Math 4. Classwork #5.

Sets.

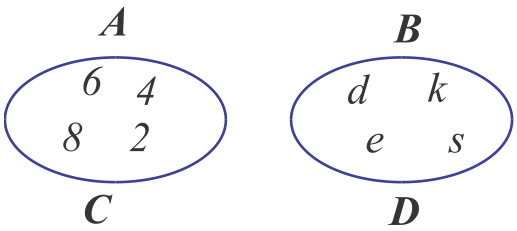
- I put a skirt, a book, a toothbrush, a coffee mug, and an apple into a bag. Can we call this collection of items a set? Do all these objects have something in common?

> **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:



Venn diagram.

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

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*****).**

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

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.

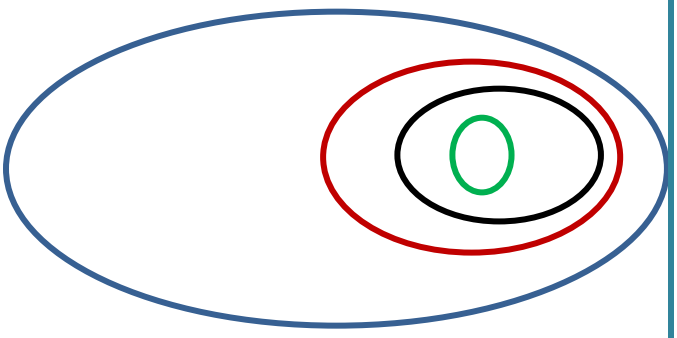
Set ***W*** will be the set of all words of the English language.

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: $T \subset Z \subset Y \subset W$



If set ***V*** is defined as a set of all English verbs, can you draw a diagram for set ***V*** on the picture above? Can you tell subset of which set ***V*** is?

$V \subset$ ____

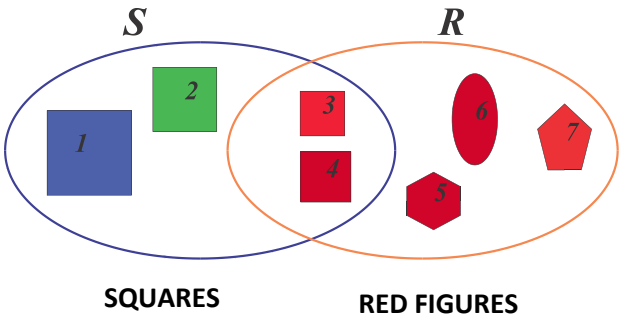
$V \not\subset$____

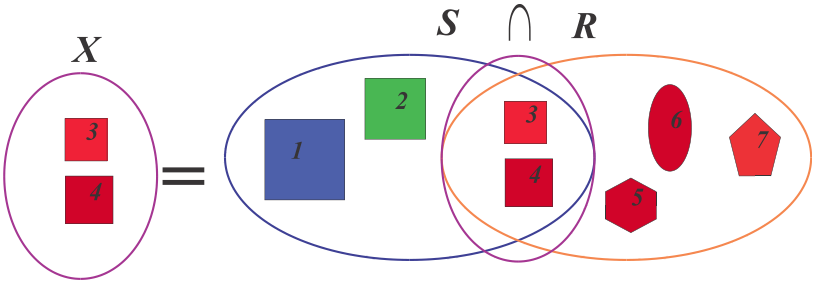
$V \not\subset$____

$V \not\subset$____

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

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



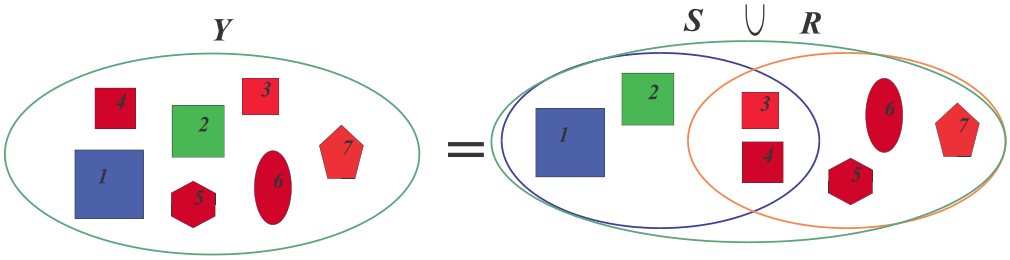


X is called an **intersection** of sets ***S*** and ***R*** and can be written using a symbol ∩.

