LESSON 3

Objective

Find the theoretical and experimental probabilities of an event involving a spinner.

Common Core State Standards

- **7.SP.5** Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
- **7.SP.6** Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*
- **7.SP.7a** Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.*

Statistics and Probability

Theoretical and Experimental Probability with Spinners

Students learn that they can use theoretical probability to predict the results of an experiment and that it may or may not be the same as the experimental probability. Here they use spinners to learn how to distinguish and compare theoretical and experimental probability and how to express the probability as a fraction, decimal, or percent.

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- Discuss that the likelihood that an event will occur is indicated by a number from 0 to 1. Zero means the event is impossible, and 1 means the event is certain.
- **Ask:** *Given the theoretical probability of the spinner landing on a number less than 4, how many times would you expect the spinner to land on one of these numbers in 10 spins? 30 spins? 50 spins?*
- **Ask:** *As you run more trials, what do you notice about the theoretical and experimental probabilities?*
- **Ask:** *Who do you think will earn more points, Thom or Maya? Why?*

Solve It

Reread the problem with students. Ask them to find the theoretical and experimental probabilities of Thom getting a point, and to use their experiment to compare and contrast theoretical and experimental probability.

More Ideas

For other ways to teach about theoretical and experimental probabilities—

- Give polyhedral dice to pairs of students. Have one student find the experimental probability of rolling a prime number on 10, 20, and 30 rolls while the other finds and uses the theoretical probability to determine the expected results.

Formative Assessment

Have students try the following problem.

A spinner is numbered 1 through 12. Lauren spins it 15 times and it lands on a number greater than 3 ten times. What is the theoretical probability that the spinner lands on a number greater than 3?

A. $\frac{1}{5}$ **B.** $\frac{1}{4}$ **C.** $\frac{3}{4}$ **D.** $\frac{4}{5}$

Try It! 30 minutes | Pairs

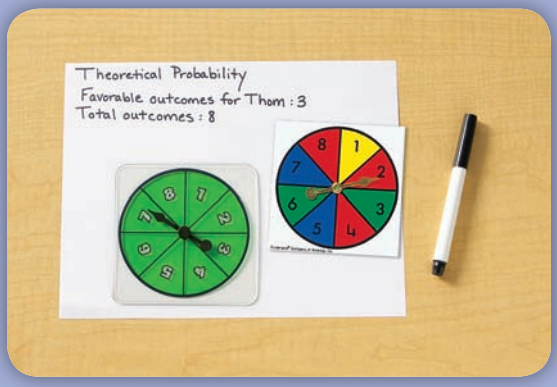
Here is a problem about theoretical and experimental probabilities.

Thom and Maya are playing a game with a spinner numbered 1–8. Thom gets a point if the spinner lands on a number less than 4. Maya gets a point if the spinner lands on 4 or greater. Compare the theoretical probability that Thom will get a point with the experimental probability using 10, 30, and 50 spins.

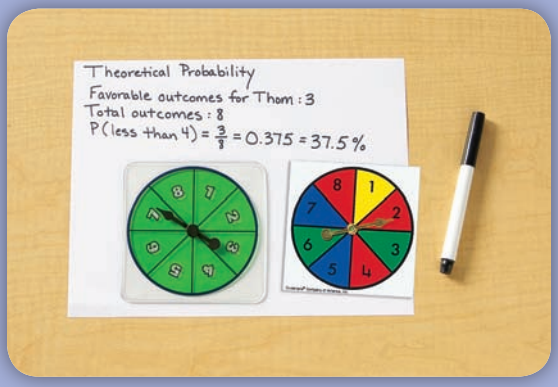
Introduce the problem. Then have students do the activity to solve the problem. Distribute the materials. Explain the difference between *theoretical probability*, which is a calculated number, and *experimental probability*, which describes what actually occurs in an experiment.

Materials

- Spinners
- paper (1 sheet per pair)



1. Say: *The theoretical probability of an event is the ratio of the number of favorable outcomes to the total number of possible outcomes.* **Ask:** *How many favorable outcomes are there for Thom? How many possible outcomes are there?*



2. Say: *You can express probability as a fraction, decimal, or percent.* Help students express as a fraction the theoretical probability of the spinner landing on a number less than 4. Then have them convert the fraction to a decimal and a percent.

3. Say: *Experimental probability is the ratio of favorable trials to the total number of trials.* Have students tally favorable trials (numbers less than 4) for 10, 30, and 50 spins, and express the experimental probabilities in three ways. Then have them compare the theoretical and experimental probabilities.

⚠ Look Out!

Some students may confuse theoretical and experimental probabilities. Emphasize that theoretical probability tells what would happen if each possible outcome appears the same number of times. For example, if a spinner has five equal sections and you spin it five times, each number would appear once, or 1 out of 5 times. In an actual experiment, a number might appear more than or less than once in five spins. What actually happens is experimental probability.

