

**O'ZBEKISTON RESPUBLIKASI XALQ TA'LIMI VAZIRLIGI
TASARRUFIDAGI ANIQ FANLARGA IXTISOSLASHTIRILGAN
DAVLAT UMUMTA'LIM MAKTEBI**



USLUBIY TAVSIYA

Mavzu: “Funktsiyalar va ularning grafigi”.

O'qituvchi: Abduraxmanova J.B.

TOSHKENT -2015

Reja:

KIRISH

ASOSIY QISM

1. “Funksiya” haqida tushuncha.
2. Chiziqli funksiyalar.
3. Kvadrat funksiyalar.
4. Teskari proporsionallik funksiyasi .
5. Juft va toq funksiyalar.
6. O’zaro teskari funksiyalar.
7. Modulli funksiyalar.

XULOSA

FOYDALANILGAN ADABIYOTLAR

KIRISH

Ma'lumki, Vatanimiz istiqbolga erishgandan so'ng shahdam odimlar bilan olg'a bormoqda, ilm-fan va texnikaning zamonaviy sohalari rivojlanmoqda va bu rivojlanish ilm ahli oldiga ko'plab zamonaviy muammolarni hal etishni ko'ndalang qilib qo'ymoqda. Ushbu fikrimizni prezidentimiz Islom Abduganiyevich Karimovning «O'zbekiston XXI asr bo'sag'asida: havfsizlikka tahdid, barqarorlik shartlari va taraqqiyot kafolatlari» nomli kitoblarida keltirilgan quyidagi so'zlardan ham bilib olsak bo'ladi:

«Respublikamizda quyidagi yo'nalishlar bo'yicha jahon darajasidagi ilmiy maktablar yaratilgan bo'lib, ularda tadqiqotlar muvaffaqiyatli olib borilmoqda. Jumladan, matematika, ehtimollar nazariyasi, tabiiy va ijtimoiy jarayonlarni matematik modellash, informatika va hisoblash texnikasi sohasidagi tadqiqotlar.

Matematika fanining ehtimollar nazariyasi va matematik statistika, differensial tenglamalar va matematik fizika, funksional tahlil sohasidagi yutuqlari respublikadan ancha uzoqda ham mashxur».

Prezidentimizning so'zlaridan xulosa chiqargan holda kelajagi buyuk davlat mustaqil O'zbekistonning milliy mafkurasi bo'lgan ma'naviyatni shakllantirishda, qaror toptirishda, halq ta'limi tizimining rivojlanishi eng asosiy ustivor vazifalardan biridir.

ASOSIY QISM

Funksiya haqida tushuncha.

Agar biror sonlar to'plamidan olingan x ning bir qiymatiga biror qoida bo'yicha y son mos qo'yilgan bo'lsa, u holda shu to'plamda funksiya aniqlangan deyiladi.

y miqdorning x miqdorga bog'liqligini ta'kidlash uchun ko'pincha $y(x)$ deb yoziladi (o'qilishi: "igrek ikstdan"). Bunda x erkli o'zgaruvchi, $y(x)$ esa erksiz o'zgaruvchi yoki **funksiya** deyiladi.

Masalan, kvadratning yuzi uning x tomoni uzunligining funksiyasi bo'ladi, ya'ni $y(x) = x^2$.

Funksiya berilishining ba'zi usullarini qaraymiz.

1. Funksiya formula bilan berilishi mumkin.

Masalan, $y=2x$

formula x ning berilgan qiymati bo'yicha y ning qiymatini qanday hisoblash kerakligini ko'rsatadi. Funksiyaning bunday usulda berilishi analitik usul deyiladi.

2. Funksiya jadval bilan berilishi mumkin.

x	1	2	3	4	5	6	7	8
y	1	4	9	16	25	36	49	64

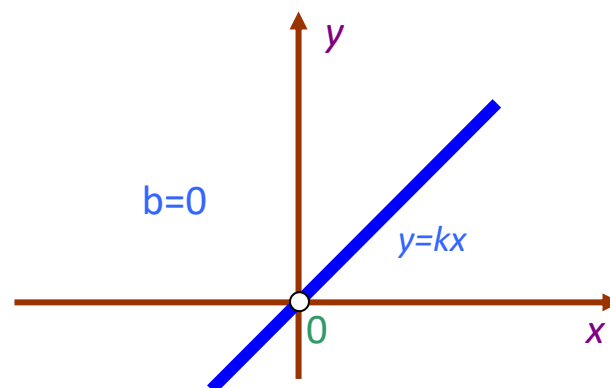
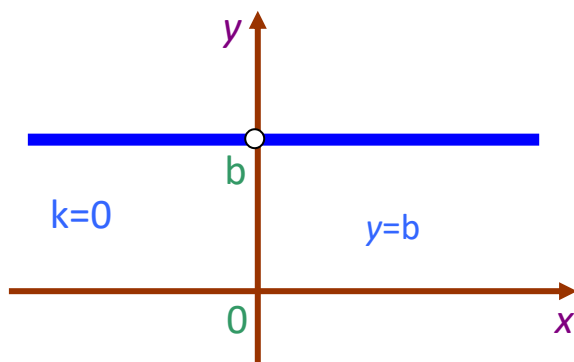
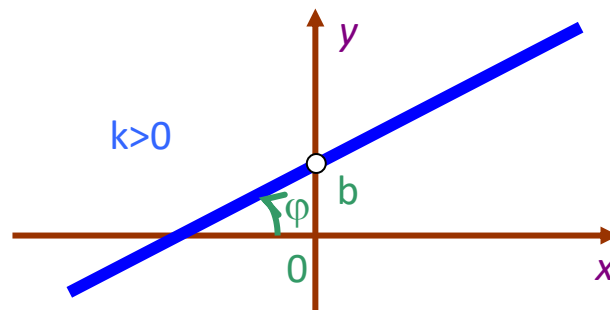
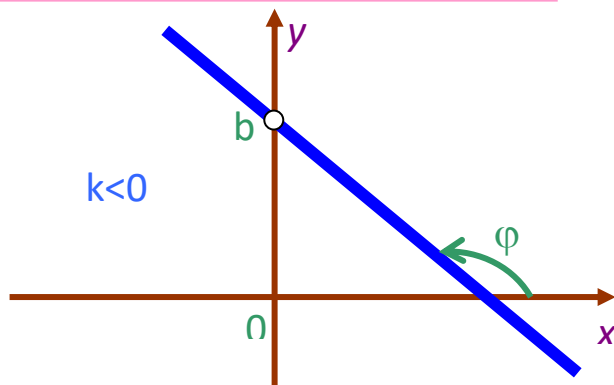
Bu jadvalga muvofiq $x = 3$ qiymatga $y = 9$ qiymat mos keladi, $x = 5$ qiymatga $y=25$ qiymat mos keladi. Funksiyaning bunday berilish usuli jadval usuli deyiladi.

