

- A train, 250 m long, is running at 30 kmph. In what time will it cross another train of length 150 m, running at a speed of 42 kmph, in opposite direction?  
(A) 20 sec (B) 18 sec (C) 17 sec (D) 19 sec
- Two trains of equal lengths are running at speeds of 30 kmph and 60 kmph. The two trains crossed each other in 30 seconds when travelling in opposite direction. In what time will they cross each other when travelling in the same direction?  
(A) 90 sec (B) 675 sec (C) 85 sec (D) 80 sec
- A police patrol party travelling at 60 kmph crosses an escaping thief travelling in the opposite direction at 48 kmph. The police party has to travel for a further 5 minutes before it can find a gap in the median where it can take a U turn and start chasing the thief. After how much time after the police party crosses the thief does it catch him?  
(A) 25 minutes (B) 50 minutes  
(C) 15 minutes (D) 32 minutes
- In a running race Sunita gives Asha a headstart of 350 m and still beats her by 50 m. If Sunita's speed is  $1\frac{1}{4}$  times Asha's speed, what is the length of the race?  
(A) 1 km (B) 2 km (C) 4 km (D) 1.5 km

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$$\frac{250 + 150}{\cancel{22} \cancel{5}} = \frac{\cancel{400}^{20}}{\cancel{20}} = 20 \text{ sec}$$



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T<sub>1</sub>  
l m  
30 kmph

T<sub>2</sub>  
l m  
60 kmph

$$\frac{2l}{60 - \frac{5}{18}} = \frac{2l}{25} \text{ secs} \approx 30$$

$$l = 375$$

$$\frac{2 \times 375}{30 - \frac{5}{18}} = \frac{2 \times 375 \times 18}{30 \times 13} = 90 \text{ sec}$$

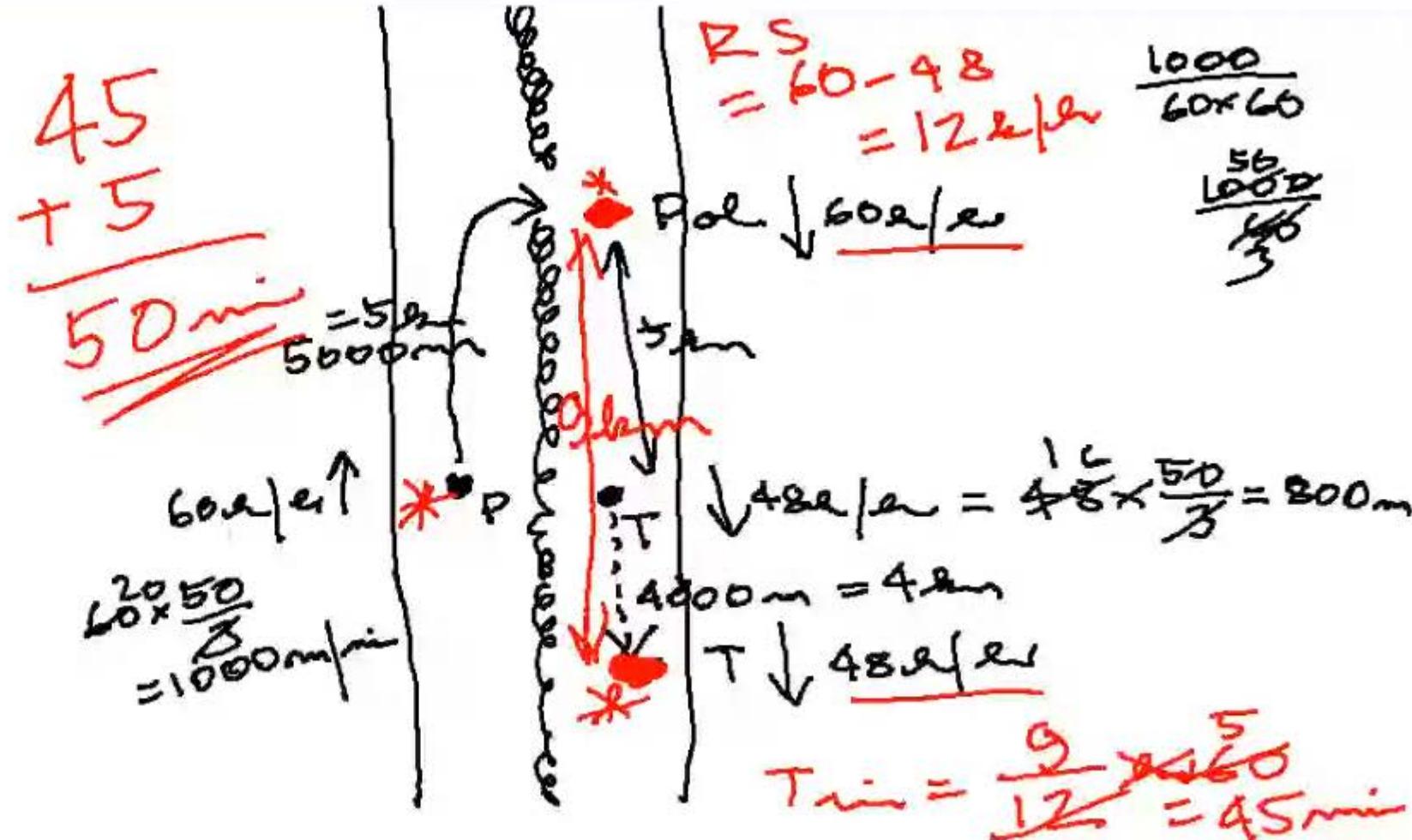
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- Two trains of equal lengths are running at speeds of 30 kmph and 50 kmph. The two trains crossed each other in 30 seconds when travelling in opposite direction. In what time will they cross each other when travelling in the same direction?  
 (A) 90 sec (B) 67.5 sec (C) 85 sec (D) 60 sec

- A police patrol party travelling at 60 kmph crosses an escaping thief travelling in the opposite direction at 48 kmph. The police party has to travel for a further 5 minutes before it can find a gap in the median where it can take a U turn and start chasing the thief. After how much time after the police party crosses the thief does it catch him?

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- In a running race Sunita gives Asha a headstart of 350 m and still beats her by 50 m. If Sunita's speed is 1.5 times Asha's speed, what is the length of the race?  
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The diagram shows two parallel horizontal arrows pointing right. The top arrow is labeled "Sunita" and "Asha" with a distance "d" between them. The bottom arrow is labeled "Asha" and "Sunita" with a distance "400 + d" between them. Below the arrows, the time taken by Asha is given as  $1\frac{1}{4}$  times the time taken by Sunita. This is written as  $1\frac{1}{4} \times$  above a fraction  $= \frac{5}{4} \times$ .

