Grade 4 Mathematics
Data Analysis, Probability, and Discrete Mathematics: Lesson 3

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students, will have an arrow symbol (⌡) by them.

Purpose of Lesson 3:

- In this lesson, the tutor and the students will
  - ✓ understand the meaning of the terms *certain*, *impossible*, *likely*, *unlikely*, and *equally likely* as they apply to probability; and
  - ✓ determine the probability of events.

Equipment/Materials Needed:

- Copies of Student Sheets 81 – 83
- Paper and pencils
- Chalkboard
- One coin of any kind and one number cube with the numbers 1, 2, 3, 4, 5, 6 on it
- Paper clips

Preparations before beginning Lesson 3:

- Run one copy of Student Sheets 81 – 83 for each student.
- Have paper and pencils available.
- Have one paper clip per two students available to use on the spinners.

Lesson 3: Data Analysis

⌋ Give Student Sheet 81 to the students.

Say:

It is often useful to know whether something is *likely* or *unlikely* to happen. An *event* is something that may happen. Sometimes, we are *certain* that an event will occur. Sometimes, we know it is *impossible*; and sometimes, we just aren't sure. Let's look at the sentences in Part A. I want you to tell me what is the chance that each of these events will happen. Is it certain, impossible, or maybe? Many of the students will say that it is certain that they will eat dinner, but something may happen on the way home and they might miss dinner. They might get sick; dinner might get burned, etc.

Answers:

1) Maybe	2) Impossible	3) Maybe
4) Certain	5) Maybe	6) Maybe

Let's look at those events for which you answered "maybe." Do you think that these are likely or unlikely to happen? (1. It really depends on the weather. 3. Probably unlikely for one class, but maybe likely for the entire school. 5. Likely 6. It is just as likely that we will get a tail. This event is considered *equally likely* to happen or not to happen.)

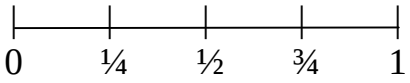
Ask students to tell you some events that are the following:
Certain (The sun will rise.)
Impossible (Frogs will talk.)
Likely to happen (We will have rain next month.)
Unlikely to happen (I will not watch TV for a year.)
Equally likely to happen or not to happen (If I pick a card from a deck of cards, it will be red.)

Say:

***Probability* is the likelihood that something may happen. Instead of just saying something is likely to happen, we can use numbers from 0 to 1 to describe probability. What kind of numbers have we studied that are between 0 and 1?** (fractions, decimals, and percents) Note: Students may not say percents. Percents will be introduced in only this lesson.

⌋ Draw the following number line on the board.

Probability Line



Say:

Probability is always shown as a number from 0 to 1. If the probability of an event happening is 0, the event is impossible. Tell me an event that has a probability of 0. (Today is Sunday, so tomorrow will be Thursday.) **How could I write 0 as a decimal?** (0.0) **Sometimes you will hear the word *percent* used when talking about probability. You might say that the probability of our mathematics books talking is 0 percent. This symbol is used for percent.** (%) **We would write 0%.** (Write 0% on the board.**) The probability of an impossible event can be represented as 0, 0.0, or 0%**

If the probability of an event is 1, then we know the event will happen. What is an event that has a probability of 1? (A triangle will always have 3 sides.) **How could you write this answer as a decimal?** (1.0) **Sometimes you will hear the weather announcer say that the probability of rain today is 100%. That prediction means that the announcer is certain that it will rain. The probability of an event that is certain to happen can be represented as 1, 1.0, or 100%.**

Often we do not know whether an event is impossible or whether that event will definitely happen. When we use numbers closer to 0 than to 1, we are representing the probability of an event that is not likely to happen. What are some numbers closer to 0 than 1? (Answers will vary: Possible answers are $\frac{1}{10}$, $\frac{1}{4}$, 0.1, 0.2, etc.) **When we use numbers that are closer to 1 than to 0, we are representing the probability of an event that is likely to happen. What are some numbers closer to 1 than 0?** (Answers will vary: Possible answers are $\frac{9}{10}$, $\frac{3}{4}$, 0.9, 0.8, etc.) **If an event is as likely to happen as not, the event has a probability of ½. How can you write ½ as a decimal?** (0.50)

⌋ Give the students Part B of Student Sheet 81. On this part, number 8 is practice for recognizing the decimal representation of 1/4, 1/2, and 3/4. This representation of decimals will help with understanding percents. Number 9 gives practice on percents. They do not really need to understand percents at this time. They must know that the smaller the percent, the less likely an event is to occur.

