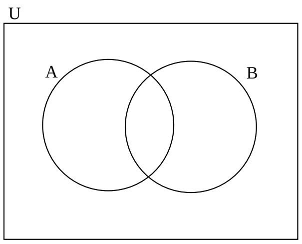
Math 102
Venn Diagrams

Note: Last time, while we were looking at set operations, we briefly introduced the concept of a Venn Diagram. Venn Diagrams turn out to be a very important and useful tool for understanding sets. We will now look at some of the uses of these diagrams in more detail.

Two Set Venn Diagrams: The following diagram shows the standard Venn Diagram for two sets A and B.

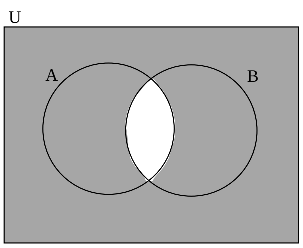


Looking carefully at this diagram, we see that it is divided into 4 regions. These regions represent the elements in A but not in B, the elements in both A and B, the elements in B but not in A, and the elements in neither A nor B.

We will use two set Venn diagrams in 2 main ways.

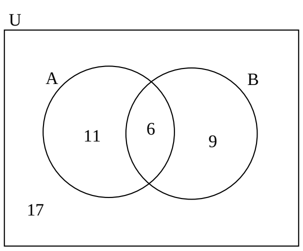
- We can use Venn diagrams to illustrate the result of carrying out set operations by shading regions in the Venn diagram.

  Example: Use a Venn diagram to represent the set $(A \cap B)'$



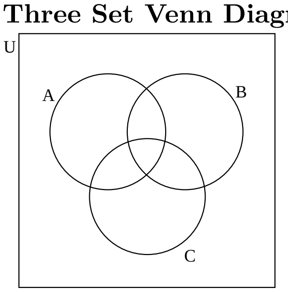
- We can use Venn diagrams to count the number of elements of each type by placing numbers in the regions of the Venn diagram.

  Example:



From the diagram above, we see that $n(A) = 17$, $n(B) = 15$, $n(B') = 28$, and $n((A \cup B)') = 17$

Three Set Venn Diagrams: The following diagram shows the standard Venn Diagram for three sets A, B, and C.

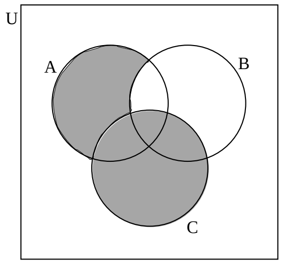


Looking carefully at this diagram, we see that it is divided into 8 regions. These regions represent the elements in A, B, and C, in A and B but not C, in A and C but not B, in B and C but not A, in only A, only B, only C, and the elements outside of A, B, and C.

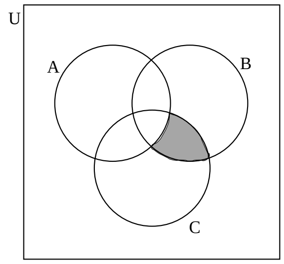
We can once again use three set Venn diagrams in 2 main ways.

- We can use Venn diagrams to illustrate the result of carrying out set operations by shading regions in the Venn diagram.

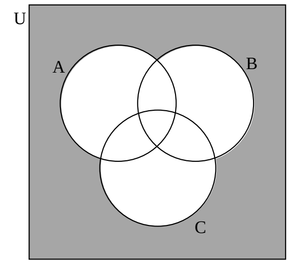
  Example: Use a Venn diagram to represent the sets $(A-B)\cup C$, $(B-A)\cap C$ and $(A\cup B\cup C)'$



$(A-B)\cup C$



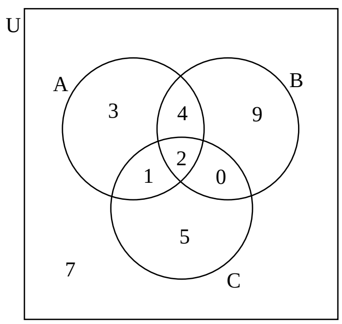
$(B-A)\cap C$



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

- We can use Venn diagrams to count the number of elements of each type by placing numbers in the regions of the Venn diagram.

  Example:



  From the diagram above, we see that $n(A)=10$, $n(B)=15$, $n(A\cap C)=3$, and $n\left((B\cup C)-A\right)=14$

Examples: Sometimes, you will be asked to work backwards from a Venn Diagram. That is, given a diagram with certain regions shaded, you will be asked to write a combination of set operations that can be used to describe the shaded regions.