The handwritten solution starts with the equation:

$$\frac{d}{\cancel{s}} = \frac{400+d}{\frac{5}{4} \cancel{s}}$$

Then, it is simplified to:

$$\frac{5}{4} d = 400 + d \Rightarrow \frac{d}{4} = 400 \Rightarrow d = 1600$$

- A person drives daily from home to office along a fixed route, at a fixed speed. One day he travels 25% faster and hence reaches office 20 mins earlier.
  - a) What is the usual time taken by the person to reach office from home ?
  - b) At what % of his usual speed should he have driven so as to reach 25 mins later ?
- A person travelling at  $\frac{2}{3}$  of his normal speed reaches his destination  $\frac{1}{2}$  hr late. What is his normal time taken ?
- Two people A and B start from P at the same time and travel 200 m away to Q, and back. The ratio of their speed is 1 : 7. Find the distance of their meeting point from P ?
- A car travels from place X to Y @ 60 km/hr and returns @ 40 km/hr. find the average speed of the whole journey ?
- On walking @ 8 km/hr, a boy reaches school from home 10 mins early. If he had walked @ 6 km/hr, he would have been 20 mins late. What was the distance from home to school ?
- A cyclist is travelling @ 18 km/hr along a road parallel to a railway track. Because of fog his vision is limited upto only 100 m. A train of length 200 m overtakes him from behind. The cyclist can see the train for only 15 secs. Find the speed of the train assuming that the cyclist never looks behind ?
- A boat travels 30 km upstream in 5 hrs and 100 km downstream in 10 hrs. Find the speed of the boat and the river ?

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$$t \leftarrow \frac{1}{3} \quad \frac{125}{100} \text{ of NS}$$

$$\therefore t = \frac{4}{5} \frac{100}{125} \text{ of NT}$$

$$\left(1 - \frac{4}{5}\right) NT = \frac{1}{5} NT \\ = 20$$

$$NT = 100 \text{ mins}$$

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$$NT = 100 \text{ mins}$$

$$125 \text{ mins} = \frac{5}{4} \text{ of NT}$$

$$\frac{4}{5} \text{ of NS} = 80 \quad \frac{4}{5} \times 100 \\ = 80$$

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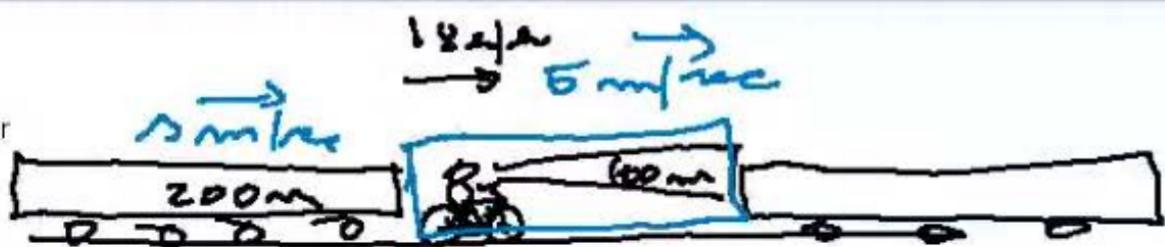
A and B start from P at the same time and travel 200 m away to Q, and back. The ratio of their speeds is 3 : 5. Find the distance of their meeting point from P ?

from place X to Y @ 60 km/hr and returns @ 40 km/hr. find the average speed of the whole journey

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$$\frac{200 + 60}{5 - 3} = 15$$

$$5 - 3 = 20$$

~~$$5 = 25$$~~

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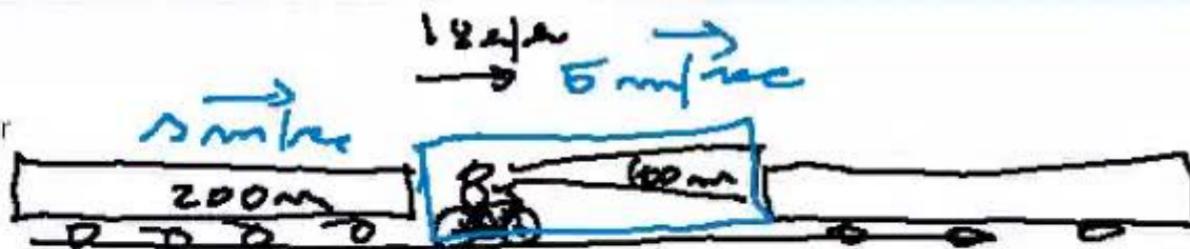
A and B start from P at the same time and travel 200 m away to Q, and back. The ratio of their speeds is 5 : 3. Find the distance of their meeting point from P?

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$$\frac{200 + 150}{5 - 3} = 175$$

$$5 - 3 = 20$$

$$150 \cancel{m/sec} = 25 m/sec$$

- A boat takes 8 hrs to travel downstream from A to B and 10 hrs upstream from B to A. What is the ratio of the speed of the boat and the river ?
- In a 1000 m race, A beats B by 100 m and C by 180 m. In a 2700 m race, by how many m will B beat C ?
- In a 1000 m race A beats B by 100 m and B beats C by 50 m. In the same race, by how many m does A beat C ?
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8.45



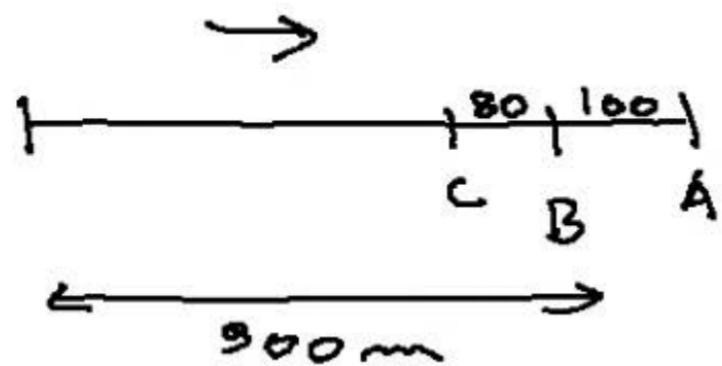
$$\frac{v_b}{v_r} = \frac{9}{1}$$

$$\frac{v_b}{v_r} = 9$$

$$\frac{d}{v_r} = 10 \quad \textcircled{2} \quad \frac{d}{v_r + v_b} = 8 \quad \textcircled{1}$$

$$\textcircled{1} \div \textcircled{2} = \frac{\frac{d}{v_r}}{\frac{d}{v_r + v_b}} = \frac{8}{10} = \frac{4}{5}$$

