19 Boats and Streams

IMPORTANT FACTS AND FORMULAE

I. In water, the direction along the stream is called ***downstream.*** And, the direction against the stream is called ***upstream.***

II. If the speed of a boat in still water is u km/hr and the speed of the stream is v km/hr, then :

$$\textit{Speed downstream} = (u + v) \text{ km/hr}$$

$$\textit{Speed upstream} = (u - v) \text{ km/hr}$$

III. If the speed downstream is a km/hr and the speed upstream is b km/hr, then:

$$\textit{Speed in still water} = \frac{1}{2}(a + b) \text{ km/hr}$$

$$\textit{Rate of stream} = \frac{1}{2}(a - b) \text{ km/hr}$$

IV. Suppose a man can swim in still water at the rate of u km/hr, the speed of current/stream is v km/hr and the man wishes to cross the stream (of width x metres) straight along its width, then time taken to cross the river is the same as time taken to swim x metres at u km/hr.

[**Note :** This is because the stream sways the man such that both the distance and the effective velocity increase and the time taken to cross the river remains unaffected.]

V. A man can swim directly across a stream of width x km in t hours when there is no current and in t' hours when there is a current. Then, the rate of the current is

$$\left(x\sqrt{\frac{1}{t^2} - \frac{1}{t'^2}}\right) \text{km/hr.}$$

SOLVED EXAMPLES

Ex. 1. ***The speed of a boat when travelling downstream is 32 km/hr, whereas when travelling upstream it is 28 km/hr, what is the speed of the boat in still water and the speed of the stream?*** (S.B.I.P.O., 2010)

Sol. Speed of boat in still water $= \frac{1}{2}(32 + 28) \text{ km/hr} = 30 \text{ km/hr.}$

Speed of stream $= \frac{1}{2}(32 - 28) \text{ km/hr} = 2 \text{ km/hr.}$

Ex. 2. ***A man takes 3 hours 45 minutes to row a boat 15 km downstream of a river and 2 hours 30 minutes to cover a distance of 5 km upstream. Find the speed of the river current in km/hr.***

Sol. Rate downstream $= \left(\frac{15}{3\frac{3}{4}}\right) \text{km/hr} = \left(15 \times \frac{4}{15}\right) \text{km/hr} = 4 \text{ km/hr.}$

Rate upstream $= \left(\frac{5}{2\frac{1}{2}}\right) \text{km/hr} = \left(5 \times \frac{2}{5}\right) \text{km/hr} = 2 \text{ km/hr.}$

$\therefore$ Speed of current $= \frac{1}{2}(4 - 2) \text{ km/hr} = 1 \text{ km/hr.}$

Ex. 3. ***The speed of a motor boat is that of the current of water as 36 : 5. The boat goes along with the current in 5 hours 10 minutes. How much time will it take to come back?*** (S.S.C., 2007)

Sol. Let the speed of the motor boat and that of the current be $36x$ km/hr and $5x$ km/hr respectively.
Then, speed downstream = $(36x + 5x)$ km/hr = $41x$ km/hr.
Speed upstream = $(36x - 5x)$ km/hr = $31x$ km/hr.
Let the distance be d km.

Then, $\frac{d}{41x} = 5\frac{10}{60} = 5\frac{1}{6} = \frac{31}{6} \Rightarrow d = \left(\frac{31 \times 41}{6}\right)x = \frac{1271x}{6}$.

$\therefore$ Time taken while coming back = $\frac{d}{31x} = \left(\frac{1271x}{6} \times \frac{1}{31x}\right)$ hrs $= \frac{41}{6}$ hrs $= 6\frac{5}{6}$ hrs

= 6 hrs 50 min.

Ex. 4. ***A man can row 6 km/hr in still water. It takes him twice as long to row up as to row down the river. Find the rate of stream.*** **(A.T.M.A., 2007)**

Sol. Let man's rate upstream be x km/hr.
Then, his rate downstream = $2x$ km/hr.

$\therefore$ Rate in still water = $\frac{1}{2}(x + 2x)$ km/hr $= \frac{3x}{2}$ km/hr.

So, $\frac{3x}{2} = 6$ or $x = 4$.

$\therefore$ Rate upstream = 4 km/hr, Rate downstream = 8 km/hr.

Hence, rate of stream = $\frac{1}{2}(8 - 4)$ km/hr $= 2$ km/hr.

Ex. 5. ***There is a road beside a river. Two friends started from a place A, moved to a temple situated at another place B and then returned to A again. One of them moves on a cycle at a speed of 12 km/hr, while the other sails on a boat at a speed of 10 km/hr. If the river flows at the speed of 4 km/hr, which of the two friends will return to place A first?***

Sol. Clearly, the cyclist moves both ways at a speed of 12 km/hr.
So, average speed of the cyclist = 12 km/hr.
The boat sailor moves downstream @ (10 + 4) *i.e.*, 14 km/hr and upstream @ (10 – 4) *i.e.*, 6 km/hr.

So, average speed of the boat sailor = $\left(\frac{2 \times 14 \times 6}{14 + 6}\right)$ km/hr $= \frac{42}{5}$ km/hr

= 8.4 km/hr.

Since the average speed of the cyclist is greater, he will return to A first.

Ex. 6. ***A man can row $7\frac{1}{2}$ kmph in still water. If in a river running at 1.5 km an hour, it takes him 50 minutes to row to a place and back, how far off is the place?*** **(P.C.S., 2009)**

Sol. Speed downstream = (7.5 + 1.5) kmph = 9 kmph;
Speed upstream = (7.5 – 1.5) kmph = 6 kmph.
Let the required distance be x km. Then,

$\frac{x}{9} + \frac{x}{6} = \frac{50}{60} \Leftrightarrow 2x + 3x = \left(\frac{5}{6} \times 18\right) \Leftrightarrow 5x = 15 \Leftrightarrow x = 3.$

Hence, the required distance is 3 km.

Ex. 7. ***A boat goes 8 km upstream and then returns. Total time taken is 4 hrs 16 minutes. If the velocity of current is 1 km/hr, find the actual velocity of the boat.*** **(Hotel Management, 2007)**

Sol. Let the actual velocity of the boat be x km/hr. Then,
Speed downstream = $(x + 1)$ km/hr; Speed upstream = $(x - 1)$ km/hr.

