CHAPTER 6 Time, Speed & Distance

6.1 Introduction

The terms 'Time' and 'Distance are related to the speed of a moving object.

Speed: We define the speed of an object as the distance covered by it a unit interval. It is obtained by dividing the distance covered by the the objected, by the time it takes to cover that distance.

Thus, $\textbf{Speed} = \dfrac{\textbf{Distance travelled}}{\textbf{Time taken}}$.

Notes:

(i) **If the time taken is constant, the distance travelled is proportional to the speed, that is, more the speed; more the distance travelled in the same time.**

(ii) **If the speed is contant, the distance travelled is proportional to the time taken; that is, more the distance travelled; more the time taken at the same speed.**

(iii) **If the distance travelled is constant, the speed is inversely proportional to the time taken, that is, more the speed; less the time taken for the same distance travelled.**

NUMERICAL CHALLENGE 6.1

Calculate the speed of a train which covers a distance of 150 km in 3 hrs.

Solution

$$\text{Speed} = \frac{\text{Distance covered}}{\text{Time taken}} = \frac{150}{3} = 50 \text{ km/hr.}$$

6.2 Units of Measurement

Generally, if the distance is measured in kilometre, we measure time in hours and speed in kilometre per hour and is written as km/hr and if the distance is measured in per second and is written as m/s.

Conversion of Units

$$\textbf{One kilometre/hr} = \frac{\textbf{1000 m}}{\textbf{60} \times \textbf{60 s}} = \frac{\textbf{5}}{\textbf{18}} \textbf{ m/s.}$$

$$\therefore \quad \textbf{One metre/s} = \frac{\textbf{18}}{\textbf{5}} \textbf{ km/hr.}$$

$$\textbf{Thus,} \quad \textbf{x km/hr} = \left(\textbf{x} \times \frac{\textbf{5}}{\textbf{18}}\right) \textbf{ m/s.}$$

$$\textbf{and,} \quad \textbf{x m/s} = \left(\textbf{x} \times \frac{\textbf{18}}{\textbf{5}}\right) \textbf{ km/hr.}$$

NUMERICAL CHALLENGE 6.2

1. How long does a train 100 m long running at the rate of 40 km/hr take to cross a telegraphic pole?

Solution

In crossing the pole, the train must travel its own length.

$\therefore$ Distance travelled is 100 m.

$$\text{Speed} = 40 \text{ km/hr} = \frac{40 \times 1000}{60 \times 60} = \frac{100}{9} \text{ m/s}$$

$\therefore$ Time taken to cross the pole $= \dfrac{100}{100/9} = 9$ s

2. A train running at a speed of 90 km/hr passes a pole on the platform in 20 s. Find the length of the train in metres.

Solution

Speed of the train = 90 km/hr

$$= 90 \times \frac{5}{18} = 25 \text{ m/s.}$$

$\therefore$ Length of the train = speed of the train × time taken in crossing the pole = 25 × 20 = 500 m.

6.3

(i) If A covers a distance d_1 km at s_1 km/hr and then d_2 km at s_2 km/hr, then the average speed during the whole journey is given by

$$\textbf{Average speed} = \frac{s_1 s_2 (d_1 + d_2)}{s_1 d_2 + s_2 d_1} \textbf{ km/hr}$$

(ii) If A goes from X to Y at s_1 km/hr and comes back from Y to X at s_2 km/hr, then the average speed during the whole journey is given by

$$\textbf{Average speed} = \frac{2 s_1 s_2}{s_1 + s_2}$$

NUMERICAL CHALLENGE 6.3

A ship sails to a certain city at the speed of 15 knots/hr and sails back to the same point at the rate of 30 knots/hr. What is the average speed for the whole journey?

Solution

Here $s_1 = 15$ and $s_2 = 30$.

$\therefore$ Average speed $= \dfrac{2 s_1 s_2}{s_1 + s_2} = \dfrac{2 \times 15 \times 30}{15 + 30}$

= 20 knots/hr

6.4

A person goes certain distance (A to B) at a speed of s_1 km/hr and returns back (B to A) at a speed of s_2 km hr. If he takes T hrs in all, the distance between A and B is.

$$T\left(\frac{s_1 s_2}{s_1 + s_2}\right)$$

NUMERICAL CHALLENGE 6.4

1. A boy goes to school with the speed of 3 km and hour and returns with a speed of 2 km/hr. If he takes 5 hrs in all, find the distance in km between the village and the school.

Solution

Here $s_1 = 3$, $s_2 = 2$ and $T = 5$.

$\therefore$ The distance between the village and the shcool

$$= T\left(\frac{s_1 s_2}{s_1 + s_2}\right) = 5\left(\frac{3\times 2}{3+2}\right) = 6 \text{ km.}$$

6.5

If two persons A and B start at the same time from two points P and Q towards each other and after crossing they take T_1 and T_2 hrs in reaching Q and P, respectively, then

$$\frac{\textbf{A's speed}}{\textbf{B's speed}} = \frac{\sqrt{T_2}}{\sqrt{T_1}}$$

NUMERICAL CHALLENGE 6.5

Nikita starts her journey from Delhi to Bhopal and simultaneously Nishita starts from Bhopal to Delhi. After crossing each other they finish their remaining journey in $5\frac{4}{9}$ hrs and 9 hrs, respectively. What is Nishita's speed if Nikita's speed is 36 km/hr?

Solution

$$\frac{\text{Nikita's speed}}{\text{Nishita's speed}} = \frac{\sqrt{T_2}}{\sqrt{T_1}} = \frac{\sqrt{9}}{\sqrt{5\frac{4}{9}}} = \frac{\sqrt{9}}{\sqrt{\frac{49}{9}}}$$

$$= \frac{\sqrt{9}}{\sqrt{\frac{81}{49}}} = \frac{9}{7}.$$

$\therefore$ Nishita's speed = $\frac{7}{9}$ Nikita's speed

$$= \frac{7}{9} \times 36 = 28 \text{ km/hr.}$$

6.6

If a body travels $d_1, d_2, d_3, \ldots, d_n$ metres with different speeds $s_1, s_2, s_3, \ldots, s_n$ m/s in time $T_1, T_2, T_3, \ldots T_n$ s, respectively, then the average speed of the body throughout the journey is given by

$$V_a = \frac{\textbf{Total distance travelled}}{\textbf{Total time taken}}$$

$$= \frac{d_1 + d_2 + d_3 + \ldots + d_n}{T_1 + T_2 + T_3 + \ldots + T_n}$$

(If $d_1, d_2, \ldots, d_n$ and $T_1, T_2, \ldots, T_n$ are known)

and $V_a = \dfrac{s_1T_1 + s_2T_2 + s_3T_3 + \ldots + s_nT_n}{T_1 + T_2 + T_3 + \ldots + T_n}$

(If $d_1\ d_2, \ldots, d_n$ and $s_1, s_2, \ldots, s_n$ are known)

NUMERICAL CHALLENGE 6.6

A car during its journey travels 40 min at a speed of 30 km/hr, another 50 min at a speed of 60 km/hr and 1 hr at a speed of 30 km/hr. Find the average speed of the car.

Solution

Here $T_1 = \frac{40}{60}$, $T_2 = \frac{50}{60}$, $T_3 = 1$, $s_1 = 30$,

$s_2 = 60$, $s_3 = 30$.

$\therefore$ Average speed of the car

$$= \frac{s_1T_1 + s_2T_2 + s_3T_3}{T_1 + T_2 + T_3} = \frac{30 \times \frac{40}{60} + 60 \times \frac{50}{60} + 30 \times 1}{\frac{40}{60} + \frac{50}{60} + 1}$$

$= 40$ km/hr.

6.7

If the new speed is $\frac{a}{b}$ of this original speed, then the change in time taken to cover the same distance is given by

Change in thime = $\left(\frac{b}{a} - 1\right)$ × original time.

NUMERICAL CHALLENGE 6.7

By walking at four-fifths of his usual speed, Mohan is 6 min late to his office. Find his usual time to cover the distance.

