

Mathematics

Quadratic Equations

ADDITIONAL EXAMPLES

Check whether the following equation is a quadratic equation:

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

Soln: $-x^2 - 2x = -6 + 2x$
 $x^2 - 2x + 6 - 2x = 0$
 $x^2 - 4x + 6 = 0$

The above eqn is of the form

$ax^2 + bx + c = 0$ Hence, the given eqn is a quadratic eqn.

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

$2x^2 - x - 6x + 3 = x^2 + 5x - x - 5$
 $2x^2 - 7x + 3 = x^2 + 4x - 5$
 $x^2 - 11x + 8 = 0$

The above eqn is of the form

$ax^2 + bx + c = 0$ Hence, the given eqn is a quadratic eqn.

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

Soln: - Consider L.H.S
 $(x + 2)^3 = x^3 + 6x^2 + 12x + 8$

Consider R.H.S

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

The above eqn is not of the form $ax^2 + bx + c = 0$ Hence, the given eqn is not a quadratic eqn.

Exercise- 4.1

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.

(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.

Soln:-

1) Let the breadth of the rectangular plot be x meters

Therefore the area of the rectangular plot =
 = Length x Breadth = $(2x+1)x \text{ m}^2$

According to the problem Situation

$(2x+1)x = 528$
 $2x^2 + x = 528$
 $2x^2 + x - 528 = 0$

Therefore the breadth of the rectangular plot satisfies the quadratic equation

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

2) Let the consecutive positive integers be x and $x+1$

Then their product = $x(x+1)$

According to the problem situation

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

Therefore, the smaller positive integer satisfies the quadratic equation

$x^2 + x - 306 = 0$

3) Let Rohans presents age be x years

Then present age of Rohans mother = $(x+26)$ years

3 years from now, age of Rohan = $(x + 3)$ years

Age of Rohans mother = $(x + 26 + 3)$ years

Therefore, the product of their ages 3 years from now = $(x + 3)(x + 29)$

According to the problem situation

$(x + 3)(x + 29) = 360$
 $x^2 + 29x + 3x + 87 = 360$
 $x^2 + 32x - 273 = 0$

Therefore, Rohans present age satisfies the quadratic equation $x^2 + 32x - 273 = 0$

4) Let the uniform speed of the train be x km/hour Then time taken by the train to cover a distance of 480 km = $\frac{480}{x}$ hours

$$\left(\text{Time} = \frac{\text{Distance}}{\text{Speed}} \right)$$

If the Speed had been 8 km/h less. Then the speed of the train = $(x-8)$ km/h

Therefore, Time taken by the train to cover a distance of 480 km now = $\frac{480}{x-8}$ hours

$$\left(\text{Time} = \frac{\text{Distance}}{\text{Speed}} \right)$$

According to the problem Situation

$= \frac{480}{x-8} = \frac{480}{x} + 3$
 $= \frac{480}{x-8} - \frac{480}{x} + 3$

$\Rightarrow 480 \left(\frac{1}{x-8} - \frac{1}{x} \right) = 3$

$\frac{1}{x-8} - \frac{1}{x} = \frac{3}{480}$
 $\frac{x - (x-8)}{(x-8)x} = \frac{1}{160}$

(Contd.....)