12-7 Theoretical and Experimental Probability

Vocabulary

Review

An *outcome* is the result of a single trial of an experiment. An *event* is a group of possible outcomes. When you roll a number cube once, the possible outcomes are 1, 2, 3, 4, 5, or 6. Write all of the possible *outcomes* for each *event* described below.

1. rolling an odd number

2. rolling a number greater than 4

3. rolling a number less than 6

4. rolling a number that is divisible by 3

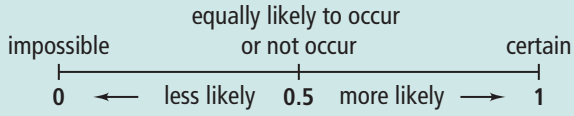
Vocabulary Builder

probability (noun) **prah buh BIL uh tee**

Definition: **Probability** is the likelihood that a certain outcome will occur.

Related Words: chance (noun), likely (adjective), trials (noun)

Main Idea: The **probability** of an event ranges from 0 to 1. You can write a probability as a fraction, a decimal, or a percent.



Use Your Vocabulary

5. Draw a line from each *event* in Column A to the correct description of its *probability* in Column B.

Column A	Column B
randomly choosing a state that begins with the letter A from all 50 states	impossible
randomly choosing a year that is not a leap year from the past 100 years	unlikely
randomly choosing a value for x such that $x \cdot 1 = x$	likely
rolling a 7 on a number cube that is marked 1, 2, 3, 4, 5, 6	certain

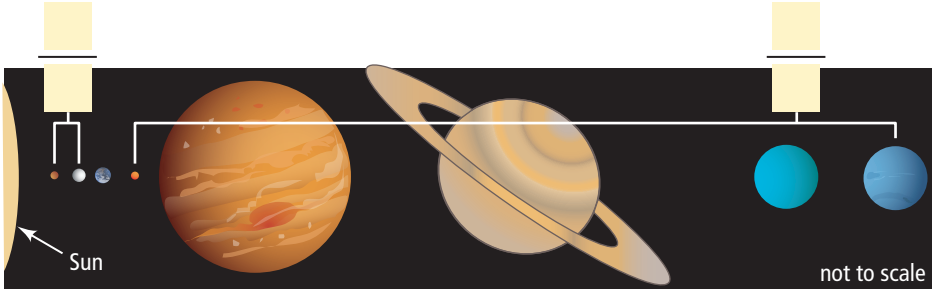
When all possible outcomes are equally likely, you can find the **theoretical probability** of an event using the following formula.

$$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

Problem 1 Finding Theoretical Probability

Got It? **Our solar system's 8 planets, in order of least to greatest distance from the sun, are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. You will randomly draw one of the names of the planets and write a report on that planet. What is the theoretical probability that you will select a planet farther from the sun than Earth?**

6. Write the probability for a name from each of the indicated groups to be drawn.



7. So, the theoretical probability that you will select a planet that is farther from the sun than Earth is _____.

The **complement of an event** consists of all outcomes in the sample space that are NOT in the event. The sum of the probabilities of an event and its complement is 1.

$P(\text{event}) + P(\text{not event}) = 1$ or $P(\text{not event}) = 1 - P(\text{event})$

Problem 2 Finding the Probability of the Complement of an Event

Got It? **In a taste test, 50 participants are randomly given a beverage to sample. There are 20 samples of Drink A, 10 samples of Drink B, 10 samples of Drink C, and 10 samples of Drink D. Suppose the number of samples of Drinks B, C, and D increases. What happens to P(not Drink A)?**

Suppose there are 50 drink samples, of which 20 are Drink A.

8. Write the probability of 1 participant sampling Drink A as a decimal.

_____

9. Write the probability of 1 participant *not* sampling Drink A as a decimal.

$1 -$ _____ $=$ _____

Suppose there are 1000 drink samples, of which 20 are Drink A.

10. Write the probability of 1 participant sampling Drink A as a decimal.

_____

11. Write the probability of 1 participant *not* sampling Drink A as a decimal.

$1 -$ _____ $=$ _____

12. As the number of samples of other drinks increases, P(not Drink A) increases / decreases.

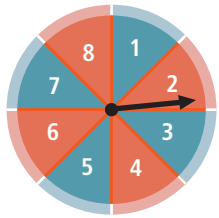
Odds describe the likelihood of an event as a ratio comparing the number of favorable and unfavorable outcomes.

$$\text{odds in } \textit{favor} \text{ of an event} = \frac{\text{number of favorable outcomes}}{\text{number of unfavorable outcomes}}$$

$$\text{odds } \textit{against} \text{ an event} = \frac{\text{number of unfavorable outcomes}}{\text{number of favorable outcomes}}$$

Problem 3 Finding Odds

Got It? **What are the odds against the spinner landing on a number less than 3?**



In Exercises 13 and 14, circle the correct answer.

13. How many sections of the spinner show numbers less than 3? Circle your answer.

2 5 6 8

14. How many other sections does that leave? Circle your answer.

2 3 6 8

15. Write the odds against the spinner landing on a number less than 3.

$\frac{6}{\quad}$ or 6 : ____

16. Write the odds in Exercise 15 in simplest form.

$\frac{\quad}{\quad}$ or ____ : ____

Experimental probability is based on data collected from repeated trials.

$$P(\text{event}) = \frac{\text{number of times the event occurs}}{\text{number of times the experiment is done}}$$

Problem 4 Finding Experimental Probability

Suppose a manufacturer inspects 2500 skateboards and observes that 2450 skateboards have no defects. What is the probability that a skateboard selected at random has no defects? Write the probability as a percent.

17. Complete the steps to find the experimental probability.

$$P(\text{event}) = \frac{\text{number of skateboards with no defect}}{\text{number of skateboards examined}}$$

$P(\text{event}) = \frac{\quad}{\quad}$ Substitute.

$= \quad$ Write as a decimal.

$= \quad$ Change to a percent.

18. So, the probability that a skateboard has no defects is ____.

19. Does an experimental probability of 100% for an event mean that the event is certain to occur? Explain.

_____

Problem 5 Using Experimental Probability

Got It? **A manufacturer inspects 700 light bulbs and finds that 692 of the light bulbs work. There are about 35,400 light bulbs in the manufacturer's warehouse. About how many of the light bulbs in the warehouse are likely to work?**

20. Circle the experimental probability for a light bulb to work.

$\frac{692}{700}$ $\frac{700}{692}$ $\frac{8}{700}$ $\frac{692}{35{,}400}$

21. Complete to find how many light bulbs are likely to work.

Number of light bulbs expected to work = P(a bulb works) · (number of bulbs in warehouse)

$= \frac{\quad}{\quad} \cdot$ ____

22. To the nearest thousand, about ____ bulbs are likely to work.

Lesson Check • Do you UNDERSTAND?

Error Analysis **Eric calculated the probability of getting a number less than 3 when randomly choosing an integer from 1 to 10. Describe and correct his error.**

~~favorable outcomes / total outcomes = 3/10~~

23. Circle the numbers that are less than 3.

1 2 3 4 5 6 7 8 9 10

24. Describe Eric's error and give the correct probability.

_____

_____

Math Success

Check off the vocabulary words that you understand.

☐ theoretical probability ☐ event ☐ odds

☐ experimental probability ☐ outcome ☐ complement of an event

Rate how well you can *find theoretical and experimental probability.*

Need to review 0 2 4 6 8 10 Now I get it!