Time, Speed and Distance (Train, Boat & Stream)

SPEED

The rate at which any moving body covers a particular distance is called its speed i.e. the distance travelled in unit time is called speed.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}; \quad \text{Time} = \frac{\text{Distance}}{\text{Speed}};$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

Average Speed

Average speed is defined as the ratio of total distance covered to the total time taken by an object *i.e.*

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

If an object travels $d_1, d_2, d_3, \ldots, d_n$ distances with different speeds $s_1, s_2, s_3, \ldots, s_n$ in time $t_1, t_2, t_3, \ldots, t_n$ respectively; then average speed (S_a) is given by

$$\boxed{S_a = \frac{d_1 + d_2 + d_3 + \ldots + d_n}{t_1 + t_2 + t_3 + \ldots + t_n}} \quad \ldots (1)$$

Since, Distance = Speed × Time

$\therefore \quad d_1 = s_1 t_1, \quad d_2 = s_2 t_2, \quad d_3 = s_3 t_3, \ldots, d_n = s_n t_n$

Hence from (1), $\boxed{S_a = \frac{s_1 t_1 + s_2 t_2 + s_3 t_3 + \ldots + s_n t_n}{t_1 + t_2 + t_3 + \ldots + t_n}}$

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

$\therefore \quad t_1 = \frac{d_1}{s_1}, \quad t_2 = \frac{d_2}{s_2}, \quad t_3 = \frac{d_3}{s_3}, \ldots, t_n = \frac{d_n}{s_n}$

Hence from (1), $\boxed{S_a = \frac{d_1 + d_2 + d_3 + \ldots + d_n}{\frac{d_1}{s_1} + \frac{d_2}{s_2} + \frac{d_3}{s_3} + \ldots + \frac{d_n}{s_n}}}$

Special cases

(i) If with two different speeds s_1 and s_2 the same distance d is covered, then

$$\text{Average speed} = \frac{2s_1 \cdot s_2}{s_1 + s_2}$$

(ii) If with three different speeds s_1, s_2 and s_3 the same distance d is covered, then

$$\text{Average speed} = \frac{3s_1 \cdot s_2 \cdot s_3}{s_1 \cdot s_2 + s_2 \cdot s_3 + s_3 \cdot s_1}$$

Relative Speed

When two bodies are moving in same direction with speeds s_1 and s_2 respectively, their relative speed is the difference of their speeds.
i.e., Relative Speed = $S_1 - S_2$, if $S_1 > S_2$ = $S_2 - S_1$, if $S_2 > S_1$
When two bodies are moving in opposite direction with speeds S_1 and S_2 respectively, then their relative speed is the sum of their speeds.

i.e., Relative Speed = $S_1 + S_2$

TRAIN

A train is said to have crossed an object (stationary or moving) only when the last coach of the train crosses the object completely. It implies that the total length of the train has crossed the total length of the object.

Concept related to motion of trains

Different situations in which Time is to be find out	Formula of time taken in different situations
(i) Time taken by a train to cross a pole, a tree or a man standing on a plateform	$= \frac{\text{Length of the train}}{\text{Speed of the train}}$
(ii) Time taken by a train to cross a man moving in the opposite direction	$= \frac{\text{Length of the train}}{(\text{Speed of the train}) + (\text{Speed of the man})}$
(iii) Time taken by a train to cross a man moving in the same direction	$= \frac{\text{Length of the train}}{(\text{Speed of the train}) - (\text{Speed of the man})}$
(iv) Time taken by a train to cross a platform, bridge or tunnel	$= \frac{(\text{Length of the plateform/bridge/terminal}) + (\text{Length of the train})}{\text{Speed of the train}}$
(v) Time taken by two trains to cross each other travelling in opposite direction	$= \frac{\text{Sum of length of two trains}}{\text{Sum of speed of two trains}}$
(vi) Time taken by a faster train to cross a slower train travelling in the same direction	$= \frac{\text{Sum of length of two trains}}{(\text{Speed of faster trains}) - (\text{Speed of slower train})}$

Note

In the case of a train crossing a man, tree or a pole, the length of the man, tree or pole is actually its diameter (or width) which is generally considered as negligible.

