10.3 Define and Use Probability
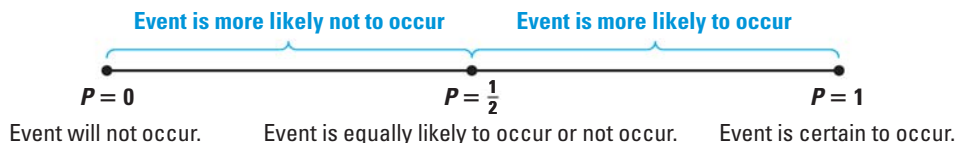
Before	You determined the number of ways an event could occur.
Now	You will find the likelihood that an event will occur.
Why?	So you can find real-life geometric probabilities, as in Ex. 39.

Key Vocabulary
• probability
• theoretical probability
• odds
• experimental probability
• geometric probability

When you roll a standard six-sided die, the possible results are called *outcomes*. The outcomes of rolling a die are 1, 2, 3, 4, 5, and 6. An *event* is an outcome or a collection of outcomes. For example, the event "rolling an odd number" consists of the outcomes 1, 3, and 5.

The **probability** of an event is a number from 0 to 1 that indicates the likelihood the event will occur, as shown on the number line below. Probabilities can be written as fractions, decimals, or percents.

Event is more likely not to occur **Event is more likely to occur**

$P = 0$ $P = \frac{1}{2}$ $P = 1$

Event will not occur. Event is equally likely to occur or not occur. Event is certain to occur.

KEY CONCEPT *For Your Notebook*

Theoretical Probability of an Event

When all outcomes are equally likely, the **theoretical probability** that an event A will occur is:

$$P(A) = \frac{\text{Number of outcomes in event } A}{\text{Total number of outcomes}}$$

The theoretical probability of an event is often simply called the probability of the event.

all possible outcomes

event A

outcomes

$P(A) = \frac{3}{8}$
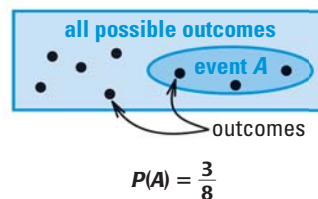
EXAMPLE 1 **Find probabilities of events**

You roll a standard six-sided die. Find the probability of (a) rolling a 5 and (b) rolling an even number.

a. There are **6** possible outcomes. Only **1** outcome corresponds to rolling a 5.

$$P(\text{rolling a 5}) = \frac{\text{Number of ways to roll a 5}}{\text{Number of ways to roll the die}} = \frac{1}{6}$$

b. A total of **3** outcomes correspond to rolling an even number: a 2, 4, or 6.

$$P(\text{rolling even number}) = \frac{\text{Number of ways to roll an even number}}{\text{Number of ways to roll the die}} = \frac{3}{6} = \frac{1}{2}$$