TIME, SPEED AND DISTANCES

1. Speed (s) = $\frac{\text{Distance (d)}}{\text{Time (t)}}$

2. Distance is constant

$$\boxed{s \propto \frac{1}{t}}$$

$$s_1 t_1 = s_2 t_2$$

Average speed :-

$\xrightarrow[d_1]{x \text{ kmph}}$ $\xleftarrow[d_2]{y \text{ kmph}}$

$$t_1 = \frac{d_1}{x} \qquad t_2 = \frac{d_2}{y}$$

Average ~~Total~~ speed = $\frac{\text{Total distance}}{\text{Total time}}$

$$= \frac{d_1 + d_2}{t_1 + t_2}$$

$$= \frac{d_1 + d_2}{\frac{d_1}{x} + \frac{d_2}{y}}$$

$$= \frac{xy(d_1 + d_2)}{d_1 y + d_2 x}$$

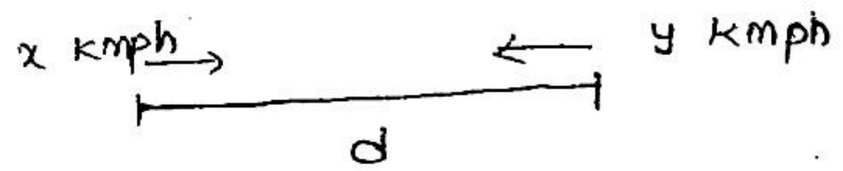
$\therefore d_1 = d_2 = d$

$$= \frac{xy(d + d)}{dy + dx}$$

$$\boxed{\text{Average speed} = \frac{2xy}{x+y} \text{ kmph}}$$

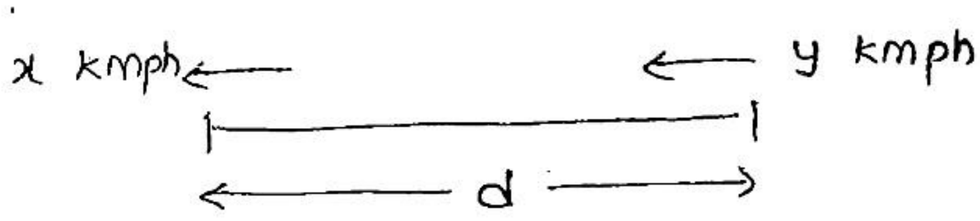
Relative speeds :-

1. In opposite directions :-



Relative speed = $(x+y)$ kmph

2. In same direction :-



Relative speed = $(y-x)$ kmph

3. Time is constant :-

$$S \propto d$$

$$S_1 d_2 = S_2 d_1$$

4. Speed is constant :-

$$d \propto t$$

$$d_1 t_2 = d_2 t_1$$

5. Units :-

$$\text{speed} \begin{cases} \text{kmph} = \frac{1000}{60\times60}\ \frac{m}{s} = \frac{5}{18}\ m/s \\ \text{mps} = \frac{18}{5}\ \text{kmph} \end{cases}$$