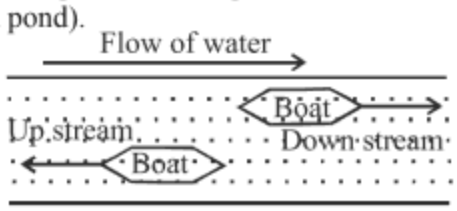
BOATS AND STREAMS

Stream : It implies that the water in the river is moving or flowing.

Upstream : Going against the flow of the river.

Downstream : Going with the flow of the river.

Still water : It implies that the speed of water is zero (generally, in a lake and pond).



Let the speed of a boat in still water be X m/sec and the speed of the stream (or current) be Y m/sec. Then,

Speed of boat with in the direction of stream (or downstream) $= (X + Y)$ m/sec.

Speed of boat in opposite direction of the stream (or upstream) $= (X - Y)$ m/sec.

Speed of boat in still water,

$$X = \frac{(X-Y)-(X+Y)}{2}$$

$$= \frac{\text{Speed of the Boat in Upstream} - \text{Speed of the Boat in Downstream}}{2}$$

Speed of the stream or current,

$$Y = \frac{(X+Y)-(X-Y)}{2}$$

$$= \frac{\text{Speed of the Boat in Downstream} - \text{Speed of the Boat in Upstream}}{2}$$

CIRCULAR MOTION

When two bodies start moving from a place on a circular track simultaneously in the same direction, the faster body keeps increasing the distance by which the slower body is behind the faster body. When this distance becomes equal to the circumference of the track, the faster body meets the slower body first time i.e. faster body comes in line with the slower body.

(i) When two bodies are moving in the opposite directions, their relative speed is equal to the sum of their individual speeds.

(ii) When two bodies are moving in the same direction, their relative speed is equal to the difference of the speeds of the two bodies.

First meeting : If A and B are two runners running in opposite direction from the same point, then time taken by A and B to meet for the first time

$$= \frac{\text{Circumference of the circular track}}{\text{Relative speed}}$$

Second meeting : If A and B are two runners running in opposite direction, then time taken by A and B to meet for the second time after first meeting

$$= \frac{\text{Circumference of the circular track}}{\text{Relative speed}}$$

EXERCISE

1. A man rides at the rate of 18 km/hr, but stops for 6 mins. to change horses at the end of every 7th km. The time that he will take to cover a distance of 90 km is
(a) 6 hrs. (b) 6 hrs. 12 min.
(c) 6 hrs. 18 min. (d) 6 hrs 24 min.

2. A man rows down a river 15 km in 3 hrs. with the stream and returns in $7\frac{1}{2}$ hrs. The rate at which he rows in still water is
(a) 2.5 km/hr (b) 1.5 km/hr
(c) 3.5 km/hr (d) 4.5 km/hr

3. By walking at $\frac{3}{4}$ of his usual speed, a man reaches his office 20 minutes later than usual. His usual time is
(a) 30 min. (b) 75 min. (c) 90 min. (d) 60 min.

4. A student goes to school at the rate of $\frac{5}{2}$ km/hr and reaches 6 minutes late. If he travels at the speed of 3 km/hr, he reaches 10 minutes earlier. The distance of the school is
(a) 45 km (b) 20 km (c) 10 km (d) 4 km

5. A is twice as fast as B and B is thrice as fast as C is. The journey covered by C in 1½ hours will be covered by A in
(a) 15 minutes (b) 20 minutes
(c) 30 minutes (d) 1 hour

5. How many seconds will a train 120 metres long running the rate of 36km/ hr take to cross a bridge of 360 metres in length?
(a) 48 sec (b) 36 sec (c) 40 sec (d) 46 sec

7. A farmer travelled a distance of 61 km in 9 hrs. He travelled partly on foot at the rate of 4 km/hr and partly on bicycle at the rate of 9 km/hr. The distance travelled on foot is
(a) 17 km (b) 16 km (c) 15km (d) 14 km

8. A man travelled a distance 72 km in 12 hour. He tavelled partly on foot at 5 km/hour and partly on bicycle at 10 km/ hour. The distance travelled foot is
(a) 46 km (b) 52 km (c) 50 km (d) 48 km

9. A man takes 6 hours 35 minutes in walking to a certain place and riding back. He would have taken 2 hours less by riding both ways. What would be the time he would take to walk both ways?
(a) 4 hours 35 minutes (b) 8 hours 35 minutes
(c) 10 hours (d) 8 hours 25 minutes
(e) None of these

