Simple Probability, Bar and Circle Graphs Spreadsheet

Mathematics

6.9 The student uses experimental and theoretical probability to make predictions. The student is expected to

(B) find the probabilities of a simple event and its complement and describe the relationship between the two.

6.10 The student uses statistical representations to analyze data.

(A) select and use an appropriate representation for presenting and displaying different graphical representations of the same data including line plot, line graph, bar graph, and stem and leaf plot.

(C) sketch circle graphs to display data.

(D) solve problems by collecting, organizing, displaying, and interpreting data.

Technology Applications

The student demonstrates knowledge and appropriate use of hardware components, software programs, and their connections. The student is expected to:

(1)(a) demonstrate knowledge and appropriate use of operating systems, software applications, and communicate and networking components.

(1)(c) demonstrate the ability to select and use software for a defined task according to quality, appropriateness, effectiveness, and efficiency.

(1)(f) perform basic software application function including, but not limited to, opening an application program and creating, modifying, printing, and saving documents.

The student uses appropriate computer-based productivity tools to create and modify solutions to problems. The student is expected to:

(7)(b) plan, create, and edit spreadsheet documents using all data types, formulas and functions, and chart information.

Materials

Advanced Preparation:

- Students should have access to computers with a spreadsheet program and/or a projection device to use a spreadsheet as a class demonstration.
- Copy the **Prize Dilemma** and **Spinner Creation** transparencies for the overhead.
- Copy the **Activity Master: Let's Match It** onto colored card stock and cut into sets one for each student group.

For each student:

- **What Color?** activity sheet
- **You Design It** activity sheet

Simple Probability, Bar and Circle Graphs Spreadsheet

For each student group of 3 - 4 students:

- Chart paper
- Markers
- Rulers
- Compass or large circular objects
- Protractors
- Color Tiles
- Paper bag (lunch size)
- **Let's Match It** card set

For whole group instruction:

- Transparencies: **Prize Dilemma** and **Spinner Creation**

Simple Probability, Bar and Circle Graphs Spreadsheet

ENGAGE

The Engage portion of the lesson is designed to create student interest in the development and understanding of simple probability as well as the creation of bar graphs and circle graphs. This part of the lesson is designed for groups of 3 to 4 students.

1. Place **Prize Dilemma** transparency on the overhead.
2. Distribute a piece of chart paper and markers to each student group.
3. Give student groups time to work the problem and record their solution on chart paper.

Facilitation Questions – Engage Phase

- Which spinner should the store choose? Why? *Spinner D, the spinner contains the smallest amount of area for cameras.*
- Which spinner should the customer choose? Why? *Spinner A, the spinner contains the largest amount of area for cameras.*
- How many different prizes are available? *4 (DVD, CD, Games and Camera)*
- Which spinner would allow an equal chance of winning each prize? *Spinner A, because all section are the same size.*
- In spinner A, how could you describe the chances of landing on a space labeled CD? DVD? Video Game? Camera? *1 out of 4 for each prize*
- Which spinner provides the greatest chance of winning the CD? How did you determine the answer? *Spinner C, more sections are assigned CD, and CD's cover half the circle.*
- In spinner C, how could you describe the chances of landing on a space labeled CD? *1 out 2*
- In spinner C, how could you describe the chances of landing on a space labeled DVD? Video Game? Camera? *1 out of 6 for each prize.*
- Which spinner would give a customer a 3 out of 8 chance of winning a CD? How did you determine the answer? *Spinner D, because it has eight section and three of them are CD's.*

All questions should be extended with a follow-up question like "How did you determine the answer?" or "Did anyone get the answer using a different strategy?"

4. Place **Spinner Creation** transparency on the overhead.
5. Distribute a second piece of chart paper, rulers, protractors and compasses (or large round objects to make circles on the chart paper.)
6. Give student groups time to create the spinners on the piece of chart paper.
7. Use a Gallery Tour to allow students to examine other groups' solutions to all the questions: Prize Dilemma and Spinner Creation.
8. Use the Facilitation Question on the next page to debrief Gallery Tour.

