120
R35
R50
R70
R10
R25
30°
12
Ø80
5tesh.Ø10
Ø20
R10
Ø70
Ø90
10
Ø40
R10
20
120
R10
R15
R5
Ø10
R40

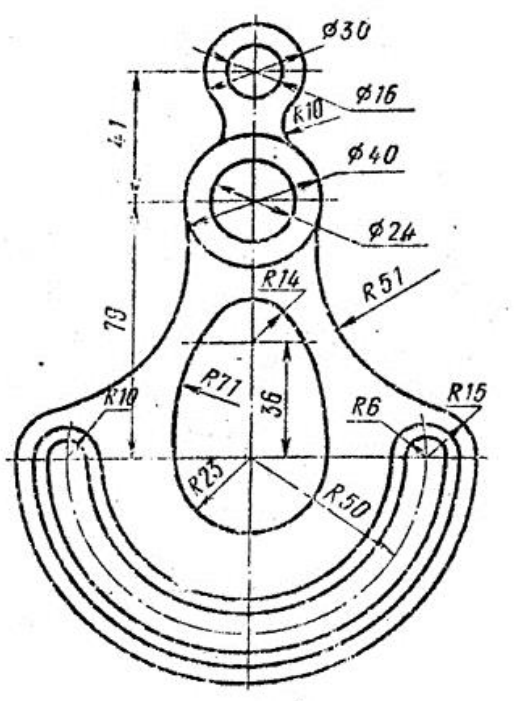
13


48
48
3отв.
Ф28
15
R100
R72
R29
R32
100
Ф78
Ф110

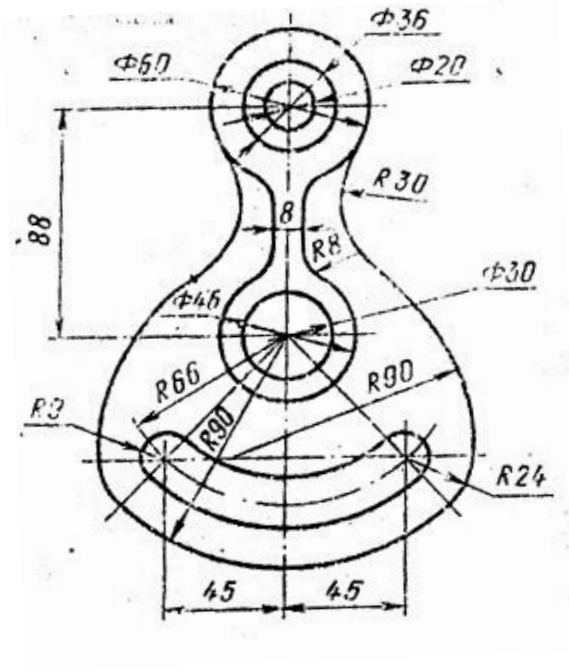
14


70
Ф32
2отв.
Ф12
R54
R10
R86
60
Ф40
R10
Ф18
55
Ф28
Ф14
40

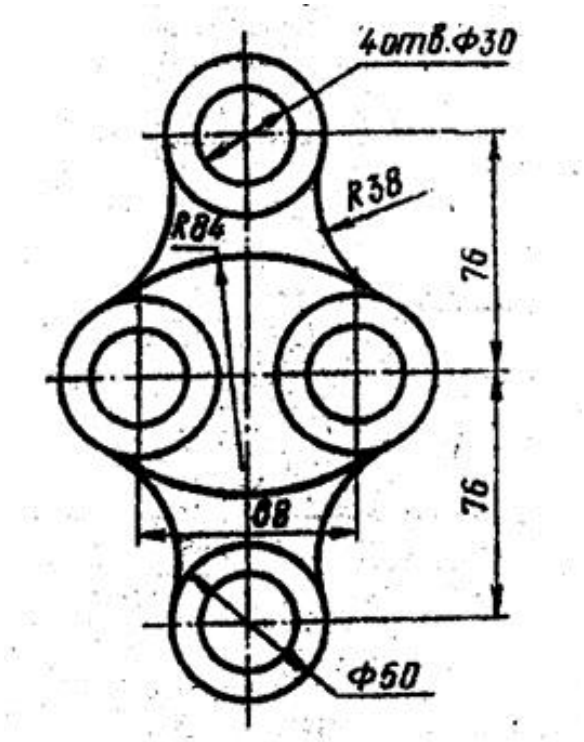
15


Ø30
Ø16
R10
41
Ø40
Ø24
R14
R51
79
R71
36
R10
R6
R15
R25
R50

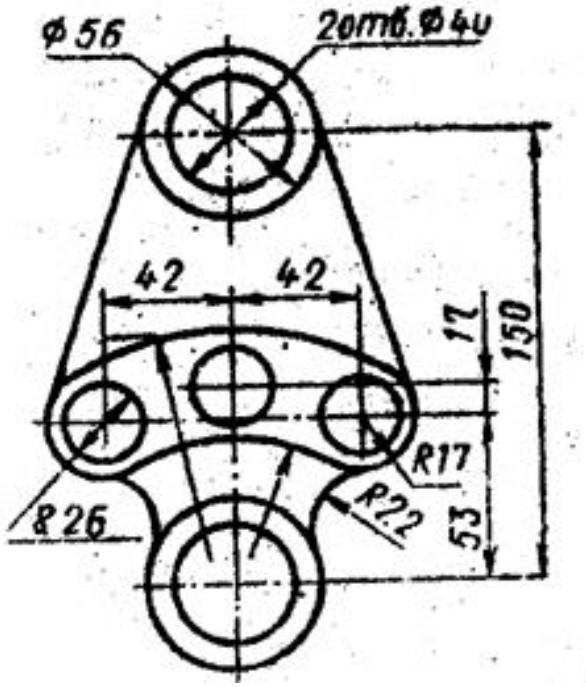
16


Ф36
Ф50
Ф20
R30
88
8
R8
Ф30
Ф46
R66
R90
R3
R90
R24
45
45

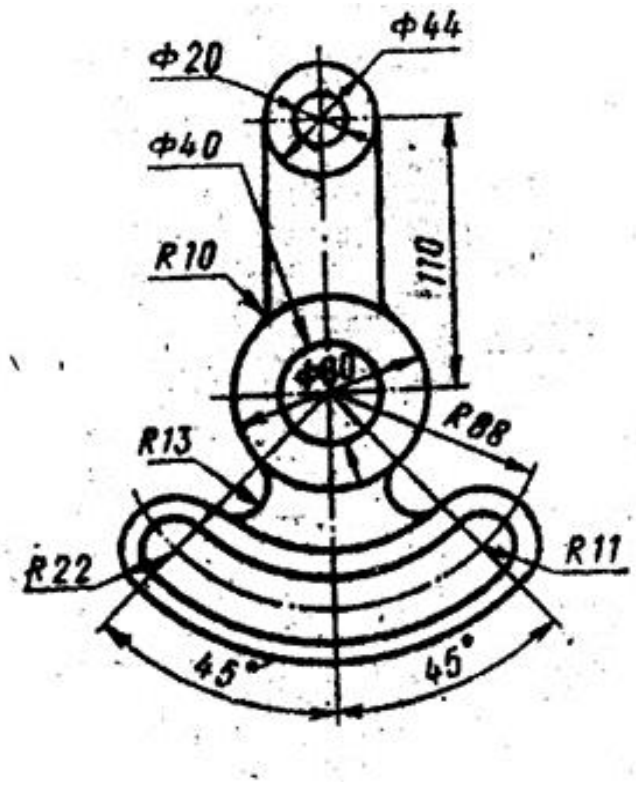
17


4отв.Ф30
R38
R84
76
76
68
Ф50

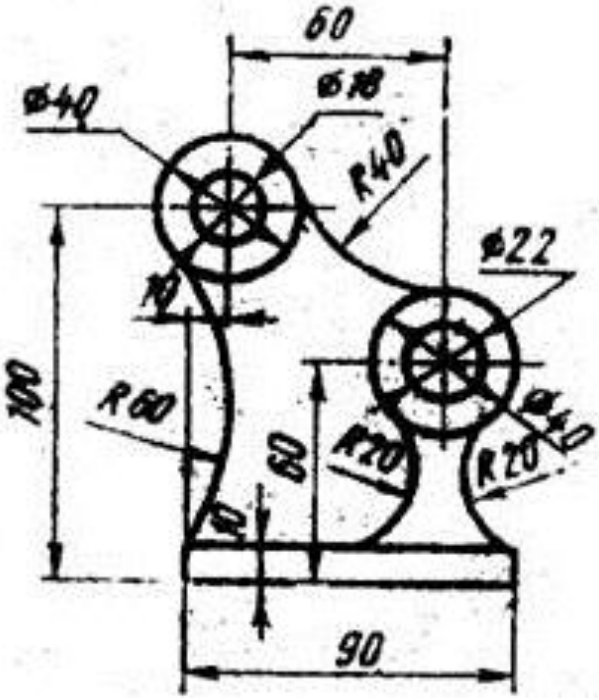
