

Essential Question How can you describe the likelihood of an event?

1 ACTIVITY: Black-and-White Spinner Game

Work with a partner. You work for a game company. You need to create a game that uses the spinner below.

- Write rules for a game that uses the spinner. Then play it.
- After playing the game, do you want to revise the rules? Explain.



Probability and Statistics

In this lesson, you will

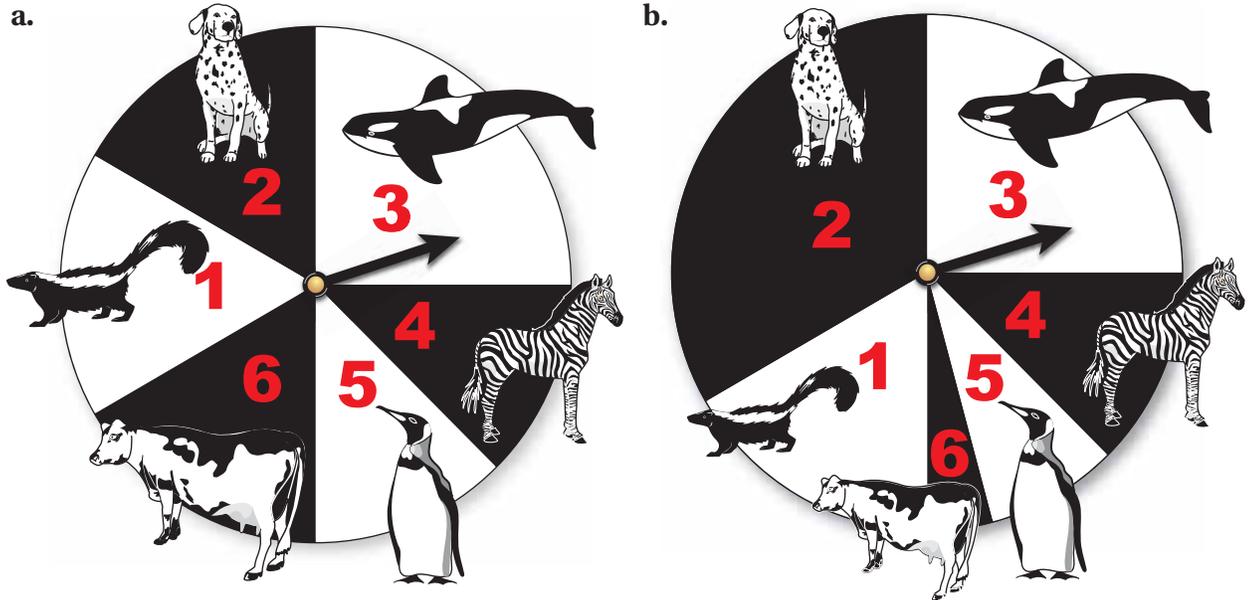
- understand the concept of probability and the relationship between probability and likelihood.
- find probabilities of events.

- CHOOSE TOOLS** Using the center of the spinner as the vertex, measure the angle of each pie-shaped section. Is each section the same size? How do you think this affects the likelihood of spinning a given number?
- Your friend is about to spin the spinner and wants to know how likely it is to spin a 3. How would you describe the likelihood of this event to your friend?

2 ACTIVITY: Changing the Spinner

Work with a partner. For each spinner, do the following.

- Measure the angle of each pie-shaped section.
- Tell whether you are more likely to spin a particular number. Explain your reasoning.
- Tell whether your rules from Activity 1 make sense for these spinners. Explain your reasoning.



3 ACTIVITY: Is This Game Fair?

Math Practice

Use Prior Results

How can you use the results of the previous activities to determine whether the game is fair?

Work with a partner. Apply the following rules to each spinner in Activities 1 and 2. Is the game fair? Why or why not? If not, who has the better chance of winning?

- Take turns spinning the spinner.
- If you spin an odd number, Player 1 wins.
- If you spin an even number, Player 2 wins.

What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you describe the likelihood of an event?
5. Describe the likelihood of spinning an 8 in Activity 1.
6. Describe a career in which it is important to know the likelihood of an event.

Practice

Use what you learned about the likelihood of an event to complete Exercises 4 and 5 on page 410.

Key Vocabulary 
probability, p. 408

Key Idea

Probability

The **probability** of an event is a number that measures the likelihood that the event will occur. Probabilities are between 0 and 1, including 0 and 1. The diagram relates likelihoods (above the diagram) and probabilities (below the diagram).



Study Tip

Probabilities can be written as fractions, decimals, or percents.

EXAMPLE 1 Describing the Likelihood of an Event



There is an 80% chance of thunderstorms tomorrow. Describe the likelihood of the event.

The probability of thunderstorms tomorrow is 80%.

- Because 80% is close to 75%, it is *likely* that there will be thunderstorms tomorrow.

On Your Own

Describe the likelihood of the event given its probability.

- The probability that you land a jump on a snowboard is $\frac{1}{2}$.
- There is a 100% chance that the temperature will be less than 120°F tomorrow.

Now You're Ready
Exercises 6–9

Key Idea

Finding the Probability of an Event

When all possible outcomes are equally likely, the probability of an event is the ratio of the number of favorable outcomes to the number of possible outcomes. The probability of an event is written as $P(\text{event})$.

$$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

EXAMPLE 2 Finding a Probability

You roll the number cube. What is the probability of rolling an odd number?



$$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$$P(\text{odd}) = \frac{3}{6}$$

There are 3 odd numbers (1, 3, and 5).

