Maths Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 3

Sequence and Series

Arithmetic progression (AP)

NTH TERM

$$T_n = a + (n-1)d, \qquad T_n = S_n - S_{n-1}$$

SUM

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

THREE TERMS

$$a, b, c \text{ in AP} \iff 2b = a + c; \qquad \text{take } a-d,\ a,\ a+d$$

ARITHMETIC MEAN

$$A = \frac{a+b}{2}; \qquad n \text{ AMs between } a, b:\ d = \frac{b-a}{n+1}$$

Geometric progression (GP)

NTH TERM

$$T_n = ar^{n-1}$$

SUM

$$S_n = \frac{a(r^n - 1)}{r - 1}\ (r \neq 1), \qquad S_\infty = \frac{a}{1-r}\ (|r| < 1)$$

GEOMETRIC MEAN

$$a, b, c \text{ in GP} \iff b^2 = ac; \qquad G = \sqrt{ab}; \qquad n \text{ GMs: } r = \left(\frac{b}{a}\right)^{\frac{1}{n+1}}$$

Harmonic progression and means

HP

$$a, b, c \text{ in HP} \iff \frac{1}{a}, \frac{1}{b}, \frac{1}{c} \text{ in AP} \iff b = \frac{2ac}{a+c}$$

AM ≥ GM ≥ HM

$$A \geq G \geq H \ (a, b > 0), \qquad G^2 = AH \ (\text{two numbers})$$

AM–GM FOR N NUMBERS

$$\frac{a_1 + a_2 + \cdots + a_n}{n} \geq \sqrt[n]{a_1 a_2 \cdots a_n}, \text{ equality iff all equal}$$

Special series

NATURAL NUMBERS

$$\sum_{k=1}^{n} k = \frac{n(n+1)}{2}, \qquad \sum k^2 = \frac{n(n+1)(2n+1)}{6}, \qquad \sum k^3 = \left[\frac{n(n+1)}{2}\right]^2$$

AGP SUM TO INFINITY

$$a + (a+d)r + (a+2d)r^2 + \cdots = \frac{a}{1-r} + \frac{dr}{(1-r)^2} \quad (|r| < 1)$$

METHOD OF DIFFERENCES

$$T_k = f(k) - f(k-1) \ \Rightarrow \ \sum_{k=1}^{n} T_k = f(n) - f(0)$$

If the differences of successive terms form an AP or GP, write T_n as a polynomial or exponential in n first.

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