Problem on Trains

Q.No	Answer
	Type I – Basic Questions
1	15 m/s
2	216 Km/h
	Type II- Train is crossing standing man/pole
1	**Answer: Option 'C'** Length = Speed × time Speed = L/T S = 400/20 S = 20 M/Sec Speed= 20×18/5 (To convert M/Sec in to Kmph multiply by 18/5) Speed = 72 Kmph
2	**Answer: Option 'B'** L = S × T L = 72 Kmph × 20Sec L = 72 × 5/18 × 20 L = 400m
3	**Answer: Option 'B'** L = S × T L = 108 Kmph × 28Sec L =108 × 5/18 × 28 L= 840m
	Type III- Train is crossing bridge/tunnel/platform/another stationary train
1	**Answer: Option 'A'** **270 m**
2	**Answer: Option 'B'** Speed of the train = (Train length + Bridge Length) / time taken to cross the bridge => 90 * (5/18)= (130 + Bridge Length) / 21 => 25 =(130 + Bridge Length) / 21 => 130 +Bridge Length = 21 x 25 =>130 +Bridge Length =525 => Bridge Length = 525 - 130 =>Bridge Length = 395 m
3	**Answer: Option 'C'** Given, Length of train =360 m Length of bridge =140 m Speed of train = 45 km/hr ---> Converting into meter/ second = 45 × (5/18) m / sec = 12.5 m/sec =>Speed of train =12.5 m/sec Required Time =(Length of train + Length of bridge) /Speed of train = (360 + 140) / 12.5 = 500 / 12.5 = 40 sec =>Required Time =40 sec
4	**Answer: Option 'C'** Given, time taken by train to pass the man = 20 sec Speed of the train = 54 km/hr ---> Converting into meter/sec => Speed of train =54 * (5/18) m/sec = 15 m/sec W.K.T: Speed of train = Length of train/ Time taken by train to pass the man => 15 =Length of train / 20 =>Length of train = 15 * 20 =>Length of train = 300 metre. Given, A train passes a station platform in 36 seconds. =>Speed of train = (Length of train + Length of platform) / Time taken by train to pass the platform => 15 = (300 +Length of platform) / 36 => 15 * 36 = (300+Length of platform) => 540 =300+Length of platform => 540 - 300 =Length of platform Thus, Length of platform = 240 meter.
5	**Answer:** Option **D** **Explanation:** Let the length of the train be *x* metres and its speed by *y* m/sec.

	Then, $\frac{x}{y} = 8 \Rightarrow x = 8y$ Now, $\frac{x + 264}{20} = y$ $\Rightarrow 8y + 264 = 20y$ $\Rightarrow y = 22.$ $\therefore$ Speed = 22 m/sec = $\left(22 \times \frac{18}{5}\right)$ km/hr = 79.2 km/hr.
Type IV- Train is crossing another moving object (Both are going in same direction)	
1	**Answer: Option 'C'** Relative speed = (40 - 20) km/hr = (20 x 5/18) m/sec = (50/9) m/sec Therefore, Length of faster train = (50/9 x 5) m = 250/9 m = 27 (7/9) m.
2	**Answer: Option 'B'** 4.5 km/hr = (4.5 x 5/18) m/sec = 5/4 m/sec = 1.25 m/sec, and 5.4 km/hr = (5.4 x 5/18) m/sec = 3/2 m/sec = 1.5 m/sec. Let the speed of the train be x m/sec. Then, (x - 1.25) x 8.4 = (x - 1.5) x 8.5 => 8.4x - 10.5 = 8.5x - 12.75 => 0.1x = 2.25 => x = 22.5 Therefore Speed of the train = (22.5 x 18/5) km/hr = 81 km/hr.
3	**Answer: Option 'B'** Length of the two trains = 600m + 400m Speed of the first train = X Speed of the second train= 48 Kmph 1000/X - 48 = 180 1000/x - 48 * 5/18 = 180 50 = 9X - 120 X = 68 Kmph
4	**Answer:** Option **B** **Explanation:** 2 kmph = $\left(2 \times \frac{5}{18}\right)$ m/sec = $\frac{5}{9}$ m/sec. 4 kmph = $\left(4 \times \frac{5}{18}\right)$ m/sec = $\frac{10}{9}$ m/sec. Let the length of the train be x metres and its speed by y m/sec. Then, $\left(\frac{x}{y - \frac{5}{9}}\right) = 9$ and $\left(\frac{x}{y - \frac{10}{9}}\right) = 10.$ $\therefore 9y - 5 = x$ and $10(9y - 10) = 9x$ $\Rightarrow 9y - x = 5$ and $90y - 9x = 100.$ On solving, we get: $x = 50.$ $\therefore$ Length of the train is 50 m.
5	Correct Option: E According to the question, $(60 - 35) \times \frac{5}{18} = \frac{D}{54}$ D = 375 m Length of the faster train = 375m, Length of the slower train = $375 \times \frac{4}{5} = 300$ m Hence, option E is correct.
Type V- Train is crossing another moving object (Both are going in opposite direction)	
1	**Answer: Option 'C'** L = S×T L = 90×5/18×30 L = 750m Length of second train= total length - Length of first train = 750 - 250 = 500m

