RACES & CIRCULAR MOTION

Agenda

* → Race → $(40 - 42)$ min

* Circular Races → $(46 - 48)$ min

* Discuss about Doubt session

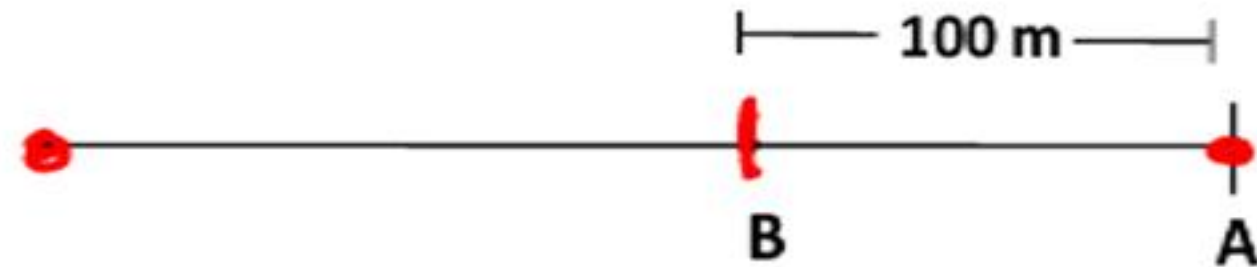Submit / Send all your doubts TSD by sunday Evening

RACES

→ Understanding of the statement

* Simple calculation
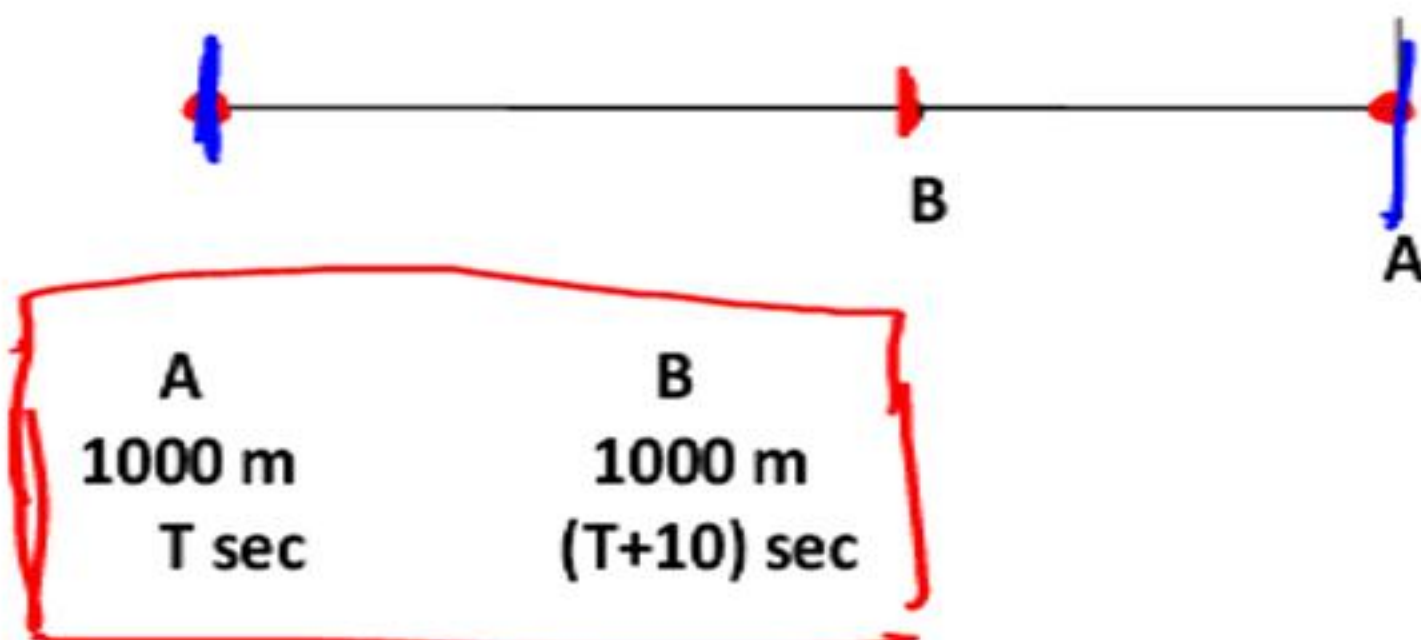
Common statements used in Race based questions

In a race of 1 km, A beats B by 100 metre.
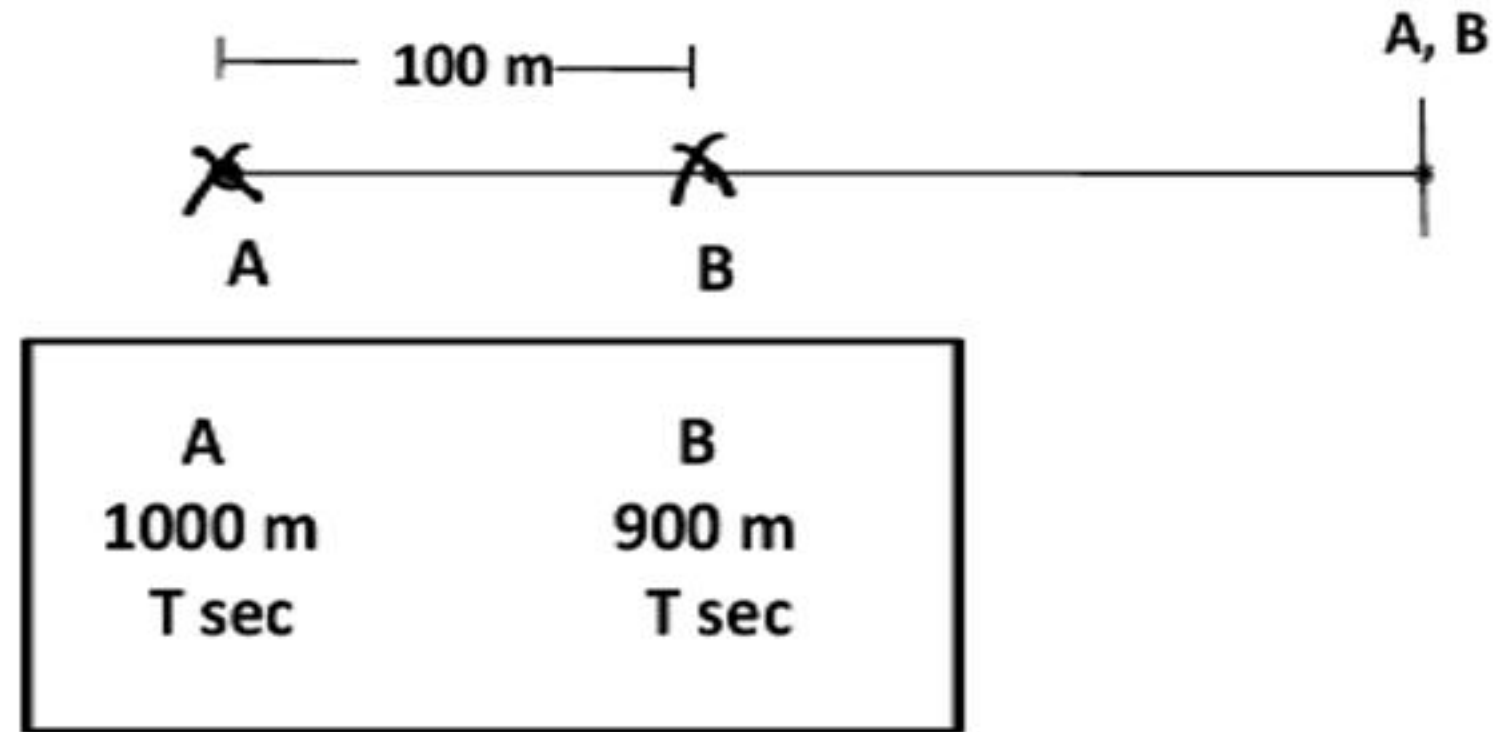

	A	B
	1000 m	900 m
	T sec.	T sec.

	A : B
Speed	10 : 9

In a race of 1 km, A beats B by 10 sec.

A	B
1000 m	1000 m
T sec	(T+10) sec

In a race of 1 km, A can give B a start of 100 metre.

Max

|—— 100 m ——| A, B

X   X |
A   B

A	B
1000 m	900 m
T sec	T sec

speeds

$$A : B$$

$$10 : 9$$

In a race of 1 km, A gives B a start of 150 metre and still wins by 10 sec.

