

Putting $a=2$ in (1), we get

$$11 \times 2 - 7b = 1 \quad \text{or} \quad 7b = 22 - 1 = 21 \Rightarrow b = 3$$

$$\text{Hence, } a=2 \Rightarrow \frac{1}{v} = 2 \Rightarrow v = \frac{1}{2} \quad \text{and } b=3 \Rightarrow \frac{1}{u} = 3 \Rightarrow u = \frac{1}{3}$$

Example 20 Formulate the following problems as a pair of linear equations and hence find their solutions :

- 02
- 3.6
- X
- (i) Ritu can row downstream 20 km in 2 hours and upstream 4 km in 2 hours. Find her speed of rowing in still water and the speed of the current.
- (ii) 2 women and 5 men can together finish a piece of embroidery in 4 days, while 3 women and 6 men can finish it in 3 days. Find the time taken by 1 woman alone to finish the embroidery, and that taken by 1 man alone.
- (iii) Roohi travels 370 km to her home partly by train and partly by bus. She takes 4 hours if she travels 250 km by train and the remaining by bus. If she travels 130 km by train and the remaining by bus, she takes 18 minutes longer. Find the speed of the train and the bus separately.

[NCERT]

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Solution. (i) Let Ritu's speed of rowing in still water = x km/h
and the speed of the current = y km/h

$$\text{Speed of boat downstream} = (x+y) \text{ km/h}$$

$$\text{Speed of boat upstream} = (x-y) \text{ km/h}$$

Since Ritu can row downstream 20 km in 2 hours,

$$\therefore 2 = \frac{20}{x+y} \Rightarrow x+y = 10 \quad \dots(1)$$

$$\left[\because \text{Time} = \frac{\text{Distance}}{\text{Speed}} \right]$$

Again, she can row upstream 4 km in 2 hours,

$$\therefore 2 = \frac{4}{x-y} \Rightarrow x-y = 2 \quad \dots(2)$$

~~X~~

EX-3.6

2(iii) Total time taken = 4 h
 $\Rightarrow \frac{250}{x} + \frac{120}{y} = 4$... (1)

Time taken to cover 130 km by train = $\frac{130}{x}$ h

Time taken to cover 240 km by bus = $\frac{240}{y}$ h

Total time taken = 4 hours and 18 minutes = $4\frac{18}{60}$ h = $\frac{43}{10}$ h

$\Rightarrow \frac{130}{x} + \frac{240}{y} = \frac{43}{10}$... (2)

Put $\frac{1}{x} = a$ and $\frac{1}{y} = b$. Then equations (1) and (2) become

$250a + 120b = 4$... (3)

$130a + 240b = \frac{43}{10}$... (4)

Multiplying equation (3) by 2, we get $500a + 240b = 8$... (5)

Subtracting (5) from (4), we get $-370a = -\frac{37}{10} \Rightarrow a = \frac{1}{100}$

Putting $a = \frac{1}{100}$ in (5), we get $5 + 240b = 8 \Rightarrow b = \frac{3}{240} = \frac{1}{80}$

Now $a = \frac{1}{x} = \frac{1}{100} \Rightarrow x = 100$ and $b = \frac{1}{y} = \frac{1}{80} \Rightarrow y = 80$

Hence, speed of the train = 100 km/h and speed of the bus = 80 km/h.

Adding (1) and (2), we get $2x = 12 \Rightarrow x = 12 \div 2 = 6$

Substituting this value of x in (1), we get $6 + y = 10 \Rightarrow y = 10 - 6 = 4$

Hence, Ritu's speed of rowing in still water is **6 kmph** and speed of current is **4 kmph**.

(ii) Suppose one woman alone can finish the work in x days and one man alone can finish the work in y days.

Then, 1 woman's 1 day work = $\frac{1}{x}$ and 1 man's 1 day work = $\frac{1}{y}$

Now 2 women and 5 men can finish the work in 4 days

$$\Rightarrow 2 \text{ women's 1 day work} + 5 \text{ men's 1 day work} = \frac{1}{4}$$

$$\Rightarrow \frac{2}{x} + \frac{5}{y} = \frac{1}{4} \quad \dots(1)$$

Again, 3 women and 6 men can finish the work in 3 days

$$\Rightarrow 3 \text{ women's 1 day work} + 6 \text{ men's 1 day work} = \frac{1}{3}$$

$$\Rightarrow \frac{3}{x} + \frac{6}{y} = \frac{1}{3} \quad \dots(2)$$

Put $\frac{1}{x} = a$ and $\frac{1}{y} = b$. Then equations (1) and (2) become

$$2a + 5b = \frac{1}{4} \Rightarrow 8a + 20b - 1 = 0$$

$$3a + 6b = \frac{1}{3} \Rightarrow 9a + 18b - 1 = 0$$

By cross-multiplication, we have

	a	b	1	
20	-1	8	20	
18	-1	9	18	

$$\frac{a}{-20+18} = \frac{b}{-9+8} = \frac{1}{144-180}$$

$$\Rightarrow \frac{a}{-2} = \frac{b}{-1} = \frac{1}{-36} \Rightarrow \frac{a}{2} = \frac{b}{1} = \frac{1}{36} \Rightarrow a = \frac{1}{18}, b = \frac{1}{36}$$

Now $a = \frac{1}{18} \Rightarrow \frac{1}{x} = \frac{1}{18} \Rightarrow x = 18$

and $b = \frac{1}{36} \Rightarrow \frac{1}{y} = \frac{1}{36} \Rightarrow y = 36$

Hence, 1 woman alone takes **18 days** and 1 man alone takes **36 days** to complete the embroidery.

(iii) Let the speed of the train = x km/h

and the speed of the bus = y km/h

As time = $\frac{\text{distance}}{\text{speed}}$

\therefore Time taken to cover 250 km by train = $\frac{250}{x}$ h

Time taken to cover 120 km by bus = $\frac{120}{y}$ h