$\therefore \quad \frac{8}{x+1} + \frac{8}{x-1} = 4\frac{16}{60} = 4\frac{4}{15} = \frac{64}{15} \Leftrightarrow \frac{(x-1)+(x+1)}{(x+1)(x-1)} = \frac{8}{15} \Leftrightarrow 30x = 8(x^2 - 1)$

$\Leftrightarrow 4x^2 - 15x - 4 = 0 \Leftrightarrow 4x^2 - 16x + x - 4 = 0 \Leftrightarrow 4x(x - 4) + (x - 4) = 0$
$\Leftrightarrow (x - 4)(4x + 1) = 0 \Leftrightarrow x = 4.$
Hence, actual velocity of the boat = 74 km/hr.

Ex. 8. ***A boatman rows to a place 45 km distant and back in 20 hours. He finds that he can row 12 km with the stream in the same time as 4 km against the stream. Find the speed of the stream.*** **(M.A.T., 2007)**

Sol. Suppose he moves 12 km downstream in x hours. Then,

Speed downstream $= \left(\frac{12}{x}\right)$ km/hr, Speed upstream $= \left(\frac{4}{x}\right)$ km/hr

$\therefore \quad \frac{45}{(12/x)} + \frac{45}{(4/x)} = 20 \Rightarrow \frac{x}{12} + \frac{x}{4} = \frac{20}{45} = \frac{4}{9} \Rightarrow \frac{x}{3} = \frac{4}{9} \Rightarrow x = \frac{4}{3}.$

So, Speed downstream $= \left(12 \times \frac{3}{4}\right)$ km/hr $= 9$ km/hr,

Speed upstream $= \left(4 \times \frac{3}{4}\right)$ km/hr $= 3$ km/hr.

$\therefore$ Speed of the stream $= \frac{1}{2}(9 - 3)$ km/hr $= 3$ km/hr.

Ex. 9. ***A man can row 40 km upstream and 55 km downstream in 13 hours. Also, he can row 30 km upstream and 44 km downstream in 10 hours. Find the speed of the man in still water and the speed of the current.***

Sol. Let rate upstream $= x$ km/hr and rate downstream $= y$ km/hr.

Then, $\frac{40}{x} + \frac{55}{y} = 13$ ...(i) and $\frac{30}{x} + \frac{44}{y} = 10$ ...(ii)

Multiplying (ii) by 4 and (i) by 3 and subtracting, we get : $\frac{11}{y} = 1$ or $y = 11$.

Substituting $y = 11$ in (i), we get : $x = 5$.

$\therefore$ Rate in still water $= \frac{1}{2}(11 + 5)$ kmph $= 8$ kmph.

Rate of current $= \frac{1}{2}(11 - 5)$ kmph $= 3$ kmph.

EXERCISE

(OBJECTIVE TYPE QUESTIONS)

Directions: ***Mark (✓) against the correct answer:***

1. A boat goes 8 km in one hour along the stream and 2 km in one hour against the stream. The speed in km/hr of the stream is **(S.S.C., 2005)**

(a) 2 (b) 3

(c) 4 (d) 5

2. In one hour, a boat goes 11 km along the stream and 5 km against the stream. The speed of the boat in still water (in km/hr) is **(B.Ed Entrance, 2009)**

(a) 3 (b) 5

(c) 8 (d) 9

3. A man rows downstream 32 km and 14 km upstream. If he takes 6 hours to cover each distance, then the velocity (in kmph) of the current is **(R.R.B., 2008)**

(a) $\frac{1}{2}$ (b) 1

(c) $1\frac{1}{2}$ (d) 2

4. A boatman rows 1 km in 5 minutes, along the stream and 6 km in 1 hour against the stream. The speed of the stream is **(S.S.C., 2010)**

(a) 3 kmph (b) 6 kmph

(c) 10 kmph (d) 12 kmph

5. A boat takes half time in moving a certain distance downstream than upstream. What is the ratio between the rate in still water and the rate of current? **(R.R.B., 2006)**

(a) 1 : 2 (b) 2 : 1

(c) 1 : 3 (d) 3 : 1

6. If a man goes 18 km downstream in 4 hours and returns against the stream in 12 hours, then the speed of the stream in km/hr is **(S.S.C., 2008)**

(a) 1 (b) 1.5

(c) 1.75 (d) 3

7. A boatman goes 2 km against the current of the stream in 1 hour and goes 1 km along the current in 10 minutes. How long will it take to go 5 km in stationary water?

(*a*) 40 minutes (*b*) 1 hour
(*c*) 1 hr 15 min (*d*) 1 hr 30 min

8. A man can row $\frac{3}{4}$ of a km against the stream in $11\frac{1}{4}$ minutes and returns in $7\frac{1}{2}$ minutes. Find the speed of the man in still water. **(M.A.T., 2008)**
(*a*) 3 km/hr (*b*) 4 km/hr
(*c*) 5 km/hr (*d*) 6 km/hr

9. 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 hour 15 minutes to cover the same distance. What was the average speed during the whole journey? **(M.A.T., 2004)**
(*a*) 40 mph (*b*) 48 mph
(*c*) 50 mph (*d*) 55 mph

10. A man swimming in a stream which flows $1\frac{1}{2}$ km/hr 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? **(M.A.T., 2008)**
(*a*) $4\frac{1}{2}$ km/hr (*b*) $5\frac{1}{2}$ km/hr
(*c*) $7\frac{1}{2}$ km/hr (*d*) None of these

11. A boat running upstream takes 8 hours 48 minutes to cover a certain distance, while it takes 4 hours to cover the same distance running downstream. What is the ratio between the speed of the boat and speed of the water current respectively ?
(*a*) 2 : 1
(*b*) 3 : 2
(*c*) 8 : 3
(*d*) Cannot be determined
(*e*) None of these

12. If a boat goes 7 km upstream in 42 minutes and the speed of the stream is 3 kmph, then the speed of the boat in still water is : **(Bank Rec., 2010)**
(*a*) 4.2 km/hr (*b*) 9 km/hr
(*c*) 13 km/hr (*d*) 21 km/hr

