

# SSC FOUNDATION



## सम्यान बैच

समय से तैयारी, समय से सफलता

# MATHEMATICS

## ALGEBRA (EQUATION)

सबसे सटीक, सबसे बेहतर

LIVE STREAM : 11:00 AM

BY - SHASHI SIR





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# ALGEBRA (बीजगणित) (CLASS-06) [Algebraic Identity]



**ALGEBRA**

Expression (अभिव्यक्ति)

$$x^2 - 4x + 4$$

Equation (समीकरण)

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



## Quadratic equation (द्विघात समीकरण)

A Quadratic equation is a polynomial equation With the highest power of the variable being two.

degree = 2  
द्विघात समीकरण एक बहुपद समीकरण है जिसमें चर की उच्चतम घात दो होती है।

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

EX-  $x^2 - 9 = 0$

$2x^2 + 7x + 6 = 0$  etc.

# Quadratic Equation Formula (द्विघात समीकरण सूत्र)

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

$$\frac{ax^2}{a} + \frac{bx}{a} + \frac{c}{a} = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \text{ जहाँ दो मूल (roots) } \Rightarrow \underline{\alpha} \text{ and } \underline{\beta} \text{ है।}$$

$$x^2 + \left(\frac{b}{a}\right)x + \left(\frac{c}{a}\right) = 0 \Rightarrow \alpha = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

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

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

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

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

$x^2 - (x + \beta) + x \cdot \beta = 0$  **⇒ If roots of  $ax^2 + bx + c = 0$  are  $\alpha$  and  $\beta$  then**

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



## Quadratic Equation Formula (द्विघात समीकरण सूत्र)

⇒ An equation which has two roots  $\alpha$  and  $\beta$  then quadratic equation is  $x^2 - (\alpha + \beta)x + \alpha.\beta = 0$

एक समीकरण के दो मूल  $\alpha$  और  $\beta$  है तो द्विघात समीकरण  $x^2 - (\alpha + \beta)x + \alpha.\beta = 0$  है।

↓  
α+β

↓  
α.β

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

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

$$\alpha = \frac{+7+1}{2 \times 1} = \textcircled{4}$$

$$\beta = \frac{7-1}{2} = \textcircled{3}$$

$$x^2 - 7x + 12 = 0$$

$$\begin{aligned} D &= b^2 - 4ac \\ &= (-7)^2 - 4 \times 12 \times 1 \\ &= 49 - 48 = \textcircled{1} \end{aligned}$$

$$\begin{aligned} D &> 0 \\ D &= 0 \\ D &< 0 \end{aligned}$$



$$D = 0$$

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

NATURE OF ROOTS (मूलों की प्रकृति)

