# SOLUTIONS

1. (b) Speed = $\frac{900}{6\times60}\times\frac{18}{5}$

= 9 km/ hr

2. (a) Avg. speed = $\frac{2}{\frac{1}{30}+\frac{1}{45}}$

= $\frac{2\times15\times6}{3+2}$ = 36 km/hr

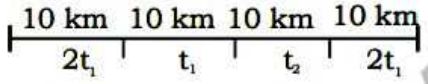
3. (a) We know that if the distance is the same then,

Average speed = $\frac{2ab}{a+b}$

Avg. speed = $\frac{2\times36\times60}{36+60}$

= $\frac{2\times36\times60}{96}$ = 45 km/hr

4. (a)




ATQ,

$\frac{10}{2t_1}=40 \Rightarrow t_1=\frac{1}{8}$

Avg. speed = $\frac{\text{total distance}}{\text{total time}}$

= $\frac{40}{\frac{1}{4}+\frac{1}{8}+\frac{1}{8}+\frac{1}{4}}$ = $\frac{40\times8}{2+1+1+2}$

= $\frac{40\times8}{6}=\frac{160}{3}$ km/hr.

5. (d) Relative distance = 300 m
Relative speed = (13 – 11) = 2 km/hr
time after which he will catch the thief = $\frac{300}{2\times1000}$

= $\frac{3}{20}$ hrs.

Distance travelled by police

= $13\times\frac{3}{20}=\frac{39}{20}$ = 1.95 km

6. (b) Required distance = $\frac{28}{8}\times6$

= 21 km

7. (b) Relative distance = 288 m
Relative speed = 12 m/min

time = $\frac{288}{12}$ = 24 min

8. (b) Avg. speed = $\frac{\text{total distance}}{\text{total time}}$

$73=\frac{\left(\frac{3}{4}\times S_1\right)+\left(\frac{75}{60}\times85\right)+(3\times70)}{5}$

$365=\frac{3}{4}S_1+\frac{5}{4}\times85+\frac{210\times4}{4}$

$1460 = 3S_1 + 425 + 840$

$\Rightarrow S_1=\frac{195}{3}$ = 65 km/hr

9. (a) Let, original speed be S km/hr

$\therefore$ Normal time of train = $\frac{1000}{S}$

and new speed = (S – 75)
$\therefore$ Time of train when speed is reduced = $\frac{1000}{S-75}$

ATQ,

$\frac{1000}{S-75}-\frac{1000}{S}=3$

$\Rightarrow 1000[S - S + 75] = 3(S - 75)S$
$\Rightarrow 75000 = 3S^2 - 225\,S$
$\Rightarrow 3S^2 - 225\,S - 75000 = 0$
$\Rightarrow S^2 - 75S - 25000 = 0$
$\Rightarrow S^2 - 200\,S + 125\,S - 25000 = 0$
$\Rightarrow S(S - 200) + 125\,(S - 200) = 0$
$\Rightarrow (S + 125)\,(S - 200) = 0$
$\Rightarrow S = 200$ km/hr

Original time = $\frac{1000}{S}=\frac{1000}{200}$

= 5 hrs

10. (c) Avg. speed = $\frac{\text{total distance}}{\text{total time}}$

= $\frac{540+(90\times5)}{\frac{240}{60}+5}$

= $\frac{990}{9}$ = 110 km/hr

11. (b) If distance is same then,

speed $\alpha$ $\frac{1}{\text{Time}}$

| | A | B | C |
|---|---|---|---|
| Time | 12 | 15 | 10 |
| Speed | $\frac{1}{12}$ | $\frac{1}{15}$ | $\frac{1}{10}$ |
| $\Rightarrow$ | 5 | : 4 | : 6 |

12. (d) Remaining distance = $\frac{88}{2}$

= 44 km

Remaining time = $\frac{1}{4}\times16$ = 4 hrs

$\therefore$ Required speed = $\frac{44}{4}$

=11 km/hr

13. (b)

| | Old | New |
|---|---|---|
| Speed | 4 | 1 |
| Time | 1 | 4 |

(+3)

ATQ,
3 unit $\rightarrow$ 45 min
Usual time (1 unit) =15 min

14. (c)

Avg. speed = $\frac{2ab}{a+b}=\frac{2\times30\times70}{30+70}$

= 42 km/hr

15. (b) Relative speed = 12 – 10 = 2 kmph.
Distance travelled by thief in 30 minutes

= $10\times\frac{1}{2}$ = 5 km.