10. A 240 metres long train crosses a platform twice its length in 40 seconds. What is the speed of the train?
(a) 6 metres/sec. (b) 28 metres/sec.
(c) 18 metres/sec. (d) 16 metres/sec.
(e) None of these

11. A man rows to a place 35 km in distance and back in 10 hours 30 minutes. He found that he can row 5 km with the stream in the same time as he can row 4 km against the stream. Find the rate of flow of the stream.
(a) 1 km/hrs (b) 0.75 km/hrs
(c) 1.33 km/hrs (d) 1.5 km/hrs

12. The distance between two places A and B is 140 kms. The first scooter departs from place A to B, at a speed of 50 kmph at 10 am. The second scooter departs from place B to A at a speed of 30 kmph at 12 pm. At what time will both the scooters meet each other?
(a) 12 : 30 pm (b) 01 : 50 pm
(c) 01 : 00 pm (d) 12 : 50 pm
(e) 01 : 30 pm

13. A train starts from *A* at 7 a.m. towards *B* with speed 50 km/h. Another train starts from *B* at 8 a.m. with speed 60 km/h towards *A*. Both of them meet at 10 a.m. at *C*. The ratio of the distance *AC* to *BC* is
(a) 5 : 6 (b) 5 : 4 (c) 6 : 5 (d) 4 : 5

14. A man walks a certain distance in certain time, if he had gone 3 km per hour faster, he would have taken 1 hour less than the scheduled time, if he had gone 2 km per hour slower, he would have been one hour longer on the road. The distance (in km) is :
(a) 60 (b) 45 (c) 65 (d) 80

15. Two trains started at the same time, one from *A* to *B* and the other from *B* to *A*. If they arrived at *B* and *A* respectively 4 hours and 9 hours after they passed each other, the ratio of the speed of the two trains was
(a) 2 : 1 (b) 3 : 2 (c) 4 : 3 (d) 5 : 4

16. In a kilometre race, *A* beats *B* by 30 seconds and *B* beats *C* by 15 seconds. If A beats *C* by 180 metres, the time taken by *A* to run 1 kilometre is
(a) 250 seconds (b) 205 seconds
(c) 200 seconds (d) 210 seconds

17. A man travelled a distance of 72 km. in 12 hours. He travelled partly on foot at 5 km/hour and partly on bicycle at 10 km/hour. The distance travelled on foot is
(a) 50 km (b) 48 km (c) 52 km (d) 46 km

18. Shalendra riding a bicycle at 20 km/hr can reach his office in 3 hours. If he is late by 1 hour at the start, then in order to reach his destination in time he should ride at the speed of ?
(a) 20 km/hr. (b) 25 km/hr.
(c) 30 km/hr. (d) 35 km/hr.

19. A man can row 6 km/hr in still water. If the speed of the current is 2 km/hr, it takes 4 hours more in upstream than in the downstream for the same distance. The distance is
(a) 30 km (b) 24 km (c) 20 km (d) 32 km

20. The speed of a boat downstream is 15 km/hr and the speed of current is 3 km/hr. Find the total time taken by the boat to cover 15 km upstream and 15 km downstream.
(a) 2 hours 40 minutes (b) 2 hours 42 minutes
(c) 3 hours 10 minutes (d) 2 hours 30 minutes

21. On a journey across Kolkata, a taxi averages 50 km per hour for 50% of the distance. 40 km per hour for 40% of it and 20 km per hour for the remaining. The average speed in km/hour, for the whole journey is:
(a) 42 (b) 40 (c) 35 (d) 45

22. Two cars are moving with speeds v_1, v_2 towards a crossing along two roads. If their distances from the crossing be 40 metres and 50 metres at an instant of time then they do not collide if their speeds are such that
(a) $v_1 : v_2 \neq 5 : 4$ (b) $v_1 : v_2 = 25 : 16$
(c) $v_1 : v_2 = 16 : 25$ (d) $v_1 : v_2 \neq 4 : 5$

23. Points *A* and *B* are 100 km apart on a highway. One car starts from *A* and another from *B* at the same time. If the cars travel in the same direction, they meet in 5 hours. If the cars travel towards each other, they meet in 1 hour. What is the speed of the faster car?
(a) 70 km/hour (b) 40 km/hour
(c) 60 km/hour (d) 80 km/hour