Answers:

7) 1. This event could be placed almost anywhere on the line except at 0 or 1. The event's occurrence depends on the weather. But let them talk about their predictions.
   2. This event should placed be at 0; it is impossible.
   3. If students think of one class, they may place the event around ¼; if they think of the entire school, they may put it closer to ¾. Again, discussion is critical.
   4. This event is certain and should be placed at 1.
   5. This event is pretty likely, so is could be placed between ¾ and 1.
   6. This event is equally likely, so it should be placed at ½.
8) Decimals: 0.25, 0.50, 0.75
   Descriptions: unlikely, equally likely, likely
9) Percents: 25%, 50%, 75%
   Descriptions: unlikely, equally likely, likely

⌋ Have students talk about Part C of Student Sheet 81.

Answers:

1) Likely 2) Equally likely 3) Unlikely
4) Impossible 5) Certain

Say:

When you toss a coin, say a nickel, two things can happen. These two things are called *outcomes*. What are the two possible outcomes? (You could get a head or a tail.) **The probability of tossing a head is ½ and the probability of tossing a tail is ½. The outcomes are *equally likely* to happen.**

If you roll a number cube with the digits 1, 2, 3, 4, 5, and 6 on the sides, how many outcomes would you have? (6) **What are the outcomes?** (1, 2, 3, 4, 5, or 6) **What is the probability of rolling a 5?** (There is 1 way to roll a 5 and there are 6 outcomes, so the probability is $\frac{1}{6}$.)

⌋ Give students Student Sheet 82.

Answers:

1) $\frac{1}{6}$ 2) $\frac{2}{6}$ or $\frac{1}{3}$ 3) 0 4) $\frac{3}{6}$ or $\frac{1}{2}$

5) $\frac{1}{4}$ 6) 0 7) $\frac{2}{4}$ or $\frac{1}{2}$ 8) 1 9) $\frac{3}{7}$

Say:

A game is considered *fair* if each player has an equal chance of winning. Suppose we were playing a game that used a number cube. If I got a point every time an even number was rolled and you got a point every time an odd number was rolled, the game would be considered fair. Why? (The probability of getting an odd number is $\frac{1}{2}$ and the probability of getting an even number is $\frac{1}{2}$.) **But I could win any time a number greater than one was rolled and you could win only if you rolled a one; the game, therefore, would not be fair. I would have a better chance of winning. What would be the probability of my winning?** ($\frac{5}{6}$); **Of your winning?** ($\frac{1}{6}$)

⌋ Give Student Sheet 83. Have students play with a partner. They can use a pencil and a paper clip to make a spinner. (There was not room for instructions on the sheet, so read the instructions to the students.)

Say:

We are going to play 4 spinner games. One of you will be red, and one of you will be blue. Each of you should take turns spinning 10 times. Keep a tally of when blue or red is spun. If you land on a line, spin again. If you land on another color, "other" gets a tally mark. Is the game fair? Do the same thing for the other 3 spinners. Spinners 1 and 3 are fair, while 2 and 4 are not.

⌋ Have one student summarize today's lesson. Understanding probability helps students make predictions about problems that involve chance.

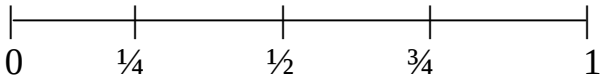
Student Sheet 81 (Data Analysis: Lesson 3)

Part A
Certain, Impossible, Maybe

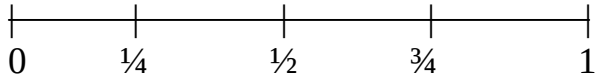
1. It will be raining tomorrow.
2. Our mathematics teacher will grow to 10 feet tall this afternoon.
3. Eight students will be absent tomorrow.
4. The day after Sunday will be Monday.
5. We will all eat dinner tonight.
6. If I toss a coin, it will come up heads.