|← 150 m →|

A — B

B
A
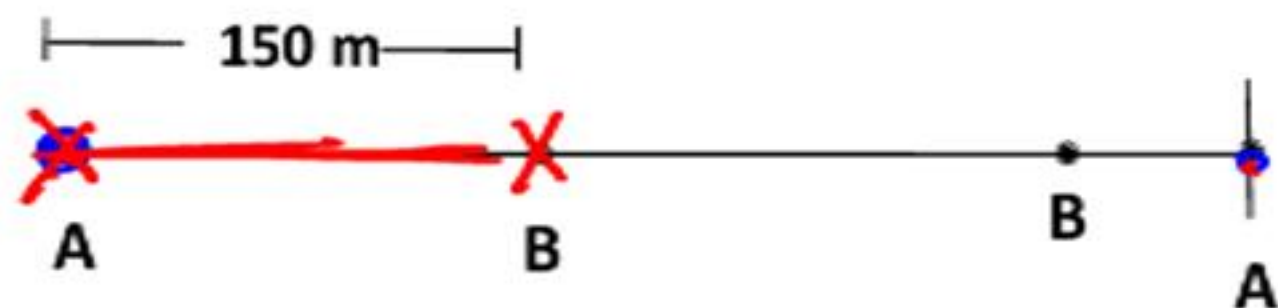
A	B
1000 m	850 m
T sec	(T+10) sec

A   B   C

1000 m   950 m   931 m

$$\frac{50 m}{1000 m} : \frac{49 m}{980 m}$$
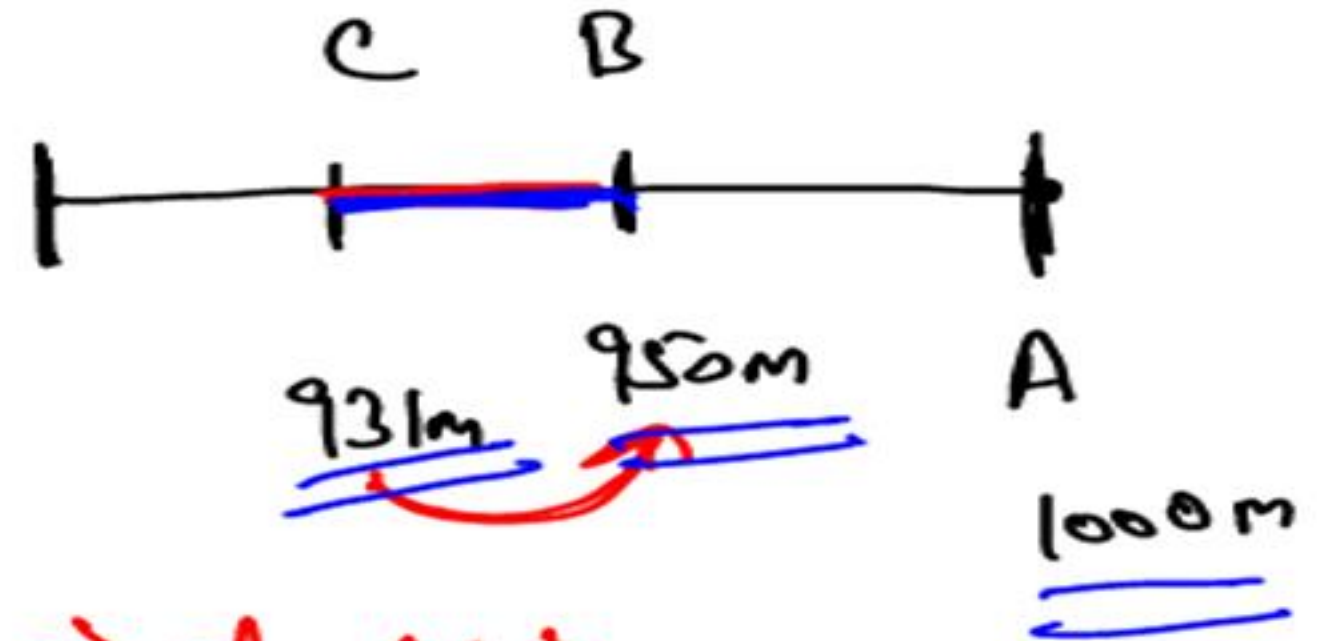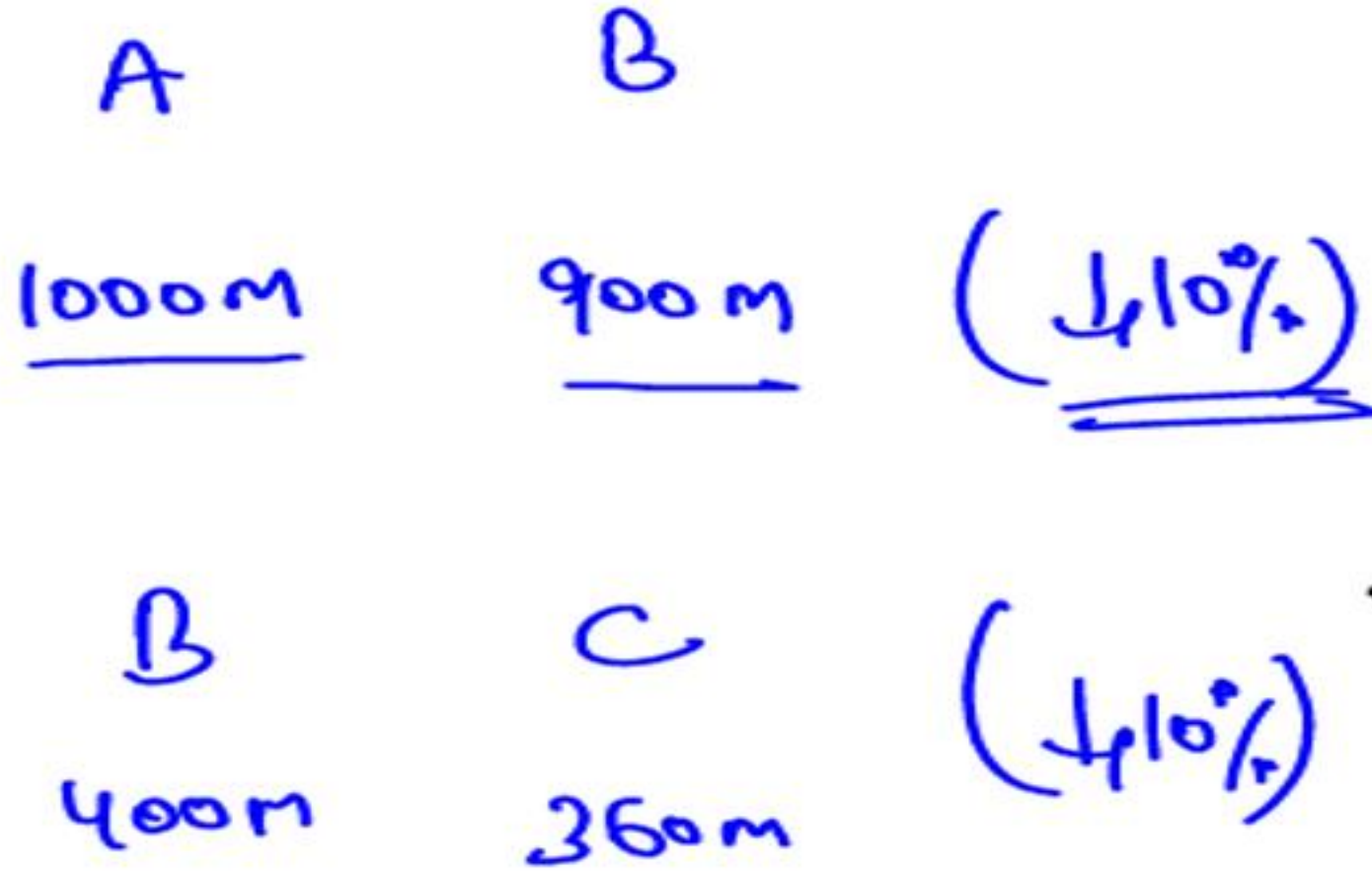
Eg. In 1 km race A, B and C are three participants. A can give B a start of 50 m, and C a start of 69 m. The start, which B can allow C is

(a) 17 m   (b) 20 m

(c) 19 m   (d) 18 m

C   B

931 m   950 m   A

1000 m

Logical App

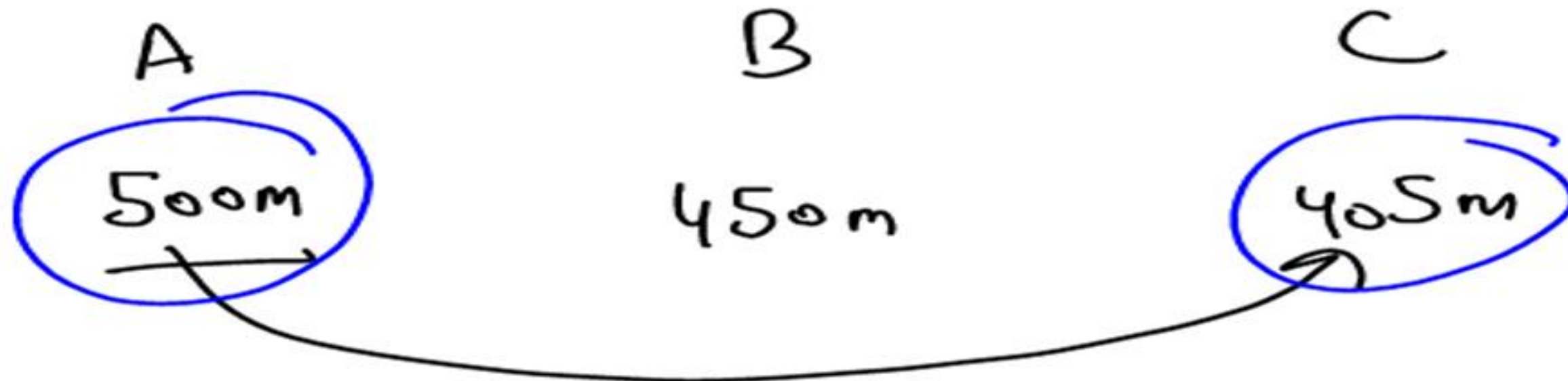A   B

1000M   900 m $\left(\downarrow, 10\% \right)$

Eg. In a race of 1000 metres, A can beat B by 100 metres. In a race of 400 metres, B beats C by 40 metres, in a race of 500 metres, A will beat C by

(a) 95 metres

B   C $\left(\downarrow, 10\% \right)$

400m   360m

Time 60sec

(b) 100 metres
(c) 45 metres
(d) 60 metres

A   B   C

500m   450m   405m

$9 \text{km}/\text{hr} \rightarrow \mathcal{9} - \dfrac{5}{\cancel{18}^2} \text{ m/sec}$

