C.S.VEERARAGAVAN
SIXPHRASE
The Finishing School

Time & Distance

To convert from km/hr to m/sec **Multiply by $\frac{5}{18}$**

To convert from m/sec to Km/hr **Multiply by $\frac{18}{5}$**

Distance = Speed x time taken

I. A man leaves P and reaches Q in 3 hours at an average speed of 60 kmph. What is the distance from P to Q? 1)240km 2)150km 3)300km 4)180km

Distance from P to Q = Speed x time taken

= 60 x 3 = 180 km.

Time taken to cross bridge

A train of length 300m travels at a speed of 36 kmph. In how many seconds does it cross a bridge of length 700m?

Speed of the Train = $36X\frac{5}{18} = 10$ m/sec.

Distance travelled = Length of the Train + Length of the Bridge

= 300 + 700 = 1000m

Time taken = $\frac{Distance\ Travelled}{Time\ taken} = \frac{1000}{10} = 100\ sec$

Speed

11

» 11.A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour?

» A. 3.6 B. 7.2 C. 8.4 D. 10

» Speed = $\frac{Distance}{Time\ taken} = \frac{600}{5X60} m/sec.$

» Speed in Km/hr = $\frac{600}{5X60} X \frac{18}{5} = 7.2Km/hr$

Speed

12

» 12. An aeroplane covers a certain distance at a speed of 240 kmph in 5 hours. To cover the same distance in $1\frac{2}{3}$ hours, it must travel at a speed of:

» A. 300 kmph B. 360 kmph

» C. 600 kmph D. 720 kmph

» Distance = 240 x 5 = 1200 km.

» Speed = $\frac{Distance}{Time\ taken} = \frac{1200}{\frac{5}{3}} = \frac{1200X3}{5}$ =720kmph

We can write $1\frac{2}{3}$ as $\frac{5}{3}$

Speed

5

- A car travelling with $\frac{5}{7}$ of its actual speed covers 42 km in 1 hr 40 min 48 sec. Find the actual speed of the car.
- A. $17\frac{6}{7}$ km/hr B. 25 km/hr
- C. 30 km/hr D. 35 km/hr
- Time taken = 1 hr 40 min 48 sec = 1 hr $40\frac{4}{5}$ min = $1+\frac{204}{300} = \frac{504}{300} = \frac{126}{75}$ hrs.
- Let the actual speed be x km/hr.
- $\frac{5x}{7} = \frac{42X75}{126}$
- X = $\frac{42X75}{126} X \frac{7}{5} = \frac{42X15}{18}$ = 35km/hr.

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

6

» 6.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:

» A. 5 kmph B. 6 kmph

» C. 6.25 kmph D. 7.5 kmph

» Let Abhay's speed be x km/hr.

» Then $\frac{30}{x} - \frac{30}{2x} = 3$.

» Solving, 6x = 30 ➔ x = 5 kmph.

Ratio of speeds

3

» 3.The ratio between the speeds of two trains is 7 : 8. If the second train runs 400 km in 4 hours, then the speed of the first train is:

» A. 70 km/hr B. 75 km/hr

» C. 84 km/hr D. 87.5 km/hr

» Let the speed of two trains be 7*x* and 8*x* km/hr.

» Then 8x = $\frac{400}{4}$=100. ➔x = $\frac{100}{8}$=12.5

» Speed of second train = 7X12.5=87.5 km/hr.

Ratio of speeds

8

- 8.It takes eight hours for a 600 km journey, if 120 km is done by train and the rest by car. It takes 20 minutes more, if 200 km is done by train and the rest by car. The ratio of the speed of the train to that of the cars is:
- A. 2 : 3 B. 3 : 2 C. 3 : 4 D. 4 : 3
- Let the speed of the train be *x* km/hr and that of the car be *y* km/hr.
- Then $\frac{120}{x}+\frac{480}{y}$=8 ➔$\frac{1}{x}+\frac{4}{y}=\frac{1}{15}\rightarrow 1$
- $\frac{200}{x}+\frac{400}{y}=\frac{25}{3}$ ➔$\frac{1}{x}+\frac{2}{y}=\frac{1}{24}\quad\rightarrow 2$
- Solving (1) and (2), we get: x = 60 and y = 80.
- Ratio of speeds = 60 : 80 = 3 : 4.

Rule 2

» If the same distance is covered at two different speeds S_1 and S_2 and the time taken to cover the distance are T_1 and T_2, then the

distance = $\frac{S_1 S_2}{S_1 - S_2}(T_1 - T_2)$

Speed

7

» 7.Robert is travelling on his cycle and has calculated to reach point A at 2 P.M. if he travels at 10 kmph, he will reach there at 12 noon if he travels at 15 kmph. At what speed must he travel to reach A at 1 P.M.?

