

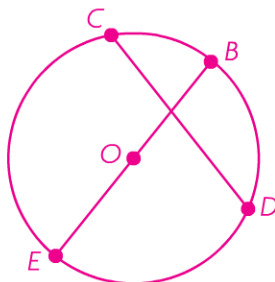
Share and Show



Draw and label a circle with a radius of 4 cm. Then draw and label the following.

- center O
- radius \overline{OB}
- chord \overline{CD}
- diameter \overline{BE}

Sample drawing shown is not to scale. Check students' drawings.



Identify each part of the circle shown below.

- the center

 L

- a radius

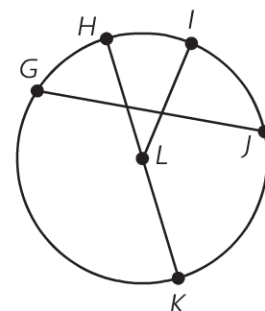
 \overline{IL} , \overline{HL} , or \overline{KL}

- a chord

 \overline{GJ} or \overline{HK}

- a diameter

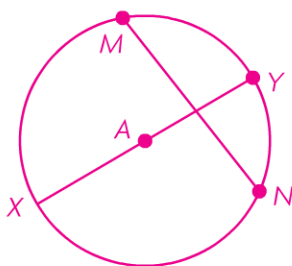
 \overline{HK}



On Your Own

Draw and label a circle with a radius of 6 cm. Then draw and label the following.

- center A
- radius \overline{AY}
- chord \overline{MN}
- diameter \overline{XY}



Sample drawing shown is not to scale. Check students' drawings.

Problem Solving



- Dave needs to buy steel to replace 5 broken spokes on his bicycle wheel. Each spoke is equal to the length of the radius of the wheel. The diameter of the wheel is 24 inches. How many inches of steel does Dave need to make 5 spokes?

 60 inches

Name _____

Estimate Circumference**Essential Question** How does the diameter of a circle relate to the circumference?

The **circumference** is the distance around a circle. You can use a ruler and string to estimate the circumference of a circle.

Activity

In this Activity, you will explore the relationship between the diameter and the circumference of a circle.

Materials: compass, centimeter ruler, string, and calculator

- STEP 1** Use a compass to draw a circle. Mark the center of the circle. Use a ruler to draw a diameter through the center of the circle.
- STEP 2** Measure the diameter of the circle to the nearest millimeter. Record your measurement.
- STEP 3** Lay the string around the circle. Mark the string where it meets itself.
- STEP 4** Use the ruler to measure the string from its end to the mark you made. Measure to the nearest millimeter. Record your measurement.
- STEP 5** Use a calculator to divide the circumference of your circle by the diameter. Record your result.
- STEP 6** Display your results on the board with those of other students in the class by making a table like the one below.

Circumference (C)	Diameter (d)	$C \div d$

Check students' work.

- Compare your results with those of other students. What appears to be the approximate ratio $\frac{C}{d}$ for any circle?

Check students' work. Their ratios should be about 3.

Share and Show



Use a compass to draw a circle with radius 4 cm. Use the circle to answer Exercises 1–4.

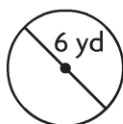
1. What is the diameter of this circle? 8 cm
2. Use a string to measure the circumference of the circle, as you did in the activity. What is an estimate of the circumference? about 24 cm
3. What is an estimate for the ratio of the circumference to the diameter of the circle? about 3
4. If you know the diameter of a circle, how can you use the ratio you found to estimate the circumference? Multiply the diameter by 3.

Estimate the circumference of the circle.

5. radius = 8 cm

about 48 cm

6.



about 18 yd

7.



about 16.2 m

8.

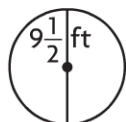


about 108 mm

On Your Own

Estimate the circumference of the circle.

9.



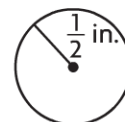
about 28.5 ft

10.



about 150 in.

11.



about 3 in.

12.



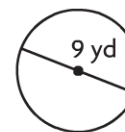
about 42 in.

13.



about 43.2 cm

14.



about 27 yd

Problem Solving

REAL WORLD

15. The diameter of the clock on the face of Big Ben in London is 23 feet. Estimate the circumference.

about 69 ft

16. The Cevahir clock at a shopping mall in Turkey may be the world's largest clock. The diameter of its face is 118 feet. A football field is 100 yd long. How does the circumference of the Cevahir clock compare with the length of a football field?

