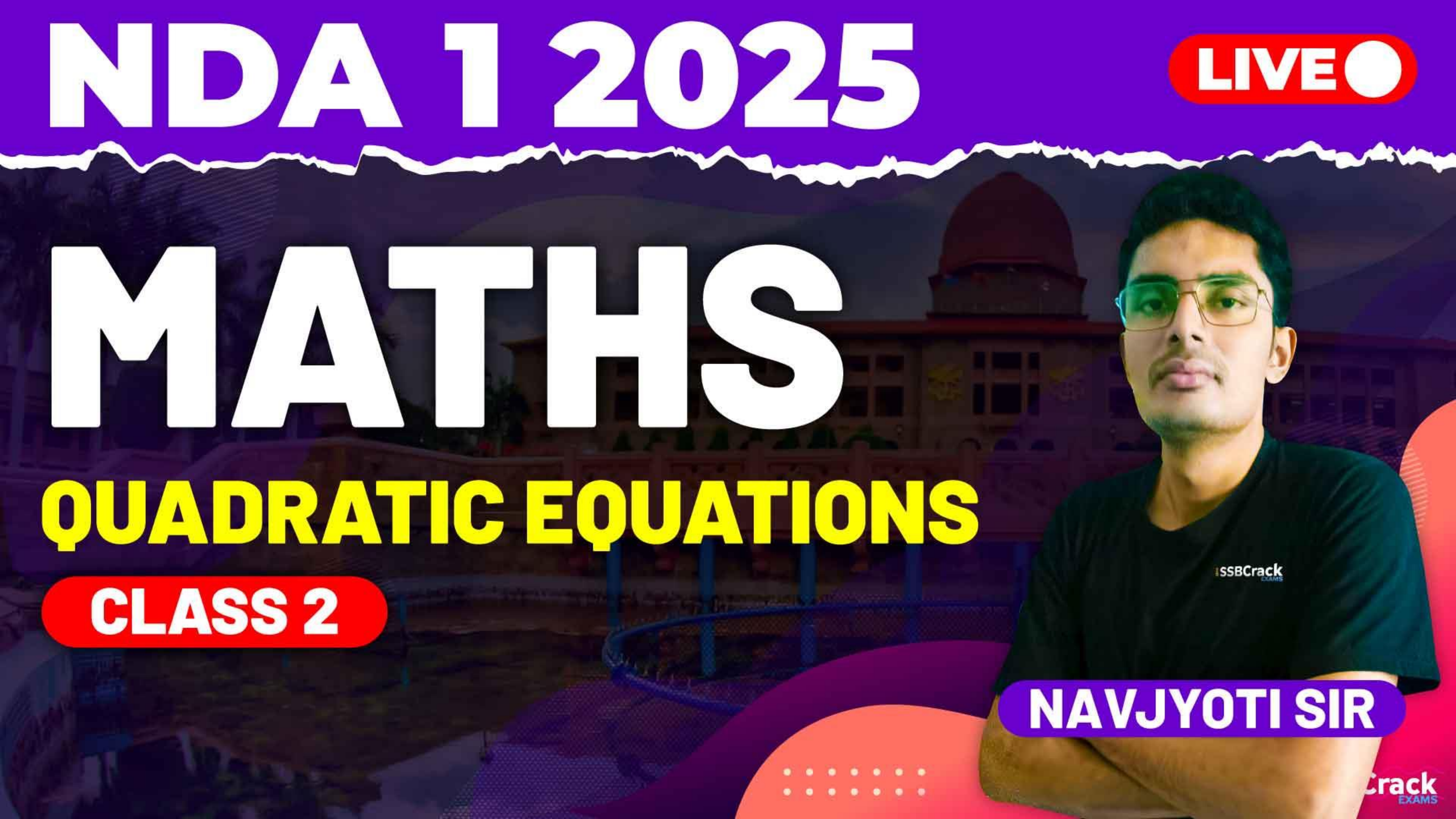

NDA 1 2025
LIVE
MATHS
QUADRATIC EQUATIONS
CLASS 2
SSBCrack EXAMS
NAVJYOTI SIR
Crack EXAMS

25 Sep 2024 Live Classes Schedule

8:00AM	25 SEP 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	25 SEP 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