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

$$D = \sqrt{25}$$

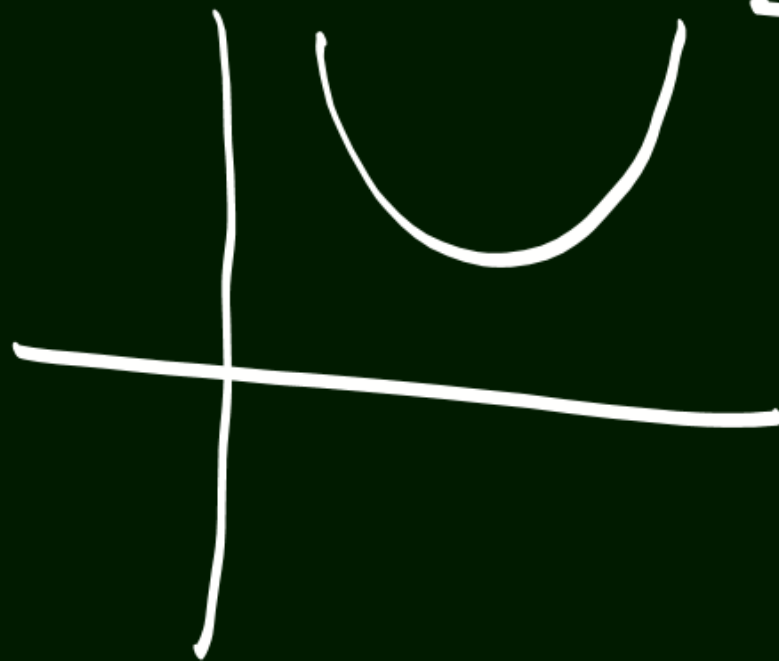
$$\frac{-b \pm \sqrt{D}}{2a}$$

$$\sqrt{27}$$

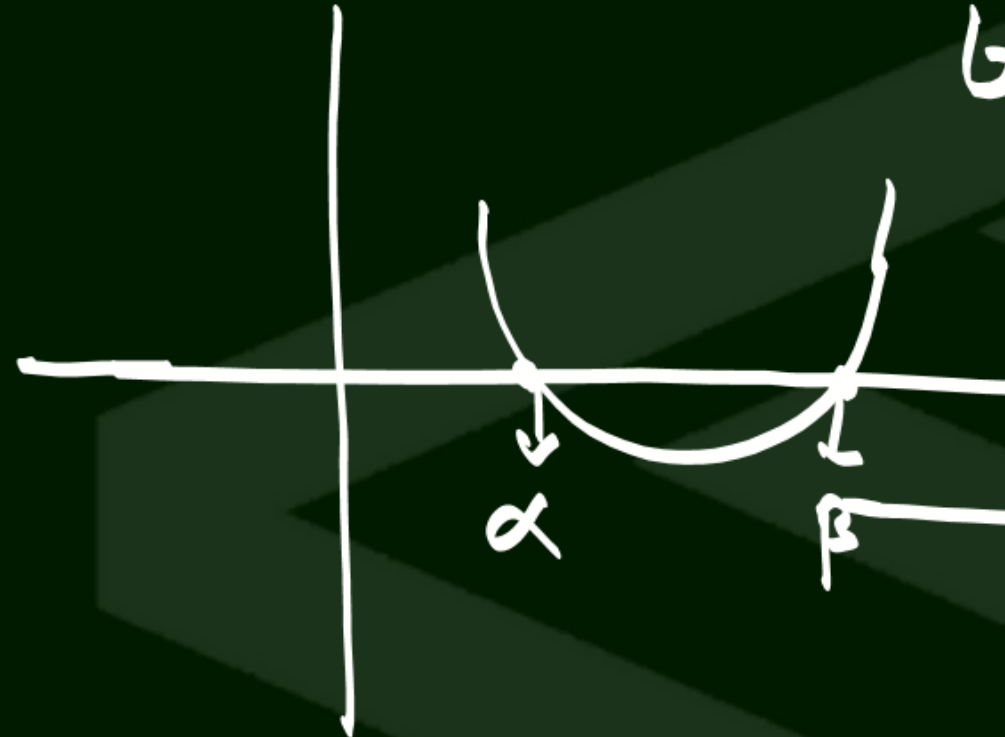
| Discriminant (D)<br>विविक्तकर                              | Nature of Roots<br>(मूलों की प्रकृति)                 | Roots (मूल)                              |
|------------------------------------------------------------|-------------------------------------------------------|------------------------------------------|
| $b^2 - 4ac = 0$                                            | Real, rational, equal<br>वास्तविक, परिमेय, समान       | $\frac{-b}{2a}, \frac{-b}{2a}$<br>$a+ib$ |
| $b^2 - 4ac > 0$<br>Perfect square (पूर्ण वर्ग)             | Real, rational, unequal<br>वास्तविक, परिमेय, असमान    | $\frac{-b \pm \sqrt{D}}{2a}$             |
| $b^2 - 4ac > 0$<br>not perfect square<br>(पूर्ण वर्ग न हो) | Real, irrational, unequal<br>वास्तविक, अपरिमेय, असमान | $\frac{-b \pm \sqrt{D}}{2a}$             |
| $b^2 - 4ac < 0$                                            | No real roots<br>काल्पनिक मूल (Imaginary)             | _____                                    |

Graph - :

