



Pair of Linear Equations in Two variables 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

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

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

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

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

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

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

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

$$u = \frac{\cancel{22}}{\cancel{110}}$$

$$v = \frac{\cancel{10}}{\cancel{110}}$$

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

Now,

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

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

$$1 \times 10 = 2(x-y)$$

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

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

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

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

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

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

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

$$x - y = 5$$

$$x + y = 11$$

$$2x = 16$$

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

$$x = 8$$

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 8 km/hr

Speed of the stream is 3 km/hr

Pair of Linear Equations in Two variables 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 $x \text{ km/hr}$ and the speed of the stream be $y \text{ km/hr}$ then

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

Speed downstream $= (x + y) \text{ km/hr}$

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

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

But, total time of journey is 6 hours

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

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

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

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

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

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

$$24u + 28v = 6$$

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

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

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

Solving these equations by cross multiplication we get

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

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

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

$$u = \frac{\cancel{56}}{\cancel{336}} \text{ and } v = \frac{\cancel{24}}{\cancel{336}}$$

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

Now,

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

$$6 = x - y \dots (v) \text{ and}$$

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

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

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

$$x - y = 6$$

$$x + y = 14$$

$$2x = 20$$

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

$$x = 10$$

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

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

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

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