

Arithmetic Cheat Sheet

Essential Formulas, Rules, and Quick Reference

1. Number Systems

- **Natural ($\mathbb{N}$):** $\{1, 2, 3, \dots\}$
- **Whole ($\mathbb{W}$):** $\{0, 1, 2, 3, \dots\}$
- **Integers ($\mathbb{Z}$):** $\{\dots, -2, -1, 0, 1, 2, \dots\}$
- **Rational ($\mathbb{Q}$):** $\frac{p}{q}$ where $q \neq 0$.
- **Irrational:** Non-terminating, non-repeating decimals (e.g., $\pi, \sqrt{2}$).

2. Divisibility Rules

- **2:** Last digit is even.
- **3:** Sum of digits is divisible by 3.
- **4:** Last two digits form a multiple of 4.
- **5:** Last digit is 0 or 5.
- **9:** Sum of digits is divisible by 9.
- **11:** Alternating sum of digits is divisible by 11.

3. Fractions & 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:**

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

4. LCM & HCF (GCD)

- For any two integers a and b :

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

- **HCF of Fractions:**

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

- **LCM of Fractions:**

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

5. Percentages

- **Percentage Formula:**

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

- **Percentage Increase/Decrease:**

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

6. Ratio & Proportion

- If $a : b = c : d$, then $ad = bc$ (Cross Product).
- **Direct Proportion:** $y = kx$
- **Inverse Proportion:** $y = \frac{k}{x}$

7. Simple & Compound Interest

- **Simple Interest (SI):**

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

- **Compound Interest (CI):**

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

$$CI = A - P$$