Independent and Dependent Events
10.5

Compound events may be *independent events* or *dependent events*. Events are **independent events** if the occurrence of one event *does not* affect the likelihood that the other event(s) will occur.

Key Idea

Probability of Independent Events

Words The probability of two or more independent events is the product of the probabilities of the events.

Symbols

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

$$P(A \text{ and } B \text{ and } C) = P(A) \cdot P(B) \cdot P(C)$$

EXAMPLE 1 Finding the Probability of Independent Events

You spin the spinner and flip the coin. What is the probability of spinning a prime number and flipping tails?

Will the outcome of spinning the spinner affect the outcome of flipping the coin? **No. So the events are independent.**

$$P(\text{prime}) = \frac{3}{5}$$

There are 3 prime numbers (2, 3, and 5).

There is a total of 5 numbers.

$$P(\text{tails}) = \frac{1}{2}$$

There is 1 tails side.

There is a total of 2 sides.

Use the formula for the probability of independent events.

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

$$P(\text{prime and tails}) = P(\text{prime}) \cdot P(\text{tails})$$

$$= \frac{3}{5} \cdot \frac{1}{2} \quad \text{Substitute.}$$

$$= \frac{3}{10} \quad \text{Multiply.}$$

The probability of spinning a prime number and flipping tails is $\frac{3}{10}$, or 30%.

On Your Own

1. What is the probability of spinning a multiple of 2 and flipping heads?

$$P(A \text{ and } B) = P(A) \bullet P(B)$$

$$P(\text{multiple of } 2 \text{ and heads}) = P(\text{multiple of } 2) \bullet P(\text{heads})$$

$$= \frac{2}{5} \bullet \frac{1}{2}$$

$$= \frac{1}{5} \quad = 20\%$$

Events are **dependent events** if the occurrence of one event *does* affect the likelihood that the other event(s) will occur.

Key Idea

Probability of Dependent Events

Words The probability of two dependent events A and B is the probability of A times the probability of B after A occurs.

Symbols $P(A \text{ and } B) = P(A) \cdot P(B \text{ after } A)$

Example: A bag contains 3 red marbles,4 green marbles, and 5 blue marbles. One marble is taken from the bag and is **NOT** replaced. Another marble is taken from the bag. What is the probability that the 1st marble is red and the 2nd marble is blue?

$$P(A\ and\ B) = P(A) \bullet P(B\ after\ A)$$

$$P(red\ and\ blue) = P(red) \bullet P(blue\ after\ red)$$

$$= \frac{3}{12} \bullet \frac{5}{11}$$

$$= \frac{1}{4} \bullet \frac{5}{11} = \frac{5}{44} = 11.4\%$$

On Your Own

2. A card is chosen at random from a standard deck of 52 playing cards. Without replacing it, a second card is chosen. What is the probability that the first card chosen is a queen and the second chosen is a jack?

$$P(A\ and\ B) = P(A) \bullet P(B\ after\ A)$$

$$P(queen\ and\ jack) = P(queen) \bullet P(jack\ after\ queen)$$

$$= \frac{4}{52} \bullet \frac{4}{51}$$

$$= \frac{1}{13} \bullet \frac{4}{51}$$

$$= \frac{4}{663}$$

$$= 0.6\%$$