Unit 8, Lesson 4

Estimating Probabilities through Repeated Experiments

Let's do some experimenting.

4.1 Decimals on the Number Line

1. Locate and label these numbers on the number line.

   a. 0.5
   b. 0.75
   c. 0.33
   d. 0.67
   e. 0.25



2. Choose one of the numbers from the previous question. Describe a game in which that number represents your probability of winning.

4.2 In the Long Run

Mai plays a game in which she only wins if she rolls a 1 or a 2 with a standard number cube.

1. List the outcomes in the sample space for rolling the number cube.

2. What is the probability Mai will win the game? Explain your reasoning.

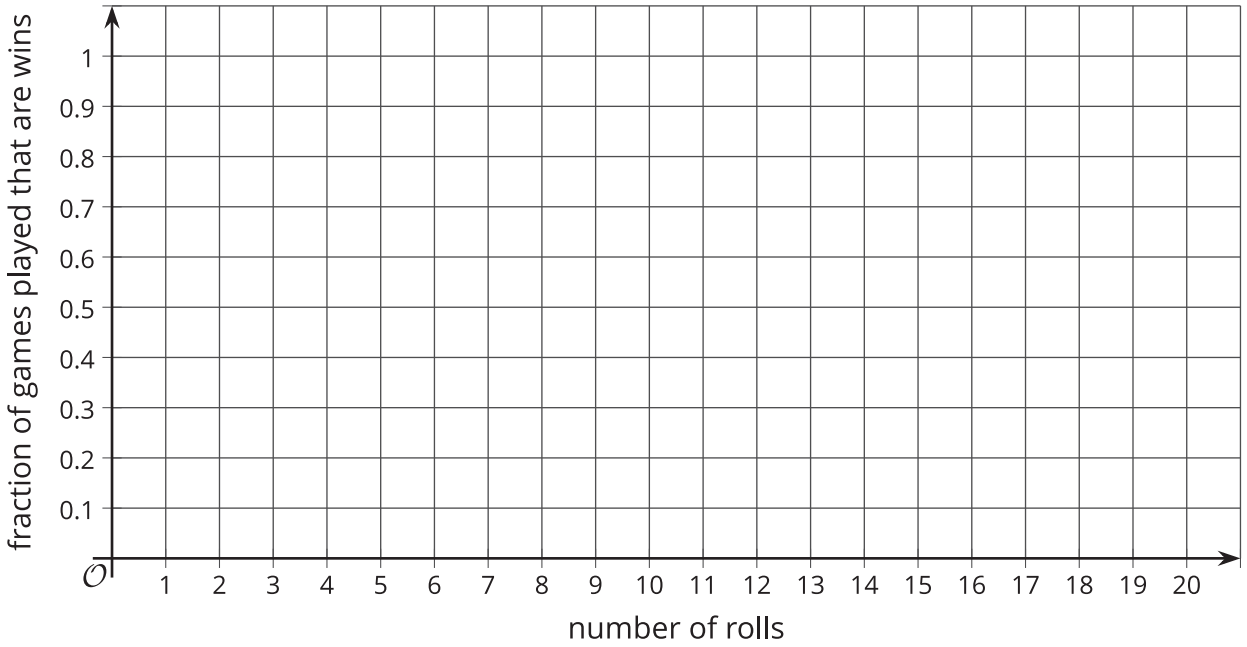
3. If Mai is given the option to flip a coin and win if it comes up heads, is that a better option for her to win?

4. With your group, follow these instructions 10 times to create the graph.
   - One person rolls the number cube. Everyone records the outcome in the table.
   - Calculate the fraction of rolls that are a win for Mai so far. Approximate the fraction with a decimal value rounded to the hundredths place. Record both the fraction and the decimal in the last column of the table.
   - On the graph, plot the number of rolls and the fraction of games that are wins.
   - Pass the number cube to the next person in the group so they can repeat these steps.
5. Describe how the graph changes as the number of rolls increases.

6. a. After 10 rolls, what fraction of the total rolls are a win?

   b. How close is this fraction to the probability that Mai will win?

roll	outcome	total number of wins for Mai	fraction of games played that are wins
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			



7. Roll the number cube 10 more times. Record your results in this table and on the graph from earlier.

roll	outcome	total number of wins for Mai	fraction of games played that are wins
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

8. a. After 20 rolls, what fraction of the total rolls are wins?

   b. How close is this fraction to the probability that Mai will win?

4.3 Due for a Win

1. For each situation, do you think the result is surprising or not? Is it possible? Be prepared to explain your reasoning.
   a. You flip the coin once, and it lands heads up.
   b. You flip the coin twice, and it lands heads up both times.
   c. You flip the coin 100 times, and it lands heads up all 100 times.

2. If you flip the coin 100 times, how many times would you expect the coin to land heads up? Explain your reasoning.

3. If you flip the coin 100 times, what are some other results that would not be surprising?

4. You've flipped the coin 3 times, and it has landed heads up once. The cumulative fraction of heads is currently $\frac{1}{3}$. If you flip the coin one more time, will it land heads up to make the cumulative fraction $\frac{2}{4}$?

Lesson 4 Summary

A probability for an event represents the proportion of the time we expect that event to occur in the long run. For example, the probability of a coin landing heads up after a flip is $\frac{1}{2}$, which means that if we flip a coin many times, we expect that it will land heads up about half of the time.

Even though the probability tells us what we should expect if we flip a coin many times, that doesn't mean we are more likely to get heads if we just got three tails in a row. The chances of getting heads are the same every time we flip the coin, no matter what the outcomes were for past flips.