24. A bus started its journey from Ramgarh and reached Devgarh in 44 minutes with its average speed of 50 km/hour. If the average speed of the bus is increased by 5 km/hour, how much time will it take to cover the same distance?
(a) 40 minutes (b) 38 minutes
(c) 36 minutes (d) 31 minutes
(e) 49 minutes

25. The distance between two cities (*M* and *N*) is 569 km. A train starts from city *M* at 8 a.m. and travels towards city *N* at the rate of 53 kmph. Another train starts from city *N* at 9 am and travels towards city *M* at the rate of 76 kmph. At what time will the trains meet?
(a) 12 : 30 p.m. (b) 1 : 00 p.m.
(c) 2 : 30 p.m. (d) 1 : 30 p.m.
(e) 2 : 00 p.m.

26. Two cars starts at the same time from *A* and *B* which is 120 km apart. If the two cars travel in opposite direction they meet after one hour and if they travel in same direction (from *A* towards *B*) then two cars crosses after 6 hours. What is the speed of car starting from *A*?
(a) 70 kmph (b) 120 kmph
(c) 60 kmph (d) Data inadequate
(e) None of these

27. The distance between 2 places *R* and *S* is 42 km. Anita starts from *R* with a uniform speed of 4 km/h towards *S* and at the same time Romita starts form *S* towards *R* also with same uniform speed. They meet each other after 6 hours. The speed of Romita is
(a) 18 km/hour (b) 20 km/hour
(c) 3 km/hour (d) 8 km/hour

28. A thief is noticed by a policeman from a distance of 200 m. the thief starts running and the policeman chases him. The thief and the policeman run at the rate of 10 km/hr. and 11 km/hr. respectively. What is the distance between them after 6 minutes ?
(a) 100 m (b) 190 m (c) 200 m (d) 150 m

29. Points 'A' and 'B' are 70 km apart on a highway and two cars start at the same time. If they travel in the same direction, they meet in 7 hours, but if they travel towards each other they meet in one hour. Find the speed of the tow cars (in km/hr).
(a) 20, 30 (b) 40, 30
(c) 30, 50 (d) 20, 40

30. A thief steals a car at 1.30 P.M. and drive it off at 40 km/hr. The thieft is discovered at 2 P.M. and the owner sets off in another car at 50 km/hr. he will overtake the thief at
(a) 5 p.m. (b) 4 p.m. (c) 4.30 p.m. (d) 6 p.m.

31. A train covers a distance of 3584 km in 2 days 8 hours. If it covers 1440 km on the first day and 1608 km on the second day, by how much does the average speed of the train for the remaining part of the journey differ from that for the entire journey?
(a) 3 km/hr (b) 4 km/hr
(c) 10 km/hr (d) 2 km/hr

32. A car driver leaves Bangalore at 8 : 30 A.M. and expects to reach a place 300 km from Bangalore at 12:30 P.M. At 10:30 he finds that he has covered only 40% of the distance. By how much he has to increase the speed of the car in order to keep up his schedule ?
(a) 45 km/hr (b) 40 km/hr
(c) 35 km/hr (d) 30 km/hr

33. If a man walks at the rate of 5 km/hour, he misses a train by 7 minutes. However if he walks at the rate of 6 km/hour, he reaches the station 5 minutes before the arrival of the train. The distance covered by him to reach the station is
(a) 7 km (b) 6.25 km (c) 6 km (d) 4 km

34. Ravi travels 300 km partly by train and partly by car. He takes 4 hours to reach. If he travels 60 km. by train and rest by car. He will take 10 minutes more if he were to travel 100 km by train and rest by car. The speed of the train is :
(a) 50 km/hr (b) 60 km/hr
(c) 100 km/hr (d) 120 km/hr

35. A, B and C walk 1 km. in 5 minutes, 8 minutes and 10 minutes respectively. C starts walking from a point at a certain time, B starts from the same point 1 minutes later and A starts from the same point 2 minutes later then C, then A meets B and C after.
(a) $\frac{5}{3}$ min, 2 min (b) 1 min, 2 min
(c) 2 min, 3 min (d) $\frac{4}{3}$ min, 3 min

36. Points A and B are 100 km apart on a highway. One car starts from A and another from B at the same time. If the cars travel in the same direction, they meet in 5 hours. If the cars travel towards each other, they meet in 1 hour. What is the speed of the faster car ?
(a) 70 km/hr. (b) 60 km/hr.
(c) 80 km/hr. (d) 40 km/hr.