NDA 1 2025 LIVE CLASSES

11:30AM	GK - PHYSICAL GEOGRAPHY - CLASS 2	RUBY MA'AM
1:00PM	BIOLOGY - HUMAN BODY - CLASS 2	SHIVANGI MA'AM
4:00PM	MATHS - QUADRATIC EQUATIONS - CLASS 2	NAVJYOTI SIR
5:30PM	ENGLISH - PARTS OF SPEECH - CLASS 1	ANURADHA MA'AM

CDS 1 2025 LIVE CLASSES

11:30AM	GK - PHYSICAL GEOGRAPHY - CLASS 2	RUBY MA'AM
1:00PM	BIOLOGY - HUMAN BODY - CLASS 2	SHIVANGI MA'AM
2:30PM	MATHS - PERCENTAGE - CLASS 2	NAVJYOTI SIR
5:30PM	ENGLISH - PARTS OF SPEECH - CLASS 1	ANURADHA MA'AM

AFCAT 1 2025 LIVE CLASSES

10:00AM	REASONING - VERBAL CLASSIFICATION	RUBY MA'AM
2:30PM	MATHS - PERCENTAGE - CLASS 1	NAVJYOTI SIR
4:00PM	STATIC GK - DEFENCE EXERCISE	DIVYANSHU SIR
5:30PM	ENGLISH - PARTS OF SPEECH - CLASS 1	ANURADHA MA'AM

RELATION B/W COEFFICIENT & ROOTS

(degree – highest power) = no. of roots

$ax^2 + bx + c = 0$

roots $\rightarrow$ α, β

$\alpha + \beta = \frac{-b}{a}$

$\alpha\beta = \frac{c}{a}$

$ax^3 + bx^2 + cx + d = 0$

α, β, γ

$\alpha + \beta + \gamma = \frac{-b}{a}$

$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$

$\alpha\beta\gamma = \frac{-d}{a}$

RELATION B/W COEFFICIENT & ROOTS

$$ax^4 + bx^3 + cx^2 + dx + e = 0 \quad (4 \text{ roots})$$

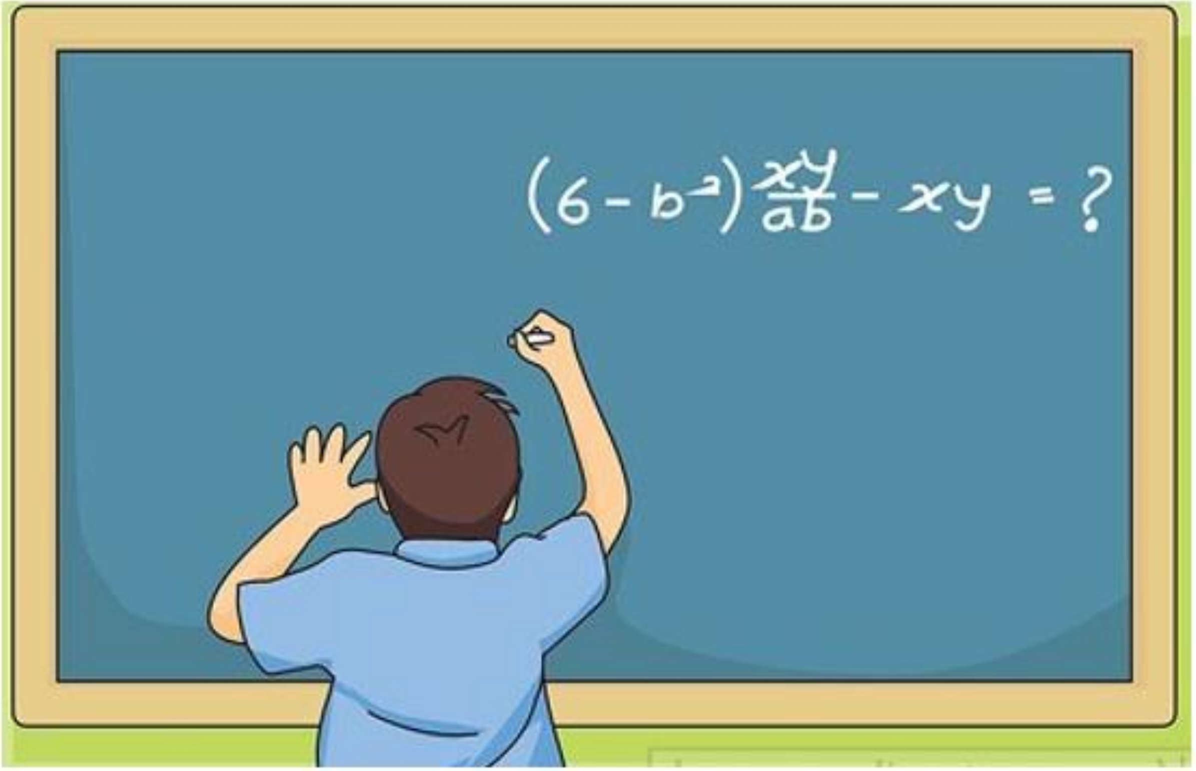
$$\alpha + \beta + \gamma + \delta = \frac{-b}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\delta + \delta\alpha = \frac{c}{a}$$

