

PARABOLALAR ORASIDAGI MAKSIMAL YUZAGA EGA TO'G'RI TO'RTBURCHAK

Ramatjonova E'zoxon Akramjon qizi

Namangan davlat pedagogika instituti

Aniq va tabiiy fanlar fakulteti talabasi.

Telefon nomer: +998-94-395-11-08.

E-mail: dadaboyevakramjon5@gmail.com

Annotatsiya: Ushbu maqolada kvadrat funksiya, uning grafigi, kvadrat funksiyaning grafigini chizish va funksiyaning xossalari hamda hosila, darajali va murakkab funksiyaning hosilasi, hosila olishdagi formulalar haqida to'liq tushunchalar yoritilgan. Shuningdek, ushbu mavzularning misollardagi tatbiqi hamda qo'llanilishi keng tahlil qilingan. Qiyin darajadagi misollar, chizmalar va formulalar yordamida ishlangan.

Kalit so'zlar: parabola, to'g'ri to'rtburchak, koordinatalar sistemasi, yuza, hosila, kasr, qiymat, daraja, ildiz, yechim.

A RECTANGLE WITH THE MAXIMUM AREA BETWEEN THE PARABOLAS

Ramatjonova E'zoxon Akramjon qizi.

Namangan state pedagogical institute

Student of the faculty "Exact and natural science"

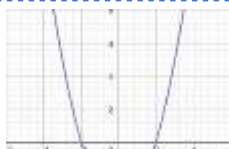
Phone number: +998-94-395-11-08.

E-mail: dadaboyevakramjon5@gmail.com

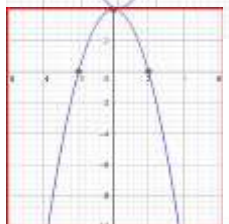
Abstract: This article covers the complete concepts of quadratic function, its graph, graphing of quadratic function and properties of function and derivative, derivative of degree and complex function, formulas in derivation. Also, the application and application of these topics in examples are widely analyzed. Difficult levels are worked out using examples, diagrams and formulas.

Key words: parabola, rectangle, coordinate system, area, derivative, fraction, value, degree, root, solution.

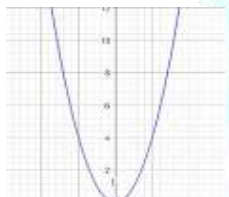
KIRISH: $y = ax^2 + bx + c$ ko'rinishidagi funksiya kvadrat funksiya deyiladi va uning grafigi paraboladan iborat bo'ladi. Umumiy holatda parabolalarning ko'rinishi



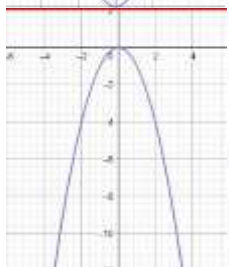
1. $D > 0$, $a > 0$ bo'lganda parabola shoxlari yuqoriga yo'nalgan va ox o'qi bilan ikkita umumiy nuqtaga ega bo'ladi



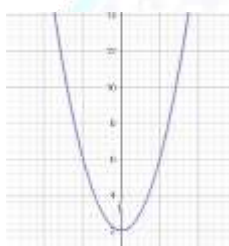
2. $D > 0$, $a < 0$ bo'lganda parabola shoxlari pastga yo'nalgan va ox o'qi bilan ikkita umumiy nuqtaga ega bo'ladi.



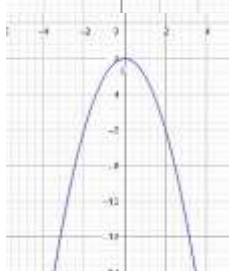
3. $D = 0$, $a > 0$ bo'lganda parabola shoxlari yuqoriga yo'nalgan va ox o'qi bilan faqat bitta umumiy nuqtaga ega bo'ladi.



4. $D = 0$, $a < 0$ bo'lganda parabola shoxlari pastga yo'nalgan va ox o'qi bilan faqat bitta umumiy nuqtaga ega bo'ladi.



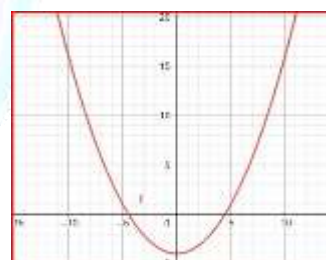
5. $D < 0$, $a > 0$ bo'lganda parabola shoxlari yuqoriga yo'nalgan va ox o'qi bilan kesishmagan bo'ladi.



6. $D < 0$, $a < 0$ bo'lganda parabola shoxlari pastga yo'nalgan va ox o'qi bilan kesishmagan bo'ladi.