13. A man's speed with the current is 15 km / hr and the speed of the current is 2.5 km / hr. The man's speed against the current is :
(*a*) 8.5 km/hr (*b*) 9 km/hr
(*c*) 10 km/hr (*d*) 12.5 km/hr

14. If a man rows at the rate of 5 kmph in still water and his rate against the current is 3.5 kmph, then the man's rate along the current is :
(*a*) 4.25 kmph (*b*) 6 kmph
(*c*) 6.5 kmph (*d*) 8.5 kmph

15. A motorboat in still water travels at a speed of 36 km/hr. It goes 56 km upstream in 1 hour 45 minutes. The time taken by it to cover the same distance down the stream will be **(C.P.O., 2007)**
(*a*) 1 hour 24 minutes (*b*) 2 hour 21 minutes
(*c*) 2 hour 25 minutes (*d*) 3 hour

16. Speed of a boat in standing water is 9 kmph and the speed of the stream is 1.5 kmph. 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 :
(*a*) 16 hours (*b*) 18 hours
(*c*) 20 hours (*d*) 24 hours

17. The speed of a boat in still water is 15 km / hr and the rate of current is 3 km / hr. The distance travelled downstream in 12 minutes is :
(*a*) 1.2 km (*b*) 1.8 km
(*c*) 2.4 km (*d*) 3.6 km

18. A man can row at 5 kmph in still water. If the velocity of current is 1 kmph and it takes him 1 hour to row to a place and come back, how far is the place? **(S.S.C., 2004)**
(*a*) 2.4 km (*b*) 2.5 km
(*c*) 3 km (*d*) 3.6 km

19. A boat takes 19 hours for travelling downstream from point A to point B and coming back to a point C midway between A and B. If the velocity of the stream is 4 kmph and the speed of the boat in still water is 14 kmph, what is the distance between A and B?
(*a*) 160 km (*b*) 180 km
(*c*) 200 km (*d*) 220 km

20. P, Q and R are three towns on a river which flows uniformly. Q is equidistant from P and R. I row from P to Q and back in 10 hours and I can row from P to R in 4 hours. Compare the speed of my boat in still water with that of the river. **(M.A.T., 2005)**
(*a*) 4 : 3 (*b*) 5 : 3
(*c*) 6 : 5 (*d*) 7 : 3

21. A man can row $9\frac{1}{3}$ kmph in still water and finds that it takes him thrice as much time to row up than as to row down the same distance in the river. The speed of the current is :
(*a*) $3\frac{1}{3}$ km/hr (*b*) $3\frac{1}{9}$ km/hr
(*c*) $4\frac{2}{3}$ km/hr (*d*) $4\frac{1}{2}$ km/hr

22. A boat takes 8 hours to cover a distance while travelling upstream, whereas while travelling downstream it takes 6 hours. If the speed of the current is 4 kmph, what is the speed of the boat in still water? **(Bank P.O., 2006)**

(*a*) 12 kmph
(*b*) 16 kmph
(*c*) 28 kmph
(*d*) Cannot be determined
(*e*) None of these

23. A motor boat can travel at 10 km/hr in still water. It travelled 91 km downstream in a river a then returned taking altogether 20 hours. Find the rate of flow of the river. **(M.A.T., 2008)**

(*a*) 3 km/hr (*b*) 5 km/hr
(*c*) 6 km/hr (*d*) 8 km/hr

24. The speed of a boat in still water is 10 km / hr. If it can travel 26 km downstream and 14 km upstream in the same time, the speed of the stream is :

(*a*) 2 km/hr (*b*) 2.5 km/hr
(*c*) 3 km/hr (*d*) 4 km/hr

25. 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 mph, the speed of the stream is :

(*a*) 2 mph (*b*) 2.5 mph
(*c*) 3 mph (*d*) 4 mph

26. A man rows to a place 48 km distant and back in 14 hours. He finds that he can row 4 km with the stream in the same time as 3 km against the stream. The rate of the stream is : **(M.A.T., 2005)**

(*a*) 1 km / hr (*b*) 1.5 km / hr
(*c*) 1.8 km / hr (*d*) 3.5 km / hr

27. A boat covers 24 km upstream and 36 km downstream in 6 hours while it covers 36 km upstream and 24 km downstream in $6\frac{1}{2}$ hours. The velocity of the current is

(*a*) 1 km/hr (*b*) 1.5 km/hr
(*c*) 2 km/hr (*d*) 2.5 km/hr

28. A boat goes 30 km upstream and 44 km downstream in 10 hours. In 13 hours, it can go 40 km upstream and 55 km downstream. The speed of the boat in still water is **(I.I.F.T., 2008)**

(*a*) 3 km/hr (*b*) 4 km/hr
(*c*) 8 km/hr (*d*) None of these

29. At his usual rowing rate, Rahul can travel 12 miles downstream in a certain river in 6 hours less than it takes him to travel the same distance upstream. But if he could double his usual rowing rate for his 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? **(M.A.T., 2001)**

(*a*) $1\frac{1}{3}$ (*b*) $1\frac{2}{3}$
(*c*) $2\frac{1}{3}$ (*d*) $2\frac{2}{3}$

30. A man can swim in still water at a rate of 4 km/ hr. The width of the river is 1 km. How long will he take to cross the river straight, if the speed of the current is 3 km/hr? **(R.R.B., 2009)**

(*a*) 10 min (*b*) 15 min
(*c*) 18 min (*d*) 20 min

31. A man wishes to cross a river perpendicularly. In still water he takes 4 minutes to cross the river, but in flowing river he takes 5 minutes. If the river is 100 metres wide, the velocity of the flowing water of the river is **(M.A.T., 2004)**

(*a*) 10 m/min (*b*) 15 m/min
(*c*) 20 m/min (*d*) 30 m/min

32. A man can row upstream at 10 kmph and downstream at 18 kmph. Find the man's rate in still water? **[Indian Railways Gr. 'D' Exam, 2014]**

(*a*) 14 kmph (*b*) 4 kmph
(*c*) 12 kmph (*d*) 10 kmph

33. A man takes 2.2 times as long to row a distance upstream as to row the same distance downstream. If he can row 55 km downstream in 2 hours 30 minutes, what is the speed of the boat in still water? **[IBPS—RRB Officers Gr. 'B' Exam, 2015]**

