Name _____ Class _____ Date _____

Theoretical and Experimental Probability

You can collect data through observations or experiments and use the data to state the **experimental probability.**

Alan has a coin. He tosses the coin 100 times and gets 60 heads and 40 tails. The experimental probability of getting heads is:

$$P(\text{heads}) = \frac{\text{number of heads}}{\text{number of trials}} = \frac{60}{100} = 0.6$$

Then Sarita calculated the **theoretical probability** of getting heads on one toss of the coin.

$$P(\text{heads}) = \frac{\text{favorable outcomes}}{\text{number of possible outcomes}} = \frac{1}{2} = 0.5$$

Alan thinks that his coin is unfair since the experimental probability is different from the theoretical probability.

Sarita suggests that they run the experiment again. This time they toss 53 heads and 47 tails. This suggests that the coin is more fair than Alan thinks. To form a more convincing conclusion, they should run the test several more times.

Suppose you have a bag with 75 marbles: 15 red, 5 white, 25 green, 20 black, and 10 blue. You draw a marble, note its color, and then put it back. You do this 75 times with these results: 12 red, 9 white, 27 green, 17 black, and 10 blue. Write each probability as a fraction in simplest form.

	1. P(red)	**2.** P(white)	**3.** P(green)	**4.** P(black)	**5.** P(blue)
Experimental Probability					
Theoretical Probability					

Suppose you surveyed the students in your class on their favorite juice flavors. Their choices were 6 apple, 10 orange, 1 grapefruit, and 3 mango. Write each probability as a fraction in simplest form.

6. P(apple) _____ **7.** P(orange) _____ **8.** P(grapefruit) _____ **9.** P(mango) _____

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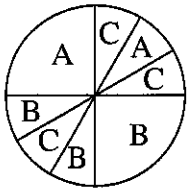
Practice: Theoretical and Experimental Probability

A dart is thrown at the game board shown. Find each probability.

1. $P(\text{A})$ _____ **2.** $P(\text{B})$ _____ **3.** $P(\text{C})$ _____

4. $P(\text{not A})$ _____ **5.** $P(\text{not B})$ _____ **6.** $P(\text{not C})$ _____



The odds in favor of winning a game are 5 to 9.

7. Find the probability of winning the game. _____

8. Find the probability of *not* winning the game. _____

A bag of uninflated balloons contains 10 red, 12 blue, 15 yellow, and 8 green balloons. A balloon is drawn at random. Find each probability.

9. $P(\text{red})$ _____ **10.** $P(\text{blue})$ _____ **11.** $P(\text{yellow})$ _____ **12.** $P(\text{green})$ _____

13. What are the odds in favor of picking a blue balloon? _____

14. What are the odds in favor of picking a green balloon? _____

15. What is the probability of picking a balloon that is not yellow? ____

16. What is the probability of picking a balloon that is not red? ____

Solve.

17. a. You are given a ticket for the weekly drawing at the grocery store each time you enter the store. Last week you were in the store once. There are 1,200 tickets in the box. Find the probability and the odds of your winning.

_____

b. Find the probability and odds of your winning if you were in the store three times last week and there are 1,200 tickets in the box. _____

18. A cheese tray contains slices of Swiss cheese and cheddar cheese. If you randomly pick a slice of cheese, $P(\text{Swiss}) = 0.45$. Find $P(\text{cheddar})$. If there are 200 slices of cheese, how many slices of Swiss cheese are on the tray? _____

19. For a raffle 10,000 tickets are sold. One ticket is drawn at random to determine a winner. Find the probability and odds of winning. _____

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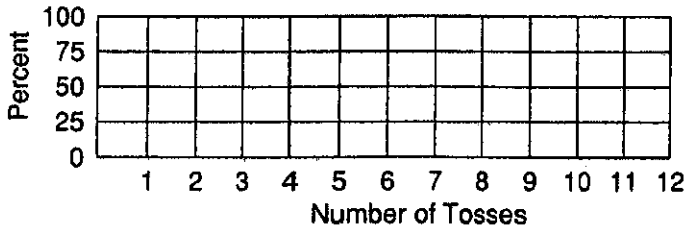
Activity 1: Theoretical and Experimental Probability

1. a. Toss a coin 12 times. Make a check (✓) beside "Tails" each time a tail appears and beside "Heads" each time a head appears. To generate the next row, write the total number of tails (or heads) you have obtained so far over the number of tosses. Find the percent by dividing the numerator by the denominator and rounding to the nearest whole number.

Before you begin: you will need a coin.

Tosses	1	2	3	4	5	6	7	8	9	10	11	12
Tails												
Total tails/tosses												
Percent												
Heads												
Total heads/tosses												
Percent												

b. Make a double line graph to show your results. Use a solid line for the percent of tails obtained. Use a dotted line for the percent of heads.



c. Analyze the graph. What do you notice?

_____

_____

_____

_____

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Activity 2: Theoretical and Experimental Probability

Work in a small group.

Materials
- number cube

1. Suppose you roll a number cube 12 times. Predict how many times each result in the table at the right will happen. Record your predictions.
2. Now roll a number cube 12 times. Use tally marks to keep a record of what happens.
3. Were all of your predictions correct? _____
4. If you roll a number cube once, what is the probability of rolling a 3? _____

   Did you roll a three exactly one sixth of the time? _____
5. Does a probability of $\frac{1}{6}$ for rolling a three mean that you will always roll one three in every six rolls? _____

Result	Prediction	Tally
1		
2		
3		
4		
5		
6		
any number from 1 through 6		
7		

6. If you answered the above questions "no," then what does a probability of $\frac{1}{6}$ for rolling a three mean? _____

   _____
7. Which of the results, if any, were you able to predict exactly? Why?
8. Suppose you had done the experiment for 24 rolls. Do you think the results would have been closer to your predictions? Why or why not?
9. Copy the above table. Make predictions for 24 rolls. Then roll a number cube 24 times. Compare your results with those you obtained for 12 rolls. Discuss what happened.
10. Think of events in everyday life. Make a list of events with a probability of happening equal to 0, of events with a probability of happening equal to *about* $\frac{1}{2}$, and of events with a probability of happening equal to 1. Trade lists with another group. Discuss whether the probabilities on the other group's list are reasonable.