Parabola uchi koordinatalari :

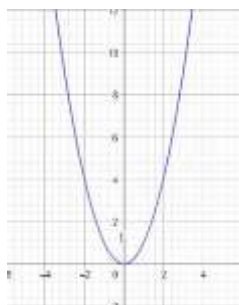
$$y = ax^2 + bx + c \quad x_0 = -\frac{b}{a} \quad y_0 = -\frac{D}{4a} \quad y_0 = \frac{4ac - b^2}{4a} = ax_0^2 + bx_0 + c$$



Asosiy qism: Bizga $f(x) = x^2$ va $g(x) = a - x^2$, $a > 0$ kvadrat funksiyalar berilgan bo'lsin, va bu funksiyalarning grafiklari orasiga chizish mumkin bo'lgan to'g'ri

to'rtburchakning eng maksimal yuzasini a orqali ifodalang? Deb savol qo'yilgan bo'lsin.

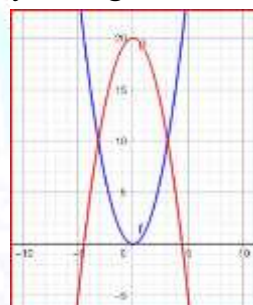
- 1) Bu funksiyalarning grafigini chizamiz: $f(x) = x^2$ funksiyaning grafigi parabola bo'lib, uning uchlari koordinatalar sistemasining markazida yotadi va shoxlari yuqoriga yo'nalgan bo'ladi. $g(x) = a - x^2$ bu funksiyaning grafigi ham parabola bo'lib, uning uchi a nuqtada yotadi va shoxlari pastga yo'nalgan bo'ladi.



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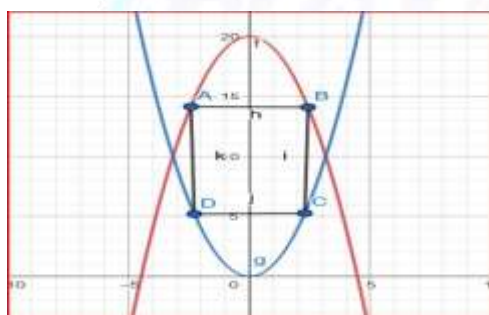


2) Birlashtirgan

grafiklarimiz orasiga maksimal yuzaga

erishadigan to'g'ri to'rtburchakni joylashtiramiz. Chizmadan foydalanib to'g'ri to'rtburchakning tomonlarini a va x_1 orqali belgilab olamiz va shu tomonlari orqali yuzini ifodalaymiz.

To'g'ri to'rtburchakning tomonlari:



$a - x_1^2$, $2x_1$. Yuzi: $S = 2x_1(a - 2x_1^2)$ ga teng bo'ladi.

- 3) Yuza eng maksimal qiymatga erishishi uchun uning hosilasini nolga tenglaymiz.

$$S' = (2x_1(a - 2x_1^2))' = 0$$

$$S'(x_1) = (2x_1a - 4x_1^3)' = 0$$

$$(2x_1a)' - (4x_1^3)' = 0$$

$$2a - 12x_1^2 = 0$$

$$2a = 12x_1^2$$

$$x_1^2 = \frac{2a}{12} = \frac{a}{6}$$

$$x_1 = \sqrt{\frac{a}{6}}$$

$S = 2x_1(a - 2x_1^2)$ formuladagi x_1 ning o'rniga topilgan qiymatni qo'yamiz.

