

# CLASS IX (MATHEMATICS)

## CHAPTER 1 : Real Numbers

- **Natural Numbers** :  $N = \{1, 2, 3, 4, \dots\}$
- **Whole Numbers** :  $W = \{0, 1, 2, 3, 4, \dots\}$
- **Integers** :  $Z = \{\dots -3, -2, -1, 0, 1, 2, 3, \dots\}$
- **Rational Numbers** : A number that can be written in the form  $\frac{p}{q}$ , where  $p$  and  $q$  are co-prime integers and  $q \neq 0$ .

Calculating the rational numbers between two numbers :

Let  $x$  and  $y$  are two numbers then

$$d = \frac{y-x}{n+1}$$

Here,  $n = 0, 1, 2, 3 \dots (y > x)$

The rational numbers are  $x + d, x + 2d, x + 3d, \dots$

- **Irrational Numbers** : A number that cannot be written in the form  $\frac{p}{q}$ , where  $p$  and  $q$  are co-prime integers and  $q \neq 0$ .
- **Real Numbers** :  $R =$  All rational and all irrational numbers taken together.
- If  $x$  and  $y$  are any two rational numbers, then :

- $x + y$  is a rational number
- $x - y$  is a rational number
- $x \times y$  is a rational number
- $x \div y$  is a rational number, ( $y \neq 0$ )

**Identities related to square roots** : ( $a, b > 0$ )

- |  |   |
|--|---|
| (i) $\sqrt{ab} = \sqrt{a}\sqrt{b}$   | (ii) $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ |
| (iii) $(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = a - b$                                       | (iv) $(a + \sqrt{b})(a - \sqrt{b}) = a^2 - b$         |
| (v) $(\sqrt{a} + \sqrt{b})(\sqrt{c} + \sqrt{d}) = \sqrt{ac} + \sqrt{ad} + \sqrt{bc} + \sqrt{bd}$ | (vi) $(\sqrt{a} + \sqrt{b})^2 = a + 2\sqrt{ab} + b$   |

**Laws of Exponents** :

- |  |                         |  |
|--|-------------------------|--|
| (i) $a^r \cdot a^s = a^{r+s}$  | (ii) $(a^r)^s = a^{rs}$ | (v) $a^{-r} = \frac{1}{a^r}, a \neq 0$                         |
| (iii) $\frac{a^r}{a^s} = a^{r-s}, r > s, a \neq 0$                                       | (iv) $a^r b^r = (ab)^r$ | (vii) $\left(\frac{a}{b}\right)^r = \frac{a^r}{b^r}, b \neq 0$ |
| (vi) $a^{\frac{r}{s}} = \left(a^r\right)^{\frac{1}{s}} = \left(a^{\frac{1}{s}}\right)^r$ |                         |  |
| (viii) $\left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m, a \neq 0, b \neq 0$  |                         |  |

**Laws of Radicals :**

(i)  $(\sqrt[n]{a})^n = a$

(iii)  $\sqrt[n]{a} \times \sqrt[n]{b} = \sqrt[n]{ab}, (a, b > 0)$

(v)  $\frac{\sqrt[p]{a^n}}{\sqrt[p]{a^m}} = \sqrt[p]{a^{n-m}}$

(vii)  $\sqrt[p]{(a^n)^m} = \sqrt[p]{a^{n.m}}$

(ii)  $\sqrt[m]{\sqrt[n]{a}} = \sqrt{mn}\sqrt{a} \quad \sqrt[n]{\sqrt[m]{a}}$

(iv)  $\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}$

(vi)  $\sqrt[p]{a^n \times a^m} = \sqrt[p]{a^{n+m}}$