Pair of Linear Equations in Two varibles Ex 3.10 Q3

Answer :

Let the speed of the boat in still water be x km/hr and the speed of the stream be y km/hr

Speed upstream $=(x-y)$ km/hr

Speed down stream $=(x+y)$ km/hr

Now,

Time taken to cover 30 km upstream $=\frac{30}{x-y}$ hrs

Time taken to cover 44 km down stream $=\frac{44}{x+y}$ hrs

But total time of journey is 10 hours

$$\frac{30}{x-y}+\frac{44}{x+y}=10\cdots(i)$$

Time taken to cover 40 km upstream$=\frac{40}{x-y}hrs$

Time taken to cover 55 km down stream $=\frac{55}{x+y}hrs$

In this case total time of journey is given to be 13 hours

Therefore, $\frac{40}{x-y}+\frac{55}{x+y}=13$ ...(ii)

Putting $\frac{1}{x-y}=u$ and $\frac{1}{x+y}=v$ in equation (i) and (ii) we get

$30u+44v=10$

$40u+55v=10$

$30u+44v-10=0\cdots(iii)$

$40u+55v-13=0\cdots(iv)$

Solving these equations by cross multiplication we get

$$\frac{u}{44\times-13-55\times-10}=\frac{-v}{30\times-13-40\times-10}=\frac{1}{30\times55-40\times44}$$

$$\frac{u}{-572+550}=\frac{-v}{-390+400}=\frac{1}{1650-1760}$$

$$\frac{u}{-22}=\frac{-v}{10}=\frac{1}{-110}$$

$$u=\frac{\not-22}{\not-110}$$

$$v=\frac{\not-10}{\not-110}$$

$u=\frac{2}{10}$ and $v=\frac{1}{11}$

Now,

$$u=\frac{2}{10}$$

$$\frac{1}{x-y}=\frac{2}{10}$$

$$1\times10=2(x-y)$$

$$10=2x-2y\div2$$

$$5 = x - y \cdots (v)$$

$$v = \frac{1}{11}$$

$$\frac{1}{x+y} = \frac{1}{11}$$

$$1 \times 11 = 1(x+y)$$

$$11 = x + y \cdots (vi)$$

By solving equation (v) and (vi) we get ,

$$x - y = 5$$

$$\frac{x + y = 11}{2x = 16}$$

$$x = \frac{16}{2}$$

$$x = 8$$

Substituting $x = 8$ in equation (vi) we get ,

$$x + y = 11$$

$$8 + y = 11$$

$$y = 11 - 8$$

$$y = 3$$

Hence, speed of the boat in still water is $\boxed{8\ km/hr}$

Speed of the stream is $\boxed{3\ km/hr}$

Pair of Linear Equations in Two varibles Ex 3.10 Q4

Answer :

We have to find the speed of the boat in still water and speed of the stream

Let the speed of the boat in still water be *x* km/hr and the speed of the stream be *y* km/hr then

Speed upstream $= (x - y)\ km/hr$

Sped down stream $= (x + y)\ km/hr$

Now, Time taken to cover 28 km down stream $= \frac{28}{x+y} hrs$

Time taken to cover 24 km upstream $= \frac{24}{x-y} hrs$

But, total time of journey is 6 hours

$$\frac{24}{x-y} + \frac{28}{x+y} = 6 \cdots (i)$$

Time taken to cover 30 km upstream $= \frac{30}{x-y} hrs$

Time taken to cover 21 km down stream $= \frac{21}{x+y} hrs$

In this case total time of journey is given to $6\frac{1}{2} hrs$ or $\frac{13}{2} hrs$

$$\frac{30}{(x-y)} + \frac{21}{(x+y)} = \frac{13}{2} \quad ...(ii)$$

By $\frac{1}{x-y}=u$ and $\frac{1}{x+y}=v$ in equation (i) and (ii) we get

$$24u+28v=6$$

$$30u+21v=\frac{13}{2}$$

$$24u+28v-6=0\cdots(iii)$$

$$30u+21v-\frac{13}{2}=0\cdots(iv)$$

Solving these equations by cross multiplication we get

$$\frac{u}{28\times\frac{-13}{2}-21\times-6}=\frac{-v}{24\times\frac{-13}{2}-30\times-6}=\frac{1}{24\times21-30\times28}$$

$$\frac{u}{-182+126}=\frac{-v}{-156+180}=\frac{1}{504-840}$$

$$\frac{u}{-56}=\frac{-v}{24}=\frac{1}{-336}$$

$u=\frac{\not-56}{\not-336}$ and $v=\frac{\not-24}{\not-336}$

$u=\frac{1}{6}$ and $v=\frac{1}{14}$

Now,

$$u=\frac{1}{x-y}=\frac{1}{6}$$

$6=x-y\cdots(v)$ and

$$v=\frac{1}{14}=\frac{1}{x+y}$$

$$x+y=14\cdots(vi)$$

By solving equation (v) and (vi) we get,

$$\begin{array}{r} x\cancel{-y}=6 \\ x\cancel{+y}=14 \\ \hline 2x=20 \end{array}$$

$$x=\frac{20}{2}$$

$$x=10$$

By substituting $x=10$ in equation (vi) we get

Hence, the speed of the stream is $\boxed{4\ km/hr}$

The speed of boat is $\boxed{10\ km/hr}$

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