



Exercise 10D

Question 23:

Let the marks obtained by Kamal in Mathematics and English be x and y

$$\therefore x + y = 40 \text{ --- (1)}$$

$$\text{and } (x + 3)(y - 4) = 360 \text{ --- (2)}$$

$$\text{From (1) } y = 40 - x$$

Putting value of y in (2)

$$(x + 3)(40 - x - 4) = 360$$

$$\Rightarrow (x + 3)(36 - x) = 360$$

$$\text{or } 36x - x^2 + 108 - 3x = 360$$

$$\Rightarrow -x^2 + 33x - 252 = 0 \quad \text{or} \quad x^2 - 33x + 252 = 0$$

$$\Rightarrow x^2 - 21x - 12x + 252 = 0$$

$$\text{or } x(x - 21) - 12(x - 21) = 0$$

$$\Rightarrow (x - 21)(x - 12) = 0$$

$$\therefore \text{when } x - 21 = 0, x = 21$$

$$\text{when } x - 12 = 0, x = 12$$

$$\text{for } x = 21, 21 + y = 40 \quad \therefore y = 19$$

$$\text{for } x = 12, 12 + y = 40 \quad \therefore y = 28$$

The marks obtained by Kamal in Mathematics and English respectively are (21,19) or (12,28).

Question 24:

Let A and B take x days and $x + 10$ respectively to finish a piece of work

$$\frac{1}{x} + \frac{1}{x + 10} = \frac{1}{12}$$

Work done by A and B in 1 day =

$$\Rightarrow \frac{x + 10 + x}{x(x + 10)} = \frac{1}{12}$$

$$\Rightarrow 12(2x + 10) = x^2 + 10x$$

$$\Rightarrow 24x + 120 = x^2 + 10x$$

$$\Rightarrow x^2 - 14x - 120 = 0$$

$$\Rightarrow x^2 - 20x + 6x - 120 = 0$$

$$\Rightarrow x(x - 20) + 6(x - 20) = 0$$

$$\Rightarrow (x - 20)(x + 6) = 0$$

$$x = 20, -6$$

But x cannot be negative

Then, B will finish work in $x + 10$ days = $20 + 10 = 30$ days

Question 25:

Let x kmph be the speed of the passenger train

time taken to move 300 km = $300/x$ hours

When speed is $(x + 5)$ km/h, time taken to move 300 km
= $300/(x+5)$ hours

$$\therefore \frac{300}{x} - \frac{300}{x+5} = 2 \Rightarrow \frac{1}{x} - \frac{1}{x+5} = \frac{2}{300} = \frac{1}{150}$$

$$\Rightarrow \frac{x+5-x}{x(x+5)} = \frac{1}{150}$$

$$\Rightarrow \frac{5}{x(x+5)} = \frac{1}{150}$$

$$\therefore x(x+5) = 750 \text{ or } x^2 + 5x - 750 = 0$$

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

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

$$\therefore x+30 = 0, x = -30, \text{ but } x \text{ cannot be negative}$$

$$\therefore x - 25 = 0, x = 25$$

Speed of passenger train is 25km/h.

Question 26:

Let the original speed of the train be x km/h

Then, increased speed = $(x + 5)$ km/h

Time taken at original speed = $360/x$

Time taken at increased speed = $360/(x+5)$

$$\begin{aligned}
\therefore \frac{360}{x} - \frac{360}{x+5} &= 1 \\
\Rightarrow \frac{1}{x} - \frac{1}{x+5} &= \frac{1}{360} \\
\Rightarrow \frac{x+5-x}{x(x+5)} &= \frac{1}{360} \Rightarrow \frac{5}{x(x+5)} = \frac{1}{360} \\
\Rightarrow x(x+5) &= 1800 \Rightarrow x^2 + 5x - 1800 = 0 \\
\Rightarrow x^2 + 45x - 40x - 1800 &= 0 \\
\Rightarrow x(x+45) - 40(x+45) &= 0 \\
\Rightarrow (x+45)(x-40) &= 0 \\
\Rightarrow x = -45 \text{ or } x = 40 \\
\Rightarrow x = 40 \text{ (since speed cannot be negative)}
\end{aligned}$$

Then original speed is 40 km/h.

Question 27:

Let the original speed of the train be x km/hour

Then speed increases by 15 km/ph = $(x + 15)$ km/hours

Then time taken at original speed = $90/x$ hours

Then, time taken at in increased speed = $90/(x+15)$ hours

Difference between the two lines taken $1/2$ h

$$\begin{aligned}
\frac{90}{x} - \frac{90}{x+15} &= \frac{1}{2} \Rightarrow \frac{1}{x} - \frac{1}{x+15} = \frac{1}{180} \\
\Rightarrow \frac{x+15-x}{x(x+15)} &= \frac{1}{180} \Rightarrow \frac{15}{x(x+15)} = \frac{1}{180} \\
\Rightarrow x^2 + 15x - 2700 &= 0 \\
\Rightarrow x^2 + 60x - 45x - 2700 &= 0 \\
\Rightarrow x(x+60) - 45(x+60) &= 0 \\
\Rightarrow (x+60)(x-45) &= 0 \\
\Rightarrow x = -60 \text{ or } x = 45 \\
\Rightarrow x = 45 \text{ (}\because \text{ speed cannot be negative)}
\end{aligned}$$

Then, original speed of the train = 45 km/h.

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