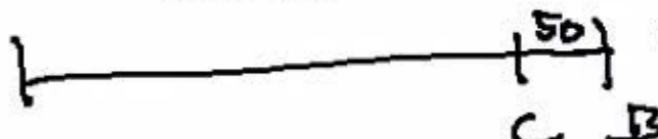
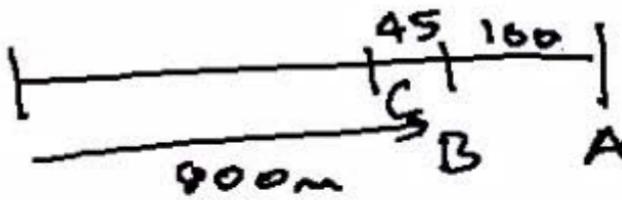
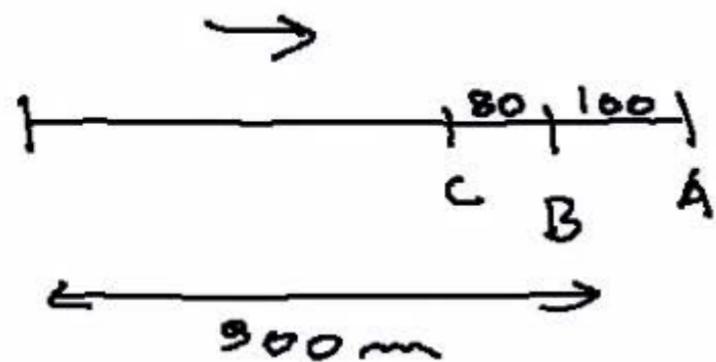
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B → 900m, C is 80 m behind

$$\begin{aligned} B \rightarrow 2700m & \quad C = \frac{80}{900} \times 2700 \\ &= \underline{\underline{240m}} \end{aligned}$$

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C is 50 m behind

$$\text{B} \rightarrow 2700\text{m} \quad C = \frac{80}{900} \times 2700$$

$$= 240\text{m}$$

$\text{B} \rightarrow 900\text{m}$

$$C = \frac{50}{1000} \times 900 = 45\text{m}$$

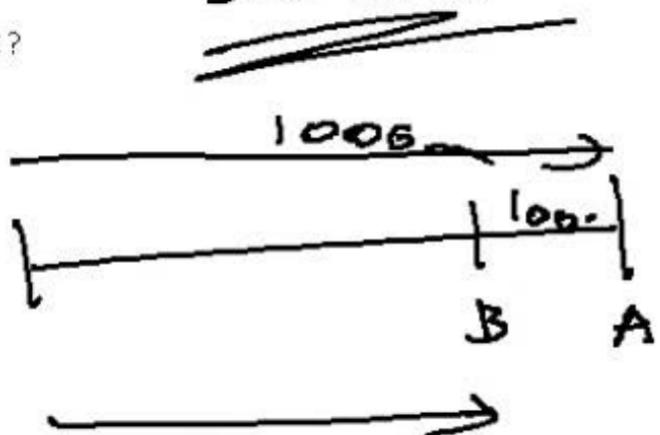
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30 secs



D & D

Ratio of D = 10 : 9      900m

,, " Sp = 10 : 9

• The ratio of the speeds of A, B and C is  $2 : 3 : 4$ . What is the ratio of the time taken by them to travel from X to Y ?

✓ • I started to travel by car from P to Q. After going for 210 km at a normal average speed, my car suddenly developed an engine problem. As a result the average speed of my travel becomes  $\frac{3}{4}$  of the normal, and I reach Q 6 hours late. Had the engine problem happened 345 km from P, I would have been late by only 5 hours.

- a) What was my normal average speed of travel ?   
b) What was the distance from P to Q ?

✓ • A is  $1 \frac{2}{3}$  rd times as fast as B. They decide to run a race by starting to run at the same time. B has a head-start of 200 m. What should be the length of the race so that both complete the race at the same time ?

✓ • At a distance of 40 m away from a dog standing at a point A, a fox is standing. The dog takes a leap of 2 m against a 1 m long leap of the fox. Also the fox takes 3 leaps in the same time the dog takes 2. At what distance from A can the dog catch the fox ?

// • A cat is standing in a railway tunnel of length 74.7 m, such that it is  $\frac{4}{9}$  th of the distance from A to B. It hears the whistle of a train approaching and runs to get out of the tunnel. If it runs towards A, it comes out of the tunnel exactly at the same moment the train enters it. If it runs towards B, it comes out of the tunnel exactly as the same moment as that of the train. Find the ratio of their speeds ?

✓ • Two men A and B start simultaneously from P and Q to travel to Q and P respectively. On reaching their destination they immediately turn back. They continue this process indefinitely, at a constant individual speed. If the distance between P and Q is 1000 m, and the ratio of the speeds of A and B is  $3 : 2$ , find the distance travelled by A when he meets B for the 4th time ?

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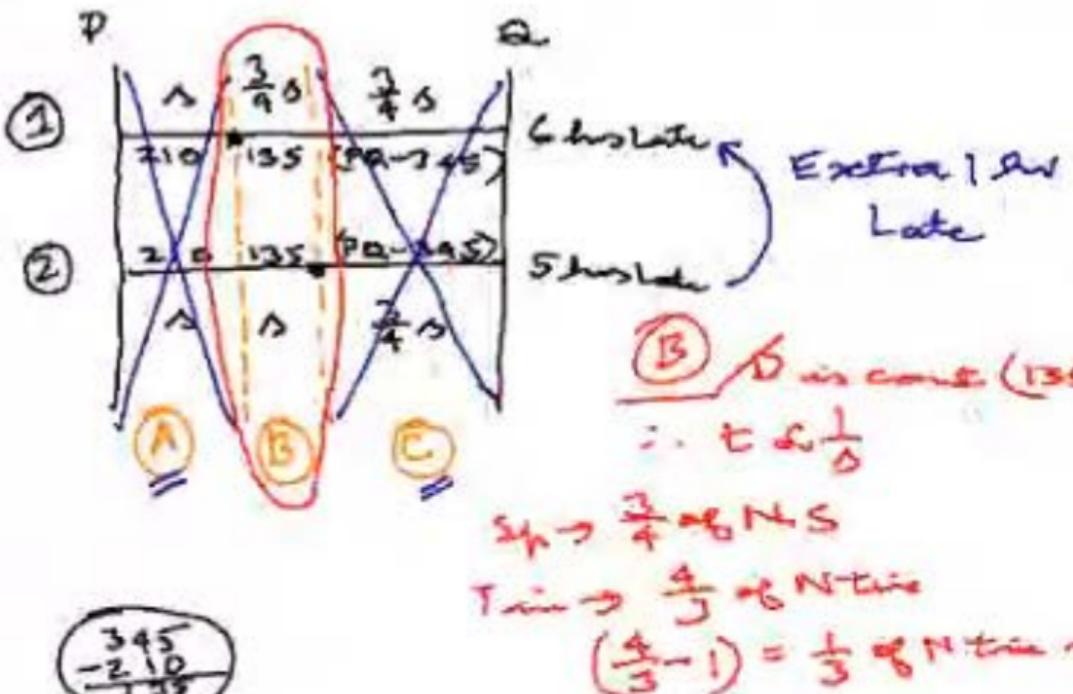
$$S_p = 2 : 3 : 4$$

