

Percentile Classes

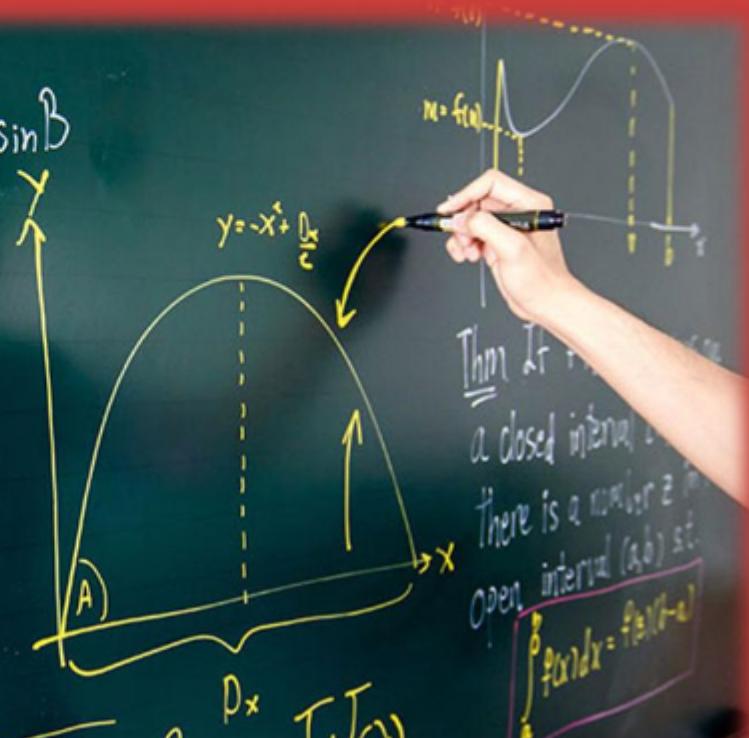
No Substitute to Hardwork

$$3) = \cos A \cos B - \sin A \sin B$$

$$= \cos^2 A - \sin^2 A$$

$$= \frac{2U^2 \cos A \sin A}{2g}$$

$$= \frac{U^2 \sin^2 A}{2g}$$



Quantitative Aptitude 01

Time Distance & Speed - 01

Abhitesh Sisodia

Theory of Time Distance and Speed

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

$$1 \text{ kmph} = \frac{5}{18} \text{ m/sec}; 1 \text{ m/sec} = 18/5 \text{ kmph}$$

Given that the distance between two points is constant, then

- ✓ IF the speeds are in Arithmetic Progression, then the times taken are in Harmonic Progression.
- ✓ IF the speeds are in Harmonic Progression, then the times taken are in Arithmetic Progression

Average Speed:

The basic formula for average speed is

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

That is,

$$\text{Average speed} = (d_1 + d_2 + \dots + d_n) / (t_1 + t_2 + \dots + t_n)$$

- When distance is constant:

The average speed is given by the formula,

$$\text{Average speed} = \frac{n}{\left(\frac{1}{s_1} + \left(\frac{1}{s_2} + \dots + \left(\frac{1}{s_n}\right)\right)\right)}$$

Where s_1 and s_2 are the two different speeds.

For e.g., if a car travels d distance at a speed of x kmph and return at y kmph then the above formula can be used to calculate the average speed.

- When time is constant:

The average speed is given by the formula

$$\text{Average speed} = \frac{s_1 + s_2 + \dots + s_n}{n}$$

For two speeds,

$$\text{Average speed} = \frac{s_1 + s_2}{2}$$

Relative speed:

The relative speed of two bodies travelling at speeds of x kmph and y kmph

- In the same direction is given by $(x - y)$ kmph
- In the opposite direction is given by $(x + y)$ kmph

Problem on trains:

Running in opposite direction, time taken by two trains of length a km and b km and speeds x mph and y kmph respectively to cross each other is given by.

$$\frac{a+b}{x+y} \text{ hours}$$

Running in same direction, time taken by two trains of length a km and b km and speeds x mph and y kmph respectively to cross each other is given by.

$$\frac{a+b}{x-y} \text{ hours}$$

- If two trains X and Y starting from A and B and run towards each other and take a and b hours to reach B and A respectively after crossing each other then,

$$\text{Speed of } X : \text{Speed of } Y = \sqrt{b} : \sqrt{a}$$

Problems on boats and streams:

If the speed of boat in still water is $x \text{ kmph}$ and the speed of the stream is $y \text{ kmph}$ then,

$$\text{Upstream speed} = (x - y) \text{ kmph}$$

$$\text{Downstream speed} = (x + y) \text{ kmph}$$

If the downstream speed is $a \text{ kmph}$ and upstream speed is $b \text{ kmph}$ then,

$$\text{Speed of boat in still water} = \frac{a+b}{2} \text{ kmph}$$

$$\text{Speed of stream} = \frac{a-b}{2} \text{ kmph}$$

Circular motion:

Relative speed of two bodies moving in a circular path in the opposite direction at x and $y \text{ kmph}$ respectively is given by

$$(x + y) \text{ kmph}$$

Relative speed of two bodies moving in a circular path in the same direction at x and $y \text{ kmph}$ respectively is given by

$$(x - y) \text{ kmph}$$

Races:**Linear Race:**

- $\text{Winners' distance} = \text{Total length of the race track}$
- $\text{Time taken by winner} = \text{Time taken by loser} - (\text{beat time} + \text{start time})$
- $\text{Loser's distance} = \text{Winner's distance} - (\text{beat distance} + \text{start distance})$
- $$\frac{\text{Winner's time}}{\text{Loser's distance}} = \frac{\text{Loser's time}}{\text{Winner's distance}} = \frac{\text{beat time} + \text{start time}}{\text{beat distance} + \text{start distance}}$$
- $A \text{ race ends in dead lock when beat time} = \text{beta distance} = 0$

Circular race:

When two people run in a circular track of length ' L ' at speeds ' a ' and ' b ' respectively in the same direction, then,

➤ Time at which they meet first = $\frac{L}{a-b}$

When two people run in a circular track of length ' L ' at speeds ' a ' and ' b ' respectively in the opposite direction, then,

➤ Time at which they meet first = $\frac{L}{a+b}$

When three people run in a circular track of length ' L ' at speeds ' a ', ' b ' and ' c ' respectively in the same direction, then,

➤ Time at which they meet first = $\frac{L}{a-b}, \frac{L}{a-c}$

Exercise 01**Time Distance Speed**

1. 'A' goes 10 km distance with average speed of 6 km/h while rest 20 km he travels with an average speed of 15 km/h. What is the average speed of 'A' during the whole journey?
 (a) 10 km/h (b) 12 km/h (c) 13 km/h (d) 14.5 km/h

2. A covers half of his distance with 20 km/h and rest with 30 km/h. What is the average speed during the whole journey?
 (a) 20 km/h (b) 24 km/h (c) 25 km/h (d) 26 km/h

3. A covers 1/4th of his journey at 20 km/h and 1/3rd of the rest at 25 km/h and half of the rest at 30 km/h and rest at the speed of 40 km/h. What is the average speed of A?
 (a) $13\frac{78}{89}$ km/h (b) 12 km/h (c) $26\frac{86}{89}$ km/h (d) 28 km/h

4. A covered half of his journey at 20 km/h and rest at x km/h, then his average speed is 24 km/h. What is the value of x ?
 (a) 30 (b) 32 (c) 36 (d) 40

5. A person goes to his office at 1/3rd of the speed at which he returns from his office. If the average speed during the whole trip (i.e., one round) is 12 km/h. What is the speed of the person while he was going to his office?
 (a) 10 (b) 6 (c) 8 (d) can't be determined

6. The speeds of Vimal and Kamal are 30 km/h and 40 km/h. Initially Kamal is at a place L and Vimal is at a place M. The distance between L and M is 650 km. Vimal started his journey 3 hours earlier than Kamal to meet each other. If they meet each other at a place P somewhere between L and M, then the distance between P and M is:
 (a) 220km (b) 250km (c) 330km (d) 320km

7. A postman goes with a speed of 36 km/h what is the speed of postman in m/s?
 (a) 4.5 m/s (b) 6 m/s (c) 10 m/s (d) can't be determined

8. A is twice fast as B and B is thrice as fast as C. The journey covered by C in 78 minutes will be covered by A in:
 (a) 12min (b) 13 min (c) 15.5 min (d) none of these

9. The ratio of speeds of A is to B is 2 : 3 and therefore A takes 20 minutes less time than B takes. What is the ratio of time taken by A and B?
 (a) 2 : 3 (b) 2 : 5 (c) 3 : 2 (d) 3 : 5

10. Walking at $4/5$ of his normal speed, Dewang is 15 minutes late in reaching his club. What is the usual time taken by him to cover the distance?
 (a) 1 h (b) 1 h 20 min (c) 45 min (d) none of these

11. Walking at $3/2$ of his normal speed Shekhawat takes 40 minutes less than the usual time? What is the changed (new) time taken by Shekhawat?
 (a) 1 h (b) 1.2 h (c) 3h (d) 2h

12. Osaka walks from his house at 5 km/h and reaches his office 10 minutes late. If this speed had been 6 km/h he would have reached 15 minutes early. The distance of his office from his house is :
 (a) 15 km (b) 12.5 km (c) 10.5km (d) 18km

13. A man covers a certain distance by his own car. Had he moved 6 km/h faster he would have taken 4 hours less. If he had moved 4 km/h slower, he would have taken 4 hours more. The distance (in km) is:
 (a) 240km (b) 640km (c) 480 km (d) none of these

14. The driver of an ambulance sees a school bus 40 m ahead of him. After 20 second, the school bus is 60 metre behind. If the speed of the ambulance is 30 km/h, what is the speed of the school bus?
(a) 10 km/h (b) 12 km/h (c) 15 km/h (d) 22 km/h
15. Patna express travels first 560 km in 7 hours and rest 360 in 9 hours. What is the average speed of the train?
(a) 39 km/h (b) 43 km/h (c) 63 km/h (d) 57.5 km/h
16. A train covers a certain distance moving at a speed of 60 km/h. However if it were to halt for a fixed time every hour, its average speed comes out to be 50 km/h. For how much time does the train halt for every hour?
(a) 6 min (b) 10 min (c) 12 min (d) none of these
17. Alok walks to a viewpoint and returns to the starting point by his car and thus takes a total time of 6 hours 45 minutes. He would have gained 2 hours by driving both ways. How long would it have taken for him to walk both ways?
(a) 8h 45min (b) 7h 45min (c) 5h 30min (d) 6h 45min
18. A motor car does a journey in 17.5 hours, covering the first half at 30 km/h and the second half at 40 km/h. Find the distance of the journey.
(a) 684km (b) 600km (c) 120km (d) 540km
19. Harsh and Vijay move towards Hosur starting from IIM, Bangalore, at a speed of 40 km/h and 60 km/h respectively. If Vijay reaches Hosur 200 minutes earlier than Harsh, what is the distance between IIM, Bangalore, and Hosur?
(a) 600km (b) 400km (c) 900km (d) 200km
20. How many seconds will a caravan 120 metres long running at the rate 10 m/s take to pass a standing boy.
(a) 10s (b) 12s (c) 11s (d) 14s
21. A man is running at the speed of 36 km/h, then how many m does he cover in 40 s?
(a) 400 m (b) 300 m (c) 2400 m (d) 100 m
22. A certain distance is covered at a speed V km/h. If half of the same the time, then the ratio for the former speed to that of the latter is:
(a) 4:1 (b) 1 : 4 (c) 2 : 1 (d) 1 : 2
23. Sama travelled the first half of the distance from her house to school at a speed of 10 km/h and for exactly half of the remaining time she travelled at 15 km/h and the rest of the time at 20 km/h. Find her average speed.
(a) 13 km/h (b) $12\frac{8}{11}$ km/h (c) 15 km/h (d) None of these
24. A train travels a distance of 192 km at an average speed of 80 km/h from station P to another station Q. It then travels back to P taking 5 h 36 min. Find the average speed of the train on the return journey to P.
(a) 72 km/h (b) 36 km/h (c) 20 km/h (d) 60 km/h
25. A starts driving from P to Q at 9 am and B starts driving from Q to P at 10 am. B is 50% faster than A. What is the time when they meet if P and Q are 300 km apart and A's speed is 50 km/h.
(a) 12:30 pm (b) 12 noon (c) 11:00 am (d) 11:30 am

Exercise 02

Problems on Train

12. Abhinav leaves Mumbai at 6 am and reaches Bangalore at 10 am. Praveen leaves Bangalore at 8 am and reaches Mumbai at 11:30 am. At what time do they cross each other?
(a) 10 am (b) 8:32 am (c) 8:56 am (d) 9:20 am
13. The Sinhagad Express left Pune at noon sharp. Two hours later, the Deccan Queen started from Pune in the same direction. The Deccan Queen overtook the Sinhagad Express at 8 p.m. Find the average speed of the two trains over this journey if the sum of their average speeds is 70 km/h.
(a) 34.28 km/h (b) 35 km/h (c) 50 km/h (d) 12 km/h
14. Two trains for Mumbai leave Delhi at 6:00 a.m. and 6:45 a.m. and travel at 100 kmph and 136 kmph respectively. How many kilometres from Delhi will the two trains be together?
(a) 262.4km (b) 260km (c) 283.33km (d) 275km
15. Two trains, Calcutta Mail and Bombay Mail, start at the same time from stations Kolkata and Mumbai respectively towards each other. After passing each other, they take 12 hours and 3 hours to reach Mumbai and Kolkata respectively. If the Calcutta Mail is moving at the speed of 48 km/h, the speed of the Bombay Mail is
(a) 24 km/h (b) 22 km/h (c) 21 km/h (d) 96 km/h
16. A railway passenger counts the telegraph poles on the rail road as he passes them. The telegraph poles are at a distance of 50 metres. What will be his count in 4 hours, if the speed of the train is 45 km per hour?
(a) 600 (b) 2500 (c) 3600 (d) 5000
17. Two trains pass each other on parallel lines. Each train is 100 metres long. When they are going in the same direction, the faster one takes 60 seconds to pass the other completely. If they are going in opposite directions they pass each other completely in 10 seconds. Find the speed of the slower train in km/h.
(a) 30 km/h (b) 42 km/h (c) 48 km/h (d) 60 km/h
18. Two trains for Howrah leave Muzaffarpur at 8:30 a.m. and 9:00 a.m. respectively and travel at 60 km/h and 70 km/h respectively. How many kilometres from Muzaffarpur will the two trains meet?
(a) 210km (b) 180km (c) 150km (d) 120km
19. A dog is passed by a train in 8 seconds. Find the length of the train if its speed is 36 kmph.
(a) 70m (b) 80m (c) 85m (d) 90m
20. The Howrah Mail leaves Trivandrum every day at 12:00 noon and reaches Howrah exactly three days later. Also, the Trivandrum Mail leaves Howrah at 12:00 noon every day and reaches Trivandrum exactly three days later. Not counting the trains just starting or just leaving the platform when a train leaves or arrives, how many Howrah Mails will one cross when travelling by Trivandrum Mail?
(a) 2 (b) 3 (c) 5 (d) 9
21. When the speed of a train is increased by 20%, it takes 20 min less to cover the same distance. What is the time taken to cover the same distance with the actual speed?
(a) 2h (b) 1h (c) 1.5 h (d) 2.5 h
22. Find the distance between two towns when by increasing the speed to 7 km/h, a train finishes the journey in 1 h less, and when the speed is reduced to 5 km/h, the train finishes the journey in 1 h more.
(a) 210 km (b) 180km (c) 240km (d) 164.4km
23. Two trains have respective lengths as 230 m and 190 m. They cross each other completely in 21 s, if they are travelling in the opposite direction and in 42 s, if they are travelling in the same direction. Find the ratio of the speeds of the two trains,
(a) 3 : 1 (b) 4 : 1 (c) 3 : 2 (d) None of these

24. A train of 300 m is travelling with the speed of 45 km/h, when it passes point A completely. At the same time, a motorbike starts from point A with the speed of 70 km/h. When it exactly reaches the middle point of the train, the train increases its speed to 60 km/h and motorbike reduces its speed to 65 km/h. How much distance will the motorbike travel while passing the train completely?
 (a) 2.52 km (b) 2.37 km (c) 2km (d) None of these
25. A 200-m-long train passes a 350-m-long platform in 5 s. If a man is walking at a speed of 4 m/s along the track and the train is 100 m away from him, how much time will it take to reach the man?
 (a) Less than 1s (b) 1.04s (c) More than 2s (d) Data insufficient

