

#

$$\text{Km/h} \rightarrow \text{m/sec} : \frac{5}{18}$$

$$\text{m/sec} \rightarrow \text{Km/h} : \frac{18}{5}$$

Ex A person covers a distance at a certain speed. If he increases his speed by 25%, then he takes 12 mins less to cover the same distance. Find the time taken by him initially to cover the distance at original speed.

$$\frac{D}{v} - \frac{4D}{5v} = 12 \text{ min} = \frac{1}{5}$$

$$\Rightarrow \frac{D}{5v} = \frac{1}{5} \Rightarrow \frac{D}{v} = 1 \text{ hr.} \quad \text{Ans} \rightarrow \underline{\underline{1 \text{ hour}}}$$

Ex A person leaves his house and travelling at 4 Km/h reaches his office 10 mins late. Had he travelled at 7 Km/h he would have reached 20 mins early. Find the distance from his house to the office?

$$\frac{D}{4} - \frac{D}{7} = \frac{1}{2}$$

$$\Rightarrow \frac{3D}{28} = \frac{1}{2}$$

$$\Rightarrow D = 1\frac{1}{3} \text{ Km.}$$

#

### Boats & Streams

$$V_s \quad V_c$$

$$V_u \quad V_d$$

$$V_u = V_s - V_c$$

$$V_d = V_s + V_c$$

$$V_s = \frac{V_u + V_d}{2}$$

$$V_c = \frac{V_d - V_u}{2}$$

Ex In a race of 1000m, A beats B by 50m or 5 seconds  
 Find (i) B's speed  
 (ii) A's speed  
 (iii) Time taken by A to complete the race.

$$B's\ speed = \frac{50\text{m}}{5\text{s}} = 10\text{m/s.}$$

$$\text{Time taken by B} = 100\text{s.}$$

$$\text{Time taken by A} = 95\text{s.}$$

$$\therefore A's\ speed = \frac{1000}{95} = \frac{200}{19}\text{ m/s} = 10\frac{10}{19}\text{ m/s.}$$

Ex Rakesh rows  $1\frac{1}{3}$  times as fast as Mukesh. In a race, if Rakesh gives a lead of 60m to Mukesh, find the distance from the starting point where both of them will meet.

Imp.  $\rightarrow$  Speed of Mukesh.

$$\frac{60}{\frac{4}{3}m-m} \quad || \quad m \text{ not given}$$

But, we know for every 3m of Mukesh, Rakesh covers 4m.

$$\begin{aligned} 1\text{m} &\rightarrow 4\text{m} \\ 60\text{m} &\rightarrow 240\text{m} \end{aligned}$$

Ex In a 1500m race, Tinu beats Minu by 150m and in the same race Minu beats Rinu by 75m. By what distance does Tinu beat Rinu?

$$\begin{array}{ccc} T & M & \nearrow \\ 1500 & 1350 & \end{array}$$

$$\begin{array}{cc} M & R \\ 1500 & 1425 \end{array}$$

$$1500 \rightarrow 1425$$

$$1350 \rightarrow \frac{1425+75}{1500} = 1282.5$$

$$\text{Ans} \rightarrow 1500 - 1282.5$$

$$= \underline{\underline{217.5}}$$

# In Clocks, usually  $\angle$ 's are measured in clockwise direction.

Ex Find the time at which the hands of clock are at right  $\angle$  b/w 7 and 8 o'clock.

Let's say it is  $p$  min.

Case 1

$$210^\circ + \frac{p}{2} - 6p = 90^\circ$$

$$\Rightarrow 120^\circ = 1\frac{1}{2}p \Rightarrow p = \frac{240}{11} = 21\frac{9}{11} \text{ min.}$$

Case 2

$$6p - 210^\circ - \frac{p}{2} = 90^\circ$$

$$\Rightarrow 300^\circ = 11\frac{1}{2}p \Rightarrow p = \frac{600}{11} = 54\frac{6}{11} \text{ min.}$$

Ex At what time b/w 2 and 3 o'clock are the hands of a clock together?

$$60 + \frac{p}{2} = 6p$$

$$\Rightarrow 11\frac{1}{2}p = 60 \Rightarrow p = \frac{120}{11} = 10\frac{10}{11} \text{ min. Ans} \rightarrow 2:10\frac{10}{11}$$

Ex If the hands of a clock coincide every 65 mins, how much time does the clock gain or lose per day?

Usually they coincide every  $\rightarrow \frac{720}{11} = 65\frac{5}{11}$  mins.

Every  $65\frac{5}{11}$  min of clock = 65 mins of correct time

Hence, clock gains time =  $\frac{5}{11}$  mins every 65 mins.

$$\text{Ans} \rightarrow \frac{5}{11} \times \frac{1}{65} \times 1440 = \frac{1440}{143} = 10\frac{10}{143} \text{ mins.}$$

Ex A beats B by 10m in a 100m race. If B beats C by 20m in the race, then A beats C by how many metres?

$$100 \rightarrow 80$$

$$90 \rightarrow \frac{80}{100} \times 90 = 72.$$

$$\text{Ans} \rightarrow 100 - 72 = \underline{28}.$$

Ex In a Race A beats B by 100m and B beats C by 200m. By what dist. A beats C?

Total distance not known.

Ans  $\rightarrow$  Can't be determined.

Ex In a Race, A beats B by 10 sec, B beats C by 20 s. By how many seconds did A beat C?

Ans  $\rightarrow$  30 seconds.

Ex In a 1000m race, A beats B by 100m. What is  $\frac{v_A}{v_B}$ ?

$$\frac{10}{9}.$$

Ex In a 1000m race, A beats B by 10s. What is  $\frac{v_A}{v_B}$ ?

$$\frac{v_A}{v_B} = \frac{t+10}{t}$$

Ans  $\rightarrow$  Can't be determined.

Ex The minute and hour hands of a clock coincide after every 65' mins. Is the clock gaining time?

Yes.