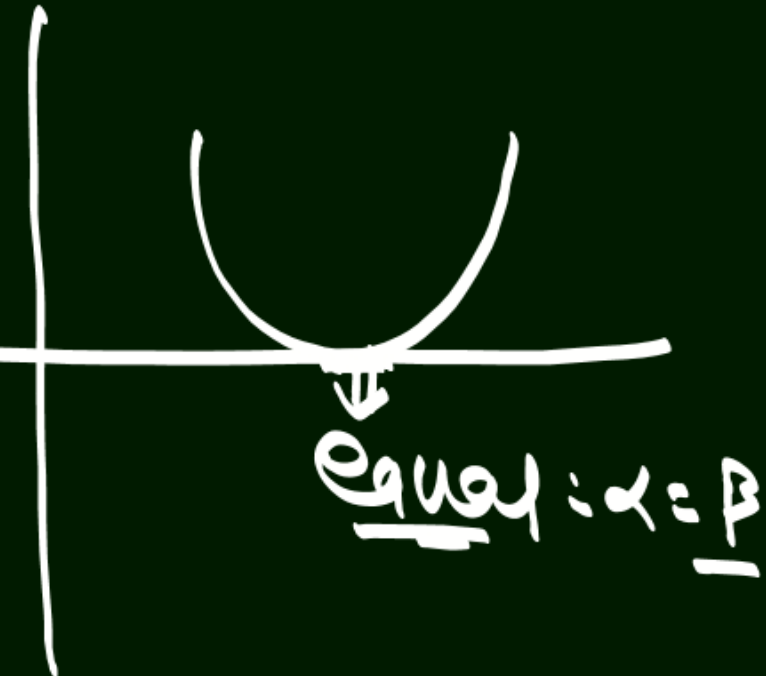
$$b^2 - 4ac < 0$$



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



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



Equal :  $\alpha = \beta$



1. Find the zeroes of all the following quadratic Expressions:

निम्नलिखित द्विघाती समीकरणों के शून्य बताओं

$$x^2 - 7x + 12 = 0$$

$$\begin{array}{c} \swarrow \searrow \\ 4 \times 3 \end{array}$$

$$x^2 - 4x - 3x + 12 = 0$$

$$x(x-4) - 3(x-4) = 0$$

$$(x-4)(x-3) = 0$$

$$x = 4$$

$$x = 3$$

$$\Rightarrow (a) x^2 - 7x + 12$$

$$\Rightarrow (b) x^2 - 7x + 6$$

$$\Rightarrow (c) a^2 + 10a + 16$$

$$\Rightarrow (d) y^2 + 10y + 21$$

H.W

$$\begin{array}{l} +4 \checkmark \\ +3 \checkmark \\ +6 \\ +1 \end{array}$$

2. निम्न में से द्विघाती समीकरण कौन-सी है?

$$x^2 - x + 4x - 4 = x^2 + 1$$

~~(a)  $x^{\frac{1}{2}} + 2x + 3 = 0$~~

~~(b)  $(x - 1)(x + 4) = x^2 + 1$~~

~~(c)  $x^4 - 3x + 5 = 0$~~

$$(d) \text{ ~~(2x+1)}~~ (3x-4) = 2x^2 + 3$$

$$6x^2 + 3x - 8x - 4 = 2x^2 + 3$$

$$4x^2$$



$$x^2 - (a+b)x + a \cdot b = 0$$

$$a + b = 24$$

$$a - b = 8$$

$$a = \frac{24+8}{2} = 16$$

$$b = \frac{24-8}{2} = 8$$

3.

यदि  $a$  और  $b$  किसी द्विघाती समीकरण के मूल इस प्रकार हैं कि  $(a + b) = 24$  और  $a - b = 8$  है तो वह समीकरण ज्ञात।

If,  $a, b$  are two roots of a quadratic equation such that  $a + b = 24$  and  $a - b = 8$ , then the quadratic equation having  $a$  and  $b$  as its root is?

