

CLASS 9 MATHS – CHAPTER 1

NUMBER SYSTEMS – ALL FORMULAE AND IDENTITIES

Laws of Exponents (for Real Numbers)

1. $a^m \times a^n = a^{m+n}$
2. $\frac{a^m}{a^n} = a^{m-n} \quad (a \neq 0)$
3. $(a^m)^n = a^{mn}$
4. $(ab)^n = a^n b^n$
5. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad (b \neq 0)$
6. $a^0 = 1 \quad (a \neq 0)$
7. $a^{-n} = \frac{1}{a^n}$

Laws of Square Roots & Radicals

1. $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$
2. $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}} \quad (b > 0)$
3. $\sqrt{a^2} = a \quad (a \geq 0)$
4. $\sqrt{a} = a^{1/2}$

Rationalization Identities

1. $(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = a - b$
2. $\frac{1}{\sqrt{a}} = \frac{\sqrt{a}}{a}$
3. $\frac{1}{\sqrt{a} + \sqrt{b}} = \frac{\sqrt{a} - \sqrt{b}}{a - b}$
4. $\frac{1}{\sqrt{a} - \sqrt{b}} = \frac{\sqrt{a} + \sqrt{b}}{a - b}$

Square Root Identities

1. $(\sqrt{a} + \sqrt{b})^2 = a + b + 2\sqrt{ab}$
2. $(\sqrt{a} - \sqrt{b})^2 = a + b - 2\sqrt{ab}$

Properties of Real Numbers

1. Closure Property:

Real numbers are closed under **addition and multiplication**

2. Commutative Property:

$$a + b = b + a$$

$$a \times b = b \times a$$

3. Associative Property:

$$(a + b) + c = a + (b + c)$$

$$(a \times b) \times c = a \times (b \times c)$$

4. Distributive Property:

$$a(b + c) = ab + ac$$

Number System Definitions

1. **Natural Numbers:** $\{1, 2, 3, \dots\}$

2. **Whole Numbers:**

$\{0, 1, 2, 3, \dots\}$

3. **Integers:**

$\{\dots, -2, -1, 0, 1, 2, \dots\}$

4. **Rational Numbers:** $\frac{p}{q}$, where $q \neq 0$

5. **Irrational Numbers:** Non-terminating, non-repeating decimals

6. **Real Numbers:** Rational + Irrational numbers