What is a Set?

A set is a collection of elements. An element belongs to a set because it meets the properties that define the set:

- United States coins with the image of a president
- States that border Arizona
- Natural numbers less than 5

Set Notation

Sets are named using capital letters, usually from the lower end of the alphabet.

One way to write the set is to list the elements. The elements of a set are enclosed in braces {}, and are separated by a comma:

- A={Lincoln penny, Washington nickel, Roosevelt dime, Washington quarter}
- B={California, Nevada, Utah, Colorado, New Mexico}
- C={1, 2, 3, 4}

If there are too many elements that it is impractical to list, then we can write the set using set builder notation:

{x | x has property P}

The set of all elements x such that x has property P

- A={x | x is a United States coin with the image of a president}
- B={x | x is a state that borders Arizona}
- C={x | x is a natural number less than 5}

We show that an element either belongs or does not belong to a set as follows:

- Wyoming $\notin$ A (Wyoming is not an element of set A)
- California $\in$ A (California is an element of set A)

Set Notation (continued)

The universal set is the set of all elements belonging to the set:

- U={1, 2, 3, 4}

A subset is a set of one or more of the elements of the set:

- D={1}; $D \subseteq C$: D is a subset of C
- E={1, 3}; $E \subseteq C$: E is a subset of C
- F={1, 2, 3, 4}; $F \subseteq C$: F is a subset of C

A subset is called a proper subset if the subset is not equal to the set:

- $D \subset C$: D is a proper subset of C
- $E \subset C$: E is a proper subset of C
- $F \not\subset C$: F is not a proper subset of C

It is possible to have a set with no elements:

G={ø}

The ø is the null symbol, not the same as 0.

To indicate the number of elements in a set:

n(C) = 4

Set Operations

Given the following sets:

A={1, 4, 9, 16, 25}
B={1, 3, 5, 7, 9}
C={1, 9}
D={36, 42}

Complement of a Set

C is a proper subset of B: $C \subset B$

The complement of C, written as C′, are all elements in set B that are not in set C:

C′={3, 5, 7}

Intersection of Two Sets

The intersection of two sets is a set that contains all elements that are common to both sets:

C= $A \cap B$ ={1, 9}

The elements of set E are all elements that are in set A **and** set B.

Union of Two Sets

The union of two sets is a set that contains all elements that are in both sets:

F= $C \cup D$ ={1, 9, 36, 42}

The elements of set F are all elements that are in set C **or** set D.

Disjoint Sets

Two sets are said to be disjoint if the have no elements in common:

$G = C \cap D = \emptyset$

There are no elements in the intersection of set C and set D.