Solution

Here change in time = 6 and $\frac{a}{b} = \frac{4}{5}$.

We have change in time = $\left(\frac{b}{a} - 1\right)$ × original time

$\Rightarrow$ Original time = $\frac{\text{Change in time}}{\left(\frac{b}{a} - 1\right)}$

$$= \frac{6}{\left(\frac{5}{4} - 1\right)} = 24 \text{ min}$$

6.8

A body covers a distance d in time T_1 with speed s_1, but when it travels with speed s_2 covers the same distance in time T_2. The following relations hold

$$\frac{\text{Product of speed}}{d} = \frac{s_1}{T_2} = \frac{s_2}{T_1} = \frac{\text{Difference of speed}}{\text{Difference of time}}$$

Equating any two of the above, we can find the unkowns as per given question.

NUMERICAL CHALLENGE 6.8

Two bicylists do the same journey by travelling respectively, at the rates of 9 and 10 km an hour. Find the length of the journey when one takes 32 min longer than the other.

Solution

Here change in speed = 10 – 9 = 1; product of speed = 9 × 10 = 90 and difference of time = $\frac{32}{60}$.

We have $\frac{\text{Product of speed}}{\text{d}} = \frac{\text{Difference of speed}}{\text{Difference of time}}$

$\Rightarrow \quad \text{d} = \text{Product of speed} \times \left(\frac{\text{Difference of time}}{\text{Difference of speed}}\right)$

$= 90 \times \frac{32}{60} = 48$ km.

6.9

A train travels a certain distance at a speed of s_1 km/hr without stoppages and with stoppages. it covers the same distance at a speed of s_2 km/hr. The stoppage time per hour is given by

$$\left(\frac{s_1 - s_2}{s_1}\right) \text{ hr or, } \left(\frac{\text{Difference of speed}}{\text{Speed without stoppages}}\right)$$

NUMERICAL CHALLENGE 6.9

Without stoppages, a train travels certain distance with an average speed of 80 km/hr and with stoppages, it covers the same distance with an average speed of 60 km/hr. How many minutes per hour the train stops?

Solution

Here $s_1 = 80$ and $s_2 = 60$

$\therefore \quad$ Stoppage time/hr $= \frac{s_1 - s_2}{s_1} = \frac{80 - 60}{80} = \frac{1}{4}$ hr

$= 15$ mins

6.10

(i) If a train overtakes a pole or a man or a milestone, the distance covered in overtaking is equal to the length of the train.

(ii) If a train overtakes a bridge or a tunnel or a platform or another train, then the distance covered is equal to the sum of the two lengths.

NUMERICAL CHALLENGE 6.10

1. A 600 m long train crosses a pole in 9 s. What is the speed of the train in km/hr?

Solution

Speed of the train

$= \frac{\text{Length of the train}}{\text{time taken in croosing the pole}}$

$= \frac{600}{9}$ m/s $= \frac{600}{9} \times \frac{18}{5} = 240$ km/hr.

2. A train 130 m long passes a bridge in 21 s moving with a speed of 90 km/hr. Find the length of the bridge.

Solution

We have speed of the train

$$= \frac{\text{length of the train} + \text{length of the bridge}}{\text{time taken in crossing the bridge}}$$

$$\Rightarrow \quad \frac{5}{18} 90 = \frac{130 + \text{length of the bridge}}{21}$$

$\therefore$ Length of the bridge = 525 – 130 = 395 m.

6.11 Relative speed

(a) If two trains of lengths L_1 km and L_2 km, respectively, are travelling in the same direction at s_1 km/hr and s_2 km/hr, respectively, such that $s_1 > s_2$, then $s_1 - s_2$ is called their relative speed and the time taken by the faster train to cross the slower train is given by $\left(\frac{L_1 + L_2}{s_1 - s_2}\right)$ hr

(b) If two trains of length L_1 km and L_2 km, respectively, are travelling in the opposite directions at s_1 km/hr and s_2 km/hr, respectively, then $s_1 + s_2$ is called their relative speed and the time taken by the trains to cross each other is given by $\left(\frac{L_1 + L_2}{s_1 + s_2}\right)$ hr

NUMERICAL CHALLENGE 6.11

A train 135 m long is running with a speed of 49 km/hr. In what time will it pass a man who is walking at 5 km/hr in the direction opposite to that of the train?

Solution

Here $L_1 = 135$, $L_2 = 0$, $s_1 = 49$ km/hr, $s_2 = 5$ km/hr.

$\therefore \quad s_1 + s_2 = 49 + 5 = 54 \text{ km/hr} = 54 \times \frac{5}{18}$ m/s

$\therefore$ The time taken $= \frac{L_1 + L_2}{s_1 + s_2} = \frac{135}{54 \times \frac{5}{18}}$

$$= \frac{135 \times 18}{54 \times 5} = 9 \text{ s.}$$

2. Two trains of length 110 metres and 90 m are running on parallel lines in the same direction with a speed of 35 km/hr and 40 km/hr, respectively. In what time will they pass each other.

Solution

Here $L_1 = 110$ m, $L_2 = 90$ m, $s_1 = 35$ km/hr and $s_2 = 40$ km/hr

$\therefore \quad s_2 - s_1 = 40 - 35 = 5 \text{ km/hr} = 5 \times \frac{5}{18}$ m/s

$\therefore$ Time taken $= \frac{L_1 + L_2}{s_2 - s_1}$

$$= \frac{110 + 90}{5 \times \frac{5}{18}} = \frac{200 \times 18}{5 \times 5}$$

$$= 144 \text{ s.}$$

6.12

Two trains of lengths L_1 m and L_2 m run on parallel tracks. When running in the same direction, the faster train passes the slower on in T_1 s, but when they are running in opposite directions with the same speeds as earlier, they pass each other in T_2 s.

Then, the speed of the faster train

$$= \frac{L_1 + L_2}{2}\left(\frac{1}{T_1} + \frac{1}{T_2}\right) \text{m/s}$$

and the speed of the slower train

$$= \frac{L_1 + L_2}{2}\left(\frac{1}{T_1} - \frac{1}{T_2}\right) \text{m/s.}$$

NUMERICAL CHALLENGE 6.12

Two trains of lengths 200 m and 175 m run on parallel tracks. When running in the same direction the faster train crosses the slower one in $37\frac{1}{2}$ s. When running in opposite directions at speeds same as their earlier speeds, they pass each other completely in $7\frac{1}{2}$ s. Find the speed of each train.

Solution

We have $L_1 = 200$, $L_2 = 175$, $T_1 = \frac{75}{2}$ and

$$T_2 = \frac{15}{2}.$$

Therefore, speed of the faster train

$$= \left(\frac{L_1 + L_2}{2}\right)\left(\frac{T_1 + T_2}{T_1 T_2}\right) = \left(\frac{200 + 175}{2}\right)\left(\frac{\frac{75}{2} + \frac{15}{2}}{\frac{75}{2} \times \frac{15}{2}}\right)$$

$$= \frac{375}{2} \times \frac{45 \times 4}{75 \times 15} = 30 \text{ m/s.}$$

Speed of slower train

$$= \left(\frac{L_1 + L_2}{2}\right)\left(\frac{T_1 - T_2}{T_1 T_2}\right) = \left(\frac{200 + 175}{2}\right)\left(\frac{\frac{75}{2} - \frac{15}{2}}{\frac{75}{2} \times \frac{15}{2}}\right) = \frac{375}{2} \times \frac{30 \times 4}{75 \times 15}$$

$$= 20 \text{ m/s.}$$

6.13

(i) A train starts from a place at s_1 km/hr and another fast train starts from the same place after T hrs at s_2 km/hr in the same direction. Then, the distance from the distance from the starting place at which both the trains will meet is given by

$$\left(\frac{s_1 \times s_2 \times T}{s_2 - s_1}\right) \text{km.}$$

Also, the time after which the two trains will meet is given by

$$\left(\frac{s_1 T}{s_2 - s_1}\right) \text{hr.}$$

(ii) The distance between two stations A and B is d km. A train starts from A to B at s_1 km/hr. T hrs later another train starts from B to A at s_2 km/hr. Then, the distance from A, at which both the trains will meet is given by

$$s_1\left(\frac{d + s_2 T}{s_1 + s_2}\right) \text{km.}$$

Also, the time after which the two trains will meet is given by

$$\left(\frac{d + s_2 T}{s_1 + s_2}\right) \text{hr.}$$

NUMERICAL CHALLENGE 6.13

1. A train starts from Mumbai at 10 a.m. with a speed of 25 km/hr and another train starts from there on the same day at 3 p.m. in the same direction with a speed of 35 km/hr. Find at what distance from Mumbai both the trains will meet and find also the time of their meeting.