~~(a)  $x^2 + 2x + 8 = 0$~~

✓ (b)  $2x^2 - 48x + 256 = 0$

~~(c)  $x^2 - 24x + 112 = 0$~~

~~(d)  $2x^2 + 8x + 9 = 0$~~

$$x^2 - 24x + 16 \times 8 = 0$$

$$2(x^2 - 24x + 128) = 0 \times 2$$

$$2x^2 - 48x + 256 = 0$$

$$x^2 - 6x + b = 0$$

$$\wedge$$

$$x + x = -\frac{b}{a} = \frac{6}{1}$$

$$2x = 6$$

$$x = 3$$

$$b = x^2 = 3^2 = 9$$

4. यदि समीकरण  $x^2 - 6x + b = 0$  के मूल समान हों तो  $b$  ज्ञात करें।

Find b, If the roots of the equation  $x^2 - 6x + b = 0$  are equal?

(a) 3

(b) 6

✓ (c) 9

(d) 12



$$\begin{array}{r} 1 = 4 \\ 7 = 28 \\ \swarrow \searrow \\ 3 : 4 \\ // \quad // \\ 12 \quad 16 \end{array}$$

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

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

$$P = \alpha \cdot \beta = 12 \times 16 = 192$$

5.

यदि समीकरण  $x^2 - 28x + P = 0$  के मूल 3 : 4 के अनुपात में है तो P का मान ज्ञात करें।

If the roots of the equation  $x^2 - 28x + P = 0$  are in the ratio 3 : 4

Find P?

- (a) 192
- (b) 144
- (c) 120
- (d) 96

$$x^2 - px + 10 = 0 \quad \alpha, \beta = 2$$

$$\alpha + \beta = 10$$

$$p = \alpha + \beta = 7$$

$$\alpha \times \beta = 10$$

$$\alpha = 5$$

$$x^2 - kx + 1 = 0$$

$$1 \times 1$$

$$k = \alpha + \beta = 1 + 1 = 8$$

6. यदि 2 समीकरण  $x^2 - px + 10 = 0$  का एक मूल है और 7 समीकरण  $x^2 - kx + P = 0$  एक मूल है तो  $k$  का मान ज्ञात करें।

If 2 is one root of  $x^2 - PX + 10 = 0$  and 7 is one root of  $x^2 - kx + p = 0$ , Find  $k = ?$

(a) 1

(b) - 8

~~(c) 8~~

(d) can't say



$$b = (\alpha + 2) = \frac{9\alpha}{2\alpha} = 4.5$$

$$\alpha = 2.5$$

7. यदि समीकरण  $ax^2 - bx + c = 0$  का एक मूल 2 रहे और  $a : b : c = 2 : 9 : 10$  है, तो दूसरा मूल ज्ञात करें।

If 2 is one root of  $ax^2 - bx + c = 0$  and  $a : b : c = 2 : 9 : 10$ , Find the other root?

(a) 4.5

✓ (b) 2.5

(c) 1.5

(d) N.O.T

$$\alpha + \beta = -\frac{b}{a} = \frac{9}{2} = 4.5$$

$$x^2 + ax + b = 0$$

$$\alpha \quad \alpha$$

$$\alpha + \alpha = -a$$

$$2\alpha = -9$$

$$\alpha = \frac{-9}{2} = -4.5$$

$$b = \alpha^2 = (-4.5)^2 = 20.25$$

$$x^2 + ax + 14 = 0$$

$$2 \times 7$$

$$a = \alpha + \beta = -9$$

8. यदि समीकरण  $x^2 + ax + b = 0$  के मूल समान हैं और समीकरण  $x^2 + ax + 14$  एक मूल 2 है, तो  $b$  का मान ज्ञात करें।

If the equation  $x^2 + 9x + b = 0$  has equal roots and 2 is one root of the equation  $x^2 + ax + 14$  find  $b$ ?

(a) 4.5

✓ (b) 20.25

(c) -20.25

(d) 81



$$x^2 - 14x + 11 = 0$$

$$a + b = 14$$

$$a \cdot b = 11$$

$$\begin{aligned} a^2 + b^2 &= (a + b)^2 - 2ab \\ &= 14^2 - 2 \times 11 \\ &= 196 - 22 \\ &= \underline{174} \end{aligned}$$

9. यदि  $a$  और  $b$  समीकरण  $x^2 - 14x + 11 = 0$  के मूल हैं, तो  $a^2 + b^2$  ज्ञात करें।

If  $a$  and  $b$  are the roots of the equation  $x^2 - 14x + 11 = 0$ , find  $a^2 + b^2$ ?

