Lesson 15.3:

Experimental and Theoretical Probability

Essential Question

How can you use relative frequencies to find probabilities?

Key Idea

Experimental Probability

Probability that is based on repeated trials of an experiment is called **experimental probability.**

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

You have three sticks. Each stick has one red side and one blue side. You throw the sticks 10 times and record the results. Use the table to find the relative frequency of the event.

Outcome	Frequency
3 red	2
3 blue	4
1 red, 2 blue	0
1 blue, 2 red	4

1. Tossing 3 red

$\frac{2}{10} = \frac{1}{5}$ or 0.2

2. Tossing 1 red, 2 blue

0

3. Tossing 1 blue, 2 red

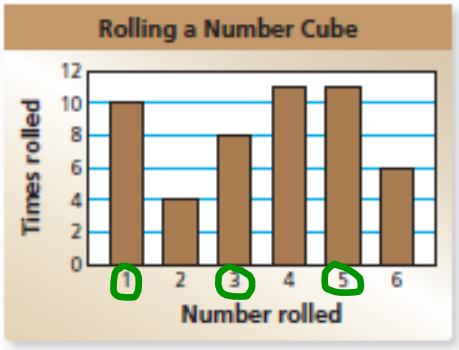
$\frac{4}{10} = \frac{2}{5}$ or 0.4

4. *Not* tossing all red

(3)

$\frac{10-2}{10} = \frac{8}{10} = \frac{4}{5}$ or 0.8

The bar graph shows the results of rolling a number cube 50 times. What is the experimental probability of rolling an odd number?



$\frac{10+8+11}{50}$

$\frac{29}{50}$ or 0.58

It rains 2 out of the last 12 days in March. If this trend continues, how many rainy days would you expect in April?

30 days

$\frac{2}{12} = \frac{1}{6}$ (experimental probability)

$\frac{1}{6} \cdot 30 =$ 5 days

1. In Example 1, what is the experimental probability of rolling an even number?

$$\frac{4+11+6}{50} = \frac{21}{50} \text{ or } 0.42$$

2. At a clothing company, an inspector finds 5 defective pairs of jeans in a shipment of 200. If this trend continues, about how many pairs of jeans would you expect to be defective in a shipment of 5,000?

$$\frac{5}{200} \cdot 5000 = \frac{250}{2} = 125$$

Key Idea

Same as normal probability

Theoretical Probability

When all possible outcomes are equally likely, the **theoretical probability** of an event is the ratio of the number of favorable outcomes to the number of possible outcomes.

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

***The higher the number of trials, the closer *experimental probability* gets to the *theoretical probability*.

You randomly choose one of the letters shown. What is the theoretical probability of choosing a vowel?

$\frac{3}{7}$

The theoretical probability of winning a bobblehead when spinning a prize wheel is $\frac{1}{6}$. The wheel has 3 bobblehead sections. How many sections are on the wheel?

f or p?

*f

$$\frac{\text{favorable}}{\text{possible}} = \frac{1}{6} \overset{\times 3}{=} \frac{3}{?}$$

18 sections

3. In Example 3, what is the theoretical probability of choosing an X?

$\frac{1}{7}$

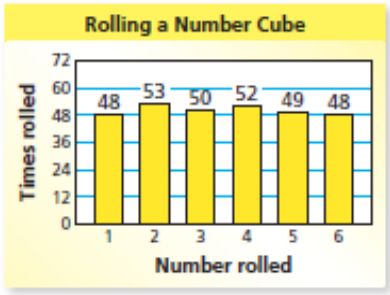
4. The theoretical probability of spinning an odd number on a spinner is 0.6. The spinner has 10 sections. How many sections have odd numbers?

$0.6 = \frac{x}{10}$ $x = 6$ sections

5. The prize wheel in Example 4 was spun 540 times at a baseball game. About how many bobbleheads would you expect were won?

$\frac{1}{6} \cdot 540 = 90$ bobbleheads

The bar graph shows the results of rolling a number cube 300 times.



a. What is the experimental probability of rolling an odd number?

$\frac{48+50+49}{300} = \frac{145 \div 5}{300 \div 5} = \frac{29}{60} \approx 48\%$

b. How does the experimental probability compare with the theoretical probability of rolling an odd number?

They are very close!

c. Compare the experimental probability in part (a) to the experimental probability in Example 1.

It's closer to 50% (500 vs 50 trials)

6. Use the bar graph in Example 5 (previous slide) to find the experimental probability of rolling a number greater than 1. Compare the experimental probability to the theoretical probability of rolling a number greater than 1.

$\frac{53+50+52+49+48}{300}$ vs. $\frac{5}{6}$

$\frac{252}{300}$ vs. $\frac{5}{6}$

0.84 vs. $0.8\overline{3}$

So close!