

$ax^2 + bx + c = 0$ where $a \neq 0$

$a, b, c = \text{Real no's}$

$x = \alpha, \beta$
Roots

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

Product of roots
 $\alpha \cdot \beta = \frac{c}{a}$

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

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

$$ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (\text{શ્રીધરાચાર્ય formula})$$

$x = \alpha, \beta$ (roots)

$b^2 - 4ac = 'D' \text{ (discriminant,)}$
વિવિધતા

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

$$\alpha = \frac{-b + \sqrt{D}}{2a}, \beta = \frac{-b - \sqrt{D}}{2a}$$

$$\sqrt{52} = \sqrt{4 \times 13}$$

EXAMPLE:-

$$3x^2 - 10x + 4 = 0$$

$$a = 3, b = -10, c = 4,$$

$$x = \frac{-(-10) \pm \sqrt{100 - 4 \times 3 \times 4}}{2 \times 3}$$

$$= \frac{10 \pm \sqrt{52}}{6} = \frac{10 \pm 2\sqrt{13}}{6} = \frac{5 \pm \sqrt{13}}{3}$$

$$\alpha = \frac{5 + \sqrt{13}}{3}, \beta = \frac{5 - \sqrt{13}}{3}$$

$$D = (-10)^2 - 4 \times 3 \times 4$$

$$D = 52$$



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

$$x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

$$x^2 + 2x \times \frac{b}{2a} + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \frac{b^2}{4a^2}$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{-4ac + b^2}{4a^2}$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

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

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

$$a^2 + 2ab + b^2 = (a+b)^2$$

$$x^2 = 25 \Rightarrow x = \pm 5$$

Nature of Roots

$$ax^2 + bx + c = 0 \text{ तो } x = \frac{-b \pm \sqrt{D}}{2a}, \quad D = b^2 - 4ac$$

1. If, $D = 0$

$$x = \frac{-b}{2a} \checkmark$$

दोनों Roots equal, **Real**

Ex. $4x^2 + 12x + 9 = 0$

$$D = 12^2 - 4 \times 4 \times 9 = 0$$

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

$$2x+3=0$$

$$x = -\frac{3}{2}, -\frac{3}{2}$$

$$\sqrt{-1} = i$$

I

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

If, Roots are equal तो, $D = 0$

$$b^2 - 4ac = 0$$

या $b^2 = 4ac$

Nature of Roots

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

2. If, $D > 0$

यदि, D is a perfect square no.
D एक पूर्ण वर्ग संख्या है।

Roots real, unequal
Rational no's (वास्तविक मूल, असमान परिमेय संख्याएँ)

Ex. $x^2 + 4x - 21 = 0$

$$D = 4^2 - 4 \times 1 \times (-21) = 100$$

पूर्णवर्ग

$$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-4 \pm \sqrt{100}}{2 \times 1} = x = \frac{-4 \pm 10}{2} = 3, -7$$

यदि D is not a perfect square no.
D एक पूर्ण वर्ग संख्या नहीं है।

Roots real, but irrational, unequal
मूल वास्तविक हैं, लेकिन अपरिमेय हैं।

$$(m \oplus \sqrt{n}), (m \ominus \sqrt{n})$$

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

3. If, $D < 0$

Roots Imaginary but unequal
मूल काल्पनिक लेकिन असमान

$$m + i\sqrt{n}, \quad m - i\sqrt{n}$$

$\sqrt{-1} = \text{imaginary no}$

$$\sqrt{-1} = i$$

$$\sqrt{-79} = \sqrt{79} \times (\sqrt{-1}) \\ = \sqrt{79}i$$

Example

$$4x^2 - 9x + 10 = 0$$

$$D = (-9)^2 - 4 \times 4 \times 10 = -79$$

$$x = \frac{9 \pm \sqrt{-79}}{8} = \frac{9}{8} + \frac{79i}{8}, \quad \frac{9}{8} - \frac{79i}{8}$$

