EXPLANATIONS

TYPE-I

1. (2) Using Rule 1,

Time taken = $\frac{\text{Distance}}{\text{time}}$

$= \frac{\frac{4}{5}}{45}$ hour $= \frac{4 \times 60 \times 60}{5 \times 45}$ sec.

= 64 seconds

2. (4) Using Rule 1,
Let the required speed is x km/hr

Then, $240 \times 5 = \frac{5}{3} \times x$

$\therefore$ x = 720 km/hr.

3. (4) Using Rule 1,
Speed of the man = 5km/hr

$= 5 \times \frac{1000}{60}$ m / min $= \frac{250}{3}$ m / min

Time taken to cross the bridge
= 15 minutes
Length of the bridge
= speed × time

$= \frac{250}{3} \times 15\text{m} = 1250\text{m}$

4. (2) Using Rule 1,

Speed $= \frac{\text{Distance}}{\text{Time}} = \frac{250}{75}$

$= \frac{10}{3}$ m/sec $= \frac{10}{3} \times \frac{18}{5}$ km/hr.

$\left[\because 1 \text{ m/s} = \frac{18}{5} \text{ km/hr}\right]$

= 2 × 6 km/hr. = 12 km/hr.

5. (4) Using Rule 1,

Speed $= \frac{\text{Distance}}{\text{Time}}$

$= \frac{200}{24}$ m / s

$\frac{200}{24}$ m / s $= \frac{200}{24} \times \frac{18}{5}$

= 30 km/h

$\left[\because x \text{ m/s} = \frac{18}{5} x \text{ km/h}\right]$

6. (4) Using Rule 1,
Speed of car = 10 m/sec.
Required speed in kmph

$= \frac{10 \times 18}{5} = 36$ km/hr

7. (1) Total distance covered
= Speed × Time
= 40 × 9 = 360 km.
The required time at 60 kmph

$= \frac{360}{60} = 6$ hours.

Aliter : Using Rule 9,
Here, $S_1 = 40$, $t_1 = 9$
$S_2 = 60$, $t_2 = ?$
$S_1t_1 = S_2t_2$
$40 \times 9 = 60 \times t_2$

$t_2 = \frac{4 \times 9}{6} = 6$ hours

8. (3) Let the distance be x km.
Total time = 5 hours 48 minutes

$= 5 + \frac{48}{60} = \left(5 + \frac{4}{5}\right)$ hours

$= \frac{29}{5}$ hours

$\therefore \frac{x}{25} + \frac{x}{4} = \frac{29}{5}$

$\Rightarrow \frac{4x + 25x}{100} = \frac{29}{5}$

$\Rightarrow 5 \times 29x = 29 \times 100$

$\Rightarrow x = \frac{29 \times 100}{5 \times 29} = 20$ km.

Aliter : Using Rule 5,
Here, x = 25, y = 4

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

$= \frac{2 \times 25 \times 4}{25 + 4} = \frac{200}{29}$

Total Distance $= \frac{200}{29} \times 5\frac{4}{5}$

$= \frac{200}{29} \times \frac{29}{5} = 40$ km

$\Rightarrow$ Required distance = 20 km

9. (1) Let the required distance be x km.
Then,

$\frac{x}{3} + \frac{x}{2} = 5$

$\Rightarrow \frac{2x + 3x}{6} = 5$

$\Rightarrow 5x = 6 \times 5$

$\therefore x = \frac{6 \times 5}{5} = 6$ km

Aliter : Using Rule 5,
Here, x = 3, y = 2

Average Speed $= \frac{2 \times x \times y}{x + y}$

$= \frac{2 \times 3 \times 2}{3 + 2}$

$= \frac{12}{5}$ km/hr

Total distance $= \frac{12}{5} \times 5 = 12$km

$\therefore$ Required distance

$= \frac{12}{2} = 6$ km

10. (1) Using Rule 1,
The boy covers 20 km in 2.5 hours.

$\Rightarrow$ Speed $= \frac{20}{2.5} = 8$ km/hr.

New speed = 16 km/hr

$\therefore$ Time $= \frac{32}{16} = 2$ hours.

11. (4) Using Rule 1,
Speed = 180 kmph

$= \frac{180 \times 5}{18}$ m/sec = 50 m/sec

$\left[\because 1 \text{ km/hr} = \frac{5}{18} \text{ m/s}\right]$

12. (2) Using Rule 1,

Speed $= \frac{150}{25} = 6$ m/sec

$= 6 \times \frac{18}{5} = \frac{108}{5} = 21.6$ kmph

13. (2) Let the distance between A and B be x km, then

$\frac{x}{9} - \frac{x}{10} = \frac{36}{60} = \frac{3}{5}$

$\Rightarrow \frac{x}{90} = \frac{3}{5}$

$\Rightarrow x = \frac{3}{5} \times 90 = 54$ km.

Aliter :
Using Rule 9,
Here, $S_1 = 9$, $t_1 = x$

$S_2 = 10$, $t_2 = x - \frac{36}{60}$

$S_1t_1 = S_2t_2$

$9 \times x = 10\left(x - \frac{36}{60}\right)$

9x = 10x – 6x = 6
Distance travelled
= 9 × 6 = 54 km

14. (4) Difference of time
= 4.30 p.m – 11.a.m.

$= 5\frac{1}{2}$ hours $= \frac{11}{2}$ hours

Distance covered in $\frac{11}{2}$ hrs

$= \frac{5}{6} - \frac{3}{8} = \frac{20-9}{24} = \frac{11}{24}$ part

$\because \frac{11}{24}$ part of the journey is covered in $\frac{11}{2}$ hours

$\Rightarrow \frac{3}{8}$ part of the journey is covered in

$= \frac{11}{2} \times \frac{24}{11} \times \frac{3}{8} = \frac{9}{2}$ hours

$= 4\frac{1}{2}$ hours.

Clearly the person started at 6.30 a.m.

15. (1) Using Rule 1,
Speed of bus = 72 kmph

$= \left(\frac{72 \times 5}{18}\right)$ metre/second

= 20 metre/second
$\therefore$ Required distance
= 20 × 5 = 100 metre

16. (3) If the required distance be x km, then

$\frac{x}{3} - \frac{x}{4} = \frac{1}{2}$

$\Rightarrow \frac{4x - 3x}{12} = \frac{1}{2}$

$\Rightarrow \frac{x}{12} = \frac{1}{2} \Rightarrow x = 6$ km

Aliter : Using Rule 9,
Here $S_1 = 4$, $t_1 = x$

$S_2 = 3$, $t_2 = x + \frac{1}{2}$

$S_1t_1 = S_2t_2$

$4 \times x = 3\left(x + \frac{1}{2}\right)$

$4x - 3x = \frac{3}{2}$ $x = \frac{3}{2}$

Distance= $4 \times \frac{3}{2} = 6$ kms

17. (1) Using Rule 1,

Time $= 10\frac{1}{2}$ hours

$= \frac{21}{2}$ hours

Speed = 40 kmph
Distance = Speed × Time

$= 40 \times \frac{21}{2} = 420$ km

18. (2) Using Rule 1,
Distance covered on foot

$= 4 \times 3\frac{3}{4}$ km. = 15 km.

$\therefore$ Time taken on cycle

$= \frac{\text{Distance}}{\text{Speed}} = \frac{15}{16.5}$ hour

$= \frac{15 \times 60}{16.5}$ minutes

= 54.55 minutes

19. (2) Using Rule 1,

Speed of train $= \frac{\text{Distance}}{\text{Time}}$

$= \frac{10}{\frac{12}{60}}$ kmph

$= \frac{10 \times 60}{12} = 50$ kmph

New speed = 45 kmph

$\therefore$ Required time $= \frac{10}{45}$ hour

$= \frac{2}{9} \times 60$ minutes

$= \frac{40}{3}$ minutes

= 13 minutes 20 seconds

20. (2) Using Rule 1,

Man's speed $= \frac{\text{Distance}}{\text{Time}}$

$= \frac{a}{b}$ kmph

$= \frac{1000a}{b}$ m/hour

$\therefore$ Time taken in walking 200 metre

$= \frac{200}{\frac{1000a}{b}} = \frac{b}{5a}$ hours

21. (4) $\because$ 1 m/sec $= \frac{18}{5}$ kmph

$\therefore \frac{10}{3}$ m/sec

$= \frac{18}{5} \times \frac{10}{3} = 12$ kmph

22. (3) Using Rule 1,
Remaining time

$= \frac{2}{5} \times 15 = 6$ hours

$\therefore$ Required speed

$= \frac{60}{6} = 10$ kmph

23. (2) Speed of train = 60 kmph
Time = 210 minutes

$= \frac{210}{60}$ hours

or $\frac{7}{2}$ hours

Distance covered

$= 60 \times \frac{7}{2} = 210$ km

Time taken at 80 kmph

$= \frac{210}{80} = \frac{21}{8}$ hours

$= 2\frac{5}{8}$ hours

Aliter : Using Rule 9,

Here, $S_1 = 60$, $t_1 = \frac{210}{60}$ hrs

$S_2 = 80$, $t_2 = ?$
$S_1t_1 = S_2t_2$

$60 \times \frac{210}{60} = 80 \times t_2$

$t_2 = \frac{21}{8}$ hrs

$t_2 = 2\frac{5}{8}$ hrs

24. (2) 90 km = 12 × 7km + 6 km. To cover 7 km total time taken $= \frac{7}{18}$ hours + 6 min. $= \frac{88}{3}$ min. So, (12 × 7 km) would be covered in $\left(12 \times \frac{88}{3}\right)$ min. and remaining 6 km is $\frac{6}{18}$ hrs or 20 min.

$\therefore$ Total time $= \frac{1056}{3} + 20$

$= \frac{1116}{3 \times 60}$ hours $= 6\frac{1}{5}$ hours

= 6 hours 12 minutes.

25. (1) 30.6 kmph

$= \left(30.6 \times \frac{5}{18}\right)$ m/sec.

= 8.5 m/sec

26. (2) Let the total journey be of x km, then

$\frac{2x}{15} + \frac{9x}{20} + 10 = x$

$\Rightarrow x - \frac{2x}{15} - \frac{9x}{20} = 10$

$\Rightarrow \frac{60x - 8x - 27x}{60} = 10$

$\Rightarrow \frac{25x}{60} = 10$

$\Rightarrow x = \frac{60 \times 10}{25} = 24$ km

27. (2) If the required distance be = x km, then

$\frac{x}{4} - \frac{x}{5} = \frac{10+5}{60}$

$\Rightarrow \frac{5x - 4x}{20} = \frac{1}{4}$

$\Rightarrow \frac{x}{20} = \frac{1}{4}$

$\Rightarrow x = \frac{1}{4} \times 20 = 5$ km.

Aliter : Using Rule 10,

Here, $S_1 = 4$, $t_1 = 5$

$S_2 = 5$, $t_2 = 10$

Distance $= \frac{(S_1 \times S_2)(t_1 + t_2)}{S_2 - S_1}$

$= \frac{(4 \times 5)(5+10)}{5-4}$

$= 20 \times \frac{15}{60} = 5$ kms

28. (1) Using Rule 12,

Relative speed

$= \left(\frac{5}{2} + 2\right)$ kmph $= \frac{9}{2}$ kmph

Time $= \frac{\text{Distance}}{\text{Relative speed}} = \frac{18}{\frac{9}{2}}$

$= \frac{18 \times 2}{9} = 4$ hours

29. (1) Journey on foot $= x$ km

Journey on cycle = $(80 - x)$ km

$\therefore \frac{x}{8} + \frac{80 - x}{16} = 7$

$\Rightarrow \frac{2x + 80 - x}{16} = 7$

$\Rightarrow x + 80 = 16 \times 7 = 112$

$\Rightarrow x = 112 - 80 = 32$ km.

Aliter : Using Rule 13,

Here, x = 80, t = 7

u = 8, v = 16

Time $= \left(\frac{vt - x}{v - u}\right)$

$= \left(\frac{16 \times 7 - 80}{16 - 8}\right)$

$= \left(\frac{112 - 80}{8}\right)$

$= \frac{32}{8} = 4$ hrs

Distance travelled

= 4 × 8 = 32 kms

30. (4) Distance covered by car in 2 hours

$= \frac{300 \times 40}{100} = 120$ km

Remaining distance

= 300 – 120 = 180 km

Remaining time = 4 – 2

= 2 hours

$\therefore$ Required speed $= \frac{180}{2}$

= 90 kmph

Original speed of car $= \frac{120}{2}$

= 60 kmph

$\therefore$ Required increase in speed

= 90 – 60 = 30 kmph

31. (2) Time taken in covering 5 Km

$= \frac{5}{10} = \frac{1}{2}$ hour

= 30 minutes

That person will take rest for four times.

$\therefore$ Required time

= (30 + 4 × 5) minutes

= 50 minutes

32. (2) Time = 12 minutes

$= \frac{12}{60}$ hour $= \frac{1}{5}$ hour

Speed of train $= \frac{10}{\frac{1}{5}}$

= 50 kmph

New speed = 50 – 5 = 45 kmph

$\therefore$ Required time $= \frac{\text{Distance}}{\text{Speed}}$

$= \frac{10}{45} = \frac{2}{9}$ hour

$= \left(\frac{2}{9} \times 60\right)$ minutes

$= \frac{40}{3}$ minutes

Aliter : Using Rule 9,

Here, $S_1 = \frac{10}{12}$ km / min

$= \frac{10}{12} \times 60$ km / hr

= 50 km/hr, $t_1 = \frac{12}{60} = \frac{1}{5}$ hr

S_2 = 45 km/hr, t_2 = ?

$S_1 t_1 = S_2 t_2$

$50 \times \frac{1}{5} = 45 \times t_2$

$t_2 = \frac{10}{45} \times 60$ min

$= \frac{40}{3}$ min

33. (2) Using Rule 12,

Distance covered by motor cyclist P in 30 minutes

$= 30 \times \frac{1}{2} = 15$ km

Relative speed

= 40 – 30 = 10 kmph

$\therefore$ Required speed = Time taken to cover is km at 10 kmph

$= \frac{15}{10} = \frac{3}{2}$ hours

34. (1) Speed of B $= x$ kmph (let)

Speed of A $= 2x$ kmph

Speed of C $= \frac{x}{3}$ kmph

$\therefore \frac{\text{Speed of A}}{\text{Speed of C}} = \frac{2x}{\frac{x}{3}} = 6$

$\therefore$ Required time $= \frac{1}{6}$ of $\frac{3}{2}$ hours

$= \frac{1}{4}$ hour $= 15$ minutes

35. (4) Using Rule 12,

Distance covered by truck in $\frac{3}{2}$ hours

= Speed × Time

$= 90 \times \frac{3}{2} = 135$ km

Remaining distance

= 310 – 135 = 175 km

$\therefore$ Time taken at 70 kmph

$= \frac{175}{70} = 2.5$ hours

$\therefore$ Total time = 1.5 + 2.5

= 4 hours

36. (3) Distance = Speed × Time

= 60 km.

Time taken at 40 kmph

$= \frac{60}{40} = \frac{3}{2}$ hours

Aliter : Using Rule 9,

Here, $S_1 = 60$, $t_1 = 1$

$S_2 = 40$, $t_2 = ?$

$S_1t_1 = S_2t_2$

$60 \times 1 = 40 \times t_2$

$t_2 = \frac{3}{2}$ hours.

37. (4) Distance of school $= x$ km

Difference of time

$= 16$ minutes $= \frac{16}{60}$ hour

$\therefore \frac{x}{\frac{5}{2}} - \frac{x}{3} = \frac{16}{60}$

$\Rightarrow \frac{2x}{5} - \frac{x}{3} = \frac{4}{15}$

$\Rightarrow \frac{6x - 5x}{15} = \frac{4}{15}$

$\Rightarrow \frac{x}{15} = \frac{4}{15}$

$\Rightarrow x = \frac{4}{15} \times 15 = 4$ km

Aliter : Using Rule 10,

Here, $S_1 = \frac{5}{2}$, $t_1 = 6$

$S_2 = 3$, $t_2 = 10$

Distance $= \frac{(S_1 \times S_2)(t_1 + t_2)}{S_2 - S_1}$

$= \frac{\frac{5}{2} \times 3(6+10)}{3 - \frac{5}{2}}$

$= 15 \times \frac{16}{60}$ km = 4 km.

38. (1) Using Rule 5,

Average speed of journey

$= \left(\frac{2xy}{x+y}\right)$ kmph

$= \frac{2 \times 40 \times 50}{40 + 50} = \frac{2 \times 40 \times 50}{90}$

$= \frac{400}{9} = 44\frac{4}{9}$ kmph

39. (1) 60 kmph $= \left(\frac{60 \times 5}{18}\right)$ m/sec

$= \frac{50}{3}$ m/sec.

$\therefore$ Speed $\propto \frac{1}{\text{Time}}$

$\Rightarrow S_1 \times T_1 = S_2 \times T_2$

$\Rightarrow \frac{50}{3} \times \frac{9}{2} = 15 \times T_2$

$\Rightarrow 75 = 15 \times T_2$

$\Rightarrow T_2 = \frac{75}{15} = 5$ hours

Aliter : Using Rule 9,

Here, $S_1 = 60$, $t_1 = 4\frac{1}{2} = \frac{9}{2}$

$S_2 = 15 \times \frac{18}{5} = 54$

$S_1t_1 = S_2t_2$

$60 \times \frac{9}{2} = 54 \times t_2$

$t_2 = \frac{270}{54} = 5$ hours

40. (*) Speed of Romita $= x$ kmph (let)

Distance = Speed × Time

According to the question,

$4 \times 6 + x \times 6 = 42$

$\Rightarrow 6x = 42 - 24 = 18$

$\Rightarrow x = 18 \div 6 = 3$ kmph

Aliter : Using Rule 11,

Distance from R to S

$= S_1t_1 + S_2t_2$

$42 = 4 \times 6 + x \times 6$

$6x = 18$ $x = 3$ km/hr.

41. (1) Distance travelled by farmer on foot $= x$ km (let)

$\therefore$ Distance covered by cycling $= (61 - x)$ km.

Time $= \frac{\text{Distance}}{\text{Speed}}$

According to the question,

$\frac{x}{4} + \frac{61 - x}{9} = 9$

$\Rightarrow \frac{9x + 61 \times 4 - 4x}{9 \times 4} = 9$

$\Rightarrow 5x + 244 = 9 \times 9 \times 4 = 324$

$\Rightarrow 5x = 324 - 244 = 80$

$\Rightarrow x = \frac{80}{5} = 16$ km.

Aliter : Using Rule 13,

Here, $t = 9$, $x = 61$

$u = 4$, $v = 9$

Time taken $= \left(\frac{vt - x}{v - u}\right)$

$= \frac{9 \times 9 - 61}{9 - 4}$

$= \frac{20}{5} = 4$ hrs.

Distance travelled

$= 4 \times 4 = 16$ km

42. (4) Distance = Speed × TIme

$= \left(40 \times 6\frac{1}{4}\right)$ km

$= \left(\frac{40 \times 25}{4}\right)$ km = 250 km

New speed = 50 kmph

$\therefore$ Required time

$= \frac{\text{Distance}}{\text{Speed}} = \frac{250}{50} = 5$ hours

Aliter : Using Rule 9,

Here, $S_1 = 40$, $t_1 = 6\frac{15}{60} = \frac{25}{4}$

$S_2 = 50$, $t_2 = ?$

$S_1t_1 = S_2t_2$

$40 \times \frac{25}{4} = 50 \times t_2$

$t_2 = 5$ hrs.

43. (3) Distance between school and house = x km (let)

Time = $\frac{\text{Distance}}{\text{Speed}}$

According to the question,

$\frac{x}{\frac{5}{2}} - \frac{x}{\frac{7}{2}} = \frac{6+6}{60} = \frac{1}{5}$

(Difference of time = 6 + 6 =12 minutes)

$\Rightarrow \frac{2x}{5} - \frac{2x}{7} = \frac{1}{5}$

$\Rightarrow \frac{14x - 10x}{35} = \frac{1}{5} \Rightarrow \frac{4x}{35} = \frac{1}{5}$

$\Rightarrow 4x = \frac{35}{5} = 7$

$\Rightarrow x = \frac{7}{4} = 1\frac{3}{4}$ km.

Aliter : Using Rule 10,

Here, $S_1 = 2\frac{1}{2}$, $t_1 = 6$

$S_2 = 3\frac{1}{2}$, $t_2 = 6$

Distance $= \frac{(S_1 \times S_2)(t_1 + t_2)}{S_2 - S_1}$

$= \frac{\left(\frac{5}{2} \times \frac{7}{2}\right)(6+6)}{\frac{7}{2} - \frac{5}{2}}$

$= \frac{35}{4} \times \frac{12}{60}$

$= \frac{7}{4}$ km $= 1\frac{3}{4}$ km

44. (3) Using Rule 1,

Let the total distance be $4x$ km.

Time = $\frac{\text{Distance}}{\text{Speed}}$

According to the question,

$\frac{x}{10} + \frac{3x}{12} = 7$

$\Rightarrow \frac{x}{10} + \frac{x}{4} = 7$

$\Rightarrow \frac{2x + 5x}{20} = 7$

$\Rightarrow 7x = 7 \times 20$

$\therefore x = \frac{7 \times 20}{7} = 20$ km.

$\therefore$ PQ = $4x = 4 \times 20 = 80$ km.

45. (1) Let the distance of school be x km.

Difference of time = 6 + 10

= 16 minutes = $\frac{16}{60}$ hour

= $\frac{4}{15}$ hour

Time = $\frac{\text{Distance}}{\text{Speed}}$

$\therefore \frac{x}{\frac{5}{2}} - \frac{x}{3} = \frac{4}{15}$

$\Rightarrow \frac{2x}{5} - \frac{x}{3} = \frac{4}{15}$

$\Rightarrow \frac{6x - 5x}{15} = \frac{4}{15}$

$\Rightarrow x = 4$ km.

Aliter : Using Rule 10,

Here, $S_1 = 2\frac{1}{2}$, $t_1 = 6$

$S_2 = 3$, $t_2 = 10$

Distance $= \frac{(S_1 \times S_2)(t_1 + t_2)}{S_2 - S_1}$

$= \frac{\frac{5}{2} \times 3(6 + 10)}{3 - \frac{5}{2}}$

$= 15 \times \frac{16}{60}$

$= \frac{16}{4} = 4$ km

46. (4) Using Rule 1,

Let the distance covered be $2x$ km.

Time = $\frac{\text{Distance}}{\text{Speed}}$

According to the question,

$\frac{x}{60} + \frac{x}{45} = 5\frac{15}{60} = 5\frac{1}{4}$

$\Rightarrow \frac{3x + 4x}{180} = \frac{21}{4}$

$\Rightarrow 7x = \frac{21}{4} \times 180$

$\Rightarrow x = \frac{21 \times 180}{4 \times 7} = 135$ km.

$\therefore$ Length of total journey $= 2 \times 135 = 270$ km.

47. (3) Distance covered by car $= 42 \times 10 = 420$ km.

New time = 7 hours

$\therefore$ Required speed = $\frac{420}{7}$

= 60 kmph.

$\therefore$ Required increase

= (60 – 42) kmph

= 18 kmph

48. (1) Distance of the office

= x km.

Difference of time = 2 hours

$\therefore \frac{x}{8} - \frac{x}{12} = 2$

$\Rightarrow \frac{3x - 2x}{24} = 2$

$\Rightarrow \frac{x}{24} = 2 \Rightarrow x = 48$ km.

$\therefore$ Time taken at the speed of 8 kmph = $\frac{48}{8}$ = 6 hours

$\therefore$ Required time to reach the office at 10 a.m. i.e., in 5 hours

$= \left(\frac{48}{5}\right)$ kmph

= 9.6 kmph

49. (1) Speed of bus = 36 kmph.

$= \left(36 \times \frac{5}{18}\right)$ m/sec.

= 10 m/sec.

$\therefore$ Distance covered in 1 second = 10 metre

50. (3) Time taken by bus moving at 60 kmph = t hours

Distance = Speed × Time

$\therefore 60 \times t = 45 \times \left(t + \frac{11}{2}\right)$

$\Rightarrow 60t - 45t = \frac{45 \times 11}{2}$

$\Rightarrow\ 15t = \frac{45\times11}{2}$

$\Rightarrow\ t = \frac{45\times11}{15\times2} = \frac{33}{2}$ hours

$\therefore$ Required distance

$= \frac{60\times33}{2} = 990$ km.

51. (4) Speed of train = 116 kmph

$= \left(116\times\frac{5}{18}\right)$ m./sec.

$= \left(\frac{580}{18}\right)$ m./sec.

$\therefore$ Required distance
= Speed × Time

$= \left(\frac{580}{18}\times18\right)$ metre

= 580 metre

52. (4) Part of journey covered by bus and rickshaw

$= \frac{3}{4}+\frac{1}{6} = \frac{9+2}{12} = \frac{11}{12}$

Distance covered on foot

$= 1-\frac{11}{12} = \frac{1}{12}$ part

$\therefore$ Total journey
= 12 × 2 = 24 km.

53. (3) Distance covered by train in 15 hours = Speed × Time
= (60 × 15) km. = 900 km.
Required speed to cover 900 km.

in 12 hours $= \frac{900}{12}$

= 75 kmph

54. (2) Distance = Speed × Time
= 330 × 10 = 3300 metre

$= \left(\frac{3300}{1000}\right)$ km. = 3.3 km.

55. (4) Let the required distance be x km.
Time = 2 hours 20 minutes

$= 2\frac{1}{3}$ hours

According to the question,

$\frac{x}{12}+\frac{x}{9} = \frac{7}{3}$

$\Rightarrow \frac{3x+4x}{36} = \frac{7}{3}$

$\Rightarrow \frac{7x}{36} = \frac{7}{3}$

$\Rightarrow x = \frac{7}{3}\times\frac{36}{7} = 12$ km.

TYPE-II

1. (3) Using Rule 1,
Let the length of train be x metre
Speed = 90 km/hr

$= \frac{90\times5}{18}$ metre / sec.

= 25 metre/sec.
$\therefore$ Distance covered in 60 sec.
= 25 × 60 = 1500 metres
Now, according to question,
2x = 1500
$\therefore$ x = 750 metre

2. (3) Using Rule 1,
When a train crosses a bridge it covers the distance equal to length of Bridge & its own length
Let the length of the train be = x
$\therefore$ Speed of the train

$= \frac{x+800}{100}$ m/s

Since train passes the 800 m bridge in 100 seconds.
Again, train passes the 400 m bridge in 60 seconds.

$\therefore \frac{400+x}{\frac{x+800}{100}} = 60$

$\Rightarrow \frac{(400+x)\times100}{x+800} = 60$

$\Rightarrow$ 40000 + 100x
= 60x + 48000
$\Rightarrow$ 100x – 60x = 48000 – 40000
$\Rightarrow$ 40x = 8000

$\therefore x = \frac{8000}{40} = 200$m

3. (3) In crossing the bridge, the train travels its own length plus the length of the bridge.
Total distance (length)
= 300 + 200 = 500 m.
Speed = 25m/sec.
$\therefore$ The required time
= 500 ÷ 25 = 20 seconds
Aliter : Using Rule 10,
Here, x = 300m, y= 200 m, t = ?
u= 25 m/sec

$t = \frac{x+y}{u}$

$= \frac{300+200}{25}$

$= \frac{500}{25}$ t = 20 seconds

4. (2) When a train crosses a tunnel, it covers a distance equal to the sum of its own length and tunnel.
Let the length of tunnel be x
Speed = 78 kmph

$= \frac{78\times1000}{60\times60}$ m/sec. $= \frac{65}{3}$ m/sec.

$\therefore$ Speed $= \frac{\text{Distance}}{\text{Time}}$

$\Rightarrow \frac{65}{3} = \frac{800+x}{60}$

$\Rightarrow$ (800 + x) × 3 = 65× 60
$\Rightarrow$ 800 + x = 65 × 20 m
$\Rightarrow$ x = 1300 – 800 = 500
$\therefore$ Length of tunnel = 500 metres.
Aliter : Using Rule 10,
Here, x = 800 m,
u = 78 km/hr

$= 78\frac{5}{18} = \frac{65}{3}$ m/sec

t = 1 min = 60 sec, y = ?

using $t = \frac{x+y}{u}$

$60 = \frac{800+y}{\frac{65}{3}}$

$60\times\frac{65}{3} = 800 + y$

1300 – 800 = y
y = 500 metres

5. (2) When a train crosses a railway platform, it travels a distance equal to sum of length of platform and its own length.
Speed = 132 kmph

$= 132\times\frac{5}{18} = \frac{110}{3}$ m/sec.

$\therefore$ Required time

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

$= \frac{275\times3}{110} = 7.5$ seconds

Aliter : Using Rule 10,
Here, x = 110m,
u = 132 km/hr.