Time after which police would catch thief = $\frac{5}{2}$ = 2.5 hrs.

ie, at 7 : 30 + 30 min + 2.5 hrs
$\Rightarrow$ at 10:30 pm

16. (a) S $\leftarrow\!\!\bullet\!\!\rightarrow$ J

ATQ,
$D_S + D_J$ = 40 kms
Let, speed of soma = S
$\therefore$ Speed of Julie = S + 4
Then,
$S \times 4 + 4\,(S + 4) = 40$
$\Rightarrow S + S + 4 = 10$
$\Rightarrow S = 3$ km/hr
Speed of julie = 7 km/hr

17. (d) Speed = $\left(\frac{750}{54}\times\frac{18}{5}\right)$ km/hr

= 50 km/hr

18. (b) Let Speed of slow local = $S_1$

∴ Speed of faster local = $S_1 + 10$

ATQ,

$$\frac{150}{S_1}-\frac{150}{S_1+10}=\frac{45}{60}$$

$$150\,(S_1+10-S_1)=\frac{45}{60}\left(S_1^2+10S_1\right)$$

$$=\frac{1500\times60}{45}=S_1^2+10S_1$$

$$\Rightarrow S_1^2+10S_1-2000=0$$

$$\Rightarrow S_1^2-40S_1+50S_1-2000=0$$

$$\Rightarrow S_1(S_1-40)+50\,(S_1-40)=0$$

$$\Rightarrow S_1=40 \text{ km/hr.}$$

19. (a)

$25\% = \frac{1}{4}$, $50\% = \frac{1}{2}$, $12.5\% = \frac{1}{8}$

Let, total distance be 400 km

$$\text{Avg. speed} = \frac{\text{total distance}}{\text{total time}}$$

$$=\frac{400}{\frac{100}{25}+\frac{200}{50}+\frac{100}{12.5}}$$

$$=\frac{400}{4+4+8}=25 \text{ km/hr}$$

20. (d)

| | Reema | Rekha |
|---|---|---|
| Speed | 5 | 4 |

Relative distance = 50 mtr.

relative speed = 1 m/sec.

time = 50 sec

∴ they will meet after a distance of 50 × 5 = 250 mtr. from starting

21. (d) Distance covered by Rajesh in 36 sec

$$=\frac{1200}{40}\times 36 = 1080 \text{ mtr.}$$

∴ Rakesh beat Rajesh by 1200 – 1080 = 120 mtr.

22. (b) Given that, the bus is 30 km ahead of car and after 3 hour the car is ahead of 60km

Speed of bus = 42 km/h

Let the speed of car = $x$ km/h

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

$$\Rightarrow x-42=\frac{90}{3}$$

$$\Rightarrow x=30+42=72 \text{ km/h}$$

23. (a) Distance covered by the car = 54 × 3 = 162 km

After the increment speed of car by 27 km/hr.

= (54 + 27) = 81 km/h

$$\text{Time taken} = \frac{162 \text{ km}}{81 \text{ km/hr}} = 2 \text{ hour}$$

24. (a) Time taken in way A

$$=\frac{114}{38}=3 \text{ hour}$$

Time taken in way B

$$=\frac{84}{42}=2 \text{ hour}$$

Time taken in way C

$$=\frac{230}{46}=5 \text{ hour}$$

Total time taken = (3 + 2 + 5) = 10 hour

Total Distance Covered

= (114 + 84 + 230) = 428 km

$$\text{Average speed} = \frac{428}{10} = 42.8 \text{ km/h}$$

25. (c) Relative Speed = (6 + 4) = 10 km/h

Time = 4 h

Distance = Speed × Time

= 10 × 4 = 40 km

26. (a) $\text{Average Speed} = \frac{2\times S_1\times S_2}{(S_1+S_2)}$

$$=\frac{2\times12\times18}{(12+18)}=14\frac{2}{5} \text{ km/h}$$

27. (c) Given,

Car covers 75.5 km in 3.5 litre of petrol

∴ Car will cover the distance in 28 litre petrol

$$=\frac{75.5}{3.5}\times28 = 604 \text{ km}$$

28. (b) Case I

Speed = 21 m/s

Time = 10 m = 600 s

Distance = Speed × Time

= 21 × 600 = 12600 = 12.6 km

Hence, Total Distance Covered

= 12.6 + 9 + 10 = 31.6 km

Total Time Taken

$$= 10 + 10 + 10 = 30\times\frac{1}{60}\text{h} = 0.5\text{h}$$

$$\text{Average Speed} = \frac{31.6 \text{ km}}{0.5\text{h}}$$

= 63.2km/h

29. (a)

$$\text{Average speed} = \frac{\text{Total Distacne}}{\text{Total Time}}$$

$$=\frac{100+140}{\frac{100}{50}+\frac{140}{70}} = 60 \text{ km/h}$$

30. (b) Given,

$S_1 : S_2 = 2 : 3$

If D is constant then T is Inverely proportional to the S.