18


Ф56
2отв.Ф40
42
42
17
150
R17
R26
R22
53

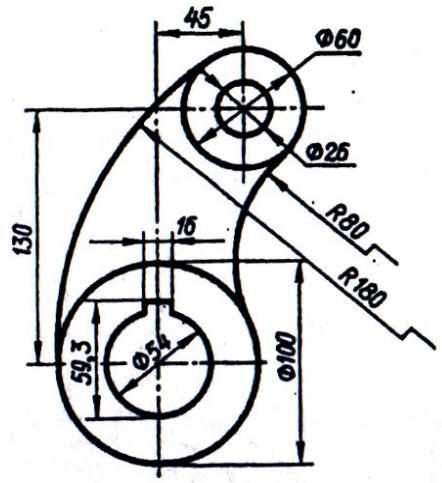
19


Ф44
Ф20
Ф40
R10
110
Ф80
R88
R13
R22
R11
45°
45°

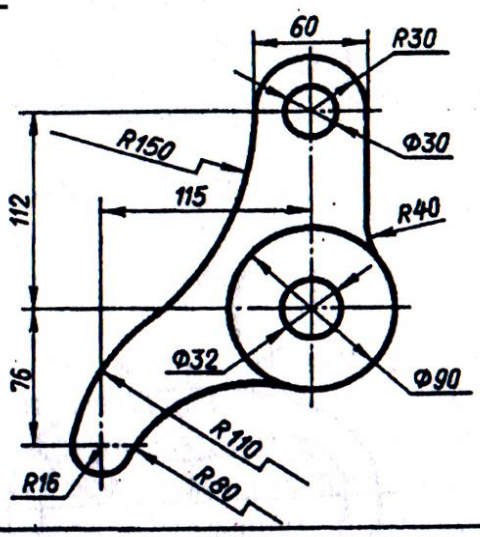
20


60
Ф18
Ф40
R40
Ф22
12
100
R60
80
R20
R20
Ф40
12
90

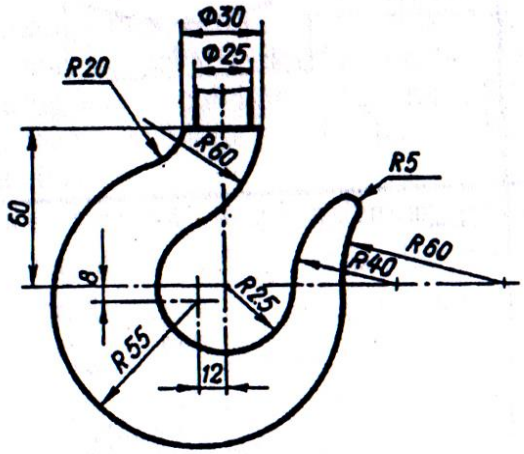
21



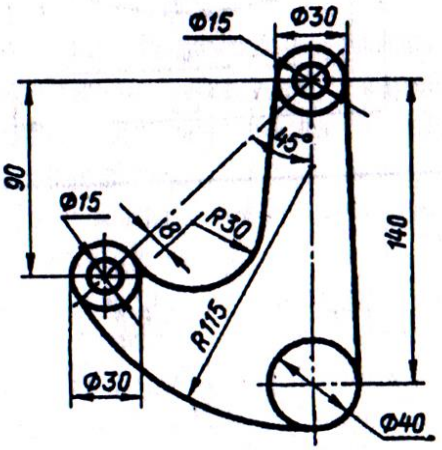
22



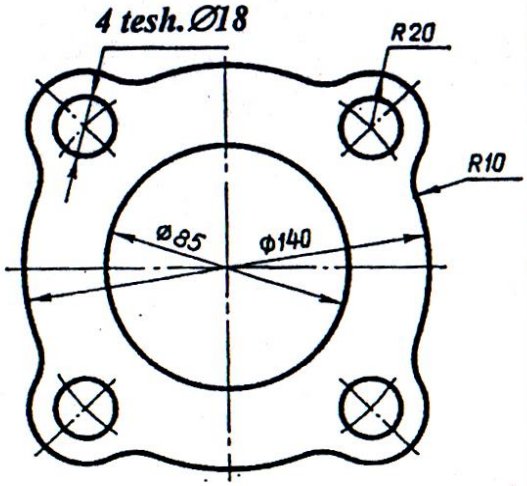
23



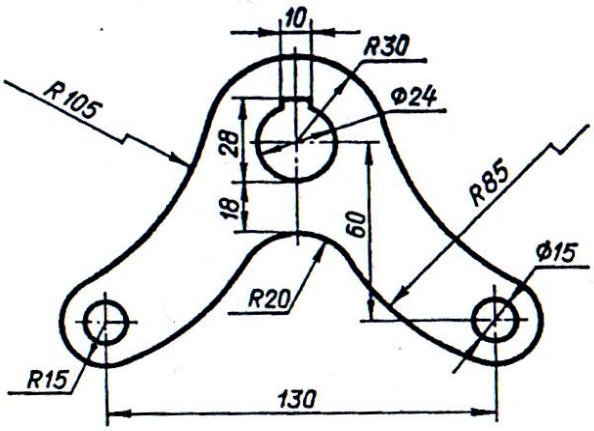
24



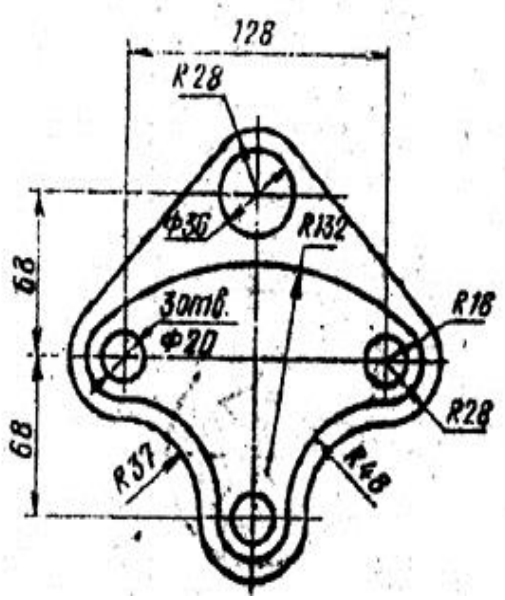
25



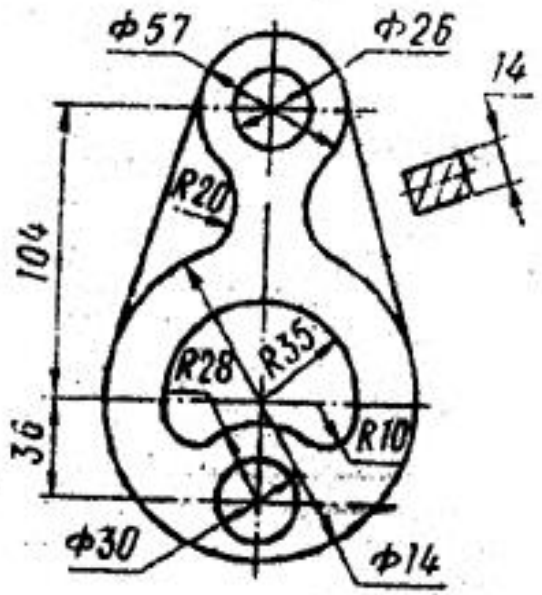
26



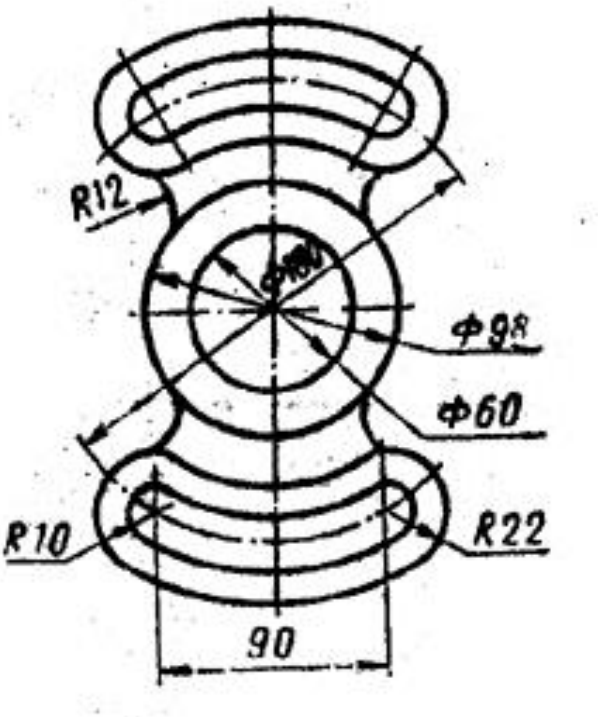
27


128
R28
Ф36
R132
68
Зотв.
