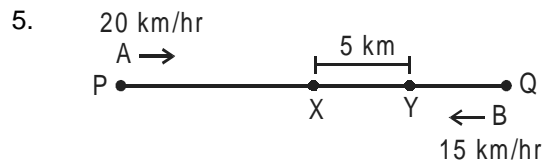


Contents

- Linear races
- Circular races
- Clock

QA - 09**CEX-Q-0210/18****Number of Questions : 30****Linear races**

- In a 500 m race, the ratio of the speeds of two contestants A and B is 2 : 3. If A has a start of 170 m, then A wins by
 (1) 5 m (2) 10 m
 (3) 15 m (4) 20 m
- In a 1 km race, A beats B by 40 m and B beats C by 25 m. By how many meters A beats C in the same race?
 (1) 65 (2) 60
 (3) 64 (4) 66
- P beats Q by 20 m in a 120 m race, and Q beats R by 24 m in the same race. By what distance will P beat R in a race of 150 m?
 (1) 54 m (2) 50 m
 (3) 48 m (4) 45 m
- A and B stay in the same apartment and study in the same school. A and B start walking towards their school at speeds of 2 km/hr and 3 km/hr respectively. The faster of the two reaches the school first, turns around and starts walking back. If A and B meet 200 m away from the home then what is the distance between their apartment and their school?
 (1) 260 m (2) 240 m
 (3) 200 m (4) 250 m



- A and B start from two locations P and Q respectively at the same time and meet every day at X on the way. Uniform speeds of A and B are 20 km/hr and 15 km/hr respectively. One day B starts t min late and meets A, 5 km ahead of X at Y. Find t .
 (1) 15 min (2) 20 min
 (3) 35 min (4) 25 min

- Karan and Arjun run a 100-meter race, in which Karan beats Arjun by 10 metres. To do a favour to Arjun, Karan starts 10 metres behind the starting line in a second 100 metre race. They both run at their earlier speeds. Which of the following is true in connection with the second race?
 (1) Karan and Arjun reach the finishing line simultaneously.
 (2) Arjun beats Karan by 10 metres
 (3) Arjun beats Karan by 11 metres.
 (4) Karan beats Arjun by 1 metre.

7. Neeta loses to Divya by 10 m in a 100 m race. Preeta loses to Divya by 15 m in a 100 m race. By how many metres will Neeta beat Preeta in a 400 m race if their speed remains constant in all the races?

(1) 25 m (2) 20 m
(3) 25.33 m (4) 22.23 m

8. Ram and Shyam run a race between points A and B, 5 km apart. Ram starts at 9 a.m from A at a speed of 5 km/hr, reaches B, and returns to A at the same speed, Shyam starts at 9:45 a.m. from A at a speed of 10 km/hr, reaches B and comes back to A at the same speed. At what time does Shyam over take Ram?

(1) 10:20 a.m. (2) 10:30 a.m.
(3) 10:40 a.m. (4) 10:50 a.m.

9. Three runners A, B and C run a race, with runner A finishing 12 m ahead of runner B and 18 m ahead of runner C, while runner B finishes 8 m ahead of runner C. Each runner travels the entire distance at a constant speed. What was the length of the race? **[CAT 2001]**

(1) 36 m (2) 48 m
(3) 60 m (4) 72 m

Circular races

10. A and B run a 5 km race on a round course of 400 m. If their speeds are in the ratio 5 : 4, then how many times will the winner of the race cross the other participant?
11. Amol and Avash start running simultaneously around a circular track from the same point in the same direction. Amol can complete 1 round in 16 seconds and Avash can do the same in 28 seconds. Find the time after which they would be together for the first time.

(1) 40 s (2) $\frac{112}{3}$ s

(3) $27\frac{2}{3}$ s (4) 37 s

12. Two runners A and B are running on a circular track of length 14 km. If A and B started simultaneously from the same point but in opposite directions with speeds 15m/s and 20m/s respectively. What is the distance covered by A by the time they cross each other for the first time?

13. A and B run along a circular track, of unknown radius, in the same direction at speeds of 3m/sec and 5m/sec respectively. Find at how many points will they meet.

