1 Chapter 1: Number Systems

1.1 1. Classification of Numbers

1. Rational Numbers: Any number that can be expressed in the form .

   Symbols: and are integers. **Usage:** Used to represent fractions, terminating decimals (like), and recurring decimals (like).

2. Irrational Numbers: Numbers that cannot be written in $\frac{p}{q}$ form.

$$s \neq \frac{p}{q}$$

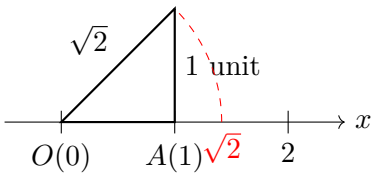
   Usage: These have non-terminating and non-recurring decimal expansions (e.g., π, $\sqrt{2}$).

1.2 2. Representation on Number Line

To represent an irrational number like on a number line, we use the Pythagoras Theorem.

1. Pythagoras Basis:

   Symbols: is the hypotenuse (the value we want to plot), is the base, and is the perpendicular height. **Usage:** If you want to plot , take base = 1 unit and height = 1 unit.



1.3 3. Operations on Real Numbers

When we combine rational and irrational numbers, the following identities are essential:

1. Square Root Products:

   Usage: Used to simplify radicals, e.g., .

2. Square Root Quotients:

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

   Usage: Used to split roots across fractions.

3. Algebraic Identities for Roots:

$$(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = a - b$$

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

   Usage: These are the primary tools used for Rationalizing the Denominator.

1.4 4. Rationalization

If the denominator of an expression contains a square root, we multiply the numerator and denominator by the conjugate.

1. Rationalizing Factor:

   Usage: Used to simplify expressions to a standard form where no radicals remain in the denominator.

1.5 5. Laws of Exponents for Real Numbers

Let be a real number and be rational numbers:

1. Product Law:
2. Quotient Law:
3. Power of a Power:
4. Product Power Law:
5. Negative Exponent:
6. Radical to Exponent: