Exercise 4.1

Question 1:

Check whether the following are quadratic equations:

(i) $(x+1)^2 = 2(x-3)$ (ii) $x^2 - 2x = (-2)(3-x)$

(iii) $(x-2)(x+1) = (x-1)(x+3)$ (iv) $(x-3)(2x+1) = x(x+5)$

(v) $(2x-1)(x-3) = (x+5)(x-1)$ (vi) $x^2 + 3x + 1 = (x-2)^2$

(vii) $(x+2)^3 = 2x(x^2-1)$ (viii) $x^3 - 4x^2 - x + 1 = (x-2)^3$

Answer :

(i) $(x+1)^2 = 2(x-3) \Rightarrow x^2 + 2x + 1 = 2x - 6 \Rightarrow x^2 + 7 = 0$

It is of the form $ax^2 + bx + c = 0$.

Hence, the given equation is a quadratic equation.

(ii) $x^2 - 2x = (-2)(3-x) \Rightarrow x^2 - 2x = -6 + 2x \Rightarrow x^2 - 4x + 6 = 0$

It is of the form $ax^2 + bx + c = 0$.

Hence, the given equation is a quadratic equation.

(iii) $(x-2)(x+1) = (x-1)(x+3) \Rightarrow x^2 - x - 2 = x^2 + 2x - 3 \Rightarrow 3x - 1 = 0$

It is not of the form $ax^2 + bx + c = 0$.

Hence, the given equation is not a quadratic equation.

(iv) $(x-3)(2x+1) = x(x+5) \Rightarrow 2x^2 - 5x - 3 = x^2 + 5x \Rightarrow x^2 - 10x - 3 = 0$

It is of the form $ax^2 + bx + c = 0$.

Hence, the given equation is a quadratic equation.

(v) $(2x-1)(x-3) = (x+5)(x-1) \Rightarrow 2x^2 - 7x + 3 = x^2 + 4x - 5 \Rightarrow x^2 - 11x + 8 = 0$

It is of the form $ax^2 + bx + c = 0$

Hence, the given equation is a quadratic equation.

(vi) $x^2 + 3x + 1 = (x-2)^2 \Rightarrow x^2 + 3x + 1 = x^2 + 4 - 4x \Rightarrow 7x - 3 = 0$

It is not of the form $ax^2 + bx + c = 0$.

Hence, the given equation is not a quadratic equation.

(vii) $(x+2)^3 = 2x(x^2-1) \Rightarrow x^3 + 8 + 6x^2 + 12x = 2x^3 - 2x \Rightarrow x^3 - 14x - 6x^2 - 8 = 0$

It is not of the form $ax^2 + bx + c = 0$

Hence, the given equation is not a quadratic equation.

(viii) $x^3-4x^3-x+1=(x-2)^3 \Rightarrow x^3-4x^2-x+1=x^3-8-6x^2+12x \Rightarrow 2x^2-13x+9=0$

It is of the form $ax^2+bx+c=0$

Hence, the given equation is a quadratic equation.

Question 2 :

Represent the following situations in the form of quadratic equations.

(i) The area of a rectangular plot is 528 m². The length of the plot (in metres) is one more than twice its breadth. We need to find the length and breadth of the plot.

(ii) The product of two consecutive positive integers is 306. We need to find the integers.

(iii) Rohan's mother is 26 years older than him. The product of their ages (in years) 3 years from now will be 360. We would like to find Rohan's present age.

(iv) A train travels a distance of 480 km at a uniform speed. If the speed had been 8 km/h less, then it would have taken 3 hours more to cover the same distance. We need to find the speed of the train.

Answer :

(i) Let the breadth of the plot be x m.

Hence, the length of the plot is $(2x + 1)$ m.

Area of a rectangle = Length x Breadth

$\therefore 528 = x(2x + 1)$

$\Rightarrow 2x^2+x-528=0$

(ii) Let the consecutive integers be x and $x + 1$.

It is given that their product is 306.

$\therefore x(x+1)=306 \Rightarrow x^2+x-306=0$

(iii) Let Rohan's age be x.

Hence, his mother's age = $x + 26$

3 years hence,

Rohan's age = $x + 3$

Mother's age = $x + 26 + 3 = x + 29$

It is given that the product of their ages after 3 years is 360.

$\therefore (x+3)(x+29)=360$

$\Rightarrow x^2+32x-273=0$

(iv) Let speed of the train = x km/h

Total distance to be covered = 480 km

$$\text{Time} = \frac{\text{distance}}{\text{speed}} = \frac{480}{x}$$

Decreased speed of the train = $(x - 8)$ km/h

Now, $$\text{Time} = \frac{480}{x-8}$$

According to question,

$$\frac{480}{x-8} - \frac{480}{x} = 3 \quad \Rightarrow \quad 480\left[\frac{1}{x-8} - \frac{1}{x}\right] = 3$$

$$\Rightarrow \quad 480\left[\frac{x-x+8}{x(x-8)}\right] = 3 \quad \Rightarrow \quad 480 \times 8 = 3x\,(x-8)$$

$$\Rightarrow \quad 3840 = 3x^2 - 24x \quad \Rightarrow \quad 3x^2 - 24x - 3840 = 0$$

$$\Rightarrow \quad x^2 - 8x - 1280 = 0$$

Which is the required quadratic equation.