

Arithmetic Word Problems: Master Cheat Sheet

Essential Formulas, Translation Keywords, and Problem-Solving Strategies

1. The 4-Step Problem Strategy

- Understand:** Read carefully, identify the unknown and given data.
- Translate:** Convert English sentences into algebraic equations.
- Solve:** Perform algebraic manipulations step-by-step.
- Verify:** Check if the answer makes logical sense in context.

2. Translation Dictionary

English	Math Operation
Sum, total, more than	+(Addition)
Difference, less than	-(Subtraction)
Product, of, times	×(Multiplication)
Quotient, per, ratio	÷(Division)
Is, was, will be, equals	= (Equality)
What, a number, unknown	x, y, z (Variables)

3. Percentage Ratio Formulas

Percentage Increase/Decrease:

$$\text{Percentage Change} = \frac{\text{New Value} - \text{Old Value}}{\text{Old Value}} \times 100$$

Simple Interest (SI):

$$SI = \frac{P \times R \times T}{100}$$

where P = Principal, R = Rate per annum, T = Time in years.

Compound Interest (CI):

$$A = P \left(1 + \frac{R}{100} \right)^T, \quad CI = A - P$$

4. Speed, Distance Time

Core Relations:

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

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

Unit Conversion:

$$\text{km/hr} \times \frac{5}{18} = \text{m/s}$$

Average Speed (Equal Distances):

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

where x and y are outbound and return speeds.

5. Work and Time Problems

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 finish in:

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

6. Mixtures and Alligations

To mix two ingredients of prices C_1 and C_2 to get a mean price C_m :

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