The circumference of the Cevahir clock is about 54 ft greater than the length of a football field.

Name _____

✓ Checkpoint

Check Concepts and Skills

Solve the equation. (pp. P283–P284)

1. $\frac{x}{7} - 8 = 0$
 $x = 56$

2. $13p + 19 = 97$
 $p = 6$

3. $3c - 42 = 15$
 $c = 19$

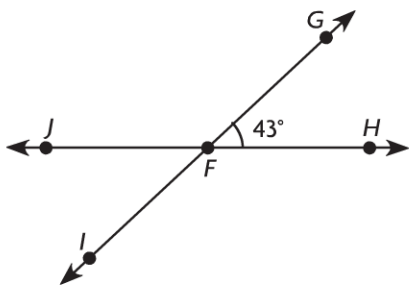
Solve the inequality. (pp. P285–P286)

4. $8y - 55 < 129$
 $y < 23$

5. $21 + 16k \geq 101$
 $k \geq 5$

6. $82 + \frac{p}{4} > 96$
 $p > 56$

For 7–9, use the drawing to find the measure of the angle. (pp. P287–P288, P289–P290)

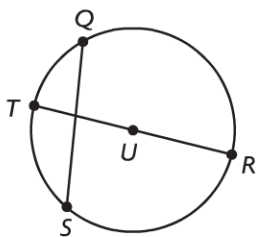


7. $m\angle JFG$
 137°

8. $m\angle JFI$
 43°

9. $m\angle IFH$
 137°

For 10–12, use the drawing to identify the parts of the circle. (pp. P291–P292)

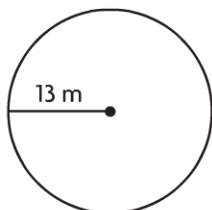


10. the center
 U

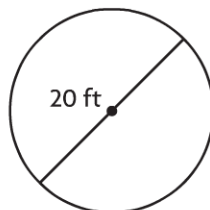
11. a radius
 \overline{UR} or \overline{UT}

12. a chord
 \overline{QS} or \overline{TR}

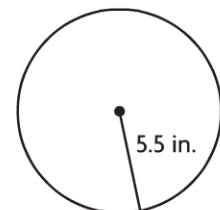
Estimate the circumference of the circle. (pp. P293–P294)



13. 78 m



14. 60 ft



15. 33 in.

Choose the letter of the correct answer.

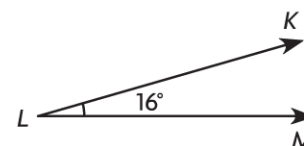
16. On Thursday, Gia took two aerobics classes and walked for an additional 20 minutes on the treadmill. On Friday, she took 1 aerobics class and walked for an additional 35 minutes. Simplify the expression $(2m + 35) + (3m + 15)$, where m represents the length in minutes of each class, to show the total number of minutes Gia exercised on those two days. (pp. P281–P282)

- (A) $5m + 20$
 (C) $6m + 20$
 (B) $5m + 50$
 (D) $6m + 50$

17. Hank and his friend are drawing a big circle as a boundary for their game. Hank holds one end of a rope and stands at what will be the center of the circle. His friend holds the other end and stands 10 feet away at what will be the edge of the circle. The 10-foot rope is the radius of the circle. What will be its estimated circumference? (pp. P293–P294)

- (A) 20 ft
 (C) 40 ft
 (B) 30 ft
 (D) 60 ft

18. Kyle drew $\angle KLM$ and has been asked to draw an angle that is complementary. What should be the measure of the new angle? (pp. P289–P290)

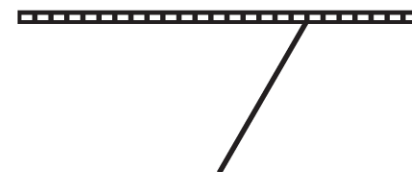


- (A) 64°
 (C) 164°
 (B) 74°
 (D) 174°

19. Carmen has a \$30 gift card for her favorite online store. She is hoping to buy 4 bracelets. She knows the bracelets will be priced the same but also knows she needs to allow for the \$6 shipping fee. Use the inequality $4p + 6 \leq 30$, where p represents the cost of each bracelet, to find the maximum price she can afford to pay per bracelet. (pp. P285–P286)

- (A) $p \leq \$5$
 (C) $p \leq \$8$
 (B) $p \leq \$6$
 (D) $p \leq \$9$

20. Emma looked at the way one of the painted parking lot lines met the curb. She incorrectly described the angles formed as vertical angles. Which term below would describe the two angles correctly? (pp. P287–P288, P289–P290)



- (A) acute
 (C) equal
 (B) complementary
 (D) supplementary

Name _____

Samples and Surveys

Essential Question How can you learn about a population by taking a sample?