$$t \propto \frac{1}{S_p}$$

$$\therefore T_{min} = \frac{1}{2} : \frac{1}{3} : \frac{1}{4}$$

$$= 6 : 4 : 3$$

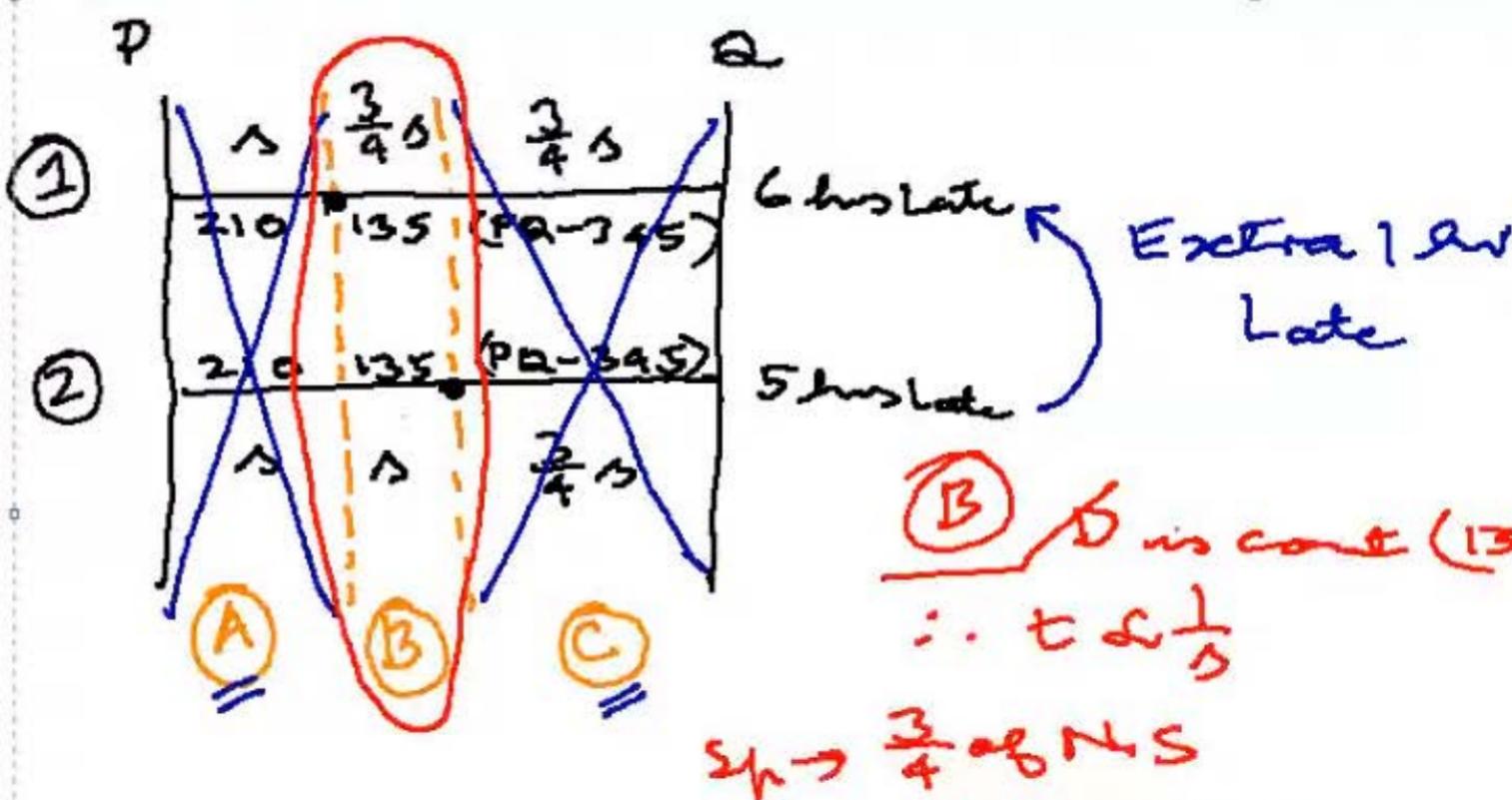
~~6 : 4 : 3~~



$$\therefore \text{N.Tire} = 3 \text{ hrs}$$

to travel 135 km

$$\therefore \text{N.Speed} = \frac{135}{3} = 45 \text{ km/hr}$$



$$\begin{aligned} \therefore N.T_{\text{in}} &= 3 \text{ hrs} \\ \text{to travel } 135 \text{ hr} \\ \therefore N.\text{Speed} &= \frac{135}{3} = 45 \text{ m/s} \end{aligned}$$

$$S_p \rightarrow \frac{3}{4} \text{ of NS}$$

$$T_{\text{in}} \rightarrow \frac{4}{3} \text{ of N.T}_{\text{in}}$$

$$\left(\frac{4}{3} - 1\right) = \frac{1}{3} \text{ of N.T}_{\text{in}} \text{ more} = 1 \text{ hr}$$

$$\begin{array}{r} 345 \\ -210 \\ \hline 135 \end{array}$$

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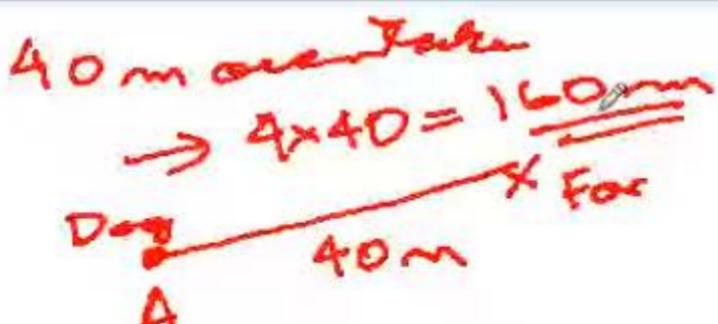
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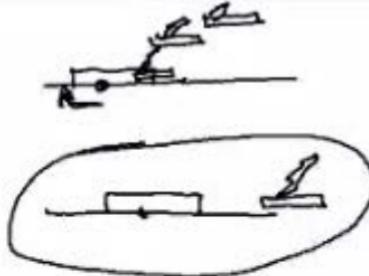
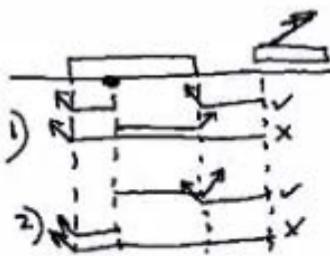
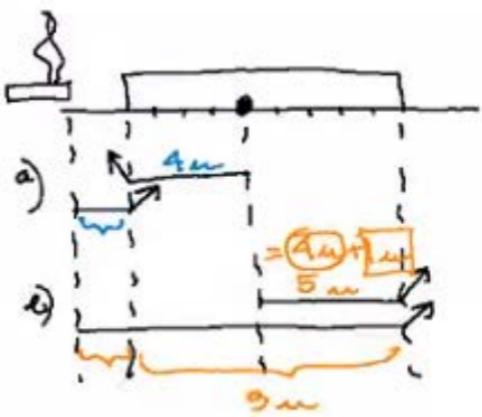
- A cat is standing in a railway tunnel of length 74.7 m, such that it is  $\frac{4}{9}$  th of the distance from A to B. It hears the whistle of a train approaching and runs to get out of the tunnel. If it runs towards A, it comes out of the tunnel exactly at the same moment the train enters it. If it runs towards B, it comes out of the tunnel exactly as the same moment as that of the train. Find the ratio of their speeds ?