3. Amalda ko'pincha funksiyani uning grafigi yordamida berilish usuli qo'llaniladi.

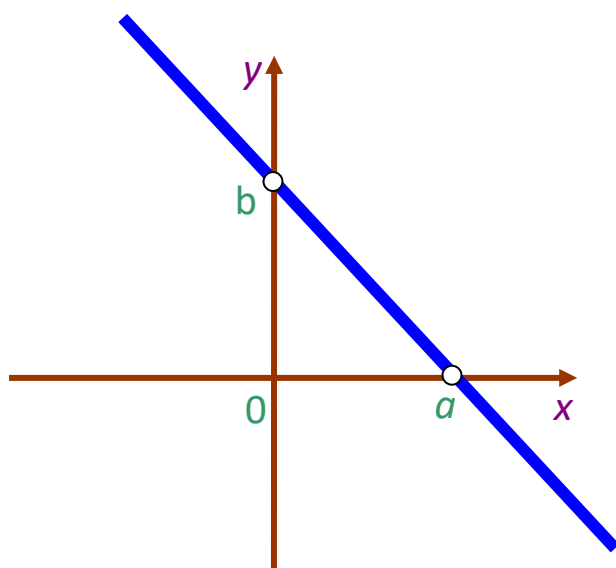
Funksiyaning grafigi - bu koordinata tekisligining abssissalari erkli o'zgaruvchining qiymatlariga, ordinatalari esa funksiyaning mos qiymatlariga teng bo'lgan barcha nuqtalari to'plamidir.

Chiziqli funksiyalar

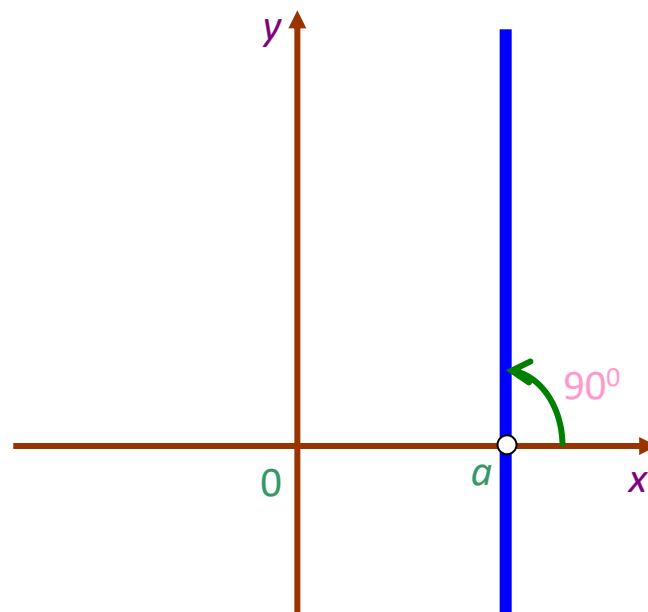
(1) $y=kx+b, \quad k=\operatorname{tg}\varphi$



(2) $\frac{x}{a} + \frac{y}{b} = 1$



$\frac{x}{a} = 1, \quad y = 0$



Funksiyaga doir yana bitta misol keltiramiz.

Asosi 3 ga, balandligi esa x ga teng bo'lgan to'g'ri to'rtburchakning yuzini hisoblaymiz. Agar izlanayotgan yuzni y harfi bilan belgilansa, u holda javobni $y=3x$ formula bilan yozish mumkin.

Agar to'g'ri to'rtburchakning asosi k ga teng bo'lsa, u holda x balandlik bilan y yuz orasidagi bog'liqlik $y = kx$ formula bilan ifoda qilinadi. k sonning har bir qiymati biror

$$y=kx \quad (1)$$

funksiyani aniqlaydi.

Endi $y = kx$ funksiyaning grafigini yasaymiz.

$k = 2$ bo'lsin, deylik. U holda funksiya bunday ko'rinishga ega bo'ladi:

$$y=2x. \quad (2)$$

x ga turli qiymatlar berib, (2) formula bo'yicha y ning mos qiymatlarini hisoblaymiz.

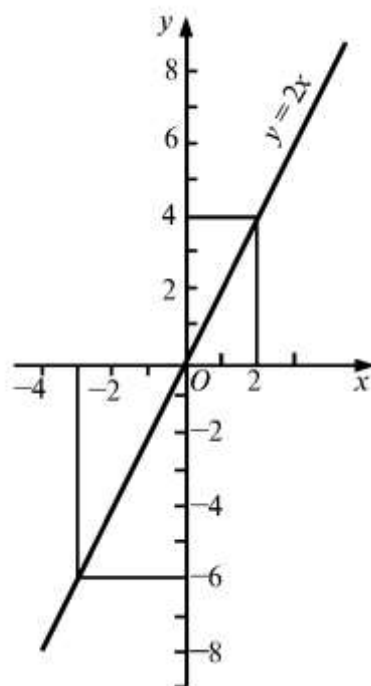
Masalan, $x = 2$ ni olib, $y = 4$ ni hosil qilamiz. Koordinatalari $(2; 4)$ bo'lgan nuqtani yasaymiz. Agar $x = 0$ bo'lsa, u holda $y = 2 \cdot 0 = 0$; agar $x = -3$ bo'lsa, u holda

$y = 2 \cdot (-3) = -6$; agar $x = 0,5$ bo'lsa, u holda $y = 2 \cdot 0,5 = 1$ bo'ladi va hokazo.

Jadval tuzamiz:

x	2	0	-3	0,5
y	4	0	-6	1

Topilgan koordinatalar bo'yicha nuqtalarni yasaymiz. Chizg'ichni qo'yib, barcha topilgan nuqtalar koordinatalar boshidan o'tuvchi bir to'g'ri chiziqda yotishiga ishonch hosil qilish mumkin. Shu to'g'ri chiziq $y = 2x$ funksiyaning grafigi bo'ladi. Koordinatalari $(x; y)$ bo'lgan nuqta faqat $y = 2x$ tenglik to'g'ri bo'lgan holdagina shu to'g'ri chiziqda yotadi. Masalan, $(-1; -2)$ koordinatali nuqta bu to'g'ri chiziqda yotadi, chunki $(-2) = 2 \cdot (-1)$ to'g'ri tenglik.



$y = kx$ funksiyaning grafigi k ning istalgan qiymatida koordinatalar boshidan o'tuvchi to'g'ri chiziq bo'ladi.

Kvadrat funksiya

Kvadrat funksiyaning ta'rifi:

$y = ax^2 + bx + c$ funksiya kvadrat funksiya deyiladi. Bunda a , b , va c – haqiqiy sonlar, $a \neq 0$, x – haqiqiy o'zgaruvchi.

Masalan: quyidagi funksiyalar kvadrat funksiyalardir

$$y = x^2, \quad y = -2x^2, \quad y = x^2 - x, \quad y = x^2 - 5x + 6, \quad y = -3x^2 + \frac{1}{2}x$$

$$y = ax^2 + bx + c \quad (1)$$

kvadrat uchhad $b = c = 0$ bo'lganda, ushbu shaklga kelib qoladi:

$$y = ax^2. \quad (2)$$

(2) funksiyaning grafigi y lar o'qiga nisbatan simmetrik bo'lib ,

koordinatalar boshidan o'tadigan, $a > 0$ bo'lganda tarmoqlari yuqoriga,

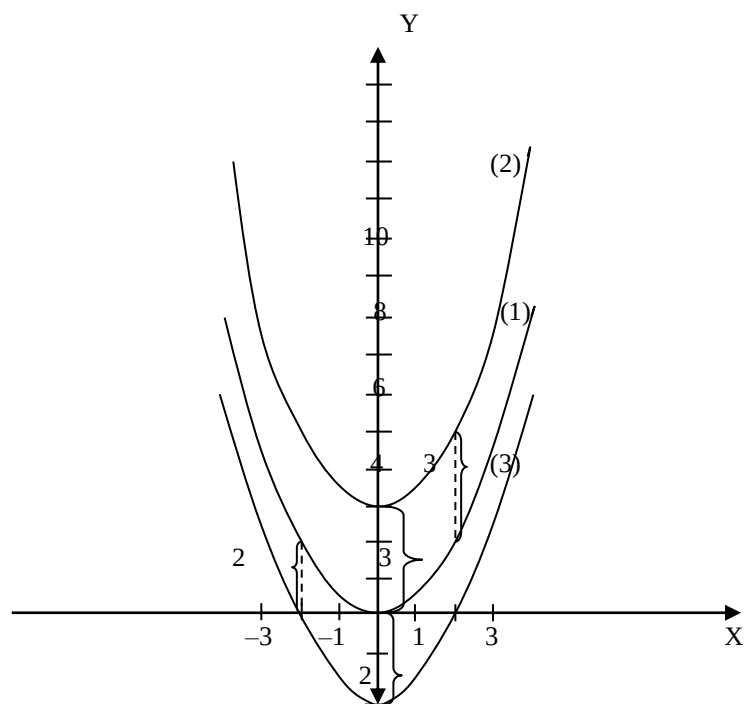
$a < 0$ bo'lganda esa pastga yo'nalgan parabola.

(1) ifodada $b = 0$ bo'lib , $c \neq 0$ bo'lsa,

$$y = ax^2 + c$$

funksiya hosil bo'ladi. $c > 0$ bo'lganda bu funksiyaning qiymati (2) funksiya qiymatidan c birlik kam bo'ladi. Bundan (3) funksiyaning grafigini (2) funksiyaning grafigidan $c > 0$ bo'lganda c birlik yuqoriga ,

$c < 0$ bo'lganda esa c birlik pastga surish bilan hosil qilish mumkin ekanligi ko'rinadi. (1–chizma).



1 – chizmada 1) $y = 0,5x^2$; 2) $y = 0,5x^2 + 3$; 3) $y = 0,5x^2 - 2$ funksiyalarning grafigi chizilgan bo`lib, 2 va 3 funksiyalarning grafiklari $y = 0,5x^2$ funksiyaning grafigini

3 birlik yuqoriga va 2 birlik pastga surish bilan hosilqilinganligi tasvir etilgan.

II.

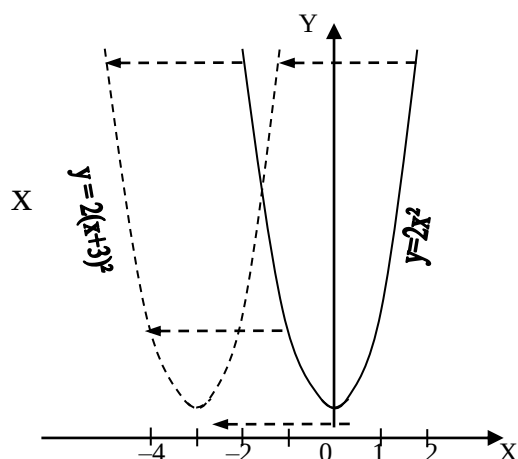
$$f(x) = ax^2, \quad (2)$$

$$\varphi(x) = a(x + m)^2, \quad (4)$$

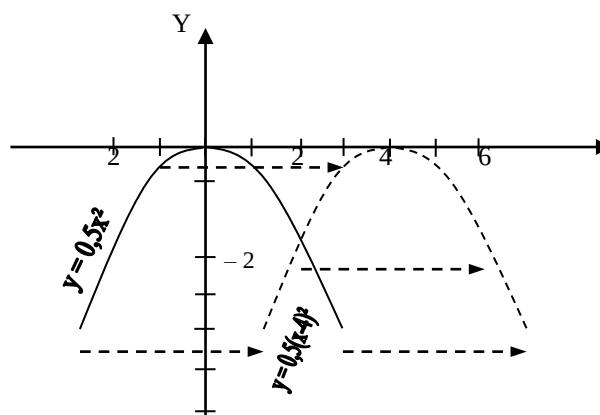
$m > 0$ bo`lsin. $f(x_1) = ax_1^2$; $N(x_1, ax_1^2)$,

$$\varphi(x_1 - m) = a(x_1 - m + m)^2 = ax_1^2; M(x_1 - m, ax_1^2)$$

N va M nuqtalarning ordinatasi bir xil bo'lib, N nuqta $y = ax^2$ ning grafigi ustida, M nuqta esa $y = a(x+m)^2$ ning grafigi ustida yotadi. M nuqta N nuqtadan m birlik (berilgan masshtabda)



2 – chizma



3 – chizma

chapga joylashgani uchun N ni m birlik chapga surish bilan M nuqtani hosil qilish mumkin. Demak, $y = ax^2$ ning grafigi ustidagi ixtiyoriy N nuqta m birlik chapga surilsa, $y = a(x+m)^2$ ning grafigi ustidagi M nuqta bilan ustma-ust tushar ekan.

Shuning uchun, $y = ax^2$ ning grafigini (parabolani) m birlik chapga surilsa, $y = a(x+m)^2$ funksiyaning grafigi hosil bo'ladi. $m < 0$ bo'lganda ham yuqoridagi singari $y = a(x+m)^2$ funksiyaning grafigi, $y = ax^2$ grafigini m birlik o'ngga surish bilan hosil qilinadi.

Xulosa. $y = ax^2$ funksiyaning grafigining abscissa o'qi yo'nalishida $|m|$ birlik ($m > 0$ bo'lsa chapga, $m < 0$ bo'lsa o'ngga) surish bilan $y = a(x+m)^2$ funksiyaning grafigi hosil qilish mumkin.

2 – chizmada $y = 2x^2$ va $y = 2(x+3)^2$ funksiyalarining grafigi tasvirlangan . Bundan $y = 2x^2$ ning grafigini 3 birlik chapga surish bilan $y = 2(x+3)^2$ ning grafigini hosil qilish mumkin ekanini ko`ramiz.

3 – chizmada esa $y = -0,5x^2$ ning grafigini 4 birlik o`ngga surish bilan $y = -0,5(x-4)^2$ ning grafigini hosil qilish tasvir etilgan.

OY o`qqa parallel bo`lgan $x = -m$ to`g`ri chizig`i (4) funksiyaning grafigi – parabolaning o`qi bo`ladi. Masalan,  $y = 2(x+3)^2$  funksiyaning grafigi – parabola o`qining tenglamasi $x = -3$

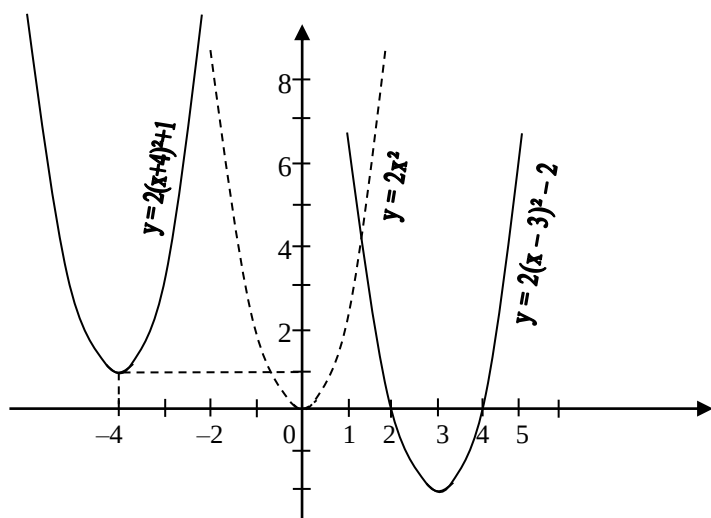
$$y = a(x+m)^2$$

$$y = a(x+m)^2 + n$$

funksiyani tekshiraylik.

