

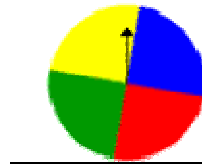
Lesson: Probability

4th Grade Objective: 4.04 – Design experiments and list all possible outcomes and probabilities for an event.

Lesson:

Probability

Problem: A spinner has 4 equal sectors colored yellow, blue, green and red. What are the chances of landing on blue after spinning the spinner? What are the chances of landing on red?



Solution: The chances of landing on blue are 1 in 4, or one fourth.
The chances of landing on red are 1 in 4, or one fourth.

This problem asked us to find some probabilities involving a spinner. Let's look at some definitions and examples from the problem above.

Definition	Example
An experiment is a situation involving chance or probability that leads to results called outcomes.	In the problem above, the experiment is spinning the spinner.
An outcome is the result of a single trial of an experiment.	The possible outcomes are landing on yellow, blue, green or red.
An event is one or more outcomes of an experiment.	One event of this experiment is landing on blue.
Probability is the measure of how likely an event is.	The probability of landing on blue is one fourth.

In order to measure probabilities, mathematicians have devised the following formula for finding the probability of an event.

Probability Of An Event
$P(A) = \frac{\text{The Number Of Ways Event A Can Occur}}{\text{Total Number Of Outcomes}}$

hThe probability of event A is the number of ways event A can occur divided by the total number of possible outcomes. Let's take a look at a slight modification of the problem from the top of the page.

Experiment 1: A spinner has 4 equal sectors colored yellow, blue, green and red. After spinning the spinner, what is the probability of landing on each color?



Outcomes: The possible outcomes of this experiment are yellow, blue, green, and red.

Probabilities:

$$P(\text{yellow}) = \frac{\text{number of ways to land on yellow}}{\text{total number of colors}} = \frac{1}{4}$$

$$P(\text{blue}) = \frac{\text{number of ways to land on blue}}{\text{total number of colors}} = \frac{1}{4}$$

$$P(\text{green}) = \frac{\text{number of ways to land on green}}{\text{total number of colors}} = \frac{1}{4}$$

$$P(\text{red}) = \frac{\text{number of ways to land on red}}{\text{total number of colors}} = \frac{1}{4}$$

Experiment 2: A single 6-sided die is rolled. What is the probability of each outcome? What is the probability of rolling an even number? of rolling an odd number?



Outcomes: The possible outcomes of this experiment are 1, 2, 3, 4, 5 and 6.

Probabilities:

$$P(1) = \frac{\text{number of ways to roll a 1}}{\text{total number of sides}} = \frac{1}{6}$$

$$P(2) = \frac{\text{number of ways to roll a 2}}{\text{total number of sides}} = \frac{1}{6}$$

$$P(3) = \frac{\text{number of ways to roll a 3}}{\text{total number of sides}} = \frac{1}{6}$$

$$P(4) = \frac{\text{number of ways to roll a 4}}{\text{total number of sides}} = \frac{1}{6}$$

$$P(5) = \frac{\text{number of ways to roll a 5}}{\text{total number of sides}} = \frac{1}{6}$$

$$P(6) = \frac{\text{number of ways to roll a 6}}{\text{total number of sides}} = \frac{1}{6}$$

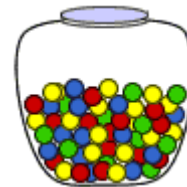
$$P(\text{even}) = \frac{\# \text{ ways to roll an even number}}{\text{total number of sides}} = \frac{3}{6} = \frac{1}{2}$$

$$P(\text{odd}) = \frac{\# \text{ ways to roll an odd number}}{\text{total number of sides}} = \frac{3}{6} = \frac{1}{2}$$

Experiment 2 illustrates the difference between an outcome and an event. A single outcome of this experiment is rolling a 1, or rolling a 2, or rolling a 3, etc. Rolling an even number (2, 4 or 6) is an event, and rolling an odd number (1, 3 or 5) is also an event.

In Experiment 1 the probability of each outcome is always the same. The probability of landing on each color of the spinner is always one fourth. In Experiment 2, the probability of rolling each number on the die is always one sixth. In both of these experiments, the outcomes are [equally likely](#) to occur. Let's look at an experiment in which the outcomes are not equally likely.