- Two men A and B start simultaneously from P and Q to travel to Q and P respectively. On reaching their destination they immediately turn back. They continue this process indefinitely, at a constant individual speed. If the distance between P and Q is 1000 m, and the ratio of the speeds of A and B is  $3 : 2$ , find the distance travelled by A when he meets B for the 4th time ?



D	F
length of L	2 m, 1 m
freq of L	2, 3
Total length in freq time	4 m, 3 m

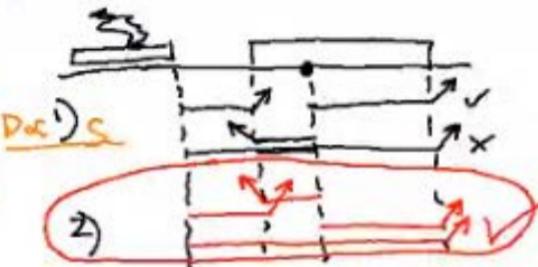
Dog  
1 m overtaking  
 $\rightarrow 4 m$



$$C_D : T_D = 1 : 9$$

Train is const.  $D \propto C_D^2 S$

$$C_S : T_S = 1 : 9$$



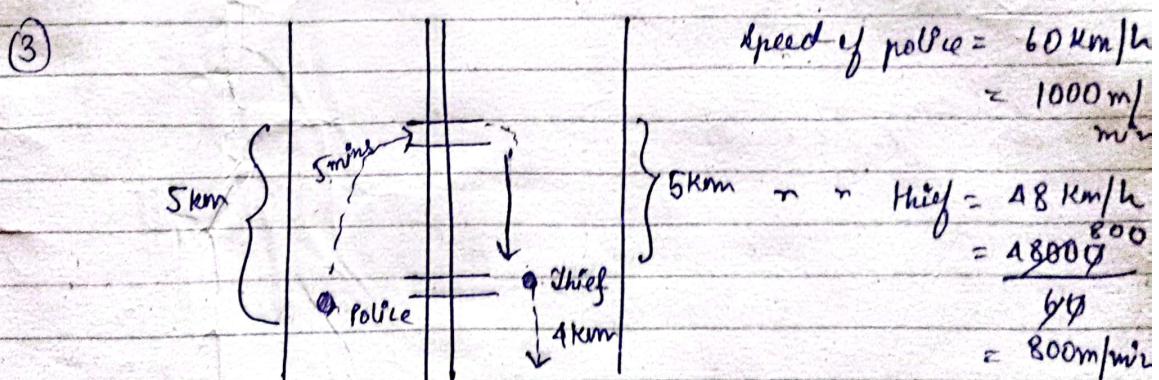
$$\textcircled{1} \quad \begin{aligned} \text{Total length} &= (250 + 150) \text{ m} = 400 \text{ m} \\ \text{Relative speed} &= \left( \frac{12+20}{18} \right) \times 5 \text{ m/s} = 20 \text{ m/s}^{-1} \\ \therefore t &= \frac{400}{20} = 20 \text{ s} \end{aligned}$$

\textcircled{2} Let lengths of both trains be  $l$ .

$$\begin{aligned} \text{Total length} &= 2l \\ \text{For opposite direction,} \quad \text{Time} &= \frac{2l}{(30+60) \times \frac{5}{18}} \\ \Rightarrow 30 &= \frac{2l}{25} \quad l = 15 \times 25 \text{ m} \\ &= 375 \text{ m} \end{aligned}$$

For same direction,

$$\begin{aligned} \text{Time} &= \frac{2l}{(60-30) \times \frac{5}{18}} \\ &= \frac{2 \times 375}{30 \times \frac{5}{18}} = \frac{2 \times 375 \times 18}{30 \times 5} \\ &= 90 \text{ s} \end{aligned}$$



In 5 mins of finding the gap, the police travels  
 $5 \times 1000 = 5000 \text{ m} = 5 \text{ km}$

After police arrives in thief's side, relative speed  
 $= 60 - 18 = 12 \text{ km/h}$

During the time the police was finding the gap,  
 thief covered  $12 \times 5 = 60 \text{ km} = 6 \text{ km}$

$\therefore$  Total dist travelled by police to catch thief from thief's spoke (RHS of diagram) is  $1\text{km} + 5\text{km} = 6\text{km}$

$$\therefore \text{Time} = \frac{6}{12} \text{ hr} = \frac{6 \times 60}{12} = 30 \text{ mins.}$$

But police travelled 5 mins before to find gap, so total time =  $30+5 = 35 \text{ mins.}$

(A)



$$\begin{aligned} \text{Let speed of Asha} &= u \\ \text{then speed of Sunita} &= \frac{5}{4} u \end{aligned}$$

Asha travels ' $d$ ' m  
Sunita  $\rightarrow (d + 350 + 50)\text{m} = d + 400\text{m}$

$$\therefore \frac{d}{u} = \frac{400+d}{\frac{5}{4}u} \quad \text{since time constant}$$

$$\frac{5}{4}d = 400+d \Rightarrow d = 1600\text{m}$$

$$\begin{aligned} \text{But length of race} &= 1600 + 350 + 50 \\ &= 2000\text{m} = 2\text{km} \end{aligned}$$

(B)

$$t \propto 1/u \quad 25\% \text{ faster} = \frac{125}{100} \text{ of } u$$

$$t = \frac{100}{125} \text{ of usual time}$$

~~in usual time~~ ~~(1 - 1/5)~~

$$\begin{aligned} (1 - 1/5) \text{ of usual time} &= 20 \text{ mins} \\ \text{usual time} &= 20 \times 5 \text{ mins} \\ &= 100 \text{ mins} \end{aligned}$$

