EXERCISE 4.1

Question 1:

Check whether the following are quadratic equations:

(i) $(x+1)^2=2(x-3)$
(ii) $x - 2x = (-2)(3-x)$
(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) $x^3 - 4x^2 - x + 1 = (x-2)^3$

Solution:

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

$\Rightarrow x^2 + 1 + 2x = 2x - 6$

$\Rightarrow x^2 + 1 + 2x - 2x + 1 = 0$

$\Rightarrow x^2 + 7 = 0$

As the highest power of x is 2, so the given equation is **quadratic.**

(ii) Given: $x^2 - 2x = (-2)(3 - x)$

$\Rightarrow x^2 - 2x = -6 + 2x$

$\Rightarrow x^2 - 4x + 6 = 0$

As the highest power of x is 2, so the given equation is **quadratic.**

(iii) Given: $(x - 2)(x + 1) = (x - 1)(x + 3)$

$\Rightarrow x^2 - 2x + x - 2 = x^2 - x + 3x - 3$

$\Rightarrow x^2 - x - 2 = x^2 + 2x - 3$

$\Rightarrow 3x - 1 = 0$

As the highest power of x is 2, so the given equation is **quadratic.**

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

$\Rightarrow 2x^2 - 6x + x - 3 = x^2 + 5x$

$\Rightarrow x^2 - 10x - 3 = 0$

As the highest power of x is 2, so the given equation is **quadratic.**

(v) Given: (2x-1)(x-3) = (x + 5)(x-1)

$\Rightarrow 2x^2 - 6x - x + 3 = x^2 + 5x - x - 5$

$\Rightarrow x^2 - 11x + 8 = 0$

As the highest power of x is 2, so the given equation is **quadratic.**.

(vi) Given: $x^2 + 3x + 1 = (x - 2)^2$

$\Rightarrow x^2 + 3x + 1 = x^2 + 4 - 4x$

$\Rightarrow 7x - 3 = 0$

As the highest power of x is 1, so the given equation is **not quadratic.**

Question 2:

Represent the following situations in the form of quadratic equations:

(i) The area of a rectangular plot is 528 m^2. 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.

Solution:

(i) Let breadth of the rectangular plot = x m

Then, length of the plot = (2x + 1)m

Area of a rectangular plot = l x b ,

$\Rightarrow 528 (2x + 1)x$

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

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

Which is the required quadratic equation.

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

Solution:

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

Then, x(x+l) = 306

$\Rightarrow x^2 + x - 306 = 0$

Which is the required quadratic equation.

(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.

Solution:

(iii) Let the present age of Rohan = x years

Rohan's mother's present age = (x + 26) years

After 3 years, Rohan's age = (x + 3) years

After 3 years, Rohan's mother's age = (x + 26 + 3) years

According to question,

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

$\Rightarrow x^2 + 29x + 3x + 87 - 360 = 0$

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

Which is the required quadratic equation.

(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.

Solution:

(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.