Solution

Time from 10 a.m. to 3 p.m. = 5 hr.

Distance of meeting point from Mumbai

$$= \left(\frac{s_1 \times s_2 \times T}{s_2 - s_1}\right) \text{km.}$$

$$= \left(\frac{25 \times 35 \times 5}{35 - 25}\right) \text{km} = 437\frac{1}{2} \text{ km.}$$

Also, time of their meeting

$$= \left(\frac{s_1 T}{s_2 - s_1}\right) \text{hr.} = \left(\frac{25 \times 5}{35 - 25}\right) \text{ hr.}$$

$$= \frac{125}{10} = 12\frac{1}{2} \text{ hr. after 3 P.M.}$$

That is , 3.30 a.m. next day

2. Chennai is at a distance of 560 km from Mumbai. A train starts from Mumbai to Chennai at 6 a.m. with a speed of 40 km/hr. Another train starts from Chennai to Mumbai at 7 a.m. with a speed of 60 km/hr. At what distance from Mumbai and at what time will the two trains be at the point of crossing?

Solution

Time from 6 a.m. to 7 a.m. = 1 hr.

Therefore, distance of meeting point from Mumbai

$$= s_1\left(\frac{d + s_2T}{s_1 + s_2}\right) \text{km.}$$

$$= 40\left(\frac{560 + 60 \times 1}{40 + 60}\right) = 248 \text{ km.}$$

Also, time of their meeting

$$= \left(\frac{d + s_2T}{s_1 + s_2}\right) \text{hr}$$

$$= \left(\frac{560 + 60 \times 1}{40 + 60}\right) = \frac{31}{5} \text{ hr}$$

= 6 hr 12 min. after 6 a.m.

That is, at 12.12 noon.

6.14

Two trains start simultaneously from the stations A and B towards each other with speeds s_1 km/hr and s_2 km/hr, respectively. When they meet it is found that the second train had travelled d km more than the first. Then the distance between the two stations is given by $d\left(\frac{s_1 + s_2}{s_2 - s_1}\right)$ km.

NUMERICAL CHALLENGE 6.14

Two trains start at the same time from Delhi and Rohtak and proceed towards each other at the rate of 75 km and 65 km/hr, respectively. When they meet, it is found that one train has travelled 10 km more than the other. Find the distance between Delhi and Rohtak.

Solution

Distance between Delhi and Rohtak

$$= d\left(\frac{s_1 + s_2}{s_2 - s_1}\right) \text{km.}$$

$$= 10\left(\frac{75 + 65}{75 - 65}\right) \text{km.}$$

= 140 km.

6.15

If the speed of a boat (or a swimmer) be x km/hr and the speed of the stream or the current be y km/hr, then
(a) speed of the boat (or swimmer) downstream = (x + y) km/hr.
(b) speed of the boat (or swimmer) upstream = (x – y) km/hr.

NUMERICAL CHALLENGE 6.15

The speed of a boat in still water is 20 km/hr. If the speed of the stream be 4 km/hr, find its downstream and upstream speeds.

Solution

Speed of the boat (x) = 20 km/hr
Speed of the stream (y) = 4 km/hr
∴ Downstream speed = x + y = (20 + 4) = 24 km/hr and upstream speed = x – y = (20 – 4) = 16 = km/hr.

6.16

(i) Speed of the boat (or swimmer) in still water = $\frac{1}{2}$ (Downstream Speed + Upstream Speed)

(i) Speed of the stream = $\frac{1}{2}$ (Downstream Speed – Upstream Speed)

NUMERICAL CHALLENGE 6.16

A boat is rowed down a river 40 km in 5 hr and up a river 21 km in 7 hr. Find the speed of the boat and the river.

Solution

Speed of the boat downstream = $\frac{40}{5}$ = 8 km/hr.

Speed of the boat upstream = $\frac{21}{7}$ = 3 km/hr.

∴ Speed of the boat

$= \frac{1}{2}$ (Downstream Speed + Upstream Speed)

$= \frac{1}{2}(8 + 3) = \frac{11}{2}$ = or 5 × 5 km/hr.

and speed of the river

$= \frac{1}{2}$ (Downstream Speed – Upstream Speed)

$= \frac{1}{2}(8 - 3) = \frac{5}{2}$ = or 2.5 km/hr.

6.17

If a man capable of rowing at the speed of x km/hr in still water, rows the same distance up and down a stream which flows at a rate of y km/hr, then his average speed throughout the journey is

$$= \frac{\text{Upstream} \times \text{Downstream}}{\text{Man's rate in still water}}$$

$$\frac{(x-y)(x+y)}{x} \text{ km/hr.}$$

NUMERICAL CHALLENGE 6.17

A man rows at a speed of 8 km/hr in still water to a certain distance upstream and back to the starting point in a river which flows at 4 km/hr. Find his average speed for total journey.

Solution

Average speed

$$= \frac{\text{Upstream} \times \text{Downstream}}{\text{Man's rate in still water}}$$

$$= \frac{(8-4)(8+4)}{8} = 6 \text{ km/hr.}$$

6.18

A man can row a boat in still water at x km/hr. In a stream flowing at y km/hr, if it takes t hrs more in upstream than to go down together stream for the same distance, then the distance is given by

$$\frac{(x^2 - y^2)t}{2y} \text{ km}$$

NUMERICAL CHALLENGE 6.18

A man can row 7 km/hr in still water. If the river is running at 3 km/hr, it takes 6 hrs more in upstream than to go downstream for the same distance. How far is the place?

Solution

The required distance

$$= \frac{(x^2 - y^2)t}{2y}$$

$$= \frac{(49-9)6}{2 \times 3} = 40 \text{ km.}$$

6.19

A man rows a certain distance downstream in t_1 hrs and returns the same distance upstream in t_2 hrs. If the speed of the stream be y km/hr, then the speed of the man in still water is given by

$$y\left(\frac{t_2 + t_1}{t_2 - t_1}\right) \text{km/hr.}$$

NUMERICAL CHALLENGE 6.19

A motorboat covers a certain distance downstream in 6 hrs but takes 8 hrs to return upstream of the starting point. If the speed of the stream be 6 km/hr, find the speed of the motor boat in still water.

Solution

Speed of the motorboat in still water

$$= y\left(\frac{t_2 + t_1}{t_2 - t_1}\right) \text{ km/hr}$$

$$= 6\left(\frac{8+6}{8-6}\right) = 42 \text{ km/hr.}$$

6.20

A man can row a boat in still water at x km/hr. In a stream flowing at y km/hr if it takes him t hrs to row to a place and come back, then the distance between the two places is

$$\frac{t(x^2 - y^2)}{2x} \text{ km.}$$

NUMERICAL CHALLENGE 6.20

A man can row 6 km/hr in the still water. If the river is running at 2 km/hr, it takes him 3 hrs to row to a place and block. How far is the place?

Solution

The required distance

$$= \frac{t(x^2 - y^2)}{2x} \text{ km.}$$

$$= \frac{3(36 - 4)}{2 \times 6} = 8 \text{ km.}$$

6.21

A boat (or a swimmer) takes n times as long to row upstream as to row downstream the river. If the speed of boat (or swimmer) be x km/hr and the speed of stream be y km/hr, then

$$x = y\left(\frac{n+1}{n-1}\right)$$

NUMERICAL CHALLENGE 6.21

A man can row at the rate of 4 km/hr. in still water. If the time taken to row a cetain distance upstream is 3 times as much as to row the same distance downstream, find the speed of the current.

