

A train, travelling at a uniform speed for 360 km, would have taken 48 minutes less to travel the same distance if its speed were 5 km/h more. Find the original speed of the train.

Solution:

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

Then, the time taken to cover 360 km at usual speed = $\frac{360}{x}$ hours

Time taken to cover 360 km at increased speed = $\frac{360}{x+5}$ hours

According to the given condition

$$\frac{360}{x} - \frac{360}{x+5} = \frac{48}{60}$$

$$360 \left(\frac{1}{x} - \frac{1}{x+5} \right) = \frac{4}{5}$$

$$360 \left[\frac{x+5-x}{x(x+5)} \right] = \frac{4}{5}$$

$$2250 = x^2 + 5x$$

$$x^2 + 5x - 2250 = 0$$

$$x^2 + 50x - 45x - 2250 = 0$$

$$x(x+50) - 45(x+50) = 0$$

$$(x+50)(x-45) = 0$$

$$\text{Either } x+50 = 0 \text{ or } x-45 = 0$$

$$\text{Either } x = -50 \text{ or } x = 45$$

Rejecting $x = -50$ as speed of the train cannot be negative.

$$\therefore x = 45$$

Original speed of the train = 45 km/h

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