Ex The avg. speed of a train b/w 2 stations, without considering the stoppages is 96 miles/hr. When the stoppages are considered the avg. speed is 84 miles/hr. How many mins/hr on an avg. were the stoppages?

$$\frac{D}{t} = 96$$

$$\frac{D}{t + \Delta t} = 84$$

$$96t = 84t + 84\Delta t$$

$$\Rightarrow 12t = 84\Delta t$$

$$\Rightarrow \frac{\Delta t}{t} = \frac{12}{84} = \frac{1}{7}$$

$$\Rightarrow \Delta t = \frac{t}{7}$$

Then, if  $t + \Delta t = 60$

$$96t = 84 \times 60$$

$$\Rightarrow t = \frac{84 \times 60}{96} = \frac{420}{8}$$

$$\therefore \Delta t = 60 - \frac{420}{8} = \frac{60}{8} = 7.5 \text{ min.}$$

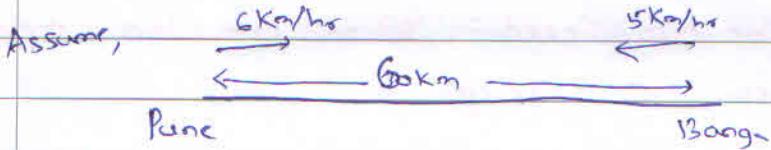
Ex Mrs. Robins started half an hr later than usual for the market place. But by increasing her speed to  $\frac{3}{2}$  times her usual speed she reached 10 mins earlier than usual. What is her usual time for this journey?

$$\frac{D}{v} - \frac{2D}{3v} = \frac{2}{3}$$

$$\Rightarrow \frac{D}{3v} = \frac{2}{3} \Rightarrow D = \underline{\underline{2 \text{ hours}}}$$

Ex A car  $C_1$  starts from Pune to Bangalore at 10:00 am and reaches Bangalore at 8:00 PM. Another car  $C_2$  starts from Bangalore to Pune at 10:00 am and reaches Pune at 10:00 PM. At what times did the cars cross each other?

$$\frac{Vc_1}{Vc_2} = \frac{12}{10} = \frac{6}{5}$$



$$\frac{60}{11} = 5 + \frac{5}{11} \times 60$$

$$= 15 \text{ hrs } 27 \text{ min}$$

Ans  $\rightarrow$  3:27 PM

Ex A man started driving at constant speed, from the site of a blast the moment he heard the blast. He heard the 2nd blast after a time of 30 mins and 30 seconds. If the 2nd blast occurred exactly 30 mins after the first, how far was he from the site when he heard the 2nd blast?

Speed of sound = 330 m/s

$$\frac{D}{330-v} = 30 \text{ s}$$

$$\Rightarrow \frac{1800 \text{ m}}{330-v} = 30$$

$$\Rightarrow \frac{60 \text{ v}}{330-v} = 30$$

$$\Rightarrow 1800 \text{ m} = 30(330-v)$$

$$\text{Ans} \rightarrow 1800 \times 30 = 330 \times 1800 \text{ m} = 9900 \text{ m.}$$

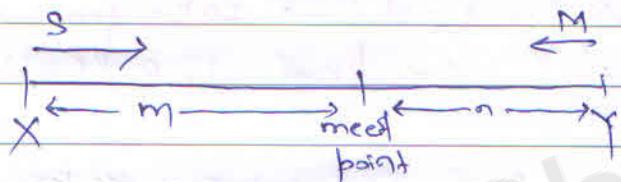
Alt.

$$30 \times 330 = 9900 \text{ m.}$$

Ex Steve and Mark start simultaneously from X and Y in their cars, towards Y and X respectively. After they meet, they exchange their speeds and proceed towards their respective destinations. If Steve took 220 mins to travel from

X to Y, what is time taken by Mark to travel from Y to X?

220 mins.



$$\frac{m}{v_s} + \frac{n}{v_m} = 220.$$

Then, que. asked:—  $\frac{n}{v_m} + \frac{m}{v_s} = \underline{\underline{220 \text{ mins.}}}$ .

Ex A man started from Hyderabad at 7 AM and reached Bangalore at 6 PM. The next day he started from Bangalore at 7 AM and returned to Hyderabad at 6 PM, using exactly the same route. The man's speed was not uniform but he moved in one direction, without retracing his path on either day. On how many instances, the man was at the same point on 2 days?

1.

Ex 2 cars, Car 1 and Car 2 move towards each other from X and Y respectively with respective speeds of 20 m/s and 15 m/s. After meeting each other Car 1 reaches Y in 10 seconds. In how many seconds does Car 2 reach X starting from Y?



$$\frac{3x}{20} \rightarrow 10 \Rightarrow 3x = 200$$

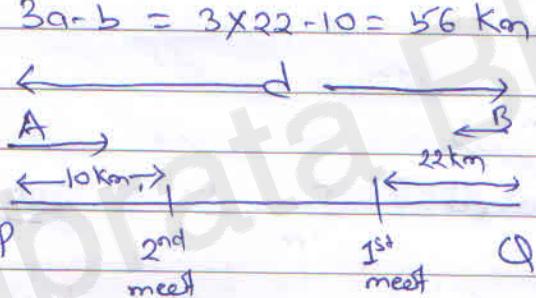
$$\frac{7x}{15} = \frac{7}{15} \times \frac{200}{3} = \frac{7 \times 40}{9} = \frac{280}{9} = 31.1 \text{ seconds.}$$

Ex

2 cars simultaneously left 2 cities P and Q for Q and P respectively. Once they arrive at their respective destinations, they turn around and move towards their starting points. They meet for first time 22 km from city Q. They meet for 2nd time 10 km from city P. Find the distance PQ.