Facilitation Questions – Engage Phase

- What do you notice about the spinners that were created for the electronics store to use so that it would never have to give away a digital camera? *Answers may vary. Digital cameras are not found on the spinner.*
- What is the probability of landing on a digital camera for these spinners? Why? *Zero*, *because the digital camera is not a possible outcome.*
- What do you notice about the spinners that were created for the electronics store to use so that the customer would always win a digital camera? *Answers may vary. The whole spinner is digital camera.*
- What is the probability of landing on a digital camera for these spinners? Why? *100%, because the digital camera is the only possible outcome.*
- In the spinner you created so that the customer's chance of winning a DVD was better than a video game, how many sections did you label DVD and how many sections did you label video game? *Answers may vary*
- In the spinner you created so that the customer's chance of winning a CD was the same as not winning a CD, how many of the sections did you label CD and how many did you not label CD? *Answers may vary.*

* All questions should be extended with a follow-up question like "How did you determine the answer?" or "Did anyone get the answer using a different strategy?"

EXPLORE

The Explore portion of the lesson provides the student with an opportunity to be actively involved in the exploration of the mathematical concepts addressed. This part of the lesson is designed for groups of three to four students.

1. Distribute the **What Color?** activity sheet.
2. Distribute a sheet of chart paper, a paper bag, some red color tiles, some blue color tiles, and some green color tiles to each student group.
3. Students will need access to the spreadsheet **What Color?**
4. Allow student groups time to work through the activity sheet.
   Note: If students are not familiar with the operation of a spreadsheet, they will need the necessary instruction at this time. Use a Gallery Tour to allow students to examine other groups' solutions.

Facilitation Questions – Explore Phase

- What fraction of the color tiles is red? How did you determine the answer? $\frac{3}{5}$
- What percent of the color tiles is red? How did you determine the answer? *60%*
- What fraction of the color tiles is blue? How did you determine the answer? $\frac{1}{5}$
- What percent of the color tiles is blue? How did you determine the answer? *20%*
- What fraction of the color tiles is green? How did you determine the answer? $\frac{1}{5}$
- What percent of the color tiles is green? How did you determine the answer? *20%*
- What is another way without using a fraction to describe the chance of getting each color? *3 out of 5 chances to get red, 1 out of 5 chances to get blue, and 1 out of 5 chances to get green.*
- What information do you need to sketch a circle graph?
  The number of sections needed to divide the circle into, and the labels of each section.
- How can you determine the number of times you will draw a particular color if you increase the number of draws from the bag?
  Multiply the fraction of getting the color you want from the original problem by the scale factor used to enlarge the set.

EXPLAIN

The Explain portion of the lesson is directed by the teacher to allow the students to formalize their understanding of the TEKS addressed in the lesson.

1. Debrief the **What Color?** activity.

Facilitation Questions – Explain Phase

- How did you and your group determine how many tiles of each color to put in the bag? *Counted the number of reds, blues, and greens from the bar graph.*
- How did you and your group determine the likelihood Mary would draw a red tile? *Determined the number of red tiles in the bag compared to the total number of tiles in the bag.*
- What does this part-whole ratio represent? *The numerator represents the number of tiles there are of one color, and the denominator represents the total number of tiles.*
- How did you and your group determine the likelihood Mary would draw a blue tile? *Determined the number of blue tiles in the bag compared to the total number of tiles in the bag.*
- What part-whole ratio represents the likelihood that Mary would draw a blue tile? $\frac{1}{5}$
- What does this part-whole ratio represent? *The numerator represents the number of blue tiles, and the denominator represents the total number of tiles.*
- How did you and your group determine the likelihood Mary would draw a green tile? *Determined the number of green tiles in the bag compared to the total number of tiles in the bag.*
- What part-whole ratio represents the likelihood that Mary would draw a green tile? $\frac{1}{5}$
- What does this part-whole ratio represent? *The numerator represents the number of green tiles, and the denominator represents the total number of tiles.*
- A part-whole relationship describes the theoretical probability of getting a particular outcome. What is the theoretical probability of drawing a red tile? $\frac{3}{5}$ A blue tile? $\frac{1}{5}$ A green tile? $\frac{1}{5}$

* All questions should be extended with a follow-up question like "How did you determine the answer?" or "Did anyone get the answer using a different strategy?"