$= 132\times\frac{5}{18} = \frac{110}{3}$ m/sec

y = 165m, t = ?

using $t = \frac{x+y}{u}$

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

$$t = \frac{275 \times 3}{110}$$

$$= \frac{25 \times 3}{10} = \frac{15}{2} = 7.5 \text{ sec}$$

6. (3) Using Rule 10,
Let the length of the train be x metres.
When a train corsses a platform it covers a distance equal to the sum of lengths of train and platform. Also, the speed of train is same.

$$\therefore \frac{x+162}{18} = \frac{x+120}{15}$$

$\Rightarrow 6x + 720 = 5x + 810$
$\Rightarrow 6x - 5x = 810 - 720$
$\Rightarrow x = 90$
$\therefore$ The length of the train = 90m.

7. (3) Using Rule 10,
When a train croses a bridge, distance covered = length of (bridge + train).
$\therefore$ Speed of train

$$= \frac{150+500}{30}$$

$$= \frac{650}{30} = \frac{65}{3} \text{ m/sec.}$$

$\therefore$ Time taken to cross the 370m long platform

$$= \frac{370+150}{\frac{65}{3}}$$

$$= \frac{520 \times 3}{65} = 24 \text{ seconds}$$

8. (4) Using Rule 10,
Speed of train = 90 kmph

$$= 90 \times \frac{5}{18} = 25 \text{ m/sec}$$

Distance covered
= 230 + 120 = 350 m

$$\therefore \text{Time taken} = \frac{350}{25}$$

= 14 seconds

9. (4) Using Rule 10,
Let the length of train be x
According to the question,

$$\frac{x+600}{30} = 30$$

$\Rightarrow x + 600 = 900$
$\Rightarrow x = 900 - 600 = 300$ m

10. (4) Using Rule 10,
Let the length of the train be x
According to the question,

$$\frac{x+122}{17} = \frac{x+210}{25}$$

$\Rightarrow 25x + 3050 = 17x + 3570$
$\Rightarrow 25x - 17x = 3570 - 3050$
$\Rightarrow 8x = 520$

$$\Rightarrow x = \frac{520}{8} = 65 \text{ metres}$$

$\therefore$ Speed of the train

$$= \frac{65+122}{17}$$

$$= \frac{187}{17} \text{ metre/second}$$

= 11 metre/second

$$= \frac{11 \times 18}{5} \text{ kmph}$$

= 39.6 kmph

11. (3) Using Rule 10,
Let the Length of the train be x

$$\text{Then, } \frac{x+162}{18} = \frac{x+120}{15}$$

(Speed of the train)

$$\Rightarrow \frac{x+162}{6} = \frac{x+120}{5}$$

$\Rightarrow 6x + 720 = 5x + 810$
$\Rightarrow x = 810 - 720 = 90$
$\therefore$ Speed of the train

$$= \frac{90+162}{18} \text{ m/sec.}$$

$$= \frac{252}{18} \times \frac{18}{5} \text{ kmph}$$

= 50.4 kmph

12. (1) Using Rule 10,
Let the length of the train be x
$\therefore$ Speed of train

$$\frac{x+300}{21} = \frac{x+240}{18}$$

$$\Rightarrow \frac{x+300}{7} = \frac{x+240}{6}$$

$\Rightarrow 7x + 1680 = 6x + 1800$
$\Rightarrow x = 120$
$\therefore$ Speed of train

$$= \frac{x+300}{21} = \frac{420}{21} = 20 \text{ m/sec}$$

$$= \left(\frac{20 \times 18}{5}\right) \text{kmph} = 72 \text{ kmph}$$

13. (2) Speed of train

$$= \frac{\text{Sum of length of both trains}}{\text{Time taken}}$$

$$\Rightarrow \frac{60 \times 5}{18} = \frac{110+170}{t} = \frac{280}{t}$$

$$\Rightarrow t = \frac{280 \times 18}{60 \times 5} = 16.8 \text{ seconds.}$$

14. (4) Speed of train

$$= \frac{\text{Length of (train + platform)}}{\text{Time taken to cross}}$$

$$= \left(\frac{500+700}{10}\right) \text{ feet/second}$$

= 120 feet/second
Aliter : Using Rule 10,
Here, x = 500 feet, y = 700 feet
t = 10 seconds, u = ?

$$\text{using } t = \frac{x+y}{u}$$

$$u = \frac{500+700}{10}$$

= 120ft/second

15. (3) Speed of train = 36kmph

$$= 36 \times \frac{5}{18} = 10 \text{ m/sec.}$$

If the length of bridge be x metre, then

$$10 = \frac{200+x}{55}$$

$\Rightarrow 200 + x = 550$
$\Rightarrow x = 550 - 200 = 350$ metre.
Aliter : Using Rule 10,
Here, x = 200 m

$$u = 36 \text{ km/hr}, \frac{36 \times 5}{18} \text{ m/second}$$

= 10 m/sec
y = ?, t = 55 sec

$$\text{using } t = \frac{x+y}{u}$$

$$55 = \frac{200+y}{10}$$

y = 550 – 200
y = 350 m

16. (2) Using Rule 10,

$$36 \text{ kmph} = \left(36 \times \frac{5}{18}\right) \text{m/sec.}$$

= 10 m/sec.

$$\text{Required time} = \frac{270+180}{10}$$

= 45 seconds

17. (3) Using Rule 10,
Speed of train

$$= \frac{\text{Length of (train + platform)}}{\text{Time taken in crossing}}$$

$$= \frac{(50+100)}{10}$$

$$= \frac{150}{10} = 15 \text{ m/sec}$$

18. (2) Using Rule 10,
Speed of train

$= \frac{\text{Length of platform and train}}{\text{Time taken in crossing}}$

$= \left(\frac{100+50}{10}\right)$ metre/second

= 15 metre/second

$= \left(15 \times \frac{18}{5}\right)$ kmph

= 54 kmph

19. (1) Using Rule 10,
Speed of train = 36 kmph

$= \left(\frac{36 \times 5}{18}\right)$ m/sec.

= 10 m/sec

Required time

$= \frac{\text{Length of train and bridge}}{\text{Speed of train}}$

$= \frac{120+360}{10} = \frac{480}{10}$

= 48 seconds

20. (4) Using Rule 10,
Time = 5 minutes

$= \frac{1}{12}$ hour

$\therefore$ Length of bridge = Speed × Time

$= 15 \times \frac{1}{12} = \frac{5}{4}$ km.

$= \left(\frac{5}{4} \times 1000\right)$ metre

= 1250 metre

21. (1) Using Rule 10,
Speed of train = 72 kmph

$= \left(\frac{72 \times 5}{18}\right)$m/sec.

= 20 m/sec.

Required time

$= \frac{\text{Length of train and bridge}}{\text{Speed of train}}$

$= \frac{(200+800)}{20}$

$= \frac{1000}{20}$ = 50 seconds

22. (2) Using Rule 10,
Length of train = x metre (let)
Speed of train

$= \frac{\text{(Length of train and bridge)}}{\text{Time taken in crossing}}$

$\Rightarrow \frac{x+500}{100} = \frac{x+250}{60}$

$\Rightarrow \frac{x+500}{5} = \frac{x+250}{3}$

$\Rightarrow 5x + 1250 = 3x + 1500$

$\Rightarrow 5x - 3x = 1500 - 1250$

$\Rightarrow 2x = 250$

$\Rightarrow x = \frac{250}{2}$ = 125 metre

23. (1) Speed of train

$= \frac{\text{length of platform and train}}{\text{Time taken in crossing}}$

$= \left(\frac{450+150}{20}\right)$ m/sec.

$= \left(\frac{600}{20}\right)$ m/sec.

$= \left(30 \times \frac{18}{5}\right)$ kmph

= 108 kmph.

24. (4) Let the length of train be x metre.

When a train crosses a platform, distance covered by it = length of train and platform.

$\therefore$ Speed of train

$= \frac{x+50}{14} = \frac{x}{10}$

$\Rightarrow \frac{x+50}{7} = \frac{x}{5}$

$\Rightarrow 7x = 5x + 250$

$\Rightarrow 7x - 5x = 250$

$\Rightarrow 2x = 250 \Rightarrow x = \frac{250}{2}$

= 125 metre

$\therefore$ Speed of train $= \frac{x}{10}$

$= \left(\frac{125}{10}\right)$ m./sec.

$= \left(\frac{125}{10} \times \frac{18}{5}\right)$ kmph

= 45 kmph.

25. (3) Let, length of train = length of platform = x metre
Speed of train = 90 kmph

$= \left(\frac{90 \times 5}{18}\right)$ m/sec.

= 25 m/sec.

$\therefore$ Speed of train

$= \frac{\text{Length of train and platform}}{\text{Time taken in crossing}}$

$\Rightarrow 25 = \frac{2x}{60} \Rightarrow 2x = 25 \times 60$

$\Rightarrow x = \frac{25 \times 60}{2}$ = 750 metre

26. (2) Speed of train

$= \frac{\text{Length of train and platform}}{\text{Time taken in crossing}}$

$= \left(\frac{221+500}{35}\right)$ metre/second

$= \left(\frac{721}{35}\right)$ metre/second

$= \left(\frac{721 \times 18}{35 \times 5}\right)$ kmph

= 74.16 kmph

27. (3) Speed of train
= 54 kmph

$= \left(\frac{54 \times 5}{18}\right)$ m/sec.

= 15 m/sec.

$\therefore$ Required time

$= \frac{\text{Length of train and bridge}}{\text{Speed of train}}$

$= \left(\frac{200+175}{15}\right)$seconds

$= \left(\frac{375}{15}\right)$ seconds

= 25 seconds

TYPE-III

1. (3) Using Rule 5,
Relative speed of man and train
= 20 – 10 = 10m/sec.

$\therefore$ Required time $= \frac{180}{10}$

= 18 seconds

2. (3) Using Rule 1,
In this situation, the train covers it length.
Required time

$= \frac{100}{30 \times 1000}$ hr.

$= \frac{100 \times 60 \times 60}{30 \times 1000}$ = 12 seconds

3. (2) Using Rule 5,
Relative speed of train
= 63–3 = 60 kmph

$= 60 \times \frac{5}{18} m / \text{sec}$

$\therefore$ Time $= \frac{\text{Length of train}}{\text{Relative Speed}}$

$= \frac{500 \times 18}{60 \times 5}$ = 30 sec.

4. (2) Using Rule 1,

Speed $= \frac{\text{Distance}}{\text{Time}}$

$= \frac{125}{30} = 4.16$m/s

4.16 m/s $= 4.16 \times \frac{18}{5}$

= 15 km/hr

5. (1) Using Rule 1,
In crossing a man standing on platform, train crosses its own length.
$\therefore$ Speed of train

$= \frac{120}{10} = 12$ m/s

6. (3) Using Rule 1,
Speed of train (in m/s)

$= 20 \times \frac{5}{18} = \frac{50}{9}$ m/sec

Required time $= \frac{75}{50} \times 9$

= 13.5 seconds

7. (1) Using Rule 1,
Speed of the train

= 144 kmph $= 144 \times \frac{5}{18}$

= 40 m/s
When a train crosses a pole, it covers a distance equal to its own length.

The required time $= \frac{100}{40}$

$= \frac{5}{2} = 2.5$ seconds.

8. (3) Using Rule 1,
Speed of train

$= \frac{120}{9} \times \frac{18}{5}$ = 48 kmph

9. (4) Using Rule 1,
Speed of train = 60 kmph

$= 60 \times \frac{5}{18} = \frac{50}{3}$ m/sec

$\therefore$ Length of train
= Speed × Time

$= \frac{50}{3} \times 30$ = 500 m

10. (3) Let the speed of train be x kmph and its length be y km.
When the train crosses a man, it covers its own length
According to he question,

$\frac{y}{(x-3) \times \frac{5}{18}} = 10$

$\Rightarrow 18y = 10 \times 5(x - 3)$
$\Rightarrow 18y = 50x - 150$ ..... (i)

and, $\frac{y}{(x-5) \times \frac{5}{18}} = 11$

$\Rightarrow 18y = 55(x-5)$
$\Rightarrow 18y = 55x - 275$ .... (ii)
From equations (i) and (ii),
$55x - 275 = 50x - 150$
$\Rightarrow 55x - 50x = 275 - 150$
$\Rightarrow 5x = 125$

$\Rightarrow x = \frac{125}{5} = 25$

$\therefore$ Speed of the train = 25 kmph
Aliter : Using Rule 7,
Here, $S_1 = 3$, $S_2 = 5$

$t_1 = \frac{10}{3600}$, $t_2 = \frac{11}{3600}$

Speed of train $= \frac{t_1S_1 - t_2S_2}{t_1 - t_2}$

$= \frac{\frac{3 \times 10}{3600} - \frac{5 \times 11}{3600}}{\frac{10}{3600} - \frac{11}{3600}}$

$= \frac{-25}{3600} \times \frac{3600}{-1}$

= 25 m/sec

11. (4) Using Rule 5,
Relative speed of train
= (36 – 9) kmph = 27 kmph

$= \frac{27 \times 5}{18}$ m/sec

$= \frac{15}{2}$ m/sec

$\therefore$ Required time

$= \frac{\text{Length of the train}}{\text{Relative speed}}$

$= \frac{150 \times 2}{15} = 20$ seconds

12. (3) Distance covered in 10 minutes at 20kmph = distance covered in 8 minutes at (20 + x) kmph

$\Rightarrow 20 \times \frac{10}{60} = \frac{8}{60}(20 + x)$

$\Rightarrow 200 = 160 + 8x$
$\Rightarrow 8x = 40$

$\Rightarrow x = \frac{40}{8} = 5$ kmph

13. (4) Using Rule 5,
If the speed of the train be x kmph, then relative speed
= $(x - 3)$ kmph.

or $(x - 3) \times \frac{5}{18}$ m/sec

$\therefore \frac{300}{(x-3) \times \frac{5}{18}} = 33$

$\Rightarrow 5400 = 33 \times 5 (x - 3)$
$\Rightarrow 360 = 11 (x - 3)$
$\Rightarrow 11x - 33 = 360$

$\Rightarrow x = \frac{393}{11} = 35\frac{8}{11}$ kmph

14. (3) Using Rule 6,
If the speed of train be x kmph then,
Its relative speed = $(x + 3)$ kmph

$\therefore$ Time $= \frac{\text{Length of the train}}{\text{Relative speed}}$

$\Rightarrow \frac{10}{3600} = \frac{\frac{240}{1000}}{(x+3)} = \frac{240}{1000(x+3)}$

$\Rightarrow x + 3 = 86.4$
$\Rightarrow x = 83.4$ kmph

15. (2) Using Rule 1,
Speed of train = 36 kmph

$= \left(\frac{36 \times 5}{18}\right)$ m/sec = 10 m/sec.

$\therefore$ Length of train
= Speed × time
= 10 × 25 = 250 metre

16. (4) Using Rule 1,
Speed of train = 90 kmph

$= \left(\frac{90 \times 5}{18}\right)$ metre/second

= 25 metre/second
If the length of the train be x then,
Speed of train

$= \frac{\text{Length of train}}{\text{Time taken in crossing the signal}}$

$\Rightarrow 25 = \frac{x}{10}$

$\Rightarrow x = 250$ metre

17. (1) Using Rule 6,
Let speed of train be x kmph
Relative speed = $(x + 5)$ kmph

Length of train $= \frac{100}{1000}$ km

$= \frac{1}{10}$ km

$\therefore \frac{\frac{1}{10}}{x+5} = \frac{36}{5 \times 60 \times 60}$

$\Rightarrow \frac{1}{10(x+5)} = \frac{1}{500}$

$\Rightarrow x + 5 = 50$
$\Rightarrow x = 45$ kmph

18. (1) Using Rule 1,
Speed of train

$= \frac{\text{Length of train}}{\text{Time taken in crossing the pole}}$

$= \frac{120}{6} = 20$ m/sec

$= 20 \times \frac{18}{5} = 72$ kmph

19. (1) Using Rule 1,
Speed of train = 54 kmph

$= \left(\frac{54 \times 5}{18}\right)$ m/sec = 15 m/sec

Required time

$= \frac{\text{Length of trains}}{\text{Speed of train}}$

$= \frac{300}{15} = 20$ seconds

20. (4) Using Rule 1,
Speed of train = 90 kmph

$= \left(90 \times \frac{5}{18}\right)$ m/sec.

= 25 m/sec.

When a train crosses a post, it covers a distance equal to its own length.

$\therefore$ Required time $= \frac{\text{Distance}}{\text{Speed}}$

$= \frac{180}{25} = 7.2$ seconds

21. (1) Let the required distance be x km.
Difference of time = 7 + 5 = 12

minutes $= \frac{1}{5}$ hour

Time $= \frac{\text{Distance}}{\text{Speed}}$

According to the question,

$\frac{x}{5} - \frac{x}{6} = \frac{1}{5}$

$\Rightarrow \frac{6x - 5x}{30} = \frac{1}{5}$

$\Rightarrow \frac{x}{30} = \frac{1}{5}$

$\Rightarrow x = \frac{30}{5} = 6$ km.

22. (2) Using Rule 1,
If the length of train be x metre, then speed of train

$= \frac{x}{20} = \frac{x + 250}{45}$

$\Rightarrow \frac{x}{4} = \frac{x+250}{9}$

$\Rightarrow 9x = 4x + 1000$
$\Rightarrow 9x - 4x = 1000$
$\Rightarrow 5x = 1000$

$\Rightarrow x = \frac{1000}{5}$

= 200 metre

23. (4) Using Rule 1,
Speed of train

$= \frac{\text{Length of train}}{\text{Time taken in crossing}}$

$= \frac{250}{50} = 5$ m/sec.

$= \left(5 \times \frac{18}{5}\right)$ kmph

= 18 kmph

24. (1) $\therefore$ Speed of train A

$= \frac{150}{30} = 5$ m/sec.

Speed of train B $= x$ m/sec.
Relative speed = $(5+x)$ m/sec.
$\therefore$ Length of both trains = Relative speed × Time
$\Rightarrow 300 = (5 + x) \times 10$

$\Rightarrow 5 + x = \frac{300}{10} = 30$

$\Rightarrow x = 30 - 5 = 25$ m/sec.

$= \left(\frac{25 \times 18}{5}\right)$ kmph.

= 90 kmph.

25. (1) Distance covered in crossing a pole = Length of train
Speed of train = 72 kmph

$= \left(\frac{72 \times 5}{18}\right)$ m./sec.

= 20 m./sec.

$\therefore$ Required time $= \frac{160}{20}$

= 8 seconds

26. (3) Speed of train = 50 kmph

$= \left(\frac{50 \times 5}{18}\right)$ m./sec.

$= \frac{125}{9}$ m./sec.

$\therefore$ Required time

$= \left(\frac{100}{\frac{125}{9}}\right)$ seconds

$= \left(\frac{100 \times 9}{125}\right)$ seconds

= 7.2 seconds

27. (4) Distance covered by train in crossing a telegraphic post = length of train

$\therefore$ Speed of train $= \frac{\text{Distance}}{\text{Time}}$

$= \left(\frac{150}{12}\right)$ m./sec.

$= \left(\frac{150}{12} \times \frac{18}{5}\right)$ kmph

= 45 kmph

28. (4) Speed of train = 36 kmph

$= \left(\frac{36 \times 5}{18}\right)$ m./sec.

= 10 m./sec.

∴ Required time

$= \frac{\text{Length of train}}{\text{Speed of train}}$

$= \frac{60}{10}$ = 6 seconds

29. (3) When a train crosses a pole it travels a distance equal to its length.

∴ Speed of train

$= \frac{240}{16}$ = 15 m./sec.

$= \left(15 \times \frac{18}{5}\right)$ kmph

= 54 kmph.

30. (2) Distance covered by train = Length of train

Speed of train = 60 kmph

$= \left(\frac{60 \times 5}{18}\right)$ m./sec.

$= \left(\frac{50}{3}\right)$ m./sec.

∴ Required time = $\frac{\text{Distance}}{\text{Speed}}$

$= \left(\frac{75}{\frac{50}{3}}\right)$ seconds

$= \frac{75 \times 3}{50}$ seconds

= 4.5 seconds

31. (2) Speed of train = 120 kmph.

$= \left(\frac{120 \times 5}{18}\right)$ m./sec.

$= \frac{100}{3}$ m./sec.

∴ Required time = $\frac{\text{Length of train}}{\text{Speed of train}}$

$= \left(\frac{100}{\frac{100}{3}}\right)$ seconds

$= \left(\frac{100}{100} \times 3\right)$ seconds

= 3 seconds

TYPE-IV

1. (3) Distance travelled by first train in one hour

= 60 × 1 = 60km

$A \xleftrightarrow{330\text{km}} B$

Therefore, distance between two train at 9 a.m.

= 330 – 60 = 270 km

Now, Relative speed of two trains = 60 + 75 = 135 km/hr

∴ Time of meeting of two trains

$= \frac{270}{135}$ = 2 hrs.

Therefore, both the trains will meet at 9 + 2 = 11 A.M.

2. (2) Using Rule 6,

Men are walking in opposite directions. Hence, they will cover the length of bridge at their relative speed.

Required time

$= \frac{1200}{(5+10)}$ = 80 minutes

3. (2) Using Rule 3,

If two trains be moving in opposite directions at rate u and v kmph respectively, then their relative speed

= $(u + v)$ kmph.

Further, if their length be x and y km. then time taken to cross each other $= \frac{x+y}{u+v}$ hours.

Here,

Total length = 160 + 140

= 300m.

Relative speed = (77 + 67) kmph

= 144 kmph $= 144 \times \frac{5}{18}$ m/s

or 40 m/sec.

∴ Time $= \frac{300}{40} = 7\frac{1}{2}$ Seconds

4. (3) Using Rule 3,

Let the speed of each train be x kmph.

Their relative speed

= $x + x = 2x$ kmph.

Time taken

$= \frac{\text{Total length of trains}}{\text{Relative Speed}}$

$= \frac{12}{60 \times 60} = \frac{240 \times \frac{1}{1000}}{2x}$

$= \frac{1}{300} = \frac{120}{1000x}$

$x = \frac{300 \times 120}{1000} = 36$

The required speed = 36 kmph.

5. (2) Using Rule 3,

Total length of trains

= 140 + 160 = 300 m.

Relative speed = 60 + 40

= 100 kmph

$= 100 \times \frac{5}{18}$ m/sec.

or $\frac{250}{9}$ m/sec.

∴ Time taken to cross each other

$= \frac{300}{\frac{250}{9}} = \frac{300 \times 9}{250} = 10.8$ sec.

6. (3) Let train A start from station A and B from station B.

Let the trains A and B meet after t hours.

∴ Distance covered by train A in t hours = $50t$

Distance covered by train B in t hours = $60t$ km

According to the question,

$60t - 50t = 120$

$\Rightarrow t = \frac{120}{10}$ = 12 hours.

∴ Distance AB = 50 × 12 + 60 × 12 = 600 + 720 = 1320 km

Aliter : Using Rule 12,

Here, a = 60, b = 50, d = 120

Distance between A and B

$= \left(\frac{a+b}{a-b}\right) \times d$

$= \left(\frac{60+50}{60-50}\right) \times 120$

$= \frac{110}{10} \times 120$ = 1320 km

7. (2) Let the speed of second train be x m/s.

80 km/h = $\frac{80 \times 5}{18}$ m / s

According to the question

$$\frac{1000}{x + \frac{80 \times 5}{18}} = 18$$

$\Rightarrow$ 1000 = 18x + 400

$\therefore x = \frac{600}{18}$ m/s

$= \frac{600}{18} \times \frac{18}{5}$ km/h = 120 km/h

8. (2) Using Rule 3,
Length of both trains
= 105 + 90 = 195 m.
Relative speed = (45 + 72)
= 117 kmph

$= 117 \times \frac{5}{18}$ or $\frac{65}{2}$ m/sec.

$\therefore$ Time taken $= \frac{195}{\frac{65}{2}} = \frac{195 \times 2}{65}$

= 6 seconds

9. (1) Using Rule 3,
Let the length of each train be x metre.

Speed of first train = $\frac{x}{18}$ m/sec

Speed of second train = $\frac{x}{12}$ m/sec

When both trains cross each other, time taken

$$= \frac{2x}{\frac{x}{18} + \frac{x}{12}}$$

$$= \frac{2x}{\frac{2x + 3x}{36}} = \frac{2x \times 36}{5x}$$

$= \frac{72}{5}$ = 14.4 seconds

10. (4) Using Rule 3,
Let the speed of the second train be x m/s
Speed of first train

$= \frac{150}{15}$ = 10 m/sec

Relative speed of trains
= (x + 10) m/s
Total distance covered
= 150 + 150 = 300 metre

$\therefore$ Time taken = $\frac{300}{x + 10}$

$\Rightarrow \frac{300}{x + 10} = 12$

$\Rightarrow$ 12x + 120 = 300

$\Rightarrow$ 12x = 300 – 120 = 180

$\Rightarrow x = \frac{180}{12}$ = 15 m/s

$= \frac{15 \times 18}{5}$ or 54 kmph.

11. (4) Let the length of the train travelling at 48 kmph be x metres.
Let the length of the platform be y metres.
Relative speed of train
= (48 + 42) kmph

$= \frac{90 \times 5}{18}$ m./sec.

= 25 m./sec.
and 48 kmph

$= \frac{48 \times 5}{18} = \frac{40}{3}$ m./sec.

According to the question,

$$\frac{x + \frac{x}{2}}{25} = 12$$

$\Rightarrow \frac{3x}{2 \times 25} = 12$

$\Rightarrow$ 3x = 2 × 12 × 25 = 600

$\Rightarrow x$ = 200 m.

Also, $\frac{200 + y}{40 / 3}$ = 45

$\Rightarrow$ 600 + 3y = 40 × 45

$\Rightarrow$ 3y = 1800 – 600 = 1200

$\Rightarrow y = \frac{1200}{3}$ = 400 m.

12. (2) Let two trains meet after t hours when the train from town A leaves at 8 AM.
$\therefore$ Distance covered in t hours at 70 kmph + Distance covered in (t – 2) hours at 110 kmph = 500km

$\therefore$ 70t + 110 (t – 2) = 500

$\Rightarrow$ 70t + 110t – 220 = 500

$\Rightarrow$ 180 t = 500 + 220 = 720

$\Rightarrow t = \frac{720}{180} = 4$ hours

Hence, the trains will meet at 12 noon.

13. (3) Using Rule 3,
Relative speed
= (68 + 40) kmph = 108 kmph

$= \left(\frac{108 \times 5}{18}\right)$ m/s or 30 m/s

$\therefore$ Required time

$$= \frac{\text{Sum of the lengths of both trains}}{\text{Relative speed}}$$

$= \left(\frac{70 + 80}{30}\right)$ second = 5 seconds

14. (3) Using Rule 3,
When a train crosses a telegraph post, it covers its own length.

$\therefore$ Speed of first train $= \frac{120}{10}$

= 12 m/sec.

Speed of second train $= \frac{120}{15}$

= 8 m/sec.
Relative speed = 12 + 8
= 20 m/sec.
Required time

$$= \frac{\text{Total length of trains}}{\text{Relative speed}}$$

$= \frac{2 \times 120}{20}$ = 12 seconds.

15. (3) Using Rule 3,
Relative speed = 42 + 48
= 90 kmph

$= \left(\frac{90 \times 5}{18}\right)$ m/s = 25 m/s

Sum of the length of both trains
= 137 + 163 = 300 metres
$\therefore$ Required time

$= \frac{300}{25} = 12$ seconds

16. (1) Using Rule 3,
Speed of second train
= 43.2 kmph

$= \frac{43.2 \times 5}{18}$ m/sec.

or 12 m/sec.
Let the speed of first train be x m per second, then

$$\frac{150 + 120}{x + 12} = 10$$

$\Rightarrow 27 = x + 12$

$\Rightarrow x$ = 15 m/s

$= 15 \times \frac{18}{5}$ kmph = 54 kmph

17. (1) Let the trains meet after t hours

Then, $21t - 16t = 60$

$\Rightarrow 5t = 60 \Rightarrow t = 12$ hours

$\therefore$ Distance between A and B

$= (16 + 21) \times 12$

$= 37 \times 12 = 444$ miles

Aliter : Using Rule 13,

Here, a = 21, b = 16, d = 60

Distance between A and B

$= \left(\frac{a+b}{a-b}\right) \times d$

$= \left(\frac{21+16}{21-16}\right) \times 60$

$= \frac{37}{5} \times 60$

$= 37 \times 12 = 444$ miles

18. (3) Using Rule 3,

Relative speed = 45 + 54

= 99 kmph

$= \left(99 \times \frac{5}{18}\right)$ m/sec.

or $\frac{55}{2}$ m/sec.

$\therefore$ Required time $= \frac{108+112}{\frac{55}{2}}$

$= \frac{220 \times 2}{55} = 8$ seconds

19. (2) Let the length of each train be x metres

Then, Speed of first train $= \frac{x}{3}$ m/sec

Speed of second train $= \frac{x}{4}$ m/sec

They are moving in opposite directions

$\therefore$ Relaive speed $= \frac{x}{3} + \frac{x}{4}$

$= \frac{4x+3x}{12} = \frac{7x}{12}$ m/sec.