Q-Type

Alt



$$\frac{V_A}{V_B} = \frac{d-22}{22}$$

$$\frac{V_A}{V_B} = \frac{22+d-10}{d-22+10} = \frac{d+12}{d-12}.$$

$$\therefore \frac{d-22}{22} = \frac{d+12}{d-12}.$$

$$\Rightarrow d^2 - 12d - 22d + 22 \times 12 = 22d + 12 \times 22$$

$$\Rightarrow d^2 = 56d$$

$$\Rightarrow \underline{\underline{d=56}}$$

Ex

A motorcyclist has to cover a distance of 200 km to reach city B from city A. After travelling a certain distance, his motorcycle develops a problem and travels at  $\frac{3}{4}$ th of its original speed, thereby reached B 1 hr late. Had the problem developed 30 km earlier, he would have reached B 12 mins later. Find the initial distance it travelled without the problem, and the speed over that part of the journey.

$$\frac{4 \times 30}{3v} - \frac{30}{v} = \frac{1}{5}$$

$$\Rightarrow \frac{30}{v} \times \frac{1}{3} = \frac{1}{5} \Rightarrow \frac{10}{v} = \frac{1}{5} \Rightarrow v = 50 \text{ Km/hr.}$$

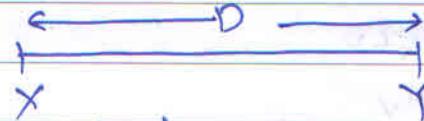
$$\frac{x}{50} + \frac{(200-x) \times 1}{50 \times 3} = \frac{200}{50} + 1$$

$$\Rightarrow \frac{3x + 800 - 4x}{150} = 5$$

$$\Rightarrow 800 - x = 750 \Rightarrow x = 50 \text{ Km.}$$

Ex 2 cities X and Y lie on a straight line. A m/s P and Q left simultaneously for Y and X from X and Y respectively. P reaches Y and immediately turns around and moves towards X. On reaching X, again he turns around and moves towards Y. This kind of movement continues indefinitely. Q also travels in similar manner. Distance b/w X and Y is 1000m and  $\frac{V_p}{V_q} = \frac{3}{2}$ . Find the distance travelled by P when he meets Q for 4th time.

Note



First meet, <sup>Total</sup> relative distance = D.

2<sup>nd</sup> meet onward, = 2D.

Total distance covered =  $1000 + 3 \times 2000 = 7000$

Then, distance travelled by P =  $7000 \times \frac{3}{5} = 4200 \text{ m.}$

Ex A bike travelling at 80 Kmph uses 40% more petrol to travel at the speed of 65 Kmph. If the bike can travel 58.8 Kms on a litre of petrol at 65 Kmph, how far can the bike travel on 6.5 litres of petrol at a speed of 80 Kmph.

$$1.4 \text{ L} \rightarrow 58.8$$

$$6.5 \text{ L} \rightarrow \frac{58.8}{1.4} \times 6.5$$

$$= 42 \times 6.5 = \underline{\underline{273 \text{ Km.}}}$$

Ex Vinay went up an ascending escalator from the ground floor to first floor in 24 seconds. Had the escalator been stationary, he would have taken 54 seconds. If Vinay's speed is  $v$  and that of the escalator is  $e$ , what can be concluded regarding  $v$  and  $e$ ?

$$\frac{D}{v+e} = 24$$

$$\frac{D}{v} = 54.$$

$$\Rightarrow 24(v+e) = 54v$$

$$\Rightarrow 4v + 4e = 9v$$

$$\Rightarrow 5v = \underline{\underline{4e}}$$

$$\Rightarrow v = \frac{4}{5} e.$$

Ex Sachin, Sourav and Rakesh run simultaneously, starting from a point, around a circular track of length 1200m, with respective speeds of 2m/s, 4m/s and 6m/s. Sachin and Sourav runs in the same dir<sup>n</sup>, whereas Rakesh runs in opp. dir<sup>n</sup>. When the 3 will meet for 1<sup>st</sup> time.

$$\frac{1200}{4-2} = 600 \text{ s}$$

Ans  $\rightarrow$  LCM (600, 120)

$$\frac{1200}{10} = 120 \text{ s.}$$

$$= \underline{\underline{600 \text{ s}}}.$$

Ex 3 runners Ajay, Bijay and Chanday run a race with Ajay finishing 20m ahead of Bijay and 34m ahead of Chanday, while Bijay finished 21m ahead of Chanday. Each runner travels the entire distance at a constant speed. What was the length of the race?

$$\begin{array}{ccc} A & B & C \\ x & x-20 & x-34 \end{array}$$

$$\begin{array}{cc} B & C \\ x & x-21 \end{array}$$

$$\frac{x-20}{x-34} = \frac{x}{x-21}$$

$$\Rightarrow x^2 - 41x + 420 = x^2 - 34x.$$

$$\Rightarrow 7x = 420 \Rightarrow x = \underline{\underline{60 \text{ m}}}.$$

Ex 2 faulty clocks are set at a correct time on Tuesday at 10:00PM. The first clock loses  $3\frac{1}{2}$  mins/hr, while the 2nd clock gains  $2\frac{1}{2}$  mins/hr. When will the times in the 2 clocks be 3 hrs apart?

6 min per hr.

180 min  $\rightarrow$  30 hr.

Time: Thursday 4:00 AM.

Ex At what time b/w 3 and 4'o clock are the 2 hands coincident?

$$90 + \frac{1}{2}p = 6p$$

$$\Rightarrow p = \frac{180}{11} = 16\frac{4}{11} \text{ min}$$

Ans  $\rightarrow$  3:16 $\frac{4}{11}$ .

Ex Ajay starts painting his room sometime b/w 6 and 7'0 clock in the evening. When he finished painting the room, sometime b/w 8 and 9'0 clock in the evening, he noticed that the hours and minute hands have interchanged their positions with what they were when he started painting. At what time did the paint job get over?

