CH 3 DISTANCE SPEED AND TIME

ANSWERS AND EXPLANATIONS

EXERCISE 1

1. (b) Let x be the length of the bridge.

Length of the train = 100 m

Speed of train = 72 km/hr

$= \frac{72\times5}{18}\text{m/s}$

Time taken by train = 25 seconds.

$\therefore \quad 25 = \frac{100+x}{72\times\frac{5}{18}}$

$\Rightarrow \quad 25 \times 72 \times \frac{5}{18} = 100+x$

$\Rightarrow$ x = 500 – 100 = 400 m.

2. (d) Train takes 20 seconds to cover its length and 36 seconds to cross the platform, it mean it has taken 16 second at 54 km/hr to cross the length of platform.

$\therefore$ Length of the platform

= Distance × Time

= 54 × 16 km / hr

= $54 \times 16 \times \frac{5}{18}$ m/sec

= 240 m.

3. (a) Train has 12 bogies. Each bogie is 15 metre long.

$\therefore$ Total length of bogie = 15 × 12

= 180

Since, train crosses in 18 second

$\therefore \quad \text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{\text{Length}}{\text{Time}} = \frac{180}{18} = 10$

Due to some problem, 2 bogies were detached

$\therefore$ Remaining bogies = 12 –2 = 10

$\therefore$ Total length of bogie = 15 × 10 = 150

Thus, $\text{time} = \frac{\text{distance}}{\text{speed}} = \frac{150}{10} = 15\,\text{sec}$

4. (d) Relative speed of both trains

= 60 + 90 = 150 km / h

Total distance = 1.10 + 0.9 = 2 km

$\therefore$ Required time

$= \frac{2\times60\times60}{150} = 48\,\text{seconds.}$

5. (d) Let the car take n hr. to cover 385 km. Using the formula for sun of n terms of an A.P., we get

$\frac{n}{2}\left[2\times40+(n-1)5\right]=385$

or $\frac{n}{2}(80+5n-5)=385$

or $80n + 5n^2 - 5n = 770$

or $5n^2 + 75n - 770 = 0$

$\therefore$ n = 7 h

6. (c) Relative speed = 90 + 60 = 150 km/hr.

Total distance to be covered = 300 + 200 = 500 m

Time required

$= \frac{500}{150\times1000}\times3600 = 12$ sec.

7. (d) $\text{Speed} = \left(5\times\frac{5}{18}\right)\text{m/sec} = \frac{25}{18}\text{ m/sec.}$

Distance covered in 15 minutes

$= \left(\frac{25}{18}\times15\times60\right)\text{m} = 1250\text{ m.}$

8. (a) Speed $= \left(\frac{750}{150}\right)$ m/sec = 5 m/sec

$= \left(5 \times \frac{18}{5}\right)$ km/hr = 18 km/hr.

9. (a) Time taken by first man $= \frac{54}{8} = \frac{27}{4}$ h

$\therefore$ Time taken by second man

$= \left(\frac{27}{4} - \frac{1}{2} - \frac{15}{60}\right)$h = 6 h

$\therefore$ speed of second man $= \frac{54}{6} = 9$km/h

Hence, ratio of their speeds = 8 : 9

10. (d) Total distance travelled

$= \left[\left(50 \times \frac{5}{2}\right) + \left(70 \times \frac{3}{2}\right)\right]$ miles

= (125 + 105) miles = 230 miles.

11. (c) Number of gaps between 21 telephone posts = 20.

Distance travelled in 1 minute = (50 × 20) m

= 1000 m = 1 km.

$\therefore$ Speed $= \frac{1}{1/60}$ km/h = 60 km/h

12. (d) Required difference $= \frac{180}{3} - \frac{180}{4} = 15$ km

13. (c) Let the husband and the wife meet after x minutes. 4500 metres are covered by Pradeep in 60 minutes.

In x minutes, he will cover $\frac{4500}{60}$x metres.

Similarily,

In x minutes, his wife will cover $\frac{3750}{60}$x m.

Now, $\frac{4500}{60}x + \frac{3750}{60}x = 726$

$\Rightarrow x = \frac{726 \times 60}{8250} = 5.28$min

14. (c) Speed $= \frac{150+45}{20} = \frac{195}{20}$m/s $= \frac{195}{20} \times \frac{18}{5}$km/h

$= 35.1$ km/h ≈ 35 km/h

15. (a) Speed of train $= \frac{150+250}{30} = \frac{400}{30} = \frac{40}{3}$ m/s

$\therefore$ Required time $= \frac{150+130}{40/3} = \frac{280 \times 3}{40} = 21$sec

16. (e) Distance covered by the car = 80 × 10 = 800 km

$\therefore$ Speed = $\frac{800}{8} = 100$km/hr

$\therefore$ Speed gain = 100 – 80 = 20 km/hr

17. (c) Speed of the car $A = \frac{5}{6} \times 90 = 75$km/hr

$\therefore$ Reqd time $= \frac{88}{90+75} \times 60 = 32$ minutes

18. (b) Relative speed of the trains

= (72 – 54) km/h = 18 km/h

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

Time taken by the trains to cross each other

= Time taken to cover (100 + 120) m at 5 m/sec

$= \left(\frac{220}{5}\right)$ sec = 44 sec.

