

Mathematics Formulae Sheet

Chapter 1: Real Numbers

- $a^c / a^d = a^{c-d}$
- $x^a \times x^b = x^{a+b}$
- $(b^c)^d = b^{(c \times d)}$
- $a^{(1/b)} = b\sqrt{a}$ (Radial Form)

Chapter 2: Logarithms

- $\log(m \times n) = \log m + \log n$
- $\log(m/n) = \log m - \log n$
- $\log(m)^n = n \log m$
- $\log_n m = \log m / \log n$

Chapter 3: Sets and Relations

1) Overlapping Sets:

- $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
- $n(A - B) = n(A \cup B) - n(B)$
- $n(A - B) = n(A) - n(A \cap B)$
- $n(A \cap B) = n(A) + n(B) - n(A \cup B)$

2) Disjoint Sets:

- $n(A \cup B) = n(A) + n(B)$
- $n(A \cap B) = n(A)$

3) Three Sets:

- $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$
- Number of elements = $n(A) \times n(B)$
- Number of binary relations = $2^{(n(A) \times n(B))}$

Chapter 4: Factorization and Algebraic Manipulation

- $(a + b)^2 = a^2 + 2ab + b^2$
- $(a - b)^2 = a^2 - 2ab + b^2$
- $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$
- $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
- $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
- $(a + b)^3 = a^3 + b^3 + 3a^2b + 3ab^2$
- $(a - b)^3 = a^3 - b^3 - 3a^2b + 3ab^2$
- $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
- $(a + b + c)^2 = (a + b)^2 + c^2 + 2c(a + b)$
- $4ab = (a + b)^2 - (a - b)^2$

Chapter 5: Linear Equations and Inequalities

1. $|a| / |b| = |a / b|$
2. $|ab| = |a| |b|$
3. $|x + 2| = -4$ (This type is impossible)

Chapter 6: Trigonometry and Bearings

- Degree to minutes = Degree \times 60'
- Degree to seconds = Degree \times 3600"
- Minutes to degrees = Minute \div 60'
- Seconds to degrees = Seconds \div 3600"
- Degrees to radians = Degree \times $\pi / 180$
- Radians to degrees = Radians \times $180 / \pi$
- Minutes to seconds = $60 \times 60''$
- Seconds to minutes = $60'' \div 60'$
- Area of sector = $1/2 r^2\theta$
- Length of arc = $r\theta$

Trigonometric Ratios:

- $1 / \sec\theta = \cos\theta$
- $1 / \cos\theta = \sec\theta$
- $1 / \tan\theta = \cot\theta$
- $\sin\theta = \text{Perpendicular} / \text{Hypotenuse}$
- $\cos\theta = \text{Base} / \text{Hypotenuse}$
- $\tan\theta = \text{Perpendicular} / \text{Base}$
- $\text{cosec}\theta = \text{Hypotenuse} / \text{Perpendicular}$
- $\sec\theta = \text{Hypotenuse} / \text{Base}$
- $\cot\theta = \text{Base} / \text{Perpendicular}$

Quotient Identities:

- $\tan\theta = \sin\theta / \cos\theta$
- $\cot\theta = \cos\theta / \sin\theta$

Pythagorean Identities:

- $\cos^2\theta + \sin^2\theta = 1$
- $\sin^2\theta = 1 - \cos^2\theta$
- $\sec^2\theta - \tan^2\theta = 1$
- $\text{cosec}^2\theta - \cot^2\theta = 1$

Chapter 7: Coordinate Geometry

- Distance formula = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- Midpoint formula = $((x_1 + x_2) / 2, (y_1 + y_2) / 2)$

Chapter 8: Geometry of Straight Lines

- Slope (m) = rise / run
- $\tan\theta = m$ (slope)
- m = coefficient of x / coefficient of y
- $m = (y_2 - y_1) / (x_2 - x_1)$

Forms of Equation of Line:

- Point-slope form: $y - y_1 = m(x - x_1)$
- Slope-intercept form: $y = mx + c$
- Two-point form: $y - y_1 = (y_2 - y_1) / (x_2 - x_1) (x - x_1)$
- Symmetric form: $(x / a) + (y / b) = 1$
- Normal form: $x \cos\alpha + y \sin\alpha = p$
- Two-intercept form: $x/a + y/b = 1$

Chapter 9: Geometry and Polygons

- $A_1 / A_2 = (h_1 / h_2)^2$
- $V_1 / V_2 = (h_1 / h_2)^3$
- Diameter = height of small diameter / smaller height
- Number of sides = Sum of exterior angles / one angle
- Sum of interior angles = $(n - 2) \times 180^\circ$
- Number of diagonals in a polygon = $n(n - 3) / 2$
- Each interior angle = $(n - 2) \times 180^\circ / n$

Chapter 10: Practical Geometry

Angles:

- 60° : Draw arc at 0°
- 120° : Draw arcs at 0° and 60°
- 45° : Draw arcs at 60° and 30°
- 90° : Draw arcs at 60° and 120°
- 75° : Draw arcs at 60° and 90°
- 30° : Draw arcs at 60° and 0°
- 105° : Draw arcs at 120° and 90°

Chapter 11: Basic Statistics

- Arithmetic mean: $\bar{x} = (\Sigma fx) / (\Sigma f)$
- Arithmetic mean (weighted mean): $\Sigma wx / \Sigma w$
- Median (grouped data): $L + ((n/2 - C) / f) \times h$
- Median (even numbers): $(n/2)\text{th value} + ((n/2) + 1)\text{th value} / 2$
- Median (odd numbers): $(n+1) / 2 \text{th value}$
- Mode = $L + ((f_m - f_1) / (2f_m - f_1 - f_2)) \times h$
- Probability of an event = $(\text{no. of favorable outcomes}) / (\text{total outcomes})$
- Expected frequency = $(\text{no. of trials}) \times (\text{probability of event})$
- Relative frequency = $(\text{frequency of an event}) / (\text{no. of trials of event})$