2	**Answer: Option 'B'** Speed of the first train = (120 /10) m/sec = 12 m/sec. Speed of the second train = (120 / 15) m/sec = 8 m/sec. Relative speed = (12 + 8) = 20 m/sec. Therefore Required time = [(120+ 120/ 20)] sec = 12 sec.
3	**Answer:** Option **C** **Explanation:** Relative speed = (60+ 90) km/hr $= \left(150 \times \frac{5}{18}\right)$ m/sec $= \left(\frac{125}{3}\right)$ m/sec. Distance covered = (1.10 + 0.9) km = 2 km = 2000 m. Required time = $\left(2000 \times \frac{3}{125}\right)$ sec = 48 sec.
4	**Answer:** Option **C** **Explanation:** Let the speed of the slower train be x m/sec. Then, speed of the faster train = $2x$ m/sec. Relative speed = (x + $2x$) m/sec = $3x$ m/sec. $\therefore \frac{(100 + 100)}{8} = 3x$ $\Rightarrow 24x = 200$ $\Rightarrow x = \frac{25}{3}$. So, speed of the faster train = $\frac{50}{3}$m/sec $= \left(\frac{50}{3} \times \frac{18}{5}\right)$ km/hr = 60 km/hr.
Type VI – Ratio of length/Logical Questions	
1	**Answer: Option 'B'** Formula Used:- If two trains start at the same time from points A and B towards each other and after crossing they take a and b hours in reaching B and A respectively, then: Ratio of their speeds is(A's speed) : (B's speed) = (√b : √a) Let us name the trains as X and Y. Then, a = 9 hours b = 16 hours Ratio of their speeds = (A's speed) : (B's speed) = √b : √a = √16 : √9 = 4 : 3.
2	**Answer:** Option **B** **Explanation:** Suppose they meet x hours after 7 a.m. Distance covered by A in x hours = $20x$ km. Distance covered by B in (x - 1) hours = $25(x - 1)$ km. $\therefore 20x + 25(x - 1) = 110$ $\Rightarrow 45x = 135$ $\Rightarrow x = 3$. So, they meet at 10 a.m.

3	Correct Option: C Let the speed of Train A be S_A = 45 kmph and that of Train B be S_b Then, time taken by Train A = T_A = 4 hrs 48 min = $4 + \frac{48}{60} = \frac{24}{5}$hrs Time taken by Train B = T_B = 3 hrs 20 min = $3 + \frac{20}{60} = \frac{10}{3}$hrs Using formula $\frac{S_A}{S_B} = \sqrt{\frac{T_B}{T_A}}$ **Note:** If two trains (or bodies) start at the same time from points A and B towards each other and after crossing they take a and b sec in reaching B and A respectively, then (A's spped) : (B's speed) = $(\sqrt{b} : \sqrt{a})$. $\therefore \frac{45}{S_B} = \sqrt{\frac{10}{3} \times \frac{5}{24}} = \sqrt{\frac{25}{36}} = \frac{5}{6}$ or, $S_B = \frac{45 \times 6}{5}$ = 54 kmph
4	Correct Option: C Let the speed of the goods train be x kmph. Distance covered by goods train in 15 hrs = Distance covered by express train in 7 hrs So, 15x = 7 × 120 or x = 56. So, Speed of goods train = 56 kmph. Hence, option C is correct.
5	Correct Option: C Let after x hours the second train will meet the first train. Because distance is same, $S_1 t_1 = S_2 t_2$ 60 (x + 2) = 80 × x 60x + 120 = 80x 80x – 60x = 120 20x = 120 x = 6 hours Hence, option C is correct.
6	**Answer:** Option **E** **Explanation:** Time taken to cross the train, running in opposite directions $= \frac{(l_1 + l_2)}{(u + v)}$ sec. $\Rightarrow 10 = \frac{(210 + 300)}{(u + v)}$ $\Rightarrow u + v = 51.$ Time taken to cross the train, running in same direction = $\frac{(l_1 + l_2)}{(u - v)}$ sec. $\Rightarrow 30 = \frac{(210 + 300)}{(u - 60 \times (5/18))}$ $\Rightarrow u = \left(17 + \frac{50}{3}\right)$m/sec. Thus, u and v can be obtained. $\therefore$ Correct answer is (E).
7	**Answer:** Option **E** **Explanation:** Let the two trains of length a metres and b metres be moving in opposite directions at u m/s and v m/s. Time taken to cross each other = $\frac{(a + b)}{(u + v)}$ sec. Now, b = 180, $u + v = \left(150 \times \frac{5}{18}\right)$m/sec $= \frac{125}{3}$ m/sec. $\Rightarrow 9 = \frac{a + 180}{}$

	(125/3) $\Rightarrow a = (375 - 180) = 195$ m.
8	**Answer:** Option **E** **Explanation:** Time taken by train to cross a man = $\frac{\text{Length of train}}{\text{Speed of train}}$ $\Rightarrow$ Speed = $\frac{l}{9}$ ....(i) Time taken by train to cross a platform = $\frac{\text{(Length of train + Length of platform)}}{\text{Speed of train}}$ $\Rightarrow$ Speed = $\frac{l + 240}{24}$ ....(ii) From (i) and (ii), we get $\frac{l}{9} = \frac{l + 240}{24}$. Thus, l can be obtained. So both I and II are necessary to get the answer. $\therefore$ The correct answer is (E).