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 :-

x kmph $\xrightarrow{\quad d_1 \quad}$ $\xleftarrow{\quad d_2 \quad}$ y kmph

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

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

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

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

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

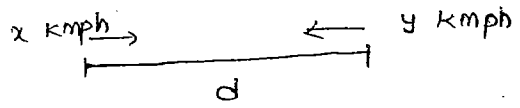
$\therefore d_1 = d_2 = d$

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

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

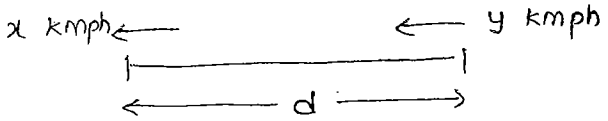
Relative speeds :-

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 :-

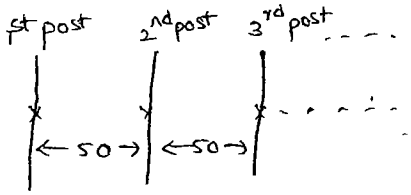
$$d \propto t$$
$$d_1 t_2 = d_2 t_1$$

5. Units :-

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

P.9 NO:- 75

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



In 3 post → two 50's are coming

like that

21 post → 20 (50's) are coming

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

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

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

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

$\text{distance} = \text{speed} \times t$

$= 80 \times (2\text{hr } \frac{15}{60})$

$= 80 \times 2.25$

$= 180 \text{ km}$

2 hr 15 min

80 kmph → ← 180 → | ← 170 → 60 kmph

B A

← 350 km →

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

$= \frac{170}{60}$

$= 2.83 \text{ hrs} \Rightarrow (2 + 0.83 \text{ hrs})$

$= 2 \text{ hours } 50 \text{ min}$

0.83×60 (min)

$= 49.8 \text{ min}$

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

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

$x = 5 \times 9 = 45 \text{ kmph}$

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

25% of x → $\frac{5x}{4}$ →

← 800 km →

← x 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 → $(50 \times 1) = 50$ km

(B) → 2 hrs → 48 kmph → $(2 \times 48) = 96$ km

(C) → 3 hrs → 52 kmph → $(52 \times 3) = 156$ km

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

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

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

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

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

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

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

$(S+10) \longrightarrow$ } 2hrs (less)
$S \longrightarrow$ }
$\longleftarrow$ 715 KM $\longrightarrow$

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

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

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

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

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

$S \simeq 55$ km/hr

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

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

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

11. 4 km/hr

3 km/hr

3 kmph $\longrightarrow$ } $\frac{1}{2}$ hr
4 $\longrightarrow$ }
$\longleftarrow$ d = ? $\longrightarrow$

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

$4-3=1$

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

$d = 6\text{hrs}$

12. $\frac{20\times30}{d} = \frac{10 \text{ hrs}}{4} \rightarrow (30-20)$

$1\frac{1}{2}$ { 30 kmph $\longrightarrow$ } $2\frac{1}{2} = \frac{3}{2} + \frac{5}{2} = 4\text{hrs}$
20 kmph $\longrightarrow$ }
A $\longleftarrow$ d = ? $\longrightarrow$ B

$d = 240$ km

2.

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

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

$1 + \frac{3}{4} = \frac{7}{4}$ hr { $(S+20) \longrightarrow$ } 45 min $= \frac{3}{4}$ hr (less)
$(S+10) \longrightarrow$ } 1 hr (less)
$S \longrightarrow$ }
$\longleftarrow$ d $\longrightarrow$

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

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

Solve (1) & (2)

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

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

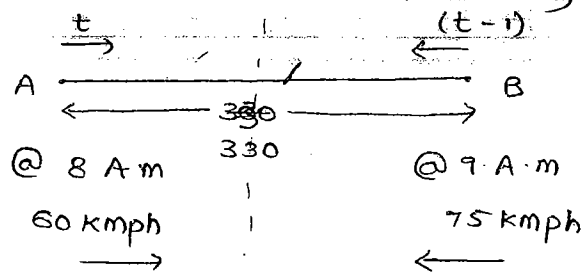
$2S^2 + 15S = 0 \Rightarrow S = 60$ km

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

$135t = 405$

$t = 3$ hrs

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



6.

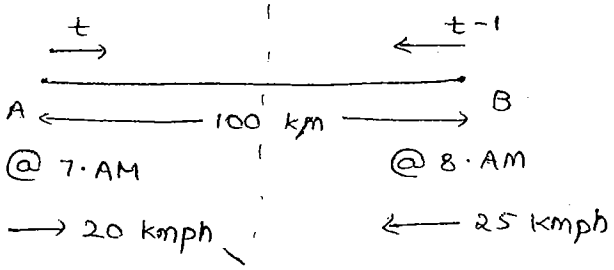
$20 \times t + 25(t-1) = 100$

$20t + 25t - 25 = 100$

$45t = 75$

$t = 2$ hrs 47 min

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



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

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

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

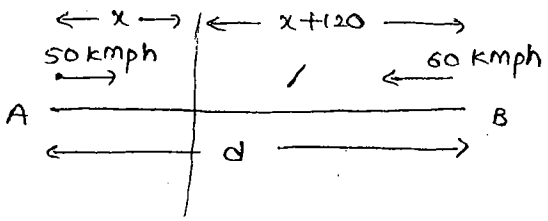
$10x = 120 \times 50$

$x = 12 \times 50$

$x = 600$ km

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

$d = 600 + 720 = 1320$ km



(or)

A	:	B
5Ø		6Ø

1 P = 120

11 P = 1320 km.

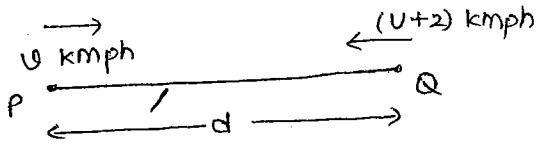
8.

M	:	P
6Ø		4Ø
6	:	4
3	:	2

(3 − 2) = 1 P = 20 km

(3 + 2) = 5 P = 100 km

14. In opposite direction

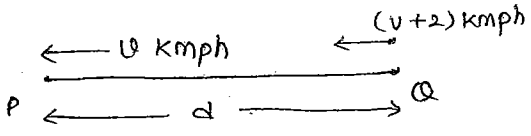


$R_s = v + v + 2 = 2v + 2$

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

$5d = 12v + 12$

In same direction



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

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

$d = 12$ km

$\therefore \quad 5(12) = 12v + 12$

$v = 48$ kmph