Math 4. Handout #5.

Sets.

- I put a skirt, a book, a toothbrush, a coffee mug, and an apple into a bag. Can we call this collection of items a set? Do all these objects have something in common?

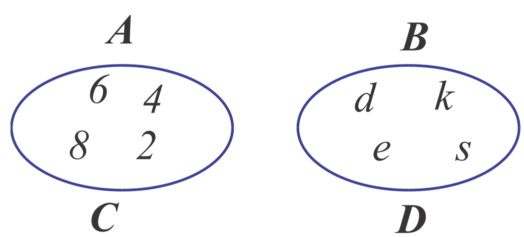
A set is a collection of objects that have something in common.

We can describe the members of a set by listing each member of the set:

A = {2, 4, 6, 8}
B = {d, e, s, k}.

Or we can describe the members of a set by using a rule:

C is the set of four first even natural numbers.
D is the set of letters of the word "desk".



Venn diagram.

Two sets are equal if they contain the same elements. If we look closer on our sets ***A*** and ***C*** we can see that all elements of set ***A*** are the same as elements of set ***C*** (same goes for sets ***B*** and ***D***).

$$A=C \quad \text{and } B=D$$

If set ***A*** contains element '2', then we can tell that element '2' belongs to set ***A***. We have a special symbol to write it down in a shorter way: $2 \in A$

The set A does not contain 105--$105 \notin A$.

Let's define several sets.

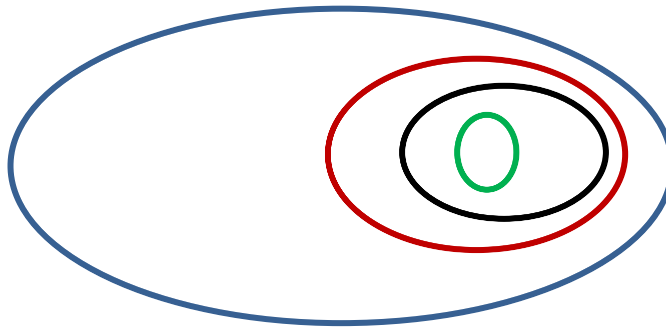
Set ***W*** will be the set of all words of the English language.

Set ***N*** will be the set of all nouns existing in the English language.

Set ***Z*** will be the set of all English nouns which have only 5 letters.

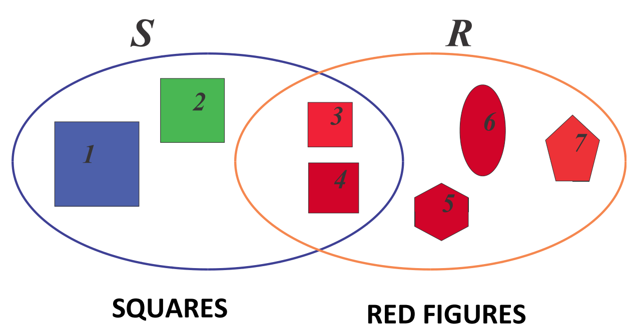
Set ***T***={"table"}. On a Venn diagram below name all these sets:

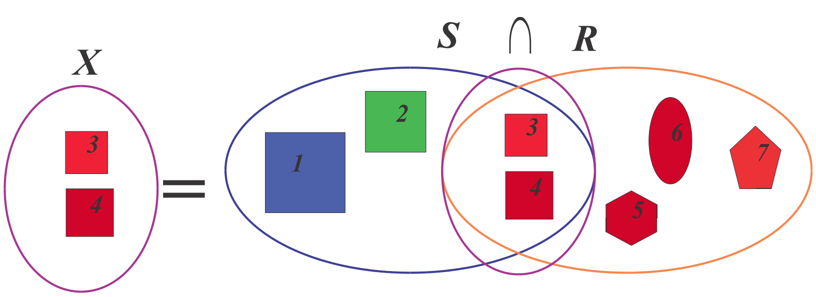
- If all elements of one set at the same time belong to another set then we can say that the first set is a subset of the second one. A special symbol $\subset$ can be used to write this statement in a shorter way: $T \subset Z \subset Y \subset W$



Set which does not have any element called an empty set in math people use symbol $\varnothing$.

When we define sets, a number of objects can belong to several sets at the same time. For example, on a picture below set ***S*** is a set of squares and a set ***R*** is a set of red figures. Figures 3 and 4 are squares and they are red, therefore they belong to both sets. The new set ***X*** contains elements that belong to the set ***S*** as well as to the set ***R***. Such set



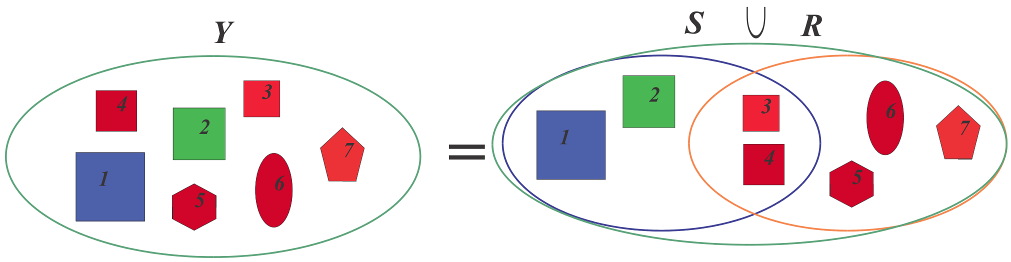


X is called an **intersection** of sets ***S*** and ***R*** and can be written using a symbol ∩.

$$X = S \cap R$$

If we combine all elements of ***S*** and ***R***, the new set ***Y*** would be a **union** of set ***S*** and ***R***. Using symbol ∪ we can easily write the sentence: Set ***Y*** contains all elements of set ***S*** and set ***R***:

$\boldsymbol{Y = S \cup R}$



Which Way Does That "U" Go? Think of them as "cups": ∪ holds more water than ∩, right?

So Union ∪ is the one with more elements than Intersection ∩

Symbols to Remember

∈	element belongs to a set
∉	element does not belong to a set
⊂	one set is a subset of another set
⊄	one set is not a subset of another set
∩	intersection of two sets (elements that are in both sets)
∪	union of two sets **(**elements that are in either set)
∅	empty set