BOAT AND STREAM

Speed of stream or current – river or water speed – y km/hr

Speed in still water – Boat speed – x km/hr

Downstream or along the stream – u → x+y

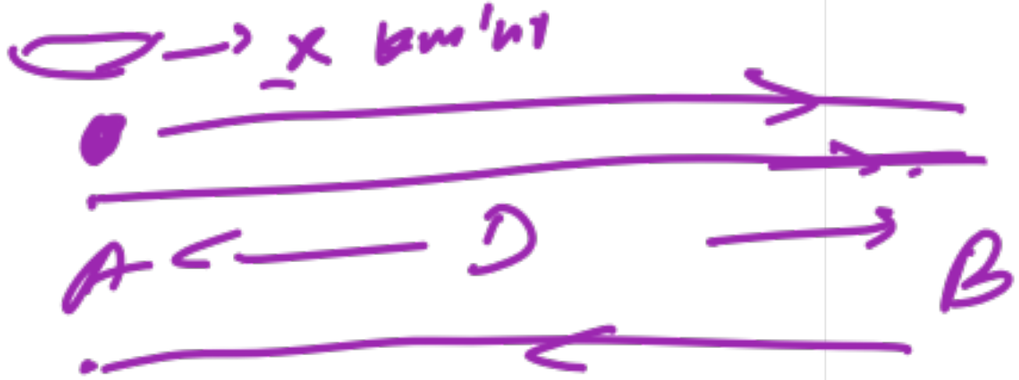
Upstream or against the stream – v ← x−y

Downstream speed $u = x + y$ km/hr

Upstream speed $v = x - y$ km/hr

$u + v = 2x$ $\quad x = \frac{u+v}{2}$

$u - v = 2y$ $\quad y = \frac{u-v}{2}$



relative speed → $x+y$; t_1 ← $x-y$; t_2

Total time $t = \frac{D}{x+y} + \frac{D}{x-y}$

$t = \frac{D}{S}$

$D = t \times \frac{x^2 - y^2}{2x}$

$D = \frac{x^2 - y^2}{2x} \times t$

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

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

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

$$D = \frac{x^2 - y^2}{2y} \times t$$

Speed of Boat = x km/hr

Speed of Stream = y km/hr

Downstream speed V = $x+y$ km/hr

Upstream speed V = $x-y$ km/hr

$$x = \frac{U+V}{2} \text{ km/hr}$$

$$y = \frac{U-V}{2} \text{ km/hr}$$

When boat goes to D km and comes back

$$D = \frac{x^2 - y^2}{2x} \times t \qquad t \text{- Total time}$$

$$D = \frac{x^2 - y^2}{2y} \times t \qquad t \text{- Extra time}$$

Downstream speed of boat is 49 km/h and upstream speed of boat is 21 km/h. Find the speed of boat (in still water) and speed of stream?

$u = 49$ km/hr

$v = 21$ km/hr

$x = ?$

$y = ?$

$$x = \frac{u+v}{2} = \frac{70}{2} = 35 \text{ km/hr}$$

$$y = \frac{u-v}{2} = \frac{28}{2} = 14 \text{ km/hr}$$

Speed of boat in still water is 9 km/h and speed of stream is 5 km/h. If total time taken by a boat to go and come back is 18 hours. Find the length of the river.

$x = 9$ km/hr

$y = 5$ km/hr

$t = 18$ h

$u = 14$

$v = 4$

D - same

$S \propto \frac{1}{T}$

$\frac{S_1}{S_2} = \frac{T_2}{T_1}$

$D = \frac{x^2 - y^2}{2x} \times t$

$= \frac{81 - 25}{18} \times 18$

$D = 56$ km

S

$+$ 4 km/hr

$\frac{U}{V} = \frac{14 \text{ km/hr}}{4 \text{ km/hr}}$

$14 : 4$

$18 = 18$ hr

$1 = 1$ hr

14 km 4 hr

$D = S \cdot T = 14 \times 4$

$= 56$ km

Speed of boat in still water is 11 km/h and speed of stream is 5 km/h. The boat takes 2.5 hours more to come back than to go . Find the length of river.

