- 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 1¼ 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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$$\frac{250+150}{22\times\frac{5}{18}} = \frac{400}{\frac{20}{}} = 20 \text{ secs}$$

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T_1 $\quad$ T_2

l m $\quad$ l m

30 km/h $\quad$ 60 km/h

$$\frac{2l}{90 \times \frac{5}{18}} = \frac{2l}{25} \text{ secs} = 30$$

$$l = 375$$

$$\frac{2 \times 375}{30 \times \frac{5}{18}} = \frac{2 \times 375 \times 18}{30 \times 5} = 90 \text{ m}$$

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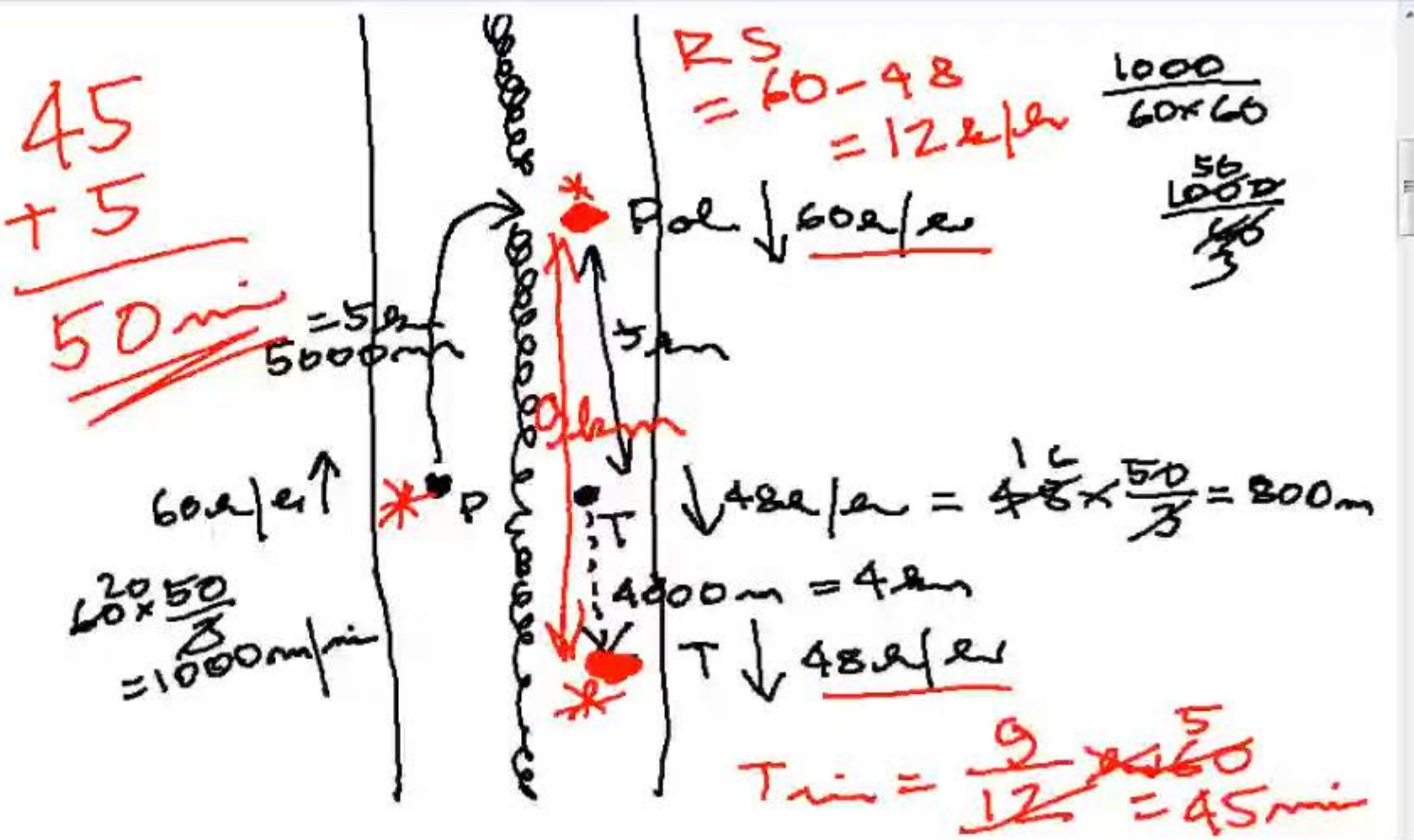

