Pair of Linear Equations in Two varibles Ex 3.10 Q7

**Answer :**

Let the speed of the train be x km/hour that of the car be y km/hr, we have the following cases

Case I: When Ramesh travels 760 Km by train and the rest by car

Time taken by Ramesh to travel 160 Km by train = $\dfrac{160}{x}$ $hrs$

Time taken by Ramesh to travel (760-160) =600 Km by car = $\dfrac{600}{y}$ $hrs$

Total time taken by Ramesh to cover 760Km = $\dfrac{160}{x} + \dfrac{600}{y}$

It is given that total time taken in 8 hours

$$\dfrac{160}{x} + \dfrac{600}{y} = 8$$

$$8\left(\dfrac{20}{x} + \dfrac{75}{y}\right) = 8$$

$$\left(\dfrac{20}{x} + \dfrac{75}{y}\right) = \dfrac{8}{8}$$

$$\dfrac{20}{x} + \dfrac{75}{y} = 1 \cdots(i)$$

Case II: When Ramesh travels 240Km by train and the rest by car

Time taken by Ramesh to travel 240 Km by train = $\dfrac{240}{x}$ $hrs$

Time taken by Ramesh to travel (760-240) =520Km by car = $\dfrac{520}{y}$ $hrs$

In this case total time of the journey is 8 hours 12 minutes

$$\dfrac{240}{x} + \dfrac{520}{y} = 8hrs\,12\min utes$$

$$\dfrac{240}{x} + \dfrac{520}{y} = 8\dfrac{12}{60}$$

$$\dfrac{240}{x} + \dfrac{520}{y} = \dfrac{41}{5}$$

$$40\left(\dfrac{6}{x} + \dfrac{13}{y}\right) = \dfrac{41}{5}$$

$$\dfrac{6}{x} + \dfrac{13}{y} = \dfrac{41}{5} \times \dfrac{1}{40}$$

$$\dfrac{6}{x} + \dfrac{13}{y} = \dfrac{41}{200} \quad \cdots(ii)$$

Putting $\dfrac{1}{x} = u$ and, $\dfrac{1}{y} = u$, the equations $(i)$ and $(ii)$ reduces to

$$20u + 75v = 1 \cdots(iii)$$

$$6u + 13v = \dfrac{41}{200} \cdots(iv)$$

Multiplying equation $(iii)$ by 6 and $(iv)$ by 20 the above system of equation becomes

$$120u + 450v = 6 \cdots(v)$$

$$120u + 260v = \frac{41}{10} \cdots (vi)$$

Subtracting equation $(vi)$ from $(v)$ we get

$$120u + 450v = 6$$

$$\frac{-120u - 260v = -\frac{41}{10}}{190v = 6 - \frac{41}{10}}$$

$$190v = \frac{60 - 41}{10}$$

$$190v = \frac{19}{10}$$

$$v = \frac{19}{10} \times \frac{1}{190}$$

$$v = \frac{1}{100}$$

Putting $v = \frac{1}{100}$ in equation $(v)$, we get

$$120u + 450 \times \frac{1}{100} = 6$$

$$120u + \frac{45}{10} = 6$$

$$120u = 6 - \frac{45}{10}$$

$$120u = \frac{60 - 45}{10}$$

$$120u = \frac{15}{10}$$

$$u = \frac{15}{10} \times \frac{1}{120}$$

$$u = \frac{1}{80}$$

Now

$$u = \frac{1}{80}$$

$$\frac{1}{x} = \frac{1}{80}$$

$$x = 80$$

and

$$v = \frac{1}{100}$$

$$\frac{1}{y} = \frac{1}{100}$$

$$y = 100$$

Hence, the speed of the train is $\boxed{80 \ km/hr}$.

The speed of the car is $\boxed{100 \ km/hr}$.

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