19. (a) Let speed of train be S km/h.

Speed of train relative to man

= [S – (– 6)] km/h

$= (S + 6) \times \frac{5}{18}$m/s

Now $(S+6) \times \frac{5}{18} = \frac{100}{18/5}$

$\Rightarrow S = 94$ m/s

20. (b) Speed of the train relative to man

$= (68 - 8)$ kmph $= \left(60 \times \frac{5}{18}\right)$ m/sec

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

Time taken by the train to cross the man

$= \left(150 \times \frac{3}{50}\right)$ sec $= 9$ sec.

21. (b) Distance covered by train A before the train B leaves Mumbai Central $= 60 \times 3 = 180$ km

$\therefore$ Time taken to cross each other

$= \frac{180}{12} = 15$ hour

$\therefore$ Reqd time = 2 pm + 15 = 5 am on the next day

22. (e) $\text{Speed of the car} = \frac{\text{Distance Covered}}{\text{Time Taken}}$

$= \frac{816}{12} = 68$ kmph.

23. (c) $\text{Speed of bus} = \frac{\text{Distance covered}}{\text{Time taken}}$

$= \frac{2924}{43} = 68$ kmph.

24. (e) Speed of train $= \frac{1560}{26}$

$= 60$ kmph.

25. (a) Distance covered = Speed × Time

$= 49 \times 7 = 343$km

26. (e) Time taken to cover a distance of 45 kms

$= \frac{45}{15} = 3$ hour

Time taken to cover a distance of 50 kms

$= \frac{50}{25} = 2$ hour

Time taken to cover distance of 25 kms

$= \frac{25}{10} = 2.5$ hour

Total distance = (45 + 50 + 25) kms = 120 kms

Total time = (3 + 2 + 2.5) hour = 7.5 hour

$\therefore$ Required average speed $= \frac{120}{7.5} = 16$ kmph

27. (e) Let the distance between the village and the school be x km.

According to the question,

$\frac{x}{4} + \frac{x}{2} = 6$

or, $\frac{x + 2x}{4} = 6$

or, $3x = 6 \times 4$

$\therefore x = \frac{6 \times 4}{3} = 8$ km

28. (a) Speed of train

$= \frac{(200 + 400)}{36} \times \frac{18}{5}$

$= 60$ km/hr.

29. (c) Distance covered in 18 seconds

$= 90 \times \frac{5}{18} \times 18 = 450\,m$

$\therefore$ length of platform

$= 450 - 160 = 290$ m

30. (b) Stoppage minute per hour

$= \frac{(64 - 48) \times 60}{64} = 15$ minutes.

31. (c) Speed of car

$= \frac{540}{9}$

$= 60$ kms/hr.

Speed of bike

$= 60 \times 2 \times \frac{2}{3}$

= 80 kms/hr.

Distance covered by bike

= 80 × 5

= 400 kms.

32. (c) Speed of bus

$= \frac{480}{12}$ = 40 km/hr

Speed of train

$= 40 \times \frac{9}{5}$ = 72 km/hr

Speed of car

$= \frac{72}{18} \times 13$ = 52 km/hr

Distance covered by car

= 52 × 5 = 260 km

33. (a) Length of platform

$= 126 \times \frac{5}{18} \times 24 - 300$ = 540 meter

$\therefore$ Speed of man = $\frac{540}{5 \times 60}$

= 1.8 meter/second

34. (e) Speed of train A = $\frac{280}{14}$ = 20 meter/second

Length of train B = 20 × 35 – 280 meter

= 700 – 280 meter

= 420 meter

35. (b) Distance = 64 × 8

= 512 km

$\therefore$ Speed = $\frac{512}{6}$

= 85 km/hr (approx.)

36. (b) Distance covered in first two hour

= 70 × 2 = 140 km

Distance covered in next two hour

= 80 × 2 = 160 km

Distance covered in first four hour

140 + 160 = 300 km

Remaining distance = 345 – 300 = 45 km. Now, this distance will be covered at the speed of 90 km/hr.

$\therefore$ Time taken = $\frac{45}{90} = \frac{1}{2}$ hour

Total time = 4 + 1/2 = 4 $\frac{1}{2}$ hour

37. (b) Clearly, time taken by him if he walked both ways = 6 hr 30 min + 2 hr 10 min = 8 hr 40 min.

EXERCISE 2

1. (b) Let the length of the two trains be l km and $l/2$ km respectively and length of the platform be x km.

then, $l + \frac{l}{2} = (36 + 54) \times \frac{12}{60 \times 60} = \frac{18}{60} = \frac{3}{10}$

$\Rightarrow \quad l = \frac{1}{5}$

Also, we have $x + l$

$= 36 \times \frac{3}{2 \times 60} = \frac{9}{10}$

$\Rightarrow \quad x = \frac{9}{10} - \frac{1}{5}$

$\Rightarrow \quad x = \frac{7}{10}$ km $= \frac{7}{10} \times 1000$m = 700m.

2. (c) We know that, the relation in time taken with two different modes of transport is

$t_{\text{walk both}} + t_{\text{ride both}} = 2\,(t_{\text{walk}} + t_{\text{ride}})$

$\frac{31}{4} + t_{\text{ride both}} = 2 \times \frac{25}{4}$

$\Rightarrow t_{\text{ride both}} = \frac{25}{2} - \frac{31}{4} = \frac{19}{4} = 4\frac{3}{4}$ hrs

3. (d) Let the distance between each pole be x m.

