

Grade 8 Mathematics

Data Analysis, Probability, and Discrete Mathematics:

Lesson 4

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 (\Rightarrow) by them.

Purpose of Lesson 4:

- 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;
 - ✓ find the total number of possible outcomes or possible choices in a given situation;
 - ✓ determine the probability of events;
 - ✓ determine probability from data displayed in tables and graphs; and
 - ✓ make predictions based on probability.

Equipment/Materials Needed:

- Copies of Student Sheets 54 and 55
- Paper and pencils
- Two coins of any kind; one number cube with the numbers 1, 2, 3, 4, 5, 6 on it

Preparations before beginning Lesson 3:

- Run off one copy of Student Sheets 54 and 55 for each student.
- Have paper and pencils available.
- Get two coins and one number cube.

Lesson 4: Data Analysis

⇒ Give Student Sheet 54 to the students.

Say:

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? It is certain, impossible, or maybe? Many of them will say that it is certain that they will eat dinner, but something might happen on the way home and they might miss dinner. They might get sick.

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.)

Tell me an event that is certain to happen. (The sun will set.) **Tell me an event that is impossible to happen.** (Cats will bark.) **Tell me an event that is likely to happen.** (We will have rain in the next month.) **Tell me an event that is unlikely to happen.** (I will not watch TV for a year.) **Tell me an event that is equally likely to happen or not to happen.** (If I pick a card from a deck of cards, it will be red.)

⇒ Place one coin in front of the students. Then place two coins.

Say:

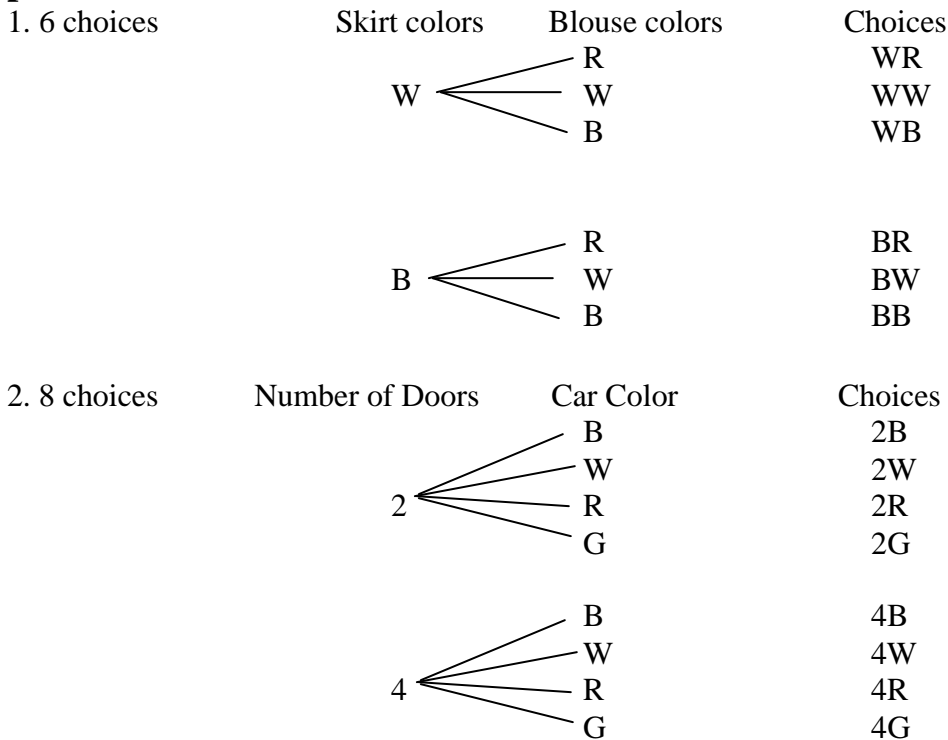
Suppose I tossed this coin. What could happen? (We could get heads or tails.) **How many outcomes are possible?** (2) **Suppose I tossed 2 coins? What could happen? Let's make a list of what could happen.** Allow time for the students to write down what they think.

We could get HH, HT, TH, or TT. How many outcomes are possible? (4) **A tree diagram could help us organize the outcomes. A tree diagram shows branches for each point where a choice is made.**

Say:

Look at the diagram in Part B of Student Sheet 54. The diagram is an example of a tree diagram for tossing two coins. When we toss the first coin, we could get either heads or tails. So we write down those two possibilities. Let's just say we got a head on the first toss. We could then get a head or a tail on the second toss. We draw branches from the H and write the two possibilities. We then do the same thing if the first toss had been a tail. So there are 4 possibilities. HH, TT, HT, TH.

Do problems 1 and 2 in part C. Draw tree diagrams to help you find the possibilities. Answers:



Say:

Let's think back on the coin problems. If I toss one coin, I can get a head or a tail. There are 2 possible outcomes. Suppose I want the outcome to be a tail. This preference is called a favorable outcome, because it is the one with which I am concerned. *Probability* is the chance or likelihood that something will happen. What we want to happen is called the favorable outcome or happening.

Probability is given as the ratio of the number of favorable outcomes to the total number of possible outcomes.

⇒ Write the equation below on the board or on a piece of paper.

$$\text{Probability} = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$$

Say:

Let's look back at tossing two coins. How many outcomes were there? (4) What if I wanted to get 2 heads. How many ways could I get 2 heads? (just one way) The probability that I get 2 heads is one out of 4 or $\frac{1}{4}$. What is the probability of getting 2 coins that are the same? (I could get HH or TT, so 2 out of 4 or $\frac{2}{4}$ or $\frac{1}{2}$.)