Ф20
R16
68
R28
R37
R48

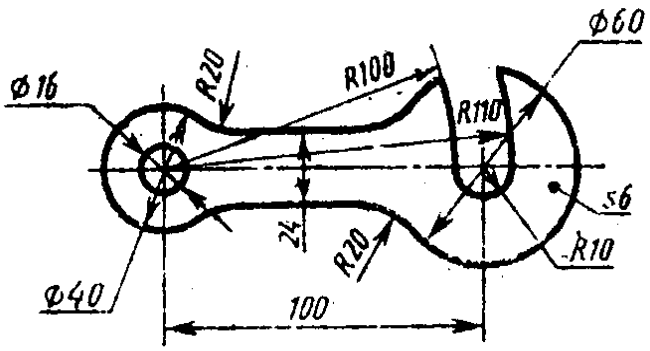
28


Ф57
Ф26
14
R20
104
R28
R35
36
R10
Ф30
Ф14

29


R12
Ф98
Ф60
R10
R22
90

30


Ф60
Ф16
R20
R100
R110
56
24
R20
R10
Ф40
100

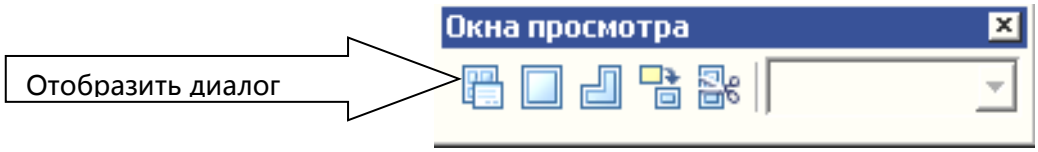
6-*TAJRIBA ISHI*

Mavzu: AutoCAD dasturidan foydalanib, uch o`lchamli ob`ektlarni shakllantirish;

REJA

1. “Modelirovaniy” uskunalar paneli haqida
2. “Ekstrudiya”, “Press”, “Vrasheniya”, “Razrez” buyruqlari
3. “Tochki Obzora” uskunalar paneli haqida

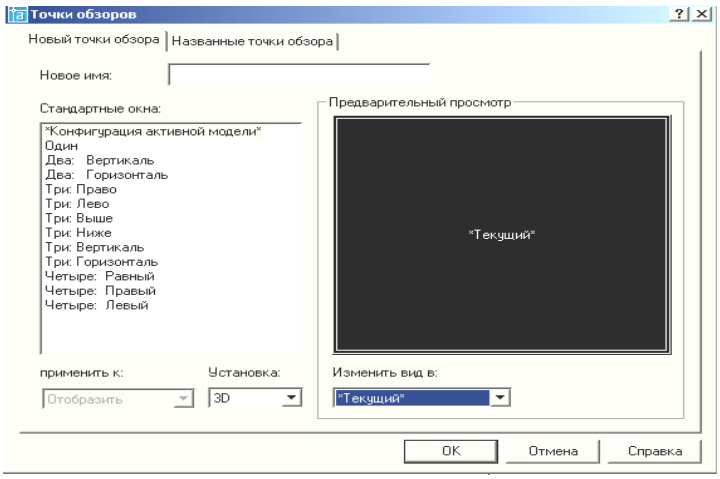
«Okno osmotra» uskunalar panelidan «Otobrazit dialog» tugmasi bosiladi (6.1 –rasm.).