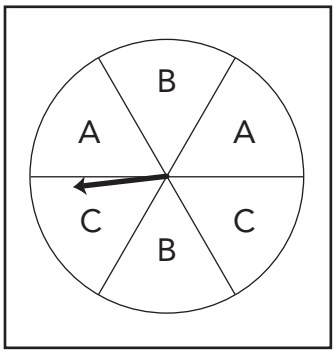
Answer Key

Use a spinner to model probability. Find each probability. (Check students' work.)

1. *P*(B) $\frac{1}{3}$

P(A) $\frac{1}{3}$

P(C) $\frac{1}{3}$



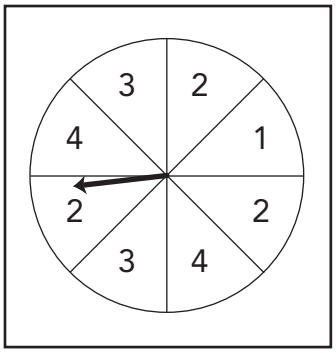
Using a spinner, model each probability. Find each probability.

2. *P*(1) $\frac{1}{8}$

P(4) $\frac{1}{4}$

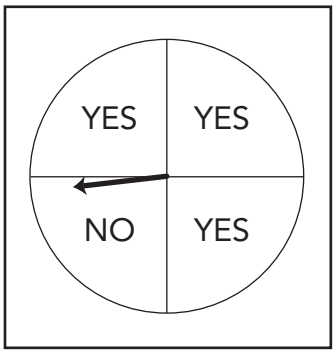
P(number < 5) 1

P(0) 0



Find each probability

3.

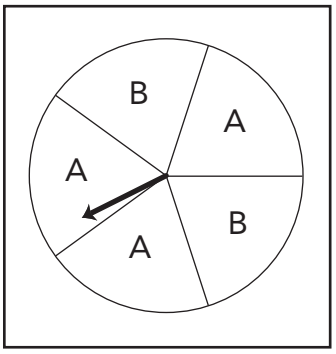


P(YES) $\frac{3}{4}$

P(NO) $\frac{1}{4}$

P(MAYBE) 0

4.



P(A) $\frac{3}{5}$

P(B) $\frac{2}{5}$

P(A or B) 1

Answer Key

Challenge! How do you use the number of sections in a spinner when finding the probability of an event?

Challenge: (Sample) The number of sections in the spinner is the denominator for the fraction when finding probability.

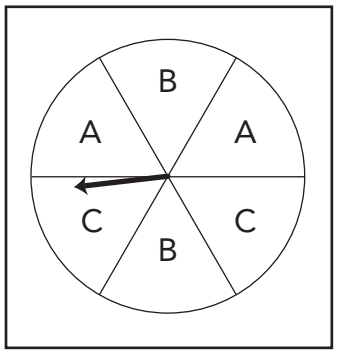
Name _____

Use a spinner to model probability. Find each probability.

1. *P*(B) _____

P(A) _____

P(C) _____



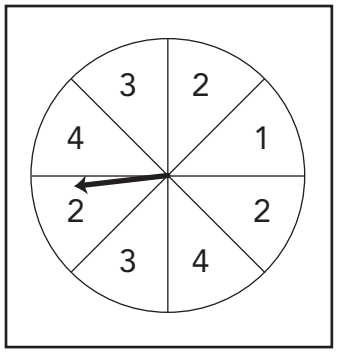
Using a spinner, model each probability. Find each probability.

2. *P*(1) _____

P(4) _____

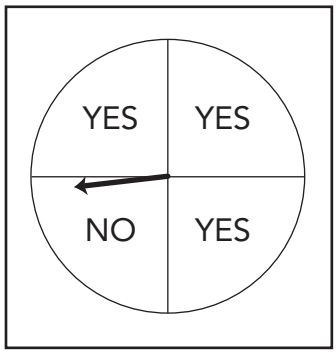
P(number < 5) _____

P(0) _____



Find each probability

3.

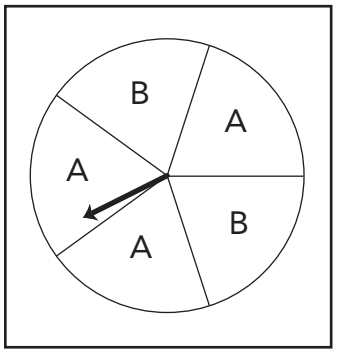


P(YES) _____

P(NO) _____

P(MAYBE) _____

4.



P(A) _____

P(B) _____

P(A or B) _____

Name _____

Challenge! How do you use the number of sections in a spinner when finding the probability of an event?