Exercise 03**Boats and Streams**

- A boat moves downstream at 1km in 5 minutes and upstream at 1 km in 12 minutes. What is the speed of current?
 (a) 4.5 km/h (b) 3.5 km/h (c) 2 km/h (d) 2.5 km/h
- A man can swim 5 km/h in still water. If the speed of current be 3 km/h, the time taken by him to swim to a place 16 km upstream and back is:
 (a) 8h (b) 7.5 h (c) 6.66 h (d) 10 h
- A man can row 15 km/h in still water and he finds that it takes him twice as much time to row up than as to row down the same distance in the river. The speed of the current (in km/h) is :
 (a) 6 km/h (b) 6.5 km/h (c) 4.5 km/h (d) 5 km/h
- The speed of a boat in upstream is $\frac{2}{3}$ that of downstream. Find the ratio of speed of boat in still water and to the average speed of boat in downstream and upstream?
 (a) $\frac{24}{25}$ (b) $\frac{25}{24}$ (c) $\frac{5}{12}$ (d) none of these
- The difference between downstream speed and upstream speed is 3 km/h and the total time taken during upstream and downstream is 3 hours. What is the downstream speed, if the downstream and upstream distance are 3 km each?
 (a) 2.5 km/h (b) 4.33 km/h (c) 4km/h (d) 3.3 km/h
- A boat sails 15 km of a river towards upstream in 5 hours. How long will it take to cover the same distance downstream, if the speed of current is one-fourth the speed of the boat in still water:
 (a) 1.8 h (b) 3h (c) 4 h (d) 5 h
- A boat takes 7 hours to go from P to R, through a midpoint Q, but it takes 8 hours to go from P to Q and then return from Q to P. How long it would take to go from R to P?
 (a) 7h (b) 8h (c) 9 h (d) none of these
- A man can cross a downstream river by steamer in 40 minutes and same by boat in 1 hour. If the time of crossing the river in upstream direction by steamer is 50% more than downstream time by the steamer and the time required by boat to cross the same river by boat in upstream is 50% more than the time required in downstream by boat. What is the time taken for the man to cross the river downstream by steamer and then return to same place by boat half the way and by steamer the rest of the way?
 (a) 85min (b) 115min (c) 120 min (d) 125 min
- A motorboat went downstream for 28 km and immediately returned. It took the boat twice as long to make the return trip. If the speed of the river flow were twice as high, the trip downstream and back would take 672 minutes. Find the speed of the boat in still water and the speed of the river flow,

- (a) 9km/h, 3km/h (b) 9km/h, 6km/h (c) 8km/h, 2km/h (d) 12km/h, 3 km/h
10. A boat sails downstream from point A to point B, which is 10 km away from A, and then returns to A. If the actual speed of the boat (in still water) is 3 km/h, the trip from A to B takes 8 hours less than that from B to A. What must the actual speed of the boat for the trip from A to B to take exactly 100 minutes?
 (a) 1 km/h (b) 2 km/h (c) 3 km/h (d) 4 km/h
11. A boat goes 40 km upstream in 8 h and a distance of 49 km downstream in 7 h. The speed of the boat in still water is
 (a) 5km/h (b) 5.5 km/h (c) 6 km/h (d) 6.5 km/h
12. A boat goes 15 km upstream in 80 minutes. The speed of the stream is 5 km/h. The speed of the boat in still water is
 (a) 16.25 km/h (b) 16 km/h (c) 15 km/h (d) 17 km/h
13. A boat rows 16 km up the stream and 30 km downstream taking 5 h each time. The velocity of the current
 (a) 1.1 km/h (b) 1.2 km/h (c) 1.4 km/h (d) 1.5 km/h
14. Vijay can row a certain distance downstream in 6 h and return the same distance in 9 h. If the stream flows at the rate of 3 km/h, find the speed of Vijay in still water.
 (a) 12 km/h (b) 13 km/h (c) 14 km/h (d) 15 km/h
15. A man can row 30 km upstream and 44 km downstream in 10 hours. It is also known that he can row 40 km upstream and 55 km downstream in 13 hours. Find the speed of the man in still water,
 (a) 4km/h (b) 6km/h (c) 8km/h (d) 12km/h
16. In a stream that is running at 2 km/h, a man goes 10 km upstream and comes back to the starting point in 55 minutes. Find the speed of the man in still water,
 (a) 20 km/h (b) 22 km/h (c) 24 km/h (d) 28 km/h
17. Vinit's rowing at a speed of 4 km/h in still water. He has to reach a destination that is 130 km downstream of a river. The river flows at a speed of 2 km/h but due to tides every 2 h, the velocity doubles and then after another 2 h, it halves. If Vinit starts at the change of the tide when the river was flowing at 2 km/h, then after how much time will he reach his destination?
 (a) $8\frac{1}{4}h$ (b) $18\frac{1}{2}h$ (c) $9\frac{1}{2}h$ (d) None of these
18. A man can row half a kilometre against the current in 12 min and returns in six min. Find the speed of the current.
 (a) 1.25 km/h (b) 1.5 km/h (c) 2.5 km/h (d) 3 km/h
19. A man rows a boat a certain distance upstream and then returns to the same place. If the time taken by him in going upstream is twice the time taken in rowing downstream, find the ratio of the speed of the boat in still water and the speed of the stream.
 (a) 2 : 1 (b) 3 : 2 (c) 5 : 3 (d) 3 : 1
20. Alok rows a boat against a stream flowing at 2 km/h for a distance of 9 km and then turns around and rows back with the current. If the whole trip lasts 6 h, find Alok's rowing speed in still water,
 (a) 4 km/h (b) 3 km/h (c) 2 km/h (d) 5km/h
21. In the above question how many per cent time Jaya saved in going via Noida of the total time taken previously:
 (a) 10% (b) 25% (c) 50% (d) 17%

Exercise 04

Races and Games

1. In a 1600 m race, A beats B by 80 m and C by 60 m. If they run at the same time then by what distance will C beat B in a 400 m race?
(a) $5\frac{15}{77}m$ (b) $5\frac{20}{76}m$ (c) $15\frac{5}{77}m$ (d) None of these

2. A runs $\frac{7}{4}$ times as fast as B. If A gives B a start of 300 m, how far must the winning post be if both A and B have to end the race at same time?
(a) 1400m (b) 700m (c) 350m (d) 210m

3. In a 1000 m race Ameesha gives a headstart of 100 m to Bipasha and beats her by 200 m. In the same race Ameesha gives a headstart of 100 m to Celina and beats her by 300 m. By how many metres would Bipasha beat Celina in a 50 m race?
(a) 6.66m (b) 7.143m (c) 8 m (d) none of these

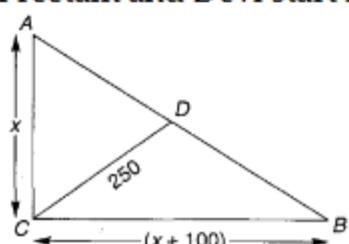
4. A gives both B and C a start of 60 m in a 1500 m race. However, while B finishes with him, C is 15 m behind them when A and B cross the finishing line. How much start can B give C for the 1500 m race course?
(a) $7\frac{6}{23}m$ (b) $15\frac{5}{8}m$ (c) $7\frac{11}{16}m$ (d) $5\frac{5}{24}m$

5. In a 600 m race Prabhat has a start of 200 m and the ratio of speeds of Prabhat and Nishith is 4 : 5, then the distance by which Prabhat wins by:
(a) 100m (b) 80m (c) 120 m (d) none of these

6. Two runner start running together for a certain distance, one at 5 km/h and another at 8km/h. The former arrives one and half an hour before the latter. The distance (in km) is:
(a) 12 (b) 20 (c) 25 (d) 36

7. A dog starts chasing to a cat 2 hours later. It takes 2 hours to dog to catch the cat. If the speed of the dog is 30 km/h, what is the speed of cat?
(a) 10 km/h (b) 15 km/h (c) 20 km/h (d) can't be determined

8. In reaching the Purnagiri a man took half as long again to climb the second third as he did to climb the first third and a quarter as long again for the last third as for the second third. He took altogether 5 hr 50 minutes. Find the time he spent on the first third of the journey?
 (a) 72 min (b) 80 min (c) 81 min (d) 88 min
9. Pathik and Rahi started from two places Andheri and Bhavnagar towards Bhavnagar and Andheri respectively at 8 : 20 am. The speeds of Pathik and Rahi are in the ratio of 4 : 5. They meet at Chandni Chowk, somewhere between Andheri and Bhavnagar, spent some-time together enjoyed coffee and burger and then both started towards their destination at 9 : 27 am. If Pathik reaches Bhavnagar at 10 : 32 am, how much time did they spend together?
 (a) 8min (b) 12 min (c) 15 min (d) can't be determined
10. A girl while walking diametrically across a semicircular playground, takes 3 minutes less than if she had kept walking round the circular path from A to B. If she walks 60 metres a minute, what is the diameter of the playground?
 (a) 60m (b) 48m (c) 84m (d) 315m
11. A surveillance plane is moving between two fixed places Pukhwara and Kargil at 120 km/h. The distance between two places is 600 km. After 18 hour what will be the distance between the Kargil and its position if it starts moving from Pukhwara?
 (a) 360km (b) 300km (c) 240 km (d) none of these
12. Priyanka, Akshay and Salman started out on a journey to "watch the newly released movie "Mujhse Shaadi Karogi", which was being shown at wave cine-multiplex. The multiplex was 120 km away from their starting point of journey. Priyanka and Salman went by car at the speed of 50 km/h, while Akshay travelled by Tonga (horse cart) at 10 km/h. After a certain distance Salman got off and travelled the rest distance by another Tonga at 10 km/h, while Priyanka went back for Akshay and reached the destination, at the same time that Salman arrived. The number of hours required for the trip was:
 (a) 4h (b) 5h (c) 4.8 h (d) can't be determined
13. A tiger is 50 of its own leaps behind a deer. The tiger takes 5 leaps per minute to the deer's 4. If the tiger and the deer cover 8 m and 5 m per leap respectively, what distance will the tiger have to run before it catches the deer?
 (a) 600m (b) 700m (c) 800m (d) 1000m
14. Den Bosch and Eastbourne are two famous cities 300 km apart. Maradona starts from Den Bosch at 8 : 24 am. An hour later Pele starts from Den Bosch. After travelling for 1 hour, Pele reaches Nottingham that Maradona had passed 40 minutes earlier. Nottingham falls on the way from Den Bosch to Eastbourne. If Pele and Maradona just reaches Eastbourne at the same time, what are the speeds of the Maradona and Pele respectively?
 (a) 100 km/h, 125 km/h (b) 60 km/h, 80 km/h
 (c) 60 km/h, 75 km/h (d) 75 km/h, 100 km/h
15. Preetam and Devi start running a race on the given track as shown in figure.



Where AC and BC are mutually perpendicular and CD is the median of triangular paths ABC. BC is 100 km longer than that of AC, again CD is 250 km. The speeds of Preetam and Devi are 30 km/h and 40 km/h, initially and their respective paths of running are CADC and CBDC. After how much time they reverse their speeds so that they return C at the same time?

- (a) $\frac{50}{7} h$ (b) $\frac{120}{7} h$ (c) $\frac{80}{11} h$ (d) None of these
16. Akbar, Birbal and Chanakya run around a circular track of length 500 m. Akbar and Birbal run with the speeds of 15 m/s and 20 m/s in the same direction respectively and Chanakya being very intelligent run in the opposite direction with a speed of 25 m/s. If all three of them start at the same time, then:
 (a) Akbar meets Chanakya more frequently than Birbal does
 (b) Akbar and Chanakya meets as frequently as Birbal and Chanakya
 (c) Akbar meets Birbal least frequently
 (d) Nothing can be concluded
17. A racetrack is in the form of a right triangle. The longer of the legs of the track is 2 km more than the shorter of the legs (both these legs being on a highway). The start and end points are also connected to each other through a side road. The escort vehicle for the race took the side road and rode with a speed of 30 km/h and then covered the two intervals along the highway during the same time with a speed of 42 km/h. Find the length of the racetrack,
 (a) 14km (b) 10km (c) 24km (d) 36km
18. In a 500 m race, the ratio of speed of two runners Vinay and Shyam is 3 : 4. If Vinay has a start of 140 m then Vinay wins by
 (a) 15m (b) 20m (c) 25m (d) 30m
19. In a race on a circular track, there were 12 laps of 150 m each. Akhil and Bharat were very close till the end of the third lap, but thereafter Bharat went on to win the race by 81 m. If Bharat gained uniformly over Akhil in all the remaining laps, the ratio of the speed of Akhil and Bharat for each of other laps was:
 (a) 129 : 150 (b) 150 : 141 (c) 150 : 129 (d) 141 : 150
20. In a kilometre race, A beats B by 10 m. In a two kilometres race, A beats B by:
 (a) 10 m (b) 20 m (c) 40 m (d) 25 m
21. In a kilometre race, Amit beats Bahadur by 100 m and Bahadur beats Chandra by 200 m. By how many metres does Amit beat Chandra in the same race?
 (a) 100m (b) $83\frac{1}{3}m$ (c) 68 m (d) 280m
22. In a kilometre race, Ajay beats Bijay by 100 m and Bijay beats Chand by 100 m. By how many m does Ajay beat Chand in the same race?
 (a) 100m (b) 200m (c) 190m (d) 119m
23. In a race of 300 m, Abhishek beats Bijay by 30 m, while Bijay beats Chandan by 50 m. By what distance should Abhishek beat Chandan in the same 300 m race?
 (a) 80 m (b) 40 m (c) 160 m (d) 75 m
24. Anand can beat Bidhan by 5 m in a 100 m race and Bidhan can beat Chandan by 10 m in a 200 m race. Then, in a race of 400 m, Anand can beat Chandan by:
 (a) 40m (b) 39m (c) 15m (d) 10m
25. Two rabbits A and B are running a race in which they have to go up to 50 m mark and then come back to the starting point. A runs in a sequence of three jumps in which the distance travelled in the first one is twice that of the other two and B runs in a sequence of three jumps in which the distance travelled in the first jump is 1.5 that of the distance travelled in the second jump and distance travelled in the second jump is twice the distance travelled in the third jump. Distance travelled by A in two jumps and by B in three jumps equal to 6 m. In the second race, they interchange their individual sequence of jumps. Who will win the first and the second match if on completing the 50 m mark they turn back and start from the first jump?
 (a) A, A (b) B, B (c) A, B (d) None of these

Exercise 05**Time Distance Speed**

1. Anjali fires two bullets from the same place at an interval of 6 minutes but Bhagwat sitting in a car approaching the place of firing hears the second fire 5 minute 32 seconds after the first firing. What is the speed of car, if the speed of sound is 332 m/s?
 (a) 56 m/s (b) 102 m/s (c) 28 m/s (d) 32 m/s

2. A man takes 4 h 20 minutes in walking to a certain place and riding back. If he walk on both sides he loses 1 h. The time he would take by riding both ways is
 (a) 2h 20min (b) 3 h 20 min (c) 2h (d) 4 h 40 min

3. The wheel of an engine of 300 cm in circumference makes 10 revolutions in 6 seconds. What is the speed of the wheel (in km/h)?
 (a) 18 (b) 20 (c) 27 (d) 36

4. A road passes through the towns Sangamner and Yeotmal. A cyclist started from Sangamner in the direction of Yeotmal. At the same time, two pedestrians started from Yeotmal travelling at the same speed, the first of them towards Sangamner and the other in the opposite direction. The cyclist covered the distance between the towns in half an hour and, continued ahead in the same direction. He overtook the second pedestrian, 1.2 hours after he met the first pedestrian. Determine the time the cyclist spent travelling from Sangamner to the point of the meeting with the first pedestrian (assuming the speeds of the cyclist and the pedestrians to be constant),
 (a) 24min (b) 18min (c) 30 min (d) Cannot be determined

5. Jaideep travels from Alaska, which is on a highway, to Burgen, which is 16 km from the highway. The distance between Alaska and Burgen along a straight line is 34 km. At what point should Jaideep turn from the highway to reach Burgen in the shortest possible time, if his speed along the highway is 10 km/h and 6 km/h otherwise.
 (a) 30 km away from A (b) 20 km away from A
 (c) 18 km away from A (d) 15 km away from A

6. The metro service has a train going from Mumbai to Pune and Pune to Mumbai every hour, the first one at 6 a.m. The trip from one city to other takes $4\frac{1}{2}$ hours, and all trains travel at the same speed. How many trains will you pass while going from Mumbai to Pune if you start at 12 noon?
 (a) 8 (b) 10 (c) 9 (d) 13

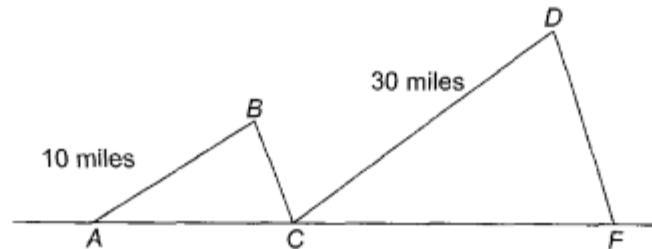
7. Ram Singh and Priyadarshan start together from the same point on a circular path and walk around, each at his own pace, until both arrive together at the starting point. If Ram Singh performs the circuit in 3 minutes 44 seconds and Priyadarshan in 6 minutes 4 seconds, how many times does Ram Singh go around the path?
 (a) 8 (b) 13 (c) 15 (d) Cannot be determined

8. An ant climbing up a vertical pole ascends 12 meters and slips down 5 meters in every alternate hour. If the pole is 63 meters high how long will it take it to reach the top?
 (a) 18 hours (b) 17 hours
 (c) 16 hours 35 minutes (d) 16 hours 40 minutes

9. A tourist covered a journey partly by foot and partly by tonga. He walked for 90 km and rode the tonga for 10 km. He spent 4 h less on the tonga than on walking. If the tourist had reversed the times he travelled by foot and on tonga, the distances travelled on each part of the journey would be equal. How long did he ride the tonga?
 (a) He rode for 6 hours (b) He rode for 4 hours
 (c) He rode for 2 hours (d) He rode for 5 hours

Direction for Questions 16 and 17: Read the following passage and solve the questions on it.