Facilitation Questions – Explain Phase

- What is the theoretical probability of not drawing a red tile? $\frac{2}{5}$
- What do you notice about the theoretical probability of drawing a red tile and not drawing a red tile? *The sum of the probabilities is 1.*
- What is the theoretical probability of not drawing a blue tile? $\frac{3}{5}$
- What do you notice about the theoretical probability of drawing a blue tile and not drawing a blue tile? *The sum of the probability is 1.*
- What is the theoretical probability of not drawing a green tile? $\frac{3}{5}$
- What do you notice about the theoretical probability of drawing a green tile and not drawing a green tile? *The sum of the probabilities is 1.*
- How did you and your group determine how many of the tiles in the 100 draws should be red, blue, and green? *Answers may vary. Students should say something about converting the fractions to percentages using benchmark mark fractions.*
- How could you find the theoretical probability of drawing a particular color if the number of draws was a number other than the original 5 or 100? *Determine the scale factor used to generate the number of draws compared to the original 5 tiles. Then multiply the theoretical probability of getting the particular color by the scale factor.*
- If Mary drew 25 tiles from the bag, how many of the tiles should be red? *15* How did you determine the answer?
- If Mary drew 25 tiles from the bag, how many of the tiles should be blue? *5* How did you determine the answer?
- If Mary drew 25 tiles from the bag, how many of the tiles should be green? *5* How did you determine the answer?
- How does the spreadsheet create the circle graph? *Find the total number of sections to know how many sections to make and then label each section according to the number of each color.*
- How did you and your group create a circle graph? *Divided the circle into the same number of sections as total tiles in the bag. Labeled each section to correspond to each of the color tiles.*
- Which one of the graphs (bar or circle), if either, tells you more about the data than the other? *Answers may vary.*

* All questions should be extended with a follow-up question like “How did you determine the answer?” or “Did anyone get the answer using a different strategy?”

ELABORATE

The Elaborate portion of the lesson provides an opportunity for the student to apply the concepts of the TEKS within a new situation. This part of the lesson is designed for groups of three to four students.

1. Distribute to each student group a set of **Let's Match It** cards, a sheet of chart paper, and markers.
2. Inform students that they will be matching a graph card to a spinner card and 5 statement cards that would match the graph and spinner.
3. Allow student groups time to work through the activity.
4. Assign each student group one match to put on chart paper.

Facilitation Questions – Elaborate Phase

- How did your group decide how to sort the cards?
  Put the bar graphs together, the circle graphs together, and the description cards together.
- How did your group determine which bar graph and which circle graph to match together?
  Look to see what the total number of items is for both, and then look at the number of each color.
- How did your group decide which cards to match with the circle graphs and the bar graph?
  Answers may vary. Students should describe how they looked at the card and then tried to determine which circle graph had the probability listed on the card.
- How did your group check to make sure your match was accurate?
  Answers may vary.

EVALUATE

The Evaluate portion of the lesson provides the student with an opportunity to demonstrate his or her understanding of the TEKS addressed in the lesson.

1. Distribute the **You Design It** activity sheet to each student.
2. Upon completion of the activity sheet, use a rubric to assess student understanding of the concepts addressed in the lesson.

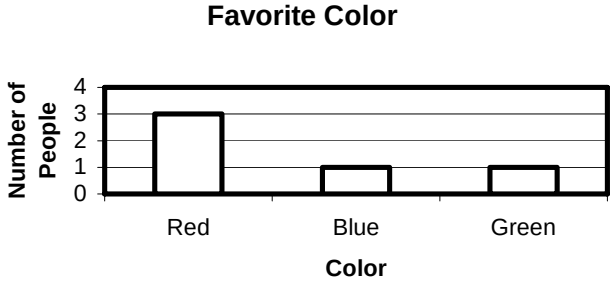
Simple Probability, Bar and Circle Graphs Spreadsheet

Answers and Error Analysis for selected response questions:

Question Number	*TEKS*	*Correct Answer*	*Conceptual Error*	*Conceptual Error*	*Procedural Error*	*Procedural Error*	*Guess*
1	6.9B	D	B	C	A		
2	6.9B	A	B	C	D		
3	6.10C	A	C		B	D	
4	6.10D	B	C	D	A		

What Color? - (Possible Answers)

Mary conducted a survey to determine the favorite color of 5 students in her advisory class. The results are shown in the bar graph below.



She then took a color tile and let it represent the color of each student's vote and put it in a bag.

