Group 3

1) Speed, Distance and Time
2) Boats and Streams
3) Problems on Trains

1 Speed, Distance and Time

Formula S-Speed, Distance(D), Time(T)

$S = \frac{D}{T}$, $T = \frac{D}{S}$, $D = S \times T$

Types of questions:

- Distance same
- Speed "
- Time "
- Avg speed = $\frac{\text{Total D}}{\text{Total T}}$ [A | T_1 | T_2 | ... | B; D_1, D_2]

1) A boy increases his speed to 9/5 times of his original speed. By this he reaches his school 30 minutes before the usual time. How much time does he takes usually?

Soln: Distance same here. in both conditions

D (usual) = D (fast)

$S_1 \times T_1 = S_2 \times T_2$

$S_1 \times T_1 = \frac{9}{5}(S_1) \times (T_1 - 30)$ → from questn

$5 \frac{S_1}{S_1} T_1 = 9T_1 - 270$

$270 = 4T_1$

$T_1 = 67.5$ min → min from question.

2) Ramesh sees a thief at a distance of 80m. Ramesh starts chasing the thief who is running at a speed of 5 m/s. Ramesh is chasing him with a speed of 7 m/s. How much distance does the thief cover before Ramesh catches him?

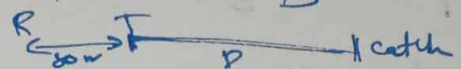
Soln: D not same, S not same

But both Ramesh, thief start running and stop when catch → so time same.

$$\text{Ramesh } T_R = \text{Thief } T_T$$

$$\frac{D_R}{S_R} = \frac{D_T}{S_T}$$

× all in m/s



Distance of Thief = 80+D

Distance of Ramesh = 80+D

$$\frac{80+D}{S_R} = \frac{D}{S_T}$$

Speed given in ques

$$\frac{80+D}{7} = \frac{D}{5} \Rightarrow 400+5D = 7D$$

$$\boxed{D = 200\text{m}}$$

3) P, Q and R are in a cycle race of 4500m. P cycles thrice as fast as Q. R cycles 1/3rd as fast as Q. R completes the race in 45 mins. Then where was Q from finishing line when P finished the race?

Soln: Here question is big, but we need only 1st 2 points

× cycle race distance → 4500m (finish line)

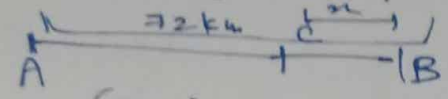
× P is 2× speed of Q $\Rightarrow P_s = 2Q_s \Rightarrow Q_s = \frac{1}{2} P_s$

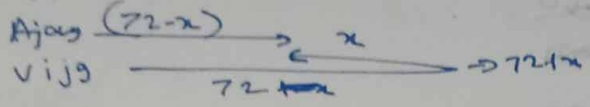
So if P is 100m, Q is in 50m

Total dist → 4500m → P at finish line → Q at half → $\frac{4500}{2} \Rightarrow \boxed{2250}$

4) Ajay and Vijay travel from A to B at 17km/hr and 19 km/hr respectively. A is 72km away from B. Vijay reaches B first and returns immediately and meets Ajay at C. Find B to C distance?

Solv:





Distance not same (Vijay covers more)

Speed not same

But both ~~meet~~ same time (T is same)

$T_A = T_V$

$\frac{D_A}{S_A} = \frac{D_V}{S_A}$

$\frac{72-x}{17} = \frac{72+x}{19}$ $\Rightarrow 19\times72 - 19x = 17\times72 + 17x$

$\Rightarrow 19\times72 - 17\times72 = 36x$

$72\times2 = 36x$

$x = 4$ km //

5) Surendra travels from home to office by car. With an average speed of 50km/hr, he is late by 30min. But when he comes with a speed of 60 km/hr, he reaches his office 10min earlier. How far is his office from his home?

Solv. I) Easiest method

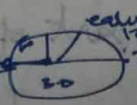
50km/hr 30mins late

60km/hr 10min early

$\Rightarrow$ saves 30+10 = 40mins

30 10km/hr diff brings ~~40~~ 40km

$\times 5$] 50km/hr $\Rightarrow$ 200 km //



II) Other method

Time diffn $\Rightarrow T_1 - T_2 = 40$ min

$\frac{D_1}{S_1} - \frac{D_2}{S_2} = \frac{40}{60}$ $\Rightarrow \frac{100}{60}$ km/hr.

in km/hr

Distance)

$\frac{D}{50} - \frac{D}{60} = \frac{40}{60}$

$\frac{60D - 50D}{60 \times 50} = \frac{40}{60}$

$100 = 2000$

$D = \frac{2000}{10}$

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Soln:. Method I: Normal (D, S, T same finding)

here speed change, time change, distance constant.

