Speed Time and Distance

Part-3

Q.1 How many seconds will a train 100 meters long running at the rate of 72 Kmph take to pass a certain electric pole?

Sol^{n} :→ $72\,\text{kmph} = 72 \times \frac{5}{18} = 20\,\text{m/sec}$, $S = \frac{L}{T} \Rightarrow 20 = \frac{100}{T} \Rightarrow T = 5\,\text{Sec.}$

Q.2 A train crosses a platform of length 150m in 15 sec. and a man standing on it in 9 sec. The train is travelling at a uniform speed. Length of the train is?

Sol^{n} :→ $\frac{L_T}{T_1} = \frac{L_T + L_P}{T_2} \Rightarrow \frac{L_T}{9} = \frac{L_T + 150}{15} \Rightarrow 5L_T = 3L_T + 450$

$L_T = 225\,m$

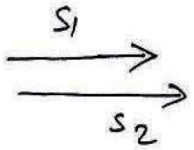
Speed is uniform

L_T = Length of Train

L_P = Length of Platform

Relative speed :→

$S_2 = S_1 + S_2$ $\qquad S_1 + S_2 = \frac{L_1 + L_2}{T}$



$S_2 = S_2 - S_1$ $\qquad S_2 - S_1 = \frac{L_1 + L_2}{T}$

Q. 3 Two trains of length 105m and 90m, respectively run at the speeds of 45 kmph and 72 kmph, respectively in opposite directions on parallel tracks. Find the time which they take to cross each other.

Soln :→ $\qquad S_1 + S_2 = \frac{L_1 + L_2}{T}$

$$(45+72) \times \frac{5}{18} = \frac{105+90}{T} \Rightarrow T = 6 \text{ sec}$$

Q.4 Two trains of lengths 50m and 65m, respectively run at the speeds of 18 mps and 17 mps, respectively in the same directions on parallel tracks. Find the time taken by the faster train to cross the slower train.

Soln :- $S_1 - S_2 = \frac{L_1 + L_2}{T} \Rightarrow 18 - 17 = \frac{115}{T} \Rightarrow T = 115$ sec.

Q.5 Two trains running in opposite directions cross a man standing on the platform in 54s and 34s respectively and they cross each other in 46s Find the ratio of their speeds.

Soln:⇒ $S_1 = \frac{L_1}{T} \Rightarrow S_1 = \frac{L_1}{54} \Rightarrow L_1 = 54S_1$

$S_2 = \frac{L_2}{T} \Rightarrow S_2 = \frac{L_2}{34} \Rightarrow L_2 = 34S_2$

$S_1 + S_2 = \frac{L_1 + L_2}{T}$

$S_1 + S_2 = \frac{54S_1 + 34S_2}{46}$

$46S_1 + 46S_2 = 54S_1 + 34S_2$

$8S_1 = 12S_2$

$\frac{S_1}{S_2} = \frac{3}{2}$

Shortcut $\frac{|46-34|}{|54-46|} = \frac{3}{2}$

2.6 Two trains running at the rates of 45 and 36 kmph respectively, on parallel rails in opposite directions, are observed to pass each other in 8 seconds, and when they are running in the same direction at the same rate as before, a person sitting in the faster train observes that he passes the other in 30 sec. Find the lengths of the trains.

Soln: $\rightarrow$ $S_1 + S_2 = \frac{L_1 + L_2}{T} \Rightarrow 81 \times \frac{5}{18} = \frac{L_1 + L_2}{8} \Rightarrow L_1 + L_2 = 180$

$S_1 - S_2 \Rightarrow \frac{L_2}{T} \Rightarrow 9 \times \frac{5}{18} = \frac{L_2}{30} \Rightarrow L_2 = 75\,m$

Person observing the crossing

$L_1 = 105\,m$, $L_2 = 75\,m$

Q.7 Two trains of length 100m and 80m respectively run on parallel line of rail. When running in the same direction the faster train passes the slower one in 18 sec, but when they are running in opposite directions with the same speeds as earlier, they pass each other in 9 sec. Find the speed of each train.

Soln: $\Rightarrow \quad S_1 - S_2 = \frac{L_1 + L_2}{T} \Rightarrow S_1 - S_2 = \frac{180}{18} \Rightarrow S_1 - S_2 = 10$

$$S_1 + S_2 = \frac{180}{9} \Rightarrow S_1 + S_2 = 20$$

$$S_1 = 15 \text{ m/sec.} \qquad S_2 = 5 \text{ m/sec.}$$

2.8 A train overtakes two persons who are walking at the rate of 4 kmph and 8 kmph in the same direction and passes them completely in 18s and 20s respectively. Find the length of the train.

Soln :⇒ $S_1 = 4$ kmph, $S_2 = 8$ kmph speed of train $= S_T$

$$S_T - S_1 = \frac{L_T}{T_1} \Rightarrow S_T - \left(4 \times \frac{5}{18}\right) = \frac{L_T}{18} \Rightarrow L_T = 18 \times \left(S_T - \frac{10}{9}\right)$$

$$S_T - S_2 = \frac{L_T}{T_2} \Rightarrow S_T - \left(8 \times \frac{5}{18}\right) = \frac{L_T}{20} \Rightarrow L_T = 20 \times \left(S_T - \frac{20}{9}\right)$$

$$18 \times \left(S_T - \frac{10}{9}\right) = 20 \times \left(S_T - \frac{20}{9}\right) \Rightarrow 9S_T - 10 = 10S_T - \frac{200}{9}$$

$$S_T = \frac{200}{9} - 10 \Rightarrow S_T = \frac{110}{9}$$

$$L_T = 18 \times \left(\frac{110}{9} - \frac{10}{9}\right)$$

$$L_T = 200 \text{ meter}$$

shortcut :⇒

$$L_T = \frac{\text{Diff. of speed} \times t_1 \times t_2}{\text{Diff of time}}$$

$$= \frac{4 \times \frac{5}{18} \times 18 \times 20}{2}$$

$$= 200 \text{ m.}$$

Thank You