Time, Speed and Distance

IF   10 hrs $\longrightarrow$ 90 kms

       1 hr $\longrightarrow$ 9 km $\longrightarrow$ speed

Speed $\longrightarrow$ distance travelled in 1 hr.

$$S = 9 \text{ km}/h$$

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

$$D = S \times T$$

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

IF D is constant.

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

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

$$D = S_1 T_1 = S_2 T_2$$

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

If speed is Consti

$$D \propto T$$

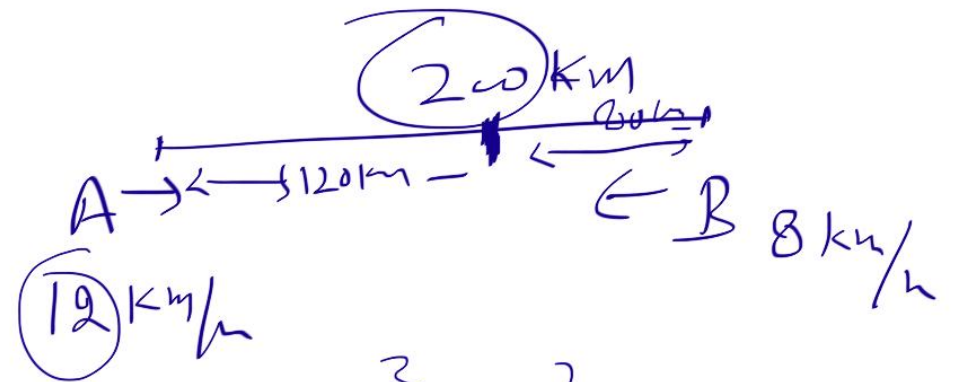Time Cons

$$D \propto S$$

① D $S_1 : S_2 = T_2 : T_1$

② S $D_1 : D_2 = T_1 : T_2$

③ T $D_1 : D_2 = S_1 : S_2$

$$E = P \times C$$

200 km

120 km

A →   B 8 km/h

12 km/h

3   2

speed 12 : 8

3 : 2 → 80

120

5 unit = 200

Eg. If price of tea increased by 10% then how much % the consumption should be decreased to keep the the expenditure same.

$$\text{Expenditure} = \text{Price} \times \text{Consumption}$$

$10\% = \dfrac{1}{10}$

$\boxed{\text{Exp}_o}$

$$P \times C$$
$$10 \times C_o$$

$$= P \times C$$
$$= 11 \times C_N \Rightarrow \dfrac{C_o}{C_N} = \dfrac{11}{10}$$

$\dfrac{\angle \rightarrow}{11} \times 100$

$= \dfrac{100}{11} \%$

Exp_N

$P_1 : P_2$

$10 \quad 11$

$11 \quad 10$

$\dfrac{1}{11} \times 100$

$= 9.9\%$

Eg.2 A person covers $\frac{4}{15}$ of the total journey by train, $\frac{5}{18}$ of total journey by bus, $\frac{7}{20}$ of total journey by car and remaining 1330 m journey on foot. Find his total journey.

Let (180)

$\frac{4}{15} \times 180$

48

$\frac{5}{18} \times 180$

50

(161)

$\frac{7}{20} \times 180$

63

(1330 m)

(19)

$19 \rightarrow 1330$

$180 \rightarrow \frac{1330}{19} \times 180$

$\checkmark = 12600 \, km$

Eg.3 Walking at 5/8 of his normal speed, Sachin is 45 minutes late in reaching his office. Find the usual time taken by him to cover the distance between his home and his office.

Speed   8   5

Time   5 : 8

$$3 \Rightarrow 45 \text{ min.}$$

$$5 \Rightarrow \frac{\overset{15}{\cancel{45}}}{3} \times 5 \Rightarrow 75 \text{ min usual time}$$

Eg. 4 A person while walking diametrically across a semi-circular playground takes 2 min less than if he had kept walking round the circular path from A to B. if he walks 30 meters in 15 sec, what is the radius of the playground.