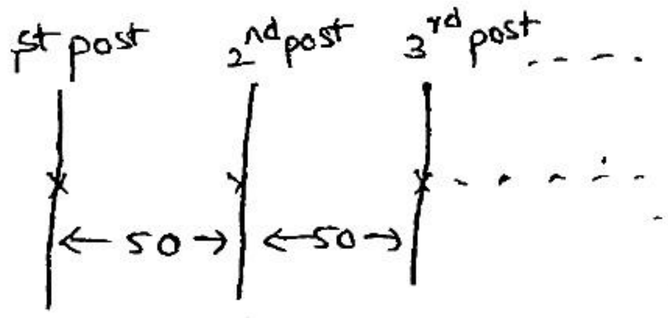
P.g No:- 75

1. $\text{speed} = \frac{\text{distance}}{\text{time}}$

$\text{distance} = (20\times50) = 1000\ m = 1\ km$

$\text{time} = 1\ min = 1 \times \frac{1}{60}\ hr$

$\therefore \text{speed} = \frac{1\ km}{\frac{1}{60}\ hr} = 60\ km/hr$



In 3 post → two 50's are coming

like that

21 post → 20 (50's) are coming

2. $S_c = \frac{d}{t}$, $S_j = \frac{d/2}{2t}$

$\frac{S_j}{S_c} = \frac{d}{4t} \times \frac{t}{d} = 1:4$

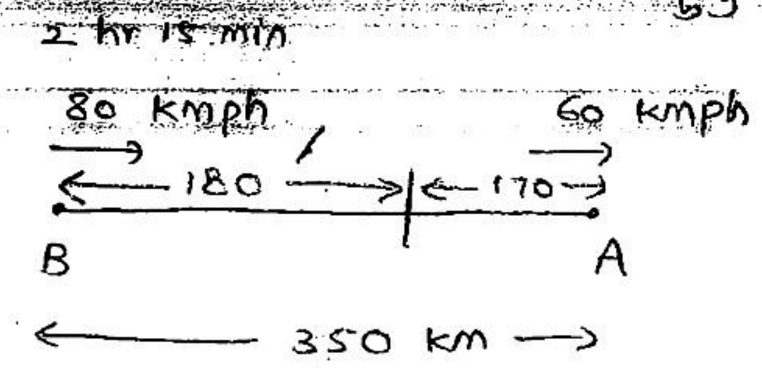
3. Speed = $\frac{\text{distance}}{t}$

distance = speed × t

= 80 × (2hr $\frac{15}{60}$)

= 80 × 2.25

= 180 km



time = $\frac{\text{distance}}{\text{speed}}$

= $\frac{170}{60}$

= 2.83 hrs ⇒ (2 + 0.83 hrs)

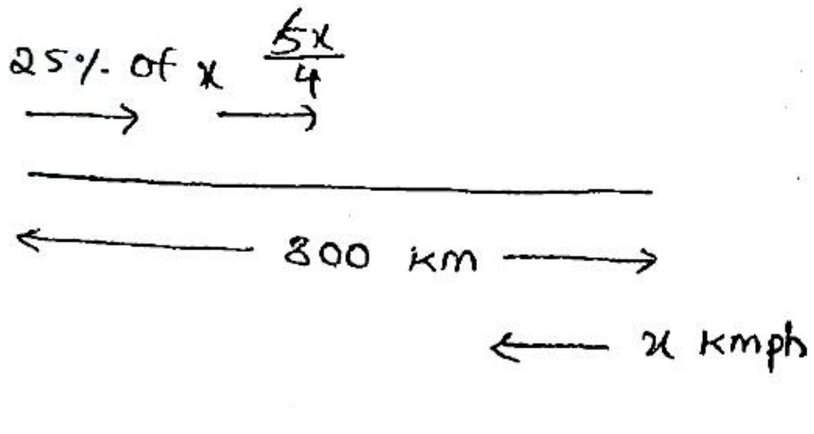
= 2 hours 50 min

0.83 × 60 ↓ min

= 49.8 min

5. Average speed = $\frac{2xy}{x+y}$

= $\frac{2\left(\frac{5x}{4}\right)(x)}{\frac{5x}{4}+x}$ = $\frac{800}{16}$



$x = 5 \times 9 = 45$ kmph

$\therefore \frac{5x}{4} = \frac{5 \times 45}{4} = 56.25$ kmph.

25% of $x = \frac{25}{100} \times x = \frac{x}{4}$

$x + \frac{x}{4} = \frac{5x}{4}$

P.9 NO:- 76

1. (A) → 1 hr → 50 kmph → (50 × 1) = 50 km

(B) → 2 hrs → 48 kmph → (2 × 48) = 96 km

(C) → 3 hrs → 52 kmph → (52 × 3) = 156 km

Mean speed = $\frac{\text{Total distance}}{\text{Total time}}$

= $\frac{50+96+156}{6}$

= $50\frac{1}{3}$ kmph

9. 6 km → $1\frac{1}{2}$ kmph → $\frac{6}{3/2}$ = 4 hrs

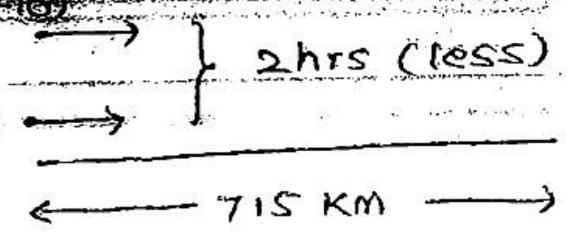
8 km → 2 kmph → $\frac{8}{2}$ = 4 hrs

32 km → 8 kmph → $\frac{32}{8}$ = 4 hrs

$\frac{d}{s} = t$

Avg. speed = $\frac{\text{Total distance}}{}$ = $\frac{6+8+32}{}$ = $3\frac{5}{12}$ kmph

