

Arithmetic Cheat Sheet

Essential Formulas, Rules, and Quick Reference

1. Number Systems

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 $q \neq 0$.

Irrational Numbers: Cannot be expressed as a simple fraction (e.g., π , $\sqrt{2}$).

2. Divisibility Rules

- **2:** Last digit is even (0, 2, 4, 6, 8).
- **3:** Sum of digits is divisible by 3.
- **4:** Last two digits form a number divisible by 4.
- **5:** Last digit is 0 or 5.
- **6:** Divisible by both 2 and 3.
- **9:** Sum of digits is divisible by 9.
- **11:** Alternating sum of digits is divisible by 11.

3. HCF and LCM

For any two positive integers a and b :

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

Fractions:

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

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

4. Fractions and Decimals

Addition/Subtraction:

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

Multiplication:

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

Division:

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$$

5. Percentages

Percentage Formula:

$$\text{Percentage} = \left(\frac{\text{Part}}{\text{Whole}} \right) \times 100$$

Percentage Increase/Decrease:

$$\% \text{ Change} = \left(\frac{\text{New} - \text{Old}}{\text{Old}} \right) \times 100$$

Successive Percentages ($a\%$ and $b\%$):

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

6. Ratio and Proportion

If $a : b = c : d$, then:

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

Componendo and Dividendo:

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

7. Profit, Loss, and Discount

Profit = SP - CP, Loss = CP - SP

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

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

Discount = MP - SP

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

8. Simple and Compound Interest

Simple Interest (SI):

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

Where P = Principal, R = Rate, T = Time.

Compound Interest (CI):

$$A = P \left(1 + \frac{R}{100} \right)^n$$

$$\text{CI} = A - P$$

9. Speed, Time, and Distance

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

Conversion:

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

Average Speed:

$$\text{Avg Speed} = \frac{2xy}{x+y} \quad (\text{for equal distances})$$

10. Averages

$$\text{Average} = \frac{\text{Sum of Observations}}{\text{Number of Observations}}$$

Arithmetic Progression (AP) Average:

$$\text{Avg} = \frac{\text{First Term} + \text{Last Term}}{2}$$

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