Total length $= x + x = 2x$ m.

$\therefore$ Time taken $= \frac{2x}{\frac{7x}{12}} = \frac{24}{7}$

$= 3\frac{3}{7}$ sec.

20. (2) Using Rule 3,

Total length of both trains = 250 metres

Let speed of second train = x kmph

Relative speed = $(65 + x)$ kmph

$= (65 + x) \times \frac{5}{18}$ m/sec

$\therefore$ Time

$= \frac{\text{Sum of length of trains}}{\text{Relative speed}}$

$\Rightarrow 6 = \frac{250}{(65+x) \times \frac{5}{18}}$

$\Rightarrow 6 \times \frac{5}{18} \times (65 + x) = 250$

$\Rightarrow 65 + x = \frac{250 \times 3}{5}$

$\Rightarrow 65 + x = 150$

$\Rightarrow x = 150 - 65 = 85$ kmph

21. (3) Using Rule 6,

Relative speed = (84 + 6)

= 90 kmph

$= \left(90 \times \frac{5}{18}\right)$ m/sec.

= 25 m/sec.

$\therefore$ Length of train

= Relative speed × Time

= 25 × 4 = 100 metre

22. (3) Using Rule 11,

$\frac{\text{Speed of X}}{\text{Speed of Y}}$

$= \sqrt{\frac{\text{Time taken by Y}}{\text{Time taken by X}}}$

$\Rightarrow \frac{45}{y} = \sqrt{\frac{\text{3 hours 20 min.}}{\text{4 hours 48 min.}}}$

$\Rightarrow \frac{45}{y} = \sqrt{\frac{\text{200 minutes}}{\text{288 minutes}}}$

$= \frac{10}{12}$

$\Rightarrow 10y = 12 \times 45$

$\Rightarrow y = \frac{12 \times 45}{10} = 54$ kmph

23. (3) Let P and Q meet after t hours.

Distance = speed × time

According to the question,

$30t - 20t = 36$

$\Rightarrow 10t = 36$

$\Rightarrow t = \frac{36}{10} = 3.6$ hours

$\therefore$ Distance between P and Q

$= 30t + 20t$

$= 50t = (50 \times 3.6)$ km.

= 180 km.

Aliter : Using Rule 13,

Here, a = 30, b = 20, d = 36

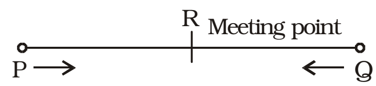
Required distance

$= \left(\frac{a+b}{a-b}\right) \times d$

$= \left(\frac{30+20}{30-20}\right) \times 36$

$= \frac{50}{10} \times 36 = 180$ km

24. (3)



Speed of train starting from Q

$= x$ kmph

$\therefore$ Speed of train starting from P

$= (x + 8)$ kmph

According to the question,

PR + RQ = PQ

$\Rightarrow (x + 8) \times 6 + x \times 6 = 162$

[Distance = Speed × Time]

$\Rightarrow 6x + 48 + 6x = 162$

$\Rightarrow 12x = 162 - 48 = 114$

$\Rightarrow x = \frac{114}{12} = \frac{19}{2}$

$= 9\frac{1}{2}$ kmph

25. (1) Let the trains meet after t hours.

Distance = Speed × Time

According to the question,

$75t - 50t = 175$

$\Rightarrow 25t = 175$

$\Rightarrow t = \frac{175}{25} = 7$ hours

$\therefore$ Distance between A and B

$= 75t + 50t = 125t$

$= 125 \times 7 = 875$ km.

Aliter : Using Rule 13,

Here, a = 75, b = 50, d = 175

Required distance

$= \left(\frac{a+b}{a-b}\right) \times d$

$= \left(\frac{75+50}{75-50}\right) \times 175$

$= \frac{125}{25} \times 175$

$= 125 \times 7 = 875$ km

26. (4) Using Rule 3,
Relative speed
= (50 + 58) kmph

$= \left(108 \times \frac{5}{18}\right)$ m/sec.

= 30 m/sec

$\therefore$ Required time

$= \frac{\text{Total length of trains}}{\text{Relative speed}}$

$= \left(\frac{150+180}{30}\right)$ seconds

$= \left(\frac{330}{30}\right)$ seconds

= 11 seconds

27. (1) Let the trains meet each other after t hours.
Distance = Speed × Time
According to the question,
$21t - 14t = 70$

$\Rightarrow 7t = 70 \Rightarrow t = \frac{70}{7}$

= 10 hours

$\therefore$ Required distance
$= 21t + 14t = 35t$
= 35 × 10 = 350 km.

Aliter : Using Rule 13,
Here, a = 21, b = 14, d = 70
Required distance

$= \left(\frac{a+b}{a-b}\right) \times d$

$= \left(\frac{21+14}{21-14}\right) \times 70$

$= \frac{35}{7} \times 70 = 350$ km.

TYPE-V

1. (3) Since the train runs at $\frac{7}{11}$ of its own speed, the time it takes is $\frac{11}{7}$ of its usual speed.

Let the usual time taken be t hours.

Then we can write, $\frac{11}{7}t = 22$

$\therefore t = \frac{22 \times 7}{11} = 14$ hours

Hence, time saved
= 22 – 14 = 8 hours

2. (3) $\frac{3}{5}$ of usual speed will take $\frac{5}{3}$ of usual time.

[$\because$ time & speed are inversely proportional]

$\therefore \frac{5}{3}$ of usual time

= usual time + $\frac{5}{2}$

$\Rightarrow \frac{2}{3}$ of usual time = $\frac{5}{2}$

$\Rightarrow$ usual time

$= \frac{5}{2} \times \frac{3}{2} = \frac{15}{4} = 3\frac{3}{4}$ hours.

Aliter : Using Rule 8,

Here, A = 3, B = 5, t = $2\frac{1}{2}$

Usual time

$= \frac{A}{\text{Diff. of A and B}} \times \text{time}$

$= \frac{3}{5-3} \times 2\frac{1}{2}$

$= \frac{3}{2} \times \frac{5}{2}$

$= \frac{15}{4} = 3\frac{3}{4}$ hours

3. (2) 1 hr 40 min 48 sec

$= 1 \text{ hr } \left(40 + \frac{48}{60}\right)$ min

$= 1 \text{ hr } \left(40 + \frac{4}{5}\right)$ min

$= 1 \text{ hr } \frac{204}{5}$ min

$= \left(1 + \frac{204}{300}\right) \text{hr} = \frac{504}{300}$ hr

$\therefore$ Speed $= \frac{42}{\frac{504}{300}} = 25$ kmph

Now, $\frac{5}{7} \times$ usual speed = 25

$\therefore$ Usual speed $= \frac{25 \times 7}{5}$

= 35 kmph

4. (3) $\frac{4}{3} \times \text{usual time} - \text{usual time} = 2$

$\Rightarrow \frac{1}{3}$ usual time = 2

$\therefore$ Usual time = 2 × 3 = 6 hours

Aliter : Using Rule 8,

Here, $\frac{A}{B} = \frac{3}{4}$, time= 2 hrs.

Usual Speed

$= \frac{A}{\text{Diff. of A \& B}} \times \text{time}$

$= \frac{3}{(4-3)} \times 2 = 6$ hours

5. (2) $\frac{4}{3}$ of usual time

= Usual time + 20 minutes

$\therefore \frac{1}{3}$ of usual time = 20 minutes

$\Rightarrow$ Usual time = 20 × 3
= 60 minutes

Aliter : Using Rule 8,
Here, A = 3, B= 4, t = 20 minutes
Usual time taken

$= \frac{A}{\text{Diff. of A \& B}} \times \text{time}$

$= \frac{3}{(4-3)} \times 20 = 60$ minutes

6. (1) Time and speed are inversely proportional.

$\therefore \frac{4}{3}$ of usual time – usual time

$= \frac{3}{2}$

$\Rightarrow \frac{1}{3} \times$ usual time $= \frac{3}{2}$

$\therefore$ Usual time $= \frac{3 \times 3}{2} = \frac{9}{2}$

$= 4\frac{1}{2}$ hours

Aliter : Using Rule 8,

Here, A = 3, B = 4, t= $\frac{3}{2}$

Usual time

$= \frac{A}{\text{Diff. of A \& B}} \times \text{time}$

$= \frac{3}{(4-3)} \times \frac{3}{2}$

$= 4\frac{1}{2}$ hrs.

7. (1) Time and speed are inversely proportional.

$\therefore \frac{7}{6} \times$ Usual time – Usual time

= 25 minutes

$\Rightarrow$ Usual time $\left(\frac{7}{6}-1\right)$

= 25 minutes

$\Rightarrow$ Usual time $\times \frac{1}{6}$

= 25 minutes

$\therefore$ Usual time = 25 × 6

= 150 minutes

= 2 hours 30 minutes

Aliter : Using Rule 8,

Here, A = 6, B = 7,

t $= \frac{25}{60} = \frac{5}{12}$ hrs.

Usual time

$= \frac{A}{\text{Diff. of A \& B}} \times \text{time}$

$= \frac{6}{(7-6)} \times \frac{5}{12} = \frac{5}{2}$ hrs.

= 2 hours 30 minutes

8. (2) Time and speed are inversely proportional.

$\therefore$ Usual time $\times \frac{7}{6}$ – usual time

= 12 minutes

$\Rightarrow$ Usual time $\times \frac{1}{6} = 12$ minutes

$\therefore$ Usual time = 72 minutes

= 1 hour 12 minutes

Aliter : Using Rule 8,

Here, A = 6, B = 7,

t $= \frac{12}{60} = \frac{1}{5}$ hrs.

Usual time

$= \frac{A}{\text{Diff. of A \& B}} \times \text{time}$

$= \frac{6}{(7-6)} \times \frac{1}{5} = 1\frac{1}{5}$ hrs.

= 1 hrs. 12 minutes

9. (2) Fixed distance = x km and certain speed = y kmph (let).

Case I,

$\frac{x}{y+10} = \frac{x}{y} - 1$

$\Rightarrow \frac{x}{y+10} + 1 = \frac{x}{y}$ --- (i)

Case II,

$\frac{x}{y+20} = \frac{x}{y} - 1 - \frac{3}{4}$

$= \frac{x}{y} - \frac{4+3}{4}$

$\Rightarrow \frac{x}{y+20} + \frac{7}{4} = \frac{x}{y}$ --- (ii)

From equations (i) and (ii),

$\frac{x}{y+10} + 1 = \frac{x}{y+20} + \frac{7}{4}$

$\Rightarrow \frac{x}{y+10} - \frac{x}{y+20} = \frac{7}{4} - 1$

$\Rightarrow x\left(\frac{y+20-y-10}{(y+10)(y+20)}\right)$

$= \frac{7-4}{4} = \frac{3}{4}$

$\Rightarrow \frac{x \times 10}{(y+10)(y+20)} = \frac{3}{4}$

$\Rightarrow$ 3 (y + 10) (y + 20) = 40 x

$\Rightarrow \frac{3(y+10)(y+20)}{40} = x$ --(iii)

From equation (i),

$\frac{3(y+10)(y+20)}{40(y+10)} + 1$

$= \frac{3\ (y+10)\ (y+20)}{40y}$

$\Rightarrow$ 3 (y +20) + 40

$= \frac{3(y+10)(y+20)}{y}$

$\Rightarrow 3y^2 + 60y + 40\,y = 3(y^2 + 30y + 200)$

$\Rightarrow 3y^2 + 100y = 3y^2 + 90y + 600$

$\Rightarrow 10y = 600 \Rightarrow y = 60$

Again from equation (i),

$\frac{x}{y+10} + 1 = \frac{x}{y}$

$\Rightarrow \frac{x}{60+10} + 1 = \frac{x}{60}$

$\Rightarrow \frac{x}{70} + 1 = \frac{x}{60}$

$\Rightarrow \frac{x+70}{70} = \frac{x}{60}$

$\Rightarrow 6x + 420 = 7x$

$\Rightarrow 7x - 6x = 420$

$\Rightarrow x = 420$ km.

10. (2) Total distance

= 7 × 4 = 28 km.

Total time

$= \left(\frac{7}{10}+\frac{7}{20}+\frac{7}{30}+\frac{7}{60}\right)$ hours

$= \left(\frac{42+21+14+7}{60}\right)$ hours

$= \frac{84}{60}$ hours $= \frac{7}{5}$ hours

$\therefore$ Average speed

$= \frac{\text{Total distance}}{\text{Total time}} = \left(\frac{28}{\frac{7}{5}}\right)$ kmph

$= \frac{28 \times 5}{7}$ = 20 kmph

11. (2) 1 m/sec = $\frac{18}{5}$ kmph

$\therefore$ 20 m/sec $= \frac{20 \times 18}{5}$

= 72 kmph

12. (1) 1 kmph $= \frac{5}{18}$ m/sec

$\therefore$ 54 kmph $= \frac{5}{18} \times 54$

= 15 m/sec.

13. (3) Speed of car = x kmph.

$\therefore$ Distance = Speed × Time

= $25x$ km.

Case II,

Speed of car $= \frac{4x}{5}$ kmph.

Distance covered = $\frac{4x}{5} \times 25$

$= 20x$ km.

According to the question,

$25x - 20x = 200$

$\Rightarrow 5x = 200$

$\Rightarrow x = \frac{200}{5} = 40$ kmph.

14. (2) Speed of car = x kmph.

Relative speed = $(x - 4)$ kmph.

Time = 3 minutes = $\frac{3}{60}$ hour = $\frac{1}{20}$ hour

Distance = 130 metre

$= \frac{130}{1000}$ km. $= \frac{13}{100}$ km.

$\therefore$ Relative speed = $\frac{\text{Distance}}{\text{Time}}$

$\Rightarrow x - 4 = \frac{13}{100} \times 20$

$\Rightarrow 5x - 20 = 13$

$\Rightarrow 5x = 20 + 13 = 33$

$\Rightarrow x = \frac{33}{5} = 6\frac{3}{5}$ kmph.

TYPE-VI

1. (2) Total distance = 10 + 12 = 22 km

Total time $= \frac{10}{12} + \frac{12}{10} = \frac{244}{120}$ hours

$\therefore$ Required average speed

$= \frac{\text{Total distance}}{\text{Total time}} = \frac{22}{\frac{244}{120}} = \frac{22}{244} \times 120$

= 10.8 km/hr.

Aliter : Using Rule 3,

Here, $d_1 = 10$, $S_1 = 12$

$d_2 = 12$, $S_2 = 10$

Average Speed = $\frac{d_1 + d_2}{\frac{d_1}{S_1} + \frac{d_2}{S_2}}$

$= \frac{10 + 12}{\frac{10}{12} + \frac{12}{10}} = \frac{22 \times 120}{244}$

= 10.8 km/hrs.

2. (1) Using Rule 3,

Total time

$= \frac{600}{80} + \frac{800}{40} + \frac{500}{400} + \frac{100}{50}$

$= \frac{246}{8}$ hours.

Average speed

$= \frac{600 + 800 + 500 + 100}{\frac{246}{8}}$

$= \frac{2000 \times 8}{246} = 65\frac{5}{123}$ km/hr.

3. (2) Using Rule 3,

Average speed

$= \frac{\text{Total distance}}{\text{time taken}}$

$= \frac{30 \times \frac{12}{60} + 45 \times \frac{8}{60}}{\frac{12}{60} + \frac{8}{60}}$

$= 12 \times 3 = 36$ kmph

4. (3) Using Rule 5,

If the same distance are covered at different speed of x kmph and y kmph, the average speed of the whole journey is given by $= \frac{2xy}{x+y}$ kmph.

$\therefore$ Required average speed

$= \frac{2 \times 6 \times 3}{6 + 3} = \frac{36}{9} = 4$ kmph

5. (3) Using Rule 5,

If two equal distances are covered at two unequal speed of x kmph and y kmph, then average speed = $\left(\frac{2xy}{x+y}\right)$ kmph

$= \frac{2 \times 12 \times 4}{12 + 4} = \frac{96}{16} = 6$ kmph

6. (1) Using Rule 2,

Remaining distance

= (3584 – 1440 – 1608) km

= 536 km.

This distance is covered at the rate of $\frac{536}{8} = 67$ kmph.

Average speed of whole journey

$= \frac{3584}{56} = 64$ kmph

$\therefore$ Required difference in speed

= (67 – 64) kmph i.e. = 3 kmph more

7. (2) Using Rule 2,

Total distance

= 24 + 24 + 24 = 72 km.

Total time

$= \left(\frac{24}{6} + \frac{24}{8} + \frac{24}{12}\right)$ hours

= (4 + 3 + 2) hours = 9 hours

$\therefore$ Required average speed

$= \frac{\text{Total distance}}{\text{Total time}} = \frac{72}{9} = 8$ kmph.

8. (4) Using Rule 5,

If same distance are covered at two different speed of x and y kmph, the average speed of journey = $\frac{2xy}{x+y}$

$= \left(\frac{2 \times 100 \times 80}{100 + 80}\right)$ kmph

= 88.89 kmph

9. (2) Using Rule 5,

Required average speed

$= \left(\frac{2xy}{x+y}\right)$ kmph

[Since, can be given as corollary If the distance between A and B be z units, then

Average speed $= \frac{\text{Total distance}}{\text{Time taken}}$

$= \frac{z + z}{\frac{z}{x} + \frac{z}{y}}$

$= \frac{2}{\frac{1}{x} + \frac{1}{y}} = \frac{2}{\frac{x+y}{xy}} = \frac{2xy}{x+y}$]

10. (1) Using Rule 5,

Average speed

$= \left(\frac{2xy}{x+y}\right)$ kmph

$= \left(\frac{2 \times 40 \times 60}{40 + 60}\right)$ kmph

= 48 kmph

11. (1) Using Rule 5,

Average speed

$= \left(\frac{2\,xy}{x+y}\right)$ kmph

$= \left(\frac{2 \times 12 \times 18}{12 + 18}\right)$ kmph

$= \left(\frac{2 \times 12 \times 18}{30}\right)$ kmph

$= 14\frac{2}{5}$ kmph

12. (2) Let the total distance be x km.

Total time $= \frac{\frac{x}{3}}{25} + \frac{\frac{x}{4}}{30} + \frac{\frac{5x}{12}}{50}$

$= \frac{x}{75} + \frac{x}{120} + \frac{x}{120}$

$= \frac{x}{75} + \frac{x}{60} = \frac{4x+5x}{300} = \frac{3x}{100}$ hours

$\therefore$ Average speed

$= \frac{\text{Total distance}}{\text{Time taken}}$

$= \frac{x}{\frac{3x}{100}} = \frac{100}{3} = 33\frac{1}{3}$ kmph

Aliter : Using Rule 18,
Here, x = 3, u = 25
y = 4, v = 30

z = $\frac{12}{5}$, w = 50

Average Speed$= \frac{1}{\frac{1}{xu}+\frac{1}{yv}+\frac{1}{zw}}$

$= \frac{1}{\frac{1}{3\times25}+\frac{1}{4\times30}+\frac{1}{\frac{12}{5}\times50}}$

$= \frac{1}{\frac{1}{75}+\frac{1}{120}+\frac{1}{120}}$

$= \frac{1}{\frac{1}{75}+\frac{1}{60}} = \frac{1}{\frac{4+5}{300}}$

$= \frac{300}{9} = \frac{100}{3}$

$= 33\frac{1}{3}$ km/hr.

13. (1) Time taken to cover 30km at

6 kmph = $\frac{30}{6}$ = 5 hours

Time taken to cover 40 km = 5 hours

$\therefore$ Average speed

$= \frac{\text{Total distance}}{\text{Total time}} = \frac{30+40}{10}$

$= \frac{70}{10} = 7$ kmph

14. (1) Using Rule 5,
Here same distances are covered at different speeds.
$\therefore$ Average speed

$= \left(\frac{2xy}{x+y}\right)$kmph

$= \left[\frac{2\times36\times45}{(36+45)}\right]$ kmph

$= \frac{2\times36\times45}{81} = 40$ kmph

15. (1) Using Rule 5,
Here, the distances are equal.
$\therefore$ Average speed

$= \left(\frac{2\times100\times150}{100+150}\right)$ kmph

$= \frac{2\times100\times150}{250}$

= 120 kmph

16. (2) Using Rule 2,
Total distance
= 5 × 6 + 3 × 6
= 30 + 18 = 48 km
Total time = 9 hours
$\therefore$ Average speed

$= \frac{48}{9} = \frac{16}{3} = 5\frac{1}{3}$ kmph

17. (3) Let the length of journey be x km, then

$\frac{x}{35} - \frac{x}{40} = \frac{15}{60} = \frac{1}{4}$

$\Rightarrow \frac{8x-7x}{280} = \frac{1}{4}$

$\Rightarrow x = \frac{280}{4} = 70$ km

18. (3) Using Rule 3,
Average speed

$= \frac{\text{Total distance}}{\text{Time taken}}$

$= \frac{12}{\frac{3}{10}+\frac{3}{20}+\frac{3}{30}+\frac{3}{60}}$

$= \frac{12}{3\left(\frac{6+3+2+1}{60}\right)}$

$= \frac{12\times60}{3\times12} = 20$ kmph

19. (1) Using Rule 2,
Distance covered

$= \left(35\times\frac{10}{60}+20\times\frac{5}{60}\right)$ km

$= \left(\frac{35}{6}+\frac{10}{6}\right) = \frac{45}{6}$ km

Total time = 15 minutes

$= \frac{1}{4}$ hour

$\therefore$ Required average speed

$= \frac{\text{Distance covered}}{\text{Time taken}}$

$= \frac{45}{6}\times4$

= 30 kmph

20. (2) Using Rule 2,
Total distance = 100 km.
Total time

$= \frac{50}{50}+\frac{40}{40}+\frac{10}{20}$

$= 1+1+\frac{1}{2} = \frac{5}{2}$hours

$\therefore$ Average speed $= \frac{100\times2}{5}$

= 40 kmph

21. (4) Using Rule 5,
Required average speed

$= \frac{2\times30\times20}{30+20}$

[$\because$ Distance covered is same]

$= \frac{2\times30\times20}{50} = 24$ kmph

22. (3) Using Rule 11,
If A and B meet after t hours, then
4 t + 6 t = 20
$\Rightarrow$ 10 t = 20

$\Rightarrow t = \frac{20}{10}$ = 2 hours.

Hence, both will meet at 9 a.m.

23. (3) Using Rule 5,

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

$= \frac{2\times20\times30}{20+30} = \frac{2\times20\times30}{50}$

= 24 kmph

24. (1) Using Rule 5,
Average speed of whole journey

$= \left(\frac{2xy}{x+y}\right)$ kmph

$= \frac{2 \times 50 \times 30}{50+30} = \frac{2 \times 50 \times 30}{80}$

= 37.5 kmph

25. (4) Required distance of office from house = x km. (let)

Time $= \frac{\text{Distance}}{\text{Speed}}$

∴ According to the question,

$\frac{x}{5} - \frac{x}{6} = \frac{6+2}{60} = \frac{2}{15}$

$\Rightarrow \frac{6x-5x}{30} = \frac{2}{15}$

$\Rightarrow \frac{x}{30} = \frac{2}{15}$

$\Rightarrow x = \frac{2}{15} \times 30 = 4$ km.

Aliter : Using Rule 10,
Here, $S_1 = 5$, $t_1 = 6$
$S_2 = 6$, $t_2 = 2$

Distance $= \frac{(S_1 \times S_2)(t_1+t_2)}{S_2 - S_1}$

$= \frac{(5 \times 6)(6+2)}{6-5}$

$= 30 \times \frac{8}{60} = 4$ km.

26. (4) Using Rule 1,

Time $= \frac{\text{Distance}}{\text{Speed}} = \frac{1050}{75}$

= 14 hours

27. (2) Using Rule 2,
Total distance covered by train in 5 minutes
= (500 + 625 + 750 + 875 + 1000) metre = 3750 metre
= 3.75 km.

Time = 5 minutes $= \frac{5}{60}$ hour

$= \frac{1}{12}$ hour

Speed of train $= \frac{\text{Distance}}{\text{Time}}$

$= \left(\frac{3.75}{\frac{1}{12}}\right)$ kmph

= (3.75 × 12) kmph
= 45 kmph

28. (1) Distance covered in first 2 hours
= 2 × 20 = 40 km.
Remaining distance
= 100 – 40 = 60 km.
Time taken in covering 60 km at 10 kmph

$= \frac{60}{10} = 6$ hours

∴ Required average speed

$= \frac{\text{Total distance}}{\text{Total Time}}$

$= \left(\frac{100}{2+6}\right)$ kmph

$= \left(\frac{100}{8}\right)$ kmph

$= \frac{25}{2}$ kmph $= 12\frac{1}{2}$ kmph

29. (1) Difference of time = 5 + 3 = 8 minutes

$= \frac{8}{60}$ hour $= \frac{2}{15}$ hour

If the speed of motorbike be x kmph, then

$\frac{25}{50} - \frac{25}{x} = \frac{2}{15}$

$\Rightarrow \frac{25}{x} = \frac{1}{2} - \frac{2}{15}$

$\Rightarrow \frac{25}{x} = \frac{15-4}{30} = \frac{11}{30}$

$\Rightarrow 11x = 25 \times 30$

$\Rightarrow x = \frac{25 \times 30}{11} = \frac{750}{11}$

= 68.18 kmph
≈ 68 kmph

30. (4) Let the speed of cyclist while returning be x kmph.
∴ Average speed

$= \frac{2 \times 16 \times x}{16+x}$

$\Rightarrow 6.4 = \frac{32x}{16+x}$

$\Rightarrow 6.4 \times 16 + 6.4x = 32x$
$\Rightarrow 32x - 6.4x = 6.4 \times 16$
$\Rightarrow 25.6x = 6.4 \times 16$

$\Rightarrow x = \frac{6.4 \times 16}{25.6} = 4$ kmph.

31. (3) Total distance covered
= 400 km.

Total time $= \frac{25}{2}$ hours

∴ $\frac{3}{4}$ th of total journey

$= \frac{3}{4} \times 400 = 300$ km.

Time taken $= \frac{\text{Distance}}{\text{Speed}}$

$= \frac{300}{30} = 10$ hours

Remaining time $= \frac{25}{2} - 10$

$= \frac{25-20}{2} = \frac{5}{2}$ hours

Remaining distance
= 100 km.
∴ Required speed of car

$= \frac{100}{\frac{5}{2}} = \frac{100 \times 2}{5} = 40$ kmph.

32. (3) Durga's average speed

$= \left(\frac{2xy}{x+y}\right)$ kmph.

$= \left(\frac{2 \times 5 \times 15}{5+15}\right)$ kmph.

$= \left(\frac{2 \times 5 \times 15}{20}\right)$ kmph

$= \frac{15}{2}$ kmph

Distance of School = 5 km.

Smriti's speed $= \frac{15}{4}$ kmph

∴ Required time $= 2\left(\frac{5}{\frac{15}{4}}\right)$ hours

$= \left(\frac{2 \times 5 \times 4}{15}\right) = \frac{8}{3}$ hours

$= \left(\frac{8}{3} \times 60\right)$ minutes

= 160 minutes

33. (4) Here, distances are equal.

$\therefore$ Average speed

$$= \left(\frac{2xy}{x+y}\right) \text{ kmph.}$$

$$= \left(\frac{2 \times 32 \times 40}{32+40}\right) \text{ kmph.}$$

$$= \left(\frac{2 \times 32 \times 40}{72}\right) \text{ kmph.}$$

$$= \left(\frac{320}{9}\right) \text{ kmph.} = 35.55 \text{ kmph.}$$

34. (1) Here, distance is same.

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

$$= \left(\frac{2 \times 40 \times 60}{40+60}\right) \text{ kmph.}$$

$$= \left(\frac{2 \times 40 \times 60}{100}\right) \text{ kmph.}$$

= 48 kmph.

35. (2) Total distance covered by the bus = 150 km. + 2 × 60 km.
= (150 + 120) km.
= 270 km.

$\therefore$ Average speed

$$= \frac{\text{Total distance}}{\text{Time taken}}$$

$$= \frac{270}{5} = 54 \text{ kmph.}$$

36. (3) Here distances are same.

$$\therefore \text{ Average speed } = \left(\frac{2xy}{x+y}\right) \text{ kmph}$$

$$= \left(\frac{2 \times 12 \times 10}{12+10}\right) \text{ kmph}$$

$$= \left(\frac{240}{22}\right) \text{ kmph}$$

= 10.9 kmph

37. (1) Total distance covered
= (50 + 40 + 90) km
= 180 km

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$\therefore$ Total time taken

$$= \left(\frac{50}{25} + \frac{40}{20} + \frac{90}{15}\right) \text{ hours}$$

= (2 + 2 + 6) hours
= 10 hours

$\therefore$ Average speed

$$= \frac{\text{Total distance}}{\text{Total time taken}}$$

$$= \frac{180}{10} = 18 \text{ kmph}$$

38. (1) Distance = Speed × Time
= (80 × 7) km.
= 560 km.

