

Sets are used as a way of grouping items such as objects, items, numbers, letters, and even statements. And like arithmetic and algebra, operations can be performed on sets.

Set operations are done between two or more sets.

**EXAMPLE:** Two people are running in an election for City Council. Each person has created their list of campaign promises for the public. Here is what they promise:

**Honest Amy**

Spend less money –  $M$   
 Enforce traffic laws to increase money –  $L$   
 Hire more police officers –  $P$   
 Decrease city taxes –  $T$   
 Improve bad neighborhoods –  $N$

**Dependable Dave**

Spend less money –  $M$   
 Improve school buildings, build new –  $S$   
 Improve benefits for city employees –  $B$   
 Increase jobs, bring in businesses –  $J$   
 Hire more police officers –  $P$

Set of Amy's promises:

$$A = \{M, L, P, T, N\}$$

Set of Dave's promises:

$$D = \{M, S, B, J, P\}$$

**I. Intersection:**

- \* Look at their lists. Do they share any common promises? If so, which ones? yes

Spend less money and hire more police officers

- \* Now, look at their sets. Do you see any elements in common? If so, which ones? yes

$M$  and  $P$

- \* Common elements in each set is called an intersection

- \* The symbol for intersection is:  $\cap$

- \* Write in symbol form the intersection of Amy's set of promises and Dave's set of promises:

$$A \cap D = \{M, P\}$$

**II. Union:**

- \* Looking at their lists. The newspaper is writing an article listing **all** campaign promises made during this election. What is that list of **all** promises?

spend less money  
enforce traffic laws  
hire more police  
decrease taxes

improve neighborhoods  
improve schools  
improve benefits  
increase jobs

- \* Now look <sup>back</sup> at their sets, list **all** the elements in the two sets:  $\{M, L, P, T, N, S, B, J\}$

- \* All the elements in each set is called a Union

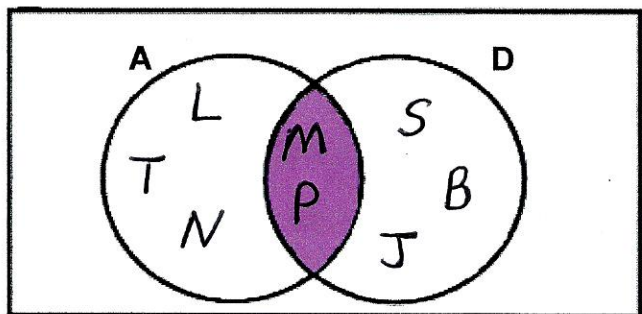
- \* The symbol for union is:  $\cup$

- \* Write in symbol form the union of Amy's set of promises and Dave's set of promises:

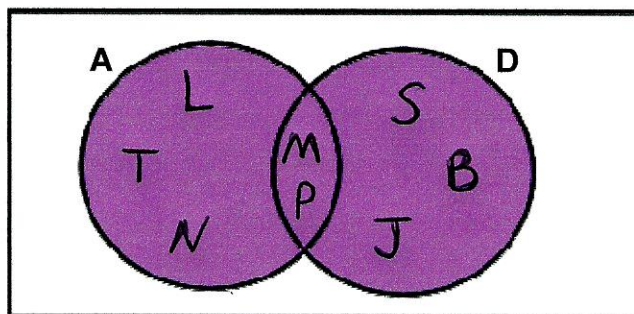
$$A \cup D = \{M, L, P, T, N, S, B, J\}$$

Venn Diagrams of the Intersection and Union of Amy's and Dave's campaign promises:

Intersection



Union



**EXAMPLE:** find the intersection of the given sets

$$1. \{2, 3, 4, 5, 6, 7\} \cap \{2, 4, 6, 8\} = \{2, 4, 6\}$$

$$2. \{1, 3, 5, 7\} \cap \{2, 4, 6, 8\} = \emptyset$$

$$3. \{\text{math, English, history, biology, computers}\} \cap \{\text{history, math, chemistry, accounting}\} = \{\text{math, history}\}$$

**EXAMPLE:** find the union of the given sets

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

$$2. \{4, 5, 6\} \cup \{7, 8, 9\} = \{4, 5, 6, 7, 8, 9\}$$

$$3. \{\text{purple, blue, yellow, orange}\} \cup \{\text{yellow, pink, blue, purple}\} = \{\text{purple, blue, yellow, orange, pink}\}$$

