Time, Speed and Distance

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

Speed is measured in Km/h or m/s or mph

Km/h to m/s

$\times \frac{5}{18}$

Example:

$36\text{Km/h} = 36 \times \frac{5}{18} = 10\text{m/s}$

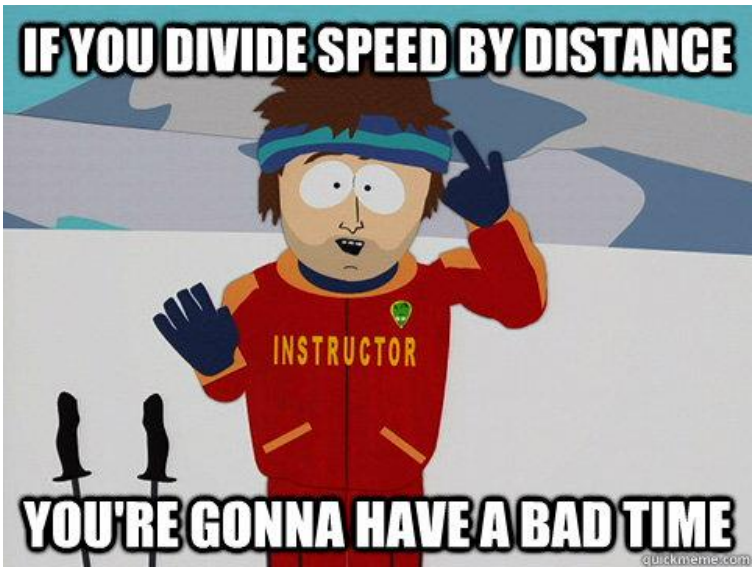
m/s to Km/h

$\times \frac{18}{5}$

Q. Find the distance covered in Km if Mohan is travelling at 12m/s for 5min?

Soln: Distance = S×t = 12×60×5 = 3600m = 3.6Km

Q. A covers 300km in 8 hours partly at a speed of 30km/h and partly at 50km/h. Find the time for which he travelled at 30km/h?



Soln: Let time for 30km/h is t then time for 50km/his (8-t).

30t+50(8-t) = 300

t = 5hrs

Average Speed

$$\text{AvgSpeed} = \frac{\text{Total Distance}}{\text{Total Time}}$$

Q. Aman goes from Ahmedabad to Mumbai at 60Km/h and comes back at 40Km/h. Find his average speed?

Soln: Let distance is x then

$$\text{AvgSpeed} = \frac{2x}{\frac{x}{60}+\frac{x}{40}} = 48\text{km/h}$$

Q. Lakhan covers first one-third distance @ 80km/h, half of total distance @ 90km/h and remaining distance @ 60km/h. Find his average speed?

Q. Lakhan covers first one-third distance @ 80km/h, half of total distance @ 90km/h and remaining distance @ 60km/h. Find his average speed?

Soln: LCM(60,80,90) = 720

Let total distance is 720km

Time for one-third distance is $\frac{240}{80}$ = 3hrs

Time for half of total distance is $\frac{360}{90}$ = 4hrs

Time for remaining distance is $\frac{120}{60}$ = 2hrs

Avg Speed = $\frac{720}{3+4+2}$ = 80km/h

D α S (when time is constant)

$$\frac{D_A}{D_B} = \frac{S_A}{S_B}$$

If distance is constant then Speed α $\frac{1}{\text{time}}$

$S_1T_1 = S_2T_2$

Q. If a person increases his speed by 25%, he reaches office 20 minutes early. Find the usual time taken by the person to reach office.

