17. TIME AND DISTANCE

IMPORTANT FACTS AND FORMULAE

1. Speed = $\left(\frac{\text{Distance}}{\text{Time}}\right)$, Time= $\left(\frac{\text{Distance}}{\text{Speed}}\right)$, Distance = (Speed * Time)

2. x km / hr = $x * \frac{5}{18}$

3. x m/sec = (x * 18/5) km /hr

4. If the ratio of the speeds of A and B is a:b , then the ratio of the times taken by them to cover the same distance is $\frac{1}{a} : \frac{1}{b}$

or b:a.

5. Suppose a man covers a certain distance at x km/ hr and an equal distance at y km / hr . Then , the average speed during the whole journey is $\frac{2xy}{x+y}$ km/ hr.

SOLVED EXAMPLES

Ex. 1. How many minutes does Aditya take to cover a distance of 400 m, if he runs at a speed of 20 km/hr?

Sol. Aditya's speed = 20 km/hr = $\{20 * \frac{5}{18}\}$ m/sec = $\frac{50}{9}$ m/sec

$\therefore$ Time taken to cover 400 m= $\{ 400 * \frac{9}{50} \}$ sec =72 sec = 1 $\frac{12}{60}$ min 1 $\frac{1}{5}$ min.

Ex. 2. A cyclist covers a distnce of 750 m in 2 min 30 sec. What is the speed in km/hr of the cyclist?

Sol. Speed = $\{ \frac{750}{150} \}$ m/sec =5 m/sec = $\{ 5 * \frac{18}{5} \}$ km/hr =18km/hr

Ex. 3. A dog takes 4 leaps for every 5 leaps of a hare but 3 leaps of a dog are equal to 4 leaps of the hare. Compare their speeds.

Sol. Let the distance covered in 1 leap of the dog be x and that covered in 1 leap of the hare by y.

Then , $3x = 4y \Rightarrow x = \frac{4}{3} y \Rightarrow 4x = \frac{16}{3} y$.

$\therefore$ Ratio of speeds of dog and hare = Ratio of distances covered by them in the same time

$= 4x : 5y = \frac{16}{3} y : 5y = \frac{16}{3} : 5 = 16:15$

Ex. 4.While covering a distance of 24 km, a man noticed that after walking for 1 hour and 40 minutes, the distance covered by him was $\frac{5}{7}$ of the remaining distance. What was his speed in metres per second?

Sol. Let the speed be x km/hr.

Then, distance covered in 1 hr. 40 min. i.e., $1\frac{2}{3}$ hrs $= \frac{5x}{3}$ km

Remaining distance = $\{ 24 - \frac{5x}{3} \}$ km.

$\therefore \frac{5x}{3} = \frac{5}{7}\{ 24 - \frac{5x}{3} \} \Leftrightarrow \frac{5x}{3} = \frac{5}{7}\{ \frac{72-5x}{3} \} \Leftrightarrow 7x = 72 - 5x$

$\Leftrightarrow 12x = 72 \Leftrightarrow x = 6$

Hence speed = 6 km/hr $= \{ 6 * \frac{5}{18} \}$ m/sec $= \frac{5}{3}$ m/sec $= 1\frac{2}{3}$

Ex. 5.Peter can cover a certain distance in 1 hr. 24 min. by covering two-third of the distance at 4 kmph and the rest at 5 kmph. Find the total distance.

Sol. Let the total distance be x km . Then,

$$\frac{\frac{2}{3}x}{4} + \frac{\frac{1}{3}x}{5} = \frac{7}{5} \Leftrightarrow \frac{x}{6} + \frac{x}{15} = \frac{7}{5} \Leftrightarrow 7x = 42 \Leftrightarrow x = 6$$

Ex. 6.A man traveled from the village to the post-office at the rate of 25 kmph and walked back at the rate of 4 kmph. If the whole journey took 5 hours 48 minutes, find the distance of the post-office from the village.