Natijada «Tochki obzorov» oynasi chiqadi (6.2 –rasm.). Undagi «Novaya imya» darchasiga nom beriladi (Masalan: «222»), Standart oynadan ko’rinishlar soni «Odin», «Ustanovka» darchasida «ZD» tanlanadi. «Izmenit vid v» oynasidan birortasini joriy qilib tanlanadi (masalan: «Izometricheskiy severo--vostok») va «OK» bosiladi.

Markazi koordinata markazida joylashgan, diametri 100 mm bo’lgan sharni qurish uchun quyidagi ishlar bajariladi:

1. «Telo» uskunalar panelidagi «Sfera» tugmasi bosiladi (6.3 – rasm.).



6.2-rasm

6.3-rasm

2. Muloqat oynasida inglizcha «*sharning markazi <0,0,0> bo’lsinmi*?» so’roviga «Enter» bosiladi (6.4 - rasm).

6.4-rasm

3. Muloqat oynasida «Sharning radiusini kiriting» so’rovga «50» soni kiritiladi.

Natijada ishchi zonada shar ko’rinadi (6.5 - rasm).

Sharning ekvatoridan 30 mm yuqoridan qirqib yuqori qismini olib tashlash uchun quyidagi ishlar bajariladi:

6.5 – rasm.

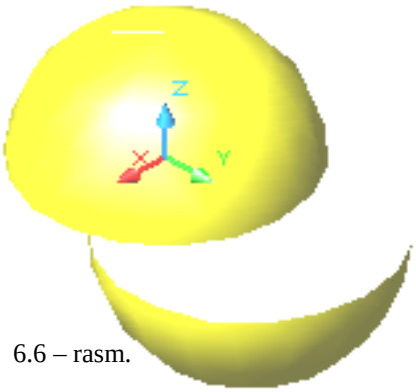
1.«Telo» uskunalar panelidagi «Sektor» tugmasi bosiladi.

2.Muloqat oynasida «Ob`ektni tanlang» so’rovga shar tanlanadi va «Enter» bosiladi.

3.Muloqat oynasida kesuvchi pichoq qanday xoldagi tekislik bo’ylab kesishini so’raydi. Shunda sichqonchaning o’ng tugmasi bosiladi va ochilgan darchadan «XU» bandi tanlanadi.

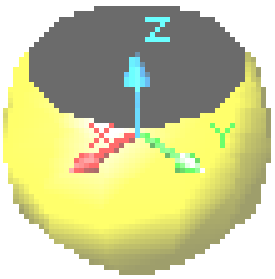
4.Muloqat oynasida XU tekisligidagi 0,0,0 nuqtasidan o’tsinmi? so’rovga «Enter» bosiladi.

5.Sichqonchaning o’ng tugmasi bosiladi va darchadan «Keep Both Sidts» bandi tanlanadi. Natijada shar teng ikkiga bo’linadi. Keraksiz bo’lagini XY tekisligida boshqa joyga ko’chirish uchun u belgilanadi va ushlanib suriladi (6.6 - rasm.).



6.6 – rasm.

Bizga kesuvchi tekislik ekvatordan 30 mm yuqordan kesishi kerak edi. Shuning uchun 3 marta «Otmenit » buyrug’i beriladi. Yuqoridagi ishlar qaytariladi 4-ishda «Enter» ni emas «0,0,30» kiritiladi va «Enter» bosiladi. Keraksiz bo’lagi belgilanib, «Delete» tugmasi bosiladi (6.7 - rasm).



6.7 - rasm.

Kesilgan sharda vertikal tsilindrik teshik ochish (diametri 30 mm) uchun quyidagi tartibda ishlar bajariladi:

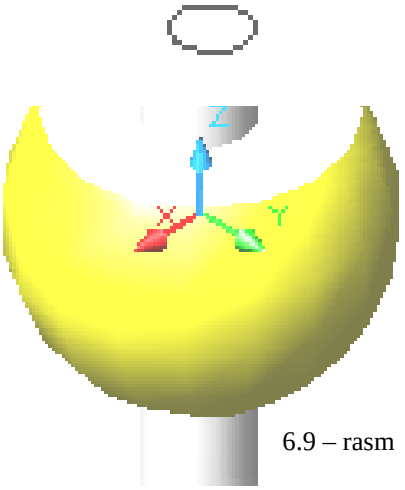
1.Shar markazidan 50 mm yuqorida aylana (diametri 30 mm)

6.8 – rasm.

chiziladi buning uchun «Chertyoj» uskunalar panelidagi «Okrujnost » tugmasi bosiladi(8-rasm.), «0,0,50» nuqta kiritiladi «Enter» bosiladi. Aylana radiusi «15» kiritiladi va aylana xosil bo’ladi(6.7 - rasm.).

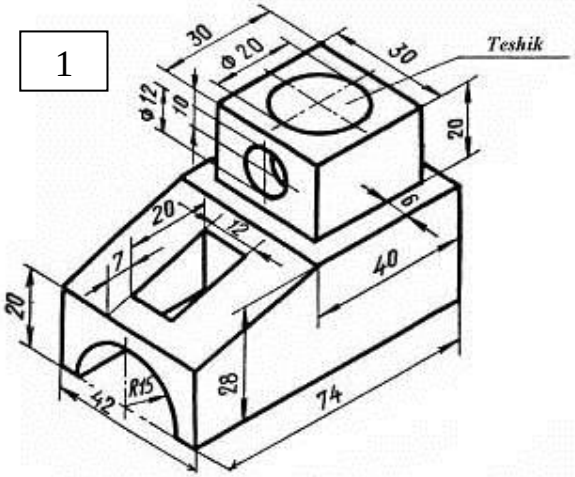
Tela uskunalar panelidan «Ekstrudi» tugmasi bosiladi. Aylana tanlanadi va «Enter» bosiladi. Muloqat oynasiga shar diametridan kattaroq son «-150» kiritiladi va «Enter» bosiladi. Natijada uzunligi 150 mm bo’lgan sharni kesib o’tuvchi tsilindr xosil bo’ladi(6.9 - rasm.)

