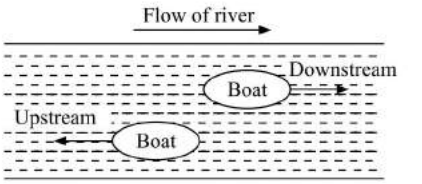
Boats and Streams

SOME IMPORTANT TERMS

1. **Still Water** If the speed of the water in the river is zero, it is *still water*.
2. **Stream** If the water of the river is moving, it is called a *stream*.
3. **Upstream** If a boat (or a swimmer) moves against the stream, i.e., in the direction opposite to that of the stream, it is called *upstream*.
4. **Downstream** If a boat (or a swimmer) moves with the stream, i.e., along the direction of the stream, it is called *downstream*.

Note:

When the speed of a boat or a swimmer is given, it usually means speed in the still water.



SOME BASIC FORMULAE

1. If the speed of a boat (or a swimmer) be x Km/h and the speed of the stream or the current be y Km/h, then

(a) speed of the boat (or swimmer) downstream $= (x + y)$ Km/h.

(b) speed of the boat (or swimmer) upstream $= (x - y)$ Km/h.

Illustration 1 The speed of a boat in still water is 20 Km/h. If the speed of the stream be 4 Km/h, find its downstream and upstream speeds

Solution: Speed of the boat $(x) = 20$ Km/h

Speed of the stream $(y) = 4$ Km/h

$\therefore$ Downstream speed $= x + y = (20 + 4) = 24$ Km/h

and upstream speed $= x - y = (20 - 4) = 16$ Km/h

2. (a) Speed of the boat (or swimmer) in still water

$$= \frac{1}{2}(\text{Downstream Speed} + \text{Upstream Speed})$$

(b) Speed of the stream

$$= \frac{1}{2}(\text{Downstream Speed} - \text{Upstream Speed})$$

Illustration 2 A boat is rowed down a river 40 Km in 5 hr and up a river 21 Km in 7 hr. Find the speed of the boat and the river

Solution: Speed of the boat downstream $= \frac{40}{5} = 8$ Km/h

Speed of the boat upstream $= \frac{21}{7} = 3$ Km/h

$\therefore$ Speed of the boat

$$= \frac{1}{2}(\text{Downstream Speed} + \text{Upstream Speed})$$

$$= \frac{1}{2}(8 + 3) = \frac{11}{2} = \text{or, } 5 \times 5 \text{ Km/h}$$

and speed of the river

$$= \frac{1}{2}(\text{Downstream Speed} - \text{Upstream Speed})$$

$$= \frac{1}{2}(8 - 3) = \frac{5}{2} \text{ or, } 2.5 \text{ Km/h}$$

Some Useful Short-cut Methods

1. If a man capable of rowing at the speed of x Km/h in still water, rows the same distance up and down a stream which flows at a rate of y Km/h, then his average speed throughout the journey is

$$= \frac{\text{Uptream} \times \text{Downstream}}{\text{Man's rate in still water}}$$

$$= \frac{(x-y)(x+y)}{x} \text{ Km/h.}$$

Illustration 3 A man rows at a speed of 8 Km/h in still water to a certain distance upstream and back to the starting point in a river which flows at 4 Km/h. Find his average speed for total journey

Solution: Average speed

$$= \frac{\text{Upstream} \times \text{Downstream}}{\text{Man's rate in still water}}$$

$$= \frac{(8-4)(8+4)}{8} = 6 \text{ Km/h}$$

2. A man can row a boat in still water at x Km/h. In a stream flowing at y Km/h, if it takes t hrs more in upstream than to go downstream for the same distance, then the distance is given by

$$\frac{(x^2-y^2)t}{2y} \text{ Km}$$

Illustration 4 A man can row 7 Km/h in still water. If the river is running at 3 Km/h, it takes 6 hrs more in upstream than to go downstream for the same distance. How far is the place?

Solution: The required distance

$$= \frac{(x^2-y^2)t}{2y}$$

$$= \frac{(49-9)6}{2\times 3} = 40 \text{ Km}$$

3. A man rows a certain distance downstream in t_1 hrs and returns the same distance upstream in t_2 hrs. If the speed of the stream be y Km/h, then the speed of the man in still water is given by

$$y\left(\frac{t_2+t_1}{t_2-t_1}\right) \text{ Km/h.}$$

Explanation

Let the speed of the man in still water be x Km/h.

Then, downstream speed = $(x+y)$ Km/h

and upstream speed = $(x-y)$ Km/h.

Since the distance covered downstream and upstream are equal, we have

$$(x+y)t_1 = (x-y)t_2$$

or, $$xt_1 + yt_1 = xt_2 - yt_2$$

or, $$x(t_2-t_1) = y(t_2+t_1)$$

$$\therefore \quad x = y\left(\frac{t_2+t_1}{t_2-t_1}\right) \text{ Km/h}$$

Illustration 5 A motorboat covers a certain distance downstream in 6 hrs but takes 8 hrs to return upstream to the starting point. If the speed of the stream be 6 Km/h, find the speed of the motor boat in still water.

Solution: Speed of the motorboat in still water

$$= y\left(\frac{t_2+t_1}{t_2-t_1}\right) \text{ Km/h}$$

$$= 6\left(\frac{8+6}{8-6}\right) = 42 \text{ Km/h}$$

4. A man can row a boat in still water at x Km/h. In a stream flowing at y Km/h if it takes him t hrs to row to a place and come back, then the distance between the two places is

$$\frac{t(x^2-y^2)}{2x} \text{ Km.}$$

Explanation

Downstream speed = $(x+y)$ Km/h

Upstream speed = $(x-y)$ Km/h

Let, the distance between the two places be d Km. We have,

Total time = Sum of time taken downstream and upstream

$$\Rightarrow \quad t = \frac{d}{x+y} + \frac{d}{x-y}$$

$$= d\left[\frac{(x-y)+(x+y)}{(x-y)(x+y)}\right]$$

$$= d\left[\frac{2x}{x^2-y^2}\right]$$

$$\therefore \quad d = \frac{t(x^2-y^2)}{2x}\text{ Km}$$

Illustration 6 A man can row 6 Km/h in the still water. If the river is running at 2 Km/h, it takes him 3 hrs to row to a place and back. How far is the place?

