QUADRATIC EQUATIONS

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10^{th} Maths - Chapter 4

This is Problem-2.1 from Exercise 4.2

1. Represent the following situations mathematically: (i) John and Jivanti together have 45 marbles. Both of them lost 5 marbles each, and the product of the number of marbles they now have is 124. We would like to find out how many marbles they had to start with.

Solution: :
Required quadratic equation is : let the number of marbles John had be x.
Then the number of marbles Jivanti had = 45–x.
The number of marbles left with John, when he lost 5 marbles = x–5
The number of marbles left with Jivanti, when she lost 5 marbles = $45 - x$–5 = 40–x
Given that product of number of marbles = 124

$$(x-5)(40-x) = 124 \tag{1}$$
$$\implies 40x - x^2 - 200 + 5x = 124 \tag{2}$$
$$\implies x^2 - 45x + 324 = 0 \tag{3}$$
$$\tag{4}$$

Using the formula for the quadratic equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{5}$$

Substituting

$$a = 1, b = -45, c = 324, \tag{6}$$

$$x_1 = \frac{45 + \sqrt{45^2 - 4 \times 1 \times 324}}{2 \times 1} \tag{7}$$

$$= \frac{45 + \sqrt{2025 - 1296}}{2} \tag{8}$$

$$= \frac{45 + \sqrt{729}}{2} \tag{9}$$

$$= \frac{45 + 27}{2} \tag{10}$$

$$= \frac{72}{2} \tag{11}$$

$$= 36 \tag{12}$$

Using the second formula for quadratic equation

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Substituting

$$x_2 = \frac{45 - \sqrt{45^2 - 4 \times 1 \times 324}}{2 \times 1} \tag{13}$$

$$= \frac{45 - \sqrt{2025 - 1296}}{2} \tag{14}$$

$$= \frac{45 - \sqrt{729}}{2} \tag{15}$$

$$= \frac{45 - 27}{2} \tag{16}$$

$$= \frac{18}{2} \tag{17}$$

$$= 9 \tag{18}$$

while,john had 36 marbles.Then jivanti will have 9 marbles.