## CHAPTER 01

# Number System

**Operations on real numbers:**

If we add, subtract, multiply or divide two or more real numbers the resulting number is also a real number.

**Properties of real numbers:**

- Irrational numbers satisfy the commutative, associative and distributive laws for addition and multiplication.
- The sum and difference of a rational and an irrational number is always irrational.
- The product and quotient of a rational (Non – zero) and an irrational number is always irrational.
- The sum, difference, product and quotient of two irrational numbers is not necessarily an irrational number i.e., the resulting number may also be a rational number.

**Example:**

Classify the following numbers as rational or irrational with justification.

(i) $3\sqrt{8}$ (ii) $\dfrac{\sqrt{147}}{\sqrt{27}}$ (iii) $\dfrac{\sqrt{56}}{\sqrt{343}}$ (iv) $\left(3\sqrt{5}-7\sqrt{3}\right)-\left(5\sqrt{3}+7\sqrt{5}\right)$

**Sol.**

**(i)** We have, $3\sqrt{8} = 3\sqrt{4\times 2} = 3\times 2\sqrt{2} = 6\sqrt{2}$, which is an irrational number. We know that product of rational and irrational number is always irrational number.

**(ii)** Since, $\sqrt{147} = \sqrt{3\times 7\times 7} = 7\sqrt{3}$, which is an irrational number.

$\sqrt{27} = \sqrt{9\times 3} = 3\sqrt{3}$, which is also an irrational number.

Now,

$\frac{\sqrt{147}}{\sqrt{27}} = \frac{7\sqrt{3}}{3\sqrt{3}} = \frac{7}{3}$, which is an irrational number.

**(iii)** Since,

$\sqrt{56} = \sqrt{2\times 2\times 7\times 2} = 2\sqrt{2}.\sqrt{7}$, which is an irrational number.

$\sqrt{343} = \sqrt{7\times 7\times 7} = 7\sqrt{7}$, which is also an irrational number.

Now,

$\frac{\sqrt{28}}{\sqrt{343}} = \frac{2\sqrt{7}\sqrt{2}}{7\sqrt{7}} = \frac{2\sqrt{2}}{7}$, which is also an irrational number.

**(iv)** $\left(3\sqrt{5}-7\sqrt{3}\right)-\left(5\sqrt{3}+7\sqrt{5}\right) = 3\sqrt{5}-7\sqrt{3}-5\sqrt{3}-7\sqrt{5}$

$= -4\sqrt{5}-12\sqrt{3}$

$\therefore \left(3\sqrt{5}-7\sqrt{3}\right)-\left(5\sqrt{3}+7\sqrt{5}\right) = -\left(4\sqrt{5}+12\sqrt{3}\right)$