

Mathematics

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(Chapter 4) (Quadratic Equations)

(Class 10)

Exercise 4.2

Question 1:

Find the roots of the following quadratic equations by factorisation:

(i). $x^2 - 3x - 10 = 0$

(ii). $2x^2 + x - 6 = 0$

(iii). $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$

(iv). $2x^2 - x + \frac{1}{8} = 0$

(v). $100x^2 - 20x + 1 = 0$

Answer 1:

(i) $x^2 - 3x - 10 = 0$

Solving the quadratic equation, we get

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

$$\Rightarrow x^2 - 5x + 2x + 10 = 0$$

$$\Rightarrow x(x - 5) + 2(x - 5) = 0$$

$$\Rightarrow (x - 5)(x + 2) = 0$$

$$\Rightarrow (x - 5) = 0 \text{ or } (x + 2) = 0$$

Either $x = 5$ or $x = -2$

Hence, the roots of the given quadratic equation are 5 and -2.

(ii) $2x^2 + x - 6 = 0$

Solving the quadratic equation, we get

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

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

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

$$\Rightarrow (x - 2) = 0 \text{ or } (2x + 3) = 0$$

Either $x = 2$ or $x = -\frac{3}{2}$

Hence, the roots of the given quadratic equation are 2 and $-\frac{3}{2}$.

(iii) $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$

Solving the quadratic equation, we get

$$\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$$

$$\Rightarrow \sqrt{2}x^2 + 5x + 2x + 5\sqrt{2} = 0$$

$$\Rightarrow x(\sqrt{2}x + 5) + \sqrt{2}(\sqrt{2}x + 5) = 0$$

$$\Rightarrow (\sqrt{2}x + 5)(x + \sqrt{2}) = 0$$

$$\Rightarrow (\sqrt{2}x + 5) = 0 \text{ or } (x + \sqrt{2}) = 0$$

Either $x = -\frac{5}{\sqrt{2}}$ or $x = -\sqrt{2}$

Hence, the roots of the given quadratic equation are $-\frac{5}{\sqrt{2}}$ and $-\sqrt{2}$.

(iv) $2x^2 - x + \frac{1}{8} = 0$

Solving the quadratic equation, we get

$$16x^2 - 8x + 1 = 0$$

$$\Rightarrow 16x^2 - 4x - 4x + 1 = 0$$

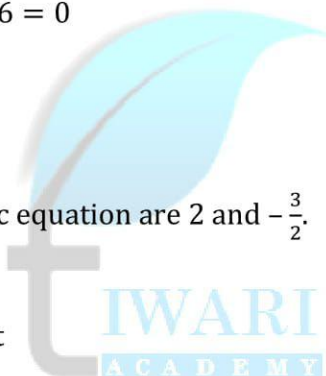
$$\Rightarrow 4x(4x - 1) - 1(4x - 1) = 0$$

$$\Rightarrow (4x - 1)(4x - 1) = 0$$

$$\Rightarrow (4x - 1) = 0 \text{ or } (4x - 1) = 0$$

Either $x = \frac{1}{4}$ or $x = \frac{1}{4}$

Hence, the roots of the given quadratic equation are $\frac{1}{4}$ and $\frac{1}{4}$.



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(v) $100x^2 - 20x + 1 = 0$

Solving the quadratic equation, we get,

$$100x^2 - 20x + 1 = 0$$

$$\Rightarrow 100x^2 - 10x - 10x + 1 = 0$$

$$\Rightarrow 10x(10x - 1) - 10(10x - 1) = 0$$

$$\Rightarrow (10x - 1)(10x - 1) = 0$$

$$\Rightarrow (10x - 1) = 0 \text{ or } (10x - 1) = 0$$

$$\text{Either } x = \frac{1}{10} \text{ or } x = \frac{1}{10}$$

Hence, the roots of the given quadratic equation are $\frac{1}{10}$ and $\frac{1}{10}$.

Question 2:

Solve the problems given in Example 1. [The problems given in the example 1 are $x^2 - 45x + 324 = 0$ and $x^2 - 55x + 750 = 0$.]

Answer 2:

$$x^2 - 45x + 324 = 0$$

Solving the quadratic equation, we get, $x^2 - 45x + 324 = 0$

$$\Rightarrow x^2 - 36x - 9x + 324 = 0$$

$$\Rightarrow x(x - 36) - 9(x - 36) = 0$$

$$\Rightarrow (x - 36)(x - 9) = 0$$

$$\Rightarrow (x - 36) = 0 \text{ or } (x - 9) = 0$$

$$\text{Either } x = 36 \text{ or } x = 9$$

Hence, John and Jivanti have 36 and 9 marbles respectively in the beginning.

$$x^2 - 55x + 750 = 0$$

Solving the quadratic equation, we get

$$x^2 - 55x + 750 = 0$$

$$\Rightarrow x^2 - 30x - 25x + 750 = 0$$

$$\Rightarrow x(x - 30) - 25(x - 30) = 0$$

$$\Rightarrow (x - 30)(x - 25) = 0$$

$$\Rightarrow (x - 30) = 0 \text{ or } (x - 25) = 0$$

$$\text{Either } x = 30 \text{ or } x = 25$$

Hence, the number of toys on that day was 30 or 25.