3. Pravka uskunalar panelidagi «Vo’chitat » tugmasi bosiladi. Shar belgilanadi va «Enter» tugmasi bosiladi.

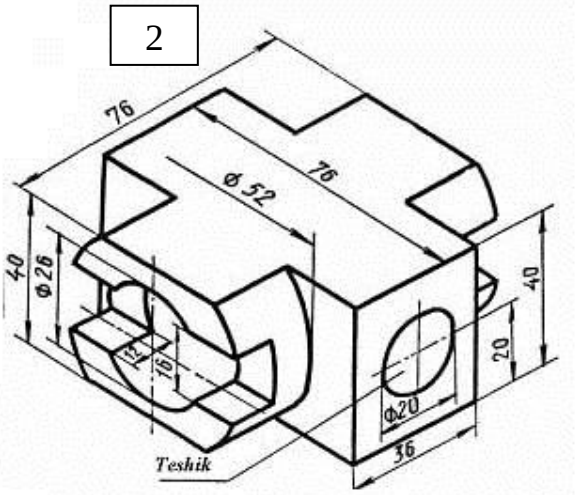


6.9 – rasm

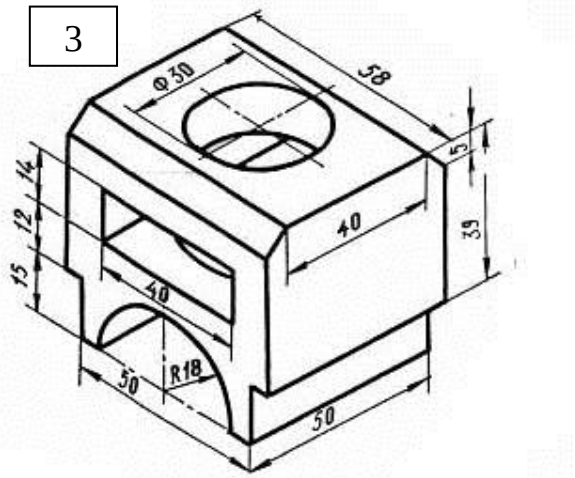
1


30
Ø20
30
Teshik
Ø12
10
20
20
12
7
6
40
20
R15
42
28
74

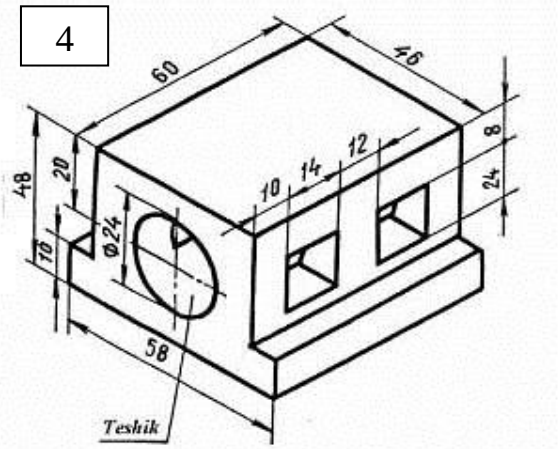
2


76
76
Ø52
40
Ø26
40
20
Ø20
36
Teshik

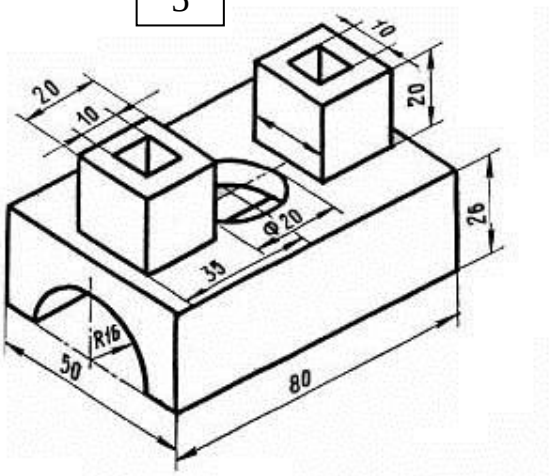
3


Ø30
58
5
14
12
15
40
40
39
R18
50
50

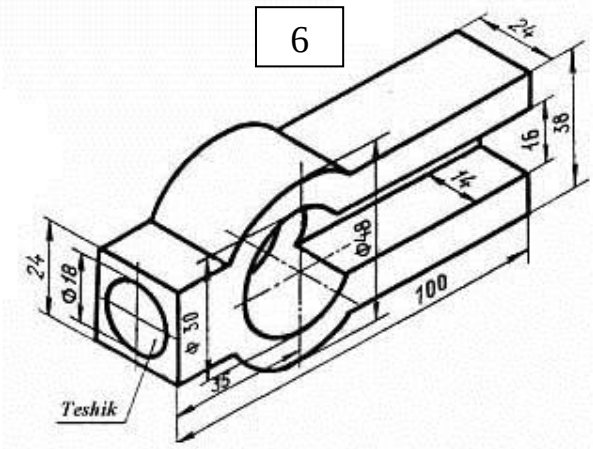
4


60
46
48
20
10
14
12
8
24
Ø24
10
58
Teshik

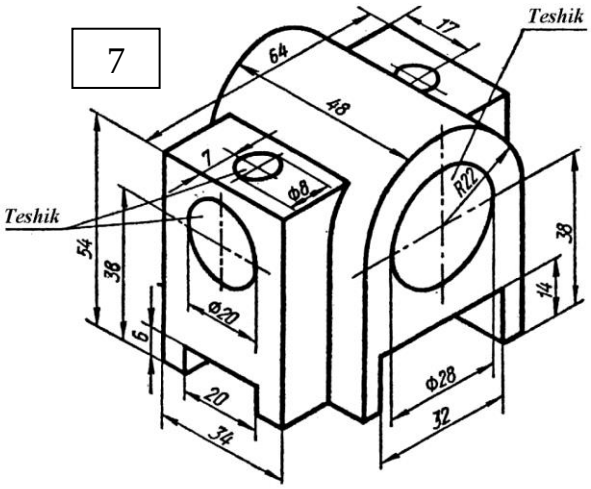
5


10
20
10
20
Ø20
26
35
R16
50
80

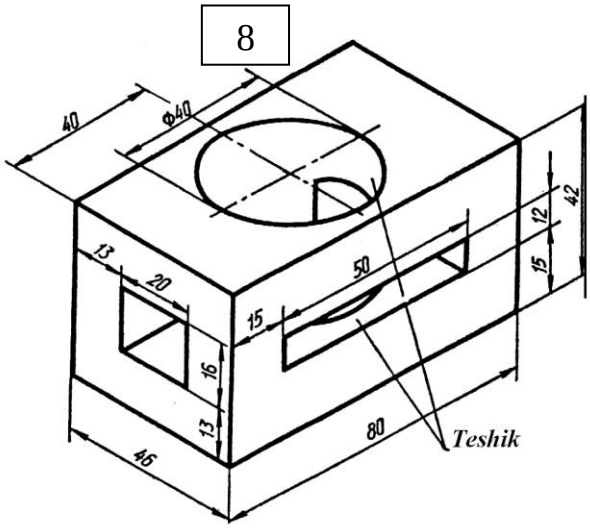
6


24
38
16
14
Ø48
24
Ø18
Ø30
100
35
Teshik

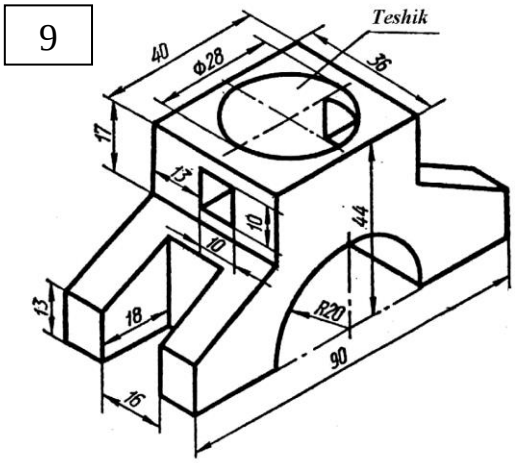
7


Teshik
Teshik
64
17
48
7
Φ8
R22
54
38
38
Φ20
6
14
20
34
Φ28
32

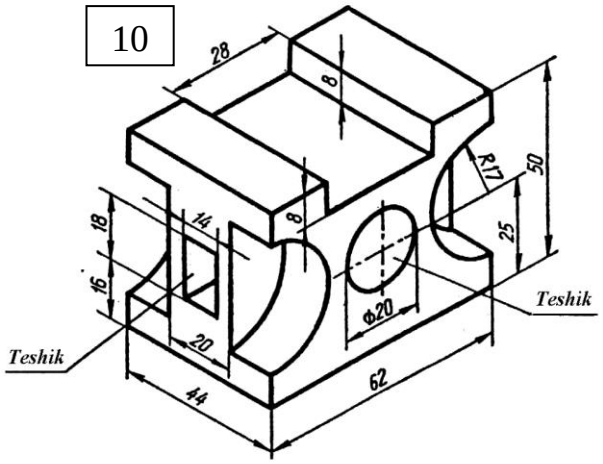
8


40
Φ40