(1) 2
(2) 3
(3) 1
(4) Cannot be determined

14. A and B start running simultaneously from the same point on a circular track with speeds 5 m/s and 15 m/s respectively. If they run in opposite directions, find the ratio of distances covered by them till their first meeting.

(1) 1 : 3 (2) 2 : 5
(3) 2 : 3 (4) 1 : 2

15. Two persons start cycling simultaneously from a point P on a circular track. If they travel at a speeds of 3 km/hr and 10 km/hr respectively, then what is the ratio of number of distinct points that they would meet on that track then when they travel in the same direction first to that when they travel in the opposite direction?

(1) 7 : 13 (2) 3 : 10
(3) 3 : 7 (4) 30 : 13

Directions for questions 16 and 17: Answer the questions on the basis of the information given below.

Chiku and Charu are running along a circular path with a diameter of 1050 m at the speeds of 15 m/s and 25 m/s respectively. Chaman is running along the path AB (diameter of the circular path) at the speed of 35 m/s. Chaman turns back immediately after reaching the point B and does the same as he reaches the point A. All of them start from point A simultaneously.

16. If Charu and Chiku are running in the opposite direction, what is the shortest distance (in metres) along the circular path between point A and the point at which Charu and Chiku meet for the third time?
 (1) 247.5 (2) 412.5
 (3) 660 (4) 1320
17. If Charu and Chiku are running in the opposite direction, what is the shortest distance (in metres) between Charu and Chiku along the circular path when Chaman reaches the point B for the fifth time?
 (1) 150 (2) 270
 (3) 412.5 (4) 900
18. In a 4000 meter race around a circular stadium having a circumference of 1000 meters, the fastest runner and the slowest runner reach the same point at the end of the 5th minute, for the first time after the start of the race. All runners have the same starting point and each runner maintains a uniform speed throughout the race. If fastest runner runs at twice the speed of slowest runner, what is the time taken by fastest runner to finish the race?

[2003(L)]

19. Two boys start simultaneously from the same point on a circular track and run in opposite directions at speeds of 2.25 km/hr and 3.5 km/hr respectively. If circumference of the track is 736 m, after how much time they meet for the first time?
 (1) 7.5 min (2) 7.68 min
 (3) 8 min (4) 6.86 min
20. A sprinter starts running on a circular path of radius r metres. Her average speed (in metres/minute) is πr during the first 30 seconds, $\frac{\pi r}{2}$ during next one minute, $\frac{\pi r}{4}$ during next 2 minutes, $\frac{\pi r}{8}$ during next 4 minutes and so on. What is the ratio of the time taken for the n th round to that for the $(n - 1)$ th round? ($n > 1$)
 (1) 4 : 1 (2) 8 : 1
 (3) 16 : 1 (4) 32 : 1
21. Three persons A, B and C, whose speeds are in the ratio 3 : 5 : 7 respectively, started running simultaneously, in the same direction, from the same point on a circular track whose radius is $\left(\frac{105}{2\pi}\right)$ km. What is the absolute difference between the distance travelled by A and the distance travelled by C, when all three persons meet for the first time at any point on the track?
 (1) 105 km (2) 131.25 km
 (3) 262.50 km (4) None of these

