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 = $\frac{160}{x} hrs$

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

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

It is given that total time taken in 8 hours

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

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

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

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

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

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

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

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

$$\frac{240}{x}+\frac{520}{y}=8hrs12\,\text{min}\,utes$$

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

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

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

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

$$\frac{6}{x}+\frac{13}{y}=\frac{41}{200} \quad \text{...(ii)}$$

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

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

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

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

$$\begin{array}{r} 120u + 450v = 6 \\ -120u - 260v = -\frac{41}{10} \\ \hline 190v = 6 - \frac{41}{10} \end{array}$$

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

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

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

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

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 **********