3. $t_1 = \frac{715}{S}$ $\quad t_2 = \frac{715}{S+10}$



$t_1 - t_2 = 2\text{hrs}$

$\frac{715}{S} - \frac{715}{S+10} = 2\text{hrs}$

$715\left[\frac{S+10-S}{S^2+10S}\right] = 2\text{hrs}$

$2S^2 + 20S - 7150 = 0$

$= \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$S \cancel{=} 55$ km/hr

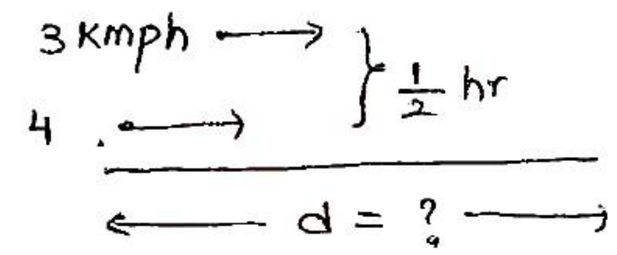
(or) $\frac{\text{product of speed}}{d} = \frac{\text{D/f of speed}}{\text{D/f of time}}$

$\frac{S(S+10)}{715} = \frac{10}{2}$

$2S^2 + 20S - 7150 = 0$

11. 4 km/hr

3 km/hr



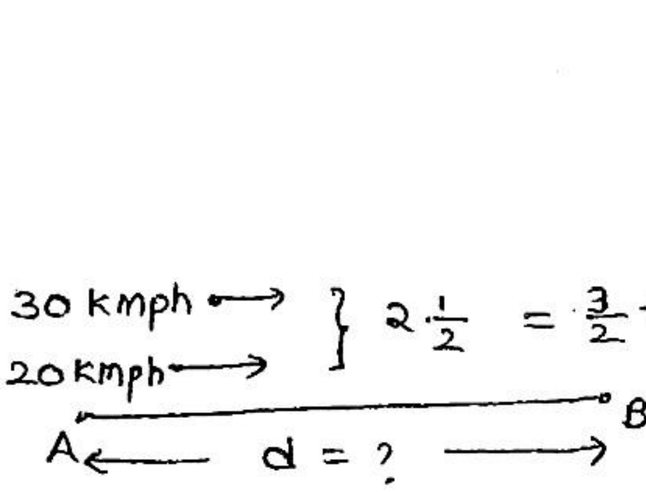
$\frac{\text{product of speed}}{d} = \frac{\text{Difference of speed}}{\text{D/f of time}}$

$4-3=1$

$\frac{3\times4}{d} = \frac{1}{1/2}$

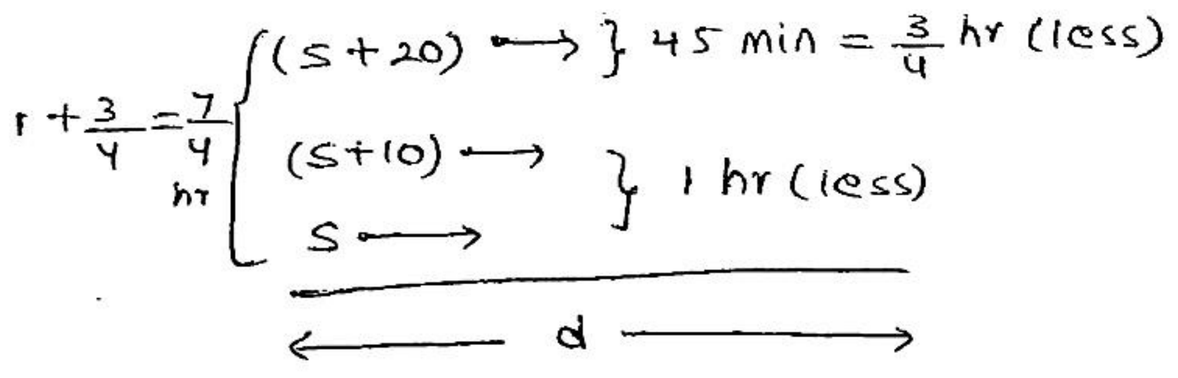
$d = 6\text{hrs}$

12. $\frac{20\times30}{d} = \frac{18\text{ hrs}}{4} \rightarrow (30-20)$



$d = 240$ km

2.