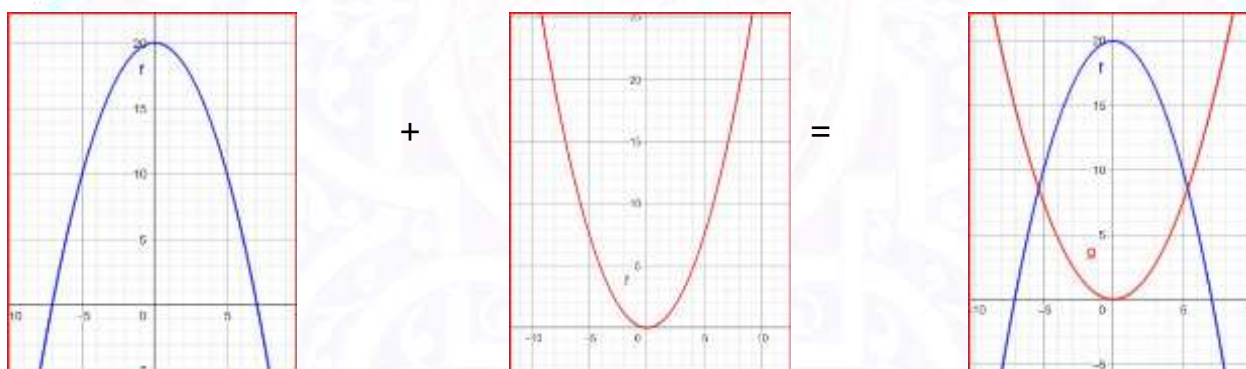
$$S = 2x_1a - 4x_1^3$$

$$S = 2\sqrt{\frac{a}{6}}a - 4\left(\sqrt{\frac{a}{6}}\right)^3$$

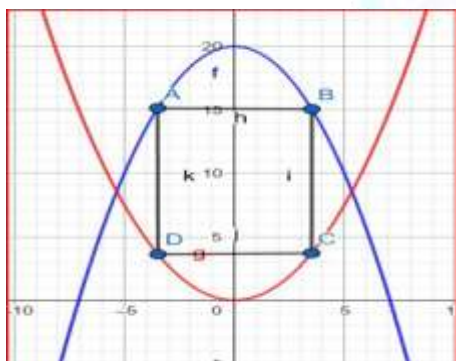
$$\begin{aligned}
 S &= \frac{2a\sqrt{a}}{\sqrt{6}} - \frac{4a\sqrt{a}}{6\sqrt{6}} \\
 S &= \frac{8a\sqrt{a}}{6\sqrt{6}} = \frac{4a\sqrt{a}}{3\sqrt{6}} \\
 S &= \frac{4a\sqrt{a}\sqrt{6}}{18} = \frac{2\sqrt{6}a\sqrt{a}}{9} \\
 S &= \frac{2\sqrt{6}a\sqrt{a}}{9}.
 \end{aligned} \tag{1}$$

Endi esa umumiyoq holatni ko‘ramiz. Bizga $f(x) = kx^2$ va $g(x) = a - lx^2$, $a > 0$ kvadrat funksiyalar berilgan bo‘lsin, va “bu funksiyalarning grafiklari orasiga chizish mumkin bo‘lgan to‘g‘ri to‘rtburchakning eng maksimal yuzasini a orqali ifodalang?” deb savol qo‘yilgan bo‘lsin.

- 1) Bu funksiyalarning grafigini chizamiz: $f(x) = kx^2$ funksiyaning grafigi parabola bo‘lib, uning uchlari koordinatalar sistemasining markazida yotadi va shoxlari yuqoriga yo‘nalgan bo‘ladi. $g(x) = a - lx^2$ bu funksiyaning grafigi ham parabola bo‘lib, uning uchi a nuqtada yotadi va shoxlari pastga yo‘nalgan bo‘ladi.



- 2) Birlashtirgan grafiklarimiz orasiga maksimal yuzaga erishadigan to‘g‘ri to‘rtburchakni joylashtiramiz. Chizmadan foydalanib to‘g‘ri to‘rtburchakning tomonlarini a , k , l va x_1 orqali belgilab olamiz va shu tomonlari orqali yuzini ifodalaymiz.



To‘g‘ri to‘rtburchakning tomonlari:

$$a - kx_1^2 - lx_1^2, \quad 2x_1.$$

Yuzi: $S = 2x_1(a - kx_1^2 - lx_1^2)$ ga teng bo‘ladi.

- 3) Yuza eng maksimal qiymatga erishishi uchun uning hosilasini nolga tenglaymiz.

$$S' = (2x_1(a - kx_1^2 - lx_1^2))' = 0$$

$$S' = (2ax_1 - 2kx_1^3 - 2lx_1^3)' = 0$$

$$S'(x_1) = (2ax_1)' - (2kx_1^3)' - (2lx_1^3)' = 0$$

$$2a - 6kx_1^2 - 6lx_1^2 = 0$$

$$2a = 6x_1^2(k + l)$$

$$x_1 = \sqrt{\frac{2a}{6(k+l)}} = \sqrt{\frac{a}{3(k+l)}}$$

$$x_1 = \sqrt{\frac{a}{3(k+l)}}$$

4) $S = 2x_1(a - kx_1^2 - lx_1^2)$) formuladagi x_1 ning o'rniga topilgan qiymatni qo'yamiz.

$$S = 2ax_1 - 2kx_1^3 - 2lx_1^3$$

$$S = 2a\sqrt{\frac{a}{3(k+l)}} - 2k\left(\sqrt{\frac{a}{3(k+l)}}\right)^3 - 2l\left(\sqrt{\frac{a}{3(k+l)}}\right)^3$$

$$S = 2a\sqrt{\frac{a}{3(k+l)}} - 2\left(\sqrt{\frac{a}{3(k+l)}}\right)^3(k+l)$$

$$S = \frac{2a\sqrt{a}}{\sqrt{3(k+l)}} - \frac{2a\sqrt{a}(k+l)}{3(k+l)\sqrt{3(k+l)}}$$

$$S = \frac{6a\sqrt{a}(k+l) - 2a\sqrt{a}(k+l)}{3(k+l)\sqrt{3(k+l)}}$$

$$S = \frac{4a\sqrt{a}(k+l)}{3(k+l)\sqrt{3(k+l)}}$$

$$S = \frac{4a\sqrt{a}}{3\sqrt{3(k+l)}}. \quad (2)$$

XULOSA: Ushbu maqolada dastlab biz $f(x) = x^2$ va $g(x) = a - x^2$ parabolalar ichiga chizilgan eng katta yuzali to'g'ri to'rtburchakni topish masalasi bilan shug'ullandik. Keyin esa umumiy holda $f(x) = kx^2$ va $g(x) = a - lx^2$ parabolalar uchun masalani ko'rib chiqdik. Ko'rish mumkinki, keyingi holatda $k = l = 1$ deb bo'lgan holda dastlabki holat kelib chiqadi. Haqiqatdan ko'rish mumkinki, (2) formulada $k = l = 1$ deb olsak, (1) formula kelib chiqadi.

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