Solution: The required distance

$$= \frac{t(x^2-y^2)}{2x}\text{ Km}$$

$$= \frac{3(36-4)}{2\times 6} = 8\text{ Km}$$

5. A boat (or a swimmer) takes n times as long to row upstream as to row downstream the river. If the speed of boat (or swimmer) be x Km/h and the speed of stream be y Km/h, then

$$x = y\left(\frac{n+1}{n-1}\right).$$

Illustration 7 A man can row at the rate of 4 Km/h. in still water. If the time taken to row a certain distance upstream is 3 times as much as to row the same distance downstream, find the speed of the current

Solution: We have,

$$\text{Speed of the man} = \left(\frac{n+1}{n-1}\right)\text{ speed of the current}$$

$$\Rightarrow \quad 4 = \left(\frac{3+1}{3-1}\right)\text{ speed of the current.}$$

$\therefore$ Speed of the current = 2 Km/h

Practice Exercises

Difficulty Level-1 (Based on Memory)

1. A man can row three-quarters of kilometer against the stream in $11\frac{1}{4}$ minutes and returns in $7\frac{1}{2}$ minutes. The speed of the man in still water is:

(*a*) 2 Km/h (*b*) 3 Km/h

(*c*) 4 Km/h (*d*) 5 Km/h

[Based on MAT, 2005]

2. A man swimming in a stream which flows $1\frac{1}{2}$ Km/h finds that in a given time he can swim twice as far with the stream as he can against it. At what rate does he swim?

(*a*) $5\frac{1}{2}$ Km/h (*b*) $4\frac{1}{2}$ Km/h

(*c*) $7\frac{1}{2}$ Km/h (*d*) None of these

[Based on MAT, 2008]

3. A boat goes 24 Km upstream and 28 Km downstream in 6 hrs. If it goes 30 Km upstream and 21 Km downstream in 6 hrs and 30 minutes, find the speed of the stream.

(*a*) 10 Km/h (*b*) 5 Km/h

(*c*) 4 Km/h (*d*) 6 Km/h

[Based on MAT, 2001]

4. A person can row with the stream at 8 Km per hour and against the stream at 6 Km an hour. The speed of the current is:

(*a*) 1 Km/h (*b*) 2 Km/h

(*c*) 4 Km/h (*d*) 5 Km/h

[Based on FMS (Delhi), 2002]

5. A man can row 6 Km/h in still water. If it takes him twice as long to row up, as to row down the river, then the rate of current in the stream would be:

(*a*) 4 Km/h (*b*) 2 Km/h

(*c*) 3 Km/h (*d*) 8 Km/h

[Based on ATMA, 2006]

6. A boat goes 30 Km upstream and 44 Km downstream in 10 hrs. In 13 hrs, it can go 40 Km upstream and 55 Km down stream. The speed of the boat in still water is:

(*a*) 3 Km/h (*b*) 4 Km/h

(*c*) 8 Km/h (*d*) None of these

[Based on ITFT, 2008]

7. A motor boat can travel at 10 Km/h in still water. It traveled 91 Km downstream in river and then returned, taking altogether 20 hrs. Find the rate of flow of river.

(*a*) 3 Km/h (*b*) 5 Km/h

(*c*) 6 Km/h (*d*) 7 Km/h

[Based on IIFT, 2005]

8. A boat goes 24 Km upstream and 28 Km downstream in 6 hrs. It goes 30 Km upstream and 21 Km downstream in 6 hrs and 30 minutes. The speed of the boat in still water is:

(*a*) 10 Km/h (*b*) 4 Km/h

(*c*) 14 Km/h (*d*) 6 Km/h

[Based on MAT, 1999]

9. A motor boat whose speed is 15 Km/h in still water goes 30 Km downstream and comes back in 4 hrs and 30 minutes. Determine the speed of the stream.

(*a*) 10 Km/h (*b*) 4 Km/h

(*c*) 5 Km/h (*d*) 6 Km/h

[Based on MAT, 1999]

10. A motor boat whose speed is 30 Km/h in still water goes 60 Km downstream, and comes back in 4 and a half hrs. The speed of the stream is:

(*a*) 5 Km/h (*b*) 10 Km/h

(*c*) 15 Km/h (*d*) 20 Km/h

[Based on MAT, 1998]

11. A boat takes 90 minutes less to travel 36 miles downstream than to travel the same distance upstream. If the speed of the boat in still water is 10 m/h, the speed of the stream is:

(*a*) 4 m/h (*b*) 3 m/h

(*c*) 2.5 m/h (*d*) 2 m/h

[Based on MAT, 1997]

12. Speed of a speed-boat when moving in the direction perpendicular to the direction of the current is 16 Km/h, speed of the current is 3 Km/h. So, the speed of the boat against the current will be:

(*a*) 22 Km/h (*b*) 9.5 Km/h

(*c*) 10 Km/h (*d*) None of these

[Based on MAT (Feb), 2006]

13. Twice the speed of a boat downstream is equal to thrice the speed upstream. The ratio of its speed in still water to its speed of current is:

(*a*) 1:5 (*b*) 1:3

(*c*) 5:1 (*d*) 2:3

[Based on MAT (Dec), 2007]

14. A man can row three-fourths of a Km against the stream in $11\frac{1}{4}$ minutes and return in $7\frac{1}{2}$ minutes. Find the speed of the man in still water.

(*a*) 4 Km/h (*b*) 3 Km/h

(*c*) 5 Km/h (*d*) 6 Km/h

[Based on MAT (May), 2008]

15. A ship 55 Km from the shore springs a leak which admits 2 tonnes of water in 6 minutes, 80 tonnes would suffice to sink her, but the pumps can throw out 12 tonnes an hour. The average rate of sailing that she may just reach the shore as she begins to sink is:

(*a*) 9.17 Km/h (*b*) 0.97 Km/h

(*c*) 55 Km/h (*d*) 5.5 Km/h

[Based on MAT (Sept), 2008 (Dec), 2002, 2006 (Feb), 2004]

16. A man who can swim 48 m/minute in still water, swims 200 m against the current and 200 m with the current. If the difference between those two times is 10 minutes, find the speed of the current.

(*a*) 30 m/min (*b*) 29 m/min

(*c*) 31 m/min (*d*) 32 m/min

[Based on MAT (Dec), 2008]

17. A boatman goes 2 Km against the current of the stream in 1 hr and goes 1 Km along the current in 10 minutes. How long will he take to go 5 Km in stationary water?

(*a*) 1 hr 30 minutes (*b*) 1 hr 15 minutes

(*c*) 1 hr (*d*) 40 minutes

[Based on MAT (Sept), 2010 (Dec), 2009, 2007]

18. A man rowed against a stream flowing 1.5 Km/h to a certain point and then turned back, stopping 2 Km short of the place from where he originally started. If the whole time occupied in rowing be 2 hrs 10 min and his uniform speed in still water be 4.5 Km/h, the man went up the stream a distance of:

(*a*) 4 Km (*b*) 8 Km

(*c*) 7 Km (*d*) 5 Km

[Based on MAT (Sept), 2010 (Dec), 2009]

19. A man can row 30 Km upstream and 44 Km downstream in 10 hrs. Also, he can row 40 Km upstream and 55 Km downstream in 13 hrs. The rate of the current is:

(*a*) 3 Km/h (*b*) 3.5 Km/h

(*c*) 4 Km/h (*d*) 4.5 Km/h

[Based on MAT (Sept), 2009]

20. A man rows 8 Km/h in still water. If the river is running at 2 Km/h, it takes 32 minutes to row to a place and back. How far is the place?

