

## Lesson 3: Chance Experiments with Equally Likely Outcomes

### Classwork

#### Example 1

Jamal, a 7<sup>th</sup> grader, wants to design a game that involves tossing paper cups. Jamal tosses a paper cup five times and records the outcome of each toss. An **outcome** is the result of a single trial of an experiment.

Here are the results of each toss:



Jamal noted that the paper cup could land in one of three ways: on its side, right side up, or upside down. The collection of these three outcomes is called the *sample space* of the experiment. The **sample space** of an experiment is the set of all possible outcomes of that experiment.

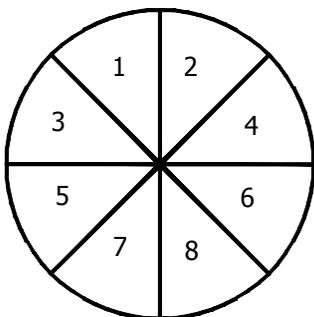
For example, the sample space when flipping a coin is Heads, Tails.

The sample space when drawing a colored cube from a bag that has 3 red, 2 blue, 1 yellow, and 4 green cubes is red, blue, yellow, green.

### Exercises 1–6

For each of the following chance experiments, list the sample space (i.e., all the possible outcomes).

1. Drawing a colored cube from a bag with 2 green, 1 red, 10 blue, and 3 black.
2. Tossing an empty soup can to see how it lands.
3. Shooting a free-throw in a basketball game.
4. Rolling a number cube with the numbers 1–6 on its faces.
5. Selecting a letter from the word: probability
6. Spinning the spinner:



**Example 2: Equally Likely Outcomes**

The sample space for the paper cup toss was on its side, right side up, and upside down. Do you think each of these outcomes has the same chance of occurring? If they do, then they are equally likely to occur.

The outcomes of an experiment are equally likely to occur when the probability of each outcome is equal.

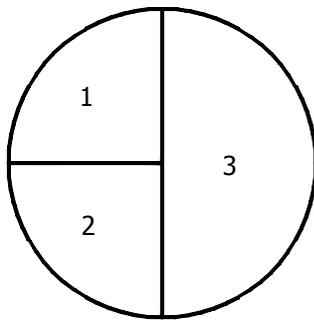
You and your partner toss the paper cup 30 times and record in a table the results of each toss.

Toss	Outcome
1	
2	
3	
4	
5	
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11	
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**Exercises 7–12**

7. Using the results of your experiment, what is your estimate for the probability of a paper cup landing on its side?
8. Using the results of your experiment, what is your estimate for the probability of a paper cup landing upside down?
9. Using the results of your experiment, what is your estimate for the probability of a paper cup landing right side up?
10. Based on your results, do you think the three outcomes are equally likely to occur?

11. Using the spinner below, answer the following questions.



- a. Are the events spinning and landing on 1 or a 2 equally likely?
  - b. Are the events spinning and landing on 2 or 3 equally likely?
  - c. How many times do you predict the spinner to land on each section after 100 spins?
12. Draw a spinner that has 3 sections that are equally likely to occur when the spinner is spun. How many times do you think the spinner will land on each section after 100 spins?

**Lesson Summary:**

An **outcome** is the result of a single observation of an experiment.

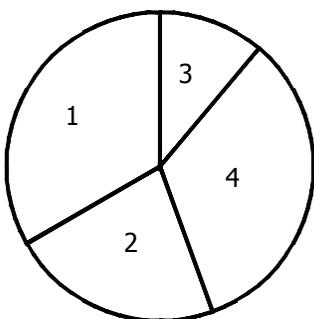
The **sample space** of an experiment is the set of all possible outcomes of that experiment.

The outcomes of an experiment are **equally likely** to occur when the probability of each outcome is equal.

Suppose a bag of crayons contains 10 green, 10 red, 10 yellow, 10 orange, and 10 purple pieces of crayons. If one crayon is selected from the bag and the color is noted, the *outcome* is the color that will be chosen. The *sample space* will be the colors: green, red, yellow, orange, and purple. Each color is *equally likely* to be selected because each color has the same chance of being chosen.

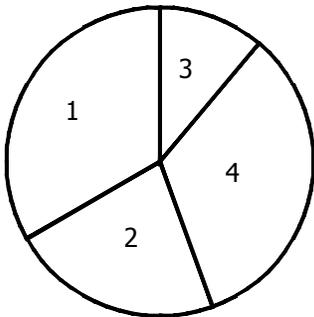
**Problem Set**

- 1. For each of the following chance experiments, list the sample space (all the possible outcomes).
  - a. Rolling a 4-sided die with the numbers 1– 4 on the faces of the die.
  - b. Selecting a letter from the word: mathematics.
  - c. Selecting a marble from a bag containing 50 black marbles and 45 orange marbles.
  - d. Selecting a number from the even numbers from 2– 14, inclusive.
  - e. Spinning the spinner below:

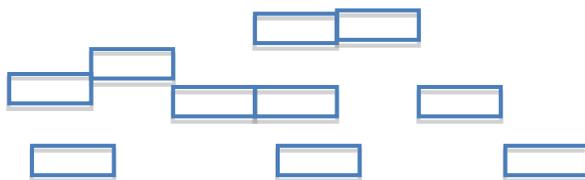


- 2. For each of the following decide if the two outcomes listed are equally likely to occur. Give a reason for your answer.
  - a. Rolling a 1 or a 2 when a 6-sided number cube with the numbers 1– 6 on the faces of the cube is rolled.

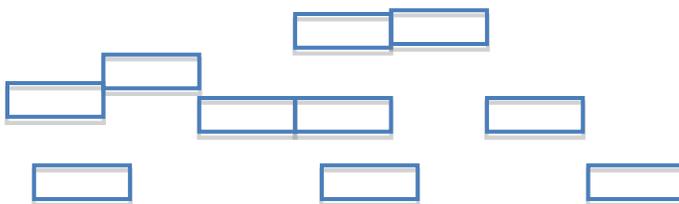
- b. Selecting the letter *a* or *k* from the word: take.
- c. Selecting a black or an orange marble from a bag containing 50 black and 45 orange marbles.
- d. Selecting a 4 or an 8 from the even numbers from 2– 14, inclusive.
- e. Landing on a 1 or 3 when spinning the spinner below.



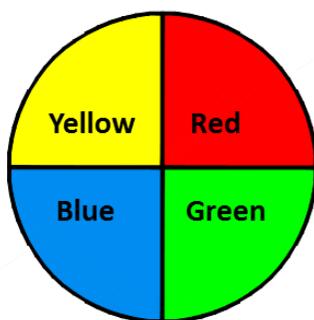
3. Color the cubes below so that it would be equally likely to choose a blue or yellow cube.



4. Color the cubes below so that it would be more likely to choose a blue than a yellow cube.



5. You are playing a game using the spinner below. The game requires that you spin the spinner twice. For example, one outcome could be Yellow on 1<sup>st</sup> spin and Red on 2<sup>nd</sup> spin. List the sample space (all the possible outcomes) for the two spins.



6. List the sample space for the chance experiment of flipping a coin twice.