Boats and Streams

LESSON#1 INTRODUCTION

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FIVE FORMULA

1. Upstream (U) (Speed) = $|B - S|$
2. Downstream (V) (Speed) = $B + S$
3. Boat Speed (B) = $\left|\frac{U+V}{2}\right|$
4. Stream Speed (S) = $\left|\frac{U-V}{2}\right|$
5. EQ. Distance =

Case (i)

$S/T/D$

Case (ii)

$S/T/D$

$D_U = D_V$

$S \times T = S \times T$

$|(B-S) \times T_1 = (B+S) \times T_2|$

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LESSON#2 Upstream & Downstream

M = 3 Km/hr S = 2 Km/hr

U = 1 Km/hr V = 5 Km/hr

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

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

$$T = \frac{10}{1} + \frac{10}{5}$$

$$T = 12 \text{ hours}$$

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

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LESSON#2 Upstream & Downstream

$B = 9$ $\quad S = 3$ $\quad D = x$

$U = 6$ km/hr $\quad V = 12$ km/hr $\quad T = 3$ hours

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

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

$$3 = \frac{2x + x}{12}$$

$$3 = \frac{3x}{12}$$

$$\boxed{x = 12 \text{ km}}$$

A boat travels upstream from B to A and downstream from A to B in 3hours. If the speed of the boat in still water is 9 Km/hr and the speed of the current is 3km/hr, the distance between A and B is

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LESSON#2 Upstream & Downstream

B: x S = 2 D = 10Km T = 55 min

U = x − 2 V = x + 2

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

$\frac{55}{60} = \frac{10}{x-2} + \frac{10}{x+2}$

$\frac{11}{12} = \frac{10(x+2)+10(x-2)}{x^2-4}$

$\frac{11}{12} = \frac{10x+20+10x-20}{x^2-4}$

$11x^2 - 44 = 240x$

$11x^2 - 240x - 44 = 0$

$x = 22$ Km/hr

-44×11

$-2 \quad +22$

$-242 \quad +x$

$11 \quad 11$

$-$

In a stream running at 2 Km/hr, a motor boat goes 10km upstream and returns to the starting point in 55min. Find out the speed of the motorboat in still water.

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LESSON#2 Upstream & Downstream

$M=10$ $S=x$ $D=91$ $T=20hr$

$U=10-x$ $V=10+x$

$$20=\frac{910+91x+910-91x}{100-x^2}$$

$$2000-20x^2=1820$$

$$20x^2=180$$

$$x^2=9$$

$$x=3$$

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

$$20=\frac{91}{10-x}+\frac{91}{10+x}$$

$$20=\frac{91(10+x)+91(10-x)}{10^2-x^2}$$

A motor-boat can travel at 10km/hr n still water.It travelled 91km downstream in a river and then returned to the same place, taking altogether 20hours. Find the rate of the flow of river.

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LESSON#2 Upstream & Downstream

$U = x - 5 \quad V = x + 5$

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

$\frac{50}{60} = \frac{10}{x-5} + \frac{10}{x+5}$

$\frac{5}{6} = \frac{10(x+5) + 10(x-5)}{x^2-25}$

$\frac{5}{6} = \frac{10x+50+10x-50}{x^2-25}$

$\frac{5}{6} = \frac{20x}{x^2-25}$

$5x^2 - 125 = 120x$

$5x^2 - 120x - 125 = 0$

5×125

$+125 \quad -$

$x = 25$ km/hr

The speed of the current is 5km/hr.A motorboat goes 10km upstream and back again to starting point in 50minutes .The speed(in km/hr) of the motorboat in still water is

(a)20 (b)26 (c)25 (d)28 (e)29

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LESSON#2 Upstream & Downstream

$U = x - 5 \qquad V = x + 5$

(b) $\frac{50}{60} = \frac{10}{21} + \frac{10}{31}$

(c) $\frac{50}{60} = \frac{10}{20} + \frac{10}{30}$

$\frac{50}{60} = \frac{30+20}{60}$

$\frac{50}{60} = \frac{50}{60}$

LHL | RHS

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

$\frac{50}{60} = \frac{10}{x-5} + \frac{10}{x+5}$

(a) $\frac{50}{60} = \frac{\cancel{2}}{\cancel{15}_{3}} + \frac{\cancel{2}}{\cancel{25}_{5}}$

(b)

The speed of the current is 5km/hr.A motorboat goes 10km upstream and back again to starting point in 50minutes .The speed(in km/hr) of the motorboat in still water is