(*a*) 1.5 Km (*b*) 2.5 Km

(*c*) 2 Km (*d*) 3 Km

[Based on MAT (Sept), 2009]

21. A man swimming in a stream which flows $1\frac{1}{2}$ Km/h finds that in a given time he can swim twice as far with the stream as he can against it. At what rate does he swim?

(*a*) $4\frac{1}{2}$ Km/h (*b*) $5\frac{1}{2}$ Km/h

(*c*) $7\frac{1}{2}$ Km/h (*d*) None of these

[Based on MAT (Sept), 2009 (Feb), 2008]

22. A boat travels upstream from *B* to *A* and downstream from *A* to *B* in 3 hrs. If the speed of the boat in still water is 9 Km/h and the speed of the current is 3 Km/h, the distance between *A* and *B* is:

(*a*) 4 Km (*b*) 8 Km

(*c*) 6 Km (*d*) 12 Km

[Based on MAT (Dec), 2008]

23. A motor boat can travel at 10 Km/h in still water. It travelled 91 Km downstream in a river and then returned, taking altogether 20 hrs. Find the rate of flow of the river.

(*a*) 6 Km/h (*b*) 5 Km/h

(*c*) 8 Km/h (*d*) 3 Km/h

[Based on MAT (Dec), 2008]

24. A man can row 40 Km upstream and 55 Km downstream in 13 h. Also, he can row 30 Km upstream and 44 Km downstream in 10 h. Find the speed of the man in still water.

(1) 5 Km/h (2) 2 Km/h

(3) 4 Km/h (4) None of these

[Based on MAT, 2011]

25. Speed of a boat in standing water is 9 Km/h and the speed of the stream is 1.5 Km/h. A man rows to a place at a distance of 105 Km and comes back to the starting point. The total time taken by him is:

(1) 20 hrs (2) 18 hrs

(3) 16 hrs (4) 24 hrs

[Based on MAT, 2011]

26. A boat takes 19 h for travelling downstream from point *A* to point *B* and coming back to point C midway between *A* and *B*. If the velocity of the stream is 4 Km/h and the speed of the boat in still water is 14 Km/h, what is the distance between *A* and *B*?

(1) 200 Km (2) 180 Km

(3) 160 Km (4) 220 Km

[Based on MAT, 2011]

27. A boat covers a certain distance downstream in 1 h, while it comes back in 1.5 h. If the speed of the stream be 3 Km/h, what is the speed of the boat in still water?

(1) 11 Km/h (2) 10 Km/h

(3) 16 Km/h (4) None of these

[Based on MAT, 2011]

28. The speed of a boat in still water is 6 Km/h and speed of the stream is 1.5 Km/h. A man rows to place at a distance of 22.5 Km and comes back to the starting point. Find the total time taken by him.

(1) 8 h (2) 4 h

(3) 7 h (4) 2 h

[Based on MAT (Feb), 2012]

29. A man who can swim 48 m/minute in still water swims 200 m against the current and 200 m with the current. If the difference between those two times is 10 minutes, what is the speed of the current?

(1) 30 m/min (2) 31 m/min

(3) 29 m/min (4) 32 m/min

[Based on MAT (Feb), 2012]

30. A boat travels upstream from *B* to *A* and downstream from *A* to *B* in 3 h. If the speed of the boat in still water is 9 Km/h and the speed of the current is 3 Km/h, what distance between *A* and *B*?

(a) 6 Km (b) 4 Km

(d) 8 Km (d) 12 Km

[Based on MAT (Dec), 2012]

Difficulty Level-2 (Based on Memory)

1. A ship carrying 1,000 people moves 12 Km down stream and then 4 Km upstream. The river current is 1 Km/h. Within what limits must the speed of the ship (which is denoted as V) lie for the entire trip to take not less than 3 hrs and not more than 4 hrs?

(*a*) $\frac{1}{3} \le V \le 2+\sqrt{3}$ (*b*) $2-\sqrt{3} \le V \le 2+\sqrt{3}$

(*c*) $\frac{1}{3} \le V \le 5$ (*d*) $2 \le V \le 5$

2. *A* and *B* in boat B_1 challenge *C* and *D* in boat B_2 in a race of 50 Km. *A* and *B* take turns to row the stretches of 6 Km and *A* begins. *C* and *D* take turns to row an hour and *C* begins. *A* and *C* can each row 5 Km/h, *B* and *D* each can row only $5\frac{1}{2}$ Km/h. Which boat wins and by what time?

(*a*) B_1 wins by 2 minutes

(*b*) B_2 wins by $1\frac{7}{11}$ minutes

(*c*) Both reach the finishing spot together

(*d*) B_1 wins by $5\frac{4}{11}$ minutes

3. At his normal speed, Ramesh can travel 18 Km downstream in a fast flowing stream in 9 hrs less than what he takes to travel the same distance upstream. The downstream trip would take one hour less than what the upstream trip would take, provided he doubles his rate of rowing. What is the speed of the stream in Km/h?

(*a*) $6\frac{2}{3}$ (*b*) $8\frac{1}{3}$

(*c*) $\frac{8\sqrt{10}}{3}$ (*d*) $\frac{950 \times 960}{1000}$

4. In a stream that is running at 2 Km/h, a man goes 10 Km upstream and comes back to the starting point in 55 minutes. Find the speed of the man in still water.

(*a*) 20 Km/h (*b*) 22 Km/h

(*c*) 24 Km/h (*d*) 28 Km/h

5. A boat sails 15 Km of a river towards upstream in 5 hrs. How long will it take to cover the same distance downstream, if the speed of current is one-fourth the speed of the boat in still water:

(*a*) 1.8 hrs (*b*) 3 hrs

(*c*) 4 hrs (*d*) 5 hrs

6. A motorboat went the river for 14 Km and then up the river for 9 Km. It took a total of 5 hrs the entire journey. Find the speed of the river flow if the speed of the boat in still water is 5 Km/h.

(*a*) 1 Km/h (*b*) 1.5 Km/h

(*c*) 2 Km/h (*d*) 3 Km/h

7. The different between downstream speed and upstream speed is 3 Km/h and the total time taken during upstream and downstream is 3 hrs. What is the downstream speed, if the downstream and upstream distance are 3 Km each?

