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ON THE ROOTS OF A QUADRATIC EQUATION DEPENDING ON A PARAMETER

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ANNOTATION
In this article, some relations between the roots of a quadratic equation that depend on a parameter are investigated, and a theorem is given that is convenient to use when solving problems of this type.

Keywords: quadratic equation, quadratic function, square triangle, root, discriminant, system of equations, system of inequalities **.**

In many cases, students encounter difficulties in determining the position of the roots of parametric quadratic equations relative to numbers that satisfy given conditions. They perform a number of computational operations when they are defined. We will tell you about the easiest way to solve such issues.

it $x^2 + px + q = 0$

(1) square of triad 2 real x_1 va x_2 $(x_1 < x_2)$ let the roots. $\lambda -$ let it be some real number, indistinguishable from the roots. So, the λ next $(-\infty, x_1)$, (x_1, x_2), (x_2, ∞) quantity lies in one of the intervals. λ the number and roots of the quadratic equation x_1 va x_2 for work, the following theorem is appropriate. 1-theorem. λ quantity (1) to to be less both roots square equations , this

$$\begin{cases} \lambda^2 + \lambda p + q > 0, \\ 2\lambda + p < 0. \end{cases} \quad (2)$$

necessary and sufficient for the inequalities to be satisfied.

2-theorem. λ number (1) quadratic equation x_1 va x_2 so that it lies between the roots $\lambda^2 + \lambda p + q < 0$ fulfillment of the inequality is necessary and sufficient.

3- theorema . λ number (1) quadratic equation x_1 va x_2 to have more roots

$$\begin{cases} \lambda^2 + \lambda p + q > 0, \\ 2\lambda + p > 0 \end{cases}$$

necessary and sufficient for the inequalities to be satisfied.

Let us consider the geometric interpretation of these statements. It $f(x) = x^2 + px + q$

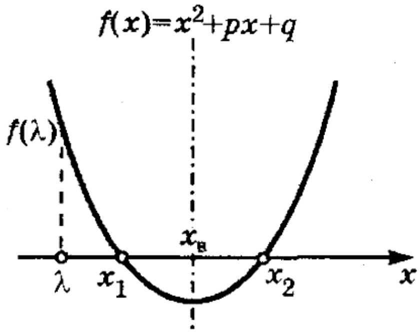
(2)

(2) quadratic function Ox axis $(x_1,0)$ and $(x_2,0)$ let intersect at points. $(x_1 \le x_2)$.$(\lambda,0)$ point $(x_1,0)$ and $(x_2,0)$ let there be a point that is different from points. Then the above theorem can be interpreted as.

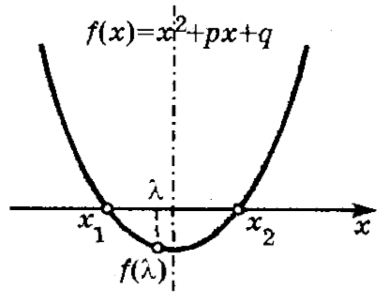
4- theorema . (2) plot the quadratic function Ox of the point of intersection of the axis $(\lambda,0)$ so that it is to the right of the point

$$\begin{cases} D = p^2 - 4q \ge 0 \\ x_0 = -\dfrac{p}{2} > \lambda \\ f(\lambda) = \lambda^2 + p\lambda + q > 0 \end{cases}$$

fulfillment of the system of inequalities is necessary and sufficient.



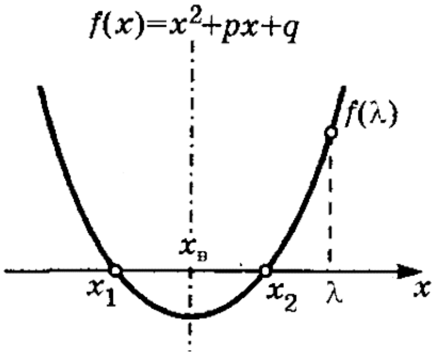
5- theorema .$(\lambda,0)$ point (2) graph of a quadratic function Ox so that the axis is located between the intersection points $f(\lambda) = \lambda^2 + p\lambda + q < 0$
necessary and sufficient for the inequality to be appropriate.



6- theorema . (2) graph the quadratic function of Ox the axis intersection $(\lambda,0)$ point to be to the left of the point, this is

$$\begin{cases} D = p^2 - 4q \ge 0 \\ x_0 = -\dfrac{p}{2} < \lambda \\ f(\lambda) = \lambda^2 + p\lambda + q > 0 \end{cases}$$

necessary and sufficient for the inequality to be appropriate.



The discriminant of a quadratic triangle in the case (2) $D=b^2-4ac$ and its derivative $f'(x)=2ax+b$ from the argument λ if the sign is known, equal to, λ the number $f(x)=ax^2+bx+c \ (a\neq 0)$ the roots of the quadratic function x_1 and x_2 the relative position of larga can be interpreted as follows, similar to the conditions given above [2].
appropriate the following assertions .

$$1^0 \ \lambda < x_1 < x_2 \Leftrightarrow \begin{cases} D>0, \\ af(\lambda)>0, \\ af'(\lambda)>0. \end{cases}$$

$$2^0 \ x_1 < \lambda < x_2 \Leftrightarrow af(\lambda) \prec 0.$$

$$3^0 \ x_1 < x_2 < \lambda \Leftrightarrow \begin{cases} D>0, \\ af(\lambda)>0, \\ af'(\lambda)>0. \end{cases}$$

1 is an example . k in what sense
$x^2-(k+1)x+k^2+k-8=0$ Will one of the roots of the equation be greater than 2 and the other less than 2?
Solution. According to theorem 2 of the above theorem, if we take the left side of the equation $f(x)=x^2-(k+1)x+k^2+k-8$ if considered as a function, so that one of its roots is less than 2, and the second root is greater than 2, $f(2)<0$ the fulfillment of the inequality is necessary and sufficient.

$$f(2)=4-2(k+1)+k^2+k-8<0$$

From this

$$k^2-k-6>0 \qquad \Leftrightarrow \qquad (k-3)(k+2)<0$$

So in this equation , $k\in(-2;3)$ one root is less than 2, and the second root is greater than 2.

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