(a)20 (b)26 (c)25 (d)28 (e)29

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LESSON#2 Upstream & Downstream

$D = 30Km \quad T = 8hr$

$$8 = \frac{\overset{10}{\cancel{30}}}{\cancel{3}y} + \frac{\overset{6}{\cancel{30}}}{5y}$$

$$8 = \frac{16^2}{y}$$

$y = 2\ Km/hr$

	B	S
	x	y
	(40)	(10)
	(4y)	(y)

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

$$8 = \frac{30}{x-y} + \frac{30}{x+y}$$

A man can row 30Km downstream and return in a total of 8 hours.If the speed of the boat in still water is four times the speed of the current, then the speed of the current is:

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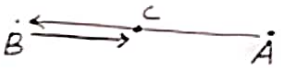
LESSON#2 Upstream & Downstream

U = 6 km/hr, V = 14 km/hr



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

$$26 = \frac{(d/2)}{6} + \frac{d}{14}$$

$$26 = \frac{d}{12} + \frac{d}{14}$$

$$\frac{26^2}{1} = \frac{12d}{84}$$

$$d = 168 \text{ km}$$

A boat takes 26 hours 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/hr and the speed of the boat in still water is 10 km/hr, what is the distance between A and B?

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LESSON#2 Upstream & Downstream

$D = 20km \quad T = 41min$

$U = x - y \quad V = x + y$

$$\frac{41}{60} = \frac{20}{x-y} + \frac{20}{x+y}$$

Data Inequality

Cannot be determined

A boat has to travel upstream 20km distance from point X of a river to Point Y. The total time taken by boat in travelling from Point X to Y and Y to X is 41minutes. What is the speed of the boat

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LESSON # 3 - Based on two Equation

A boat covers 12Km Upstream and 18Km downstream in 3 hours,while it covers 36Km upstream and 24Km downstream in 6(1/2)hours.What is the speed of the current

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$$3 = \frac{12}{x-y} + \frac{18}{x+y} \quad -①$$

$$\frac{13}{2} = \frac{36}{x-y} + \frac{24}{x+y} \quad -②$$

$① \times 3 \Rightarrow 9 = \frac{36}{x-y} + \frac{54}{x+y}$

$② \Rightarrow \frac{13}{2} = \frac{36}{x-y} + \frac{24}{x+y}$

$9 - \frac{13}{2} = \frac{30}{x+y}$

$\frac{5}{2} = \frac{30}{x+y}$

$x+y=12$

$3 = \frac{12}{x-y} + \frac{18}{12}$

$3 - \frac{3}{2} = \frac{12}{x-y}$

$\frac{3}{2} = \frac{12}{x-y}$

$x-y=8$

$x+y=12$

$x-y=8$

$2y=4$

$y=2$

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

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LESSON # 3 - Based on two Equation

A motor-boat travelling at a same speed can cover 25Km upstream and 39Km downstream in 8 hours.At the same speed,it can travel 35km upstream and 52Km downstream in 11 hours.The speed of the stream is

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① $\quad 8 = \frac{25}{x-y} + \frac{39}{x+y}$

② $\quad 11 = \frac{35}{x-y} + \frac{52}{x+y}$

① $\times 4 \Rightarrow 32 = \frac{100}{x-y} + \frac{156}{x+y}$

② $\times 3 \Rightarrow 33 = \frac{105}{x-y} + \frac{156}{x+y}$

$-1 = -5$

$x-y=5$

$x+y=13$

$-2y=-8$

$y=4$

$x-y=5$

$8 = \frac{25}{5} + \frac{39}{x+y}$

$3 = \frac{39}{x+y}$ 13

$x+y=13$

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LESSON # 3 - Based On two Equation

A boat cover 24Km upstream and 36km downstream in 6h, while it covers 36km upstream ad 24km downstream in 6(1/2)hours.The speed of the current is

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$$x-y=8$$
$$-\quad x+y=12$$
$$-2y=-4$$
$$y=2$$

$$\frac{12-39}{2}=\frac{-60}{x-y}$$
$$\frac{24-39}{2}=\frac{-60}{x-y}$$
$$\frac{-15}{2}=\frac{-60}{x-y}$$
$$x-y=8$$
$$6=\frac{24}{8}+\frac{36}{x+y}$$
$$6=\frac{36}{x+y}$$
$$x+y=12$$

$$6=\frac{24}{x-y}+\frac{36}{x+y}$$
$$\frac{13}{2}=\frac{36}{x-y}+\frac{24}{x+y}$$