(*a*) 40 km/h (*b*) 8 km/h
(*c*) 16 km/h (*d*) 24 km/h

34. Boat A travels downstream from Point X to Point Y in 3 hours less than the time taken by Boat B to travel upstream from Point Y to Point Z. The distance between X and Y is 20 km, which is half of the distance between Y and Z. The speed of Boat B in still water is 10 km/h and the speed of Boat A in still water is equal to the speed of Boat B upstream. What is the speed of Boat A in still water? (Consider the speed of the current to be the same.) **[RBI Gr. 'B' (Phase I) Exam, 2015]**

(*a*) 10 km/h (*b*) 16 km/h
(*c*) 12 km/h (*d*) 8 km/h

35. The speed of the boat in still water is 5 times that of the current, it takes 1.1 hours to row to point B form point A downstream. The distance between point A and point B is 13.2km. How much distance (in km) will it cover in 312 minutes upstream? **[IBPS—Bank Spl. Officer (IT) Exam, 2015]**

(*a*) 43.2 (*b*) 48
(*c*) 41.6 (*d*) 44.8

36. A boat can travel 36 km upstream in 5 hours. If the speed of the stream is 2.4 kmph, how much

time will the boat take to cover a distance of 78 km downstream? (in hours)

(*a*) 5 (*b*) 6.5

(*c*) 5.5 (*d*) 8

[United India Insurance Co. Ltd. (UIICL) Assistant (Online) Exam, 2015]

Direction (*Question No. 37*): The following question is followed by two statements number I and II are given. You have to read both the statements and then give the answer.

a. If the data given in Statement I alone are sufficient to answer the question whereas the data given in Statement II alone are not sufficient to answer the questions.

b. If the data given in Statement II alone are sufficient to answer the question I alone are not sufficient to answer the question.

c. If the data in either Statement I alone or in Statement II alone are sufficient to answer the question.

d. If the data in both the statement I and II are not sufficient to answer the question.

e. If the data given in both the Statements I and II are necessary to answer the question.

37. What is the speed of the boat in still water? (in km/hr)

I. The boat takes total time of 4*h* to travel 14 km upstream and 35 km downstream together.

II. The boat takes total time of 5*h* to travel 29 km upstream and 24 km downstream together.

[CET—Maharashtra (MBA) Exam, 2016]

ANSWERS

1. (*b*)	**2.** (*c*)	**3.** (*c*)	**4.** (*a*)	**5.** (*d*)	**6.** (*b*)	**7.** (*c*)	**8.** (*c*)	**9.** (*b*)	**10.** (*a*)
11. (*c*)	**12.** (*c*)	**13.** (*c*)	**14.** (*c*)	**15.** (*a*)	**16.** (*d*)	**17.** (*d*)	**18.** (*a*)	**19.** (*b*)	**20.** (*b*)
21. (*c*)	**22.** (*c*)	**23.** (*a*)	**24.** (*c*)	**25.** (*a*)	**26.** (*a*)	**27.** (*c*)	**28.** (*c*)	**29.** (*d*)	**30.** (*b*)
31. (*b*)	**32.** (*a*)	**33.** (*c*)	**34.** (*d*)	**35.** (*c*)	**36.** (*b*)				

SOLUTIONS

1. Speed of the stream $= \frac{1}{2}(8-2)\text{ km/hr} = 3\text{ km/hr}.$

2. Speed of the boat in still water $= \frac{1}{2}(11+5)\text{ km/hr} = 8\text{ km/hr}.$

3. Rate downstream $= \left(\frac{32}{6}\right)\text{kmph};$

Rate upstream $= \left(\frac{14}{6}\right)\text{kmph}.$

Velocity of current $= \frac{1}{2}\left(\frac{32}{6}-\frac{14}{6}\right)\text{kmph}$

$= \frac{3}{2}\text{kmph} = 1\frac{1}{2}\text{kmph}.$

4. Rate downstream $= \left(\frac{1}{5}\times 60\right)\text{kmph} = 12\text{ kmph};$

Rate upstream = 6 kmph.

Speed of the stream $= \frac{1}{2}(12-6)\text{ kmph} = 3\text{ kmph}.$

5. Ratio of times taken (Downstream : Upstream) = 1 : 2.

$\therefore$ Speed downstream : Speed upstream = 2 : 1.

Let speed downstream = 2*x* kmph and speed upstream = *x* kmph.

Required ratio $= \frac{\text{Rate in still water}}{\text{Rate of current}} = \frac{\frac{1}{2}(2x+x)}{\frac{1}{2}(2x-x)} = 3:1.$

6. Speed downstream $= \left(\frac{18}{4}\right)\text{km/hr} = 4.5\text{ km/hr};$

Speed upstream $= \left(\frac{18}{12}\right)\text{km/hr} = 1.5\text{ km/hr}.$

$\therefore$ Speed of the stream $= \frac{1}{2}(4.5-1.5)\text{ km/hr} = 1.5\text{ km/hr}.$

7. Rate downstream

$= \left(\frac{1}{10}\times 60\right)\text{km/hr} = 6\text{ km/hr};$ Rate upstream = 2 km/hr.

Speed in still water $= \frac{1}{2}(6+2)\text{ km/hr} = 4\text{ km/hr}.$

$\therefore$ Required time $= \left(\frac{5}{4}\right)\text{hrs} = 1\frac{1}{4}\text{ hrs} = 1\text{ hr }15\text{ min}.$

8. Rate upstream $= \left(\frac{750}{675}\right)\text{m/sec} = \frac{10}{9}\text{ m/sec};$

Rate downstream $= \left(\frac{750}{450}\right)\text{m/sec} = \frac{5}{3}\text{ m/sec}.$

$\therefore$ Rate in still water

$= \frac{1}{2}\left(\frac{10}{9}+\frac{5}{3}\right)\text{m/sec} = \frac{25}{18}\text{ m/sec} = \left(\frac{25}{18}\times\frac{18}{5}\right)\text{km/hr}$

$= 5\text{ km/hr}.$

9. Time taken to cover 50 miles downstream $= \left(\frac{50}{60}\right)\text{hr} = \frac{5}{6}\text{ hr}.$

Time taken to cover 50 miles upstream

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

Total time taken to cover 100 miles $= \left(\frac{5}{6}+\frac{5}{4}\right)\text{hrs} = \frac{25}{12}\text{ hrs.}$

$\therefore$ Average speed

$= \frac{100}{\left(\frac{25}{12}\right)}\text{mph} = \left(\frac{100\times 12}{25}\right)\text{mph} = 48 \text{ mph.}$

10. Let speed upstream = x km/hr.

Then, speed downstream = $2x$ km/hr.