Then, the distance up to 12th pole = 11 x m

Speed = $\frac{11x}{24}$ m/s

Time taken to covers the total distance of 19x

$= \frac{19x \times 24}{11x} = 41.45s$

4. (c) After 5 minutes (before meeting), the top runner covers 2 rounds i.e., 400 m and the last runner covers 1 round i.e., 200 m.

$\therefore$ Top runner covers 800 m race in 10 minutes.

5. (d) Let after t hour they meet then,

$3t + 4t = 17.5 \Rightarrow t = 2.5$

$\therefore$ Time = 10 am + 2.5 h = 12 : 30pm

6. (a) Let original speed = S km/h

Here, distance to be covered is constant

$\therefore S \times 8 = (S+5)\left(\frac{20}{3}\right)$

$\Rightarrow 8S - \frac{20}{3}S = \frac{100}{3} \quad \Rightarrow S = \frac{100}{4} = 25 \text{ km/h}$

7. (d) Let C_1 takes t hr Then,

$\because$ Distance is same.

$\therefore 30t = 45\left(t - \frac{5}{2}\right)$

$\Rightarrow t = \frac{15}{2}\text{hrs}$

$\therefore \text{Distance} = 30 \times \frac{15}{2} = 225\text{km}$

8. (a) $d = \text{product of speed}\left[\frac{\text{difference of time}}{\text{difference of speed}}\right]$

$d = \frac{4 \times 5}{60}\left[\frac{10-(-5)}{5-4}\right]$ [Here, –ve sign indicates before the schedule time]

$\Rightarrow$ d = 5 km

9. (a) Due to stoppages, it covers 20 km less .

Time taken to cover $20\text{km} = \frac{20}{80}\text{h} = \frac{1}{4}\text{h}$

$= \frac{1}{4} \times 60\text{min} = 15 \text{ min}$

10. (b) If new speed is $\frac{a}{b}$ of original speed, then

usual time $\times \left(\frac{b}{a} - 1\right) =$ change in time

$\therefore$ usual time $\times \left(\frac{4}{3} - 1\right) = \frac{1}{3}$

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

11. (b) Let the distance between the two stations be x km.

Then, $\frac{x}{50} - \frac{10}{6} = \frac{x}{30} - \frac{50}{6}$

$\Rightarrow \frac{x}{50} - \frac{1}{6} = \frac{x}{30} - \frac{5}{6}$

or $\frac{x}{30} - \frac{x}{50} = \frac{2}{3}$

or $x = 50\text{km}$

Thus distance between the station A and B = 50 km

12. (c) Let the speed of the bus be x km / h.

then speed of the car = (x + 25) km / h

$\therefore \frac{500}{x} = \frac{500}{x+25} + 10$

$\Rightarrow x^2 + 25x - 1250 = 0 \Rightarrow x = 25$

Thus speed of the bus = 25 km/h

Speed of the car = 50 km/h

Alternative:

Difference in speeds 25 km / hr is in only option (c).

13. (a) Distance to be covered by the thief and by the owner is same.

Let after time 't', owner catches the thief.

$\therefore 40 \times t = 50\left(t - \frac{1}{2}\right)$

$\Rightarrow 10t = 25 \Rightarrow t = \frac{5}{2}\text{hr} = 2\frac{1}{2}\text{hr}$

14. (a) A covers 3.5 km before he meets B in

$(18 \times 3.5 + 3) = 66 \text{ min} = \frac{66}{60} = \frac{11}{10}\text{h}$

Now, B covers a distance of 5.5 km in $\frac{11}{10}$ hour

$\Rightarrow$ B's speed $= \frac{11}{2} \times \frac{10}{11} = 5\text{km/h}$

15. (a) Average speed $= \frac{\text{Total distance}}{\text{Total time}}$

$= \frac{400 \times 4 \times 9}{88+96+89+87} = \frac{400 \times 4 \times 9}{360}$

= 40 metres /minutes

16. (a) Let the speed of car = S km /h.

Also, let previous time = t hr. Then,

$420 = St \quad \ldots (i)$

Also , $420 = (S + 10)(t - 1)$

$\Rightarrow 420 = (S+10)\left(\frac{420}{S} - 1\right)$ [By (i)]

$\Rightarrow S^2 + 10S - 4200 = 0$

$\Rightarrow (S + 70)(S - 60) = 0$

$\Rightarrow S = 60$ km/h

17. (c) Total distance travelled in 12 hour

= (35 + 37 + 39 + ... upto 12 terms)

This is an A.P. with first term a = 35,

number of terms n = 12, common difference d = 2.

$\therefore$ Required distance

$= \frac{12}{2}[2 \times 35 + (12-1) \times 2] = 6(70+22) = 552 \text{ km.}$

18. (b) Average speed $= \frac{2v_1v_2}{v_1+v_2} = \left(\frac{2 \times 40 \times 20}{40+20}\right)\text{km/hr}$

$= \left(\frac{80}{3}\right)\text{km/hr} = 26.67 \text{ km/hr.}$

19. (b) Due to stoppages, it covers 9 km less.

