TIME, SPEED & DISTANCE

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CONCEPT

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

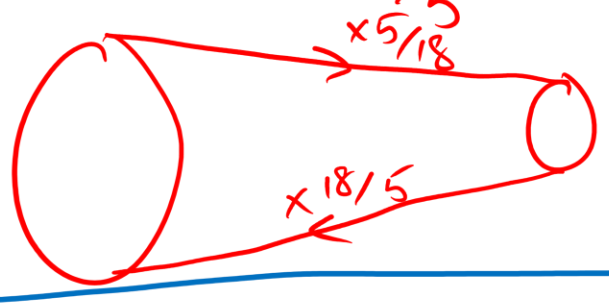
$S_{AVG} = \frac{D_{Total}}{T_{Total}}$

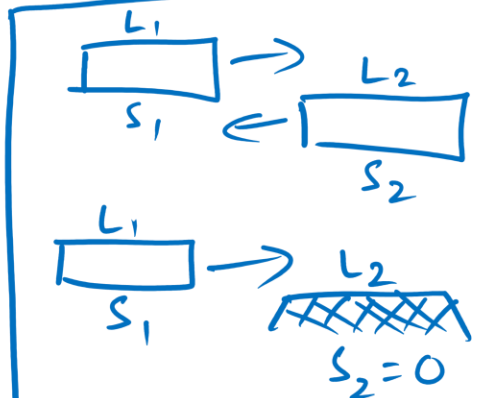
$S_{AVG} = \frac{2S_1S_2}{S_1+S_2}$ $[D_1 = D_2]$

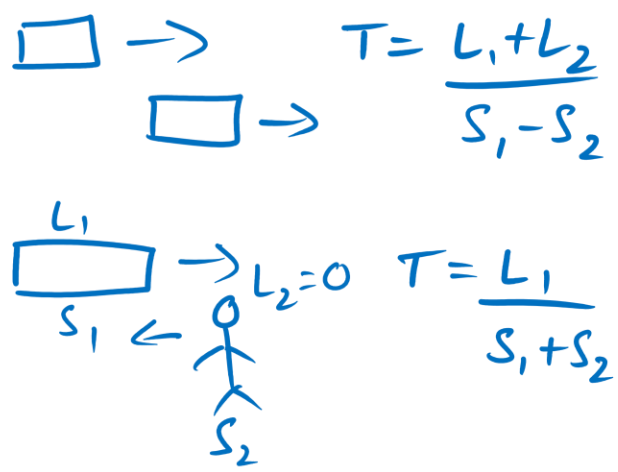
$= \frac{S_1+S_2}{2}$ $[T_1 = T_2]$

km/h $\xrightarrow{\times 5/18}$ m/s $\xrightarrow{\times 18/5}$ km/h

$\frac{1\,km}{1\,hr} = \frac{1000\,m}{3600\,sec} = \frac{5}{18}\,m/s$







1. The Hogwarts Express travels 650 km in 5 hours and another 940 km in 10 hours. What is the average speed of the train?

A) 112 kmph B) 168 kmph C) 106 kmph D) 126 kmph

$$S_{AVG} = \frac{650 + 940}{5 + 10} = 106$$

2. Two trains having lengths of 140 m and 160 m run at the speeds of 60 km/hr and 40 km/hr respectively in opposite directions (on parallel tracks). The time which they take to cross each other, is

A) 3 sec B) 9.8 sec C) 54 sec D) 10.8 sec

$$T = \frac{140+160}{(60+40)\times\frac{5}{18}} = \frac{300}{100}\times 18 = \frac{54}{5} = 10.8$$

3. A train 125 m long passes a man, running at 5 km/hr in the same direction in which the train is going, in 10 seconds. The speed of the train is:

A) 45 kmph B) 50 kmph

C) 40 kmph D) 55 kmph

$$S-5 = \frac{125}{10}\times\frac{18}{5} = 45$$

$$S = 45+5 = 50$$

4. The length of the bridge, which a train 130 metres long and travelling at 45 km/hr can cross in 30 seconds, is:

A) 200 m B) 225 m C) 245 m D) 250 m

$$L+130 = 45\times\frac{5}{18}\times 30 = 375$$

$$L = 375-130 = 245$$

5. A train crosses a man in 9 seconds. The same train crosses a 240-metre-long platform in 24 seconds. What is the time taken by the train to cross another train of 256 m length moving at 12 m/sec in the same direction?