Q-Type

Glo. Painting

$$180 + \frac{p}{2} = 6q$$

$$\Rightarrow 360 + p = 12q$$

$$480 + q = 12p$$

8 hrs 9 min.

$$240 + \frac{q}{2} = 6p$$

$$360 = 12q - p$$

$$480 = 12p - q$$

$$\Rightarrow 480 \times 12 = 144p - 12q$$

$$\therefore 480 \times 12 + 360 = 143p$$

$$\Rightarrow p = \frac{6120}{143}$$

$$q = \frac{180 + p/2}{6}$$

$$= \frac{4800}{143}$$

$$\text{Ans} \rightarrow 8: \frac{4800}{143} \text{ PM.}$$

Ex Towns X and Y are in the countries P and Q respectively. X is 3600 km to the west of Y. An airline operates non-stop flights b/w X and Y. Its schedule is tabulated below. The given times are local times of the same day.

Departure Town	Time	Arrival Town	Time
X	4:00 PM	X	7:30 PM
Y	3:00 AM	Y	1:30 PM

The planes cruise at same speed in both dir<sup>n</sup>s. However, a steady wind blows from Y to X at 75 kmph. The effective speed of each plane is affected by this.

- (i) Find time difference b/w X and Y.
- (ii) Find the speed at which plane cruises.

Assume time difference to be a hr.

$$\frac{D}{v+75} = \frac{7}{2} + a$$

$$\frac{D}{v-75} = \frac{21}{2} - a.$$

$$\Rightarrow (v+75) \left( \frac{7}{2} + a \right) = (v-75) \left( \frac{21}{2} - a \right)$$

$$\Rightarrow \frac{3600}{v+75} + \frac{3600}{v-75} = 14.$$

$$\Rightarrow v = 525 \text{ Km/h}$$

$$\text{Then, } \frac{3600}{600} = \frac{7}{2} + a \Rightarrow a = \underline{\underline{2.5 \text{ hours}}}.$$

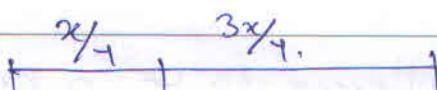
Ex. A jaguar spots a rabbit in a forest and decides to hunt it for prey. In the ensuing chase it is seen that the rabbit takes 4 paces for every 3 paces of the jaguar. But each pace of the jaguar is 1.5 m long, whereas each pace of the rabbit is 0.5 m long. In how many paces will the jaguar catch the rabbit, if it is 10m behind the rabbit initially?

J	$3 \times 1.5$	4.5
R	$4 \times 0.5$	2

$$\begin{aligned}
 4.5 \text{ m} &\longrightarrow 2.5 \text{ m} \\
 2.5 \text{ m} &\longrightarrow 4.5 \text{ m} \\
 10 \text{ m} &\longrightarrow \underline{\underline{18 \text{ m}}}
 \end{aligned}$$

$$\text{No. of paces} = \frac{18}{1.5} = \underline{\underline{12}}.$$

Ex Mr Bajaj's car failed after he had covered  $\frac{1}{4}$ th of the distance from his home to office. He then boards a bus which takes him to his office. The time he spent travelling by bus is 9 times the time he spent travelling by car. How many times the speed of the bus is speed of the car?



$$\frac{\frac{3x}{4}}{v_B} = 9 \times \frac{\frac{x}{4}}{v_C} \Rightarrow \frac{3}{v_B} = \frac{9}{v_C}$$

$$\Rightarrow 3v_B = v_C$$

$$\Rightarrow \frac{v_B}{v_C} = \frac{1}{3}$$

Ex Vijay left P for Q at 10:00 AM. At the same time, Ajay left Q for P. After their meeting at a point on the way, Vijay took 24 mins to reach Q and Ajay took 54 mins to reach P. At what time did they meet?

1Q-Type

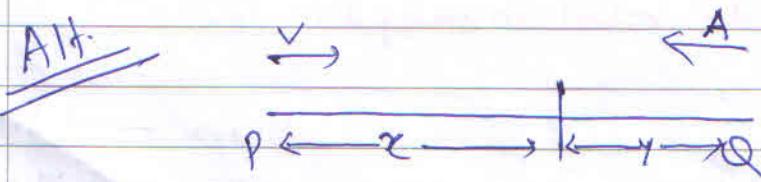
$$d = \sqrt{t_1 t_2}$$

$$= \sqrt{24 \times 54} = \sqrt{6 \times 4 \times 6 \times 9}$$

$$= 6 \times 2 \times 3$$

$$= 36$$

Ans  $\rightarrow$  10:36 AM.



$$\frac{V_V}{V_A} = \frac{x}{y}, \quad \frac{y}{V_V} = 24, \quad \frac{x}{V_A} = 54.$$

$$\therefore \frac{v_v}{v_A} = \frac{54 v_A}{24 v_v}$$

$$\Rightarrow 24 v_v^2 = 54 v_A^2$$

$$\Rightarrow 4 v_v^2 = 9 v_A^2$$

$$\Rightarrow \underline{\underline{2 v_v = 3 v_A}}.$$

$$t = \frac{x}{v_v} = \frac{y}{v_A}$$

$$= \frac{54 v_A}{v_v} = \frac{54 \times 2}{3} = \underline{\underline{36}}.$$

Ex Mr. Mehta takes 18 hours to go by train to a certain city and return by car. He loses 4 hours if he goes both ways by train. How long would he have taken if he had travelled both ways by car?

$$\frac{D}{v_T} - \frac{V}{v_C} = \underline{\underline{4}}.$$

$$\text{Ans} \rightarrow 18 - 4 = \underline{\underline{14}}.$$

Ex If a man travels  $\frac{3}{7}$ th of his original speed he reaches his office 12 mins late. Calculate the actual duration of his travel.

$$\frac{7D}{3v} - \frac{D}{v} = \underline{\underline{12}}$$

$$\Rightarrow \frac{D}{v} \times \frac{4}{3} = \underline{\underline{12}} \quad \Rightarrow \frac{D}{v} = \frac{3}{20} = \underline{\underline{9 \text{ min}}}.$$

Ex A car covered a distance of 300 Km in 5 hours, covering a part of it at 50 Km/hr and remaining at 80 Km/hr. For how much time did the car travel at 50 Km/hr.