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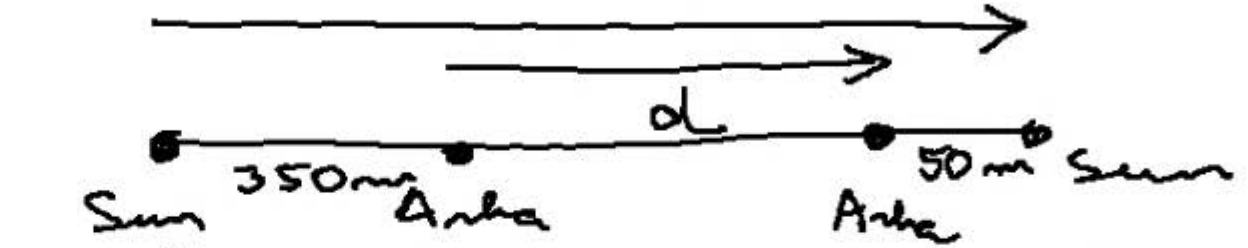

$400+1600 = 2$ km

Asha $\rightarrow$ d m

Sunita $\rightarrow$ (400+d) m

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

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

- 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 2/3 of his normal speed reaches his destination 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 ?

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$t \propto \frac{1}{S}$ $\quad \frac{125}{100}$ of NS

$\therefore t = \frac{4}{\frac{125}{5}}$ of Nt

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

$= 20$

$NT = 100$ min

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$= 20$

$Nt = 100$ mins

125 mins $= \frac{5}{4}$ of Nt

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

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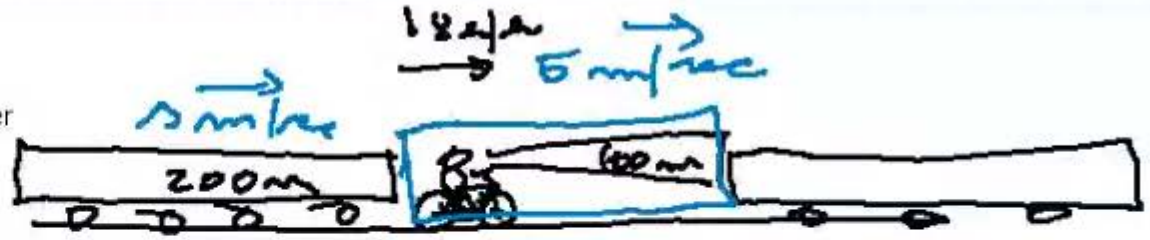

$$\frac{200+100}{S-5} = 15$$

$$S - 5 = 20$$

$$S = 25$$

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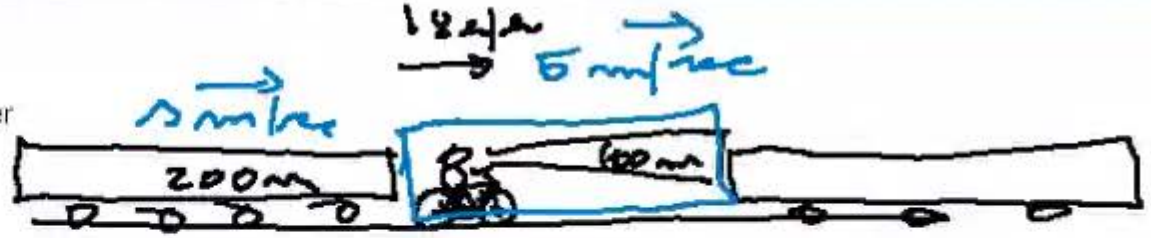

$$\frac{200+100}{s-5} = 15$$

$$s - 5 = 20$$

$$s = 25 \text{ m/sec}$$

- 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 ?
- In a race A beats B by 10 secs and B beats C by 20 secs. By how many secs did A beat C ?
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8.45

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$\frac{xb}{7x} = \frac{9}{7}$

