

# **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:  $(\sqrt{6})^2 \times 6$  ■<sup>1</sup>
- 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