Mathematics

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(Chapter 4) (Quadratic Equations)
(Class 10)
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 1:

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

Simplifying the given equation, we get

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

or $x^2 + 0x + 7 = 0$

This is an equation of type $ax^2 + bx + c = 0$.

Hence, the given equation is a quadratic equation.

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

Simplifying the given equation, we get

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

or $x^2 - 4x + 6 = 0$

This is an equation of type $ax^2 + bx + c = 0$.

Hence, the given equation is a quadratic equation.

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

Simplifying the given equation, we get

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

or $3x - 1 = 0$

This is not an equation of type $ax^2 + bx + c = 0$.

Hence, the given equation is not a quadratic equation.

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

Simplifying the given equation, we get

$(x-3)(2x+1) = x(x+5) \Rightarrow 2x^2 - 6x + x - 3 = x^2 + 5x \Rightarrow x^2 - 10x - 3 = 0$

or $x^2 - 10x - 3 = 0$

This is an equation of type $ax^2 + bx + c = 0$.

Hence, the given equation is a quadratic equation.

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

Simplifying the given equation, we get

$(2x-1)(x-3) = (x+5)(x-1) \Rightarrow 2x^2 - x - 6x + 3 = x^2 + 5x - x - 5 \Rightarrow x^2 - 11x + 8 = 0$

or $x^2 - 11x + 8 = 0$

This is an equation of type $ax^2 + bx + c = 0$.

Hence, the given equation is a quadratic equation.

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

Simplifying the given equation, we get

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

or $7x - 3 = 0$

This is not an equation of type $ax^2 + bx + c = 0$.

Hence, the given equation is not a quadratic equation.

(vii) $(x+2)^3 = 2x(x^2-1)$
Simplifying the given equation, we get
$(x+2)^3 = 2x(x^2-1) \Rightarrow x^3+6x^2+12x+8 = 2x^3-2x \Rightarrow -x^3+6x^2+14x+8=0$
or $x^3-6x^2-14x-8=0$
This is not an equation of type $ax^2+bx+c=0$.
Hence, the given equation is not a quadratic equation.

(viii) $x^3-4x^2-x+1=(x-2)^3$
Simplifying the given equation, we get
$x^3-4x^2-x+1=(x-2)^3 \Rightarrow x^3-4x^2-x+1=x^3-6x^2+12x-8 \Rightarrow 2x^2-13x+9=0$
or $2x^2-13x+9=0$
This is an equation of type $ax^2+bx+c=0$.
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 2:

(i) Let, the breadth of plot = x m, therefore, the length of plot = $2x+1$ m
Hence, area = $x(2x+1)$ m^2
According to questions, $x(2x+1)=528 \Rightarrow 2x^2+x=528 \Rightarrow 2x^2+x-528=0$
Hence, the length and breadth of plot satisfies the equation $2x^2+x-528=0$.

(ii) Let the first integer = x, therefore, the second integer = $x+1$
Hence, the product = $x(x+1)$
According to questions, $x(x+1)=306 \Rightarrow x^2+x=306 \Rightarrow x^2+x-306=0$
Hence, the two consecutive integers satisfies the quadratic equation $x^2+x-306=0$.

(iii) Let, Rohan's age = x years, therefore, mother's age = $x+26$ years
After three years, Rohan's age = $x+3$ years and mother's age = $x+29$ years
Hence, the product of ages = $(x+3)(x+29)$ years
According to questions,
$(x+3)(x+29)=360 \Rightarrow x^2+3x+29x+87=360 \Rightarrow x^2+32x-273=0$
Hence, the age of Rohan satisfies the quadratic equation $x^2+x-306=0$.

(iv) Let the speed of train = x km/h, total distance = 480 km
Therefore, time taken = $\frac{480}{x}$ hours
If the speed had been 8 km/h less, then time taken = $\frac{480}{x-8}$ hours
According to questions,
$$\frac{480}{x-8}-\frac{480}{x}=3 \Rightarrow \frac{480x-480(x-8)}{(x-8)x}=3$$
$\Rightarrow 480x-480x+3640=3(x-8)x$
$\Rightarrow 3640=3x^2-24x \Rightarrow 3x^2-24x-3640=0$
Hence, the speed of train satisfies the quadratic equation $3x^2-24x-3640=0$.