$\frac{b}{x} = \frac{9}{1}$

$\frac{d}{b-x} = 10$ — ② $\frac{d}{b+x} = 8$ — ①

① ÷ ② = $\frac{b-d}{b+d} = \frac{8}{10}\ \frac{4}{5}$

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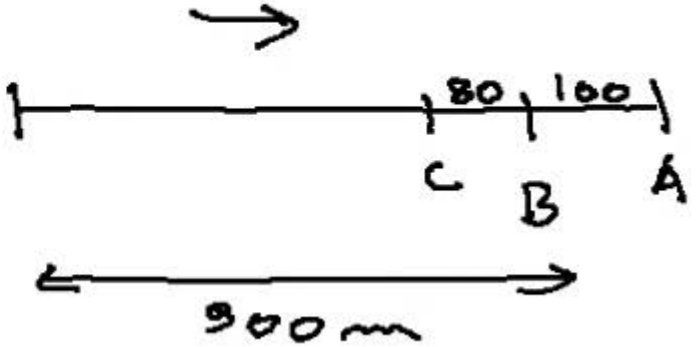

B → 900 m, C in 80 m behind

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

= 240 m

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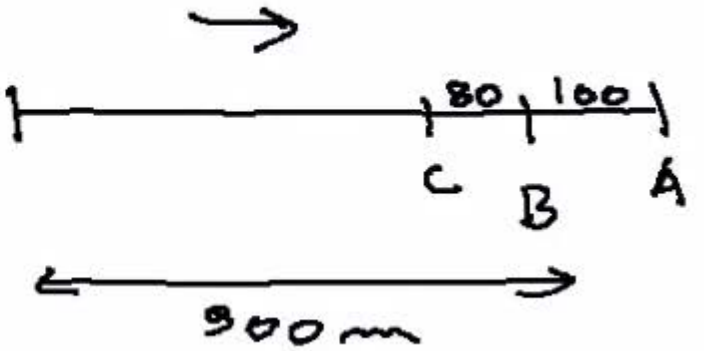

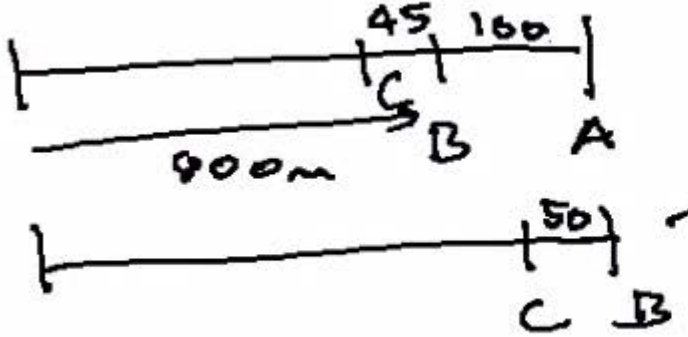

B → 1000m, C is 50m behind

B → 900m, C is 45m behind

B → 2700m $C = \frac{80}{900} \times 2700$

$= 240m$

B → 900 m

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

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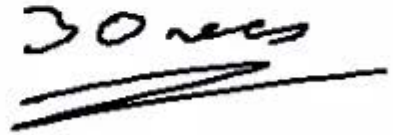

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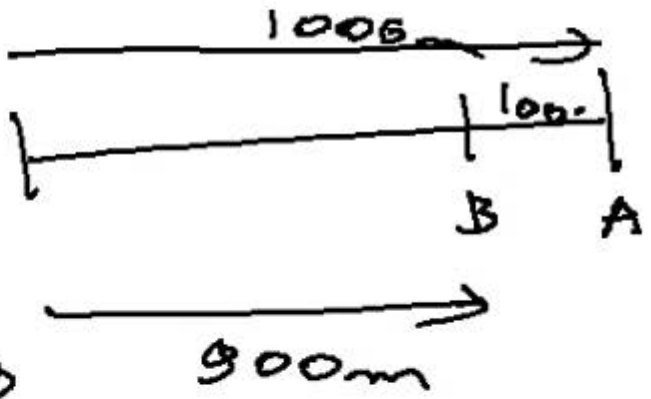
30 secs