(a) 174

(b) 196

(c) 218

(d) N.O.T

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

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

$$\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha} = \frac{\alpha^3 + \beta^3}{\alpha \cdot \beta}$$

$$\frac{(\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)}{\alpha \cdot \beta} = \frac{-\frac{b^3}{a^3} - 3 \times \frac{c}{a} \times -\frac{b}{a}}{\frac{c}{a}}$$

$$\frac{-b^3 + 3abc}{a^2 \times \frac{c}{a}} = \frac{3abc - b^3}{a^2 c}$$

10. यदि समीकरण  $ax^2 + bx + c = 0$  के मूल  $\alpha$  और  $\beta$  हैं, तो  $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$  का मान ज्ञात करें।

If  $\alpha$  and  $\beta$  are the roots of the quadratic equation  $ax^2 + bx + c = 0$  then the

value of  $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$

(a)  $\frac{3bc - a^3}{b^2 - c}$

(b)  $\frac{3abc - b^3}{a^2 c}$

(c)  $\frac{3abc + b^3}{a^2 c}$

(d)  $\frac{ab - b^2 c}{2b^2 c}$



$$a + b = \frac{1}{1} = 1$$

$$a \cdot b = 1$$

$$a^3 + b^3 = (a+b)^3 - 3ab(a+b)$$

$$= 1 - 3 \times 1 \times 1 = -2$$

$$(ab)^3 = 1$$

$$\text{Q} = x^2 - (a+b)x + ab^3 = 0$$

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

11. यदि  $a$  तथा  $b$  समीकरण  $x^2 - x + 1 = 0$  के मूल हैं, तो किसी समीकरण के मूल  $a^3$  तथा  $b^3$  होंगे?

If  $a$  and  $b$  are the roots of equation  $x^2 - x + 1 = 0$ , then which equation will have roots  $a^3$  and  $b^3$ ?

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

**(b)  $x^2 - 2x - 1 = 0$**

(c)  $x^2 + 3x - 1 = 0$

(d)  $x^2 - 3x + 1 = 0$

$$a^2 + b^2 =$$

$$\downarrow$$

$$a^4 + b^4 =$$

$$\downarrow$$

$$a^8 + b^8 =$$

12. a तथा b द्विघात समीकरण  $x^2 - x - 1 = 0$  के मूल हैं। तो  $a^8 + b^8$  का मान क्या है?

a and b are the roots of the quadratic equation  $x^2 - x - 1 = 0$  what is the value of  $a^8 + b^8$ ?