Times taken to cover 9 km

$= \left(\frac{9}{54} \times 60\right)\text{min} = 10 \text{ min.}$

20. (d) Distance covered in 2 hr 15 min ,

i.e. $2\frac{1}{4}\text{hr} = \left(80 \times \frac{9}{4}\right)\text{hrs} = 180 \text{ km}$

Time taken to cover remaining distance

$= \left(\frac{350-180}{60}\right)\text{hrs} = \frac{17}{6}\text{hrs} = 2\frac{5}{6}\text{hrs}$

= 2 hr 50 min.

Total time taken = (2 hr 15 min + 2 hr 50 min)

= 5 hr 5 min.

So, Anna reached city A at 10.25 a.m.

21. (a) Since A and B move in the same direction along the circle, so they will first meet each other when there is a difference of one round between the two.

Relative speed of A and B

= (6 – 1) = 5 rounds per hour.

Time taken to complete one round at this speed

$= \frac{1}{5}$ hr = 12 min.

Hence, they shall first cross each other at 7:42 a.m.

22. (c) Relative speed = (2 + 3) = 5 rounds per hour.

So, they cross each other 5 times in an hour and 2 times in half an hour.

Hence, they cross each other 7 times before 9 :.30 a.m.

23. (c) Their relative speeds

= (4.5 + 3.75) = 8.25 km/h

Distance = 726 metres $= \frac{726}{1000} = 0.726\text{km}$

Required time $= \frac{0.726}{8.25} \times 60 = 5.28$ min

24. (c) Remaining distance = 3 km

and remaining time

$= \left(\frac{1}{3}\times 45\right)\text{min} = 15\,\text{min.} = \frac{1}{4}\text{ hr.}$

$\therefore$ Required speed = (3 × 4) km/h

= 12 km / hr.

25. (a) Let the duration of the flight be x hour Then,

$$\frac{600}{x}-\frac{600}{x+\frac{1}{2}}=200 \Rightarrow \frac{600}{x}-\frac{1200}{2x+1}=200$$

$\Rightarrow$ x (2x + 1) = 3

$\Rightarrow$ $2x^2 + x - 3 = 0$

$\Rightarrow$ (2x + 3) (x – 1) = 0

$\Rightarrow$ x = 1 hr. [neglecting the –ve value of x].

26. (c) Here, distance to be covered by the thief and by the owner is same.

Let after 2 : 30 p. m., owner catches the thief in t hr

Then, $60 \times t = 75\left(t-\frac{1}{2}\right) \Rightarrow t = \frac{5}{2}\text{ hrs}$

So, the thief is overtaken at 5 p.m.

27. (d) Let the speed in return journey be x km / hr.

Then, speed in onward journey

$= \frac{125}{100}x = \left(\frac{5}{4}x\right)\text{ km/hr.}$

Average speed

$$= \left(\frac{2\times\frac{5}{4}x\times x}{\frac{5}{4}x+x}\right)\text{km/hr} = \frac{10x}{9}\text{ km/hr.}$$

$$\therefore \left(800\times\frac{9}{10x}\right)=16 \Rightarrow x = \left(\frac{800\times 9}{16\times 10}\right)=45.$$

So, speed in onward journey

$= \left(\frac{5}{4}\times 45\right)\text{ km/hr} = 56.25\text{ km/hr.}$

28. (c) Let the length of the journey be x km.

Suppose speed of the train be y km/h.

$\therefore$ Time taken to cover x km = $\frac{x}{y}$ hour

$\therefore$ $\frac{x}{y+6}=\frac{x}{y}-4,\ \frac{x}{y-6}=\frac{x}{y}+6$

Solving these equations, we get

y = 30, x = 720.

$\therefore$ Length of the journey = 720 km.

29. (a) Relative speed of the thief and policeman

= (11 – 10) km/h = 1 km/h.

Distance covered in 6 minutes

$= \left(\frac{1}{60}\times 6\right)\text{km} = \frac{1}{10}\text{ km} = 100\text{ m.}$

$\therefore$ Distance between the thief and policeman

= (200 – 100) m = 100 m.

30. (d) Relative speed = (3.5 + 4.5) = 8 kmph.

Time to meet = 32/8 = 4 hour

So when they meet at 5 pm, one will have walked 3.5 × 4 = 14 km and the other will have walked 4.5 × 4 = 18 km.

31. (d)

Time taken to travel 96 miles = $\frac{96}{11}$ hr = 8 hr 43 minutes

During the journey of 96 miles, he has to stop for 13 times to change the horse.

$\therefore$ Total stoppage time = 13 × 5 = 65 mins. = 1 hr. 5 mins.

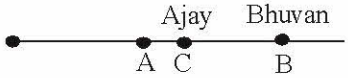
Hence the total time = 8 hr 43 mins + 1 hr. 5 mins.

= 9 hr 48 mins.

32. (d) Let the speed of Ajay be V and the speed of Bhuvan and Subbu be 1 and 4 respectively.

Then OA = 4 and OB = 4.

At 12:00 noon.



Let Ajay be at C at 12:00 noon at a distance of V from A (towards B)

∴ Time taken for them to meet from 12:00 noon.