A **survey** is a method of gathering information about a group. Surveys are usually made up of questions or other items that require responses. You can survey a population, which is the entire group of individuals or objects. If the population is large, you can survey a part of the population, called a **sample**.

UNLOCK the Problem REAL WORLD

Ron surveys students at his school about their favorite pizza toppings. He surveys the first 25 students to walk into school on Monday morning. What sampling method does he use?

Math Idea

Underline the sentence that tells you what you are trying to find.

Identify the sampling method.

A **sampling method** is a way to choose a sample of a population. The table summarizes some sampling methods.

Sampling Method	Definition	Example
Random Sampling	Every individual or object has an equal chance of being chosen for the survey.	Assign a number to every student in the school. Then use a computer to randomly select numbers.
Convenience Sampling	Individuals or objects that are easily available are chosen for the survey.	Choose a convenient location, such as the library, and survey students as they enter.
Systematic Sampling	Choose a random individual or object as the starting point and then use a pattern to choose additional individuals or objects.	Randomly choose a name from a list of all students and then choose every 10th name after that.

Describe how Ron chooses the sample for his survey.

He surveys the first 25 students to walk into the school.

So, Ron uses convenience sampling.

Possible answer: When the population is large, it may be difficult or impossible to choose a random sample.

Math Talk

Describe why someone might use a convenience sample rather than a random sample.

Try This!

Meg takes a similar survey. She chooses one name at random from a list of all students at the school. Then she chooses every 15th name after that. What sampling method does she use?

systematic sampling

Share and Show



Identify the sampling method.

1. Brianna randomly chooses 20 names from a database of all students at her school.

Every student has an equal chance of being chosen. So, Brianna's method is

random sampling

2. Jorge randomly chooses one name from a phone list of all employees at his company. Then he chooses every 10th name after that.

systematic sampling

On Your Own

Identify the sampling method.

3. Mitchell stands at the exit of a train station and surveys 25 commuters as they leave the station.

convenience sampling

5. A caterer randomly chooses 20 names from a list of clients and surveys them to see if they are satisfied with his service.

random sampling

4. Marie wants to survey owners of pet stores in her city. She chooses the name of a pet store from the phone book. Then she chooses every 3rd pet store after that.

systematic sampling

6. Ray wants to know how many books people in his town read each month. He surveys the first 50 people that walk into a grocery store.

convenience sampling

Problem Solving



7. A manager wants to know how many of the light bulbs that a factory produces might be defective. She randomly chooses and tests 30 light bulbs produced at the factory. Identify the sampling method the manager used.

random sampling

8. Lashonda wants to know the favorite type of music of teens in her town. She surveys 10 students sitting near her at lunch. Identify the sampling method she used.

convenience sampling

Name _____

Make Predictions from Samples**Essential Question** How can you use a sample to make a prediction about a population?

You can use equivalent ratios to make predictions about samples.

UNLOCK the Problem REAL WORLD

There are 90 sixth graders at Webb Middle School. In a randomly selected sample of 25 sixth graders at the school, 20 said that they spend more than 3 hours per week exercising. Based on the sample, predict how many of the sixth graders at Webb Middle School spend more than 3 hours exercising per week.

Find equivalent ratios by using a unit rate.**STEP 1**

Write ratios that compare the number of students that exercise more than 3 hours per week to total number of students.

$$\frac{20}{25} = \frac{\square}{90}$$

STEP 2

90 is not a multiple of 25.

Write the known ratio as a unit rate.

$$\frac{20 \div 25}{25 \div 25} = \frac{\square}{90}$$

$$\frac{0.8}{1} = \frac{\square}{90}$$

STEP 3Write an equivalent rate by multiplying the numerator and the denominator by the same value.Think: Multiply 1 by 90 to get 90.So, multiply the numerator by 90 also.

$$\frac{0.8 \cdot 90}{1 \cdot 90} = \frac{72}{90}$$

So, based on the sample, 72 students out of the 90 sixth graders at Webb Middle School are predicted to spend more than 3 hours per week exercising.