22. Two Astronauts, Vaibhav and Kanishk land on a spherical shaped meteor of diameter 7 km, which is rotating about its own central axis at 2.5 km/sec. Equator is the maximum circumference possible on the spherical shaped meteor. Vaibhav starts running along the equator at 20% of the speed of the meteor in a direction opposite to the direction of the rotation of meteor. Kanishk standing at a point from where Vaibhav started, records the time taken by Vaibhav to reach the starting point once again. Calculate the time recorded by Kanishk.
 (1) 44 sec (2) 12 sec
 (3) 48 sec (4) 11 sec
- Clock**
23. A boy looks at the reflection in the mirror and sees the time to be 9:30:10. The correct time is
 (1) 2 : 29 : 50 (2) 3 : 29 : 50
 (3) 1 : 29 : 50 (4) 4 : 30 : 50
24. The time between 7 and 8 o'clock, correct to the nearest minute, when the hands of a clock will form an angle of 84 degrees are:
 (1) 7 : 23 and 7 : 53
 (2) 7 : 20 and 7 : 50
 (3) 7 : 22 and 7 : 53
 (4) 7 : 23 and 7 : 52
25. Hour hand and minute hand of a clock coincides every 64 minutes. How much time does the clock gain or lose in a day?
 (1) $32\frac{8}{11}$ minutes gain
 (2) $32\frac{8}{11}$ minutes lose
 (3) $31\frac{4}{11}$ minutes gain
 (4) $31\frac{4}{11}$ minutes lose
26. Two clocks show the correct time at 4 pm. One clock gains 15 minutes every hour and the other one is correct. Next day, if the time in the faulty clock is 7 am, then what is the time shown by the correct clock?
27. There are 2 clocks. One clock gains 3 min in 15 hours and the other loses 2 min in 20 hours. If clocks show the correct time at 1 PM on Monday, what will be the correct time and day when they both show the same time again?
28. A clock loses 12 minutes every 24 hours. It is set right at 7:25 p.m. on Monday. What will be the time when the clock shows 1:45 p.m. the following day? **(SNAP 2008)**
 (1) 1:20:35 p.m.
 (2) 1:35:50 p.m.
 (3) 1:25:35 p.m.
 (4) None of these
29. In a watch, the minute hand crosses the hour hand for the third time exactly after every 3 hr 18 min and 15 s of watch time. What is the time gained or lost by this watch in one day? **(CAT 1996)**
 (1) 14 min 10 s lost
 (2) 13 min 50 s lost
 (3) 13 min 20 s gained
 (4) 14 min 40 s gained
30. It takes the pendulum of a clock 7 seconds to strike 4 o'clock. How much time will it take to strike 11 o'clock? **(CAT 1994)**
 (1) 18 seconds
 (2) 20 seconds
 (3) 19.25 seconds
 (4) 23.33 seconds

Visit "Test Gym" for taking Topic Tests / Section Tests on a regular basis.

QA - 09 : TSD - 3

Answers and Explanations

CEX-Q-0210/18

1	1	2	3	3	2	4	4	5	3	6	4	7	4	8	2	9	2	10	–
11	2	12	–	13	1	14	1	15	1	16	2	17	4	18	–	19	2	20	3
21	4	22	1	23	1	24	1	25	1	26	–	27	–	28	2	29	2	30	4

1. 1 Distance to be covered by A = $(500 - 170) = 330$ m.
In the time A covers 2 m, B covers 3 m.

So, in the time A covers 330 m, B covers $\left(\frac{3}{2} \times 330\right)$ m
= 495 m
∴ When A reaches the winning post, B covers 495 m
and therefore remains 5 m behind.
Hence, A wins by 5 m.

2. 3 Let the speeds of A, B and C be S_A , S_B and S_C .

$$S_A : S_B = \frac{1000}{960} = \frac{25}{24}$$

$$S_B : S_C = \frac{1000}{975} = \frac{40}{39}$$

$$S_A : S_C = \frac{1000}{936}$$

Hence, A beats C by 64 m.

3. 2 Let the speeds of P, Q and R be S_P , S_Q and S_R respectively.

$$\begin{aligned} \therefore S_P : S_Q &= 120 : 100 = 6 : 5 \\ \text{and } S_Q : S_R &= 120 : 96 = 5 : 4 \\ \Rightarrow S_P : S_Q : S_R &= 6 : 5 : 4 \end{aligned}$$

$$\text{Hence, the distance} = 150 - \frac{150 \times 4}{6} = 50 \text{ m.}$$

4. 4 Let the distance where they met be 'x' metres from the school.

So the distance travelled by A = 200 m and that travelled by B = $(2x + 200)$ m

Since the ratio of their speeds is 2 : 3, the ratio of the distances travelled should also be 2 : 3.

$$\text{Hence, we have } \frac{200}{(200 + 2x)} = \frac{2}{3}$$

On solving, we get $x = 50$ m

The distance between their apartment and the school is given by $(200 + x) = 200 + 50 = 250$ m

5. 3 Suppose they normally meet at 9 a.m. at X.
 $XY = 5$ km. So A takes 15 min to cover it and B takes 20 min to cover it. So, when A, B are at Y the time is 9.15 a.m. when B reaches X it would be 9.35 a.m.
Hence, B is 35 min late on that day.