Argumentning bir xil qiymatida (4`) va (5) funksiyalarning qiymati bir-biridan  $n$  birlik farq qiladi.  $n > 0$  bo`lsa, $y = a(x+m)^2 + n$ ning qiymati $y = a(x+m)^2$ ning qiymatidan n birlik katta, $n < 0$ bo`lganda esa  $n$  birlik kichik bo`ladi. Shuning uchun $y = a(x+m)^2$ ning grafigini OY o`q yo`nalishida $n > 0$ bo`lsa,  $n$  birlik yuqoriga ;  $n < 0$  bo`lsa, $|n|$ birlik pastga surish bilan $y = a(x+m)^2 + n$ ning grafigini hosil qilish mumkin.

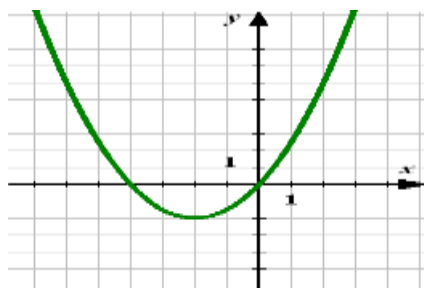
$y = a(x+m)^2$ ning grafigi $y = ax^2$ grafigini OX o`q yo`nalishida $|m|$ birlik surish bilan hosil qilinganligidan, $y = a(x+m)^2 + n$ ning grafigini $y = ax^2$ parabolaning grafigini OX o`q yo`nalishida $m > 0$ bo`lsa ,  $m$  birlik chapga;  $m < 0$  bo`lsa o`ngga so`ngra OY o`q yo`nalishida $|n|$ birlik ($n > 0$ bo`lsa yuqoriga,  $n < 0$  bo`lsa pastga) surish bilan hosil qilish mumkin.



4 – chizmada uchta kvadrat uchhadning grafigi tasvirlangan. Bunda $y = 2x^2$ ning grafigini 3 birlik oʻngga, 2 birlik pastga surish bilan $y = 2(x - 3)^2 - 2$ ning grafigi, yoki 4 birlik chapga, soʻngra 1 birlik yuqoriga surish bilan esa $y = 2(x+4)^2 + 1$ ning grafigi hosil qilingan.

Oʻquvchilar uchun mashqlar :

Grafikdan foydalanib argumentning funksiya manfiy boʻladigan qiymatlarini ayting:



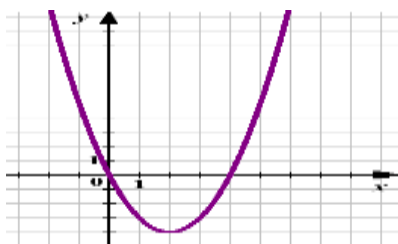
$[-4; 0]$

$[-2; 0]$

$(-2; 0)$

$(-4; 0)$

Grafikdan foydalanib argumentning Funksiya musbat boʻlmaydigan qiymatlarini ayting:



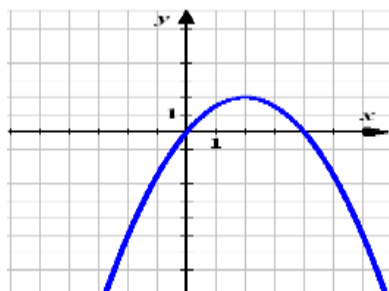
$[0; 4]$

$(0; 4)$

$(-4; 0)$

$(-4; 0]$

Grafikdan foydalanib argumentning funksiya manfiy bo'lmaydigan qiymatlarini ayting:



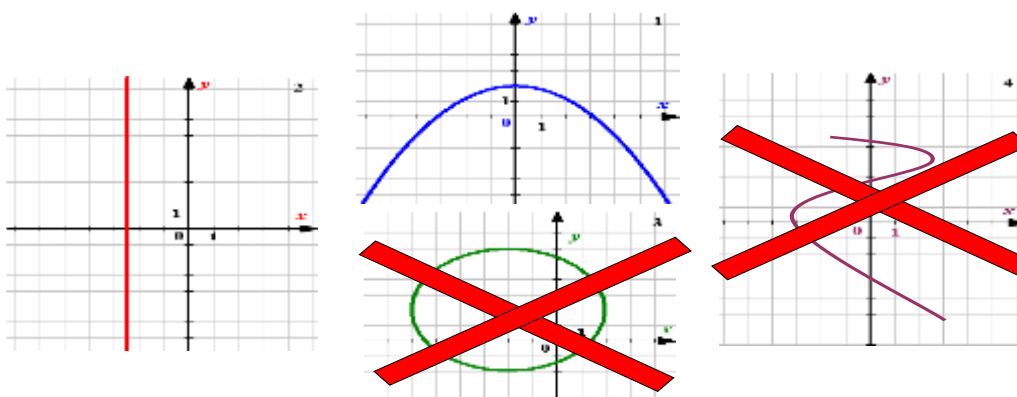
$$(0; 2)$$

$$[0; 2]$$

$$[0; 4]$$

$$(0; 4)$$

Quyida berilgan chizmalarning qaysilari biror funksiyaning grafigi bo'ladi?



Qaysi funksiya chiziqli?

$$\begin{array}{llll} y = \frac{9}{x} & y = 9,5x & y = -4x + 8 & \\ y = \sqrt{x} & y = -x^2 & y = x(4-x) & y = \frac{x}{10} \\ & y = 0,6x^3 + 2 & y = -0,2x & \\ & & y = 3x - 5 & \end{array}$$

Chiziqli funksiya.

$$y = ax + b$$

To'g'ri proporsionallikni ko'rsating

$$\begin{array}{llll} y = \frac{9}{x} & y = 9,5x & & \\ y = \sqrt{x} & y = -x^2 & y = x(4-x) & y = \frac{x}{10} \\ & y = 0,6x^3 + 2 & y = -0,2x & \end{array}$$

To'g'ri proporsionallik funksiyasi.

$$y = kx$$

Teskari proporsionallikni toping

$$y = \frac{9}{x} \quad y = -x^2 \quad y = x(4-x)$$
$$y = \sqrt{x} \quad y = 0,6x^3 + 2$$

Teskari proporsionallik funksiyasi.