$T_1 : T_2 = 3 : 2$

1 unit = 10 s

$T_1$ = 30 s and $T_2$ = 20 s

$$S_2 - S_1 = \frac{50}{20}-\frac{50}{30}$$

$$=50\left(\frac{3-2}{60}\right)=\frac{5}{6}\text{m/s}$$

31. (d) $\text{Average Speed} = \frac{2\times60\times40}{60+40}$

= 48 km/h

32. (a)

| Lap | Distance | Time | Speed |
|---|---|---|---|
| First | 200 km | 4 h | 50 km/h |
| Second | 162 km | $\frac{D}{S}=\frac{162}{15}\times\frac{5}{18}$ = 3 h | 15 m/s |
| Third | — | 4 h | — |

Total distance

= 50 × 11 = 550 km

Remaining distance for third lap

= 550 – 362 = 188 km

Speed of car in third lap

$$=\frac{188}{4}=47 \text{ km/h}$$

33. (c) Distance from Initial Position

$$=\sqrt{24^2+10^2}$$

$$=\sqrt{576+100}=\sqrt{676}=26 \text{ m}$$

34. (b)

| Speed | Time | Distance |
|---|---|---|
| 100 km/h | $\frac{1}{2}$h | 50 km |
| 80 km/h | $\frac{240}{80}$=3 h | Remaining distance =290–50 =240 km |

Total time = 0.5 + 3 = 3.5 hours

35. (a)

If distance is constant, time is inversely proportional to speed.

Given $s_A : s_B = 3 : 5$

$t_A : t_B = 5 : 3$

Time difference, $t_A - t_B = 30$ minutes

$\Rightarrow$ 2 units = 30 minutes

$\Rightarrow$ 1 units = 15 minutes

Hence, Time taken by A, $t_A$

= 5 × 15 minutes

= 75 minutes = 1 hour 15 minutes

36. (a) Average speed = $\frac{\text{Total Distance}}{\text{Time Taken}}$

$= \frac{120}{\frac{60}{60}+\frac{30}{60}+\frac{30}{30}} = 48$ km/h

37. (a) Distance covered by first car in 1 hour = 50 km.

Now, relative speed

= (75 – 50)km/h = 25 km/h

Time taken by second car to cover 50 km

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

Hence, they will meet at 06:00 pm.

38. (b) Concept,

Speed × Time = Distance

$1\text{km/hr} = \frac{5}{18}\text{m/s}$

Given that, Speed of police = 12 km/h and speed of Theif = 10 km/h.

Thief is spotted by police at a distance of 250 m.

Relative speed

= (12 – 10) km/h = 2 km/hr

Time taken by the police to caught the theif $= \frac{250}{2} \times \frac{18}{5} = 450$ seconds

Distance covered by the theif before he is caught

$= 10 \times \frac{5}{18} \times 450$

$= 1250$ m $= 1.25$ km

**SMART APPROACH:-**

The ratio of speed of police and theif is = 6 : 5

Then the ratio of distance = 6 : 5

1 unit = 250 m

5 units = 1250 m = 1.25 km

39. (c) Speed of policeman = 7 m/s

Speed of thief = 5 m/s

Relative speed = (7 – 5) m/s

= 2 m/s

Distance = 150 m

Time = $\frac{\text{Distance}}{\text{Speed}} = \frac{150}{2} = 75$ s

The distance covered by the thief when he is caught by the policeman,

= Speed of thief × time

= 5 m/s × 75 s = 375 m

**SMART APPROACH:-**

The ratio of speed of thief and police = 5 : 7

Then, the ratio of distance = 5 : 7

$(7 - 5)x = 2x = 150$

$x = 75$ m

$\therefore 5x = 5 \times 75 = 375$ m

40. (c) Relative Speed = (8 – 7) = 1 km/h

Distance Run by the theif

$= 7 \text{ km/h} \times \frac{120}{1} = 840$ m

**SMART APPROACH:-**

The ratio of speed of thief and police = 7 : 8

ratio of distance = 7 : 8

$(8 - 7)x = x = 120$ m

$7x = 840$ m

41. (a) Total length of the race is 12 km = 12000 m

Track Length = 1200 m

Number of round to complete the race $= \frac{12000}{1200} = 10$

The race will be finished by A in

= 300 × 10 = 3000 seconds

Now, When both of them start the running

A and B will meet the first time

= LCM (300, 400)

= 1200 seconds

A and B will meet the second time

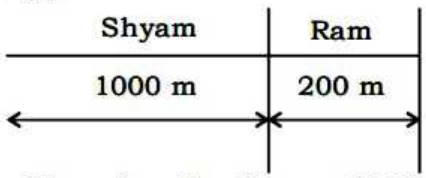
= 2400 seconds

For next meet,

Time would be 3600 seconds, which is not possible as A complete the race in 3000 seconds.

Hence, Both of them will meet last time at 2400 seconds.

42. (b)




Given, Length of Race = 1200 m

Ram can beat Shyam by 200 m or 20 sec, it means Shyam is covering 1000 m in the race and if he has given 20 sec he will finish the race.

Speed of Shyam $= \frac{200}{20} = 10$ m/s

The ratio of distance covered by Ram and Shyam

= 1200 : 1000 = 6 : 5

Here, Time is constant

If time is constant, speed is directly proportional to distance.

The ratio of speed of Ram and Shyam = 6 : 5

Hence, Speed of Ram

$= \frac{10}{5} \times 6 = 12$ m/s

**SMART APPROACH:-**

Speed of Shyam $= \frac{200}{20} = 10$m/s

Time is constant

Ratio of Ram and Shyam = ratio of thier speed distance

Ratio of speed = 6 : 5

$5x = 10$ m/s

$6x = 12$ m/s

43. (b) Given

Distance = 1500 m

Speed of B = 6 m/s

Time taken by B to complete the race

$= \frac{1500}{6} = 250$ sec

Time taken by A to complete the race

= 250 – 10 = 240 sec

We know, 60 sec = 1 min

$\therefore$ 240 sec = 4 min

A will take 4 minutes to complete the race.

44. (c) If d is constant,

$\Rightarrow \frac{S_A}{S_B} = \frac{t_B}{t_A} = \frac{30}{25} = \frac{6}{5}$

If T is constant

$\Rightarrow \frac{d_A}{d_B} = \frac{S_A}{S_B} = \frac{6}{5}$

To end race at dead-heat in 1 km race A has to give start of B

$= \frac{1}{6} \times 1000\text{m} = 166.67\text{m}$

45. (a) Given,

Ratio of speed of Geeta and Babita = 5 : 2

If time is constant then distance is directly proportional to the speed

Hence, the ratio of distance covered by Geeta and Babita = 5 : 2
Given,
Lead distance = 5 – 2 = 3 units
3 units = 40 m

$5 \text{ units} = \frac{40}{3} \times 5 = 66.67\text{m}$

46. (b) Time taken by P to cover the track

$= \frac{36}{3} = 12 \text{ hour}$

Time taken by Q to cover the track

$= \frac{36}{4} = 9 \text{ hour}$

Time taken by R to cover the track

$= \frac{36}{6} = 6 \text{ hour}$

LCM of 12, 9 and 6 = 36 hour

47. (a) $20\% = \frac{-1}{5}$

If distance is constant, speed is inversely proportional to time.
$t_1 : t_2 = 5 : 4$
$s_1 : s_2 = 4 : 5$

Net increment $= \frac{1}{4} \times 100\% = 25\%$

48. (a) $\because$ Distance same

So, Speed $\propto \frac{1}{\text{Time}}$

(A) speed 1 : 2
Time 2 : 1

$x = 2 + \frac{1}{2} + 1$

$x = \frac{7}{2}$

So, $2x = \frac{7}{2} \times 2 = 7$ hours

A require 7 hours for walking 40 km

49. (a) $\frac{300}{n} - \frac{300}{n+10} = 5$

By Hit and Trial,
n = 20 km/h
n + 10 = 30 km/h

Average speed $= \frac{2 \times 30 \times 20}{30 + 20}$

= 24 km/h

50. (d) Distance constant

So, Speed $\propto \frac{1}{\text{Time}}$

T → 75 : 45
S → 3 : 5

51. (a) Speed of Bus $= \frac{60}{1 + \frac{1}{2}}$

= 40 km/h

Speed of Car $= \frac{60}{\frac{3}{4}} = 80$ km/h

Ratio = 80 : 40
= 2 : 1

**SMART APPROACH:-**

Here, distance is constant
T = 90 : 45 = 2 : 1
Speed = 1 : 2
Hence, Required ratio = 2 : 1