Math Talk

Explain how you know that your prediction is reasonable.

Possible answer: More than half of the students in the sample spend more than 3 hours per week exercising, so the prediction should be more than half of the students in the school.

Share and Show



1. There are 80 children registered for a swimming contest. In a randomly selected sample of 15 children, 3 were over the age of 12. Based on the sample, predict how many contestants are over the age of 12.

16 children

$$\frac{3}{15} = \frac{\square}{80}$$
$$3 \div \frac{15}{15} = \frac{\square}{80}$$
$$\frac{0.2}{1} = \frac{\square}{80}$$
$$0.2 \cdot \frac{80}{80} = \frac{16}{80}$$
$$1 \cdot \frac{80}{80}$$

2. A comic book store carries 80 different titles. In a randomly selected sample of 10 titles, 2 had been published in the last year. Based on the sample, predict how many titles in the store had been published in the last year.

16 titles

3. Annita has 300 songs on her computer. In a randomly selected sample of 12 songs, 4 songs were rock. Base on the sample, predict how many rock songs Annita has.

100 songs

On Your Own

4. A car dealership has 200 cars in the parking lot. In a randomly selected sample of 25 cars, 6 cars were white. Based on the sample, predict how many cars at the dealership are white.

48 cars

5. There are 480 pages in a sixth grade math book. In a randomly selected sample of 40 pages, 15 had color pictures on them. Based on the sample, predict how many pages in the entire book have color pictures.

180 pages

Problem Solving



6. There are 170 students at Riverdale Middle School. In a randomly selected sample of 30 students, 12 said that they would attend the play. Based on the sample, predict how many students at Riverdale Middle School will attend the play.

68 students

7. The Widget Factory produces 500 widgets in one hour. In a randomly selected sample of 20 widgets, 2 were found to be defective. Based on the sample, predict how many widgets produced in one hour are defective.

50 widgets

Name _____

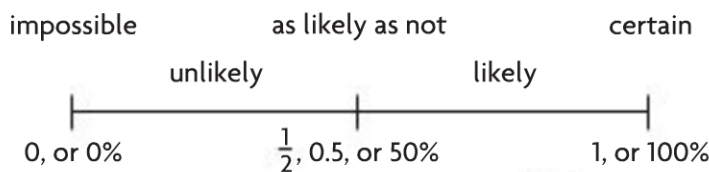
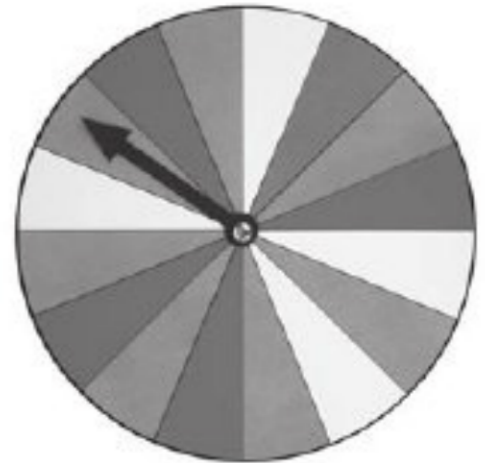
Probability and Likelihood

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

An **experiment** is an activity involving chance where the results are observed or measured, such as spinning a spinner. A possible result of an experiment is an **outcome**.

The **sample space** of an experiment is the set of all possible outcomes.

An **event** is a set of one or more outcomes. The **probability** of an event measures the likelihood that the event will occur. Probabilities range from 0 (the event is impossible) to 1 (the event is certain).



UNLOCK the Problem REAL WORLD

A number cube used in a board game has faces labeled 1 to 6. Describe each event as *impossible*, *unlikely*, *as likely as not*, *likely*, or *certain*.

A. Evelyn rolls the number cube and gets a 6.

unlikely

B. James rolls the number cube and gets an even number.

as likely as not

C. Stefan rolls the number cube and gets a number

greater than 0. certain

Math Idea

When rolling a six-sided number cube, an impossible event would be rolling a 9.

Possible answer: a number less than 7 will be rolled with a six-sided number cube labeled 1 to 6.

Math Talk

Give an example of an event that is certain to happen.

Try This! According to a weather forecast, the probability that it will rain on Monday is 70%. Describe the likelihood of rain on Monday as impossible, unlikely, as likely as not, likely, or certain.

likely

Share and Show



A spinner has 10 equal-sized sections that are numbered 1–10. Describe each event as *impossible*, *unlikely*, *as likely as not*, *likely*, or *certain*.