37. A man goes downstream with a boat to some destination and returns upstream to his original place in 5 hours. If the speed of the boat in still water and the stream are 10 km/hr and 4 km/hr respectively, the distance of the destination from the starting place is :
(a) 16 km (b) 18 km
(c) 21 km (d) 25 km

38. A man rows to a place 60 km distance and back in 13 hours 30 minutes. He finds that he can row 5 km with the stream in the same time as he can row 4 km against the stream. Find the rate of the stream.
(a) 8 km/hr (b) 1/2 km/hr
(c) 10 km/hr (d) 1 km/hr

Hints & Solutions

1. (b) Number of stoppages $= \frac{90}{7} \cong 12$

$\therefore$ Total time $= \left(\frac{90}{18}\right)$ hours $+ 12 \times 6$ minutes

$= 6$ hours 12 minutes

2. (c) Speed of person in still water $= x$ kmph and speed of current $= y$ kmph

$\therefore \quad x + y = \frac{15}{3} = 5$ kmph ...(i)

$x - y = \frac{15}{\frac{15}{2}} = 2$ kmph ...(ii)

On adding both eq. (i) and (ii) $2x = 7$

$\Rightarrow \quad x = \frac{7}{2} = 3.5$ km/hr

3. (d) New speed $= \frac{3}{4} \times$ usual speed

$\therefore$ New time $= \frac{4}{3} \times$ usual time

$\therefore \quad \frac{1}{3} \times$ usual time $= 20$ minutes

$\Rightarrow$ Usual time $= 3 \times 20 = 60$ minutes

4. (d) Let original time taken by student be x hours.

$$\frac{5}{2} \times \left(x + \frac{6}{60}\right) = 3 \times \left(x - \frac{10}{60}\right)$$

$5x + \frac{1}{2} = 6x - 1$ or $x = \frac{3}{2}$ hours

$\therefore$ Distance of school $= \frac{5}{2} \times \left(\frac{3}{2} + \frac{1}{10}\right) = 4$ km

5. (a) Let C's speed $= x$ km/h
Then, B's speed $= 3x$ km/h and A's speed $= 6x$ km/h
Ratio of speeds of A, B, $C = 6x : 3x : x = 6 : 3 : 1$

Ratio of time taken $= \frac{1}{6} : \frac{1}{3} : 1 = 1 : 2 : 6$

It C's 90 minutes
Hence, $6x = 90$ or $x = 15$ minutes
Hence, A should take 15 minutes.

6. (a) Total distance = Length of train + Length of bridge
$= 120 + 360 = 480$ m

$$\text{Speed} = 36 \text{ km/h} = 36 \times \frac{5}{18} = 10 \text{ m/sec}$$

$$\text{So time} = \frac{\text{Distance}}{\text{Speed}} = \frac{480}{10} = 48 \text{ sec}$$

7. (b) Let the distance travelled by foot be x km.
Then, distance travelled by bicycle = $(61 - x)$ km

$$\text{So, } \frac{x}{4} + \frac{61 - x}{9} = 9$$
$$9x + 4(61 - x) = 9 \times 36$$
$$9x - 4x = 324 - 244$$
$$5x = 80 \text{ or } x = 16 \text{ km}$$

8. (d) Let distance travelled by foot = x km/hr
Let distance travelled by bicycle = $72 - x$ km/hr

$$\frac{x}{5} + \frac{(72 - x)}{10} = 12$$
$$2x + 72 - x = 120$$
$$x = 120 - 72 = 48 \text{ km}$$

9. (b) Time taken in walking one way + riding other way
= 6 hours 35 minutes ...(i)
Time taken in riding both ways
= 4 hours 35 minutes ...(ii)
By equation (i) × 2 – (ii),
2 × Time taken in walking one way
= 13 hours 10 minutes – 4 hours 35 minutes
= 8 hours 35 minutes

10. (c) Length of the train = 240 metre
∴ Length of the platform = 480 metre
We know that when a train crosses a platform, it covers a distance equal to the sum of its length and that of platform.