$$\alpha\beta\gamma + \beta\gamma\delta + \gamma\delta\alpha + \delta\alpha\beta = -\frac{d}{a}$$

$$\alpha\beta\gamma\delta = \frac{e}{a}$$

PRACTISE
TIME !



Q) Let α and β be the roots of the equation $x^2-(1-2a^2)x+(1-2a^2)=0$

Under what condition is $\frac{1}{\alpha^2}+\frac{1}{\beta^2}<1$?

(a) $a^2<\frac{1}{2}$ (b) $a^2>\frac{1}{2}$

(c) $a^2>1$ (d) $a^2\in\left(\frac{1}{3},\frac{1}{2}\right)$

$\frac{1}{\alpha^2}+\frac{1}{\beta^2}<1$

$\frac{\beta^2+\alpha^2}{(\alpha\beta)^2}<1$

$\frac{(\alpha+\beta)^2-2\alpha\beta}{(\alpha\beta)^2}<1$

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

$a=1$

$b=-(1-2a^2)$

$c=1-2a^2$

$\alpha+\beta=1-2a^2$

$\alpha\beta=1-2a^2$

$\frac{(1-2a^2)^2-2(1-2a^2)}{(1-2a^2)^2}<1$

$$\frac{(1-2a^2)^2 - 2(1-2a^2)}{(1-2a^2)^2} < 1$$

$$-1 > -2$$
$$\downarrow$$
$$1 < 2$$

$$\frac{1+4a^4-\cancel{4a^2}-2+\cancel{4a^2}}{1+4a^4-4a^2} < 1$$

$$\underline{1+4a^4}-2 < \underline{1+4a^4}-4a^2$$

$$-2 < -4a^2$$

$$2 > 4a^2 \Rightarrow 1 > 2a^2 \Rightarrow \underline{\frac{1}{2} > a^2}$$

Q) Let α and β be the roots of the equation

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

Under what condition is $\frac{1}{\alpha^2} + \frac{1}{\beta^2} < 1$?

(a) $a^2 < \frac{1}{2}$

(b) $a^2 > \frac{1}{2}$

(c) $a^2 > 1$

(d) $a^2 \in \left(\frac{1}{3}, \frac{1}{2}\right)$

Ans: (a)

Q) If one root of the equation $(\ell - m)x^2 + \ell x + \ell = 0$ is double the other and ℓ is real, then what is the greatest value of m?