» A. 8 kmph B. 11 kmph

» C. 12 kmph D. 14 kmph

» Let the distance travelled by *x* km.

» Then, $\frac{x}{10} - \frac{x}{15}=2$

» 3x – 2x = 60.

» X = 60.

Short cut

S_1=15 and S_2=10 and T_2-T_1=2.

Hence Distance = $\frac{2X15X10}{5}$= 60 km

» Time taken to travel 60 km at 10 km/hr =$\frac{60}{10}$ =6hrs.

» So, Robert started 6 hours before 2 P.M. *i.e.,* at 8 A.M.

» Required speed = $\frac{60}{5}$=12 kmph.

AVERAGE SPEED

4

- **If same distance travelled in two different speeds then the average speed during the whole journey is given by**

$$\textbf{Average speed} = \frac{2X Product\ of\ Speeds}{Relative\ Speeds}$$

- 4. A man on tour travels first 160 km at 64 km/hr and the next 160 km at 80 km/hr. The average speed for the first 320 km of the tour is:
- A. 35.55 km/hr B. 36 km/hr
- C. 71.11 km/hr D. 71 km/hr
- Average speed = $\frac{2X64X80}{64+80}$=71.11 km/hr.
- **If same distance travelled in three different speeds A,B & C, then,**
- **Average Speed =** $\frac{3ABC}{AB+BC+CA}$

Average Speed

V

V. A person travelled from Hyderabad to Mahabubnagar at an average speed of 30 kmph and then came back to Hyderabad at an average speed of 90 kmph along the same route. What is the average speed for the entire journey?

1)75kmph 2)60kmph 3)45kmph 4)Cannot be determined

Average speed = $\frac{2X30X90}{30+90} = 45$ kmph.

Average speed

XIII

Dheeraj travelled for 2 hours at an average speed of 48 kmph and travelled for another 2 hours at an average speed of 52 kmph. What is the average speed?(in kmph) 1)49 2)50 3)51 4)52

As the duration of journey at different speeds is constant, the average speed of the journey is average of the speeds.

Average speed = $\frac{48+52}{2}$= 50 kmph.

Average speed

XIV

A bus left P for Q and travelled at an average speed of 40 kmph and reached Q one hour later than the scheduled time. Had the bus travelled at an average speed of 60 kmph, it would have reached Q one hour earlier than the scheduled time. What should be the average speed of the bus to reach Q on time? 1) 48 kmph 2)50 kmph 3) 52 kmph 4) 54kmph

Let the distance between P and Q be d km and the required time be t hours.

$t = \frac{d}{40} - 1$ *and* $t = \frac{d}{60} + 1$

$\frac{d}{40} - \frac{d}{60} = 2 \rightarrow \frac{d(3-2)}{120} = 2$

d = 240 km.

The average speed of the bus to reach the scheduled time = $\frac{240}{40} - 1$

= 5 hours.

Average speed

XI

A travelled for 3 hours at a speed of 60 kmph and then for 4 hours at a speed of 95 kmph. What is the average speed of the journey? 1)155 kmph 2) 77.5 kmph 3)80 kmph 4)100 kmph.

Total distance travelled = 3x60 + 4 x 95 = 560 km

Total time taken = 3 + 4 = 7

Average speed = $\frac{560}{7}$=80 km/hr.

Distance

13

» 13.If a person walks at 14 km/hr instead of 10 km/hr, he would have walked 20 km more. The actual distance travelled by him is:

» A. 50 km B. 56 km C.70 km D.80 km

» Let the actual distance travelled be x km.

$$\frac{x}{10} = \frac{x+20}{14}$$

» $14x = 10x + 200$

» $4x = 200$

» $x = 50$ km.

Shortcut method.

» By increasing his speed by 4km/hr he walked 20 km means he walked 5 hours. Original speed = 10km/hr. Hence distance = 50km.

Distance

10

» 10.A man covered a certain distance at some speed. Had he moved 3 kmph faster, he would have taken 40 minutes less. If he had moved 2 kmph slower, he would have taken 40 minutes more. The distance (in km) is: A. 35 B. $36\frac{2}{3}$ C. $37\frac{1}{2}$ D.40

» Let distance = *x* km and usual rate = *y* kmph.

$\frac{x}{y} - \frac{x}{y+3} = \frac{40}{60}$ ➔ $2y(y + 3) = 9x$ ....(i)

$\frac{x}{y-2} - \frac{x}{y} = \frac{40}{60}$ ➔ $y(y - 2) = 3x$ ....(ii)

On dividing (i) by (ii), we get: $x = 40$.

