12

TIME, DISTANCE & TRAIN

The terms Time and Distance are related to the speed of a moving object.

Speed: We define the speed of an object as the distance covered by it in a unit time interval. It is obtained by dividing the distance covered by the object in the time it takes to cover that distance.

Thus,

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

SOME BASIC FORMULAE

1. $\text{Speed} = \dfrac{\text{Distance}}{\text{Time}}$
2. Distance = Speed × Time
3. $\text{Time} = \dfrac{\text{Distance}}{\text{Speed}}$

Units of Measurement

Generally, if the distance is measured in kilometre, we measure time in hour and speed in kilometre per hour and is written as km/h and if the distance is measured in metre then time is taken in second and speed in metre per second and is written as m/s.

Conversion of Units

One kilometre/hour

$$= \frac{1000 \text{ metre}}{60 \times 60 \text{ Seconds}} = \frac{5}{18} \text{ m/s}$$

$$\therefore \text{ One metre/second} = \frac{18}{5} \text{km/h}$$

$$\text{Thus, } x \text{ km/h} = \left(x \times \frac{5}{18}\right) \text{m/s}$$

$$\text{and, } x \text{ m/s} = \left(x \times \frac{18}{5}\right) \text{km/h}$$

Important Things to Remember

1. (a) If A covers a distance d_1 km at S_1 km/h and then d_2 km at S_2 km/h, then the average speed during the whole journey is given by

Average speed

$$= \frac{s_1 s_2 (d_1 + d_2)}{s_1 d_2 + s_2 d_1} \text{ km/h}$$

(b) If A goes from X to Y at S_1 km/h and comes back from Y to X at S_2 km/h, then the average speed during the whole journey is given by

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

EXPLANATION

(a) Time taken to travel d_1 km at S_1 km/h is

$$t_1 = \frac{d_1}{s_1} h$$

Time taken to travel d_2 km at S_2 km/h is

$$t_2 = \frac{d_2}{s_2} h$$

Total time taken

$$= t_1 + t_2 = \left(\frac{d_1}{s_1} + \frac{d_2}{s_2}\right) h$$

$$\left(\frac{s_1 d_2 + s_2 d_1}{s_1 s_2}\right) h$$

Total distance covered

= $(d_1 + d_2)$ km. Therefore,

Average speed

$$= \frac{\text{Total distance covered}}{\text{Total time taken}}$$

$$= \frac{s_1 s_2 (d_1 + d_2)}{s_1 d_2 + s_2 d_1} \text{km/h} \qquad \text{....(i)}$$

(b) Let the distance from X to Y be d km. Take $d_1 = d_2 = d$ in (i), we get

Average speed

$$= \frac{2 d s_1 s_2}{d(s_1 + s_2)} = \frac{2 s_1 s_2}{s_1 + s_2}$$

2. If a body travels $d_1, d_2, d_3, \ldots, d_n$ metres with different speeds $s_1, s_2, s_3, \ldots, s_n$ m/sec in time $T_1, T_2, T_3, \ldots, T_n$ seconds respectively, then the average speed of the body throughout the journey is given by

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

$$= \frac{d_1 + d_2 + d_3 + \ldots\ldots dn}{T_1 + T_2 + T_3 \ldots\ldots + Tn}$$

[If $d_1, d_2, \ldots\ldots dn$ and $T_1, T_2, \ldots.. T_n$ are known]

and,

$$Va = \frac{s_1 T_1 + s_2 T_2 + s_3 d_3 + \ldots\ldots + s_n T_n}{T_1 + T_2 + T_3 \ldots.. Tn}$$

[If $T_1, T_2, \ldots., T_n$ and $s_1, \ldots\ldots.. s_n$ are known]

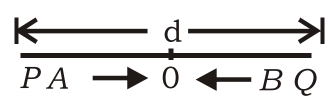
3. If two persons A and B start at the same time from two points P and Q towards each other and after crossing they take T_1 and T_2 hours in reaching Q and P respecitvely, then

$$\frac{A\text{'s speed}}{B\text{'s speed}} = \frac{\sqrt{T_2}}{\sqrt{T_1}}$$

Explanation

Let the total distance between P and Q be d km.

Let the speed of A be s_1 km/h and that of B be s_2 km/h.



Since they are moving in opposite directions, their relative speed is $(s_1 + s_2)$

They will meet after $\left(\dfrac{d}{s_1 + s_2}\right)$h

Distance travelled by A in

$$\left(\frac{d}{s_1+s_2}\right)h = PO = \left(\frac{ds_1}{s_1+s_2}\right)km$$

Distance travelled by B in $\left(\frac{d}{s_1+s_2}\right)h$

$$= QO = \left(\frac{ds_2}{s_1+s_2}\right)h$$

$$= QO = \left(\frac{ds_2}{s_1+s_2}\right)km$$

$= T_1$ (given). ......(i)

Time taken by B to travel PO

$$= \frac{\left(\frac{ds_1}{s_1+s_2}\right)}{s_1}$$

T_2 (given) ......(ii)

Dividing equation (ii) by equation (i), we get

$$\frac{s_1/s_2}{s_2/s_1} = \frac{T_2}{T_1}$$

or, $\left(\frac{s_1}{s_2}\right)^2 = \frac{T_2}{T_1}$ or, $\frac{s_1}{s_2} = \sqrt{\frac{T_2}{T_1}}$

$$\therefore \frac{A\text{'s speed}}{B\text{'s speed}} = \frac{\sqrt{T_2}}{\sqrt{T_1}}$$

4. If the new speed is $\frac{a}{b}$ of the original speed, then the change in time taken to cover the same distance is given by

Change in time $= \left(\frac{b}{a} - 1\right) \times$ original time

5. A body covers a distance d in time T_1 with speed S_1, but when it travels with speed S_2 it covers the same distance in time T_2

The following relations hold

$$= \frac{\text{product of speed}}{d} = \frac{s_1 - s_2}{T_2 - T_1}$$

$$= \frac{\text{Difference of speed}}{\text{Difference of time}}$$

Equating any two of the above, we can find the unknows as per the given question.

EXAMPLE

1. Ramesh crosses a street 600 m long in 5 minutes. His speed in km/h is.

Sol. Speed $= \frac{\text{Distance travelled}}{\text{Time taken}}$

$$= \left(\frac{600}{5 \times 60}\right) m/s$$

$$= \left(\frac{600}{5 \times 60} \times \frac{18}{5}\right) km/h$$

= 7.2 km/h

2. Mohan covers 10.2 km in 3 hours, the distance covered by him in 5 hours is

Sol. Mohan's speed

$$= \left(\frac{(10.2)}{3}\right) km/h = 3.4 \text{ km/h}$$

∴ Distance covered by him in 5 hours

= (3.4 × 5) km = 17 km

Alternate

3units $\longrightarrow$ 10.2

1unit $\longrightarrow \frac{10.2}{3}$

5units $\longrightarrow \frac{10.2}{3} \times 5 = 17$

∴ Distance covered by him in 5 hours = 17 km

3. A ship sails to a certain city at the speed of 20 knots/h and sails back to the same point at the rate of 30 knots/h. What is the average speed for the whole journey?

Sol. Here, $s_1 = 20$ and $s_2 = 30$

∴ Average speed

$$= \frac{2s_1 s_2}{s_1 + s_2} = \frac{2 \times 20 \times 30}{20 + 30}$$

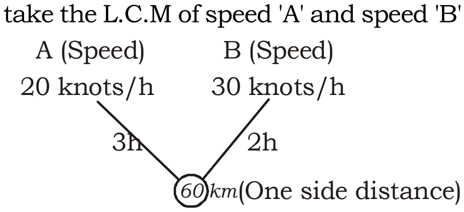
= 24 knots/h

Alternate

Speed A = 20 knots/h

Speed B = 30 knots/h

To know the one side of a distance we take the L.C.M of speed 'A' and speed 'B'



∴ Total distance covered

= 2 × 60 = 120 km

Average speed $= \frac{\text{Distance travelled}}{\text{Time taken}}$

$$= \frac{120}{(3+2)} = \frac{120}{5}$$

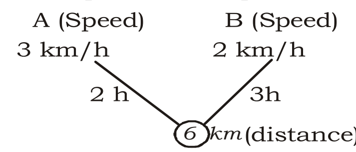
= 24 knots/h

4. A boy goes to school at the speed of 3 km/h and returns at the speed of 2 km/h if he takes 5 hours in all, find the distance in kilometre between the village and the school.

Sol. Speed A = 3 km/h

Speed B = 2 km/h

To know the distance we take the L.C.M of speed A and speed B



∴ In this time taken by the boy is 5 hr and in our question time is also given 5 hr, therefore both times are equal

∴ Distance = 6 km

5. A and B are two towns. A car goes from A to B at a speed of 64 km/h and returns to A at a slower speed. If its average speed for the whole journey is 56 km/hr, it returned with what speed?