6. 4 Situation (I):
In whatever time Karan covers a distance of 100 m, Arjun covers 90 m in the same time.

Situation (II):

Now Karan is 10 m behind the starting point. Once again to cover 100 m from this new point Karan will be taking the same time as before. In this time Arjun will be covering 90 meters only. This means that now both of them will be at the same point, which will be 10 meters away from the finish point. Since both of them are required to cover the same distance of 10 m now and Karan has a higher speed, he will beat Arjun by 1 metre.

$$7. 4 \quad \frac{\text{Divya}}{\text{Neeta}} = \frac{100}{90}, \frac{\text{Preeta}}{\text{Divya}} = \frac{85}{100}.$$

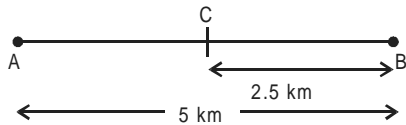
$$\text{Hence, } \frac{\text{Preeta}}{\text{Neeta}} = \frac{100}{90} \times \frac{85}{100} = \frac{17}{18}.$$

Hence, when Neeta runs 400 m, Preeta runs

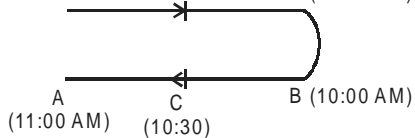
$$\frac{17}{18}(400) \approx 377.77 \text{ m. Hence, Neeta beats Preeta by}$$

$$400 - 377.77 \text{ m, i.e. } 22.23 \text{ m (Approximately)}$$

8. 2

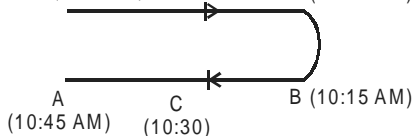


Ram: A (9:00 AM) C (9:30) B (10:00 AM)



Ram : @ 5kph

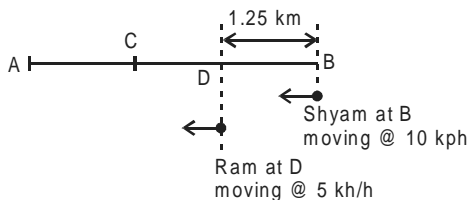
Shyam: A (9:45 AM) C (10:00 AM) B (10:15 AM)



Shyam: @ 10 kph

It is clear from the diagram that at 10:30; Shyam overtakes Ram.

Alternate: At 10:15 the situation is as show:



Time taken for Shyam to overtake Ram

$$= \frac{1.25}{(10-5)} \times 60 = 15 \text{ min.}$$

⇒ Shyam overtakes Ram at 10:30 AM.

9. 2 Let L be length in metres of the race, which A finishes in t seconds.

$$\text{Speed of A} = \frac{L}{t} \text{ m/s}$$

$$\text{Speed of B} = \frac{L-12}{t} \text{ m/s}$$

$$\text{Speed of C} = \frac{L-18}{t} \text{ m/s}$$

Time taken by B to finish the race

$$= \frac{L}{(L-12)/t} \text{ s} = \left(\frac{L}{L-12} \right) t \text{ s}$$

In this time, C covers $(L-8)$ m

$$\left(\frac{L-18}{t} \right) \left(\frac{L}{L-12} \right) t = L-8$$

$$\Rightarrow L = 48 \text{ m.}$$

10. Let the speed of A and B be 50 m/sec and 40 m/sec, respectively.

$$\text{Time taken by A to complete the race} = \frac{5000}{50}$$

$$= 100 \text{ sec.}$$

Time interval after which A crosses B every time

$$= \frac{400}{50-40} = 40 \text{ sec.}$$

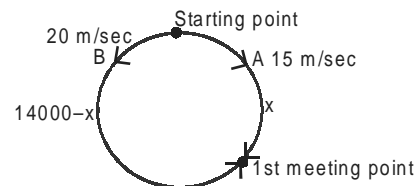
Hence, in 100 seconds A will cross B two times.