$$\frac{x}{50} + \frac{300-x}{80} = 5$$

$$\Rightarrow \frac{8x+1500-5x}{400} = 5$$

$$\Rightarrow 3x+1500 = 2000 \Rightarrow x = \frac{500}{3}$$

$$\text{Ans} \rightarrow \frac{500}{3 \times 50} = \frac{10}{3} = 3\frac{1}{3} \text{ hours.}$$

Ex 2 buses C and D are operated b/w cities M and N. One day C and D started from M and N respectively towards N and M respectively. After the 2 buses cross each other, the bus C takes 5 hrs to reach city N and the bus D takes 3 hrs 12 mins to reach city M. After how much time from the start did the buses C & D cross each other?

$$t = \sqrt{t_1 t_2}$$

$$= \sqrt{5 \times 15\frac{1}{5}}$$

$$= 4 \text{ hours.}$$

Ex 2 Athletes X and Y simultaneously start walking from points P and Q towards Q and P respectively. Points P and Q are diametrically opposite points on a circular track. Both of them take the same segment of the circular road joining X and Y. They meet at a point R after  $t$  hours. From R, X takes  $t_1$  hours to reach Q and Y takes  $t_2$  hours to reach P.

Find the relation b/w  $t, t_a, t_b$ .

$$t = \sqrt{t_a t_b}$$



$$\frac{m}{v_x} = t_a \quad \frac{m}{v_y} = t_b \quad t_a = \frac{m}{v_x} \quad t_b = \frac{m}{v_y}$$

$$\frac{v_x}{v_y} = \frac{m}{\eta} = \frac{t_b}{t_a}$$

~~$$t(v_x + v_y) = v_x t_a + v_y t_b$$~~

$$v_x t_a + v_y t_a = v_y t_b + v_y t_b$$

$$\Rightarrow v_x t_a - v_y t = v_y t - v_x t_a$$

$$\Rightarrow 2v_x t_a = 2v_y t$$

$$\Rightarrow v_x t_a = v_y t$$

~~$$\Rightarrow \frac{v_x t_a}{t_a} = \frac{v_y t}{t}$$~~

$$v_y = \frac{v_x t_a}{t}$$

$$\Rightarrow \frac{v_x t}{t_b} = \frac{v_x t_a}{t}$$

$$\Rightarrow t^2 = t_a t_b \Rightarrow$$

~~$$t = \sqrt{t_a t_b}$$~~

Ex Ganesh and Sureh are running along a circular track of length 300m. If the speeds of Ganesh and Sureh are 6m/s and 12m/s respectively, how many more rounds than Ganesh will Sureh complete in 1 hr?

$$\frac{3600}{300/12} - \frac{3600}{300/6} = \frac{3600}{25} - \frac{3600}{50}$$

$$= 144 - 72 = \underline{\underline{72}}$$

Ex Having started from the same point and at the same time, 2 runners A and B are running around a circular track of length 300m in opp directions with speeds of 5m/s and 8m/s respectively. If they exchange their speeds after meeting for 1<sup>st</sup> time, who will reach the starting point first?

Both will reach simultaneously.

Ex A bus has to travel a total distance of 480 Km. After travelling a part of the distance, the bus develops an engine problem and proceeds at  $\frac{3}{4}$ th of its former speed and arrives at the destination 50 mins late. Had the problem developed 40 Km later, the bus would have arrived 10 mins sooner. Find the distance it travelled without any problem.

$$\frac{\frac{40x}{v} - \frac{40}{v}}{3v} = \frac{1}{6}$$

$$\Rightarrow \frac{40}{v} \times \frac{1}{3} = \frac{1}{6}$$

$$\Rightarrow v = 80 \text{ Km/hr.}$$

$$\frac{x}{80} + \frac{480-x}{80 \times \frac{3}{4}} = 6 + \frac{5}{6}$$

$$\Rightarrow \frac{x}{80} + \frac{480-x}{60} = \frac{41}{6}$$

$$\Rightarrow \frac{3x+1920-4x}{240} = \frac{41}{6}$$

$$\Rightarrow 1920-x = 41 \times 40$$

$$\Rightarrow x = 1920 - 1640 = \underline{\underline{280 \text{ Km}}}$$

Ex Manoj travelled  $\frac{3}{4}$  of total distance of his trip by a bus, and the remaining distance by a tonga, spending 8 times as long travelling by tonga as he did travelling by bus. Find  $\frac{v_t}{v_b}$ .



$$\frac{x}{v_t} = 8 \times \frac{3x}{v_b} \Rightarrow 24v_t = v_b$$

$$\Rightarrow \frac{v_t}{v_b} = \frac{1}{24}.$$

Ex A train crosses a telegraph post in 25 seconds. Had it increased its speed by a fifth, it would have crossed a platform of length 50m in 25s. Find the length of the train.

$$\frac{L}{v} = 25.$$

$$\frac{L+50}{6v/5} = 25.$$

$$\frac{L}{v} = \frac{L+50}{6v/5} \Rightarrow L = \frac{15L+250}{6} \Rightarrow L = \underline{\underline{250}} \text{ m.}$$

Ex Acc swimmer Alexander swims from point X to point Y and back in 10 hours. He drops his goggles at point X. The goggles take 15 hrs to float to point Y. Find  $\frac{v_s}{v_c}$ .

