NDA 1 2025

LIVE

MATHS

QUADRATIC EQUATIONS

CLASS 1

NAVJYOTI SIR

Crack
EXAMS

SSBCrack EXAMS

24 Sep 2024 Live Classes Schedule

8:00AM	24 SEP 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	24 SEP 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

NDA 1 2025 LIVE CLASSES

11:30AM	GK - PHYSICAL GEOGRAPHY - CLASS 1	RUBY MA'AM
1:00PM	BIOLOGY - HUMAN BODY - CLASS 1	SHIVANGI MA'AM
4:00PM	MATHS - QUADRATIC EQUATIONS - CLASS 1	NAVJYOTI SIR

CDS 1 2025 LIVE CLASSES

11:30AM	GK - PHYSICAL GEOGRAPHY - CLASS 1	RUBY MA'AM
1:00PM	BIOLOGY - HUMAN BODY - CLASS 1	SHIVANGI MA'AM
2:30PM	MATHS - PERCENTAGE - CLASS 1	NAVJYOTI SIR

AFCAT 1 2025 LIVE CLASSES

10:00AM	REASONING - VERBAL ANALOGY	RUBY MA'AM
2:30PM	MATHS - PERCENTAGE - CLASS 1	NAVJYOTI SIR
4:00PM	STATIC GK - DEFENCE EXERCISE	DIVYANSHU SIR

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QUADRATIC EQUATION

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

a, b, c are real numbers and $a \neq 0$

(coefficient of x^2 cannot be zero)

$ax^2 + bx^1 + cx^0$ → quadratic expression

$ax^1 + bx + c$

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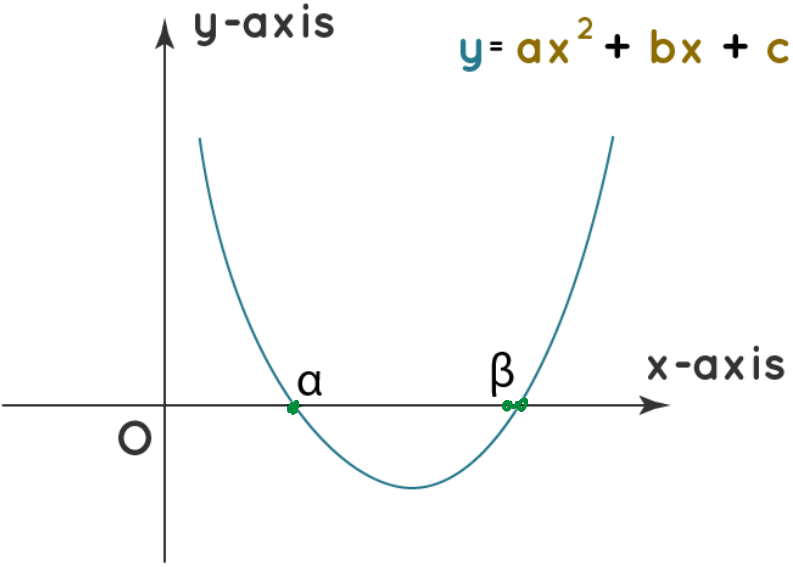
ROOTS OF QUADRATIC EQUATIONS



2 roots

values of x at which ax^2+bx+c becomes 0.

(points on the curve of ax^2+bx+c where it cuts the x-axis)

Which of the following equations has 2 as a root?

(A) $x^2 - 4x + 5 = 0$

(B) $x^2 + 3x - 12 = 0$

(C) $2x^2 - 7x + 6 = 0$

(D) $3x^2 - 6x - 2 = 0$

(A) $(2)^2 - 4(2) + 5 = 4 - 8 + 5 \neq 0$

(B) $(2)^2 + 3(2) - 12 = 4 + 6 - 12 \neq 0$

(C) $2(2)^2 - 7(2) + 6 = 8 - 14 + 6 = 0$ ✓

If $\frac{1}{2}$ is a root of the equation $x^2 + kx - \frac{5}{4} = 0$, then the value of k is