Distance $2r$ πr

Speed is Same

$$\text{Speed} \Rightarrow \frac{2r}{210} = \frac{30}{15}$$

$$r = 210 \text{ m}$$

Time $2r : \pi r$

$$2 : \frac{22}{7} \Rightarrow \boxed{7 : 11}$$

$$210 \text{ Sec}$$

4 unit

2 min Less -120 sec

4 unit $\Rightarrow$ 120 Sec.

$D \to 90 \, km/h \Rightarrow T_1 = \dfrac{D}{90}$

$2D \to 60 \, km/h \Rightarrow T_2 = \dfrac{2D}{60}$

$T = T_1 + T_2$

$\quad = \dfrac{D}{90} + \dfrac{2D}{60}$

Avg speed $= \dfrac{Total \, D}{total \, time}$

$\quad = \dfrac{3D}{\dfrac{D}{90} + \dfrac{2D}{60}}$

$\quad = \dfrac{3}{\dfrac{2+6}{180}} \to \dfrac{3 \times 180}{8} = 67.5 \, km/h$

Eg.5 A train covers a distance with the speed 90 km/hr and then double of the previous distance with the speed 60 km/hr find out its average speed.
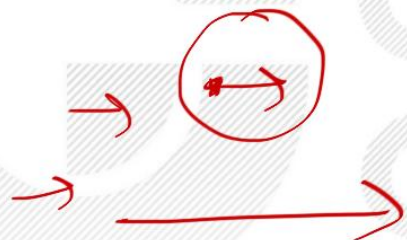
Avg. Speed $= \dfrac{Total \, D}{total \, time}$

Let $D \Rightarrow 180$

✓ Avg Speed $= \dfrac{180 + 360}{2 + 6} = \dfrac{540}{8}$

$= 67.5 \, km/h$

✓ If train crosses a Person, Tree, Pole then the distance covered= **Length of train**

✓ If train crosses a platform then the distance covered= **Length of train + Length of Platform**

Speed of train − Speed of person

Relative speed ⇒ Speed of train + Speed of person

Eg.6 A train running with the speed of 90 km/hr crosses a platform in 20 secs. If the length of train be 200 m. Find the length of platform.

$D = 25 \times 20$

$200 + P = 500$

$$\boxed{P = 300 \text{ m}} \quad \text{Ans}$$

$90 \text{ km/h} \Rightarrow 90 \times \dfrac{5}{18} = \boxed{25 \text{ m/s}}$

$90 \dfrac{1000 \text{ m}}{3600 \text{ sec}} \dfrac{5}{18}$

$\dfrac{5}{18} \times \text{km/h} = \text{m/s}$

$\dfrac{18}{5} \times \text{m/s} = \text{km/h}$

Eg. 7 A and B run a 7.5Kms race on a round course of 270m. If their speed in the ratio of 5:3 then find how many times the winner will pass the other.

$$\frac{7500 \, m}{135 \times 5} = \frac{100}{9} = 11 \frac{1}{9}$$

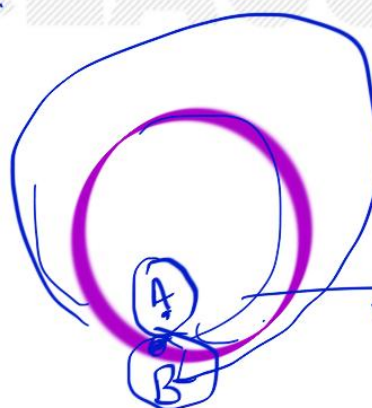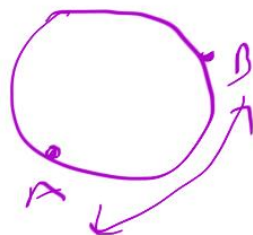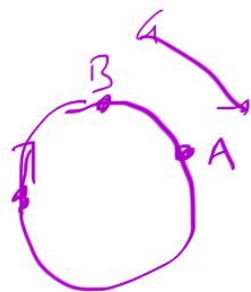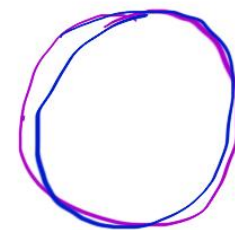$$\frac{5 \, m}{9}$$

Speed   5 : 3

$$A \rightarrow \boxed{5 : 3}$$

$$\boxed{135 \times 5 \, m}$$

2 unit $\Rightarrow$ 270 m

1 unit $\Rightarrow$ 135 m

$A > B$

Eg. 8 A boat can cover a certain distance in downstream in 40 second. The same boat can cover the same distance in 2 min in upstream. How much time will it take to cover the same distance in still water.

