General Rules

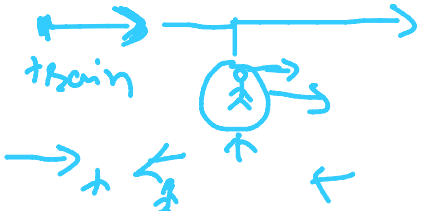
Tuesday, June 1, 2021 10:19 AM

1. Object I : Those object who cross another object is considered as object I (most of the case object I is train).

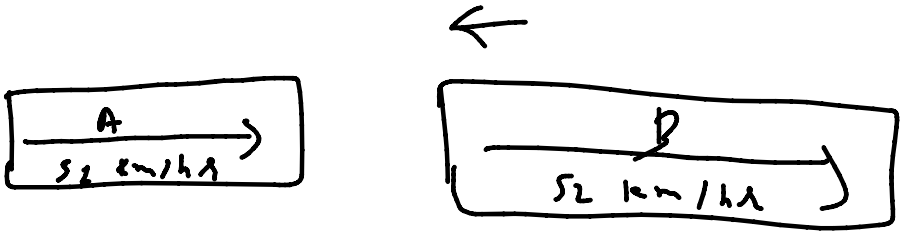
Ex:- train, bus, tree, person, ... etc.

2. object II : Those object who are crossed by object I.

=) Concept / General Rule :-



(1) When both object are moving in same direction



Relative speed $= s_1 - s_2 \quad (s_1 > s_2)$

(2) When they moving in opposite direction

Relative speed $= s_1 + s_2$

=) Concept of distance:

=) Concept of time

Time is always constant. (object 1 to cross object 2).

1. When a moving train crosses a standing person.

$$S_1 = \frac{L_1}{T}$$

Ex: find the time taken by a train 150 m long, running at 54 km/hr in crossing an electric pole:-

$$S = \frac{L}{T}$$

$$T = \frac{L}{S} = \frac{150}{54 \times \frac{5}{18}\ m/s} = \frac{150}{15} = 10\ sec$$

2. When a moving train crosses a moving person in the same direction

$$S_1 - S_2 = \frac{L_2}{T} \quad \text{and} \quad L_2 = 0$$

Ex: A train 180 m long is running at the speed of 65 km/hr. In what time it pass a man who is running at a speed of 5 km/hr in the same direction?

$$S_1 - S_2 = \frac{L_1}{T}$$

$$T = \frac{L_1}{S_1 - S_2} = \frac{180 \text{ m}}{(65-5) \times \frac{5}{18}} = \frac{180}{60 \times \frac{5}{18}} = 10.8 \text{ sec}$$

3. When a moving train crosses a moving person in opposite direction

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

Ex: A train 150 m is moving 85 km/hr. It cross a man coming from the opposite direction at the speed of 5 km/hr.

$$S_1 + S_2 = \frac{L}{T}$$

$$(85 + 5) * \frac{5}{18} = \frac{150}{T} \Rightarrow T = \frac{150}{5 \times 5} \times 18$$

$$= 6 \text{ sec}_{//}$$

4. When a moving train crosses a platform

$$S_1 = \frac{L_1 + L_2}{T}, \quad S_2 = 0.$$

Ex: A train 140 m long is running at 60 km/hr. In how much time will it pass a platform 260 m long?

$$\rightarrow \quad S. = \frac{L_1 + L_2}{T}$$

$$T = \frac{140 + 260}{60 \times \frac{5}{18}} \Rightarrow T = 24 \text{ sec}_{//}$$

5. When a moving train crosses another stationary train?

$$S = \frac{L_1 + L_2}{T}$$

$$S_1 = \frac{L_1 + L_2}{T}, \quad S_2 = 0$$

Ex: A train 180 m long taken 20 sec in crossing a stationary train 220 m long find speed of moving train. (km/h)

$$\rightarrow S = \frac{L_1 + L_2}{T} = \frac{180 + 220}{20} = \frac{400}{20} = 20$$

$$S = 20 \times \frac{18}{5} = 72 \text{ km/h}$$

Q) When a moving train crosses another moving train in same direction.

