

## Comparing Sets (Section 1.4)

**The Splitting Hairs Principle:** Mathematics is much pickier than everyday language. Learn to “split hairs” when reading mathematical terminology.

- If two terms are similar but sound slightly different, they usually do not mean exactly the same thing. “Set A is equal to set B” does not mean the same thing as “Set A is equivalent to set B”.
- If two notations are similar, but slightly different, the same is true. They usually do not mean exactly the same thing.  $a < 4$  does not mean the same thing as  $a \leq 4$ .
- When two terms, notations, or ideas seem similar, but slightly different, you need to consciously work to get a clear idea of exactly what the difference is. Not making the proper distinctions is often the cause of errors.

## Equal, Equivalent, or Not?

In mathematics, language is used very precisely. The words “equal” and “equivalent” do not mean the same thing when applied to sets.

**equal sets:** have exactly the same elements in them (not necessarily in the same order).

**equivalent sets:** have exactly the same number of elements in them (not necessarily the same elements).

**Practice:** Circle the correct term (equal/equivalent) to make each statement true.

$A = \{c, a, t\}$  is equal/equivalent to  $B = \{a, c, t\}$

$C = \{1, 2, 3, 4\}$  is equal/equivalent to  $D = \{2, 4, 6, 8\}$

## Subsets

**Subset:** Set A is a subset of Set B if all the elements of set A are also contained in set B.

You can always tell if set A is a subset of set B by asking: “is every element of set A also an element of set B?” If every element in A is also in B, then A is a subset of B.

**Practice:** Circle the sets below that qualify as “subsets” of set  $G = \{0, 1, 2, 3, 4, 5\}$ .

$A = \{0, 2, 4\}$      $B = \{0, 1, 2, 3, \dots\}$      $C = \{0, 1, 2, 3, 4, 5\}$      $D = \{0, 1, -1, 2, -2\}$      $E = \{1\}$

According to the definition of subset, is a set a subset of itself? Why or why not?

$\subseteq$  is the symbol for **subset**.  $\not\subseteq$  is the symbol for “is not a subset”.

$\subseteq$  Fill in the blanks below to make true statements using  $\subseteq$  or  $\not\subseteq$ .

a.  $\{1, 2, 3\}$  \_\_\_\_\_ W      b. W \_\_\_\_\_ N      c.  $\{2, 4, 6\}$  \_\_\_\_\_  $\{1, 2, 3, 5, 6\}$

d. N \_\_\_\_\_ W      e. W \_\_\_\_\_ J      f.  $\{4, 5\}$  \_\_\_\_\_  $\{4, 5\}$

It is not correct to use  $J \in R$  because \_\_\_\_\_

### Proper Subset

**Proper Subset:** There is a special name and symbol for a set that is a subset and is not identical to the other set. Such a set is a **Proper Subset**.  $\subset$  is the symbol for **proper subset**. Notice there is no “or equal to” bar underneath it. A proper subset cannot be equal to the set it is being related to.

#### Examples:

$\{1, 2\}$  is both a subset and a proper subset of the set N.

$$\{1, 2\} \subseteq N \quad \text{and} \quad \{1, 2\} \subset N$$

$\{1, 2, 3, 4, \dots\}$  is a subset of N but is not a proper subset of N.

$$\{1, 2, 3, 4, \dots\} \subseteq N \quad \text{but} \quad \{1, 2, 3, 4, \dots\} \not\subset N$$

**Practice:** Circle the symbols that make the statement true. More than one symbol may apply.

a.  $\{1, 2\}$   $\subseteq, \not\subseteq, \subset, \not\subset$   $\{1, 2, 3\}$       b. W  $\subseteq, \not\subseteq, \subset, \not\subset$  N      c. i.  $\{0\}$   $\subseteq, \not\subseteq, \subset, \not\subset$   $\emptyset$

d. Is  $\{ \} \subset \{1\}$ ?????      Why or why not?

e. Is  $\emptyset \subseteq N$ ????      Why or why not?

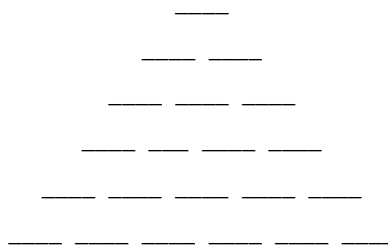
### Five properties to remember about subsets:

- Every set is a subset of itself ( $\subseteq$ ).
- The empty set is a subset of every set.
- For a set with  $n$  elements, there are \_\_\_\_\_ distinct subsets.
- For a set with  $n$  elements, there are \_\_\_\_\_ proper subsets, as you do not include the entire set.
- Pascal's Triangle gives you the number of each-size subsets of a set.

**Practice** Write out all the subsets of set A if  $A = \{a, e, i\}$ . Does this match the property above? \_\_\_\_

### Forming Pascal's Triangle

Fill in Pascal's Triangle



### Pascal's Triangle and Finding all the Subsets of a Set

Use Pascal's Triangle to be sure you find all the subsets of  $B = \{a, b, c, d, e\}$ .

How many proper subsets does  $B$  have?

Assignment Due Wed. Jan 20<sup>th</sup> : (No classes on Monday-Martin Luther King Jr. Holiday)

Read pp. 34-39

Complete #3, 6, 10, 11, 16, 17, 20, 21, 34, 44, 47, 50, 58 on pp. 39-41

Review your notes and assignments for the first quiz on Jan. 22<sup>nd</sup>