$$y = k/x$$

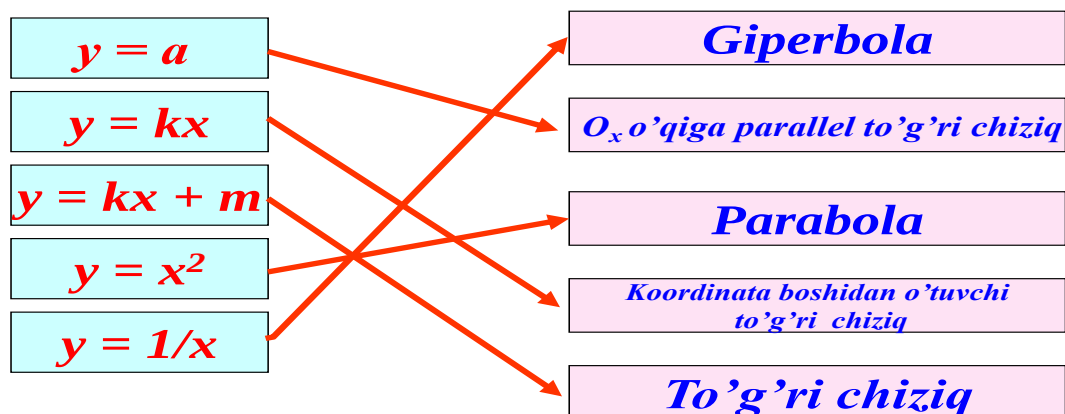
Qaysi biri kvadrat funksiya?

$$y = \sqrt{x} \quad y = -x^2 \quad y = x(4-x)$$
$$y = 0,6x^3 + 2$$

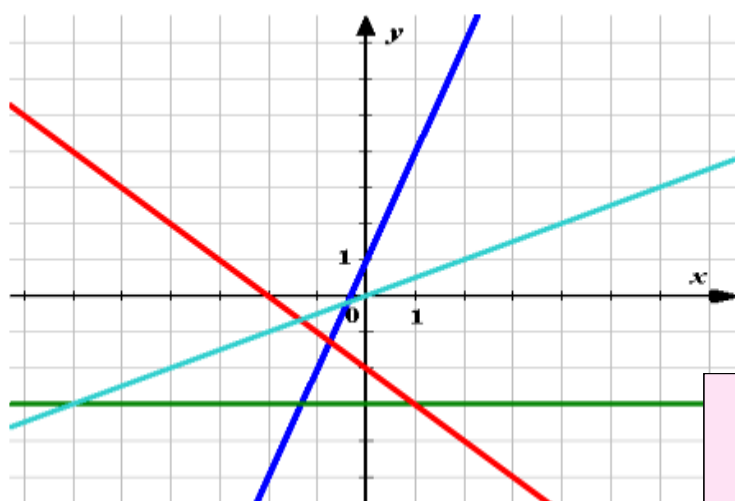
Kvadrat funksiya.

$$y = ax^2 + bx + c$$

Har bir formulaga mos grafik nomini tanlang .



Moslikni o'rnatish:



$$y = 0,5x$$



$$y = -x - 2$$



$$y = 3x + 1$$



$$y = -3$$



Qaysi grafik to'g'ri
proporsionallik
grafigi?

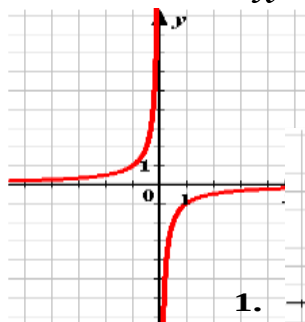
Moslikni toping:

$$y = \frac{1}{x}$$

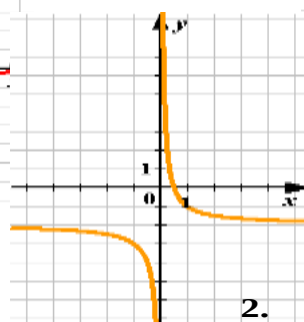
$$y = -\frac{1}{x}$$

$$y = \frac{1}{x} + 2$$

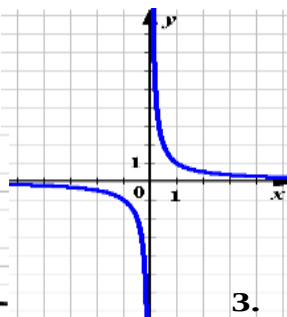
$$y = \frac{1}{x} - 2$$



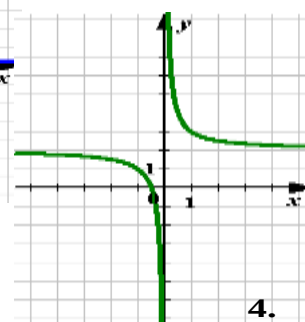
1.



2.

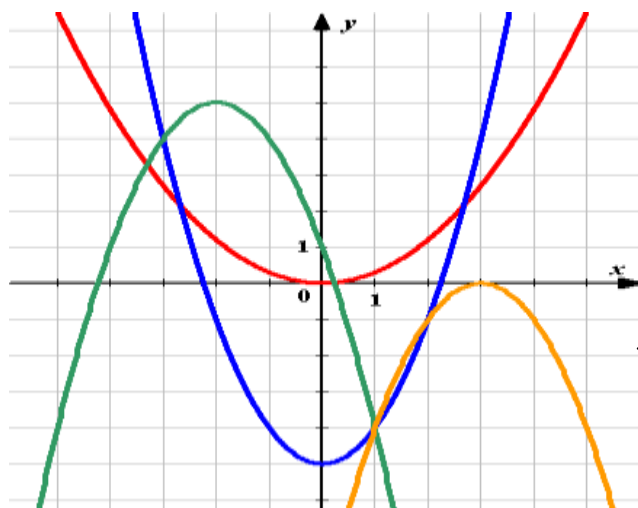


3.



4.

Moslikni toping:



$$y = x^2 - 5$$



$$y = 0,3x^2$$



$$y = -(x - 3)^2$$



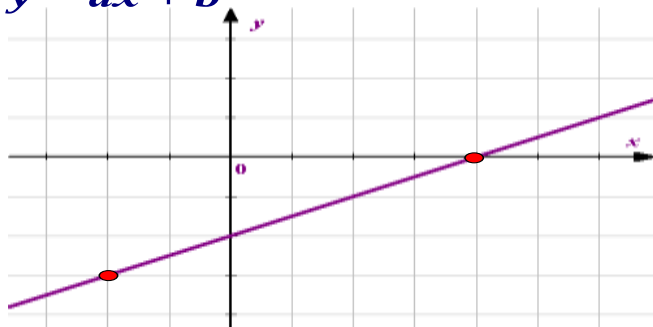
$$y = -(x + 2)^2 + 5$$



Chiziqli funktsiya grafigini yasash.

$$y = ax + b$$

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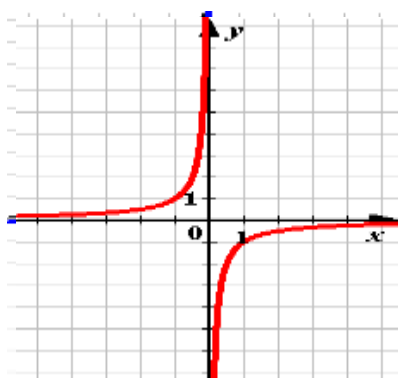


x	y
x_1	y_1
x_2	y_2

Teskari proporsionallik funktsiyasi grafigini yasash.

$$y = k/x$$

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1. Funktsiya grafigi qaysi choraklardan o'tishini aniqlash.

$k > 0$ – I va III ch.