39. (4) Required speed of car

$$= \frac{\text{Distance}}{\text{Time}}$$

$$= \left(\frac{216}{3.2}\right) \text{ kmph.}$$

$$= \left(\frac{216}{3.2} \times \frac{5}{18}\right) \text{ m./sec.}$$

= 18.75 m./sec.

TYPE-VII

1. (3) Let the distance of destination be D km
Let the speed of A = 3x km/hr
then speed of B = 4x km/hr
$\therefore$ According to question,

$$\frac{D}{3x} - \frac{D}{4x} = 30 \text{ minutes}$$

$$= \frac{1}{2}\text{hr}$$

$$\therefore \frac{D}{12x} = \frac{1}{2}$$

$$\Rightarrow \frac{D}{3x} = \frac{4}{2} = 2 \text{ hours}$$

Hence, time taken by A to reach destination = 2hrs.

Aliter : Using Rule 9,
Here, $S_1 = 3x$, $S_2 = 4x$

$$t_2 = y,\ t_1 = y + \frac{30}{60} = y + \frac{1}{2}$$

$$S_1t_1 = S_2t_2$$

$$3x \times \left(y + \frac{1}{2}\right) = 4 \text{ x} \times \text{y}$$

$$3y + \frac{3}{2} = 4y$$

$$y = \frac{3}{2}$$

$\therefore$ Time taken by A

$$= \frac{3}{2} + \frac{1}{2} = 2 \text{ hrs.}$$

2. (1) Ratio of speed = 3 : 4
Ratio of time taken = 4 : 3
Let the time taken by A and B be $4x$ hours and 3 x hours respectively.

$$\text{Then, } 4x - 3x = \frac{20}{60} \Rightarrow x = \frac{1}{3}$$

$\therefore$ Time taken by A = $4x$ hours

$$= \left(4 \times \frac{1}{3}\right) \text{ hours } = 1\frac{1}{3} \text{ hours}$$

Aliter : Using Rule 9,
Here, $S_1 = 3x$, $S_2 = 4x$

$$t_2 = y,\ t_1 = y + \frac{20}{60} = y + \frac{1}{3}$$

$$S_1t_1 = S_2t_2$$

$$3x\left(y + \frac{1}{3}\right) = 4xy$$

3y + 1 = 4y, y = 1

$\therefore$ Time taken by A

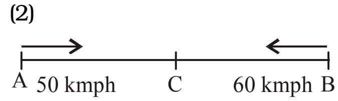
$$= 1 + \frac{1}{3} = 1\frac{1}{3} \text{ hours}$$

3. (3) Required ratio

$$= \frac{5}{6} : \frac{3}{5} = \frac{30 \times 5}{6} : \frac{30 \times 3}{5}$$

= 25 : 18

4. (2)



AC = Distance covered by train starting from A in 3 hours
= 50 × 3 = 150 km
BC = Distance covered by train starting from B in 2 hours
= 60 ×2 = 120 km
$\therefore$ AC : BC = 150 : 120 = 5 : 4

5. (2) Using Rule 11,
Required ratio of the speed of two

$$\text{trains} = \frac{\sqrt{9}}{\sqrt{4}} = \frac{3}{2} \text{ or } 3 : 2$$

6. (3) Using Rule 1,
Speed of second train

$$= \frac{364}{4} = 91 \text{ kmph}$$

$$\therefore\ 7x \equiv 91$$

$$\Rightarrow\ 6x \equiv \frac{91}{7x} \times 6x \equiv 78 \text{ kmph}$$

7. (3) Using Rule 1,
Speed of truck
= 550m/minute

$$\text{Speed of bus} = \frac{33000}{45} \text{ m/minute}$$

or $\frac{2200}{3}$ m/minute

$\therefore$ Required ratio $= 550 : \frac{2200}{3}$

$= 1 : \frac{4}{3} = 3 : 4$

8. (2) Required ratio $= \frac{1}{3} : \frac{2}{2} : \frac{3}{1}$

$= \frac{1}{3} : 1 : 3$

$\frac{1}{3} \times 3 : 1 \times 3 : 3 \times 3$

$\left[\because \text{ Speed} = \frac{\text{Distance}}{\text{Time}}\right]$

= 1 : 3 : 9

9. (3) The winner will pass the other, one time in covering 1600m. Hence, the winner will pass the other 3 times in completing 5km race.

10. (3) Using Rule 1,
Distance covered on the first day

$= \frac{4}{5} \times 70 = 56$ km

$\therefore$ Required ratio = 42 : 56
= 3 : 4

11. (1) Using Rule 1,
Let speed of cyclist = x kmph
& Time = t hours

Distance $= \frac{xt}{2}$ while time $= 2t$

$\therefore$ Required ratio $= \frac{xt}{2 \times 2t} : x$

= 1 : 4

12. (3) Using Rule 1,
Speed of train = x kmph
Speed of car = y kmph
Case I,

$\frac{120}{x} + \frac{600-120}{y} = 8$

$\Rightarrow \frac{120}{x} + \frac{480}{y} = 8$

$\Rightarrow \frac{15}{x} + \frac{60}{y} = 1$ ...(i)

Case II,

$\frac{200}{x} + \frac{400}{y} = 8$ hours 20 minutes

$\Rightarrow \frac{200}{x} + \frac{400}{y} = 8\frac{1}{3}$ hours

$= \frac{25}{3}$

$\Rightarrow \frac{8}{x} + \frac{16}{y} = \frac{1}{3}$

$\Rightarrow \frac{24}{x} + \frac{48}{y} = 1$ ....(ii)

$\therefore \frac{15}{x} + \frac{60}{y} = \frac{24}{x} + \frac{48}{y}$

$\Rightarrow \frac{24}{x} - \frac{15}{x} = \frac{60}{y} - \frac{48}{y}$

$\Rightarrow \frac{9}{x} = \frac{12}{y} \Rightarrow \frac{x}{y} = \frac{9}{12} = \frac{3}{4} = 3 : 4$

13. (2) Let the speed of train be x kmph. and the speed of car be y kmph.

Time $= \frac{\text{Distance}}{\text{Speed}}$

According to the question,

$\frac{120}{x} + \frac{480}{y} = 8$

$\Rightarrow \frac{15}{x} + \frac{60}{y} = 1$ ..... (i)

and, $\frac{200}{x} + \frac{400}{y} = \frac{25}{3}$

$\Rightarrow \frac{8}{x} + \frac{16}{y} = \frac{1}{3}$

$\Rightarrow \frac{24}{x} + \frac{48}{y} = 1$ ..... (ii)

From equations (i) and (ii),

$\Rightarrow \frac{24}{x} + \frac{48}{y} = \frac{15}{x} + \frac{60}{y}$

$\Rightarrow \frac{24}{x} - \frac{15}{x} = \frac{60}{y} - \frac{48}{y}$

$\Rightarrow \frac{9}{x} = \frac{12}{y}$

$\Rightarrow \frac{x}{y} = \frac{9}{12} = \frac{3}{4} = 3 : 4$

14. (3) Speed of truck $= \frac{550 \text{ metre}}{60 \text{ second}}$

$= \left(\frac{55}{6}\right)$ m./sec.

Speed of bus $= \frac{33 \times 1000 \text{ metre}}{\frac{3}{4} \times 60 \times 60 \text{ second}}$

$= \frac{440}{36}$ m./sec.

$\therefore$ Required ratio $= \frac{55}{6} : \frac{440}{36}$

= 55 × 6 : 440
= 3 : 4

15. (1) Speed $= \frac{\text{Distance}}{\text{Time}}$

$\therefore$ Speed of car : Speed of train

$= \frac{80}{2} : \frac{180}{3} = 40 : 60 = 2 : 3$

16. (3) Speed $\propto \frac{1}{\text{Time}}$

$\therefore$ Required ratio of time

$= 1 : \frac{1}{3} : \frac{1}{5}$

$= 15 : \frac{1}{3} \times 15 : \frac{1}{5} \times 15$

= 15 : 5 : 3

TYPE-VIII

1. (1) Using Rule 12,
Relative speed of police
= 11 – 10 = 1 kmph

$= \frac{5}{18} m / \text{sec}$

$\therefore$ Distance decreased in 6 minutes $= \frac{5}{18} \times 6 \times 60 = 100$ m

$\therefore$ Distance remained between them = 200–100 = 100 m

2. (1) Suppose the speed of first train be x kmph
Speed of second train
= 30 kmph

$= \frac{30 \times 1000}{60} = 500$ m per min.

$\therefore$ According to question

$\frac{\text{Total Distance}}{\text{Relative speed}}$

$= \frac{(66+88)}{x-500} = 0.168$

$\Rightarrow \frac{154}{x-500} = 0.168$

$\Rightarrow$ 0.168x – 84 = 154
$\Rightarrow$ 0.168x = 238

$\Rightarrow x = \frac{238}{0.168}$

$= \left(\frac{238 \times 1000}{168}\right)$ m per minute

$= \frac{238 \times 1000}{168} \times \frac{3}{50}$ kmph

= 85 kmph

3. (1) Using Rule 1,
The gap of 114 metre will be filled at relative speed. Required time

$= \left(\frac{114}{21-15}\right)$ minutes

$= \frac{114}{6} = 19$ minutes

4. (4) Both trains are moving in the same direction.
$\therefore$ Their relative speed
= (68 – 50) kmph = 18 kmph

$= 18 \times \frac{5}{8} = 5$ m/sec

Total length = 50 + 75 = 125 m
$\therefore$ Required time

$= \frac{\text{Total length}}{\text{Relative speed}}$

$= \frac{125}{5} = 25$ seconds.

5. (2) The constable and thief are running in the same direction
$\therefore$ Their relative speed
= 8 – 7 = 1km.

$= 1 \times \frac{5}{18}$ m/sec.

$\therefore$ Required time $= \frac{200}{\frac{5}{18}}$

$= \frac{200 \times 18}{5} = 720$ sec

$= \frac{720}{60}$ minutes = 12 minutes

6. (4) Relative speed
= (58 – 30) km/hr

$= \left(28 \times \frac{5}{18}\right)$ m/sec. $= \frac{70}{9}$ m/sec.

$\therefore$ Length of train $= \frac{70}{9} \times 18$

= 140 metres

7. (3) Relative speed
= 56 – 29 = 27 kmph

$= 27 \times \frac{5}{18} = \frac{15}{2}$ m/sec

$\therefore$ Distance covered in 10 seconds

$= \frac{15}{2} \times 10 = 75$ m

Hence, length of train = 75 m.

8. (1) Let the speed of the truck be x kmph
Relative speed of the bus
$= (45 - x)$ kmph

$\therefore$ Time $= \frac{\text{Distance}}{\text{Relative speed}}$

$\Rightarrow \frac{30}{60 \times 60} = \frac{\frac{150}{1000}}{(45-x)}$

$\Rightarrow \frac{1}{120} = \frac{15}{100(45-x)}$

$\Rightarrow \frac{1}{6} = \frac{3}{(45-x)} \Rightarrow (45 - x) = 18$

$\Rightarrow x = 45 - 18 = 27$ kmph

9. (2) Let the length of each train be x metre.
Relative speed
= 46 – 36 = 10 kmph

$= \frac{10 \times 5}{18}$ metre/second

$= \frac{25}{9}$ metre/second

$\therefore \frac{2x}{\frac{25}{9}} = 36$

$\Rightarrow 2x = \frac{36 \times 25}{9} = 100$

$\Rightarrow x = 50$ metre

10. (3) Relative speed
= 45– 40 = 5 kmph
$\therefore$ Required distance

$= \left(5 \times \frac{45}{60}\right)$ km

$= \frac{15}{4}$ km = 3 km 750

11. (3) Let the speed of Scooter be x
Distance covered by cycling in $3\frac{1}{2}$ hours = Distance covered by scooter in $2\frac{1}{4}$ hours

$\Rightarrow 12 \times \frac{7}{2} = x \times \frac{9}{4}$

$\Rightarrow x = \frac{12 \times 7 \times 2}{9}$

$= \frac{56}{3} = 18\frac{2}{3}$ kmph

12. (2) Relative speed

$= \frac{1000}{8} - \frac{1000}{10}$

$= \frac{5000 - 4000}{40} = \frac{1000}{40}$ m/minute

$\therefore$ Required time

$= \frac{100}{\frac{1000}{40}} = \frac{4000}{1000} = 4$ m/minute

$\therefore$ Distance covered by the thief

$= \frac{1000}{10} \times 4 = 400$ metres

13. (3) Relative speed = 40 – 20
= 20 km/hour

$= \frac{20 \times 5}{18}$ m/sec.

$\therefore$ Length of the faster train

$= \frac{20 \times 5}{18} \times 5$ metres

$= \frac{250}{9} = 27\frac{7}{9}$ metres

14. (4) Distance = Speed × Time
= 80 × 4.5 = 360 km

$\therefore$ Required speed $= \frac{360}{4}$

= 90 kmph.

15. (2) Required time

$= \frac{\text{Sum of the lengths of trains}}{\text{Relative speed}}$

Relative speed = 65 + 55
= 120 kmph

$= \frac{120 \times 5}{18}$ m/sec

Required time $= \frac{180 + 120}{\frac{120 \times 5}{18}}$

$= \frac{300 \times 18}{120 \times 5} = 9$ seconds

16. (1) When two trains cross each other, they cover distance equal to the sum of their length with relative speed.
Let length of each train = x metre
Relative speed = 90 – 60
= 30 kmph

$= \left(\frac{30 \times 5}{18}\right)$ m/sec.

$= \left(\frac{25}{3}\right)$ m/sec.

$\therefore \dfrac{2x}{\frac{25}{3}} = 30$

$\Rightarrow 2x = \dfrac{30 \times 25}{3}$

$\Rightarrow 2x = 250$

$\Rightarrow x = 125$ metres

17. (4) Relative speed = 35 – 25
= 10 kmph

$= \dfrac{10 \times 5}{18}$ m/sec.

Total length = 80 + 120
= 200 metres

$\therefore$ Required time

$= \dfrac{\text{Sum of the length of trains}}{\text{Relative speed}}$

$= \dfrac{200}{\frac{10 \times 5}{18}} = \dfrac{200 \times 18}{10 \times 5}$

= 72 seconds

18. (1) Distance covered by the first goods train in 8 hours = Distance covered by the second goods train in 6 hours.

$\Rightarrow 18 \times 8 = 6 \times x$

$\Rightarrow x = \dfrac{18 \times 8}{6} = 24$ kmph

19. (3) Relative speed
= (33 + 39) kmph
= 72 kmph

$= \left(\dfrac{72 \times 5}{18}\right)$ m/sec.

= 20 m/sec.

$\therefore$ Time taken in crossing

$= \dfrac{\text{Length of both trains}}{\text{Relative speed}}$

$= \dfrac{125 + 115}{20} = \dfrac{240}{20}$

= 12 seconds

20. (2) Distance covered by the thief in half an hour $= \dfrac{1}{2} \times 40 = 20$ km

Relative speed of car owner
= 50 – 40 = 10 km

$\therefore$ Required time

$= \dfrac{\text{Difference of distance}}{\text{Relative speed}}$

$= \dfrac{20}{10} = 2$ hours

i.e. at 4 p.m.

21. (1) Length of each train
= x metre

Relative speed = 46 – 36
= 10 kmph

$= \left(10 \times \dfrac{5}{18}\right)$ m/sec

$= \dfrac{25}{9}$ m/sec

$\therefore$ Time taken in crossing

$= \dfrac{\text{Length of both trains}}{\text{Relative speed}}$

$\Rightarrow 36 = \dfrac{2x}{\frac{25}{9}}$

$\Rightarrow 2x = 36 \times \dfrac{25}{9} = 100$

$\Rightarrow x = \dfrac{100}{2} = 50$ metre

22. (3) Let both trains meet after t hours.

$\therefore$ Distance = speed × time

$\therefore 60t - 50t = 120$

$\Rightarrow 10t = 120 \Rightarrow t = 12$ hours

$\therefore$ Required distance

$= 60t + 50t$

$= 110t = 110 \times 12$

= 1320 km

23. (3) $\overrightarrow{35 \text{ kmph}}$ $\overrightarrow{25 \text{ kmph}}$

A B C

Let both cars meet at C after t hours.

$\therefore$ Distance covered by car A
= AC = $35t$ km

Distance covered by car B
= BC = $25t$ km

$\therefore$ AC – BC = AB = 60 km.

$\Rightarrow 35t - 25t = 60$

$\Rightarrow 10t = 60$

$\Rightarrow t = \dfrac{60}{10} = 6$ hours

24. (2) Let the speed of train C be x kmph.

$\therefore$ Relative speed of B
= $(100 - x)$ kmph.

$\therefore$ Time taken in crossing

$= \dfrac{\text{Length of both trains}}{\text{Relative speed}}$

$\Rightarrow \dfrac{2}{60} = \dfrac{\left(\dfrac{150 + 250}{1000}\right)}{100 - x}$

$\Rightarrow \dfrac{1}{30} = \dfrac{2}{5(100 - x)}$

$\Rightarrow \dfrac{1}{6} = \dfrac{2}{100 - x}$

$\Rightarrow 100 - x = 12$

$\Rightarrow x = 100 - 12 = 88$ kmph.

25. (1) Let the speed of goods train be x kmph.

$\therefore$ Distance covered by goods train in 10 hour = distance covered by passenger train in 4 hours

$\Rightarrow 10x = 80 \times 4$

$\Rightarrow x = \dfrac{80 \times 4}{10} = 32$ kmph.

26. (4) Relative speed = 45 – 40
= 5 kmph.

$\therefore$ Gap between trains after 45 minutes $= \left(5 \times \dfrac{45}{60}\right)$ km.

= 3.75 km.

27. (3) Distance between thief and policeman = 400 metre

Relative speed of policeman with respect to thief
= (9 – 5) kmph
= 4 kmph

$= \left(\dfrac{4 \times 5}{18}\right)$ m./sec.

$= \dfrac{10}{9}$ m./sec.

Time taken in overtaking the thief

$= \left(\dfrac{400}{\frac{10}{9}}\right)$ second

$= \left(\dfrac{400 \times 9}{10}\right)$ second

= 360 second

$\therefore$ Distance covered by thief
= Speed × Time

$= \left(5 \times \dfrac{5}{18} \times 360\right)$ metre

= 500 metre

28. (4) Let the length of each train be x metre.

Relative speed = (46 – 36) kmph
= 10 kmph

$= \left(\dfrac{10 \times 5}{18}\right)$ m./sec.

$= \dfrac{25}{9}$ m./sec.

$\therefore \dfrac{2x}{\frac{25}{9}} = 36$

$\therefore 2x = 36 \times \dfrac{25}{9} = 100$

$\Rightarrow x = \dfrac{100}{2} = 50$ metre

TYPE-IX

1. (3) Time taken to cover 20 km at the speed of 5km/hr
= 4 hours.
$\therefore$ Fixed time = 4 hours – 40 minutes
= 3 hour 20 minutes
Time taken to cover 20 km at the speed of 8 km/hr $= \frac{20}{8}$ = 2 hours 30 minutes
$\therefore$ Required time = 3 hours 20 minutes – 2 hours 30 minutes = 50 minutes

2. (1) Since man walks at $\frac{2}{3}$ of usual speed, time taken wil be $\frac{3}{2}$ of usual time.

$\therefore \frac{3}{2}$ of usual time
= usual time + 1 hour.

$\Rightarrow \left(\frac{3}{2}-1\right)$ of usual time = 1

$\Rightarrow$ usual time = 2 hours.

3. (3) Let x km. be the required distance.
Difference in time
= 2.5 + 5 = 7.5 minutes

$= \frac{7.5}{60}$ hrs. $= \frac{1}{8}$ hrs.

Now, $\frac{x}{8} - \frac{x}{10} = \frac{1}{8}$

$\Rightarrow \frac{5x-4x}{40} = \frac{1}{8}$

$\Rightarrow x = \frac{40}{8} = 5$ km.

Aliter : Using Rule 10,
Here, $S_1 = 8$, $t_1 = 2.5$
$S_2 = 10$, $t_2 = 5$

Distance $= \frac{(S_1 \times S_2)(t_1+t_2)}{S_2 - S_1}$

$= \frac{(8 \times 10)(2.5+5)}{10-8}$

$= 40 \times \frac{7.5}{60} = 5$ km

4. (4) Let the distance be x km and initial speed be y kmph.
According to question,

$$\frac{x}{y} - \frac{x}{y+3} = \frac{40}{60} \qquad ...(i)$$

and,

$$\frac{x}{y-2} - \frac{x}{y} = \frac{40}{60} \qquad ...(ii)$$

From equations (i) and (ii),

$$\frac{x}{y} - \frac{x}{y+3} = \frac{x}{y-2} - \frac{x}{y}$$

$$\Rightarrow \frac{1}{y} - \frac{1}{y+3} = \frac{1}{y-2} - \frac{1}{y}$$

$$\Rightarrow \frac{y+3-y}{y(y+3)} = \frac{y-y+2}{y(y-2)}$$

$\Rightarrow 3(y-2) = 2(y+3)$
$\Rightarrow 3y - 6 = 2y + 6$
$\Rightarrow y = 12$
From equation (i),

$$\frac{x}{12} - \frac{x}{15} = \frac{40}{60} \Rightarrow \frac{5x-4x}{60} = \frac{2}{3}$$

$$\Rightarrow x = \frac{2}{3} \times 60 = 40$$

$\therefore$ Distance = 40 km.

5. (3) If the distance be x km, then

$$\frac{x}{40} - \frac{x}{50} = \frac{6}{60}$$

$$\Rightarrow \frac{x}{4} - \frac{x}{5} = 1$$

$\Rightarrow x = 20$ km.
$\therefore$ Required time

$= \left(\frac{20}{40}\right)$ hour – 11 minutes

$= \left(\frac{1}{2} \times 60 - 11\right)$ minutes

= 19 minutes

6. (2) Let the required distance be x km.
Difference of time

= 6 + 6 = 12 minutes $= \frac{1}{5}$ hr.

According to the question,

$$\frac{x}{\frac{5}{2}} - \frac{x}{\frac{7}{2}} = \frac{1}{5} \Rightarrow \frac{2x}{5} - \frac{2x}{7} = \frac{1}{5}$$

$$\Rightarrow \frac{14x - 10x}{35} = \frac{1}{5}$$

$$\Rightarrow \frac{4x}{35} = \frac{1}{5} \Rightarrow x = \frac{35}{20} = \frac{7}{4} \text{ km.}$$

Aliter : Using Rule 10,

Here, $S_1 = 2\frac{1}{2}$, $t_1 = 6$

$S_2 = 3\frac{1}{2}$, $t_2 = 6$

Distance $= \frac{(S_1 \times S_2)(t_1+t_2)}{S_2 - S_1}$

$= \frac{\frac{5}{2} \times \frac{7}{2} \times (6+6)}{\frac{7}{2} - \frac{5}{2}}$

$= \frac{35}{4} \times \frac{12}{60} = \frac{7}{4}$ km

7. (4) Let the required distance be x km.
According to the question,

$$\frac{x}{4} - \frac{x}{5} = \frac{18}{60}$$

$$\Rightarrow \frac{5x-4x}{20} = \frac{3}{10}$$

$$\Rightarrow x = \frac{3}{10} \times 20 = 6 \text{ km}$$

Aliter : Using Rule 10,
Here, $S_1 = 4$, $t_1 = 9$
$S_2 = 5$, $t_2 = 9$

Distance $= \frac{(S_1 \times S_2)(t_1+t_2)}{S_2 - S_1}$

$= \frac{(4 \times 5)(9+9)}{5-4}$

$= 20 \times \frac{18}{60} = 6$ km

8. (2) Let the initial speed of the car be x kmph and the distance be y km.

Then, $y = \frac{9}{2}x$ ...(i)

and, $y = 4(x+5)$ ...(ii)

$\therefore \frac{9x}{2} = 4(x+5)$
$\Rightarrow 9x = 8x + 40$
$\Rightarrow x = 40$ kmph

9. (3) Let the distance of office be x km.

$$\therefore \frac{x}{24} - \frac{x}{30} = \frac{11}{60}$$

$\Rightarrow \frac{5x-4x}{120}=\frac{11}{60}$

$\Rightarrow \frac{x}{120}=\frac{11}{60}$

$\Rightarrow x = \frac{11}{60} \times 120 = 22$ km.

Aliter : Using Rule 10,
Here, $S_1 = 24$, $t_1 = 5$
$S_2 = 30$, $t_2 = 6$

Distance $= \frac{(S_1 \times S_2)(t_1+t_2)}{S_2-S_1}$

$= \frac{24 \times 30(5+6)}{30-24}$

$= \frac{720 \times 11}{6 \times 60} = 22$ km

10. (3) Let the required distance be x km.

Then, $\frac{x}{3}-\frac{x}{5}=\frac{24}{60}$

$\Rightarrow \frac{5x-3x}{15}=\frac{2}{5} \Rightarrow \frac{2x}{3}=2$

$\Rightarrow 2x = 2 \times 3 \Rightarrow x = 3$ km

Aliter : Using Rule 10,
Here, $S_1 = 3$, $t_1 = 9$
$S_2 = 5$, $t_2 = 15$

Distance $= \frac{(S_1 \times S_2)(t_1+t_2)}{S_2-S_1}$

$= \frac{(3 \times 5)(9+15)}{5-3}$

$= \frac{15}{2} \times \frac{24}{60} = 3$ km

11. (2) Let the required distance be x km.

$\frac{x}{\frac{5}{2}}-\frac{x}{3}=\frac{16}{60}$

$\Rightarrow \frac{2x}{5}-\frac{x}{3}=\frac{4}{15}$

$\Rightarrow \frac{6x-5x}{15}=\frac{4}{15} \Rightarrow x = 4$ km.

Aliter : Using Rule 10,

Here, $S_1 = 2\frac{1}{2}$, $t_1 = 6$

$S_2 = 3$, $t_2 = 10$

Distance $= \frac{(S_1 \times S_2)(t_1+t_2)}{S_2-S_1}$

$= \frac{\frac{5}{2}\times 3(6+10)}{3-\frac{5}{2}}$

$= 15 \times \frac{16}{60}$ km = 4 km

12. (3) Let the distance be x km.

$\therefore \frac{x}{10}-\frac{x}{12}=\frac{12}{60}$

$\Rightarrow \frac{6x-5x}{60}=\frac{1}{5}$

$\Rightarrow x = \frac{1}{5} \times 60 = 12$ km.

Aliter : Using Rule 10,
Here, $S_1 = 10$, $t_1 = 6$
$S_2 = 12$, $t_2 = 6$

Distance $= \frac{(S_1 \times S_2)(t_1+t_2)}{S_2-S_1}$

$= \frac{(10 \times 12)(6+6)}{12-10}$

$= \frac{120 \times 12}{2}$

$= 60 \times \frac{12}{60}$ km = 12km

13. (1) Using Rule 1,
Let the distance between stations be x km, then speed of train

$= \frac{x}{\frac{45}{60}} = \frac{4x}{3}$ kmph

$\therefore \frac{x}{\frac{4x}{3}-5}=\frac{48}{60}$

$\Rightarrow \frac{3x}{4x-15}=\frac{4}{5}$

$\Rightarrow 16x - 60 = 15x$
$\Rightarrow x = 60$ km

14. (2) Using Rule 1,

Speed of train $= \frac{\text{Distance}}{\text{Time}}$

$= \frac{10}{\frac{12}{60}}$ kmph

$= \frac{10 \times 60}{12} = 50$ kmph

New speed = 45 kmph

$\therefore$ Required time $= \frac{10}{45}$ hour

$= \frac{2}{9} \times 60$ minutes

$= \frac{40}{3}$ minutes

or 13 minutes 20 seconds

15. (2) Let the distance of the office be x km, then

$\frac{x}{5}-\frac{x}{6}=\frac{8}{60}$

$\Rightarrow \frac{6x-5x}{30}=\frac{2}{15}$

$\Rightarrow x = 2 \times 2 = 4$ km

Aliter : Using Rule 10,
Here, $S_1 = 5$, $t_1 = 6$
$S_2 = 6$, $t_2 = 2$

Distance $= \frac{(S_1 \times S_2)(t_1+t_2)}{S_2-S_1}$

$= \frac{(6 \times 5)\times(6+2)}{6-5}$

$= 30 \times \frac{8}{60} = 4$ km

16. (2) Let the distance of school be x km, then

$\frac{x}{3}-\frac{x}{4}=\frac{20}{60}$

$\Rightarrow \frac{x}{12}=\frac{1}{3} \Rightarrow x = \frac{12}{3} = 4$ km

Aliter : Using Rule 10,
Here, $S_1 = 3$, $t_1 = 10$
$S_2 = 4$, $t_2 = 10$

Distance $= \frac{(S_1 \times S_2)(t_1+t_2)}{S_2-S_1}$

$= \frac{(3 \times 4)(10+10)}{4-3}$

$= 12 \times \frac{20}{60} = 4$ km

17. (3) Using Rule 1
Distance between stations X and Y = Speed × Time
= 55 × 4 = 220 km.
New speed = 55 + 5 = 60 kmph

$\therefore$ Required time $= \frac{220}{60}$

$= \frac{11}{3}$ hours

= 3 hours 40 minutes.
$\therefore$ Required answer
= 4 hours – 3 hours 40 minutes
= 20 minutes

18. (3) Distance of journey = x km
Difference of time = 12 – 3
= 9 minutes

$= \frac{9}{60}$ hour $= \frac{3}{20}$ hour

$\therefore \frac{x}{70} - \frac{x}{80} = \frac{3}{20}$

$\Rightarrow \frac{x}{7} - \frac{x}{8} = \frac{3}{2}$

$\Rightarrow \frac{8x - 7x}{56} = \frac{3}{2}$

$\Rightarrow \frac{x}{56} = \frac{3}{2}$

$\Rightarrow x = \frac{3}{2} \times 56 = 84$ km

∴ Required correct time

$= \frac{84}{70}$ hours – 12 minutes

$= \left(\frac{84}{70} \times 60 - 12\right)$ minutes

= 72 – 12 = 60 minutes
= 1 hour

TYPE-X

1. (4) Rule 10 and Rule 1,
Let the length of train be x metres
∴ According to question

Speed of the train $= \frac{x}{10}$ m/sec.