Given below is the structure of roads from A to F . ABC and CDF are two similar mountains with ideal straight lines AB



and CD as their slant heights. $\angle BAC - \angle DCF = 30^\circ$ and $\angle BCA = DFC - 60^\circ$. Speed of Manoj Kumar uphill is 20 miles/h and downhill is 40 miles/h.

16. What is the total time taken by him to travel from A to F ?
(a) 3h 12min (b) 2h 21min (c) 2 h 35 min (d) Cannot be determined

17. Jonathan Livingston Seagull is flying between the points B and D . What is the distance travelled by Jonathan?
(a) $10\sqrt{\frac{28}{3}}$ miles (b) $10\sqrt{\frac{7}{3}}$ miles (c) $\frac{10}{3}$ miles (d) None of these

18. Anil left his house for school S min late but he travelled at $\frac{4}{3}$ th of his usual speed and reached school S min early. Next day, he left home S min earlier than the previous day and travelled at $\frac{8}{11}$ th of his usual speed. He reached his office:
(a) S min late (b) 25 min late (c) Exactly on time (d) Cannot be determined

Exercise 06

1. Two horses start trotting towards each other, one from A to B -and another from B to A. They cross each other after one hour and the first horse reaches B, $\frac{5}{6}$ hour before the second horse reaches A. If the distance between A and B is 50 km. What is the speed of the slower horse?
 (a) 30 km/h (b) 15 km/h (c) 25 km/h (d) 20 km/h
2. A car travelled first 36 km at 6 km/h faster than the usual speed, but it returned the same distance at 6 km/h slower than the usual speed. If the total time taken by car is 8 hours, for how many hours does it travelled at the faster speed?
 (a) 4 (b) 3 (c) 2 (d) 1
3. Bipasha and Mallika leave towns Kolkata and Ambala at 6 am and travel towards Ambala and Kolkata respectively. Speed of Bipasha is 60 km/h and speed of Mallika is 120 km/h. Rani leaves Kolkata for Ambala sometime later and travels at a speed of 90 km/h. If the distance between Kolkata and Ambala is 1080 km and all three meet at the same point on the way, at same time, then at what time did Rani leave Kolkata?
 (a) 7 am (b) 8 am (c) 7 : 30 am (d) 10 am
4. Due to the technical snag in the signal system two trains start approaching each other on the same rail track from two different stations, 240 km away from each other. When the train starts a bird also starts moving to and fro between the two trains at 60 km/h touching each time each train. The bird is initially sitting on the top of the engine of one of the trains and it moves so till these trains collide. If these trains collide one and a half hour after the start, then how many kilometres bird travells till the time of collision of trains?
 (a) 90km (b) 130km (c) 120km (d) none of these
5. Two boats go downstream from point X to point Y. The faster boat covers the distance from X to Y 1.5 times as fast as the slower boat. It is known that for every hour the slower boat lags behind the faster boat by 8 km. However, if they go upstream, then the faster boat covers the distance from Y to X in half the time as the slower boat. Find the speed of the faster boat in still water.
 (a) 12kmph (b) 20kmph (c) 24kmph (d) 25 kmph
6. Three ghats X, Y and Z on the Yamuna in Delhi are located on the river bank. The speed of the river flow is 8 km/h in the direction of its flow, Ghat Y being located midway between X and Z. A raft and a launch leave Y at the same time, the raft travelling down the river to Z and the launch travelling to X. The speed of the launch in still water is 5 km/h. Having reached X, the launch reverses its direction and starts to Z. Find the range of values of V for which the launch arrives at Z later than the raft.
 (a) $8 < V < 24$ km/h (b) $8 < V < 16$ km/h (c) $8 < V < 20$ km/h (d) $12 < V < 24$ km/h
7. Three sprinters A, B, and C had to sprint from points P to Q and back again (starting in that order). The time interval between the starting times of the three sprinters A, B and C was 5 seconds each. Thus C started 10 seconds after A, while B started 5 seconds after A. The three sprinters passed a certain point R, which is somewhere between P and Q, simultaneously (none of them having reached point Q yet). Having reached Q and reversed the direction, the third sprinter met the second one 9 m short of Q and met the first sprinter 15 m short of Q. Find the speed of the first sprinter if the distance between PQ is equal to 55 m.
 (a) 4m/s (b) 3 m/s (c) 2 m/s (d) 1 m/s
8. A dog sees a cat. It estimates that the cat is 25 leaps away. The cat sees the dog and starts running with the dog in hot pursuit. If in every minute, the dog makes 5 leaps and the cat makes 6 leaps and one leap of the dog is equal to 2 leaps of the cat. Find the time in which the cat is caught by the dog (assume an open field with no trees)
 (a) 12 minutes (b) 15 minutes (c) 12.5 minutes (d) None of these
9. The distance between two towns is x km. A car travelling between the towns covers the first k km at an average speed of y km/h and the remaining distance at z km/h. The time taken for the journey is
 (a) $\frac{k}{y} + \frac{(x-k)}{z}$ (b) $ky + \frac{(k-x)}{z}$ (c) $\frac{k}{y} + \frac{(k-z)}{z}$ (d) $ky + z(x - k)$

10. A motorcyclist left point A for point B . Two hours later, another motorcyclist left A for B and arrived at B at the same time as the first motorcyclist. Had both the motorcyclists started simultaneously from A and B travelling towards each other, they would have met in 80 minutes. How much time did it take the faster motorcyclist to travel from A to B ?
 (a) 6 hours (b) 3 hours (c) 2 hours (d) 4 hours
11. Ayrton Senna had to cover a distance of 60 km. However, he started 6 minutes later than his scheduled time and raced at a speed 1 km/h higher than his originally planned speed and reached the finish at the time he would reach it if he began to race strictly at the appointed time and raced with the assumed speed. Find the speed at which he travelled during the journey described.
 (a) 25 km/h (b) 15 km/h (c) 10 km/h (d) 6 km/h
12. Points A , B and C are at the distances of 120, 104.66 and 112 km from point M respectively. Three people left these points for point M simultaneously: the first person started from point A , the second from B and the third from C . The first person covered the whole way at a constant speed and arrived at M an hour before the second and the third persons (who arrived simultaneously). The third person covered the whole way at a constant speed. The second person, having travelled 72 km at the same speed as the first, stopped for 2 hours. The rest of the way he travelled at a speed that is less than the speed of the third person by the same amount as the speed of the third is less than that of the first. Determine the speed of the first person.
 (a) 6 kmph (b) 5 kmph (c) 4 kmph (d) 3 kmph
13. Shaurya and Arjit take a straight route to the same terminal point and travel with constant speeds. At the initial moment, the positions of the two and the terminal point form an equilateral triangle. When Arjit covered a distance of 80 km, the triangle becomes right-angled. When Arjit was at a distance of 120 km from the terminal point, the Shaurya arrived at the point. Find the distance between them at the initial moment assuming that there are integral distances throughout the movements described.
 (a) 300km (b) 240km (c) 200km (d) 225km
14. A cyclist moving on a circular track of radius 100 metres completes one revolution in 2 minutes. What is the average speed of cyclist (approximately)?
 (a) 314 m/minute (b) 200 m/minute (c) 300 m/minute (d) 900 m/minute
15. Ram and Rahim left Bombay simultaneously towards Pune. Speed of Ram is 15 km/h and the speed of Rahim is 12 km/h. Half an hour later, Mohan started from Bombay towards Pune on the same road in the same direction. After some time, he overtook Rahim and 90 mins further, he overtook Ram. What is Mohan's speed?
 (a) 18 km/h (b) 24 km/h (c) 32 km/h (d) 36 km/h

Direction for Questions 16 and 17: Read the passage given below and solve the questions based on it.

A train started at 9:00 am from station X with a speed of 72 km/h. After 2 h, another train started from station Y towards X with a speed 90 km/h. The two trains are expected to cross each other at 1:30 pm. Owing to a signal problem arising at 12 noon, the speed of each of them was reduced by the same quantity! and they crossed each other at 4:30 pm.

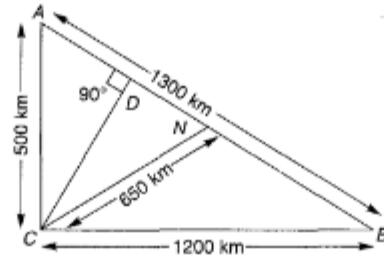
16. What is the new speed of the train that started from station?
 (a) 18km/h (b) 36 km/h (c) 45 km/h (d) 54 km/h
17. If the signal problem had occurred at 1:00 pm instead of 12 noon, at what time would the two trams cross each other?
 (a) 2 : 30 pm (b) 3 : 00 pm (c) 2 : 00 pm (d) 2 : 30 pm
18. In the shooting of the movie 'AKS', Manu, the actor, is running towards a vertical mirror with a speed of 10 m/s on a line which is perpendicular to the plane of the mirror. The mirror is moving towards Manu with the speed of 6 m/s along the same line. Find the speed of Manu's image with respect to Manu (the image of Manu forms on the other side of the mirror such that the distance between the image of Manu and the mirror is equal to the distance between Manu and the mirror).

- (a) 15 m/s (b) 25 m/s (c) 30 m/s (d) None of these
19. Two persons Prabhat and Vinay are walking around a circular park of the length 960 m. Prabhat walks at the rate of 80 m/min, while Vinay walks at the rate of 60 m/min. If both of them start from the same starting point at the same time in the same direction, when will they be together?
(a) 24 min (b) 48 min (c) 96 min (d) 120 min
20. A train's journey is disrupted due to an accident on its track after it has travelled 30 km. Its speed then come down to four-fifth of its original, and consequently, it runs 45 min late. Had the accident taken place 18 km farther away, it would have been 36 min late. Find the original speed of the train.
(a) 25 km/h (b) 36 km/h (c) 30 km/h (d) 20 km/h
21. A and B start at the same time from P and Q (55 km apart) to Q and P at 3 km/h and $2\frac{1}{2} \text{ km/h}$ respectively. They meet at R and then reach Q and P to return immediately and meet again at S. The distance from R to S is:
(a) 10km (b) 12km (c) 15km (d) 16km
22. Two points A and B are diametrically opposite points on a 6 km long circular road. A cyclist started from A and made two rounds. He made the first round with a certain uniform speed and then decreased his speed by 3 km/h. The interval between his two passages through point B is 50 min. Find the speed with which the cyclist made the first round.
(a) 6 km/h (b) 9 km/h (c) 12 km/h (d) 16 km/h
23. A train approaches a tunnel PQ which is 16 m long. Two rabbits A and B are standing at points which are 12 m and 8 m inside the tunnel with respect to the entrance P. When the train is x m away from P, A starts running towards P and B towards Q. Difference between the ratios of the speed of A to that of the train and the ratio of the speed of B to that of train is $1/8$. How much can the distance x be, if both of them get caught at the ends of the tunnel?
(a) 30m (b) 16m (c) 48 m (d) None of these
24. Michael Johnson is a great sprinter. He can climb 12 stairs of a staircase in 3 s. But after climbing 480 stairs his speed reduces to eight stairs in 3 s. The Empire State Building in NY has 90 floors and the lift takes 4 s per floor. To get to the next floor, one has to climb 12 stairs. If Michael is on the ground floor how should he reach the 90th floor to be the first?
(a) By lift (b) Running
(c) Run till 50th floor and then take the lift (d) None of these
25. Saket runs twice on a circular track at a uniform speed. Bidhan starts at the same time as Saket and after Bidhan has completed one lap, he stops and Sunny starts and completes the second lap at a uniform speed. It is given that they start the race exactly at 2:30 pm and the track is 500 m in circumference. Sunny runs at a speed of 5 km/h greater than that of Bidhan and Saket's speed is 2 km/h greater than that of Bidhan. When does Saket finish the second lap if Sunny also finishes at the same time?
(a) 2:32 pm (b) 2:35 pm (c) 2:33 pm (d) 2:36 pm

Exercise 07

1. Mahindra starts a journey for his office, which is in the north east of his home. An hour after starting meets with a minor accident. He takes one hour in resuming his journey. After that he proceeds at $\frac{5}{6}$ th of his former speed and arrives at the office 1 hour 36 minutes late than the scheduled time. Had the accident occurred 80 kms further from the actual place of accident, he would have arrived 1 hour 20 minutes beyond the scheduled time. What is the distance between his office and his home?
 (a) 180km (b) 240km (c) 250km (d) 300km
2. Two trains Ajanta express and Barouni express simultaneously started on two parallel tracks from Meerut to Nagpur, which are 390 km apart. The ratio of the speed of Ajanta express and Barouni express is 6 : 7. After how long (in kms) travelling, Barouni express exchanges the speed with Ajanta express so that both the trains reach at their destination simultaneously:
 (a) 150km (b) 190km (c) 210 km (d) can't be determined

Directions for question number: In the following figure the route is shown which is followed by Professor Jai and Professor Jaya, who are visiting faculty at IIM-A and IIM-B respectively. A, B denote IIM-A and IIM-B respectively and C denotes the residence of Prof. Jai and Prof. Jaya. They leave home for classes at the same time and their driving speeds are $\frac{500}{13}$ km/h and $\frac{1200}{13}$ km/h respectively. Also they finish the classes at the same time to reach home.



- The path adopted by Jai and Jaya is CADC and CBDC respectively. Prof. Jai and Prof. Jaya are husband and wife respectively.
3. If both of them start and finish the classes at the same time, then who returned home earlier than other, if no one of them halts for anywhere in the route and they just leave the institution as soon as they finish the lectures?
 (a) Prof. Jai (b) Prof. Jaya
 (c) Return at the same time (d) Can't be determined
4. Harsha takes 3 hours more than Ashok, who drives his car 5 km/h faster than Harsha drives, to cover 180 km distance. What is the speed of Harsha?
 (a) 12 km/h (b) 15 km/h (c) 30 km/h (d) 40 km/h
5. In the shown figure N and D denotes Noida and Delhi respectively, who returned home late and by how much time, if Jaya turned from Noida instead of Delhi?
 (a) Jai, 9 h 10 min (b) Jaya, 9 h 50 min (c) Jai, 2 h 55 min (d) Jai, 16 h 10 min
6. A and B runs around a circular track. A beats B by one round or 10 minutes. In this race, they had completed 4 rounds. If the race was only of one round, find the A's time over the course:
 (a) 8 min (b) 7.5 min (c) 12.5 min (d) 12 min
7. A, B and C participated in a race. A covers the same distance in 49 steps, as B covers in 50 steps and C in 51 steps. A takes 10 steps in the same time as B takes 9 steps and C takes 8 steps. Who is the winner of the race?
 (a) A (b) B (c) C (d) can't be determined
8. A motorboat moves from point A to point B and back again, both points being located on the river-bank. If the speed of the boat in still water is doubled, then the trip from A to B and back again would take 20% of the time that the motorboat usually spends in the journey. How many times is the actual speed of the launch higher than the speed of the river flow?
 (a) $\sqrt{\frac{3}{2}}$ (b) $\frac{\sqrt{3}}{3}$ (c) $\frac{2}{3}$ (d) $\frac{3}{2}$

9. A robot began moving from point A in a straight line at 6 p.m. with an initial speed of 3 m/s. One second later, the speed of the robot became equal to 4 m/s. Find the acceleration of the robot at the end of the 2nd second if its speed changes by the law $s(t) = (at^2 + It + b)$
- (a) 1 m/s² (b) -2 m/s² (c) 0 m/s² (d) 2 m/s²
10. A passenger train left town Alpha for town Beta. At the same time, a goods train left Beta for Alpha. The speed of each train is constant throughout the whole trip. Two hours after the trains met, they were 450 km apart. The passenger train arrived at the place of destination 16 hours after their meeting and the goods train, 25 hours after the meeting. How long did it take the passenger train to make the whole trip?
- (a) 21 hours (b) 28 hours (c) 14 hours (d) None of these

Directions for Questions 11 to 13: Read the following and answer the question that follow.