$$\frac{D}{v_c} = 15 \Rightarrow 15v_c.$$

$$\frac{15v_c}{v_s+v_c} + \frac{15v_c}{v_s-v_c} = 10$$

$$\Rightarrow 3v_c v_s - 3v_c^2 + 3v_c v_s + 3v_c^2 = 2v_s^2 - 2v_c^2.$$

$$\Rightarrow 6v_c v_s = 2v_s^2 - 2v_c^2 \Rightarrow v_s^2 - v_c^2 = 3v_c v_s$$

$$\Rightarrow \frac{v_s^2}{v_c^2} - 1 = \frac{3v_s}{v_c}.$$

$$\Rightarrow x^2 - 3x - 1 = 0.$$

$$\Rightarrow x = \frac{3 \pm \sqrt{9+4}}{2}$$

$$= \frac{3 + \sqrt{13}}{2}$$

$$\Rightarrow \frac{v_s}{v_c} = \frac{3 + \sqrt{13}}{2}$$

-ve not possible.  $\underline{x > 0}$

Ex In a race of length 'l' metres, Johnson beats Lewis by 'm' metres and Greene by 'n' metres. By how many metres does Lewis beat Greene in the same race? ( $m < n$ )

$$\begin{array}{ccc} J & D.L & G \\ l & l-m & l-n \end{array}$$

$$\begin{aligned} l-m &\rightarrow l-n \\ l &\rightarrow \left(\frac{l-n}{l-m}\right)l. \end{aligned}$$

$$\text{Ans} \rightarrow l - l \left( \frac{l-n}{l-m} \right)$$

$$= l \left[ 1 - \frac{l-n}{l-m} \right]$$

$$= l \times \frac{l-m-l+n}{l-m}$$

$$= l \times \frac{n-m}{l-m}$$

Ex In a 1000m car race, car P beats car Q by 100m. Car Q beats car R by 50m in 500m race. If car P beats car R by 30 seconds, in a 2000m race, how long would car Q take to travel a distance of 3000m?

P      Q      R  
 1000    900    810.

$$V_R = \frac{380}{30} = \frac{38}{3}$$

$$V_Q = \frac{38}{3} \times \frac{10}{9} = \frac{380}{27} \text{ m/s.}$$

$$\text{Ans} \rightarrow 3000 \div \frac{380}{27} = \frac{3000 \times 27}{380} = \frac{4050}{19} \text{ s.}$$

Ex In a running race, Ajay gives Vijay a headstart of 200m and still beats him by 100m. If Ajay's speed is  $1\frac{3}{7}$  times Vijay's speed, what is the length of the race?

10 : ?

1000 : 700

Ans  $\rightarrow$  1000m

Ex In a 3000m race A reaches the finish line 50 seconds earlier than B and beats C by 1000m. If  $V_C = 8 \text{ m/s}$ , what is  $V_B$ ?

Time for C to run 2000m =  $\frac{2000}{8} = 250 \text{ s.}$

$$V_A = \frac{3000}{250} = 12 \text{ m/s.}$$

$$V_B = \frac{3000}{30} = 100 \text{ m/s.}$$

Ex Bharath beats Arjun by 180m in a cycling race of 720m. Charan beats Arjun by 90m in a cycling race of 900m. If Bharath beats Charan by 5 seconds in a cycling race of 600m, how long will Charan take to cycle a distance of 2.4 Km?

$$V_c = \frac{100}{5} = 20 \text{ m/s}$$

$$\text{Ans} \rightarrow \frac{2400}{20} = 120 \text{ sec} = 2 \text{ min}$$

Ex A wall clock is set correctly at 12:00 noon on Tuesday. On Wednesday, when the correct time is 6:00 PM, the clock shows 6:30 PM. When the correct time is 8:00 AM on Thursday, what will the clock show?

$$30 \text{ hrs} \rightarrow 30 \text{ mins}$$

$$44 \text{ hrs} \rightarrow 44 \text{ mins}$$

$$\text{Ans} \rightarrow 8:44 \text{ AM.}$$

Ex One evening, Zombic goes out for a drive, sometime b/w 4 o'clock and 5 o'clock. When he gets back, sometime b/w 7 o'clock and 8 o'clock, he noticed that the minute and hour hands have interchanged their positions with where they were when he started. For how long was he out for drive?

$$120 + p/2 = 6q$$

$$210 + q/2 = 6p$$

$$240 + p = 12q$$

$$420 + q = 12p$$

$$\Rightarrow 240 = 12q - p$$

$$420 = 12p - q$$

$$420 \times 12 = 144p - 12q$$

$$\Rightarrow 420 \times 12 = 143p$$

$$\Rightarrow p = \frac{5040}{143}$$

$$q = \frac{120 + 7/2}{6}$$

$$= \frac{3280}{143}.$$

$$\text{Ans} \rightarrow 4: \frac{5040}{143} - 7: \frac{3280}{143} = 4: \frac{1760}{143}$$

$$7: 22.937 - 4: 35.244 \\ = 2 \text{ hours } \underline{46 \text{ min.}}$$

Date :- 24.09.2016

Ex  
Q-Type

Rajesh walked down a descending escalator and took 40 steps to reach bottom. Sunil started simultaneously from the bottom taking 2 steps for every one step taken by Rajesh. The time taken by Rajesh to reach the bottom from the top is same as the time taken by Sunil to reach the top from bottom. How many more steps more than Rajesh did Sunil take before they crossed each other on the escalator?

$$40+x = 80-x$$

$$\Rightarrow 2x = 40 \Rightarrow \underline{\underline{x = 20}}$$

No. of steps by Rajesh Total no. of effective steps = 60.

They must meet on half.

$$\text{Ans} \rightarrow \frac{80}{2} - \frac{40}{2} = \underline{\underline{20}}$$

Ex Anil walks down an Up-escalator and counts 150 steps. Bibin walks up the same escalator and counts 75 steps. Anil takes 3 times as many steps in a given time as Bibin. How many steps are visible on the escalator?

<u>Anil</u>	<u>Bibin</u>	$x \neq y$
$150 - x$	$75 + y$	
If <u>Bibin</u> , he would have take <u>50 steps</u> .		As they don't take same time.

But for Bibin took 75. So,  $y = \underline{\underline{1.5x}}$ .