(a) $-\frac{9}{8}$ ✗

(b) $\frac{9}{8}$ ✓

(c) $-\frac{8}{9}$ ✗

(d) $\frac{8}{9}$

$(\ell - m)x^2 + \ell x + l = 0$

$\alpha \quad 2\alpha$

$\frac{\alpha + 2\alpha}{(3\alpha)} = -\frac{\ell}{\ell - m}$

$\alpha(2\alpha) = \frac{1}{\ell - m}$

$2\alpha^2 = \frac{\ell}{\ell - m}$

$-3\alpha = 2\alpha^2$

$2\alpha^2 + 3\alpha = 0$

$\alpha(2\alpha + 3) = 0$

$\alpha = 0, \quad \alpha = -\frac{3}{2}$

For $\alpha = 0 \Rightarrow \ell = 0$

$$\alpha = -\frac{3}{2}$$

$$(l-m)x^2 + lx + l = 0$$

$$(l-m)\left(-\frac{3}{2}\right)^2 + l\left(-\frac{3}{2}\right) + l = 0$$

$$\frac{9l - 9m - 6l + 4l}{4} = 0$$

$$-9m + 7l = 0$$

$$m = \left(\frac{7}{9}l\right)$$

if l is real,

(max. of m — max. from options)

Q) If one root of the equation $(1-m)x^2 + lx + l = 0$ is double the other and l is real, then what is the greatest value of m?

(a) $-\frac{9}{8}$

(b) $\frac{9}{8}$

(c) $-\frac{8}{9}$

(d) $\frac{8}{9}$

Ans: (b)

SSBCrack EXAMS

Q) If the roots of the equation $x^2 - nx + m = 0$ differ by 1, then

(a) $n^2 - 4m - 1 = 0$ (b) $n^2 + 4m - 1 = 0$
(c) $m^2 + 4n + 1 = 0$ (d) $m^2 - 4n - 1 = 0$

$\alpha + 1$ α

$(\alpha+1) + \alpha = -\left(\frac{-n}{1}\right) = n$

$2\alpha + 1 = n$

$(\alpha+1)\alpha = m$

$\alpha^2 + \alpha = m$

(a) $n^2 - 4m - 1 = 0 \Rightarrow n^2 = 4m + 1$

$n^2 = (2\alpha+1)^2 = 4\alpha^2 + 4\alpha + 1$

$4m = 4\alpha^2 + 4\alpha$

$4m + 1 = 4\alpha^2 + 4\alpha + 1$

Q) If the roots of the equation $x^2 - nx + m = 0$ differ by 1, then

(a) $n^2 - 4m - 1 = 0$ (b) $n^2 + 4m - 1 = 0$

(c) $m^2 + 4n + 1 = 0$ (d) $m^2 - 4n - 1 = 0$

Ans: (a)

Directions The equation formed by multiplying each root of $ax^2 + bx + c = 0$ by 2 is $x^2 + 36x + 24 = 0$.

α β (roots)

2α 2β

2α and 2β are roots of $x^2 + 36x + 24 = 0$

$2\alpha + 2\beta = -36 \Rightarrow \underline{\alpha + \beta = -18}$

$(2\alpha)(2\beta) = 24 \Rightarrow \underline{\alpha\beta = 6}$

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

$x^2 - (-18)x + 6 = 0$

$\underline{x^2 + 18x + 6 = 0}$

Q) If α and β are the roots of the equation $3x^2 + 2x + 1 = 0$, then the equation whose roots are $\alpha + \beta^{-1}$ and $\beta + \alpha^{-1}$ is

(a) $3x^2 + 8x + 16 = 0$

(b) $3x^2 - 8x - 16 = 0$

(c) $3x^2 + 8x - 16 = 0$

(d) $x^2 + 8x + 16 = 0$

$3x^2 + 2x + 1 = 0$

$\alpha + \beta = -\frac{2}{3}$ $\quad$ $\alpha\beta = \frac{1}{3}$ ✓

$\alpha + \beta^{-1} = \alpha + \frac{1}{\beta} = \frac{\alpha\beta + 1}{\beta}$ ✓