$= \frac{4-V}{1+V}$

Since V is not known $\frac{4-V}{1+V}$ cannot be determined.

33. (d) Let the speed of the second train be x km/h

The relative speed = (50 + x) km/h

These trains will cross each other in a time equivalent of covering a distance equal to 108 + 112, i.e. 220 meters in 6 seconds, running a speed of (50 + x) km/h

$\therefore \quad \frac{1}{50+x} \times \frac{220}{1000} = \frac{6}{3600}$

$\Rightarrow \quad x = 82$

∴ The speed of the second train = 82 km/h.

34. (d) Let the length of the first train be x metres and the length of the bridge be y metres.

∴ The first train running with the speed of 90 km/h crosses the bridge by covering a distance of (x + y) meters in 36 seconds i.e. The first train crosses the bridge in 36 seconds running with the speed of 25 meters per second.

$\therefore x + y = 36 \times 25 = 900$

The second train crosses the bridge by covering a distance of [(x – 100) + y] meters with the speed of 45 km/h, i.e. with the speed of $12\frac{1}{2}$ metres per second.

Since x + y = 900, therefore the second train crosses the bridge by covering a distance of 800 meters @ $12\frac{1}{2}$ meters per second, i.e. the second train crosses the bridge in $\frac{800}{12\frac{1}{2}} = \frac{800 \times 2}{25} = 64$ seconds.

35. (a) $\text{Time} = \frac{225}{6 \times \frac{5}{18}} = 135 \text{sec} = 2\frac{1}{4} \text{ min.}$

36. (a) Relative speed

$= \left(\frac{280}{9}\right) \text{m/sec} = \left(\frac{280}{9} \times \frac{18}{5}\right) \text{ kmph}$

= 112 kmph.

∴ Speed of goods train

= (112 – 50) kmph = 62 kmph.

37. (b) Let us name the trains as A and B. Then,

(A's speed) : (B's speed)

$= \sqrt{b} : \sqrt{a} = \sqrt{16} : \sqrt{9} = 4 : 3.$

38. (a) Let actual speed of train $= S_T$ km/h.

Then, $S_T - 6 = \frac{75}{18} \times \frac{18}{5} = 15$

$\Rightarrow \quad S_T = 21$ km/h

Now, let speed of second man = S_m

$21 - S_m = \frac{75}{15} \times \frac{18}{5} = 18$

$\Rightarrow S_m = 3 \text{km/h}$

39. (c) Speed of train relative to jogger

= (45 – 9) km/h = 36 km/h

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

Distance to be covered = (240 + 120) m = 360 m.

∴ Time taken = $\left(\frac{360}{10}\right)$ sec = 36 sec.

40. (d) Relative speed = (40 – 20) km/h

$= \left(20 \times \frac{5}{18}\right) \text{m/sec} = \left(\frac{50}{9}\right) \text{m/sec.}$

Length of faster train

$= \left(\frac{50}{9} \times 5\right) \text{m} = \frac{250}{9} \text{m} = 27\frac{7}{9} \text{ m}.$

41. (d) Let speed of trains be S_1 m/s and S_2 m/s.

Then, $S_1 - S_2 = \frac{130-110}{60} = 4$ ... (i)

and $S_1 + S_2 = \frac{130+110}{3} = 80$ ... (ii)

on solving (i) and (ii), we get

S_1 = 42 m/s , S_2 = 38 m/s

42. (b) Let actual speed of train = S m /sec

and length of train = L m.

Then, $S - \frac{2\times 5}{18} = \frac{L}{9}$

$\Rightarrow$ 9S = L + 5 ... (i)

and $S - 4\times\frac{5}{18} = \frac{L}{10}$

$\Rightarrow 90S = 9L + 100$ ... (ii)

By (i) & (ii), we get L = 50 m.

43. (a) Let speed of man = S km/h. Then,

Distance covered in 15 min = Distance covered in 12 min

$16\times\frac{15}{60} = \frac{12}{60}[16+S]$

$\Rightarrow$ 16 + S = 20 $\Rightarrow$ S = 4 km/h

44. (a) Let speed of man = S km/h. Then,

$36\times\frac{14}{60} = \frac{18}{60}[36-S]$

$\Rightarrow$ 36 – S = 28

$\Rightarrow$ S = 8 km/h.

45. (d) 4.5 km/h = $\left(4.5\times\frac{5}{18}\right)$ m/sec = 1.25 m/sec,

& 5.4 km/h = $\left(5.4\times\frac{5}{18}\right)$ m/sec = 1.5 m/sec.

Let the speed of the train be S m/sec.

Then, (S – 1.25) × 8.4 = (S – 1.5) × 8.5

$\Rightarrow$ 8.4S – 10.5 = 8.5S – 12.75

$\Rightarrow$ 0.1S = 2.25

$\Rightarrow$ S = 22.5.

$\therefore$ Speed of the train = $\left(22.5\times\frac{18}{5}\right)$ km/h

= 81 km/h.

46. (b) Let the speeds of the two trains be S_1 m/sec and S_2 m/sec respectively. Then, length of the first train = $27S_1$ metres, and length of the second train = $17S_2$ metres.