A naughty bird is sitting on top of a car. It sees another car approaching it at a distance of 12 km. The speed of the two cars is 60 kmph each. The bird starts flying from the first car and moves towards the second car, reaches the second car and comes back to the first car and so on. If the speed at which the bird flies is 120 kmph then answer the following questions. Assume that the two cars have a crash.

11. The total distance travelled by the bird before the crash is
- (a) 6km (b) 12km (c) 18km (d) None of these
12. The total distance travelled by the bird before it reaches the second car for the second time is
- (a) 10.55km (b) 11.55km (c) 12.33km (d) None of these
13. The total number of times that the bird reaches the bonnet of the second car is (theoretically):
- (a) 12 times (b) 18 times (c) Infinite times (d) Cannot be determined
14. If all of them travelled a distance of 100 miles, who reached first and at what time (assume the last leg time increases to cover 100 miles)?
- (a) Mohan at 6 p.m. (b) Ram at 8 p.m. (c) Shyam at 6 p.m. (d) Mohan at 8 p.m.
15. Two joggers left Delhi for Noida simultaneously. The first jogger stopped 42 min later when he was 1 km short of Noida and the other one stopped 52 min later when he was 2 km short of Noida. If the first jogger jogged as many kilometres as the second and the second as many kilometres as the first, the first one would need 17 min less than the second. Find the distance between Delhi and Noida.
- (a) 5km (b) 15km (c) 25km (d) 35km
16. Two ants start simultaneously from two ant holes towards each other. The first ant covers 8% of the distance between the two ant holes in 3 hours, the second ant covered $\frac{7}{120}$ of the distance in 2 hours 30 minutes. Find the speed (feet/h) of the second ant if the first ant travelled 800 feet to the meeting point.
- (a) 15 feet/h (b) 25 feet/h (c) 45 feet/h (d) 35 feet/h
17. Amar and Akbar left Bhubaneshwar simultaneously and travelled towards Cuttack. Amar's speed was 15 km/h and that of Akbar was 12 km/h. Half an hour later, Anthony left Bhubaneshwar and travelled in the same direction. Sometime later, he overtook Akbar and 90 minutes further on he overtook Amar. Find Anthony's speed.
- (a) 18 kmph (b) 24 kmph (c) 20 kmph (d) 16 kmph
18. A, B, and C start running a race from the same starting point at the same time in the same direction. A's speed around a path which is an equilateral triangle. B's path is a square and C's path is a regular hexagon. One edge of the triangular path, square path and hexagonal path completely overlaps with each other. If all of them complete one round at the same time then which of the following is true?
- (a) Speed of C is twice that of the speed of A. (b) Speed of A is half that of C.
 (c) Speed of B is 50% more than that of A. (d) None of these

Direction for Questions 19 and 20: Read the passage below and solve the questions based on it.

A jetfighter moving 3 km above the ground with a speed of 360 km/h tries to cross the border. A radar station notices it at distance of 6 km from the Jet. But it can fire antiaircraft missile only when the plane enters in its border. The border is at a distance of $\sqrt{3}$ km from radar station. (Assume that the fighter moves in a straight line in the same plane with the same speed)

19. If it fires the missile at the fighter as soon as it notices the jetfighter such that it will hit the fighter as soon as it enters in the borderline, then at what speed should be missile fired?
 (a) 360 km/h (b) 240 km/h (c) $200\sqrt{3}$ km/h (d) None of these
20. The radar station can fire 10 missiles simultaneously in such a way that the first missile will meet the fighter exactly at the border if the fighter moves with its original speed. The other missiles will reach up to the line of movement of the jet at same time, but at a distance of 100 m from each other such that one of them will hit the fighter even if the fighter increases its speed. If jetfighter has to escape the attack, at what increased speed it should move?
 (a) 400 km/h (b) 545 km/h (c) 464 km/h (d) 380 km/h
21. At his normal speed, Rishu can go 18 km downstream in a flowing river in 9 h less than what he takes to go the same distance upstream. The downstream journey would take 1 h less than what the upstream journey would take provided he doubles his rate of rowing. Find the speed of the river (in km/h)?
 (a) $6\frac{2}{3}$ km (b) 8 km (c) $9\frac{1}{2}$ km (d) 12 km
22. P and Q start running simultaneously – one from point A to B and the second from point B to A. P's speed is $\frac{6}{5}$ th of g's speed. If after crossing Q, P takes $2\frac{1}{2}$ h to reach B, how much time does Q take to reach A after crossing P?
 (a) 3:36 min (b) 3:48 min (c) 4 : 12 min (d) None of these
23. A group of soldiers are marching with a speed of 5 m/s. The distance between the first and the last row of soldiers is 100 m. A dog starts running from the last row and moves towards the first row, turns and comes back to the last row. If the dog has travelled 400 m, the speed of the dog is:
 (a) $5\sqrt{2}$ m/s (b) $3\sqrt{5}$ m/s (c) $6\sqrt{5}$ m/s (d) $6\sqrt{2}$ m/s
24. Pranesh wants to travel to Pune. He has three options.
Route-1 Travel by a train from Chiplun to Mumbai and then from Mumbai to Pune. The trains take 4.5 h and 3 h, respectively.
Route-2 Travel by a bus via Bhor. The distance covered by this route is 300 km at 40 km/h and there is a half an hour break in between.
Route-3 Travel by a bus via Koyana. The distance covered by this route is 500 km at 60 km/h. If Pranesh goes by train, there is a time span of 30 min between the respective trains. Which route should he take to save his time?
 (a) Route 1 (b) Route 2 (c) Route 3 (d) [1] or [2]
25. Four men start to move from a particular point. Two of them go in the direction opposite to each other at an equal speed. The other two also move in the opposite directions at an equal speed, but in a direction that is perpendicular to that of the original two. All of them stop at the same time, if the final positions of the men are joined, then it forms,

Exercise 08**Short Answers/ TITA**

- Inspired by the 'Golden quadrilateral project' UP Government recently accomplished a diamond triangular project. Under this project the State Government laid down 6 lane roads connecting three cities Ayodhya, Banaras and Chitrakoot, which are equally separated from each other i. e., in terms of geometry they form an equilateral triangle. Angad and Bajrang start simultaneously from Ayodhya and Banaras respectively, towards Chitrakoot. When Angad covers 100 kms, Bajrang covers such a distance that the distance between Angad and Bajrang makes 90° angle with the road joining Banaras and Chitrakoot. When Bajrang reaches Chitrakoot, Angad is still 150 km away from Chitrakoot. What is the distance between Ayodhya and Banaras?
- Two friends started walking simultaneously from points A and B towards each other. 144 minutes later the distance between them was 20% of the original distance. How many hours does it take the faster walker to cover the distance AB if he needs eight hours less to travel the distance than his friend (assume all times to be in whole numbers and in hours)?
- Two friends Arun and Nishit, on their last day in college, decided to meet after 20 years on a river. Arun had to sail 42 km to the meeting place and Nishit had to sail 35% per cent less. To arrive at the meeting place at the same time as his friend Nishit, Arun started at the same time as Nishit and sailed with the speed exceeding by 5 km/h the speed of Nishit. Find the speed of Arun.

Directions for Questions 4 and 5:

'Two trains – A and B simultaneously started from Delhi to Agra and Agra to Delhi respectively. After reaching their respective destinations, they turned back towards their starting points and finished their journeys after reaching their starting stations. They met for the first time at a distance of 80 km away from the Delhi station and they met for the second time 40 km away from the Agra station. It is further known that during both the meetings they were travelling in the opposite direction. Answer the following questions:

- What is the ratio of the speeds of trains B and A?
- Anand Pagare entered a bar between 12 AM to 1 AM when the angle between the minute hand and the hour hand of the clock was at 30° . If he spent exactly 1 hour 20 minutes in the bar and came out, and he came out at a time represented by A:B:C where A represents hours, B represents minutes and C represents seconds. Then, find the value of A+B+C.

Directions for Questions 6 and 7:

Two places A and B are 120 feet apart. Ramesh starts travelling from A to B and at the same time Akhilesh starts travelling from B to A. Ramesh travels $\frac{1}{3}$ rd of the total journey at a speed of 8 feet/minute, half of the remaining distance at 10 feet/minute and the rest at 16 feet/minute. Akhilesh completes the whole journey by travelling at 8 feet/minute, 10 feet/minute and 12 feet/minute, respectively, for equal intervals of time. Based on the above information answer questions 55 and 56:

- The distance between Ramesh and Akhilesh after 5 minutes of the start of the journey was found to be 'x' meters. Find the value of x.
- After how much time (in seconds) of the starting of 'the journey will they cross each other?
- Bhola and Vrjay start running simultaneously on a circular track from the same points in the same direction. How many times Bhola meets Vijay before they meet at the starting point for the first time (Ratio of speeds of Bhola and Vijay is 6:1)?

Directions for questions 9 and 10:

Dhoni and Kohli start running simultaneously from opposite ends on a race-track of length 100 m with speeds of 10 m/s and 4 m/s respectively. If both of them keep running continuously from one end to the other end (to and fro) then answer the following questions.

- After how much time (in seconds) would they meet & the third time?

10. When they meet for the third time what will be the distance of Dhoni (in meters) from his starting point?
11. Hemant and Ajay start a two-length swimming race at the same moment but from opposite ends of the pool. They swim in lane and at uniform speeds, but Hemant is faster than Ajay. They first pass at a point 18.5 m from the deep end and having completed one length, each one is allowed to rest on the edge for exactly 45 seconds. After setting off on the return length, the swimmers pass for the second time just 10.5 m from the shallow end. How long is the pool?
12. An ant moved for several seconds and covered 3 mm in the first second and 4 mm more in each successive second than in its predecessor. If the ant had covered 1 mm in the first second and 8 mm more in each successive second, then the difference between the path it would cover during the same time and the actual path would be more than 6 mm but less than 30 mm. Find the time for which the ant moved (in seconds).
13. Two motorists met at 10 a.m. at the Dadar railway station. After their meeting, one of them proceeded in the East direction while the other proceeded in the North direction. Exactly at noon, they were 60 km apart. Find the speed of the slower motorist if the difference of their speeds is 6 km/h.
14. An urgent message had to be delivered from the house /6r the Peshwas in Pune to Shivaji who was camping in Bangalore. A horse rider travels on horseback from Pune to Bangalore at a constant speed. If the horse increased its speed by 6 km/h, it would take the rider 4 hours less to cover that distance. And travelling with a speed 6 km/h lower than the initial speed, it would take him 10 hours more than the time he would have taken had he travelled at a speed 6 kmph higher than the initial speed. Find the distance between Pune and Bangalore.

Directions for questions 15 and 16:

John's office is 80 km from his house. One day he started from home, an hour later than his usual time of leaving for his office. In order to cover up the delay, he increased his speed by 4 kmph and thus reached the office on time. Now answer the following questions:

15. What is the final speed of John?
16. What is the percentage increase in John's speed?
17. The distance between two cities A and B is 100 km and the speed of Ram and Rahim are 50 km/h and 30 km/h respectively. Initially Ram is at A and Rahim is at B. If they move between A and B to and fro, then the distance (in kms) covered by Ram by the time they meet for the 3rd time would be?
18. X, Y, Z run on a circular track at speeds of 10 m/s, 20 m/s, 25 m/s respectively. If they start from the same point in the same direction at the same time and X covers 1 km when they meet again for the first time at the starting point, then the total distance covered by Y (in Km) is?

Directions for questions 19 and 20:

Three persons X, Y, Z run on a circular track of length 1 Km. at speeds of 20 m/s, 40 m/s and 60 m/s respectively in the same direction.

19. If they start running simultaneously, after how much time (in seconds) will they meet again?
20. After how much time will they meet at the starting point?
21. A tortoise lays eggs on the beach and goes back to the sea where its mate is waiting. One way to reach the mate is going down 12 km on a straight line perpendicular to the sea, turning 90° and swimming for 5 km on a straight line. On its way down to the sea, the tortoise can cut the water at any point. The speed of the tortoise on land is 1 km/h and in water is 2 km/h. If the tortoise takes the described route, at what distance from the point where it had laid the eggs will the tortoise cut the water, if the total time taken is 12 h?

22. Distance between Lucknow and Patna is 300 km. Mayank leaves at a speed of x km/h from Lucknow towards Patna. After 3 h, Sharat leaves at the speed of $(x + 10)$ km/h from Lucknow towards Patna. If x and the number of hours taken to meet after Sharat starts are integers, how much distance can Mayank cover before they meet?
23. Two trains going on a parallel line in opposite directions take 10 s to cross each other. But if they are going in the same direction, the longer train crosses the shorter train in 30 s. If the length of the longer train is decreased by 50%, the time taken to cross the shorter train while going in the same direction decreases by 8 s. Find the time taken by the longer train to cross a tunnel twice its length, if the difference between the length of the trains is 25 m?
24. Vinod and Kaurvaki start travelling in the same direction at 8 km/h and 13 km/h, respectively. After 4 h, Vinod doubled his speed and Kaurvaki reduced his speed by 1 km/h and reached the destination together. How long did the entire journey last?
25. A train has to travel the distance between Aurangabad and Daulatabad, equal to 20 km, at a constant speed. It travelled half the way with the specified speed and stopped for three minutes, to arrive at Daulatabad on time, it had to increase its speed by 10 km/h for the rest of the way. Next time the train stopped half-way for five minutes. By what speed must it increase its speed for the remaining half of the distance to arrive at Daulatabad as per the schedule?

Time Distance and Speed**Answers Key****Exercise 01**

1. A	2. b	3. c	4. a	5. c
6. c	7. c	8. b	9. a	10. a
11. d	12. b	13. c	14. b	15. d
16. b	17. a	18. b	19. b	20. b
21. a	22. a	23. b	24. d	25. b

Exercise 02

1. c	2. d	3. c	4. b	5. a
6. b	7. c	8. b	9. b	10. c
11. c	12. c	13. a	14. c	15. d
16. c	17. a	18. a	19. b	20. a
21. a	22. a	23. a	24. b	25. a

Exercise 03

1. b	2. d	3. d	4. b	5. b
6. b	7. c	8. b	9. a	10. d
11. c	12. a	13. c	14. d	15. c
16. b	17. d	18. a	19. d	20. a
21. d	22. b	23. b	24. d	25. a

Exercise 4

1. a	2. b	3. b	4. b	5. a
6. b	7. b	8. b	9. c	10. d
11. a	12. c	13. c	14. d	15. a
16. c	17. a	18. b	19. d	20. b
21. d	22. d	23. d	24. b	25. c

Exercise 05

1. c	2. b	3. a	4. b	5. c
6. c	7. b	8. c	9. c	10. d
11. a	12. c	13. d	14. b	15. b
16. c	17. a	18. b	19. b	20. a
21. b	22. b	23. a	24. d	25. d

Exercise 06

1. d	2. c	3. b	4. a	5. b
6. a	7. d	8. c	9. a	10. c
11. d	12. a	13. b	14. a	15. a
16. a	17. a	18. d	19. b	20. c
21. a	22. b	23. c	24. d	25. b

Exercise 07

1. b	2. c	3. c	4. b	5. c
6. b	7. a	8. a	9. b	10. d
11. b	12. b	13. c	14. d	15. b
16. d	17. a	18. b	19. a	20. c
21. a	22. a	23. a	24. d	25. d

Exercise 08

1. 300 km	2. 4 hours	3. 14 km/h	4. 1.5	5. 53
6. 38 metres	7. 6.9 minutes or 414 seconds	8. 5 times	9. 14 m/s	10. 14.28 metres
11. 45 m	12. 4s	13. 18 km/h	14. 720 km	15. 20kmph
16. 25%	17. 312.5 km	18. 2 : 4 : 5	19. 50 sec	20. 50 sec
21. 7 km	22. 60km	23. 24s	24. 9h	25. 16 kmph

Solutions**Exercise 01****Time Distance Speed**

1. Ans: a

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}} = \frac{10+20}{\frac{10}{6} + \frac{20}{15}} \\ = \frac{30}{\frac{90}{30}} = \frac{30}{3} = 10 \text{ km/h}$$

2. Ans: b

$$\text{Average speed (when distances are same)} = \frac{2uv}{u+v} \\ = \frac{2 \times 20 \times 30}{(20+30)} = 24 \text{ km/h}$$

Where u, v are the different speeds.

(or use the general formula - Total distance / Total time)

3. Ans c

Suppose the total distance equals to 4 times the LCM of the speeds.

$$\therefore \text{Total distance} = 2400 \text{ km}$$

$$\therefore \text{Total time} = \frac{600}{20} + \frac{600}{25} + \frac{600}{30} + \frac{600}{40} \\ = 30 + 24 + 20 + 15 = 87 \text{ h}$$

$$\therefore \text{Average speed} = \frac{2400}{87} = 26 \frac{86}{87} \text{ km/h}$$

4. Ans: a

$$\frac{2 \times 20 \times x}{(20+x)} = 24$$

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

Alternatively: Go through options.