Speed of stream $= \frac{1}{2}(2x - x)\text{ km/hr} = \frac{x}{2}\text{ km/hr.}$

$\therefore \quad \frac{x}{2} = 1\frac{1}{2} \Leftrightarrow \frac{x}{2} = \frac{3}{2} \Leftrightarrow x = 3.$

So, speed upstream = 3 km/hr;

Speed downstream = 6 km/hr.

Hence, rate of swimming $= \frac{1}{2}(3+6)\text{ km/hr} = 4\frac{1}{2}\text{ km/hr.}$

11. Let the man' rate upstream be x kmph and that downstream be y kmph. Then, Distance covered upstream in 8 hrs 48 min. = Distance covered downstream in 4 hrs.

$\Rightarrow \quad \left(x\times 8\frac{4}{5}\right) = (y\times 4) \Rightarrow \frac{44}{5}x = 4y \Rightarrow y = \frac{11}{5}x.$

$\therefore$ Required ratio

$= \left(\frac{y+x}{2}\right):\left(\frac{y-x}{2}\right) = \left(\frac{16x}{5}\times\frac{1}{2}\right):\left(\frac{6x}{5}\times\frac{1}{2}\right) = \frac{8}{5}:\frac{3}{5} = 8:3.$

12. Rate upstream $= \left(\frac{7}{42}\times 60\right)\text{kmph} = 10 \text{ kmph.}$

Speed of stream = 3 kmph.

Let speed in still water be x km/hr.

Then, speed upstream = $(x - 3)$ km/hr.

$\therefore \quad x - 3 = 10 \quad \text{or} \quad x = 13$ km/hr.

13. Man's rate in still water = (15 – 2.5) km/hr = 12.5 km/hr.

Man's rate against the current = (12.5 – 2.5) km/hr

= 10 km/hr.

14. Let the rate along the current be x kmph.

Then, $\frac{1}{2}(x + 3.5) = 5 \text{ or } x = 6.5$ kmph.

15. Speed upstream

$= \left(\frac{56}{1\frac{3}{4}}\right)\text{km/hr} = \left(56\times\frac{4}{7}\right)\text{km/hr} = 32 \text{ km/hr.}$

Let speed downstream be x km/hr.

Then, speed of boat in still water $= \frac{1}{2}(x + 32)\text{ km/hr.}$

$\therefore \quad \frac{1}{2}(x + 32) = 36 \Rightarrow x = 40.$

Hence, required time $= \left(\frac{56}{40}\right)\text{hrs} = 1\frac{2}{5}\text{ hrs} = 1 \text{ hr } 24 \text{ min.}$

16. Speed upstream = 7.5 kmph; Speed downstream = 10.5 kmph.

$\therefore$ Total time taken $= \left(\frac{105}{7.5}+\frac{105}{10.5}\right)\text{hours} = 24 \text{ hours.}$

17. Speed downstream = (15 + 3) kmph = 18 kmph.

Distance travelled $= \left(18\times\frac{12}{60}\right)\text{km} = 3.6 \text{ km.}$

18. Speed downstream = (5 + 1) kmph = 6 kmph;

Speed upstream = (5 – 1) kmph = 4 kmph.

Let the required distance be x km.

Then, $\frac{x}{6}+\frac{x}{4} = 1 \Leftrightarrow 2x + 3x = 12$

$\Leftrightarrow 5x = 12 \Leftrightarrow x = 2.4$ km.

19. Speed downstream = (14 + 4) km/hr = 18 km/hr;

Speed upstream = (14 – 4) km/hr = 10 km/hr.

Let the distance between A and B be x km.

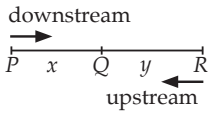
Then, $\frac{x}{18}+\frac{(x/2)}{10} = 19 \Leftrightarrow \frac{x}{18}+\frac{x}{20} = 19$

$\Leftrightarrow \frac{19x}{180} = 19 \Leftrightarrow x = 180$ km.

20. Let $PQ = QR = x$ km.

Let speed downstream = a km/hr,

and speed upstream = b km/hr.



Then, $\frac{x}{a}+\frac{x}{b} = 10 \Rightarrow x = \frac{10ab}{a+b}$ ...(*i*)

And, $\frac{2x}{a} = 4 \Rightarrow x = \frac{4a}{2} = 2a$ ...(*ii*)

From (*i*) and (*ii*), we have :

$2a = \frac{10ab}{a+b} \Rightarrow 5b = a + b \Rightarrow a = 4b.$

$\therefore$ Required ratio $= \frac{\text{Speed in still water}}{\text{Speed of river}}$

$= \frac{\frac{1}{2}(a+b)}{\frac{1}{2}(a-b)} = \frac{(a+b)}{(a-b)} = \frac{4b+b}{4b-b} = \frac{5}{3}.$

21. Let speed upstream be x kmph.

Then, speed downstream = $3x$ kmph.

Speed in still water $= \frac{1}{2}(3x + x)\text{ kmph} = 2x \text{ kmph.}$

$\therefore \quad 2x = \frac{28}{3} \Rightarrow x = \frac{14}{3}.$

So, Speed upstream $= \frac{14}{3}\text{ km/hr;}$

Speed downstream = 14 km/hr.

Hence, speed of the current

$\frac{1}{2}\left(14 - \frac{14}{3}\right)\text{km/hr} = \frac{14}{3}\text{ km/hr} = 4\frac{2}{3}\text{ km/hr.}$

22. Let the speed of the boat in still water be x kmph.

Then, Speed downstream = $(x + 4)$ kmph,

Speed upstream = $(x - 4)$ kmph.

$\therefore (x + 4) \times 6 = (x - 4) \times 8$

$\Rightarrow 6x + 24 = 8x - 32 \Rightarrow 2x = 56 \Rightarrow x = 28$ kmph.