A) 16 sec B) 50 sec C) 144 sec D) 100 sec

$\frac{L}{S} = 9$

$L = 9S$

$\frac{L+240}{S} = 24$

$9S + 240 = 24S$

$15S = 240$

$S = \frac{240}{15} = 16 \text{ m/s}$

$L = 9 \times 16 = 144 \text{ m}$

$T = \frac{144+256}{16-12}$

$= \frac{400}{4} = 100 \text{ sec}$

6. Walking at 3/4 of his normal speed, Gandalf is 16 minutes late reaching his office. The usual time taken by him to cover the distance between his home and his office is

A) 48 min B) 60 min C) 42 min D) 62 min

$$D_1 = D_2$$

$$S_1 T_1 = S_2 T_2$$

$$S T = \frac{3}{4} S (T + 16)$$

$$4T = 3T + 48$$

$$T = 48$$

7. Sam and Frodo travel the same distance at the rate of 6 km per hour and 10 km per hour respectively. If Sam takes 30 minutes longer than Frodo, the distance travelled by each is:

A) 6 km B) 10 km C) 7.5 km D) 20 km

$$D_S = D_F$$

$$S_S T_S = S_F T_F$$

$$6\left(T + \frac{30}{60}\right) = 10T$$

$$6T + 3 = 10T$$

$$4T = 3$$

$$T = 3/4$$

$$D = 10 \times \frac{3}{4}$$

$$= 7.5 \text{ km}$$

8. Harry beats Ron by 30 metres or 10 seconds. How much time was taken by Harry to complete the race of 1200 metres?

A) 6 min 40 sec B) 3 min 15 sec C) 12 min 10 sec D) 6 min 30 sec

$S_R = \frac{30}{10} = 3\ m/s$

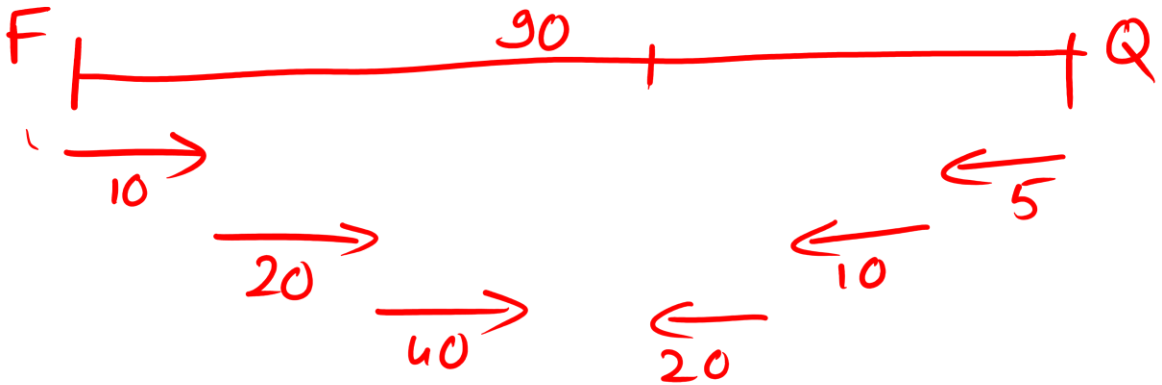
$T_R = \frac{1200}{3} = 400\ sec$

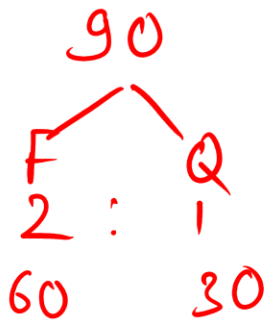
$T_H = 400 - 10 = 390\ sec$

$= 6\ min\ 30\ sec$

9. Flash and Quicksilver are 90 km away from one another. They are starting to move towards each other simultaneously, Flash at a speed of 10 kmph and Quicksilver at a speed of 5 kmph. If after every hour they double their speeds, what is the distance that Flash will travel until he meets Quicksilver?

