# Mathematics Formula Handbook (Detailed Revision Notes)

1) Sequences & Series

Arithmetic Progression (AP)
Definition: A sequence where the difference between consecutive terms is constant.
General form: a, a+d, a+2d, a+3d,...

nth Term:
a_n = a + (n-1)d

Sum of First n Terms:
S_n = n/2 [2a + (n-1)d]
Alternate: S_n = n/2 (a + l)
Special Case (Natural numbers): S_n = n(n+1)/2

Geometric Progression (GP)
General form: a, ar, ar^2, ar^3,...
nth Term: a_n = ar^(n-1)
Sum of First n Terms ($r \neq 1$):
S_n = a(1 - r^n)/(1 - r)
Infinite GP (|r| < 1):
S = a/(1 - r)

Harmonic Progression (HP)
If AP is a, a+d, a+2d,...
HP is 1/a, 1/(a+d), 1/(a+2d)

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2) Linear Equations & Algebra

Linear Equation (One Variable):
ax + b = 0
x = -b/a

Linear Equations (Two Variables):
a1x + b1y = c1
a2x + b2y = c2

Determinant Method:
x = (c1b2 - c2b1)/(a1b2 - a2b1)
y = (a1c2 - a2c1)/(a1b2 - a2b1)

Quadratic Equation:
ax^2 + bx + c = 0
x = [-b ± sqrt(b^2 - 4ac)]/(2a)
Discriminant: D = b^2 - 4ac

Algebraic Identities:
(a+b)^2 = a^2 + 2ab + b^2
(a-b)^2 = a^2 - 2ab + b^2

$a^2 - b^2 = (a-b)(a+b)$
$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$
$(a-b)^3 = a^3 - b^3 - 3ab(a-b)$

Binomial Theorem:
$(a+b)^n = \Sigma(nCk)\ a^{(n-k)}\ b^k$

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3) Basic Geometry & Mensuration

2D Geometry

Rectangle:
Area = $l \times b$
Perimeter = $2(l + b)$
Diagonal = $\sqrt{l^2 + b^2}$

Square:
Area = $a^2$
Perimeter = $4a$
Diagonal = $a\sqrt{2}$

Triangle:
Area = $1/2\ bh$
Heron's Formula:
$s = (a+b+c)/2$
Area = $\sqrt{[s(s-a)(s-b)(s-c)]}$

Equilateral Triangle:
Area = $(\sqrt{3}/4)a^2$

Circle:
Area = $\pi r^2$
Circumference = $2\pi r$
Sector Area = $(\theta/360)\pi r^2$
Arc Length = $(\theta/360)2\pi r$

Trapezium:
Area = $1/2\ (a+b)h$

Parallelogram:
Area = $bh$

3D Mensuration

Cube:
Surface Area = $6a^2$
Volume = $a^3$
Diagonal = $a\sqrt{3}$

Cuboid:
Surface Area = $2(lb + bh + hl)$
Volume = $lbh$
Diagonal = $\sqrt{l^2 + b^2 + h^2}$

Cylinder:
Volume = πr^2h
Curved Surface Area = 2πrh
Total Surface Area = 2πr(h+r)

Cone:
Volume = 1/3 πr^2h
Slant height l = sqrt(r^2 + h^2)

Sphere:
Surface Area = 4πr^2
Volume = 4/3 πr^3

Coordinate Geometry

Distance Formula:
sqrt[(x2-x1)^2 + (y2-y1)^2]

Midpoint Formula:
((x1+x2)/2 , (y1+y2)/2)

Slope:
m = (y2-y1)/(x2-x1)

Equation of Line:
y = mx + c