Solution

We have,

$$\text{Speed of the man} = \left(\frac{n+1}{n-1}\right) \text{ speed of the current}$$

$$\Rightarrow \quad 4 = \left(\frac{3+1}{3-1}\right) \text{ speed of the current.}$$

$\therefore$ Speed of the current = 2 km/hr.

1. Udai travels half of his journey by train at the speed of 120 km/h and rest half by car at 80 km/h. What is the average speed

Sol. Let the total distance be 2D km, then

Total time = Time taken by train + Time taken by car

$$= \frac{D}{120}+\frac{D}{80}$$

$$\therefore \quad \text{Average speed} = \frac{2D}{\frac{D}{120}+\frac{D}{80}}$$

$$\frac{2D}{D\left(\frac{1}{120}+\frac{1}{80}\right)} = \frac{2}{\left(\frac{2+3}{240}\right)} = 96 \text{ km/h}$$

Alternatively: Consider the distance in numbers (since it dependent of the distance) as the LCM of the speeds. Then, the total distance = LCM of 120 and 80 = 240

Thererfore, time taken by train = $\frac{120}{120} = 1\text{h}$

and time taken by car = $\frac{120}{80}-\frac{3}{2}\text{h}$

$$\therefore \quad \text{Average speed} = \frac{\text{Total distance}}{\text{Total time taken}}$$

$$= \frac{240}{1+\frac{3}{2}} = 96 \text{ km/h}$$

Alternatively: Average speed = $\frac{2(xy)}{(x+y)}$

where x and y are the speeds.

$$\therefore \quad \text{Average speed} = \frac{2\times 120\times 80}{120+80} = 96 \text{ km/h}$$

2. Speed of karan is 40 km/h and speed of Arjun is 60 km/h. What is the ratio of time taken by each to cover the same distance ?

Sol.

Karan	Arjun		
Speed	40	:	60
$\Rightarrow$	2	:	3
$\therefore$ Time	3	:	2

Alternatively: Time taken = $\frac{1}{40}:\frac{1}{60} = 3:2$

Note: For the constant distance covered, the ratio of time taken by each person is the ratio of the reciprocal of their speeds and vice-versa.

If the ratio of speeds of A, B, C , D be a : b : c : d, then the ratio of time taken by A, B, C and D to cover the same distance

$$= \frac{1}{a}:\frac{1}{b}:\frac{1}{c}:\frac{1}{d}$$

and if the time taken by A, B, C and D be p : q : r : s, then the ratio of their speeds

$$= \frac{1}{p}:\frac{1}{q}:\frac{1}{r}:\frac{1}{s}$$

3. The distance of the college and the home of Rajeev is 80 km. One day he was late by 1 hour than the normal time to leave for the college, so he increased his speed by 4 km/h and thus he reached to college at the normal time. What is the changed (or increased) speed of Rajeev ?

Sol. Let the normal speed be x km/h, then

$$\frac{80}{x}-\frac{80}{(x+4)} = 1$$

$$\Rightarrow \quad x^2 + 4x - 320 = 0$$

$$\Rightarrow \quad x(x + 20) - 16(x + 20) = 0$$

$$(x + 20)(x - 16) = 0$$

$$x = 16 \text{ km/h}$$

$$\therefore \quad (x + 4) = 20 \text{ km/h}$$

Therefore increased speed = 20 km/h

Alternatively : If t_1 and t_2 be the original and changed time and S_1 and S_2 be the original and changed speeds, then

$$S_1 \times S_2 = \frac{\text{Distance}\times(S_1 \sim S_2)}{(t_1 \sim t_2)}$$

$$\text{Also,} \quad t_1 \times t_2 = \frac{\text{Distance}\times(t_1 \sim t_2)}{(S_1 \sim S_2)}$$

$$\therefore \quad S_1 \times S_2 = \frac{80}{1} \times 4 = 320$$

$$\therefore \quad S_1 \times S_2 = 320$$

$$\text{or} \quad S_1 \times (S_1 + 4) = 320$$

$$\Rightarrow \quad S_1 \text{ 16 and } S_2 = 20$$

Note: Here you need not to solve necessarily quadratic equation. You can just try and find two factors of 320 in such a way that (in this particular problem) one factor must be greater than the other factor by 4.

Alternatively: Go through options. Consider 20

$$t_2 = \frac{80}{20} = 4$$

$$t_1 = 4 + 1 = 5$$

$$S_1 = \frac{80}{5} = 16$$

Since, S_1 is 4 km/h less than S_2. Hence, option (d) is together.

4. Shweta when increase her speed from 24 km/h to 30 km/h she takes one hour less than the usual time to cover a certain distance. What is the distance usually covered by shweta?

Sol. Let the original time be t hours, then

$$24t = 30 \times (t - t) = D \quad \text{(Distance)}$$

then $t = 5$

$\therefore$ Distance $= 24 \times 5 = 120$ km

Alternatively: Go through options.

$$\left.\begin{matrix}\frac{120}{24} = 5h \\ \frac{120}{30} = 4h\end{matrix}\right\} 1 \text{ hour less}$$

Hence, the option (c) is correct.

Alternatively: Since distance (D) is constant.

Therefore, $D = S_1 \times t_1 = S_2 \times t_2$

It means here we can apply product constancy

Speed		Time
$\frac{1}{4}\uparrow$	$\frac{1}{5}\downarrow$	= 1 hour

$\therefore$ Original time taken $= 5 \times 1 = 5$ hours

Therefore, Distance = Original speed × Original time

$= 24 \times 5 = 120$ km

Note: In the given exercise or in the whole chapter you have to solve maximum problems through product constancy concept described in the chapter of ratio proportion and variation.

Solving through product constancy gives faster resultes.

Alternatively: Let the distance be D, then

$$\frac{D}{24} - \frac{D}{30} = 1$$

$$D = 120 \text{ km.}$$

5. Kriplani goes to school at 20 km/h and reaches the school 4 minutes late. Next time, she goes at 25 km/h and reaches the school 2 minutes earlier than the scheduled time. What is the distance of her school ?

Sol. Increase in speed = 5 km/h

Decrease in time = 6 min(4 + 2)

By product constancy :

Speed		Time
$\frac{1}{4}\uparrow$	$\frac{1}{5}\downarrow$	= 6 min

It means original time = 30 min $\left(\because \frac{x}{5} = 6 \Rightarrow x = 30\right)$

$\therefore$ Total distance = Original speed × Original time

$$= 20 \times \frac{30}{60} = 10 \text{ km}$$

6. Amit covers a certain distance with his own speed, but he when reduces his speed by 10 km/h his time duration for the journey increase by 40 hours, while if he increases his speed by 5 km/h form his original speed he takes 10 hours less than the original time taken. Find the distance covered by him.

Sol. $\left.\begin{matrix}S & & T \\ -10 & \times & +40\end{matrix}\right\}$ $40S - 10T = |-400|$ ... (i)

$\left.\begin{matrix}S & & T \\ +5 & \times & -10\end{matrix}\right\}$ $-10S + 5T = |-50|$ ... (ii)

Solving eq. (i) and (ii), we get

$S = 25$ and $T = 60$

$\therefore$ Distance (D) = S × T

$= 25 \times 60 = 1500$ km

where D → Distance, S → speed, T → Time

'+' means increase in value.

and '–' means decrease in value.

Alternatively: Let distance be x km and usual speed y km/h.

$$\frac{x}{(y-10)} - \frac{x}{y} = 40$$

$$\Rightarrow \quad x\left[\frac{10}{y(y-10)}\right] = 40$$

$$\Rightarrow \quad x = 4y(y - 10)$$

and $$\frac{x}{y} - \frac{x}{(y+5)} = 10$$

$$\Rightarrow \quad x = 2y(y + 5)$$

from equation (i) and (ii

$$4y(y - 10) = 2y(y + 5)$$

$$2y - 20 = y + 5$$

$$y = 25 \text{ km/h}$$

$$x = 1500 \text{ km.}$$

7. A train met with an accident 60 km away from Anantpur station. It completed the remaining journey at $\frac{5}{6}$ th of the previous speed and reached the Baramula station I hour 12 min late. Had the accident taken place 60 km further, it would have been only 1 hour late.