23. Let the rate of flow of the river be x km/hr. Then,

Speed downstream = $(10 + x)$ km/hr;

Speed upstream = $(10 - x)$ km/hr

$$\therefore \quad \frac{91}{(10+x)}+\frac{91}{(10-x)}=20 \Rightarrow 91\left[\frac{20}{(10+x)(10-x)}\right]=20$$

$\Rightarrow (10 + x)(10 - x) = 91$

$\Rightarrow 100 - x^2 = 91 \Rightarrow x^2 = 9 \Rightarrow x = 3.$

Hence, rate of flow of the river = 3 km/hr.

24. Let the speed of the stream be x km/hr.

Then, Speed downstream = $(10 + x)$ km/hr,

Speed upstream = $(10 - x)$ km/hr.

$$\therefore \quad \frac{26}{(10+x)}=\frac{14}{(10-x)} \Leftrightarrow 260 - 26x = 140 + 14x \Leftrightarrow 40x = 120 \Leftrightarrow x = 3 \text{ km/hr.}$$

25. Let the speed of the stream be x mph.

Then, Speed downstream = $(10 + x)$ mph,

Speed upstream = $(10 - x)$ mph.

$$\therefore \quad \frac{36}{(10-x)}-\frac{36}{(10+x)}=\frac{90}{60} \Leftrightarrow 72x \times 60 = 90\,(100 - x^2)$$

$\Leftrightarrow x^2 + 48x + 100 = 0$

$\Leftrightarrow (x + 50)(x - 2) = 0 \Leftrightarrow x = 2$ mph.

26. Suppose he moves 4 km downstream in x hours.

Then, Speed downstream = $\left(\frac{4}{x}\right)$km/hr.

$$= \text{Speed upstream} = \left(\frac{3}{x}\right)\text{km/hr.}$$

$$\therefore \quad \frac{48}{(4/x)}+\frac{48}{(3/x)}=14 \text{ or } x=\frac{1}{2}.$$

So, Speed downstream = 7 km/hr,

Speed upstream = 6 km/hr

Rate of the stream = $\frac{1}{2}(8 - 6)$ km/hr = 1 km/hr.

27. Let rate upstream = x kmph and rate downstream = y kmph.

Then, $\frac{24}{x}+\frac{36}{y}=36$ ...(*i*)

and $\frac{36}{x}+\frac{24}{y}=\frac{13}{2}$ ...(*ii*)

Adding (*i*) and (*ii*), we get :

$$60\left(\frac{1}{x}+\frac{1}{y}\right)=\frac{25}{2} \text{ or } \frac{1}{x}+\frac{1}{y}=\frac{5}{24} \quad ...(iii)$$

Subtracting (*i*) from (*ii*), we get :

$$12\left(\frac{1}{x}-\frac{1}{y}\right)=\frac{1}{2} \text{ or } \frac{1}{x}-\frac{1}{y}=\frac{1}{24} \quad ...(iv)$$

Adding (*iii*) and (*iv*), we get : $\frac{2}{x}=\frac{6}{24}$ or $x = 8$.

So, $\frac{1}{8}+\frac{1}{y}=\frac{5}{24} \Leftrightarrow \frac{1}{y}=\left(\frac{5}{24}-\frac{1}{8}\right)=\frac{1}{12} \Leftrightarrow y = 12.$

$\therefore$ Speed upstream = 8 kmph,

Speed downstream = 12 kmph.

Hence, rate of current = $\frac{1}{2}(12 - 8)$ kmph = 2 kmph.

28. Let rate upstream = x km/hr and rate downstream = y km/hr.

Then, $\frac{30}{x}+\frac{44}{y}=10$ ...(*i*)

and $\frac{40}{x}+\frac{55}{y}=13$ ...(*ii*)

Multiplying (*i*) by 4 and (*ii*) by 3 and subtracting, we get : $\frac{11}{y}=1$ or $y = 11$.

Putting $y = 11$ in (*i*), we get : $x = 5$.

Hence, speed in still water = $\frac{1}{2}(11 + 5)$ km/hr = 8 km/hr.

29. Let the speed in still water be x mph and the speed of the current be y mph. Then,

Speed upstream = $(x - y)$;

Speed downstream = $(x + y)$

$$\therefore \quad \frac{12}{(x-y)}-\frac{12}{(x+y)}=6 \Leftrightarrow 6\,(x^2 - y^2) = 24y$$

$\Leftrightarrow x^2 - y^2 = 4y \Leftrightarrow x^2 = (4y + y^2)$ ...(*i*)

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

$\Leftrightarrow 4x^2 - y^2 = 24y \Leftrightarrow x^2 = \frac{24y + y^2}{4}$ ...(*ii*)

From (*i*) and (*ii*), we have :

$4y + y^2 = \frac{24y + y^2}{4} \Leftrightarrow 16y + 4y^2 = 24y + y^2$

$\Leftrightarrow 3y^2 = 8y \Leftrightarrow y = \frac{8}{3}.$

$\therefore$ Speed of the current = $\frac{8}{3}$ mph = $2\frac{2}{3}$ mph.

30. Required time = Time taken to cover 1 km @ 4 kmph

$$= \left(\frac{1}{4}\times 60\right)\text{min} = 15 \text{ min.}$$

31. Velocity of the river = $\left(100\sqrt{\frac{1}{4^2}-\frac{1}{5^2}}\right)$m/min

$$= \left(100\sqrt{\frac{1}{16}-\frac{1}{25}}\right)\text{m/min}$$

$$= \left(100\sqrt{\frac{9}{400}}\right)\text{m/min} = \left(100\times\frac{3}{20}\right)\text{m/min}$$

= 15 m/min.

32. Speed of boatman in still water

$$= \frac{1}{2}(\text{Rate downstream + Rate upstream})$$

$$= \frac{1}{2}(18+10)=\frac{28}{2}=14 \text{ kmph}$$

33. Speed of the boat in downstream $= \frac{55}{2.2} = \frac{55\times10}{2.5} = 22$ km/h

Then, speed of the boat in upstream

$= \frac{22}{2.2} = \frac{22\times10}{22} = 10$ km/h

$\therefore$ Speed of boat in still water $= \frac{22+10}{2} = 16$ km/h

34. Let the speed of current in water = s *km/h*

The time taken by boat A = t_a

And the time taken by boat B = t_b

Distance between point X to point Y = 20 km

Distance between point Y to Point Z = 40 km

According to the question

$\frac{40}{t_b} = 10 + s$ ...(i)

$t_a = t_b\ 3$

The speed of boat A in still water

= The speed of boat B in upstream = (10 + s) km/h

So, t_a = 20/10 = 2 hours

Hence, $t_b = t_a + 3 = 2 + 3 = 5$ hours.

By using equation (i)

$\frac{40}{5} = 10 + S$

$\Rightarrow$ 8 = 10 + S

S = 2 *km/h*

The speed of boat A in still water = (10 – 2) = 8 km/h

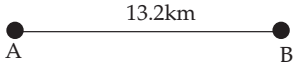
35. Let the speed of the current be x kmph.

Then speed of the boat in still water = $5x$

$\therefore$ Downstream speed = $(5x + x) = 6x$ kmph

Upstream speed = $(5x - x) = 4x$ kmph

Now,



According to the question,

$1.1 \times 6x = 13.2$

$\Rightarrow$ $6.6x = 13.2$

$\Rightarrow$ $x = \frac{13.2}{6.6}$

$\therefore$ x = 2 kmph

$\therefore$ Upstream speed = $4x = 4 \times 2 = 8$ kmph

$\therefore$ 312 minutes = $5\frac{1}{5}$ hours = $\frac{26}{5}$ hours

$\therefore$ Required distance travelled upstream = Speed × Time

$= 8\times\frac{26}{5} = 41.6$ km

36. Distance covered by a boat in 5 hours = 36 km

Rate upstream of boat $= \frac{36}{5} = 7.2$ kmph

Speed of stream = 2.4 kmph

$\therefore$ Speed of boat in still water

= (7.2 + 2.4) kmph

= 9.6 kmph

$\therefore$ Rate downstream of boat

= (9.6 + 2.4) kmph

= 12 kmph

$\therefore$ Time taken in covering 78 km distance = $\frac{78}{12} = 6.5$ hours.

37. Let upstream speed be a km/hr and downstream speed be b km/hr

Statement I = $\frac{14}{a} + \frac{35}{b} = 4$

Statement II $\frac{29}{a} + \frac{24}{b} = 5$

Let, $\frac{1}{a} = m$, $\frac{1}{b} = n$

$\Rightarrow 14m + 35b = 4$ ....(i)

and $29m + 24b = 5$ ....(ii)

Solving Equations (i) and (ii), we get

$m = \frac{79}{679}$ and $n = \frac{46}{679}$

$\therefore$ $a = \frac{1}{m} = \frac{679}{79}$ and $b = \frac{1}{n} = \frac{679}{46}$

Hence, data in both the statements I and II will give the answer.

Hence, option (*e*) is correct.

EXERCISE

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (*Questions 1 to 8*): *Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the question. Read both the statements and*

Give answer **(a)** *if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;*

Give answer **(b)** *if the data in Statement II alone are sufficient to answer the question while the data in statement I alone are not sufficient to answer the question;*

Give answer **(c)** *if the data either in Statement I or in Statement II alone are sufficient to answer the question;*

Give answer **(d)** *if the data even in both Statements I and II together are not sufficient to answer the question;*

Give answer **(e)** *if the data in both Statements I and II together are necessary to answer the question.*

1. What is the speed of the boat in still water? **(Bank P.O., 2003)**

I. It takes 2 hours to cover the distance between A and B downstream.

II. It takes 4 hours to cover the distance between A and B upstream.

2. What is the speed of the stream?

I. The ratio of the speed upstream to the speed downstream of a boat is 2 : 3.

II. The distance travelled upstream in 2 hours by the boat is more than the distance travelled by it downstream in 1 hour by 4 km.

3. What is the speed of the boat in still water? **(Bank P.O., 2008)**

I. The boat covers a distance of 48 kms in 6 hours while running upstream.

II. The boat covers the same distance in 4 hours while running downstream.

4. What is the speed of the boat in still water? **(Bank P.O., 2006)**

I. The boat running downstream takes 6 hours from A to B.

II. The boat running upstream takes 8 hours from B to C.

5. What is the man's speed in still water?

I. The speed of the stream is one-third of the man's speed in still water.

II. In a given time, the man can swim twice as far with the stream as he can against it.

6. A boat takes a total time of three hours to travel downstream from P to Q and upstream back from Q to P. What is the speed of the boat in still water?

I. The speed of the river current is 1 km per hour.

II. The distance between P and Q is 4 km.

7. What is the speed of the boat in still water?

I. The speed downstream of the boat is thrice the speed upstream.

II. The sum of the speeds of the boat, upstream and downstream is 12 kmph.

8. What is the speed of the boat in still water? **(Bank P.O., 2007)**

I. Speed of the current is 2 kmph.

II. Time taken by the boat to cover a distance of 24 km running upstream is one hour more than the time taken to cover the same distance running downstream.

Directions (*Questions 9-11*): ***Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement (s) is/are necessary to answer the questions.***

9. What is the speed of the current? **(R.B.I., 2004)**

I. Speed of the boat is 4 km/hr in still water.

II. The boat runs at a speed of 6 km/hr downstream.

III. The difference between the speeds of the boat while travelling in still water and downstream is 2 km/hr.

(*a*) Only I and II

(*b*) Only III

(*c*) Any one of the three

(*d*) Only I and either II or III

(*e*) Either I and II together or only III

10. What is the speed of the boat in still water?

I. The speed downstream is 12 kmph.

II. The speed upstream is 4 kmph.

III. In a to and fro journey between two points, the average speed of the boat was 6 kmph.

(*a*) I and II only

(*b*) All I, II and III

(*c*) III, and either I or II

(*d*) Any two of the three

(*e*) None of these

11. What is the speed of stream? **(Bank P.O., 2004)**

I. The boat covers 24 km in 6 hours moving upstream.

II. The boat covers 24 km in 3 hours moving downstream.

III. The ratio between the speed of boat and stream is 3 : 1 respectively.

(*a*) Any two of the three

(*b*) I and II only

(*c*) II and III only

(*d*) I and III only

(*e*) All I, II and III

ANSWERS

1. (*d*) **2.** (*e*) **3.** (*e*) **4.** (*d*) **5.** (*d*) **6.** (*e*) **7.** (*b*) **8.** (*e*) **9.** (*e*) **10.** (*d*) **11.** (*a*)

SOLUTIONS

1. Let AB = x km. Then,

I. Speed downstream = $\frac{x}{2}$ km/hr.

II. Speed upstream = $\frac{x}{4}$ km/hr.

$\therefore$ Speed of the boat in still water

$= \frac{1}{2}\left(\frac{x}{2}+\frac{x}{4}\right)\text{km/hr} = \frac{3x}{8}\text{ km/hr}$

Thus, I and II both even do not give the answer.
Hence, the correct answer is (*d*).

