It means that tap of smaller diameter fills $\dfrac{1}{x}^{th}$ part of tank in 1 hour.... (1)

And, tap of larger diameter fills $\dfrac{1}{x-10}^{th}$ part of tank in 1 hour. ... (2)

When two taps are used together, they fill tank in 758 hours.

In 1 hour, they fill $\dfrac{8}{75}^{th}$ part of tank $\left(\dfrac{1}{\dfrac{75}{8}} = \dfrac{8}{75} \right)$ ... (3)

From (1), (2) and (3),

$\dfrac{1}{x} + \dfrac{1}{x-10} = \dfrac{8}{75}$

$\Rightarrow \dfrac{x-10+x}{x(x-10)} = \dfrac{8}{75}$

$\Rightarrow 75\,(2x-10) = 8\left(x^2 - 10x\right)$

$\Rightarrow 150x - 750 = 8x^2 - 80x$

$\Rightarrow 8x^2 - 80x - 150x + 750 = 0$

$\Rightarrow 4x^2 - 115x + 375 = 0$

Comparing equation $4x^2 - 115x + 375 = 0$ with general equation $ax^2 + bx + c = 0$,

We get $a = 4$, $b = -115$ and $c = 375$

Applying quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$x = \frac{115 \pm \sqrt{(-115)^2 - 4(4)(375)}}{2 \times 4}$$

$$\Rightarrow x = \frac{115 \pm \sqrt{13225 - 6000}}{8}$$

$$\Rightarrow x = \frac{115 \pm \sqrt{7225}}{8}$$

$$\Rightarrow x = \frac{115 \pm 85}{8}$$

$$\Rightarrow x = \frac{115 + 85}{8}, \frac{115 - 85}{8}$$

$$\Rightarrow x = 25, 3.75$$

Time taken by larger tap $= x - 10 = 3.75 - 10 = -6.25$ hours

Time cannot be in negative. Therefore, we ignore this

value.

Time taken by larger tap = $x - 10 = 25 - 10 = 15$ hours

Therefore, time taken by larger tap is 15 hours and time taken by smaller tap is 25 hours.

$2x^2 - 3x + 5 = 0$

Q10. An express train takes 1 hour less than a passenger train to travel 132 km between Mysore and Bangalore (without taking into consideration the time they stop at intermediate stations). If, the average speed of the express train is 11 km/h more than that of the passenger train, find the average speed of two trains.

Ans. Let average speed of passenger train = x km/h

Let average speed of express train = $(x + 11)$ km/h

Time taken by passenger train to cover 132 km = $\dfrac{132}{x}$ hours

Time taken by express train to cover 132 km = $\left(\dfrac{132}{x+11}\right)$ hours

According to the given condition,

$\dfrac{132}{x} = \dfrac{132}{x+11} + 1$

$\Rightarrow 132\left(\dfrac{1}{x} - \dfrac{1}{x+11}\right) = 1$

$\Rightarrow 132\left(\dfrac{x+11-x}{x(x+11)}\right) = 1$

$\Rightarrow 132\,(11) = x\,(x + 11)$

$\Rightarrow 1452 = x^2 + 11x$

$\Rightarrow x^2 + 11x - 1452 = 0$

Comparing equation $x^2 + 11x - 1452 = 0$ with general quadratic equation $ax^2 + bx + c = 0$, we get $a = 1$, $b = 11$ and $c = -1452$

Applying Quadratic Formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$x = \dfrac{-11 \pm \sqrt{(11)^2 - 4(1)(-1452)}}{2 \times 1}$$

$$\Rightarrow x = \dfrac{-11 \pm \sqrt{121 + 5808}}{2}$$

$$\Rightarrow x = \dfrac{-11 \pm \sqrt{5929}}{2}$$

$$\Rightarrow x = \dfrac{-11 \pm 77}{2}$$

$$\Rightarrow x = \dfrac{-11 + 77}{2}, \dfrac{-11 - 77}{2}$$

$$\Rightarrow x = 33, -44$$

As speed cannot be in negative. Therefore, speed of passenger train = 33 km/h

And, speed of express train = $x + 11 = 33 + 11 = 44$ km/h

Q11. Sum of areas of two squares is 468 m². If, the difference of their perimeters is 24 metres, find the sides of the two squares.

Ans. Let perimeter of first square $= x$ metres

Let perimeter of second square $= (x + 24)$ metres

Length of side of first square $= \dfrac{x}{4}$ metres {Perimeter of square $= 4 \times length\ of\ side$ }

Length of side of second square $= \left(\dfrac{x+24}{4}\right)$ metres

Area of first square $=$ side $\times$ side $= \dfrac{x}{4} \times \dfrac{x}{4} = \dfrac{x^2}{16} m^2$

Area of second square $= \left(\dfrac{x+24}{4}\right)^2 m^2$

According to given condition:

$$\dfrac{x^2}{16} + \left(\dfrac{x+24}{4}\right)^2 = 468$$

$$\Rightarrow \dfrac{x^2}{16} + \dfrac{x^2 + 576 + 48x}{16} = 468$$

$$\Rightarrow \dfrac{x^2 + x^2 + 576 + 48x}{16} = 468$$

$$\Rightarrow 2x^2 + 576 + 48x = 468 \times 16$$

$$\Rightarrow 2x^2 + 48x + 576 = 7488$$

$$\Rightarrow 2x^2 + 48x - 6912 = 0$$

$$\Rightarrow x^2 + 24x - 3456 = 0$$

Comparing equation $x^2 + 24x - 3456 = 0$ with standard form $ax^2 + bx + c = 0$,

We get $a = 1$, $b = 24$ and $c = -3456$

Applying Quadratic Formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$x = \frac{-24 \pm \sqrt{(24)^2 - 4(1)(-3456)}}{2 \times 1}$$

$$\Rightarrow x = \frac{-24 \pm \sqrt{576 + 13824}}{2}$$

$$\Rightarrow x = \frac{-24 \pm \sqrt{14400}}{2} = \frac{-24 \pm 120}{2}$$

$$\Rightarrow x = \frac{-24 + 120}{2}, \frac{-24 - 120}{2}$$

$$\Rightarrow x = 48, -72$$

Perimeter of square cannot be in negative. Therefore, we discard $x = -72$.

Therefore, perimeter of first square = 48 metres

And, Perimeter of second square = $x + 24 = 48 + 24 = 72$ metres

$$\Rightarrow \text{Side of First square} = \frac{Perimeter}{4} = \frac{48}{4} = 12 \, m$$

And, Side of second Square = $\dfrac{Perimeter}{4} = \dfrac{72}{4} = 18 \, m$

********** END *********