11. 2 Let length of the track = L

$$\therefore \text{Required time} = \frac{L}{\text{Relative Speed}}$$

$$= \frac{L}{\frac{L}{16} - \frac{L}{28}} = \frac{28 \times 16}{28-16} = \frac{28 \times 16}{12} = \frac{112}{3} \text{ sec.}$$

12.



Let x be the distance covered by A.

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

$$\therefore \frac{x}{15} = \frac{14000-x}{20}$$

$$\Rightarrow 35x = 14000 \times 15$$

$$\Rightarrow x = 6000 \text{ m} = 6 \text{ km.}$$

13. 1 A and B will meet at $5-3=2$ points, irrespective of the radius of the circular track.

14. 1 Required ratio = $5:15=1:3$

(Since the time taken by both of them is same, distance covered will be directly proportional to their respective speeds.)

15. 1 If they travel in same direction they will meet at $10-3=7$ distinct points.

If they travel in opposite direction they will meet at $10+3=13$ distinct points.

Hence, the ratio = $7:13$.

For questions 16 and 17: When Charu and Chiku are running in the opposite direction.

16. 2 Charu and Chiku will meet for the first time after

$$\frac{3300}{(25 + 15)} = 82.5 \text{ seconds}$$

So they will meet for the third time after

$$82.5 \times 3 \text{ sec} = 247.5 \text{ seconds}$$

By this time total distance covered by Charu is

$$25 \times 247.5 \text{ m} = 6187.5 \text{ m}$$

Hence, they are a distance of 2887.5 m i.e.

$$(6187.5 - 3300) \text{ m from point A.}$$

But this is not the shortest distance.

The shortest distance between the point A and the point at which they meet for the third time is $(3300 - 2887.5)$ i.e., 412.5 m.

17. 4 Chaman will be at point B for the fifth time after $(30 + 4 \times 60) = 270$ seconds.

At this point Charu has covered $270 \times 25 \text{ m} = 6750 \text{ m}$ i.e. he is at a distance of $(6750 - 6600) \text{ m} = 150 \text{ m}$ from point A.

At this point Chiku has covered $270 \times 15 \text{ m} = 4050 \text{ m}$ i.e. he is at a distance of $(4050 - 3300) \text{ m} = 750 \text{ m}$ from point A.

Hence, the shortest distance between Charu and Chiku is $750 + 150 = 900 \text{ m}$.

18. Ratio of speeds of the fastest and slowest runners is 2 : 1. Hence they should meet at only one point on circumference i.e. the starting point (As difference in ratio in reduced form is 1). For the two of them to meet for first time, faster should have completed one complete round over slower one. Since two of them meet for the first time after 5 min, faster one should have completed 2 rounds (i.e. 2000 m) and slower one should have completed 1 round (i.e. 1000 m) in this time. Thus, faster one would complete the race (i.e. 4000 m) in 10 min.

$$19. 2 \text{ Required time} = \frac{0.736 \times 60}{2.25 + 3.5} = \frac{0.736 \times 60}{5.75} = 7.68 \text{ minutes}$$

20. 3 As options are independent of n
Let $n = 2$

$$\text{Time taken for first round} = \frac{1}{2} + 1 + 2 + 4 = 7.5 \text{ min}$$

$$\text{Time taken for second round} = 8 + 16 + 32 + 64 = 120 \text{ min}$$

$$\text{Ratio} = \frac{120}{7.5} = 16.$$

21. 4 Circumference of the circular track = 105 km.
Let the speeds of A, B and C be $3x \text{ km/hr}$, $5x \text{ km/hr}$ and $7x \text{ km/hr}$ respectively.

A and B will meet for the first time after

$$\frac{105}{5x - 3x} = \frac{105}{2x} \text{ hrs}$$

B and C will meet for the first time after

$$\frac{105}{7x - 5x} = \frac{105}{2x} \text{ hrs}$$

So, A, B and C will meet for the first time after

$$\frac{105}{2x} \text{ hrs} \left(\text{LCM of } \frac{105}{2x} \text{ and } \frac{105}{2x} \right)$$

$$\begin{aligned} \text{Distance travelled by A in } \frac{105}{2x} \text{ hrs} &= \frac{105}{2x} \times 3x \\ &= \frac{105 \times 3}{2} \text{ km} \end{aligned}$$

$$\begin{aligned} \text{Distance travelled by C in } \frac{105}{2x} \text{ hrs} &= \frac{105}{2x} \times 7x \\ &= \frac{105 \times 7}{2} \text{ km} \end{aligned}$$

$$\text{Hence, the required difference} = \frac{105 \times 4}{2} = 210 \text{ km.}$$

