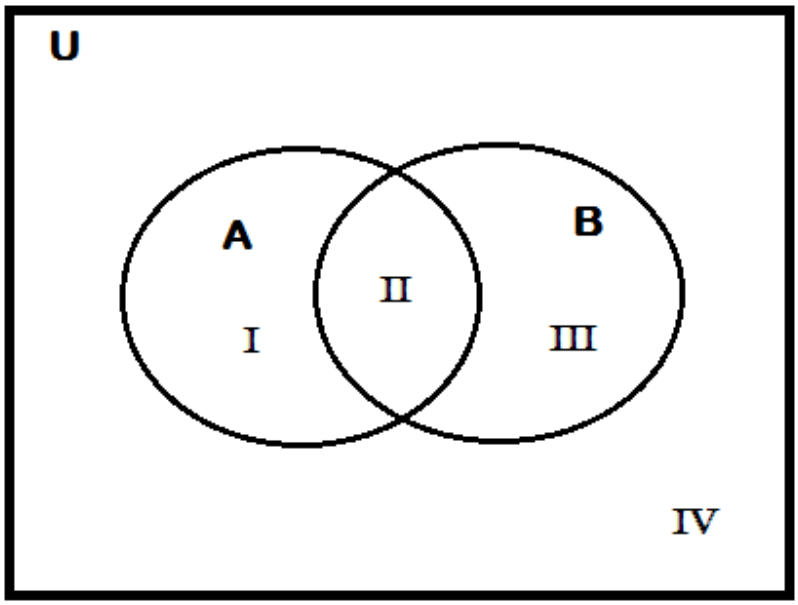
Section 2.3 - Venn Diagrams and Set Operations

Venn diagrams can be extremely useful for illustrating set operations and solving problems involving sets.

Two sets A and B are **disjoint** if they have no elements in common, i.e., that do not overlap ($A \cap B = \emptyset$).

When a two-set Venn diagram is drawn in the usual way, 4 disjoint regions are formed. We will label those regions with Roman numerals.



In order to set operation problems with two-set Venn diagrams:

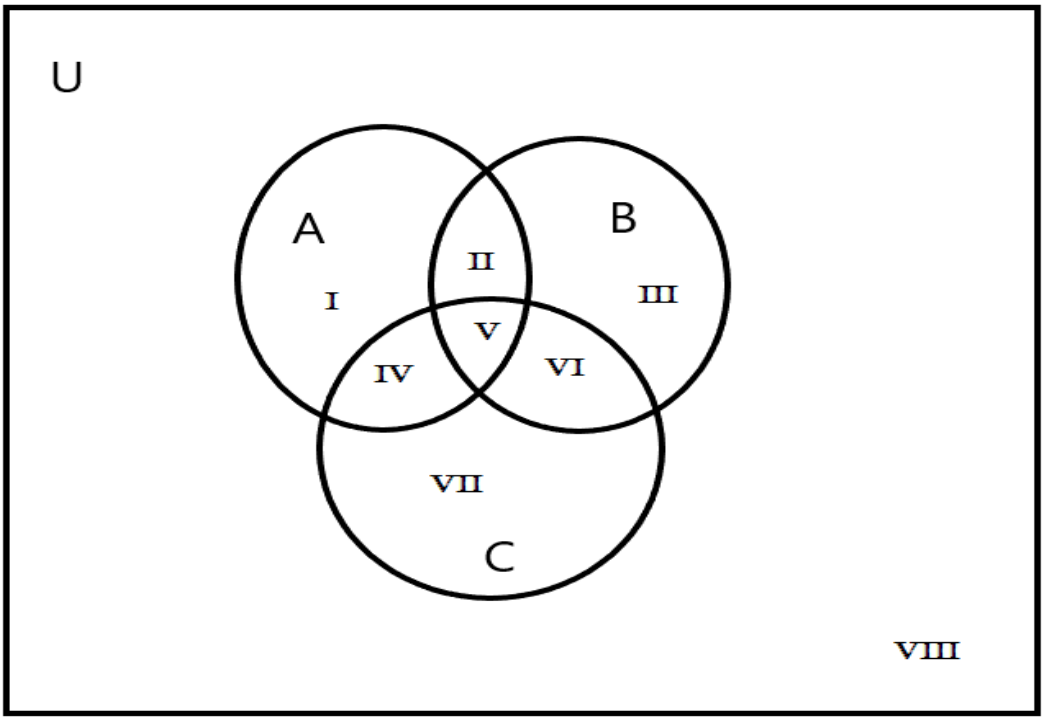
1. Sketch a two-set Venn diagram.
2. Label the disjoint regions with Roman numerals.
3. Treat the Roman numerals as the elements of the sets and perform the operations on the "elements."

For example, let's shade the region of a two-set Venn diagram corresponding to $(A \cup B)'$.

Example

Shade the region of a two-set Venn diagram that corresponds with $A' \cap B$.

When a three-set Venn diagram is drawn in the usual way, 8 disjoint regions are formed. As before, we will label those regions with Roman numerals.



Example

Shade regions of two different three-set Venn diagrams to determine if $(A \cup B) \cap C$ is equal to $(A \cap C) \cup (B \cap C)$.

Venn diagrams can help with counting and sorting data.

Example

Suppose $n(A) = 34$, $n(B) = 29$, $n(A \cap B) = 15$, and $n(U) = 50$. Determine $n(A \cup B)$.

After the previous example, it is easy to deduce the following formula

$$n(A \cup B) = n(A) + n(B) - n(A \cap B).$$