5. Ans: c

$$u = k, v = 3k$$

$$\therefore \frac{2uv}{u+v} \Rightarrow \frac{2 \times k \times 3k}{(k+3k)} = 12$$

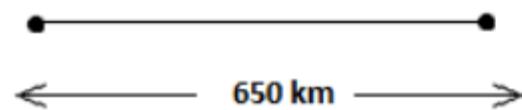
$$\Rightarrow 1.5k = 12$$

$$\Rightarrow k = 8 \text{ km/h}$$

Alternatively: Go through options

Alternatively: Solve through alligation

6. Ans: c



In the first 3 hours Vimal covers 90 km.

So, the rest distance = 560 km

Now, Kamal and Vimal both travel towards each other.

$$\text{So, the time} = \frac{\text{Distance}}{\text{Speed}} = \frac{560}{70} = 8 \text{ h}$$

Thus, Vimal travels total = $3 + 8 = 11 \text{ h}$ Thus, the distance travelled by Vimal = $11 \times 30 = 330 \text{ km}$.

7. Ans: c

$$\text{Speed} = 36 \text{ km/h}$$

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

8. Ans: b

The ratio of speed of A, B, C = 6 : 3 : 1

∴ The ratio of time taken by A, B, C = 1 : 2 : 6

∴ Time taken by A = 13 min

9. Ans: a

$$\begin{array}{ll} \text{Speed} & \text{A : B} \\ \text{Time} & 2 : 3 \\ & 3x : 2x \end{array}$$

10. Ans: a

Apply the product constancy concept

$$\begin{array}{ll} \text{Speed} & \text{Time} \\ \frac{1}{5} \downarrow & \frac{1}{4} \uparrow = 15 \text{ min} \\ \text{Since, } & \frac{x}{4} = 15 \text{ min} \Rightarrow x = 60 \text{ min} = 1 \text{ h} \\ \text{So, the original (or usual) time} & = 60 \text{ min} = 1 \text{ h} \end{array}$$

11. Ans: d

$$\begin{array}{ll} \text{Speed} & \text{Time} \\ \frac{1}{2} \uparrow & \frac{1}{3} \downarrow = 40 \text{ min} \\ \Rightarrow \text{Usual time} & = 3 \times 40 = 120 \text{ min} = 2 \text{ h} \end{array}$$

12. Ans: b

Increase in speed = 1 km

Change in time = 25 min

$$\begin{array}{ll} \text{Speed} & \text{Time} \\ \frac{1}{5} \uparrow & \frac{1}{6} \downarrow = 25 \\ \Rightarrow \text{Usual (normal) time} & = 6 \times 25 = 150 \text{ min} = \frac{5}{2} \text{ h} \\ \therefore \text{Distance} & = \text{Normal speed} \times \text{Normal time} \\ & = 5 \times \frac{5}{2} = 12.5 \text{ km} \end{array}$$

13. Ans: c

Let the distance = x km and usual rate = y km/h

$$\therefore \frac{x}{y} - \frac{x}{(y+6)} = 4 \text{ h} \quad \dots(i)$$

$$\frac{x}{(y-4)} - \frac{x}{y} = 4 \text{ h} \quad \dots(ii)$$

From Eqs. (i) and (ii), we get

$$\begin{aligned} \frac{x}{y} - \frac{x}{(y+6)} &= \frac{x}{(y-4)} - \frac{x}{y} \\ \Rightarrow y &= 24 \end{aligned}$$

Now putting the value of $y = 24$ in Eq. (i), we get

$$x = 480$$

Alternatively:

$$\begin{array}{ll} S \nearrow T \\ +6 \searrow -4 & \Rightarrow -4S + 6T = |-4 \times 6| \\ S \nearrow T \\ -4 \searrow +4 & \Rightarrow 4S - 4T = |-4 \times 4| \\ \therefore & -4S + 6T = 24 \\ & 4S - 4T = 16 \end{array}$$

∴ Solving these two equations, we get

$$T = 20 \text{ and } S = 24$$

$$\begin{aligned} \therefore \text{Distance} &= \text{Speed} \times \text{Time} \\ &= 24 \times 20 = 480 \text{ km} \end{aligned}$$

14. Ans: b

Relative speed

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

$$= \frac{60+40}{20} = 5 \text{ m/s}$$

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

Now, Relative speed

$$= 18 \text{ km/h}$$

$$= \text{Speed of ambulance} - \text{Speed of school bus}$$

$$18 = 30 - \text{speed of school bus}$$

Speed of school bus = 12 km/h

15. Ans: d

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

$$= \frac{560+360}{16} = 57\frac{1}{2} \text{ km/h}$$

16. Ans: b

Suppose the total distance be 300 km (LCM of 50 and 60) then in the first case it takes only 5 hours and in the second case it takes 6 hours.

Thus, in 6 hours trains halts for 1 hour.

Therefore in 1 hour train halts for $\frac{1}{6}$ hour = 10 min

Alternatively: Difference in speeds = 10 km/h Faster speed = 60 km/h

$$\therefore \text{Required time per hour} = \frac{10}{60} = \frac{1}{6} \text{ h} = 10 \text{ min}$$

17. Ans: a

Since he gains 2 hours by driving both ways (instead of walking one way) the time taken for driving would be 2 hours less than the time taken for walking. Hence, he stands to lose another two hours by walking both ways. Hence his total time should be 8 hrs 45 minutes.

18. Ans: b

If the car does half the journey @ 30 kmph and the other half at 40 kmph its average speed can be estimated using weighted averages. Since, the distance traveled in each part of the journey is equal, the ratio of time for which the car would travel would be inverse to the ratio of speeds. Since, the speed ratio is 3:4, the time ratio for the two halves of the journey would be 4:3. The average speed of the car would be: $(30 \times 4 + 40 \times 3)/7 = 240/7$ kmph. It is further known that the car traveled for 17.5 hours (which is also equal to $35/2$ hours). Thus, total distance = average speed x total time = $(240 \times 35)/(2 \times 7) = 120 \times 5 = 600$ km

19. Ans: b

At 40 kmph, Harsh would cover $(200/60) \times 40$ km.
 $= 400/3$ km. = 133.33 km.

This represents the distance by which Vijay would be ahead of Harsh, when Vijay reaches the endpoint means in essence that Vijay must have travelled for $133.33/20$ hours $\rightarrow 6.66$ hours
Hence, the distance is $60 \times 6.66 = 400$ km.

20. Ans: b

Distance to be covered = 120 meters. Speed = 10 m/s \rightarrow Time required = $120/10 = 12$ seconds.

21. Ans: a

$$\text{Speed} = 36 \frac{\text{km}}{\text{h}} = 36 \times \frac{\frac{5}{8} \text{ m}}{\text{s}} = 10 \text{ m/s}$$

In 40s, he will covers 400 m.

22. Ans: a

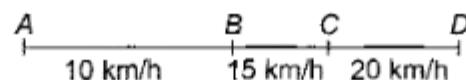
Former's speed = v km/h
Latter's speed = $\frac{v}{4}$

Therefore, former speed : latter speed = 4 : 1.

23. Ans: b

Let us assume that total distance is 60 km

Now,



Such that $BC = CD = \frac{1}{2}AB$

Now, AB will be 30 km, $t_1 = \frac{30}{10} = 3$ h

$$BC = 15 \text{ km}, t_2 = \frac{15}{15} = 1 \text{ h}$$

$$CD = 20 \text{ km}, t_3 = \frac{15}{20} = 0.75 \text{ h}$$

$$\text{Since, average speed} = \frac{\text{Total distance}}{\text{Total time}} = \frac{60}{3+1+0.75} = \frac{60}{4.75} = 12.63 \text{ km/h}$$

24. Ans: d

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

$$\text{Total distance} = 192 + 192 = 384 \text{ km}$$

$$t_1 = \frac{192}{80} = 2.4 \text{ h}, t_2 = 5 \text{ h } 36 \text{ min} = 5.6 \text{ h}$$

$$\text{Total time taken} = 5.6 + 2.4 = 8 \text{ h}$$

$$\text{Therefore, average speed} = \frac{384}{8} = 48 \text{ km/h}$$

25. Ans: b

A 's speed is 50 km/h and B 's speed will be 75 km/h.

Since A starts at 9 am, the distance travelled by A = 50 km Relative speed = $50 + 75 = 125$ km/h

Now, distance between them at 10 am = $300 - 50 = 250$ km

$$\text{Time} = \frac{250}{125} = 2 \text{ h.}$$

Exercise 02

Problems on Train

1. Ans: c

Time (required)
$$\frac{\text{Length of train}}{\text{Speed of train}} \quad \left(T = \frac{D}{S} \right)$$

$$= \frac{350}{70} = 5s$$

2. Ans: d

Let the length of the Sabarmati express is x metre then,

$$\frac{x-162}{18} = \frac{x+120}{15} \text{ Speed of train}$$

$$\Rightarrow x = 90m$$

3. Ans: c

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

$$= \frac{200}{19} = 10\frac{10}{19}s$$

(Relative speed = $72 - 3.6 = 68.4 \frac{km}{h} = 19m/s$)

4. Ans: b

$$\text{Relative speed} = 50 - 40 = 10 \text{ km/h } \frac{50}{18} \text{ m/s}$$

$$\therefore \text{Time taken} = \frac{\text{Sum of length of the trains}}{\text{Relative Speed}}$$

$$= \frac{200}{50} \times 18 = 72s$$

5. Ans: a

Let the length of train be x m, then

$$\frac{x}{10} = \frac{120+x}{18}$$

$$\Rightarrow x = 150m$$

6. Ans: b

Let the speed of train be x km/h, then

$$\frac{175}{10} = (9 + x) \times \frac{5}{18}$$

$$\Rightarrow x = 54 \text{ km/h}$$

7. Ans: c

Let the length of each train be x m, then

$$S_1 = \frac{x}{4} \text{ and } S_2 = \frac{x}{5}; S_1 \text{ and } S_2 \text{ are speeds}$$

$$\text{Now, required time} = \frac{2x}{\frac{x}{4} + \frac{x}{5}} = \frac{40}{9}s$$

8. Ans: b

$$\frac{S_1}{S_2} = \sqrt{\frac{t_2}{t_1}}$$

$$\frac{120}{S_2} = \sqrt{\frac{9}{16}} = \frac{3}{4}$$

$$\Rightarrow S_2 = 160 \text{ km/h}$$

9. Ans: b

Let the speed of X and Y be the x km/h and y km/h respectively. Since they meet after 3 hours, so $x + y = 100$. Since, the faster train takes atleast $3 + 2 = 5$ hours to complete the 300 km journey. Hence, minimum possible speed for the slower train = 40 km/h at which speed it will take 7.5 h to complete the journey. ($7.5 = \frac{300}{40}$)

10. Ans: c

Note here the length of the train in which passenger is travelling is not considered since we are concerned with the passenger instead of train. So, the length of the bridge will be directly proportional to the time taken by the passenger respectively.

$$\text{Therefore, } \frac{t_1}{t_2} = \frac{l_1}{l_2} \quad \begin{array}{l} t \rightarrow \text{Time} \\ l \rightarrow \text{Length of bridge} \end{array}$$

$$\Rightarrow \frac{7}{4} = \frac{280}{x}$$

$$x = 160 \text{ m}$$

11. Ans: c

Let the length of the train be L metres and speeds of the train Arjun and Srikrishna be R, A and K respectively, then

$$\text{And } \frac{\frac{L}{R-A}}{\frac{L}{(R+K)}} = 24 \quad \dots (ii)$$

From eq. (i) and (ii)

$$\begin{aligned} 3(R - A) &= 2(R + K) \\ \Rightarrow R &= 3A + 2K \end{aligned}$$

In 30 minutes (i.e., 1800 seconds), the train covers 1800R (distance) but the Arjun also covers 1800A (distance) in the same time.

Therefore distance between Arjun and Srikrishna, when the train has just crossed Srikrishna

$$\begin{aligned} &= 1800(R - A) - 24(A + K) \\ \therefore \text{Time required} &= \frac{1800(R-A)-24(A+K)}{(A+K)} \\ &= (3600 - 24) = 3576 \text{ s} \end{aligned}$$

12. Ans: c

Time taken by Abhinav = 4h

Time taken by Praveen = 3.5h

For your convenience take the product of times taken by both as a distance.

Then the distance = 14km

Since, Abhinav covers half of the distance in 2 hours (i.e., at 8 am)

Now, the rest half (i.e., 7km) will be covered by both Praveen and Abhinav.

$$\text{Time taken by them} = \frac{7}{7.5} = 56 \text{ min}$$

Thus, they will cross each other at 8 : 56 am.

13. Ans: a

The ratio of time for the travel is 4:3 (Sinhagad to Deccan Queen). Hence, the ratio of speeds would be 3:4. Since, the sum of their average speeds is 70 kmph, their respective speeds would be 30 and 40 kmph respectively.

Use alligation to get the answer as 34.28 kmph.

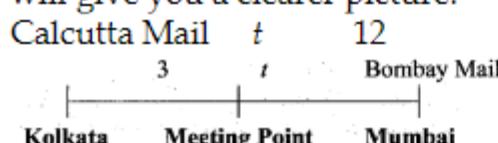
14. Ans: c

The train that leaves at 6 am would be 75 km ahead of the other train when it starts. Also, the relative speed being 36 kmph, the distance from Mumbai would be:

$$(75/36) \times 136 = 283.33 \text{ km}$$

15. Ans: d

If you assume that the initial stretch of track is covered by the two trains in time t each, the following figure will give you a clearer picture.



From the above figure, we can deduce that,

$$\frac{t}{3} = 12/t$$

Hence, $t^2 = 36$, gives us $t = 6$.

Hence, the distance between Kolkata to the starting point is covered by the Calcutta Mail in 6 hours, while the same distance is covered by the Bombay Mail in 3 hours.

Hence, the ratio of their speeds would be 1:2. Hence, the Bombay Mail would travel at 96 kmph.

16. Ans: c

In four hours, the train will travel 180 km (180,000 metres). The number of poles would be $180,000/50 = 3600$.

17. Ans: a

$$(S_f - S_s) \times 60 = 200$$

Where S_f and S_s are speeds of the faster and slower train respectively

$$\rightarrow S_f - S_s = 3.33$$

$$\text{Also, } S_f - S_s \times 10 = 200.$$

$$\rightarrow S_f + S_s = 20$$

$$\text{Solving we get } S_s = 8.33 \text{ m/s}$$

$$= 8.33 \times 18/5 = 30 \text{ kmph}$$

18. Ans: a

When the second train leaves Muzaffarpur, the first train would have already traveled 30 km. Now, after 9 AM, the relative speed of the two trains would be 10 kmph (i.e. the rate at which the faster train would catch the slower train).

Since the faster train has to catch up a relative distance of 30 km in order for the trains to meet, it would take $30/10 = 3$ hours to catch up. Distance from Muzaffarpur = $70 \times 3 = 210$ km

19. Ans: b

The length of the train would be given by: $36 \times 5/18 \times 8 = 80$ meters.

20. Ans: a

Assume that the Howrah mail is leaving on 13th November at 12 noon. It will be reaching its destination on 16th November at 12 noon. Now, any train that leaves Trivandrum between the 10th and 16th November (excluding extremes) will be meeting Howrah mail on the track. These are five trains.

21. Ans: a

Using product stability ratio method: $D = S \times T$

Since speed has been increased by 20% or $\frac{1}{5}$, so time will reduce by $\frac{1}{6}$.

Now, $\frac{1}{6}$ of T (Time) = 20 min

$T = 120 \text{ min} = 2 \text{ h}$

22. Ans: a

23. Ans: a

Let the speed of two trains be x m/s and y m/s

Case I In opposite direction:

Relative speed will be = $(x + y)$ m/s

$$\frac{420}{x+y} = 21$$

$$x + y = 20 \quad (i)$$

Case II In same direction:

Relative speed = $(x - y)$ m/s

$$\text{That is, } \frac{420}{42} = x - y$$

$$\text{Hence, } x - y = 10 \quad (ii)$$

On solving (i) and (ii), we get $x = 15 \text{ m/s}$ $y = 5 \text{ m/s}$

Hence, the ratio = 3 : 1

24. Ans: b

Speed of train while passing point A = $70 \times (5/18) \text{ m/s} = V_1$,

Speed of bike initially = $70 \times (5/18) \text{ m/s} = V_2$

Time taken by the bike to reach at the mid-point of the train = $150/(V_2 - V_1)$

Again find out the new speeds of train and bike and calculate the time taken by the bike to cover the rest 150 m distance relative to the train.

25. Ans: a

The train can cover $(200 + 350) \text{ m}$ distance in 5 s which means the speed of the train is 110 m/s. Relative speed of man and train is 114 m/s. To cover the distance of 100 m, it will take less than 1s.

