

TIME, SPEED AND DISTANCE

Concepts

- Speed= Distance/ Time**

- When a person travels two equal distances at two different speeds X and Y then **Average Speed= $\frac{2XY}{X+Y}$**

- Relative speed:** When two objects are travelling in opposite directions, relative speed, $SR = (S_1 + S_2)$. When two objects are travelling in the same direction, relative speed, $SR = (S_1 - S_2)$. S_1 and S_2 are the respective speeds of two objects.

- Problems based on boats:** If the Stream & the Boat are moving in same direction, effective speed $S_E = S_B + S_s$. If the Stream & Boat are moving in opposite directions, effective speed, $S_E = S_B - S_s$. S_B is the speed of the boat and S_s , the speed of the stream.

- Problems on races:**

- Dead heat in a race means all runners reach the finish line at the same time.

- In races involving circular tracks, if two runners start at the same time and from the same point in the same direction, when they meet for the first time, the faster runner would have a completed one round more than the slower runner.

The time taken for the first meeting=Track length/Relative Speed

- If two runners start at the same time and from the same point, the time taken for them to meet at the starting point for the first time is the LCM of the time taken by each of them to complete one round.

- When three runners start from the same point at the same time, the time taken for their first meeting is the LCM of the time taken by the fastest runner to get a lead of one complete round over each of the other two.

Drill

1. Assume that you are participating in a race and driving at an average speed of 180 kmph. What will be the distance covered by you in:

(i) 2 hours: _____ (ii) 5 hours: _____ (iii) 35 minutes: _____

2. For the same data, what will be the time taken by you to cover: 540 km: _____ 60 km: _____ 15 km: _____ 800 m: _____

3. Walking at $(5/7)$ th of your usual speed, you will reach the market 16 minutes late. What is the usual time taken by you to reach the market? _____ min

4. If you ride your scooter at a speed of 20 kmph from your house, you will reach your college at 9.05 a.m. If you ride at 30 kmph, then you will reach at 8.55 a.m. Find the distance between your house and college _____ km

5. If you travel 210 km from town A to town B at a speed of 30 kmph and from there to town C at a speed of 70 kmph for another 140 km, then what is your average speed during the entire journey?

6. If you travel from your house to office at the speed of 30 kmph and return home at the speed of 70 kmph, then what is your average speed for the entire journey?

7. You are in need of Rs.10,000 and decide to borrow it from your friend who lives 120 km away from your place.

Case 1: You decide to go to his place in your car at an average speed of 40 kmph to collect it. How long will you take to meet him? _____ hrs

Case 2: Both of you are travelling towards each other. Your friend is travelling in his bike at a speed of 20 kmph and you are travelling at a speed of 40 kmph.

(i) What will be the distance between you and your friend after an hour? _____ km

(ii) After how much time will you meet your friend? _____ hrs

Case 3: Your friend is already on his way to his office (which is in the opposite direction), travelling at a speed of 20 kmph. You decide to chase him down, travelling at a speed of 40 kmph.

(i) What will be the distance between you and your friend after an hour? _____ km

(ii) After how much time will you meet your friend? _____ km

8. What is the time taken by a 90 m long train travelling at a speed of 18 kmph to cross a bridge of length 270 m?

9. A train 90 m long is travelling at a speed of 40 kmph. A man is running at a speed of 5 kmph in a direction opposite to the motion of the train. What would be the time taken by the train to cross the man?

10. A boat can travel at a speed of 13 kmph in still water. If the speed of the stream is 4 kmph, find the time taken by the boat to travel 68 km downstream.

11. A motorboat travels 40 km downstream in 5 hours and 30 km upstream in 6 hours. Find the speed of the stream (in kmph).

12. In a 100 m race, A covered a distance in 36 seconds and B in 45 seconds. By what distance did A win the race?

13. In a 100 m race, A can beat B by 25 m and B can beat C by 4 m. In the same race, by how many meters can A beat C?

14. Two bicycle riders ride in opposite directions around a circular track, starting at the same time from same point. Cyclist A rides at a speed of 3 kmph and cyclist B rides at a speed of 1 kmph. If the track has a diameter of 4 km, after how much time will the two cyclists meet?

