

TOPIC  
**9**

### GET READY!

## Review What You Know!

**Vocabulary**  
Choose the best term from the box to complete each definition.

equivalent  
frequency  
diagram  
ratio

- A(n)  is a drawing that can be used to visually represent information.
- The number of times a specific value occurs is referred to as .
- A(n)  is a relationship between one quantity and another quantity.
- Quantities that have the same value are .

### Operations with Fractions

Solve for  $x$ .

5.  $\frac{2}{5} + x = 1$

6.  $225 \cdot \frac{1}{3} = x$

7.  $1 = \frac{1}{8} + x + \frac{2}{8}$

### Ratios

Write each ratio in fraction form. Then write the percent equivalent.

8. 72 out of 96

9. 88 out of 132

10. 39 out of 104

11. 23 out of 69

12. 52 out of 208

13. 25 out of 200

### Order Fractions and Decimals

Plot the following fractions and decimals on the number line.

$0.7, \frac{1}{3}, \frac{2}{6}, 0.4, 0.125, \frac{5}{6}$

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## Build Vocabulary

Sort the vocabulary words from Topic 9 into categories of your choosing. Write a brief explanation of each category, and be prepared to discuss why you grouped the words as you did.

compound event    event    experimental probability    outcome  
probability simulation    probability model    relative frequency    sample space  
theoretical probability

**Category:**  

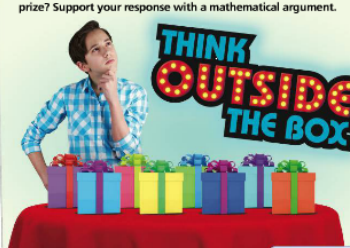

**Category:**  


**Category:**  


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### Solve & Discuss It!

For a game show, Jared has to choose 1 of 8 boxes to win a prize. One of the boxes has a big prize, 3 boxes have a medium prize, 3 boxes have smaller prizes, and 1 box is empty. How confident should Jared be that whatever box he chooses, he will win a prize? Support your response with a mathematical argument.



**Make Sense and Persevere**  
What are the chances that Jared will choose a box with a prize?

#### Lesson 9-1

### Understand Likelihood and Probability

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**I can...**  
describe the likelihood that an event will occur.

**Focus on math practices**  
**Construct Arguments** Suppose the empty box is taken out of the game. How confident should Jared be that he will win a prize? Explain.

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### Essential Question


What is probability?

#### EXAMPLE 1

### Use Probability to Describe Chance

Alisa and Cheri spin the pointer to the right and record the color that it lands on. The table shows their results after 100 spins. How can Alisa and Cheri explain their results?

Color	Frequency
Red	23
Yellow	24
Green	27
Blue	26



There are 4 possible results, or **outcomes**, when Alisa and Cheri spin the pointer:

- The pointer lands on the red section.
- The pointer lands on the yellow section.
- The pointer lands on the green section.
- The pointer lands on the blue section.

Each section is the same size. There is 1 section of each color.

Each of the 4 outcomes is equally likely because the pointer has an equal chance of landing on any of the 4 sections.

Each time they spin the pointer, the likelihood, or **probability**, of the pointer landing on red, yellow, green, or blue is the same.


Each of the equal-sized sections is shaded 1 of 4 colors, so the probability of the pointer landing on any given color is 1 out of 4, or  $\frac{1}{4}$ . Since  $\frac{1}{4} = 25\%$ , the probability can also be written as 25%.

The spinner has 4 sections. Each section is shaded 1 of 4 colors.

The pointer should land on each color about 1 out of 4 times, or about 25 times out of 100 spins.

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**Try It!**  
How might the probability of the pointer landing on a given color change for the spinner shown at the right?



**Convince Me!** How would the probability of the pointer landing on a given color change if the spinner had six equal-sized sections with each section a different color?

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**EXAMPLE 2** Use Probability and Likelihood to Describe Situations

Carrie will roll a number cube with sides labeled 1 to 6.

a. What is the probability that she will roll a 2?  
Only 1 out of 6 total sides is a 2.  
So, the probability is 1 out of 6, or  $\frac{1}{6}$ .

b. What is the probability that she will roll a number less than 7?  
All 6 numbers on the cube are less than 7.  
So, it is certain that she will roll a number less than 7.  
The probability is 6 out of 6, or 1.

c. What is the probability that she will roll a number greater than 6?  
None of the 6 numbers on the cube is greater than 6.  
So, it is impossible to roll a number greater than 6.  
The probability is 0 out of 6, or 0.



**Try It!**

The game piece shown has 12 sides, labeled 1 to 12.

a. What is the probability of rolling an 11?  
b. What is the probability of rolling a number greater than 5?  
c. What is the probability of rolling a number greater than 12?



**EXAMPLE 3** Use Probability to Examine Fairness

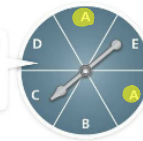
Marisol designed a spinner for a game. **The spinner is fair if there is an equal chance for the pointer to land on each number. Is the spinner a fair spinner?**

The probability of the pointer landing on "A" is 2 out of 6, which is equivalent to 1 out of 3, or  $\frac{1}{3}$ .