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

AP   AP

$B+R$ B $B-R$

$AP \propto \dfrac{1}{HP}$

40   ?   120

$HM \Rightarrow \dfrac{2 \times 40 \times 120}{40 + 120}$

60 Sec Ans

$$= \dfrac{2 \times \cancel{40} \times \cancel{120}^{30}}{\cancel{160}_{4}} \Rightarrow 60$$

Eg. 9 In a 100 meter race A beats B by 20 m & B beats C by 20 m. Find out by what distance A beats C.

A : B : C

5 : 4   4

5   5 : 4

(25) : 20 : 16

100

64 m

36 m ← Ans

A   B

100 m   80 m

A : B

5 : 4

B   C

100 m   80 m

B : C

5 : 4

Q.1 A tourist covers half of his journey by train at 60 km/h, half of the remainder by bus at 30 km/h and the rest by cycle at 10 km/h. The average speed of the tourist in km/h during his entire journey is

A. 36
B. 30
C. 24
D. 18

Avg speed

$= \dfrac{120}{1+1+3}$

$= \dfrac{120}{5} = 24 \text{ km/h}$

$\dfrac{1}{2} \times 120 = 60$ 60 km/h

$\dfrac{1}{4} \times 120 = 30$ 30 km/h

$\dfrac{1}{4} \times 120 = 30$ 10 km/h

Q.2 Two cars at the same time from the same location and go in the same direction. The speed of the first car is 50 km/h and the speed of the second car is 60 km/h. The number of hours it takes for the distance between the two cars to be 20 km is ____.

A. 1
B. 2
C. 3
D. 6

20 km

Speed 50 60

D = 5 : 6 → 120 km

100 km   1 unit = 20 km

Q.3 The distance between Delhi and Agra is 233 km. A car P started travelling from Delhi to Agra and another car Q started from Agra to Delhi along the same road 1-hour after the car P started. The two cars crossed each other 75 minutes after the car Q started. Both cars were travelling at constant speed. The speed of car P was 10 km/hr more than the speed of car Q. How many kilometers the car Q had travelled when the cars crossed each other?

A. 66.6
B. 75.2
C. 88.2
D. 116.5

$$P - 10 = \frac{842}{14}$$

$$D \Rightarrow \frac{842}{14} \times \frac{5}{4}$$

$$= \frac{4210}{56} = 75.17$$
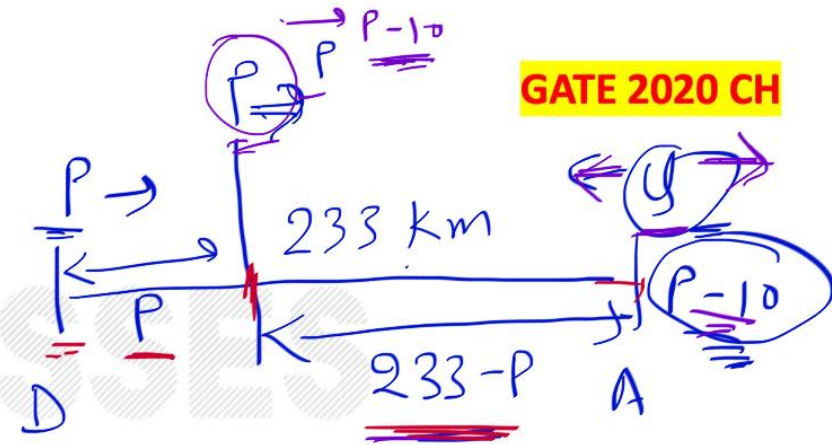
$$P + P - 10$$

$$\frac{233 - P}{P + P - 10} = \frac{5}{4} \text{ hr.} \quad D$$

$$\frac{233 - P}{2P - 10} = \frac{5}{4} \Rightarrow 10P - 50 = 932 - 4P$$

$$14P = 982$$

$$P = \frac{982}{14}$$

75 min

233 km

233 − P

233 − P

P − 10

Q.4 Velocity of an object fired directly in upward direction is given by $V = 80 - 32t$, where t (time) is in seconds. When will the velocity be between $32 \ m/sec$ and $64 \ m/sec$?