A) 45 km B) 60 km C) 30 km D) 80 km





10. Without stoppages a train travels a certain distance with an average speed of 50 km/h and with stoppages it covers the same distance with an average speed of 40 km/h. How many minutes per hour does the train stop?

A) 10 min/h B) 15 min/h C) 12 min/h D) 8 min/h

$$Ch\,\% = \frac{Ch}{Old} \times 100$$

$$= \frac{10}{50} \times 60 = 12$$

w/o 1 hr ⟶ 50 km

w 1 hr ⟶ 40 km

} 10 km

$$T_{10} = \frac{10}{50} = \frac{1}{5}\,hrs = \frac{1}{5} \times 60 = 12\ mins$$

11. A car travels from A to B at V_1 km/hr, travels back from B to A at V_2 km/hr and again goes back from A to B at V_2 km/hr. The average speed of the car is:

A) $2V_1V_2/(V_1+2V_2)$ B) $2V_1V_2/(2V_1+V_2)$

C) $3V_1V_2/(2V_1+V_2)$ D) $3V_1V_2/(V_1+2V_2)$

	C_1	C_2	C_3
Dist	D	D	D
Speeds	V_1	V_2	V_2
Time	$\frac{D}{V_1}$	$\frac{D}{V_2}$	$\frac{D}{V_2}$

$$S_{AVG} = \frac{3D}{\frac{D}{V_1}+\frac{2D}{V_2}} = \frac{3}{\frac{1}{V_1}+\frac{2}{V_2}}$$

$$= \frac{3}{\frac{V_2+2V_1}{V_1V_2}} = \frac{3V_1V_2}{2V_1+V_2}$$

12. Shinchan walking at a speed of 20km/h reaches his college 10 min late. Next time he increases his speed by 5 km/h, but finds that he is still late by 4 min. What is the distance of his college from his home?

A) 20 km B) 6 km C) 12 km D) None of these

$$D_1 = D_2$$

$$S_1 T_1 = S_2 T_2$$

$$\cancel{20}^{4}\left(T + \frac{10}{60}\right) = \cancel{25}^{5}\left(T + \frac{4}{60}\right)$$

$$4T + \frac{40}{60} = 5T + \frac{20}{60}$$

$$T = \frac{40}{60} - \frac{20}{60} = \frac{20}{60}$$

$$D = 20\left(\frac{20}{60} + \frac{10}{60}\right)$$

$$= 20 \times \frac{30}{60} = 10$$

13. Sansa goes to office at a speed of 6 kmph and returns to her home at the speed of 4 kmph. If she takes 10 hours in all, what is the distance between her office and her home?

A) 24 km B) 12 km C) 48 km D) 30 km

$D_1 = D_2$

$S_1 T_1 = S_2 T_2$

$6T = 4(10-T)$

$6T = 40 - 4T$

$10T = 40$

$T = 4$

$D = 6 \times 4$

$= 24$

14. Bruce covers a distance in 40 minutes if he drives at a speed of 60 kmph on an average. Find the speed at which he must drive at to reduce the time of the journey by 25%.

A) 60 kmph B) 70 kmph C) 75 kmph ~~D) 80 kmph~~ ✓

$$D_1 = D_2$$

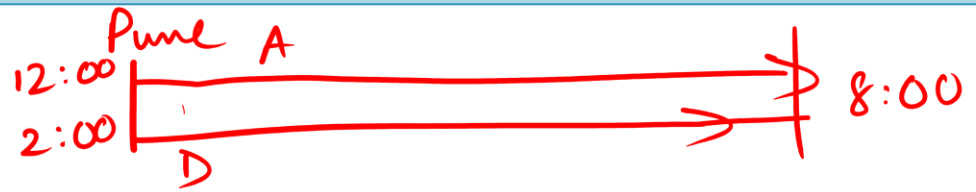
$$S_1 T_1 = S_2 T_2$$

$$\cancel{60} \times \frac{40}{\cancel{60}} = x \times \frac{\cancel{30}}{\cancel{60}}$$

$$x = 80$$

15. The Alpha Express left Pune for Mumbai at noon sharp. Two hours later, the Deccan Queen started from Pune in the same direction. The Deccan Queen overtook the Alpha Express at 8 p.m. Find the average speed of the two trains over the journey if the sum of their average speeds is 70 kmph.