① $\times 2 \Rightarrow 12=\frac{48}{x-y}+\frac{72}{x+y}$

② $\times 3 \Rightarrow \frac{39}{2}=\frac{108}{x-y}+\frac{72}{x+y}$

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LESSON # 3 - Based on two Equatio

$x+y=12$
$x-y=6$
$2x=18$
$x=9$

$\frac{3-44}{12}=\frac{-8}{x+y}$

$\frac{36-44}{12}=\frac{-8}{x+y}$

$x+y=12$

$1=\frac{4}{x-y}+\frac{4}{12_3}$

$1-\frac{1}{3}=\frac{4}{x-y}$

$\frac{2}{3}=\frac{4}{x-y}$

$x-y=6$

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

$\frac{11}{12}\frac{55}{60}=\frac{3}{x-y}+\frac{5}{x+y}$

① $\times 3 \Rightarrow 3=\frac{12}{x-y}+\frac{12}{x+y}$

② $\times 4 \quad \frac{44}{12}=\frac{12}{x-y}+\frac{20}{x+y}$

A boat goes 4Km upstream and 4Km downstream in 1 hour.The same boat goes 5km downstream and 3km upstream in 55minutes.What is the speed of the boat in still water?

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LESSON #4 - Based on twice/thrice

A person can row 7(1/2)Km/hr in still water and he finds that it takes him twice as long as to row up as to row down the river.The speed of the stream is:

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Speed (x) = $7\frac{1}{2} = \frac{15}{2}$ Km/hr

y = ?

$U_T = 2 \times D_T$

$\frac{D}{U_S} = 2 \times \frac{D}{D_S}$

$D_S = 2 \times U_S$

$\left(\frac{15}{2} + y\right) = 2 \times \left(\frac{15}{2} - y\right)$

$\left(\frac{15+2y}{2}\right) = 2 \times \left(\frac{15-2y}{2}\right)$

$15 + 2y = 30 - 4y$

$6y = 15$

$y = \frac{15}{6}$

$y = 2.5$ Km/hr

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LESSON #4 - Based on twice/thrice

Speed (x) = $4\frac{1}{2} = \frac{9}{2}$ km/hr

y = ?

$|U_T = 2 \times D_T|$

$\frac{D}{S_U} = 2 \times \frac{D}{S_D}$

$\boxed{S_D = 2 \times S_U}$

$\left(\frac{9}{2} + y\right) = 2 \times \left(\frac{9}{2} - y\right)$

$\frac{9+2y}{2} = 2 \times \frac{(9-2y)}{2}$

$9 + 2y = 18 - 4y$

$9 = 6y$

$y = 9/6$

$\boxed{y = 1.5}$

A man can row at a speed of 4(1/2)km/hr in still water.If he takes 2 times as long to row a distance upstream as to row the same distance downstream, then the speed of the stream is:

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LESSON #4 - Based on twice/thrice

Against the Stream = Up.
direction of the Current = Down.

$6+y = 18-3y$

$12 = 4y$

$y = \frac{12}{4}$

$y = 3$

$\boxed{U_T = 3 \times D_T}$

$\frac{\cancel{D}}{S_U} = 3 \times \frac{\cancel{D}}{S_D}$

$\boxed{S_D = 3 \times S_U}$

$(6+y) = 3(6-y)$

A boat goes 6Km an hour in still water, it takes thrice as much time in going the same distance against the current comparison to direction of the current.The Speed of the current is:

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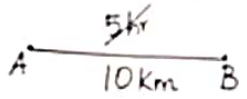
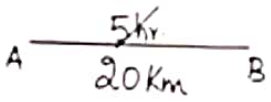
LESSON #4 - Based on twice/thrice

$x = ?$ $y = 3$ Km/hr



$|D_D = 2x\ D_U|$



$S \times T = 2 \times (S \times T)$

$(x+3) = 2(x-3)$

$x + 3 = 2x - 6$

$x = 9$

In a fixed time, a boy swims double the distance along the current that he swims against the current.If the speed of the current is 3Km/hr, the speed of the boy in still water is:

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LESSON #4 - Based on twice/thrice

Speed of the boat in still water is 6km/hr.Time Taken by the boat in upstream is four times the time taken in downstream .Then find the speed of the current.

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Answ

3.6 Km/hr