Sol. Let the speed for the return journey be x km/h

Then, $56 = \frac{2s_1 s_2}{s_1 + s_2} = \frac{2 \times 64 \times x}{64 + x}$

$\Rightarrow 7(64 + x) = 16x$ or $9x = 448$

$\therefore \quad x = \frac{448}{9} = 49.78$ km/h

6. A bicycle rider covers his onward journey from A to B at 10 km/h and during the return journey from B to A he covers the same distance at 8 km/h. if he finishes the onward and return journey in $4\frac{1}{2}$ hours, then the total distance covered by him during the entire journey is

Sol. Here, $s_1 = 10$ and $s_2 = 8$

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

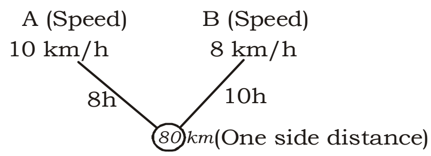
$= \dfrac{2 \times 10 \times 8}{10+8} = \dfrac{80}{9}$ km/h

Total time taken for the entire journey $= \dfrac{9}{2}$ hours

∴ Total distance covered

= Average speed × total time taken $= \dfrac{80}{9} \times \dfrac{9}{2} = 40$km

Alternate



∴ Total distance covered

= 2 × 80 = 160 km

In 18 hours distance covered = 160 km

In 1 hour distance covered

$= \dfrac{160}{18}$ km

In $4\dfrac{1}{2}$ hours distance covered

$= \dfrac{160}{18} \times \dfrac{9}{2} = 40$ km

∴ Distance = 40 km

7. Once in a tour a man travels at the rate of 64 km an hour for the first 160 km, then travels the next 160 km at the rate of 80 km an hour. The average speed in km per hour for the first 320 km of the tour is ?

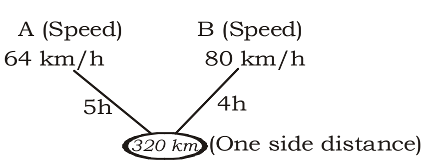
Sol. Here, $s_1 = 64$ and $s_2 = 80$

∴ Average speed

$= \dfrac{2s_1 s_2}{s_1+s_2} = \dfrac{2 \times 64 \times 80}{64+80}$

= 71.11 km/h

Alternate



Total distance travelled

= 2 × 320 = 640 km

Average speed

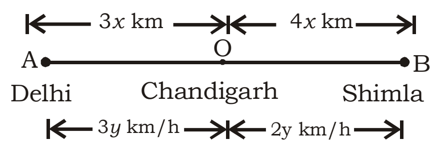
$= \dfrac{\text{Total distance}}{\text{Total time}} = \dfrac{640}{9}$

= 71.11 km/h

8. Shyam went from Delhi to Shimla via Chandigrah by car. The distance from Delhi to Chandigrah is $\dfrac{3}{4}$ times the distance from Chandigrah to Shimla. The average speed from Delhi to Chandigrah is $\dfrac{3}{2}$ times the average speed from to Chandigrah to Shimla. If the average speed for the entire journey was 49 km/h, what was the average speed form Chandigrah to Shimla?

Sol.

$\dfrac{\text{Avg. Speed Delhi to Chandigarh}}{\text{Avg. Speed Chandigarh to Shimla}} = \dfrac{3y}{2y}$



Time taken from Chandigarh to Shimla $= \dfrac{4x}{2y} = \dfrac{2x}{y}$ hour

Time taken from Delhi to Chandigarh $= \dfrac{3x}{3y} = \dfrac{x}{y}$ hour

Given: average speed from

Delhi to Shimla $= \dfrac{7x}{\dfrac{x}{y} + \dfrac{2x}{y}} = 49$

⇒ y = 21 km/h.

Hence, average speed from Chandigrah to Shimla

= 21 × 2 = 42 km/h

9. A car during its journey travels 40 minutes at a speed of 30 km/h, another 50 minutes at a speed of 60 km/h and 1 hour at a speed of 30 km/h. Find the average speed of the car ?

Sol. Here, $T_1 = \dfrac{40}{60}$, $T_2 = \dfrac{50}{60}$, $T_3 = 1$, $s_1 = 30$,

$s_2 = 60$, $s_3 = 30$

Average speed of the car

$= \dfrac{s_1T_1 + s_2T_2 + s_3T_3}{T_1 + T_2 + T_3}$

$= \dfrac{30 \times \dfrac{40}{60} + 60 \times \dfrac{50}{60} + 30 \times 1}{\dfrac{40}{60} + \dfrac{50}{60} + 1}$

= 40 km/h

10. A man walks 6 km at a speed of $1\dfrac{1}{2}$ km/hr, runs 8 km at a speed of 2 km/h and goes by bus another 32 km. Speed of the bus is 8 km/hr. If the speed of the bus is considered as the speed of the man, find the average speed of the man?

Sol. Here, $x_1 = 6$, $x_2 = 8$, $x_3 = 32$,

$s_1 = \dfrac{3}{2}$

$s_2 = 2$ and $s_3 = 8$

∴ Average speed of the man

$= \dfrac{x_1 + x_2 + x_3}{\dfrac{x_1}{s_1} + \dfrac{x_2}{s_2} + \dfrac{x_3}{s_3}}$

$= \dfrac{6+8+32}{\dfrac{6}{3/2} + \dfrac{8}{2} + \dfrac{32}{8}}$

$= \dfrac{46}{12} = 3\dfrac{5}{6}$ km/h

11. Nikita starts her journey from Delhi to Bhopal and simultaneously Nishita starts from Bhopal to Delhi. After crossing each other they finish their remaining journey in $5\dfrac{4}{9}$ hours and 9 hours, respectively. What is Nishita's speed if Nikita's speed is 36 km/h?

Sol. $\dfrac{\text{Nikita's speed}}{\text{Nishita's speed}} = \sqrt{\dfrac{T_2}{T_1}}$

$= \dfrac{\sqrt{9}}{\sqrt{5\dfrac{4}{9}}} = \dfrac{\sqrt{9}}{\sqrt{\dfrac{49}{9}}} = \sqrt{\dfrac{81}{49}} = \dfrac{9}{7}$

Nishita's speed = $\frac{7}{9}$ Nikita's speed

$= \frac{7}{9} \times 36 = 28$ km/h

12. By walking at $\frac{4}{5}$th of his usual speed, Mohan is 6 minutes late to office. Find his usual time to cover the distance ?

Sol. Here, change in time

$= 6$ and $\frac{a}{b} = \frac{4}{5}$

We have, change in time

$= \left(\frac{b}{a} - 1\right) \times$ original time

$\Rightarrow$ original time

$$= \frac{\text{change in time}}{\left(\frac{b}{a} - 1\right)} = \frac{6}{\left(\frac{5}{4} - 1\right)}$$

= 24 minutes

Alternate

	Original	New
Speed	5	4
Time	4	5

1 unit difference

$$\text{Time} \alpha \frac{1}{\text{Speed}}$$

$1\text{unit} \longrightarrow 6 \text{ minutes}$

$4\text{units} \longrightarrow 6 \times 4 = 24 \text{ minutes}$

Usual time to cover the distance = 24 minutes.

13. By walking at $\frac{3}{4}$th of his usual speed, a man reaches office 20 minutes later than usual. His usual time is ?

Sol. Here, change in time

$= 20$ and $\frac{a}{b} = \frac{3}{4}$

We have, change in time

$= \left(\frac{b}{a} - 1\right) \times$ original time

$\Rightarrow$ Original time

$$= \frac{\text{Change in time}}{\left(\frac{b}{a} - 1\right)}$$

$$= \frac{20}{\left(\frac{4}{3} - 1\right)} = 60 \text{ minutes}$$

Alternate

	Old	New
Speed	4	3
Time	3	4

1 unit difference

$1\text{unit} \longrightarrow 20 \text{ minutes}$

$3\text{ units} \longrightarrow 20 \times 3 = 60 \text{ minutes}$

Usual time to reach = 60 minutes

14. Two bicyclists do the same journey by travelling respectively, at the rates of 9 and 10 km an hour, find the length of the journey when one takes 32 minutes longer than the other ?

Sol. Here, change in speed

= 10 – 9 = 1; product of speed

= 9 × 10 = 90 and difference of

time $= \frac{32}{60}$

We have, $\frac{\text{Product of speed}}{d}$

$$= \frac{\text{Difference of speed}}{\text{Difference of time}}$$

$\Rightarrow$ d = product of speed

$$\times \left(\frac{\text{Difference of time}}{\text{Difference of speed}}\right)$$

$= 90 \times \frac{32}{60} = 48$ km

Alternate

	A	B
Speed	9	10
Time	10	9

1 unit more

$1\text{unit} \longrightarrow 32 \text{ minutes}$

$10\text{units} \longrightarrow 32 \times 10 \text{ minutes}$

$= 320$ minutes $= 5\frac{1}{3}$h

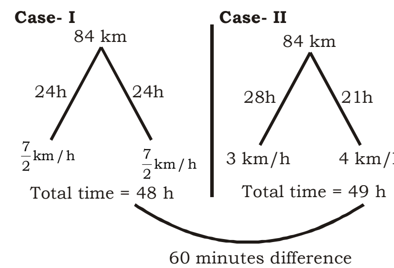
Therefore, distance travelled in

$5\frac{1}{3}$h = (320 × 9) ÷ 60 = 48 min.

15. Mohan walks from Tilak Nagar to Moti Nagar and back in a certain time at the rate of $3\frac{1}{2}$km/h. But if he had walked from Tilak Nagar to Moti Nagar at the rate of 3 km/h and back from Moti Nagar to Tilak Nagar at the rate of 4 km/h, he would have taken 10 minutes longer. The distance between Tilak Nagar and Moti Nagar is

Sol. Let the distance = 84 km

(L.C.M. of 4,3,$\frac{7}{2}$)



$60 \longrightarrow 10 \text{ minutes}$

$1 \longrightarrow \frac{10}{60}$

$84 \longrightarrow \frac{10}{60} \times 84 = 14\text{km}$

distance = 14 km

16. Two persons x and y walk from a place P at 5 km/hr and 6 km/hr respectively. How much distance will they be apart (in kms) after 4 hours.