A) 35 kmph ✓ B) 34.28 kmph C) 50 kmph D) 12 kmph



$D_A = D_D$

$S_A T_A = S_D T_D$

$S_A \times 8^4 = (70 - S_A) 6^3$

$4S_A = 210 - 3S_A$

$7S_A = 210$

$S_A = \frac{210}{7} = 30$ km/hr

$S_A + S_D = 70$

$S_D = 70 - S_A$

$S_D = 70 - 30 = 40$ km/hr

$S_{AVG} = \frac{2 \times 30 \times 40}{30 + 40}$

$= 34.28$

16. Two trains for Mumbai leave Delhi at 6 a.m. and 6:45 a.m. and travel at 100 kmph and 136 kmph respectively. How many kilometers from Delhi will the two trains be together?

A) 272 km B) 260 km ✓C) 283.33 km D) 262.4 km

$D_1 = D_2$

$S_1 T_1 = S_2 T_2$

$100\ T = 136\left(T - \frac{45}{60}\right)$

$100\ T = 136\ T - 136 \times \frac{3}{4}$

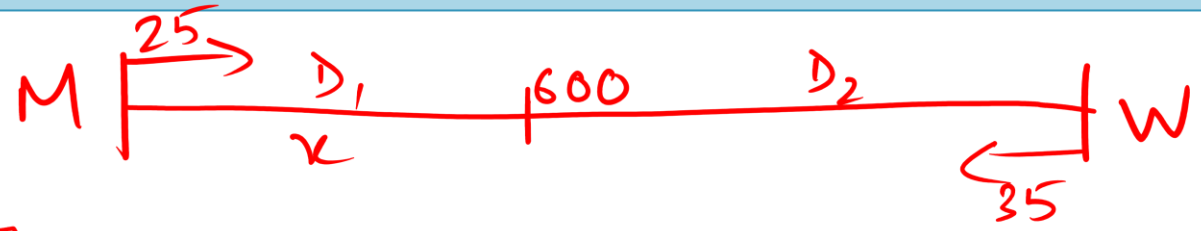
$36T = 136 \times \frac{3}{4}$

$T = \frac{34 \cancel{17} \times 3}{\cancel{4} \times \cancel{36}_{2} \cancel{+2}_{3}} = \frac{17}{6}$ hrs

$D = \cancel{100}^{50} \times \frac{17}{\cancel{6}_{3}} = 283.33$

17. Mirzapur and Wasseypur are two stations 600km apart. A train starts from Mirzapur and moves towards Wasseypur at the rate of 25km/h. After 2 hours, another train starts from Wasseypur in the opposite direction at the rate of 35km/h. How far from Mirzapur will they cross each other?

A) 250 km B) 300 km C) 279.166 km D) 475 km



$D_1 + D_2 = 600$

$S_1T_1 + S_2T_2 = 600$

$25T + 35(T-2) = 600$

$25T + 35T - 70 = 600$

$60T = 670$

$T = \frac{670}{60} = \frac{67}{6}$ hrs

$D_1 = 25 \times \frac{67}{6} = 279.166$

18. A & B are traveling from X to Y. A starts at 12 pm at a speed of 63 mph. B starts at 1:30pm at a speed of 84 mph. At what time will A be 34 miles ahead of B?