$\therefore \frac{27S_1+17S_2}{S_1+S_2} = 23 \Rightarrow 27S_1+17S_2 = 23S_1+23S_2$

$\Rightarrow 4S_1 = 6S_2 \Rightarrow \frac{S_1}{S_2} = \frac{3}{2}$.

47. (c) Relative speed of the trains = (40 + 20)

= 60 m/s

Distance = (120 + 120) = 240 m

Time taken by trains to cross each other completely

$= \frac{240}{60} = 4$s

EXERCISE 3

1. (a) Let each side of the square be x km and let the average speed of the plane around the field be y km/h. Then,

$\frac{x}{200}+\frac{x}{400}+\frac{x}{600}+\frac{x}{800} = \frac{4x}{y}$

$\Rightarrow \frac{25x}{2400} = \frac{4x}{y} \Rightarrow y = \left(\frac{2400\times 4}{25}\right) = 384.$

$\therefore$ Average speed = 384 km/h.

2. (b) Rest time = Number of rest × Time for each rest

= 4 × 5 = 20 minutes

Total time to cover 5 km

$= \left(\frac{5}{10}\times 60\right)$ minutes + 20 minutes = 50 minutes.

3. (d) Let the average speed be x km/h.

and Total distance = y km. Then,

$$\frac{0.2}{10}y+\frac{0.6}{30}y+\frac{0.2}{20}y=\frac{y}{x}$$

$$\Rightarrow x=\frac{1}{0.05}=20\text{km/h}$$

4. (a) Let the length of the journey =x km.

∴ Journey rides by horse cart

$$=x\left(1-\frac{1}{2}-\frac{1}{3}\right)=\frac{1}{6}x\text{ km.}$$

Then, total time taken to complete journey

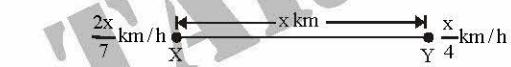
$$=\frac{31}{5}\text{hr}$$

$$\Rightarrow t_1+t_2+t_3=\frac{31}{5}$$

$$\Rightarrow \frac{x}{2}\times\frac{1}{4}+\frac{x}{3}\times\frac{1}{12}+\frac{x}{6\times9}=\frac{31}{5}$$

$$\Rightarrow x=\frac{31}{5}\times\frac{216}{37}=36.2\text{km}\approx36\text{km}$$

5. (b) Let the distance between X and Y be x km. Then, the speed of A is $\frac{x}{4}$ km/h and that of B is $\frac{2x}{7}$ km/h.



Relative speeds of the trains

$$=\left(\frac{x}{4}+\frac{2x}{7}\right)=\frac{15x}{28}\text{ km/h}$$

Therefore the distance between the trains at 7 a.m.

$$=x-\frac{x}{2}=\frac{x}{2}\text{ km}$$

Hence, time taken to cross each other

$$=\frac{\frac{x}{2}}{\frac{15x}{28}}=\frac{x}{2}\times\frac{28}{15x}=\frac{14}{15}\times60=56\text{min}$$

Thus, both of them meet at 7 : 56 a.m.

6. (a) Let the distance be x km. Let speed of train be y km/h. Then by question, we have

$$\frac{x}{y+4}=\frac{x}{y}-\frac{30}{60}\quad\text{...(i)}$$

and $$\frac{x}{y-2}=\frac{x}{y}+\frac{20}{60}\quad\text{...(ii)}$$

On solving (i) and (ii), we get x = 3y

Put x = 3y in (i) we get

$$\frac{3y}{y+4}=3-\frac{1}{2}\quad\Rightarrow y=20$$

Hence, distance = 20 × 3 = 60 km.

7. (a) Let the speed of the goods train be x kmph.

Distance covered by goods train in 10 hour

= Distance covered by express train in 4 hour

∴ 10x = 4 × 90 or x = 36.

So, speed of goods train = 36 kmph.

8. (b) $$\text{usual time}\times\left(\frac{4}{5}-1\right)=\frac{-30}{60}$$

$$\Rightarrow\text{usual time}=\frac{1}{2}\times5=2\frac{1}{2}\text{hr}$$

9. (b) Due to stoppages the train travels (45 – 36) = 9 km less in an hour than it could have travelled without stoppages.

Thus train stops per hour for $\frac{9}{45}\times60=12\text{ min.}$

10. (c) Let speed of jogging be x km/h.

Total time taken

$$=\left(\frac{9}{6}\text{ hrs}+1.5\text{ hrs}\right)=3\text{ hrs.}$$

Total distance covered = (9 + 1.5x) km.

$$\therefore\frac{9+1.5x}{3}=9\Rightarrow9+1.5x=27$$

$$\Rightarrow\frac{3}{2}x=18\Rightarrow x=\left(18\times\frac{2}{3}\right)=12\text{ kmph.}$$

11. (a) Let speed of the train be x km/h and that of the car be y km/h.

Now, $\frac{160}{x}+\frac{600}{y}=8$ ...(i)

and $\frac{240}{x}+\frac{520}{y}=\frac{41}{5}$ ...(ii)

Solving (i) and (ii), we have x = 80 km/h and y = 100 km/h.

12. (b) Let the speed of the train and the car be x km/h and y km/h, respectively.

