

Arithmetic Master Cheat Sheet

Essential Formulas, Properties, and Shortcuts for Rapid Calculations

1. Number Systems & Properties

Natural Numbers (N): $\{1, 2, 3, \dots\}$ **Whole Numbers (W):** $\{0, 1, 2, 3, \dots\}$ **Integers (Z):** $\{\dots, -2, -1, 0, 1, 2, \dots\}$ **Rational Numbers (Q):** $\frac{p}{q}$ where $q \neq 0$.

Properties of Operations:

- **Commutative:** $a + b = b + a$, $ab = ba$
- **Associative:** $(a + b) + c = a + (b + c)$
- **Distributive:** $a(b + c) = ab + ac$

2. Fractions & Decimals

Addition/Subtraction:

$$\frac{a}{b} \pm \frac{c}{d} = \frac{ad \pm bc}{bd}$$

Multiplication/Division:

$$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}, \quad \frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

3. Divisibility Rules

2

Sum of digits is divisible by 2. **4**

Last digit is 0 or 5. **9**

Diff. of alternate sum of digits is 0 or mult. of 11.

4. HCF and LCM

For any two positive integers a and b :

$$\text{HCF}(a, b) \times \text{LCM}(a, b) = a \times b$$

Fractions:

$$\text{HCF}\left(\frac{a}{b}, \frac{c}{d}\right) = \frac{\text{HCF}(a, c)}{\text{LCM}(b, d)}$$

$$\text{LCM}\left(\frac{a}{b}, \frac{c}{d}\right) = \frac{\text{LCM}(a, c)}{\text{HCF}(b, d)}$$

5. Percentages

Percentage Change:

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

Successive Percentage (for $a\%$ and $b\%$):

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

6. Ratio & Proportion

If $\frac{a}{b} = \frac{c}{d}$, then:

- **Invertendo:** $\frac{b}{a} = \frac{d}{c}$
- **Alternendo:** $\frac{a}{c} = \frac{b}{d}$
- **Componendo & Dividendo:**

$$\frac{a + b}{a - b} = \frac{c + d}{c - d}$$

Last digit is even (0, 2, 4, 6, 8). **3**

Last two digits form a number divisible by 4. **5**

Sum of digits is divisible by 9. **11**

Profit/Loss:

11

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

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

Discount:

$$\text{Discount} = \text{MP} - \text{SP}$$

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

8. Simple & Compound Interest

Simple Interest (SI):

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

Compound Interest (CI):

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

Difference (CI - SI for 2 yrs):

$$\text{Diff} = \frac{PR^2}{100^2}$$

9. Speed, Time & Distance

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

Unit Conversion:

$$1 \text{ km/hr} = \frac{5}{18} \text{ m/s}$$

Average Speed (Equal Distances):

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