(*a*) 2.5 Km/h (*b*) 4.3 Km/h

(*c*) 4 Km/h (*d*) 3.3 Km/h

8. The current of the stream is 1 Km/h. A boat goes 35 Km upstream and back to the starting point in 12 hrs. The speed of the motorboat in still water is:

(*a*) 6 Km/h (*b*) 7 Km/h

(*c*) 8.5 Km/h (*d*) 8 Km/h

9. A boat takes 5 hrs more while going back in upstream than in downstream. If the distance between two places is 24 Km and the speed of boat in still water so that if can row donwstream, 24 Km, in 4 hrs?

(*a*) 1.5 Km/h (*b*) 3.5 Km/h

(*c*) 4.5 Km/h (*d*) 3 Km/h

10. A man can row 30 Km upstream and 44 Km downstream in 10 hrs. It is also known that he can row 40 Km upstream and 55 Km downstream in 13 hrs. Find the speed of the man in still water.

(*a*) 4 Km/h (*b*) 6 Km/h

(*c*) 8 Km/h (*d*) 12 Km/h

11. A boat, while going downstream in a river covered a distance of 50 miles at an average speed of 60 miles per hour. While returning because of the water resistance, it took 1 hr 15 minutes to cover the same distance. What was the average speed during the whole journey?

(*a*) 40 m/h (*b*) 48 m/h

(*c*) 50 m/h (*d*) 55 m/h

12. A boat takes 90 minutes less to travel 36 miles downstream than to travel the same distance upstream. If the speed of the boat in still water is 10 m/h, the speed of the stream is:

(*a*) 4 (*b*) 3

(*c*) 2.5 (*d*) 2

13. Speed of a speed boat when moving in the direction perpendicular to the direction of the current is 16 Km/h, speed of the current is 3 Km/h. So the speed of the boat against the current will be (in Km/h):

(*a*) 22 (*b*) 9.5

(*c*) 10 (*d*) None of these

14. Two boats, travelling at 5 and 10 Km/h, head directly towards each other. They begin at a distance of 20 Km from each other. How far apart are they (in Kms) one minute before they collide?

(*a*) 1/12 (*b*) 1/6

(*c*) 1/4 (*d*) 1/3

15. At his usual rowing rate, Rahul can travel 12 miles downstream in a certain river in 6 hrs less than it takes him to travel the same distance upstream. But if he could double his usual rowing rate for this 24 mile round trip, the downstream 12 miles would then take only one hour less than the upstream 12 miles. What is the speed of the current in miles per hour?

(*a*) 7/3 (*b*) 4/3

(*c*) 5/3 (*d*) 8/3

16. A man can row 30 Km upstream and 44 Km downstream in 10 hrs. Also, he can row 40 Km upstream and 55 Km downstream in 13 hrs. Find the rate of the current and the speed of the man in still water.

(*a*) 3 Km/h, 8 Km/h (*b*) 3×5 Km/h, 7×5 Km/h

(*c*) 4 Km/h, 7 Km/h (*d*) 4×5 Km/h, 6×5 Km/h

17. P, Q, R are three towns on a river which flows uniformly. Q is equidistant from P and R. A man rows from P to Q and back in 10 hrs. He can row from P to R in 4 hrs. The ratio of speed of man in still water to the speed of the current is:

(*a*) 5:3 (*b*) 3:5

(*c*) 2:5 (*d*) 1:2

18. A boatman goes 2 Km against the current of the stream in 1 hr and goes 1 Km along the current in 10 minutes. How long will he take to go 5 Km in stationary water?

(*a*) 1 hr (*b*) 1 hr 15 minutes

(*c*) $1\frac{1}{2}$ hrs (*d*) 40 minutes

19. A man can swim 3 Km/h in still water. If the velocity of the stream be 2 Km/h, the time taken by him to swim to a place 10 Km upstream and back, is:

(*a*) $8\frac{1}{3}$ hrs (*b*) $9\frac{1}{5}$ hrs

(*c*) 10 hrs (*d*) 12 hrs

20. Twice the speed downstream is equal to the thrice the speed upstream, the ratio of speed in still water to the speed of the current is:

(*a*) 1:5 (*b*) 5:1

(*c*) 1:3 (*d*) 2:3

21. A man rows upstream 12 Km and downstream 28 Km taking 5 hrs each time. The velocity of water current is:

(*a*) $2\frac{1}{5}$ Km/h (*b*) $2\frac{1}{2}$ Km/h

(*c*) 3 Km/h (*d*) $1\frac{3}{5}$ Km/h

22. A man swimming in a stream which flows $1\frac{1}{2}$ Km/h finds that in a given time he can swim twice as far with the stream as he can against it. At what rate does he swim?

(*a*) $4\frac{1}{2}$ Km/h (*b*) $5\frac{1}{2}$ Km/h

(*c*) $7\frac{1}{2}$ Km/h (*d*) None of these

23. A boat travels upstream from *B* to *A* and downstream from *A* to *B* in 3 hrs. If the speed of the boat in still water is 9 Km/h and the speed of the current is 3 Km/h, the distance between *A* and *B* is:

(*a*) 8 Km

(*b*) 16 Km

(*c*) 12 Km

(*d*) None of these

24. In a river flowing at 2 Km/h, a boat travels 32 Km upstream and then returns downstream to the starting point. If its speed in still water be 6 Km/h, find the total journey time.

(*a*) 16 hrs (*b*) 12 hrs

(*c*) 14 hrs (*d*) None of these

25. If a man's rate with the current is 12 Km/h and the rate of the current is $1\frac{1}{2}$ Km/h, then his rate against the current is:

(*a*) 13 Km/h (*b*) 7 Km/h

(*c*) 9 Km/h (*d*) None of these

26. A swimmer covers a distance of 28 Km against the current and 40 Km in the direction of the current. If in each case he takes 4 hrs, then the speed of the current is:

(*a*) 3.5 Km/h (*b*) 1.5 Km/h

(*c*) 2.5 Km/h (*d*) None of these

27. Speed of a man is 10 Km/h in still water. If the rate of current is 3 Km/h, then the effective speed of the man upstream is:

(*a*) 7 Km/h (*b*) 8.5 Km/h

(*c*) 9 Km/h (*d*) None of these

28. A man can row at 5 Km/h in still water. If the river is running at 1 Km/h, it takes him 75 minutes to row to a place and back. How far is the place?