Eg. In a 100 m race A runs at a speed of 9 Km/Hr. He gives a start of 10 m to B and still defeat him by 10 sec. find speed of B.
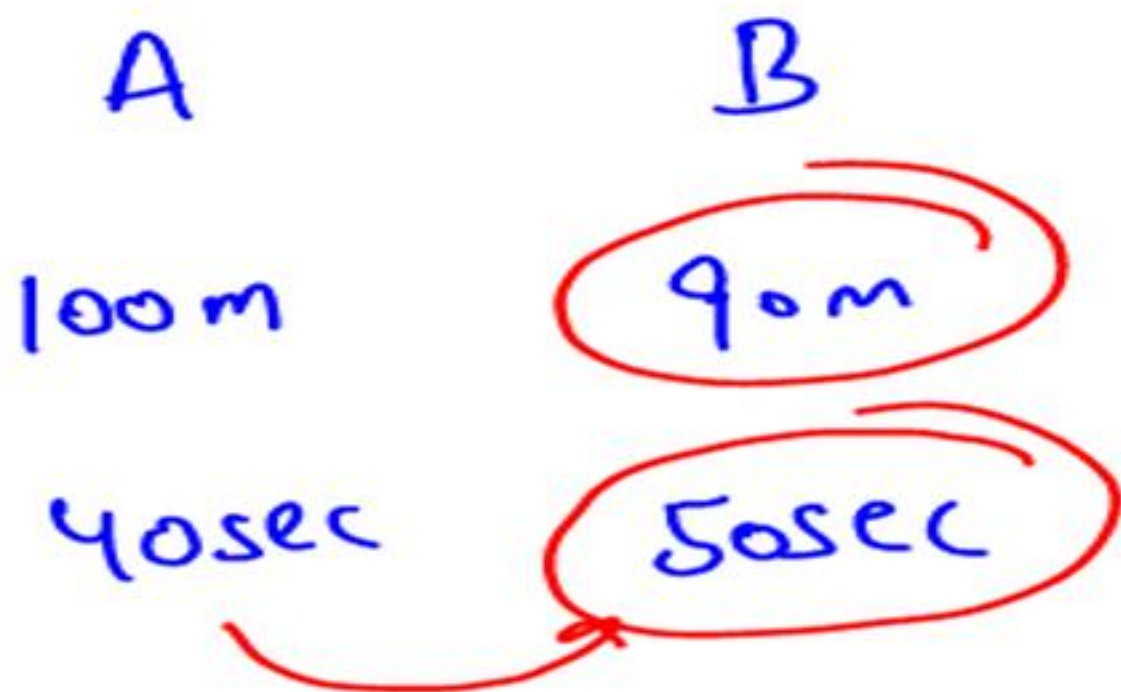
Time 75sec

$T_A = \dfrac{100-2}{5} = 40\text{sec}$

(a) $6\dfrac{12}{25}$ km/hr ✓

(b) $6\dfrac{16}{25}$ km/hr

(c) $6\dfrac{18}{25}$ km/hr

(d) $6\dfrac{21}{25}$ km/hr

A   B

100m   90m

40sec   50sec
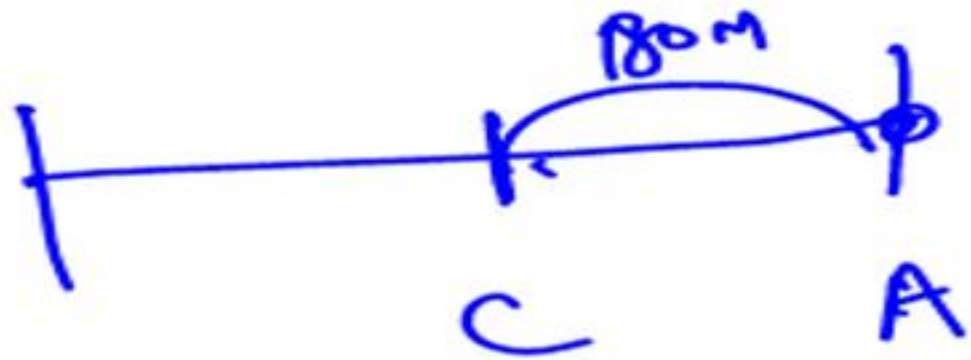
$\dfrac{9\cancel{0}}{5\cancel{0}} \times \dfrac{18}{5} = \dfrac{162}{25}$

Eg. In a Km. race, A beats B by 30 seconds and B beats C by 15 seconds. If A beats C by 180m, the time taken by A to run 1 km is :

(a) 250 sec.   (b) 205 sec.

(c) 200 sec.   (d) 210 sec.

A

100 m

1000 m

T

C

$(T+45)$ sec

80 m

C   A

$\dfrac{180}{45} = 4m/sec$

$\dfrac{1000}{4} = T+45$

$T = 205 sec$

C

A

1000M

T

C

1000 m

T+55sec

Eg. A and B run 1 km and A wins by 25 second. A and C run 1 km and A wins by 275 metre. When B and C run the same distance, B wins by 30 seconds. The time taken by A to run 1 km is

(a) 2 min 25 sec   (b) 2 min 50 sec
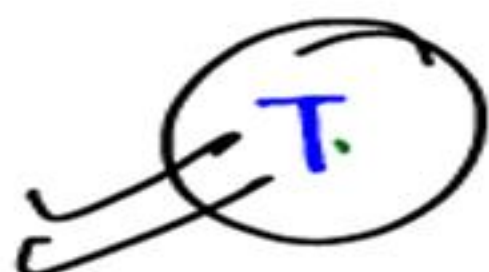(c) 3 min 20 sec   (d) 3 min 30 sec

Time → 75sec

$$\text{Speed of } C = \frac{275}{55} \quad 5m/sec$$

$$\frac{1000}{5} = T + 55$$

$$T = 145sec$$

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V.Amp

Eg. In a race of 1 km, A gives B a start of 100 metres and still wins by 20 seconds. But if A gives B a start of 25 seconds, B wins by 50 metres. The time taken by A to run 1 km is

Time → 2min

A
1000 m

$(T.)$

B
900 M

$(T+20)sec$

(a) 17 second

(b) $\dfrac{500}{29}$ second

(c) $\dfrac{1200}{29}$ Second

(d) $\dfrac{700}{29}$ second

A
950m

$(T.')$

$\left(\dfrac{19}{20}T\right)$

B
1000m

$(T+25)sec$

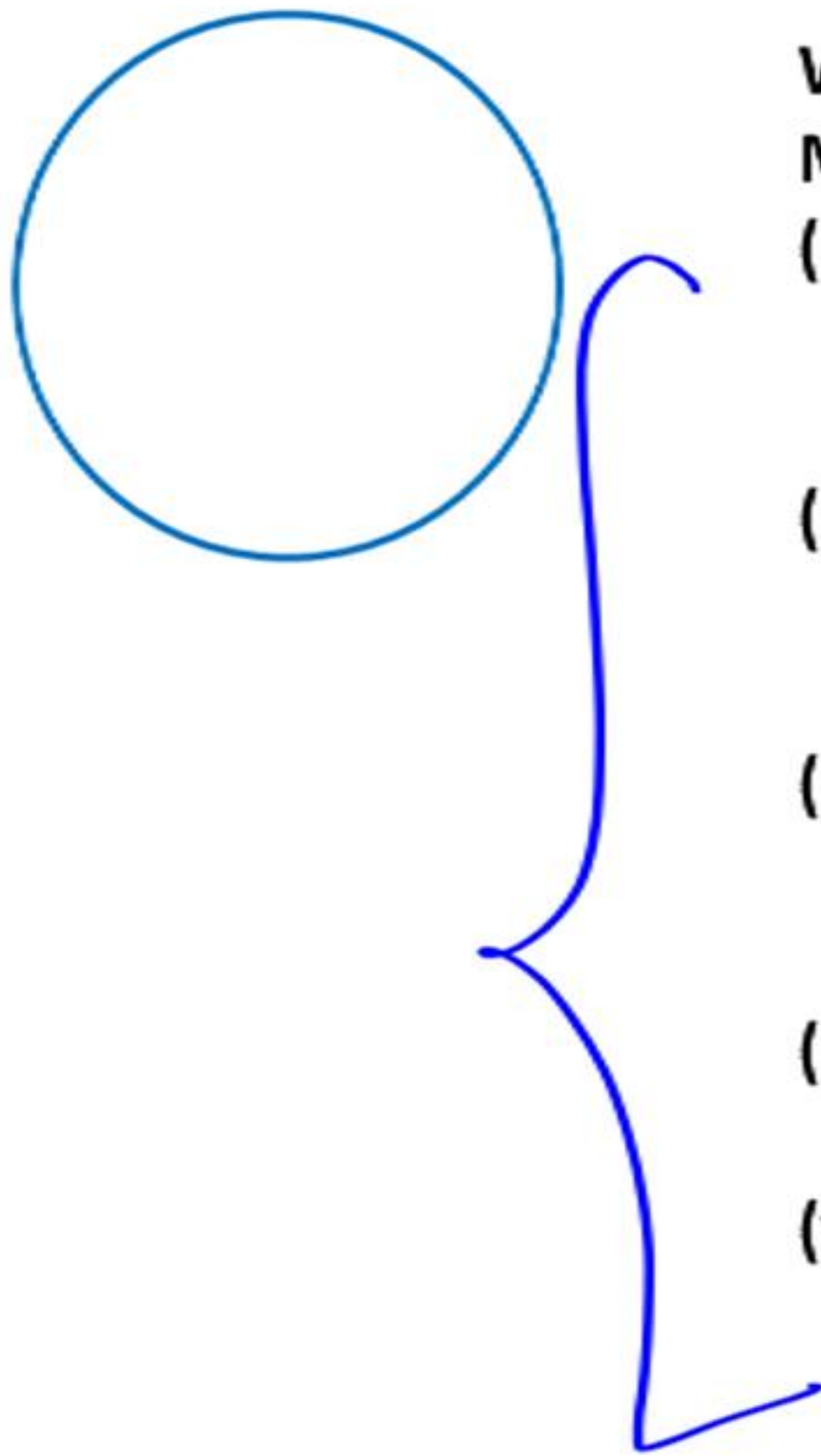$\left(\dfrac{19}{20}T+25\right)$

1000 m ⟶ T

$\dfrac{T}{1000} \cdot \dfrac{950}{20}$ A

$\dfrac{900}{T+20} = \dfrac{1000}{\dfrac{19}{20}T+25}$

$\dfrac{171}{20}T + 225 = 10T + 200$

CIRCULAR MOTION

Circular Track

What kind of questions are asked on Circular Motion?

