
The background of the slide is a complex, abstract fractal pattern in shades of green and black. It features intricate, swirling, and branching structures that resemble mathematical or natural forms like ferns or snowflakes. The overall effect is a dense, textured field of organic-looking patterns.

“If people do not believe that mathematics is simple, it is only because they do not realize how complicated life is”

John von Neumann  
Hungarian Mathematician

“Nothing in life is to be feared. It is only to be understood”

Marie Curie  
Polish Physicist

The background is a complex, multi-layered fractal pattern in shades of green and dark teal. It features intricate, repeating geometric shapes that resemble organic structures like ferns or coral, with a central point of convergence where the patterns become more dense and detailed. The overall effect is a sense of depth and complexity.

# Preliminary Concepts

# Properties of Real Numbers $\mathbb{R}$

Let  $a, b, c, x, y, z \in \mathbb{R}$

Closure Property:  $a + b \in \mathbb{R}$  and  $a \cdot b \in \mathbb{R}$

Commutative Property:  $a + b = b + a$  and  $a \cdot b = b \cdot a$

Associative Property:  $a + (b + c) = (a + b) + c$  and  $a \cdot (b \cdot c) = (a \cdot b) \cdot c$

Identity Properties:  $a + 0 = a$  and  $a \cdot 1 = a$

Inverse Properties:  $a + (-a) = 0$  and  $a \cdot \left(\frac{1}{a}\right) = 1$

Distributive Property:  $a \cdot (b + c) = a \cdot b + a \cdot c$

## Addition Property of Equality

If  $a = c$  and  $b = d$ , then  $a + b = c + d$

## Subtraction Property of Equality

If  $a = c$  and  $b = d$ , then  $a - b = c - d$

## Multiplication Property of Equality

If  $a = c$  and  $b = d$ , then  $a \cdot b = c \cdot d$

## Division Property of Equality

If  $a = b$  and  $c \neq 0$ , then  $\frac{a}{c} = \frac{b}{c}$

## Transitive Property of Equality

If  $a = b$  and  $b = c$ , then  $a = c$

## Trichotomy Property

For every  $a$  and  $b$ , one and only one of the following conditions holds:  
 $a = b$ ,  $a < b$ ,  $a > b$

## Transitive Property of Inequality

If  $a < b$  and  $b < c$ , then  $a < c$

## Addition Property of Inequality

If  $a < b$  and  $x \leq y$ , then  $a + x < b + y$

## Multiplication Property of Inequality

If  $x < y$  and  $0 < a$ , then  $a \cdot x < a \cdot y$

The background is a complex, abstract fractal pattern in shades of green and black. It features intricate, self-similar structures that resemble a combination of a Sierpinski triangle and a fractal curve, creating a dense, textured appearance. The colors range from deep forest green to bright, almost white highlights, giving it a three-dimensional, crystalline feel.

**“The essence of mathematics is not to make  
simple things complicated, but to make  
complicated things simple”**

**Schindler Gudder**

**American Mathematician**