2. **I.** Let speed upstream = $2x$ km/hr and speed downstream = $3x$ km/hr.

II. $(2 \times 3x) - (1 \times 2x) = 4 \Rightarrow 4x = 4 \Rightarrow x = 1$.

$\therefore$ Speed upstream = 2 km/hr and
Speed downstream = 3 km/hr.

Speed of the stream = $\frac{1}{2}$ (3 – 2) km/hr

= $\frac{1}{2}$ km/hr.

Thus, I and II together give the answer.
Hence, the correct answer is (*e*).

3. **I.** Speed upstream = $\frac{48}{6}$ km/hr = 8 km/hr.

II. Speed downstream = $\frac{48}{4}$ km/hr = 12 km/hr.

Speed of the boat in still water

$= \frac{1}{2}(8+12)\text{ km/hr} = 10\text{ km/hr}.$

Thus, I and II together give the answer.
Hence, the correct answer is (*e*).

4. **I.** Let the distance AB be x km.

Then, speed downstream = $\frac{x}{6}$ km/hr.

II. Let the distance BC be y km.

Then, Speed upstream = $\frac{y}{8}$ km/hr.

Speed of the boat in still water $\frac{1}{2}\left(\frac{x}{6}+\frac{y}{8}\right)\text{km/hr}$.

Thus, I and II together do not give the answer.
Hence, the correct answer is (*d*).

5. Let the man's speed in still water be x km/hr.

I. Speed of the stream = $\frac{x}{3}$ km/hr.

Speed downstream = $\left(x+\frac{x}{3}\right)\text{km/hr} = \frac{4x}{3}\text{ km/hr}.$

Speed upstream = $\left(x-\frac{x}{3}\right)\text{km/hr} = \frac{2x}{3}\text{ km/hr}.$

Suppose that the fixed time is t hours. Then,

II. Gives : $2\left(\frac{4x}{3}\times t\right) = \left(\frac{2x}{3}\times t\right)$, which does not give x.

Hence, the correct answer is (*d*).

6. **I.** Speed of the current = 1 km/hr.

II. PQ = 4 km. Let the speed of the boat in still water be x km/hr.

Then, $\frac{4}{(x+1)}+\frac{4}{(x-1)}$ = 3. This gives x.

Hence, the correct answer is (*e*).

7. Let the speed upstream be x km/hr. Then,

I. Speed downstream = $3x$ km/hr.

II. Gives, speed of the boat in still water

$= \left(\frac{1}{2}\times 12\right)\text{km/hr} = 6\text{ km/hr}.$

So, II only gives the correct answer.
Hence, the correct answer is (*b*).

8. Let the speed of the boat in still water be x km/hr.

I. Speed downstream = $(x + 2)$ km/hr,
Speed upstream = $(x - 2)$ km/hr.

II. Gives : $\frac{24}{(x-2)} = \frac{24}{(x+2)} + 1$

$\Rightarrow$ $24(x + 2) = 24(x - 2) + (x^2 - 4)$

$\Rightarrow$ $x^2 = 100 \Rightarrow x = 10$

$\therefore$ The speed of the boat in still water is 10 km/hr.

Thus, both I and II are necessary to get the correct answer.
Hence, the correct answer is (*e*).

9. Let the speed of the current be x km/hr. Then,

I. Speed downstream = $(x + 4)$ km/hr,
Speed upstream = $(x - 4)$ km/hr.

II. $x + 4 = 6 \Rightarrow x = 2$.

III. Let the speed of the boat in still water be y.
Then, $(y + x) - y = 2 \Rightarrow x = 2$.

$\therefore$ Either I and II together or only III are required.
Hence, the correct answer is (*e*).

10. **From I and II:** Speed of boat in still water

$= \frac{1}{2}(12+4)\text{ km/hr} = 8\text{ km/hr}.$

From II and III, we get

$$\frac{2\times 4\times y}{4+y} = 6 \Rightarrow 8y = 24 + 6y \Rightarrow 2y = 24 \Rightarrow y = 12.$$

$\left[\because \text{Average speed} = \frac{2xy}{(x+y)}\right]$

$\therefore$ Required speed = $\frac{1}{2}(12+4)\text{ km/hr} = 8\text{ km/hr}.$

Thus, II and III give the answer.
Similarly, I and III give the answer.
Hence, the correct answer is (*d*).

11. **I.** Speed upstream = $\frac{24}{3}$ km/hr = 4 km/hr.

II. Speed downstream = $\frac{24}{3}$ km/hr = 8 km/hr.

III. Let the speed of the boat in still water be $3x$ km/hr.
Then, speed of the stream is x km/hr.

$\therefore$ Speed downstream = $\frac{1}{2}(3x + x)$ km/hr $= 2x$ km/hr.

Speed upstream = $\frac{1}{2}(3x - x)$ km/hr $= x$ km/hr.

From I and II: Speed of stream = $\frac{1}{2}$ (8 – 4) km/hr
= 2 km/hr.

From II and III: We get $2x = 8 \Rightarrow x = 4$.

$\therefore$ Speed downstream = (2 × 4) km/hr = 8 km/hr.

$\therefore$ Speed of the stream = $\frac{1}{2}$ (8 – 4) km/hr = 2 km/hr.

From I and III: We get $x = 4$ and $2x = 8$.

$\therefore$ Speed of the stream = $\frac{1}{2}$ (8 – 4) km/hr = 2 km/hr.

Thus, any two of the three will give the answer.
Hence, the correct answer is (*a*).