(A) 2 (B) -2 (C) $\frac{1}{4}$ (D) $\frac{1}{2}$

$$\left(\frac{1}{2}\right)^2 + k\left(\frac{1}{2}\right) - \frac{5}{4} = 0$$

$$\frac{1}{4} + \frac{k}{2} - \frac{5}{4} = 0$$

$$\frac{k}{2} - 1 = 0 \Rightarrow k = 2$$

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DISCRIMINANT

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

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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{-b + \sqrt{b^2 - 4ac}}{2a} = \frac{-b + \sqrt{D}}{2a}$$

$$\frac{-b - \sqrt{b^2 - 4ac}}{2a} = \frac{-b - \sqrt{D}}{2a}$$

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NATURE OF ROOTS

(1) $D > 0$ ⟶ roots are unequal / distinct and real.

if D is a perfect square

$\sqrt{D}$ is rational number.

roots will be rational and unequal

$$x = \begin{cases} \dfrac{-b + \sqrt{D}}{2a} \\ \dfrac{-b - \sqrt{D}}{2a} \end{cases}$$

if D is not a perfect square,

$\sqrt{D}$ is irrational $\begin{cases} 2+\sqrt{3} \\ 2-\sqrt{3} \end{cases}$ (occur in pairs)

roots will be irrational, unequal and will

(2) $D = 0$

$$x = \frac{-b + \sqrt{D}}{2a} \quad ; \quad x = \frac{-b - \sqrt{D}}{2a}$$

$$\sqrt{D} = \sqrt{0} = 0$$

$$x = \frac{-b + 0}{2a} \quad ; \quad x = \frac{-b - 0}{2a}$$

$$\left(x = \frac{-b}{2a}\right) ; \left(x = \frac{-b}{2a}\right)$$

Roots are equal and real

(3) $D < 0$,

$$x = \frac{-b + \sqrt{D}}{2a} \quad ; \quad x = \frac{-b - \sqrt{D}}{2a}$$

if $D < 0 \Rightarrow \sqrt{D}$

($\sqrt{-3}, \sqrt{-6} \longrightarrow$ imaginary numbers)

Roots are imaginary (complex)

Values of k for which the quadratic equation $2x^2 - kx + k = 0$ has equal roots is

(A) 0 only (B) 4 (C) 8 only (D) 0, 8

$D = 0$

$ax^2 + bx + c = 0$

$a = 2$

$b = -k$

$c = k$

$b^2 - 4ac = 0$ (for equal roots)

$(-k)^2 - 4 \times 2 \times k = 0$

$k^2 - 8k = 0$

$k(k - 8) = 0$

$k = 0$; $k - 8 = 0$

$k = 8$

Which of the following equations has no real roots?

(A) $x^2 - 4x + 3\sqrt{2} = 0$ (B) $x^2 + 4x - 3\sqrt{2} = 0$

(C) $x^2 - 4x - 3\sqrt{2} = 0$ (D) $3x^2 + 4\sqrt{3}x + 4 = 0$

No real roots $\Rightarrow$ $D < 0$

(A) $(-4)^2 - 4 \times 1 \times 3\sqrt{2} = 16 - 12\sqrt{2} = 16 - 12(1.414) \approx 16 - 18 < 0$ ✓

(B) $(4)^2 - 4 \times 1 \times -3\sqrt{2} = 16 + 12\sqrt{2} > 0$ ✓

~ 1.5

(C) $(-4)^2 - 4 \times 1 \times -3\sqrt{2} = 16 + 12\sqrt{2} > 0$ ✓

(D) $(4\sqrt{3})^2 - 4 \times 3 \times 4 = 48 - 48 = 0$ ✓

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RELATIONSHIP BETWEEN COEFFICIENTS AND ROOTS

$ax^2 + bx + c = 0$

roots $\longrightarrow$ α, β

Sum of roots $= \alpha + \beta = -\frac{b}{a} = -\frac{\text{coefficient of } x}{\text{coefficient of } x^2}$

product of roots $= \alpha\beta = \frac{c}{a} = \frac{\text{constant term}}{\text{coefficient of } x^2}$

Which of the following equations has the sum of its roots as 3?