Also, the speed of the train

$= \left(\frac{x+50}{14}\right)$ m/sec.

[∵ It passes the platform in 14 seconds]
Both the speeds should be equal, i.e.,

$\frac{x}{10} = \frac{x+50}{14}$

or 14x = 10x + 500
or 14x – 10x = 500
or 4x = 500
∴ x = 125 metres

Hence, Speed $= \frac{125}{10} = 12.5$ m/sec.

$= \frac{12.5 \times 18}{5}$ km/hr.

= 45 km/hr.

2. (2) Rule 10 and Rule 1,
Let length of train be x m

∴ Speed of train $= \frac{x+264}{20}$

Also, speed of train $= \frac{x}{8}$

Obviously, $\frac{x}{8} = \frac{x+264}{20}$

$\Rightarrow \frac{x}{2} = \frac{x+264}{5}$
$\Rightarrow$ 5x = 2x + 528
$\Rightarrow$ 5x – 2x = 528
$\Rightarrow$ x = 528 ÷ 3 = 176 m

3. (4) Rule 10 and Rule 1,
Let the length of train be x metres.
Then, speed of train when it passes a telegraph post $= \frac{x}{8}$ m/sec.
and speed of train, when it passes the bridge $= \frac{x+264}{20}$
Clearly,

$\frac{x}{8} = \frac{x+264}{20}$

$\Rightarrow \frac{x}{2} = \frac{x+264}{5}$
$\Rightarrow 5x = 2x + 528$
$\Rightarrow 3x = 528$

$\Rightarrow x = \frac{528}{3} = 176$m

∴ Speed of train

$= \frac{176}{8} = 22$ m/sec.

$= 22 \times \frac{18}{5}$ Kmph

= 79.2 kmph

4. (1) Rule 10 and Rule 1,
Let the length of train be x metres.
When the train crosses the standing man, its speed $= \frac{x}{9}$
When the train crosses the platform of length 84 m, its speed

$= \frac{x+84}{21}$

Obviously, $\frac{x}{9} = \frac{x+84}{21}$
$\Rightarrow 21x - 9x = 9 \times 84$
$\Rightarrow 12x = 9 \times 84$

$\Rightarrow x = \frac{9 \times 84}{12} = 63$ m

∴ Required speed $= \frac{63}{9}$ m/sec

$= \frac{63}{9} \times \frac{18}{5}$ kmph = 25.2 kmph

5. (4) Rule 10 and Rule 1,
Suppose length of train be x
According to question

$\frac{x+50}{14} = \frac{x}{10}$
$\Rightarrow 14x = 10x + 500$
$\Rightarrow 4x = 500$

$\Rightarrow x = \frac{500}{4} = 125$ m

Therefore, speed

$= \frac{125}{10} \times \frac{18}{5} = 45$ kmph

6. (4) Rule 10 and Rule 1,
Let the length of the train be x
According to the question,
Speed of the train

$= \frac{x+90}{30} = \frac{x}{15}$
$\Rightarrow x + 90 = 2x$
$\Rightarrow x = 90$ m

∴ Speed of train $= \frac{90}{15}$

= 6 m/s $= 6 \times \frac{18}{5}$ kmph

= 21.6 kmph

7. (3) Rule 10 and Rule 1,
Let the length of the train be x metre
Speed of train when it crosses man $= \frac{x}{10}$
Speed of train when it crosses platform $= \frac{x+300}{25}$
According to the question,

Speed of train $= \frac{x}{10} = \frac{x+300}{25}$
$\Rightarrow 25x = 10x + 3000$
$\Rightarrow 15x = 3000$

$\Rightarrow x = \frac{3000}{15} = 200$ metres

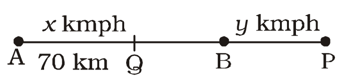
∴ Length of train = 200 metre

Speed of train $= \frac{x}{10} = \frac{200}{10}$
= 20 m/sce
∴ Time taken in crossing a 200 m long platform $= \frac{200+200}{20}$
= 20 seconds

8. (4) Rule 10 and Rule 1,
Let the length of the train be x metres.
Speed of train in crossing boy = $\frac{x}{30}$
Speed of train in crossing platform = $\frac{x+110}{40}$
According to the question,
$$\frac{x+110}{40} = \frac{x}{30}$$
$$\Rightarrow \frac{x+110}{4} = \frac{x}{3}$$
$\Rightarrow 4x = 3x + 330$
$\Rightarrow x = 330$ metres

9. (3) Rule 10 and Rule 1,
Let the length of train be x metre.
$$\therefore \frac{x}{15} = \frac{x+100}{25}$$
$$\Rightarrow \frac{x}{3} = \frac{x+100}{5}$$
$\Rightarrow 5x = 3x + 300$
$\Rightarrow 2x = 300$
$$\Rightarrow x = \frac{300}{2} = 150 \text{ metres}$$

10. (2)



Let speed of car starting from A be x kmph
and speed of car starting from B be y kmph
Case I
When cars meet at P,
$7x = AP = AB + BP = 70 + 7y$
$\Rightarrow 7x - 7y = 70$
$\Rightarrow x - y = 10$ ...(i)
Case II
When cars meet at Q,
$x + y = 70$ ...(ii)
On adding these equations,
$x = 40$ kmph
Putting the value of x in equation (i),
$y = 40 - 10 = 30$ kmph

11. (2) Let the speed of trains be x and y metre/sec respectively,
$$\frac{100+95}{x-y} = 27$$
$$\Rightarrow x - y = \frac{195}{27} = \frac{65}{9} \quad .....(i)$$
Again,
$$\frac{195}{x+y} = 9$$
$$\Rightarrow x + y = \frac{195}{9} \quad .....(ii)$$
By equation (i) + (ii)
$$2x = \frac{65}{9} + \frac{195}{9} = \frac{260}{9}$$
$$\Rightarrow x = \frac{260}{2\times 9} = \frac{130}{9} \text{ m/sec.}$$
$$= \left(\frac{130}{9} \times \frac{18}{5}\right) \text{ kmph} = 52 \text{ kmph}$$
From equation (ii),
$$y = \frac{195}{9} - \frac{130}{9} = \frac{65}{9} \text{ m/sec.}$$
$$= \frac{65}{9} \times \frac{18}{5} = 26 \text{ kmph}$$

12. (2) Rule 10 and Rule 1,
Let the length of train be x metre, then
$\therefore$ Speed of train
$$= \frac{x}{7} = \frac{x+390}{28}$$
$$\Rightarrow x = \frac{x+390}{4}$$
$\Rightarrow 4x - x = 390$
$$\Rightarrow x = \frac{390}{3} = 130 \text{ metres}$$

13. (3) Rule 10 and Rule 1,
Speed of train = 36 kmph
$$= 36 \times \frac{5}{18} = 10 \text{ m/sec}$$
Length of train = 10×10
= 100 metres
$$\therefore \text{Required time} = \frac{100+55}{10}$$
$$= 15\frac{5}{10} = 15\frac{1}{2} \text{ second}$$
= 15.5 seconds

14. (2) Rule 10 and Rule 1,
Speed of train = 60 kmph
$$= \left(60 \times \frac{5}{18}\right) \text{ m/sec.}$$
$$= \frac{50}{3} \text{ m/sec.}$$
If the length of platform be = x metre, then
Speed of train
$$= \frac{\text{Length of (train + platform)}}{\text{Time taken in crossing}}$$
$$\Rightarrow \frac{50}{3} = \frac{200+x}{30}$$
$\Rightarrow 50 \times 10 = 200 + x$
$\Rightarrow x = 500 - 200 = 300$ metre

15. (4) Let both trains meet after t hours since 7 a.m.
Distance between stations A and B = x Km.
$$\therefore \frac{x}{4} \times t + \frac{x}{\frac{7}{2}} \times (t-1) = x$$
$$\left[\text{Speed} = \frac{\text{Distance}}{\text{Time}}\right]$$
$$\Rightarrow \frac{t}{4} + \frac{2(t-1)}{7} = 1$$
$$\Rightarrow \frac{7t+8t-8}{28} = 1$$
$\Rightarrow 15t - 8 = 28$
$\Rightarrow 15t = 28 + 8 = 36$
$$\Rightarrow t = \frac{36}{15} = \frac{12}{5} \text{ hours}$$
= 2 hours 24 minutes
$\therefore$ Required time = 9 :24 a.m.

16. (2) Speed of train = 72 kmph.
$$= \left(\frac{72\times 5}{18}\right) \text{ m./sec.}$$
= 20 m./sec.
Required time
$$= \frac{\text{Length of train and bridge}}{\text{Speed of train}}$$
$$= \left(\frac{110+132}{20}\right) \text{ seconds}$$
$$= \left(\frac{242}{20}\right) \text{ seconds}$$
= 12.1 seconds

17. (2) Relative speed of train
= (60 + 6) kmph.
$$= \left(\frac{66\times 5}{18}\right) \text{ m/sec.}$$
$$= \frac{55}{3} \text{ m/sec.}$$
Length of train = 110 metre
$$\therefore \text{Required time} = \left(\frac{110}{\frac{55}{3}}\right) \text{ seconds}$$
$$= \left(\frac{110\times 3}{55}\right) \text{ seconds}$$
= 6 seconds

TYPE-XI

1. (2) Let the time taken to complete the race by A,B, and C be x minutes.

$\therefore$ Speed of A = $\frac{1000}{x}$,

B = $\frac{1000-50}{x} = \frac{950}{x}$

C = $\frac{1000-69}{x} = \frac{931}{x}$

Now, time taken to complete the race by

B = $\frac{1000}{\frac{950}{x}} = \frac{1000 \times x}{950}$

and distance travelled by C in

$\frac{1000x}{950}$ min

= $\frac{1000x}{950} \times \frac{931}{x}$ = 980 km.

$\therefore$ B can allow C

= 1000 – 980 = 20 m

2. (4) Ratio of the speed of A, B and C = 6 : 3 : 1

$\Rightarrow$ Ratio of the time taken

= $\frac{1}{6} : \frac{1}{3} : 1$ = 1 : 2 : 6

$\therefore$ Time taken by A

= $\frac{72}{6}$ =12 minutes

3. (2) Let A take x seconds in covering 1000m and b takes y seconds

According to the question,

$x + 20 = \frac{900}{1000}y$

$\Rightarrow x + 20 = \frac{9y}{10}$ ...(i)

and, $\frac{950}{1000}x + 25 = y$ ...(ii)

From equation (i),

$\frac{10x}{9} + \frac{200}{9} = y$

$\Rightarrow \frac{10x}{9} + \frac{200}{9} = \frac{950x}{1000} + 25$

$\Rightarrow \frac{10x}{9} + \frac{200}{9} = \frac{19x}{20} + 25$

$\Rightarrow \frac{10x}{9} - \frac{19x}{20} = 25 - \frac{200}{9}$

$\Rightarrow \frac{200x - 171x}{180} = \frac{225-200}{9}$

$\Rightarrow \frac{29x}{180} = \frac{25}{9}$

$\Rightarrow x = \frac{25}{9} \times \frac{180}{29} = \frac{500}{29}$

seconds.

4. (3) Time taken by Kamal

= $\frac{100}{18 \times \frac{5}{18}}$ = 20 seconds

$\therefore$ Time taken by Bimal

= 20 + 5 = 25 seconds

$\therefore$ Bimal's speed = $\frac{100}{25}$ =4 m/sec

= $\frac{4 \times 18}{5}$ kmph = 14.4 kmph.

5. (1) When A runs 1000m, B runs 900m.

$\therefore$ When A runs 500m, B runs 450 m.

Again, when B runs 400m, C runs 360 m.

$\therefore$ When B runs 450m, C runs

= $\frac{360}{400} \times 450$ = 405 metres

Required distance = 500 – 405

= 95 metres

6. (1) According to the question,

$\therefore$ When A runs 800 metres, B runs 760 metres

$\therefore$ When A runs 200 metres, B

runs = $\frac{760}{800} \times 200$ = 190 metres

Again, when B runs 500 metres, C runs 495 metres.

$\therefore$ When B runs 190 metres, C

runs = $\frac{495}{500} \times 190$ = 188.1 metres

$\therefore$ Hence, A will beat C by

200 – 188.1 = 11.9 metres in a race of 200 metres.

7. (3) According to the question,

$\because$ When B runs 200 m metres, A runs 190 metres

$\therefore$ When B runs 180 metres, A

runs = $\frac{190}{200} \times 180$ = 171 metres

When C runs 200m, B runs 180 metres.

Hence, C will give a start to A by

= 200 – 171 = 29 metres

8. (2) According to the question,

When A covers 1000m, B covers

= 1000 – 40 = 960 m

and C covers =1000 – 70 = 930 m

When B covers 960m, C covers 930 m.

$\therefore$ When B covers 1000m, C covers = $\frac{930}{960} \times 1000$

= 968.75 metre

Hence, B gives C a start of

= 1000 – 968.75 = 31.25 metre

9. (2) Relative speed

= 95 – 75 = 15 kmph

Required time = $\frac{\text{Distance}}{\text{Relative speed}}$

= $\frac{5}{15}$ hours = $\frac{5}{15} \times 60$ minutes

= 20 minutes

10. (1) Time taken by C = t hours

$\therefore$ Time taken by B = $\frac{t}{3}$ hours

and time taken by A = $\frac{t}{6}$ hours

Here, $t = \frac{3}{2}$ hours

$\therefore$ Required time taken by A

= $\frac{\frac{3}{2}}{6}$ hour

= $\frac{1}{4}$ hour

= $\left(\frac{1}{4} \times 60\right)$ minutes

= 15 minutes

11. (3) 2 hours 45 minutes

= $\left(2 + \frac{45}{60}\right)$ hours

= $\left(2 + \frac{3}{4}\right)$ hours = $\frac{11}{4}$ hours

$\therefore$ Distance = Speed × Time

= 4 × $\frac{11}{4}$ = 11 km.

$\therefore$ Time taken in covering 11 km at 16.5 kmph

= $\frac{11}{16.5}$ hour

= $\left(\frac{11 \times 10 \times 60}{165}\right)$ minutes

= 40 minutes

12. (2) Let the total distance be x km.

Time = $\frac{\text{Distance}}{\text{Speed}}$

According to the question,

$\frac{10}{6} + \frac{20}{16} + \frac{x-30}{3} = 4\frac{35}{60}$

= $4\frac{7}{12}$

$\Rightarrow \frac{5}{3} + \frac{5}{4} + \frac{x}{3} - 10 = \frac{55}{12}$

$\Rightarrow \frac{x}{3} + \frac{5}{3} + \frac{5}{4} - 10 = \frac{55}{12}$

$\Rightarrow \frac{x}{3} + \left(\frac{20+15-120}{12}\right) = \frac{55}{12}$

$\Rightarrow \frac{x}{3} - \frac{85}{12} = \frac{55}{12}$

$\Rightarrow \frac{x}{3} = \frac{85}{12} + \frac{55}{12} = \frac{140}{12}$

$\Rightarrow x = \frac{140}{12} \times 3 = 35$ km.

13. (1) Usual time = x minutes

New time = $\frac{4x}{3}$ minutes

$\left(\because \text{Speed} \propto \frac{1}{\text{Time}}\right)$

According to the question,

$\frac{4x}{3} - x = 20$

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

$\Rightarrow x = 60$ minutes i.e. 1 hour.

14. (2) Let, A's speed = x kmph.

$\therefore$ B's speed = $(7 - x)$ kmph

Time = $\frac{\text{Distance}}{\text{Speed}}$

According to the question,

$\frac{24}{x} + \frac{24}{7-x} = 14$

$\Rightarrow 24\left(\frac{7-x+x}{x(7-x)}\right) = 14$

$\Rightarrow \frac{24 \times 7}{x(7-x)} = 14$

$\Rightarrow x(7 - x) = 12 = 4 \times 3$ or 3×4

$\Rightarrow x(7 - x) = 4(7 - 4)$ or $3(7 - 3)$

$\Rightarrow x = 4$ or 3

$\therefore$ A's speed = 4 kmph.

15. (3) Relative speed

= 12 + 10 = 22 kmph

Distance covered

= 55 – 11 = 44 km

$\therefore$ Required time

$= \left(\frac{44}{22}\right)$ hours

= 2 hours

16. (2) Required time = LCM of 40 and 50 seconds

= 200 seconds

17. (1) Distance between starting point and multiplex = x metre

Time = $\frac{\text{Distance}}{\text{Speed}}$

According to the question,

$\frac{x}{3} - \frac{x}{4} = \frac{5+5}{60} \Rightarrow \frac{4x-3x}{12} = \frac{1}{6}$

$\Rightarrow \frac{x}{12} = \frac{1}{6} \Rightarrow x = \frac{12}{6} = 2$ km.

TYPE-XII

1. (2) Two ways walking time = 55 min ...(i)

One way walking + One way riding time = 37 min. ....(ii)

By 2 × (ii) – (i),

2 ways riding time

= 2×37–55 = 19 minutes.

2. (3) Let the distance be x km

Time taken by $A = \frac{x}{40}$ hrs.

Time taken by $B = \frac{x}{50}$ hrs.

Now, $\frac{x}{40} - \frac{x}{50} = \frac{15}{60}$

$\frac{5x-4x}{200} = \frac{15}{60}$

$\therefore x = \frac{15}{60} \times 200 = 50\text{km}$

Method 2 :

Distance

$= \frac{\text{Product of speed}}{\text{Diff. of speed}} \times \text{Diff. in time}$

$= \frac{40 \times 50}{50-40} \times \frac{15}{60} = 50$ km

3. (4) Let the speed of man be x kmph.

$\therefore 30x - 30\left(x - \frac{x}{15}\right) = 10$

$\Rightarrow 30\left(x - x + \frac{x}{15}\right) = 10$

$\Rightarrow \frac{x}{15} = \frac{10}{30}$

$\Rightarrow x = \frac{150}{30} = 5$ kmph

4. (1) Required time = LCM of 252, 308 and 198 seconds.

Now, 252 = 2 × 2 × 3 × 3 × 7

308 = 2 × 2 × 7 × 11

198 = 2 × 3 × 3 × 11

$\therefore$ LCM = 2 × 2 × 3 × 3 × 7 × 11

= 36 × 77 seconds

$= \frac{36 \times 77}{60}$ minutes

$= \frac{231}{5}$ = 46 minutes 12 seconds

5. (4) Suppose, time taken while walking be x hours

And, time taken on riding be y hours

$\therefore$ According to question

$x + y = 4\frac{1}{2}$ hours ...(i)

Then, $2y$ = 3 hours

$y = 1\frac{1}{2}$ hours

From equation (i)

$x = 4\frac{1}{2} - 1\frac{1}{2} = 3$ hours

Time required to walk both ways = 6 hours

6. (4) Let the required distance be x km.

$\therefore \frac{x}{\frac{9}{2}} + \frac{x}{3} = 5$

$\Rightarrow x\left(\frac{2}{9} + \frac{1}{3}\right) = 5 \Rightarrow x\left(\frac{2+3}{9}\right) = 5$

$\Rightarrow x = \frac{5 \times 9}{5} = 9$ km.

7. (4) Distance covered by A in 4 hours = 4 × 4 = 16 km

Relative speed of B with respect to A = 10 – 4 = 6 km/hr

$\therefore$ Time taken to catch A

$= \frac{16}{6} = \frac{8}{3}$ hours

$\therefore$ Required distance

$= \frac{8}{3} \times 10 = \frac{80}{3}$

= 26.67 km. ≈ 26.7 km

8. (2) Suppose distance be x km

$\frac{x}{2 \times 40} + \frac{x}{2 \times 60} = 10$

$\Rightarrow \frac{x}{80} + \frac{x}{120} = 10$

$\Rightarrow \frac{3x+2x}{240} = 10$

$\Rightarrow \frac{5x}{240} = 10$

$x = 480$ km

9. (1) If A covers the distance of 1 km in x seconds, B covers the distance of 1 km in $(x + 25)$ seconds. If A covers the distance of 1 km, then in the same time C covers only 725 metres.

If B covers 1 km in $(x + 25)$ seconds, then C covers 1 km in $(x + 55)$ seconds.

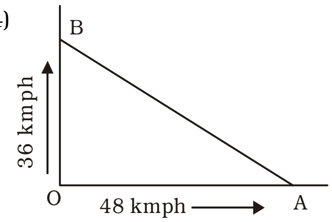
Thus in x seconds, C covers the distance of 725 m.

$\therefore \frac{x}{725} \times 1000 = x + 55$

$\Rightarrow x = 145$

$\therefore$ A covers the distance of 1 km in 2 minutes 25 seconds.

10. (4)



Let O be the starting point. The car running at 36 kmph is moving along OB and that at 48 kmph moving along OA. Also let they reach at B and A respectively after 15 seconds.

$\therefore$ OA $= 48 \times \frac{5}{18} \times 15 = 200$ m

and OB $= 36 \times \frac{5}{18} \times 15 = 150$ m

$\therefore$ Required distance = AB

$= \sqrt{(200)^2 + (150)^2}$

W (By Pythagoras theorem)

$= \sqrt{40000 + 22500}$

$= \sqrt{62500} = 250$ m

11. (2) A beats B by 30 seconds and B beats C by 15 seconds. Clearly, A beats C by 45 seconds. Also, A beats C by 180 metres. Hence, C covers 180 metres in 45 seconds.

$\therefore$ Speed of C $= \frac{180}{45} = 4$ m/sec

$\therefore$ Time taken by C to cover 1000 m

$= \frac{1000}{4} = 250$ sec.

$\therefore$ Time taken by A to cover 1000 m = 250–45 = 205 sec.

12. (2) Difference of time
= 6 min. – 5 min. 52 sec.
= 8 seconds
Distance covered by man in 5 min. 52 seconds
= Distance covered by sound in 8 seconds
= 330 × 8 = 2640 m.
$\therefore$ Speed of man

$= \frac{2640\,\text{m}}{5\,\text{min.}\,52\,\text{sec.}}$

$= \frac{2640}{352}$ m/sec

$= \frac{2640}{352} \times \frac{18}{5}$ kmph

= 27 kmph

13. (1) Let the required distance be x km.
Difference of time
= 15 + 5 = 20 minutes

$= \frac{1}{3}$ hour

According to the question,

$\frac{x}{35} - \frac{x}{42} = \frac{1}{3} \Rightarrow \frac{6x - 5x}{210} = \frac{1}{3}$

$\Rightarrow \frac{x}{210} = \frac{1}{3}$

$\Rightarrow x = \frac{210}{3} = 70$ km.

14. (3) $\left(1 - \frac{5}{6}\right)$ of time taken by B
=1 hour 15 minutes
$\therefore$ Time taken by B
= 1 hour 15 minutes × 6
=7 hours 30 minutes

15. (1) Abhay's speed = x kmph
Sameer's speed = y kmph

$\therefore \frac{30}{x} - \frac{30}{y} = 2$ ...(i)

and, $\frac{30}{y} - \frac{30}{2x} = 1$ ...(ii)

On adding,

$\frac{30}{x} - \frac{30}{2x} = 3$

$\Rightarrow \frac{60 - 30}{2x} = 3$

$\Rightarrow \frac{30}{2x} = 3 \Rightarrow 6x = 30$

$\Rightarrow x = 5$ kmph

16. (3) Time taken in walking both ways = 7 hours 45 minutes ....(i)
Time taken in walking one way and riding back = 6 hours 15 minutes ....(ii)
By equation (ii) × 2 – (i), we have Time taken by the man to ride both ways
= 12 hours 30 minutes – 7 hours 45 minutes
= 4 hours 45 minutes

17. (1) Let the total distance be 100 km.
Average speed

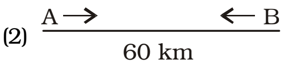
$= \frac{\text{Total distance covered}}{\text{Time taken}}$

$= \frac{100}{\frac{30}{20} + \frac{60}{40} + \frac{10}{10}}$

$= \frac{100}{\frac{3}{2} + \frac{3}{2} + 1} = \frac{100}{\frac{3 + 3 + 2}{2}}$

$= \frac{100 \times 2}{8} = 25$ kmph

18. (2)

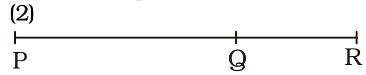


Let the speed of A = x kmph and that of B = y kmph
According to the question,
$x \times 6 + y \times 6 = 60$
$\Rightarrow x + y = 10$ ....(i)

and, $\frac{2}{3} x \times 5 + 2y \times 5 = 60$

$\Rightarrow 10x + 30y = 180$
$\Rightarrow x + 3y = 18$ ...(ii)
From equations (i) × (3) – (ii)
$3x + 3y - x - 3y = 30 - 18$
$\Rightarrow 12x = 12$
$\Rightarrow x = 6$ kmph.

19. (2)



Let the trains meet after t hours, then
$24t - 18t = 27$
$\Rightarrow 6t = 27$

$\Rightarrow t = \frac{27}{6} = \frac{9}{2}$ hours

$\therefore$ QR = $18t = 18 \times \frac{9}{2} = 81$ km

20. (3) Let the speed of Ravi be x kmph then, Ajay's speed = $(x + 4)$ kmph
Distance covered by Ajay
= 60 + 12 = 72 km
Distance covered by Ravi
= 60 – 12 = 48 km.
According to the question,

$\frac{72}{x + 4} = \frac{48}{x}$

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

$\Rightarrow 3x = 2x + 8$
$\Rightarrow x = 8$ kmph

21. (2) Let man walked for t hours. then, $t \times 4 + (9 - t) \times 9 = 61$
$\Rightarrow 4t + 81 - 9t = 61$
$\Rightarrow 81 - 5t = 61$
$\Rightarrow 5t = 20$
$\Rightarrow t = 4$
$\therefore$ Distance travelled on foot
= 4 × 4 = 16 km.

22. (1) Let the required distance be x km, then

$\frac{x}{5} - \frac{x}{6} = \frac{12}{60} = \frac{1}{5}$

$\Rightarrow \frac{6x - 5x}{30} = \frac{1}{5} \Rightarrow \frac{x}{30} = \frac{1}{5}$

$\Rightarrow x = 6$ km.

23. (4) Let the required distance be x km.