The probability of the pointer landing on "B" is 1 out of 6, or  $\frac{1}{6}$ .

Each of the probabilities of the pointer landing on "C", "D", or "E" is also 1 out of 6, or  $\frac{1}{6}$ .

It is more likely that the pointer will land on "A" than on any other number. So, it is not a fair spinner.



**Try It!**

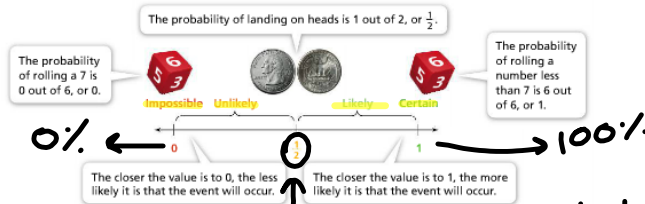
Is the spinner shown a fair spinner? If yes, explain why. If not, describe a change that could make the spinner fair.



**KEY CONCEPT**

$$P(\text{want}) = \frac{\text{want}}{\text{total}}$$

The probability that something will occur is a value from 0 to 1, which describes its likelihood. You can write probability as a ratio, such as 1 out of 2, or  $\frac{1}{2}$ , or as a percent, such as 50%.



*"as likely as unlikely to occur" or "neither likely nor unlikely"*

**Do You Understand?**

- Essential Question** What is probability?
- Construct Arguments** How can you use probability to draw conclusions about the likelihood that something will occur?
- Reasoning** Why is probability limited to numbers between 0 and 1?

**Do You Know How?**

Allie is going to select a card from the group of cards shown. Complete each statement.



- The probability that Allie will select a card labeled 3 is 2 out of 10, or 20%.
- Because the probability that each number will be selected is not the same or equal, the group of cards is not fair.
- It is more likely that Allie will select a card labeled with a number less than 6.
- It is more likely that Allie will select a card labeled 4.

$$P(3) = \frac{2 \times 10}{10 \times 10} = \frac{20}{100}$$

1 2 3 4 5 6 7 8 9 10

Name: \_\_\_\_\_

**Practice & Problem Solving**

**Leveled Practice** In 8–10, fill in the boxes to complete each statement.

8. A spinner has 8 equal-sized sections. Six of the sections are green.

a. What is the probability that the spinner will land on green?  
 out of 8, or  $\frac{\text{ }{\text{ }}}{8}$ , or  %

b. Use words to describe the probability.  
 It is  that the spinner will land on green.

9. Marcus is rolling a number cube with sides labeled 1 to 6.

a. The probability that the number cube will show 10 is .


b. It is  that the number cube will show 10.

10. Of the marbles in a bag, 3 are yellow, 2 are red, and 2 are blue. Sandra will randomly choose one marble from the bag.

a. The probability that Sandra will choose a blue marble from the bag is  out of  or  $\frac{\text{ }{\text{ }}}{\text{ }}$ .

b. It is  that Sandra will choose a blue marble from the bag.

11. Suppose you have a bag with 20 letter tiles in it, and 3 of the tiles are labeled Y. Suppose a second bag has 500 letter tiles in it, and 170 of the tiles are labeled Y. From which bag are you more likely to pick a tile that is labeled Y? Explain.



12. **Make Sense and Persevere** Suppose you have a bag of 40 marbles, and 20 of them are white. If you choose a marble without looking, the probability that you choose a white marble is  $\frac{20}{40}$ . Describe the probability.

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13. Suppose Nigel has a bag of colored wristbands, and he chooses one without looking. The bag contains a total of 25 wristbands and 6 of the wristbands are blue.



- What is the probability that Nigel will choose a blue wristband?
- Is it likely, unlikely, or neither likely nor unlikely that Nigel will choose a blue wristband?

14. A box contains four equal-sized cards labeled 1, 3, 5, and 7. Tim will select one card from the box.

- What is the probability that Tim will select a card labeled 4?
- What is the probability that Tim will select a card labeled with a number less than 6?
- What is the probability that Tim will select a card labeled with an odd number?

15. **Model with Math** Henry is going to color a spinner with 10 equal-sized sections. Three of the sections will be orange and 7 of the sections will be purple. Is this spinner fair? If so, explain why. If not, explain how to make it a fair spinner.

16. **Higher Order Thinking** Without being able to calculate probability, describe the likelihood that the following event will occur.  
All 21 students in a class share the same birthday.

**Assessment Practice**

17. After many studies, a researcher finds that the probability that a word recognition app correctly interprets a handwritten word is  $\frac{9}{10}$ . Which statement is true?
- It is impossible that the handwritten word will be correctly interpreted.
  - It is unlikely that the handwritten word will be correctly interpreted.
  - It is likely that the handwritten word will be correctly interpreted.
  - It is certain that the handwritten word will be correctly interpreted.

18. A bag contains 8 letter tiles of the same size. The tiles are labeled either A, B, C, D, E, or F. Three of the tiles are labeled C. If Corey selects 1 tile from the bag without looking, is the selection of letters fair? Explain.

