

Section 2-1
Applied Topics in Mathematics
Vocabulary

Set – is a collection of objects, which are called **elements or members** of the set.

A set is **well defined** if its contents can be clearly determined. The set of U.S. presidents is well defined. The set of the three best movies are not well defined because the word best is interpreted differently by different people.

Braces { } - are used to list the elements of a set.

This is called **Roster Form** $A = \{1, 2, 3, \dots\}$

1 is an element of set A. The symbol for element is \in

Example 1

Express the following in roster form

a) Set A is the set of natural number less than 5.

$$A = \{1, 2, 3, 4\}$$

b) Set B is the set of natural numbers less than or equal to 7

$$B = \{1, 2, 3, 4, 5, 6, 7\}$$

c) Set P is the set of planets in Earth's solar system.

$$P = \{\text{Mars, Jupiter, Uranus, Mercury, Venus,}$$

d) The set of natural numbers between 4 and 9, inclusive.

$$D = \{4, 5, 6, 7, 8, 9\}$$

↓
N

Saturn,
Earth
Neptune
Pluto

Set Builder Notation – $D = \{x \mid \text{condition(s)}\}$

Set D is the set of all elements x such that condition(s)

Natural numbers = N

Example $E = \{x \mid x \in N \text{ and } x > 10\}$ $\{x \mid$

Example

Write set $B = \{1, 2, 3, 4, 5\}$ in set-builder notation

$$B = \{x \mid x \in N \text{ and } x \leq 5\}$$

Example

Write set $C = \{\text{North America, South America, Europe, Asia, Australia, Africa, Antarctica}\}$ in set-builder notations.

$$C = \{x \mid x \text{ is a continent}\}$$

Example

Write set $A = \{x \mid x \in N \text{ and } 2 < x < 8\}$ in roster form.

$$A = \{3, 4, 5, 6, 7\}$$

A set is **finite** if it either contains no elements or the number of elements in the set is a natural number. $A = \{2, 4, 6, 8\}$

A set is **infinite** if it is not finite.

Set A is **equal** to set B, symbolized by $A = B$, if set A and set B contain exactly the same elements.

$$A = \{a, b, c\}$$

$$B = \{c, b, a\}$$

The **cardinal number** of set A, symbolized by $n(A)$, is the number of elements in set A.

$$n(A) = 4$$

Example: set B = {England, Brazil, Japan} has a cardinal number of 3; that is, $n(B) = \underline{3}$.

Set A is **equivalent** to set B if and only if $n(A) = n(B)$

$$A = \{a, b, c\}$$

$$B = \{bob, joe, mary\}$$

One to one correspondence when every element in set A can be matched with exactly one element of set B and every element in set B can be matched with exactly one element in set A.

Example

$A = \{6, 8, 3, 2, 4\}$ $B = \{ \text{Trumbull, Fairfield, Monroe, Shelton, BPT} \}$

The set that contains no elements is called the null set or the empty set. It is symbolized by $\{ \}$ or \emptyset

Note that $\{\emptyset\}$ is not the empty set.

A **universal set**, symbolized U , is a set that contains all the elements for any specific discussion.

For example, the universal set for a particular problem is defined as $U = \{1, 2, 3, 4, 5, \dots, 10\}$, then only the natural numbers 1 through 10 may be used in that problem.

PRACTICE THE SKILLS

In Exercises 13–18, determine whether each set is well defined.

13. The set of the best books **NOT**
14. The set of the easiest courses at your school **NOT**
15. The set of states that have a common border with Kansas **well**
16. The set of the four states in the United States having the largest areas **well**
17. The set of astronauts who walked on the moon **well**



In Exercises 25–34, express each set in roster form. You may need to use a world almanac or some other reference source.

25. The set of states in the United States whose names begin with the letter M

$$M = \{ \text{Montana, Maine, Maryland, Mississippi} \}$$

30. The set of states west of the Mississippi River that have a common border with the state of Florida

~~\emptyset~~

31. The set of football players over the age of 70 who are still playing in the National Football League

~~\emptyset~~

32. The set of states in the United States that have no common border with any other state

$$\{ \text{Hawaii, Alaska} \}$$