



## SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai  
Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &  
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)



### Races

A race or a games of skill includes the contestants in a contest and their skill in the concerned contest/game.

#### Important Terms:

**Race :** A race is a contest of speed in running, driving, riding, sailing or rowing.

**Race Course :** The ground/path on which a contest is organized in a systematic way, is called a race course.

**Starting point :** The exact point/place from where a race begins, is called starting point.

**Start :** If two persons A and B are contesting a race and before the start of the race, A is at the starting point and B is ahead of A by 20 m, then it is said that A gives B a start of 20 m.

**For example,** If A and B are the contestants for a 100 m race and A has to cover 100 m, while B has to cover  $(100-20)=80$  m.

**Finishing point :** The exact point/place where a race ends, is known as finishing point.

**Winning Point /Goal :** A person who reaches the finishing point first, is called the winner.

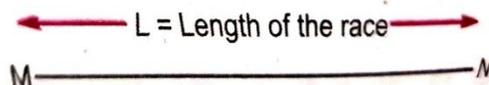
**Note:** For a winner, finishing point is as same as the winning point/goal.

**Dead Heat race :** A race is said to be a dead heat race, if all the contestants reach the finishing point exactly at the same time.

#### Some Facts about Race:

For Two Contestants A and B:

1. If A beats B by  $x$  m, then



Distance covered by A ( winner) =  $L$  m

Distance covered by B (loser) =  $(L - x)m$



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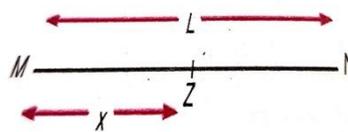
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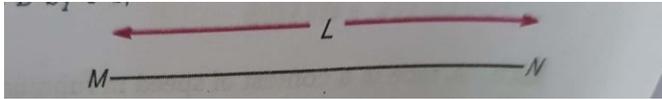
2. If B starts from  $x$  m ahead of A (or A gives B a start of  $x$  m), then



A starts from M and B starts from Z.

Distance covered by B =  $(L - x)m$

3. If A beats B by T s, then

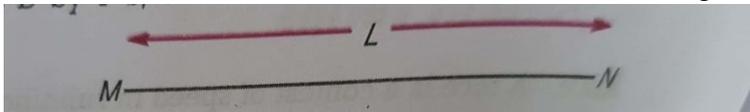


A and B both start from point M.

Time taken by A (winner) = Time taken by B (loser) - T

It means that A completes the race in T s less time than that of B.

4. If B starts the race T s before the time A starts (or if A gives B a start of T s), then



In such case, we say that A starts T s after the time B starts.

5. If both of the contestants get at the finishing point at the same time, then

Difference in time of defeat = 0 ; Difference in distance of defeat = 0

**Example : 1** In a race of 100 m, A gives B a start of 10 m. What distance will be covered by B?

**Solution:** Required distance =  $(100-10) m = 90 m$ .

**Example : 2** In a race, x gives y a start of 30 m making length of race for y a distance of 170 m. Find the total length of race.

**Solution :** Required length =  $(170+30) = 200 m$

**Example : 3** In a 300 m race, M gives some start to N and this makes the length of race for N 225 m. What start does N get from M?

**Solution :** Start given by M to N =  $(300-225) = 75 m$ .



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**Example:4** In a 100 m race, Ajay runs at the speed of 4 km/h. Ajay gives Brijesh a start of 4 m and still beats him by 15 s. Find the speed of Brijesh.

**Solution :** Time taken by Ajay to cover 100 m =  $\left(\frac{60 \times 60}{4000} \times 100\right) s = 90 s$

Brijesh covers ( 100 – 4) = 96 m in ( 90 + 15) = 105 s.

Brijesh's speed =  $\frac{96}{105} m/s = \frac{96}{105} \times \frac{18}{5} = 3.29 km/h$

**Example : 5** P covers 1 km in 4 min 40 s, while Q covers the same distance in 5 min. By what distance does P defeat Q?

**Solution :** Clearly, P beats Q by 20 s.

Distance covered by Q in 20 s =  $\frac{1000}{300} \times 20 = 66\frac{2}{3} m$ .

**Example : 6** A can run 1 km in 5 min and B can run the same distance in 6 min. How many metres start, can A give to B in 1 km race, so that the race may end in a dead heat?

**Solution:** Time taken by A to run 1 km = 300 s and Time taken by B to run 1 km = 360 s.

A can give B a start of (360-300) = 60 s

In 360 s, B runs 1000 m.

In 60 s, B runs  $\frac{1000}{360} \times 60 m = \frac{1000}{6} m = \frac{500}{3} m = 166\frac{2}{3} m$

Hence, A can give a start of  $166\frac{2}{3} m$ .

**Example : 7** In a game of 100 points, A scores 100 points, while B scores only 75 points. In this game, how many points can A give to B?

**Solution :** Score of A = 100 points and Score of B = 75 points

A can give (100 – 75) = 25 points to B.

**Example : 8** In 100 m race, A runs at 8 km/h. If A gives B a start of 4 m and still beats him by 15 s, then what is the speed of B?