$D \propto S$

Ratio of D = 10 : 9

" " S = 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 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.
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- 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 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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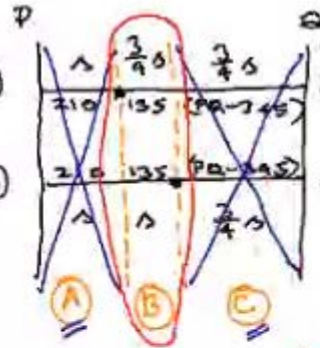
$S_r = 2 : 3 : 4$

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

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

$= 6 : 4 : 3$



(B) / D is const (135 km)

$\therefore t \propto \frac{1}{S}$

$\therefore$ N. Time = 3 hrs to travel 135 km

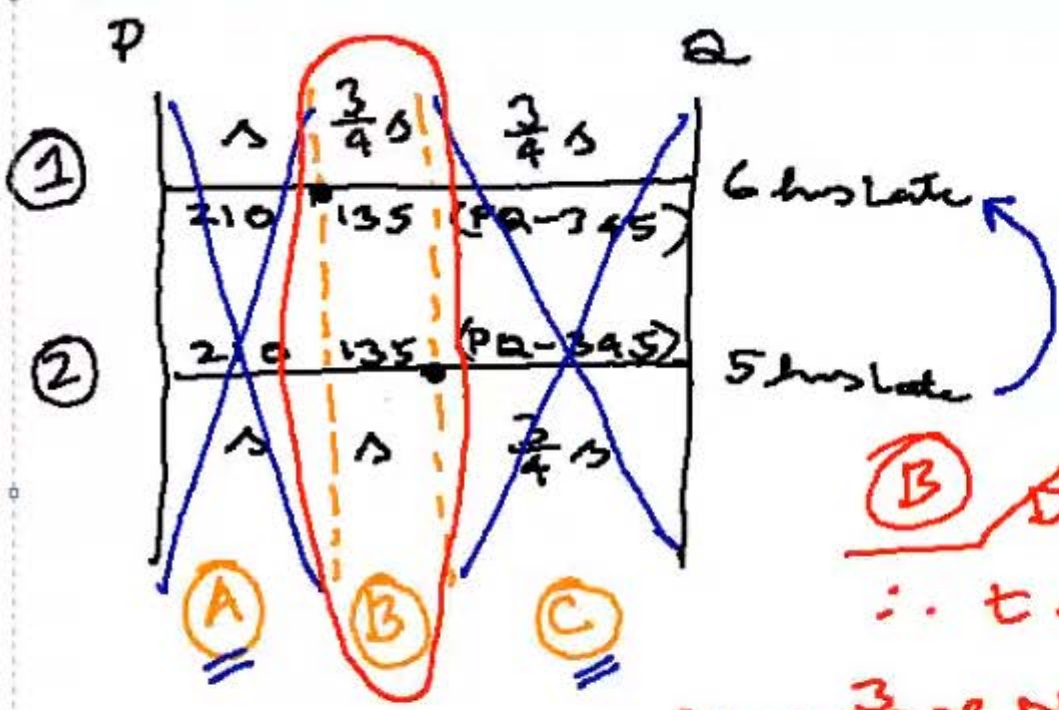
$\therefore$ N. Speed $= \frac{135}{3} = 45$ km/hr

Sp → $\frac{3}{4}$ of N.S

Time → $\frac{4}{3}$ of N.time

$\left(\frac{4}{3}-1\right) = \frac{1}{3}$ of N.time more. = 1 hr

$345 - 210 = 135$



Extra 1 hr Late

345
−210
135

B → D is const (135 km)