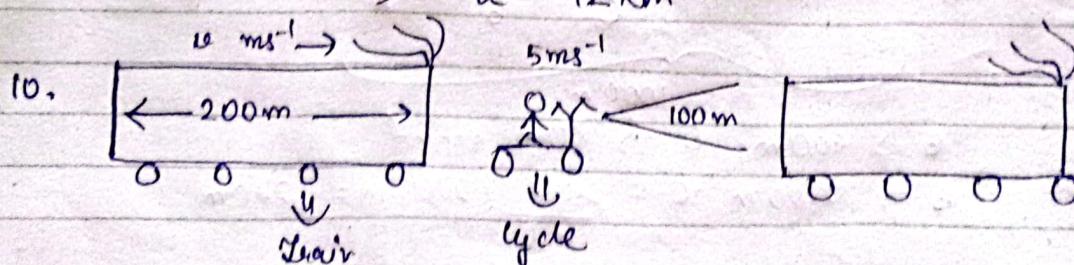
15.  $125 \text{ mins} = \frac{5}{4}$  of normal time  
 $\Rightarrow \frac{4}{5}$  of normal speed since  $t \propto \frac{1}{v}$   
 $\approx 80\%$

6. Normal speed =  $v$        $d = vt$   
 & time =  $t$        $d = \frac{2}{3}vt \times (\frac{4}{3})$   
 Distance =  $d$        $vt = \frac{2}{3}vt + \frac{1}{3}vt$   
 $\frac{1}{3}vt = \frac{1}{3}vt$   
 $t = 1 \text{ hr.}$

8. Average speed =  $\frac{2 \times d}{d + \frac{d}{60}} = \frac{2 \times 120 \times 60}{2d + 3d} = 24 \times 2 = 48 \text{ km/h}$

9.  $v_1 = 8 \text{ km/h}$        $v_2 = 6 \text{ km/h}$

10 mins early      20 mins late  
 $i. \cancel{\frac{d}{8}} - \frac{d}{6} = -\frac{(10+20)}{60}$   
 $\Rightarrow \frac{8d - 6d}{18} = \frac{30}{60}$   
 $\Rightarrow d = 12 \text{ Km}$



Relative speed =  $(v - 5) \text{ ms}^{-1}$   
 Total distance =  $(200 + 100) \text{ m} = 300 \text{ m}$

Time =  $\frac{300}{v-5} = 15 \Rightarrow v = 25 \text{ ms}^{-1}$

$b = \text{height}$ ,  $n = \text{width}$

11.  $b+n = \frac{100}{10} = 10 \Rightarrow \text{downstream}$

$b-n = \frac{30}{5} = 6 \Rightarrow \text{upstream}$

$$\frac{b+n}{b-n} = \frac{10}{6}$$

$$\frac{b+n+b-n}{b+n-b+n} = \frac{10+6}{10-6}$$

$$\frac{b}{n} = 1 \Rightarrow b = 1n$$

$$\frac{b}{n} = 2 \\ b = 2n$$

12.  $b+n = \frac{d}{8} \quad b-n = \frac{d}{10}$

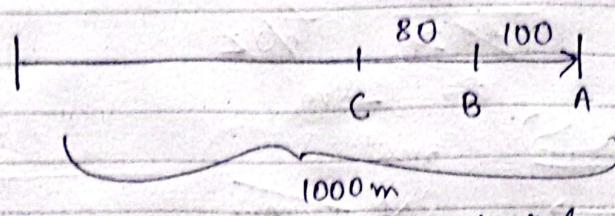
$$\frac{b+n}{b-n} = \frac{10}{8} \Rightarrow \frac{b}{n} = 9$$

$$b = 9n$$

$$\cancel{8(b+n)} = 10(b-n) \\ \cancel{8b+8n} = 10b - 10n \\ 18n =$$

$$\text{Ratio} = 9:1$$

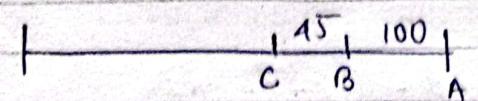
13.



$B \Rightarrow 900m$ ,  $C \Rightarrow 80m \text{ behind}$

$$B \Rightarrow 2700m, C = \frac{80}{900} \times 2700m = 240m$$

14.



$\Rightarrow B \Rightarrow 1000m$ ,  $C \text{ is } 50m \text{ behind}$

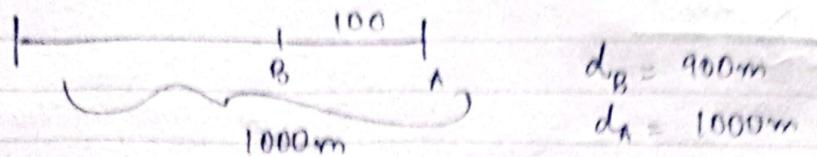
$$B = 900m, C = \frac{50}{100} \times 900 \\ = 45m$$

$$\therefore \text{Total} = 145m$$

$$= 15m$$

$$15, 20+10 = 80 \text{ s}$$

16.



$$\propto \text{S.} \Rightarrow S_A : S_B = 1000 : 900 = 10 : 9$$

- 17.  $2 : 8 : 1 \Rightarrow$  Ratio of speed

$$\downarrow \quad s \propto 1/t$$

$$\frac{1}{2} : \frac{1}{3} : \frac{1}{4} \Rightarrow \text{ratio of time} \Rightarrow \left( \frac{1}{2} : \frac{1}{3} : \frac{1}{4} \right) \times \text{lcm}(2, 3, 4)$$

$$= 6 : 4 : 3$$

P	s	$\frac{3}{1/8}$	$\frac{3}{1/8}$	g		
210	135	$(PQ - 3A5)$		6 hrs later	$\therefore$	Normal time = 3 hrs to travel 135 km
210	135	$PQ - 3A5$		5 n n		
1	s	$\frac{3}{1/8}$				Normal speed = $\frac{135}{3}$ $= 45 \text{ km/h}$

(A)      (B)      (C)

D is constant (135 km)

$$t \propto 1/s$$

Speed =  $\frac{3}{1/8}$  of normal speed

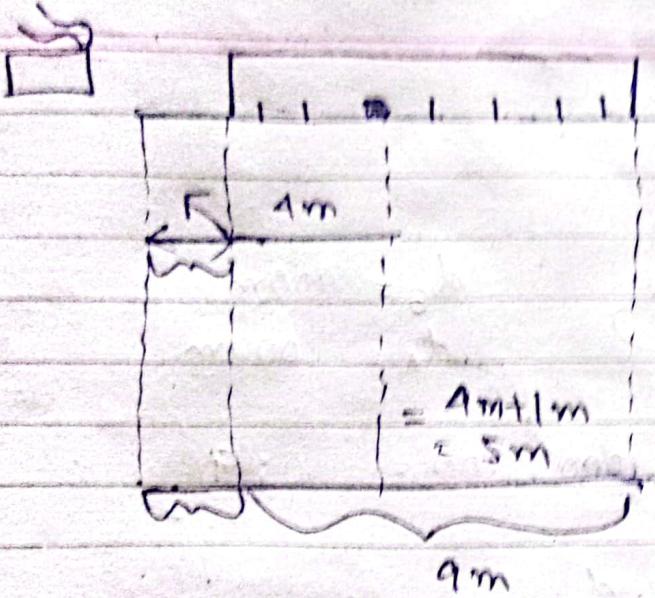
Time  $\rightarrow 1/3$  of normal time

$(1/3 - 1) = \frac{1}{3}$  of Normal time more = 1 hr.