(i) If they walk in the same direction.

(ii) If they walk in opposite direction.

(a) 4,44 (b) 5,55

(c) 4,34 (d) 5,44

Sol. (a) Distance travelled by x in 4 hours = 5 × 4 = 20 km.

Distance travelled by y in 4 hours = 6 × 4 = 24 km.

If they go in same direction,

Distance b/w them = 24 – 20

= 4 km.

If they go in opposite direction,

Distance b/w them = 24 + 20

= 44 km.

Alternate

By the concept of relative speed.

If they go in same direction relative speed $= (6 - 5)$ km/hr.
$= 1$ km/hr.

If they go in opposite direction relative speed $= (6 + 5) = 11$ km/hr.

Since they walk for same interval of time i.e. 4 hours

Distance b/w them when they walk in same direction = Relative speed × time $= 1 \times 4 = 4$ km.

Distance b/w them when they walk in opposite direction

$= 11 \times 4 = 44$ km.

17. A theif runs at a speed of 10m/s. A policeman runs behind him at a speed of 12.5m/sec but the policeman had started running after 10 seconds. After how many meters, will the policeman catch the thief?
(a) 600 mtr. (b) 500 mtr.
(c) 400 mtr. (d) 300 mtr.

Sol (b) Since, Policeman started after 10 sec.

Distance covered by thief in 10 sec = 10 m/s × 10 sec = 100 m.

Relative speed to policeman & thief $= 12.5 - 10 = 2.5$ m/s

Time taken by policeman to catch the theif $= \frac{100}{2.5} = 40$ sec.

Distance covered by policeman in 40 sec will be the required distance $= 12.5 \times 40$
$= 500$ meters.

18. Two persons cover the same distance at a speed of 25km/hr. and 30km/hr respectively. Find the distance travelled if one person takes 25 min. more than the other.
(a) 62.5 km (b) 63.9 km
(c) 60 km. (d) 72 km

Sol. (a) Let x be the distance travelled by two persons with speed S_1 & S_2 respectively and t be the more time required by a person to cover same distance.

We can say that,

$$\frac{x}{S_1} - \frac{x}{S_2} = t$$

$$x\,\frac{S_2 - S_1}{S_1 S_2} = t$$

$$x = \left[\frac{S_1 . S_2}{S_2 - S_1}\right] .t$$

$$\text{Distance} = \frac{\text{Product of Speed}}{\text{Difference of Speed}} \times [\text{more time}]$$

Using above formula:-

$t = \frac{25}{60}$ hours

$$\text{Distance} = \frac{30 \times 25}{5} \times \frac{25}{60} = \frac{125}{2}$$
$= 62.5$ km.

Alternate

$\text{Speed} \propto \frac{1}{\text{Time}}$

Ratio of speed	25		30
⇒	5	:	6
Ratio of time	6	:	5

+1

1 Unit = 25 min.

time required by first person to cover the distance = 6 Units

$= 25 \times 6 = 150$ min i.e. $2\frac{1}{2}$ hours.

Total distance = speed × time

$= 25 \times \frac{5}{2} = \frac{125}{2} = 62.5$ km.

19. A person covers certain distance at a speed of 60 km/hr without stoppage and with stopages he travels the same distance at a speed of 40 km/hr. How many minutes/hour does he stop?
(a) 30 min. (b) 26 min.
(c) 20 min. (d) 35 min.

Sol. (c) Let the Distance be = D km.

time taken without stoppage at the rate of 60 km/hr, $T = \frac{D}{60}$ hr.

time taken with stoppage at the rate of 40 km/hr, $T = \frac{D}{40}$ hr.

Difference in time

$= \frac{D}{40} - \frac{D}{60} = \frac{D}{120}$ hr.

Rest/hour $= \frac{D}{120} \div \frac{D}{40}$ hr.

$= \frac{D}{120} \times \frac{40}{D} = \frac{1}{3}$ hr. = 20 min.

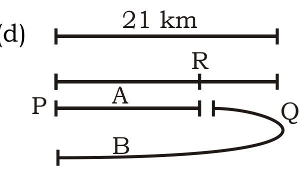
Alternate

$$\text{Time} = \frac{\text{Diff. in speed}}{\text{Speed without stopage}} \times 60$$

$= \frac{20}{60} \times 60 = 20$ min.

20. Two persons A and B walk from P to Q, which are at a distance of 21 km at 3 km/hr and 4 km/hr respectively, B reaches Q returns immediately and meets A at R. Find the distance from P to R.
(a) 12 km (b) 16 km
(c) 28 km (d) 18 km

Sol. (d)



Let A & B meet after "t" time

Now, In time t

A cover PR & B covers PQ + QR.

Total distance by A & B both

= PR + PQ + QR = 2 PQ

$\therefore$ $3t + 4t = 2 \times 21$

$7t = 42$

$t = 6$ hours.

Distance covered by A in 6 hours in $3 \times 6 = 18$ km.

So, PR = 18 km.

21. A person covers a distance in 40 min, if he runs at a speed of 45 km/hr on an average. Find the speed at which he must run to reduce the time of Journey to 30 min.
(a) 50 km/hr. (b) 35 km/hr.
(c) 60 km/hr. (d) 36 km/hr.

Sol. (c) Distance covered in both the cases is equal

$S_1 t_1 = S_2 t_2$

$45 \times \frac{40}{60} = S_2 \times \frac{30}{60}$

$S_2 = 60$ km/hr.

22. A man takes 6 hours and 30 mins for walking to a certain place and riding back respectively. He would have gained 2 hours 10 minutes by riding both ways. How long would he take to walk both ways?
(a) 480 mins. (b) 520 mins.
(c) 560 mins. (d) 600 mins.

Sol. (b) Walk + Ride = 390 min ..(i)

Gained two hours10 min. by riding means riding both ways he took 390 – 130 = 260 min.

$\therefore$ Ride + Ride = 260 min.

one side riding = 130 min.

Put the value in equation (i)

Walk + 130 min = 390 min

One side walk = 390 – 130

= 260 min

Both side walk = 2 × 260 min

= 520 min.

23. A person has to reach a certain place at a certain time and he find that he will be 15 minutes late if he walks at 4 km/hr and 10 min earlier, if he walks at 6 km/hr. Find the distance he has to cover?

(a) 3 km (b) 4 km

(c) 5 km (d) 6 km

Sol. (c) Let the distance be 'D' km.

$$\frac{D}{4} - \frac{D}{6} = \frac{15+10}{60}$$

$$\frac{D}{12} = \frac{25}{60}$$

D = 5 km

Alternate

$$D = \frac{S_1 \times S_2}{S_1 - S_2} \text{ [Difference of time]}$$

$$\Rightarrow \frac{6 \times 4}{2} \times \frac{25}{60} = 5 \text{ km.}$$

24. A man covered a certain distance at certain speed. If he had moved 3km/hr faster, he would have taken 40 minutes less. If he had moved 2 km/hr slower, he would have taken 40 mins more. The distance (in kms) is :

(a) 35 (b) $36\frac{2}{3}$

(c) $37\frac{1}{2}$ (d) 40

Sol. (d) Distance in both the case in same.

$$D = \frac{S_1 \times S_2}{S_1 - S_2} \times \text{[Difference of time]}$$

Let Speed of the man be S km/hr.

$$\frac{S(S+3)}{3} \times \frac{40}{60} = \frac{S(S-2)}{2} \times \frac{40}{60}$$

2 (S + 3) = 3 (S – 2)

S = 12 km/hr.

$$\text{Distance} = \frac{12 \times (12+3)}{3} \times \frac{40}{60}$$

= 40 km.

25. A person has to cover a distance of 6 km in 45 min. If he covers one half of the distance in two–third of the total time then to cover the remaining distance in the remaining time, his speed must be:-

(a) 6km/hr. (b) 8 km/hr.

(c) 12 km/hr. (d) 15 km/hr.

Sol. (c) Half of the distance = 3 km.

Two-third of the total time

$= \frac{2}{3} \times \frac{45}{60} = \frac{1}{2}$ hour.

Speed for half of the journey

$= \frac{3}{1/2}$ = 6 km/hr.

Time to cover remaining the distance (3 km) = $1/4$ hr.

Speed must be = $\frac{3}{1/4}$ = 12 km/hr.