$\therefore \frac{x}{3} - \frac{x}{4} = \frac{30}{60}$

$\Rightarrow \frac{x}{12} = \frac{1}{2} \Rightarrow x = \frac{1}{2} \times 12$ =6 km

24. (2) Let the speed of train be x kmph and that of car be y kmph, then

$$\frac{60}{x}+\frac{240}{y}=4 \qquad ...(i)$$

and, $\frac{100}{x}+\frac{200}{y}=\frac{25}{6}$

$$\Rightarrow \frac{4}{x}+\frac{8}{y}=\frac{1}{6} \qquad ...(ii)$$

By equation (i) – equation (ii) × 30

$$\frac{60}{x}+\frac{240}{y}-\frac{120}{x}-\frac{240}{y}=4-5$$

$$\Rightarrow -\frac{60}{x}=-1$$

$\Rightarrow x$ = 60 kmph

25. (2) Ratio of the speed of A and B
= A : B = 2 : 1 = 6 : 3
B : C = 3 : 1
$\therefore$ A : B : C = 6 : 3 : 1
$\therefore$ Ratio of their time taken

$$=\frac{1}{6}:\frac{1}{3}:1 = 1:2:6$$

$\therefore$ Time taken by B

$$=\left(\frac{2}{6}\times 114\right) \text{ minutes}$$

= 38 minutes

26. (3) Let speed of train A = x kmph and speed of train B = y kmph

$$\therefore \frac{x}{y}=\sqrt{\frac{t_2}{t_1}}$$

$$\Rightarrow \frac{45}{y}=\sqrt{\frac{3+\frac{1}{3}}{4+\frac{48}{60}}}=\sqrt{\frac{\frac{10}{3}}{4+\frac{4}{5}}}$$

$$=\sqrt{\frac{10}{3}\times\frac{5}{24}}=\sqrt{\frac{25}{36}}=\frac{5}{6}$$

$\Rightarrow 5y = 45 \times 6 \Rightarrow y = \frac{45\times 6}{5}$

= 54 kmph

27. (2) Total distance of trip

$$=\frac{1200\times 5}{2}=3000 \text{ km}$$

Part of journey covered by train

$$=1-\frac{2}{5}-\frac{1}{3}=\frac{15-6-5}{15}=\frac{4}{15}$$

$\therefore$ Distance covered by train

$$=3000\times\frac{4}{15}=800 \text{ km}$$

28. (1) A's speed = $\frac{1000}{5}$
= 200 m/minute

B's speed = $\frac{1000}{8}$
= 125 m/minute

C's speed = $\frac{1000}{10}$
= 100 m/minute

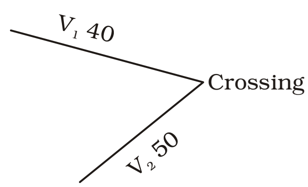
Distance covered by C in 2 minutes = 200 metre
Distance covered by B in 1 minute = 125 metre
Relative speed of A with respect to C = 100 metre

$\therefore$ Time = $\frac{200}{100}=2$ minutes

Relative speed of A with respect ot B = 75 metre

$\therefore$ Time = $\frac{125}{75}=\frac{5}{3}$ minutes

29. (2)



Let time taken be equal

i.e., $\frac{40}{V_1}=\frac{50}{V_2}$, then they will collide i.e. cars will reach at the same time.

$$\therefore \frac{V_1}{V_2}\neq\frac{40}{50}=\frac{4}{5}$$

30. (1) Time taken in covering 999km

$$=\frac{999}{55.5}=18 \text{ hours}$$

$\therefore$ Required time = 18 hours + 1 hour 20 minutes
= 19 hours 20 minutes
i.e. 1 : 20 am

31. (1) Speed = 45 kmph

$$=\left(\frac{45\times 1000}{60\times 60}\right) \text{ metre/second}$$

$$=\left(\frac{45\times 5}{18}\right) \text{ metre/second}$$

= 12.5 metre/second

32. (1) Distance covered in 2nd minute = 90 – 50 = 40 metre
Distance covered in 3rd minute
= 130 – 90 = 40 metre
$\therefore$ Required distance
= 50 + 40 × 14
= 50 + 560 = 610 metre

33. (3) Here distance is constant.

$$\therefore \text{Speed} \propto \frac{1}{\text{Time}}$$

$\therefore$ Ratio of the speeds of A and B

$$=\frac{\frac{7}{2}}{4}=7:8$$

$\therefore$ A's speed = $7x$ kmph (let)
B's speed = $8x$ kmph
$\therefore$ AB = $7x \times 4 = 28x$ km.
Let both trains cross each other after t hours from 7 a.m.
According to the question,
$7x(t+2)+8x\times t=28x$
$\Rightarrow 7t+14+8t=28$
$\Rightarrow 15t=28-14=14$

$$\Rightarrow t=\frac{14}{15} \text{ hours}$$

$$=\left(\frac{14}{15}\times 60\right) \text{ minutes}$$

= 56 minutes
$\therefore$ Required time = 7 : 56 A.M.

34. (4) Speed of plane = $\frac{\text{Distance}}{\text{Time}}$

$$=\frac{6000}{8}=750 \text{ kmph}$$

New speed = (750 + 250) kmph
= 1000 kmph

$\therefore$ Required time = $\frac{9000}{1000}$
= 9 hours

35. (1) Let speed of train be x kmph.
Speed of car = y kmph.

Case I,

$$\because \text{Time}=\frac{\text{Distance}}{\text{Speed}}$$

$$\therefore \frac{240}{x}+\frac{210}{y}=8\frac{40}{60}=8\frac{2}{3}$$

$$\Rightarrow \frac{240}{x}+\frac{210}{y}=\frac{26}{3} \qquad ... (i)$$

Case II,

$$\frac{180}{x}+\frac{270}{y}=9 \qquad ..... (ii)$$

By equation (i) × 3 – (ii) × 4,

$$\frac{720}{x}+\frac{630}{y}-\frac{720}{x}-\frac{1080}{y}$$

= 26 – 36

$$\Rightarrow \frac{-450}{y}=-10$$

$\Rightarrow y$ = 45 kmph.

36. (3) Difference of time = 11 minutes 45 seconds – 11 minutes = 45 seconds

Distance covered by sound in 45 seconds = Distance covered by train in 11 minutes

$\Rightarrow 330 \times 45 = 11 \times 60 \times$ Speed of train

$\Rightarrow$ Speed of train

$= \left(\frac{330 \times 45}{11 \times 60}\right)$ m/sec.

$= \left(\frac{45}{2} \times \frac{18}{5}\right)$ kmph.

= 81 kmph.

37. (2) Distance covered in 3 hours

36 minutes i.e. $3\frac{36}{60}$ hours

i.e. $3\frac{3}{5}$ hours

$= 5 \times \frac{18}{5} = 18$ km.

$\therefore$ Time taken at 24 kmph.

$= \frac{18}{24}$ hour

$= \left(\frac{18}{24} \times 60\right)$ minutes

= 45 minutes

38. (3) Let the original speed of aeroplane be x kmph.
According to the question,

$$\frac{1200}{x-300} - \frac{1200}{x} = 2$$

$$\Rightarrow 1200\left(\frac{x - x + 300}{x(x-300)}\right) = 2$$

$$\Rightarrow x(x-300) = \frac{1200 \times 300}{2}$$

$\Rightarrow x(x-300) = 600 \times 300$
$\Rightarrow x(x-300) = 600\ (600 - 300)$
$\Rightarrow x = 600$ kmph.
$\therefore$ Scheduled duration of flight =

$\frac{1200}{600} = 2$ hours

39. (4) Consumption of petrol in covering 540 km

$= \frac{540}{45} = 12$ litres

$\therefore$ Required expenses
= Rs. (12 × 20)
= Rs. 240

40. (2) $\because$ 18 km ≡ 1.5 cm

$\therefore$ 1 km ≡ $\frac{1.5}{18}$ cm

$\therefore$ 72 ≡ $\left(\frac{1.5 \times 72}{18}\right)$ cm = 6 cm

41. (2) Length of journey on foot = x km. (let).
$\therefore$ Length of journey on cycle = $(61 - x)$ km.
According to the question,

Time = $\frac{\text{Distance}}{\text{Speed}}$

$\therefore \frac{x}{4} + \frac{61 - x}{9} = 9$

$\Rightarrow \frac{9x + 244 - 4x}{36} = 9$

$\Rightarrow 5x + 244 = 36 \times 9 = 324$
$\Rightarrow 5x = 324 - 244 = 80$

$\Rightarrow x = \frac{80}{5} = 16$ km.

42. (1) Let the distance covered on foot be x km.
$\therefore$ Distance covered on cycle = $(61 - x)$ km.

Time = $\frac{\text{Distance}}{\text{Speed}}$

$\therefore \frac{x}{4} + \frac{61 - x}{9} = 9$

$\Rightarrow \frac{x}{4} - \frac{x}{9} = 9 - \frac{61}{9}$

$\Rightarrow \frac{9x - 4x}{36} = \frac{81 - 61}{9}$

$\Rightarrow \frac{5x}{36} = \frac{20}{9}$

$\Rightarrow x = \frac{20}{9} \times \frac{36}{5} = 16$ km.

43. (4) Distance = Speed × Time
= 330 × 10 = 3300 metre

44. (2) Let total distance covered be $2x$ km.
Total time = 14 hours 40 minutes

$= 14\frac{40}{60}$ hours $= 14\frac{2}{3}$ hours

$= \frac{44}{3}$ hours

Time = $\frac{\text{Distance}}{\text{Speed}}$

According to the question,

$\frac{x}{60} + \frac{x}{50} = \frac{44}{3}$

$\therefore \frac{5x + 6x}{300} = \frac{44}{3}$

$\Rightarrow \frac{11x}{300} = \frac{44}{3}$

$\Rightarrow x = \frac{44}{3} \times \frac{300}{11} = 400$

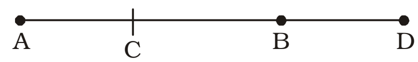
$\therefore$ Total distance
$= 2x = 2 \times 400 = 800$ km

45. (2) Distance between both donkeys = 400 metre.
Relative speed = (3 + 2) m./sec.
= 5 m./sec.
$\therefore$ Required time

$= \frac{\text{Distance}}{\text{Relative speed}}$

$= \frac{400}{5} = 80$ seconds

46. (2)



A's speed = x kmph.
B's speed = y kmph.
When A and B move in opposite directions they meet at C and when they move in the same direction, they meet at D.

Case I,
AC + CB = AB

$\frac{x}{2} + \frac{y}{2} = 15$

$\Rightarrow x + y = 30$ ..... (i)

Case II,
AD – BD = AB

$\Rightarrow x \times \frac{5}{2} - y \times \frac{5}{2} = 15$

$\frac{5}{2}(x - y) = 15$

$\Rightarrow x - y = \frac{15 \times 2}{5} = 6$ .....(ii)

$\therefore$ On adding equations (i) and (ii),
$x + y + x - y = 30 + 6$
$\Rightarrow 2x = 36$

$\Rightarrow x = \frac{36}{2} = 18$ kmph.

47. (2) Speed of person = 3 kmph

$= \left(\frac{3000}{60}\right)$ m./min.

= 50 m./min.
$\therefore$ Length of the diagonal of square field
= 50 × 2 = 100 metre

$\therefore$ Required area = $\frac{1}{2} \times (100)^2$

= 5000 sq. metre

❑❑❑

TEST YOURSELF

1. Express speed of 36 km per hr. in metres per second.
(1) 10 m/sec. (2) 8 m/sec.
(3) 12 m/sec. (4) 18m/sec.

2. Express speed of 60 metres per sec. in km per hour.
(1) 232 kmph (2) 216 kmph
(3) 116 kmph (4) 118 kmph

3. A man covers 20 kms in 2 hours. Find the distance covered by him in $5\frac{1}{2}$ hours.
(1) 50 km (2) 65 km
(3) 55 km (4) 45 km

4. A car runs at 60 km per hr. A man runs at one-third the speed of the car and reaches office from his house in 15 minutes. How far is his office from his house?
(1) 7 km (2) 5.5 km
(3) 6 km (4) 5 km

5. Walking at a speed of 6 km per hour, a man takes 5 hours to complete his journey. How much time will he need to complete the same journey at the rate of 8 km per hr.?
(1) $3\frac{3}{4}$ hours (2) 3 hours
(3) $2\frac{3}{4}$ hours (4) 3.5 hours

6. A person covers 10 kms at 4 km per hr. and then further 21 kms at 6 km per hr. Find his average speed for whole journey.
(1) $5\frac{1}{3}$ kmph (2) $5\frac{1}{6}$ kmph
(3) $5\frac{1}{2}$ kmph (4) $4\frac{1}{2}$ kmph

7. P and Q are two cities. A boy travels on cycle from P to Q at a speed of 20 km per hr. and returns at the rate of 10 km per hr. Find his average speed for the whole journey.
(1) $13\frac{2}{3}$ kmph (2) $12\frac{1}{3}$ kmph
(3) $13\frac{1}{3}$ kmph (4) $12\frac{2}{3}$ kmph

8. A man walked a certain distance. One-third he walked at 5 km per hr. Another one-third he walked at 10 km per hr. and the rest at 15 km per hr. Find his average speed.
(1) $8\frac{1}{11}$ kmph (2) $7\frac{1}{11}$ kmph
(3) $7\frac{2}{11}$ kmph (4) $8\frac{2}{11}$ kmph

9. An aeroplane travels a distance in the form of a square with the speed of 400 km per hr, 600 km per hr, 800 km per hr. and 1200 km per hr respectively. Find the average speed for the whole distance along the four sides of the square.
(1) 640 kmph (2) 620 kmph
(3) 630 kmph (4) 650 kmph

10. A man covers one-third of his journey at 30 km per hr. and the remaining two-third at 45 km per hr. If the total journey is of 150 kms, what is his average speed for the whole journey?
(1) 38 kmph (2) $38\frac{4}{7}$ kmph
(3) 64 kmph (4) $39\frac{4}{7}$ kmph

11. When a person covers the distance between his house and office at 50 km per hr. he is late by 20 minutes. But when he travels at 60 km per hr. he reaches 10 minutes early. What is the distance between his office and his house?
(1) 140 km. (2) 160 km.
(3) 150 km. (4) 120 km.

12. A boy walks from his house at 4 km per hr. and reaches his school 9 minutes late. If his speed had been 5 km per hr. he would have reached his school 6 minutes earlier. How far his school from house?
(1) 6.5 km. (2) 5.5 km.
(3) 6 km. (4) 5 km.

13. A car travels a distance of 300 kms at uniform speed. If the speed of the car is 5 km per hr more it takes two hours less to cover the same distance. Find the original speed of the car.
(1) 25 kmph (2) 20 kmph
(3) 24 kmph (4) 28 kmph

14. A car can finish a certain journey in 10 hours at a speed of 48 km per hr. In order to cover the same distance in 8 hours, how much the speed be increased by ?
(1) 10 kmph (2) 12 kmph
(3) 14 kmph (4) 15 kmph

15. If a boy walks from his house to school at the rate of 4 km per hr, he reaches the school 10 minutes earlier than the scheduled time. However if he walks at the rate of 3 km per hr, he reaches 10 minutes late. Find the distance of his school from his house.
(1) 3.5 km (2) 3 km
(3) 4 km (4) 4.5 km

16. A man has to reach a place 40 kms away. He walks at the rate of 4 km per hr. for the first 16 kms and then he hires a rickshaw for the rest of the journey. However if he had travelled by the rickshaw for the first 16 kms and the remaining distance on foot at 4 km per hr, he would have taken an hour longer to complete the journey. Find the speed of rickshaw.
(1) 6.5 kmph (2) 7.5 kmph
(3) 6 kmph (4) 8 kmph

17. Walking $\frac{3}{4}$ of my usual speed, a late is marked on my cards by 10 minutes. Find my usual time.
(1) 30 minutes (2) 35 minutes
(3) 32 minutes (4) 36 minutes

18. By walking $\frac{5}{3}$ of usual speed a student reaches school 20 minutes earlier. Find his usual time.
(1) 45 minutes
(2) 50 minutes
(3) 60 minutes
(4) None of these

19. Walking at $\frac{3}{4}$ of his usual speed a man is late by $2\frac{1}{2}$ hours. The usual time would have been what?

(1) 7 hours (2) 7.5 hours
(3) 8 hours (4) 8.5 hours

20. Two men *A* and *B* walk from *X* to *Y* a distance of 42 kms at 5 km and 7 km an hour respectively. *B* reaches *Y* and returns immediately and meets *A* at *R*. Find the distance from *X* to *R*.

(1) 32 km (2) 30 km
(3) 35 km (4) 40 km

21. Two men *A* and *B* start walking simultaneously from *P* to *Q*, a distance of 21 kms, at the speed of 3 km and 4 km an hour respectively. *B* reaches *Q*, returns immediately and meets *A* at *R*. Find the distance from *P* to *R*.

(1) 22 km (2) 20 km
(3) 16 km (4) 18 km

22. Ram travelled one-third of a journey with a speed of 10 km per hr, the next one-third with a speed of 9 km per hr. and the rest at a speed of 8 km per hr. If he had travelled half the journey at speed of 10 km per hr. and the other half with a speed of 8 km per hr, he would have been 1 minute longer on the way. What distance did he travel?

(1) 36 km (2) 32 km
(3) 35 km (4) 40 km

23. A man walks a distance of 35 kms. He walks for some time at 4 km per hour and for some time at 5 km per hr. If he walks at 5 km per hr. instead of 4 km per hr. and 4 km per hr. instead of 5 km per hr, he will walk 2 kms more in the same span of time. Find his total time of total journey.

(1) 8.5 hours (2) 7.5 hours
(3) 8 hours (4) 7 hours

24. A man travels 400 kms in 4 hours partly by air and partly by train. If he had travelled all the way by air, he would have saved $\frac{4}{5}$ of the time he was in train and would have arrived his destination 2 hours early. Find the distance he travelled by train.

(1) 95 km. (2) 85 km.
(3) 90 km. (4) 100 km.

25. On increasing the speed of a train at the rate of 10 km per hr, 30 minutes is saved in a journey of 100 kms. Find the initial speed of train.

(1) 40 kmph (2) 45 kmph
(3) 42 kmph (4) 44 kmph

26. Ravi can walk a certain distance in 40 days when he rests 9 hours a day. How long will he take to walk twice the distance, twice as fast and rest twice as long each day?

(1) 80 days (2) 100 days
(3) 90 days (4) 95 days

27. A monkey climbing up a greased pole ascends 12 metres and slips down 5 metres in alternate minutes. If the pole is 63 metres high, how long will it take him to reach the top?

(1) 18 minutes
(2) 16 minutes
(3) $16\frac{7}{12}$ minutes
(4) 18 minutes 20 seconds

28. A hare sees a dog 100 metres away from her and scuds off in the opposite direction at a speed of 12 km per hr. A minute later the dog perceives her and chases her at a speed of 16 km per hr. How soon will the dog overtake the hare and at what distance from the spot when the hare took flight?

(1) 900 metres (2) 950 metres
(3) 1000 metres (4) 1100 metres

29. A hare, pursued by a grey hound is 50 of her own leaps before him. While the hare takes 4 leaps, the grey hound takes 3 leaps. In one leap, the hare goes 1.75 metres and the grey hound 2.75 metres. In how many leaps, will the grey hound overtake the hare?

(1) 210 leaps (2) 220 leaps
(3) 230 leaps (4) 250 leaps

30. In a flight of 600 kms, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km per hr. and the time of flight increased by 30 minutes. Find the duration of flight.

(1) 1.2 hours (2) 1 hour
(3) 1.5 hours (4) 2 hours

31. Two trains leave a railway station at the same time. The first train travels due west and the second train due north. The first train travels 5 km per hr. faster than the second train. If after two hours they are 50 km apart, find the average speed of faster train.

(1) 18 kmph (2) 15 kmph
(3) 20 kmph (4) 25 kmph

32. A carriage driving in a fog passed a man who was walking at the rate of 6 km per hr. in the same direction. He could see the carriage for 4 minutes and it was visible to him up to a distance of 200 metres. Find the speed of the carriage.

(1) 8.75 kmph (2) 8.5 kmph
(3) 8 kmph (4) 9 kmph

33. Two bullets were fired at a place at an interval of 12 minutes. A person approaching the firing point in his car hears the two sounds at an interval of 11 minutes 40 seconds. The speed of sound is 330 metres per second. What is the approximate speed of the car?

(1) 34 kmph (2) 32 kmph
(3) 36 kmph (4) 38 kmph

34. *A* and *B* start simultaneously at 5 km per hr. and 4 km per hr. from *P* and *Q*, 180 kms apart, towards *Q* and *P* respectively. They cross each other at *M* and after reaching *Q* and *P* turn back immediately and meet again at *N*. Find the distance *MN*.

(1) 45 km (2) 40 km
(3) 35km (4) 42 km

35. A car driving in the morning fog passes a man walking at 4 km per hr. in the same direction. The man can see the car for 3 minutes and visibility is upto a distance of 130 metres. Find the speed of the car.

(1) 7.5 kmph (2) 6.6 kmph
(3) 6 kmph (4) 7 kmph

36. Ram starts his journey from Bombay to Pune and simultaneously Mohan starts from Pune to Bombay. After crossing each other they finish their remaining journey in $6\frac{1}{4}$ and 4 hours respectively. What is Mohan's speed if Ram's speed is 20 km per hr. ?

(1) 28 kmph (2) 24 kmph
(3) 25 kmph (4) 30 kmph

37. A train meets with an accident after travelling 30 kms, after which it moves with $\frac{4}{5}$ th of its original speed and arrives at the destination 45 minutes late. Had the accident happened 18 kms further on, it would have been 9 minutes before. Find the distance of journey and original speed of the train.

(1) 120 km ; 25 kmph
(2) 125 km ; 25 kmph
(3) 130 km ; 30 kmph
(4) 120 km ; 30 kmph

38. A train met with an accident 3 hours after starting, which detains it for one hour, after which it proceeds at 75% of its original speed. It arrives at the destination 4 hours late. Had the accident taken place 150 km further along the railway line, the train would have arrived only $3\frac{1}{2}$ hours late. Find the length of the trip and the original speed of the train.

(1) 1100 km ; 100 kmph
(2) 1200 km ; 100 kmph
(3) 1200 km ; 90 kmph
(4) 1600 km ; 90 kmph

39. A train after travelling 100 kms from *P* meets with an accident and then proceeds at $\frac{3}{4}$ th of its original speed and arrives at the terminus *Q* 90 minutes late. Had the accident occurred 60 kms further on, it would have reached 15 minutes sooner. Find the original speed of the train and the distance *PQ*.

(1) 65 kmph; 480 km
(2) 75 kmph; 450 km
(3) 80 kmph; 460 km
(4) 85 kmph; 460 km

40. Two trains *A* and *B* are 110 km apart on a straight line. One train starts from *A* at 7 a.m. and travels towards *B* at 20 km per hr. Another train starts from *B* at 8 am. and travels towards *A* at a speed of 25 km per hr. At what time will they meet?

(1) 10 : 15 a.m.
(2) 09 : 50 a.m.
(3) 09 : 30 a.m.
(4) 10 : 00 a.m.

41. Two boys begin together to write out a booklet containing 817 lines. The first boy starts with the first line, writing at the rate of 200 lines an hour and the second boy starts with the last lines then writes line 816 and so on. Backward proceeding at the rate of 150 lines an hour. At what line will they meet?

(1) 467^{th} line (2) 468^{th} line
(3) 470^{th} line (4) 475^{th} line

42. Two men set out the same time to walk towards each other from two points *A* and *B*, 72 km apart. The first man walks at the rate of 4 km per hr. The second man walks 2 km in the first hour, $2\frac{1}{2}$ km in the second hour, 3 km in the third hour and so on. Find the time after which the two men will meet.

(1) 8 hours (2) 9 hours
(3) 8.5 hours (4) 9.5 hours

43. A man is standing on a railway bridge which is 50 metres long. He finds that a train crosses the bridge in $4\frac{1}{2}$ seconds but himself in 2 seconds. Find the length of the train and its speed.

(1) 60 m ; 20 m/sec
(2) 40 m ; 20 kmph
(3) 40 m ; 20 m/sec
(4) 40 m ; 25 m/sec

44. Two places *A* and *B* are 162 kms apart. A train leaves *A* for *B* and at the same time another train leaves *B* for *A*. The two trains meet at the end of 6 hours. If the train travelling from *A* to *B* travels 8 km per hr. faster than the other, find the speed of the faster train.

(1) 16.5 kmph (2) 16 kmph
(3) 17 kmph (4) 17.5 kmph

45. A train running at 25 km per hour take 18 seconds to pass a platform. Next, it takes 12 seconds to pass a man walking at the rate of 5 km per hr. in the same direction. Find the length of the platform.

(1) 25 metres (2) 20 metres
(3) 24 metres (4) 28 metres

46. Two trains 200 metres and 175 metres long are running on parallel lines.They take $7\frac{1}{2}$ seconds when running in opposite directions and $37\frac{1}{2}$ seconds when running in the same direction to pass each other. Find their speeds in km per hour.

(1) 118 kmph ; 75 kmph
(2) 108 kmph ; 72 kmph
(3) 120 kmph ; 75 kmph
(4) 125 kmph ; 80 kmph

47. A train travelling at the rate of 60 km per hr, while inside a tunnel, meets another train of half its length travelling at 90 km per hr. and passes completely in $4\frac{1}{2}$ seconds. Find the length of the tunnel if the first train passes completely through it in 4 minutes $37\frac{1}{2}$ seconds.

(1) 5 km (2) 3.5 km
(3) 4.5 km (4) 6 km

48. A train overtakes two person walking at 2 km per hr. and 4 km per hr. respectively and passes completely them in 9 sec. and 10 sec. respectively. What is the length of the train?

(1) 65 metres (2) 60 metres
(3) 55 metres (4) 50 metres

49. A train takes 18 seconds to pass completely through a station 162 metres long and 15 seconds to pass completely through another station 120 metres long. Find the speed of train in km per hr.

(1) 50.4 kmph (2) 52 kmph
(3) 55 kmph (4) 60 kmph

50. Two trains of which one is 50 metres longer than the other are running in opposite directions and cross each other in 10 seconds. If they be running in the same direction then faster train would have passed the other train in 1 minute 30 seconds. The speed of faster train is 90 km per hr. Find the speed of other train.
(1) 25 m/sec. (2) 20 m/sec.
(3) 30 m/sec. (4) 35 m/sec.

51. A man standing on a 170 metre long platform watches that a train takes $7\frac{1}{2}$ seconds to pass him and 21 seconds to cross the platform. Find the speed of train.
(1) $12\frac{16}{27}$ m/sec.
(2) 12.5 m/sec.
(3) $12\frac{13}{27}$ m/sec.
(4) None of these

52. A goods train 158 metres long and travelling at the speed of 32 km per hr. leaves Delhi at 6 am. Another mail train 130 metres long and travelling at the average speed of 80 km per hr. leaves Delhi at 12 noon and follows the goods train. At what time will the mail train completely cross the goods train?
(1) 4 hours
(2) 4 hours 21.6 sec.
(3) 5 hours 21.6 sec.
(4) None of these

53. A motor-boat goes 2 km upstream in a stream flowing at 3 km per hr. and then returns downstream to the starting point in 30 minutes. Find the speed of the motor-boat in still water.
(1) 9.5 kmph (2) 8.5 kmph
(3) 9 kmph (4) 8 kmph

54. A person can row a boat 32 km upstream and 60 km downstream in 9 hours. Also, he can row 40 km upstream and 84 km downstream in 12 hours. Find the rate of the current.
(1) 3 kmph (2) 2.5 kmph
(3) 1.5 kmph (4) 2 kmph

55. A boatman takes his boat in a river against the stream from a place *A* to a place *B* where *AB* is 21 km and again returns to *A*. Thus he takes 10 hours in all. The time taken by him downstream in going 7 km is equal to the time taken by him against stream in going 3 km. Find the speed of river.
(1) 2 kmph (2) 2.5 kmph
(3) 3 kmph (4) 3.5 kmph

56. A motorist and a cyclist start from *A* to *B* at the same time. *AB* is 18 km. The speed of motorist is 15 m per hr. more than the cyclist. After covering half the distance, the motorist rests for 30 minutes and thereafter his speed is reduced by 20%. If the motorist reaches the destination *B*, 15 minutes earlier than that of the cyclist, then find the speed of the cyclist.
(1) 16 kmph (2) 12 kmph
(3) 14 kmph (4) 15 kmph

57. A man covered a distance of 3990 km partly by air, partly by sea and remaining by land. The time spent in air, on sea and on land is in the ratio 1 : 16 : 2 and the ratio of average speed is 20 : 1 : 3 respectively. If total average speed is 42 km per hr, find the distance covered by sea.
(1) 1720 km. (2) 1620 km.
(3) 1520 km. (4) 1820 km.

58. A railway engine is proceeding towards *A* at uniform speed of 30 km/hr. While the engine is 20 kms away from *A* an insect starting from *A* flies again and again between *A* and the engine relentlessly. The speed of insect is 42 km per hr. Find the distance covered by the insect till the engine reaches *A*.
(1) 25 km. (2) 32 km.
(3) 30 km. (4) 28 km.

59. Distance between two stations *X* and *Y* is 220 km. Trains *P* and *Q* leave station *X* at 8 a.m. and 9.51 a.m. respectively at the speed of 25 kmph and 20 kmph respectively for journey towards *Y*. A train *R* leaves station *Y* at 11.30 a.m. at a speed of a 30 kmph. for journey towards *X*. When will *P* be at equal distance from *Q* and *R*?
(1) 12:48 pm. (2) 12:30 pm.
(3) 12:45 pm. (4) 11:48 pm.

60. A person travels a certain distance on a bicycle at a certain speed. Had he moved 3 km/hour faster, he would have taken 40 minutes less. Had he moved 2km/hour slower, he would have taken 40 minutes more. Find the distance.
(1) 45 km. (2) 40 km.
(3) 50 km. (4) 55 km.

61. A steamer goes downstream from one port to another in 4 hours. It covers the same distance upstream in 5 hours. If the speed of the stream be 2 km/hr, find the distance between the two ports.
(1) 60 km. (2) 45 km.
(3) 80 km. (4) 65 km.