∴ $t \propto \frac{1}{S}$

S → $\frac{3}{4}$ of N.S

T → $\frac{4}{3}$ of N.time

$\left(\frac{4}{3}-1\right) = \frac{1}{3}$ of N.time more = 1 hr

∴ N.Time = 3 hrs to travel 135 km

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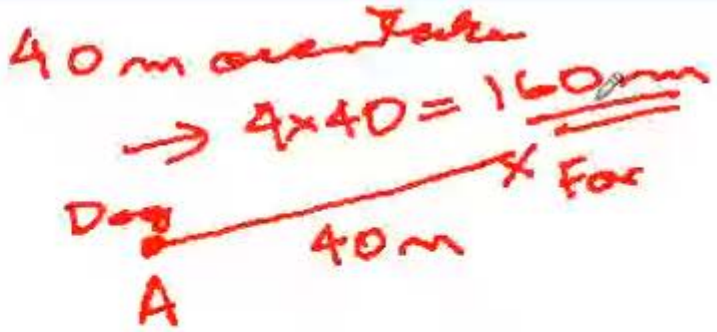
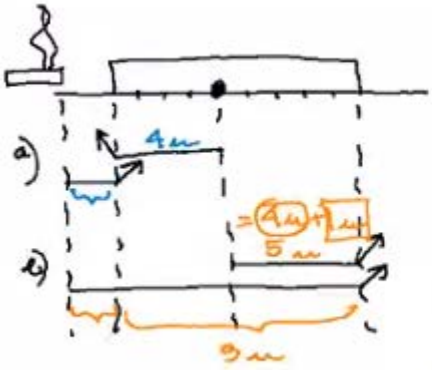
- A cat is standing in a railway tunnel of length 74.7 m, such that it is 4/9 th of the distance from A to B. It hears the whistle of a train approaching and runs to get out of the tunnel. If it runs towards A, it comes out of the tunnel exactly at the same moment the train enters it. If it runs towards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

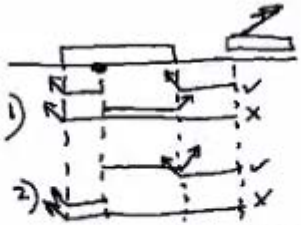
- Two men A and B start simultaneously from P and Q to travel to Q and P respectively. On reaching their destination they immediately turn back. They continue this process indefinitely, at a constant individual speed. If the distance between P and Q is 1000 m, and the ratio of the speeds of A and B is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

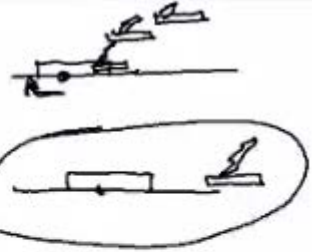


	D	F
Length of L	2m	1m
Freq of L	2	3
Total length in Freq time	4m	3m

Dog 1m overtake
→ 4m



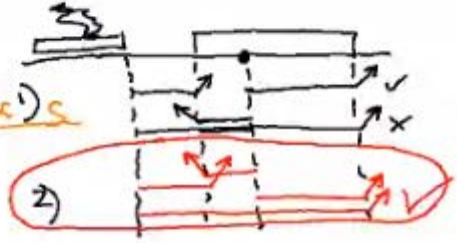




$C_D : T_D = 1 : 9$

Train is Coming Down

$C_S : T_S = 1 : 9$



(1) Total length = (250 + 150) m = 400 m

Relative speed = $(42 + 30) \times \frac{5}{18}$ ms^{-1} = 20 ms^{-1}

$\therefore$ t = 400 / 20 = 20 s

(2) Let lengths of both trains be l.

Total length = 2l

For opposite direction,

$$\text{Time} = \frac{2l}{(30+60) \times \frac{5}{18}}$$

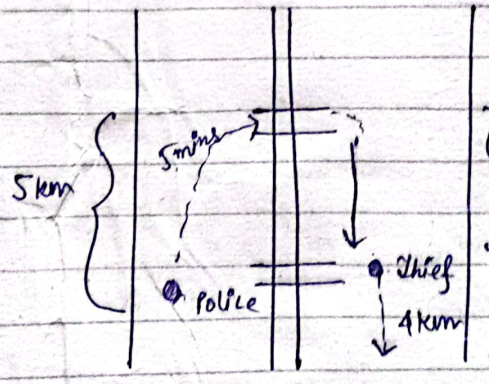
$$\Rightarrow 30 = \frac{2l}{25} \qquad l = 15 \times 25 \text{ m} = 375 \text{ m}$$

For same direction,

$$\text{Time} = \frac{2l}{(60-30) \times \frac{5}{18}} = \frac{2 \times 375}{30 \times \frac{5}{18}} = \frac{2 \times 375 \times 18}{30 \times 5}$$

$$= 90 \text{ s}$$

(3)