Experiment 3: A glass jar contains 6 red, 5 green, 8 blue and 3 yellow marbles. If a single marble is chosen at random from the jar, what is the probability of choosing a red marble? a green marble? a blue marble? a yellow marble?



Outcomes: The possible outcomes of this experiment are red, green, blue and yellow.

Probabilities:

$$P(\text{red}) = \frac{\text{number of ways to choose red}}{\text{total number of marbles}} = \frac{6}{22} = \frac{3}{11}$$

$$P(\text{green}) = \frac{\text{number of ways to choose green}}{\text{total number of marbles}} = \frac{5}{22}$$

$$P(\text{blue}) = \frac{\text{number of ways to choose blue}}{\text{total number of marbles}} = \frac{8}{22} = \frac{4}{11}$$

$$P(\text{yellow}) = \frac{\text{number of ways to choose yellow}}{\text{total number of marbles}} = \frac{3}{22}$$

The outcomes in this experiment are not equally likely to occur. You are more likely to choose a blue marble than any other color. You are least likely to choose a yellow marble.

Experiment 4: Choose a number at random from 1 to 5. What is the probability of each outcome? What is the probability that the number chosen is even? What is the probability that the number chosen is odd?

Outcomes: The possible outcomes of this experiment are 1, 2, 3, 4 and 5.

Probabilities:

$$P(1) = \frac{\text{number of ways to choose a 1}}{\text{total number of numbers}} = \frac{1}{5}$$

$$P(2) = \frac{\text{number of ways to choose a 2}}{\text{total number of numbers}} = \frac{1}{5}$$

$$P(3) = \frac{\text{number of ways to choose a 3}}{\text{total number of numbers}} = \frac{1}{5}$$

$$P(4) = \frac{\text{number of ways to choose a 4}}{\text{total number of numbers}} = \frac{1}{5}$$

$$P(5) = \frac{\text{number of ways to choose a 5}}{\text{total number of numbers}} = \frac{1}{5}$$

$$P(\text{even}) = \frac{\text{number of ways to choose an even number}}{\text{total number of numbers}} = \frac{2}{5}$$

$$P(\text{odd}) = \frac{\text{number of ways to choose an odd number}}{\text{total number of numbers}} = \frac{3}{5}$$

The outcomes 1, 2, 3, 4 and 5 are equally likely to occur as a result of this experiment. However, the events even and odd are not equally likely to occur, since there are 3 odd numbers and only 2 even numbers from 1 to 5.

Summary: The probability of an event is the measure of the chance that the event will occur as a result of an experiment. The probability of an event A is the number of ways event A can occur divided by the total number of possible outcomes.

Practice:

1. Ms. Wilson has three rose bushes in front of her house with 6 roses on each bush. One of the rose bushes grows red roses, one grows white roses, and the third bush grows pink roses. If Mr. Wilson picks a rose for his wife from their front yard, what is the probability that Ms. Wilson will receive a red rose?
2. George has a bag of marbles: 6 of the marbles are red, 5 are clear, 3 are yellow, and 7 are black. If George picks out a marble without looking, what is the probability of picking a clear marble?
3. If George picks out a second marble without putting the first marble back, what is the probability that he will choose another clear marble?
4. If George puts the second clear marble back into the bag, and chooses a third time, what is the probability that he will end up with a yellow marble?
5. Using the original bag, with all the original marbles, which has a greater probability of being drawn, a black marble, or a red marble? Why?

Mark spins a spinner with four different colored sections. The colors on the spinner are orange, blue, white, and brown. When Mark finishes tallying the number of times that his spinner landed on each color, he has a chart that looks like the following;

Color	Times Spun
Orange	5
Blue	1
White	2
Brown	2

6. Which section of the spinner has the largest area? _____

7. What color of the spinner has the smallest area? _____

8. What two areas are probably equal in size? _____

9. What is the probability of spinning the spinner and landing on blue? _____

10. What is the probability of landing on Brown? _____

11. What is the probability of landing on Brown or White? _____