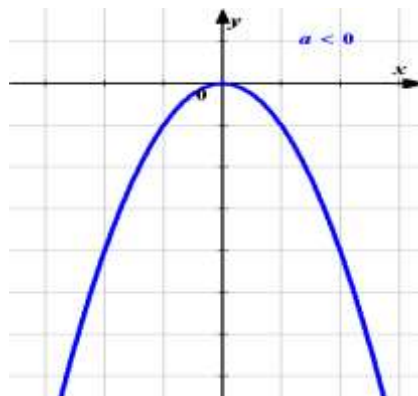
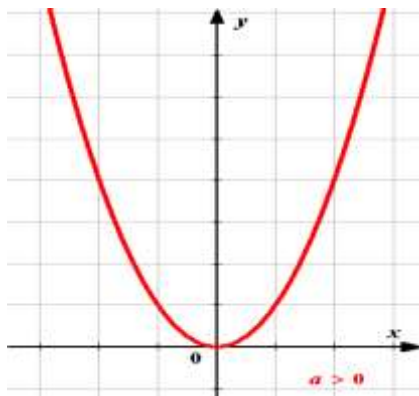
$k < 0$ – II va IV ch.

2. Funktsiyaning qiymatlar jadvalini tuzish.

$y = ax^2 + bx + c$ funktsiyaning grafigini yasash.

1. Parabola tarmoqlari yo'nalishini aniqlash.

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Parabola uchining koordinatasini aniqlash ($m; n$).

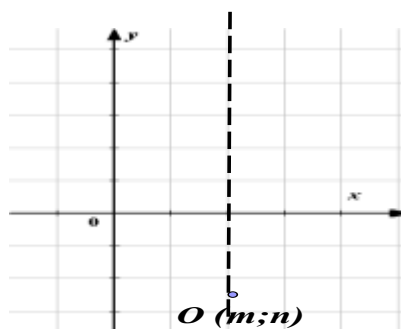
2.

$$m = \frac{-b}{2a}$$

$$n = y(m)$$

3. Simmetriya o'qini o'tkazish.

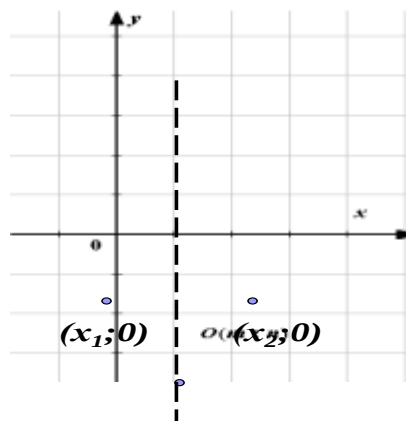
$$x = m$$



4. Funksiyaning nollarini topish.

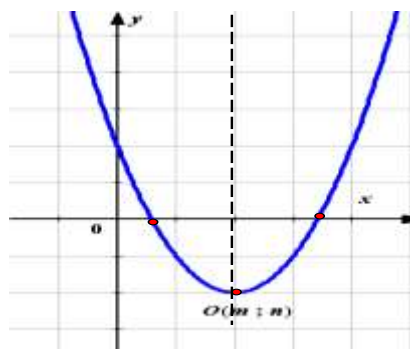
$$y = 0$$

$$ax^2 + bx + c = 0$$



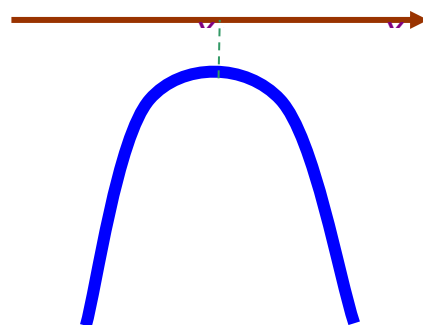
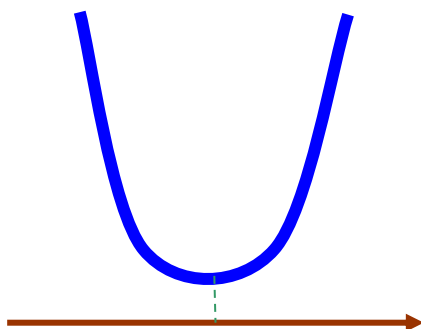
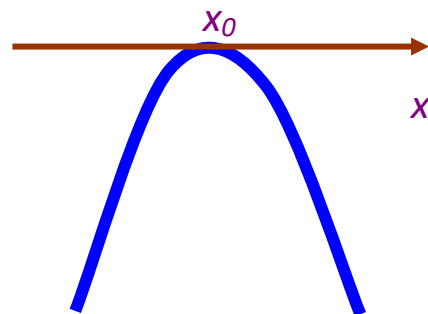
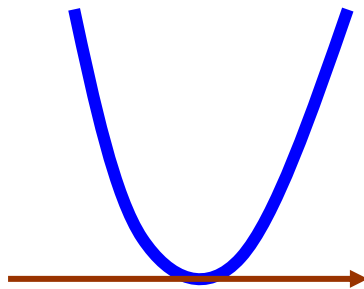
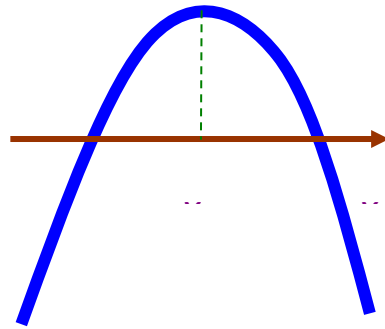
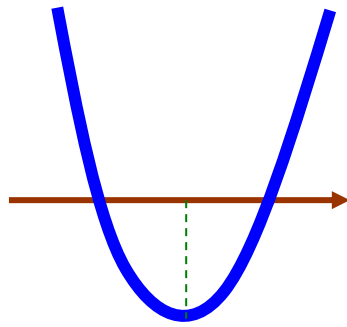
5. Funksiyaning qiymatlar jadvalini tuzish (bunda parabolaning simmetriya o'qi hisobga olinadi).

x	x_1	x_2	x_3	x_4
y	y_1	y_2	y_3	y_4



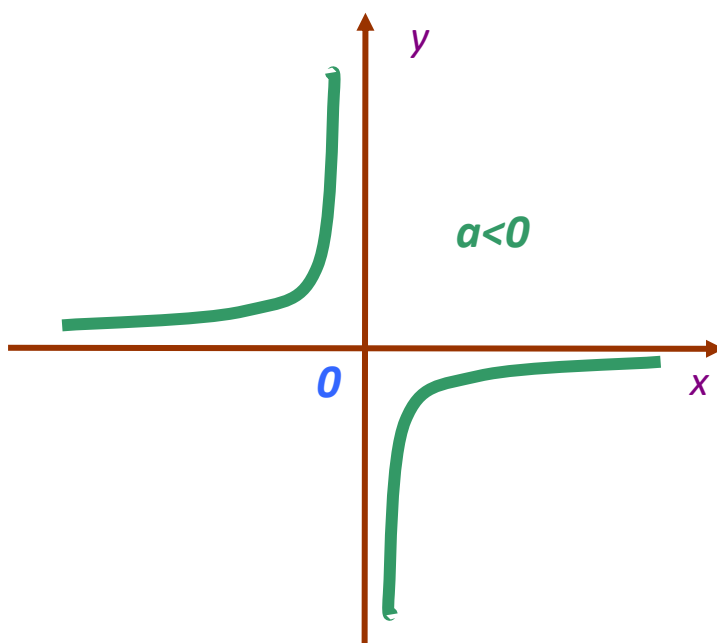
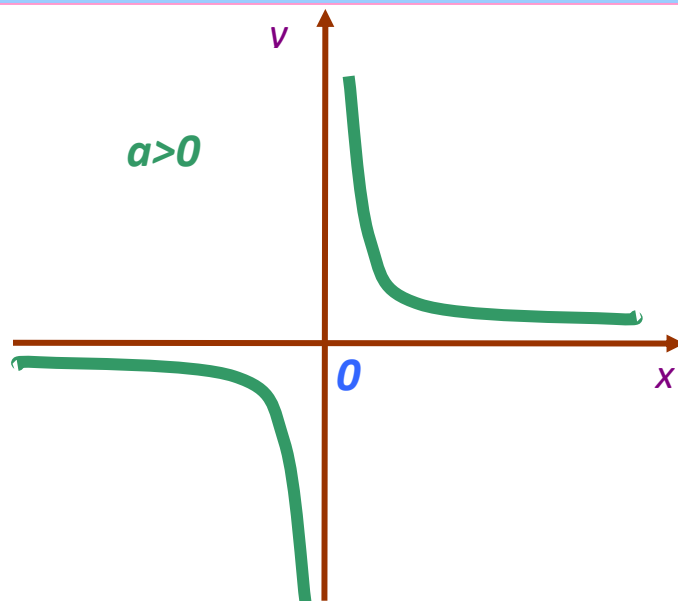
$$y = ax^2 + bx + c = a \left(x + \frac{b}{2a} \right)^2 - \frac{b^2 - 4ac}{4a}$$

