

## 4.3: Venn Diagrams

### Learning Objectives

- Use a Venn diagram to illustrate the relationship between 2 and 3 sets
- Create an expression relating 2 and 3 sets from a Venn diagram

To visualize the interaction of sets, John Venn in 1880 thought to use overlapping circles, building on a similar idea used by Leonhard Euler in the 18<sup>th</sup> century. These illustrations now called **Venn Diagrams**.

### Venn Diagram

A **Venn diagram** represents each set by a circle, usually drawn inside of a containing box representing the universal set. Overlapping areas indicate elements common to both sets.

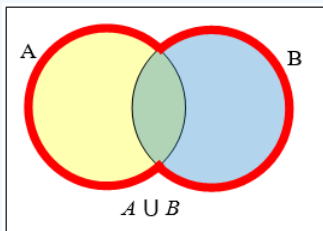
Basic Venn diagrams can illustrate the interaction of two or three sets.

### ✓ Example 4.3.1

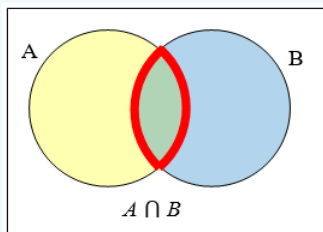
Create Venn diagrams to illustrate  $A \cup B$ ,  $A \cap B$ , and  $A' \cap B$ .

#### Solution

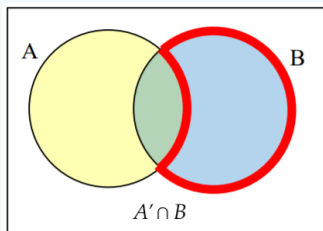
$A \cup B$  contains all elements in either set.



$A \cap B$  contains only those elements in both sets - in the overlap of the circles.



$A' \cap B$  contains the elements of B that are not in A.

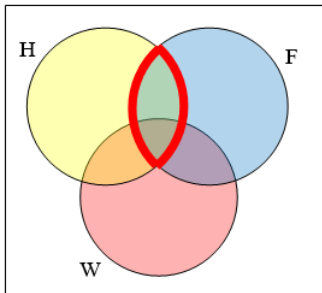


✓ Example 4.3.2

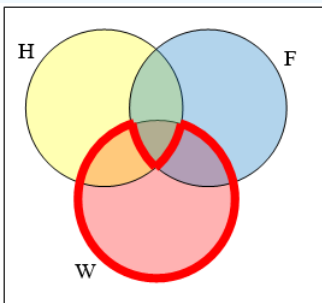
Use a Venn diagram to illustrate  $(H \cap F)' \cap W$ .

**Solution**

We'll start by identifying everything in the set  $H \cap F$ .

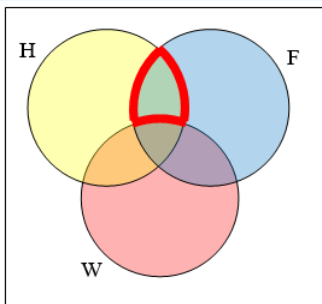


Now,  $(H \cap F)' \cap W$  will contain everything not in the set identified above that is also in set  $W$ .



✓ Example 4.3.3

Create an expression to represent the outlined part of the Venn diagram shown.

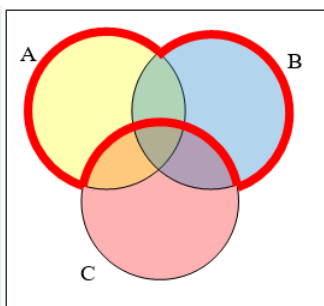


**Solution**

The elements in the outlined set are in sets  $H$  and  $F$ , but are not in set  $W$ . So we could represent this set as  $H \cap F \cap W'$ .

✎ Try It 4.3.1

Create an expression to represent the outlined portion of the Venn diagram shown



**Answer**

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

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