**EXAMPLE:** find the union or intersection of the given sets.

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

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

$$B = \{2, 4, 6\}$$

$$C = \{3, 4, 5, 6\}$$

$$A' = \{5, 6\}$$

$$C' = \{1, 2\}$$

$$B' = \{1, 3, 5\}$$

$$1. A \cup B = \{1, 2, 3, 4, 6\}$$

$$2. B \cap C = \{4, 6\}$$

$$3. A' \cap B = \{6\}$$

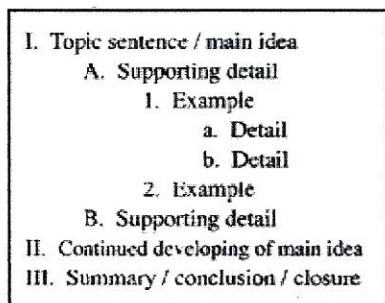
$$4. B' \cup C = \{1, 3, 4, 5, 6\}$$

$$5. A \cap (B \cup C') = A \cap \{1, 2, 4, 6\} = \{1, 2, 4\}$$

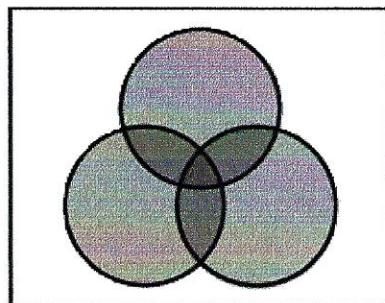


III. Venn diagrams can represent all kinds of information. They can show sets, subsets, intersections, and unions. Venn diagrams are one of many ways to organize information and show relationships, such as, items in common or not in common, similarities or differences.

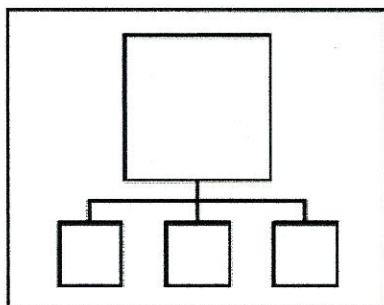
### Examples of information organization



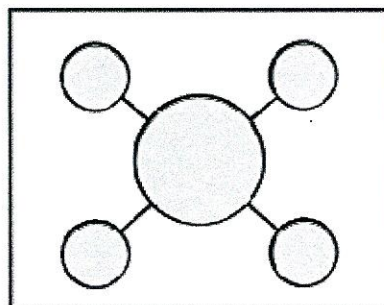
Basic outline



Venn diagram

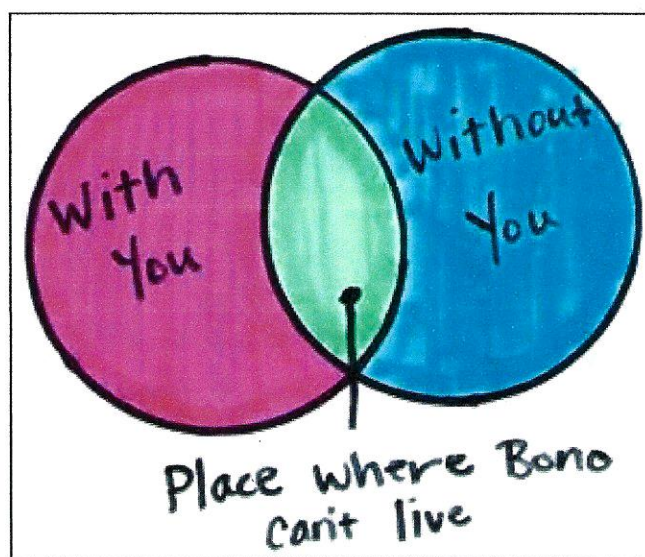
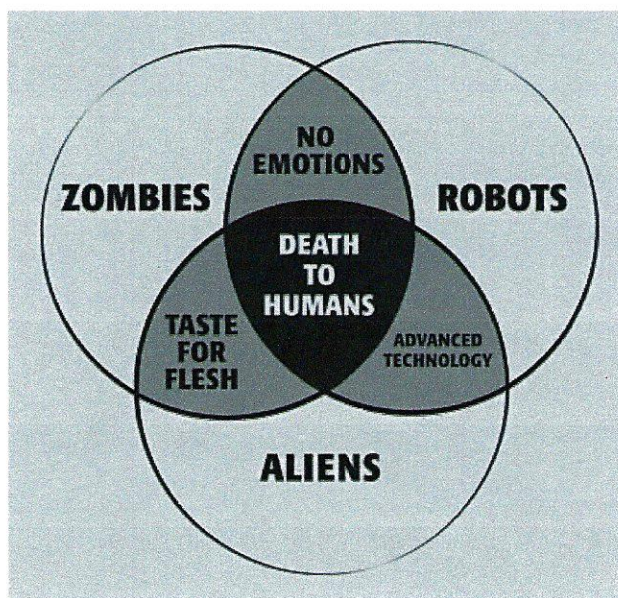