42
12
15
13
20
50
15
16
13
80
46
Teshik

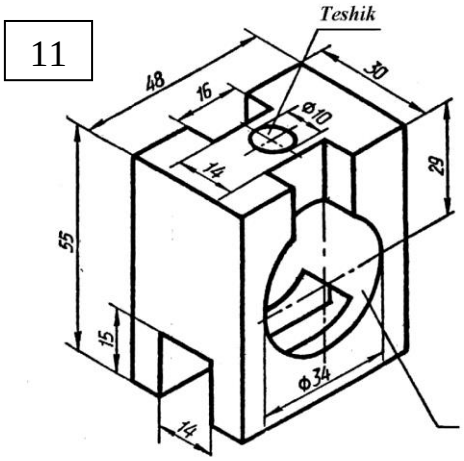
9


Teshik
40
Φ28
35
17
13
10
10
44
13
18
R20
90
15

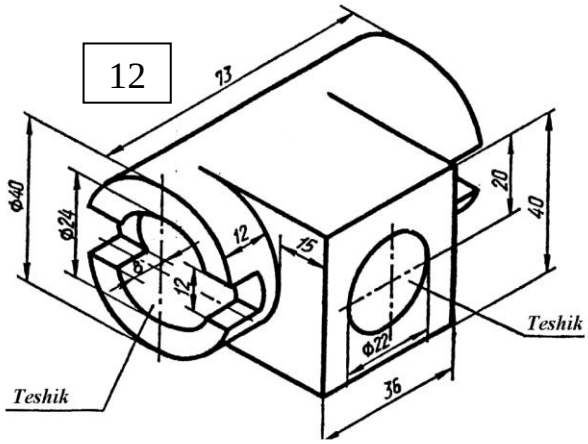
10


28
8
R17
50
18
14
8
25
16
Φ20
Teshik
Teshik
20
62
44

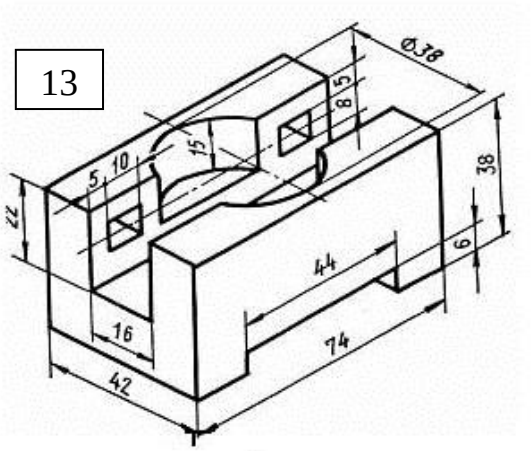
11


Teshik
48
16
30
Φ10
14
29
55
15
Φ34
14

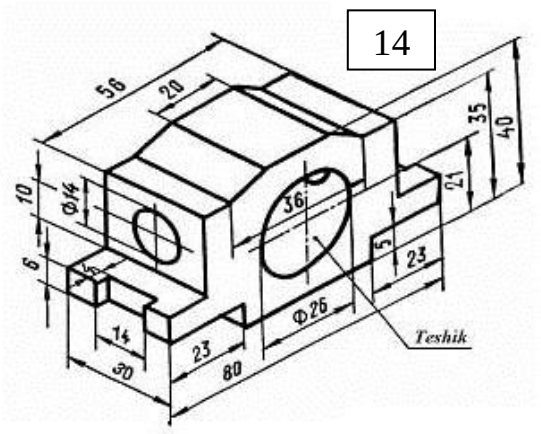
12


73
Φ40
Φ24
12
15
20
40
12
Teshik
Φ22
Teshik
36

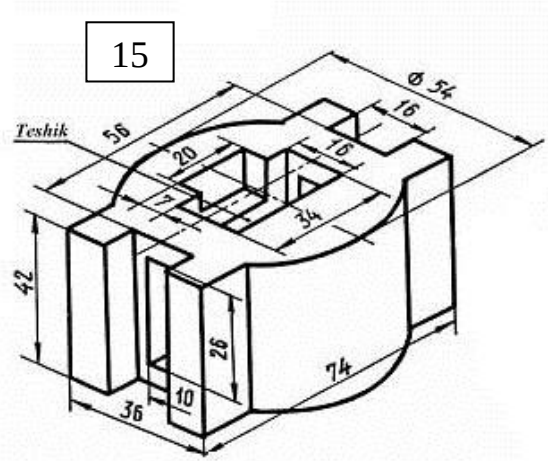
13



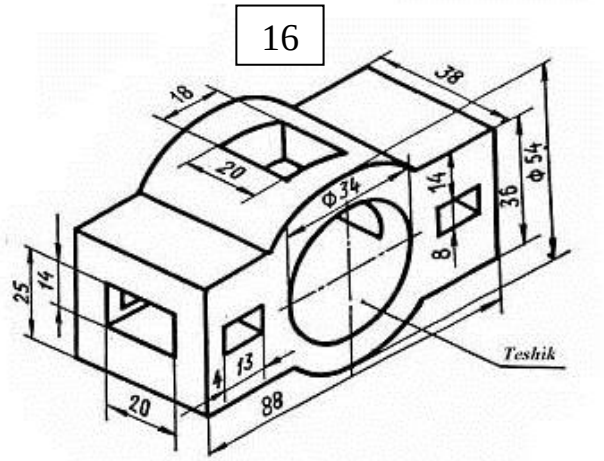
14



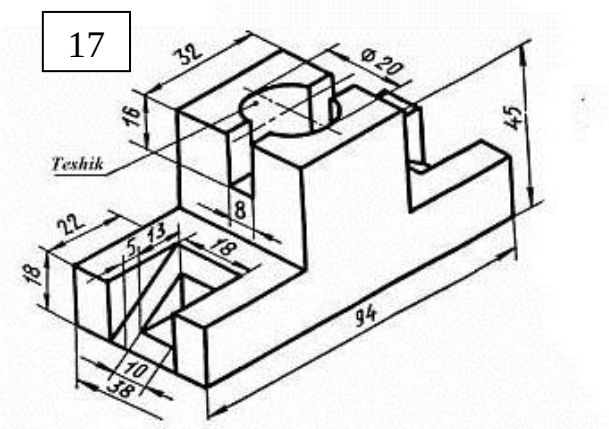
15



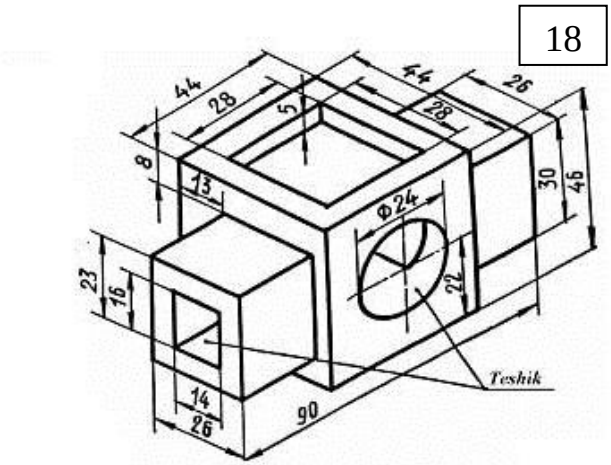
16



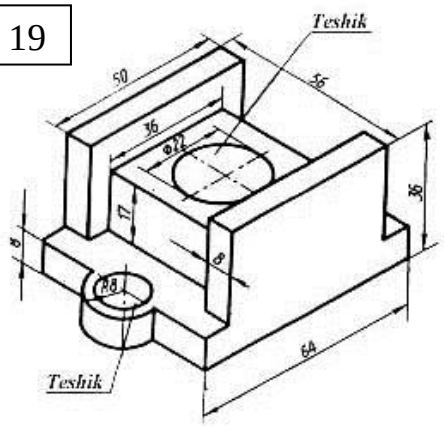
17



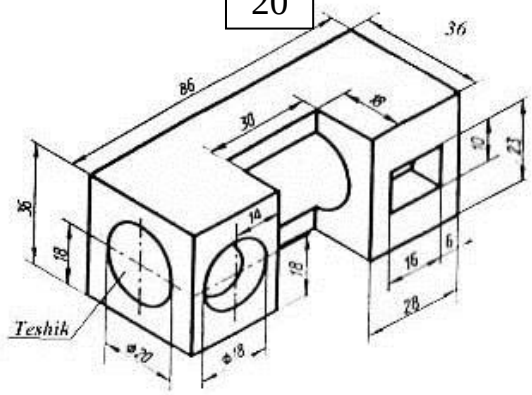
18



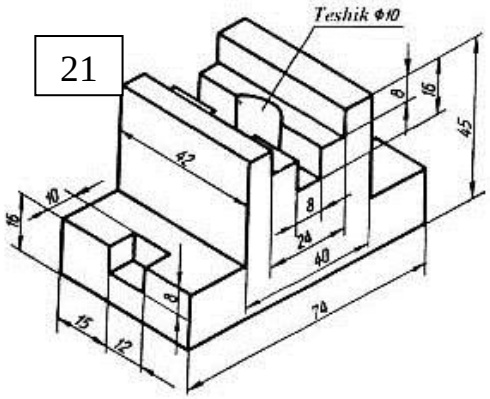
19



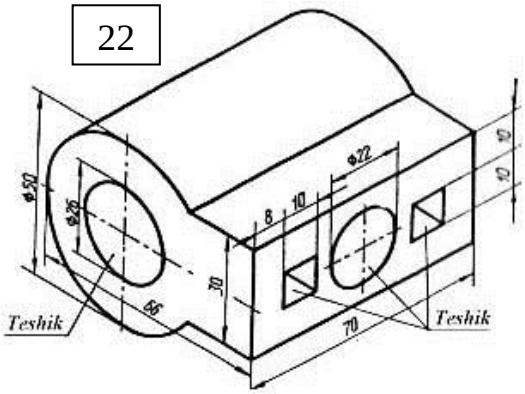
20



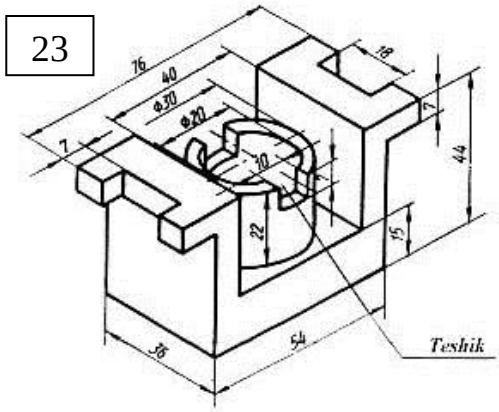
21