$\beta + \alpha^{-1} = \beta + \frac{1}{\alpha} = \frac{\alpha\beta + 1}{\alpha}$ ✓

Sum of roots $= \left(\frac{\alpha\beta+1}{\beta}\right) + \left(\frac{\alpha\beta+1}{\alpha}\right)$

$= \frac{\alpha^2\beta + \alpha + \alpha\beta^2 + \beta}{\alpha\beta}$

$= \frac{\alpha\beta(\alpha+\beta) + (\alpha+\beta)}{\alpha\beta}$

$= \frac{(\alpha\beta+1)(\alpha+\beta)}{\alpha\beta}$ ✓

$$\frac{(\alpha+\beta)(\alpha\beta+1)}{\alpha\beta}$$

$$\frac{\left(-\frac{2}{3}\right)\left(\frac{1}{3}+1\right)}{\frac{1}{3}} = \left(-\frac{2}{3} \times \frac{4}{3}\right)3 = \frac{-8}{3} \checkmark$$

product of roots $= \left(\frac{\alpha\beta+1}{\alpha}\right)\left(\frac{\alpha\beta+1}{\beta}\right)$

$$= \frac{(\alpha\beta+1)^2}{\alpha\beta} = \frac{\left(\frac{1}{3}+1\right)^2}{\frac{1}{3}} = \frac{\frac{16}{9}}{\frac{1}{3}} = \frac{16}{3}$$

Sum of roots $= -\frac{8}{3}$

product of roots $= \frac{16}{3}$

$$x^2 - \left(-\frac{8}{3}\right)x + \frac{16}{3} = 0$$

$$\frac{3x^2 + 8x + 16}{3} = 0$$

$$3x^2 + 8x + 16 = 0$$

Q) If α and β are the roots of the equation $3x^2 + 2x + 1 = 0$, then the equation whose roots are $\alpha + \beta^{-1}$ and $\beta + \alpha^{-1}$ is

(a) $3x^2 + 8x + 16 = 0$ (b) $3x^2 - 8x - 16 = 0$

(c) $3x^2 + 8x - 16 = 0$ (d) $x^2 + 8x + 16 = 0$

Ans: (a)

Q) What is the value of $b : c$?

(a) $3 : 1$ (b) $1 : 2$ (c) $1 : 3$ (d) $3 : 2$

$x^2 + 18x + 6 = 0$ | $ax^2 + bx + c = 0$

$a = 1$,

$b = 18$

$c = 6$

$b : c = \frac{b}{c} = \frac{18}{6} = 3 : 1$

Q) What is the value of $b : c$?

(a) $3 : 1$ (b) $1 : 2$ (c) $1 : 3$ (d) $3 : 2$

Ans: (a)

Q) Which one of the following is correct?

(a) $bc = a^2$

(b) $bc = 36a^2$

(c) $bc = 72a^2$

(d) $bc = 108a^2$ ✓

$a = 1$, $b = 18$, $c = 6$

$bc = 108 = 108a^2$

Q) Which one of the following is correct?

(a) $bc = a^2$

(b) $bc = 36a^2$

(c) $bc = 72a^2$

(d) $bc = 108a^2$

Ans: (d)

Directions Consider the equation $ax^2 + bx + c = 0$, then condition that

SSBCrack EXAMS

Q) One roots is the reciprocal of the other roots is

(a) $a = c$

(b) $a = -\frac{c}{2}$

(c) $2b = a$

(d) $b = a$

$\alpha \quad \frac{1}{\alpha}$

$\alpha \cdot \frac{1}{\alpha} = \frac{c}{a}$

$1 = \frac{c}{a} \Rightarrow \underline{a = c}$

Q) One roots is the reciprocal of the other roots is

(a) $a = c$

(b) $a = -\dfrac{c}{2}$

(c) $2b = a$

(d) $b = a$

Ans: (a)