$\frac{S(S+10)}{d} = \frac{10}{1}$

$10d = S^2 + 10S \rightarrow (1)$

$\frac{S(S+20)}{d} = \frac{20}{7/4}$

$20d = \frac{7}{4}S^2 + 35S \rightarrow (2)$

solve (1) & (2)

$20d = \frac{7}{4}S^2 + 35S$

$20d = 2S^2 + 20S$

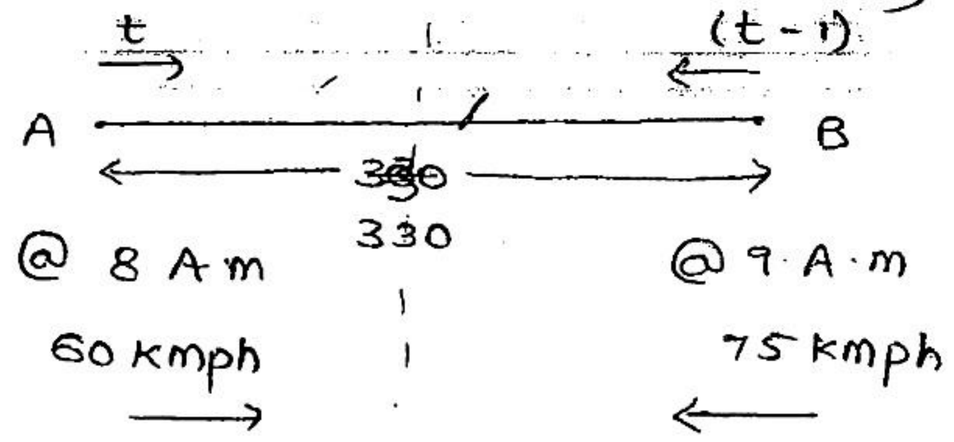
$\frac{1}{4}S^2 + 15S = 0 \quad \therefore S = 60$ km

5. $60 \times t + 75 \times (t-1) = 330$

$135t = 405$

$t = 3$ hrs

@ $8 + 3 = 11$ A.M.



6.