(a) 47

(b) 54

(c) 59

(d) 68

H.W



## Maximum and minimum of quadratic equation (द्विघात समीकरण का महत्तम और न्यूनतम)

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

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

$$y \text{ का min या max. value} = -\frac{D}{4a} = \frac{4ac - b^2}{4a}$$



**Note:** किसी भी द्विघात समीकरण में एक ही value संभव है या तो maximum या तो minimum.

**Note -:** y का max या min value "x" के किस मान के लिए होगा तो  $x = \frac{-b}{2a}$

**Note-** यदि द्विघात समीकरण का एक मूल  $(\alpha) = a + \sqrt{b}$  हो तो दूसरा मूल  $(\beta) = a - \sqrt{b}$  होगा

## Max. and min.

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

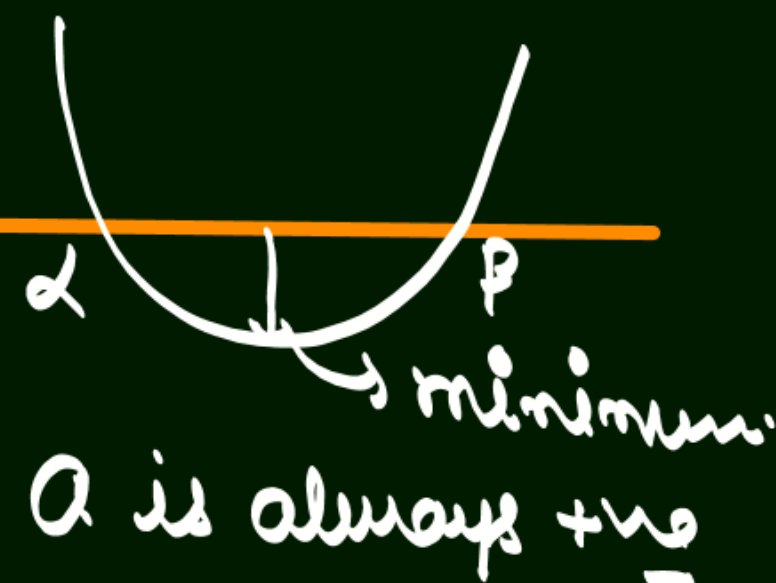
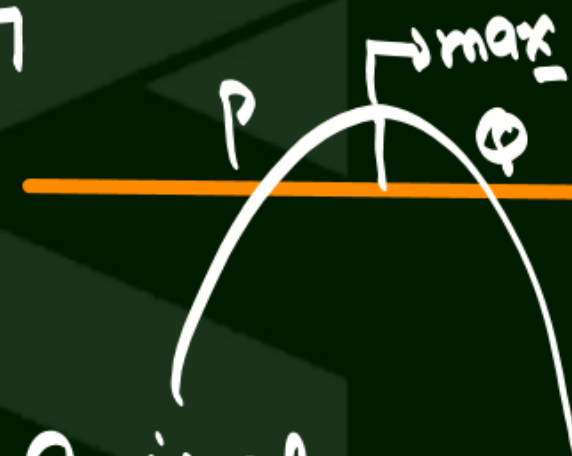
अदि  $a$   $\begin{matrix} +ve \\ \downarrow \\ \text{minimum} \\ \text{value} \end{matrix}$   $\begin{matrix} -ve \\ \downarrow \\ \text{maximum} \\ \text{value} \end{matrix}$

$x$  के किस मान के लिए  
function  $y$  का value  
max/min होगा

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

$$= \boxed{\frac{-b}{2a}}$$

$a$  is always  
-ve



$a$  is always +ve

\* function  $y$  का max/min value  
 $= \frac{4ac - b^2}{4a} = \boxed{\frac{-D}{4a}}$



13. P के किस मान के लिए  $p^2 - 4p + 5$  का मान न्यूनतम होगा?

$$p = -\frac{b}{2a} = \frac{4}{2 \times 1} = \frac{4}{2}$$

$$= 2$$

For what value of P will the value of  $p^2 - 4p + 5$  be minimum?

- a) 2
- b) 3
- c) 4
- d) -2

14.  $x$  के किस मान के लिए  $2x^2 - 48x + 3$  का मान न्यूनतम होगा?

For what value of  $x$  will the value of  $2x^2 - 48x + 3$  be minimum?

a) 24

☒ b) 12

c) 6

d) - 12

$$\frac{48}{4} = 12$$



15.  $X$  के किस मान पर  $(X - 3)(X - 7)$  का न्यूनतम मान ?  
For what value of  $X$  does  $(X - 3)(X - 7)$  attain its minimum value?

- a) 5
- b) -5
- c) 10
- d) -15

11.50  
—

16.  $2x^2 - 3x + 7$  का न्यूनतम संभव मान ज्ञात करें ।

Find the minimum possible value of  $2x^2 - 3x + 7$ .