Q) One roots is n times the other root is

(a) $ac(n+1)^2 = b^2 n$ (b) $ab^2(n+1)^2$

(c) $ac(n+2)^2 = b^2$ (d) $4a^2 = b^2$

$\alpha \quad n\alpha$ | $ax^2+bx+c=0$

$\alpha + n\alpha = \frac{-b}{a} \Rightarrow \alpha(1+n) = \frac{-b}{a} \Rightarrow \alpha = \frac{-b}{a(n+1)}$

$\alpha(n\alpha) = \frac{c}{a} \Rightarrow n\alpha^2 = \frac{c}{a}$

$n\left(\frac{-b}{a(n+1)}\right)^2 = \frac{c}{a}$

$\frac{nb^2}{a^{\cancel{2}}(n+1)^2} = \frac{c}{\cancel{a}}$

$nb^2 = ac(n+1)^2$

Q) One roots is n times the other root is

(a) $ac(n+1)^2 = b^2 n$ (b) $ab^2(n+1)^2$

(c) $ac(n+2)^2 = b^2$ (d) $4a^2 = b^2$

Ans: (a)

Q) $f(x) = x^2 + 2ax + 1$ and α is a root of the equation $f(x) = 0$, where a is real.

Which one of the following is correct ?

(a) $f(\alpha) = 0$ and $f(1/\alpha) \neq 0$ ✓

(b) $f(\alpha) = 0$ and $f(1/\alpha) = 0$ ✓

(c) $f(\alpha) \neq 0$ and $f(1/\alpha) = 0$

(d) $f(\alpha) \neq 0$ and $f(1/\alpha) \neq 0$

$$f(x) = x^2 + 2ax + 1$$

$$f(1) = 1^2 + 2a(1) + 1$$

$$= 1 + 2a + 1$$

$$f(\alpha) = \alpha^2 + 2a\alpha + 1 = 0 \text{ (}\alpha\text{ is a root)}$$

$$\alpha^2 + 2a\alpha + 1 = 0$$

$$f\left(\frac{1}{\alpha}\right) = \left(\frac{1}{\alpha}\right)^2 + 2a\left(\frac{1}{\alpha}\right) + 1 = \frac{1}{\alpha^2} + \frac{2a}{\alpha} + 1 = \frac{1 + 2a\alpha + \alpha^2}{\alpha^2} = \frac{0}{\alpha^2} = 0$$

SSBCrack EXAMS

Q) $f(x) = x^2 + 2ax + 1$ and α is a root of the equation $f(x) = 0$, where a is real.

Which one of the following is correct ?

(a) $f(\alpha) = 0$ and $f(1/\alpha) \neq 0$

(b) $f(\alpha) = 0$ and $f(1/\alpha) = 0$

(c) $f(\alpha) \neq 0$ and $f(1/\alpha) = 0$

(d) $f(\alpha) \neq 0$ and $f(1/\alpha) \neq 0$

Ans: (b)

Q) If p and q are the non-zero roots of the equation $x^2 + px + q = 0$, then how many possible values can q have?

(a) Nil
(b) One ✓
(c) Two
(d) Three

$p + q = -p \Rightarrow 1 + q = -1$

$q = -2$

$pq = q \Rightarrow p = 1$

Q) If p and q are the non-zero roots of the equation $x^2 + px + q = 0$, then how many possible values can q have?

(a) Nil (b) One
(c) Two (d) Three

Ans: (b)

SSBCrack EXAMS

Q) What is the value of

$$\sqrt{5\sqrt{5\sqrt{5\sqrt{\ldots\infty}}}}\ ?$$

(a) 5 (b) $\sqrt{5}$

(c) 1 (d) $(5)^{1/4}$

$$\sqrt{a\sqrt{a\sqrt{a\ldots\infty}}} = a$$

Let $x = \sqrt{5\sqrt{5\sqrt{5\sqrt{\ldots\infty}}}}$

$x = \sqrt{5x}$

$x^2 = 5x \Rightarrow x^2 - 5x = 0$

$x(x-5) = 0$

$x = 0$; $x = 5$

(rejected) as x cannot be equal to 0.

