The probability that a randomly selected student will be a junior given that the student owns a car is $\frac{1}{3}$.

REVIEW EXAMPLES

1. This table shows the names of students in Mr. Leary's class who do or do not own bicycles and skateboards.

Bicycle and Skateboard Ownership			
Owns a Bicycle	**Owns a Skateboard**	**Owns a Bicycle AND Skateboard**	**Does NOT Own a Bicycle OR Skateboard**
Ryan	Brett	Joe	Amy
Sarah	Juan	Mike	Gabe
Mariko	Tobi	Linda	Abi
Nina		Rose	
Dion			

Let set *A* be the names of students who own bicycles, and let set *B* be the names of students who own skateboards.

a. Find *A* and *B.* What does the set represent?

b. Find *A* or *B.* What does the set represent?

c. Find (*A* or *B*)′. What does the set represent?

Solution:

a. The intersection is the set of elements that are common to both set *A* and set *B*, so *A* and *B* is {Joe, Mike, Linda, Rose}. This set represents the students who own both a bicycle and a skateboard.

b. The union is the set of elements that are in set *A* or set *B* or in both set *A* and set *B*. You only need to list the names in the intersection one time, so *A* or *B* is {Ryan, Sarah, Mariko, Nina, Dion, Joe, Mike, Linda, Rose, Brett, Juan, Tobi}. This set represents the students who own a bicycle, a skateboard, or both.

c. The complement of *A* or *B* is the set of names that are not in *A* or *B*. So, the complement of *A* or *B* is {Amy, Gabe, Abi}. This set represents the students who own neither a bicycle nor a skateboard.

2. In a certain town, the probability that a person plays sports is 65%. The probability that a person is between the ages of 12 and 18 is 40%. The probability that a person plays sports and is between the ages of 12 and 18 is 25%. Are the events independent? How do you know?

Solution:

Let $P(S)$ be the probability that a person plays sports.

Let $P(A)$ be the probability that a person is between the ages of 12 and 18.

If the two events are independent, then $P(S \text{ and } A) = P(S) \cdot P(A)$.

Because $P(S \text{ and } A)$ is given as 25%, find $P(S) \cdot P(A)$ and then compare.

$P(S) \cdot P(A) = 0.65 \cdot 0.4$

$= 0.26$

Because $0.26 \neq 0.25$, the events are not independent.

3. A random survey was conducted to gather information about age and employment status. This table shows the data that were collected.

Employment Survey Results

	Age (in Years)		
Employment Status	**Less than 18**	**18 or greater**	**Total**
Has Job	20	587	607
Does Not Have Job	245	92	337
Total	265	679	944

a. What is the probability that a randomly selected person surveyed has a job, given that the person is less than 18 years old?

b. What is the probability that a randomly selected person surveyed has a job, given that the person is greater than or equal to 18 years old?

c. Are having a job (A) and being 18 or greater (B) independent events? Explain.

- $P(A)$ = has a job
- $P(A')$ = does not have a job
- $P(B)$ = 18 years old or greater
- $P(B')$ = less than 18 years old

Solution:

a. Find the total number of people surveyed less than 18 years old: 20 + 245 = 265. Divide the number of people who have a job and are less than 18 years old, 20, by the number of people less than 18 years old, 265: $\frac{20}{265} \approx 0.08$. The probability that a person surveyed has a job, given that the person is less than 18 years old, is about 0.08.

$$P(A \mid B') = \frac{P(A \text{ and } B')}{P(B')} = \frac{\frac{20}{944}}{\frac{265}{944}} = \frac{20}{265} = 0.08$$

b. Find the total number of people surveyed greater than or equal to 18 years old: 587 + 92 = 679. Divide the number of people who have a job and are greater than or equal to 18 years old, 587, by the number of people greater than or equal to 18 years old, 679: $\frac{587}{679} \approx 0.86$. The probability that a person surveyed has a job, given that the person is greater than or equal to 18 years old, is about 0.86.

$$P(A \mid B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{\frac{587}{944}}{\frac{679}{944}} = \frac{587}{679} = 0.86$$

c. The events are independent if $P(A \mid B) = P(A)$ *and* $P(B \mid A) = P(B)$.
From part (b), $P(A \mid B) \approx 0.86$.

$P(A) = \frac{607}{944} \approx 0.64$

$P(A \mid B) \neq P(A)$, so the events are not independent.