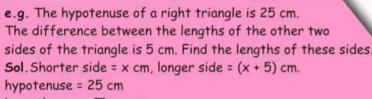
Application

1. Speed =
$$\frac{\text{Distance}}{\text{Time}}$$

- 2. Area of figures
- 3. Flow rate x time = volume of water
- 4. Number or ages



$$x^{2} + (x + 5)^{2} = 25^{2}$$

 $x^{2} + 5x - 300 = 0$

$$(x + 20)(x - 15) = 0$$

This gives x = 15 or x = -20.

We reject x = -20 and take x = 15.

Thus, length of shorter side = 15 cm.

Length of longer side = (15 + 5) cm, i.e., 20 cm.

Factorisation method

In this method ($ax^2 + bx + c$) be expressible as the product of two linear expression, say (px + q) and (rx + s), where p, q, r are real numbers such that $p \neq 0$ and $r \neq 0$ Then $ax^2 + bx + c = 0 \Rightarrow (px + q)(rx + s) = 0$

$$\Rightarrow (px + q) = 0 \text{ or } (rx + s) = 0$$

$$\Rightarrow x = -\frac{q}{p} \text{ or } x = -\frac{s}{r}$$

Quadratic Equations



An equation of the form $ax^2 + bx + c = 0$, where a,b,c are real numbers and $a \neq 0$, is called a quadratic equation in x.

Solution or Roots of Quadratic Equation A real number α is called a root of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ if $a\alpha^2 + b\alpha + c = 0$

Method of finding solution

Completing the square method

$$ax^{2} + bx + c = 0, a \neq 0.$$

$$x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

$$x^2 + \frac{b}{a}x = -\frac{c}{a}$$

$$x^2 + 2\left(\frac{b}{2a}\right)x + \left(\frac{b}{2a}\right)^2 = \left(\frac{b}{2a}\right)^2 - \frac{c}{a}$$

$$\left(x + \frac{b}{2a}\right)^2 = \left(\frac{b}{2a}\right)^2 - \frac{c}{a}$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

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

Obtain the values of x by shifting the constant term $\frac{b}{2a}$ on RHS

Nature of roots

 $ax^2 + bx + c = 0$, where $a \neq 0$ D = $(b^2 - 4ac)$. and the roots are given by

$$\alpha = \frac{-b + \sqrt{D}}{2a}$$
 and $\beta = \frac{-b - \sqrt{D}}{2a}$

Case - I

When D > 0, roots are real distinct and given by

$$\alpha = \frac{-b + \sqrt{D}}{2a} \text{ and } \beta = \frac{-b - \sqrt{D}}{2a}$$

Case - II

When D = 0, roots are real and equal and roots are given by

$$\alpha = \beta = -\frac{b}{2a}$$

Case - III

When D < 0, roots are not real.

Quadratic formula:

for
$$ax^2 + bx + c = 0$$
,
 $D = b^2 - 4ac$

$$x = \frac{-b \pm \sqrt{D}}{2a}$$