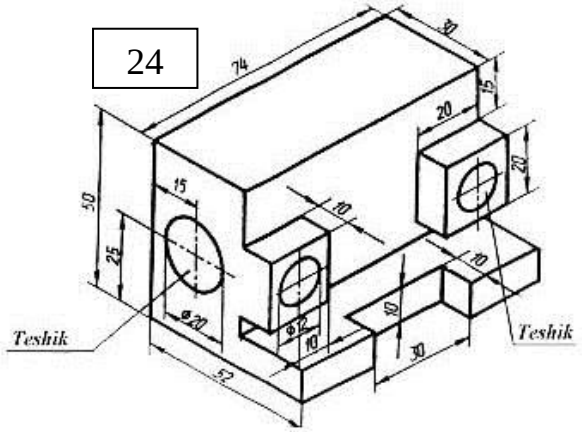
22



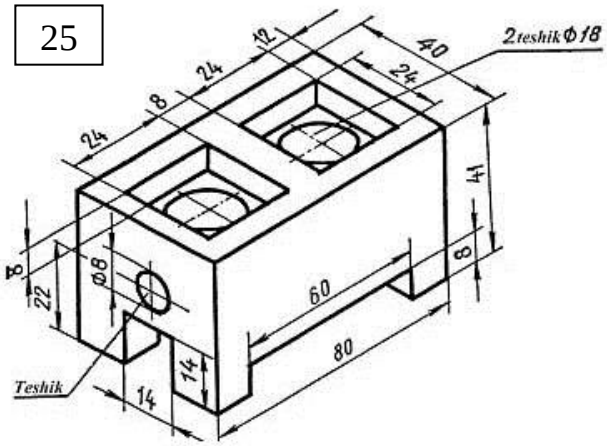
23



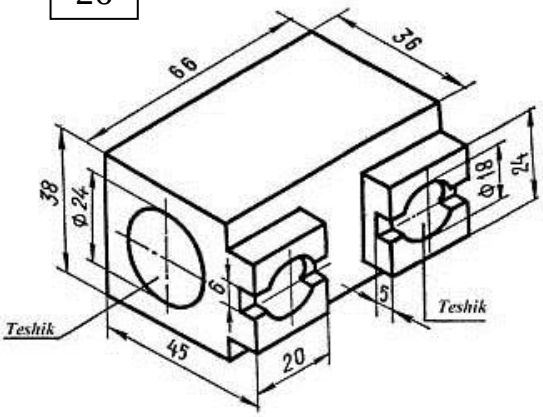
24



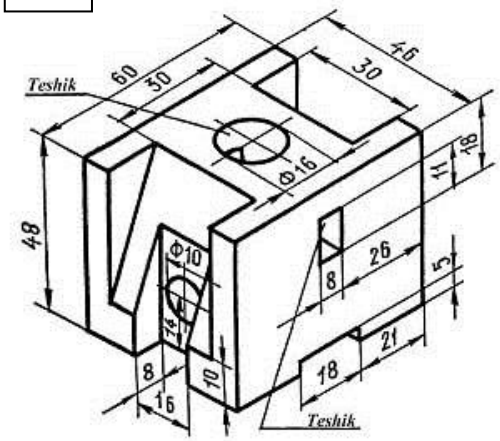
25



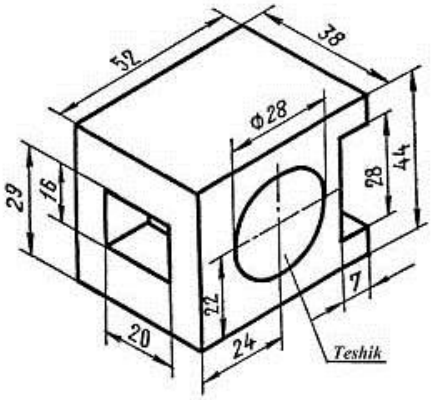
26



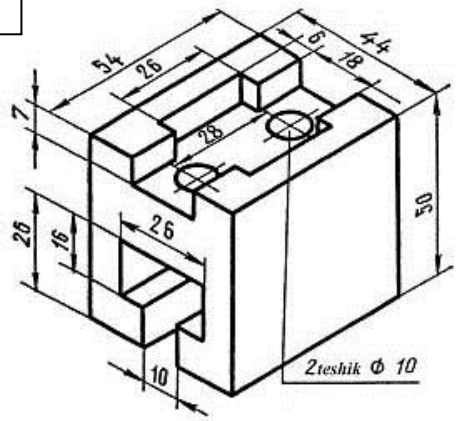
27



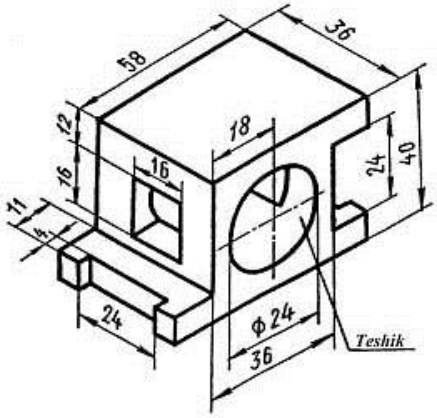
28



29



30



Foydalanilgan adabiyotlar

1. Peregudov L.V va boshqalar «Avtomatlashtirilgan korxona stanoklari». Toshkent, «O'zbekiston». 1999 y.
2. Peregudov L.V i dr. «Texnologicheskoe oborudovanie avtomatizirovannogo proizvodstva » T. 2001 g
3. Kapustin N.M. i dr. Proektirovanie texnologii avtomatizirovannogo proizvodstva. M., Mashinostroeniya, 2001g.
4. Makarova N.V. Informatika, Toshkent, Talqin, 2005
5. Miraxmedov D.A. « Avtomatik boshqarish nazariyasi» T. «O'zbekiston». 1993 y.
