

# RBI PHASE 1 RECAP

14th JULY '18

QUANT – TIME, SPEED, DISTANCE

# TIME, SPEED, DISTANCE

## DEFINITION OF TERMS:

The speed of a body is defined as the distance covered by it in unit time.

Speed = distance / time

Time = distance / time

Distance = time x speed

## UNITS AND MEASUREMENT:

\*Time is measured in seconds (s), minutes (m) or hours (hr.).

\*Distance is usually measured in meters (m) and kilometers (km) but sometimes in miles, yards and feet.

\*Speed is usually measured in meters/sec. (m/s), kilometers/hour (km/hr.) or miles/hr.

# TIME, SPEED, DISTANCE

## CONVERSION OF UNITS:

\*1 hour = 60 minutes = 60x60 seconds

\*1 kilometer = 1000 meters

\*1 yard = 3 feet

\* Conversion of km/hr. into m/s

=  $1000/3600 = 5/18$

As there are 1000 meter in 1 kilometer and 3600 seconds in 1 hour.

5/18 means 5 meters in 18 seconds.

\*m/s = 18 km / 5 hr.

## AVERAGE SPEED:

Average speed of a body travelling at different speeds is defined as follows:

Average speed = Total distance travelled / total time taken

\*Average speed of a moving body IS NOT equal to the average of the speeds.

If a body travels from point A to point B with a speed of P and back to point A (from point B) with a speed of q, then the average speed of the body can be calculated as

$(2pq) / (p + q)$

## RELATIVE SPEED:

The speed of one moving body in relation to the another moving body is called the relative speed of these two bodies.

\* **CASE 1:** If two bodies are moving in the same direction at speed  $S_1$  and  $S_2$ , the relative speed is equal to the difference of the speeds of the two bodies.

i.e.,  $S_1 - S_2$  when  $S_1$  is greater than  $S_2$ .

$S_2 - S_1$  when  $S_2$  is greater than  $S_1$ .

\* **CASE 2:** If two bodies are moving in opposite directions at speed  $S_1$  and  $S_2$ , the relative speed is equal to the sum of the speeds of the two bodies.

i.e.,  $S_1 + S_2$

# TIME, SPEED, DISTANCE

**Q.1) Ram and Shyam start simultaneously from X towards Y and Y towards X respectively. They shuttle down between X and Y indefinitely. They meet for the first time at 20 km from Y after 1 hour. They meet at a point 10 km from X the second time. If their speeds are in the ratio 3:2, then where and after how many hours from the start would they meet for the third time?**

- [a] at Y after 5 hr.**
- [b] at X after 7.5 hr.**
- [c] at Y after 6 hr.**
- [d] at X after 7.5 hr.**

# TIME, SPEED, DISTANCE

**Solution 1. (a)**

**Let the total distance between X and Y be 5 km.**

**Let the speeds (in km/hr.) of Ram and Shyam be 3P and 2P respectively. (since they are in the ratio 3:2)**

**After they meet the first time, distance travelled by Ram = (S-20) km**

**Distance travelled by Shyam = 20 km.**

**Time taken from both of them is 1 hour**

$$\text{So, } S-20 / 3P = 20/2P = 1$$

$$S = 50 \text{ km}$$

**Distance travelled by Ram = S-20 = 30 km**

**Distance travelled by Shyam = 20 km**

**So, their speeds are 30 km/h and 20 km/h.**

**They meet the third time after they together travelling a distance = 5S = 250 km**

**They travel this distance in the ratio 3:2**

**i.e., they travel 150 km and 100 km.**

**after Ram and Shyam travel 150 km and 100 km respectively they meet at point Y.**

**they take  $150/30 = 100/20 = 5$  hours to cover the distance.**

# TIME, SPEED, DISTANCE

**Q.2) John buys a new Honda bike which can normally travel at speeds up to speeds of 90 km/h. It has the nitro-boost facility which can double the normal speed of the bike. The nitro-boost system works for 2 hours and then needs to be switched off for 2 hours to get recharged again. He decides to show his bike to his parents, who are staying in a village which is 960 km away from his place. What is the minimum time (in hr.) in which he can reach the village on his bike?**

- [a]  $3 \frac{1}{4}$**
- [b]  $3 \frac{3}{4}$**
- [c]  $6 \frac{2}{3}$**
- [d]  $6 \frac{3}{4}$**

# TIME, SPEED, DISTANCE



## Solution 2.(c)

John has to start off with nitro-boost, which takes him at 180 km/h, to reach his destination in minimum time.

As it works only for 2 hours he travels 360 km.

Then for the next two hours he travels at 90 km/h, till the nitro=boost system gets recharged. He covers 180 km in these 2 hours.

After it gets recharged again he travels 360 km in 2 hours.

Therefore, in 6 hours he travels  $360+180+360= 900$  km

For the rest 60 km he travels at 90 km/h and covers it in  $2/3$  hr.