Exercise 03

Boats and Streams

1. Ans: b

$$S_D = 12 \text{ km/h}$$

$$S_U = 5 \text{ km/h}$$

$$\text{Speed pf current} = \frac{12-5}{2} = 3.5 \text{ km/h}$$

2. Ans: d

$$\frac{16}{8} + \frac{16}{2} = 10h$$

3. Ans: d

$$\frac{D_T}{U_T} = \frac{1}{2} \Rightarrow \frac{D_s}{U_s} = \frac{2}{1} \Rightarrow \frac{B+S}{B-S} = \frac{2}{1} \Rightarrow \frac{B}{S} = \frac{3}{1}$$

D_T and U_T are the downstream and upstream times and D_s and U_s are the downstream and upstream speeds. Here we can use componendo and dividendo.

$$\begin{aligned} \therefore \frac{\text{Speed of boat}}{\text{Speed of stream}} &= \frac{3}{1} = \frac{15}{x} \\ \therefore \text{Speed of stream} &= 5 \text{ km/h} \end{aligned}$$

4. Ans: b

$$\frac{D_s}{U_s} = \frac{B+S}{B-S} = \frac{3}{2}$$

Where $B \rightarrow$ Speed of boat in still water

$S \rightarrow$ Speed of current/stream

$$\Rightarrow \frac{2B}{2S} = \frac{5}{1} \quad (\text{by componendo and dividendo})$$

$$\Rightarrow \frac{B}{S} = \frac{5/2}{12/5} = \frac{25}{24}$$

5. Ans: b

Let x be the upstream speed, then the downstream speed will be $(x+3)$.

$$\begin{aligned} \therefore \frac{3}{x} + \frac{3}{x+3} &= 3 \\ \Rightarrow x^2 + x - 3 &= 0 \\ \Rightarrow x &= \frac{-1+\sqrt{13}}{2} \\ &= \frac{-1+3.6}{2} = 1.3 \text{ km/h} \\ \therefore (x+3) &= 4.3 \text{ km/h} \end{aligned}$$

6. Ans: b

Upstream speed = $B - S$

Downstream speed = $B + S$

$$B - S = \frac{15}{5} = 3 \text{ km/h}$$

Again,

$$B = 4S$$

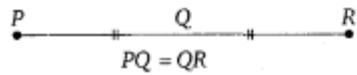
$$\therefore B - S = 3 = 3S$$

$$\Rightarrow S = 1 \text{ and } B = 4 \text{ (km/h)}$$

$$\therefore B + S = 5 \text{ km/h}$$

$$\therefore \text{Time during downstream} = \frac{15}{5} = 3 \text{ h}$$

7. Ans: c



$P \rightarrow Q \rightarrow R (7h)$

It means $P \rightarrow Q (3.5h)$

Again $\{P \rightarrow Q \text{ and } Q \rightarrow P\}(8h)$

It means $Q \rightarrow P (4.5h)$

Therefore, $R \rightarrow Q (4.5h)$
 Thus, from R to P boat will take 9 hours.

8. Ans: b
 Downstream (Steamer) = 40 min
 Downstream (Boat) = 60 min
 Upstream (Steamer) = 60 min
 Upstream (Boat) = 90 min
 Required time = $40 + 30 + 45 = 115$ min
9. Ans: a
 From the situation described in the first condition itself we can see that the speed of coming back has to be double the speed of going downstream. Checking the options, only option (a) fits this condition i.e. Downstream speed = $2 \times$ Upstream speed. Hence, option (a) is correct.
10. Ans: d
 In order to solve this, you first need to think of the speed of the river flow (if the speed of the boat in still water is 3 kmph). If we take the speed of the river flow as s , we get downstream speed as $3 + s$ and upstream speed as $3 - s$.
 $10/(3 - s) - 10/(3 + s) = 8$ hours $\rightarrow s = 2$ kmph.
Note: It is obvious that since the difference between the downstream time and the upstream time is 8 hours, the upstream and downstream speeds would both be factors of 10. The only value of s such that both $3 + s$ and $3 - s$ are factors of 10 is $s = 2$. If the boat needs to reach 10 km downstream in 100 minutes (1.66 hours) it means: $10/1.66 = 6$ kmph is the downstream speed.
 Since, the speed of the stream is 2 kmph, the required speed of the boat = 4 kmph
11. Ans: c
 Upstream speed = $40/8 = 5$ kmph. Downstream speed = $49/7 = 7$ kmph. Speed in still water = average of upstream and downstream speed = 6 kmph.
12. Ans: a
 15 km upstream in 80 minutes $\rightarrow 15/1.33 = 11.25$ kmph. (upstream speed of the boat).
 Thus, still water speed of the boat
13. Ans: c
 Upstream speed = 3.2 kmph Downstream speed = 6 kmph. Thus, speed of stream = 1.4 kmph.
14. Ans: d
 Vijay takes 9 hours to return upstream after going for 6 hours downstream. Solve using options. Option (d) fits as we get Downstream speed = 18 kmph \rightarrow distance = $18 \times 6 = 108$ km
 Also, upstream speed = 12 kmph \rightarrow distance = $12 \times 9 = 108$ km
15. Ans: c
 The given situations are satisfied with the speed of the boat as 8 kmph and the speed of the stream as 3 kmph. Option (c) is correct.
16. Ans: b
 $10/(x - 2) + 10/(x + 2) = 55/60 = 11/12$ hours. $x = 22$ fits the expression.
17. Ans: d
 Go through the options.
18. Ans: a
 Let speed of the man = x km/h
 And speed of the current = y km/h

Therefore, against current relative speed = $(x - y)$ km/h = 2.5 km/h
 And with current = $(x + y)$ km/h = 5 km/h. On solving, we get $y = 1.25$ km/h

19. Ans: d

Let speed of boat = x km/h
 Speed of stream = y km/h
 Upstream speed = $(x - y)$ km/h
 Downstream speed = $(x + y)$ km/h
 Since $\frac{D}{x-y} = \frac{2D}{x+y}$
 $\frac{x+y}{x-y} = \frac{2}{1}$
 $x : y = 3 : 1$

20. Ans: a

Speed of stream = 2 km/h
 Let speed of boat = x km/h
 According to condition $\frac{9}{x-2} + \frac{9}{x+2} = 6$
 On solving, we get $x = 4$ km/h.

21. Ans: d

Time saved in percentage = $\frac{175}{1020} \times 100 = 17.15\%$

22. Ans: b

Since both rest for 6 seconds so when B is just about to start the journey A reaches there at the shallow end so they meet at they shallow end.

23. Ans: b

For the first watch: When a watch creates the difference of 12 hours, it shows correct time.
 So to create the difference of 12 h required time

$$= \frac{60 \times 12}{24} = 30 \text{ days}$$

For the second watch: To create the difference of 12 h required time

$$= \frac{30 \times 12}{24} = 15 \text{ days}$$

So, after 30 days at the same time both watches show the correct time.

24. Ans: d

To show the correct time again, watch must create 24 h difference. (Since in one round hour-hand covers 24 h.)
 So, they required time = $\frac{4}{3} \times \frac{60 \times 24}{24} = 80 \text{ days}$

25. Ans: a

Solution:

Let the distance travelled by train B before the first meeting be ' d ' km.

Distance travelled by train A before 2nd and after first meeting = $(40 + d)$ km.

Distance travelled by train B before 2nd and after 1st meeting = $80 + 80 + d - 40 = (120 + d)$ km.

Since, their speeds are constant, the ratio of distances covered would be constant too (for both the time periods). This gives us the equation:

$$\frac{80}{d} = \frac{40+d}{120+d} \rightarrow d = 120.$$

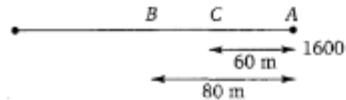
Hence, the distance between Agra and Delhi = $80 + 120 = 200$ km.

Exercise 04

Races and Games

1. Ans: a

In a 1600 m race



$C \rightarrow 1540, B \rightarrow 1520$

The ratio of speeds of C : B is 77 : 76. It means in 77 m race C beats B by 1m. So, in 400m race C will beat B by

$$400 \times \frac{1}{77} m = 5 \frac{15}{77} m$$

2. Ans: b

Speed	$A : B$
Time	$7 : 4$
Distance	$4 : 7$ (Since distance \propto time)
Now,	$7x - 4x = 300$
	$3x = 300$
⇒	$x = 100$
∴	$7x = 700$

Thus, the winning post be 700 m away drom the starting point.

3. Ans: b

When Ameesha runs 1000m, then Bipasha runs only 700 m [1000-(100+200)]

When Ameesha runs 1000m, then Celina runs only 600m

$$[1000-(100+300)]$$

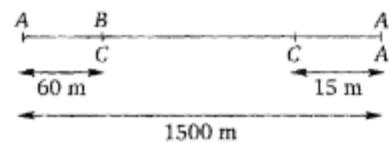
Therefore,

Now, since in 700 m race Bipasha beats Celina by 100 m. So, in 50 m race Bipasha will beat Celina by

$$50 \times \frac{100}{700} = 7.14m$$

Alternatively: Bipasha beats Celina by 14.28% of the distance then in 50 m race Bipasha will beat Celina by 7.14m.

4. Ans: b



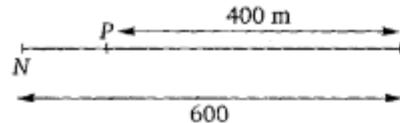
In the same time, when A covers 1500m, B covers 1440 m and C covers 1425 m.

So, in 1440 m race B can give a start of 15 m.

∴ In 1500 m race B will give a start of

$$\frac{15}{1440} \times 1500 = 15 \frac{5}{8} m$$

5. In 600 m race Prabhat can have only start of 120 m. Now since he has more than 200m start up so he will win the race.



Now, when Prabhat will cover 400 m distance, then in the same time Nishith will cover only 500m. So, Prabhat will win by 100m.

6. Ans: b

You can go through options to check the required difference.

Alternatively:

Required distance

$$= \frac{s_1 s_2}{(s_1 - s_2)} \times \text{Time difference}$$

$$= \frac{5 \times 8}{3} \times \frac{3}{2} = 20 km$$

Alternatively:

Take the LCM of distances then solve by unitary method.

$$\text{LCM of } 5, 8 = 40$$

Now, consider 40 km as a distance, then there is a 3 hours difference in 40 km. So, $\frac{3}{2}$ hours difference will be in 20 km.

Alternatively: Let x be the distance, then

$$\Rightarrow \frac{x}{5} - \frac{x}{8} = \frac{3}{2}$$

$$x = 20\text{ km}$$

7. Ans: b

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

$$2 = \frac{2 \times x}{(30-x)}$$

$$\Rightarrow x = 15\text{ km/h}$$

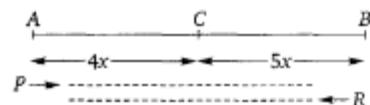
8. Ans: b

Let the time taken in first third part of the journey be x minutes, then the time required in second third part of the journey is $\frac{3x}{2}$ and in the last third part of the journey time required is $\frac{15x}{8}$.

$$\text{Therefore, } x + \frac{3x}{2} + \frac{15x}{8} = 350 \text{ min}$$

$$\Rightarrow x = 80 \text{ min}$$

9. Ans: c



Note that the distances covered by them to meet at C are in the direct ratio of their speeds. Therefore

$$AC : BC = 4x : 5x$$

Now, for any particular person (say Pathik) the time required to cover different distances is directly proportional to the different distances. So, time taken by Pathik to cover AC and BC are the ratio of 4 : 5 (excluding staying or halt time at Chandni Chowk).

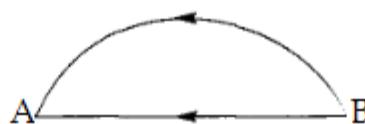
Thus time required to cover AC is 52 minutes only since he covers BC in 65 minutes.

But since he leaves Chandni Chowk for Bhavnagar at 9 : 27 am i.e., 67 minutes later, when he left Andheri. It means he must have stayed at C for $(67 - 52) = 15$ minutes.

10. Ans: d

Let the radius be r , then difference in the distance

$$= (\pi r - 2r) = r(\pi - 2)$$

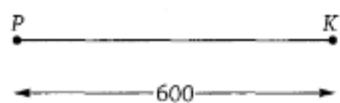


$$= r \left(\frac{22}{7} - 2 \right) = 60 \times 3$$

$$\Rightarrow 2r = 315\text{ m}$$

$[\pi r \rightarrow \text{semiperimeter and } 2r \rightarrow \text{diameter}]$

11. Ans: a



In 18 h plane will cover $18 \times 120 = 2160 \text{ km}$

Now, $2160 = (600 \times 2) + 600 + 360$

So, the plane will be 360 km away from Kargil it means it will be 240 km ($600 - 360$) away from Pukhwara.

12. Ans: c

13. Ans: c

Speed of tiger = 40 m/min

Speed of deer = 20 m/min

Relative speed = $40 - 20 = 20 \text{ m/min}$

Difference in distances = $50 \times 8 = 400 \text{ m}$

\therefore Time taken in overtaking (or catching) = $\frac{400}{20} = 20 \text{ min}$

\therefore Distance travelled in 20 min = $20 \times 40 = 800 \text{ m}$

14. Ans: d

Let Pele covers $x \text{ km in 1 hour}$. So Maradona takes $(2 \text{ h} - 40 \text{ min}) = 1 \text{ h } 20 \text{ min}$ to cover $x \text{ km}$. Let speed of Maradona and Pele be M and P respectively than

$$x = M \times \frac{4}{3} \text{ and } x = P \times 1$$

$$\Rightarrow \frac{M}{P} = \frac{3}{4}$$

$$\text{Again, } \frac{300}{M} - \frac{300}{P} = 1$$

$$\Rightarrow \frac{300}{3k} - \frac{300}{4k} = 1$$

$$\Rightarrow k = 25$$

$$\Rightarrow M = 3k = 75 \text{ km/h}$$

$$\text{And } P = 4k = 100 \text{ km/h}$$

(Through option it is very easy to solve.)

15. Ans: a

$$x^2 + (x + 100)^2 = (500)^2 \text{ (Using Pythagoras theorem)}$$

$$\Rightarrow x = 300 \text{ km}$$

Now, let they change their speeds after t_1 hours and then the rest time is t_2 then

$$30t_1 + 40t_2 = 800 \quad \dots (i)$$

$$40t_1 + 30t_2 = 900 \quad \dots (ii)$$

Solving Eq. (i) and (ii), we get

$$t_1 = \frac{120}{7} \text{ and } t_2 = \frac{50}{7}$$

16. Ans: c

Akbar meets Birbal once $\frac{500}{20-15} = 100 \text{ s}$

Birbal meets Chanakya once $= \frac{500}{20+25} = 11\frac{1}{9} \text{ s}$

Akbar meets Chanakya once $= \frac{500}{15+25} = 12.5$

17. Ans: a

The requisite conditions are met on a Pythagoras triplet 6,8,10. Since the racetrack only consists of the legs of the right triangle the length must be $6 + 8 = 14 \text{ km}$.

18. Ans: b

When Shyam does 500, Vinay does 375. Since Vinay has a start of 140 m, it means that Vinay only needs to cover 360 m to reach the destination.

When Vinay does 360, Shyam would cover 480 m and lose by 20 m. (Since the ratio of their speeds is 3:4)

19. Ans: d

Total distance covered by Bharat and Akhil = 1800 m and 1719 m, respectively.

Therefore, speed of Akhil : Bharat = 1719 : 1800 = 0.95.

Also, 141 : 150 = 0.95.

20. Ans: b

In a km, A beats B by 10 m. Therefore, in two kilometres A beats B by 20 m.

Hence, option (b) is the answer.

21. Ans: d

Distance covered by Amit = 1000 m and that covered by Bahadur = 900 m

Therefore, speed of Amit : speed of Bahadur = 1000 : 900 = 10 : 9

Similarly, speed of Bahadur = $1000:800 = 10:8$
 Therefore, speed of Amit:Bahadur:Chandra = $100:90:72$
 Therefore, in a kilometre race, Amit will travel 1000 m and Chandra will travel 720 m.
 Hence, option (d) is the answer.

22. Ans: d

Distance covered by Amit = 1000 m and that covered by Bahadur = 900 m
 Ratio of speed of Ajay:Bijay = $1000:900 = 10:9$ Ratio of speed of Bijay:Chand = $1000:900 = 10:9$
 Therefore, ratio of speed of Ajay:Bijay:Chand = $100:90:80$
 Therefore, in a kilometre race Ajay beats Chand by 190 m.
 Hence, option (c) is the answer.