(i) After how many seconds they will meet for the first time?

(ii) After how many seconds they will meet for the first time at starting point?

(iii) At how many points on the track they will meet?

(iv) When will be their n^{th} meeting?

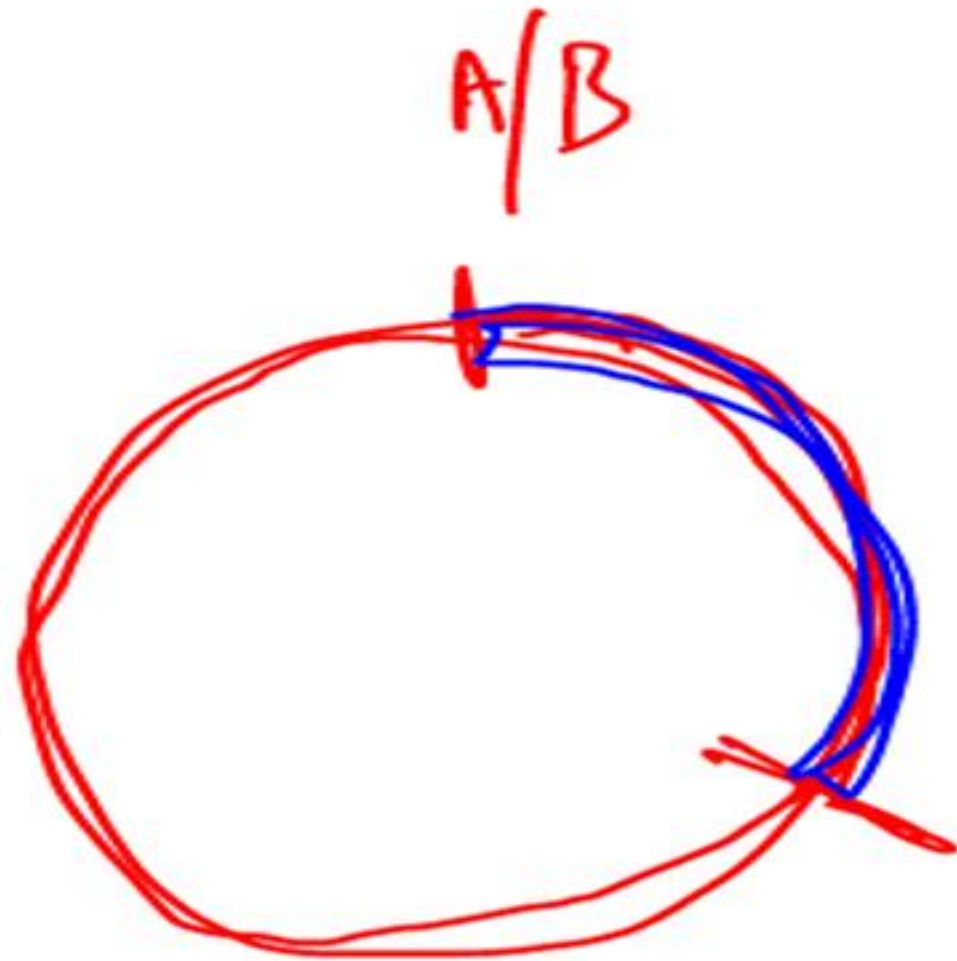(v) At what distance the nth meeting will take place?

Just imagine,
Two persons are running on circular track, when they will meet for the first time?
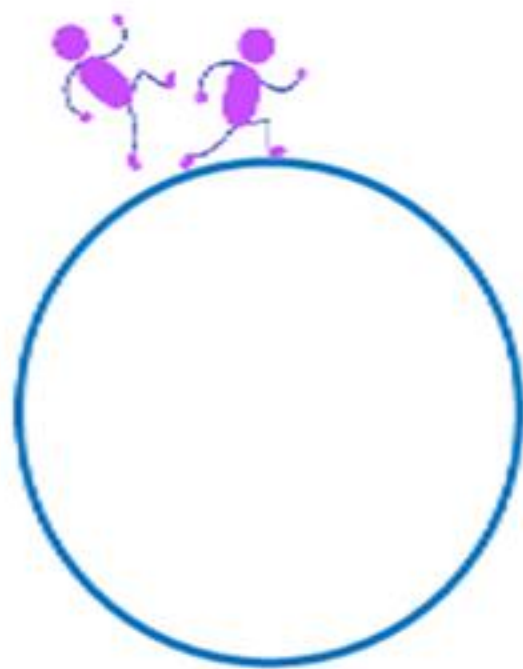
* They will meet for the first when the faster one has cover 1 Round more.

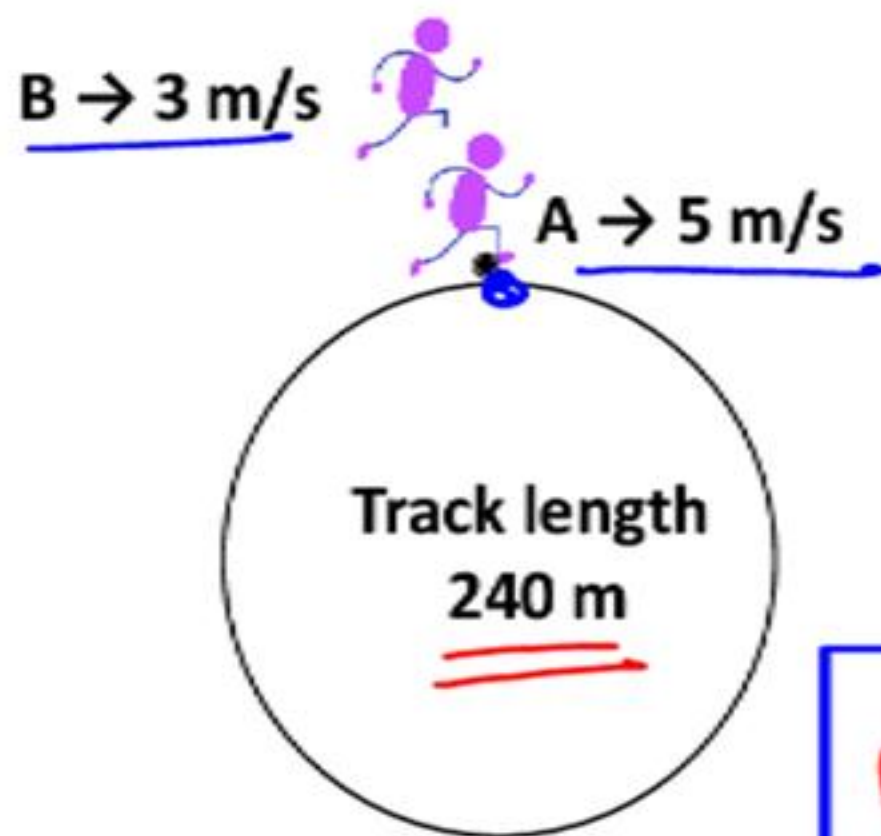**For the first meeting the faster one has to travel one round more than the slower one.**

A/B

Slow	Fast
A	B
x round	(x+1) round
0.4	1.4

1st meeting

1st meeting

B → 3 m/s

A → 5 m/s

Track length
240 m

A → 5 m/s ; B → 3 m/s ;
Track length → 240 m
If they start simultaneously from the same point in the same direction.
(i) After how many seconds they will meet for the first time?

First meeting → $\dfrac{\text{Track length}}{\text{Relative speed}}$

$$= \dfrac{240}{2} = 120 \text{ sec}$$

Ans 1

Ans. 120 sec

B → 3 m/s

A → 5 m/s

Track length
240 m

A → 5 m/s ; B → 3 m/s ;
Track length → 240 m
If they start simultaneously from the same
point in the same direction.
(ii) After how many seconds they will meet
    for the first time at starting point?
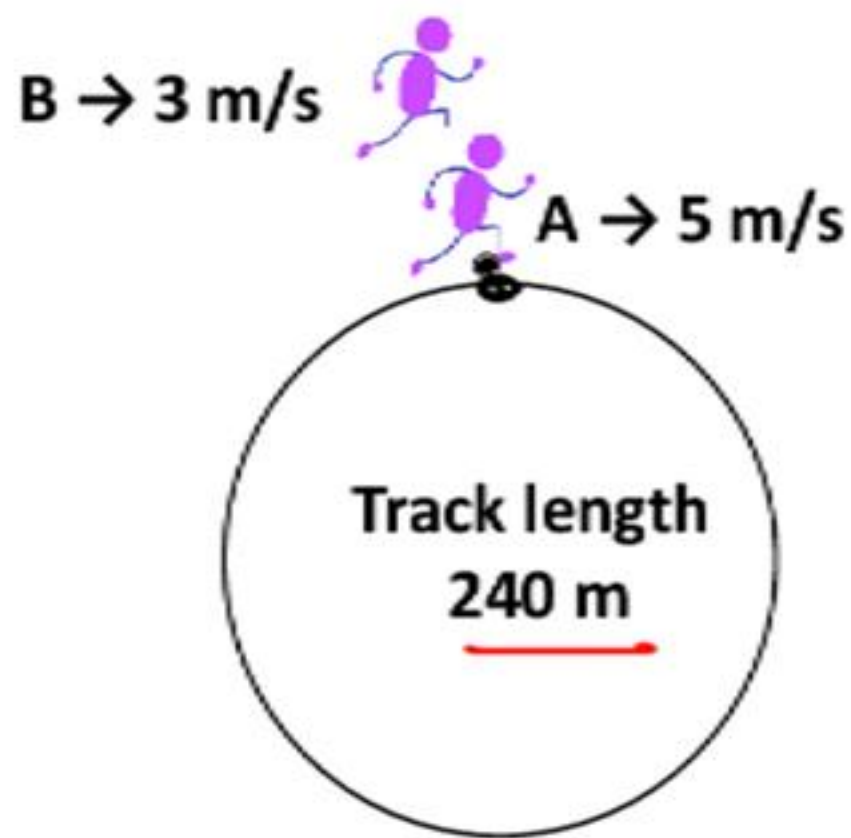
T_A → Time taken by A
to cover 1 Round

