

## Number Cubes

**STRAND: Probability**

**STRAND CONCEPT: Outcomes and Probability**

**SOL 5.15**

### ***Remediation Plan Summary***

Students play an unfair game that uses number cubes, and, through the use of a sample space, determine the probability of each player winning. Students represent in fraction and decimal forms predictions related to the probability of outcomes in these problems

### ***Common Misconceptions***

Some students think that when you roll two number cubes, each of the sums 2-12 can come up an equal number of times. They do not realize that there are more combinations to make 6, 7 and 8 than other sums.

### ***Materials***

Number cubes of two different colors (each pair receives one of each color)

Desmos Calculators

Copies of the attached recording sheets

### ***Introductory Activity***

Allow students about five minutes to complete the “Will It Happen?” worksheet. Then, hold a class discussion about the students’ responses, having them share their answers and asking them to explain their reasoning. Some students may say that the world could vanish tomorrow or that a wizard could change all red colors to green. In that case, remind them that they are dealing with the real world, not the world of fantasy. Correct answers will vary but focus on the students’ reasoning. Guide the discussion so that all students agree that knowledge about an event can help a person make a prediction about the probability of that event occurring. Tell the class that in this lesson, they will focus on ways to display information so that the probability of an event’s occurring can be predicted more accurately.

### ***Plan for Instruction***

1. Allow students to work with a partner. Give each set of partners two number cubes and a copy of the “What’s the Probability? Part 1” sheet. Discuss directions with the class until everyone understands how to play the game.
2. Give students sufficient time to complete the worksheet. As they finish, have one member of each set of partners transfer their results to a displayed class record sheet.
3. Hold a class discussion to analyze the results displayed on the class record sheet. Lead students to discover that some numbers, e.g., 6, 7, and 8, appear more often than others. Ask the students why that is. The numbers 5 and 9 might also appear a significant number of times, but students should recognize that the more times the experiment is conducted,

the more frequently the numbers 6, 7, and 8 appear. Discuss who won, player A or B. Relate the fractions students completed to the winning and losing players.

4. Have partners complete Part 2 of the worksheet after a discussion of the instructions. As students work, check for accuracy as you informally assess understanding.
5. As a class, compare findings. Point out that the chart students completed and shaded is called a sample space.
6. The discussion should lead students to conclude that the Number-Cube Game, with the sums assigned as they are to each player, is unfair because Player B has more chances of winning. Include in the discussion the factor that makes a game fair: the chance of either player winning is  $\frac{1}{2}$  or 0.50. Point out the calculations they did game a more precise probability than the chart they used during the warm up.

***Pulling It All Together (Reflection)***

Exit slip: Quick Write

Teacher will pose the following question to students and provide them with one to two minutes to respond independently and in writing.

*“The next time you play this game, will you be player A or B? Why?”*

Teacher should follow-up the quick write with whole class discussion. Teacher should also collect and review quick write responses to check for understanding.

**Note: The following pages are intended for classroom use for students as a visual aid to learning.**

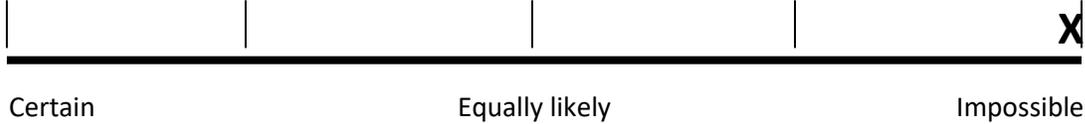
Name: \_\_\_\_\_

## Will It Happen?

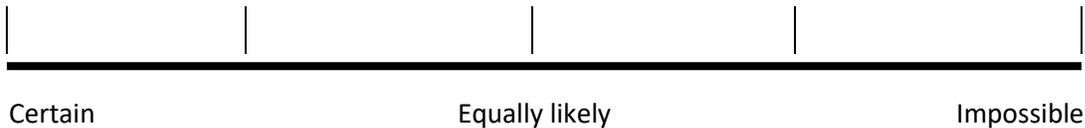
Listed below is a set of events. Some will definitely happen, some will never happen, and some may or may not happen. Place an X on the “Line of Certainty” shown below each event to indicate the chances of the event happening.

### Example

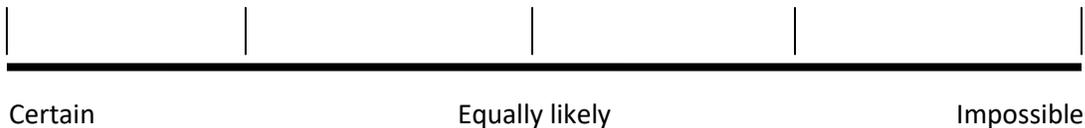
You will have two birthdays this year.



