Pair of Linear Equations in Two varibles Ex 3.10 Q11

Answer :

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

Case I: When Roohi travels 300 Km by train and the rest by bus

Time taken by Roohi to travel 60 Km by train = $\frac{60}{x}hrs$

Time taken by Roohi to travel (300-60) =240 Km by bus = $\frac{240}{y}hrs$

Total time taken by Roohi to cover 300Km= $\frac{60}{x}+\frac{240}{y}$

It is given that total time taken in 4 hours

$$\frac{60}{x}+\frac{240}{y}=4$$

$$60\left(\frac{1}{x}+\frac{4}{y}\right)=4$$

$$\left(\frac{1}{x}+\frac{4}{y}\right)=\frac{4}{60}$$

$$\frac{1}{x}+\frac{4}{y}=\frac{1}{15}\cdots(i)$$

Case II: When Roohi travels 100 km by train and the rest by bus

Time taken by Roohi to travel 100 Km by train = $\frac{100}{x}hrs$

Time taken by Roohi to travel (300-100) =200Km by bus = $\frac{200}{y}hrs$

In this case total time of the journey is 4 hours 10 minutes

$$\frac{100}{x}+\frac{200}{y}=4hrs10\,\text{min}\,utes$$

$$\frac{100}{x}+\frac{200}{y}=4\frac{10}{60}$$

$$\frac{100}{x}+\frac{200}{y}=4\frac{1\cancel{0}}{6\cancel{0}}$$

$$\frac{100}{x}+\frac{200}{y}=\frac{25}{6}$$

$$100\left(\frac{1}{x}+\frac{2}{y}\right)=\frac{25}{6}$$

$$\frac{1}{x}+\frac{2}{y}=\frac{25}{6}\times\frac{1}{100}$$

$$\frac{1}{x}+\frac{2}{y}=\frac{1}{24}\qquad\text{...(i)}$$

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

$$1u+4v=\frac{1}{15}\cdots(iii)$$

$$1u+2v=\frac{1}{24}\cdots(iv)$$

Subtracting equation (iv) from (iii)we get

$$\begin{array}{r} \cancel{1u} + 4v = \frac{1}{15} \\ -\cancel{1u} - 2v = -\frac{1}{24} \\ \hline 2v = \frac{1}{15} - \frac{1}{24} \end{array}$$

$$2v = \frac{24-15}{360}$$

$$2v = \frac{9}{360}$$

$$v = \frac{1}{40} \times \frac{1}{2}$$

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

Putting $v = \frac{1}{80}$ in equation (iii), we get

$$1u + 4v = \frac{1}{15}$$

$$1u + 4 \times \frac{1}{80} = \frac{1}{15}$$

$$1u + \frac{4}{80} = \frac{1}{15}$$

$$1u = \frac{1}{15} - \frac{4}{80}$$

$$1u = \frac{1}{15} - \frac{1}{20}$$

$$1u = \frac{20-15}{300}$$

$$1u = \frac{5}{300}$$

$$u = \frac{1}{60}$$

Now

$$u = \frac{1}{60}$$

$$\frac{1}{x} = \frac{1}{60}$$

$$x = 60$$

and

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

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

$$y = 80$$

Hence, the speed of the train is $\boxed{60\ km/hr}$.

The speed of the bus is $\boxed{80\ km/hr}$.

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