T_B → Time taken by B
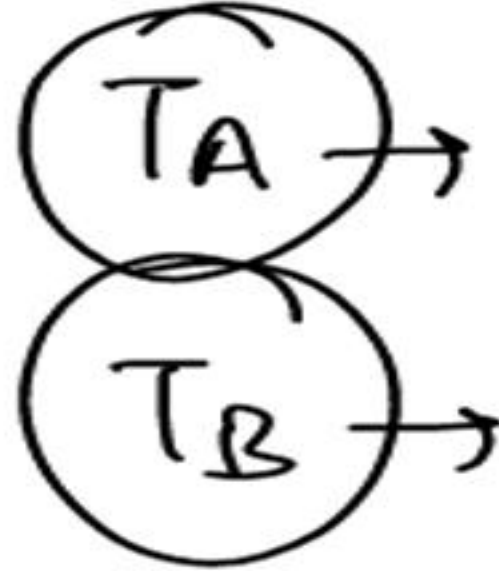to cover 1 Round

$$T_A = \frac{240}{5} = 48 \, sec$$

$$T_B = \frac{240}{3} = 80 \, sec$$

$$LCM \ of \ (48 \& 80) = 240 \, sec$$

Ans2

Ans. 240 sec

First meeting at starting pt
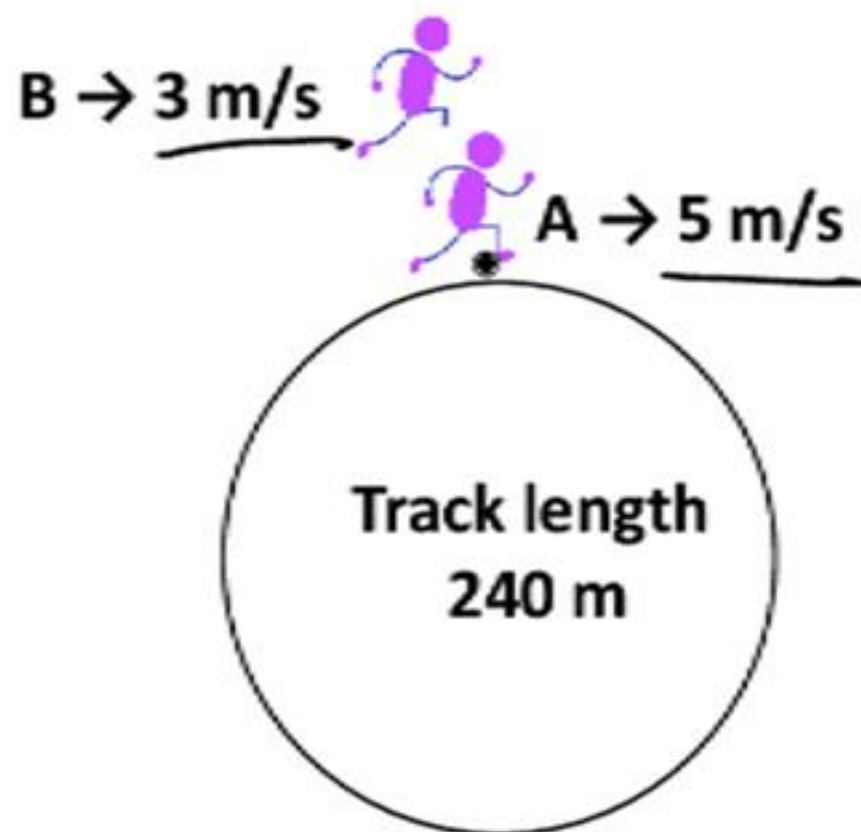
T_A →

T_B →

$(LCM \text{ of } T_A \text{ & } T_B)$

B → 3 m/s

A → 5 m/s

Track length
240 m

A → 5 m/s ; B → 3 m/s ;

Track length → 240 m

If they start simultaneously from the same point in the same direction.

(iii) At how many points on the track they will meet?

(i)

No. of pts → $\dfrac{Ans\ 2}{Ans\ 1}$ ✓

(ii)   Better Approach   Same

$$A \qquad B \qquad (5-3)$$

$$\underline{5} \quad : \quad \underline{3} \quad = \underline{2\ pts}$$

2 pts

3 pts

4 pts
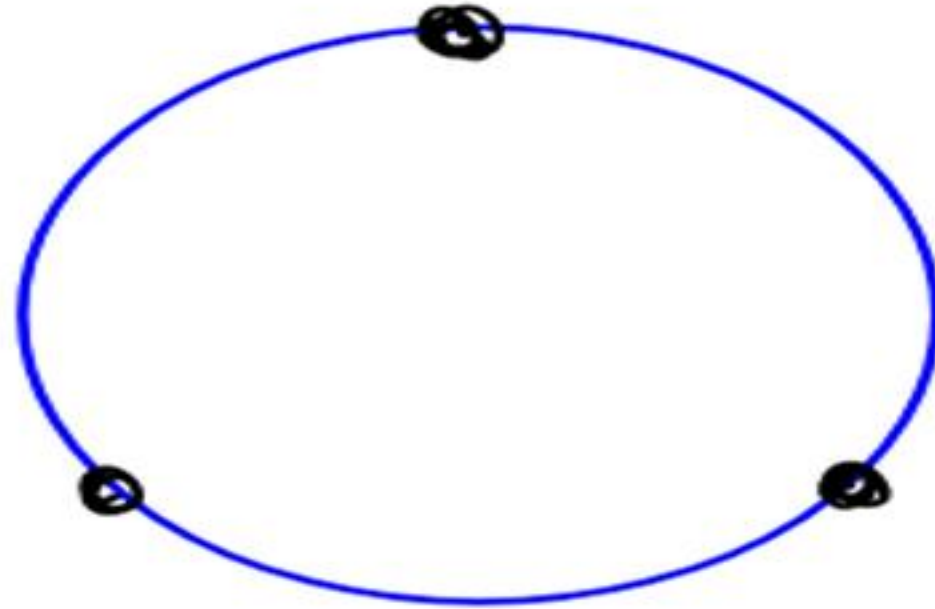
6 pts
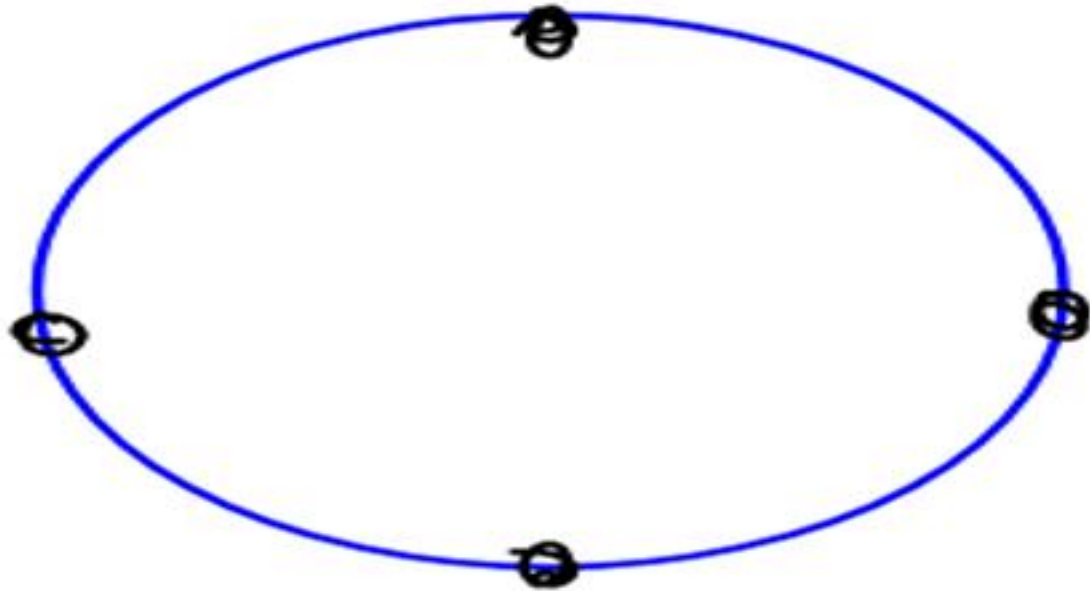
B → 4 m/s
A → 9 m/s
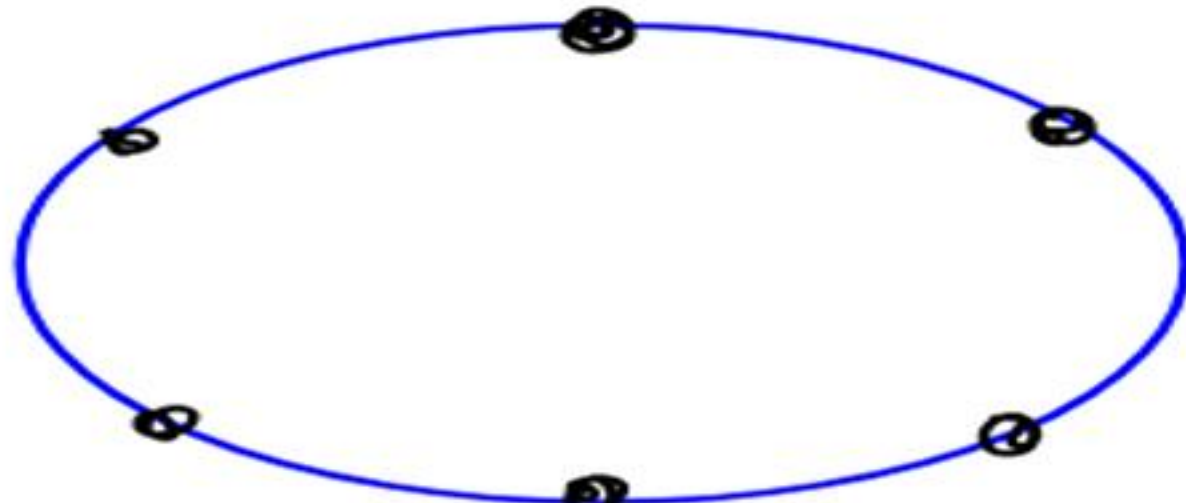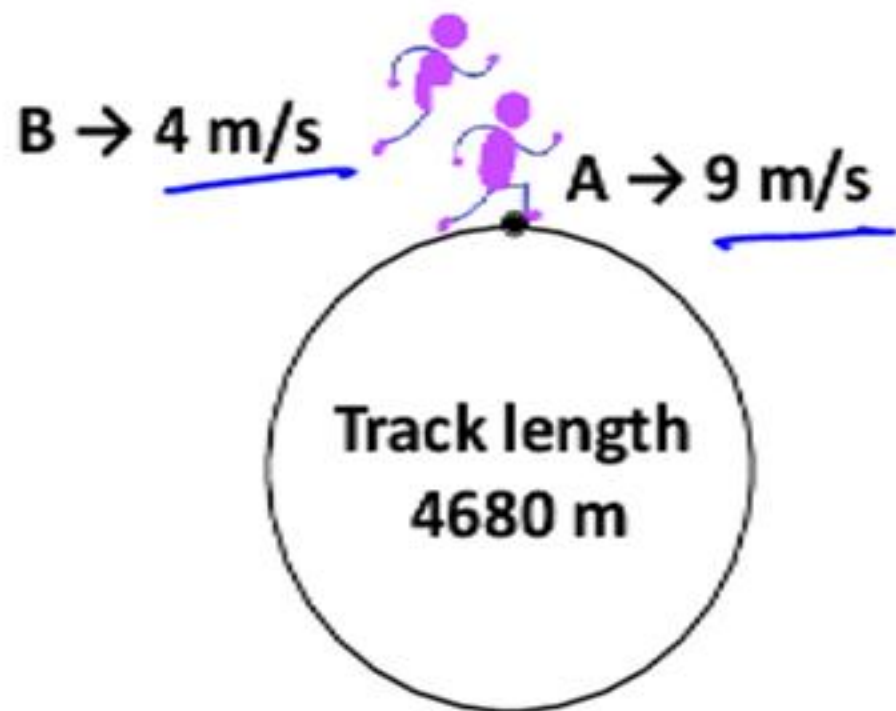
Track length
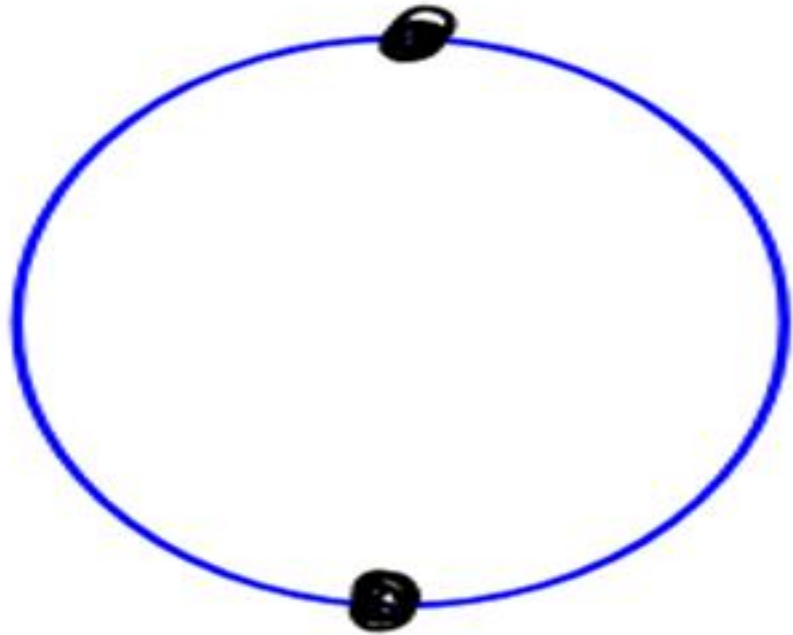4680 m