A. $\left(1, \dfrac{3}{2}\right)$

B. $\left(\dfrac{1}{2}, 1\right)$

C. $\left(\dfrac{1}{2}, \dfrac{3}{2}\right)$

D. $(1, 3)$

$32 < V < 64$

$32 < 80 - 32t < 64$

$32 - 80 < -32t < 64 - 80$

$-48 < -32t < -16$

$-3 < -2t < -1$

$3 > 2t > 1$

$\dfrac{3}{2} > t > \dfrac{1}{2}$

Q.5 A car travels $8\ km$ in the first quarter of an hour, $6\ km$ in the second quarter and $16\ km$ in the third quarter. The average speed of the car in km per hour over the entire journey is

A. 30
B. 36
C. 40
D. 24

$$\text{Avg. Speed} = \frac{8 + 6 + 16}{\frac{1}{4} + \frac{1}{4} + \frac{1}{4}}$$

$$= \frac{30}{3/4} = \frac{30}{3} \times 4 \Rightarrow 40\ km/h$$

Q.6 A train that is 280 metres long, travelling at a uniform speed, crosses a platform in 60 seconds and passes a man standing on the platform in 20 seconds. What is the length of the platform in metres?

$$280 + P = 60 \times S$$

$$280 = 20 \times S \times 3$$

$$280 \times 3 = 60 \times S$$

$$P = 280 \times 2$$

$$= 560 \, m$$

$$P - 280 \times 2 = 0$$

Q.7 It takes 30 minutes to empty a half-full tank by draining it at a constant rate. It is decided to simultaneously pump water into the half-full tank while draining it. What is the rate at which water has to be pumped in so that it gets fully filled in 10 minutes?

A. 4 times the draining rate

B. 3 times the draining rate

C. 2.5 times the draining rate

D. 2 times the draining rate

30 unit   half

-D   3k

-1

4

D + P

D   10 min

30 min

Q.8 A man can row at 8 km per hour in still water. If it takes him thrice as long to row upstream, as to row downstream, then find the stream velocity in km per hour.