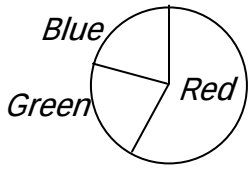
1. How many color tiles of each color should she put in the bag? Justify your answer.
   3 red, 1 blue, and 1 green

2. If Mary draws a color tile at random out of the bag, how likely is she to draw a red tile? Why?
   3 chances out of 5

3. If Mary draws a color tile at random out of the bag, how likely is she to draw a blue tile? Why?
   1 chance out of 5

4. If Mary draws a color tile at random out of the bag, how likely is she to draw a green tile? Why?
   1 chance out of 5

5. Sketch a circle graph to represent what part of the whole each color tile represents in the Favorite Color data.



6. Transfer your sketch onto a piece of chart paper.

7. Record on the chart paper: What are the similarities and differences in the circle graph you drew and the bar graph you were given?

(Continue: What Color?)

Mary wanted to conduct an experiment using the bag of tiles she created based on the information in the Favorite Color graph. She decided she would draw a tile out of the bag, record the color of the tile, return the tile to the bag, and draw again. She decided to repeat this process for 25 draws.

8. How many of the 25 draws should Mary expect to be red? Why?
   15

9. How many of the 25 draws should Mary expect to be blue? Why?
   5

10. How many of the 25 draws should Mary expect to be green? Why?
    5

You will need to model the same experiment that Mary did.

- **Create a frequency table like the one below on the chart paper**
- **Put a color tile for each student vote in the bag**
- **Draw a color tile at random from the bag**
- **Record the color of the tile on the chart paper and worksheet**
- **Return the tile to the bag**
- **Repeat this process 25 times**

Color	Tally	Frequency
Red		
Blue		
Green		

The number of tiles you actually draw from the bag in an experiment is called the *Experimental Probability*.

11. What was your experimental probability of drawing a red?
    Answers may vary.

12. What was your experimental probability of drawing a blue?
    Answers may vary.

13. What was your experimental probability of drawing a green?
    Answers may vary.

(Continue: What Color?)

14. How did the number of red tiles you drew compare to the number you said Mary should have drawn?
    Answers may vary.

15. How did the number of blue tiles you drew compare to the number you said Mary should have drawn?
    Answers may vary.

16. How did the number of green tiles you drew compare to the number you said Mary should have drawn?
    Answers may vary.

17. How close was your prediction to the actual results?
    Answers may vary.

Open the *What Color?* spreadsheet file.

- **Select *Sheet 1* and follow the directions to simulate the experiment.**
- **Select *Sheet 2* and follow the directions to create a circle graph.**

Color	Tally	Frequency
Red		
Blue		
Green		

The number of tiles of one color in the bag compared to total number of tiles in the bag is called the *Theoretical Probability* of selecting a tile of that color.

18. How close was your prediction to the actual results? (Record your response on the chart paper.)

19. What could you do to get your experimental probability to be closer to the theoretical probability? (Record your response on the chart paper.)
    Perform more trials.

You Design It - (Possible Answers)

Open a spreadsheet document. Use the spreadsheet to design a spinner that has each of the theoretical probabilities listed in the table.

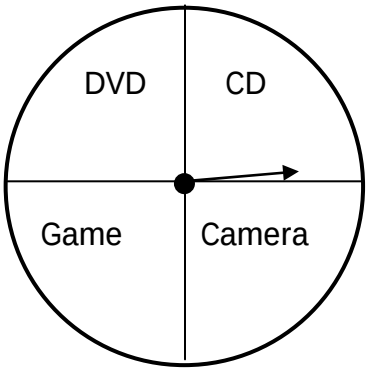
P(Red)	$= \frac{1}{3}$
P(Blue)	$= \frac{1}{4}$
P(Green)	$= \frac{1}{4}$
P(Yellow)	$= \frac{1}{6}$

Explain how you designed your spinner.

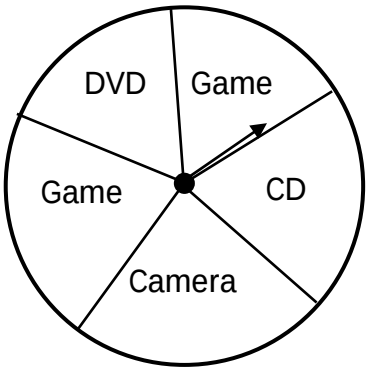
Answers may vary. However, the spinner should have 12 sections with 4 labeled red, 3 labeled blue, 3 labeled green, and 2 labeled yellow.