Soln: $S \times t = 1.25S \times (t-20)$

$\Rightarrow t = 100$ min

Q. If a person decreases his speed by 30% then find the % increase in the time to cover the same distance?

Soln: $S \times t = 0.7\ S \times x$

$\Rightarrow x = \frac{t}{0.7} = \frac{10t}{7} = (1+\frac{3}{7})t$

$\Rightarrow 42.84\%$

Q. In covering a distance of 30 km, Abhay takes 2 hours more than Sameer. If Abhay doubles his speed, then he would take 1 hour less than Sameer.
Abhay's speed is:

Soln:

	Abhay	Sameer
Initial time	(t+2)	t
Final time	$\frac{(t+2)}{2}$ = t-1	t

$$\frac{(t+2)}{2}+1 = t$$

⇨ t = 4 hrs

Time for Abhay is 4+2 = 6hrs

Speed of Abhay is 30/6 = 5km/h

Relative speed(S_R)

Note: It is applicable for 2 at a time when both are moving

When both are moving in opposite direction

$S_R = S_A + S_B$

When both are moving same direction

$S_R = |S_A - S_B|$

Q. A thief is running at a speed of 10m/s. A policeman who is 5000m behind the thief, is chasing him at a speed of 20m/s. There is a dog ‘running’ at 30m/s. which starts from the policeman and keeps on running to and fro between the policeman and the thief till the latter gets caught. Find: total distance travelled by the dog?

Soln:

The policeman will catch the thief in

$$\frac{5000}{20\text{-}10} = 500 \text{ sec}$$

Thus total distance travelled by dog = 500 × 30 m = 15000 m

Q. Bus I leaves at 7 am with 40km/h and bus II leaves at 9am (same day) with 50km/h from Ahmedabad for Mumbai. At what time

Both the buses are together Or Both the buses meet each other Or

Bus II crosses/overtakes bus I

Soln: Distance covered by both the buses is same.

Therefore, $S_1T_1 = S_2T_2$

Let time for bus II is x hrs then time for bus I is (x+2)hrs

$40 (x+2) = 50x$

⇨ x = 8hrs, This 8hrs from 9am.

Hence, Answer is (8+9) = 17= 5pm

Q. A starts from Ahmedabad at 9 am and reaches Mumbai at 1pm(same day) and B starts from Mumbai at 9 am and reaches Ahmedabad at 3pm(same day).

At what time both were together?

Soln:

Time take by A is 4 hrs and time taken by B is 6hrs.

Consider Total distance = LCM of (4,6) = 12Km

Then speed of A = 3 and speed of B = 2

$$\text{Time} = \frac{12}{2+3} = 2.4\text{hrs}$$

2.4 hrs from 9 am.

Therefore , 9+2.4 = 11.4hrs or 11:24 am

Questions related to train

(i) Time taken by train to cross an electric pole or tree(object of negligible length)

$$t = \frac{L}{S}$$

(ii) Time taken by train to cross a bridge or tunnel or platform (of length x)

$$t = \frac{L+x}{S}$$

Q. A train is 1km in length. It is travelling at 60km/hr. It enters a tunnel which is 1km in length. How long will it take for the whole train to pass through the tunnel?

Soln: Total distance covered by train is 2km.

Therefore, total time is = 2 min

(iii) Time taken by 2 trains to cross each other when both moving in opposite direction

$$t = \frac{L_1 + L_2}{S_1 + S_2}$$

(iv) Time taken by faster train to cross slower train when both are moving in same direction

$$t = \frac{L_1 + L_2}{|S_1 - S_2|}$$

Boats and stream

x: Speed of Boat in still water

y: Speed of water/flow/river/stream

Upstream: Opposite to flow

Speed = x-y

Downstream: with flow

Speed = x+y

Race

A beats B by 50m in 1000m race

A gives B a head start of 40m in a race

A can give B a head start of 50m in 1000m race.

Q. In a 1000m race A beats B by 40m then A beats B by in 400m race is:

Soln: In 1000m race beats by 40 means in 100m race betas by 4m.

Therefore, in 400m race 4×4 = 16m

Q. In a 200 m race, A defeats B by 20m and A defeats C by 29m. Then by what distance does B beat C in the same race?

Soln: When A covers 200m, B covers 180m and C covers 171m.

Therefore, B beats C by 9m in 180m race.

9 180

? 200

$= \frac{200 \times 9}{180} = 10\text{m}$

Therefore, in 200m race B beats C by 10m.

When the two people A and B with respective speeds of A and B (A>B) are running around a circular track (of length L) starting at the same point and at the same time then,

	When the two persons are running in the SAME direction	When the two persons are running in the OPPOSITE direction
Time taken to meet for the FIRST TIME EVER	$\frac{L}{(A-B)}$	$\frac{L}{(A+B)}$