(a) What is the normal speed of the train?

(b) What is the distance between Anantpur and Baramula ?

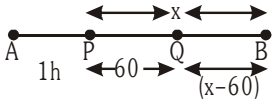
Sol. **Case I.** Since the speed is decreased by $\frac{1}{6}$. So, that time will be increased by 1/5, which is equal to 1 hour 12 minutes.

It means the normal time required for this remaining part (x) of the journey is 5×72 min = 360 min = 6 h.

($\because$ 1 h 12 min = 72 min)

P is the place of accident.

Case II. When accident is supposed to be happened at Q.



Since, the speed is decreased by $\frac{1}{6}$, hence, the time will be increased by $\frac{1}{5}$, which is equal to 1 hour, hence the normal time required for this remaining part (x – 60) of journey = $5 \times 1 = 5$ hours.

8. The distance between two placess P and Q is 700 km. Two persons A and B started towards Q and P from P and Q simultaneously. The speed of A is 30 km/h and speed of B is 40 km/h. They meet at a point M which lies on the way from P to Q.

(i) How long will they rake to meet each other at M?

(ii) What is the ratio of PM : MQ?

(iii) What is the disatance MQ?

(iv) What is the extra time needed by A reach at Q than to reach at P by B?

(v) What is the ratio of time taken by A and B to reach their respective destinations after meeting at M?

(vi) In how many hours will they be separated by only 560 from each other when they cross M (time to be considered after their meeting)?

(vii) How long will it take is separate then by 280 km.

Sol.

(i) Since, they are coming towards each other from opposite ends, therefore the relative speed will be the sum of their speeds = 30 + 40 + 70 km/h.

Thus, the required time to meet at M

= Time required to cover 700 km (combined)

$= \frac{700}{70} = 10$ h

Thus in 10 hours they will meet each other at M.

(ii) The ratio of their distance covered to meet at M

= Ratio of their speeds 3 : 4

(Since, time is constant i.e., same for each)

Thus PM : MQ = 3 : 4

(iii) $MQ = \frac{4}{7} \times 700 = 400$ km

(iv) Time required by A to reach at Q = $\frac{700}{30} = \frac{70}{3}$h

Time required by B to reach at P = $\frac{700}{40} = \frac{70}{4}$h

$\therefore$ Extra time required by A = $\frac{70}{3} - \frac{70}{4}$

$= 70 \times \frac{1}{12} = 5$h 50 min

(v) Time required by A to cover MQ = $\frac{400}{30}$

and time required by B to cover MP = $\frac{300}{40}$

$\therefore$ Required ratio = $\frac{400/30}{300/40} = \frac{16}{9}$

Remember: It speed of A is S_A and speed of B is S_B and A takes t_A time to cover MQ and B takes t_B time to cover MP, then

$$\frac{S_A}{S_B} = \sqrt{\frac{t_B}{t_A}}$$

(vi) It means they that have to cover (700 – 560) = 140 km. Thus, the required time to cover 140 km distance

$= \frac{140}{70} = 2$h

(vii) Since in each hour they separate by 70 km from each other. Hence, to separate by 280 km, time required

$= \frac{280}{70} = 4$h

9. A boat can move at 5 km/h in still water (i.e., when water is not flowing). The speed of river is 1 km/h. A beat takes 80 minutes to go from a point A to another point B and return to the same point.

(i) What is the distance between the two points?

(ii) What is the ratio of downstream speed and upstream speed?

(iii) Whati is the ratio of time taken in downstream speed to the upstream speed?

Sol. Downstream speed of boat = (5 + 1) = 6 km/h
Upstream speed of boat = (5 – 1) = 4 km/h

Therefore,

$$\frac{\text{Downstream speed}}{\text{Upstream speed}} = \frac{\text{Downstream time}}{\text{Upstream time}}$$

$$\frac{6}{4} = \frac{3}{2} = \frac{\text{Time taken in upstream direction}}{\text{Time taken in downstream direction}}$$

$$\therefore \text{Time taken in downstream} = \frac{2}{5} \times 80 = 32 \text{ min and}$$

$$\text{time taken in upstream direction} = \frac{3}{5} \times 80 = 48 \text{ min}$$

$\therefore$ Distance between two points = DS speed × DS time
= US speed × US time

where DS → Downstream and US → upstream

$$D = \frac{6 \times 32}{60} = 3.2 \text{ km}$$

or $$D = 4 \times \frac{48}{60} = 3.2 \text{ km}$$

(i) 3.2 km (ii) 3 : 2 (iii) 2 : 3

10. A man can row 9 km/h in still water. It takes him twice as long as row up as to row down. Find the rate of stream of the river.

Sol. $$\frac{\text{Time taken in upstream}}{\text{Time taken in downstream}} = \frac{2}{1}$$

$$\therefore \quad \frac{\text{Downstream speed}}{\text{Upstream speed}} = \frac{2}{1} \text{ where } \frac{B+R}{B-R} = \frac{2}{1}$$

B → speed of boat in still water

R → speed of current

$$\Rightarrow \quad \frac{B}{R} = \frac{3}{1} \qquad \text{(By componendo and dividendo)}$$

$$\Rightarrow \quad \frac{9}{R} = \frac{3}{1} \Rightarrow R = 3 \text{ km/h}$$

11. A train, 110 m long, travels at 60 kmph. How long does it take to cross

(a) a telegraph post?

(b) a man running at 6 kmph in the same direction ?

(c) a man running at 6 kmph in the opposite direction?

(d) a platform 240 m long?

(e) another train 170 m long, standing on another parallel track?

(f) another train 170 m long, running at 54 kmph in same direction?

(g) another train 170 metre long, running at 80 kmph in opposite direction?

Sol. Since 1 kmph = $\frac{5}{18}$ m/s

$\therefore$ Speed of train = 60 kmph = $60 \times \frac{5}{18}$ m/s.

(a) The telegraph post is a stationary object, so, the time taken by the train is the same as the time taken by the train to cover a distance equal to its own length.

$$\text{Required time} = \frac{110+0}{60 \times \frac{5}{18}} = 6.6 \text{ seconds.}$$

(b) The man is moving in same direction, so length to be covered = Length of the train and relative speed = speed of train – speed of man.

So, required time

$$\frac{110}{(60-6) \times \frac{5}{18}} = \frac{110}{15} = 7.33 \text{ seconds.}$$

(c) The man is moving, in opposite direction, so length to be covered = Length of the train and relative speed = speed of train + speed of man.
So, required time

$$\frac{110}{(60+6) \times \frac{5}{18}} = \frac{110 \times 18}{330} = 6 \text{ seconds.}$$

(d) The platform is stationary of length 240 m. Length to be covered

= Length of the train + Length of the platform = 110 + 240 = 350 m and relative speed = speed of train. So, required time

$$= \frac{350}{60 \times \frac{5}{18}} = \frac{350 \times 18}{300} = 21 \text{ seconds.}$$

(e) Another train is stationary.

Length to be covered

= Length of the train + Length of the other train

= 110 + 170 = 280 m and relative speed = 60 kmph.

So, required time

$$= \frac{280}{60\times\frac{5}{18}} = \frac{280\times 18}{300} = 16.8 \text{ seconds.}$$

(f) Another train is moving in same direction. Length to be covered = Length of the train + Length of the other train = 110 + 170 = 280 m and relative speed = 60 – 54 = 6 kmph. So, required

$$\text{time} = \frac{280}{6\times\frac{5}{18}} = \frac{280\times 3}{5} = 168 \text{ seconds.}$$

(g) Here, another train is moving in opposite direction. Length to be covered

= Length of the train + Length of the other train

= 110 + 170 = 280m and relative speed

= 60 + 80 = 140 kmph. So, required time

$$= \frac{280}{140\times\frac{5}{18}} = \frac{280\times 18}{140\times 5} = 7.2 \text{ seconds.}$$

12. A man rows 10 km upstream and back again to the starting point in 55. If the speed of stream is 2 kmph, then find the speed of rowing in still water.