**Solution:** Time taken by A to cover 8 km = 1 h

Time taken by A to cover 8000 m = 60 × 60 s

Time taken by A to cover 100 m =  $\frac{60 \times 60}{8000} \times 100 = 45 s$

Now, B covers (100-4) = 96 m in (45 + 15 ) = 60 s

B's speed =  $\frac{\text{Distance covered}}{\text{Time taken}} = \frac{96}{60} m/s = \frac{90 \times 60 \times 60}{60 \times 1000} km/h = 5.76 km/h$ .



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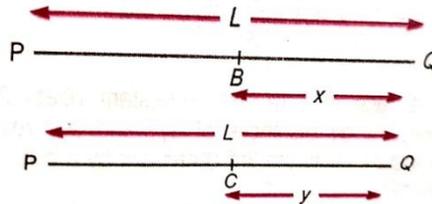
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For Three Contestants A, B and C:



Let A, B and C participate in a race of  $L$  m.

Let A comes 1<sup>st</sup> in the race by beating B by  $x$  m and C by  $y$  m, respectively.



Here, the values of  $x$  and  $y$  will decide 2<sup>nd</sup> and 3<sup>rd</sup> positions.

If  $x < y$ , then B will beat C, ie., B will get the 2<sup>nd</sup> position.

If  $x > y$ , then C will beat B, ie., C will get the 2<sup>nd</sup> position.

**Example : 9** A, B and C are three contestants in 1 km race. If A can give B a start of 40 m and A can give C a start of 64 m, how many metres start can B give C?

**Solution:** While A covers 1000m, B covers  $(1000-40)= 960$  m and

C will cover  $(1000-64)=936$  m.

So, when B covers 1000 m, C will cover  $\left(\frac{936}{960} \times 1000\right) = 975$  m

B can give C a start of  $(1000-975)$ m ie., 25 m.

## Technique : 1

For 2 contestants, following relation will be valid.

$$\frac{\text{Time taken by the winner}}{\text{Distance covered by the loser}} = \frac{\text{Time taken by the loser}}{\text{Distance covered by the winner}}$$

$$= \frac{\text{Difference of winning time} + \text{Initial time}}{\text{Difference of winning distance} + \text{Initial distance}}$$

**Example : 10** In 1 km race, A beats B by 36 m or 18 s. Find the A's time over the course.

**Solution :** Initial time = 0, Initial distance = 0, difference of winning time = 18 s and difference of winning distance = 36 m

$$\frac{\text{Time taken by the winner}}{\text{Distance covered by the loser}} = \frac{\text{Difference of winning time} + \text{Initial time}}{\text{Difference of winning distance} + \text{Initial distance}}$$

$$\frac{\text{Time taken by A}}{100 - 36} = \frac{18}{36}$$

Time taken by A =  $\frac{18}{36} \times 964 = \frac{1}{2} \times 964 = 482$  s



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### Technique : 2

If in a race of  $L$  m, 1<sup>st</sup> contestant beats 2<sup>nd</sup> contestant and 3<sup>rd</sup> contestant by distance of  $a_{12}$  and  $a_{13}$  respectively and the 2<sup>nd</sup> contestant beats the 3<sup>rd</sup> contestant by a distance of  $a_{23}$ , then we get the following relation  $(L - a_{12})a_{23} = L(a_{13} - a_{12})$

**Example : 11** P, Q and R are three contestants in a 2 km race. If P can give Q a start of 100 m and P can give R a start of 138 m, then how many metres start can Q give to R?

**Solution :** Here  $a_{12} = 100$  m,  $a_{13} = 138$  m,  $a_{23} = ?$  and  $L = 2000$  m

According to the formula,

$$\begin{aligned}(L - a_{12})a_{23} &= L(a_{13} - a_{12}) \\ (2000 - 100)a_{23} &= 2000(138 - 100) \\ 1900a_{23} &= 2000 \times 38 \\ a_{23} &= \frac{2000 \times 38}{1900} = \frac{760}{19} = 40 \text{ m}\end{aligned}$$

### Technique : 3

If in a race of  $L_1$  m, 1<sup>st</sup> contestant beats the 2<sup>nd</sup> contestant by a distance of  $a_{12}$ , in a race of  $L_2$  m 2<sup>nd</sup> contestant beats the 3<sup>rd</sup> contestant by a distance of  $a_{23}$  and in a race of  $L_3$  m 1<sup>st</sup> contestant beats the 3<sup>rd</sup> contestant by a distance of  $a_{13}$ , then for a race of  $L$  m

$$A_{12} = \frac{a_{12}}{L_1} \times L; A_{23} = \frac{a_{23}}{L_2} \times L; A_{13} = \frac{a_{13}}{L_3} \times L$$

Now, we get the following relation

$$(L - A_{12})A_{23} = L(A_{13} - A_{12})$$

**Example : 12** In a race of 1200 m, A can beat B by 120 m and in race of 500 m, B can beat C by 100 m. By how many metres will A beat C in a race of 800 m?

**Solution:** If A runs 1200 m, then B runs 1080 m.

If A runs 800 m, then B runs  $\left(\frac{1080}{1200} \times 800\right) = 720$  m

When B runs 500 m, then C runs 400 m.

When B runs 720 m, then C runs  $\left(\frac{400}{500} \times 720\right) = 576$  m

A beats C by  $(800 - 576)m = 224$  m.