Speed of police = 60 km/h = 1000 m/min

Speed of Thief = 48 km/h = $\frac{48000}{60}$ m/min = 800 m/min

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

After police arrives in Thief's side, relative speed = 60 − 48 = 12 km/h

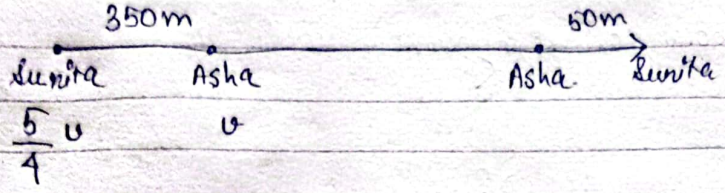
During the time the police was finding the gap, Thief covered a $800 \times 5 = 4000$ m = 4 km

∴ Total dist travelled by police to catch thief from thief's side (RHS of diagram) is 4km + 5km = 9km

∴ Time = $\frac{9}{12}$ hr = $\frac{9}{12} \times 60^{5}$ = 45 mins.

But police travelled 5 mins before to find gap, so total time = 45+5 = 50 mins.

(4.)



Let speed of Asha = v

" " Sunita = $5/4\ v$

Asha travels 'd' m

Sunita " $('d' + 350 + 50)$ m = $'d' + 400$ m

∴ $\frac{d}{v} = \frac{400+d}{5/4\ v}$ since time constant

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

But length of race = 1600 + 350 + 50

= 2000m = 2km

(5) $t \propto 1/v$ 25% faster = $\frac{125}{100}$ of v

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

$= \frac{4}{5}$

∴ ~~Usual time~~ $(1 - \frac{4}{5})$th of usual time = 20 mins

usual time = 20 × 5 mins

= 100 mins

5. 125 mins = 5/4 of normal time

$\Rightarrow$ $\frac{4}{5}$ of normal speed since $1 \equiv 1/5$

$= 80\%$

6. Normal speed = v ∴ $d = vt$

time = t

Distance = d

$d = \frac{2}{3} v \times (t + 1/2)$

$vt = \frac{2}{3} vt + \frac{1}{3} v$

$\frac{1}{3} vt = \frac{1}{3} v$

$t = 1$ hr.

8. Average speed = $\frac{2 \times d}{\frac{d}{60} + \frac{d}{40}} = \frac{2 \times 120 \, d}{2d + 3d} = \frac{24}{5} = 2$

$= 48$ km/h

9. $v_1 = 8$ km/h $\quad v_2 = 6$ km/h.

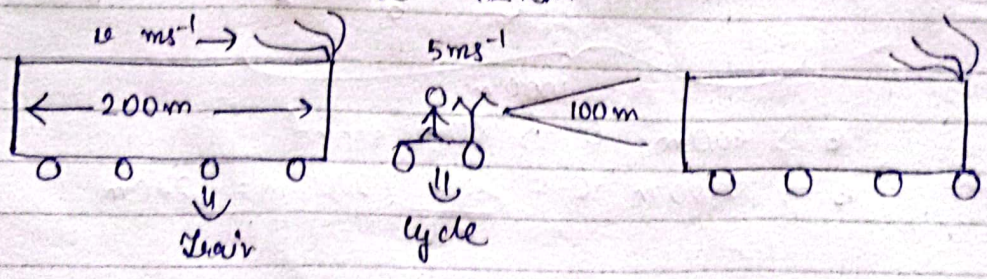
⇓ 10 mins early $\quad$ 20 mins late

∴ $\frac{d}{8} - \frac{d}{6} = -\frac{(10+20)}{60}$

$\Rightarrow \frac{8d - 6d}{48} = \frac{30}{60}$

$\Rightarrow d = 12$ km

10.