$$\therefore \text{ Speed of train} = \left(\frac{240 + 480}{40}\right) \text{ m/sec.}$$
$$= \frac{720}{40} = 18 \text{ m/sec.}$$

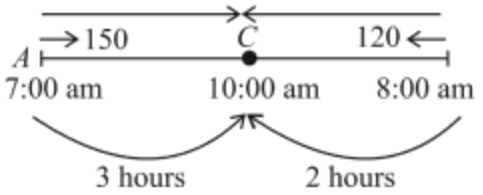
11. (b) Let speed of man and stream is 'V' and 'U' respectively

$$\text{Then, } \frac{5}{V + U} = \frac{4}{V - U}$$

[Travelling distance in same time]
$$5V - 5U = 4V + 4U$$
$$V = 9U \Rightarrow \frac{V}{U} = \frac{9}{1}$$
Let $U = x$, $V = 9x$
$$\frac{35}{2x}\left(\frac{1}{5} + \frac{1}{4}\right) = \frac{21}{2} \Rightarrow \frac{5}{x} \times \frac{9}{20} = 3$$
$$x = \frac{3}{4} = 0.75$$
Speed of stream = $1 \times 0.75 = 0.75$ km/hr.

12. (a) Let both scooters meet after t hours from 10 a.m.
∴ Distance = Speed × Time
∴ Distance covered by scooter A in t hours + distance covered by scooter B in $(t - 2)$ hour = 140
$\Rightarrow 50t + 30(t - 2) = 140 \Rightarrow 80t - 60 = 140$
$$\Rightarrow 80t = 200 \Rightarrow t = \frac{200}{80} = \frac{5}{2} \text{ hours}$$
i.e., after 2 hours 30 minutes i.e. at 12 : 30 p.m.

13. (b)



⇒ Distance, covered by A in 3 hours with the speed of 50 km/h = $50 \times 3 = 150$ km.
⇒ Distance covered by B in 2 hours with the speed of 60 km/h = $60 \times 2 \Rightarrow$ 120 km.
then $AC : BC = 150 : 120 = 5 : 4$

14. (a) Let the speed = x km/hr
then time = y hr.
A.T.O.
$x \times y = (x + 3)(y - 1)$
$xy = xy + 3y - x - 3$
$x - 3y = -3$ ...(i)
$x \times y = (x - 2)(y + 1)$
$xy = xy - 2y + x - 2$
$x - 2y = 2$ ...(ii)
Solve equation (i) and (ii)
$x = 12$, y = 5
Distance = Speed × time = $12 \times 5 = 60$ km.

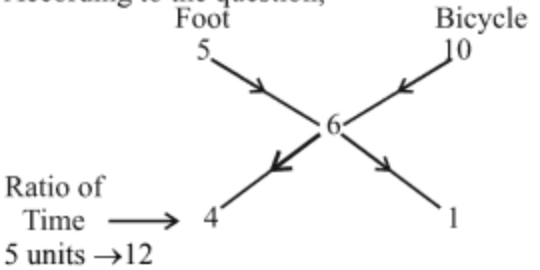
15. (b) As speed is inversely proportional to time

$$\frac{\text{Speed of } A}{\text{Speed of } B} = \sqrt{\frac{\text{Time of } B}{\text{Time of } A}} = \sqrt{\frac{9}{4}} = \frac{3}{2}$$

⇒ Speed of A : Speed of $B = 3 : 2$

16. (b) Let time taken by A to cover 1 km. = x sec.
Time taken by B and $C = x + 30$ and $x + 45$ sec
$$\frac{x}{x + 45} = \frac{(1000 - 180)}{1000} = \frac{41}{50}$$
$$50x = 41x + 1845$$
$x = 205$ sec.

17. (b) According to the question,



5 units → 12
1 unit → $\frac{12}{5}$
4 units = $\frac{12}{5} \times 4 = \frac{48}{5}$

$$\text{Distance travelled on foot} = \frac{48}{5} \times 5 = 48 \text{ km}$$

18. (c) Distance = 20 × 3 = 60 km.
When 1 hour late then reducing time = 3 – 1 = 2 hours
Then increasing speed $= \frac{60}{2} = 30$ km/hr

19. (d) Speed of man in still water, (x) = 6 km/hr
Speed of current (y) = 2 km/hr
Let Distance = M
ATQ
Upstream time = Downstream time + 4

$$\frac{M}{4} = \frac{M}{8} + 4$$

$$\frac{M}{4} = \frac{M+32}{8}$$

$$\frac{M}{1} = \frac{M+32}{2}$$

$M = 32$
$\therefore$ Distance = 32 km.