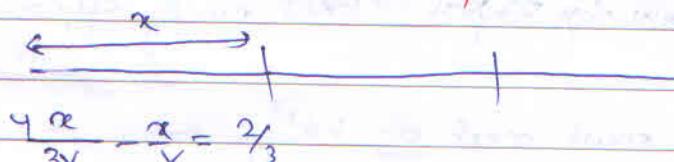
$$\therefore 150 - x = 75 + 1.5x$$

$$\Rightarrow 2.5x = 75$$

$$\Rightarrow x = \frac{75}{2.5} = \underline{\underline{30}}.$$

$$\text{Ans} \rightarrow 150 - 30 = \underline{\underline{120}}$$

Ex A person is travelling from station A to station B. He covers the 1<sup>st</sup>  $\frac{1}{3}$ rd at  $\frac{3}{4}$ th usual speed, 2<sup>nd</sup>  $\frac{1}{3}$ rd at  $\frac{4}{5}$ th usual speed, 3<sup>rd</sup>  $\frac{1}{3}$ rd at  $\frac{5}{6}$ th usual speed. When he reached station C which is at  $\frac{1}{3}$ rd of distance from A, he is 40 min late than usual time. When he reached B, he will be late by how much time?



$$\Rightarrow \frac{x}{v} = \underline{\underline{2}}.$$

$$\text{Ans} \rightarrow \frac{3x}{3v} + \frac{5x}{4v} + \frac{6x}{5v} - \frac{3x}{v}.$$

$$= \frac{80x + 75x + 72x}{60v} - \frac{3x}{v} = \frac{227x}{60v} - \frac{3x}{v}$$

$$= \frac{47x}{60v} \times \underline{\underline{2}} = \frac{47}{60} \times 2 \times 60 \text{ min} = \underline{\underline{94 \text{ min}}}$$

Ex A man arrives at a railway station  $1\frac{1}{2}$  hr before the time at which he had ordered his carriage to meet him. He walks at the rate of 4 Km/hr and meets the carriage 8 Km from his house and reached 1 hour earlier than usual time. What is the speed of carriage and distance from the station to his house?

$$\text{Distance of railway station from home} = 4 \times 1\frac{1}{2} + 8 \\ = 14 \text{ Km.}$$



$$\text{Time saved, } \frac{6+8}{V_c} = 1$$

$$\Rightarrow V_c = 12 \text{ Km/hr.}$$

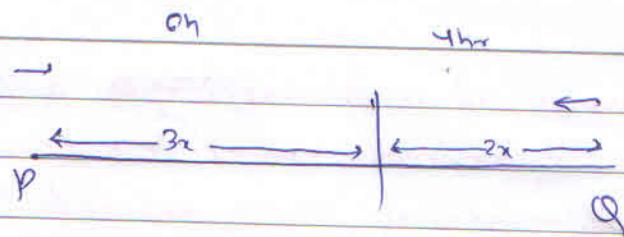
Ex A gun is fired from place with a time gap of 30 mins. A person going away from this point hears the 2nd shot 33 mins after he heard the 1st shot. What is the speed of the man, if sound travels at 330 m/sec?

$$\frac{1800v}{330-v} = 180$$

$$\Rightarrow 10v = 330 - v$$

$$\Rightarrow 11v = 330 \Rightarrow v = 30 \text{ m/s} = \frac{30 \times 18}{5} = 108 \text{ Km/hr.}$$

Ex 2 trains start simultaneously from P & Q towards Q & P respectively at 8 am. They cross each other at 12 noon. Train starting from Q, thereafter takes 6 hrs to reach P. On a particular day, the train starting from P reduced its speed and arrived at Q, 200 min late. At what time did the trains cross each other on that day?



$$3x \rightarrow 200 \text{ min}$$

$$15x \rightarrow \frac{200}{3} \times 15 = 1000$$

$$3x \rightarrow 4 \text{ hrs}$$

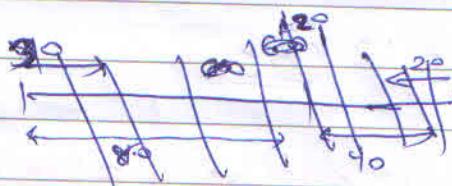
$$5x \rightarrow \frac{4 \times 5}{3} = \frac{20}{3} \text{ hrs}$$

$$\frac{D}{v} = \frac{20}{3}$$

$$\Rightarrow \frac{D}{v} \times x - \frac{D}{v} = \frac{10}{3}$$

$$\Rightarrow x-1 = \frac{1}{2} \Rightarrow x = \underline{\underline{3\frac{1}{2}}}$$

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



$$\frac{D}{v + \frac{2v}{3}} = 7$$

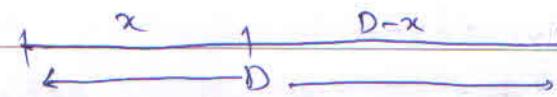
$$\frac{3D}{5v} = \underline{\underline{4}}$$

$$\frac{D}{\frac{2v}{3} + \frac{2v}{3}} = \frac{3D}{4v} = \frac{3}{4} \times \frac{20}{3}$$

$$= \underline{\underline{5}} = \underline{\underline{1 \text{ PM}}}$$

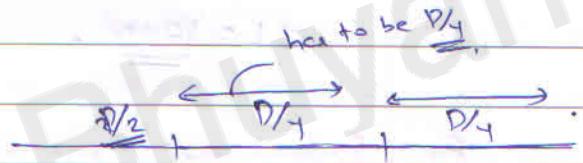
Ex Adarsh starts in car from Mumbai towards Bangalore. After some time he realized that he will cover only  $\frac{3}{4}$ th of the distance in the scheduled time. He, therefore, doubles his speed immediately and thus he manages to reach Bangalore exactly on time. Find the time from start, after which Adarsh

changed his speed, given that he could have been late by 3 hrs if had not changed his speed?