Q1. A → 9 m/s ; B → 4 m/s ;
Track length → 4680 m
If they start simultaneously from the same point in the same direction.

(i) After how many seconds they will meet for the first time?

$$\rightarrow \quad \frac{4680}{5} = 936 \, sec$$

$$T_A = \frac{4680}{9} = 520 \left. \vphantom{\frac{4680}{9}} \right\} \, g$$

$$T_B = \frac{4680}{4} = 1170 \left. \vphantom{\frac{4680}{4}} \right\}$$

(ii) After how many seconds they will meet for the first time at starting point?

$$\longrightarrow \quad 4680 \, sec$$

(iii) At how many points on the track they will meet?

$$9:4 \longrightarrow 9-4$$
$$= 5 \, pts$$

Ans.
(i) 936 sec　　　　(ii) 4680　　　　(iii) 5 points

B → 3 m/s

A → 5 m/s
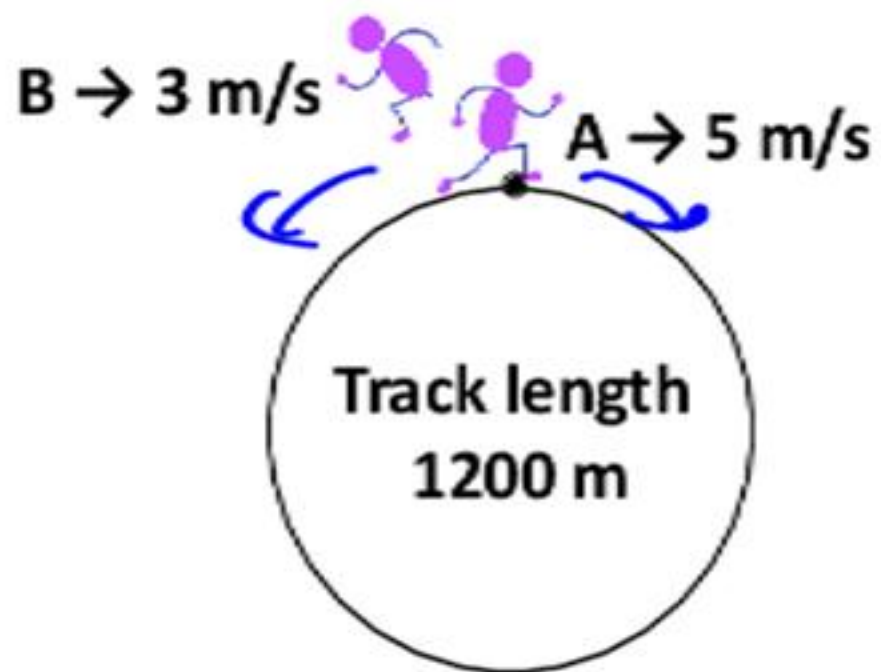
Track length
1200 m

$T_A = 240 sec$
$T_B = 400 sec$

Q2. A → 5 m/s ; B → 3 m/s ;
Track length → 1200 m
If they start simultaneously from the same point
in the opposite direction.
(i) After how many seconds they will meet for
the first time?

$$\frac{1200}{8} = 150 sec$$

(ii) After how many seconds they will meet for
the first time at starting point?

1200 sec

(iii) At how many points on the track they will
meet?

3 : 5   (3+5)
          = 8 pts

Ans.

(i) 150 sec   (ii) 1200 sec   (iii) 8 points
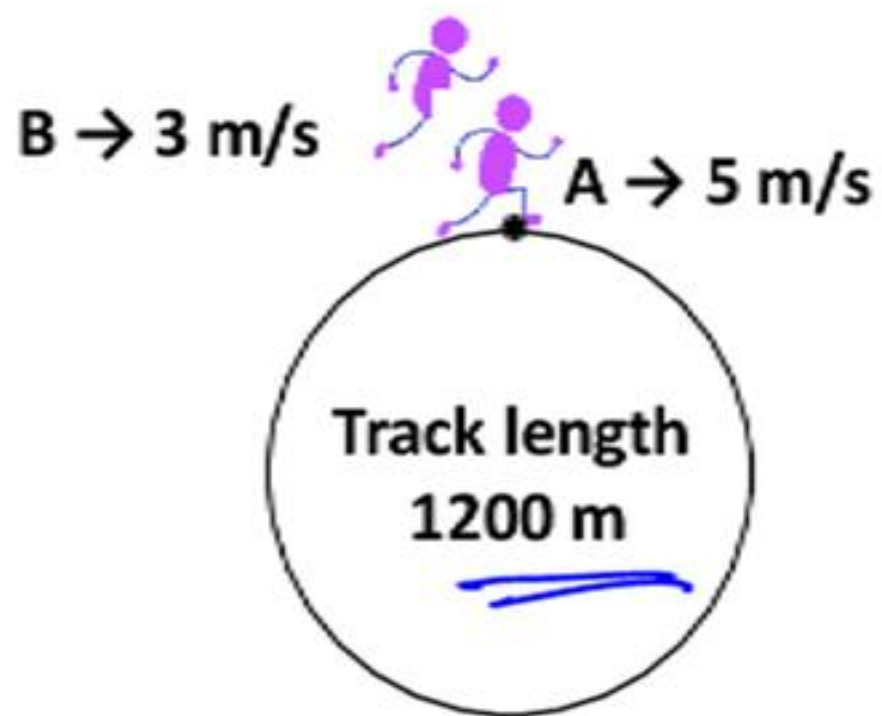
B → 3 m/s

A → 5 m/s

Track length
1200 m

Q3. A → $\underline{5 \text{ m/s}}$; B → $\underline{3 \text{ m/s}}$; Track length → $\underline{1200 \text{ m}}$

If they start simultaneously from the same point in the same direction.

