

Arithmetic Word Problems Masterclass

Ultimate Formula & Concept Sheet

1. Percentage, Profit, Loss & Discount

- **Percentage Change:** Percentage Increase/Decrease = $\left(\frac{\text{New Value} - \text{Old Value}}{\text{Old Value}}\right) \times 100$

- **Profit and Loss:**

$$\text{Profit} = \text{SP} - \text{CP}, \quad \text{Loss} = \text{CP} - \text{SP}$$

$$\text{Profit}\% = \left(\frac{\text{Profit}}{\text{CP}}\right) \times 100, \quad \text{Loss}\% = \left(\frac{\text{Loss}}{\text{CP}}\right) \times 100$$

- **Discount & Marked Price:** Discount = MP - SP, Discount% = $\left(\frac{\text{Discount}}{\text{MP}}\right) \times 100$

2. Ratio, Proportion & Partnership

- **Direct & Inverse Proportion:** If y varies directly as x , then $y = kx$. If inversely, $xy = k$.
- **Partnership Share:** Profit Ratio = Investment₁ × Time₁ : Investment₂ × Time₂

3. Averages, Mixtures & Alligation

- **Average Formula:** Average = $\frac{\sum \text{Observations}}{\text{Number of Observations}}$
- **Alligation Rule:** For mixing two quantities at prices C_1 and C_2 to form a mixture at mean price M :

$$\frac{\text{Quantity of Cheaper}}{\text{Quantity of Dearer}} = \frac{C_2 - M}{M - C_1}$$

4. Time, Speed & Distance

- **Core Relations:** Distance = Speed × Time
- **Average Speed:** Average Speed = $\frac{2xy}{x+y}$ (for equal distances covered at speeds x and y).
- **Relative Speed:** For two bodies moving in opposite directions at S_1 and S_2 , relative speed is $S_1 + S_2$. In the same direction, it is $|S_1 - S_2|$.

5. Time & Work, Pipes & Cisterns

- **Efficiency Concept:** If A can do a piece of work in n days, A's 1 day work = $\frac{1}{n}$.
- **Combined Work:** If A and B take a and b days respectively, working together they take $\frac{ab}{a+b}$ days.
- **Pipes & Cisterns:** Inlet pipes carry positive work rates ($+1/x$), while outlet/leak pipes carry negative work rates ($-1/y$).