t - extra time

$x = 11$ km/hr

$y = 5$ km/hr

$2.5x = 5/2$ hr

D - same

$D = \frac{x^2 - y^2}{2y} \times t$

$D = \frac{121 - 25}{10_2} \times \frac{5}{2}$

$D = \frac{96}{4}^{24} = 24$ km

$u = 16$

$v = 6$

$\frac{u}{v} = \frac{16}{6}$

$6\frac{3}{8} = 3/8)5 = 2.5$ hr

$8\frac{1}{2} = 4$ hr

$D = 6 \times 4 = 24$ km

Speed of boat in still water is 19 km/h and speed of stream is 11 km/h. The boat takes total 9 ½ hours to go and come back. Find the length of the river.

t-total

$9\frac{1}{2} = \frac{19}{2}$

$D = \frac{x^2 - y^2}{2x} \times t$

$= \frac{361 - 121}{2 \times 9} \times \frac{19}{2}$

$D = \frac{240}{4} = 60\ km$

x

y

$u = 30$ $v = 8$

S T

$\frac{D}{V}$: 30 km/hr, $\frac{8}{30}$ hr, $\frac{4}{15}$ hr

$\frac{2}{\frac{4}{15}} = \frac{19}{\frac{1}{2}} = 9.5\ hr$

$D = 30 \times 2 = 60\ km$

Length of a river is 8 km. Speed of boat in still water is 6 km/h boat takes 3 hours to go and come back. Find the speed of stream.

D — y = ? — x — t total

$$D = \frac{x^2 - y^2}{2x} \times t$$

$$8 = \frac{36 - y^2}{2 \times 6} \times 3$$

$$8 \times 4 = 36 - y^2$$

$$y^2 = 36 - 32$$

$$y^2 = 4$$

$$y^2 = 2^2 \Rightarrow y = 2 \text{ km/hr}$$

Length of river is 40 km. Speed of stream is 3 km/h. Boat takes 6 hours more to return than to go in river. Find the speed of boat in still water.

D

$x = ?$ y

t - Extra

$D = \frac{x^2 - y^2}{2y} \times t$

$40 = \frac{x^2 - 9}{2 \times 3} \times 6$

$x^2 - 9 = 40 : 9 = 7^2$

$x = 7$ kmph

A boat covers 64 km upstream in 8 hours and 120 km downstream in 12 hours. What is the speed (in m/s) of the boat in still water?

1. 2.5 ✓
2. 2 ✗
3. 3.5 ✗
4. 3 ✗

$v = \frac{64}{8} = 8$ km/hr

$u = \frac{120}{12} = 10$ km/hr

$x = \frac{u+v}{2} = \frac{18}{2} = 9$ km/hr

$= 9 \times \frac{5}{18} = 2.5$ m/s

A boat can travel 60 km in 3 hours while going downstream, It can travel 90 km in 5 hours while going upstream. What is the ratio of the speed of boat in still water to the speed of the stream?

1. 6 : 1
2. 4 : 1
3. 19 : 1
4. 10 : 9

$u = \frac{60}{3} = 20$ km/hr

$v = \frac{90}{5} = 18$ km/hr

$x = \frac{38}{2} = 19$

$y = \frac{2}{2} = 1$

$x : y = 19 : 1$

In one hour, a man rows his canoe against the stream at 11 km/h and along the stream at 23 km/h. What is the speed (in km/h) of stream?

1. 6 ✔
2. 5 ✗
3. 17 ✗
4. 16.5 ✗

$v = 11$ km/hr $u = 23$ km/hr

$y = \frac{23-11}{2} = \frac{12}{2} = 6$ km/hr

A boat goes a distance of 4 km upstream in 2 hours and the same distance downstream in 20 minutes. How long will it take to go $10\frac{1}{2}$ km in still water?

1. $1\frac{1}{2}$ hours ✓
2. 48 minutes ✗
3. $1\frac{1}{4}$ hours ✗
4. 1 hour ✗

v = 4/2 = 2 km/hr

u = 4/(1 20/60) = 4/(1 1/3)

x = 14/2 = 7 km/hr

u = 4 × 3 = 12 km/hr

T = D/S = 3/2 = 1.5 = 1 hr 30 min

21/2

1 1/2

The speed of a boat in still water is 30 km/h. If the boat covers 60 km downstream in 1 hour 30 minutes, then what is the time taken by the boat to cover 60 km upstream?