20. (a) Given,
Speed of boat down stream = 15 km/hr
Speed of current = 3 km/hr
Speed of boat in still water = 12 km/hr

Time taken at upstream $= \frac{15}{12-3} = \frac{15}{9}$ h = 1 h 40 min

Time taken at downstream $= \frac{15}{12+3} = 1$ h

Total time = 2h 40 min

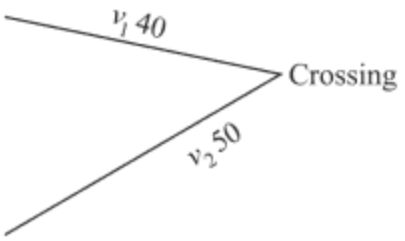
21. (b) Total distance = 100 km.

$$\text{Total time} = \frac{50}{50} + \frac{40}{40} + \frac{10}{20}$$

$$= 1 + 1 + \frac{1}{2} = \frac{5}{2} \text{ hours}$$

$\therefore$ Average speed $= \frac{100 \times 2}{5} = 40$ kmph

22. (d)



If $\frac{40}{v_1} = \frac{50}{v_2}$ then they will collide i,e. cars will reach at the same time.

$\therefore \quad \frac{v_1}{v_2} \neq \frac{40}{50} = \frac{4}{5}$

23. (c) Let the speed of car be x and other be y
Distance covered from A in 5 hrs = $5x$
Distance covered from B in 5 hrs = $5y$
ATQ
when they travel in same direction

$$5x - 5y = 100$$

$$x - y = 20 \quad \text{...(i)}$$

When they travel towards each other
ATQ,

$$x + y = 100 \quad \text{...(ii)}$$

Now, adding eqn (i), & (ii)

$$2x = 120$$

$x = 60$ km/hr

24. (a) Distance between Ramgarh and Devgarh

$$= \frac{50 \times 44}{60} = \frac{110}{3} \text{ km}$$

New speed = 55 kmph $= \frac{55}{60}$ km/minute

$\therefore$ Required time $= \frac{\text{Distance}}{\text{time}} = \frac{110}{3} \times \frac{60}{55}$

= 40 minutes

25. (b) Let the trains meet after t hours from 8 a.m.
Distance = speed × time
According to the question,
$53 \times t + 76(t-1) = 569 \Rightarrow 53t + 76t - 76 = 569$
$\Rightarrow \quad 129t = 569 + 76 = 645$

$\Rightarrow \quad t = \frac{645}{129} = 5$ hours

$\therefore$ Required time = 8 a.m. + 5 hours = 1 p.m.

26. (a) Let speed of car starting at $A = x$ km/hr
and speed of car starting at $B = y$ km/hr

$\therefore \quad x + y = 120 \quad \text{...(i)}$

$$6x - 6y = 120 \quad \text{...(ii)}$$

$\Rightarrow \quad x = 70$ km/hr.
$y = 50$ km/hr

27. (c) Let speed of Romita be x km/hr
According to question,

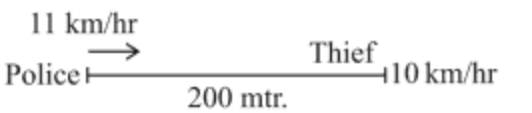
4km/hr	x km/hr
Anita	Romita
R	S

$d = 42$ km
$t = 6$h

$$(4+x) = \frac{42}{6} \qquad \left(\because S = \frac{d}{t}\right)$$

$4 + x = 7$
$x = 3$ km/h

28. (a)



$$V_{rel} = (11 - 10) = 1 \text{ km/hr} = \frac{1 \times 1000}{60} \text{ mt/min}$$

Distance between them after 6 min.

$$= 200 - \frac{1000}{60} \times 6 = 100 \text{ mtr.}$$

29. (b) Let the speed of the cars be S_1 and S_2

$= S_1 - S_2 = \frac{70}{7} = 10$ ...(i)

and $S_1 + S_2 = \frac{70}{1} = 70$ ...(ii)

from equation (i) and (ii)

$S_1 = \frac{10+70}{2} = 40\,\text{km/hr}$ and $S_2 = \frac{70-10}{2} = 30\,\text{km/hr}$

$\therefore$ Required speeds are 40 km/hr and 30 km/hr

30. (b) Distance, covered by thief in (2 pm – 1:30 pm)

$= \frac{1}{2}$ hr at speed of 40 km/hr $= 40 \times \frac{1}{2} = 20$ kms.