$$x_0 = -\frac{b}{2a} \quad D = b^2 - 4ac \quad \text{- diskriminant}$$



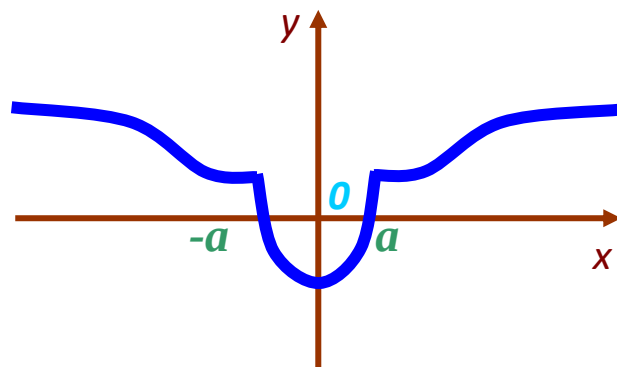
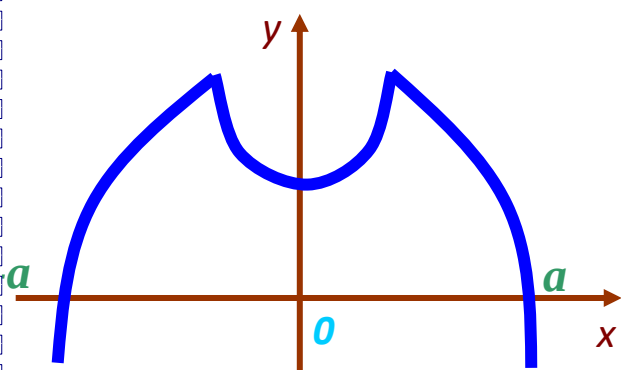
Teskari proporsionallik funksiyasi

$$y = \frac{a}{x}; \quad y, x \in (-\infty, 0) \cup (0; +\infty)$$



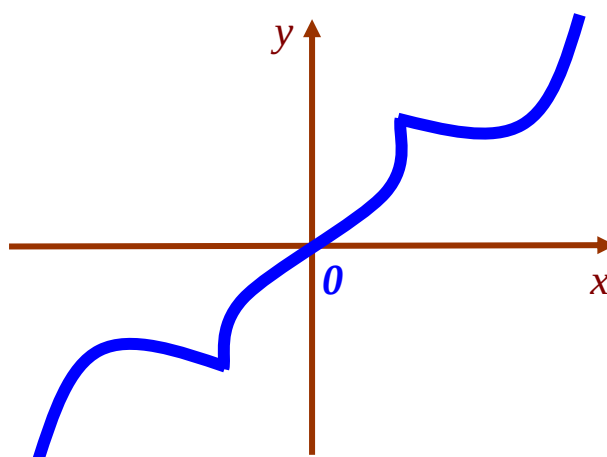
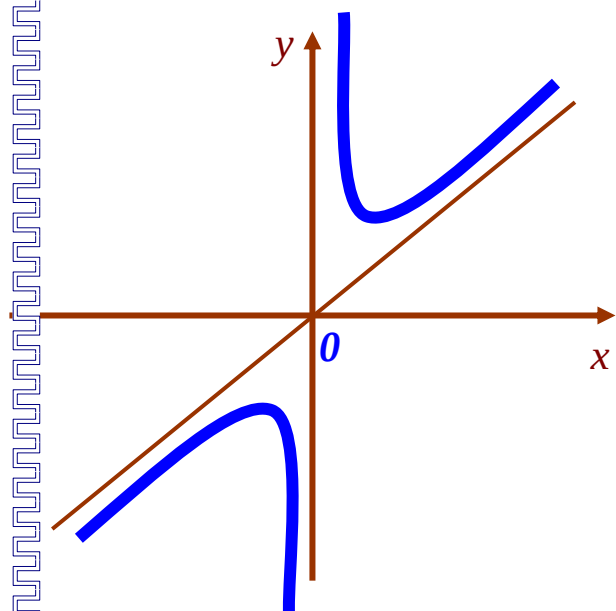
Juft va toq funksiyalar

(1) *Juft funksiyalar:* $f(-x)=f(x)$



Ordinatalar o'qi $0y$ ga nisbatan simmetrik.