	Dog	Fox	
Length of L	2m	1m	
Freq of L	2	3	
Total length in freq	4m	3m	1m overtake $\rightarrow 4m$

40m n  $\rightarrow 40 \times 1$   
 $= 160m$

g

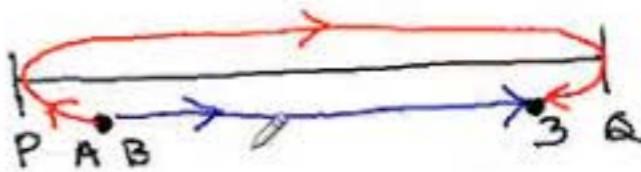
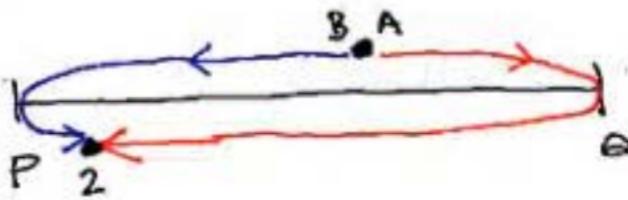
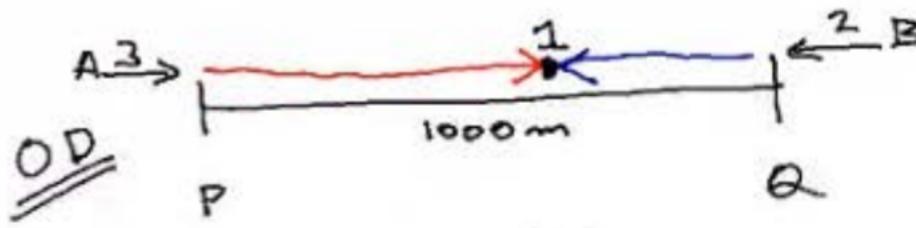


$$C_D : T_D = 1 : 9$$

~~R<sub>D</sub>~~  $\rightarrow$  Time constant  $\rightarrow$  DAS

$$C_S : T_S = 1 : 9$$

- Two men A and B start simultaneously from P and Q to travel to Q and P respectively. On reaching their destination they immediately turn back. They continue this process indefinitely, at a constant individual speed. If the distance between P and Q is 1000 m, and the ratio of the speeds of A and B is 3 : 2, find the distance travelled by A when he meets B for the 4th time ?
- Two men A and B start simultaneously from P and Q to travel to Q and P respectively. They meet at a point. From there A takes 16 mins to reach Q and B takes 25 mins to reach P. Find the ratio of the speeds of A and B ?
- My son's school closes at 5 pm. Every weekday I leave home to reach his school at sharp 5 pm to pick him up and return home, driving along a fixed route and at a constant speed. One day, unknown to me, my son's school closed at 4 pm. Not seeing me, he decided to walk home. I started at the usual time from home for his school, met my son on the way, picked him up, and returned home 30 mins earlier. How long had my son walked ?



Start → 1st M

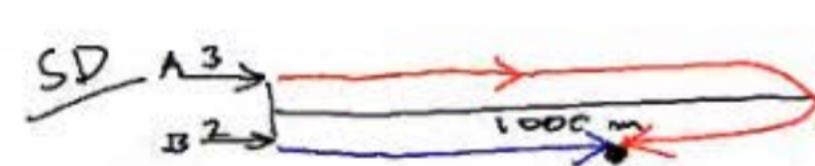
$$A_D + B_D = 1000$$

1st M → 2nd M

$$A_D + B_D = 2000$$

2nd M → 3rd M

$$A_D + B_D = 2000$$



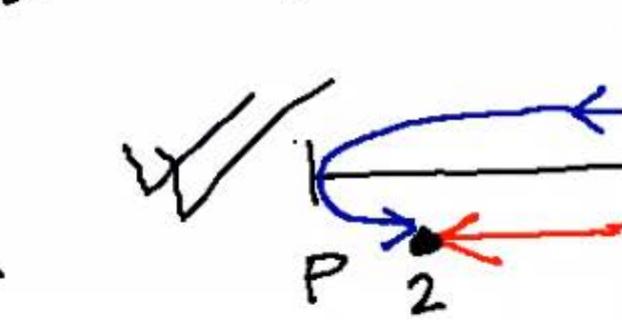
Start to 1st Meet

$$A_D + B_D = 2000 \text{ m}$$

• Two men A and B start simultaneously from P and Q to travel to Q and P respectively. On reaching their destination they immediately turn back. They continue this process indefinitely, at a constant individual speed. If the distance between P and Q is 1000 m, and the ratio of the speeds of A and B is 3 : 2, find the distance travelled by A when he meets B for the 4th time ?



✓ • Two men A and B start simultaneously from P and Q to travel to Q and P respectively. They meet at a point. From there A takes 16 mins to reach Q and B takes 25 mins to reach P. Find the ratio of the speeds of A and B ?



✓ My son's school closes at 5 pm. Every weekday I leave home to reach his school at sharp 5 pm to pick him up and return home, driving along a fixed route and at a constant speed. One day, unknown to me, my son's school closed at 4 pm. Not seeing me, he decided to walk home. I started at the usual time from home for his school, met my son on the way, picked him up, and returned home 30 mins earlier. How long had my son walked ?