1. spinning a 4 or 5

unlikely

2. spinning a number greater than 2

likely

3. spinning an even number

as likely as not

4. spinning a number less than 9

likely

On Your Own

A jar contains 10 marbles. There are 1 green, 1 red, and 8 blues. A marble is picked at random. Describe each event as *impossible*, *unlikely*, *as likely as not*, *likely*, or *certain*.

5. picking a blue

likely

6. picking a yellow

impossible

Describe each event as *impossible*, *unlikely*, *as likely as not*, *likely*, or *certain*.

7. The probability that Jack throws a paper ball into a wastebasket is 16%.

unlikely

8. There is a 50% chance of snow on Tuesday.

as likely as not

Problem Solving



9. The probability that Marguerite will win a game is 20%. Describe the event of Marguerite winning as impossible, unlikely, as likely as not, or certain.

unlikely

10. A spinner has 5 equal-sized sections. The sections are numbered 1–5. If Jeff spins the spinner, describe the likelihood that he spins a number less than 5.

likely

Name _____

Write Probabilities

Essential Question How can you write the probability of an event?

You can write the probability of an event as a fraction, decimal, or percent.

UNLOCK the Problem REAL WORLD

A restaurant is having a prize giveaway. The probability that a customer will win a prize is $\frac{1}{8}$. Write this probability as a decimal and as a percent.

STEP 1 Write the probability as a decimal. Divide the numerator by the denominator.

$$\frac{1}{8} = 1 \div 8$$

0.125
8)1.000
8
20
16
40
40

$$\frac{1}{8} = 1 \div 8 = \underline{0.125}$$

STEP 2 Write the probability as a percent. Multiply the decimal by 100, and include a percent sign.

$$0.125 = \underline{12.5\%}$$

STEP 3 Check that 12.5% is correct.

$$12.5\% = \frac{12.5}{100} = \frac{125}{1,000} = \frac{1}{8}$$

Unlikely; the probability is much less than 50%.

Math Talk Describe the likelihood that a customer will win a prize.

Try This! Write the probability in two different ways.

A. The probability of rain on Wednesday is 85%.

Fraction: $\frac{85}{100} = \frac{\boxed{17}}{\boxed{20}}$

Decimal: 0.85

B. The probability of scoring a point is 0.625.

Fraction: $\frac{\boxed{5}}{\boxed{8}}$ Percent: 62.5%

Share and Show



Write the probability in two different ways.

1. The probability of a light bulb being defective is 15%.

Fraction: $\frac{15}{100} = \frac{3}{20}$

Decimal: 0.15

2. The probability of a thunderstorm occurring today is 0.66.

Fraction: $\frac{66}{100} = \frac{33}{50}$

Percent: 66%

On Your Own

Write the probability in two different ways.

3. Sarah randomly chooses a cookie from a jar. The probability that the cookie is peanut butter is $\frac{3}{5}$.

Decimal: 0.6

Percent: 60%

4. The probability that a player wins a prize at a carnival is 5%.

Decimal: 0.05

Fraction: $\frac{1}{20}$

5. The probability that Jan makes a free throw is 0.94.

Percent: 94%

Fraction: $\frac{47}{50}$

6. The probability that Max wins a competition is $\frac{9}{20}$.

Decimal: 0.45

Percent: 45%

Problem Solving

REAL WORLD

Write the probability in two different ways.

7. A teacher will randomly choose a student to help with decorations for an upcoming dance. The probability that Raymond will be chosen is 0.08.

8%; $\frac{2}{25}$

8. Melvin tries to throw a ball into a cup. The probability that he makes the shot is $\frac{27}{40}$.

0.675; 67.5%

Name _____

Experimental Probability

Essential Question How can you calculate the experimental probability of an event?

A **trial** is one performance of an experiment. The **experimental probability** of an event is the ratio of the number of times the event occurs to the total number of trials of the experiment.

Each time an experiment is performed is called a **trial**.


Experimental Probability

$$P(\text{event}) = \frac{\text{number of times that the event occurs}}{\text{total number of trials}}$$

UNLOCK the Problem REAL WORLD

A spinner has 16 sections that are red, orange, yellow, or green. Cara spins the pointer 20 times and records her results in the table. Write each probability as a fraction, decimal, and percent. What color is the most likely result of a spin?