Exercise

1. A man crosses a road 250 metres wide in 75 seconds. His speed in km/hr is:
(a) 10 km/hr (b) 12 km/hr
(c) 12.5 km/hr (d) 15 km/hr

2. An athlete runs 200 metres race in 24 seconds. His speed (in km/hr) is:
(a) 20 km/hr (b) 24 km/hr
(c) 28.5 km/hr (d) 30 km/hr

3. A man walking at the rate of 5 km/hr crosses a bridge in 15 minutes. The length of the bridge (in metres) is :
(a) 600 m (b) 750 m
(c) 1000 m (d) 1250 m

4. A man reduces his speed to 2/3, he takes 1 hour more in walking a certain distace. The time (in hours) to cover the distance with his normal speed is:
(a) 2 hrs (b) 1 hrs
(c) 3 hrs (d) 1.5 hrs

5. A and B start at the same time with speeds of 40 km/hr and 50 km/hr respectively. If in covering the journey A takes 15 minutes longer than B, the total distance of the journey is:
(a) 46 km (b) 48 km
(c) 50 km (d) 52 kms

6. The speeds of A and B are in the ratio 3 : 4. A takes 20 minutes more than B to reach a destination. In what time does A reachs the destination?
(a) $1\frac{1}{3}$ hours (b) 2 hours
(c) $2\frac{2}{3}$ hours (d) $1\frac{2}{3}$ hours

7. A car can cover a certain distance in $4\frac{1}{2}$ hours. If the speed is increased by 5 km/hour, it would take $\frac{1}{2}$ hour less to cover the same distance. Find the slower speed of the car:
(a) 50 km/hour (b) 40 km/hour
(c) 45 km/hour (d) 60 km/hour

8. Two men start together to walk a certain distance, one at 4 km/h and another at 3 km/h. The former arrives half an hour before the later. Find the distance :
(a) 8 km (b) 7 km
(c) 6 km (d) 9 km

9. A train running at $\frac{7}{11}$ of its own speed reached a place in 22 hours. How much time could be saved if the train would run at its own speed ?
(a) 14 hours (b) 7 hours
(c) 8 hours (d) 16 hours

10. A man with $\frac{3}{5}$ of his usual speed reaches the destination $2\frac{1}{2}$ hours late. Find his usual time to reach the destination:
(a) 4 hours (b) 3 hours
(c) $3\frac{3}{4}$ hours (d) $4\frac{1}{2}$ hours

11. A car travelling with $\frac{5}{7}$ of its usual speed covers 42 km in 1 hour 40 min 48 sec. What is the usual speed of the car ?
(a) $17\frac{6}{7}$ km/hr
(b) 35 km/hr
(c) 25 km/hr (d) 30 km/hr

12. A and B started at the same time from the same place for a certain destination. B walking at $\frac{5}{6}$ of A's speed reached the destination 1 hour 15 minutes after A and B reached the destination in :
(a) 6 hours 15 minutes
(b) 7 hours 15 minutes
(c) 7 hours 30 minutes
(d) 8 hours 15 minutes

13. Buses start from a bus terminal with a speed of 20 km/hr at intervals of 10 minutes. What is the speed of a man coming from the opposite direction towards the bus terminal if he meets the buses at intervals of 8 minutes?
(a) 3 km/hr (b) 4 km/hr
(c) 5 km/hr (d) 7 km/hr

14. By walking at $\frac{3}{4}$ of his usual speed, a man reaches his office 20 minutes later than his usual time. The usual time taken by him to reach his office is:
(a) 75 minutes
(b) 60 minutes
(c) 40 minutes
(d) 30 minutes

15. A boy starts everyday from home to pick up his girlfriend from college at 3 : 30 p.m. One day his girlfriend left the college at 2 : 30 p.m. and start walking to home at 6 km/h. She meets her boyfriend in the way who start at his normal time and they reach home 24 minutes earlier than usual. Find his speed :
(a) 24 km/h (b) 66 km/h
(c) 6 km/h (d) 36 km/h

16. Rakesh yadav starts in Honda city from Delhi towards Goa. After sometime he realises that he will cover only 75% of the distance in the scheduled time and he therefore doubles his speed immediately and thus manages to reach Goa exactly on time. Find the time after which Rakesh yadav changed his speed, given that he could have been late by 3 hours if he had not changed his speed:
(a) 3 h (b) 4 h
(c) 5 h (d) 6 h

17. After travelling 3 hours a train meets with an accident due to this it stops for an hour. After this the train moves at 75 % speed of its original speed and reaches to destination 4 hours late. If the accident would occur at 150 km

ahead in the same line then the train reaches only 3.5 hours late. Then find the distance of journey and the original speed of the train?

(a) 100 km/h, 1200km
(b) 150 km/h, 1200 km
(c) 75 km/h, 1000km
(d) 125 km/h, 900km

18. After travelling 25 km the speed of the car increases by $1/4^{th}$ of its original speed, due to this the car reaches 30 minutes earlier to its destination. If the speed of the car increased 10 km before, then it reaches to its destination $32\frac{2}{5}$ minutes earlier. Then find the distance travelled by car:

(a) 125 km (b) 150 km
(c) 140 km (d) 165 km

19. Ravi, who lives in the countryside, caught a train for home earlier than usual day. His wife normally drives to the station to meet him. But yesterday he set out on foot from the station to meet his wife on the way. He reached home 12 minutes earlier than he would have reached, had he waited at the station for his wife.The car travels at a uniform speed, which is 5 times Ravi's speed on foot. Ravi reached home at exactly 6 O 'clock'. At what time would he have reached home if his wife, forewarned of his plan, had met him at the station?

(a) 5 : 48 (b) 5 : 24
(c) 5 : 00 (d) 5 : 36

20. Two rifles are fired from the same place at a difference of 11 minutes 45 seconds. But a man who is coming towards the place in a train hears the second sound after 11 minutes. Find the speed of train (assuming speed of sound = 330 m/s):

(a) 72 km/h (b) 36 km/h
(c) 81 km/h (d) 108 km/h

21. A dog after travelling 50 km meets a swami who counsels him to go slower. He then proceeds at 3/4 of his former speed and arrives at his destination 35 minutes late. Had the meeting occured 24 km further the dog would have reached its destination 25 minutes late. The speed of the dog before meeting swami is:

(a) 48 km/h (b) 36 km/h
(c) 54 km/h (d) 58 km/h

22. An aeroplane covers a certain distance at a speed of 240 km/hour in 5 hours. To cover the same distance in $1\frac{2}{3}$ hours, it must travel at a speed of :

(a) 30 km./hr. (b) 360 km./hr.
(c) 600 km./hr. (d) 720 km./hr.

23. A car travelling at a speed of 40 km/hour can complete a journey in 9 hours. How long will it take to travel the same distance at 60 km/hour?

(a) 6 hours (b) 3 hours
(c) 4 hours (d) $4\frac{1}{2}$ hours

24. A person, who can walk down a hill at the rate of $4\frac{1}{2}$ km/hour, and up the hill at the rate of 3km/hour ascends and comes down to his starting point in 5 hours. How far did he ascend?

(a) 13.5 km (b) 3 km
(c) 15 km (d) 9 km

25. A boy runs 20 km in 2.5 hours. How long will he take to run 32 km at double the previous speed?

(a) 2 hours (b) $2\frac{1}{2}$ hours
(c) $4\frac{1}{2}$ hours (d) 5 hours

26. A car completes a journey in 10 hours. If it covers half of the journey at 40 kmph and the remaining half at 60 kmph, the distance covered by car is :

(a) 400 km (b) 480 km
(c) 380 km (d) 300 km

27. Two cars start at the same time from one point and move along two roads at right angles to each other. Their speeds are 36 km/hour and 48 km hour respectively. After 15 seconds the distance between them will be :

(a) 400 m (b) 150 m
(c) 300 m (d) 250 m

28. A runs twice as fast as B and B runs thrice as fast as C. The distance covered by C in 72 minutes, will be covered by A in:

(a) 18 minutes
(b) 24 minutes
(c) 16 minutes
(d) 12 minutes

29. A truck covers a distance of 550 metres in 1 minute whereas a bus covers a distance of 33 kms in 45 minutes. The ratio of their speeds is:

(a) 4 : 3 (b) 3 : 5
(c) 3 : 4 (d) 50 : 3

30. Walking at the rate of 4 km an hour, a man covers a certain distance in 3 hours 45 minutes. If he covers the same distance on cycle, cycling at the rate of 16.5 km/hour, the time taken by him is:

(a) 55.45 minutes
(b) 54.55 minutes
(c) 55.44 minutes
(d) 45.55 minutes

31. A man can reach a certain place in 30 hours. If he reduces his speed by $\frac{1}{15}$th, he goes 10 km less in that time. Find his speed per hour :

(a) 6 km/hr (b) $5\frac{1}{2}$ km/hr
(c) 4 km/hr (d) 5 km/hr

32. A person started his journey in the morning. At 11 a.m. he covered $\frac{3}{8}$ of the journey and on the same day at 4.30 p.m. he covered $\frac{5}{6}$ of the journey. He started his journey at:

(a) 6.00 a.m. (b) 3.30 a.m.
(c) 7.00 a.m. (d) 6.30 a.m.

33. Rakesh yadav and Bhuvnesh start travelling together in the same direction at 8 km/hr and 13 km/hr respectively. After 5 hours Rakesh yadav doubles his speed and Bhuvnesh reduces his

speed by 2 km/hr and reached the distination together. How long the entire journey last?

(a) 10 h (b) 9 h

(c) $10\frac{1}{2}$ h (d) $9\frac{1}{2}$ h

34. Ajay went on a ten-mile drive of his new imported bike. He started with a certain speed and after covering each mile, his speed is decreased by 20 % for the next mile. If he took 5 minutes to cover the first five mile of the drive, what is the approximate time taken by him to cover the next five miles?

