The Intersection of Two Sets

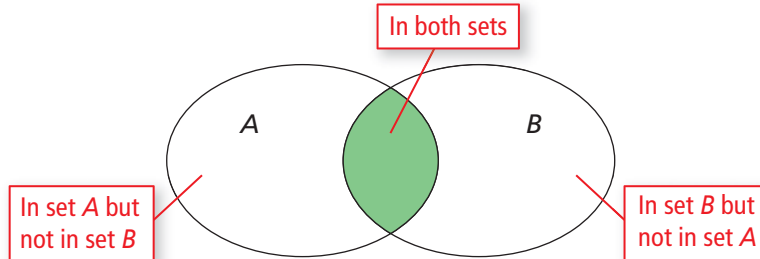### Finding the Intersection of Two Sets

The **intersection** of set A and set B is everything that is in set A *and* set B. A set diagram for the intersection of two sets is shown below.

In both sets

A   B
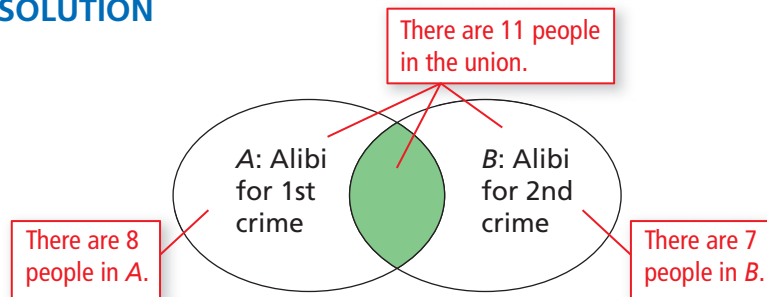
In set A but not in set B

In set B but not in set A

There are two formulas in set theory that relate the number of items in the union and intersection of two sets.

$$\boxed{\text{Number in union}} = \boxed{\text{Number of items in } A} + \boxed{\text{Number of items in } B} - \boxed{\text{Number in intersection}}$$

$$\boxed{\text{Number in intersection}} = \boxed{\text{Number of items in } A} + \boxed{\text{Number of items in } B} - \boxed{\text{Number in union}}$$

EXAMPLE 3   Using a Set Diagram

You are reading a mystery novel about two crimes committed on a yacht. There are 11 passengers. Each passenger has at least 1 alibi, 8 have an alibi for 1 crime, and 7 have an alibi for the other crime. Assuming the alibis are valid, how many of the passengers are certain to have *not* committed either crime?

SOLUTION

There are 11 people in the union.

A: Alibi for 1st crime

B: Alibi for 2nd crime

There are 8 people in A.

There are 7 people in B.

$$\boxed{\text{Number in intersection}} = \boxed{\text{Number of items in } A} + \boxed{\text{Number of items in } B} - \boxed{\text{Number in union}}$$

$$= 8 + 7 - 11 = 4$$

So, four of the passengers have alibis for both crimes. You can be certain that none of these four committed either crime.

✔ Checkpoint

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Suppose that of the 11 passengers, each has at least 1 alibi, 9 have an alibi for 1 crime, and 8 have an alibi for the other crime. Assuming the alibis are valid, how many of the passengers are certain to have *not* committed either crime?