

Races

"Race" is a competition of speeds. All participants of a race are required to run a specific distance; whoever does it in the minimum will be the winner of the race.

When all participants reach the finishing point at the same instant of time, the race is said to end in a "Dead Heat"

The various types of phrases used in problems on races and their interpretations are as follows:

1. **A gives B y meters:** This means, both A and B start at the starting point at the same instant of time, but while A reaches the finishing point, B is y meters behind. This indicates that A is the winner of the race.

2. **A gives B t minutes:** This means, both A and B start at the starting point at the same instant, but B takes t minutes more as compared to A to finish the race. Here also, A is the winner.

3. **A can give B a start of y meters:** A starts from the starting point and B starts y meters ahead, but still both A and B reach the finishing point at the same instant of time. So, the race ends in a dead heat.

4. **A can give B a start of t minutes:** A starts t minutes after B starts from the starting point, but still, both A and B reach the finishing point at the same instant of time. So, again the race ends in a dead heat.

5. **A gives B y meters and t minutes:** A and B start at the starting point at the same instant, but while A reaches the finishing point, B is behind by y meters, and, B takes t minutes compared to A to complete the race. So, B covers remaining y meters in extra t minutes. This gives the speed of B as y/t

Solved Examples

In a KM race Peter beats Tony by 35 meters or 7 seconds. What is Peter's time over the course?

Here Peter beats Tony by 35 meters means, when Peter covers 1000 meters, Tony covered $(1000 - 35) = 965$ meters only. Also Tony took another 7 seconds to cover this 35 meters.

Tony and Peter's speed's ratio = Ratio of their distances covered = $1000 : 965 = 200:193$

So Their times are in the ratio = $193 : 200$

But we know that Peter has taken 7 seconds extra and the above values are exactly satisfying this condition. So time taken to cover the distances are 193 and 200 seconds for Peter and Tony.

Alternate method:

Tony runs 35 meters in 7 seconds. To cover 1000 meters he took $\frac{1000}{35} \times 7 = 200$ seconds. But Peter covers this distance 7 seconds less than Tony. So he completes the race in 193 seconds

Tom, Dick and Harry are the contestants in a race in a km. race. If Tom can give Dick a start of 40 meters and Tom can give Harry a start of 64 meters, How many meters can Dick give Harry?

Tom covers 1000 meters, Dick covers 960 meters and Harry covers 936 meters.

When Dick covers 960 meters Harry covers 936

If Dick covers 1000 then Harry has to cover $\frac{1000}{960} \times 936 = 975$ meters.

Dick gives Harry $(1000 - 975) = 25$ meters.

A beats B by 24 m and C by 20 m, C beats B by 1 sec in a race of 120 m. In how many seconds does A complete the race?

A beats B by 24 meters means when A completed his race of 120 m, B covered $(120 - 24) = 96$ meters. or A and B's speeds are in the ratio $120 : 96 = 5 : 4$

A beats C by 20 meters means when A completed his race of 120 m, C covered $(120 - 20) = 100$ meters. or A and C's speeds are in the ratio $120 : 100 = 6 : 5$

Combining above two ratio's we get their speeds ratio as $A : B : C = 30 : 24 : 25$

and their times ratio = $\frac{1}{30} : \frac{1}{24} : \frac{1}{25} = 20 : 25 : 24$

We know that B and C's speeds are in the ratio $24 : 25$ so when C completes his race of 120 m, B covers = $\frac{24}{25} \times 120 = 115.2$

So B covers 4.8 meters in 1 second. To cover 120 meters he takes $= 120/4.8 = 25$.

But we know that A and B's time's are in the ratio $20 : 25$. When B completes his race in 25 seconds, A completes it in 20 seconds.

A can beat B by 20m and C can beat B by 40 m in a race of 100m. By how much can C beat A in the race?

A beat B by 20 meters means when A covers 100 m, B covers 80 m. So speed ratio $= 5 : 4$

C can beat B by 40 meters means when C covers 100 meters B covers 60 meters. Speeds ratio of C and B $= 5 : 3$ or $B : C = 3 : 5$

Combining both the Ratio's, the speeds of A, B, C $= 15 : 12 : 20$

From the above ratio, when C covers 100 meters, A can cover 75 meters. So C beats A by 25 meters.

A Tortoise and a Hare go for a race. The tortoise gets a head start of 100 m but Hare is 10 times faster. What is the distance travelled by Hare to catch up Tortoise?

Given that when Tortoise covers 1m, Hare covers 10 meters. That is, for every second the distance between the Hare and Tortoise gets reduced by 9 meters. To cover 100 meters it takes $100 / 9 = 11.11$ seconds for Hare. So the distance covered by Hare = $11.11 \times 10 = 111.1$

A gives a start of 10m to B in a 100 m race. B gives a start of 25m to C in a 150 m race. How much start can A give to C in a 200m race?

When A covers 100 meters B covers only 90 meters. Also when B covers 150 meters, C covers 125 meters.

Assume Total distance = 500 m. Then when A covers 500m, B covers 450m, and C covers 375 m.

That is when A covers 500 meters B covers 375 meters. or their speeds are in the ratio 20 : 15.

If the race is for 200 m, then When A covers 200 meters, B covers 150 metres. So A must give C a start of 50 meters.

A runs $1\frac{2}{3}$ times as fast as B. If A gives B a start of 80m, how far must the winning post be for the race to end in dead heat?

From above, A and B speeds are in the ratio = $1\frac{2}{3} : 1$ or $5 : 3$.

A gives B a start of 80 meters, then B is already 80 meters ahead of A. But we know that A covers 2 meters more for every second. To cover 80 meters he need 40 seconds or the dead line must be at $5 \times 40 = 200$ meters.

Two cyclist A and B cover a distance of 110 km, A reaches to the destination one hour before B. Even if B had given a start of 8 km, he would have reached 12 minutes late. Find the speed of A.

In first case, B is late by 60 minutes.

In second case B, after getting a start of 8 km, he reaches 12 minutes late.

Therefore, Time taken by B travel 8 km = $60 - 12 = 48$ minutes

Therefore, B's speed = $\frac{8}{48} \times 60 = 10$ km/h

Therefore, Time taken by B = $\frac{110}{10} = 11$ hours

Therefore, Time taken by A = $11 - 1 = 10$ hours

Therefore, A's speed = $\frac{110}{10} = 11$ km/h

Two cyclist A and B cover a certain distance. A reaches to the destination one hour before B. Even if B had given a start of 5 km, he would have reached 10 minutes late. Find the speed of B.

In first case, B is late by 60 minutes.

In second case B, after getting a start of 5 km, he reaches 10 minutes late.

Therefore, Time taken by B to travel 5 km = $60 - 10 = 50$ minute

Therefore, B's speed = $\frac{5}{50} \times 60 = 6$ km/h