- a)  $\frac{47}{8}$
- b)  $\frac{3}{2}$
- c)  $\frac{3}{4}$
- d)  $\frac{3}{8}$

$$\min = \frac{4ac - b^2}{4a} = \frac{4 \times 2 \times 7 - 9}{4 \times 2}$$

$$= \frac{56 - 9}{8} = \frac{47}{8}$$



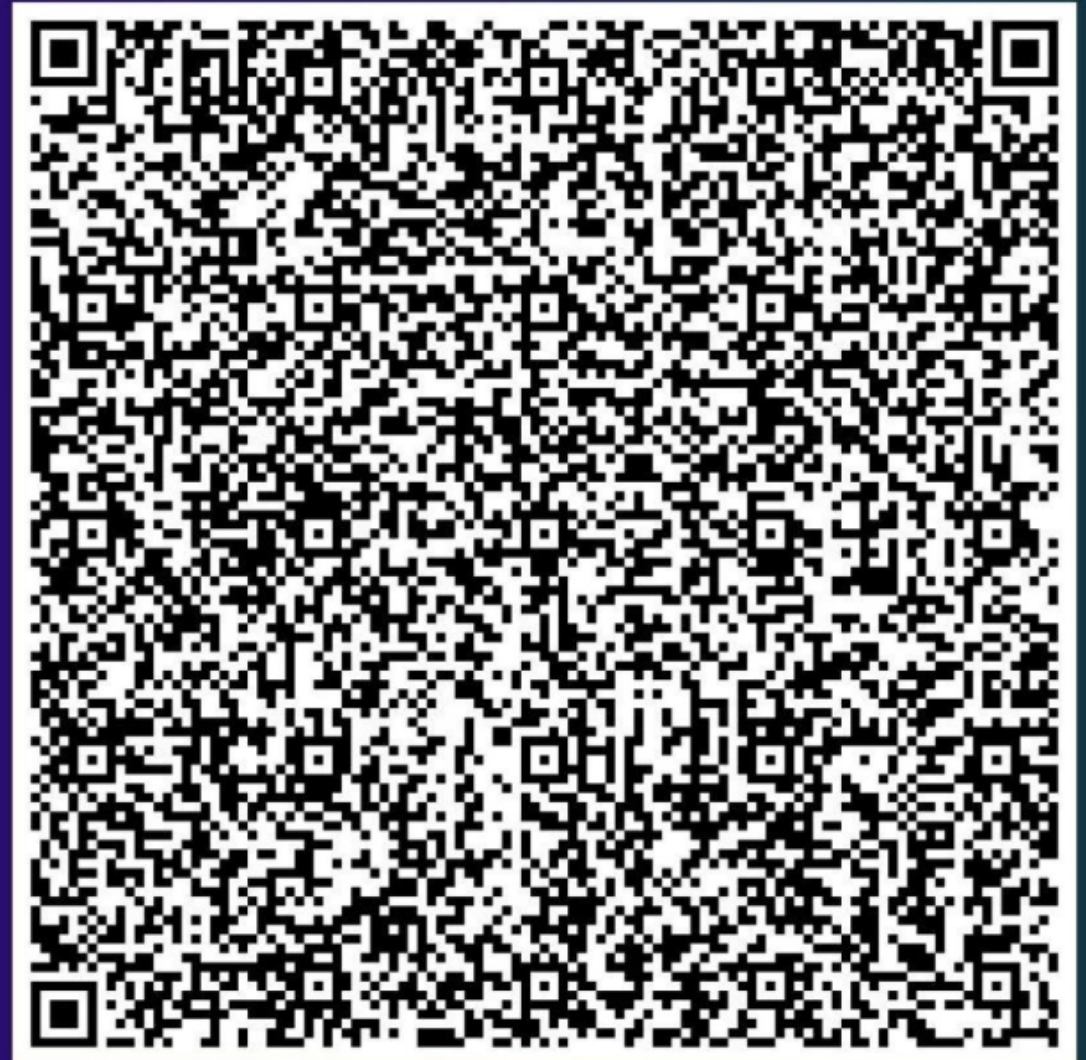
17.  $-x^2 + 7x - 12$  का अधिकतम संभव मान क्या होगा, यदि  $x$  एक वास्तविक संख्या है?

What is the maximum possible value of  $-x^2 + 7x - 12$ , if  $x$  is a real number?

- a) 4
- b) -4
- c)  $\frac{1}{4}$
- d)  $-\frac{1}{4}$

11.5

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