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 $a \le 4$.
- 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).

<u>Practice:</u> 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 <u>subset</u> 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.

<u>Practice:</u> 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, . . . } 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.** $\nsubseteq$ is the symbol for "is not a subset".

$\subseteq$ Fill in the blanks below to make true statements using $\subseteq$ or $\nsubseteq$.

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   and   {1, 2} $\subset$ N

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

{1, 2, 3, 4, . . . } $\subseteq$ N but {1, 2, 3, 4, . . . } $\not\subset$ N

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

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

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

e. Is $\varnothing \subseteq$ 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 20th : (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. 22nd