There is a total of 6 numbers.

$$= \frac{1}{2} \quad \text{Simplify.}$$

∴ The probability of rolling an odd number is $\frac{1}{2}$, or 50%.

EXAMPLE 3 Using a Probability

The probability that you randomly draw a short straw from a group of 40 straws is $\frac{3}{20}$. How many are short straws?

- (A) 4 (B) 6
(C) 15 (D) 34



$$P(\text{short}) = \frac{\text{number of short straws}}{\text{total number of straws}}$$

$$\frac{3}{20} = \frac{n}{40}$$

Substitute. Let n be the number of short straws.

$$6 = n \quad \text{Solve for } n.$$

There are 6 short straws.

∴ So, the correct answer is (B).

On Your Own

Now You're Ready
Exercises 11–15

- In Example 2, what is the probability of rolling a number greater than 2?
- In Example 2, what is the probability of rolling a 7?
- The probability that you randomly draw a short straw from a group of 75 straws is $\frac{1}{15}$. How many are short straws?

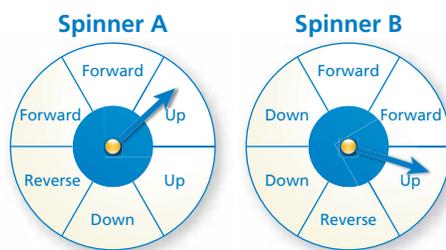
Vocabulary and Concept Check

- VOCABULARY** Explain how to find the probability of an event.
- REASONING** Can the probability of an event be 1.5? Explain.
- OPEN-ENDED** Give a real-life example of an event that is impossible. Give a real-life example of an event that is certain.

Practice and Problem Solving

You are playing a game using the spinners shown.

- You want to move down. On which spinner are you more likely to spin “Down”? Explain.
- You want to move forward. Which spinner would you spin? Explain.



Describe the likelihood of the event given its probability.

- Your soccer team wins $\frac{3}{4}$ of the time.
- There is a 0% chance that you will grow 12 more feet.
- The probability that the sun rises tomorrow is 1.
- It rains on $\frac{1}{5}$ of the days in July.
- VIOLIN** You have a 50% chance of playing the correct note on a violin. Describe the likelihood of playing the correct note.



You randomly choose one shirt from the shelves. Find the probability of the event.

- Choosing a red shirt
- Choosing a green shirt
- Not choosing a white shirt
- Not choosing a black shirt
- Choosing an orange shirt
- ERROR ANALYSIS** Describe and correct the error in finding the probability of *not* choosing a blue shirt from the shelves above.

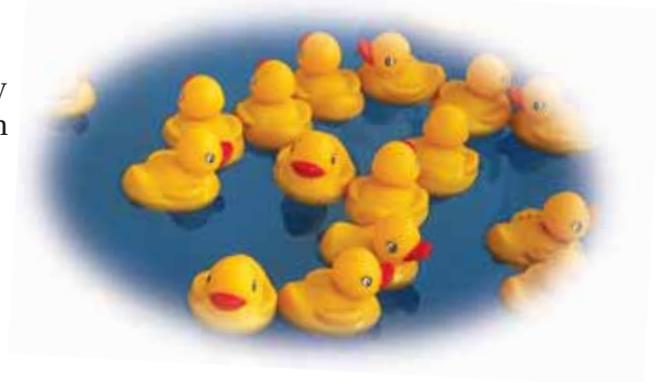


$$P(\text{not blue}) = \frac{4}{10} = \frac{2}{5}$$

17. **CONTEST** The rules of a contest say that there is a 5% chance of winning a prize. Four hundred people enter the contest. Predict how many people will win a prize.

18. **RUBBER DUCKS** At a carnival, the probability that you choose a winning rubber duck from 25 ducks is 0.24.

- How many are *not* winning ducks?
- Describe the likelihood of *not* choosing a winning duck.



19. **DODECAHEDRON** A dodecahedron has twelve sides numbered 1 through 12. Find the probability and describe the likelihood of each event.

- Rolling a number less than 9
- Rolling a multiple of 3
- Rolling a number greater than 6

A Punnett square is a grid used to show possible gene combinations for the offspring of two parents. In the Punnett square shown, a boy is represented by XY. A girl is represented by XX.

		Mother's Genes	
		X	X
Father's Genes	X	XX	
	Y		

20. Complete the Punnett square.

21. Explain why the probability of two parents having a boy or having a girl is equally likely.

22. **Critical Thinking** Two parents each have the gene combination Cs. The gene C is for curly hair. The gene s is for straight hair.

- Make a Punnett square for the two parents. When all outcomes are equally likely, what is the probability of a child having the gene combination CC?
- Any gene combination that includes a C results in curly hair. When all outcomes are equally likely, what is the probability of a child having curly hair?



Fair Game Review What you learned in previous grades & lessons

Solve the inequality. Graph the solution. (Section 4.2 and Section 4.3)

23. $x + 5 < 9$

24. $b - 2 \geq -7$

25. $1 > -\frac{w}{3}$

26. $6 \leq -2g$

27. **MULTIPLE CHOICE** Find the value of x. (Section 7.4)

(A) 85

(B) 90

(C) 93

(D) 102