Question 3:

Find two numbers whose sum is 27 and product is 182.

Answer 3:

Let the first number = x

Therefore, the second number = $27 - x$

According to question,

$$\text{Product} = x(27 - x) = 182$$

$$\Rightarrow 27x - x^2 = 182$$

$$\Rightarrow x^2 - 27x + 182 = 0$$

$$\Rightarrow x^2 - 13x - 14x + 182 = 0$$

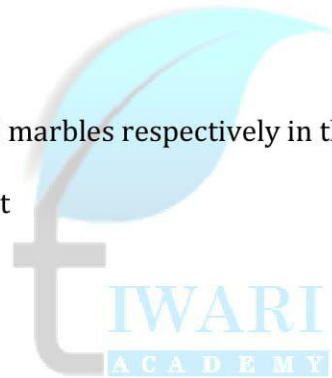
$$\Rightarrow x(x - 13) - 14(x - 13) = 0$$

$$\Rightarrow (x - 13)(x - 14) = 0$$

$$\Rightarrow (x - 13) = 0 \text{ or } (x - 14) = 0$$

$$\text{Either } x = 13 \text{ or } x = 14$$

Hence, the two required numbers are 13 and 14.



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Question 4:

Find two consecutive positive integers, sum of whose squares is 365.

Answer 4:

Let the first number = x , Therefore, the second number = $x + 1$

According to questions, $x^2 + (x + 1)^2 = 365$

$$\Rightarrow x^2 + x^2 + 2x + 1 = 365 \quad \Rightarrow 2x^2 + 2x - 364 = 0$$

$$\Rightarrow x^2 + x - 182 = 0 \quad \Rightarrow x^2 - 13x + 14x + 182 = 0$$

$$\Rightarrow x(x - 13) + 14(x - 13) = 0 \quad \Rightarrow (x - 13)(x + 14) = 0$$

$$\Rightarrow (x - 13) = 0 \text{ or } (x + 14) = 0 \Rightarrow \text{Either } x = 13 \text{ or } x = -14$$

Hence, the two consecutive positive integers are 13 and 14.

Question 5:

The altitude of a right triangle is 7 cm less than its base. If the hypotenuse is 13 cm, find the other two sides.

Answer 5:

Let the base = x cm Therefore, the height = $x - 7$ cm

Given that: Hypotenuse = 13 cm

Using Pythagoras theorem, $x^2 + (x - 7)^2 = 13^2$

$$\Rightarrow x^2 + x^2 - 14x + 49 = 169 \quad \Rightarrow 2x^2 - 14x - 120 = 0$$

$$\Rightarrow x^2 - 7x - 60 = 0 \quad \Rightarrow x^2 - 12x + 5x - 60 = 0$$

$$\Rightarrow x(x - 12) + 5(x - 12) = 0 \quad \Rightarrow (x - 12)(x + 5) = 0$$

$$\Rightarrow (x - 12) = 0 \text{ or } (x + 5) = 0$$

Either $x = 12$ or $x = -5$

But $x \neq -5$, as x is side of triangle.

Therefore, $x = 12$ and the second side = $x - 7 = 12 - 7 = 5$

Hence, the other two sides are 5 cm and 12 cm.

Question 6:

A cottage industry produces a certain number of pottery articles in a day. It was observed on a particular day that the cost of production of each article (in rupees) was 3 more than twice the number of articles produced on that day. If the total cost of production on that day was ₹90, find the number of articles produced and the cost of each article.

Answer 6:

Let, the number of article = x

Therefore, the cost of one article = $2x + 3$

According to question, the total cost = $x(2x + 3) = 90$

$$\Rightarrow 2x^2 + 3x = 90$$

$$\Rightarrow 2x^2 + 3x - 90 = 0$$

$$\Rightarrow 2x^2 + 15x - 12x - 90 = 0$$

$$\Rightarrow x(2x + 15) - 6(2x + 15) = 0$$

$$\Rightarrow (2x + 15)(x - 6) = 0$$

$$\Rightarrow (2x + 15) = 0 \text{ or } (x - 6) = 0$$

Either $x = -\frac{15}{2}$ or $x = 6$

But, $x \neq -\frac{15}{2}$, as x is number of articles.

Therefore, $x = 6$ and the cost of each article = $2x + 3 = 2 \times 6 + 3 = 15$

Hence, the number of articles = 6 and the cost of each article is ₹15.