

QB365 QUESTION BANK SOFTWARE

10th Maths CBSE Important Case Study Questions for Quadratic Equations 2024

SECTION A

2 x 4 = 8

1) A quadratic equation can be defined as an equation of degree 2. This means that the highest exponent of the polynomial in it is 2. The standard form of a quadratic equation is $ax^2 + bx + c = 0$, where a , b , and c are real numbers and $a \neq 0$. Every quadratic equation has two roots depending on the nature of its discriminant, $D = b^2 - 4ac$. Based on the above information, answer the following questions.

(i) Which of the following quadratic equations have no real roots?

(a) $-4x^2 + 7x - 4 = 0$ (b) $-4x^2 + 7x - 2 = 0$

(c) $-2x^2 + 5x - 2 = 0$ (d) $3x^2 + 6x + 2 = 0$

(ii) Which of the following quadratic equations have rational roots?

(a) $x^2 + x - 1 = 0$ (b) $x^2 - 5x + 6 = 0$

(c) $4x^2 - 3x - 2 = 0$ (d) $6x^2 - x + 11 = 0$

(iii) Which of the following quadratic equations have irrational roots?

(a) $3x^2 + 2x + 2 = 0$ (b) $4x^2 - 7x + 3 = 0$

(c) $6x^2 - 3x - 5 = 0$ (d) $2x^2 + 3x - 2 = 0$

(iv) Which of the following quadratic equations have equal roots?

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

(c) $5x^2 - 10x + 1 = 0$ (d) $9x^2 + 6x + 1 = 0$

(v) Which of the following quadratic equations has two distinct real roots?

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

(c) $4x^2 + 8x + 4 = 0$ (d) $3x^2 + 6x + 4 = 0$

Answer : (i) (a): To have no real roots, discriminant ($D = b^2 - 4ac$) should be < 0 .

(a) $D = 7^2 - 4(-4)(-4) = 49 - 64 = -15 < 0$

(b) $D = 7^2 - 4(-4)(-2) = 49 - 32 = 17 > 0$

(c) $D = 5^2 - 4(-2)(-2) = 25 - 16 = 9 > 0$

(d) $D = 6^2 - 4(3)(2) = 36 - 24 = 12 > 0$

(ii) (b): To have rational roots, discriminant ($D = b^2 - 4ac$) should be > 0 and also a perfect square

(a) $D = 1^2 - 4(1)(-1) = 1 + 4 = 5$, which is not a perfect square.

(b) $D = (-5)^2 - 4(1)(6) = 25 - 24 = 1$, which is a perfect square.

(c) $D = (-3)^2 - 4(4)(-2) = 9 + 32 = 41$, which is not a perfect square.

(d) $D = (-1)^2 - 4(6)(11) = 1 - 264 = -263$, which is not a perfect square.

(iii) (c) : To have irrational roots, discriminant ($D = b^2 - 4ac$) should be > 0 but not a perfect square.

(a) $D = 2^2 - 4(3)(2) = 4 - 24 = -20 < 0$

(b) $D = (-7)^2 - 4(4)(3) = 49 - 48 = 1 > 0$ and also a perfect square.

(c) $D = (-3)^2 - 4(6)(-5) = 9 + 120 = 129 > 0$ and not a perfect square.

(d) $D = 3^2 - 4(2)(-2) = 9 + 16 = 25 > 0$ and also a perfect square.

(iv) (d): To have equal roots, discriminant ($D = b^2 - 4ac$) should be $= 0$.

(a) $D = (-3)^2 - 4(1)(4) = 9 - 16 = -7 < 0$

(b) $D = (-2)^2 - 4(2)(1) = 4 - 8 = -4 < 0$

(c) $D = (-10)^2 - 4(5)(1) = 100 - 20 = 80 > 0$

(d) $D = 6^2 - 4(9)(1) = 36 - 36 = 0$

(v) (a): To have two distinct real roots, discriminant ($D = b^2 - 4ac$) should be > 0 .

(a) $D = 3^2 - 4(1)(1) = 9 - 4 = 5 > 0$

(b) $D = 3^2 - 4(-1)(-3) = 9 - 12 = -3 < 0$

(c) $D = 8^2 - 4(4)(4) = 64 - 64 = 0$

(d) $D = 6^2 - 4(3)(4) = 36 - 48 = -12 < 0$

2) Raj and Ajay are very close friends. Both the families decide to go to Ranikhet by their own cars. Raj's car travels at a speed of x km/h while Ajay's car travels 5 km/h faster than Raj's car. Raj took 4 h more than Ajay to complete the journey of 400 km.



- (i) What will be the distance covered by Ajay's car in 2 h?
 (a) $2(x + 5)$ km (b) $(x - 5)$ km
 (c) $2(x + 10)$ km (d) $(2x + 5)$ km
- (ii) Which of the following quadratic equation describe the speed of Raj's car?
 (a) $x^2 - 5x - 500 = 0$ (b) $x^2 + 4x - 400 = 0$
 (c) $x^2 + 5x - 500 = 0$ (d) $x^2 - 4x + 400 = 0$
- (iii) What is the speed of Raj's car?
 (a) 20 km/h (b) 15 km/h
 (c) 25 km/h (d) 10 km/h
- (iv) How much time took Ajay to travel 400 km?
 (a) 20 h (b) 40 h
 (c) 25 h (d) 16 h

Answer : (i) (a) Since, Ajay's car travels a distance in one hour is $(x + 5)$ km. Therefore, Ajay's car travels a distance two hours is $2(x + 5)$ km.

(ii) (c) $\therefore \text{Time} = \frac{\text{Distance}}{\text{Speed}}$

Time taken by Ajay and Raj to complete the 400 km journey,

$$t_1 = \frac{400}{x+5} \text{ h}$$

$$\text{and } t_2 = \frac{400}{x} \text{ h}$$

According to the question,

$$t_2 = t_1 + 4$$

$$\therefore \frac{400}{x} = \frac{400}{x+5} + 4$$

$$\Rightarrow \frac{100}{x} = \frac{100}{x+5} + 1 \text{ [dividing by 4]}$$

$$\Rightarrow 100(x + 5) = 100x + x(x + 5)$$

$$\Rightarrow 100x + 500 = 100x + x^2 + 5x$$

$$\Rightarrow x^2 + 5x - 500 = 0$$

(iii) (a) Consider the quadratic equation $x^2 + 5x - 500 = 0$

On comparing with $ax^2 + bx + c = 0$, we get

$a = 1$, $b = 5$ and $c = -500$

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

$$= \frac{-5 \pm \sqrt{(5)^2 - 4 \times (1)(-500)}}{2 \times 1}$$

$$= \frac{-5 \pm \sqrt{25 + 2000}}{2} = \frac{-5 \pm \sqrt{2025}}{2}$$

$$= \frac{-5 \pm 45}{2} = \frac{-50}{2}, \frac{40}{2} = -25, 20$$

Since, speed cannot be negative, so we consider only $x = 20$.

Hence, the speed of Raj's car is 20 km/h.

(iv) (d) To travel 400 km, time taken by Ajay

$$t_1 = \frac{400}{(x + 5)}$$

$$= \frac{400}{20 + 5} = \frac{400}{25} = 16 \text{ h}$$