$D_1 = D_2$

$S_1 \times T_1 = S_2 \times T_2$ ←

$50\left(x + \frac{30}{60}\right) = 60\left(x - \frac{10}{60}\right)$

Let time to reach be x

1st case $\rightarrow x + 30$ | as speed in km/h

2nd case $\rightarrow x - 10$ | change min to hour

$\frac{30}{60}$ & $\frac{10}{60}$

$5\left(\frac{60x + 30}{60}\right) = 6\left(\frac{60x - 10}{60}\right) \Rightarrow 5(60x + 30) = 6(60x - 60)$

$\Rightarrow 300x + 150 = 360x - 60$

$210 = 60x$

$x = 7/2$ hrs //

apply in any part of $D_1 = D_2$ (L.H.S or R.H.S)

$D = 50\left(\frac{7}{2} + \frac{30}{60}\right) \Rightarrow 50\left(\frac{8}{2}\right) \Rightarrow 200$ km //

Method II

difference of time between case I and case II

+30min, −10min

so 2nd case we differ by 40mins

$T_1 - T_2 = 40\text{min} \Rightarrow \frac{D_1}{S_1} - \frac{D_2}{S_2} = \frac{40}{60} \Rightarrow \frac{D_1}{50} - \frac{D_2}{60} = \frac{40}{60}$

$\frac{60D - 50D}{60 \times 50} = \frac{40}{60} \Rightarrow 10D = 2000 \Rightarrow \boxed{D = 200\text{kms}}$

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6) Rohit drives from his home at a speed of 30km/hr and reaches his bank 20mins late. Then the next day he increases his speed by 15km/hr but still he is late by 8 mins. How far is his bank from his home?

Soln: Easy method: 20mins late, → 8mins late

diff → 12min

$T_1 - T_2 = 12\text{min}$ speed in km/hr so (min → hrs)

$\frac{D}{30} - \frac{D}{45} = \frac{12}{60}$

$\frac{45D - 30D}{30 \times 45} = \frac{12}{60} \Rightarrow 15D = 6 \times 45$

$\boxed{D = 18\text{kms}}$

(or) S, D, T same formula.

7) Pratik travels 96kms at a speed of 96km/hr using a bike, 124 kms at 31km/h by car and another 105 kms at 7km/h in horse cart. Then find his average speed for entire distance travelled?

Sol: Avg speed = $\frac{\text{Total D}}{\text{Total T}}$

Total distance = 96 + 124 + 105 +

⇒ 325 kms

Total Time $= \frac{D_b}{S_b} + \frac{D_c}{S_c} + \frac{D_h}{S_h}$

$= \frac{96}{16} + \frac{124}{31} + \frac{105}{7}$

Tot time $= 25$ hrs

Avg speed $= \frac{325}{25} \Rightarrow 13$ km/hr //

8) Rohit covers one fourth of total distance at 20km/h one fourth at 10km/h and rest of his journey at 80km/h Find Rohit's avg speed for whole distance?

Soln. Let Total distance $= D$

$\frac{D}{4} = 20$km/hr , $\frac{D}{4} = 10$km/hr ,

remain $\Rightarrow D - \frac{D}{4} - \frac{D}{4} \Rightarrow D - \frac{D}{2} \Rightarrow \frac{D}{2} = 80$km/hr

Avg speed $= \frac{T \cdot D}{T \cdot T} \Rightarrow \frac{D}{T\text{-Time}}$

T-Time $= T_1 + T_2 + T_3$

$T = \frac{D}{S} \Rightarrow T_1 = \frac{D/4}{20}$, $T_2 = \frac{D/4}{10}$, $T_3 = \frac{D/2}{80}$

$T \cdot T = \frac{D/4}{20} + \frac{D/4}{10} + \frac{D/2}{80}$

$= \frac{D}{80} + \frac{D}{40} + \frac{D}{160} \Rightarrow \frac{2D + 4D + D}{160}$

$T \cdot T = \frac{7D}{160}$

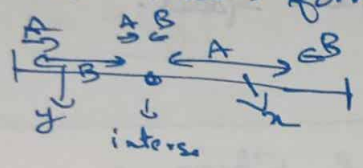
Avg speed $= \frac{D}{7D/160} \Rightarrow \frac{160}{7}$ km/hr //

a) A walks from Jammu to Delhi and at the same time B starts walking from Delhi to Jammu. After passing each other, they complete their journeys in 361 hours and 289 hours, respectively. Find ratio of speed of A to that of B?

Soln: Normal D,ST same method will be complex.

When two bodies intersect and move on then if ratio of speed of A to B Then → formula Speed(A) : Speed(B)

$= \sqrt{y} : \sqrt{x}$



y is distance travel by B after intersect

x is " A "

Formula

$S(A) : S(B) = \sqrt{y} : \sqrt{x}$

Note : opposite : A → y
B → x
root x → $\sqrt{x}$

From question $x = 361$, $y = 289$

$$\frac{SpA}{SpB} = \frac{\sqrt{y}}{\sqrt{x}} \Rightarrow \frac{\sqrt{289}}{\sqrt{361}} \Rightarrow \boxed{\frac{17}{19}}$$

b) A car travelling with 5/7th of its actual speed 42km in 1hr, 40min. 48secs. Find actual speed of car.

Soln: let actual speed be S

present speed = $S \times \frac{5}{7}$, Time = 1hr 40min 48sec

$= 60 \times 60 + 40 \times 60 + 48$

$= 3600 + 2400 + 48$

$T = 6048$ sec

D = 42km
= 42000 mm

$S = \frac{D}{T} \Rightarrow S \times \frac{5}{7} = \frac{42000}{6048} \Rightarrow S = \frac{\cancel{42000}^{\,840} \times 7}{\cancel{6048}_{\,864} \times 5}$

$S = \frac{8400}{864} \Rightarrow \frac{700}{72} \Rightarrow \frac{350}{36}$ m/s

$8400 = 2100 \times 4 = 700$

$864 = 216 \times 4 = 72$

$700 = 350 \times 2 = 36$

To km/hr to m/s $\times \frac{5}{18}$

m/s to km/hr $= \times \frac{18}{5}$

$\frac{350}{36} \times \frac{18}{5} \Rightarrow 35$

$70 \times 5 = 350$

$36 \times 5 = 18 \times 2$

$S = 35$ km/hr actual speed.