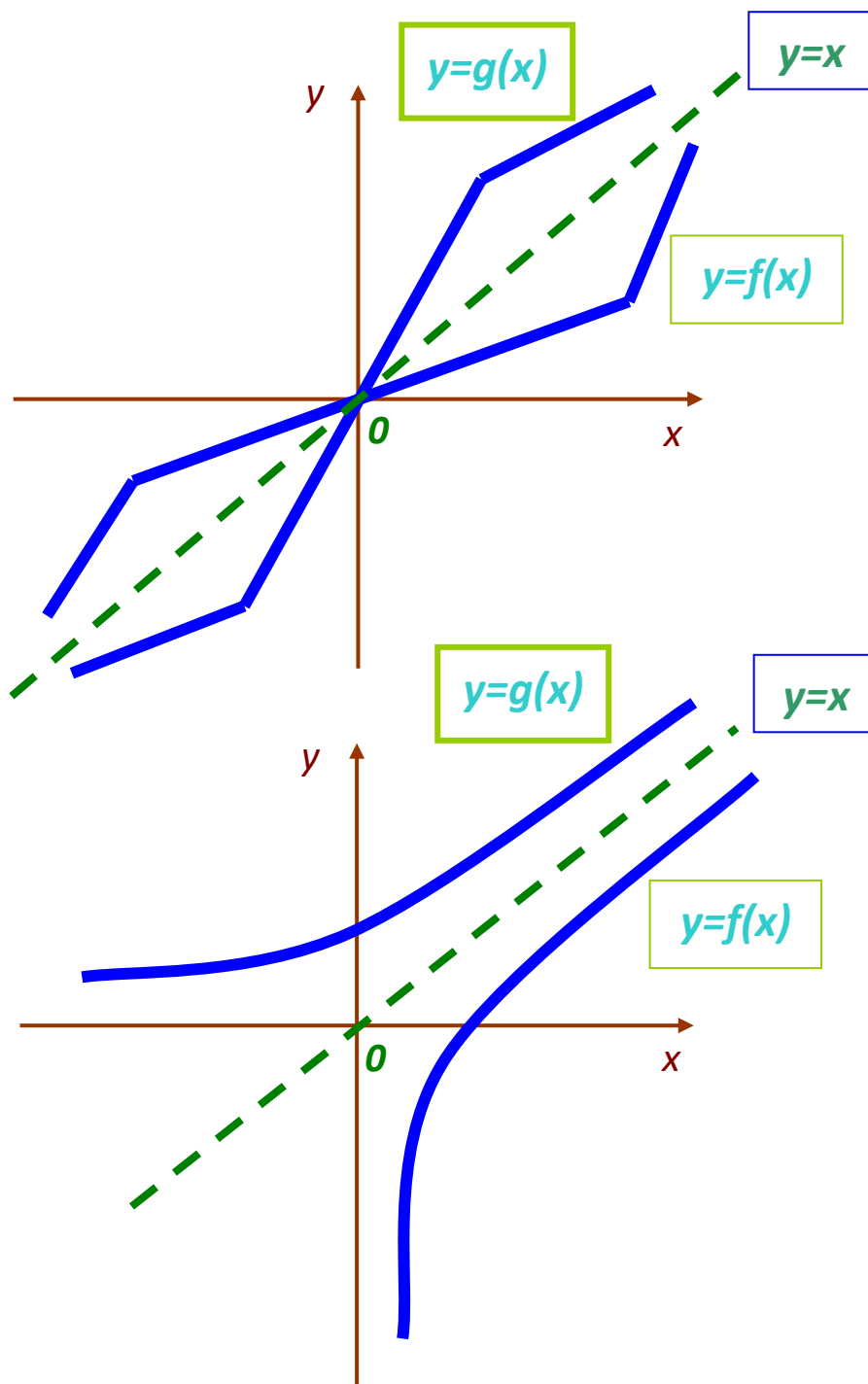
(2) *Toq funksiyalar:* $f(-x)=-f(x)$



Koordinatalar boshi 0 nuqtaga nisbatan simmetrik.

O'zaro teskari funksiyalar

$y=f(x)$ va $y=g(x)$ o'zaro teskari funksiyalar

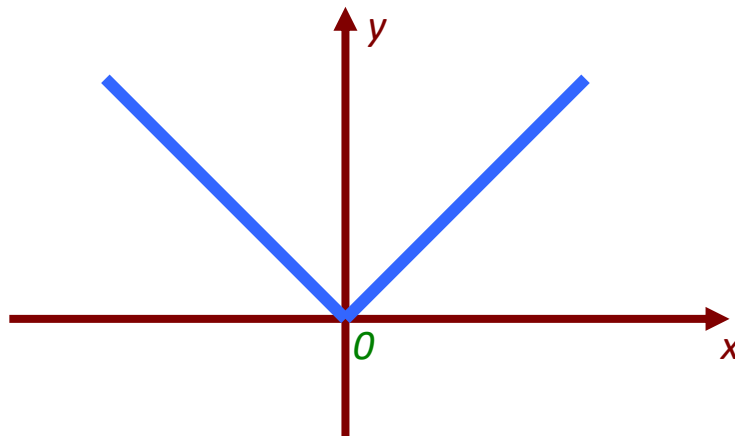


$y=x$ funksiyaga nisbatan simmetrik

Modulli funksiya

$$y = |x|$$

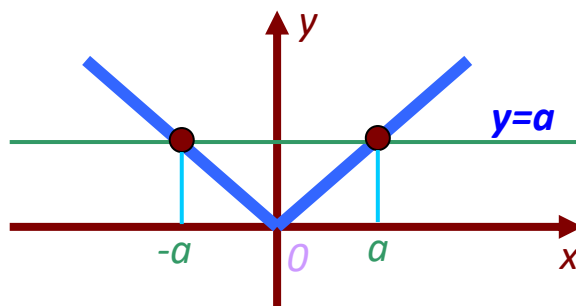
$$|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$



Modulli tenglama va tengsizliklar

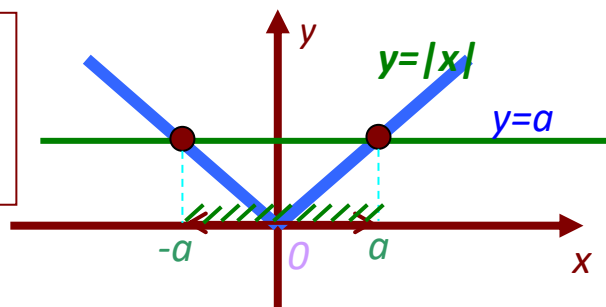
1. $|x| = a$

$$\begin{cases} y = |x| \\ y = a \end{cases}$$



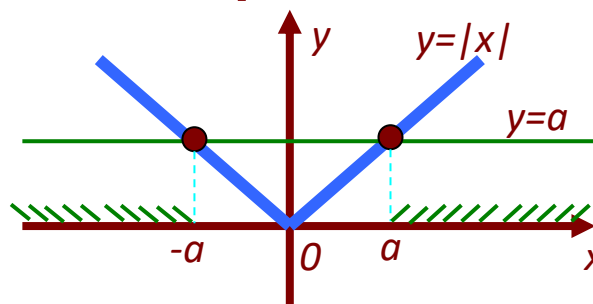
2. $|x| \leq a$

$$\begin{cases} x \leq a \Leftrightarrow -a \leq x \leq a \\ x \geq -a \end{cases}$$



3. $|x| \geq a$

$$\begin{cases} x \geq a \\ x \leq -a \end{cases}$$



XULOSA

Matematika o'sib kelayotgan yosh avlodni kamol toptirishda o'quv fani sifatida keng imkoniyatlarga ega. U o'quvchi tafakkurini rivojlantirib, ularning aqlini peshlaydi, uni tartibga soladi, o'quvchilarda maqsadga yo'nalganlik, mantiqiy fikrlash, topqirlik hislatlarini shakllantira boradi. Shu bilan birga chizmalar chizishning mukammal texnikasini egallashi, algebraik ifodalar ustida amallarni qulayroq bajariladigan shaklga keltirish bilan o'quvchilarni didli, go'zallikka ehtiyojli qilib tarbiyalab boradi.

Respublikamizning kelajagini barpo qiluvchi yosh avlodga xozirgi zamon fanining yangiliklarini, uning murakkab qirralarini o'rgatish bilan bir qatorda o'tmish merosimizni o'rganishga imkoniyat tug'dirish kerak.

Shuning uchun matematika darslarimiz ham milliy g'oya, milliy ong, mafkura tushunchalari bilan uyg'unlashgan holda olib borilishi lozim.

Har bir darsimizda shu mavzu bilan bog'liq holda ulug' allomalarimiz Al-Xorazmiy, G'iyosiddin al-Koshiy, Mirzo Ulug'bek, Nasriddin at-Tusiy, Abu Rayhon Beruniy va xozirgi zamon mashxuro'zbek matematiklarining ishlari to'g'risida tushuncha berish o'quvchilar dunyoqarashini kengaytiradi, bilimdonligini oshirib, ularni vatanparvarlik milliy iftixor ruhida tarbiyalaydi.

FOYDALANILGAN ADABIYOTLAR

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