A) 4:22:51 pm B) 4:42:51 pm C) 4:32:51 pm D) 4:38:51 pm

$D_A - D_B = 34$

$S_A T_A - S_B T_B = 34$

$63T - 84(T - 1.5) = 34$

$63T - 84T + 126 = 34$

$21T = 92$

$T = \frac{92}{21} = 4.38$ hrs

4 hrs 0.38 x 60 mins

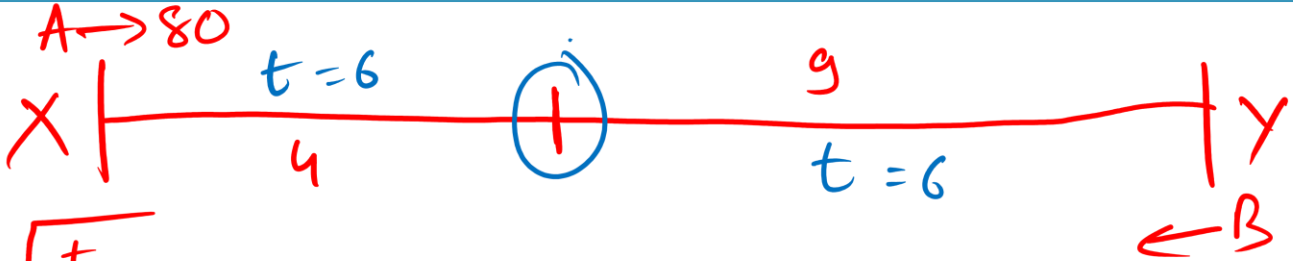
4 hrs 22 mins

4:22 pm

19. Two trains A and B start simultaneously in the opposite directions from two points X and Y respectively and arrive at their destinations 9 and 4 hours respectively after meeting each other. At what rate does the second train B travel if the first train travels at 80 km per hour?

A) 60 kmph B) 100 kmph C) 120 kmph D) 80 kmph

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



$\frac{S_1}{S_2} = \sqrt{\frac{t_2}{t_1}}$

$\frac{80}{x} = \sqrt{\frac{4}{9}} = \frac{2}{3}$

$x = \frac{80 \times 3}{2} = 120$

$\frac{t}{4} = \frac{9}{t}$

$t^2 = 9 \times 4 = 36$

$t = 6$

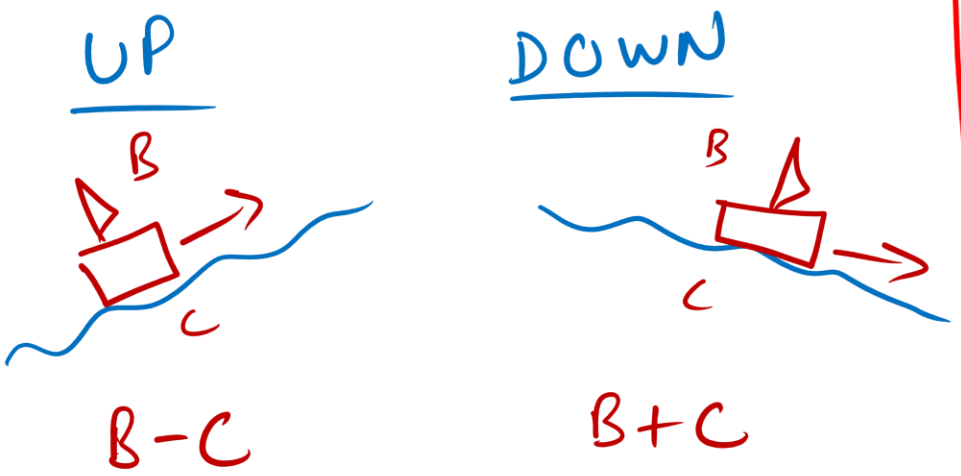
$D_A = D_B$

$80 \times 15 = x \times 10$

$x = 120$

20. A boat goes 15 km upstream in 80 min. The speed of the stream is 5 km/h. The speed of the boat in still water is

A) 6.25 kmph B) 16.25 kmph C) 11.25 kmph D) 17 kmph



$S_u = B - C = \frac{15}{80/60} = \frac{15 \times 8^3}{8_4} = \frac{45}{4} = 11.25$