(*a*) 2.5 Km (*b*) 3 Km

(*c*) 4 Km (*d*) 5 Km

[Based on FMS, 2005]

Answer Keys

Difficulty Level-1

1. (*d*) **2.** (*b*) **3.** (*c*) **4.** (*a*) **5.** (*b*) **6.** (*c*) **7.** (*a*) **8.** (*a*) **9.** (*c*) **10.** (*b*) **11.** (*d*) **12.** (*c*) **13.** (*c*)
14. (*c*) **15.** (*d*) **16.** (*d*) **17.** (*b*) **18.** (*d*) **19.** (*a*) **20.** (*c*) **21.** (*a*) **22.** (*d*) **23.** (*d*) **24.** (*d*) **25.** (*d*) **26.** (*b*)
27. (*d*) **28.** (*a*) **29.** (*d*) **30.** (*d*)

Difficulty Level-2

1. (*a*) **2.** (*b*) **3.** (*a*) **4.** (*b*) **5.** (*b*) **6.** (*c*) **7.** (*b*) **8.** (*a*) **9.** (*b*) **10.** (*c*) **11.** (*b*) **12.** (*d*) **13.** (*c*)
14. (*c*) **15.** (*d*) **16.** (*a*) **17.** (*a*) **18.** (*b*) **19.** (*d*) **20.** (*b*) **21.** (*d*) **22.** (*a*) **23.** (*c*) **24.** (*b*) **25.** (*c*) **26.** (*b*)
27. (*a*) **28.** (*b*)

Explanatory Answers

Difficulty Level-1

1. (*d*) Speed upstream $= \frac{3}{4}\times\frac{4}{45}\times 60 = 4$ Km/h.

Speed downstream $= \frac{3}{4}\times\frac{2}{15} = 6$ Km/h.

Speed in still water $= \frac{1}{2}(6+4) = 5$ Km/h.

2. (*b*) $x+\frac{3}{2} = 2\left(x-\frac{3}{2}\right)$

$\therefore \quad x = 4\frac{1}{2}$ Km/h.

3. (*c*) Let the speed of the stream be x Km per hour.

Let speed of the boat in still water be y Km/h.

$\therefore$ Boat will travel downstream @ $(y+x)$ Km/h and upstream @ $(y-x)$ Km/h.

$\therefore \quad \frac{24}{y-x}+\frac{28}{y+x} = 6$

and, $\frac{30}{y-x}+\frac{21}{y+x} = 6\frac{1}{2} = \frac{13}{2}$

$\Rightarrow \quad y+x = 14, y-x = 6$

$\Rightarrow \quad x = 4, y = 10.$

4. (*a*) Let the speed of the current be x Km/h and speed of the person in still water be y Km/h.

$\therefore \quad y+x = 8$

$y-x = 6$

$\Rightarrow \quad y = 7, x = 1$

$\therefore$ Speed of the current = 1 Km/h.

5. (*b*) D = distance

x = speed of stream,

Then, $\frac{2D}{6+x} = \frac{2D}{6-x}$

$\therefore \quad x = 2$ Km/h.

6. (*c*) Suppose 30 Km upstream is covered in $3x$ hrs and 40 Km upstream is covered in $4x$ hrs.

44 Km downstream is covered in $4y$ hrs and 55 Km downstream is covered in $5y$ hrs.

Then,

$3x + 4y = 10 \quad (1)$

$4x + 5y = 13 \quad (2)$

On solving, we get $x = 2$ and $y = 1$

$\therefore$ Upstream speed $= \frac{30 \text{ km}}{3x}$

$= \frac{30}{3\times 2} = 5$ Km/h

and, downstream speed $= \frac{44 \text{ km}}{4y}$

$= \frac{44}{4\times 1} = 11$ Km/h

$\therefore$ Speed of boat $= \frac{11+5}{2} = 8$ Km/ hr.

7. (*a*) Since, $\frac{91}{x+y}+\frac{91}{x-y} = 20$

$\therefore \quad = \frac{91}{10+y}+\frac{91}{10-y} = 20$

By option, if $y = 3$

$\frac{91}{13}+\frac{91}{7} = 20.$

8. (*a*) Let a Km/h be the speed of the boat in still water. Let b Km/h be the speed of the current.

$\therefore$ Boat will travel downstream @ $(a+b)$ Km/h and upstream @ $(a-b)$ Km/h.

$\therefore \quad \frac{28}{a+b}+\frac{24}{a-b} = 6$

$\frac{21}{a+b}+\frac{30}{a-b} = 6\frac{1}{2} = \frac{13}{2}$

$\Rightarrow \quad \frac{84}{a+b}+\frac{72}{a-b} = 18 \quad (1)$

$\frac{84}{a+b}+\frac{120}{a-b} = 26 \quad (2)$

Equation (1) and (2) give

$-\frac{48}{a-b} = -8 \Rightarrow a-b = 6$

$\therefore$ Eq. (1) $\Rightarrow \quad \frac{28}{a+b}+\frac{24}{6} = 6$

$\Rightarrow \quad a+b = 14$

$\therefore \quad a = 10, b = 4$

9. (*c*) Let speed of the stream be K Km/h.

Speed of the stream in still water = 15 Km/h

$\therefore$ Speed of the boat downstream = $(15+K)$ Km/h

$\therefore$ Speed of the boat upstream = $(15 - K)$ Km/h

$\therefore$ $\dfrac{30}{15+K} + \dfrac{30}{15-K} = \dfrac{9}{2}$

$\Rightarrow$ $K = 5$

10. (b) Suppose speed of stream = x Km/h

$\therefore$ Speed of boat upstream = $(30 - x)$ Km/h

and speed of boat downstream = $(30 + x)$ Km/h.

$\therefore$ Time taken to cover 60 Km upstream

$$= \frac{60}{30-x}\text{hr}$$

and time taken to cover 60 Km upstream

$$= \frac{60}{30-x}\text{hr}$$

According to the question,

$$\frac{60}{30-x} + \frac{60}{30+x} = 4\frac{1}{2} = \frac{9}{2}$$

or, $\dfrac{60(30+x+30-x)}{(30-x)(30+x)} = \dfrac{9}{2}$

or, $60 \times 60 \times 2 = 9(900 - x^2)$

or, $900 - x^2 = 800$

or, $x^2 = 100$

$\therefore$ $x = 10$ Km/h.

11. (d) Suppose speed of the stream = K m/h

Speed of the boat in still water = 10 m/h

$\therefore$ Boat will travel with the stream (downstream) @ $(10 + K)$ m/h and boat will travel against the stream (upstream) @ $(10 - K)$ m/h.

Now, from the question,

$$\frac{36}{10+K} + \frac{90}{60} = \frac{36}{10-K}$$

$\Rightarrow$ $K = 2$

12. (c) Speed of speed boat = $16 - 3 = 13$ Km/h

$\therefore$ Speed of boat against the current

$$= 13 - 3 = 10 \text{ Km/h}$$

13. (c) Let the speed in still water be x Km/h and speed of current be y Km/h.

Then, $2(x + y) = 3(x - y)$

$\Rightarrow$ $x = 5y$

$\Rightarrow$ $\dfrac{x}{y} = \dfrac{5}{1}$

14. (c) Let the speed of man in still water be x Km/h and speed of stream be y Km/h.