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

Ex: Two trains travelling in the same direction at 54 km/hr and 36 km/hr completely pass one another in 1 minute. If the length of first train

is 125 m. then find length of second train

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

$$(54 - 36) \times \frac{5}{18} = \frac{125 + L_2}{10}$$

$$5 \times 10 = 125 + L_2 \Rightarrow L_2 = 175 \text{ m} //$$

7: When a moving train crosses another moving train coming from opposite direction

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

Ex: Two trains are running in opposite directions with the same speed. If the length of each train is 120 m and they cross each other in 12 seconds. find the speed.

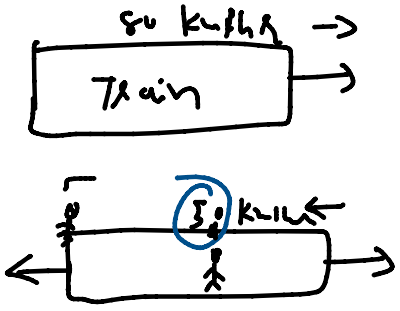
→ Let the speed of each train is x

$$\frac{120+120}{x+x} = 12 \Rightarrow 2x = \frac{240}{12}$$

$$\Rightarrow x = 10 \text{ m/s}.$$

$$\Rightarrow x = 10 \times \frac{18}{5} = 36 \text{ km/hr}.$$

6) When a moving train crosses a person sitting in another train?



$$S_1 \pm S_2 = \frac{L_1}{T}, \quad L_2 = 0$$

Ex: A goods train 150 m long moving with speed 54 km/hr. A man is sitting in the passenger train which is moving with 18 km/hr in the same direction find the time to cross each other?

→ $S_1 - S_2 = \frac{L}{T}$

$$(54 - 18) \times \frac{5}{18} = \frac{150 \text{ m}}{}$$

$$(54-18)\times\frac{5}{18} = \frac{150\text{ m}}{T}$$

$$T = 150/10 = 15 \text{ sec.}$$

9) When a moving train crosses two different objects.

Ex: A train running at the speed of 30 km/hr takes 18 sec to pass a platform and it takes 15 sec to pass a man who is running at the speed of 6 km/hr in the same direction. find length of platform.

→ Let the length of train is L & platform is P

$$S_1 = \frac{L+P}{T} \Rightarrow 30\times\frac{5}{18} = \frac{L+P}{18}$$

$$\Rightarrow L+P = 150 \text{ m} \quad \text{---- (1)}$$

Again.

$$S_1 - S_2 = \frac{L}{\quad}$$

$$S_1 - S_2 = \frac{L}{T}$$

$$(30-6)\times\frac{5}{18} = \frac{L}{15} \Rightarrow L = 100\text{ m}.$$

$\Rightarrow L+P = 150 \Rightarrow P = 150 - 100$

$= 50$ m.

Ex: A train travelling at 36 km/hr completely crosses another train, having half its length and travelling in the opposite direction at 54 km/hr in 12 seconds. It it also passes a railway platform in $1\frac{1}{2}$ minutes. Find the length of platform.

→ Relative speed $= (36+54)$ km/hr

$= 90$ km/hr

$= 90\times\frac{5}{18} = 25$ m/s

$$\frac{l+\frac{a}{2}}{\qquad} = 12 \Rightarrow l = 200\text{ m}.$$

$36 \text{ km/hr} \Rightarrow 36 \times \frac{5}{18} = 10 \text{ m/s}.$

→ Let platform length = x m.

$$\frac{x + 200}{10} = 90 \Rightarrow x = 700 \text{ m},$$

10) When two trains start from two points X & Y towards each other at the same time and after crossing they take P & Q seconds to reach Y & X respectively then ratio of

$$\text{Speed} = \sqrt{Q} : \sqrt{P}$$

Ex = Two trains X and Y start starting at and B towards B and A respectively. After passing each other. they take 4 hours 48 minutes and 3 hours 20 minutes to reach B and A

respectively. If train x is moving at 40 km/hr find the speed of train y ?

$$\frac{x\text{'s speed}}{y\text{'s speed}} = \sqrt{\frac{\text{Time taken by y to reach A}}{\text{Time taken by x to reach B}}}$$

$$\frac{40}{y\text{'s speed}} = \sqrt{\frac{2\text{ hr} \times 60}{2\text{ hr} \times 60}} = \sqrt{\frac{100}{144}} = \sqrt{\frac{50}{72}}$$

$$= \sqrt{\frac{25}{36}}$$

$$= \frac{5}{6}$$

$$y \text{ speed} = \frac{6 \times 40}{5} = 48 \text{ km/hr}$$