

Theoretical and Experimental Probability

Theoretical probability is used to show what should happen in an experiment.
Experimental probability is what happens in a real life experiment.

Stevie tossed a coin. What is the probability that she tossed a tails?

$$P(\text{tails}) = \frac{\text{favorable outcomes}}{\text{total outcomes}} = \frac{1}{2}$$

Stevie tossed a coin 100 times. By theoretical probability, she should get tails $\frac{1}{2}(100) = 50$ times. In her experiment, Stevie got heads 48 times and tails 52 times.

$$\text{Experimental probability (tails)} = \frac{52}{100} = \frac{13}{25}$$

In this case, the experimental probability of tossing tails is slightly greater than the theoretical probability of tossing tails.

$$\frac{13}{25} > \frac{1}{2}$$

Dan wanted to test the probability of tossing a number greater than 4 using a number cube numbered 1-6. He tossed the cube 100 times. The table shows the results.

Number tossed	1	2	3	4	5	6
Number of times tossed	16	15	17	12	17	23

- Find the theoretical probability of tossing a number greater than 4.

- Find the experimental probability of tossing a number greater than 4.

- If you flip a coin 1,000 times, about how many times would you expect to get heads? tails?

- About how many times might you expect to get a number less than 3 when you toss a 1-6 number cube 600 times?

- Number Sense** Why does the experimental probability of an experiment differ from the theoretical probability?

Theoretical and Experimental Probability

1. You have 26 number cards, numbered from 1 to 26. How many times might you expect to draw the 24 card in 1,300 tries?

2. If you had a jar with 166 white marbles and 2 red marbles, and you reached in without looking, how many times might you select a red marble after 1,000 tries?

3. **Reasoning** Gene said that if you toss a number cube 420 times, you will get a 1 about 70 times. Is he correct? Explain.

In baseball, a player's batting average is found by dividing the number of hits by the number of times he or she has been at bat. The batting average is therefore an expression of experimental probability.

4. Casey had 637 at bats last season, and he got hits on 213 of those at bats. What is the experimental probability that he will get a hit the next time he has an at bat?

5. Sam has a batting average of .346. How many base hits can he expect to get in 544 at bats?

6. A spinner has four sections of equal size: blue, green, yellow, and red. How many times might you expect to spin green out of 2,200 spins?
A 500 C 700
B 550 D 1000
7. **Writing to Explain** Explain how to find the experimental probability of getting heads in 100 coin flips.

