Section 2.4: Functions and Relations

Relation: is used to represent a relationship between 2 numbers or objects.

Examples: 5 is less than 7

I am shorter than my husband.

I am older than my brother.

Ways to represent a relation:

- **Arrow diagram:** Use arrows to indicate the relation.

  Example 1: Given $\{2, 4, 6, 8\}$, represent the relation "is a divisor of" using an arrow diagram.

- **Ordered pairs:** Uses ordered pairs to indicate the relation.

  Example 2: Given $\{2, 4, 6, 8\}$, represent the relation "is a divisor of" using ordered pairs.

THREE RELATION PROPERTIES:

1. **Reflexive Property:** A relation R on a set A is reflexive if $(a, a) \in R$ for all $a \in A$. (In other words, every element of A is related to itself).

2. **Symmetric Property:** A relation R on as set A is symmetric if whenever $(a, b) \in R$ then$(b, a) \in R$. (In other words, if a is related to b, then b is related to a.)

3. **Transitive Property:** A relation R on a set A is transitive if whenever $(a, b) \in R$ and $(b, c) \in R$ then $(a, c) \in R$. (In other words, if a is related to b and b is related to c, then a is related to c.)

Equivalence relation: is a relation R on a set A which is reflexive, symmetric, and transitive.

Functions: are relations that match one element of the first set (called **domain**) to one element of the second set (called **codomain**) in such a way that no element in the first set is assigned to two different elements in the second set.

NOTE: A function can assign more than one element from the domain to the same element in the codomain.

Function notation: A function f that assigns an element of set A to an element in set B is denoted $f : A \rightarrow B$. If $a \in A$, then the function notation for the element in B that is assigned to a is $f(a)$ (read f of a).

range: is the set of all elements in the codomain that the function pairs with an element of the domain. Hence, the range is a subset of the codomain.

Ways to represent a function:

1. Arrow Diagram

2. Tables

3. Ordered pairs

4. Function machines

5. Formulas

6. Graphs

Sequence: is a list of numbers, called terms, arranged in a particular order.

Special Sequences:

- **Arithmetic sequence:** is a sequence in which successive terms differ by the SAME number, called the **common difference**.

- **Geometric sequence:** is a sequence in which successive terms are found by multiplying the previous term by the SAME number, called the **common ratio**.

Example 3: Determine if each of the following sequences are arithmetic, geometric, or neither. For arithmetic and geometric, find the 200th term.

(a)   7, 20, 33, 46, 59, . . .

(b)   2, 5, 10, 50, 500, 250000, . . .

(c)   3, 12, 48, 192, . . .

Example 4: How many terms are in the following sequence:

$$3, \ 18, \ 13, \ 18, \ 23, \ \ldots, \ 343?$$