Assignment Discovery Online Curriculum

Lesson title:
Understanding Probability

Grade level:
6-8

Subject Area:
Mathematics

Duration:
One to two class periods

Objectives:

Students will
1. learn what probability is,
2. learn different ways to express probability numerically: as a ratio, a decimal, and a percentage, and
3. learn how to solve problems based on probability.

Materials:
- Copies of Classroom Activity Sheet: Probability Problem Solving
- Computers with Internet access (optional but very helpful)
- Reference materials such as almanacs and encyclopedias
- Copies of Take-Home Activity Sheet: Spin the Wheel!

Procedures:

1. Begin the lesson by asking students to define probability (the likelihood or chance that a given event will occur). Probability is usually expressed as a ratio of the number of likely outcomes compared with the total number of outcomes possible. Ask students if they can give an example of probability.

2. To help students understand probability, work on the following problem as a class: Imagine that you have boarded an airplane. The rows are numbered from 1 to 30, and there are six seats per row, three on each side of the isle. Seats in each row are labeled A through F. Using that information, work together as a class to solve the problems listed below.

    a. How many seats are in the airplane? *180 seats*
    b. What are your chances of sitting in row number 7? *6/180, or 1/30*
    c. What are your chances of sitting in a window seat? *There are two window seats per aisle, for a total of 60 window seats. Your chances of seating at a window would be 60/180, or 1/3.*

d. What are your chances of sitting in an "A" seat? *There are 30 A seats, so your chances are 30/180, or 1/6.*
e. What are your chances of sitting in an even-numbered row? *Of the 30 rows, 15 are even-numbered, so your chances are 15/30, or 1/2.*

3. To figure out each problem, students must set up a ratio between the total number of outcomes—in these problems either the total number of seats or rows—and the specific question asked. Tell students that they will write their answer as a fraction, decimal, and percentage. Example: The chance of sitting in seat 7A is 1/180, .00555, or .555 percent. The ratio presented as a percentage helps make it clear if the probability of an event is great or small.

4. Distribute the Classroom Activity Sheet and tell students that they are going to work on several probability problems in class, expressing the answer as a fraction, decimal, and percentage. Students may work individually or with partners. The problems and the answers are listed below:

    a. Your sock drawer is a mess. Twelve black socks and six red socks are mixed together. What are the chances that, without looking, you pick out a red sock? What are the chances of picking a black sock? *The total is 18 socks, and one-third of them are red (6/18, or 1/3, or .33, or 33 percent). The probability of picking a red sock is 1/3, or 33 percent. Because three-quarters of the socks are black (12/18, or 2/3, or 66 percent), the probability of picking a black one is higher—2/3, or 66 percent, compared with 1/3, or 33 percent.*
    b. You are rolling a regular die. What is the probability of rolling a 3? *Of the total of six outcomes, 3 is one outcome. The probability is the ratio 1/6, .1666, or 16.66 percent.*
    c. If you are rolling a regular die, what is the probability of rolling an even number? *Of the six possible outcomes, half, or three outcomes, could be an even number. The probability is 3/6, 1/2, .5, or 50 percent.*
    d. You are randomly choosing a card from a deck of 52 cards. What is the probability that the card you pick will be a king? *Of the 52 possible outcomes, four outcomes are kings. The probability is 4/52, 1/13, .076, or 7.6 percent.*
    e. You are visiting a kennel that has three German shepherds, four Labrador retrievers, two Chihuahuas, three poodles, and five West Highland terriers. When you arrive, the dogs are taking a walk. What is the probability of seeing a German shepherd first? *Out of a total of 17 dogs, 3 are German shepherds. The probability of seeing a German shepherd is 3/17, .176, or 17.6 percent.*
    f. Two out of three students in Mr. Allen's class prefer buying lunch to bringing it. Twenty students prefer buying lunch. How many students are in Mr. Allen's class? *Students can set up the following problem: 20/30, or 2/3, of the total number of students (X) buy lunch (20). To express that mathematically, 2/3 (X) = 20. Solve for X, which equals 30, so there are 30 students in Mr. Allen's class.*

5. After students have completed the Classroom Activity Sheet, go over their responses. Then assign the Take-Home Activity Sheet: Spin the Wheel! If time permits, review their answers during the next class period.

Adaptation for younger students:
Work on the Classroom Activity Sheet as a whole-class activity. Have students write their answers as a ratio only. Then challenge students to work on the Take-Home Activity Sheet in pairs. Go over their responses in class.

Discussion Questions:

1. Name professions that use probability. Give an example. *Many scientists and social scientists use probability, including epidemiologists, psychologists, economists, and statisticians. They predict outcomes of events, such as the incidence of diseases and the strength of the stock market.*

2. Imagine you are on the school debate team and the subject at hand is whether companies should drill for oil in Antarctica. What statistics would you look for if you're arguing in favor of oil exploration there? What statistics would you look for to support your argument *against* drilling there? What are some ways that numbers could support arguments on both sides?

3. Think about numbers you may have seen in advertisements, such as "X Juice is 90 percent real juice," or "Y cereal has 35 percent of the total vitamins needed in one day." How would you write each percentage as a ratio?

4. What does it mean when you hear the weather reporter predict a 10 percent chance of rain? Is that a high or low probability?