62. In a 200 metre race, A beats B by 20 metres; while in a 100 metres race, B beats C by 5 metres. Assuming that the speed of A, B and C remain the same in various races, by how many metres will A beat C in one kilometre race ?
(1) 140 metre (2) 145 metre
(3) 135 metre (4) 125 metre

63. Two places A and B are 80 km apart from each other on a highway. A car starts from A and another from B at the same time. If they move in the same direction, they meet each other in 8 hours. If they move in opposite directions towards each other, they meet in 1 hour 20 minutes. Determine the speed of the faster car.
(1) 20 kmph (2) 25 kmph
(3) 35 kmph (4) 30 kmph

64. In a one-kilometre race, A beats B by 15 seconds and B beats C by 15 seconds. If C is 100 metres away from the finishing mark, when B has reached it, find the speed of A.
(1) 9.5 m/sec. (2) 9 m/sec.
(3) 8 m/sec. (4) 8.3 m/sec.

65. A train running at the speed of 72 km/hr passes a tunnel completely in 3 minutes. While inside the tunnel, it meets another train of $\frac{3}{4}$ of its length coming from opposite direction at the speed of 90km/hr and passes it completely in $3\frac{1}{2}$ seconds. Find the length of the tunnel.
(1) 3510 metre (2) 3500 metre
(3) 3400 metre (4) 3600 metre

SHORT ANSWERS

1. (1)	**2.** (2)	**3.** (3)	**4.** (4)
5. (1)	**6.** (2)	**7.** (3)	**8.** (4)
9. (1)	**10.** (2)	**11.** (3)	**12.** (4)
13. (1)	**14.** (2)	**15.** (3)	**16.** (4)
17. (1)	**18.** (2)	**19.** (2)	**20.** (3)
21. (4)	**22.** (1)	**23.** (3)	**24.** (4)
25. (1)	**26.** (2)	**27.** (3)	**28.** (4)
29. (1)	**30.** (2)	**31.** (3)	**32.** (4)
33. (1)	**34.** (2)	**35.** (2)	**36.** (3)
37. (4)	**38.** (2)	**39.** (3)	**40.** (4)
41. (1)	**42.** (2)	**43.** (3)	**44.** (4)
45. (1)	**46.** (2)	**47.** (3)	**48.** (4)
49. (1)	**50.** (2)	**51.** (1)	**52.** (2)
53. (3)	**54.** (4)	**55.** (1)	**56.** (2)
57. (3)	**58.** (4)	**59.** (1)	**60.** (2)
61. (3)	**62.** (2)	**63.** (3)	**64.** (4)
65. (1)			

EXPLANATIONS

1. (1) 36 km/hr.

$$= \left(36 \times \frac{5}{18}\right) \text{ m/sec.}$$

= 10 m/sec.

2. (2) 60 metres per sec.

$$= \left(60 \times \frac{18}{5}\right) \text{ km per hr.}$$

= 216 km per hr.

3. (3) Distance = 20 kms

Time = 2 hours

$$\therefore \text{ Speed } = \frac{\text{Distance}}{\text{Time}}$$

$$= \frac{20}{2} = 10 \text{ km per hr.}$$

Now, we have, Speed = 10 km per hr.

$$\text{Time } = \frac{11}{2} \text{ hr.}$$

$\therefore$ Distance = Speed × Time

$$= 10 \times \frac{11}{2} = 55 \text{ km.}$$

4. (4) Man's speed $= \frac{1}{3}$ of the speed of car

$$= \frac{1}{3} \times 60 = 20 \text{ km per hr.}$$

Time taken to reach office= 15 minutes $= \frac{15}{60} = \frac{1}{4}$ hr.

$\therefore$ Distance between his house and office

= Speed × Time

$$= 20 \times \frac{1}{4} = 5 \text{ km.}$$

5. (1) Speed = 6 km/hr

Time taken = 5 hours

$\therefore$ Distance covered

= 6 × 5 = 30 kms

$\therefore$ Time required to cover 30 kms at the speed of 8 km/hr.

$$= \frac{\text{Distance}}{\text{Speed}} = \frac{30}{8} = \frac{15}{4} \text{ hours}$$

$$= 3\frac{3}{4} \text{ hours}$$

6. (2) **Case I.**

Distance = 10 kms

Speed = 4 km/hr.

$$\therefore \text{ Time taken } (t_1) = \frac{10}{4} = \frac{5}{2} \text{ hrs.}$$

Case II.

Distance = 21 kms

Speed = 6 km/hr.

$$\therefore \text{ Time taken } (t_2) = \frac{21}{6} = \frac{7}{2} \text{ hrs.}$$

$$\text{Total time taken } = \frac{5}{2} + \frac{7}{2}$$

$$= \frac{5+7}{2} = 6 \text{ hrs.}$$

Total distance covered

= 10 + 21 = 31 kms

$\therefore$ Average Speed

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

$$= \frac{31}{6} \text{ km per hr.}$$

$$= 5\frac{1}{6} \text{ km per hr.}$$

7. (3) Let the speed between P and Q be x km.

Then time taken to cover x km.

$$P \text{ to } Q = \frac{x}{20} \text{ hrs.}$$

Time taken to cover x km from Q to P at 10 km per hr. P to Q

$$= \frac{x}{10} \text{ hrs.}$$

$\therefore$ Total distance covered

= x + x = $2x$ km.

Time taken to cover $2x$ km.

$$= \frac{x}{20} + \frac{x}{10} = \frac{x+2x}{20} = \frac{3x}{20} \text{ hrs.}$$

$\therefore$ Average Speed

$$= \frac{2x}{\frac{3x}{20}} = \frac{2x \times 20}{3x}$$

$$= \frac{40}{3} \text{ km per hr.}$$

$$= 13\frac{1}{3} \text{ km per hr.}$$

Method 2 :

Here, x = 20 km per hr.

y = 10 km per hr.

$\therefore$ Average speed

[$\because$ Distance is same]

$$= \frac{2xy}{x+y} = \frac{2 \times 20 \times 10}{20+10}$$

$$= \frac{400}{30} = \frac{40}{3} = 13\frac{1}{3} \text{ km per hr.}$$

8. (4) Here, the man covers equal distance at different speeds. Using the formula, the Average Speed is given by

$$= \frac{3}{\frac{1}{5}+\frac{1}{10}+\frac{1}{15}} = \frac{3}{\frac{6+3+2}{30}}$$

$$= \frac{90}{11} = 8\frac{2}{11} \text{ km per hour.}$$

9. (1) As distance is covered along four sides (equal) of a square at different speeds, the average speed of the aeroplane

$$= \frac{4}{\frac{1}{400}+\frac{1}{600}+\frac{1}{800}+\frac{1}{1200}}$$

[$\because$ All the sides of square are equal, so distance between them is same]

$= \dfrac{4}{\dfrac{30+20+15+10}{12000}}$

$= \dfrac{48000}{75} = 640$ km per hr.

10. (2) Length of journey = 150 kms

$\dfrac{1}{3}$ rd of journey $= \dfrac{150}{3} = 50$ kms

Remaining $\dfrac{2}{3}$ journey

= 150 – 50 = 100 kms

Time taken in $\dfrac{1}{3}$ rd journey at 30 km per hr.

$t_1 = \dfrac{50}{30} = \dfrac{5}{3}$ hrs.

Time taken in $\dfrac{2}{3}$ rd journey at 45 km per hr.

$t_2 = \dfrac{100}{45} = \dfrac{20}{9}$ hrs.

Total time taken in whole journey = $t_1 + t_2$

$= \dfrac{5}{3} + \dfrac{20}{9} = \dfrac{15+20}{9} = \dfrac{35}{9}$ hrs.

Average Speed

$= \dfrac{150}{\dfrac{35}{9}} = \dfrac{150 \times 9}{35} = \dfrac{270}{7}$

$= 38\dfrac{4}{7}$ km per hr.

11. (3) Let time taken to reach office at 50 kmph be x hrs

Then time taken to reach office at 60 kmph = $\left(x + \dfrac{30}{60}\right)$ hrs

As, distance covered is same,

$\therefore x \times 50 = 60\left(x + \dfrac{30}{60}\right)$

$50x = 60x + 30$

$\Rightarrow x = 3$ hrs

Hence, distance = 3 × 50

= 150 km

12. (4) Let time taken to reach school at 4 kmph be x hrs.

Then time taken to reach school at 5 kmph = $\left(x + \dfrac{15}{60}\right)$ hrs

Since, distance is equal.

$\therefore 4x = 5\left(x + \dfrac{15}{60}\right)$

$x = \dfrac{5}{4}$ hrs.

Hence, distance between school & house = $4 \times \dfrac{5}{4}$ km = 5 km

13. (1) Let the original speed of the car = x km per hr.

When it is increased by 5 km per hr, the speed = $x + 5$ km per hr.

As per the given information in the question,

$\dfrac{300}{x} - \dfrac{300}{x+5} = 2$

$\Rightarrow \dfrac{300(x+5) - 300x}{x(x+5)} = 2$

$\Rightarrow \dfrac{300x + 1500 - 300x}{x^2 + 5x} = 2$

$\Rightarrow \dfrac{1500}{x^2 + 5x} = 2$

$\Rightarrow \dfrac{750}{x^2 + 5x} = 1$

$\Rightarrow x^2 + 5x = 750$

$\Rightarrow x^2 + 5x - 750 = 0$

$\Rightarrow x^2 + 30x - 25x - 750 = 0$

$\Rightarrow x(x + 30) - 25(x + 30) = 0$

$\Rightarrow (x + 30)(x - 25) = 0$

$\Rightarrow x = -30$ or 25

The negative value of speed is inadmissible.

Hence, the required speed = 25 km per hr.

14. (2) Time = 10 hours,

Speed = 48 km per hr.

$\therefore$ Distance = Speed × Time

= 48 × 10 = 480 km

Now, this distance of 480 kms is to be covered in 8 hours. Hence, the required Speed

$= \dfrac{\text{Distance}}{\text{New time}} = \dfrac{480}{8}$

= 60 km per hr.

$\therefore$ Increase in speed

= 60 – 48 = 12 km per hr.

15. (3) Let the distance be x kms.

$\therefore$ Time taken at 4 km per hr. t_1

$= \dfrac{x}{4}$ hrs.

Time taken at 3 km per hr. t_2

$= \dfrac{x}{3}$ hrs.

Difference in timings

= 10 + 10 = 20 minutes

or $\dfrac{20}{60} = \dfrac{1}{3}$ hour

$\therefore \dfrac{x}{3} - \dfrac{x}{4} = \dfrac{1}{3}$

$\Rightarrow \dfrac{4x - 3x}{12} = \dfrac{1}{3}$

$\Rightarrow \dfrac{x}{12} = \dfrac{1}{3}$

$\therefore x = 4$ km.

Hence the required distance

= 4 kms.

16. (4) Let the speed of Rickshaw be 'x'.

Then, time taken to cover 16 km on foot and 24 km on Rikshaw = $\dfrac{16}{4} + \dfrac{24}{x}$ hrs

and time taken to travel 24 km on foot & 16 km on Rikshaw

$= \dfrac{16}{x} + \dfrac{24}{4}$ hrs

According to question,

$= \dfrac{16}{4} + \dfrac{24}{x} + 1 = \dfrac{16}{x} + \dfrac{24}{4}$

$\Rightarrow \dfrac{5 + 24}{x} = \dfrac{16}{x} + 6$

$\Rightarrow \dfrac{24 - 16}{x} = 1$

$\Rightarrow x = 8$ km/hr

17. (1) Since I walk at $\frac{3}{4}$ of my usual speed the time taken is $\frac{4}{3}$ of my usual time.

[$\because$ the speed and time are in the inverse ratio]

$\therefore$ $\frac{4}{3}$ of usual time

= Usual time + Time I reach late

$\therefore$ $\frac{1}{3}$ of usual time

= 10 minutes

$\therefore$ Usual time

= 10 × 3 = 30 minutes.

18. (2) $\frac{5}{3}$ of usual speed means $\frac{3}{5}$ of usual time as he reaches earlier.

$\therefore$ $\frac{3}{5}$ usual time + 20 minutes= Usual time

20 minutes $=\left(1-\frac{3}{5}\right)$ usual time

$=\frac{2}{5}$ usual time

$\therefore$ Usual time

$=\frac{20\times5}{2}$ = 50 minutes.

19. (2) New speed is $\frac{3}{4}$ of the usual speed

$\therefore$ New time taken $=\frac{4}{3}$ of the usual time

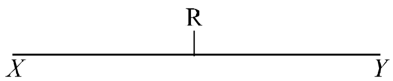
$\therefore$ $\frac{4}{3}$ of the usual time – Usual time $=\frac{5}{2}$

$\Rightarrow$ $\frac{1}{3}$ of the usual time $=\frac{5}{2}$

$\therefore$ Usual time $=\frac{5}{2}\times3$

$=\frac{15}{2}$ hours or 7.5 hrs

20. (3) When *B* meets *A* at *R*, by then B has walked a distance (*XY* + *YR*) and *A*, the distance *XR*. That is both of them have together walked twice the distance from *X* to *Y*, i.e., 42 kms.

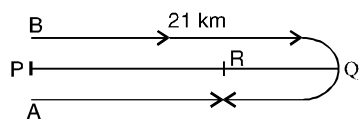


Now, the ratio of speed of *A* and *B* is 5 : 7 and they walk 84 kms.

$\therefore$ Hence, the distance *XR* travelled by

A $=\frac{5}{5+7}\times84$ = 35 kms.

21. (4) Let *A* and *B* meet after time *t* hours.



Distance covered by *A* in *t* hours = 3 *t* km.

Distance covered by *B* in *t* hours = 4 *t* km.

Total distance covered by *A* and *B* = (3*t* + 4*t*) km = 7 *t* km.

From the diagram we can see that the total distance covered by *A* and *B* is equal to twice the distance between *P* and *Q*.

$\therefore$ 7*t* = 2 × 21

$t=\frac{2\times21}{7}$

t = 6 hours

Distance *PR* = 6 × 3 = 18 km.

22. (1) Let the total distance travelled be *x* kms.

Case I :

Speed for the first one-third distance i.e. $\frac{x}{3}$ kms =10 km per hr.

$\therefore$ Time taken $=\frac{x}{30}$ hours

Similarly, time taken for the next one-third distance

$=\frac{x}{27}$ hours

and time taken for the last one-third distance $=\frac{x}{24}$ hours.

$\therefore$ Total time taken to cover *x* kms.

$=\left(\frac{x}{30}+\frac{x}{27}+\frac{x}{24}\right)$ hours.

Case II :

Time taken for one-half distance at the speed of 10 km per hr.

$=\frac{x}{20}$ hrs.

and time taken for remaining $\frac{1}{2}$ of distance $=\frac{x}{16}$ hrs. at 8 km per hr.

Total time taken

$=\left(\frac{x}{20}+\frac{x}{16}\right)$ hrs.

Time taken in (Case II – Case I)

= 1 minute $=\frac{1}{60}$ hr.

$\therefore$ According to the question

$$\frac{x}{20}+\frac{x}{16}-\left(\frac{x}{30}+\frac{x}{27}+\frac{x}{24}\right)$$

$$=\frac{1}{60}$$

$$\Rightarrow\frac{108x+135x-72x-80x-90x}{2160}$$

$$=\frac{1}{60}$$

$$\Rightarrow\frac{243x-242x}{2160}=\frac{1}{60}$$

$$\Rightarrow\frac{x}{2160}=\frac{1}{60}$$

$$\Rightarrow x=\frac{2160}{60}=36\text{ km.}$$

Hence the required distance = 36 km.

23. (3) Let the man walks for *x* hours at 4 km per hr. and *y* hours at 5 km per hr. and covers a distance of 35 kms.

$\therefore$ Distance = 4*x* + 5*y* = 35 ...(*i*)

Now, he walks at 5 km per hr.

for x hours and at 4 km per hr. for y hours and covers a distance (35 + 2) = 37 kms

$\therefore$ Distance = $5x + 4y = 37$...(*ii*)

By 5 × (*i*) – 4 × (*ii*) we have

$20x + 25y = 175$

$20x + 16y = 148$

–   –   –

$9y = 27$

$\Rightarrow y = 3$

Putting the value of (y) in equation (*i*), we have

$4x + 5 \times 3 = 35$

$\Rightarrow 4x = 35 - 15 = 20$

$\Rightarrow x = 5$

$\therefore$ Total time taken

$= x + y = 5 + 3 = 8$ hours.

24. (4) Obviously, $\frac{4}{5}$ of total time in train = 2 hours

$\therefore$ Total time in train

$= \frac{5}{4} \times 2 = \frac{5}{2}$ hours

Total time to cover 400 km is 4 hours

$\therefore$ Time spent in travelling by air $= 4 - \frac{5}{2} = \frac{8-5}{2} = \frac{3}{2}$ hours

If 400 kms is travelled by air, then time taken = 2 hours

$\therefore$ In 2 hours, distance covered by air = 400 kms

In $\frac{3}{2}$ hours distance covered

$= \frac{400}{2} \times \frac{3}{2}$ = 300 kms

Distance covered by the train

= 400 – 300 = 100 kms.

25. (1) Let the original speed be x km/hr

then, increased speed

= (x + 10) km/hr

According to question,

$$\frac{100}{x} - \frac{100}{x+10} = \frac{30}{60}$$

$$\left[\begin{array}{l} \because \text{Original time – New time} \\ = 30 \text{ minute or } \frac{30}{60} hr \end{array}\right]$$

$$\Rightarrow 100\left[\frac{1}{x} - \frac{1}{x+10}\right] = \frac{1}{2}$$

$$\Rightarrow \frac{x+10-x}{x(x+10)} = \frac{1}{200}$$

$\Rightarrow 10 \times 200 = x(x + 10)$

$\Rightarrow x^2 + 10x - 2000 = 0$

$\Rightarrow x^2 + 50x - 40x - 2000 = 0$

$\Rightarrow x(x + 50) - 40(x + 50) = 0$

$\Rightarrow x = -50, 40$

Speed can't be negative.

Hence, Original speed = 40 kmph

26. (2) Working hours per day= 24 – 9 = 15 hrs.

Total working hours for 40 days = 15 × 40 = 600 hrs.

On doubling the distance, the time required becomes twice but on walking twice as fast, the time required gets halved. Therefore, the two together cancel each other with respect to time required. Increasing rest to twice reduces walking hours per day to

24 – (2 × 9) = 6 hrs.

$\therefore$ Total number of days required to cover twice the distance, at twice speed with twice the rest.

$= \frac{600}{6} = 100$ days

27. (3) In 1 minute the monkey climbs 12 metres but then he takes 1 minute to slip down 5 metres. So, at the end of 2 minutes the net ascending of the monkey is 12 – 5 = 7 metres. So, to cover 63 metres the above process is repeated $\frac{63}{7} = 9$ times. Obviously, in 9 such happenings the monkey will slip 8 times, because on 9th time, it will climb to the top.

Thus, in climbing 8 times and slipping 8 times, he covers 8 × 7 = 56 metres.

Time taken to cover 56 metres

$= \frac{56 \times 2}{7}$ = 16 minutes

Remaining distance

= 63 – 56 = 7 metres

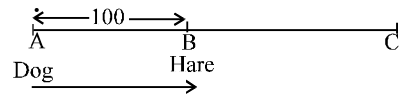
Time taken to ascend 7 metres

$= \frac{7}{12}$ minutes

$\therefore$ Total time taken $= 16 + \frac{7}{12}$

$= 16\frac{7}{12}$ minutes.

28. (4)



Let the hare at B sees that dog is at A.

$\therefore$ AB = 100 metres

Again, let C be the position of the hare when the dog sees her.

$\therefore$ BC= the distance covered by the hare in 1 minute

$= \frac{12 \times 1000 \times 1}{60}$ = 200 metres

$\therefore$ $AC = AB + BC$

= 100 + 200 = 300 metres

Thus, hare has a start of 300 metres.

Now, the dog gains 16 – 12 = 4 kms

4000 metres in 1 hour i.e. 60 minutes

$\therefore$ The distance gained by dog in 1 minute

$= \frac{4000}{60} = \frac{200}{3}$ metres

$\because \frac{200}{3}$ metres is covered in 1 minute

$\therefore$ 300 metres is covered in

$\frac{300 \times 3}{200} = \frac{9}{2}$ minutes

Again the distance walked by hare in $\frac{9}{2}$ minutes

$= \frac{12000}{60} \times \frac{9}{2}$ = 900 metres

$\therefore$ Total distance from

B = 200 + 900 = 1100 metres.

29. (1) Grey hound and hare make 3 leaps and 4 leaps respectively. This happens at the same time. The hare goes 1.75 metres in 1 leap.

∴ Distance covered by hare in 4 leaps = 4 × 1.75 = 7 metres

The grey hound goes 2.75 metres in one leap.

∴ Distance covered by it in 3 leaps

= 3 × 2.75 = 8.25 metres

Distance gained by grey hound in 3 leaps $=(8.25-7)$

= 1.25 metres

Distance covered by hare in 50 leaps = 50 × 1.75 metres

= 87.5 metres

Now, 1.25 metres is gained by grey hound in 3 leaps

∴ 87.5 metres is gained in

$\frac{3}{1.25}\times 87.5$ = 210 leaps.

30. (2) Let the original speed be x kmph

then, new speed = $(x-200)$ kmph

According to question,

Time taken with new speed – time taken with original speed = 30 min. i.e $\frac{1}{2}$ hr.

$$\therefore \frac{600}{x-200}-\frac{600}{x}=\frac{1}{2}$$

$$\Rightarrow 600\left[\frac{1}{x-200}-\frac{1}{x}\right]=\frac{1}{2}$$

$$\Rightarrow \frac{x-x+200}{x(x-200)}=\frac{1}{1200}$$

$\Rightarrow 24000 = x(x-200)$

$\Rightarrow x^2 - 200x - 24000 = 0$

$\Rightarrow x^2 - 600x + 400x - 24000 = 0$

$\Rightarrow x(x-600) + 400(x-600) = 0$

$\Rightarrow (x-600)(x+400) = 0$

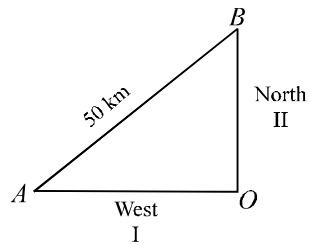
$\Rightarrow x = 600, -400$

Speed cannot be negative

Hence, original speed = 600 kmph and duration of flight

$=\frac{600}{600}$ hr. = 1 hr.

31. (3) Let the speed of the second train be x km per hr. Then the speed of the first train is $x + 5$ km per hr.



Let O be the position of the railway station from which the two trains leave. Distance travelled by the first train in 2 hours = $OA = 2(x+5)$ km.

Distance travelled by the 2nd train in 2 hours= $OB = 2x$ km.

By Pythagoras theorem, $AB^2 = OA^2 + OB^2$

$\Rightarrow 50^2 = [2(x+5)]^2 + [2x]^2$

$\Rightarrow 2500 = 4(x+5)^2 + 4x^2$

$\Rightarrow 2500 = 4(x^2 + 10x + 25) + 4x^2$

$\Rightarrow 8x^2 + 40x - 2400 = 0$

$\Rightarrow x^2 + 5x - 300 = 0$

$\Rightarrow x^2 + 20x - 15x - 300 = 0$

$\Rightarrow x(x+20) - 15(x+20) = 0$

$\Rightarrow (x-15)(x+20) = 0$

$\Rightarrow x = 15, -20$

But x cannot be negative

∴ $x = 15$

∴ The speed of the second train is 15 km per hr. and the speed of the first train is 20 km per hr.

32. (4) The distance covered by man in 4 minutes

$=\frac{6\times 1000\times 4}{60}$ = 400 metres

The distance covered by carriage in 4 minutes

= 200 + 400 = 600 metres

∴ Speed of carriage

$=\frac{600}{4}\times\frac{60}{1000}$ km per hr.

= 9 km per hr.

33. (1) If the car were not moving, the person would have heard the two sounds at an interval of 12 minutes. Therefore, the distance travelled by car in 11 minutes 40 seconds is equal to the distance that could have been covered by sound in 12 min – 11 min. 40 seconds = 20 seconds.

Distance covered by sound in 20 seconds

= 330 × 20 = 6600 m

In 11 min 40 seconds

or 700 seconds the car travels 6600 m.

In 1 second the car will travel

$\frac{6600}{700}$ metre $=\frac{66}{7}$ metre

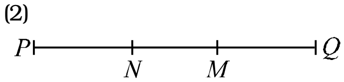
∴ Speed of the car $=\frac{66}{7}$ metre per second

$=\frac{66}{7}\times\frac{18}{5}$ km per hr.

$=\frac{1188}{35}$ km per hr.

$=33\frac{33}{35}$ km per hr. ≈ 34 kmph

34. (2)



When A and B cross each other at M for the first time, they have together covered the whole distance PQ = 180 km.

When they meet again at N, they have together covered total distance equal to 3 times of PQ = 3 × 180 = 540 km.

$PM=\frac{5}{5+4}\times 180=100$ km

[Distance covered by each will be in the ratio of their speeds)

$QP+PN=\frac{4}{5+4}\times 540$

= 240 km

or PN = 240 – QP = 240 – 180 = 60 km.

Then, $MN = PM - PN$

= 100 – 60 = 40 km.

35. (2) Distance covered by man in 3 minutes

$=\left(\frac{4\times 1000}{60}\right)\frac{\text{m}}{\text{minutes}}\times 3$ minutes

=200 metres

Total distance covered by the car in 3 min.

= (200 + 130) m = 330 metres

∴ Speed of the car

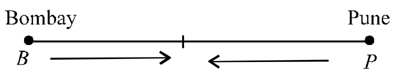
$=\frac{330}{3}$ m per min.

$= 110$ m per minutes

$= \dfrac{\frac{110}{1000}}{\frac{1}{60}} = \dfrac{33}{5}$ km per hr.

or 6.6 kmph

36. (3)



Suppose that Ram and Mohan meet at A. Let Ram's speed be x km per hr. and Mohan's speed be y km per hr. Then $AP = \dfrac{25}{4}x$ km and $AB = 4y$ km.

Now, time taken by Ram in going from B to A $= \dfrac{4y}{x}$

and the time taken by Mohan in going from P to A $= \dfrac{25x}{4y}$.

Obviously time taken is equal

$\therefore \dfrac{4y}{x} = \dfrac{25x}{4y}$

$\Rightarrow 16y^2 = 25x^2$

$\Rightarrow \dfrac{y^2}{x^2} = \dfrac{25}{16}$

$\Rightarrow \dfrac{y}{x} = \dfrac{5}{4}$

$\Rightarrow y = \dfrac{5}{4}x$

Here, $x = 20$ km per hr.

$\therefore$ y = Mohan's speed

$= \dfrac{5}{4} \times 20 = 25$ km per hr.

37. (4) Let the original speed be x and distance be y

Case I.

Time taken by train to travel 30 km $= \dfrac{30}{x}$

Time taken by train after accident

$= \dfrac{y-30}{4/5\,x}$

Total time taken $= \dfrac{30}{x} + \dfrac{y-30}{4/5\,x}$

Case II :

Time taken by train to travel 48 km $= \dfrac{48}{x}$

Time taken by train after accident $= \dfrac{y-48}{4/5\,x}$

Total time taken $= \dfrac{48}{x} + \dfrac{y-48}{4/5\,x}$

According to question,

$$\left(\frac{30}{x} + \frac{y-30}{4/5\,x}\right) - \left(\frac{48}{x} + \frac{y-48}{4/5\,x}\right)$$

$= \dfrac{9}{60}$ [$\because$ Difference between time is 9 minutes]

$$\left(\frac{y-30}{4/5x} - \frac{y-48}{4/5x}\right) + \left(\frac{30}{x} - \frac{48}{x}\right)$$

$= \dfrac{9}{60}$

$$\frac{y-y-30+48}{4/5x} + \frac{(-18)}{x} = \frac{9}{60}$$

$$\frac{5(18)}{4x} - \frac{18}{4x} = \frac{9}{60}$$

$$\Rightarrow \frac{90-72}{4x} = \frac{9}{60}$$

$$x = \frac{18 \times 60}{4 \times 9} = 30$$

Hence, original speed = 30 kmph

Also,

$$\frac{30}{x} + \frac{y-30}{4/5x} = \frac{y}{x} + \frac{45}{60}$$

[Original time + 45 minute = New time]

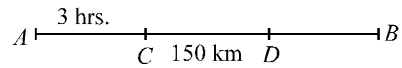
$\Rightarrow 3x - y = -30$

$\Rightarrow 3(30) - y = -30$

$\Rightarrow y = 120$ km

i.e. Distance = 120 km

38. (2) Let A be the starting point, B the terminus. C and D are points where accidents take place.



$\therefore 0.75 = \dfrac{3}{4}$

By travelling at $\dfrac{3}{4}$ of its original speed, the train would take $\dfrac{4}{3}$ of its usual time i.e., $\dfrac{1}{3}$ more of the usual time.