Prize Dilemma - Transparency

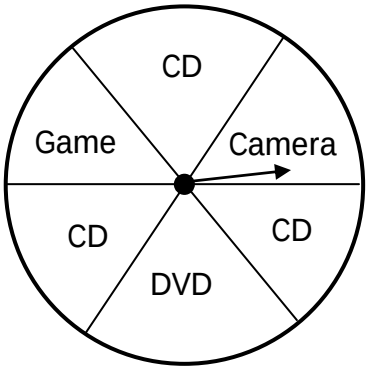
An electronics store is giving away prizes to its customers. Each customer will spin a spinner and receive the prize that the spinner lands on. The four spinners shown below are the spinners the company is considering using.



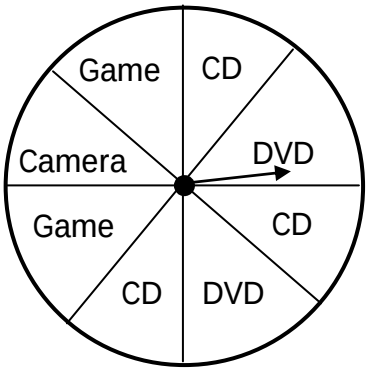
Spinner A



Spinner B



Spinner C



Spinner D

1. If the store wants to give away as few digital cameras as possible, which spinner should it offer each customer to use? Justify your answer.

2. If a customer can select any spinner and he or she wants the best chance to win the digital camera, which spinner should he or she use? Justify your answer.

Spinner Creation - Transparency

3. Create a spinner for the electronics store to use so that it would never have to give away a digital camera. Justify your spinner.

4. Create a spinner that the customer could use so that he or she would win a digital camera every time. Justify your spinner.

5. Create a spinner so the customer's chance of winning a DVD is better than the chance of winning a video game. Justify your spinner.

6. Create a spinner so that the customer's chance of winning a CD is the same as not winning a CD. Justify your spinner.

Let's Match It - Activity Master

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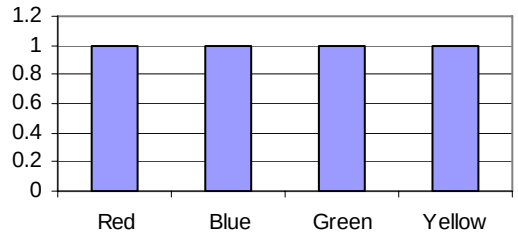
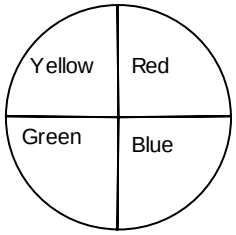
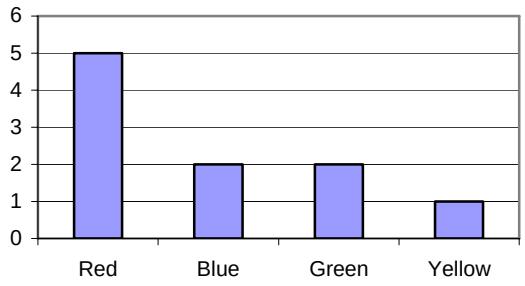
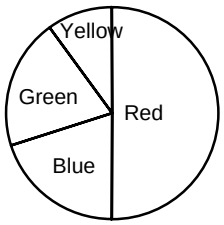
Let's Match It 	Let's Match It 
Let's Match It 	Let's Match It 

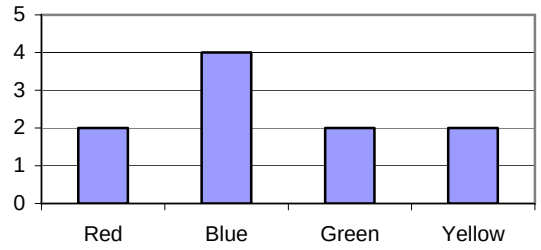
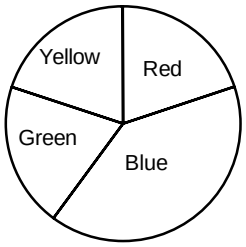
Let's Match It - Activity Master

	
The theoretical probability of drawing red is $\frac{1}{4}$.	The theoretical probability of NOT drawing green is $\frac{3}{4}$.
The theoretical probability of drawing yellow is $\frac{1}{4}$.	The theoretical probability of NOT drawing blue is $\frac{3}{4}$.
A bag contains four marbles: 1 red, 1 blue, 1 yellow, and 1 green marble.	