$\therefore$ $(x - y) \times \dfrac{45}{4 \times 60} = \dfrac{3}{4}$

$\Rightarrow$ $x - y = \dfrac{3 \times 60}{45} = 4$ (1)

and, $(x + y) \times \dfrac{15}{2 \times 60} = \dfrac{3}{4}$

$\Rightarrow$ $x + y = \dfrac{3 \times 2 \times 60}{4 \times 15} = 6$ (2)

Solving Eqs. (1) and (2), $x = 5$ Km/h.

15. (d) In 1 h water entered into ship = $(20 - 12) = 8$ tonnes

Now, it will take 10 hrs to allow to enter 50 tonnes of water into ship and in this time ship has to cover 55 Km of distance.

Hence, required speed = 5.5 Km/h.

16. (d) Let the speed of current be x m/minute. Then, speed with current = $(48 + x)$ m/minute and speed against current = $(48 - x)$ m/minute

$$\frac{200}{(48-x)} - \frac{200}{(48+x)} = 10$$

$\Rightarrow$ $40x = (48)^2 - x^2$

$\Rightarrow$ $x^2 + 40x - 2304 = 0$

$\Rightarrow$ $(x + 72)(x - 32) = 0$

$\Rightarrow$ $x = 32$ m/minute.

17. (b) Upstream speed = 2 Km/h

Downstream speed = $\dfrac{1}{10} \times 60 = 6$ Km/h

$\therefore$ Speed in stationary water

$$= \frac{2+6}{2} = 4 \text{ Km/h}$$

$\therefore$ Required time = $\dfrac{5}{4}$ = 1 hr 15 minute.

18. (d) Let the man went up the stream for x Km. Then, he turned back for $(x - 2)$ Km.

$\therefore$ $\dfrac{x}{(4.5-1.5)} + \dfrac{x-2}{(4.5+1.5)} = 2$ hrs 10 minutes

$\Rightarrow$ $\dfrac{2x+x-2}{6} = 2\dfrac{1}{6}$

$\Rightarrow$ $3x - 2 = 13$

$\Rightarrow$ $x = 5$ Km

19. (*a*) Let the speed of man and current be x Km/h and y Km/h respectively.

Then, $\frac{30}{x-y}+\frac{44}{x+y}=10$ (1)

and, $\frac{40}{x-y}+\frac{55}{x+y}=13$ (2)

Solving Eqs. (1) and (2),

$\Rightarrow \quad x+y=11$ (3)

and, $x-y=5$ (4)

Solving Eqs. (3) and (4),

$y=3$ Km/h.

20. (*c*) Let the place be x Km.

Then, $\frac{x}{8-2}+\frac{x}{8+2}=\frac{32}{60}$

$\Rightarrow \quad \frac{5x+3x}{30}=\frac{32}{60}$

$\Rightarrow \quad x=\frac{32}{60}\times\frac{30}{8}=2$ km.

21. (*a*) Let the man was swimming at the rate of x Km/h and he can swim D Km upstream.

$\therefore \quad \frac{D}{x-1\frac{1}{2}}=\frac{2D}{x+1\frac{1}{2}}$

$\Rightarrow \quad x+\frac{3}{2}=2x-3$

$\Rightarrow \quad x=4\frac{1}{2}$ Km/h.

22. (*d*) Let the distance between A and B be x Km.

Given, speed of boat in still water = 9 Km/h and speed of current = 3 Km/h

$\therefore$ Upward speed = (9 – 3) = 6 Km/h and downward speed = (9 + 3) = 12 Km/h

$\therefore \quad \frac{x}{6}+\frac{x}{12}=3$

$\Rightarrow \quad x=12$ Km

23. (*d*) Let the rate of flow of river be x Km/h.

Then, downward speed = $(10+x)$ Km/h

and upward speed = $(10-x)$ Km/h

Given, $\frac{91}{(10+x)}+\frac{91}{(10-x)}=20$

For $x=3$, the above expression holds true.

Hence, speed of flow of river is 3 Km/h.

24. (*d*) Let the upstream speed be x Km/h and the downstream speed be y Km/h

Then, according to the question,

$\frac{40}{x}+\frac{55}{y}=13$ (1)

and, $\frac{30}{x}+\frac{44}{y}=10$ (2)

Solving the equations (1) and (2), we get $x=5$ and $y=11$

Therefore, the speed of the man in still water $=\frac{1}{2}(x+y)=\frac{1}{2}(5+11)=\frac{16}{2}=8$ km/h.

25. (*d*) Speed of the boat in standing water = 9 Km/h

Speed of the stream = 1.5 Km/h

$\therefore$ Speed downstream = 9 + 1.5 = 10.5 Km/h

and speed upstream = 9 – 1.5 = 7.5 Km/h

Therefore, total time taken to row up and down $=\frac{105}{10.5}+\frac{105}{7.5}=10+14=24$ hrs

26. (*b*) Let the distance $AB=x$

Now, speed downstream = 14 + 4 = 18 Km/h

Speed upstream = 14 – 4 = 10 Km/h

Since, $\frac{\text{Distance}}{\text{Speed}}=\text{Time}$

$\therefore \quad \frac{x}{18}+\frac{x}{2.10}=19$

$\Rightarrow \quad \frac{x}{18}+\frac{x}{20}=19$

$\Rightarrow \quad \frac{(10+9)x}{180}=19$

$\Rightarrow \quad x=180$ Km.

27. (*d*) Let the speed of boat in still water = x Km/h

If distance covered by the boat in one side be d, then

$\frac{d}{x+3}=1$ (1)

[$\because$ speed downstream = $x+3$]

and, $\frac{d}{x-3}=\frac{3}{2}$ [$\because$ speed upstream = $x-3$]

$\Rightarrow \quad 2d=3(x-3)$

$\Rightarrow \quad 2(x+3)=3(x-3)$ [using Eq.(1)]

$\Rightarrow \quad 2x+6=3x-9$

$\Rightarrow \quad x=15$ Km/h.

28. (*a*) Required time = Time spent in upstream + Time spent in downstream

$=\frac{22.5}{6-1.5}+\frac{22.5}{6+1.5}$

$=\frac{22.5}{4.5}+\frac{22.5}{7.5}$

$=5+3=8$ hrs.

29. *(d)* Let speed of the current be x Km/h.

Then,

$$\frac{200}{48-x}-\frac{200}{48+x}=10$$

$$\Rightarrow \quad 20(48+x-48+x)=(48+x)(48-x)$$

$$\Rightarrow \quad 20\times 2x=2301-x^2$$

$$\Rightarrow \quad x^2+40x-2304=0$$

$$\Rightarrow \quad x=32 \text{ m/min}$$

30. *(d)* Let the distance between A and B be x Km.
Here, speed of stream = 3 Km/h
Speed of boat = 9 Km/h
According to the question,

$$\frac{x}{9-3}+\frac{x}{9+3}=3$$

$$\Rightarrow \quad \frac{x}{6}+\frac{x}{12}=3$$

$$\Rightarrow \quad 3x=36$$

$$\therefore \quad x=12 \text{ Km.}$$

DIFFICULTY LEVEL-2

1. *(a)* Let V be the speed of the ship.