Color	Frequency
Red	2
Orange	11
Yellow	4
Green	3

 Write each probability as a fraction, decimal, and percent.

$$P(\text{red}) = \frac{2}{20} = \frac{1}{10} \text{ or } 0.1 \text{ or } 10\%$$

$$P(\text{orange}) = \frac{11}{20} \text{ or } \mathbf{0.55} \text{ or } \mathbf{55\%}$$

$$P(\text{yellow}) = \frac{\boxed{4}}{20} = \frac{1}{\boxed{5}} \text{ or } \mathbf{0.2} \text{ or } \mathbf{20\%}$$

$$P(\text{green}) = \frac{\boxed{3}}{\boxed{20}} \text{ or } \mathbf{0.15} \text{ or } \mathbf{15\%}$$

So, orange is the most likely result of a spin because this color has the greatest experimental probability.

Math Talk Explain how you compared the experimental probabilities.

Possible explanation:
Compare the percents: 55% > 20% > 15% > 10%.

Try This! Amirah and Scott each roll a number cube at the same time, and they record the sum. They performed 50 trials, and rolled a sum of 5 seven different times. Find the experimental probability of rolling a sum of 5.

$$P(5) = \underline{7} \text{ out of } \underline{50}, \text{ or } \underline{14}\%$$

Share and Show



Dylan randomly selects a marble from a bag and replaces it. He does this a total of 40 times and records his results in the table. Use the table to find the experimental probability. Write the probability as a fraction, decimal, and percent.

Color	Red	Blue	Green
Frequency	12	20	8

1. $P(\text{red})$

$$= \frac{12}{40} = \frac{3}{10}$$

$$= \underline{0.3} = \underline{30\%}$$

2. $P(\text{blue})$

$$\underline{\frac{1}{2} = 0.5 = 50\%}$$

3. $P(\text{green})$

$$\underline{\frac{1}{5} = 0.2 = 20\%}$$

On Your Own

A spinner has 10 sections, labeled 1–10. Trey spins the spinner and records his results each time. Use the results in the table to find the experimental probability. Write the probability as a percent.

4. spinning a 4

$$\underline{10\%}$$

5. spinning a 1

$$\underline{15\%}$$

6. spinning a 7

$$\underline{0\%}$$

7. spinning a 9 or 10

$$\underline{20\%}$$

9	2	3	10	8
3	2	6	5	8
1	4	9	3	4
1	10	2	1	6

Problem Solving



8. Ling tossed two coins, at the same time, 5 times. Her results were TT, TH, TH, HH, and HT. What is her experimental probability of flipping two tails? Express your answer as a decimal, fraction, and percent.

$$\underline{\frac{1}{5}, 0.2, 20\%}$$

9. The letters R, A, N, D, O, and M are written on cards and placed in a bag. Jack randomly chooses and replaces a card several times. Find the experimental probability of picking an N. Express your answer as a percent.

Letter	R	A	N	D	O	M
Frequency	0	2	3	1	2	4

$$\underline{25\%}$$

Name _____

Checkpoint

Check Concepts and Skills

Identify the sampling method. (pp. P297–P298)

1. Sam wants to know which genre of movie is the favorite among his classmates. He randomly chooses 15 names from a list of the students in his class.
2. Shaelun is interested in finding the number of students in her school who like math. She asks the people on her team in gym class.

random sampling

convenience sampling

Write the probability in two different ways. (pp. P303–P304)

3. The probability of precipitation is 30%.

Fraction: $\frac{3}{10}$ Decimal: 0.3

4. The probability of picking a diamond from a standard deck of cards is $\frac{1}{4}$.

Decimal: 0.25 Percent: 25%

5. The probability that Jiho will select a blue marble from a bag is 0.19.

Fraction: $\frac{19}{100}$ Percent: 19%

6. The probability that the pointer will land on red when Yvette spins a prize wheel is $\frac{1}{20}$.

Decimal: 0.05 Percent: 5%

Problem Solving



Valerie places some cards in a bag. Each card shows a color. She randomly chooses and replaces a card 20 times. Use the results in the table to find the experimental probability indicated. Express your answer as a percent. (pp. P305–P306)

Color	Red	Yellow	Blue	Green	Orange	Purple	Black	Brown
Frequency	2	5	3	0	2	2	3	3

7. What is the experimental probability of choosing an orange card?
8. What is the experimental probability of choosing a yellow card?

10%

25%