

NUMBER SYSTEM – SURDS & INDICES (FOUNDATION → PLACEMENT LEVEL)

1. INDICES (POWERS) – COMPLETE THEORY

Indices represent powers of a number. They tell us how many times a number is multiplied by itself. Indices are frequently tested in placement aptitude because they check basic algebraic clarity.

- $a^m \times a^n = a^{(m+n)}$
- $a^m \div a^n = a^{(m-n)}$
- $(a^m)^n = a^{(mn)}$
- $a^0 = 1$ ($a \neq 0$)
- $a^{-n} = 1 / a^n$

Solved Examples – Indices

- Example 1: $2^3 \times 2^2 = 2^{(3+2)} = 2^5 = 32$
- Example 2: $5^4 \div 5^2 = 5^{(4-2)} = 5^2 = 25$
- Example 3: $(3^2)^3 = 3^{(2 \times 3)} = 3^6 = 729$
- Example 4: $7^0 = 1$
- Example 5: $2^{-3} = 1 / 2^3 = 1/8$

2. SURDS – COMPLETE THEORY

A surd is a number that contains a root (square root, cube root, etc.) which cannot be simplified into a whole number. Surds appear in simplification and algebra-based aptitude questions.

- $\sqrt{2}, \sqrt{3}, \sqrt{5}$ are surds
- $\sqrt{4} = 2$ and $\sqrt{9} = 3$ are not surds
- $\sqrt{a} \times \sqrt{b} = \sqrt{(ab)}$
- $\sqrt{a} / \sqrt{b} = \sqrt{(a/b)}$

Simplification of Surds (Step-by-step)

- Example 1: $\sqrt{50} = \sqrt{(25 \times 2)} = 5\sqrt{2}$
- Example 2: $\sqrt{72} = \sqrt{(36 \times 2)} = 6\sqrt{2}$
- Example 3: $\sqrt{18} = \sqrt{(9 \times 2)} = 3\sqrt{2}$

Operations on Surds

- Addition/Subtraction: Only like surds can be added $\rightarrow 3\sqrt{2} + 5\sqrt{2} = 8\sqrt{2}$
- Multiplication: $\sqrt{3} \times \sqrt{5} = \sqrt{15}$

3. PRACTICE QUESTIONS (HOMEWORK)

- 1. Simplify: $2^4 \times 2^3$
- 2. Simplify: $(5^2)^3$
- 3. Find value of: 4^{-2}
- 4. Simplify: $\sqrt{98}$
- 5. Simplify: $7\sqrt{3} + 2\sqrt{3}$
- 6. Simplify: $\sqrt{6} \times \sqrt{15}$
- 7. Simplify: $\sqrt{45}$

4. ANSWERS (FOR SELF-CHECK)

- 1. $2^7 = 128$
- 2. $5^6 = 15625$
- 3. $1/16$
- 4. $\sqrt{98} = 7\sqrt{2}$
- 5. $9\sqrt{3}$
- 6. $\sqrt{90} = 3\sqrt{10}$
- 7. $\sqrt{45} = 3\sqrt{5}$