23. Ans: d

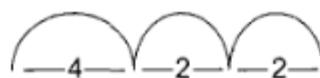
Abhishek beats Bijay by 30 m in a race of 300 m,
 That is, ratio of speed of Abhishek : Bijay = $300 : 270 = 10 : 9$.
 Similarly, ratio of speed of Bijay : Chandan = $300 : 250 = 6 : 5$
 Therefore, ratio of speed of Abhishek : Bijay : Chandan = $20 : 18 : 15$
 Therefore, in a race of 300 m, Abhishek will travel 300 m and Chandan will travel 225 m.
 Hence, Abhishek beats Chandan by 75 m.

24. Ans: b

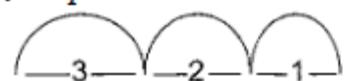
Ratio of speed of Anand : Bidhan = $100 : 95 = 20 : 19$
 Ratio of speed of Bidhan : Chandan = $200 : 190 = 20 : 19$
 Therefore, ratio of speed of Anand : Bidhan : Chandan = $400 : 380 : 361$
 Hence, Anand can beat Chandan by 39 m.

25. Ans: c

A's Jump



B's Jump



Therefore, distance covered by A in three jumps is 8 m.

And distance covered by B = 6 m.

Therefore, A will win the first race and B will win the second race.

Hence, option (c) is the answer.

Exercise 05

Time Distance Speed

1. Ans: c

$$\frac{(\text{speed of wind})}{(\text{speed of car})} = \frac{(\text{time utilised})}{(\text{Time saved})}$$

$$\frac{332}{x} = \frac{332}{28}$$

$$\Rightarrow x = 28 \text{ m/s}$$

2. Ans: b

$$W + R \rightarrow 4 \text{ h } 20 \text{ min}$$

$$W + W \rightarrow 5 \text{ h } 20 \text{ min}$$

$$\therefore R + R \rightarrow 3 \text{ h } 20 \text{ min}$$

3. Ans: a

Circumference means one revolution.

Therefore, distance covered in 10 revolutions = $300 \times 10 = 30m$

i.e., 30 metre in 6 seconds.

$$\therefore \text{Speed of wheel} = \frac{30}{6} \text{ m/s} = 5 \text{ m/s}$$

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

4. Ans: b

5. Ans: c

6. Ans: c

If you start at 12 noon, you would reach at 4:30 PM. You would be able to meet the train which left Mumbai at 8 AM, 9 AM, 10 AM, 11 AM, 12 Noon, 1 PM, 2 PM, 3 PM and 4 PM - a total of 9 trains.

7. Ans: b

The respective times are 224 seconds and 364 seconds. They will meet at the starting point in the LCM of these times, i.e., 224×13 . Hence, Ram Singh will cover the circle 13 times.

8. Ans: c

The ant would cover $7 \times 8 = 56$ meters in 16 hours. Further, it would require $\frac{7}{12}$ of the 17th hour to reach the top. Thus time required = 16 hours 35 minutes

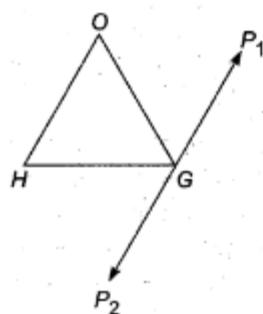
9. Ans: c

Solve this question through options.

For option (c), the conditions match since: If he rode for 2 hours (speed = 5 kmph), he would have walked for 6 hours (4 hours more) and his walking speed would be 15 kmph.

If we interchange the times, we get $15 \times 2 = 5 \times 6$.

10. Ans: d



From the figure above we see that Shyam would have walked a distance of $4 + 4 + 4 = 12$ km. (G to P, P₁ to G and G to P₂).

11. Ans: a

Since the train travels at 60 kmph, its speed per minute is 1 km per minute. Hence, if its speed with stoppages is 40 kmph, it will travel 40 minutes per hour.

12. Ans: c



In the above figure, the train travels from A to B in 11:30 minutes.

Suppose, you denote the time at which the first gunshot is heard as $t = 0$. Also, if you consider the travel of the sound of the second the gunshot is heard at point B at $t = 11:30$ minutes. Also, the second gunshot should reach point B at $t = 12$ minutes. Hence, the sound of the 2nd gunshot would take 30 seconds to travel from B to A.

Thus,

$$\frac{s_{\text{train}}}{s_{\text{sound}}} = \frac{t_{\text{sound}}}{t_{\text{train}}}$$

$$s_{\text{train}} = 330 \times \frac{30}{690} = \frac{330}{23} \text{ m/s}$$

13. Ans: d

By increasing the speed by 33.33%, it would be able to reduce the time taken for travel by 25%. But since this is just able to overcome a time delay of 30 minutes, 30 minutes must be equivalent to 25% of the time originally taken. Hence, the original time must have been 2 hours and the original speed would be 750 kmph. Hence, the new speed would be 1000 kmph.

14. Ans: b

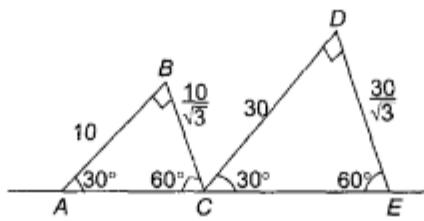
Speed of running of the train = 1.25 km/hr. With stoppage, an effective speed of 60 kmph means that the time of travel per hour would be $60/1.25 = 48$ minutes.

Thus, the train stops for 12 minutes per hour.

15. Ans: b

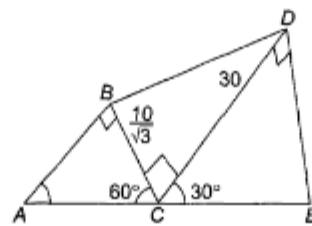
$$(1/4) \times 2\pi r = 4\pi \text{ (Since } r = 8\text{ cm)}$$

16. Ans: c



$$\begin{aligned} \text{Total time taken} &= \frac{10}{20} + \frac{10/\sqrt{3}}{40} + \frac{30}{20} + \frac{30/\sqrt{3}}{40} + \frac{40}{20} + \frac{40\sqrt{3}}{40} \\ &= 2 + 0.58 = 2.58 \text{ h} = 2 \text{ h } 35 \text{ min} \end{aligned}$$

17. Ans: a



$$\text{Using } \cos C = \frac{BC^2 + CD^2 - BD^2}{2BC \cdot CD}$$

$$\cos 90^\circ = \frac{\left(\frac{10}{\sqrt{3}}\right)^2 + 30^2 - BD^2}{2 \times \frac{10}{\sqrt{3}} \times 30}$$

$$\text{Or } 0 = \frac{100}{3} + 900 - BD^2$$

$$\text{Or } BD^2 = \frac{2800}{3}$$

$$\text{Or } BD = 10 \sqrt{\frac{28}{3}} \text{ miles}$$

Hence, option (a) is the answer.

18. Ans: b

Assume any value of S and solve

19. Ans: b

At 2 O'clock Aflatoon has already covered 16 km @ 8 km/h, Bablajoon starts running in the same direction @ 10 km/h. The relative speed is 2 km/h. They will be 5 km apart at 7:30 pm the same day and 12:30 am on the next day.

20. Ans: a

21. Ans: b

Speed of train = 1 km/h

And distance covered by train = 1 km.

That means the total duration was 1 h.

Let us consider speed of car be x km/h.

$$\text{Total time taken by car} = \frac{1}{x+1} + \frac{1}{x-1} - 1$$

On solving, we get $(x = \sqrt{2} + 1)$ km/h

Therefore, distance covered in 1 h by car = $\sqrt{2} + 1$ km

Hence, option (b) is the answer.

22. Ans: b

Here, total distance is 600 km.

Let speed of train be x km/h and speed of car be y km/h.

$$\text{Now, } \frac{120}{x} + \frac{480}{y} = 8$$

$$\frac{200}{x} + \frac{400}{y} + \frac{25}{3}$$

On solving, we get $x = 60 \frac{\text{km}}{\text{h}}$, $y = 80 \text{ km/h}$

23. Ans: a

24. Ans: d

As we do not know, the exact positions where the road is perpendicular to PQ , it cannot be determined.

25. Ans: d

With 60 miles/h, it goes 20 miles on a gallon @ 70 miles/h. It will go 14 miles on a gallon.

Therefore, for 210 miles, 15 gallon of gas will be required.

Exercise 6

1. Ans: d

If the speed of faster horse be f_s and that of slower horse be S_s , then

$$f_s + S_s = \frac{50}{\frac{1}{1}} = 50$$

$$\text{And } \frac{50}{S_s} - \frac{50}{f_s} = \frac{5}{\frac{1}{6}}$$

Now, you can go through options.

The speed of slower horse is 20 km/h.

Since, $20 + 30 = 50$

$$\text{And } \frac{50}{20} - \frac{50}{30} = \frac{5}{\frac{1}{6}}$$

2. Ans: c

Let the original speed be x km/h then,

$$\frac{36}{(x-6)} + \frac{36}{(x+6)} = 8$$

Now, you can go through options or solve it as follows

$$\frac{(x+6+x-6)}{(x^2-36)} = \frac{8}{36}$$

$$\Rightarrow x = 12 \text{ and } x = -3$$

Thus, the possible value of $x = 12$

\therefore Time taken by faster speed = 2 h

3. Ans: b

$$\text{Time taken to meet Bipasha and Mallika} = \frac{1080}{(60+120)} = 6 \text{ h}$$

So, in 6 hours Bipasha covers 360 km and this 360 km distance Rani covers in $\frac{360}{90} = 4 \text{ h}$.

Hence, Rani leaves Kolkata 2 hours later than Bipasha i.e., at 8 am. Rani leaves Kolkata.

Note:

The distance 360 covered by Bipasha to meet Mallika can also be calculated by the ratio of their speeds.

4. Ans: a

Time taken to collide the two trains = $\frac{3}{2} h$

So, in $\frac{3}{2} h$ bird travels $\frac{3}{2} \times 60 = 90\text{km}$

5. Ans: b

6. Ans: a

7. Ans: d

8. Ans: c

Initial distance = 25 dog leaps.

Per minute → dog makes 5 dog leaps

Per minute → Cat makes 6 cat leaps = 3 dog leaps

Relative speed = 2 dog leaps/minutes.

An initial distance of 25 dog leaps would get covered in 12.5 minutes.

9. Ans: a

The total time = time in the first part of the journey + time for the second part of the journey = $k/y + (x - k)/z$. Option (a) is correct.

10. Ans: c

Since they cover the distance in 80 minutes traveling in opposite directions we infer 100% distance is covered in 80 minutes → 1.25% per minute → 75% per hour.

i.e., their combined distance coverage is 75% per hour. Since we are asked for the time the faster motorcyclist takes, we can pick up this time from the options.

Options	Time for faster motorcyclist	Faster's % coverage per hour	Slower's % coverage per hour
a	6 hours	16.66	58.33
b	3 hours	33.33	41.66
c	2 hours	50	25
d	4 hours	25	50
e	5 hours	20	55

It is clear that options a, b, d and e are not feasible as it is making the faster motorcyclist slower.

Thus option (c) has to be correct. Note: You can use the values in option (c) to check the other condition in problem and see that it works.

11. Ans: d

Solve this question through options. For instance, if he travelled at 25 kmph, his original speed would have been 24 kmph.

The time difference can be seen to be 6 minutes in this case:

$60/24 - 60/25 = 0.1\text{ hrs} = 6\text{ mins}$. Thus, this is the correct answer.

12. Ans: a

13. Ans: b

14. Ans: a

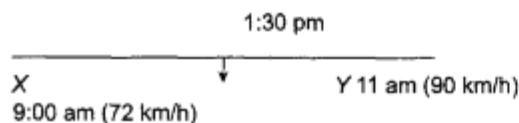
The length of the circular track would be equal to the circumference of the circle. In 2 minutes thus, the cyclist covers $3.14 \times 200 = 628$ meters (using the formula for the circumference of a circle). Thus, the cyclist's speed would be $628/2 = 314$ meters/minute.

15. Ans: a

Distance covered by Ram and Rahim in half an hour is 7.5 km and 6 km, respectively. Let speed of Mohan be x km/h as Mohan overtook Rahim and then Ram.

So, $\frac{7.5}{x-15} - \frac{6}{x-12} = 90/60h$
 On solving, we get $x = 18 \text{ km/h}$
 Hence, option (a) is the answer.

16. Ans: a



They cross each other at 1:30 pm which means the distance is 549 km.

At 12 noon, a signal was down, distance travelled by x and y at 12 noon is 306 km. Rest of the distance will be covered in 4.5 h which mean the relative speed is 54 km. After reducing an equal speed from the speed of both the trains, the equation is like this: $72 - p + 90 - p = 54$, so, $p = 54$.

Hence, the answer is 18 km/h.

17. Ans: a

Suppose that the signal problem occurred at 1 pm, the distance travelled by them is $(72 \times 4 + 19 \times 2)$ km. Rest of the distance will be covered by reduced speed.

18. Ans: d

19. Ans: b

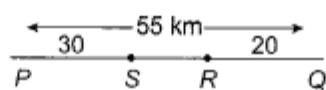
Relative speed of Vinay and Prabhat will be 20 m/min to cover the track of 960 m. It will take 48 min.

20. Ans: c

Let the original speed be $X \text{ km/h}$

According to the question, $18/(4/5x) - 18/x = 9/60 \text{ h}$ $x = 30 \text{ km/h}$

21. Ans: a



Here, relative speed will be = 5.5 km/h

First meeting point is 'R'.

That is, $= \frac{55}{5.5 \text{ km/h}} = 10 \text{ h}$

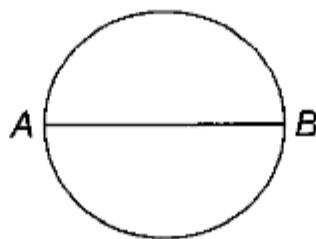
That means $PR = 30 \text{ km}$, and $QP = 25 \text{ km}$

Second meeting point is 'S' $= \frac{110}{5.5} = 20 \text{ h}$

That means A will travel 60 km from 'R'.

That is, $RS = 10 \text{ km}$

22. Ans: b



Let the speed with which the cyclist made the first round be $x \text{ km/h}$

Then, the speed for second round = $(x - 3) \text{ km/h}$

Time taken to reach 'B' $\frac{3}{x}$

Again, the time taken to reach 'B' in the second round $= \frac{3}{x} + \frac{3}{x-3}$

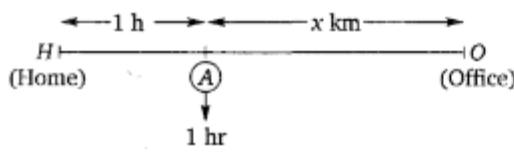
As given $x \frac{3}{x} + \frac{3}{x-3} = \frac{50}{60}$

On solving we get, $x = 9 \text{ km/h}$

23. Ans: c
Go through the actual calculation method.
24. Ans: d
He takes 3 s to get to the next floor.
Up to 480 stairs or 40 floors, his speed = 3 sec/floor. For next 50 floors, his speed = 4.5 second/floor.
Therefore, he should run till 40th floor and then take the lift.
25. Ans: b
Let the speed of Bidhan be x km/h
Then, speed of Saket = $(x + 2)$ km/h
And speed of Sunny = $(x + 5)$ km/h
Time taken by Saket $\frac{2 \times 0.5}{x+2} h$
Time taken by Bidhan = $\frac{0.5}{x} h$
Time taken by Sunny = $\frac{0.5}{x+5} h$
Now, $\frac{2 \times 0.5}{x+2} = \frac{0.5}{x} + \frac{0.5}{(x+5)}$
 $\frac{1}{x+2} = \frac{1}{2x} + \frac{1}{2(x+5)}$
On solving, we get
 $x = 10$ km/h
Hence, Saket's speed = 12 km/h
Therefore, Saket will finish the lap at 2 : 35 pm

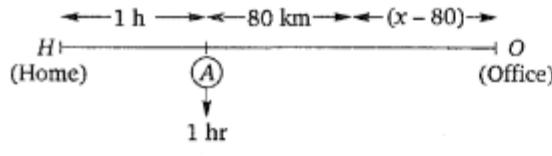
Exercise 07

1. Ans: b



Speed	Time
$\frac{1}{6} \downarrow$	$\frac{1}{5} \uparrow = 36 \text{ min}$

\Rightarrow actual time required to cover x km is $5 \times 36 = 180 \text{ min}$



Speed	Time
$\frac{1}{6} \downarrow$	$\frac{1}{5} \uparrow = 20$

\Rightarrow actual time required for $(x - 80)$ km = $5 \times 20 = 100 \text{ min}$

It means he can move = $x - (x - 80) = 80 \text{ km}$ in

$$(180 - 80) = 80 \text{ min}$$

It means his actual speed = 60 km/h

Thus, the total distance from his home to his office

$$= 60 \times 1 + 60 \times 3 = 240 \text{ km}$$

2. Ans: c

Basically they will exchange their speeds just after half of the time required for the whole journey. It means after covering 210 km distance they will exchange their speeds. Check it out graphically for more clarification.