At what distance from the starting point their 79th meeting will take place?

No. of meeting pts

$5 - 3 = 2$ pts

2nd / 4th

@ 600m

1st / 3rd ---- 79th
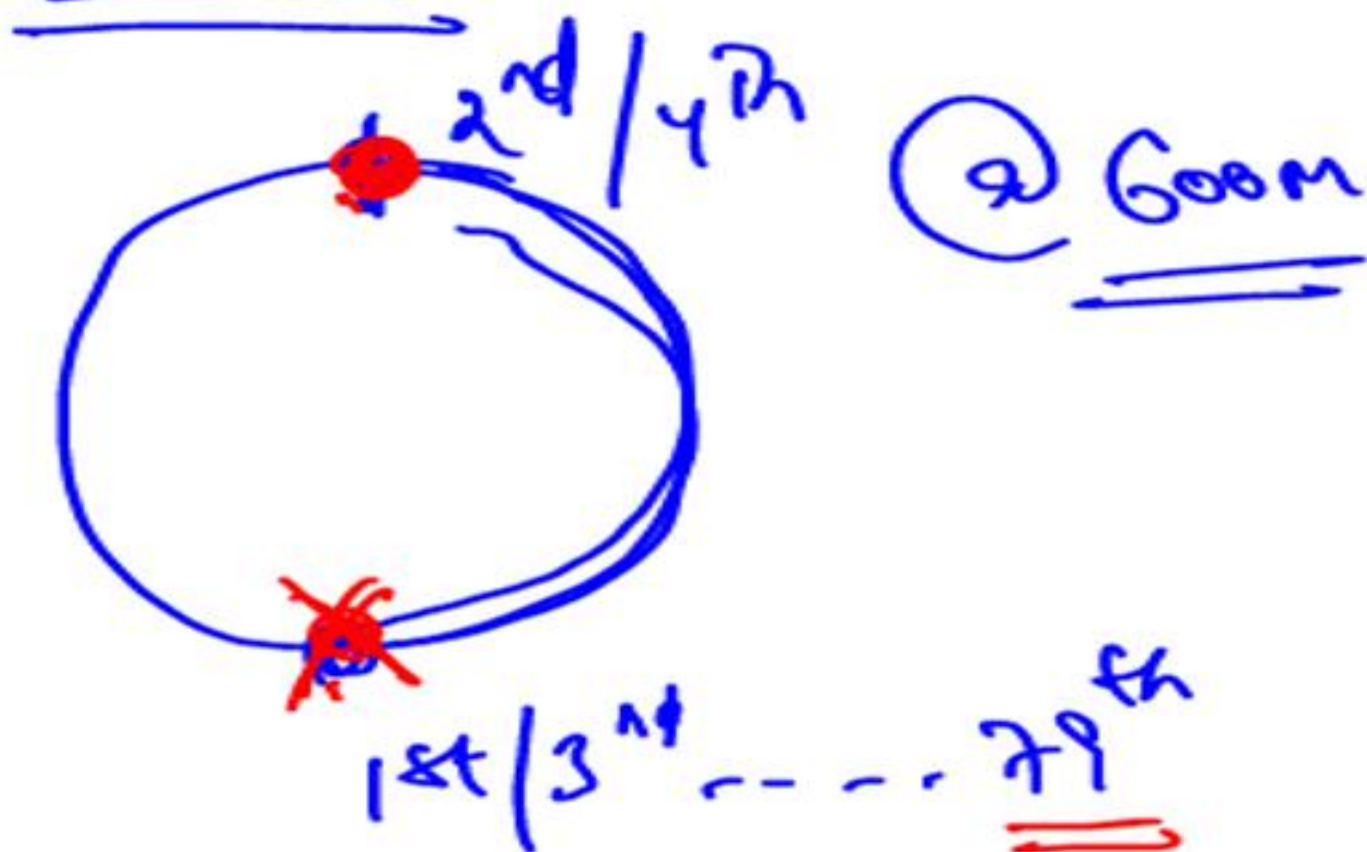
Ans. 600 m

B → 30 m/s   A → 50 m/s
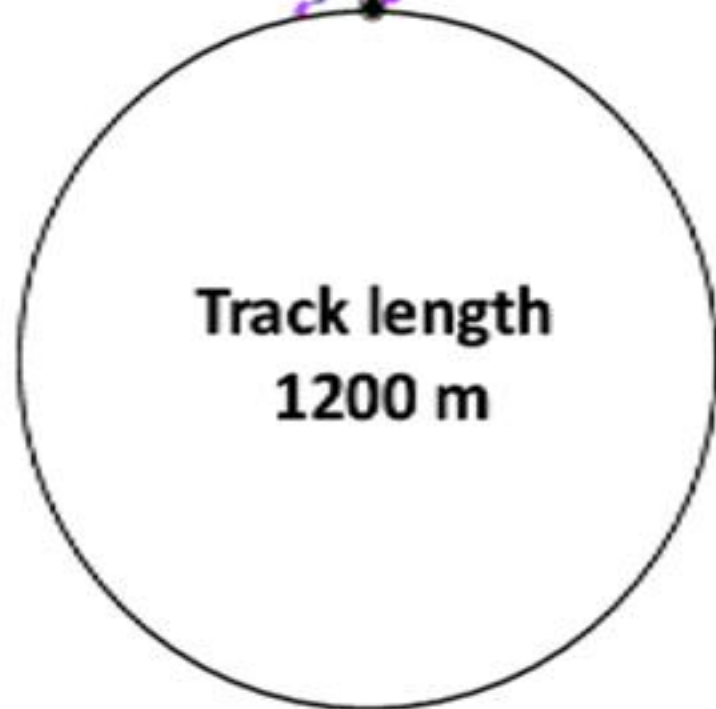
Q4. A → 50 m/s ; B → 30 m/s ;
Track length → 1200 m

Track length
1200 m

A : B

5 : 3

Find the no. of meetings of A and B
in the time interval in which B has
covered 18 rounds.

2 min

(i) **Same direction**

A	B	Cap	No
5R	3R	2R	2
	↳ 18R		12

(ii) **Opposite direction**

A   B
5R   3R
          18R

No. of meeting
48 meeting

Ans. 12
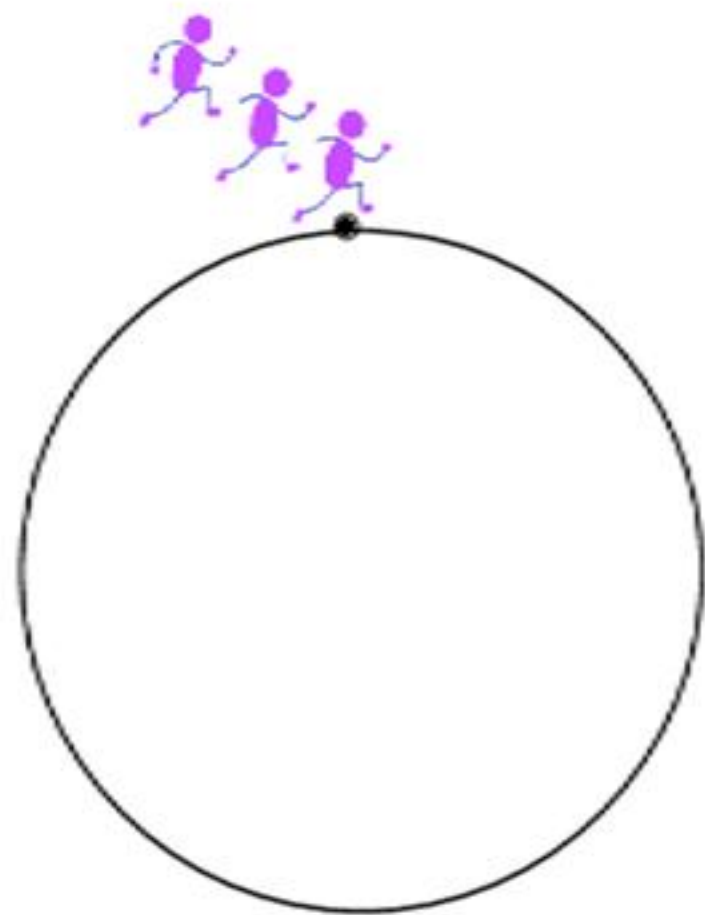
If there are **3 persons** who were running on a circular track.