Let's Match It - Activity Master

	
The theoretical probability of NOT drawing red is $\frac{1}{2}$.	The theoretical probability of drawing blue is $\frac{1}{5}$.
The theoretical probability of drawing green is $\frac{1}{5}$.	The theoretical probability of NOT drawing yellow is $\frac{9}{10}$.
A bag contains 10 marbles: 5 red, 2 blue, 1 yellow, and 2 green marbles.	

Let's Match It - Activity Master

	
The theoretical probability of drawing red is $\frac{1}{5}$.	The theoretical probability of NOT drawing blue is $\frac{3}{5}$.
The theoretical probability of NOT drawing yellow is $\frac{4}{5}$.	The theoretical probability of drawing green is $\frac{1}{5}$.
A bag contains 10 marbles: 2 red, 4 blue, 2 yellow, and 2 green marbles.	

Let's Match It - Activity Master

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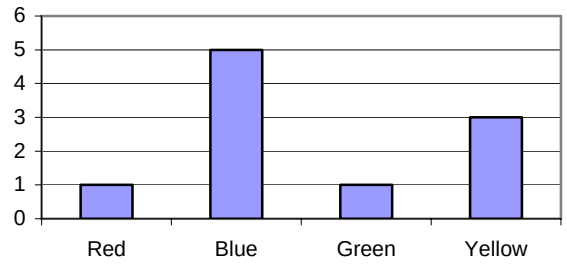
<tr>
<td> 
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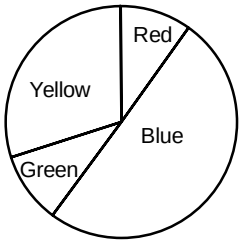
<td> 
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<tr>
<td>The theoretical probability of NOT drawing yellow is $\frac{7}{10}$.</td>
<td>The theoretical probability of drawing green is $\frac{1}{10}$.</td>
</tr>
<tr>
<td>The theoretical probability of NOT drawing blue is $\frac{1}{2}$.</td>
<td>The theoretical probability of drawing red is $\frac{1}{10}$.</td>
</tr>
<tr>
<td>A bag contains 10 marbles: 1 red, 5 blue, 3 yellow, and 1 green marble.</td>
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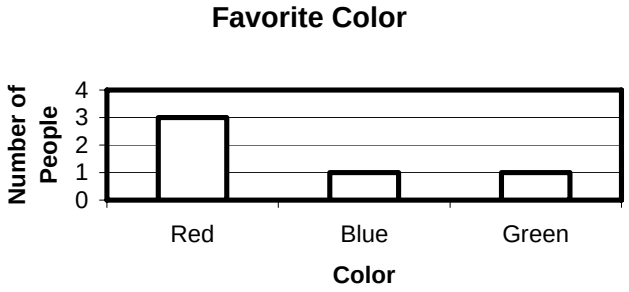
</table>

Simple Probability, Bar and Circle Graphs Spreadsheet

What Color?

Mary conducted a survey to determine the favorite color of 5 students in her advisory class. The results are shown in the bar graph below.



She then took a color tile and let it represent the color of each student's vote and put it in a bag.

1. How many color tiles of each color should she put in the bag? Justify your answer.

2. If Mary draws a color tile at random out of the bag, how likely is she to draw a red tile? Why?

3. If Mary draws a color tile at random out of the bag, how likely is she to draw a blue tile? Why?

4. If Mary draws a color tile at random out of the bag, how likely is she to draw a green tile? Why?

5. Sketch a circle graph to represent what part of the whole each color tile represents in the Favorite Color data.

6. Transfer your sketch onto a piece of chart paper.

7. Record on the chart paper: What are the similarities and differences in the circle graph you drew and the bar graph you were given?

(Continue: What Color?)

Mary wanted to conduct an experiment using the bag of tiles she created based on the information in the Favorite Color graph. She decided she would draw a tile out of the bag, record the color of the tile, return the tile to the bag, and draw again. She decided to repeat this process for 25 draws.

8. How many of the 25 draws should Mary expect to be red? Why?

9. How many of the 25 draws should Mary expect to be blue? Why?

10. How many of the 25 draws should Mary expect to be green? Why?

You will need to model the same experiment that Mary did.