Sol. Let x be the speed of rowing in still water.

y = speed of stream = 2 kmph. Total time $T = \frac{55}{60}h$.

Hence, Total time

$$= \frac{\text{Speed in still water} \times \text{Total distance}}{\text{Upstream rate} \times \text{Downstream rate}}$$

$$\Rightarrow \frac{55}{60} = \frac{x\times 2\times 10}{(x+2)(x-2)} \Rightarrow \frac{55}{60}(x^2 - 2^2) = 2\times x\times 10$$

$$\Rightarrow 11x^2 - 240x - 44 = 0 \Rightarrow (x - 22)(11x + 2) = 0$$

$\therefore$ x = 22, since (–)ve value of x is not admissible.

Total Distance = Downstream distance + Upstream distance = 2 × any one side distance.

13. A man who can swim 48 m/min in still water swims 200 m against the current and 200 m with the current. If the difference between these two times is 10 min, then find the speed of the current in m per min.

Sol. Let the speed of stream be x kmph. The equation becomes

$$\frac{200}{48-x} - \frac{200}{48+x} = 10$$

$\Rightarrow$ 200(48 + x) – 200(48 – x) = 10[$48^2 - x^2$]

$\Rightarrow$ x^2 + 40x – 2304 = 0.

On solving it we get x = 32 and x = –72 (not acceptable) i.e. speed of stream is 32 m/min.

14. The metro trains which travel at a uniform speed between stations A and B run at a regular interval of 12 min. If Ajay, walking along the railway track at uniform speed, observes that every 10 min there is a train coming from the opposite direction and passes him, then what is the time-gap between one train that overtakes him from behind and the immediately next train overtaking him?

(1) 15 min (2) 16 mins

(3) 13.5 mins (4) None of these

Sol. Let the speed of train be V and speed of Ajay be v. Then, by relative speed

10(V + V) = 12V ...(i)

Similarly,

T(V – v) = 12V ...(ii)

From Eqs. (i) and (ii),

$$\frac{V+v}{V} + \frac{V-v}{V} = \frac{12}{10} + \frac{12}{T}$$

$$\Rightarrow T = 12 \times \frac{10}{8} = 15 \text{ min}$$

15. In covering a distance of 30 km, Amit takes 2 hrs more than Suresh. If Amit doubles his speed, then the would take 1 hour less than Suresh. Amit's speed is

(1) 5 km/hr (2) 7.5 km/hr

(3) 6 km/hr (4) 6.25 km/hr

Sol. Let Amit's speed = x km/hr

Let Suresh's speed = y km/hr

$$\therefore \quad \frac{30}{x} = \frac{30}{y} + 2 \quad \text{....(i)}$$

If Amit's speed becomes 2x km/hr, then

$$\frac{30}{2x} = \frac{30}{y} - 1 \quad \text{....(ii)}$$

From Eqs. (i) and (ii)

$$\Rightarrow \quad \frac{30}{x} - 2 = \frac{30}{2x} + 1$$

$\Rightarrow$ x = 5, y = 7.5

16. Two persons A and B are at two places P and Q. respectively. A walks at v km/hr and B is 2 km/hr faster than A, starting simultaneously from where they stand. If they walk towards each other, they meet in 72 min. It they walk in the same direction, the faster overtakes the slower in 6 hrs. Find their respective speeds (in km/hr).

Sol. Let d kilometres be the distance between A and B.

When A and B walk towards each other $\frac{d}{v+(v+2)}$

$= \frac{72}{60}$ and if they walk in the same direction

$\frac{d}{(v+2)-v} = 6,$

i.e. $\frac{d}{2} = 6$ or d = 12 km

So, $\frac{d}{2v+2} = \frac{72}{60}$ and v = 4 km/hr Ratio of speeds = 4 : 6

17. A starts 3 min after B are for a place 4.5 km distant B, on reaching his destination, immediately returns and after walking a km meets A. If A can walk 1 km in 18 mins, then what is B's speed ?

Sol. A covers 3.5 km before meeting B in (18 × 3.5) + 3 = 66 mins

B covers a distance of 5.5 km in 66 mins, i.e. $\frac{66}{60}$ hrs, i.e. $\frac{11}{10}$ hrs.

$\therefore$ B's speed = $\frac{11}{2} \times \frac{10}{11}$ = 5 km/hr.

18. Two champion swimmings start a two-length swimming face at the same time but from opposite ends of the pool. They swim in line and at constant but different speeds. They first pass at a point 18.5 m from the deep end and having completed one length, each swimmer is allowed to rest on the edge of the pool for 45 s. After setting off on the return length, the swimmers pass for the second time just 10.5 m from the shallow end. Thus, the length of the pool is

Sol. When they pass for the first time, the combined distance = Length of the pool. When they meet for second time, the combined distance = 3 × length pool. As both have constant speeds, hence at the second meeting each swimmer had covered 3 times as much distance as at the first meeting. Since the swimmer starting at the deep end had covered 18.5 m when they first met, he covered 18.5 × 3 = 55.5 m when they next met. It is clear then this distance is 10.5 m more than the length of the pool which is hence, 55.5 – 10.5 = 45 m.

1. A 125 meters long train overtakes a man walking at the rate of 4 km/hr, parallel to the line in the same direction, in 9 seconds. The speed of the train is
(1) 48 km/hr (2) 54 km/hr
(3) 80 km/hr (4) 100 km/hr

2. A clerk walks from his house at 4 km/hr and reaches his office 5 minutes late. If his speed is 5 km/hr, he will reach his office 10 minutes early. How far is his from home?
(1) 5 km. (2) $\frac{5}{12}$ km. (3) $\frac{5}{2}$ km (4) 15 km

3. Ravi rows a distance of 1 km down the stream in 10 minutes and takes 30 minutes to cover the same distance up stream. The speed of the stream is
(1) 5 km per hour (2) 3 km per hour
(3) 2 km per hour (4) 4 km per hour

4. It takes an hour for a saree to dry in the sun. 25 such sarees will dry in
(1) 50 hrs (2) 20 hrs
(3) 1 hr (4) 625 hours

5. A monkey ascends a greased pole 21 m high. In the first minute he ascends 5 m and in the next minute he descends 3 m. If he continues this process, in how many minutes will he reach the top?
(1) 17 minutes (2) 10.5 minutes
(3) 21 minutes (4) 40 minutes

6. A train running at a speed of 54 km/hour passes a signal post in it 8 seconds. The length of train is
(1) 432 m. (2) 150 m.
(3) 120 m. (4) Data inadequate

7. A car is 25 km ahead of a scooter. The car is travelling at 40 km/hr and the scooter at 50 km/hr. The scooter will overtake the car after
(1) $1\frac{1}{2}$ hrs (2) $2\frac{1}{2}$ hrs (3) $3\frac{1}{2}$ hrs (4) 3 hrs

8. Hari singh can cover a circular path of radius 21 m. in 44 sec. He will cover a distance of 3 km in
(1) 16 min. 20 secs. (2) 16 min. 40 secs.
(3) 18 min. 00 secs. (4) 18 min. 30 secs.

9. Two cars start from one point and move along two roads at right angles to each other. Their speeds are 36 km/hr and 48 km/hr respectively. After 15 sec. the distance between them will be
(1) 400 m. (2) 150 m.
(3) 300 m. (4) 250 m.