$4 \, km/h$ Ans

$M + S$

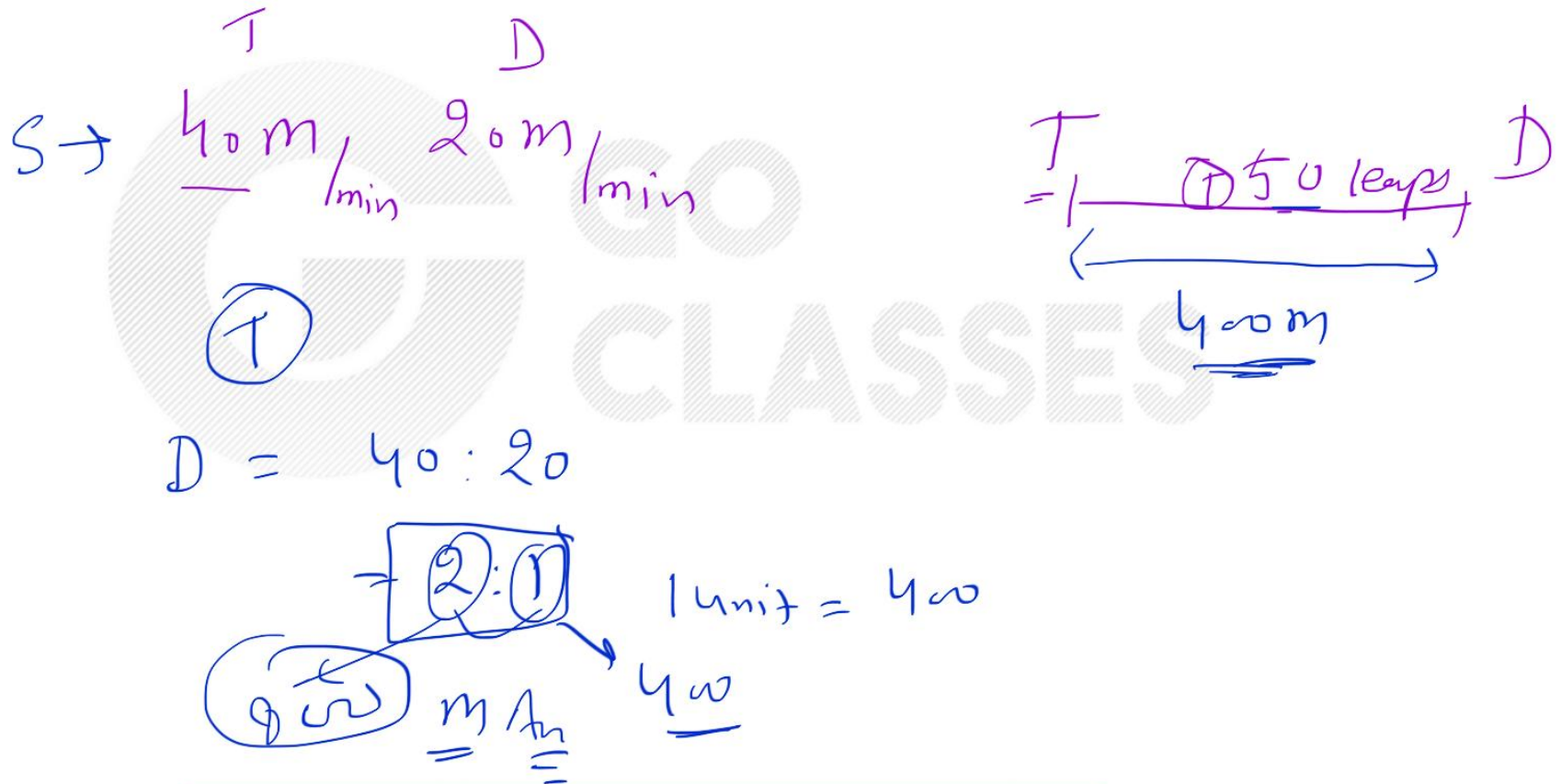speed. $8 + S$ $8 - S$

time $\dfrac{8-S}{1}$: $\dfrac{8+S}{3}$

$1 : 3$

$\dfrac{8-S}{8+S} = \dfrac{1}{3} \Rightarrow 24 - 3S = 8 + S$

$4S = 16$

$S = 4 \, km/h$

Q.9 A tiger is 50 leaps of its own behind a deer. The tiger takes 5 leaps per minute to the deer's 4. If the tiger and the deer cover 8 meter and 5 meter per leap respectively, what distance in meters will the tiger have to run before it catches the deer?

$$S \rightarrow \quad \overset{T}{40\,m}/_{min} \quad \overset{D}{20\,m}/_{min}$$

$$T$$

$$D = 40 : 20$$

$$\boxed{2 : 1}$$

$$\underset{=}{gap} \quad m\,A_m \rightarrow 400$$

$$T \underset{=}{\longmapsto} \underset{\longleftrightarrow}{\underset{400\,m}{50\ leaps}} \quad D$$

$$1\,unit = 400$$

Q.10 It takes 10 s and 15 s, respectively, for two trains travelling at different constant speeds to completely pass a telegraph post. The length of the first train is 120 m and that of the second train is 150 m. The magnitude of the difference in the speeds of the two trains (in m/s) is _____.