$$\frac{D/4}{v} = 3$$

$$\Rightarrow \frac{D}{v} = 12$$



$$\text{Ans} \rightarrow \frac{D/2}{v} = 6 \text{ hr}$$

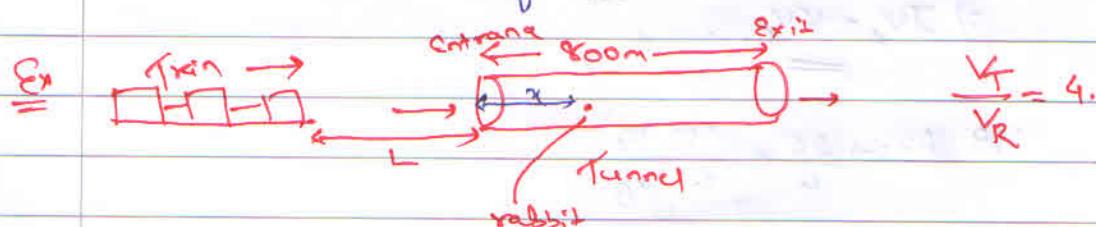
Ex Distance b/w P and Q is 100 km. A & B starts from P & Q respectively and keeps on moving to and fro from the 2 stations. Their 1<sup>st</sup> meeting is at 60 km from P. Find the point of 5<sup>th</sup> meeting.

$$\frac{V_A}{V_B} = \frac{3}{2}$$

$$\text{Total dist} = 100 + 100 \times 2 \times 4 = \underline{\underline{900}}.$$

$$\text{Dist by A} = \frac{900 \times 3}{5} = \underline{\underline{540}}.$$

$$\text{Ans} \rightarrow 60 \text{ Km from } \underline{\underline{P}}.$$



If rabbit runs towards entrance, they meet at entrance.

If " " " exit, " " " exit.

Find L.

$$\frac{x}{V_R} = \frac{L}{V_T} \Rightarrow 4x = L \Rightarrow x = \underline{\underline{L}}.$$

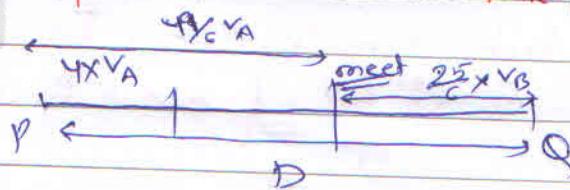
$$\frac{800-x}{v_R} = \frac{L+400}{v_T}$$

$$\Rightarrow 3200 - 4x = L + 400$$

$$\Rightarrow L + 4x = 2400$$

$$\Rightarrow L = \underline{\underline{1200}}.$$

Ex Ramit and Amit travel with uniform speed from  $\overset{A}{\text{B}}$  to  $\overset{B}{\text{A}}$  and  $\text{B}$  to  $\text{A}$  respectively, via the same route. Ramit starts at 5 AM, while Amit starts 4 hrs later. They meet on the way at 1:10 PM. At what time do they reach their destination, if both of them reach at the same time?



$$\frac{D - 4xv_A}{v_A + v_B} = \frac{4+1}{6} = \frac{25}{6}.$$

$$\text{Then, } \frac{49}{6} \frac{v_A}{v_B} = \frac{25}{6} \frac{v_B}{v_A}$$

$$\Rightarrow 49v_A^2 = 25v_B^2$$

$$\Rightarrow \underline{\underline{7v_A = 5v_B}}.$$

$$\text{Ans} \rightarrow \frac{25}{6} + \frac{49}{6} \frac{v_A}{v_B}$$

$$= \frac{25}{6} + \frac{49}{6} \times \frac{5}{7}$$

$$= \frac{25+35}{6} = \underline{\underline{10 \text{ hrs}}}.$$

$$\text{Ans} \rightarrow \underline{\underline{7PM}}.$$

Ex 4 people A, B, C and D are running around a circular ground in a 432 km race in 2 laps. Initially they all are separated by  $\frac{1}{4}$ th of the circumference of the ground and their speeds are 10 m/s, 20 m/s, 30 m/s and 40 m/s respectively. After every hr, they all exchange their speeds such that A takes B's speed, B takes D's speed, C takes A's speed and D takes C's speed. Find the time taken by the winner to finish the race?

$$A \rightarrow 10 \text{ m/s} = 36 \text{ Km/hr}$$

$$B \rightarrow 20 \text{ m/s} = 72 \text{ Km/hr}$$

$$C \rightarrow 30 \text{ m/s} = 108 \text{ Km/hr}$$

$$D \rightarrow 40 \text{ m/s} = 144 \text{ Km/hr}$$

Initially, A - 10    B - 20    C - 30    D - 40

After 1 hr, A - 20    B - 40    C - 10    D - 30

After 2 hr, A - 40    B - 30    C - 20    D - 10

After 3 hr, A - 30    B - 10    C - 40    D - 20  
 D (end)

At the end of 4 hr, every one covers equal distance.

$$= (10 + 20 + 30 + 40) \times 3600 = 3600 \times 100$$

$$= \underline{\underline{360 \text{ Km}}}$$

Thus, winner is D.

$$\text{Time} = 4 + \frac{72}{144} = 4.5 \text{ hr.}$$

Ex On one of the escalators on the Paris metro, Maria finds that if she walks down 26 steps she needs 30 seconds to get to the bottom, but if on another trip she makes 34 steps, then she needs only 18 seconds to reach the bottom. If the time is measured from the instant that the step begins to descend until the time Maria steps off the last step at the bottom onto the level platform, what is the height of stairway in steps and how many seconds does it take the escalator to travel one step?

$$26 + 5x = \frac{34}{18} + 3x$$

$$\Rightarrow 2x = 8$$

$$\Rightarrow x = \underline{\underline{4}}.$$

$$\text{Height} = 26 + 4 \times 5 = \underline{\underline{46}}.$$

$$T_{\text{time}} = 20 \rightarrow 30$$

$$1 \rightarrow \underline{\underline{1.5}} \text{ s}$$

Ex 2 guys A & B are walking down an escalator in the direction of motion of escalator. A takes 2 steps in the time B takes 1 step. When A takes 60 steps he got out of the escalator, while B takes 40 steps. Find the no. of steps in escalator, when it is stationary?

$$A \rightarrow 60+x$$

$$40+y$$

$$B \rightarrow \underline{\underline{30}}$$

$$\therefore y = \frac{4}{3}x$$

$$60+x = 40+\frac{4}{3}x$$

$$\Rightarrow \frac{x}{3} = 20 \Rightarrow x = 60.$$

$$\text{Ans} \rightarrow \underline{\underline{120}}.$$