(a) 14 minutes and 1 seconds
(b) 15 minutes and 15 seconds
(c) 16 minutes and 16 seconds
(d) 17 minutes and 17 seconds

35. A bus meets with an auto at 10 : 00 am while going on the same way in the same direction towards Haridwar. The Bus reach at Haridwar at 12 : 30 p.m. and take 1 hour rest at there. Bus return on the same way and meet with the same auto half an hour later. At what time the Auto will reach at Haridwar:

(a) 3 pm (b) 4 pm
(c) 3 : 30 pm (d) 5 pm

36. Rakesh yadav starts from X to Y a 42 km distance with a speed of 60 km/hr. But after every 10 min. he decreases his speed by 6 km/h. How much time did he take to reach at Y:

(a) 52 minutes (b) 54 minutes
(c) 55 minutes (d) 53 minutes

37. A student moves $\sqrt{2}x$ km East from his residence and then moves x km North. He then goes x km North-East and finally he takes a turn of 90° towards right and moves a distance x km and reaches his school. What is the shortest distance of the school from his residence?

(a) $(2\sqrt{2}+1)x$ km (b) $3x$ km

(c) $2\sqrt{2}\ x$ km (d) $3\sqrt{2}\ x$ km

38. The length of the minute hand of a clock is 8 cm. Find the distance travelled by its outer end in 15 minutes:

(a) 4π cm (b) 8π cm
(c) 12π cm (d) 16π cm

39. Two swimmers started simultaneously from the beach, one to the south and the other to the East. Two hours later, the distance between them turned out to be 100 km. Find the speed of the faster swimmer, knowing that the speed of one of them was 75 % of the speed of the other:

(a) 30 kmph (b) 40 kmph
(c) 45 kmph (d) 60 kmph

40. A wall clock gains 6 minutes in 36 hours, while a table clock loses 2 minutes in 36 hours; both are set right at noon on Tuesday. The correct time when they both show the same time next would be :

(a) 12 : 30 night (b) 12 noon
(c) 1 : 30 night (d) 12 night

41. In reaching the Everest, Rakesh Yadav took half as long again to climb the second third as he did to climb the first third and a quarter as long again for the last third as for the second third. He took altogether 5 hrs 50 minutes. Find the time he spent on the first third of the journey?

(a) 72 min (b) 80 min
(c) 81 min (d) 88 min

42. The relative speed of minute-hand with-respect to hour-hand is :

(a) $\left(5\frac{1}{2}\right)^0$ per minute

(b) $\left(\frac{21}{12}\right)$ minute per minute

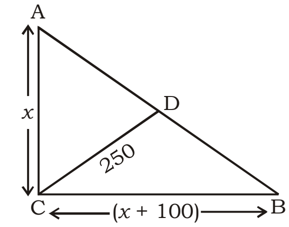
(c) 6° per minute

(d) $\left(\frac{11}{120}\right)$ per minute

43. Rakesh yadav and Bhuvnesh start from A and B respectively with uniform velocities. Rakesh Yadav is headed towards B and Bhuvnesh towards A and both cities are 600 km apart. Rakesh Yadav rests whenever Bhuvnesh is on the move and Bhuvnesh rest whenever Rakesh yadav is on the move. The speed of Rakesh Yadav and Bhuvnesh is 25km/h and 30 km/h respectively. If Rakesh yadav starts first and reaches B in 36 hours, then find the least time that Bhuvnesh would take to reach his destination after Rakesh Yadav makes a start:

(a) 20 h (b) 36 h
(c) 44 h (d) none of these

44. P and Q start running a race on the given track as shown in figure:



Where AC and BC are mutually perpendicular and CD is the median of triangular paths ABC. BC is 100 km longer than that of AC, and CD is 250 km. The speeds of P and Q are 30 km/h and 40km/h, respectively and their respective paths of running are CADC and CBDC. After how much time they reverse their speeds so that they return C at the same time?

(a) $\frac{50}{7}$ h (b) $\frac{120}{7}$ h

(c) $\frac{80}{11}$ h (d) none of these

45 A candle of 6 cm long burns at the rate of 5 cm in 5 h and another candle of 8 cm long burns at the rate of 6 cm in 4 h. What is the time required by each candle to remain of equal lengths after burning for some hours, when they start to burn simultaneously with uniform rate of burning?

(a) 1 h (b) 1.5 h
(c) 2 h (d) 4 h

46. Resting 9 hrs. a day Rakesh Yadav travels a certain distance in 40 days. Resting double the time how many days will he take to travel double the distance at double the speed ?

(a) 100 (b) 120
(c) 90 (d) 80

47. Resting 4 hrs a day Rakesh Yadav

travels a certain distance in 60 days. Resting thrice the time how many days will he take to travel thrice the distance at thrice the speed?

(a) 100 (b) 120

(c) 90 (d) 80

48. A officer goes to office from his home, which is 8 km apart. His speed is 4 km/h. After 5 min the feels that he left some important documents at home. He returns to home and now he travels with fast speed towards the office, and reaches office on time. Find his increase speed?

(a) $4\frac{4}{11}$ km/h (b) $4\frac{9}{11}$ km/h

(c) $3\frac{8}{11}$ km/hr (d) 4 km/hr

49. A cyclist travels 500 km in 4 hours and then he changes his speed and travels 450 km in 5 hours. Then find his second speed is how much percent less than the first speed?

(a) 28 % (b) $38\frac{8}{9}$ %

(c) 30 % (d) 40 %

50. Rakesh yadav can see apprx. d km far from the h metre above high level in sea water. And the relation between d and h is $2d^2$ = 25 h. Then find from how much high level Rakesh yadav can see 10 km?

(a) 8 m (b) 10 m

(c) 16 m (d) 12 m

Solution

1. (b) $\because$ Speed $= \frac{\text{Distance}}{\text{Time}}$

$= \frac{250}{75} = \frac{10}{3}$ m/s

$= \frac{10}{3} \times \frac{18}{5}$ = 12 km/hr.

2. (d) $\because$ Speed $= \frac{\text{Distance}}{\text{Time}}$

$= \frac{200}{24} = \frac{25}{3}$ m/s

$= \frac{25}{3} \times \frac{18}{5} km/hr.$

= 30 km/hr.

3. (d) Speed of the man = 5 km/hr

$= \frac{5 \times 1000}{60}$ m/min

$= \frac{250}{3}$ m/min

& Time taken to cross the bridge = 15 minutes

$\therefore$ Length of the bridge = speed × time

$= \frac{250}{3} \times 15$ = 1250 m.

4. (a)

	Initial	Final
Speed $\longrightarrow$	3(let)	2
Time $\longrightarrow$	2	3

1 unit more

$\left\{\because \text{ speed } \alpha \frac{1}{\text{time}}\right\}$

According to the question, it takes 1 hr more.

$\therefore$ 1 unit $\longrightarrow$ 1hour

$\Rightarrow$ 2 units $\longrightarrow$ 2 hours

i.e. Initial time taken = 2 hours

5. (c) Let the required distance = L.C.M. of (40,50) = 200 km

A 40km/hr — 5 hrs

B 50km/hr — 4 hrs

200

i.e.

A takes 5 – 4 = 1 unit more time than B.

But given that A takes 15 min more time than B

$\therefore$ 1 unit $\longrightarrow$ 15 min

$\Rightarrow$ 1 unit $\longrightarrow \frac{15}{60}$ hr

$\Rightarrow$ 200 units $\longrightarrow \frac{15}{60} \times 200 = 50$

i.e. Distance = 50 km

6. (a)

	A	B
Speed $\longrightarrow$	3	4
time $\longrightarrow$	4	3

1 unit more

But, given that A takes 20 minutes more

i.e.

1unit $\longrightarrow$ 20

$\therefore$ 4 units $\longrightarrow 20 \times 4 = 80\text{min} = \frac{80}{60}\text{hrs} = 1\frac{1}{3}\text{hrs}$

i.e. time taken by A to reach destination $= 1\frac{1}{3}$ hrs

7. (b) Let the initial speed of the car be x km/hr and the distance be y km.

$\therefore$ $y = \frac{9}{2}x$ .....(i)

and $y = 4(x + 5)$ .....(ii)

$\therefore$ $\frac{9x}{2} = 4(x + 5)$

$\Rightarrow 9x = 8x + 40 \Rightarrow x = 40$ km/hr

Alternatively :

	Initial	:	Final
Ratio of time →	$\frac{9}{2}$	:	$\frac{9}{2}-\frac{1}{2}=4$
	= 9	:	8
∴ Ratio of speed →	8	:	9

increased by 1 unit

i.e. 1unit ⟶ 5

∴ 8 units ⟶ 5×8 = 40 km/hr

i.e. Initial speed = 40 km/hr

8. (c) Ratio of speeds = 4 : 3

∴ Ratio of times

= 3 : 4

1 unit less time

∴ Distance = 4 × 3 = 12 units

But given that former takes half an hour less than the latter.

i.e.

$$1 \text{ unit} \longrightarrow \frac{1}{2}$$

$$\therefore 12 \text{ units} \longrightarrow 12 \times \frac{1}{2} = 6$$

i.e. Required distance = 6 km

9. (c) Let original speed = 11 units

∴ Final (or New) speed = 7 units

	Origianl	:	New
Ratio of speed →	11	:	7
Ratio of time →	7	:	11
	×2		×2
	14		22

∴ Time saved = 22 – 14 = 8 hours

10. (c)

	Initial	:	Final
Ratio of speeds →	5 (let)	:	3
Ratio of times →	3	:	5

2 hours late

$$\text{i.e. } 2 \text{ units} \longrightarrow 2\frac{1}{2} = \frac{5}{2}$$

⇒ 3 units ⟶

$$\frac{5}{2} \times \frac{3}{2} = \frac{15}{4} = 3\frac{3}{4} \text{ hours}$$

i.e. usual time to reach the destination $= 3\frac{3}{4}$ hours

11. (b) According to the question,

Initial Speed	:	New speed
7v	:	5v

t = 1 hour 40 minutes 48 seconds $= \frac{504}{300}$ hours

$$\frac{504}{300} = \frac{42}{5v} \rightarrow v = 5 \text{ km/h}$$

Initial speed = 5 × 7 = 35 km/h

12. (c)