$\Rightarrow$ Their relative speed in same direction
$= (50 - 40) = 10$ km/hr

$\Rightarrow$ According to question,
20 km, is the distance that has to cover by owner to over take the thief.

$\Rightarrow$ Required time $= \frac{20\text{ km}}{10} = 2$ hours

$\Rightarrow$ Therefore, he will overtake the thief at
$= 2$ pm + 2 hr. = 4 pm.

31. (a) Given : Train covers 3584 kms in 2 day 8 hour

(2 days 8 hours $= \frac{7}{3}$ days)

Average speed $= \frac{3584}{\frac{7}{3}} = 1536$ km./day

$= \frac{1536}{24} = 64$ km/hr

Distance covered in two days = 1440 + 1608 = 3048 km.
Remaining distance for third day = 3584 –3048 = 536 km.
Third day 536 km is covered in 8 hour with speed of

$= \frac{536}{8} = 67$ km./h

Difference of Average speed $= (67 - 64) = 3$ km./hr

32. (d) Distance travelled by driver in 2 hours

$= 300 \times \frac{40}{100} = 120\,\text{km}$

Distance to be covered in 2 hours = 300 – 120 = 180 km

Required speed $= \frac{180}{2} = 90$ km/h

Required difference $= 90 - \frac{120}{2} = 30$ km/hr

So increased speed = 30 km/hr.

33. (c) Diff. of time = (6 – 5) hours

$\Rightarrow$ 1 hour

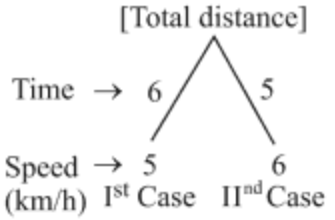
Actual diff. of time
= 7 min. – (– min)

$\Rightarrow$ (7 + 5) min.

$\Rightarrow$ 12 min.

1 hour $\xrightarrow{1/5}$ 12 min.

30 km $\xrightarrow{1/5}$ 6 km



34. (b)

	Train	Car		
+40	60 km	240 km	4 hr	+10 min
	100 km	200 km	4 hr/ 10 min	
+200	300 km	0 km	5 hr	+10×5 = 50 min

= Speed of train $= \frac{300}{5} = 60$ km/hr

35. (a) Speed of A, B and $C = \frac{1000}{5}, \frac{1000}{8}, \frac{1000}{10}$

= 200 m/ min., 125 m/min., 100 m/min.

Distance travelled by B and C before A starts
= 125, 200 metres

Time taken by A to meet B and C

$= \frac{125}{200-125}, \frac{200}{200-100} = \frac{5}{3}$ min., 2 min

36. (b) According to the question,
Let the speed of fastest car = x km/h
the speed of slower car = y km/hr.

Speed $= \frac{\text{Distance}}{\text{time}}$

$x + y = \frac{100}{1}$ km/hr and $x - y = \frac{100}{5} = 20$ km/hr

$x + y = 100$ ...(i)
$x - y = 20$ ...(ii)
Solve eqn. (i) and (ii) we get
$x = 60$ km/hr
$y = 40$ km/hr
Speed of fastest car = 60 km/hr.

37. (c) $T = \frac{2xD}{x^2 - y^2}$

$D = \frac{(10^2 - 4^2)\,5}{2 \times 10} = \frac{84 \times 5}{20} = 21$ km.

38. (d) ATQ

$\frac{60}{x+y} + \frac{60}{x-y} = \frac{27}{2}$ ...(i)

and $\frac{5}{x+y} = \frac{4}{x-y}$

$5x - 5y = 4x + 4y$
$x = 9y$ ...(ii)
Put this in equation (i)

$\frac{60}{10y} + \frac{60}{8y} = \frac{27}{2}$

Or $\frac{27}{2y} = \frac{27}{2}$ or $y = 1$ km/hr