

Arithmetic Word Problems: Master Cheat Sheet

Essential Strategies, Formulas, and Quick-Solve Techniques

1. Fundamental Translation Successive Percentages

Guide

Translating English sentences into mathematical equations is the bedrock of solving word problems. Look out for these key translations:

- **Is, was, are, will be:** Equals (=)
- **Of:** Multiplication ($\times$)
- **Per, out of:** Division (/)
- **What, how many:** Variable (x, y)
- **Exceeds by:** Difference ($a - b = k$)

Ages Time Problems

* Let present age be x . Age n years later: $x + n$. * Age n years ago: $x - n$. * **Ratio approach:** If ages are in ratio 4 : 5, use $4x$ and $5x$.

2. Percentages Ratios

Percentage Change

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

If a value increases by $a\%$ and then by $b\%$, the net percentage change is:

$$\text{Net Change} = \left(a + b + \frac{ab}{100} \right) \%$$

Alligation Rule

Used to find the ratio in which two ingredients at given prices must be mixed to get a mixture of a desired price:

$$\frac{\text{Quantity of Cheaper}}{\text{Quantity of Dearer}} = \frac{\text{Cost of Dearer} - \text{Mean Price}}{\text{Mean Price} - \text{Cost of Cheaper}}$$

3. Speed, Time Distance

Core Formula

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

Average Speed

When distance is constant (d each way):

$$\text{Average Speed} = \frac{2xy}{x + y}$$

where x and y are the two speeds.

Relative Speed

* **Same Direction:** $S_1 - S_2$ * **Opposite Direction:** $S_1 + S_2$

Trains

$$\text{Time} = \frac{\text{Length of Train} + \text{Length of Platform}}{\text{Relative Speed}}$$

4. Work Time

Core Principle

If a person can complete a work in n days, their 1-day work is $\frac{1}{n}$.

Combined Work

If A takes a days and B takes b days, working together they take:

$$\text{Time} = \frac{ab}{a + b} \text{ days}$$

Pipes and Cisterns

* Inlet pipe = Positive work ($+\frac{1}{x}$) * Outlet/Leak pipe = Negative work ($-\frac{1}{y}$)

5. Profit, Loss Discount

Core Formulas

* Profit = SP - CP * Loss = CP - SP * Profit % = $\left(\frac{\text{Profit}}{\text{CP}} \right) \times 100$ * Discount = MP - SP

Marked Price Selling Price

$$\text{SP} = \text{MP} \times \left(1 - \frac{\text{Discount \%}}{100} \right)$$