Then, time $\quad t=\dfrac{12}{V+1}+\dfrac{4}{V-1}$

$$\therefore \qquad 3\le \frac{12}{V+1}+\frac{4}{V-1}\le 4$$

$$\Rightarrow 3(V^2-1)\le 12(V-1)+4\ (V+1\le 4(V^2-1)$$

$$\Rightarrow (3V^2-3)\le (16V-8)\le (4V^2-4)$$

$$\Rightarrow 3V^2-16V+5\le 0 \text{ and } 4V^2-16V+4\ge 0$$

1st inequality is satisfied when $\dfrac{1}{3}\le V\le 5$ and the 2nd inequality is satisfied for $(2-\sqrt{3})\le V\le (2+\sqrt{3})$.

$\therefore$ we get $\dfrac{1}{3}\le V\le 2+\sqrt{3}$.

2. *(b)* For boat B_1

To row 6 Km, A takes $\dfrac{6}{5\frac{1}{2}}=\dfrac{12}{11}$ hrs.

To row 6 Km, B takes $\dfrac{6}{5}$ hrs.

$\therefore$ For each 12 Km, they take

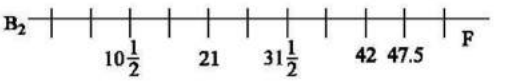
$$\frac{12}{11}+\frac{6}{5}=\frac{126}{55} \text{ hrs}$$

At the end, there remains 2 Km, which is covered by A in $\dfrac{2}{5\frac{1}{2}}=\dfrac{4}{11}$ hrs

$\therefore$ Total time required by boat B_1

$$=\frac{126\times 4}{55}+\frac{4}{11}=\frac{4}{11}\left(\frac{126}{5}+1\right)=\frac{524}{55}=9\frac{29}{55} \text{ hrs}$$

For boat B_2



In every 2 hrs, C and D cover 10.5 Km in 8 hrs, B_2 covers 42 Km $\Rightarrow$ in the next 1 hour, C covers 5.5 Km

To cover the last $2\frac{1}{2}$ Km, D takes $\dfrac{2\frac{1}{2}}{5}=\dfrac{1}{2}$ hr

Total time required by boat $B_2=8+1+\dfrac{1}{2}=9\dfrac{1}{2}$ hrs

B_2 wins by $\dfrac{29}{55}-\dfrac{1}{2}=\dfrac{3}{110}$ hour $=\dfrac{3}{110}\times 60=1\dfrac{7}{11}$ minutes.

3. *(a)* Let Ramesh's normal speed be u Km/h and the speed of the current be v Km/h.

$$\frac{18}{u-v}-\frac{18}{u+v}=9$$

and,
$$\frac{18}{2u-v}-\frac{18}{2u+v}=1$$

Let,
$$u=kv$$

$$\frac{1}{k-1}-\frac{1}{k+1}=\frac{v}{2} \qquad (1)$$

and,
$$\frac{1}{2k-1}-\frac{1}{2k+1}=\frac{v}{18} \qquad (2)$$

Dividing Eqs. (1) by (2)

$$\frac{2}{k^2-1}\frac{4k^2-1}{2}=9$$

$\Rightarrow \quad 4k^2 - 1 = 9k^2 - 9$

$\Rightarrow \quad k = \sqrt{8/5}$

From Eq. (1) $\Rightarrow \quad v = \dfrac{4}{k^2 - 1} = \dfrac{4(5)}{3} = \dfrac{2}{3}6$

4. (*b*) Let the speed of the man in still water be x Km/h.

Then,

$$\frac{10}{(x-2)} + \frac{10}{(x+2)} = \frac{55}{60} \Rightarrow x = 22 \text{ Km/h.}$$

5. (*b*) Upstream speed $= B - S$

Downstream speed $= B + S$

$$B - S = \frac{15}{5} = 3 \text{ Km/h}$$

Again, $\quad B = 4S$

$\therefore \quad B - S = 3 = 3S$

$\Rightarrow \quad S = 1$ and $B = 4$ Km/h

$\therefore \quad B + S = 5$ Km/h

$\therefore$ Time during downstream $= \dfrac{15}{2} = 3$ hrs.

6. (*c*) Let the speed of the stream be x Km/h

Then, Upward speed $= (5 - x)$ Km/h and Downward speed $= (5 + x)$ Km/h

$$\frac{14}{(5+x)} + \frac{9}{(5-x)} = 5 \Rightarrow x = 2 \text{ Km/h.}$$

7. (*b*) Let x be the upstream speed, then the downstream speed will be $(x + 3)$

$\therefore \quad \dfrac{3}{x} + \dfrac{3}{x+3} = 3$

$\Rightarrow \quad x^2 + x - 3 = 0$

$\Rightarrow \quad x = \dfrac{-1\sqrt{13}}{2}$

$= \dfrac{-1 + 3.6}{2} = 1.3$ Km/h

$\therefore \quad (x + 3) = 4.3$ Km/h.

8. (*a*) Let the speed in the still water be x Km/h

$$\frac{35}{(x-1)} + \frac{35}{(x+1)} = 12$$

or, $\quad 35 \times 2x = 12(x^2 - 1)$

$\Rightarrow \quad 12x^2 - 70x - 12 = 0$

or, $\quad x = 6$ Km/h

9. (*b*) $\dfrac{24}{(5.5 - R)} - \dfrac{24}{(5.5 + R)} = 5$

$\Rightarrow R = 2.5$ Km/h; $R \rightarrow$ Speed of river/current

Again $(B2 + R) = \dfrac{24}{4} = 6$

$\Rightarrow \quad (B_2 + 2.5) = 6 \Rightarrow B_2 = 3.5$ Km/h.

10. (*c*) Let the speed of the man in still water be x Km/h and speed of the stream be y Km/h then,

$$\frac{30}{(x-y)} + \frac{44}{(x+y)} = 10 \qquad (1)$$

$$\frac{40}{(x-y)} + \frac{55}{(x+y)} = 13 \qquad (2)$$

Solving (1) and (2) $x = 8$ Km/h and $y = 3$ Km/h.