Now, $\frac{120}{x}+\frac{480}{y}=8$ ...(i)

and $\frac{200}{x}+\frac{400}{y}=\frac{25}{3}$ ...(ii)

From (i),

$120y + 480x = 8xy$ and ...(iii)

From (ii),

$200y + 400x = \frac{25}{3}xy$ ...(iv)

From (iii) and (iv),

$$\frac{120y+480x}{8}=\frac{3(200y+400x)}{25}$$

or $15y + 60x = 24y + 48x$

or $12x = 9y$ or $\frac{x}{y}=\frac{3}{4}$

13. (c) Let the original planned time of the flight be x hour

$\therefore$ The average speed of the flight

$= \frac{6000}{x}$ km/h

If the average speed is

$\left(\frac{600}{x}-400\right)$ km/h,

then the time of the flight is

$\left(x+\frac{1}{2}\right)$ hour

$\therefore \quad \left(x+\frac{1}{2}\right)\left(\frac{6000}{x}-400\right)=6000$

$\Rightarrow \quad -400x+\frac{3000}{x}-200=0$

$\Rightarrow \quad -4x+\frac{30}{x}-2=0$

$\Rightarrow \quad -4x^2 + 30 - 2x = 0$

$\Rightarrow \quad 4x^2 + 2x - 30 = 0$

$\Rightarrow \quad 2x^2 + x - 15 = 0$

$\Rightarrow \quad x=\frac{-1\pm\sqrt{1+120}}{4}=\frac{-1\pm11}{4}$

$=\frac{10}{4}=\frac{5}{2}=2\frac{1}{2}$

14. (c) Let the speed of the car be x km/h and y km/h, respectively.

Their relative speeds when they are moving in same direction = (x – y) km/h.

Their relative speeds when they are in opposite directions = (x + y) km/h.

Now, $\frac{70}{x+y}=1$

or $x + y = 70$ ..... (i)

and $\frac{70}{(x-y)}=7$ or $x - y = 10$ ..... (ii)

Solving (i) and (ii), we have

x = 40 km/h and y = 30 km/h.

15. (c) Here, distance to be covered is constant.

Suppose they meet x hour after 14.30 hr

Then, 60x = 80 (x – 2) or x = 8.

$\therefore$ Required distance = (60 × 8) km = 480 km.

16. (d) Let the usual speed of the plane be x km/h

$\therefore$ Time taken in covering the distance of 1500 km

$$= \frac{1500}{x} \text{ hour}$$

$$\therefore \quad \frac{1500}{x+250} = \frac{1500}{x} - \frac{1}{2}$$

$$\Rightarrow 3000x = 3000(x+250) - x(x+250)$$

$$\Rightarrow x^2 + 250x - 3000 \times 250 = 0$$

$$\Rightarrow x = \frac{-250 \pm \sqrt{62500 + 3000000}}{2}$$

$$= \frac{-250 + 1750}{2} = 750 \text{ km/h}$$

17. (c) $\text{Usual time} = \dfrac{-10}{\left(\frac{5}{6} - 1\right)} = 60 \text{ min}$

18. (b) $\dfrac{\text{1st man's speed}}{\text{2nd man's speed}}$

$$= \frac{\sqrt{b}}{\sqrt{a}} = \frac{\sqrt{b}}{\sqrt{a}} = \sqrt{\frac{4\frac{4}{5}}{3\frac{1}{3}}}$$

$$= \sqrt{\frac{24}{5} \times \frac{3}{10}} = \sqrt{\frac{36}{25}} = \frac{6}{5}$$

$$\therefore \frac{12}{\text{2nd man's speed}} = \frac{6}{5}$$

$\therefore$ 2nd man's speed $= \dfrac{60}{6} = 10$ km/hr.

19. (a) Let speed by x $\Rightarrow \dfrac{50}{x}$ = time taken

also $\dfrac{300}{3x} = \dfrac{100}{x}$ = time taken.

Hence ratio is 1 : 2.

20. (d) Net distance gained by car over the bus

= 40 + 60 = 100m, in 20 sec.

$$\text{Time} = \frac{\text{Distance}}{\text{Relative speed}} \Rightarrow 20 = \frac{100}{\left(36 \times \frac{5}{18}\right) - S_2}$$

$$\Rightarrow \quad S_2 = 5 \text{ m/s} = 18 \text{ kmph.}$$

21. (d) Let the distance be x.

Ratio of speeds of 3 car = 2 : 3 : 4

$$\therefore \quad S_1 = \frac{2}{9}, S_2 = \frac{3}{9}, S_3 = \frac{4}{9}$$

Now, as we know, distance = speed × time

$$\therefore \quad x = \frac{2}{9}T_1, x = \frac{3}{9}T_2, x = \frac{4}{9}T_3$$

$$\Rightarrow \quad \frac{T_1}{x} = \frac{9}{2}, \frac{T_2}{x} = \frac{9}{3}, \frac{T_3}{x} = \frac{9}{4}$$

$$\therefore \quad \frac{T_1}{x} : \frac{T_2}{x} : \frac{T_3}{x} = \frac{9}{2} : \frac{9}{3} : \frac{9}{4}$$

$$\equiv 108 : 72 : 54 \equiv 6 : 4 : 3$$

$\therefore$ Required ratio = 6 : 4 : 3.