52. (d) $\frac{300}{n} - \frac{300}{n+10} = 5$

By hit and trial
n = 20 km/h
Speed for onward journey = 20 km/h

53. (c) Distance same

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

Speed – 5 → 9
Time – 9 → 5
(4) = 40 minutes
Usual time (9) = 90 minutes

54. (a) Distance same
Speed 1 : 2
Time 2 : 1

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

$x = \frac{7}{2}$

A takes time to cover 40 km
$= 2x = 7$ hours
B takes time to cover 40 km = 4 hours 30 minutes
Total time taken by (A + B)

$= \left(7 + 4\frac{1}{2}\right)$ hours

Average $= \frac{23}{2 \times 2} = 5$ hours 45 min.

55. (d) Person has to travel a distance = 30 km

He has covered $\frac{5}{6}$ part of the distance in 3h 20 min

$= 30 \times \frac{5}{6} = 25$ km

Speed $= \frac{D}{T} = \frac{25 \times 3}{10} = \frac{15}{2} = 7.5$ km/h

56. (b) $\frac{7}{2} = \frac{150}{x} + \frac{90}{y} = 7xy$

$= 300y + 180x$ .....(i)

$\frac{11}{3} = \frac{100}{x} + \frac{140}{y}$

$= 11xy = 300y + 420x$ .....(ii)

$7xy = 300y + 180x$
$11xy = 300y + 420x$
$4xy = 240x$

y = 60 (Speed of bus)

Speed of train $= \frac{7}{2} = \frac{150}{x} + \frac{90}{60}$

$x = 75$ (speed of train)

**SMART APPROACH:-**

| Train | Car | |
|---|---|---|
| 150 | 90 | 3h 30 min |
| 100 | 140 | 3 h 40 min |
| 0 | 240 | 4 h |

(+ 50 km) (+10 min)

$\therefore$ Speed of car $= \frac{240}{4} = 60$ km/h

Speed of train $= \frac{150}{2} = 75$ km/h

57. (a) We know that,

$\frac{S_A}{S_B} = \sqrt{\frac{T_B}{T_A}}$

$\frac{S_A}{8.4} = \sqrt{\frac{4.05}{2.45}}$

$\frac{S_A}{8.4} = \frac{9}{7}$

$S_A = 10.8$ km/h.

58. (d) $T = \frac{D}{S} = \frac{20}{5} = 4\text{h}$

Usual time = 4 h – 30 min = 3h 20 min
Speed of man = 8 km/h

$T = \frac{20}{8} = 2$ h 30 min

Time difference = (3h + 20 min) – (2h + 30 min) = 50 min

**Method:-2**

$$\Rightarrow \frac{D}{S} \rightarrow \frac{5\times 8}{8-5}\times\frac{(40+x)}{60} = 20$$

$$\Rightarrow \frac{40}{3}\times\frac{(40+x)}{60} = 20$$

$\Rightarrow 80 + 2x = 180$

$\Rightarrow x = 50$ min

59. (d) Distance = $50 \times 8 = 400$ km

New speed of Ranjeet = 60km/h

$$\text{Speed of Rehman} = \frac{400}{5} = 80 \text{ km/h}$$

New Speed of Rahman = 100 km/h

$$\text{Time Difference} = \frac{400}{60} - \frac{400}{100}$$

$$= \frac{20}{3} - \frac{4}{1} = \frac{8}{3} = 2 \text{ h } 40 \text{ min}$$

60. (b) ATQ,

$$\frac{6\times(x-12)}{60} = 4\times\frac{(x+10)}{60}$$

$\Rightarrow 3x - 36 = 2x + 20$

$\Rightarrow x = 56$ min

$$\text{Speed of the man} = \frac{6(56-12)}{60\times\frac{56}{60}}$$

$$= \frac{6\times 44}{56} = \frac{33}{7} = 4\frac{5}{7} \text{ km/h}$$

61. (b) Let the distance between station A and station B is = D km.

A.T.Q,

$$\frac{d}{30} + \frac{d}{40} = \frac{63}{10}$$

$$\Rightarrow \frac{7d}{120} = \frac{63}{10}$$

$\Rightarrow d = 108$ km

**SMART APPROACH:-**

$$\text{Distance} = \frac{S_1\times S_2}{S_1+S_2}\times \text{total time}$$

$$= \frac{30\times 40}{70}\times 6.3 = 108 \text{ km}$$

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