$$X = S \cap R$$

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***:

$$Y = S \cup R$$

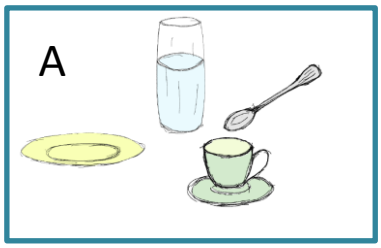


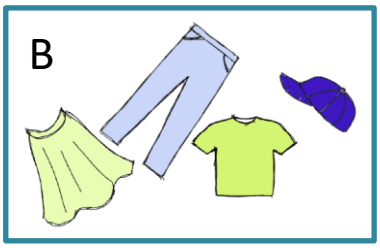
Which Way Does That "U" Go? Think of them as "cups": ∪ holds more water than ∩, right?

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

1. $A = \{a, b, c\}, B = \{1, 2, 3, 4\}$. Write the intersection $(A \cap B)$ and the union $(A \cup B)$ of these two sets.

2. Which word we can use to describe a set, subset of which is drawn on the pictures below. List a few other objects that can be added to these sets.





3. In 2 boxes there are 160 notebooks altogether. In one box there are 20 more notebooks than in the other. How many notebooks are there in each box?

4. There are 20 students in a Math class. 10 students like apples and 15 students like pears.

   Show that there are some students who like both apples and pears.

   - Assume that each student likes at least one of the fruits. (This means that each student like either apples, or pears, or both). How many students like both pears and apples?

   - Is it possible to determine if there are any students who do not like apples and do not like pears?

   - Which part of the diagram shows:" Those who like apples, but not pears"?

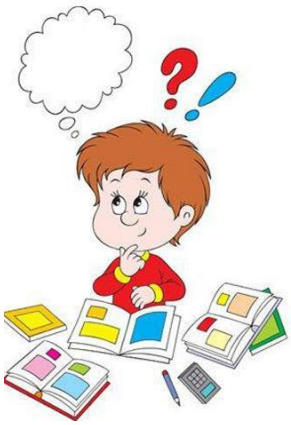
5. The same Math class (with 20 students) forms a soccer team and a basketball team.

   Every student signs up for at least one team:

   - 12 students play only soccer;
   - 2 students play both soccer and basketball;

   How many students play basketball only?

6. Students who participated in math competition had to solve 2 problems, one in algebra and another one in geometry. Among 100 students 65 solved an algebra problem, 45 solved a geometry problem, 20 students solved both problems. How many students didn't solve any problem at all?



7. 240 students from New-York and Seattle attended a math camp. Of the total number of students, 125 were boys. 65 boys were from New-York. There were 53 girls from Seattle. How many students came from New-York?

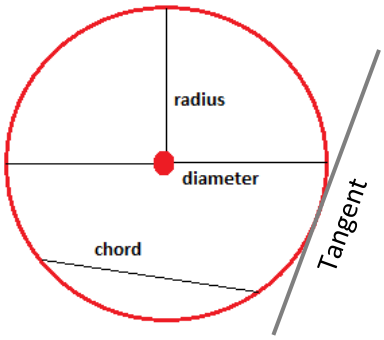
Symbols to Remember

$\in$	element belongs to a set
$\notin$	element does not belong to a set
$\subset$	one set is a subset of another set
$\not\subset$	one set is not a subset of another set
$\cap$	intersection of two sets (elements that are in both sets)
$\cup$	union of two sets **(**elements that are in either set)
$\varnothing$	empty set

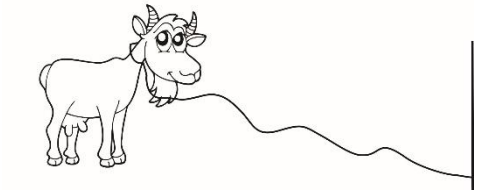
Geometry

Circle is the set of all points on a plane that are a fixed distance from a center.

The circle is a plane shape (two dimensional)



- A goat is tied to a stake with a rope that is L meters long. What shape will it graze?



- A goat is tied to 2 poles with a rope that is L meters long. What shape will it graze?