Therefore, for 960 km he takes  $6+2/3 = 6 \frac{2}{3}$  hours.

# TIME, SPEED, DISTANCE

**Q.3) Two buses travel between two cities along the same route. The first bus travels at 60 km/h and the second bus travels at 50 km/h. The second bus starts 30 min after the first bus starts from the same city. After 3 hours of journey in the first bus, a man decides to travel in the second bus. He gets down and starts walking at 5 km/h towards the second bus. How much time does he walk before he catches the second bus?**

- [a]  $1 \frac{2}{3}$  hr.
- [b]  $1 \frac{3}{4}$  hr.
- [c] 1 hr.
- [d]  $1 \frac{2}{9}$  hr.

**Solution (c)**

Speed of the 1<sup>st</sup> bus is 60 km/h

Time travelled in 1<sup>st</sup> bus is 3 hr.

Distance travelled in 1<sup>st</sup> bus =  $60 \times 3 = 180$  km

Speed of 2<sup>nd</sup> bus = 50 km/h

2<sup>nd</sup> bus starts half an hour after 1<sup>st</sup> bus. Therefore, it travels for 2.5 hr.

Distance covered by second bus =  $50 \times 2.5 = 125$  km

Distance between man and second bus =  $180 - 125 = 55$  km

Relative speed when man is walking 5 km/h =  $50 + 5$  or 55 km/h

So, time taken by 2<sup>nd</sup> bus to reach man =  $55/55$  or 1 hour.

# TIME, SPEED, DISTANCE

1. 4) There are two persons A and B at two ends P and Q respectively. They can both walk at 8 m/s. There are two loads X and Y which reduce the speed of walking by 4 m/s and 2 m/s when they are carried respectively. A is carrying X and begins to walk towards Q. at the same time, B is carrying Y, and begins to walk towards P. they reverse their directions when they meet each other and also when they reach respective starting points. They exchange the weights they are carrying when they meet each other. The distance between P and Q is 500 m.

Q.4) After how many minutes from the starts do they meet for the second time?

- [a] 2 min.
- [b] 2.5 min.
- [c] 3 min.
- [d] 3.5 min.

# TIME, SPEED, DISTANCE



**Solution 4.(b)**

**Distance between P and Q = 500 m**

**Initial speed of A and B = 8 m/s each**

**A is carrying X from P**

**His reduced speed =  $8-4 = 4$  m/s**

**B is carrying Y from Q.**

**His reduced speed =  $8-2 = 6$  m/s.**

**Their combined speed =  $4+6 = 10$  m/s.**

**(this combined speed does not change even after the loads are exchanged)**

**They have to cover the distance between P and Q thrice before they meet 2<sup>nd</sup> time**

**Time taken before they meet second time**

$$= (500 \times 3) / 10 = 150 \text{ sec.}$$

$$= 150 / 60 = 2.5 \text{ min.}$$

# TIME, SPEED, DISTANCE

1. 5) There are two persons A and B at two ends P and Q respectively. They can both walk at 8 m/s. There are two loads X and Y which reduce the speed of walking by 4 m/s and 2 m/s when they are carried respectively. A is carrying X and begins to walk towards Q. at the same time, B is carrying Y, and begins to walk towards P. they reverse their directions when they meet each other and also when they reach respective starting points. They exchange the weights they are carrying when they meet each other. The distance between P and Q is 500 m.

Q.5) What distance does B cover till the time he meets A for the second time?

- [a] 300 m
- [b] 400 m
- [c] 500 m
- [d] 700 m

# TIME, SPEED, DISTANCE

**Solution 5. (d)**

**Time taken before they meet for the first time =  $500 / 10 = 50$  sec.**

**Distance travelled by B in 50 sec. =  $50 \times 6 = 300$  m**

**They exchange their weights after they meet the 1<sup>st</sup> time and reverse their directions.**

**So, speed of B becomes 4 m/s**

**Distance they travel between their first and first and second meeting = 1000 m**

**Their combined speed = 10 m/s**

**Total time taken =  $1000 / 10 = 100$  s**

**Distance travelled by B in 100 s at 4 m/s = 400 m**

**Therefore, total distance travelled by B till they meet second time =  $400 + 300 = 700$  meters**

# TIME, SPEED, DISTANCE

**Q.6) A man is travelling from A to B in a car whose tank's capacity is 20 liters, with the reserve level at  $1/6^{\text{th}}$  of the tank's capacity. He fills up the tank and after travelling for 250 km finds that the fuel is at the reserve level. He fills 3 more liters and just manages to cover the remaining distance by using all the fuel. What is the distance between A and B?**