Concept review questions

1. Ram takes 3 hours more than Karthick, who drives his car 5 kmph faster than Ram, to cover a distance of 180 km. What is the speed of Ram?

a. 8 kmph b. 10 kmph c. 15 kmph d. 20 kmph

2. Two identical trains A and B running in opposite directions with equal speeds take 2 minutes to cross each other completely. The number of bogies of A is increased from 12 to 16. How much more time would they now require to cross each other?

a. 40 s b. 50 s c. 60 s d. 20 s

3. Starting from my office, I reach the house 20 minutes late if I walk at 3 kmph. Instead, if I walk at 4 kmph, I reach the house 15 minutes early. How far is my house from my office?

a. 4 km b. 5 km c. 7 km d. 6 km

4. A man can row a boat at a speed of 6 kmph in still water. If it takes him twice as long to row up as to row down the river, the rate of current in the stream would be?

a. 4 kmph b. 2 kmph c. 3 kmph d. 2.5 kmph

5. Prem and Shyam travel the same distance at the speeds of 10 kmph and 15 kmph respectively. If Prem takes 30 minutes longer than Shyam, then the distance travelled is
- a. 15 km b. 2 km c. 10 km d. 30 km
6. Walking at $\frac{4}{7}$ th of his usual speed, Ram gets late by 15 minutes. Find the time he would have taken walking at his usual speed.
- a. 25 min b. 20 min c. 30 min d. 24 min
7. In a 200 m race, A gives B a head start of 25 m and wins by 10 s. If A gives B a head start of 45 m, the race ends in a dead heat. What will be the time taken by A to complete the race?
- a. 100 s b. 77.5 s c. 86 s d. 155 s
8. Arjun is standing on an old building and there is a railway track beside on which a train travels at a speed of 72 kmph. When the train passes by the building, Arjun tries to jump inside the train. He somehow manages to enter the train through the last door of the last bogie. After jumping in, he runs towards the other end of the train at a speed of 36 kmph. When he reaches a distance of 300 m from the building, the building exploded. After how many seconds since Arjun's jump did the building explode?
- a. 30 s b. 10 s c. 15 s d. 20 s
9. Two stations A and B are 110 km apart on a straight line. One train starts from A at 7 a.m. and travels toward B at a speed of 20 kmph. Another train starts from B at 8 a.m. and travels toward A at a speed of 25 kmph. At what time will they meet?
- a. 9 A.M b. 10 A.M c. 11 A.M d. None
10. A train which is travelling at a constant speed crosses a lamp post in 9 seconds and it takes 13.5 seconds to cross a platform 99 m long. Find the length of the train.
- a. 99 m b. 198 m c. 135 m d. 12 m
11. Two boats traveling at 5 kmph and 10 kmph head towards each other. They begin at a distance of 20 km from each other. How far apart are they (in km) one minute before they collide?
- a. $\frac{1}{2}$ b. $\frac{1}{6}$ c. $\frac{1}{4}$ d. $\frac{1}{3}$
12. A and B walk around a circular track. They start at 10 a.m. from the same point in the opposite directions. A and B walk at a speed of 2 rounds per hour and 3 rounds per hour respectively. How many times shall they cross each other before 11.30 a.m.?
- a. 5 b. 6 c. 7 d. 8
13. In a 300 m race, Ani beats Bini by 22.5 m or 6 seconds. What is the time taken by Bini to complete the race?
- a. 86 s b. 80 s c. 76 s d. None
14. Filsha travelling at the speed of 100 kmph reaches her destination in 80 minutes. If she travels at the speed of 125 kmph, in how many minutes will she reach her destination?
- a. 64 min b. 80 min c. 60 min d. 55 min
15. Kanyakumari Express is a daily train from Kashmir to Kanyakumari. The train leaves Kashmir at 11 a.m. everyday and reaches Kanyakumari after exactly 10 days at 11 a.m. Kashmir Express is a similar daily train which leaves Kanyakumari at 11 a.m. everyday and reaches Kashmir after exactly 10 days at 11 a.m. Let us say, you are on the train which is leaving Kashmir on 20th April. When you reach Kanyakumari on 30th April, how many Kashmir Express trains would have crossed you from the opposite direction?
- a. 19 b. 10 c. 9 d. None