Relative speed = $(v - 5)$ ms^{-1}

Total distance = $(200 + 100)$ m = 300 m

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

b = boat, r = river

11. $b + r = \frac{100}{10} = 10$ ⇒ downstream

$b - r = \frac{30}{5} = 6$ ⇒ upstream

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

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

$\frac{b}{r} = 4 \Rightarrow b = 4r$

Let $r = 2$

$b = 8$

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

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

$b = 9r$

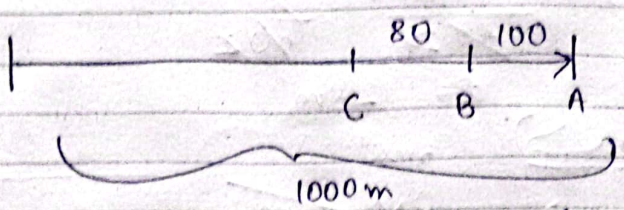
$8(b+r) = 10(b-r)$

$8b + 8r = 10b - 10r$

$18r = 2b$

Ratio = 9 : 1

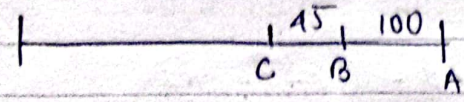
13.

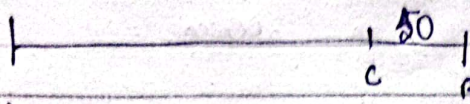


B ⇒ 900 m, C ⇒ 80 m behind

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

14.





⇒ B ⇒ 1000 m, C is 50 m behind

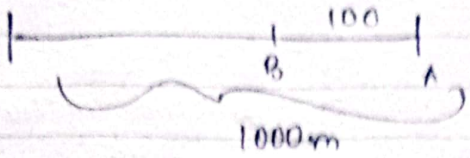
B = 900 m, C is $\frac{50}{1000} \times 900$

= 45 m

∴ Total = 145 m

15. $20+10 = 30$ s

16.



$d_B = 900m$

$d_A = 1000m$

$d \propto s \Rightarrow s_A : s_B = 1000 : 900 = 10 : 9$

17. $2 : 3 : 4 \Rightarrow$ ratio of speed

$s \propto 1/t$

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

$= 6 : 4 : 3$

18.

P		Q
s	3/4 s	3/4 s
210	135	PQ − 345 (6 hrs later)
210	135	PQ − 345 (5 hrs)
s	s	3/4 s

(A) (B) (C)

D is constant (135 km)

$t \propto 1/s$

Speed = 3/4 of normal speed

Time → 4/3 of normal time

$(4/3 - 1) = \frac{1}{3}$ of Normal time more = 1 hr.

∴ Normal time = 3 hrs to travel 135 km

Normal speed = $\frac{135}{3}$

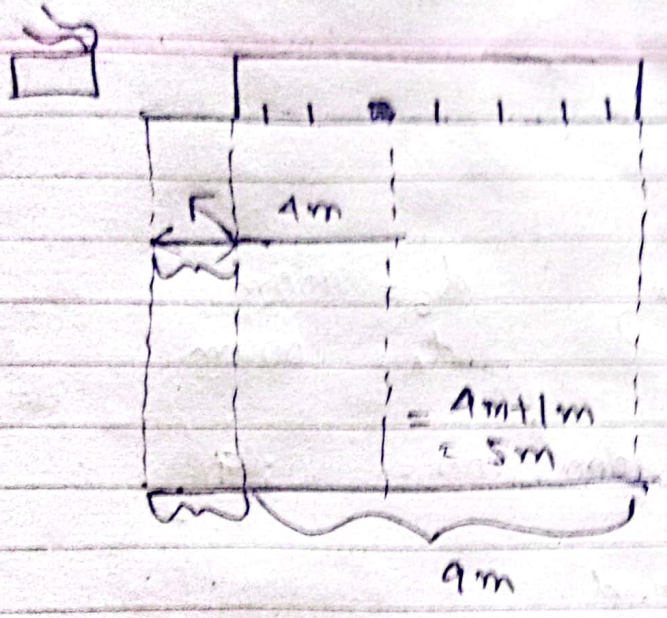
$= 45$ km/h

	Dog	Fox
Length of L	2m	1m
Freq of L	2	3
Total length in freq	4m	3m

1m overlake → 4m

40m " → 40 × 4

= 160m



$C_D : T_D = 1 : 9$

Time constant = DACS

$C_S : T_S = 1 : 9$