• Experimental Probability (page 470)

Name _____

Teacher Notes:
- Students require 6 marbles (4 green and 2 white) and a small, opaque bag to complete the activity. (If marbles are not available, use small objects that cannot be distinguished by touch, such as different colored paper clips.)
- Students may complete the experiment without a partner if one is not available.
- The extensions are optional.

- **Theoretical probability** is done by analyzing the structure of an experiment.
- Setting up a probability ratio to calculate the probability of rolling a certain number on a number cube is an example of theoretical probability.
- **Experimental probability** must be done by observation or by doing an experiment repeatedly.
- Many real-world situations need surveys for this.

  A pizza company wants to know what types of pizzas will be needed for a football game, so they ask 500 customers what type of pizza they would order: cheese, tomato, or mushroom.

- The number of customers who choose each type of pizza is the **frequency** for that type of pizza.
- Dividing the frequency by the total number of customers gives the **relative frequency.** The relative frequency is either a fraction or a decimal.
- Relative frequency can be used to estimate the probability that a type of pizza will be ordered.
- Showing the relative frequency as a percent gives the **chance** that a type of pizza will be ordered.

  Out of the 500 customers, 175 chose cheese, 225 chose tomato, and 100 chose mushroom. The chart shows the frequency, relative frequency, and percent chance for each type of pizza.

Type	Frequency	Relative Frequency	Chance
Cheese	175	$\frac{175}{500} = 0.35$	35%
Tomato	225	$\frac{225}{500} = 0.45$	45%
Mushroom	100	$\frac{100}{500} = 0.20$	20%

- The company plans to make 3000 pizzas for the football game. How many mushroom pizzas should they make?

  Multiply the relative frequency by the number of pizzas:

  $3000 \times 0.2 = 600$

  About **600 pizzas** should be mushroom.

INVESTIGATION 9 (continued) (page 471)

A town has 4 markets:

Bob's Market

The Corner Grocery

Express Grocery

Fine Foods

A sample of 80 adults were surveyed for their favorite market:

30 chose Bob's Market

12 chose Corner Grocery

14 chose Express Grocery

24 chose Fine Foods

1. Present the data in a relative frequency table similar to the one for pizza.

Store	Frequency	Relative Frequency	Chance
Bob's Market	30	$\frac{30}{80} = 0.375$	$37\frac{1}{2}\%$
Corner Grocery		$\frac{\quad}{80} = \_\_ . \_\_ \_\_$	
Express Grocery		$\frac{\quad}{80} = \_\_ . \_\_ \_\_ \_\_$	
Fine Foods		$\frac{\quad}{80} = \_\_ . \_\_$	

2. Estimate the probability that an adult's favorite market is Express Grocery. Write your answer as a **decimal.** _____

3. Estimate the probability that an adult's favorite market is Bob's Market. Write your answer as a **reduced fraction.** _____

4. Estimate the chance that an adult's favorite market is Fine Foods. Write your answer as a **percent.** _____

5. Suppose the town has 4000 adult residents. The Corner Grocery is the favorite market of about how many adults in the town? _____

Multiply 4000 by the relative frequency for Corner Grocery.

Activity : *Probability Experiment*

- This experiment will determine the probability that 2 green marbles will be drawn out of a bag at the same time.

6. Repeat the steps below exactly 25 times and record your results.

1. Place 4 green marbles and 2 white marbles in a bag.
2. Shake the bag.
3. Without looking in the bag, take two marbles.
4. Tally the results in the table.

Outcome	Tally
Both green	
Both white	
One of each	

7. Use your tally table to make a relative frequency table. (The frequency is the number of tallies for each result. Divide each frequency by 25 to find the relative frequency.)

Outcome	Frequency	Relative Frequency
Both green		$\frac{\quad}{25} =$
Both white		$\frac{\quad}{25} =$
One of each		$\frac{\quad}{25} =$

8. Estimate the probability that both marbles drawn will be green. Write your answer as a reduced fraction and as a decimal. _____ , _____

- Because 25 is really a small amount of times to try, this probability is only a guess.
- The more times an experiment is repeated, the more likely the estimate will be close to the theoretical probability.

extensions

a. Ask 10 students the following question: "What is your favorite sport: baseball, football, soccer, or basketball?" Record each response in the relative frequency table. Share the results of the survey with your class.

Sport	Frequency	Relative Frequency
Baseball		$\frac{}{10} =$
Football		$\frac{}{10} =$
Soccer		$\frac{}{10} =$
Basketball		$\frac{}{10} =$

b. In groups conduct an experiment by drawing two marbles out of a bag containing 3 green marbles and 3 white marbles. Each group should perform the experiment 30 times. Record each group's tallies in the frequency table shown below.

	Both Green		Both White		One of Each	
	Tally	Rel. Freq.	Tally	Rel. Freq.	Tally	Rel. Freq.
Group 1						
Group 2						
Group 3						
Group 4						
Group 5						
Group 6						
Whole Class						

Calculate the relative frequency for each group by dividing the tallies by 30 (the number of times each group performed the experiment). Then combine the results from all the groups. To combine the results, add the tallies in each column and write the totals in the last row of the table. Then divide each of these totals by the *total* number of times the experiment was performed (equal to the number of groups times 30). The resulting quotients are the whole-class relative frequencies for each event. Discuss your findings. On the basis of their own data, which groups would guess that the probabilities were *less* than the whole class's data indicate? _____

Which groups would guess that the probabilities were *greater* than the whole class's data indicate? _____

extensions (continued)

c. Roll two number cubes 100 times. Each time, record the sum of the upturned faces. When you are finished, fill out the relative frequency table. The sample space of the experiment has 11 outcomes.

Sum	2	3	4	5	6	7	8	9	10	11	12
Frequency											
Relative Frequency											

Are the outcomes equally likely? _____

If not, which outcomes are more likely and which are less likely?

more likely _____

less likely _____

Estimate the probability that the sum of a roll will be 8. _____

Estimate the probability that the sum will be **at least** 10. _____

Estimate the probability that the sum will be odd. _____