- **Create a frequency table like the one below on the chart paper.**
- **Put a color tile for each student vote in the bag.**
- **Draw a color tile at random from the bag.**
- **Record the color of the tile on the chart paper and worksheet.**
- **Return the tile to the bag.**
- **Repeat this process 100 times.**

Color	Tally	Frequency
Red		
Blue		
Green		

The number of tiles you actually draw from the bag in an experiment is called the *Experimental Probability*.

11. What was your experimental probability of drawing a red?

12. What was your experimental probability of drawing a blue?

13. What was your experimental probability of drawing a green?

(Continue: What Color?)

14. How did the number of red tiles you drew compare to the number you said Mary should have drawn?

15. How did the number of blue tiles you drew compare to the number you said Mary should have drawn?

16. How did the number of green tiles you drew compare to the number you said Mary should have drawn?

17. How close was your prediction to the actual results?

Open the *What Color?* spreadsheet file.

- **Select *Sheet 1* and follow the directions to simulate the experiment.**
- **Select *Sheet 2* and follow the directions to create a circle graph.**

Color	Tally	Frequency
Red		
Blue		
Green		

The number of tiles of one color in the bag compared to total number of tiles in the bag is called the *Theoretical Probability* of selecting a tile of that color.

18. How close was your prediction to the actual results? (Record your response on the chart paper.)

19. What could you do to get your experimental probability to be closer to the theoretical probability? (Record your response on the chart paper.)

You Design It

Open a spreadsheet document. Use the spreadsheet to design a spinner that has each of the theoretical probabilities listed in the table.

P(Red) = $\frac{1}{3}$
P(Blue) = $\frac{1}{4}$
P(Green) = $\frac{1}{4}$
P(Yellow) = $\frac{1}{6}$

Explain how you designed your spinner.

Simple Probability, Bar and Circle Graphs Spreadsheet

1 Alan has 3 peppermint candies, 8 cinnamon candies, 4 root beer candies, and 6 butterscotch candies in a bag. If he draws a piece of candy at random from the bag, what is the probability he will draw a piece of butterscotch candy?

A $\frac{5}{7}$

B $\frac{3}{5}$

C $\frac{2}{5}$

D $\frac{2}{7}$

2 Mary has a quarter to buy a gumball from a machine. In the machine there are 3 red gumballs, 4 blue gumballs, 3 yellow gumballs, and 2 green gumballs. What is the probability that Mary will NOT get a yellow gumball when she puts her quarter in the machine to buy a gumball?

A $\frac{3}{4}$

B $\frac{2}{3}$

C $\frac{1}{3}$

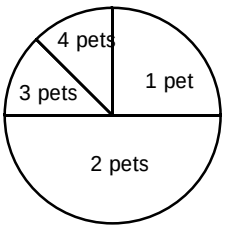
D $\frac{1}{4}$

3 Alicia conducted a survey about the number of pets people owned. The results of the survey are shown in the table below.

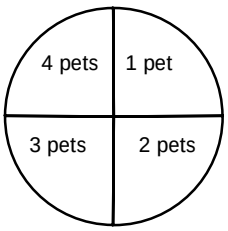
Number of Pets

Number of Pets	People
1	50
2	100
3	25
4	25

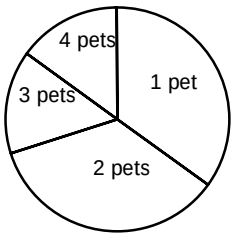
A

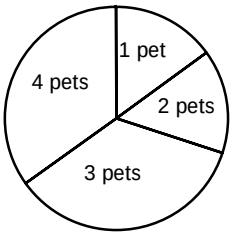


C

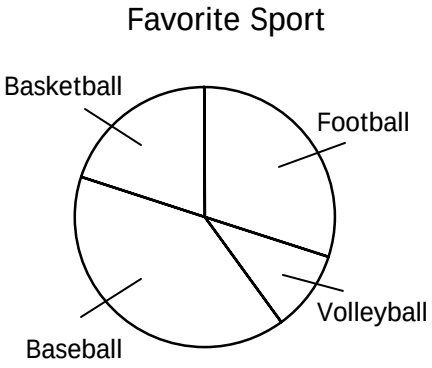


B





4 The circle graph shows the results of a survey about students' favorite sports.



Which statement is supported by the information in the circle graph?

A Football is the most popular sport.

B More people said baseball was their favorite sport than basketball.

C Basketball is the least favorite sport.

D More people said basketball was their favorite sport than football.