	A	:	B
Ratio of speeds →	6	:	5
∴ Ratio of times →	5	:	6

after 1 unit of time

i.e. B reached after 1 unit of time

But, given that, B reach after 1 hr 15 min $= \frac{5}{4}$ hrs

$$\text{i.e } 1 \text{ unit} \longrightarrow \frac{5}{4}$$

$$\therefore 6 \text{ units} \longrightarrow \frac{5}{4} \times 6 = \frac{15}{2}$$

i.e. B reached the destination in $\frac{15}{2}$ hours = 7 hours 30 minutes

13. (c) Distance covered in 10 minutes at 20 km/hr = distance covered in 8 minutes at (20 + x) km/hr

$$\Rightarrow 20 \times \frac{10}{60} = \frac{8}{60}(20 + x)$$

$$\Rightarrow 200 = 160 + 8x$$

$$\Rightarrow x = \frac{40}{8} = 5 \text{ km/hr}$$

14. (b)

	Usual	:	New
Ratio of speeds →	4	:	3
∴ Ratio of times →	3	:	4

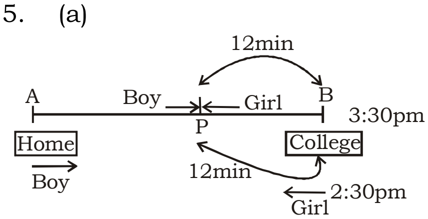
1 unit late

i.e. 1 unit ⟶ 20

⇒ 3 units ⟶ 20 ×3 = 60

i.e., the usual time taken by him to reach his office = 60 minutes.

15. (a)



Let P is a point where the Boy and his Girlfriend meet. They reached home 24 min earlier because his girlfriend left the college 1 hour earlier and meet his boyfriend on the way at P. They saved 24 min because he did not travel the distance $\overrightarrow{PB}$ and $\overleftarrow{BP}$.

Time taken by boy in travelling the distance PB $= \frac{24}{2}$ = 12 min

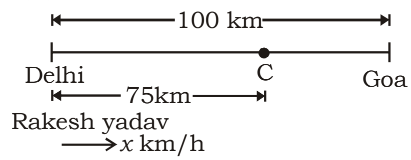
It means boy is at P on 3 : 18 pm

Now we conclude :

Boy	:	Girl	
12	:	48	[Time]
4	:	1	[Speed]
× 6		× 6	
$\boxed{24\text{km/h}}$		6 km/h	

Speed of the boy = 24 km/h

16. (d)



Let the original speed of Rakesh Yadav be x km/h and scheduled time = t hours.

Let the distance between Delhi and Goa is 100 km.

From question,

Condition (I) : -

He covers 75% of the distance in scheduled time

xt = 75 .... (i)

and x(t + 3) = 100 ... (ii)

From (i) & (ii)

$$x = \frac{25}{3} \text{ km/h, t = 9 hours}$$

Condition (II):-

Let he doubles his speed after n hours then :

$$n \times \frac{25}{3} + \frac{50}{3} \times (9 - n) = 100$$

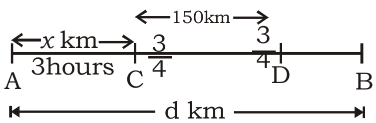
$$\frac{25}{3}[n + 18 - 2n] = 100$$

18 – n = 12

n = 6 hours

So we can say to reach on time he will doubles his speed after 6 hours.

17. (a) Let the original speed of the train is x km/h and the distance of the journey is d km.



Let C is a point where the train meets with an accident. From this point the train will move 75% of its former speed.

$$75\% = \left(\begin{array}{l}3 \rightarrow \text{orignial time} \\ 4 \rightarrow \text{original speed}\end{array}\right.$$

Condition (I) :-

$\therefore$ Difference in time
$= 4 - 3 = 1$ hour

	Speed	:	**Time**
Original $\rightarrow$	4	:	3
New $\rightarrow$	3	:	4

$\textcircled{-1}$ $\left[\therefore \boxed{T \propto \frac{1}{S}}\right]$

from question $\rightarrow$ 3 hours
1 unit = 3 hours
3 units = 3 × 3 = 9 hours

Condition (II):-

If accident would occur 150 km ahead then,

$$1 \text{ unit} \rightarrow \frac{5}{2},$$

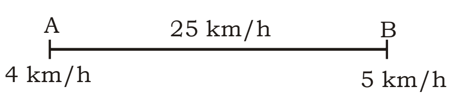
$$3 \text{ units} \rightarrow \frac{15}{2} \text{ hours}$$

$$\text{Speed} = \frac{d}{t}$$

$$= \frac{150}{\left(9 - \frac{15}{2}\right)} = \frac{150 \times 2}{3} = 100$$

$\Rightarrow$ Speed = 100 km/h
Distance = 12 × 100 = 1200 km

18. (b)



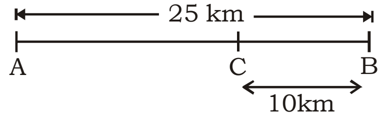
From question condition (i),
Let original speed of the car is 4 km/h

	Speed	:	**Time**
Original $\rightarrow$	4		5
New $\rightarrow$	5		4

$\textcircled{-1}$

1 unit $\rightarrow$ 30 min
5 units (original time) = 30 × 5 =150 min

New from condition (ii)



Now the speed would increase when car will reached at point C.
similarly

	Speed	:	**Time**
Original $\rightarrow$	4		5
New $\rightarrow$	5		4

$\textcircled{-1}$

From question,

$$1 \text{ unit} \rightarrow \frac{162}{5}$$

$$(\text{original time}) \ 5 \text{ units} \rightarrow \frac{162}{5} \times 5 = 162 \text{ min}$$

Note : Now try to understand that the difference in time is due to 10km. So we can say the car would travel 10 km in 12 mins.

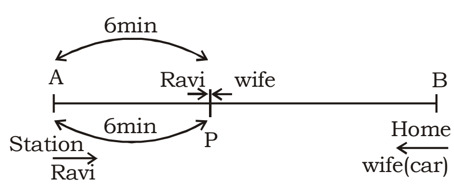
12 min $\rightarrow$ 10 km

$$1 \text{ min} \rightarrow \frac{10}{12}$$

$$150 \text{ min} \rightarrow \frac{10}{12} \times 150 = 125 \text{ km}$$

Total distance = 125 km + 25 km
= 150 km

19. (a)



Ravi reached 12 minutes earlier.

Let P is a point where Ravi and his wife meet. Time taken by wife to travel P - A is 6 min.

From question,

Ravi	:	**Car**
1	:	5
5	:	1
×6		×6
30min	:	6min

Car takes 6 minutes to travel from A to P and Ravi takes 30 minutes.

Effective time = 30 – 6= 24 minutes

Thus, if Ravi had got the car at the station, he would have saved 24 minutes more and reached at 5 : 36

20. (c)

Let A is the place where both the rifles are fired. When first rifle is fired then position of the train is unknown. But when the second rifle is fired then the train is at B. If the train does not move then the man hears the sound after 11 minutes 45 seconds but he hears the sound after 11 minutes, because both the sound and the train are in a moving state.

Now we can say-

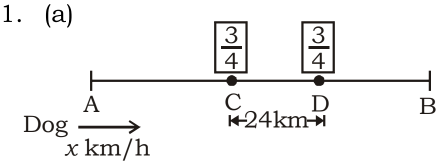
The distance travelled by the train in 11 min = distance travelled by sound in 45 seconds.

	(Man)Train	:	**Sound**
Time $\rightarrow$	11 × 60	:	45
Speed $\rightarrow$	3	:	44

speed of man(Train)

$$= \frac{330}{44} \times 3 = \frac{90}{4} \times \frac{18}{5} = 81 \text{ km/h}$$

21. (a)



Let the speed of the dog is x km/h, and C is a place where the dog meets to a swami. D is a place where the next meeting occured.

From question :

Condition (i):-

When meeting held at C.

Time : **Speed**

Actual → 3 : 4

$\big)$ (−1)

New → 4 : 3

Delay = New time – Actual time = 1 unit

From question 1 unit → 35 minutes actual time = 35 × 3

= 105 minutes

Condition (ii):-

When meeting held at D.

Time : **Speed**

Actual → 3 : 4

$\big)$ (−1)

New → 4 : 3

According to question → 1 unit → 25 minutes

Actual time 3 units → 75 mins

Now we conclude the dog would travel 24 km in 30 minutes then:

Speed of the dog

$= \frac{24}{30} \times 60 = 48$km/h

Alternate:-

Let,

the speed of the dog before meeting swami = 4x

speed of the dog after meeting swami = 3x

Basically time difference which is 10 minutes is due to 24 kms we can say that,

$$\frac{24}{3x} - \frac{24}{4x} = \frac{10}{60}$$

$$\frac{24}{12x} = \frac{1}{6}$$

$$\frac{2}{x} = \frac{1}{6},\ x = 12$$

Speed of dog before meeting swami Þ $4x = 48$ km/hr.