Q1 when they will meet for FIRST TIME

Sol^n

T(AB) first meeting $\longrightarrow$ x sec

T(BC) first meeting $\longrightarrow$ y sec

$$\boxed{\text{LCM of } x \text{ & } y}$$

Q2   first meeting @ staring Pt

Sol^M T_A

T_B $\longrightarrow$ LCM

T_C
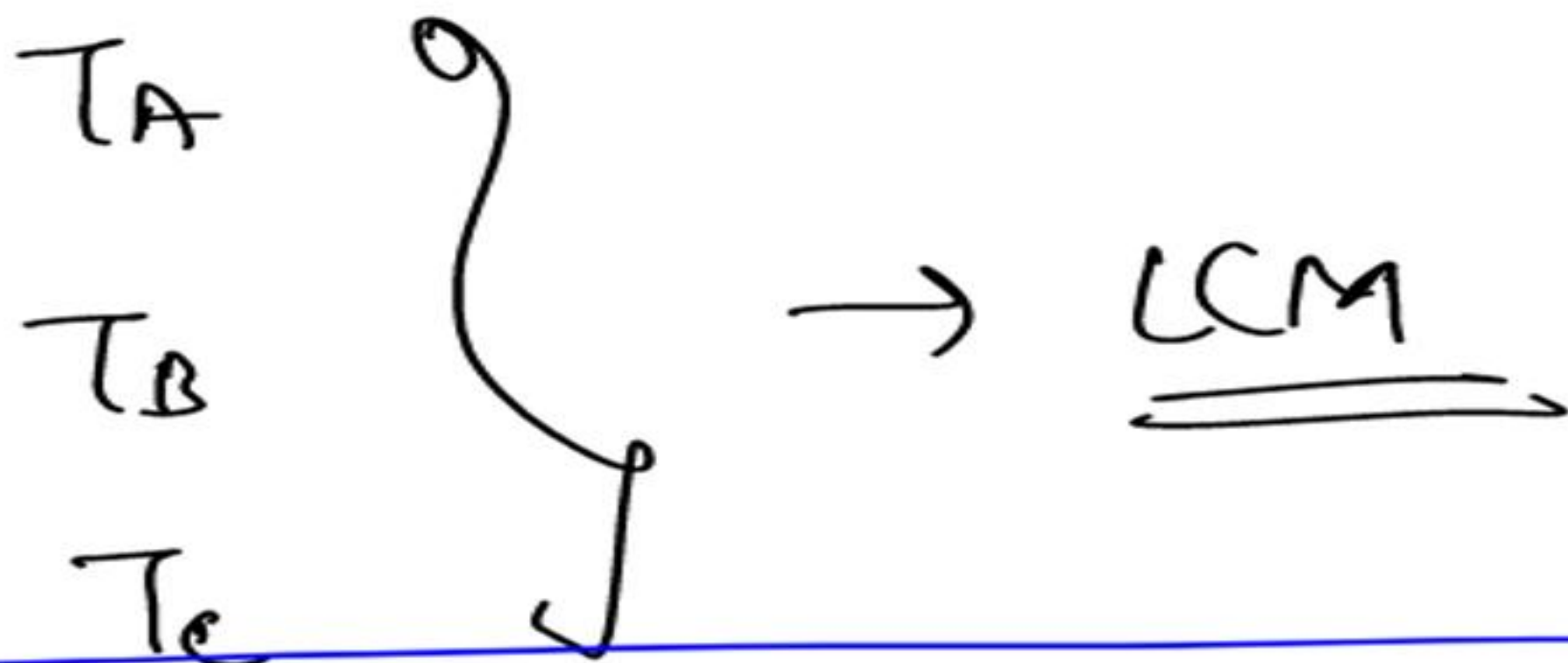
Q3   No. of meeting pts

AB meetings $\longrightarrow$ m   HCF of m & n

BC meetings $\longrightarrow$ n

1. A runs $1\frac{2}{3}$ times as fast as B. If A gives B a start of 80 m, how far must the winning post from the starting point be so that A and B might reach it at the same time?

(a) 200 m
(b) 300 m
(c) 270 m
(d) 160 m

Ans. (a)

2. The ratio of speeds of X and Y is 5 : 6. If Y allows X a start of 70 m in a 1.2 km race, then who will win the race and by what distance?
(a) X wins the race by 30 m
(b) Y wins the race by 90 m
(c) Y wins the race by 130 m
(d) The race finishes in a dead heat

Ans. (c)

3. In a 100 m race, A runs at 6 km/hr. If A gives B a start of 8 m and still beats him by 9 seconds, what is the speed of B?

(a) 4.6 km/hr   (b) 4.8 km/hr
(c) 5.2 km/hr   (d) 5.4 km/hr

Ans. (b)

4. In a race of 1000 m, A beats B by 150 m, while in another race of 3000 m, C beats D by 400 m. Speed of B is equal to that of D. (Assume that A, B, C and D run with uniform speed in all the events). If A and C participate in a race of 6000 m, then which one of the following is correct?

(a) A beats C by 250 m

(b) C beats A by 250 m

(c) A beats C by 115.38 m

(d) C beats A by 115.38 m

Ans. (c)

5. In a race A, B and C take part. A beats B by 30 m, B beats C by 20 m and A beats C by 48 m. Which of the following is/are correct?

1) The length of the race is 300 m.

2) The speed of A, B and C are in the ratio 50 : 45 : 42.

Select the correct answer using the code given below:

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

Ans. (c)

6. In a race of 1000 m, A beats B by 100 m or 10 seconds. If they start a race of 1000 m simultaneously from the same point and if B gets injured after running 50 m less than half the race length and due to which his speed gets halved, then by how much time will A beat B?

(a) 65 seconds

(b) 60 seconds

(c) 50 seconds

(d) 45 seconds

Ans. (a)

7. In a 300m race A runs at a speed of 9 km/hr. He gives a start of 30m to B and still defeats him by 15 sec. What is the speed of B?

(a) 6.3 km/hr (b) 8.1 km/hr

(c) 7.2 km/hr (d) 8 km/hr

Ans. (c)

8. Priya can run 250m in 15 seconds and Payal in 20 seconds. How many meters start can Priya give to Payal in one km race so that the race may end in a dead-heat?

(a) 100 m

(b) 250 m

(c) 150 m

(d) 50 m

Ans. (b)

9. A gives B, a start of 30 m or 10 seconds and end up the race of 1 km in dead heat. What is the ratio of speeds of A and B ?

(a) 50:47

(b) 100:95

(c) 10:9

(d) 100:97

Ans. (d)

10. In a one km race, A gives B a start of 100 m and in a one km race, B gives a start of 80 m to C. In a 1 km race among all three, by how much distance will the 2nd worst performer win from the worst performer?

(a) 72m

(b) 64m

(c) 108 m

(d) 172 m

Ans. (a)

11. In a 1 km race A wins over B by 80 m or 20 seconds. B can give a start of 100 m to C in 1 km race. Find out that by how much time A will win over C ? Also, find the ratio of speeds of B and C.

(a) 47.77 sec, 10:9

(b) 45 sec, 8:9

(c) 47.77 sec, 8:9

(d) 46.67 sec, 10:9

Ans. (a)

12. In a race of senior citizens, Mr. A can give his fiend Mr. B a start of 20 m and Mr. C a start of 39 m in a race of 100 m. How much start can Mr. B give Mr. C in a 100m race ?

(a) 10 m

(b) 15 m

(c) 18 m

(d) 23.75 m

Ans. (d)

13. In a 6 km race B has 250 m head start and C has 500 m head start by A, still A beats C and B by 235 m and 350 m respectively. How many metres start up can B give to C so as to end up the race at the same time with C in the race of 6 km. Also find the ratio of speeds of A : B : C.

(a) 150 m, 400:360:351

(b) 175 m, 200:180:125

(c) 150 m, 400:350:270

(d) 175 m, 200:170:251

Ans. (a)

14. A Rabbit and a turtle started a race of 2 km with speed 3 m/s and 5 m/min respectively. After taking some rest during the race, the rabbit again started with same speed. If turtle reached the destination 5 min earlier than rabbit, find the times wasted by rabbit.

(a) 6 hours

(b) $6\dfrac{61}{108}$ hours

(c) $6\dfrac{60}{108}$ hours

(d) $6\dfrac{2}{3}$ hours

Ans. (b)

15. In a 1000 metres race Ravi gives Vinod a start of 40m and beats him by 19 seconds. If Ravi gives a start of 30 seconds then Vinod beats Ravi by 40m. What is the ratio of speed of Ravi to that of Vinod?

(a) 4 : 5

(b) 6 : 5

(c) 3 : 8

(d) 5 : 4

Ans. (b)

16. A, B and C at the same time in the same
direction to run around a circular stadium. A
completes a round in 252 seconds, B in 308
seconds and C in 198 seconds, all starting at
the same point. After what time will they
next meet at the starting point again?
(a) 46 minutes 12 seconds
(b) 45 minutes
(c) 42 minutes 36 seconds
(d) 26 minutes 18 seconds

Ans. (a)

17. A, B and C start together from the same place to walk round a circular oath of length 12km. A walks at the rate of 4 km/hr. B 3 km/hr. and C 3/2 km/hr. they will meet together at the starting place at the end of

(a) 10 hours
(b) 12 hours
(c) 15 hours
(d) 24 hours

Ans. (d)

18. Peehu and Ayu are running on a 28m diameter circular path. Speed of Peehu is 48m/sec and speed of Ayu is 40m/sec . They Start from same point in same direction at a time. When will they met first time with each other?

(a) 8 sec   (b) 11 sec

(c) 13 sec   (d) 14 sec

Ans. (b)

19. A person wants to plant trees at the edge of a circular field of radius 63 km at every 6 km of distance. Find the no. of trees he will have to buy for this purpose?

(a) 66

(b) 44

(c) 22

(d) 110

Ans. (a)

20. Raunak and Rohit run around a circular track. they simultaneously start running in the same direction. Raunak runs at the speed of 8 m/s and Rohit runs at a speed of x m/s (x>8m/s). If they cross each other at exactly three points on this track. find the value of x (which is less than 30).

(a) 16   (b) 24
(c) 20   (d) 28

Ans. (c)

21. At a circular track, A walks with a speed of one rotation/hour and B walks with a speed of six rotation/hour. Both starts moving in same direction at 7:30 am then at what time, both will cross each other.
(a) 7:42 A.M.
(b) 7:48 A.M.
(c) 8:10 A.M.
(d) 8:30 A.M.

Ans. (a)

22. 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?

(a) 6 km

(b) 8 km

(c) 12 km

(d) 3 km

Ans. **(a)**

23. 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.

(a) 2

(b) 3

(c) 1

(d) Cannot be determined

Ans. (a)

24. 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.

(a) 1 : 3   (b) 2 : 5

(c) 2 : 3   (d) 1 : 2

Ans. (a)

25. 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?

(a) 7 : 13

(b) 3 : 10

(c) 3 : 7

(d) 30 : 13

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