1000

2000

2000

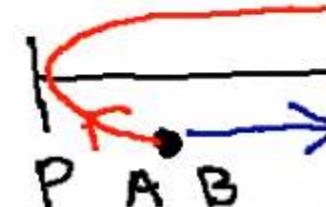
2000

$$A_S : B_S = 3 : 2$$

$$A_D : B_D = 3 : 2$$

$$\frac{1000}{A_D + B_D} = \frac{1}{7000}$$

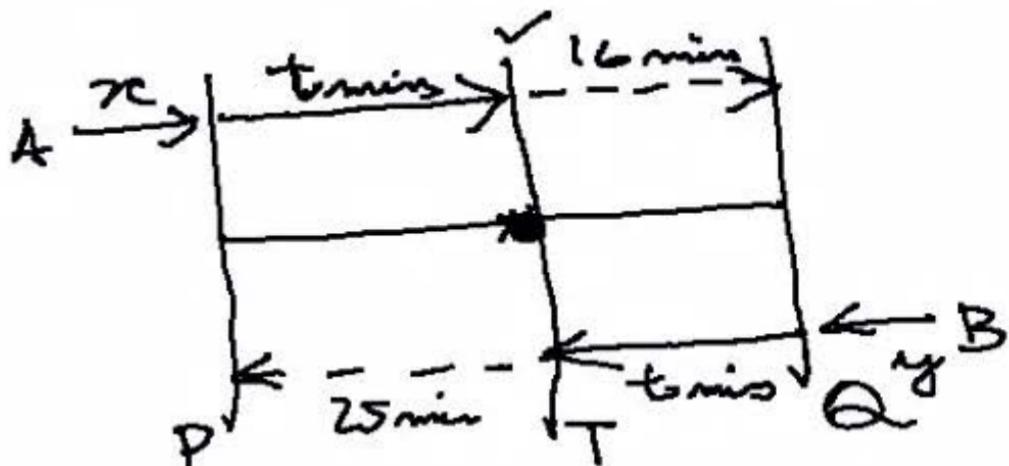
$$A_D = \frac{3}{5} \times \frac{1400}{2000} = 4200$$



Two men A and B start simultaneously from P and Q to travel to Q and P respectively. On reaching their destination they immediately turn back. They continue this process indefinitely, at a constant individual speed. If the distance between P and Q is 1000 m, and the ratio of the speeds of A and B is 3 : 2, find the distance travelled by A when he meets B for the 4th time?

✓ Two men A and B start simultaneously from P and Q to travel to Q and P respectively. They meet at a point. From there A takes 16 mins to reach Q and B takes 25 mins to reach P. Find the ratio of the speeds of A and B?

1. My son's school closes at 5 pm. Every weekday I leave home to reach his school at sharp 5 pm to pick him up and return home, driving along a fixed route and at a constant speed. One day, unknown to me, my son's school closed at 4 pm. Not seeing me, he decided to walk home. I started at the usual time from home for his school, met my son on the way, picked him up, and returned home 30 mins earlier. How long had my son walked?



$$\begin{aligned} 25xy &= PT = xt \\ 16xz &= QT = yt \end{aligned}$$


---


$$25x16yz = 25yt^2$$

$$t = 5 \times 4 = 20 \text{ mins}$$

$$A_t = 20 + 16 = 36 \text{ mins}$$

$$B_t = 20 + 25 = 45 \text{ mins}$$

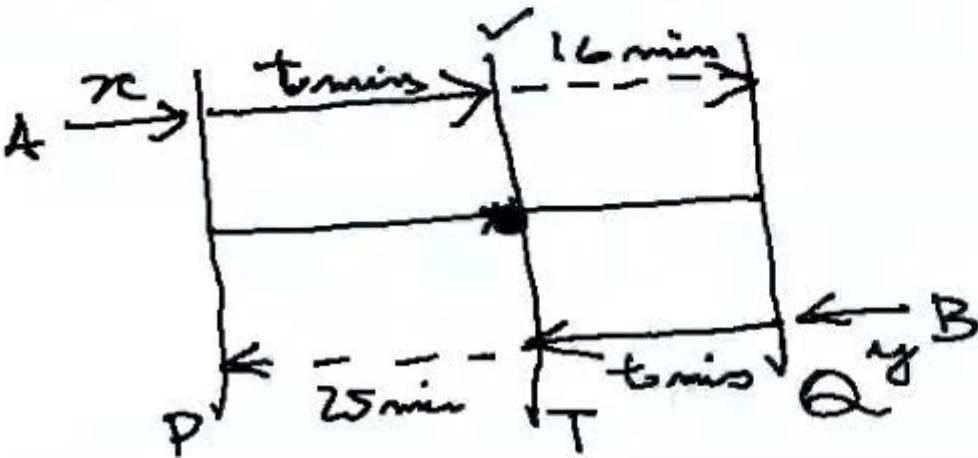
$$A_t : B_t = 36 : 45 = 4 : 5$$



1. Two men A and B start simultaneously from P and Q to travel to Q and P respectively. On reaching their destination they immediately turn back. They continue this process indefinitely, at a constant individual speed. If the distance between P and Q is 1000 m, and the ratio of the speeds of A and B is 3 : 2, find the distance travelled by A when he meets B for the 4th time ?

✓ 2. Two men A and B start simultaneously from P and Q to travel to Q and P respectively. They meet at a point. From there A takes 16 mins to reach Q and B takes 25 mins to reach P. Find the ratio of the speeds of A and B ?

✓ 3. My son's school closes at 5 pm. Every weekday I leave home to reach his school at sharp 5 pm to pick him up and return home, driving along a fixed route and at a constant speed. One day, unknown to me, my son's school closed at 4 pm. Not seeing me, he decided to walk home. I started at the usual time from home for his school, met my son on the way, picked him up, and returned home 30 mins earlier. How long had my son walked ?



$$A_s : B_s = 5 : 4$$

$$2S_Ay = PT = xt$$

$$\frac{x}{16}x = QT = \frac{x}{25}t$$


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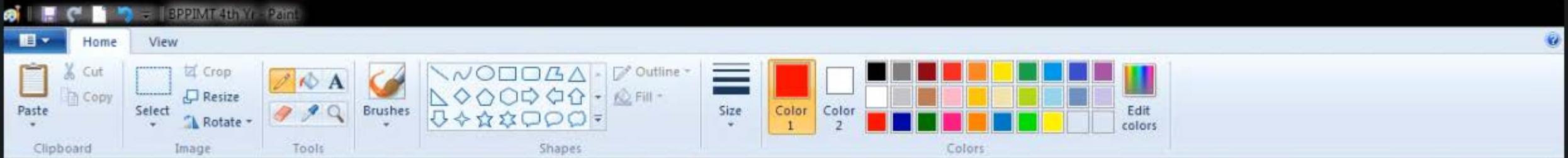
$$25 \times 16 = 25xt^2$$

$$t = 5 \times 4 = 20 \text{ mins}$$

$$A_t = 20 + 16 = 36 \text{ mins}$$

$$B_t = 20 + 25 = 45 \text{ mins}$$

$$A_t : B_t = 36 : 45 = 4 : 5$$



✓ Two men A and B start simultaneously from P and Q to travel to Q and P respectively. They meet at a point. From there A takes 16 mins to reach Q and B takes 25 mins to reach P. Find the ratio of the speeds of A and B ?

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