Hierarchical topical organizer



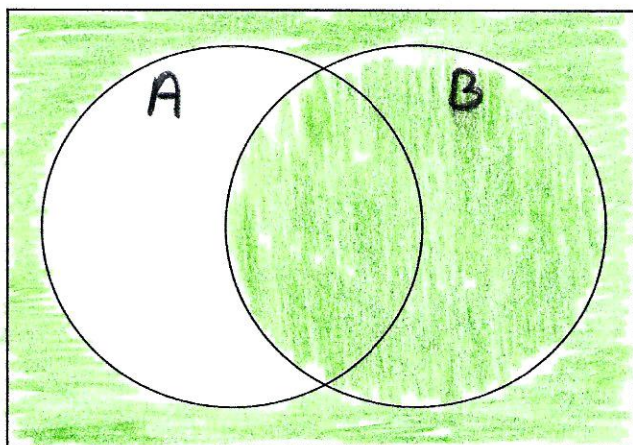
Bubble topical organizer

### Examples of Venn Diagrams

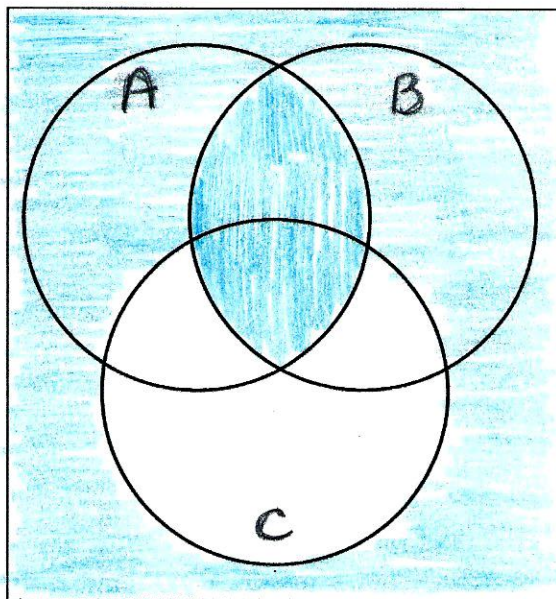


**EXAMPLE:** Shade the resulting area of the Venn diagram

$$A' \cup B$$



$$(A \cap B) \cup C'$$



**IV.** Difference of sets: (subtract, take away) elements of  
one set are taken away from another set. The  
elements left over become the new set.

**EXAMPLE:** find the difference of the two sets

$$A = \{1, \cancel{2}, \cancel{3}, 4, 5, \cancel{6}, \cancel{7}, 8, 9, 10\}$$

$$B = \{2, 3, 6, 7, 9\}$$

$$\text{What is } A - B? \quad \{1, 4, 5, 8, 10\}$$



**EXAMPLE:** find the difference of the sets

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

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

$$B = \{2, 4, 6\}$$

$$C = \{3, 4, 5, 6\}$$

$$1. A - B = \{1, 3\}$$

$$2. B - C = \{2\}$$

$$3. C - B = \{3, 5\}$$

**V.** Sometimes in math, things are paired together and the order is important. Just like an ordered pair (point). An ordered pair has two numbers in a specific order (x, y).

Cartesian product is creating a set of ordered pairs from the elements of two sets.

every element in set A is paired with every element in set B, written as  $A \times B$  (A cross B)

**EXAMPLE:** find the Cartesian Product

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

$$B = \{4, 5\}$$

What is  $A \times B$ ?

$$\{(1, 4), (1, 5), (2, 4), (2, 5), (3, 4), (3, 5)\}$$

What is  $B \times A$ ?

$$\{(4, 1), (4, 2), (4, 3), (5, 1), (5, 2), (5, 3)\}$$

Is  $A \times B = B \times A$ ?

NO