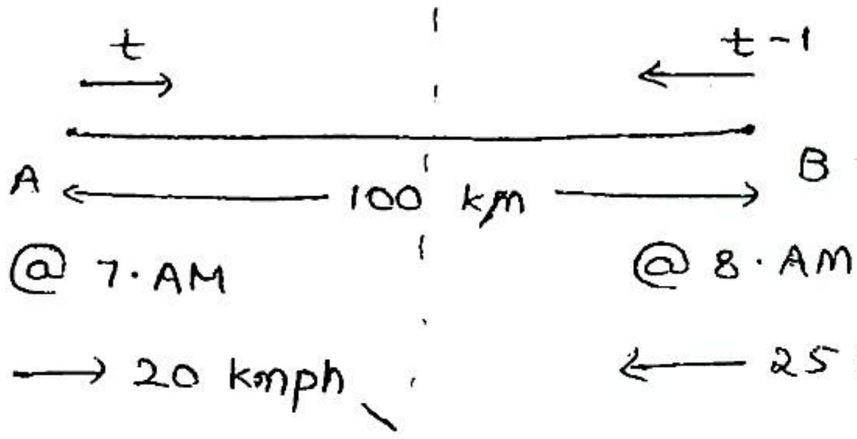
$20 \times t + 25(t-1) = 100$

$20t + 25t - 25 = 100$

$45t = 75$

$t = 2$ hrs 47 min

@ 7 + 2 hr 47 min = 9 : 47 AM



7. $d = s \times t \quad t = \frac{d}{s}$

$\frac{x}{50} = \frac{x+120}{60}$

$60x - 50x = 120 \times 50$

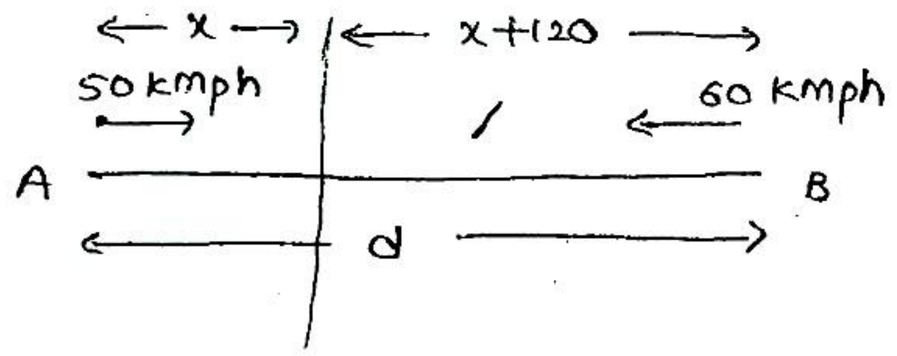
$10x = 120 \times 50$

$x = 12 \times 50$

$x = 600$ km

$x + 120 = 600 + 120 = 720$ km

$d = 600 + 720 = 1320$ km



(or)

A : B

5∅ 6∅

1 ∅ = 120

11 ∅ = 1320 km.

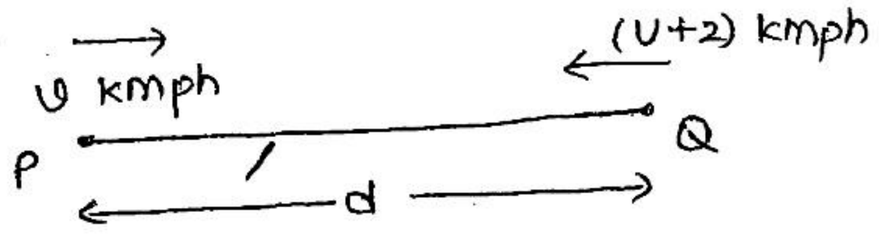
8.

M	:	P
6∅		4∅
6	:	4
3	:	2

(3 − 2) = 1 P = 20 km

(3 + 2) = 5 P = 100 km

14. In opposite direction



$R_S = U + U + 2 = 2U + 2$

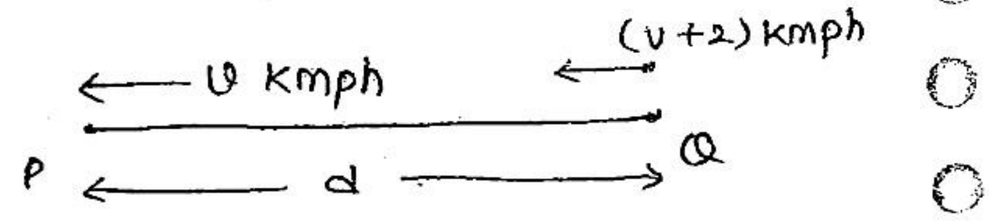
$$\frac{d}{2U+2} = \frac{72}{60}$$

$5d = 12U + 112$

$\therefore \quad 5(12) = 12U + 112$

$V = 48$ kmph

In opposite direction



Relative speed $= U + 2 - U = 2$ kmph

$$\frac{d}{2} = 6$$

$d = 12$ km

Problems on Trains

1. Speed of the train $= \dfrac{\text{distance (d)} + \text{length of the train (LT)}}{\text{Time (T)}}$

$$\boxed{ST = \frac{d + LT}{T}}$$

15. Given $ST = 132 \text{ kmph} \times \frac{5}{18} = \frac{110}{3}$ m/sec

$LT = 110$ m

$D = 165$ m

$T = ?$

$$\frac{110}{3} = \frac{165 + 110}{T}$$

$T = 7.5$ sec

16. Given

23 sec $\longrightarrow$ 272 m

19 sec $\longrightarrow$ 200 m

speed is constant

$$\frac{272 + LT}{23} = \frac{200 + LT}{19}$$

$LT = 142$ m

23 sec $\longrightarrow$ 272 m

19 sec $\longrightarrow$ 200 m

(or)

4 sec $\longrightarrow$ 72 m

1 sec $\longrightarrow$ 18 m

23 sec $\longrightarrow$ $23 \times 18 = 414$

19 sec $\longrightarrow$ $19 \times 18 = 342$

$L \cdot T = 414 - d \Rightarrow 414 - 272 = 142$ m

$L \cdot T = 342 - d \Rightarrow 342 - 200$

$= 142$ m