22. (d)**Case - I:-**

Distance = 240 × 5 = 1200 km

Case - II:-

Distance = 1200 km, time

$= 1\frac{2}{3}$ hr $= \frac{5}{3}$ hr

$\therefore$ speed $= \frac{1200}{5/3}$

= 240 × 3 = 720 km/hr.

23. (a) Ratio of speed = 40 : 60 = 2 : 3

$\therefore$ Ratio of times =

$$\begin{array}{ccc} 3 & : & 2 \\ \downarrow{\times 3} & & \downarrow{\times 3} \\ 9 & & 6 \end{array}$$

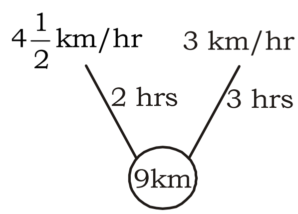
$\left\{\Theta \text{ speed } \alpha \frac{1}{\text{time}}\right\}$

i.e. , the required time = 6 hours

24. (d) Let the required distance

= LCM of $\left(4\frac{1}{2}, 3\right)$

= 9 km



$\therefore$ total time taken = 2+3 = 5 hrs = the total given time in question

$\therefore$ the required distance = 9 km

25. (a) Initial speed

$= \frac{20}{2.5} = 8$km/hr

$\therefore$ New speed = 16 km/hr

& New distance = 32 km

$\therefore$ time $= \frac{32}{16}$ = 2 hours

26. (b) Let the total distance covered by the car = 2d km

According to the question,

$$\frac{d}{40} + \frac{d}{60} = 10 \Rightarrow \frac{3d+2d}{120} = 10$$

5d = 1200 ⇒ d = 240 km

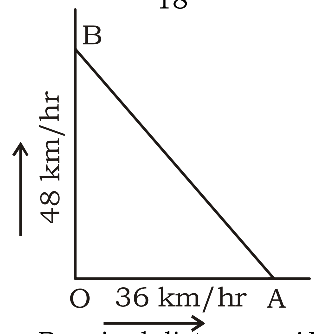
total distance = 2d

= 2 × 240 = 480km

27. (d) Let O be the starting point. The car running at 36 km/hr is moving along OA and another car 48 km/hr moving along OB. Also, let they reach at A and B after 15 seconds respectively.

$\therefore$ OA $= 36 \times \frac{5}{18} \times 15 = 150$ m

& OB $= 48 \times \frac{5}{18} \times 15 = 200$ m



$\therefore$ Required distance = AB

$= \sqrt{(OA)^2 + (OB)^2}$

$= \sqrt{(150)^2 + (200)^2}$

$= \sqrt{62500} = 250$ m.

28. (d) Ratio of the speed of A, B and C = 6 : 3 : 1

$\therefore$ Ratio of the times taken

$= \frac{1}{6} : \frac{1}{3} : 1$

$$\begin{array}{ccccc} 1 & : & 2 & : & 6 \\ \downarrow{\times 12} & & & & \downarrow{\times 12} \\ 12 & & & & 72 \end{array}$$

i.e. Time taken by A = 12 minutes

29. (c) Required ratio

$= \frac{550}{1} : \frac{33 \times 1000}{45}$

$= 550 : \frac{2200}{3} = 1 : \frac{4}{3} = 3 : 4$

30. (b) Distance covered on foot

$= 4 \times 3\frac{3}{4} = 15$ km

$\therefore$ Time taken by cycle

$= \frac{\text{Distance}}{\text{Speed}} = \frac{15}{16.5}$

$= \frac{15 \times 60}{16.5}$ minutes

= 54.55 minutes

Alternatively:-

Time = 3 hrs 45 min.

= 225 minutes

Ratio of speeds = 4 : 16.5

$= 4 : \frac{165}{10} = 8 : 33$

$\therefore$ Ratio of time = 33 : 8

$$33 \xrightarrow{\times \frac{75}{11}} 225 \qquad 8 \xrightarrow{\times \frac{75}{11}} \frac{600}{11}$$

i.e. Required time

$= \frac{600}{11}$ min.

= 54.55 min.

31. (d) Let initial speed = 15 km/hr

$\left[\therefore \frac{15 \times 1}{15} = 1\right]$

$\therefore$ Reduced speed

= 15 – 1 = 14 km/hr

Time = 30 hours in both case.

$\therefore$ Distance (in case I)

= 15 × 30 = 450 km

& Distance (in case II)

= 14 × 30 = 420 km

$\therefore$ Difference = 450 – 420

= 30 km

But, the given difference =10 km

$\therefore$ 30 units $\longrightarrow$ 10

$\Rightarrow$ 1 unit $\longrightarrow \frac{10}{30} = \frac{1}{3}$

$\Rightarrow$ 15 units $\longrightarrow \frac{1}{3} \times 15 = 5$

i.e. initial speed = 5 km/hr

32. (d) Let the distance of total journey = LCM of (8, 6) = 24 units

$\therefore \frac{3}{8}$ of the journey $= \frac{3}{8} \times 24$

= 9 units

and $\frac{5}{6}$ of the journey $= \frac{5}{6} \times 24 =$

20 units

i.e. it covered 20 – 9

= 11 units of distance in 4.30 p.m. – 11a.m.

$= 5\frac{1}{2}$ hours $= \frac{11}{2}$ hours

$\therefore$ Speed of person $= \frac{11}{11/2}$

= 2 km/hr

$\therefore \frac{3}{8}$ of the journey will be covered in

$= \frac{9}{2} = 4\frac{1}{2}$ hours

i.e. The person started at 11 a.m.

$- 4\frac{1}{2}$ hour = 6.30 a.m.

33. (a) Speeds of Rakesh Yadav and Bhuvnesh are 8 km/h and 13 km/h respectively.(Given) let the entire journey lasts after t hours, total distance covered by Rakesh Yadav

= 5 × 8 + (t – 5) 16

total distance covered by Bhuvnesh

= 5 × 13 + (t – 5)11

according to the question,

distance covered by both will be same

40+ 16(t – 5) = 65 + (t – 5)11

40 + 16t – 80 = 65 + 11t – 55

– 40 + 16t = 11t + 10

5t = 50

$\Rightarrow$ t = 10 hours

Alternate:-

Take help from options to quick response.

option (a) assume t = 10 hours

Distance covered by Rakesh yadav

= 5 × 8 + 16 × 5 = 120 km

Distance covered by Bhuvnesh

= 5 × 13 + 5 × 11 = 120 km

Distance covered by Rakesh yadav and Bhuvnesh is same. So it satisfy the question condition.

34. (b) Let the speed of Ajay for the first mile be x miles/minute

$\Rightarrow$ The speed of the Ajay for the 2nd, 3rd, 4th ....miles is

$\frac{4}{5}x, \frac{16}{25}x, \frac{64}{125}x,$ ...respectively.

Since, the speed of ajay for the successive miles is in geometric progression $\left(\text{with } r = \frac{4}{5}\right)$, the speeds of Ajay for the 6th, 7th, 8th, 9th and 10th miles will be

$\left(\frac{4}{5}\right)^5$ times the speeds of the 1st, 2nd, 3rd, 4th and 5th miles respectively.

Hence, the average speed of Ajay for the last five miles is

$\left(\frac{4}{5}\right)^5$ times the average speed of the first five miles.

$\Rightarrow$ The time taken by Ajay to cover the last five miles

$= \left(\frac{5}{4}\right)^5$ times the time taken by him to cover the first five miles

$= \left(\frac{5}{4}\right)^5 \times 5 = \frac{3125}{1024} \times 5 = 3.05 \times 5$

= 3.05 × 5

= 15.25 minutes = 15 minutes and 15 seconds

Alternatively:-

$20\ \% = \frac{1}{5}$

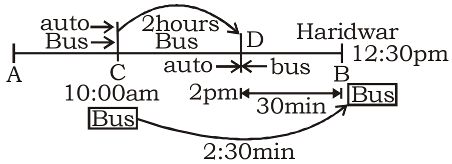
Speed of the first five miles		**Speed of last five miles**
5	$\longrightarrow$	5 – 1 = 4
5	$\longrightarrow$	4
5	$\longrightarrow$	4
5	$\longrightarrow$	4
5	$\longrightarrow$	4
5^5 =3125		4^5 =1024

$\therefore$ Ratio of time $\rightarrow 1024 \longrightarrow 3125$

$$1024 \xrightarrow{\times \frac{5}{1024}} 5 \text{ min.} \qquad 3125 \xrightarrow{\times \frac{5}{1024}} 3125 \times \frac{5}{1024} = 15.25 \text{ min.}$$

= 15 minutes and 15 seconds

35. (a)



Let C is a point where the auto and the bus meet first time and D is a point where the auto and the bus meet 2nd time

according to above diagram :

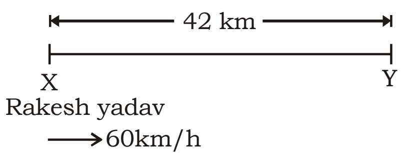
Distance(CD) covered by bus in 2 hours and auto covered the same distance in 4 hours.

Then distance (CB) covered by the auto in (double the time)

$= \frac{5}{2} \times 2 = 5$ hours

then auto will reach at Haridwar at 3 pm.