Sol. Average speed $= \{ \frac{2xy}{x+y} \}$ km/hr $= \{ \frac{2*25*4}{25+4} \}$ km/hr $= \frac{200}{29}$ km/hr

Distance traveled in 5 hours 48 minutes i.e., $5\frac{4}{5}$ hrs. $= \{ \frac{200}{29} * \frac{29}{5} \}$ km $= 40$ km

Distance of the post-office from the village $= \{ \frac{40}{2} \} = 20$ km

Ex. 7.An aeroplane files along the four sides of a square at the speeds of 200,400,600 and 800km/hr.Find the average speed of the plane around the field.

Sol. :

Let each side of the square be x km and let the average speed of the plane around the field by y km per hour then ,

$x/200+x/400+x/600+x/800=4x/y \Leftrightarrow 25x/2500 \Leftrightarrow 4x/y \Leftrightarrow y=(2400*4/25)=384$

hence average speed =384 km/hr

Ex. 8.Walking at $\frac{5}{7}$ of its usual speed, a train is 10 minutes too late. Find its usual time to cover the journey.

Sol. : New speed =5/6 of the usual speed

New time taken=6/5 of the usual time

So,(6/5 of the usual time)-(usual time)=10 minutes.
=>1/5 of the usual time=10 minutes.
⇨ usual time=10 minutes

Ex. 9.If a man walks at the rate of 5 kmph, he misses a train by 7 minutes. However, if he walks at the rate of 6 kmph, he reaches the station 5 minutes before the arrival of the train. Find the distance covered by him to reach the station.
Sol. Let the required distance be x km
Difference in the time taken at two speeds=1 min =1/2 hr
Hence x/5-x/6=1/5<=>6x-5x=6
⇔x=6
Hence, the required distance is 6 km

Ex. 10. A and B are two stations 390 km apart. A train starts from A at 10 a.m. and travels towards B at 65 kmph. Another train starts from B at 11 a.m. and travels towards A at 35 kmph. At what time do they meet?
Sol. Suppose they meet x hours after 10 a.m. Then,
(Distance moved by first in x hrs) + [Distance moved by second in (x-1) hrs]=390.

$65x + 35(x-1) = 390 \Rightarrow 100x = 425 \Rightarrow x = 17/4$

So, they meet 4 hrs.15 min. after 10 a.m i.e., at 2.15 p.m.

Ex. 11. A goods train leaves a station at a certain time and at a fixed speed. After ^hours, an express train leaves the same station and moves in the same direction at a uniform speed of 90 kmph. This train catches up the goods train in 4 hours. Find the speed of the goods train.
Sol. Let the speed of the goods train be x kmph.
Distance covered by goods train in 10 hours= Distance covered by express train in 4 hours
10x = 4 x 90 or x =36.
So, speed of goods train = 36kmph.

Ex. 12. A thief is spotted by a policeman from a distance of 100 metres. When the policeman starts the chase, the thief also starts running. If the speed of the thief be 8km/hr and that of the policeman 10 km/hr, how far the thief will have run before he is overtaken?
Sol. Relative speed of the policeman = (10-8) km/hr =2 km/hr.
Time taken by police man to cover 100m $\left(\frac{100}{1000} \times \frac{1}{2}\right)$ hr = $\frac{1}{20}$ hr.
In $\frac{1}{20}$ hrs, the thief covers a distance of $8 \times \frac{1}{20}$ km = $\frac{2}{5}$ km = 400 m

Ex.13. I walk a certain distance and ride back taking a total time of 37 minutes. I could walk both ways in 55 minutes. How long would it take me to ride both ways?

Sol. Let the distance be x km. Then,

(Time taken to walk x km) + (time taken to ride x km) =37 min.

(Time taken to walk 2x km) + (time taken to ride 2x km)= 74 min.

But, the time taken to walk 2x km = 55 min.

Time taken to ride 2x km = (74-55)min =19 min.