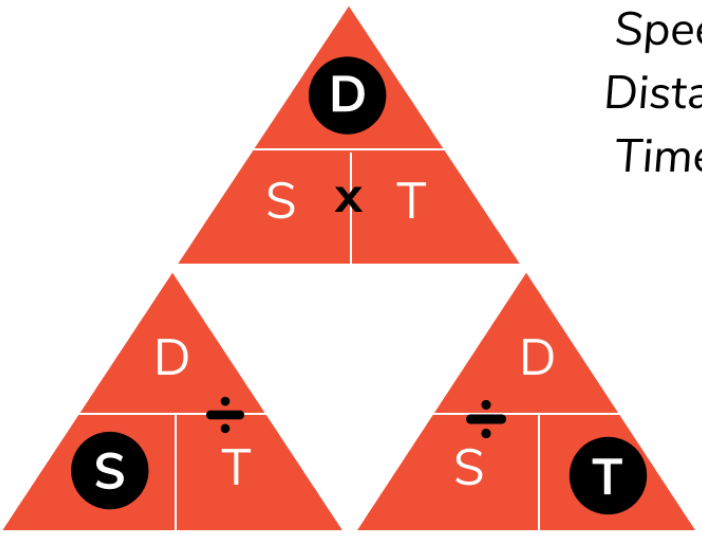

Speed = Distance / Time
Distance = Speed x Time
Time = Distance / Speed

Relationship Between Speed, Time & Distance

Speed = Distance/Time –

This tells us how slow or fast an object moves. It describes the distance travelled divided by the time taken to cover the distance.

Speed is directly Proportional to Distance and Inversely proportional to Time. Hence,

Distance = Speed X Time

Time = Distance / Speed,

as the speed increases the time taken will decrease and vice versa.

Units of Speed Time & Distance

Each Speed, Distance and Time can be expressed in different units:

Time: seconds(s), minutes (min), hours (hr)

Distance: (meters (m), kilometres (km), miles, feet

Speed: m/s, km/hr

So, if Distance = km and Time = hr, then as Speed = Distance/ Time, the units of Speed will be km/ hr.

Speed, Time & Distance Conversions

- To convert from km / hour to m / sec, we multiply by 5 / 18. So, 1 km / hour = 5 / 18 m / sec
- To convert from m / sec to km / hour, we multiply by 18 / 5. So, 1 m / sec = 18 / 5 km / hour = 3.6 km / hour
- Similarly, 1 km/hr = 5/8 miles/hour
- 1 yard = 3 feet
- 1 kilometre= 1000 meters = 0.6214 mile
- 1 mile= 1.609 kilometre
- 1 hour= 60 minutes= 60*60 seconds= 3600 seconds
- 1 mile = 1760 yards
- 1 yard = 3 feet
- 1 mile = 5280 feet
- 1 mph = (1 x 1760) / (1 x 3600) = 22/45 yards/sec
- 1 mph = (1 x 5280) / (1 x 3600) = 22/15 ft/sec
- For a certain distance, if the ratio of speeds is a: b, then the ratio of times taken to cover the distance would be b: a and vice versa.

Application of Speed, Time & Distance

1.Average Speed

Average Speed = (Total distance travelled) / (Total time taken)

Case 1 – When the distance is constant: **Average speed = 2 * x * y / x + y**

Where, x and y are the two speeds at which the same distance has been covered.

Case 2 – When the time taken is constant: **Average speed = (x + y) / 2**

Where, x and y are the two speeds at which we travelled for the same time.

Examples:

A person travels from one place to another at 30 km/hr and returns at 120 km/hr. If the total time taken is 5 hours, then find the Distance.

Solutions:

Here the Distance is constant, so the Time taken will be inversely proportional to the Speed. Ratio of Speed is given as 30:120, i.e., 1:4

So the ratio of Time taken will be 4:1.

Total Time taken = 5 hours; Time taken while going is 4 hours and returning is 1 hour.

Hence, Distance = 30x 4 = 120 km

2. Inverse Proportionality of Speed & Time

Speed is inversely proportional to Time when the Distance is constant. S is inversely proportional to 1/T when D is constant. If the Speeds are in the ratio m:n then the Time taken will be in the ratio n: m.

There are two methods to solve questions:

- Using Inverse Proportionality
- Using Constant Product Rule

Example:

After traveling 50km, a train meets with an accident and travels at (3/4)th of the usual Speed and reaches 45 min late. Had the accident happened 10km further on it would have reached 35 min late. Find the usual Speed?

Solutions:

Using Inverse Proportionality Method

Here there are 2 cases

Case 1: accident happens at 50 km

Case 2: accident happens at 60 km

Difference between two cases is only for the 10 kms between 50 and 60. The time difference of 10 minutes is only due to these 10 kms.

In case 1, 10 kms between 50 and 60 is covered at (3/4) Speed.

In case 2, 10 kms between 50 and 60 is covered at usual Speed.

So, the usual Time “t” taken to cover 10 kms, can be found out as below. 4/3 t – t = 10 mins = > t = 30 mins, d = 10 kms

so usual Speed = 10/30min = 10/0.5 = 20 km/hr

Using Constant Product Rule Method

Let the actual Time taken be T

There is a (1/4) th decrease in Speed, this will result in a (1/3)rd increase in Time taken as Speed and Time are inversely proportional

(A 1/x increase in one of the parameters will result in a 1/(x+1) decrease in the other parameter if the parameters are inversely proportional) The delay due to this decrease is 10 minutes

Thus 1/3 T= 10 and T=30 minutes or ½ hour

Also, Distance = 10 km

3. Meeting Point Questions

If two people travel from two points A and B towards each other, and they meet at point P. The total Distance covered by them on the meeting will be AB. The Time taken by both of them to meet will be the same. As the Time is constant, Distances AP and BP will be in the ratio of their Speed. Say that the Distance between A and B is d.

If two people are walking towards each other from A and B, when they meet for the first Time, they together cover a Distance “d” .When they meet for the second Time, they together cover a Distance “3d” When they meet for the third Time, they together cover a Distance of “5d”

Example:

Amit and Aman have to travel from Delhi to Jaipur in their respective cars. Amit is driving at 60 kmph while Aman is driving at 90 kmph. Find the Time taken by Aman to reach Jaipur if Amit takes 9 hrs.

Solutions:

As the Distance covered is constant in both cases, the Time taken will be inversely proportional to the Speed. In the problem, Speed of Amit and Aman is in ratio 60: 90 or 2:3.

So, the ratio of the Time taken by Amit to that taken by Aman will be in the ratio 3:2. So if Amit takes 9 hrs, Aman will take 6 hrs.