36. (b)



Distance travelled by Rakesh Yadav in first 10 minutes

$= 60 \times \frac{10}{60} = 10$km

Now he will reduce his speed by 6 km/h = (60 – 6) = 54 km/h

Distance in next 10 minutes

$= 54 \times \frac{10}{60} = 9$km

Similarly:-

Time (10min) → I II III IV V

Distance(km) → 10 9 8 7 6

Total time = 50 min, Total distance covered = 40 km

Remaining distance=42 – 40= 2km

Now speed of Rakesh Yadav

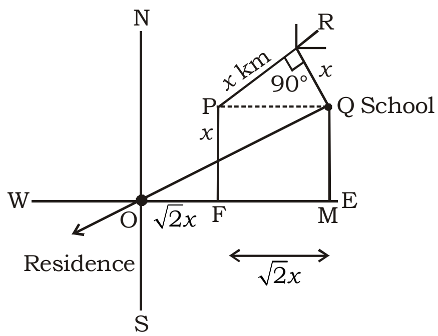
= 30 km/h

Required time$= \frac{2}{30} \times 60 = 4$min

Total time = (50 + 4)

= 54 minutes

37. (b) In Isosceles right angle Δ PQR →



PF = QE = x km

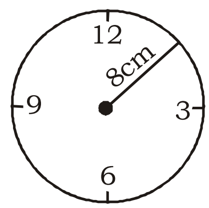
PQ = $\sqrt{x^2+x^2} = \sqrt{2}\,x$

Now in ΔOMQ

OQ = $\sqrt{\left(2\sqrt{2}x\right)^2+x^2} \Rightarrow$ OQ

= $3x$ km

38. (a) Angle made by minute hand in 15 minutes = 15 × 6 = 90°

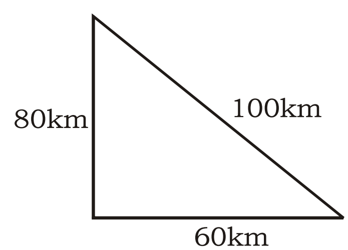


Distance travelled = $\frac{2\pi r\theta}{360}$

$= \frac{2\times\pi\times8\times90}{360}$

Distance travelled = 4 π

39. (b) The following figure gives the movemets of the two swimmers.



Note:- On the basis of Pythagorus triplets

The faster swimmer must have travelled 80 km in 2 hours and

hence speed = $\frac{80}{2}$

S = 40 km/h

40. (b) The wall clock gains 6 minutes in 36 hours while the table clock loses 2 minutes in 36 hours. Hence, the time difference in 36 hours = 8 minutes. For them to show the same time again, we need a total difference of 12 hours.

8 min difference in 36 hours

1 min $\longrightarrow \frac{36}{8}$

1 hour $\longrightarrow \frac{36}{8} \times 60$

12 hours $\longrightarrow \frac{36}{8} \times 60 \times$

12 = 3240 hours

for required no. of days it would be divided by 24 hours per day =

$\frac{3240}{24} = 135$ days

After 135 days the watch will show the same time at 12 noon.

41. (b) Let the time taken in first third part of the journey be x minutes.

Then according to question.

I II III

$(x) + \left(\frac{x}{2}+x\right) + \frac{1}{4}\left(x+\frac{x}{2}\right)+\frac{3x}{2}$

= 350min.

$\Rightarrow x + \frac{3x}{2} + \left(\frac{3x}{8}+\frac{3x}{2}\right)$

= 350 min.

$\Rightarrow x + \frac{3x}{2} + \frac{15x}{8} = 350$

$\Rightarrow \frac{8x+12x+15x}{8}=350$

$\Rightarrow \frac{35x}{8} = 350$

x = 80 minutes

42. (a) **Note**:- Both minute-hand and hour hand move in the same direction then:

Relative speed = Speed of minute hand – Speed of hour hand

Angle rotated by min-hand and hour-hand in 1 min is 6° and $\frac{1}{2}^{\circ}$

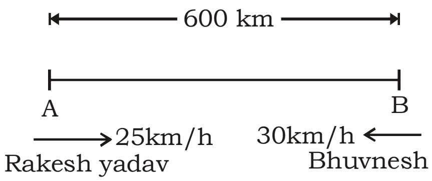
respectively.

Relative Speed

$= 6^\circ - \frac{1}{2}^\circ = 5\frac{1}{2}^\circ$ per minute

Hence option (a) is correct.

43. (c)



According to the question,
time taken by Rakesh Yadav
= 36 hours

Actual time required by Rakesh Yadav $= \frac{600}{25}$ = 24 hours.

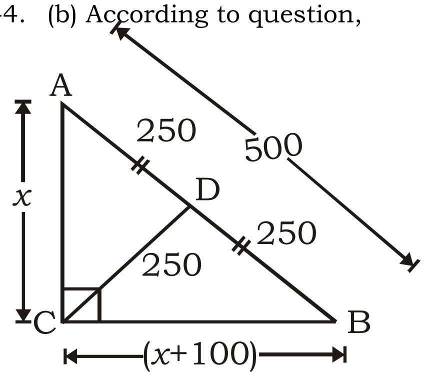
It means Rakesh Yadav rests for = (36 – 24) = 12 hours.

Now the time required for Bhuvnesh $= \frac{600}{30}$ = 20 hours.

But Bhuvnesh already walked for 12 hours in which Rakesh Yadav rests, So he needs only (20 – 12) = 8 hours extra.

Thus the total time taken by Bhuvnesh = 36 + 8 = 44 hours

44. (b) According to question,



$AC \perp CB$

CD is the median then AD = BD

ΔACB is a right angle Δ then AD = BD = CD = 250

By Pythagoras theorem :

$x^2 + (x + 100)^2 = (500)^2$

after solving x = 300 km

Now, let they change their speeds after t_1 hours and then the rest time is t_2 then :

$30t_1 + 40t_2 = 800$ .... (i)

$40t_1 + 30t_2 = 900$ .... (ii)

After adding both equation (i) & equation (ii)

$70(t_1 + t_2) = 1700$

$t_1 + t_2 = \frac{170}{7}$ .... (iii)

After subtracting both equation (i) & (ii) $-10t_1 + 10t_2 = -100$

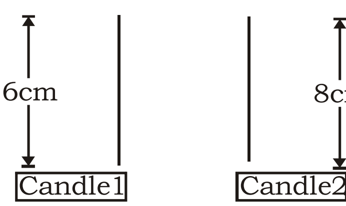
$t_1 - t_2 = 100$ .... (iv)

From equation (iii) & (iv)

$t_1 = \frac{120}{7}$ hours, $t_2 = \frac{50}{7}$ hours

So they will change their speed after $\frac{120}{7}$ hours.

45. (d)



Rate of burning of Candle 1
= 5/5 = 1 cm/hour

Rate of burning of Candle 2
= 6/4 = 1.5 cm/hour

According to the question,

Let after x hours they will be equal

$(6 - x) = (8 - 1.5x)$

$6 - x = 8 - 1.5x$

$\frac{1}{2}x = 2 \Rightarrow x = 4$ hours

46. (a) **Note** : (i) Always remember in such type of questions the given formula.

$$\boxed{\frac{M_1D_1H_1}{W_1} = \frac{M_2D_2H_2}{W_2}}$$

(ii) Also remember we should take working hours not resting hours.

(a) working hours = (24 – 9) = 15 hours

(b) In second time working hours = (24 – 18) = 6 hours

Efficiency(E_1) : Efficiency (E_2)

1 : 2

$= \frac{15\times40}{1} = \frac{2\times6\times D}{2}$

D = 100 days

47. (a)

$$\boxed{\frac{M_1D_1E_1H_1}{W_1} = \frac{M_2D_2E_2H_2}{W_2}}$$

$\frac{1\times20\times60}{1} = \frac{12\times3\times D}{3}$

D = 100 days

48. (a) **Note- I** : In such type of questions always remember this below given formula :

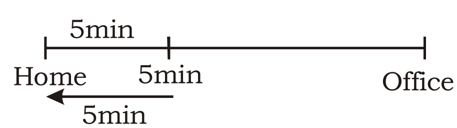
$$\boxed{\text{Distance} = \frac{xy}{x-y}\times(t_1 - t_2)}$$

where $y \to$ First speed

$x \to$ speed at second time

t_1 and t_2 refer intial and later time.

Note-II : (i) In this question remember $t_2 - t_1$ = 10 mins, because he takes 10 minutes to go to the point and returns to home.



Total late = 10 min

D = 8 km, y = 4 km/h, x = ?

$(t_2 - t_1) = \frac{10}{60}$ hours

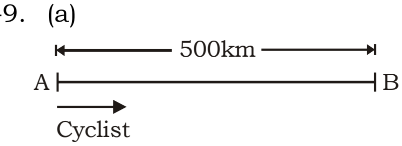
put values in formula

$\Rightarrow 8 = \frac{4x}{(x-4)} \times \frac{10}{60}$

$\Rightarrow 12x - 48 = x$

$11x = 48 \Rightarrow x = 4\frac{4}{11}$ km/h

49. (a)



Distance = 500 km,
time = 4 hours
Initial speed of the cyclist

$= \frac{500}{4} = 125 km/h$

from question, New distance
= 450 km, New time = 5 hours
New speed of the cyclist

$= \frac{450}{5} = 90 km/h$

% Reduction in speed

$= \frac{\Delta s}{\text{actual speed}} \times 100$

$= \frac{(125-90)}{125} \times 100$

$= \frac{35}{125} \times 100 = 28\%$

50. (a) From question,
$2d^2 = 25h$ (given)
d = 10 km,
put in equation :-
$2 \times 100 = 25h \Rightarrow h = 8m$