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LESSON 7

Experimental Probability

Theoretical probability is the measure of how likely an event is to occur when each outcome is equally likely. **Experimental probability** is based on repeated trials from an experiment or observations. Outcomes in experimental probability are ***not*** equally likely.

To find the experimental probability, *P,* of an event, use this formula:

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

A fair coin is flipped once. It can land either heads-side up or tails-side up. The theoretical probability of the coin landing heads-side up is $\frac{1}{2}$.

A fair coin is flipped 100 times. The coin lands heads-side up 45 of those times. The experimental probability of landing heads-side up is $\frac{45}{100}$ or $\frac{9}{20}$.

You can make predictions for the likelihood of future events based on the results of experimental data.

A sample of 200 tires is inspected for defects. Of those, 8 tires have defects. Based on these results, what is the expected number of tires with defects in a set of 2,500 tires?

Find the experimental probability of a tire having defects.

$$P = \frac{8}{200} \text{ or } \frac{1}{25}$$

Multiply this probability by the total number of tires in the set.

$$2{,}500 \cdot \frac{1}{25} = 100$$

About 100 tires from the set of 2,500 are expected to have defects.

The formula for theoretical probability:

$$P = \frac{\text{favorable outcomes}}{\text{possible outcomes}}$$

A **trial** is an event from experimental data or observations.

When used to make predictions, experimental probability gives a reasonable estimate, ***not*** an exact amount.

SAMPLE

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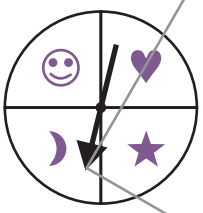
GUIDED PRACTICE

Read and solve each problem.

1 The arrow on this spinner is spun 50 times. The arrow lands on the heart a total of 10 times. What type of probability is used to show the chances of the arrow landing on the heart on the next spin?



Theoretical probability considers each outcome equally likely. Experimental probability does not.

A theoretical because the heart results $\frac{1}{4}$ of the time

B theoretical because the heart results $\frac{1}{5}$ of the time

C experimental because the heart results $\frac{1}{4}$ of the time

D experimental because the heart results $\frac{1}{5}$ of the time

2 A spinner contains 3 equal-sized sections of red, yellow, and blue. The arrow on this spinner is spun 150 times. Which of the following best describes the experimental probability of the arrow landing on red for these trials?

Does experimental probability give a reasonable estimate or an exact amount?

A exactly 30 times

B close to 30 times

C exactly 50 times

D close to 50 times

3 This table shows the number of brothers and sisters the students in Colton's class have.

NUMBER OF BROTHERS AND SISTERS

Brothers and Sisters	Number of Students
0	8
1	4
2	9
3	3
4	1

A total of 450 students are in Colton's school. He predicts that about 90 of the students have no brothers or sisters based on these data. Is his prediction reasonable? Explain how you know.

Find the experimental probability. Is it close to Colton's prediction?

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TEST YOURSELF

Read and solve each problem.

1 A 1–6 number cube is rolled 60 times. The number 3 results 15 times. What is the experimental probability of rolling a 3?

A $\frac{1}{6}$ **C** $\frac{1}{3}$

B $\frac{1}{4}$ **D** $\frac{1}{2}$

2 Contestants in a game show are asked to select one of four identical envelopes. They could win money, a gift basket, a vacation, or a shopping spree. So far, 68 contestants have selected envelopes. Which of the following best describes the experimental probability of a contestant selecting a vacation?

A close to 17 **C** close to 23

B exactly 17 **D** exactly 23

3 Steve flipped a coin 40 times. The coin landed tails-side up 24 times. If Steve flipped the coin a total of 500 times, what would be the expected number of times it would land tails-side up?

A 60 **C** 300

B 240 **D** 350

4 Willow made 3 free throws and missed 2 free throws in her last basketball game. How many free throws would Willow be expected to make on her next 30 attempts based on her last game?

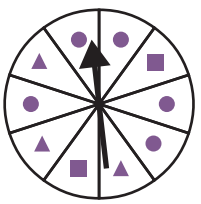
A 10 **C** 20

B 18 **D** 24

5 Levi made 50 phone calls during a charity fund-raising drive and received 4 pledges for donations. If he makes 120 calls, about how many pledges could Levi expect?

Answer _____

6 Padma spun the arrow on this spinner 250 times.



The arrow landed on a square 60 times. How do the theoretical and experimental probabilities of the arrow landing on a square compare?

_____

_____

_____

_____

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7 Zoe tosses a cone-shaped party hat into the air. She reasons that the hat will land upright or it won't, so the probability of the hat landing upright must be $\frac{1}{2}$.

Part A Is Zoe's reasoning correct? Explain how you know.

Part B Zoe then tosses a postcard in the air 25 times. Of those times, the picture side lands face up 10 times. If Zoe tosses the postcard in the air a total of 80 times, about how many times is the picture side expected to land face up? Explain how you know.

8 Aria rolls a 1–6 number cube once.

Part A What is the probability Aria rolls a number less than 4?

Answer _____

Part B Aria then rolls the number cube a total of 25 times. The number 2 results 5 times. What type of probability, theoretical or experimental, would be used to show the chances of the number 2 resulting on the next roll? Explain how you know.

SAMPLE

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