$B - 5 = 11.25$

$B = 11.25 + 5 = 16.25$

21. A boat rows 16 km up the stream and 30 km downstream taking 5 hours each time. The speed of the current is

A) 1.1 kmph B) 1.2 kmph C) 1.4 kmph D) 1.5 kmph

$S_U = B - C = \frac{16}{5}$ — (1)

$S_D = B + C = \frac{30}{5}$ — (2)

(2) − (1)

$2C = \frac{30}{5} - \frac{16}{5} = \frac{14}{5}$

$C = \frac{14}{5 \times 2} = \frac{14}{10} = 1.4$

22. A motorboat went downstream for 28km and immediately returned. It took the boat twice as long to make the return trip. If the speed of the river flow were twice as high, the trip downstream and back would take 672 min. Find the speed of the boat in still water and the speed of the river flow.

A) 9 kmph, 3 kmph

B) 9 kmph, 6 kmph

C) 8 kmph, 2 kmph

D) 12 kmph, 3 kmph

$T_U = 2T_D$

$\frac{28}{B-C} = \frac{2 \times 28}{B+C}$

$B+C = 2B-2C$

$\boxed{B = 3C}$

23. A boat goes downstream at x km/h and upstream at y km/h. The speed of the boat in still water is

A) 0.5(x+y) B) 0.5(x-y) C) x+y D) x-y

$S_D = B + C = x$

$S_U = B - C = y$

$\oplus$

$2B = x + y$

$B = \frac{x+y}{2}$

24. A boat running upstream takes 8 hours 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) 1 : 3 B) 2 : 1 C) 1 : 2 D) 3 : 1

$$\frac{T_U}{T_D} = \frac{8}{4} = \frac{2}{1} = \frac{S_D}{S_U} = \frac{B+C}{B-C}$$

$$2B - 2C = B + C$$

$$B = 3C$$

$$\frac{B}{C} = \frac{3}{1}$$

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

$$T_D = T_U - 1.5$$

$$\frac{36}{B-C} - \frac{36}{B+C} = 1.5$$

$$\frac{36(B+C-(B-C))}{B^2-C^2} = 1.5$$

$$\frac{36 \times 2C}{B^2-C^2} = 1.5$$

$$\overset{24}{72}C = (100-C^2)\frac{3}{2}$$

$$48C = 100 - C^2$$

$$C^2 + 48C - 100 = 0$$

$$C^2 + 50C - 2C - 100 = 0$$

$$C(C+50) - 2(C+50) = 0$$

$$(C+50)(C-2) = 0$$

$$C = -50 \text{ or } +2$$

EXTRA QUESTIONS:

26. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. The duration of the flight is:

A. 1 hour B. 2 hours C. 3 hours D. 4 hours

27. In covering a distance of 30 km, Abhay takes 2 hours more than Sameer. If Abhay doubles his speed, then he would take 1 hour less than Sameer. Abhay's speed is:

A. 5 kmph B. 6 kmph C. 6.25 kmph D. 7.5 kmph

28. A jogger running at 9 kmph alongside a railway track in 240 metres ahead of the engine of a 120 metres long train running at 45 kmph in the same direction. In how much time will the train pass the jogger?

A. 3.6 sec B. 18 sec C. 36 sec D. 72 sec

29. Two trains are running in opposite directions with the same speed. If the length of each train is 120 metres and they cross each other in 12 seconds, then the speed of each train (in km/hr) is:

A. 10 B. 18 C. 36 D. 72

30. A man takes twice as long to row a distance against the stream as to row the same distance in favour of the stream. The ratio of the speed of the boat (in still water) and the stream is:

A. 2 : 1 B. 3 : 1 C. 3 : 2 D. 4 : 3

ANSWER KEY – TIME, SPEED & DISTANCE

QUESTION	ANSWER	QUESTION	ANSWER	QUESTION	ANSWER
1	C	11	C	21	C
2	D	12	D	22	A
3	B	13	A	23	A
4	C	14	D	24	D
5	D	15	B	25	A
6	A	16	C	26	A
7	C	17	C	27	A
8	D	18	A	28	C
9	B	19	C	29	C
10	C	20	B	30	B