22. (b) Radius of circular track = 100m

$\therefore$ Circumference of track

$$= 2\pi \times 100 = 200 \times \frac{22}{7}$$

$$\text{Total distance} = 200 \times \frac{22}{7}$$

Now, time taken to complete 1 revolution

= 2 min

$\therefore$ Speed of the cyclist

$$= \frac{200 \times \frac{22}{7}}{2} = \frac{200 \times 22}{2 \times 7}$$

$$= \frac{2200}{7} = 314.28$$

$$\approx 314 \text{ m/min}$$

23. (d) Let speed of car = x km / hr

Let speed of pedestrian = y = 2km / hr

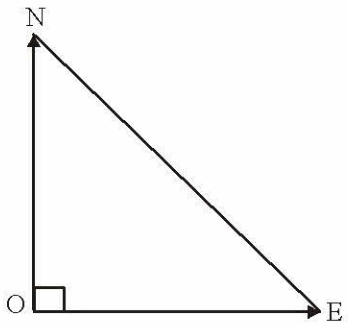
$\therefore$ Relative speed = (x – 2) km / hr

$\therefore$ According to the question,

$$(x-2)\times\frac{6}{60}=0.6 \Rightarrow x-2=6$$

$\Rightarrow$ x = 8 km / h

24. (a) Let the speed of the Bus which is moving towards East is x km/hr.



Since, speed of bus moving towards North is 5 greater than the speed of Ist bus

$\therefore$ speed = (x + 5) km/hr.

Now, time = 2 hr.

$\therefore$ Distance travelled by the first bus in two hour,

OE = 2x

and distance travelled by the second bus in two hour, ON= 2(x + 5)

Also, NE = 50 km (given)

$\therefore$ By Pythagorus theorem, we have

$(ON)^2 + (OE)^2 = (NE)^2$

$\Rightarrow$ $[2\ (x + 5)]^2 + (2x)^2 = (50)^2$.

$\Rightarrow$ $4\ (x^2 + 2\ 5 + 10x) + 4x^2 = 2500$

$\Rightarrow$ $8x^2 + 40\ x - 2400 = 0$

$\Rightarrow$ $x^2 + 5x - 300 = 0$

$\Rightarrow$ $x = 15\ , -20$ $(x \neq -20)$

Hence, speed of the slower bus = 15 km/hr.

25. (c) Let the length of the course be *x m*.

then speed of Muan = $\frac{x}{90}$ $\left(\because\ 1\frac{1}{2}\text{m in} = 90\text{sec}\right)$

and speed of Sanjay = $\frac{x-10}{90}$

Since, Muan ran 40 m and Sanjay ran 39 m

$\therefore$ Time taken by Muan = $\frac{40\times 90}{x}$ ....(1)

and Time taken by Sanjay = $\frac{39\times 90}{x-10}$ ....(2)

Since, time taken by both is same.

$\therefore$ (1) = (2) gives

$$\frac{40\times 90}{x}=\frac{39\times 90}{x-10}$$

$\Rightarrow 40x - 400 = 39x$

$\Rightarrow x = 400m.$

26. (c) Let the speed of train be x km/hr and the speed of second person be y km/hr.

Then, according to the question, we have

$$(x-6)\times\frac{15}{2\times 60\times 60}=\frac{75}{1000}$$

$\Rightarrow$ x – 6 = 36 $\Rightarrow$ x = 42 ...(1)

and $(x-y)\times\frac{27}{4\times 60\times 60}=\frac{75}{1000}$

$\Rightarrow$ x – y = 40

From (1), 42 – y = 40 $\Rightarrow$ y = 2.

Hence, speed of second person = 2 km/hr.

27. (a) Time difference between 11 a.m. and 2 p.m.

= 3 hr

$\therefore$ Distance covered by train A in 3 hr

= 3 × 60

= 180 km

Now, Train B gains = 72 – 60

= 12 km / hr

$\therefore$ Train A and Train B will meet after

$\frac{180}{12}$ hr = 15 hr

They will meet at 2 p.m. + 15 hr = 5 a.m.

The time will be 5 a.m. on the next day.

28. (b) Total time taken by person = 6 hr

Total distance covered by person = 285 km

Now, person complete his journey in two stages.

∴ In first part of Journey,time

= 3 hr and in second part

= 3 hr

Now, Distance covered in first part of Journey(which is by bus)

= 40 × 3 = 120 km

∴ Distance covered in second journey (which is by train)

= Total distance – Distance in1st part of Journey

= 285 – 120 = 165 km.

29. (d) Given, A can beat B by 60 metres in race of 600 m.

∴ When A run 600 meter

B will run = 600 – 60 = 540 meter

Similarly, B can beat C by 25 metres in race of 500 m.

∴ When B run 500 meter

C will run = 500 – 25 = 475 meter

∴ When B run 1 meter then C will run

$= \frac{475}{500}$m

∴ When B run 540 meter then C will run

$= \frac{475 \times 450}{500}$m

= 513 meter

Thus, when A run 600 meters C will run = 513 meter

∴ When Arun 1 meter, C will run

$= \frac{513}{600}$m

∴ When A run 400 meter, C will run

$= \frac{513 \times 400}{600}$

= 342 meter

∴ A beats C by 400 – 342 = 58 meters

Hence, A can beat C by 58 metre in race of 400 m.