A. 2.0 Ans
B. 10.0
C. 12.0
D. 22.0

$120 = S_A \times 10 \Rightarrow S_A = 12 \, m/s$
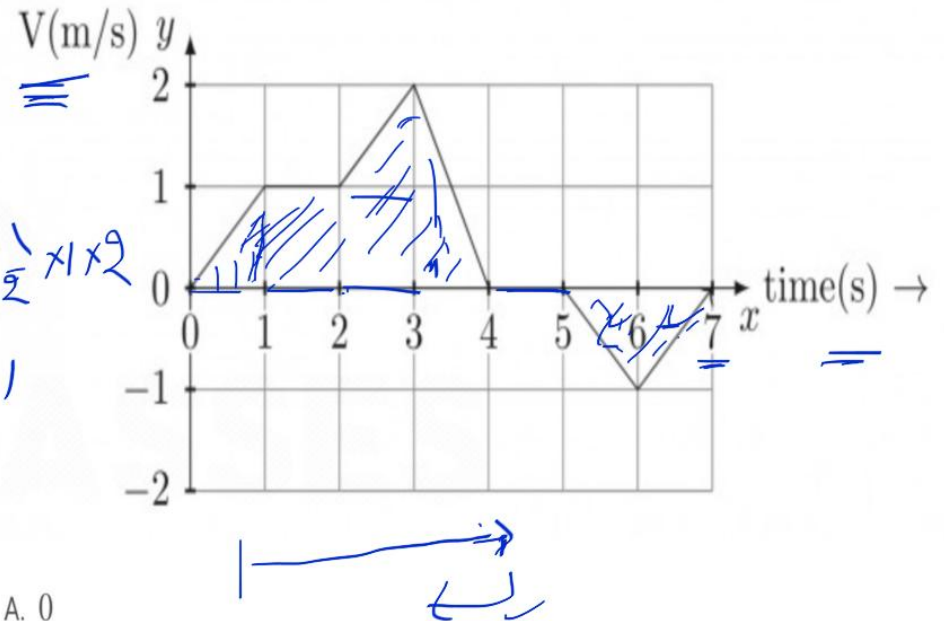
$150 = S_B \times 15 \Rightarrow S_B = 10 \, m/s$

Q.11 The velocity V of a vehicle along a straight line is measured in m/s and plotted as shown with respect to time in seconds. At the end of the 7 seconds, how much will the odometer reading increase by (in m)?

$$D = S \times T$$

$$\frac{1}{2} \times 1 \times 1 \; + \; 1 \times 1 \; + \; 1 \times 1 + \frac{1}{2} \times 1 \times 1 + \frac{1}{2} \times 1 \times 2$$

$$+ \frac{1}{2} \, N \times 1 + \frac{1}{2} \times 1 \times 1$$

$$0.5 + 1 + 1 + 0.5 + 1 + 0.5 + 0.5$$

A. 0
B. 3
C. 4
D. 5

5

Q.12 Budhan covers a distance of 19 km in 2 hours by cycling one fourth of the time and walking the rest. The next day he cycles (at the same speed as before) for half the time and walks the rest (at the same speed as before) and covers 26 km in 2 hours. The speed in km/h at which Budhan walk is

    A. 1
    B. 4
    C. 5
    D. 6

$$19 = \frac{1}{2} \times c + \frac{3}{2} w$$

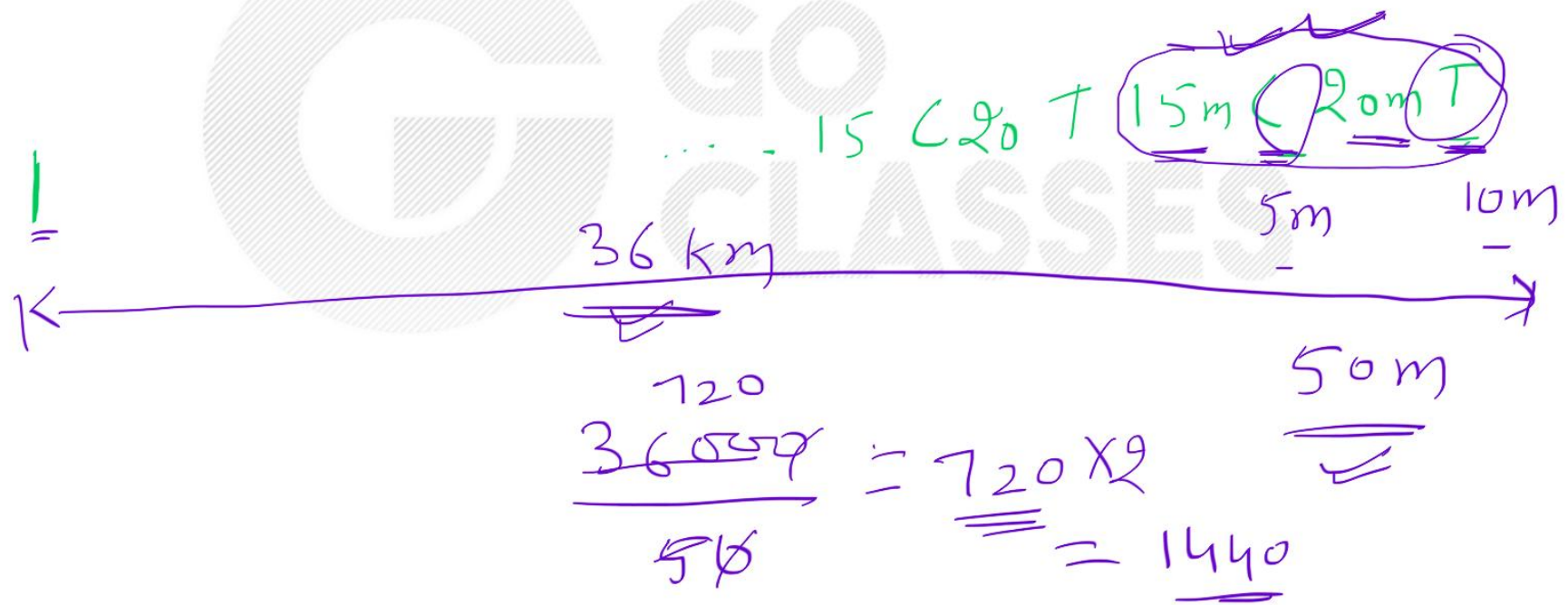$$\frac{26}{2} = 13 = \frac{1 \times c}{2} + \frac{1 w}{2}$$