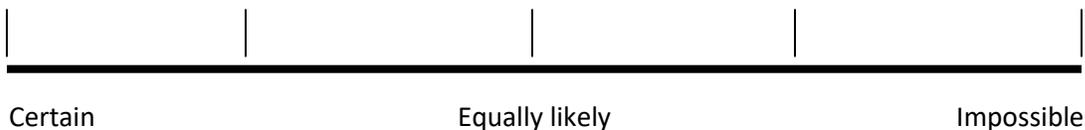
1. The sun will set, and darkness will come over the Earth tomorrow.



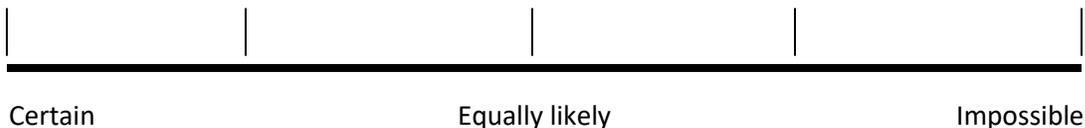
2. Everything in the world that is colored red will turn to green today.



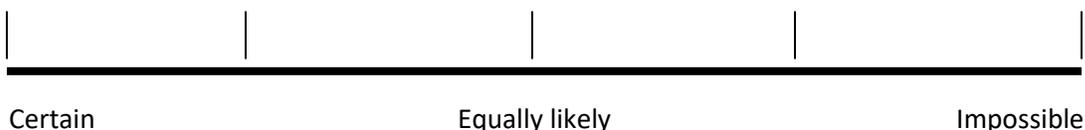
3. It will rain today.



4. When you flip a coin, it will land on heads.



5. You have a spinner that is divided into four equal parts with an “A” printed in one part, a “B” in another part, a “C” in another part, and a “D” in the last part. When you spin the spinner, it will land on “B.”





Name: \_\_\_\_\_

## What's the Probability? Part 1

### Know the Rules

Two friends created a number-cube game, using a pair of number cubes. They decided that Player A scores a point whenever the *sum* of a roll of the cubes is 2, 3, 4, 9, 10, 11, or 12. Player B scores a point whenever the *sum* is 5, 6, 7, or 8. For example, they roll the cubes, and one cube is 5 and the other is 4. Because the sum is 9, Player A scores a point. One game consists of rolling the cubes 25 times.

### Predict the Results

Which player do you think will win the game?

Player \_\_\_\_\_

### Play the Game to Verify Your Prediction

With your partner, take turns rolling a pair of number cubes 25 times. Using the rules stated above, record on the chart below the points earned. Use tally marks to record the results in each column.

<b>Player A</b> <b>(2, 3, 4, 9, 10, 11, 12)</b>	<b>Player B</b> <b>(5, 6, 7, 8)</b>

Player A got \_\_\_\_\_ points.

Player B got \_\_\_\_\_ points.

Which player won? \_\_\_\_\_

Why do you think that player got more points?

\_\_\_\_\_



Name: \_\_\_\_\_

## What's the Probability? Part 2

Use the chart below to display *all possible outcomes* of rolling a pair of differently colored number cubes. One of the cubes is red and the other is yellow. The chart is partially completed. Fill in the empty boxes with the correct sums.

Then, shade in each box containing a sum that gives a point to Player A (2, 3, 4, 9, 10, 11, or 12). Do not shade the boxes containing sums that give points to Player B (5, 6, 7, or 8).

Possible Outcomes

	R1	R2	R3	R4	R5	R6
Y1	2					
Y2					7	
Y3						
Y4						
Y5			8			
Y6						12

The number of possible outcomes of rolling a pair of different colored cubes is \_\_\_\_\_.

Player A can get a point with \_\_\_\_\_ of these \_\_\_\_\_ outcomes. Express this number as a ratio (fraction). Then, simplify the fraction, if possible, and finally express it as a decimal.

$$\text{Player A: } \frac{\text{number of winning outcomes}}{\text{number of possible outcomes}} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \underline{\hspace{2cm}}$$

Player B can get a point with \_\_\_\_\_ of these \_\_\_\_\_ outcomes. Express this number as a ratio (fraction). Then, simplify the fraction, if possible, and finally express it as a decimal.

$$\text{Player B: } \frac{\text{number of winning outcomes}}{\text{number of possible outcomes}} = \frac{\quad}{\quad} = \frac{\quad}{\quad} = \underline{\hspace{2cm}}$$

Compare the results of playing the game in Part 1 with the results of rolling the number cubes in Part 2. Share your results with those found by another set of partners. Be ready to participate in a class discussion of your findings.