5. Express the probability that your mother will let you have a sleepover next weekend as a probability, assuming that the total number of outcomes is 100. What factors would increase the probability that she would say yes? *(If you finish all your homework and chores, go to bed on time.)* What factors would decrease the probability that she would say yes? *(If you misbehave, do not finish your homework or chores, or go to bed on time.)*

6. How do you think authors of *The Farmer's Almanac* make their predictions about weather for a year? How do you think they use probability?

Evaluation:

Use the following three-point rubric to evaluate students' work during this lesson:

> **Three points:** demonstrates a strong understanding of probability based on their participation in class, their ability to complete the Classroom Activity Sheet, and their ability to complete the Take-Home Activity Sheet

Two points: demonstrates a moderate understanding of probability based on their participation in class, their ability to complete the Classroom Activity Sheet, and their ability to complete the Take-Home Activity Sheet

One point: demonstrates a weak understanding of probability based on their participation in class, their ability to complete the Classroom Activity Sheet, and their ability to complete the Take-Home Activity Sheet.

Extensions:

Probability in Advertising
Ask students to look at newspapers and magazines for examples of how numbers are used in advertisements. For example, it is not unusual to see something like "two-thirds less fat than the other leading brand" or "four out of five dentists recommend Brand T gum for their patients who chew gum." Why do advertisers use numbers like these? What information are they trying to convey? Do students think that the numbers give accurate information about a product? Why or why not?

They Said What?
Ask students to look at newspapers or magazines for examples of how politicians, educators, environmentalists, or others use data such as statistics and probability. Then have them analyze the use of the information. Why did the person use data? What points were effectively made? Were the data useful? Did the data strengthen the argument? Have students provide evidence to support their ideas.

Suggested Reading:

***Chance and Average (Math Matters* series)**
Grolier Education, 1999.
For a brief but clear presentation of how numbers and chance work together, this volume in the *Math Matters* series is ideal. Important terms are underlined and included in a short glossary. Clear drawings demonstrate the concepts along with easy experiments to try.

Why Do Buses Come in Threes? The Hidden Mathematics of Everyday Life
Rob Eastaway and Jeremy Wyndham.
John Wiley & Sons, 1998.

Set up in question-and-answer format, this book offers explanations for those questions that perplex us all, starting with "Why can't I find a four-leafed clover?" The text is illustrated with line drawings, and additional problems/questions and solutions appear in shaded boxes. If you need to know "Why am I always in traffic jams?" this is your book!

Vocabulary:

factor
Definition: Something, such as a circumstance or an influence, that contributes to the production of a result.
Context: Weather is an important **factor** to consider when planning a picnic.

outcome
Definition: Something that comes out of or follows from an activity or process; consequence.
Context: She flipped the coin ten times, and the **outcome** was five heads and five tails.

percent
Definition: One part in one hundred.
Context: He passed the test by answering 85 **percent** of the questions correctly.

probability
Definition: Fairly convincing, though not absolutely conclusive; intrinsic or extrinsic evidence of support.
Context: High moisture in the air and a dropping temperature led the meteorologist to conclude a high **probability** of snow.

random
Definition: lacking or seeming to lack a regular plan, marked by an absence of bias.
Context: The judges picked the winning number at **random**.

Academic standards:

Grade level:
6-8
Subject area:
Mathematics
Standard:
Understands and applies basic and advanced concepts of probability.
Benchmark:
Understands the relationship between the numerical expression of a probability (e.g., fraction, percentage, odds) and the events that produce these numbers.

Credit
Marilyn Fenichel, freelance education writer and editor.

DiscoverySchool.com
http://www.discoveryschool.com

Name: _____

Probability Problem Solving

Below are six probability problems. Work by yourself or with a partner to solve the problems, but be sure to fill out your own sheet. Write your answer as a ratio, a decimal, and a percentage. Be prepared to discuss your responses in class.

1. Your sock drawer is a mess. There are 12 black socks and 6 red socks mixed together. What are the chances that, without looking, the one sock you pick out of the drawer is a red sock? What are the chances of the sock being a black one?

2. You are rolling a regular die. What is the probability of rolling a 3?

3. If you are rolling a regular die, what is the probability of rolling an even number?

4. You are randomly choosing a card from a regular deck of 52 cards. What is the probability that the card you pick will be a king?

5. You are visiting a kennel that has three German shepherds, four Labrador retrievers, six Chihuahuas, five poodles, and four West Highland terriers. When you arrive, the dogs are taking a walk. What is the probability of seeing a German shepherd first?

6. Two out of three students in Mr. Allen's class prefer buying lunch to bringing it. Twenty students prefer buying lunch. How many students are in Mr. Allen's class?

Take-Home Activity Sheet: **Understanding Probability**

Name: _____

Spinning the Wheel!

You're at a school fair, where one of the games is "Spin the Wheel!" Players spin a giant wheel with numbers 1-40. Here's the trick: You win a toy if you spin a number that meets a certain criteria, such as an even number or a multiple of 10. There's a different criteria each round of the game. What is the probability of spinning a number and winning a toy for each of the criteria listed below? Express the probability as a fraction, a decimal, and as a percentage.

Criteria	**Probability as a Fraction**	**Probability as a Decimal**	**Probability as a Percentage**
An odd number			
A multiple of 6			
A factor of 12			
A multiple of 2 and 3			
A square number greater than 16			
A square number less than 16			
A prime number			
A multiple of 2			
An even number			
An even and an odd number			
A even number less than 40			
An odd number less than 40			
An even number between 20 and 40			
An odd number between 1 and 20			
A multiple of 9			
The number 2 cubed			