Part B

7. Where would you place the events in Part A on the number line? Mark the points on the line and label them as 1, 2, 3, 4, 5, or 6**.**



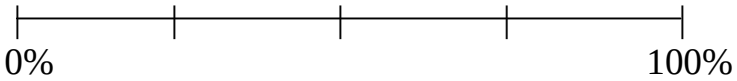
8. This number line shows probabilities. Fill in the blanks with the correct decimal for each marking. Describe the probability of each in words.



Decimals: 0.0 _____ _____ _____ 1.0

Descriptions: Impossible _____ _____ _____ Certain

9. This number line shows the probabilities but uses percents. Fill in the blanks with the correct percent for each marking. Describe the probability of each in words.



Percents: 0% _____ _____ _____ 100%

Descriptions: Impossible _____ _____ _____ Certain

Part C

Are the events below impossible, unlikely, equally likely, likely, or certain to occur?

1. Ms. Compton said the probability of having homework tonight was 75%.

2. Tommy said that the likelihood of his mother's having a baby girl was $\frac{1}{2}$.

3. Since Tia has been punished this week, she said the chance of her watching TV tonight was $\frac{1}{4}$.

4. The probability of your mathematics book talking to you tonight is 0.

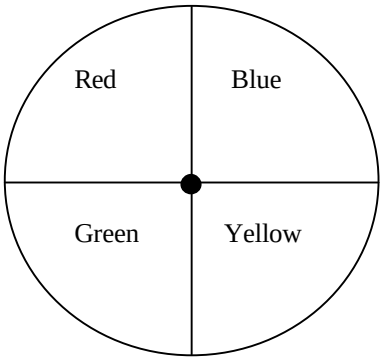
5. If you pull a card from a standard deck of cards, the probability that you will pull a red or black card is 100%.

Student Sheet 82 (Data Analysis: Lesson 3)

For problems 1 – 4, pretend you are rolling a number cube with the numbers 1, 2, 3, 4, 5, and 6 on the faces.

1. What is the probability of rolling a 3? _____
2. What is the probability of rolling numbers greater than 4? _____
3. What is the probability of rolling numbers less than 1? _____
4. What is the probability of rolling an even number? _____

For problems 5—8, use the spinner below.



5. If you spin the spinner once, what is the probability of spinning red? _____

6. What is the probability of spinning orange? _____

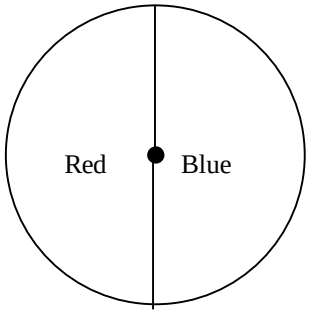
7. What is the probability of spinning blue or green? _____

8. What is the probability of spinning red, blue, green, or yellow? _____

9. Suppose you had cubes in a bag. Three are red, 2 are blue, and 2 are green. Without looking, you reach in and pull out one cube. What is the probability that the cube will be red? _____

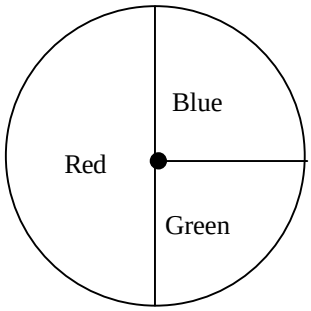
Student Sheet 83 (Data Analysis: Lesson 3)

1.



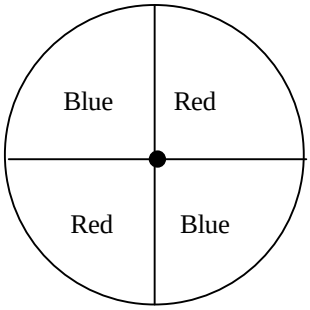
	Total
Red	
Blue	
Other	

2.



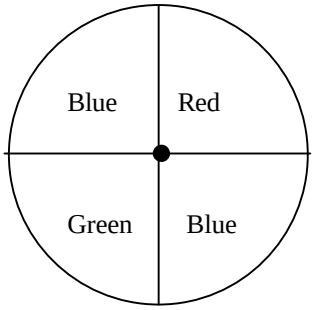
	Total
Red	
Blue	
Other	

3.



	Total
Red	
Blue	
Other	

4.



	Total
Red	
Blue	
Other	