Time taken

1

- 1. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. The duration of the flight is:
- A. 1 hour B. 2 hours
- C. 3 hours D. 4 hours
- Let the duration of the flight be x hours.
- $\frac{600}{x} - \frac{600}{x+\frac{1}{2}} = 200$
- $\frac{600}{x} - \frac{1200}{2x+1} = 200$
- $x(2x + 1) = 3$
- $2x^2 + x - 3 = 0$
- $(2x + 3)(x - 1) = 0$
- $x = 1$ hr. [neglecting the -ve value of x]

Rule 4

XI

- If different time taken to travel different distance then,
- Average speed = $\frac{Total\ Distance\ travelled}{Total\ Time\ taken}$
- XI. A travelled for 3 hours at a speed of 60kmph and then for 4 hours at a speed of 95 kmph. What is the average speed?
- 1)155kmph 2)77.5kmph 3)80kmph 4)100kmph.
- Average speed = $\frac{3X60+4X95}{3+4} = \frac{560}{7}$=80kmph.

Rule 5

2

- If some part of distance covered in a speed and remaining part of distance in a different speed and the total time taken given, then
- Total distance =Total Time Taken X $\frac{2\ X\ product\ of\ speed}{Sum\ of\ speeds}$
- 2.A man complete a journey in 10 hours. He travels first half of the journey at the rate of 21 km/hr and second half at the rate of 24 km/hr. Find the total journey in km.
- A. 220 km B. 224 km C. 230 km D. 234 km
- $\frac{\frac{1}{2}x}{21}+\frac{\frac{1}{2}x}{24}$=10
- $\frac{x}{21}+\frac{x}{24}$=20
- $15x$=168X20
- x=224 km

Short cut

Total Distance =10 X $\frac{2X21X24}{45}$= 224 km

Distance

9

» 9.A farmer travelled a distance of 61 km in 9 hours. He travelled partly on foot @ 4 km/hr and partly on bicycle @ 9 km/hr. The distance travelled on foot is:

» A.14 km B.15 km C.16 km D.17 km

» Let the distance travelled on foot be x km.

» Then, distance travelled on bicycle = (61 -x) km.

» $\frac{x}{4} + \frac{61-x}{9} = 9$

» 9x + 4(61 -x) = 9 x 36

» 5x = 80

» x = 16 km.

Speed

14

14.A train can travel 50% faster than a car. Both start from point A at the same time and reach point B 75 kms away from A at the same time. On the way, however, the train lost about 12.5 minutes while stopping at the stations. The speed of the car is:

A. 100 kmph B. 110 kmph C. 120 kmph D. 130 kmph

Let speed of the car be x kmph. Speed of the train=$\frac{150x}{100} = \frac{3x}{2}$.

$$\frac{75}{x} - \frac{75}{\frac{3}{2}x} = \frac{125}{10X60}$$

$$\frac{75}{x} - \frac{50}{x} = \frac{5}{24}$$

$$\frac{25}{x} = \frac{5}{24}$$

X=$\frac{24X25}{5}$=120

Stopping time

- Excluding stoppages, the speed of a bus is 54 kmph and including stoppages, it is 45 kmph. For how many minutes does the bus stop per hour? A. 9 B.10 C.12 D.20
- Due to stoppages, it covers 9 km less.
- Time taken to cover 9 km = $\frac{9}{54} X 60$=10 min.

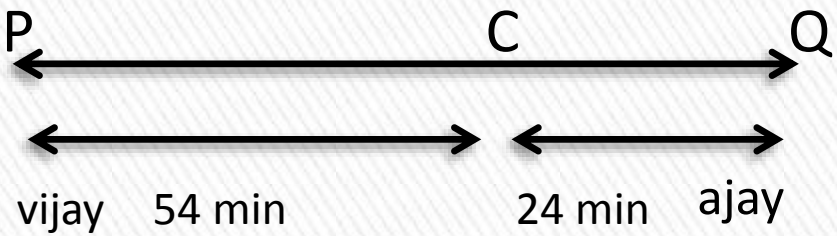
Meeting Time

XVII

Vijay left P for Q at 10:00 am. At the same time Ajay left Q for P. After their meeting at a point on the way, Vijay took 24 minutes to reach Q and Ajay took 54 minutes to reach P. At what time did they meet?
1) 10:37 am 2) 10:36 am
3) 10:39 am 4) 10:38 am.

Meeting time = $\sqrt{54\ X\ 24}$ = 36.

Hence they meet at 10:36 am.