6. Norenkov I. P. Vvedenie v avtomatizirovannoe proektirovanie texnicheskix ustroystv i sistem. Minsk.: "Vo'sheyshaya shkola". 1986
7. A.T.Jadaev «AutoCAD-2006» Moskva «Luchshie knigi» 2006 g
8. T.Sokolova «AutoCAD-2005» Piter 2006 g
9. T.Xolmatov, N.I.Toyloqov "Amaliy matematika, dasturlash va komp yuterning dasturiy ta`minoti" Mexnat Toshkent -2000 y

Qo'shimcha adabiyotlar

1. Aripov M, Muxammadaliev J. «Informatika va informatsion texnologiyalar», Toshkent, 2004 y.
2. Petrov A. «Vo'chislitel naya texnika i programmirovaniya», Moskva, Vo'shaya shkola, 1991 g.
3. Omirov A., Kayumov A. «Mashinasozlik texnologiyasi». T. «O'zbekiston». 2003 y.
4. Kuznetsov M.M. i dr. «Proektirovanie avtomatizirovannogo proizvodstvennogo oborudovaniya» M., Mashinostroeniya, 1987 g.
5. A. Axmedov, N. Toyloqov. «Informatika».
6. Holmatov T. «Informatika» Toshkent. 2000 y.
7. Internet ma`lumotlari