

(Updated)

Math Formula Sheet

Type 1: Work / Tank Problems

$$\text{Formula 1} \rightarrow \frac{1}{A} + \frac{1}{B} = \frac{1}{x}$$

If Taps A and B are adding water while Tap C is draining water:

$$\text{Formula 2} \rightarrow \frac{1}{A} + \frac{1}{B} - \frac{1}{C} = \frac{1}{x}$$

Formula 3:

If A and B are working at the same job, but for different times $\rightarrow$

$$\frac{\text{Time A works for}}{\text{Total Time A takes for full job}} + \frac{\text{Time B works for}}{\text{Total Time B takes for full job}} = 1$$

Type 2: Ratio & Proportion

Direct Relations: Cross Multiply

Inverse Relations: Head-to-head Multiply

Examples:

1. Number of men hired is inversely proportional to the number of days taken to finish a certain job. Hence
 $\rightarrow m_1 \times t_1 = m_2 \times t_2$

2. Two wheels attached together – number of revolutions made by each wheel is inversely proportional to its radius (or diameter). Hence:
 $\text{radius}_1 \times \text{revolutions}_1 = \text{radius}_2 \times \text{revolutions}_2$

Combination of Direct & Inverse Relations:

$$m_1 \times t_1 \times w_2 = m_2 \times t_2 \times w_1$$

Type 3: Percentages / Selling Price / Cost Price

$$\text{Selling price} = \text{Cost} + \text{Profit}$$

$$\text{Discounted SP} = \text{Original SP} - \text{Discount}$$

$$\text{Change in Discount} = \text{Change in Profit}$$

$$\text{Profit or loss \%} = \frac{\text{Amount of Profit or loss}}{\text{Cost}} \times 100$$

$$\text{Markup \%} = \frac{\text{Profit}}{\text{Cost}} \times 100$$

$$\text{Margin \%} = \frac{\text{Profit}}{\text{Selling Price}} \times 100$$

To find Percentage Increase or Decrease:

$$\text{Percentage Change} = \frac{\text{Change}}{\text{Original}} \times 100$$

$$\text{What \% is } x \text{ of } y? \rightarrow \frac{\text{is}}{\text{of}} \times 100 = \frac{x}{y} \times 100$$

Percentage change in area of any geometric shape when **all sides** are increased by $x\%$ =

$$\frac{(100 + x)^2}{100} - 100$$

Percentage change in area of any geometric shape when **ones side** is increased by $x\%$ and the **other side** is increased by $y\%$ =

$$x + y + \frac{xy}{100}$$

Note: For decrease in any side, use negative signs

Type 4: Averages

$$\text{Average} = \text{Sum} / \text{Number}$$

$$\text{Sum} = \text{Average} \times \text{Number}$$

$$\text{Last Score} = \text{Old Average} + (n \times \text{change})$$

$$\text{New Average} = \text{Old Average} + \text{change}$$

Type 5 (a): Arithmetic Progression

$$\text{Average of an Arithmetic Progression} = \frac{(a + l)}{2}$$

$$\text{Sum of an Arithmetic Progression} = \frac{(a + l)}{2} \times n$$

$$N^{\text{th}} \text{ Term of an Arithmetic Progression}$$

$$T_n = a + (n - 1)d$$

$$\text{Sum of an Arithmetic Progression}$$

$$S_n = \frac{n}{2}(2a + (n - 1)d) \quad \text{OR} \quad S_n = \frac{n}{2}(a + l)$$

$$\text{Number of terms} = \frac{l - a}{d} + 1$$

Type 5b: Geometric Progression

$$\text{Term of a Geometric Progression}$$

$$T_n = a \times r^{n-1}$$

$$\text{Sum of } n \text{ terms} = \frac{a(r^n - 1)}{r - 1}$$

$$\text{Sum to infinity (can only be found if } 1 < r < 1)$$

$$= \frac{a}{1 - r}$$

Type 6: Speed Problems

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

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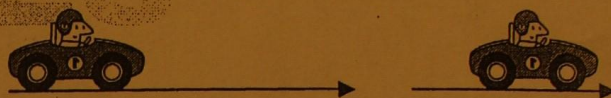
$$\text{Distance} = \text{Speed} \times \text{Time}$$

Average Speed for a Round Trip (also for a trip broken in two parts, each part consisting of the same distance)

Whenever an object travels a certain distance at one speed (a mph) and comes back the SAME distance at another speed (b mph), the average speed for the ROUND-TRIP can be calculated by the formula

$$\text{Average Speed for round trip} = \frac{2ab}{(a + b)}$$

When Two Objects Travel in the Same Direction (one object trying to catch up with another)



In such cases **SUBTRACT** the speeds (find the **NET SPEED**)

If Car B is trying to catch up with Car A that is traveling ahead of B in the same direction:

$$\text{Method 1} \rightarrow S_A \times t_A = S_B \times t_B$$

$$\text{Method 2} \rightarrow \text{Time for B to catch A} =$$

$$\frac{\text{Headstart distance of A}}{\text{Net Speed}}$$

When Two Objects Travel in the Opposite Directions



In such cases **ADD** the speeds (find the **COMBINED SPEED**)

If Car A and Car B travel from opposite sides towards each other, the time for them to meet each other :

$$\text{Time to meet} = \frac{\text{distance}}{\text{combined speed}}$$