Let Vijay and Ajay take t minutes to meet at C.
Hence Vijay takes t minutes to cover PC.
But Ajay takes 54 minutes to cover PC.
As distance is same, speeds are in inverse ratio of times.

$$\frac{speed\ of\ vijay}{speed\ of\ ajay} = \frac{time\ taken\ by\ ajay}{time\ taken\ by\ vijay} = \frac{54}{t} = \frac{t}{24}$$

Hence $t^2 = 54 \times 24$.
T = 36.

Meeting time

XVI

Two persons start simultaneously from A and B towards B and A respectively. The first person reached B in 10 minutes and the second person reached A in 15 minutes from the time of their start. In how many minutes from their start do they meet each other? 1)5 2)8 3)7 4)6

Let the distance between A and B be d km.

In one minute the total distance travelled by them

$= \frac{d}{10} + \frac{d}{15} = \frac{d}{6}$

Hence in 6 minutes they will meet each other.

Meeting Time

IV

A left P for Q at 9.00 am. and B left P for Q at 10.00 am. If the speeds of A and B are 60 kmph and 80 kmph respectively, at what time do they meet, given that P and Q are 1000 km apart?

1)12.00noon 2)1.00pm 3)2.00pm 4)12.30pm

From 9.00 am to 10.am, A travels for 1 hour ie.,60 km.

At 10.00 am, A & B are separated by 60 km. The relative speed of B w.r.t A = 80–60 = 20 km/hr.

The time taken by B to Meet A = $\frac{60}{20}$=3 hours.

10.00 am + 3 hours = 1.00 pm. B meets A.

Meeting Time

P and Q are 300 km apart. At 8.00 am, buses X and Y left P and Q simultaneously for Q and P respectively. If the speeds of buses X and Y are 40 kmph and 60 kmph respectively, when do they meet?

The relative speed = 40 + 60 = 100 kmph

Time taken to meet = $\frac{300}{100}$= 3 hours.

8.00 am + 3 hours = 1.00 pm.

Time Travelled	X	Y	Balance time travelled By X and Y
In one hour	40	60	260,240
In Two hours	80	120	220,180
In Three hours	120	180	180,120

Meeting Time

VIII

P started running towards North at 6.00 am. Q started running towards North at 8.00 am. At what time do they meet, if their speeds are in the ratio 3:5?

If both starts from the same point, then the distance of separation between them is the distance travelled by P in 2 hours. (8.00 am – 6.00 am)

The information about the starting point is not given. Hence data insufficient.

Speed

VI

A train of length 300 metres takes 20 seconds to completely cross a pole. What is the speed of the train? 1)36kmph 2)54kmph 3)72kmph 4)90kmph

Speed of the train = $\frac{300}{20}$=15 m/sec

= 15x$\frac{18}{5}$=54kmph =

Time & distance in Clock

VII

At 3.30 pm, what is the angle between the hour hand and the minute hand of a clock?

1) 75^0 2)90^0 3)105^0 4)60^0

For each minute the hour hand moves $\frac{1}{2}^0$.

The hour hand has moved 210 minutes = 105^0.

Time & Distance in Boat & Streams

IX

Ajay can row a boat in still water at a speed of 6 kmph. If the speed of the stream is 2kmph, then in how many hours will he row a distance of 24 km with the stream? 1)2 2)4 3)6 4)3

Speed of the boat with the stream = 6+2=8kmph.

Time taken to row = $\frac{24}{8}$ = 3 km.

Time & Distance in Races & Games

A beats B by 250m in a kilometer race. What is the speed of B, if the speed of A is 8 m/sec?

The ratio of speeds of A and B = The ratio of distances travelled by A and B

A beats B by 250m means A covered 1000 m, B covers only 750m.

Therefore the ratio of speeds of A & B = 1000:750

= 4:3.

The speed of B = $\frac{3}{4} X 8$ = 6 m/sec.

Time & Distance in races

XV

A beats B by 10 meters in a 100 metres race. If B beats C by 20 meters in the same race, then A beats C by how many meters in that race? 1) 32 2)30 3) 28 4) 26

Ratio of speeds of A and B = 100:90 = 10:9

Ratio of speeds of B and C = 100:80 = 10:8

Ratio of speeds of A,B & C = 100: 90: 72

A:C = 100:72

A beats C by 28 meters.

XII

Ganesh and Suresh are running along a circular track of length 300m. If the speeds of Ganesh and Suresh are 6 m/sec and 12 m/sec respectively, how many rounds more than Ganesh will Suresh complete in 1 hour?

Difference in speeds = 12 – 6 = 6 m/sec.

The difference in no of rounds made = No of rounds made at 6 m/sec = $\frac{6X3600}{300}$=72 rounds.