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Master Cheat Sheet: Number Series for Competitive Exams

1. Arithmetic Progression (AP)

Concept: Constant difference (d) between consecutive terms.

$$d = T_n - T_{n-1}$$
$$T_n = a + (n - 1)d$$
$$S_n = \frac{n}{2}[2a + (n - 1)d]$$

Example: 3, 7, 11, 15, ... ($d = +4$).

2. Geometric Progression (GP)

Concept: Constant ratio (r) between consecutive terms.

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

Example: 2, 6, 18, 54, ... ($r = 3$).

3. Difference Series

When the first difference is not constant, check the second or third difference.

- **1st Level:** $T_2 - T_1, T_3 - T_2, \dots$
- **2nd Level:** Constant difference of differences (Quadratic pattern).

Example: 2, 5, 10, 17, 26, ... (Diffs: 3, 5, 7, 9 → AP of diffs).

4. Squares and Cubes

Always check proximity to squares and cubes ($n^2 \pm k$ or $n^3 \pm k$).

- **Squares:** 1, 4, 9, 16, 25, 36, ...
- **Cubes:** 1, 8, 27, 64, 125, ...
- **Offsets:** $n^2 + 1$ or $n^3 - n$.

5. Prime Number Series

Series based purely on prime numbers or composite numbers.

- **Primes:** 2, 3, 5, 7, 11, 13, 17, ...
- **Alternate Primes:** 2, 5, 11, 17, ...
- **Primes ± 1 :** 3, 7, 13, 19, ... ($p_i + 1$).

6. Mixed / Two-Tier Series

Alternating two independent series interwoven into one sequence. *Example:* 2, 9, 4, 16, 6, 25, ...

- **Odd positions:** 2, 4, 6 (+2)
- **Even positions:** 9, 16, 25 ($3^2, 4^2, 5^2$)

7. Fibonacci Lucas Series

Each term is the sum of the preceding two terms.

$$T_n = T_{n-1} + T_{n-2}$$

Example: 1, 1, 2, 3, 5, 8, 13, ... *Variants:* Multiplying factors before adding ($2a + 3b$).

8. Pro-Tips for Exams

1. **Check Ratios first** if numbers grow rapidly.
2. **Check Differences** if growth is gradual.
3. **Look for Decimals** ($x \times 0.5, x \times 1, x \times 1.5$).
4. **Digit manipulation** (sum of digits = constant).