$$6 = 1 \times w \Rightarrow w = 6 \, km/h$$

Q.13 Trucks (10 m long) and cars (5 m long) go on a single lane bridge. There must be a gap of at least 20 m after each truck and a gap of at least 15 m after each car. Trucks and cars travel at a speed of 36 km/h. If cars and trucks go alternately, what is the maximum number of vehicles that can use the bridge in one hour?

A. 1440
B. 1200
C. 720
D. 600

$A2$

$S = 36 \, km/h$

$15 \, C \, 20 \, T \, 15m \, C \, 20m \, T$

$5m$ $10m$

$36 \, km$

$50m$

720

$$\frac{36000}{50} = 720 \times 2 = 1440$$

Q.14 An automobile travels from city A to city B and returns to city A by the same route. The speed of the vehicle during the onward and return journeys were constant at $60 km/h$ and $90 km/h$, respectively. What is the average speed in km/h for the entire journey?

    A. 72 km/h

    B. 73 km/h

    C. 74 km/h

    D. 75 km/h

$$\text{Avg speed} \Rightarrow \frac{180 + 180}{3 + 2}$$

$$= \frac{360}{5} \Rightarrow 72$$

Q.15 From the time the front of a train enters a platform, it takes 25 seconds for the back of the train to leave the platform, while traveling at a constant speed of 54 km/h. At the same speed, it takes 14 seconds to pass a man running at 9 km/h in the same direction as the train. What is the length of the train and that of the platform in meters, respectively?

- A. 210 and 140
- B. 162.5 and 187.5
- C. 245 and 130
- D. 175 and 200 ✓

Ⓣ   Ⓟ

$\frac{1}{=}$ 25 sec $S \Rightarrow 54 \, km/h$

175m
↑
↓200

$T + P = 25 \times 15$
$T = 14 \times \dfrac{25}{2}$
$=$

$P = 8 \times 25$

$P = 200 \, m$

$\dfrac{5}{45 \times 5} = \dfrac{25}{2} \, m/s$

$= 54 \times \dfrac{5}{18}$
$= 15 \, m/s$

$54 - 9$
$45 \, km/h$

→ 9 km/h
⟶ 54 km/h

Q.16 Two trains started at 7AM from the same point. The first train travelled north at a speed of 80km/h and the second train travelled south at a speed of 100km/h. The time at which they were 540 km apart is _____ AM.

A. 9
B. 10
C. 11
D. 11.30

← Number system

$$T = \frac{240}{80} \Rightarrow 3\,hr$$

240 km

$$D = 80 : 100$$
$$= 4 : 5 \rightarrow 300\,km$$

80 km/h

4 km

540 km

100 km/h

9 unit ⇒ 540 km

1 unit = 60 km