If I roll a number cube, with the numbers 1, 2, 3, 4, 5, and 6 on it, what are the possible outcomes? (1, 2, 3, 4, 5, 6) What is the probability that I would roll a 4? (1 out of 6 or $\frac{1}{6}$.) What is the probability that I would roll an even number? (I could roll 2, 4, or 6, so 3 chances out of 6 or $\frac{3}{6}$ or $\frac{1}{2}$.) Probability is always a number between 0 and 1. Zero indicates an impossible event and 1 indicates a certain event.

⇒ Give Student Sheet 55 to the students. Have the students work each part, discuss the problems, and then go on to the next part.

Answers:

Part A:

- 1) 4 out of 12 or $\frac{4}{12}$ or $\frac{1}{3}$. Any of these answers is correct.
- 2) 6 out of 12 or $\frac{6}{12}$ or $\frac{1}{2}$.
- 3) Since there are no black shorts in the drawer, the probability is $\frac{0}{12}$ or 0.

Part B:

- 1) There are 3 odd numbers so 3 out of 6 or $\frac{3}{6}$ or $\frac{1}{2}$.
- 2) There is only one number greater than 5; the probability is $\frac{1}{6}$.
- 3) There are 2 multiples of 3, 3 and 6; the probability is $\frac{2}{6}$ or $\frac{1}{3}$.
- 4) The number cannot be less than one; the probability is 0.
- 5) There are 5 numbers that are factors of 36, 1, 2, 3, 4, and 6. The probability is $\frac{5}{6}$.
- 6) There is only one number that is a multiple of both 3 and 6. It is 6; the probability is $\frac{1}{6}$.

Part C:

1. 50 students were surveyed.
2. 20 out of 50 or $\frac{2}{5}$
3. 10 out of 50 or $\frac{1}{5}$
4. Out of the 50 students, Debbie got $\frac{1}{10}$ of the votes; so out of 150, we could predict that she would get $\frac{1}{10} \times 150$, or 15.
5. Out of the 50 students, George got $\frac{1}{5}$ of the votes; so out of 200, we could predict that he would get $\frac{1}{5} \times 200$, or 40.

⇒ Have one student summarize today's lesson. The students should realize that probability allows them to make predictions about events that involve chance.

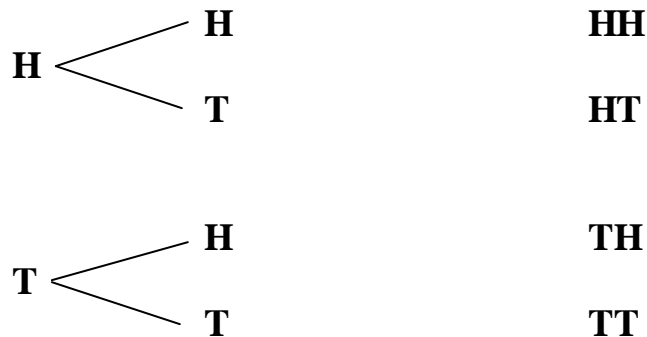
Student Sheet 54 (Data Analysis: Lesson 4)

Part A Certain, Impossible, Maybe

1. It will be sunny tomorrow.
 2. Our mathematics books will talk to us this afternoon.
 3. Ten students will be absent tomorrow.
 4. The sun will rise tomorrow.
 5. We will all eat dinner tonight.
 6. If I toss a coin, it will come up heads.
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Part B

First Coin Second Coin



Part C

1. The cheerleading team must decide on a uniform. They have a choice of a white or blue skirt and a red, white, or blue blouse. How many choices do they have and what are they? Draw a tree diagram to find the choices.
2. Donald is buying a car. He can get a 2-door or a 4-door in the model he wants. He is looking at black, white, red, or gold cars. What are his choices? Draw a tree diagram to find his choices.

Student Sheet 55 (Data Analysis: Lesson 4)

Part A:

Andy reaches into a drawer and, without looking, pulls out a pair of shorts. There are 12 pairs of shorts in the drawer. Six shorts are white, 4 shorts are navy, and 2 shorts are red. Use this information to answer the following questions.

1. What is the probability that the pair of shorts she pulls out is navy?
2. What is the probability that the shorts will not be white?
3. What is the probability that the shorts will be black?

Part B:

The faces of a cube are labeled 1, 2, 3, 4, 5, 6. You roll the number cube once. Use this information to answer the following questions.

1. What is the probability that the number on the top will be odd?
2. What is the probability that the number on the top will be greater than 5?
3. What is the probability that the number on top will be a multiple of 3?
4. What is the probability that the number on the top will be less than 1?
5. What is the probability that the number on top will be a factor of 36?
6. What is the probability that the number on the top will be a multiple of both 3 and 6?

Part C:

Candidate	Number of votes
Debbie	5
Earl	20
Frieda	15
George	10

The chart shows the results of a survey of students about the upcoming class election. Use this survey to answer the questions. Remember that the probabilities are predictions based on the survey. The value of the predictions depend on the reliability of the survey and on whether students change their minds before the election.

1. How many students were surveyed?
2. What is the probability that Earl will win?
3. What is the probability that 1 student, chosen at random from those surveyed, would chose George?
4. If 150 students actually vote in the election, how many votes would you predict Debbie would get?
5. If 200 students actually vote in the election, how many votes would you predict George would get?