22. 1 Since Kanishk is standing on meteor, there would be no effect on speed of Vaibhav due to rotation of the meteor.

$$\text{Speed of Vaibhav} = 20\% \text{ of } 2.5 \text{ km/sec} = \frac{1}{2} \text{ km/sec}$$

$$\text{Distance} = \pi d = \pi \times 7 = 22 \text{ kms}$$

$$\begin{aligned} \text{Therefore time recorded by Kanishk} &= \frac{22 \text{ km}}{\frac{1}{2} \text{ km/sec}} \\ &= 44 \text{ sec.} \end{aligned}$$

23. 1 This question is more of a visualisation than a calculation. The correct time in the clock is 2:29:50.

24. 1 Let the position of minute hour be m.

$$\theta = \left| \frac{11}{2}m - 30h \right|$$

$$\Rightarrow 84 = \left| \frac{11}{2} \times m - 30 \times 7 \right|$$

$$\Rightarrow m = \frac{(30 \times 7 - 84) \times 2}{11} \text{ or } \frac{(30 \times 7 + 84) \times 2}{11}$$

$$\Rightarrow m \approx 23 \text{ or } 53.$$

25. 1 In a correct clock the hour and minute hands coincide after every $65\frac{5}{11}$ minutes.
- \therefore 64 minutes of correct clock = $65\frac{5}{11}$ of the faulty clock
- \therefore 60 minutes of correct clock = $61\frac{4}{11}$ of the faulty clock
- Hence, the incorrect clock gains $1\frac{4}{11}$ minute/hr
- \therefore Total gain in 24 hr = $32\frac{8}{11}$ minutes.
26. Number of hours between 4 pm and 7 am = 15 hrs
- \therefore Actual time elapsed = $\frac{15}{1.25} = 12$ hrs.
- \therefore The correct clock will show 4 am.
27. It is clear from the question that in 60 hrs (LCM of 15 and 20) one clock will gain 12 minutes and the other will lose 6 minutes
The time difference between the two clocks in 60 hrs = 18 m
Both the clock will show the same time when time different = 12 hrs (i.e. 720 m)
- \therefore Required time $\frac{60}{18} \times 720$ hrs
- = 2400 hrs = 100 days
Both the clocks will show the same time again after 100 day. Hence, the required day is Wednesday and time is 1 pm.
28. 2 The clock is losing 12 minutes every 24 hours.
Hence, by 1:45 p.m. the following day i.e. after 18 hours the clock would have lost 9 minutes. And in the next 20 minutes. it would have lost another 10 seconds.
Hence, when the clock showed 1:45 p.m. actual time would have been 1:35:50 p.m.
29. 2 In a watch that is running correct, the minute hand should cross the hour hand once in every $65 + \frac{5}{11}$ min. So they should ideally cross three times once in
- $3 \times \left(\frac{720}{11} \right) = \frac{2060}{11}$ min = 196.36 min. But in the watch under consideration they meet after every 3 hr, 18 min and 15 s, i.e. $(3 \times 60 + 18 + \frac{15}{60}) = \frac{793}{4}$ min = 198.25 min. In other words, our watch is actually losing time (as it is slower than the normal watch). Hence, when our watch elapsed 198.25 min, it actually should have elapsed 196.36 min. So in a day, when our watch will elapse $(60 \times 24) = 1440$, it should actually elapse
- $\left(1440 \times \frac{196.36}{198.25} \right) = 1426.27$. Hence, the amount of time lost by our watch in one day = $(1440 - 1426.27) = 13.73$, i.e. 13 min and 50 s (approximately).
30. 4 If a clock has to strike 4 or 4 times, there are 3 time intervals between the 4 strikes (Since the first strike happens at the zeroth second).
So in 7 seconds the pendulum elapses 3 time intervals. To strike 11, there has to be 10 time intervals, which will take $\frac{10 \times 7}{3} = 23.33$ seconds.