

NUMBER SYSTEM – SURDS & INDICES (ADVANCED + RATIONALISATION)

1. RATIONALISATION – CORE CONCEPT

Rationalisation is the process of removing surds from the denominator of a fraction. In placement exams, answers are usually expected in rationalised form.

Basic rule: $1 / \sqrt{a} = \sqrt{a} / a$ When the denominator contains two terms, we multiply numerator and denominator by the conjugate.

Solved Examples – Basic Rationalisation

- Example 1: $1/\sqrt{2} = \sqrt{2}/2$
- Example 2: $3/\sqrt{5} = (3\sqrt{5})/5$
- Example 3: $7/\sqrt{11} = (7\sqrt{11})/11$

2. CONJUGATE METHOD (VERY IMPORTANT)

When the denominator has two terms like $(a + \sqrt{b})$ or $(a - \sqrt{b})$, we multiply numerator and denominator by its conjugate.

Conjugates: $(a + \sqrt{b}) \rightarrow (a - \sqrt{b})$ $(a - \sqrt{b}) \rightarrow (a + \sqrt{b})$ Formula: $(a + \sqrt{b})(a - \sqrt{b}) = a^2 - b$

Solved Examples – Conjugate Method

- Example 4: $1/(2 + \sqrt{3}) = (2 - \sqrt{3})$
- Example 5: $5/(\sqrt{7} - 2) = 5(\sqrt{7} + 2)/3$
- Example 6: $3/(4 - \sqrt{5}) = 3(4 + \sqrt{5})/11$

3. COMBINATION OF INDICES & SURDS

Some placement questions combine indices and surds. Applying laws of indices before simplifying surds makes these questions easy.

- Example 7: $(\sqrt{5})^2 \times 5^{-1} = 5 \times 1/5 = 1$
- Example 8: $(2\sqrt{3})^2 = 4 \times 3 = 12$

4. PRACTICE QUESTIONS (HOMEWORK)

- 1. Rationalise: $1/\sqrt{7}$
- 2. Rationalise: $4/(\sqrt{3} + 1)$
- 3. Rationalise: $5/(2 - \sqrt{3})$
- 4. Simplify: $(\sqrt{6})^2 \times 6^{\frac{1}{2}}$
- 5. Simplify: $(3\sqrt{2})^2$

5. ANSWERS (FOR SELF-CHECK)

- 1. $\sqrt{7}/7$
- 2. $2(\sqrt{3} - 1)$
- 3. $5(2 + \sqrt{3})$
- 4. 1
- 5. 18