11-2 Probability

Vocabulary

Review

1. Draw a line from each *experiment* in Column A to a corresponding set of possible outcomes in Column B.

Column A	Column B
Toss a coin.	G, R, B
Roll a six-sided number cube.	heads or tails
Draw a ball at random from a box holding 1 green, 1 red, and 1 blue ball.	1, 2, 3, 4, 5, 6

Vocabulary Builder

theoretical probability (noun)

thee uh RET ih kul prah buh BIL uh tee

Definition: The **theoretical probability** of an event is the ratio of the number of ways that the event can occur to the total number of equally likely outcomes in the sample space.

Example: A student rolls a six-sided number cube. The **theoretical probability** that the student rolls an even number is

$$P(\text{even}) = \frac{\text{number of ways to roll an even number}}{\text{number of possible outcomes}} = \frac{3}{6}$$

probability

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

Use Your Vocabulary

2. Write T for *true* or F for *false*.

___ *Theoretical probability* is the sum of the number of ways an event can occur and the number of possible outcomes.

___ The ratio of the number of ways for an event to occur to the total number of possible outcomes is the *theoretical probability*.

Problem 1 Finding Experimental Probability

Got It? A softball player got a hit in 20 of her last 50 times at bat. What is the experimental probability that she will get a hit in her next at bat?

3. Use the words in the box at the right to complete the ratio. Then substitute and simplify.

number of times at bat
number of hits

$P(\text{hit}) =$ _____ / _____

_____

= _____ = = %

Problem 3 Finding Theoretical Probabilities

Got It? What is the theoretical probability of getting a sum that is an odd number on one roll of two fair number cubes?

4. The table shows the possible sums for one roll of two number cubes. Circle the favorable outcomes.

5. There are favorable outcomes.

6. Complete and simplify the ratio.

$P(\text{odd number}) = \frac{\quad}{36} = \frac{\quad}{\quad}$

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Problem 4 Finding Probability Using Combinatorics

Got It? What is the theoretical probability of being dealt all four 7's in a 5-card hand?

7. Complete the reasoning model below.

Think	Write
First, I find the number of combinations of four 7's from four 7's.	${}_4C_{\square} = \frac{4!}{\square!(4-\square)!} = \square$
A five-card hand with four 7's has one non-7 card. I find the number of combinations of one non-7 from 48 remaining cards.	${}_{48}C_{\square} = \frac{48!}{\square!(48-\square)!} = \frac{48!}{\square!} = \square$
I multiply to find the number of 5-card hands with four 7's.	${}_4C_{\square} \cdot {}_{48}C_{\square} = \square \cdot \square = \square$

8. Find the total number of possible 5-card hands.

$${}_{52}C_{\quad} = \frac{52!}{!(52 - \quad)!} = \frac{52!}{!(\quad)!} =$$

9. Use your answers to Exercises 7 and 8 to write the probability.

$$P(\text{hand with four 7's}) = \frac{\text{5-card hands with four 7's}}{\qquad\qquad\qquad\qquad}$$

10. Substitute and simplify.

$$P(\text{hand with four 7's}) = \underline{\qquad\qquad} = \underline{\qquad\qquad}$$

Problem 5 Finding Geometric Probability

Got It? **Suppose a batter's strike zone is 15 in. by 20 in. and his high-inside strike zone is 3 in. by 5 in. What is the probability that a baseball thrown at random within the strike zone will be a high-inside strike?**

11. Find the area of the batter's strike zone.

$A(\text{strike zone}) = 15 \cdot \quad = \quad \text{in.}^2$

12. Find the area of the batter's high-inside strike zone.

$A(\text{high-inside}) = 3 \cdot \quad = \quad \text{in.}^2$

13. Complete the equation to solve the problem. Round your final answer to two decimal places.

$$P(\text{high-inside strike}) = \frac{\text{area of high-inside strike zone}}{\qquad\qquad\qquad\qquad} = \underline{\qquad} \approx$$

14. The probability that a baseball thrown at random within the strike zone will be a high-inside strike is ____ %.

Lesson Check • Do you know HOW?

Find $P(3)$ when rolling a fair number cube.

15. Complete.

$$P(3) = \frac{\text{number of ways you can roll 3}}{\text{number of possible outcomes}} = \underline{\quad}$$

Find $P(2 \text{ or } 4)$ when rolling a fair number cube.

16. Complete.

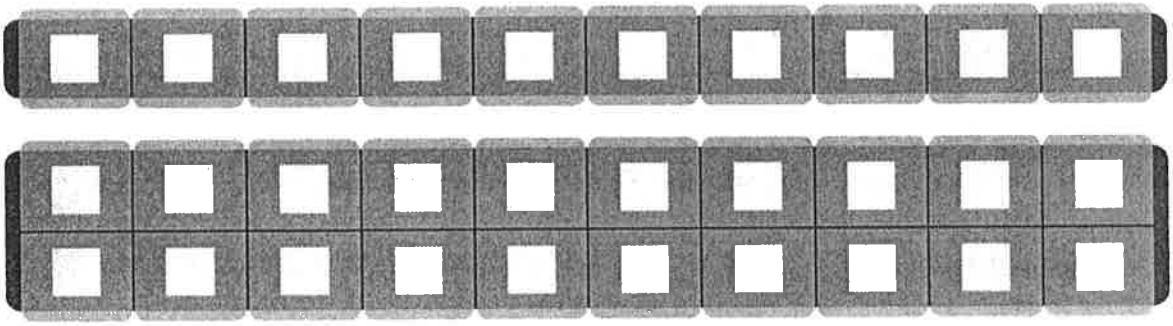
$$P(2 \text{ or } 4) = \frac{\text{number of ways you can roll 2 or 4}}{\text{number of possible outcomes}} = \underline{\quad}, \text{ or } \underline{\quad}$$

Lesson Check • Do you UNDERSTAND?

Reasoning Why is a simulation better the more times you perform it?

17. Using your graphing calculator, enter randInt (1, 2, 5). This will generate a list of 5 outcomes of 1 or 2. Let 1 represent a tossed coin landing heads-up and let 2 represent a tossed coin landing tails-up. Record your results in the table.

18. Repeat the experiment two more times with 10 and 20 in place of the 5. Record the results.



19. Find the experimental probability of landing on heads for each experiment above.

$P(\text{heads}) = \frac{\quad}{5} =$ $P(\text{heads}) = \frac{\quad}{10} =$ $P(\text{heads}) = \frac{\quad}{20} =$

20. Explain why a simulation is better the more times you perform it.

Math Success

Check off the vocabulary words that you understand.

☐ experimental probability ☐ simulation ☐ theoretical probability

Rate how well you can *determine the probability of events.*