



Download the ExamBhai App: <https://play.google.com/store/apps/details?id=com.exambhai.app>

ExamBhai.com — Premium Study Material

ARITHMETIC FORMULA SHEET

1. Number Systems & Properties

• Types of Numbers:

- Natural Numbers ($\mathbb{N}$): $\{1, 2, 3, \dots\}$
- Whole Numbers ($\mathbb{W}$): $\{0, 1, 2, 3, \dots\}$
- Integers ($\mathbb{Z}$): $\{\dots, -2, -1, 0, 1, 2, \dots\}$
- Rational Numbers ($\mathbb{Q}$): $\{\frac{a}{b} \mid a, b \in \mathbb{Z}, b \neq 0\}$

• Fundamental Properties:

- Commutative: $a + b = b + a \mid a \cdot b = b \cdot a$
- Associative: $(a + b) + c = a + (b + c) \mid (a \cdot b) \cdot c = a \cdot (b \cdot c)$
- Distributive: $a \cdot (b + c) = a \cdot b + a \cdot c$

• HCF & LCM Properties:

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

$$\text{HCF of Fractions} = \frac{\text{HCF of Numerators}}{\text{LCM of Denominators}}$$

$$\text{LCM of Fractions} = \frac{\text{LCM of Numerators}}{\text{HCF of Denominators}}$$

2. Percentages, Profit & Loss

• Percentage Formula:

$$\text{Percentage} = \left(\frac{\text{Value}}{\text{Total Value}} \right) \times 100$$

• Percentage Change:

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

• Profit and Loss:

$$\text{Profit (P)} = \text{SP} - \text{CP}, \quad \text{Loss (L)} = \text{CP} - \text{SP}$$

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

• Discount and Marked Price:

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

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

3. Simple & Compound Interest

• Simple Interest (SI):

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

$$\text{Amount (A)} = P + \text{SI} = P \left(1 + \frac{R \times T}{100} \right)$$

• Compound Interest (CI):

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

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

• Compounding n times a year:

$$A = P \left(1 + \frac{R}{100k} \right)^{k \cdot n} \quad (k = \text{compounding frequency})$$

4. Ratio, Proportion & Averages

• Ratio & Proportion:

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

$$\text{Duplicate Ratio of } a : b = a^2 : b^2$$

$$\text{Triplicate Ratio of } a : b = a^3 : b^3$$

• Average / Arithmetic Mean:

$$\text{Average} = \frac{\text{Sum of all observations}}{\text{Total number of observations}}$$

• Weighted Average:

$$A_w = \frac{w_1 x_1 + w_2 x_2 + \dots + w_n x_n}{w_1 + w_2 + \dots + w_n}$$

5. Time, Speed & Distance

- **Fundamental Formula:**

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

- **Unit Conversion:**

$$1 \text{ km/h} = \frac{5}{18} \text{ m/s}, \quad 1 \text{ m/s} = \frac{18}{5} \text{ km/h}$$

- **Average Speed:**

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

- **Equal Distance Formula:**

$$\text{Average Speed} = \frac{2xy}{x+y} \quad (\text{for speeds } x \text{ and } y)$$

- **Relative Speed:**

- Same Direction: $S_{rel} = |S_1 - S_2|$
- Opposite Direction: $S_{rel} = S_1 + S_2$

6. Time & Work

- **Work Done:**

$$\text{Work} = \text{Rate (Efficiency)} \times \text{Time}$$

- **Combined Work:** If A completes a job in x days and B in y days:

$$\text{Combined Rate} = \frac{1}{x} + \frac{1}{y} = \frac{x+y}{xy}$$

$$\text{Time taken together} = \frac{xy}{x+y} \text{ days}$$

- **Man-Days-Hours Rule:**

$$\frac{M_1 \cdot D_1 \cdot H_1}{W_1} = \frac{M_2 \cdot D_2 \cdot H_2}{W_2}$$

7. Progression & Series

- **Arithmetic Progression (AP):**

$$n^{\text{th}} \text{ term } (a_n) = a + (n-1)d$$

$$\text{Sum } (S_n) = \frac{n}{2}[2a + (n-1)d] = \frac{n}{2}[a + l]$$

- **Geometric Progression (GP):**

$$n^{\text{th}} \text{ term } (a_n) = a \cdot r^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1 - r} \quad (|r| < 1)$$