11. (*b*) Time taken by boat in down stream

$$= \frac{50}{60} = \frac{5}{6} \text{ hrs}$$

Time taken by boat in upstream $= \dfrac{5}{4}$ hrs

Average speed$= \dfrac{2 \times 50}{\frac{5}{6} + \frac{5}{4}} = \dfrac{100 \times 24}{50} = 48$ m/h

12. (*d*) Speed of boat in still water $= 10$ m/h

Let the speed of the steam $= x$ m/h

Then, speed of boat downward stream $= (10 + x)$ m/h

Speed of boat upward steam $= (10 - x)$ m/h

$\therefore \quad \dfrac{36}{(10+x)} + \dfrac{90}{60} = \dfrac{36}{(10-x)}$

$\Rightarrow \quad \dfrac{1}{6} = 4\left(\dfrac{1}{10-x} - \dfrac{1}{10+x}\right)$

$\Rightarrow \quad \dfrac{1}{6} = 4\left(\dfrac{2x}{100-x^2}\right)$

$\Rightarrow \quad 100 - x^2 = 48x$

$\Rightarrow x^2 + 48x - 100 = 0$

$\Rightarrow \quad x = 2$ because $x \neq -50$.

13. (*c*) Speed of speed-boat $= 16 - 3 = 13$ Km/h.

$\therefore$ Speed of boat against the current

$= 13 - 3 = 10$ Km/h.

14. (*c*) In the final 1 minute before collision, the two boats travel $5 \times \frac{1}{60}$ Km, and $10 \times \frac{1}{60}$ Km i.e., $\frac{1}{12}$ Km and $\frac{1}{6}$ Km. As they move in opposite directions, distance between the boats 1 minute before collision is

$$\frac{1}{12} + \frac{1}{6} = \frac{1}{4} \text{ Km.}$$

15. (*d*) Let the speed of man in still water is x m/h and speed of the current be y m/h.

Then, $$\frac{12}{x-y} - \frac{12}{x+y} = 6 \qquad (1)$$

and, $$\frac{12}{2x-y} - \frac{12}{2x+y} = 1 \qquad (2)$$

Solving Eqs. (1) and (2), $y = 8/3$.

16. (*a*) Let upstream speed = x Km/h and downstream speed = y Km/h

Then, $\frac{30}{x} + \frac{44}{y} = 10$, and $\frac{40}{x} + \frac{55}{y} = 13$

or, $30u + 44v = 10$, and $40u + 55v = 13$

where, $u = \frac{1}{x}$ and $v = \frac{1}{y}$

Solving, we get $u = \frac{1}{5}$ and $v = \frac{1}{11}$

$\therefore$ $x = 5$ and $y = 11$

$\therefore$ Rate in still water $= \frac{5+11}{2} = 8$ Km/h.

Rate of current $= \frac{11-5}{2} = 3$ Km/h

17. (*a*) Let the speed of man in still water = x Km/h

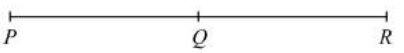
Speed of the current = y Km/h

Speed downstream = $(x + y)$ Km/h

Speed upstream = $(x - y)$ Km/h

Let river be flowing from P to R and $PQ = QR = a$

Then, $PR = 2a$



$\therefore$ $$\frac{a}{x+y} + \frac{a}{x-y} = 10. \qquad (1)$$

and, $$\frac{2a}{x+y} = 4$$

$\therefore$ $$\frac{a}{x+y} = 2 \qquad (2)$$

$\therefore$ (1) $\Rightarrow$ $$\frac{a}{x-y} = 8 \qquad (3)$$

Dividing (2) and (3), we get

$$\frac{x-y}{x+y} = \frac{1}{4}$$

$\therefore$ $4x - 4y = x + y$

or, $3x = 5y$

or, $\frac{x}{y} = \frac{5}{3}$ or, 5:3

18. (*b*) Upstream speed = 2 Km/h

Downstream speed = 6 Km/h

$\therefore$ Speed in still water $= \frac{2+6}{2} = 4$ Km/h

$\therefore$ Time required to go 5 Km in still water

$= \frac{5}{4}$ hrs = 1 hr 15 minutes.

19. (*d*) Speed upstream = (3 – 2) Km/h = 1 Km/h

Speed downstream = (3 + 2) Km/h = 5 Km/h

Total time taken $= \left(\frac{10}{1} + \frac{10}{5}\right)$ hrs = 12 hrs

20. (*b*) Let speed in still water = x Km/h

Speed of current = y Km/h

Speed downstream = $(x + y)$ Km/h

Speed upstream = $(x - y)$ Km/h

$\therefore$ $2(x + y) = 3(x - y)$

$\therefore$ $x = 5y$

or, $\frac{x}{y} = \frac{5}{1}$ or, 5:1

21. (*d*) Let man's rowing speed in still water = x Km/h and speed of current = y Km/h

Speed upstream = $(x - y)$ Km/h and speed downstream = $(x + y)$ Km/h

$\therefore$ $5(x - y) = 12$ and $5(x + y) = 28$

subtracting $10y = 16$

$\therefore$ $y = \frac{8}{5} = 1\frac{3}{5}$ Km/h

22. (*a*) Speed of man $= \left(\frac{n+1}{n-1}\right)$ speed of stream

$$= \left(\frac{2+1}{2-1}\right) \times \frac{3}{2} = \frac{9}{2} \text{ or, } 4\frac{1}{2} \text{ Km/h.}$$

23. (*c*) The distance between A and B is

$$= \frac{t(x^2 - y^2)}{2x} \text{ Km} = \frac{3(81-9)}{2 \times 9} = 12 \text{ Km.}$$

24. (*b*) Let the total journey time be t

Then, we have $d = \frac{t(x^2 - y^2)}{2x}$

$$\Rightarrow \quad 32 = \frac{t(36-4)}{2 \times 6}$$

$$\therefore \quad t = 12 \text{ hrs}$$

25. (*c*) Speed of the man downstream = 12 Km/h

Speed of the stream $= \frac{3}{2}$ Km/h

Let the speed of the man upstream = x Km/h

We have, Speed of the stream

$= \frac{1}{2}$ (Downstream Speed – Upstream Speed)

$$\Rightarrow \quad \frac{3}{2} = \frac{1}{2}(12 - x)$$

$$\therefore \quad x = 12 - 3 = 9 \text{ Km/h}$$

26. (*b*) Speed of the swimmer upstream

$$= \frac{28}{4} = 7 \text{ Km/h}$$

Speed of the swimmer downstream

$$= \frac{40}{4} = 10 \text{ Km/h}$$

$\therefore$ Speed of the stream

$= \frac{1}{2}$ (Downstream Speed – Upstream Speed)

$$= (10 - 7) = \frac{3}{2} = 1.5 \text{ Km/h}$$

27. (*a*) Speed of man in still water = 10 Km/h

Speed of current = 3 Km/h

$\therefore$ Speed of man upstream = 10 – 3 = 7 Km/h

28. (*b*) $\because \quad \frac{x}{4} + \frac{x}{6} = \frac{75}{60}$

$$\therefore \quad \frac{10x}{24} = \frac{5}{4}$$

$$\Rightarrow \quad x = 3 \text{ Km.}$$