Nature of Roots

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

a, b, c, are Integers

One root $\rightarrow 7 + 2\sqrt{6}$

Second root $\rightarrow 7 - 2\sqrt{6}$

Example

$$8x^2 - 32x + 91 = 0$$

Roots $\rightarrow \alpha, \beta$

$$\alpha + \beta = -\frac{b}{a} = -\frac{(-32)}{8} = 4$$

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

✓ ✓

$$x \div 8 \rightarrow 8, \frac{3}{2}$$

$$x=8 \Rightarrow x-8=0$$

$$x=\frac{3}{2} \Rightarrow x-\frac{3}{2}=0 \text{ या } x-3=0$$

द्विघात समीकरण = ?

$$(x-8)(2x-3)=0$$

$$2x^2 - 19x + 24 = 0$$

If Roots of a quadratic equation are $\rightarrow \alpha, \beta$

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

$\div a$

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

Compare

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

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

Then $(x - \alpha)(x - \beta) = 0$

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

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

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

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

Roots का sum $\rightarrow 12$

Roots का Product $\rightarrow 35$

$$x^2 - 12x + 35 = 0$$

$$x^2 - 12x + 35 = 0$$

1. For equation $(2m-3)x^2 + (m+1)x + 5 = 0$ to represent a quadratic equation, which of the following must be definitely true?

यदि समीकरण $(2m-3)x^2 + (m+1)x + 5 = 0$ एक द्विघात समीकरण है, तो निम्नलिखित में से क्या सत्य होना चाहिए?

(RRB NTPC GRADUATE LEVEL CBT-1 2026)

[A] $m = -1$

[C] $m \neq 2$

[B] $m = \frac{-3}{2}$

[D] $m \neq \frac{3}{2}$

$a \neq 0$

$2m-3 \neq 0$

$m \neq \frac{3}{2}$

2. For the quadratic equation $7x^2 - 28x + 21 = 0$, what is the sum of the roots?

द्विघात समीकरण $7x^2 - 28x + 21 = 0$ के लिए मूलों का योगफल कितना है?

(RRB NTPC GRADUATE LEVEL CBT-1 2025) (RRB GROUP-D 2026)

[A] 4

[B] 5

[C] 2

[D] 3



$$\alpha + \beta = -\frac{b}{a} = -\frac{(-28)}{7} = 4$$

3. Find the sum of the roots of $\sqrt{2}x^2 - 2\sqrt{5}x + \sqrt{3} = 0$?

$\sqrt{2}x^2 - 2\sqrt{5}x + \sqrt{3} = 0$ के मूलों का योग ज्ञात करें?

(RRB GROUP-D 2022)

☒ [A] $\sqrt{10}$

☐ [C] $-\sqrt{10}$

[B] $5\sqrt{2}$

[D] $2\sqrt{5}$

$$\alpha + \beta = -\frac{(-2\sqrt{5})}{\sqrt{2}} = \sqrt{2} \times \sqrt{5}$$

4. What is the product of roots of $6 - 5x^2 - 8x = 0$?
द्विघात समीकरण $(6 - 5x^2 - 8x = 0)$ के मूलों का गुणनफल क्या होगा?

[RRB Group D-2022]

[A] $\frac{8}{5}$

[B] $\frac{6}{5}$

[C] $-\frac{6}{5}$ ✓

[D] $-\frac{8}{5}$

$$5x^2 + 8x - 6 = 0$$

$$\alpha \cdot \beta = \frac{c}{a} = -\frac{6}{5}$$

5. The product of the roots of the equation $a^2 - 5a + k = 10$ is -4 . Find the value of K ?
समीकरण $a^2 - 5a + k = 10$ के मूलों का गुणनफल -4 है। K का मान ज्ञात कीजिए?

[RRB Group D-2022]

[A] 6

[C] 4

[B] 5

[D] 7

$$1 \cdot a^2 - 5a + (k-10) = 0$$

$$\alpha \cdot \beta$$

$$\frac{k-10}{1} = -4$$

$$k = 6$$