$\therefore$ $\dfrac{1}{3}$ of the usual time taken to travel the distance CB.

$= 4 - 1 = 3$ hrs. ...(i)

and $\dfrac{1}{3}$ of the usual time taken to travel the distance

$DB = 3\dfrac{1}{2} - 1 = 2\dfrac{1}{2}$ hrs. ...(ii)

Subtracting equation (ii) from (i) we can write,

$\dfrac{1}{3}$ of the usual time taken to travel the distance

$CD = 3 - 2\dfrac{1}{2} = \dfrac{1}{2}$ hr.

$\therefore$ Usual time taken to travel

CD (150 km) $= \dfrac{\frac{1}{2}}{\frac{1}{3}} = \dfrac{3}{2}$ hr.

Usual speed of the train

$= \dfrac{150}{\frac{3}{2}} = 100$ km per hr.

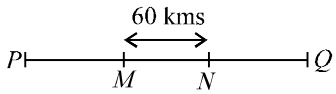
Usual time taken to travel CB

$= \dfrac{3}{\frac{1}{3}} = 9$ hrs.

Total time = 3 + 9 = 12 hrs.

$\therefore$ Length of the trip $= 12 \times 100 = 1200$ km.

39. (3)



Let P be the starting point, Q the terminus, M and N the places where accidents occur.

At $\frac{3}{4}$th of the original speed, the train will take $\frac{4}{3}$ of its usual time to cover the same distance i.e., $\frac{1}{3}$rd more than the usual time.

$\frac{1}{3}$rd of the usual time to travel a distance of 60 kms between MN = 15 min.

$\therefore$ Usual time to travel 60 kms

= 15 × 3 = 45 min. = $\frac{3}{4}$ hr.

$\therefore$ Usual speed of the train per hour = $60 \times \frac{4}{3}$ = 80 km per hr.

Usual time taken to travel MQ= 90 × 3

= 270 min. or $\frac{9}{2}$ hrs.

$\therefore$ The distance MQ

$= 80 \times \frac{9}{2} = 360$ km.

Therefore, the total distance PQ = $PM + MQ$

= 100 + 360 = 460 kms.

40. (4) Let they meet x hrs after 7 am.

Distance covered by A in x hours = $20x$ km

Distance covered by B in $(x - 1)$ hr. = 25 $(x - 1)$ km

$\therefore$ $20x + 25(x - 1) = 110$

$\Rightarrow 20x + 25x - 25 = 110$

$\Rightarrow 45x = 110 + 25 = 135$

$\Rightarrow x = 3$

$\therefore$ Trains meet at 10 a.m.

41. (1) Writing ratio $= 200 : 150 = 4 : 3$

In a given time first boy will be writing the line number

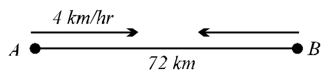
$\frac{4}{7} \times 817$

$= \frac{3268}{7}$ th line $= 466\frac{6}{7}$ th line

or, 467 th line

Hence, both of them shall meet on 467th line.

42. (2) Let the two men meet after t hours.



Distance covered by the first man starting from A = 4 t km.

Distance covered by the second man starting from B

$= 2 + 2.5 + 3 + ... + \left[2 + \left(\frac{t-1}{2}\right)\right]$

This is an arithmetic series of t terms with $\frac{1}{2}$ as common difference.

$\therefore$ By applying formula

$S = \frac{n}{2}\left[2a + (n-1)d\right]$

Where, n = no. of terms

a = first term

d = common difference

We have its sum

$= \frac{t}{2}\left[(2 \times 2) + (t-1) \times \frac{1}{2}\right]$

$= 2t + \frac{t^2 - t}{4}$

Total distance covered by two men $= 4t + 2t + \frac{t^2 - t}{4} = 72$

or $6t + \frac{t^2 - t}{4} = 72$

or $24t + t^2 - t = 288$

or $t^2 + 23t - 288 = 0$

or $t^2 - 9t + 32t - 288 = 0$

or $t(t-9) + 32(t - 9) = 0$

or $(t - 9)(t + 32) = 0$

$\therefore$ Either $t - 9 = 0 \Rightarrow t = 9$

or, $(t + 32) = 0 \Rightarrow t = -32$

Time cannot be negative. Hence, the two men will meet after 9 hrs.

43. (3) Let the length of the train be x metres

Then, the time taken by the train to cover $(x + 50)$ metres is $4\frac{1}{2}$ seconds

$\therefore$ Speed of the train

$= \frac{x + 50}{\frac{9}{2}}$ m/s

or $\frac{2x + 100}{9}$ m per second ...(i)

Again, the time taken by the train to cover x metres in 2 seconds.

$\therefore$ Speed of the train $= \frac{x}{2}$ metre per second ..(ii)

From equations (i) and (ii), we have

$\frac{2x + 100}{9} = \frac{x}{2}$

$\Rightarrow 4x + 200 = 9x$

$\Rightarrow 5x = 200$

$\Rightarrow x = 40$

$\therefore$ Length of the train = 40 metres

$\therefore$ Speed of the train

$= \frac{x}{2} = \frac{40}{2}$ = 20 m per sec.

44. (4) Both trains meet after 6 hours.

$\therefore$ The relative speed of two trains $= \frac{162}{6}$ = 27 km per hr.

The speed of the slower train starting from B

$= \frac{27 - 8}{2} = \frac{19}{2} = 9\frac{1}{2}$ km per hr.

$\therefore$ The speed of the faster train

$= 9\frac{1}{2} + 8 = 17\frac{1}{2}$ km per hr.

45. (1) Let the length of train be x metres and the length of platform be y metres.

Speed of the train

$= \left(25 \times \frac{5}{18}\right)$ m/sec

$= \frac{125}{18}$ m per sec.

Time taken by train to pass the platform

$= \left[(x+y)\times\frac{18}{125}\right]$ sec.

$\therefore\ (x+y)\times\frac{18}{125} = 18$

or, $x + y = 125$ ...(i)

Speed of train relative to man = (25 + 5) km per hr.

$= \left(30\times\frac{5}{18}\right)$ m per sec.

$= \frac{25}{3}$ m per sec.

Time taken by the train to pass the man

$= \left(x\times\frac{3}{25}\right)$ sec. $= \frac{3x}{25}$ sec.

$\therefore\ \frac{3x}{25} = 12$

$\Rightarrow x = \left(\frac{25\times 12}{3}\right) = 100$ metres

Putting $x = 100$ in equation (i), we get, $y = 25$ metres.

$\therefore$ Length of train = 100 metres and length of the platform = 25 metres.

46. (2) Let the speed of the train be x metre per sec. and y metre per sec. respectively.

Sum of the length of the trains = 200 + 175 = 375 metres

Case : I

When the trains are moving in opposite directions

Relative speed = $(x + y)$ m per sec.

In this case the time taken by the trains to cross each other

$= \frac{375}{x+y}$ sec.

$\therefore\ \frac{375}{x+y} = \frac{15}{2}$

$\Rightarrow x + y = 50$ ...(i)

Case : II

When the trains are moving in the same direction.

Relative speed = $(x - y)$ m per sec.

In this case, the time taken by the trains to cross each other

$= \frac{375}{x-y}$ sec.

$\therefore\ \frac{375}{x-y} = \frac{75}{2}$

$\Rightarrow x - y = 10$ ...(ii)

Now, $x + y = 50$

$x - y = 10$

$2x = 60$

$\Rightarrow x = 30$

Putting this value in equation (i), we have

$y = 50 - 30 = 20$

$\therefore$ Speed of trains = 30 m per sec.

$= 30\times\frac{18}{5} = 108$ km per hr.

and 20 m per sec. $= 20\times\frac{18}{5}$

= 72 km per hr.

47. (3) Trains are running in opposite direction.

$\therefore$ Relative speed of the two trains = 90 + 60 = 150 km per hr.

Distance travelled in $4\frac{1}{2}$ seconds with speed of 150 km per hr. $= 150\times\frac{5}{18}$ m per sec.

$= 150\times\frac{5}{18}\times\frac{9}{2} = \frac{375}{2}$ metres

Let the length of the first train be x metres.

Then the length of the second train be $\frac{x}{2}$ metres

$\therefore\ x+\frac{x}{2} = \frac{375}{2}$

$\Rightarrow \frac{3x}{2} = \frac{375}{2}$

$\Rightarrow 3x = 375$

$\Rightarrow x = 125$ metres

Hence, the length of the first train = 125 metres

Speed of the first train = 60 km per hr.

$= 60\times\frac{5}{18} = \frac{50}{3}$ m per sec.

Time taken by the first train to cross the tunnel = 4 minutes and $37\frac{1}{2}$ sec.

$= 240+\frac{75}{2}$ sec. $= \frac{480+75}{2}$

$= \frac{555}{2}$ sec.

Speed of first train

$= \frac{50}{3}$ m per sec.

$\therefore$ Distance covered by it in $\frac{555}{2}$ sec.

$= \frac{50}{3}\times\frac{555}{2} = 4625$ metres

Hence, length of tunnel

= 4625 – 125 = 4500 metres

= 4.5 km

48. (4) Let the length of the train be x km and its speed y km per hr.

Case I : When it passes the man walking at 2 km per hr. in the same direction

Relative speed of train = $(y - 2)$ km per hr.

$\therefore\ \frac{x}{y-2} = 9$ seconds

$= \frac{9}{3600} = \frac{1}{400}$ hour ..(i)

Case II : When the train crosses the man walking at 4 km per hr. in the same direction.

Relative speed of train= (y – 4) km per hr.

$\therefore\ \frac{x}{y-4} = 10$ sec.

$\Rightarrow \frac{x}{y-4} = \frac{10}{3600}$ hrs.

$\Rightarrow \frac{x}{y-4} = \frac{1}{360}$ hrs. ..(ii)

On dividing equation (i) by (ii), we have

$$\frac{y-4}{y-2}=\frac{\frac{1}{400}}{\frac{1}{360}}=\frac{360}{400}=\frac{9}{10}$$

$\Rightarrow$ 10y – 40 = 9y – 18

$\Rightarrow$ 10y – 9y = 40 – 18

$\Rightarrow$ y = 22 km per hr.

$\therefore$ From equaton (i), we have

$$\frac{x}{22-2}=\frac{1}{400}$$

$$\Rightarrow x=\frac{1}{20}\text{ km}$$

$$=\frac{1000}{20}=50\text{ metres.}$$

49. (1) Let the length of the train be x metres

Then, in 18 sec. the train travels (x + 162) metres ...(i)

and in 15 sec. the train travels (x + 120) metres

$\therefore$ In (18 – 15) = 3 sec. the train travels (x + 162) – (x + 120) = 42m.

$\therefore$ In 1 sec the train travels $=\frac{42}{3}$ = 14 metres ...(ii)

$\therefore$ In 18 sec. the train travels = 14 × 18 = 252 metres ...(iii)

From equations (i) and (iii)

$\therefore$ x + 162 = 252

$\Rightarrow$ x = 252 – 162 = 90

$\therefore$ Length of the train = 90 metres

Also, from equation (ii) we see that in 1hr. the train travels

= 14 × 60 × 60 metres

$$=\frac{14\times 60\times 60}{1000}\text{ km}=50.4\text{ km}$$

$\therefore$ The speed of the train

= 50.4 km per hr.

50. (2) Let the length of trains be x m and (x + 50)m and the speed of other train be y m per sec.

The speed of the first train

= 90 km per hr.

$$=90\times\frac{5}{18}=25\text{ m per sec.}$$

Case I : Opposite direction,

Their relative speed

= (y + 25)m per sec.

Distance covered = x + x + 50

= 2x + 50 metres

$$\therefore\text{ Time taken}=\frac{2x+50}{y+25}=10$$

$\Rightarrow$ 2x + 50 = 10y + 250 ...(i)

Case II. Direction is Same

Their relative speed

= (25 – y) m per sec.

Distance covered = x + x + 50

= 2x + 50m

$$\therefore\text{ Time taken}=\frac{2x+50}{25-y}=90$$

$\Rightarrow$ 2x + 50 = 90 (25 – y) ...(ii)

From equations (i) and (ii)

10y + 250 = 2250 – 90y

$\Rightarrow$ 10y + 90y = 2250 – 250

$$\Rightarrow y=\frac{2000}{100}=20$$

Putting y = 20 in equation (i), we have

2x + 50= 10 × 20 + 250 = 450

$\Rightarrow$ 2x = 450 – 50 = 400

$$\Rightarrow x=\frac{400}{2}=200$$

$\therefore$ x + 50 = 200 + 50

= 250 metres.

Hence,

The length of the 1st train = 200 metres.

The length of the 2nd train

= 250 metres.

The speed of the 2nd train

= 20 m per sec.

51. (1) Let the length of the train be x m and its speed y m/sec.

Distance covered in crossing the platform

= 170 + x metres

and time taken = 21 seconds

$$\therefore\text{ Speed } y=\frac{170+x}{21}\quad ...(i)$$

Distance covered to cross the man = x metres

and time taken $=7\frac{1}{2}=\frac{15}{2}$ seconds

$$\therefore\text{ Speed } y=\frac{x}{\frac{15}{2}}=\frac{2x}{15}\quad ...(ii)$$

From equations (i) and (ii),

$$\frac{170+x}{21}=\frac{2x}{15}$$

$\Rightarrow$ 2550 + 15x = 42x

$\Rightarrow$ 42x – 15x = 2550

$\Rightarrow$ 27x = 2550

$$\Rightarrow x=\frac{2550}{27}=94\frac{4}{9}\text{ metres}$$

From equation (ii),

$$y=\frac{2\times 2550}{15\times 27}$$

$$=\frac{340}{27}=12\frac{16}{27}\text{ m per sec.}$$

Hence, speed $=12\frac{16}{27}$ m per sec

52. (2) The goods train leaves Delhi at 6 am and mail train at 12 noon, hence after 6 hours

The distance covered by the goods train in 6 hours at 32 km per hr. $=32\times 6=192$ kms

The relative velocity of mail train with respect to goods train = 80 – 32 = 48 km per hr.

To completely cross the goods train, the mail train will have to cover a distance

= 192 km + 158m + 130m

= 192km + 0.158 km + 0.130 km

= 192.288 km more

Since, the mail train goes 48 kms more in 1 hour.

$\therefore$ The mail train goes 192.288 kms more in

$$=\frac{192288}{1000}\times\frac{1}{48}=\frac{2003}{500}$$

= 4 hours 21.6 sec.

53. (3) Let the speed of the motorboat in still water be Z km per hr.

Downstream speed= (Z + 3) km per hr.

Upstream speed

= (Z – 3) km per hr.

Total journey time

$= 30$ minutes $= \frac{30}{60}$ hr. $= \frac{1}{2}$ hour

We can write,

$\frac{2}{Z-3} + \frac{2}{Z+3} = \frac{1}{2}$

or, $2\left[\frac{(Z+3)+(Z-3)}{(Z-3)(Z-3)}\right] = \frac{1}{2}$

or, $\frac{2Z}{Z^2-9} = \frac{1}{4}$

or, $Z^2 - 9 = 8Z$

or, $Z^2 - 8Z - 9 = 0$

or, $Z^2 + Z - 9Z - 9 = 0$

or, $Z(Z+1) - 9(Z+1) = 0$

or, $(Z+1)(Z-9) = 0$

$\therefore$ $Z = -1$ or 9.

Since speed can't be negative

Therefore, the speed of the motor-boat in still water = 9 km per hr.

54. (4) Let the upstream speed be x km per hr. and downstream speed be y km per hr.

Then, we can write,

$\frac{32}{x} + \frac{60}{y} = 9$

and, $\frac{40}{x} + \frac{84}{y} = 12$

Let $\frac{1}{x} = m$ and $\frac{1}{y} = n$

The above two equations can now be written as

$32m + 60n = 9$ ...(*i*)

and, $40m + 84n = 12$ ...(*ii*)

$7 \times (i) - 5 \times (ii)$ gives $24m = 3$

or $m = \frac{1}{8}$ or $x = 8$ km per hr.

$4 \times (ii) - 5 \times (i)$ gives $36n = 3$

or, $n = \frac{1}{12}$ or $y = 12$ km per hr.

Rate of current

$= \frac{y-x}{2} = \frac{12-8}{2} = 2$ km. per hr.

55. (1) Let the speed of boat and river be x km per hr. and y km per hr. respectively. Then,

The speed of boatman downstream = $(x + y)$ km per hr.

and the speed of boatman upstream = $(x - y)$ km per hr.

Time taken by boatman in going 21 km downstream

$= \frac{21}{x+y}$ hours

Time taken by boatman in going 21 km upstream $= \frac{21}{x-y}$ hrs.

According to the question,

$\frac{21}{x+y} + \frac{21}{x-y} = 10$ ..(*i*)

Now, time taken for 7 kms downstream $= \frac{7}{x+y}$ hrs.

and time taken for 3 kms upstream $= \frac{3}{x-y}$ hrs.

According to the question

$\frac{7}{x+y} - \frac{3}{x-y} = 0$ ...(*ii*)

By $(ii) \times 7 + (i)$

$\frac{49}{x+y} - \frac{21}{x-y} + \frac{21}{x+y} + \frac{21}{x-y} = 10$

$\Rightarrow \frac{70}{x+y} = 10$

$\Rightarrow x + y = 7$ ...(*iii*)

Putting $x + y = 7$ in equation (*ii*) we have

$\frac{7}{7} - \frac{3}{x-y} = 0$

$\Rightarrow 1 - \frac{3}{x-y} = 0$

$\Rightarrow x - y = 3$ ..(*iv*)

On adding (*iii*) and (*iv*), we have

$2x = 10$

$\Rightarrow x = 5$

$\therefore y = 7 - x = 7 - 5 = 2$

$\therefore$ Speed of river = 2 km per hr.

56. (2) Let the speed of the cyclist be x km per hr.

Speed of the motorist= $(x + 15)$ km per hr.

Time taken by the motorist to cover half of the distance

$= \frac{18}{2 \times (x+15)} = \frac{9}{x+15}$ hrs.

After covering 9 kms, the speed of motorist gets reduced by 20%

$\therefore$ New speed $= (x+15) \times \frac{80}{100}$

$= \frac{4(x+15)}{5}$ km per hr.

Time taken by the motorist to cover the remaining half distance

$= \frac{9 \times 5}{4(x+15)} = \frac{45}{4(x+15)}$ hrs.

Total time taken by the motorist

$= \frac{9}{x+15} + \frac{1}{2} + \frac{45}{4(x+15)}$ hrs.

Total time taken by the cyclist

$= \frac{18}{x}$ hrs.

Motorist reaches 15 minutes, i.e., $\frac{1}{4}$ hr. earlier.

$\therefore \frac{18}{x} - \frac{9}{x+15} - \frac{1}{2} - \frac{45}{4(x+15)}$

$= \frac{1}{4}$

$\Rightarrow$

$\frac{18 \times 4(x+15) - 36x - 2x(x+15) - 45x}{4x(x+15)} = \frac{1}{4}$

$\Rightarrow 72x + 1080 - 36x - 2x^2 - 30x - 45x = x^2 + 15x$

$\Rightarrow 3x^2 + 54x - 1080 = 0$

$\Rightarrow x^2 + 18x - 360 = 0$

$\Rightarrow x^2 + 30x - 12x - 360 = 0$

$\Rightarrow x(x + 30) - 12(x + 30) = 0$

$\Rightarrow (x + 30)(x - 12) = 0$

$\Rightarrow x = -30, 12$

The speed cannot be negative.

$\therefore$ The speed of the cyclist = 12 km per hr.

57. (3) Total distance travelled
= 3990 km
Distance = Time × Speed
Ratio of time spent = 1 : 16 : 2
Ratio of speed = 20 : 1 : 3
$\therefore$ Ratio of time × speed
= 20 × 1 : 16 × 1 : 2 × 3
= 20 : 16 : 6
Sum of the ratios
= 20 + 16 + 6 = 42
$\therefore$ Distance covered by sea

$= \frac{3990}{42} \times 16$ = 1520 kms

58. (4) Relative speed of insect
= 30 + 42 = 72 km per hr.
Distance between railway engine and insect = 20 km.
Engine and insect will meet for the first time after $= \frac{20}{72}$ hr.
Distance covered in this period

$= \frac{20}{72} \times 42 = \frac{35}{3}$ km

The insect will cover $\frac{35}{3}$ km in returning to A.
The distance covered by engine in this period

$= \frac{20}{72} \times 30 = \frac{25}{3}$ km

Since, the insect when reaches *A*, the engine will cover $\frac{25}{3}$ km to *A*.
$\therefore$ Remaining distance between *A* and engine

$= 20 - \left(\frac{25}{3} + \frac{25}{3}\right)$

$= 20 - \frac{50}{3} = \frac{10}{3}$ km.

Again, engine and insect will meet after $\frac{10}{3 \times 72} = \frac{5}{108}$ hr.
The distance covered by the insect in this period

$= \frac{5}{108} \times 42 = \frac{35}{18}$ km

and again the insect will cover $\frac{35}{18}$ km in returning.
$\therefore$ Total distance covered by the insect $= \frac{70}{3} + \frac{70}{18} + ...$

$$\left[\begin{array}{l} \frac{35}{3} + \frac{35}{3} = \frac{70}{3} \text{ and} \\ \frac{35}{18} + \frac{35}{18} = \frac{70}{18} \text{ and so on} \end{array}\right]$$

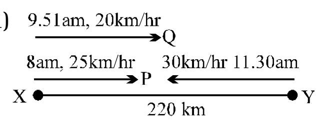
$$= \frac{70}{3}\left[1 + \frac{1}{6} + ...\infty\right]$$

It is a Geometric Progression to infinity with common ratio $\frac{1}{6}$.

$$= \frac{70}{3}\left[\frac{1}{1-\frac{1}{6}}\right] \quad \left[\because S_\infty = \frac{a}{1-r}\right]$$

$$= \frac{70}{3} \times \frac{1}{\frac{5}{6}} = \frac{70}{3} \times \frac{6}{5} = 28 \text{ km}$$

59. (1)



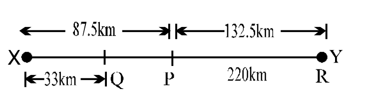
Distance covered by *P* till 11.30 a.m.
= (11.30 a.m. – 8 a.m.) × 25km

$= 3\frac{1}{2}$ × 25 = 87.5 km.

Distance covered by *Q* till 11.30 a.m.
= (11.30 – 9.51 am) × 20

$= 1\frac{39}{60}$ hrs. × 20 = 33 km

So, at 11.30 a.m. the three trains will be at positions shown below :



P gains 5 km every hour over *Q*.
Relative speed of *P* w.r.t. *R*
= 20 + 30 = 50 km per hr

Let *P* be at equal distance from *Q* and *R* after *t* hours.
$\therefore$ (87.5 – 33) + 5*t*
= 132.5 –55t
or, 54.5 + 5*t* = 132.5 – 55t
or, 60 *t* = 78

or, $t = \frac{78}{60}$ hrs.

= 1 hr 18 minutes
11.30 am + 1 hr. 18 min.
= 12.48 pm
At 12.48 pm, *P* would have covered a distance
= (12.48 pm – 8 am) × 25
= 120 km
Therefore, *P* will be at equal distance from *Q* and *R* at 12.48 pm

60. (2) Let the original speed of the person be *x* km/hr. and the distance be y km.

Case I : $\frac{y}{x} - \frac{y}{x+3} = 40$ minutes

or $\frac{40}{60}$ hr

or, $\frac{y}{x} - \frac{y}{x+3} = \frac{40}{60} = \frac{2}{3}$

or, $y\left[\frac{1}{x} - \frac{1}{(x+3)}\right] = \frac{2}{3}$

or, $y\left[\frac{x+3-x}{x(x+3)}\right] = \frac{2}{3}$

or, $\frac{3y}{x(x+3)} = \frac{2}{3}$

or, 2 *x* (*x* + 3) = 9*y* ...(i)

Case II : $\frac{y}{x-2} - \frac{y}{x} = \frac{40}{60}$

or, $y\left(\frac{1}{x-2} - \frac{1}{x}\right) = \frac{2}{3}$

or, $y\left[\frac{x-x+2}{x(x-2)}\right] = \frac{2}{3}$

or, $\frac{2y}{x(x-2)} = \frac{2}{3}$

or, *x* (*x* – 2) = 3*y* ... (ii)
On dividing equation (i) by (ii) we have,

$$\frac{2x(x+3)}{x(x-2)} = \frac{9y}{3y}$$

or, $\frac{2(x+3)}{(x-2)} = 3$

or, $2x + 6 = 3x - 6$

or, $3x - 2x = 6 + 6 = 12$

or, $x = 12$ km/hr.

$\therefore$ Original speed of the person = 12 km/hr.

Putting the value of x in equation (ii)

$12\ (12 - 2) = 3y$

or, $3y = 12 \times 10$

or, $y = \frac{12 \times 10}{3} = 40$

$\therefore$ The required distance = 40km.

61. (3) Let the speed of steamer in still water = x kmph

$\therefore$ Rate downstream = $(x + 2)$ kmph

Rate upstream = $(x - 2)$ kmph

Obviously, distance covered downstream and upstream are equal

$\Rightarrow 4\ (x + 2) = 5\ (x - 2)$

$\Rightarrow 4x + 8 = 5x - 10$

$\Rightarrow 5x - 4x = 10 + 8 \Rightarrow x = 18$

$\therefore$ Rate downstream = 18 + 2 = 20 kmph

Therefore, the required distance = Speed downstream × Time = 20 × 4 = 80 km.

62. (2) According to the question, when A covers the distance of 200 metres, B covers only 200–20 = 180 metres

Again, in 100 metre race, B beats C by 5 metres.

Hence, if B runs 100 metres, C runs 100–5 = 95 metres

$\because$ If B runs 100 m, C runs = 95 m

$\therefore$ If B runs 180 m, C runs

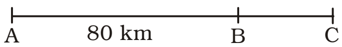
$= \frac{95 \times 180}{100} = 171$ m

$\therefore$ A : B : C = 200 : 180 : 171

Hence, A will beat C by = 200–171 = 29 m in 200 m race.

i.e., 29 × 5 = 145 m in 1 km race.

63. (3) **Case I :** When the cars are moving in the same direction.



Let A and B be two places and C be the place of meeting.

Let the speed of car starting from A be x kmph, and that of car starting from B be y kmph.

Relative speed = $(x - y)$ kmph

According to the question.

$(x - y) \times 8 = 80$

$\Rightarrow x - y = 10$ ...(i)

Case II : When the cars are moving in the opposite directions and they meet at point C.

Relative speed = $(x + y)$ kmph

Time taken = 1 hour 20 minutes

$= 1 + \frac{1}{3} = \frac{4}{3}$ hours

$\therefore (x + y) \times \frac{4}{3} = 80$

$\Rightarrow x + y = \frac{80 \times 3}{4}$

$\Rightarrow x + y = 60$ ...(ii)

Adding equations (i) and (ii),

$2x = 70$

$\Rightarrow x = 35$

From equation (ii),

$x + y = 60$

$\Rightarrow 35 + y = 60$

$\Rightarrow y = 60 - 35 = 25$

$\therefore$ Speed of the faster car = 35 kmph

64. (4) Let B take x seconds to run 1000 m.

$\therefore$ Time taken by C = $(x + 15)$ seconds

$\therefore \frac{x}{x+15} = \frac{900}{1000} = \frac{9}{10}$

$\Rightarrow 10x = 9x + 135$

$\Rightarrow x = 135$ seconds

Now in a one kilometre race, A beats B by 15 seconds.

It means A covers 1000 m in 135 – 15 = 120 seconds

$\therefore$ Speed of A

$= \frac{1000}{120} = \frac{25}{3}$ m/sec

= 8.3 m/sec.

65. (1) Trains are running in opposite directions.

$\therefore$ Relative speed = 72 + 90 = 162 kmph

$= 162 \times \frac{5}{18} = 45$ m/sec

Let the length of the first train be = x metre.

$\therefore$ Length of the second train

$= \frac{3}{4}x$ meter.

Now,

distance travelled in $3\frac{1}{2}$ seconds at 45 m/sec

$= 45 \times \frac{7}{2} = \frac{315}{2}$ metre

This distance is equal to sum of the lengths of trains.

$\therefore x + \frac{3x}{4} = \frac{315}{2}$

$\Rightarrow \frac{4x+3x}{4} = \frac{315}{2}$

$\Rightarrow \frac{7x}{4} = \frac{315}{2}$

$\Rightarrow x = \frac{315}{2} \times \frac{4}{7} = 90$

Hence, the length of the first train = 90 metre.

Speed of first train = 72 kmph

$= 72 \times \frac{5}{18} = 20$ m/sec

Time taken by the first train to cross the tunnel = 3 minutes = 180 seconds

$\therefore$ Distance covered by it in 180 seconds = 180 × 20 = 3600 metre

$\therefore$ Length of (first train + tunnel) = 3600 metre

$\therefore$ Length of tunnel = 3600 – 90 = 3510 metre