Basic Maths For Class-11/WBJEE/JEE

Bong Study Hub

Quadratic Equations And Solving Inequalities

Presented by

Trisanjit Das

Roots of Quadratic Equations

A quadratic equation $ax^2 + bx + c = 0$ has two and only two roots.

The roots of $ax^2 + bx + c = 0$ are

$$\frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

If $ax^2 + bx + c = 0$ has more than two (complex number or real number), then this is an identity, i.e., $a = b = c = 0$.

JEE Main 2020: 05 Sep - I

The product of the root of the equation

$9x^2 - 18|x| + 5 = 0$ is

A) 5/9

B) 25/81

C) 5/27

D) 25/9

Nature Of Roots of Quadratic Equation

For a quadratic equation
$ax^2 + bx + c = 0$

$D=b^2-4ac$
D=Discriminant

If a, b, c ∈ R (real numbers):

- If D ≥ 0, roots are real and distinct
- If D = 0, roots are real and equal
- If D < 0, roots are imaginary and conjugate of each other

$(p + iq, p - iq)$

If a, b, c ∈ Q (rational numbers):

- If D is a perfect square, then roots will be rational
- If D is not a perfect square, then roots will be irrational and conjugate of each othe

$(p + \sqrt{q}, p - \sqrt{q})$

JEE Main 2019: 09 April - I

Let p,q ϵ R. If $2-\sqrt{3}$ is a root of the quadratic equation, $x^2 + px + q=0$, then

A) $p^2 - 4q - 12 = 0$

B) $q^2 - 4p - 16 = 0$

C) $q^2 + 4p + 14 = 0$

D) $p^2 - 4q + 12 = 0$

Roots and Co-efficients Relation

If α and β are roots of
$ax^2 + bx + c = 0$, then

Sum of roots:
$\alpha + \beta = -b / a$
(coefficient of x ÷ coefficient of x^2)

$|\alpha - \beta| = \sqrt{D} / |a|$

(Important Formula)

Product of roots:
$\alpha\beta = c / a$
(constant term ÷ coefficient of x^2)

Also, if
$f(x) = ax^2 + bx + c = 0$, then

$f(x) = a(x - \alpha)(x - \beta)$

JEE Main 2019: 12 jan - I

If λ be the ratio of the roots of the quadratic equation in x, $3m^2x^2 + m(m - 4)x + 2 = 0$, then the least value of m for which $\lambda + 1/\lambda = 1$

A) $2-\sqrt{3}$

B) $-2 + \sqrt{2}$

C) $4 - 2\sqrt{3}$

D) $4 - 3\sqrt{2}$

JEE Main 2022: 26 july - I

If for some p, q, r $\in \mathbb{R}$ not all have same sign, one of the roots of the equation

$(p^2 + q^2)x^2 - 2q(p + r)x + q^2 + r^2 = 0$

is also a root of the equation

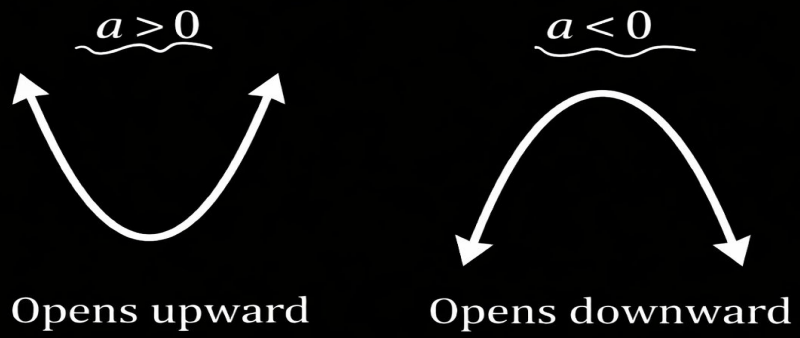
$x^2 + 2x - 8 = 0$,

then $(q^2 + r^2) / p^2$ is equal to ?

A) 150 B) 270 C) 272 D) None of These

Graph of Quadratic Equation

$$f(x) = ax^2 + bx + c$$



(i) Coefficient of x^2 = a

(ii) Vertex = (–b / 2a , –D / 4a)

(iii) Point where it cuts Y-axis is : (0,c)

(iv) Line of symmetry : x = –b / (2a)

Range of Quadratic Equation

$f(x) = ax^2 + bx + c$ (only when $x \in \mathbb{R}$)

Range:

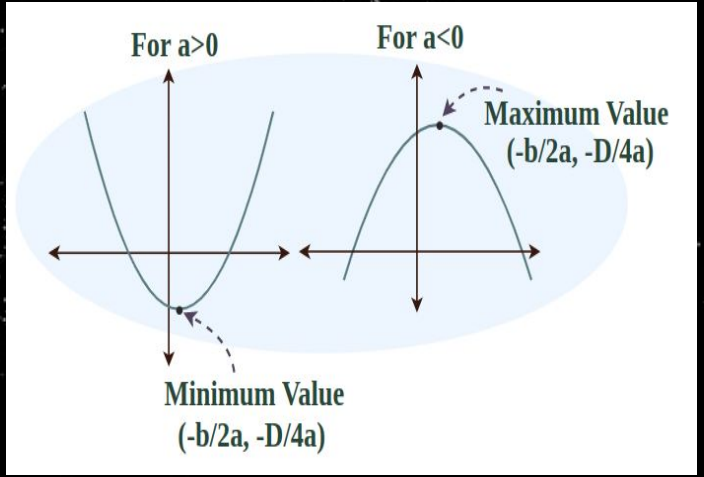
If $a > 0 \Rightarrow f(x) \in [\ -D / (4a), \infty\ )$

If $a < 0 \Rightarrow f(x) \in (\ -\infty, -D / (4a)\ ]$

$D=b^2-4ac$
D=Discriminant

Here maximum and minimum values of expression f(x) is $-D / (4a)$

It occurs at $x = -b / (2a)$ (at vertex)



JEE Main 2021: 25 Feb - I

Find integral value of k for which

$$x^2 - 2(3k - 1)x + 8k^2 - 7 > 0 \ \forall \in R.$$

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WBJEE 2015

$(5x^2 - 26x + 5) / (3x^2 - 10x + 3) < 0$, then

A) $1/5 < x < 3$

B) $1/5 < x < 1/3$ or $3 < x < 5$

C) $x > 5$

D) $x < ⅙$

WBJEE 2025

If the sum of the squares of the roots of the equation
$x^2 - (a - 2)x - (a + 1) = 0$
is least for an appropriate value of the variable parameter a, then the value of a will be

A) 2
B) 3
C) 1
D) 0

WBJEE 2022

If a, b are odd integers, then the roots of the equation $2ax^2 + (2a + b)x + b = 0$, $a \neq 0$ are

A) rational
B) non-real
C) equal
D) irrational

WBJEE 2024

If the quadratic equation $ax^2 + bx + c = 0$ $(a > 0)$ has two roots α and β such that $\alpha < -2$ and $\beta > 2$, then

Multiple correct

A) $a - b + c > 0$
B) $a - b + c < 0$
C) $a + b + c > 0$
D) $c < 0$

WBJEE 2012

The Quadratic equation

$2x^2 - (a^3 + 8a - 1)x + (a^2 - 4a) = 0$

Has roots of opposite sign . Then ,

A) $a \geq 8$

B) $a \leq 0$

C) $4 \leq a < 8$

D) $0 < a < 4$

THANK YOU

WISH YOU BEST OF LUCK FOR YOUR FUTURE ENDEAVOURS

For Course Details, Contact 9883284104