10. Javed walks at the rate of 3 km/hr for 2 hours and then at the rate of 2 km/hr for 3 hours. His average speed is .... km/hr.
(1) 4 (2) 2.4 (3) 2.5 (4) 5

11. Rohit can row 18 km in 4 hrs down stream but while returning he takes 12 hours. The speed of the water current is
(1) 1.5 km/hr (2) 4 km/hr
(3) 2 km/hr (4) 3 km/hr

12. Two persons move towards each other from two places 55 km apart. One moves at a speed of 12 km/hr and other at 10 km/hr. They will be first 11 km apart after moving for
(1) 3 hrs (2) 2hrs (3) 6hrs (4) 4hrs

13. Kishan cycles at a speed of 8 km/hr. After every 10 km, he rests for 20 minutes. How long will he take to travel a distance 40 km?
(1) 6 hrs 20 min (2) 8 hrs
(3) 6 hrs (4) 5 hrs

14. The length of a running train A is 30 percent more than the length of another train B running in the opposite direction. To find out the speed of the train B, which of the following informations given in the statements P and Q is/are required?
P. The speed of train A is 80 km/hr
Q. They take 90 seconds to cross each other
(1) Either P or Q is sufficient
(2) Both P and Q together are not sufficient
(3) Only P is sufficient
(4) Only Q is sufficient

15. A train 220 metres long is moving at a speed of 90 km/hr. The time taken by the train to cross a platform 440 m long is
(1) 21.6 second (2) 23.88 second
(3) 26.4 second (4) 28.88 second

16. A train 150 m long is moving at a speed of 30 km/hr. It will cross a cyclist coming from the opposite direction at a speed of 10 km/hr in
(1) 11.5 second (2) 13.5 second
(3) 14.25 second (4) 15.75 second

17. What is the speed of a 75 m long train which passes a 150 m long platform in 10 second?
(1) 63 km/hr (2) 72 km/hr
(3) 76.75 km/hr (4) 81 km/hr

18. A train takes 40 minutes for a journey if it runs at 0.05 km/sec. The rate at which the train must run to reduce the time to 28 minutes will be nearly
(1) 257 km/hr (2) 212 km/hr
(3) 188 km/hr (4) 88 km/hr

19. A man takes 6 hours 15 minutes to walk a certain distance and riding back. He could walk both ways in 7 hours 45 minutes. He can ride both ways in
(1) 4 hrs 30 min. (2) 6 hrs 30 min.
(3) 4 hrs 45 min. (4) None of above

20. A thief steals a scooter at 1 P.M. and drives at the speed of 45 Km/hr. The theft is discovered at 2 P.M. and the owner chases him at 54 km/hr. He will be caught at
(1) 7 P.M. (2) 6 P.M.
(3) 8 P.M. (4) 6.30 P.M.

21. A man rows upstream for 13 km and downstream for a distance of 28 km in 5 hrs each time. The speed of the water current is
(1) 2 km/hr (2) 1.5 km/hr
(3) 2.5 km/hr (4) 3 km/hr

22. A train with stoppages, covers a distance at 60 km/hr and without stoppages at 90 km/hr. The train stops for ... minutes per hour.
(1) 20 (2) 15 (3) 30 (4) 25

23. Anuva takes 20 minutes less to reach her office if her speed increase by 5 km/h and takes 30 minutes more if her speed decreases by 5 km/h. What is her original speed ?
(1) 20 km/h (2) 30 km/h
(3) 35 km/h (4) None of these

24. A boat takes 20 minutes and 30 minutes to cover a particular distance downstream and upstream respectively. If the speed of the boat in still water is 20 m/s, find the speed of the stream ?
(1) 6 m/s (2) 8 m/s (3) 12 m/s (4) 4 m/s

25. A 100 m long train crosses a stationary man in 10 seconds. What is the speed of the train ?
(1) 18 km/h (2) 27 km/h
(3) 36 km/h (4) 45 km/h

26. The speed of boat in still water is 12 km/h. If it takes 1 hour to go upstream 6 kms; in what time will it return same distance downstream ?
(1) 20 min (2) 30 min (3) 5 min (4) 10 min

27. Two trains A and B, travelling in opposite directions, cross each other in six seconds. The speed of train A is 126 km/h, while that of train B is 90 km/h. If the length of train A is 160 metres, what is the length of train B ?
(1) 100 m (2) 80 m (3) 180 m (4) 200 m

28. A train crosses a stationary person in 3 seconds while it takes 10 seconds to cross a platform, travelling at same speed. If the length of the platform is 210 metres, what is the length of the train ?
(1) 180 m (2) 135 m (3) 90 m (4) 45 m

29. A 225 m long train crosses another 150 m long train travelling in opposite direction in 12.5 sec. If one of the trains travels @ 72 km/h, what is the speed of the other?
(1) 54 km/h (2) 27 km/h
(3) 36 km/h (4) 45 km/h

30. What is the speed of a train which overtakes a man walking at a speed of 5 km/h in 30 seconds, if the train is 274 metres long ?
(1) 51.88 km/h (2) 47.88 km/h
(3) 37.88 km/h (4) 21.67 km/h

31. Two persons, 27 km apart, starting out at the same time are together in 9 hrs if they walk in the same direction, but in 3 hrs. if they walk in opposite directions. What are their rates of walking (in km/h) ?
(1) 5, 2 (2) 4, 3 (3) 6, 3 (4) 8, 7

32. A train starts from station X at the rate of 60 km/h and reaches station Y in 45 minutes. If the speed is reduced by 6 km/h. how much more time will the train take to return from station Y to station X ?
(1) 5 min (2) $7\frac{1}{2}$ min (3) 6 min (4) 4 min

33. In one hour a boat goes 11 km along the stream and 5 km against the stream. The speed of the boat in still water (in km/h) is :
(1) 5 (2) 6 (3) 8 (4) 9

34. A boat has to run upstream to reach point Y from a point X, 20 kms away. The boat starts from point X for point Y and comes back to point X in a total time of 41 minutes and 40 seconds. What is the speed of the boat ?
(1) 166 km/h (2) 7.2 km/h
(3) 148 km/h (4) data inadequate

35. Two trains for Bombay leave Delhi at 6 a.m. and 6 : 45 am and travel at 100 km/h and 136 km/h respectively. How many kilometres from Delhi will the two trains be together ?
(1) 262.4 km (2) 260 km
(3) 283.33 km (4) 272.2 km

36. In a 500 m race, the ratio of speed of two runners Vinay and Shyam is 3 : 4. If Vinay has a start of 140 m then Vinay wins by
(1) 15 m (2) 20 m (3) 25 m (4) 30 m

37. A motorboat whose speed in still water is 15 km/h goes 30 km down stream and comes back in a total 4 hours 30 min. Determine the speed of the stream.
(1) 2 km/h (2) 3 km/h
(3) 4 km/h (4) 5 km/h

38. Sujit covers a distance in 40 minutes if he drives at a speed of 60 km/h on an average. Find the speed at which he must drive at to reduce the time of the journey by 25% ?
(1) 60 km/h (2) 70 km/h
(3) 75 km/h (4) 80 km/h

39. Salil walks a certain distance at 2.5 km/h for 2 hours and then runs 10 km at a certain speed for 3 hours. Salil's average speed for the whole journey is ____.
(1) 2 km/h (2) 3 km/h
(3) 5 km/h (4) 6 km/h

40. A train 150 meters long completely passes a boy walking in the opposite direction at 6 kmph in 9 seconds and a car travelling in the opposite direction in 6 seconds. Find the speed of the car.
(1) 18 kmph (2) 36 kmph
(3) 48 kmph (4) 60 kmph

41. Rakesh travelled from Hyderabad to mumbai in his car at a certain speed. He would have reached Mumbai $2\frac{1}{2}$ hours early if he had driven his car at 75 km/h. If the distance between Hyderabad and Mumbai is 750 km, then the speed at which Rakesh travelled is
(1) 60 km/h (2) 50 km/h
(3) 80 km/h (4) 90 km/h

42. A train 100 meters long completely passes a man walking in the same direction at 6 kmph in 5 seconds and a car travelling in the same direction in 6 sec. Find the speed of the car.
(1) 30 kmph (2) 24 kmph
(3) 48 kmph (4) 18 kmph

43. If a 300 m long train is travelling at a constant speed, then find the ratio of the time it takes to cross a pole and a 500 m long bridge.
(1) 3 : 8 (2) 3 : 5
(3) 5 : 6 (4) 5 : 12

44. A car traveles x km at 60 kmph and then travels another 2x km at 40 kmph. Find its average speed for the entire distance.
(1) 45 kmph (2) 48 kmph
(3) 50 kmph (4) 56 kmph

45. A policeman, travelling at 75 km/h, chases a thief 1500 m away from him and travelling at 60 km/h. What is the time taken by the policeman to catch the thief ?
(1) 6 min (2) 16 min (3) 12 min (4) 8 min

46. The ratio of the speeds of Amar and Akbar is 8 : 5. If Akbar takes 15 minutes more than Amar to cover a certain distance, then find the time taken by Akbar to cover the same distance.
(1) 25 minutes (2) 15 minutes
(3) 20 minutes (4) 40 minutes

47. A cat sights a rat at a distance of 200 m away from it and starts running towards it at 20m/sec. At this moment, the rat notices the cat and moves away from it at a speed of 15 m/sec. After what time will the cat be able to catch the rat ?
(1) 20 sec. (2) 40 sec.
(3) 60 sec. (4) 80 sec.