- [a] 325 km**
- [b] 345 km**
- [c] 365 km**
- [d] 375 km**

**Solution (b)**

**Capacity of the tank is 20 liters**

**Reserve level is  $1/6^{\text{th}}$  of the tank capacity which is equal to  $20/6$  liters**

**He travels 250 km with  $(20-20/6)$  liters**

**Mileage of the car is  $250 / (20-20/6) = 15$  km/h**

**He fills 3 more liters and covers the remaining distance.**

**Distance covered after refilling the tank**

$$= 3 + (20/6) \times 15 = 95 \text{ km}$$

$$\text{Total distance covered} = 250 + 95 = 345 \text{ km}$$

# TIME, SPEED, DISTANCE

**Q.7) A suspected thief escapes from city 'A' on a bike and moves towards city 'B' on a straight road which is 185 km long at a speed of 70 km/hr. after half an hour two police teams leave A and B, to catch the thief, each at 80 km/hr. When the suspect is caught, they held him for interrogation on the spot. Which of the following statements is false?**

- [a] The thief is caught by the team from A, 1 hour after they start.**
- [b] The thief is caught by the team from B, 1 hour after they start.**
- [c] When the thief is caught by one team, the other team is 25 km away from the spot.**
- [d] When the thief is caught the other team reaches the spot after 18.75 minutes.**

# TIME, SPEED, DISTANCE

## Solution 7. (a)

The police groups from A and B leave their respective places half an hour after the thief escapes. Therefore, the thief travels 35 km from A towards B.

### Option [a]

Relative speed of the thief with relation to the police party from A =  $80 - 70 \text{ km/h} = 10 \text{ km/h}$

Distance between them = 35 km

The time the police from city A will take to catch the thief =  $35/10 = 3.5 \text{ hours}$

### Option [b]

Relative speed of the police from B with relation to the thief =  $80+70 = 150 \text{ km/h}$

Distance between them =  $185-35 = 150 \text{ km}$

Time taken to catch the thief =  $150 / 150 = 1 \text{ hour}$

So, the police group from B catches the thief after 1 hour at a distance of 80 km from B.

### Option [c]

The police from city A travel 80 km in 1 hour. The thief is caught 105 km from A.

Therefore, the police from A are  $105-80 = 25 \text{ km}$  away from spot when the thief is caught.

### Option [d]

so, the police from A reach the spot after  $25/80 = 18.75 \text{ minutes}$ .

So, only option A is false.

# TIME, SPEED, DISTANCE

Q.8) Two friends A and B are going for a morning walk. There is a tree after every kilometer. They decide to stop only if they meet under a tree. A covers the first, third, fifth etc. kilometers in 4 minutes and the 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup> etc. kilometers in 3 min. B covers the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup> etc. kilometers in 2 min. and even numbered km. in 6 min. After how many minutes do they stop?

- [a] 14
- [b] 16
- [c] 18
- [d] 20

Solution 8. (c)

Time taken to cover 1<sup>st</sup> kilometer

For A = 4 min

For B = 2 min

Time taken to cover 2<sup>nd</sup> km

For A = 4+3 = 7 min

For B = 2+6 = 8 min

Time taken to cover 5<sup>th</sup> km in the same way

For A = 4+3+4+3+4 = 18 min

For B = 2+6+2+6+2 = 18 min

So, both of them cover 5 km in 18 min

So, they stop after 18 min covering 5 Km.

# TIME, SPEED, DISTANCE

**Q.9) Two buses are travelling between cities P and Q and R and S respectively. All four cities P, Q, R and S are along a straight road. R and P are 40 km apart. The bus from P starts at 10:00 am. and the bus from R starts at 10:15 am. They travel in the same direction, away from P, and meet at 11:00 am. by then they would have travelled 20% of their respective distances. Find the distance between Q and S.**

- [a] 150 km**
- [b] 160 km**
- [c] 200 km**
- [d] 240 km**

**Solution 9. (b)**

**The distance between P and R is 40 km**

**Let the distance from R to their meeting point be 'X' km**

**Distance travelled by the bus from P =  $(40 + X)$  km**

**Distance travelled by the bus from R = X**

**They have travelled 20% of their distances**

**Therefore, they have to travel a distance equal to 4 times of the distance already travelled.**

**Distance between the meeting point and S =  $4 \times X = 4X$**

**Distance between the meeting point and Q =  $(40 + X)4 = 160 + 4X$**

**Distance between Q and S =  $160 + 4X - 4X = 160$  km**

# TIME, SPEED, DISTANCE

Q.10) A, B and C are running around a circular park. They start at the same point. A overtake C, 3 times for every round that C makes. C overtakes B, 6 times for every round that B makes. What is the ratio of A's speed to that of B?

- [a] 9:2
- [b] 18:1
- [c] 28:1
- [d] 10:1

Solution 10. (c)

Given A overtake C, 3 times per round, where the 3<sup>rd</sup> is at the starting point.

So, A completes 4 rounds in the time C completes 1 round.

So, the ratio of the speeds is 4:1

C overtakes B, 6 times per round.

In the same way as above, the ratio of speeds of C and B is 7:1

So, A: C = 4:1

C: B = 7:1

A: B = A:C:	B	
4	1	
	7	1

A: B = 28: 1