1. 3 hours
2. 5 hours
3. 4 hours
4. 1 hour

$u = \frac{D}{T} = \frac{60}{3} \times 2 = 40$ km/hr

$u = x + y \quad = 40$

$30 \quad 10 \quad y = 10$ km/hr

$x = 30$ km/hr

$v = 20$ km/hr

$T = \frac{D}{S} = \frac{60}{20} 3 = 3$ hr

$v = x - y$

1 hr 30 min

1 hr $\frac{30}{60}$ hr

$1\frac{1}{2} = \frac{3}{2}$ hr

The speed of a boat in still water is 15 km/h. The speed of the current is 3 km/h. In how much time (in hours) will the boat travel a distance of 54km upstream and the same distance downstream?

1. $7\frac{1}{2}$
2. 7
3. 6
4. $6\frac{1}{2}$

x

y

D-SG

$D = \frac{x^2 - y^2}{2x} \times t$

$54 = \frac{225 - 9}{2 \times 15} \times t$

$t = \frac{54 \times 2 \times 15}{216} 7.5 = 7\frac{1}{2}$ hr

A boat takes 80 minutes to row 12 km upstream and 60 minutes to row 15 km downstream. How long will it take to row a distance of 36 km in still water?

1. 2 hours
2. 3 hours
3. 4 hours
4. 2.5 hours

$x = ?$

$V = \frac{12}{80} \times 60 = 9$ km/hr (80/60)

60 min 15 km

1 hr 15 km

$U = 15$ km/hr

$x = \frac{U+V}{2} = \frac{24}{2} = 12$ km/hr

$T = \frac{D}{S} = \frac{36}{12} 3 = 3$ h

The speed of a boat in still water is 6 km/h. Time taken by the boat to cover a certain distance upstream is 3 hours more than the time taken to cover the same distance downstream. If the speed of the stream is 2 km/h, then what is the total distance, upstream and downstream, covered by the boat?

1. 72 km
2. 24 km
3. 48 km ✓
4. 36 km

$x = 6$ km/hr

$y = 2$ km/hr

D	$t = \frac{3}{-}$ hr extra
D	2D

$$2D = \frac{x^2 - y^2}{2y} \times t = \frac{36 - 4}{2 \times 2} \times 3 \times 2$$

$$2D = \frac{32}{2} \times 3 = 48 \text{ km}$$

If speed of stream is 20% of the speed of boat in still water and it covers 120 km upstream in 150 minutes, then what is the downstream speed of the boat?

1. 75 km/h
2. 72 km/h
3. 80 km/h
4. 64 km/h

$y = x \times \frac{20}{100} = \frac{x}{5}$

$x/y = 5/1$

$x : y : 5 : 1$

$x = 5a$, $y = 1a : a$

$x = 60$ km/hr $\quad y = 12$ km/hr

$u = x + y = 60 + 12 = 72$ km/hr

$v = \frac{120}{150} \times 60 = 48$ km/hr

$v = x - y = 48$

$5a - a = 48$

$4a = 48$

$a = 12$ km/hr

A man can row a boat in still water at a speed of 5 m/s. He covers a stretch of 200 m in a river downstream during high and low tides in 10 s and 25 s respectively. What is the ratio of the speed (in m/s) of the water flowing in the river during high and low tides?

1. 5 : 3
2. 5 : 1
3. 3 : 2
4. 4 : 3

x = 5 m/s

y =

$T_h = 10$ sec $T_L = 25$ sec

$U_h = \frac{D}{T}$ U_L

$y_h : y_L$

5 : 3

5 : 1

$x + y_h = \frac{200}{10} = 20$ km/hr

5 is

$U_L = \frac{D}{T} = \frac{200}{25} = 8$ km/h.

$x + y_L = 8$

$5 + 3$

Abhi rows upstream a distance of 28 km in 4 hour and rows downstream a distance of 50 km in 2 hour. To row a distance of 44.8 km in still water, how much time he will take ?

अभि 4 घंटे में 28 किमी की दूरी ऊपर की ओर और 2 घंटे में 50 किमी की दूरी नीचे की ओर तय करता है। शांत जल में 44.8 किमी की दूरी तय करने के लिए, उसे कितना समय लगेगा?

[CGL Mains 2018]

(a) 3.2 h
(b) 2.8 h
(c) 2.4 h
(d) 2.2 h

$S = \frac{D}{T}$

$V = \frac{28}{6} = 7 km/hr$

$U = \frac{50}{2} = 25 km/hr$

$T = \frac{D}{S}$

$x = \frac{c+v}{2}$