48. Two persons A and B move towards each other from P and Q respectively. They meet 50 kms away from Q. If the ratio of the speeds of A and B is 4 : 1, find the distance between P and Q.
(1) 200 km (2) 175 km
(3) 125 km (4) 250 km

49. Two trains 150 m long and 250 m long are travelling at the speeds of 30 kmph and 33 kmph respectively on parallel tracks in opposite directions. What is the time taken by these trains to cross each other completely from the moment they meet ?
(1) $22\frac{6}{7}$ sec (2) $21\frac{3}{7}$ sec
(3) $22\frac{1}{7}$ sec (4) $21\frac{5}{7}$ sec

50. A person takes 1 h more than that of his friend to reach a party. The distance travelled by the person is 20 km more than that of his friend. Also given that the speed of the person is 16 km/h while that of his friend is 15 km/h, find the distance travelled by his friend to reach the party.
(1) 60 km (2) 40 km (3) 80 km (4) 30 km

51. The average of the speed of the boat upstream and the speed of the boat downstream is equal to the :-
(1) speed of the boat in still water
(2) speed of the stream
(3) speed of the boat upstream
(4) speed of the boat downstream.

52. A man can swim downstream at 10 km/h and upstream at 4 km/h. Find the speed of the man in still water and the speed of the current respectively.
(1) 7 kmph; 2 kmph
(2) 7.5 kmph; 2.5 kmph
(3) 7 kmph; 3 kmph
(4) 8 kmph; 2 kmph

53. A car covers 300 km at a constant speed. If its speed was 10 kmph more, it would have taken one hours less to travel the same distance. Find the speed of the car.
(1) 60 kmph (2) 50 kmph
(3) 40 kmph (4) 75 kmph

54. The sum of the time taken by train P and train Q to cross their own lengths is twice the time taken by them to cross each other when they are travelling in opposite direction to each other. If P takes 20 seconds to cross a stationary pole, find the time taken by Q to do the same. (in seconds)
(1) 25 (2) 30 (3) 20 (4) 15

55. A man can row 20 kmph in still water. It takes him thrice as long to row up as to row down the river. Find the speed of the stream.
(1) 8 kmph (2) 10 kmph
(3) 12 kmph (4) 15 kmph

56. A person saves 5 minutes in covering a certain distance by increasing his speed by 20%. What is the time taken to cover the distance at his usual speed ?
(1) 25 minutes (2) 30 minutes
(3) 45 minutes (4) 50 minutes

57. A train leaves Hyderabad at 5 a.m. and reaches Bangalore at 3 p.m. Another train leaves Banglore at 7 a.m. and reaches Hyderabad at 5 p.m. When do the two trains meet ?
(1) 10 a.m. (2) 11 a.m. (3) 12 noon (4) 1 p.m.

58. Two trains are travelling in opposite directions with speeds 25 m/sec and 30 m/sec respectively. If the length of one train is 300 m and that of the other train is 250 m, then find the time taken by the trains to cross each other.
(1) 8 sec. (2) 10 sec. (3) 12 sec. (4) 14 sec.

59. Shiva walks at 3 km/h from his house and reaches his office 17 minutes late. If he walks at 5 km/h he is early to the office by 15 minutes. Find the distance between his office and house.
(1) 3 km (2) 5 km (3) 4 km (4) 2 km

60. In a 900 meters race, Sreenivas beats Vishnu by 270 meters and Venkat by 340 meters. By how many meters does Vishnu beat Venkat in the same race ?
(1) 70 (2) 200 (3) 100 (4) 140

61. Ashok ran around a square plot ABCD once in the following manner. He ran the distance AB and BC at 4 kmph and 6 kmph respectively. He ran the distance CD and DA at 4 kmph and 6 kmph respectively. His average speed for running from A to C was 4.8 kmph. Find his average speed for running around the square plot once. (in kmph)
(1) 3.6 (2) 4 (3) 4.8 (4) 5.4

62. In a 100 m race, A beats B by 20 m or 5 seconds, Find the speed of A.
(1) 2 m/sec (2) 4 m/sec
(3) 5 m/sec (4) 8 m/sec

63. Ravi travels at the speed of 20 kmph and after 5 hours, Pradeep starts from the same point and travels in the direction as Ravi at 25 kmph. What distance does Pradeep travel before he catches up with Ravi ?
(1) 200 km (2) 300 km
(3) 500 km (4) 150 km

64. Ravi is $1\frac{1}{3}$ times as fast as Pradeep. If Pradeep has a head start of 50 meters, what should be the length of the racecourse such that both of them reach the finishing point at the same time?
(1) 250 m (2) 100 m (3) 150 m (4) 200 m

65. A train 100 meters long, crosses a telegraphic post in 10 seconds. Another train of the same length crosses a platform 125 meters long, in 15 seconds. What is the difference of the distance covered by the two trains in 3 hours?
(1) 54 km (2) 60 km (3) 72 km (4) 90 km

66. In an 1800 m race, Girish beats Harish by 50 seconds. In the same race, Harish beats Suresh by 40 seconds. If Girish beats Suresh by 450 m, by what distance does Girish beat Harish ? (in m)
(1) 225 (2) 175.75
(3) 150 (4) 281.25

67. A man misses a train by 1 hour if he travels at a speed of 4 km/h. If he increase his speed to 5 km/h he still misses the train by 24 minutes. At what speed should he travel so that he reaches the station exactly on time ?
(1) 12 kmph (2) 8 kmph
(3) 6 kmph (4) 10 kmph

68. A train P takes 40 seconds to cross a train 800 m long, and having a speed of 30 m/sec, in the opposite direction. It takes 120 seconds to cross another train twice its length and having the same speed and moving in the opposite direction to it. Find the length of the train P in metres.
(1) 600 (2) 800 (3) 1000 (4) 1200

69. Subodh and Hari run a race. Subodh gives Hari a start of 10 meters and is beaten by atmost 10 metres. Who has a higher speed between the two ?
(1) Subodh
(2) Hari
(3) Both have equal speeds
(4) Subodh's speed is greater than or equal to Hari

70. A boat covers a round trip journey in a river in a certain time. If its speed in still water is doubled and the speed of the stream tripled, it would take the same time for the round trip journey. Find the ratio of the speed of boat in still water to the speed of the stream.
(1) $3\sqrt{2} : \sqrt{3}$ (2) $2\sqrt{2} : \sqrt{3}$
(3) $4\sqrt{2} : \sqrt{7}$ (4) None of these

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	1	3	3	1	3	2	2	4	2	1	2	3	2	3	2	4	1	3	1
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	2	1	4	4	3	1	4	3	3	3	3	1	3	4	3	2	4	4	2	2
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	1	4	1	1	1	4	2	4	1	1	1	3	2	3	2	2	2	2	3	3
Que.	61	62	63	64	65	66	67	68	69	70										
Ans.	3	3	3	4	1	4	3	2	4	4										