(A) $2x^2 - 3x + 6 = 0$

(B) $-x^2 + 3x - 3 = 0$ ✓

(C) $\sqrt{2}x^2 - \frac{3}{\sqrt{2}}x + 1 = 0$

(D) $3x^2 - 3x + 3 = 0$

sum of roots $= -\frac{\text{coefficient of } x}{\text{coefficient of } x^2}$

(A) $-\frac{(-3)}{2} = \frac{3}{2}$ ✗

(B) $\frac{-3}{(-1)} = 3$ ✓

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If the product of the roots of the equation $mx^2 + 6x + (2m - 1) = 0$ is -1, then the value of m is

(a) $m = \frac{1}{3}$ (b) $m = \frac{1}{2}$ (c) $m = \frac{2}{3}$ (d) $m = 2$

✓

$ax^2 + bx + c = 0$

$mx^2 + 6x + (2m-1) = 0$

product of roots $= \frac{c}{a} = \frac{2m-1}{m} = -1$

$2m - 1 = -m$

$3m = 1$

$m = \frac{1}{3}$

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FORMING QUADRATIC EQUATION FROM ROOTS

$$x^2 - (\text{sum of roots})x + (\text{product of roots}) = 0$$

$$x^2 - (\alpha+\beta)x + \alpha\beta = 0$$

$$x^2 - \left(\frac{-b}{a}\right)x + \frac{c}{a} = 0$$

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

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MAXIMUM & MINIMUM VALUE

Case I $a > 0$

$\because \quad ax^2 + bx + c \geq \dfrac{4ac - b^2}{4a}$

$\therefore$ Minimum value of $ax^2 + bx + c$ is $\dfrac{4ac - b^2}{4a}$ and this value attains at $x = -\dfrac{b}{2a}$.

Case II $a < 0$

$\because \quad ax^2 + bx + c \leq \dfrac{4ac - b^2}{4a}$

$\therefore$ Maximum value of $ax^2 + bx + c$ is $\left(\dfrac{4ac - b^2}{4a}\right)$ and this value attains at $\left(x = -\dfrac{b}{2a}\right)$

$ax^2+bx+c=0$

(Max. and minimum value is calculated for the LHS of quadratic eqn, which is the quadratic expression.

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Q) If r and s are roots of $x^2 + px + q = 0$, then what is the value of $(1/r^2) + (1/s^2)$?

(a) $p^2 - 4q$

(b) $\dfrac{p^2 - 4q}{2}$

(c) $\dfrac{p^2 - 4q}{q^2}$

(d) $\dfrac{p^2 - 2q}{q^2}$

$r+s = \dfrac{-p}{1}$ $\quad rs = \dfrac{q}{1}$

$r+s = -p$; $rs = q$

$$\frac{1}{r^2} + \frac{1}{s^2} = \frac{(s^2 + r^2)}{r^2 s^2} = \frac{((r+s)^2) - 2rs}{(rs)^2}$$

$$= \frac{(-p)^2 - 2q}{q^2} = \frac{p^2 - 2q}{q^2}$$

Q) If r and s are roots of $x^2 + px + q = 0$, then what is the value of $(1/r^2) + (1/s^2)$?

(a) $p^2 - 4q$

(b) $\frac{p^2 - 4q}{2}$

(c) $\frac{p^2 - 4q}{q^2}$

(d) $\frac{p^2 - 2q}{q^2}$

Ans: (d)

What is the number of real roots of the equation $(x-1)^2+(x-3)^2+(x-5)^2=0$? **(PYQ – NDA 2 2024)**

(a) None ✓

(b) Only one

(c) Only two

(d) Three ✗

$$(x^2-2x+1)+(x^2-6x+9)+(x^2-10x+25)=0$$

$$3x^2-18x+35=0$$

$$D=(-18)^2-4\times3\times35$$

$$=324-420<0$$

What is the number of real roots of the equation $(x-1)^2+(x-3)^2+(x-5)^2=0$? **(PYQ – NDA 2 2024)**

(a) None

(b) Only one

(c) Only two

(d) Three

Ans: A

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