3. Ans. c

Length of DC = $\frac{600}{13}$ (for this, refer geometry section)

Total distance covered in the returning by Jai

$$= AD + CD \\ = \frac{2500}{13} + \frac{6000}{13} = \frac{8500}{13} \text{ km}$$

$$\text{Required time} = \frac{8500/13}{500/13} = 17 \text{ h}$$

Total distance covered by Jaya while returning

$$= BD + DC \\ = \frac{14400}{13} + \frac{6000}{13} \\ \therefore \text{Required time} = \frac{20400/13}{1200/13} = 17$$

Hence, both will reach at the same time.

Alternatively: Since the ratio of speeds is same as that of distance. So, they will take same time to reach the home.

4. Ans: b

Very similar to question number 57.

$$180 \times \frac{5}{3} = 60 \times 5 \\ S_1 \times S_2 = 300 = 15 \times 20 \\ S_1 = 15 \text{ km/h} \\ \text{And} \\ S_2 = 20 \text{ km/h} \\ \text{Alternatively: } S_1 \times (S_1 \times 5) = 300 \\ \Rightarrow S_1 = 15 \text{ km/h}$$

5. Ans: c

The distance of route $ADC = \frac{8500}{13}$

And the distance of route $BNC = 1300$

And the time taken by Jai is $\frac{8500/13}{500/13} = 17 \text{ h}$

And the time taken by Jaya is $\frac{1300}{1200/13} = \frac{169}{12} \text{ h} = 14\frac{1}{12} \text{ h} = 14 \text{ h } 05 \text{ min.}$

6. Ans: b

B runs around the track in 10 min.

i.e., Speed of B = 10 min per round

\therefore A beats B by 1 round

Time taken by A to complete 4 rounds

$$= \text{Time taken by B to complete 3 rounds} \\ = 30 \text{ min}$$

A's speed = $\frac{30}{4}$ min per round

= 7.5 min per round

Hence, if the race is only of one round A's time over the course = 7 min 30 sec.

7. Ans: a

The ratio of speeds of A, B, C = $\frac{10}{49} : \frac{9}{50} : \frac{8}{51}$

Hence, A is the fastest

8. Ans: a

9. Ans: b

10. Ans: d

11. Ans: b

The total distance the bird would travel would be dependent on the time that the cars crash with each other. Also, the speed of the bird is the same as the relative speed of the cars. Hence, the answer to question 41 will be 12 km.

12. Ans: b

The bird would travel at 120 kmph for $4 + \frac{4}{3} - \frac{4}{9}$ minutes, i.e., 5.77 minutes. Hence, the answer is $(\frac{5.77}{60}) \times 120 = 11.55$ km.

13. Ans: c

The bird would be able to theoretically reach the bonnet of the second car an infinite number of times.

14. Ans: d

Mohan at 8 pm (each of the others would reach later).

15. Ans: b

Solve using options. The first option you would check for (given the values in the questions) would be option (b). This would give that the first jogger would run at 3 min per km, while the second jogger would run at 4 min per km. In the new condition, the first jogger would jog for 13 km while the second jogger would jog for 14 km and their respective times would be 39 mins and 56 minutes. This is consistent with the condition in the question which talks about a difference of 17 minutes in their respective times.

16. Ans: d

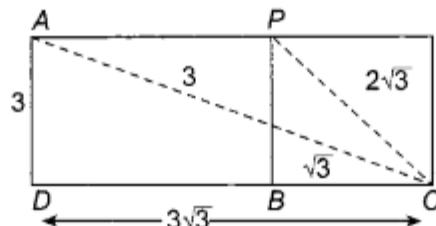
Since the second ant covers $\frac{7}{120}$ of the distance in 2 hours 30 minutes, we can infer that it covers $\frac{8.4}{120} = 7\%$ of the distance in 3 hours. Thus, in 3 hours both ants together cover 15% of the distance $\rightarrow 5\%$ per hour \rightarrow they will meet in 20 hours. Also, ratio of speeds = 8:7.

So, the second ant would cover 700 ft to the meeting point in 20 hours and its speed would be 35 feet/hr.

17. Ans: a

18. Ans: b

19. Ans: a



Let 'A' be the point the radar station notices the jet plane.

C and B be the points at which the radar station and its border, respectively.

Since AC = 6 km, AQ = 3 km

Therefore, QC = $3\sqrt{3}$ km. And also PC = $2\sqrt{3}$ km

$$AP = QC - BC = 3\sqrt{3} - \sqrt{3}$$

$$AP = 2\sqrt{3}$$

Therefore, distance travelled by jet fighter = AP = $2\sqrt{3}$ km.

And also distance travelled by missile = PC = $2\sqrt{3}$ km

Therefore, speed of missile = speed of jet fighter [as both cover same distance in equal internal of time]

Hence, option (a) is the answer.

20. Ans: c

21. Ans: a

Let a speed of Rishu be $x \text{ km/h}$ and speed of the river be $y \text{ km/h}$.

$$\text{Case I} \quad = \frac{18}{x+y} - \frac{18}{x-y} = 9$$

$$\text{Case II} \quad = \frac{18}{2x-y} - \frac{18}{2x+y} = 1$$

On solving we get $y = \frac{20}{3} \text{ km/h}$

22. Ans: a

23. Ans: a

Form the equations first and then use the options.

24. Ans: d

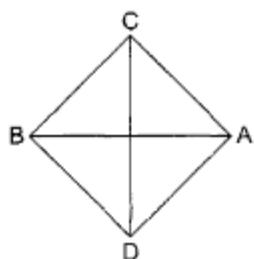
Route 1 : Total time = $4.5h + 3h + 0.5h = 8h$

Route 2: Total time = $\frac{300}{40} + 0.5 h = 7.5 h + 0.5 h = 8 h.40$

Route 2 will take more than 8 h.

Hence, option (d) is the answer.

25. Ans: d

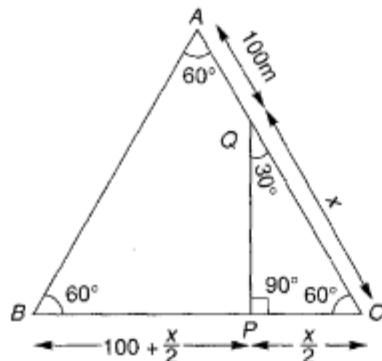


Since diagonals bisect at 90° and diagonals are equal.

Hence, it will be a square.

Exercise 08**Short Answers/ TITA**

1. Ans: 300 km



$$\begin{aligned} \frac{100 + \frac{x}{2}}{100} &= \frac{100 + x}{(100 + x - 150)} \\ &= \frac{\text{Speed of Bajrang}}{\text{Speed of Angad}} \\ \frac{200 + x}{200} &= \frac{(100 + x)}{(x - 50)} \\ &= (200 + x)(x - 50) = 200(100 + x) \\ &= x^2 + 150x - 10000 = 20000 + 200x \\ &= x^2 - 50x - 30000 = 0 \\ &\Rightarrow (x - 200)(x + 150) = 0 \\ &\Rightarrow x = 200 \text{ km} \end{aligned}$$

Therefore distance between Ayodhya and Banaras is 300 km since $AB = BC = AC$.

(With the help of trigonometry we can find the value of PC in terms of x i.e., $\cos 60^\circ = \frac{PC}{QC} = \frac{1}{2}$. Hence $PC = \frac{x}{2}$)

2. Ans: 4 hours

3. Ans: 14 km/h

4. Solution:

$$\text{Required ratio} = \frac{120}{80} = \frac{3}{2} = 1.5$$

5. Solution:

Let Aman entered the bar at ' x ' minutes past 12 A.M.

$$\text{Speed of minute hand} = \frac{360}{60} \text{ degree/minute}$$

$$\text{Speed of hour hand} = \frac{360}{60} \text{ degree/minutes}$$

$$\therefore (360^\circ - 30^\circ) \frac{x}{60} = 30^\circ$$

$$x = \frac{30 \times 60}{330} = \frac{60}{11} = 5 \frac{5}{11} \text{ or } 5.455 \text{ minutes or } 5 \text{ minutes } 27.27 \text{ seconds}$$

Therefore, Aman entered the bar at 00:05:27 AM

He came out the bar at 00:05:27 AM + 1:20:00 = 1:25:27 AM.

$A = 1; B = 25$ and $C = 27$. Sum of the three = 53.

6. Solution:

If Akhilesh travels at 8 feet/minute, 10 feet /minute and 12 feet/minute for ' t ' minutes then according to the conditions in the problem: $8t + 10t + 12t = 120 \rightarrow t = 4 \text{ minutes}$

Distance travelled by Akhilesh in 5 minutes = $8 \times 4 + 10 \times 1 = 42 \text{ meters}$.

Time taken by Ramesh to travel $1/3^{\text{rd}}$ of the distance = $\frac{120}{3 \times 8} = 5 \text{ minutes}$.

Therefore, distance between Ramesh and Akhilesh after 5 minutes = $120 - (42 + 40) = 38 \text{ meters}$

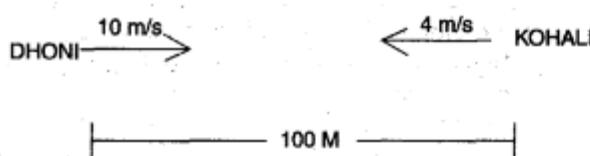
7. Solution:

Time after which Ramesh and Akhilesh meet = 5 minutes + $\frac{38}{10+10} = 6.9 \text{ minutes or } 414 \text{ seconds.}$

8. Solution:

Since their ratio of speeds is 6:1, they will meet for the first time at the starting point when Vijay completes his first round. At that time, since Bhola too would have been running for the entire time, Bhola would have covered six times the distance which would mean that Bhola would have covered the track for the sixth time – thus it would be their sixth meeting. Hence, he would have met Vijay 5 times before they meet at the starting point.

9. Solution:



Dhoni will cover two laps in 20 seconds (as he runs at a speed of 10 m/s and the track is 100 meters). In the same time, Kohli will cover $4 \times 20 = 80$ meters.

Therefore, during the first 20 seconds they would meet twice.

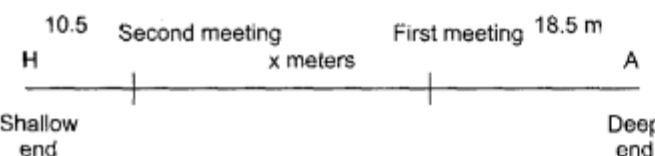
Also, after covering the track twice, Dhoni would be back to his original position. At that time, the distance between them would be 20 meters (distance left for Kohli to finish his first lap). Also, they would be moving in opposite directions and hence their relative speed would be 14 m/s.

10. Solution:

At their third meeting, Dhoni will be at $10 \times \frac{10}{7} = \frac{100}{7} = 14.28 \text{ meters from his starting point.}$

11. Ans: 45m

The following figure represents the travel of the two:



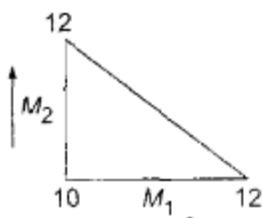
Once, you can visualise this figure, try to extract the value of x by taking the length as given in the options. For option (a) length of pool is 55.5 meters, the ratio of speeds of Ajay to Hemant on the basis of the first meeting = 18.5/37. The ratio of speeds on the basis of the second meeting = Ajay's travel to Hemant's travel = 47.5/63.5. The two ratios are not the same which they should have been as both these ratios represent the speed ratio between Ajay and Hemant.

For option (b), length of pool is 45 meters, the ratio of speeds of Ajay to Hemant on the basis of the first meeting = 18.5/26.5. The ratio of speeds on the basis of the second meeting = Ajay's travel to Hemant's travel = 37/53. The two ratios are the same – which they should have been as both these ratios represent the speed ratio between Ajay and Hemant. Hence, this is the correct answer.

12. Ans: 4s

The movement of the ant in the two cases would be 3, 7, 11, 15, 19, 23 and 1, 9, 17, 25, 33, 41. It can be seen that after 3 seconds the difference is 6mm, after 4 seconds, the difference is 16mm and after 5 seconds the difference is 30 mm. Thus, it is clearly seen that the ant moved for 4 seconds.

13. Ans: 18 km/h



The distance between the motorists will be shown on the hypotenuse. Using the 3, 4, 5 Pythagoras triplet and the condition that the two speeds are 6 kmph different from each other, you will get the triplet as: 18, 24, and 30. Hence, the slower motorist travelled at 18 kmph.

14. Ans: 720 km

The question's structure (and solving) have to be done on the basis of integers. The following equations emerge:

$$\frac{d}{s} - \frac{d}{(s+6)} = 4 \text{ and } \frac{d}{(s-6)} - \frac{d}{(s+6)} = 10$$

Solving these expressions through normal solving methods is close to impossible (at the very least it would take a huge amount of time.) Instead this question has to be solved using the logic that integral difference in ratios in such a situation can only occur in all the three ratios (d/s), $d/(s + 6)$ and $d/(s - 6)$) are integers. Hence, d should have three divisors which are 6 units apart from each other.

15. Solution:

Let's assume the initial speed of John is x kmph.

Now after increasing his speed by 4 kmph his final speed = $x + 4$ kmph.

According to the question:

$$\frac{80}{x} - \frac{80}{x+4} = 1$$

$$x^2 + 4x - 320 = 0$$

$$(x - 16)(x + 20) = 0$$

So $x = 16$ kmph.

Final speed of John = $16 + 4 = 20$ kmph.

16. Solution:

$$\text{Percentage change in speed} = \frac{20-16}{16} \times 100 = 25\%$$

17. Solution:

Distance covered by Ram and Rahim together till the 1st meeting = 100 km

Distance covered by Ram and Rahim together till the 3rd meeting = 100 km + 2 × 200 km = 500 km.

Distance covered by Ram and Rahim is always in the ratio of 5:3.

Distance covered by

$$\text{Ram} = 500 \times \frac{5}{3+5} = \frac{2500}{8} = 312.5 \text{ km.}$$

18. Ans:

Ratio of distance covered by them = Ratio of speeds of $X, Y, Z = 10: 20: 25 = 2: 4: 5$

If X covers 1 km, then Y covers 2 km.

19. Solution:

$$Z \text{ meets } X \text{ after every } \frac{1000}{(60-20)} = \frac{1000}{40} = 25 \text{ sec.}$$

$$Z \text{ meets } Y \text{ after every } \frac{1000}{(60-40)} = \frac{1000}{20} = 50 \text{ sec.}$$

LCM of 25, 50 = 50 seconds

Therefore X, Y, Z meet after every 50 seconds.

20. Solution:

$$X \text{ completes one round in } \frac{1000}{20} = 50 \text{ sec.}$$

$$Y \text{ completes one round in } \frac{1000}{40} = 25 \text{ sec.}$$

$$Z \text{ completes one round in } \frac{1000}{60} = \frac{100}{6} = \frac{50}{3} \text{ sec.}$$

$$LCM \text{ of } \left(50, 25, \frac{50}{3} \right) = \frac{50}{1} = 50 \text{ seconds}$$

Therefore, X, Y, Z would meet for the first time at the starting point after 50 seconds.

21. Ans: 7 km

22. Ans: 60km

One of the ways of solving this question is going through equations. But after a certain stages, we will be required to start assuming the values because all the data are not given.

Another way of doing this problem is: start working by assuming some values. Let us assume the speed of Mayank = 10 km/h. In 3 h, he has covered 30 km. Now, Sharat starts with a speed of 20 km/h. He will take 3 h to meet Mayank. Till that time, the total distance covered by Mayank will be 60 km.

23. Ans: 24s

Let the length of shorter and longer trains be $x, x + 25m$

And their speed be y and x m/s, respectively

Case I: In opposite direction

$$\frac{d+d+25}{10} = x + y \quad (i)$$

$$\frac{2d+25}{10} = x + y$$

Case II: In the same direction 2d

$$\frac{2d+25}{30} = x - y$$

Case III: In same direction with decreased length

$$\frac{d+\frac{d+25}{2}}{22} = x - y$$

On solving (i), (ii), and (iii)

We get $d = 175$ m, $x = 25$ m/s, $y = 12.5$ m/s

Therefore, the length of two trains be 175,200 m.

Now, the length of platform = $2 \times 200 = 400$ m

Therefore, distance = $400 + 200$ m

Time taken to cross tunnel = $\frac{600}{25} = 24s$

Hence, option (b) is the answer.

24. Ans: 9 h

Distance travelled by Vinod in 4h = $8 \times 4 = 32$ km

And distance travelled by Kaurvaki in 4h = $13 \times 4 = 52$ km

New speed of Vinod = 16 km/h

And also new speed of Kaurvaki = 12 km/h

Now, distance between Vinod and Kaurvaki = 52 km - 32 km = 20 km

Relative speed = 4 km/h

Time = $\frac{20}{4} = 5$ h

Total time = $4 + 5 = 9$ h.

25. Ans: 16kmph