Sets

A **set** is a collection of distinct objects. The objects are called **elements** of the set.

Two sets are equal if they have exactly the same elements.

The symbol $\in$ means "is an element of".

A is a **subset** of B, written $A \subseteq B$, if each element of A is also an element of B.

A is a **proper subset** of B, written $A \subset B$, if $A \subseteq B$ and $A \neq B$.

The **empty set**, $\emptyset$, is the set containing no elements.

Set Builder Notation: $\{x : P\}$ = Set of all elements x such that property P is satisfied.

Suppose A and B are subsets of U.

$$A \cup B = \{x : x \in A \text{ or } x \in B\}$$

$$A \cap B = \{x : x \in A \text{ and } x \in B\}$$

$$A' = \bar{A} = \{x : x \in U \text{ and } x \notin A\}$$

$$A - B = \{x : x \in A \text{ and } x \notin B\}$$

$$A \times B = \{(x, y) : x \in A \text{ and } y \in B\}$$

$$n(A) = \text{ Number of elements in } A$$

$$n(A \times B) = n(A) \cdot n(B)$$

Functions

A **function** from a nonempty set A into a nonempty set B is a rule or correspondence that assigns to each element of A a single element of B.

The **domain** of a function is the set of inputs.

The **range** of a function is the set of outputs.

The **graph** of a function f is the set of all ordered pairs $(x, f(x))$, where x is in the domain of f.

A **linear function** is a function whose graph is a nonvertical line. Any linear function can be defined by an equation of the form $y = mx + b$, where m and b are numbers.

Lines

Slope: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Point-Slope Form: $y - y_1 = m(x - x_1)$

Slope-Intercept Form: $y = mx + b$

Standard Form: $Ax + By = C$

Vertical Lines: $x = a$

Horizontal Lines: $y = b$

Patterns and Sequences

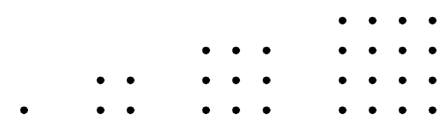
Pascal's Triangle:

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1
1 7 21 35 35 21 7 1
1 8 28 56 70 56 28 8 1

Fibonacci Sequence:

$$1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, \ldots$$

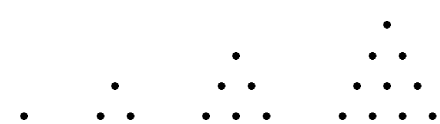
Square Numbers:



1 4 9 16

$$n\text{th square number} = n^2$$

Triangular Numbers:



1 3 6 10

$$n\text{th triangular number} = \frac{n(n+1)}{2}$$

Arithmetic Sequence:

$$n\text{th term} = \text{first term} + \text{difference} \times (n - 1)$$

Geometric Sequence:

$$n\text{th term} = \text{first term} \times (\text{ratio})^{(n-1)}$$