$x = 5$

Q) What is the value of

$$\sqrt{5\sqrt{5\sqrt{5\sqrt{\ldots\infty}}}}\ ?$$

(a) 5 (b) $\sqrt{5}$

(c) 1 (d) $(5)^{1/4}$

Ans: (a)

SSBCrack EXAMS

Q) If the roots of the quadratic equation $x^2 + 2x + k = 0$ are real, then

(a) $k < 0$
(b) $k \leq 0$
(c) $k < 1$
(d) $k \leq 1$ ✓

roots are real,

$\underbrace{D > 0 \quad \text{and} \quad D = 0}$

$D \geq 0$

$(2)^2 - 4 \times 1 \times k \geq 0$

$4 - 4k \geq 0$

$4 \geq 4k$

$1 \geq k$

Q) If the roots of the quadratic equation $x^2 + 2x + k = 0$ are real, then

(a) $k < 0$
(b) $k \leq 0$
(c) $k < 1$
(d) $k \leq 1$

Ans: (d)

Q) If $\sin\theta$ and $\cos\theta$ are the roots of the equation $ax^2 + bx + c = 0$, then which one of the following is correct?

(a) $a^2 + b^2 - 2ac = 0$

(b) $-a^2 + b^2 + 2ac = 0$

(c) $a^2 - b^2 + 2ac = 0$ ✓

(d) $a^2 + b^2 + 2ac = 0$

$\sin\theta + \cos\theta = \frac{-b}{a}$

$\sin\theta\cos\theta = \frac{c}{a}$

$(\sin\theta + \cos\theta)^2 - 2\sin\theta\cos\theta - 1 = 0$

$\left(\frac{-b}{a}\right)^2 - 2\left(\frac{c}{a}\right) - 1 = 0$

$\frac{b^2}{a^2} - \frac{2c}{a} - 1 = 0$

$\frac{b^2 - 2ac - a^2}{a^2} = 0$

$b^2 - 2ac - a^2 = 0$

$a^2 + 2ac - b^2 = 0$

$a^2 - b^2 + 2ac = 0$

SSBCrack EXAMS

Q) If $\sin\theta$ and $\cos\theta$ are the roots of the equation $ax^2 + bx + c = 0$, then which one of the following is correct?

(a) $a^2 + b^2 - 2ac = 0$

(b) $-a^2 + b^2 + 2ac = 0$

(c) $a^2 - b^2 + 2ac = 0$

(d) $a^2 + b^2 + 2ac = 0$

Ans: (c)

c α

b x α

Q) In solving a problem that reduces to a quadratic equation, one student makes a mistake in the constant term and obtains 8 and 2 for roots. Another student makes a mistake only in the coefficient of first-degree term and finds –9 and –1 for roots. The correct equation is

(a) $x^2 - 10x + 9 = 0$
(b) $x^2 - 10x - 9 = 0$
(c) $x^2 - 10x + 16 = 0$
(d) $x^2 - 8x - 9 = 0$

$$-\frac{b}{a} = \alpha + \beta = 8 + 2 = 10 \text{ — sum of roots}$$

$$\frac{c}{a} = \alpha\beta = (-9)(-1) = 9 \text{ — product of roots}$$

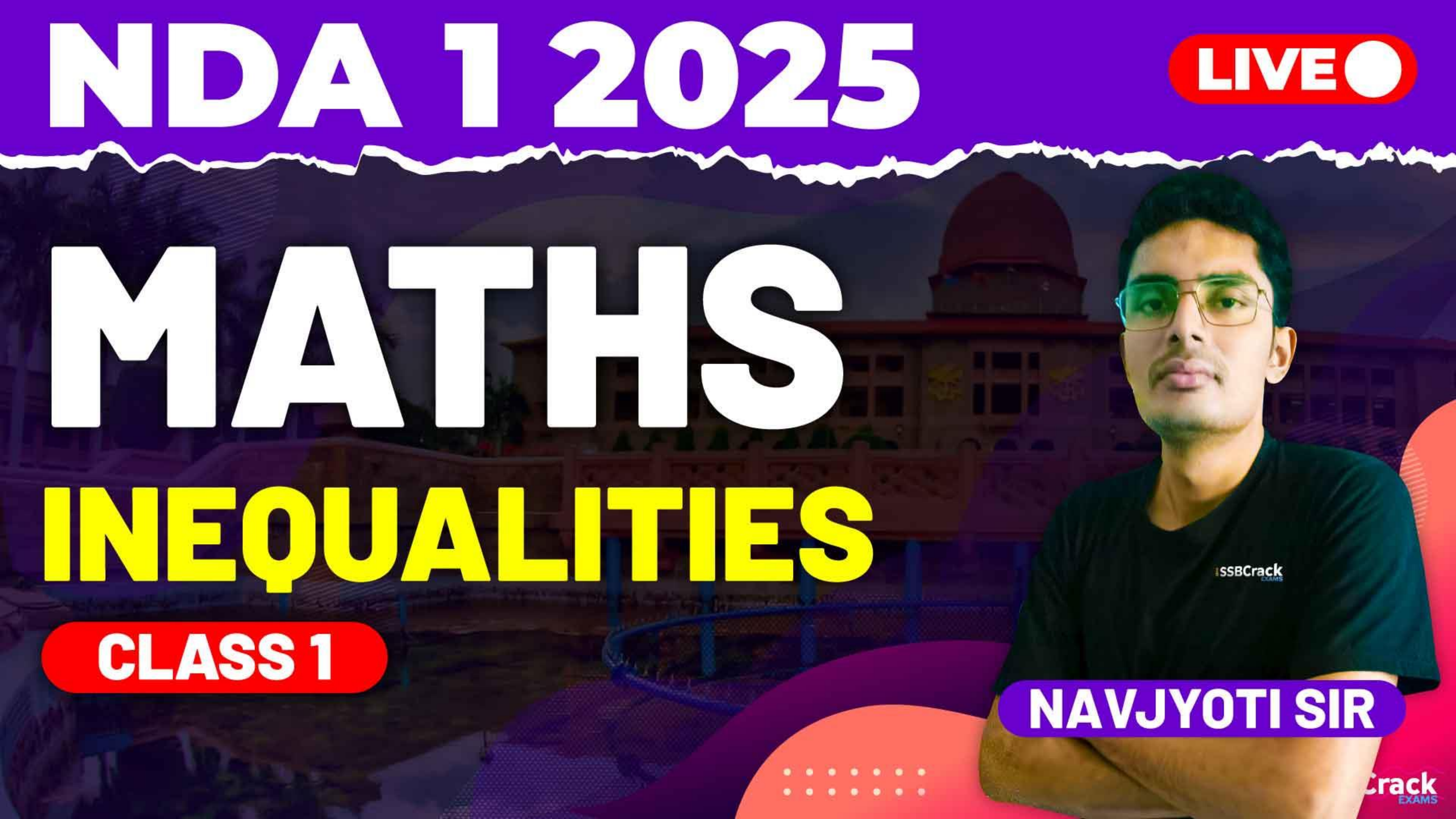
$$x^2 - 10x + 9 = 0$$

Q) In solving a problem that reduces to a quadratic equation, one student makes a mistake in the constant term and obtains 8 and 2 for roots. Another student makes a mistake only in the coefficient of first-degree term and finds –9 and –1 for roots. The correct equation is

(a) $x^2 - 10x + 9 = 0$ (b) $x^2 - 10x - 9 = 0$

(c) $x^2 - 10x + 16 = 0$ (d) $x^2 - 8x - 9 = 0$

Ans: (a)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