

## **Dear Family,**

The next unit in your child's mathematics class this year is ***How Likely Is It?: Understanding Probability***. This unit helps students understand and reason about experimental and theoretical probability and the relationship between them. Students make important connections between probability and rational numbers, geometry, statistics, science, and business.

### **UNIT GOALS**

Students will learn to find probabilities in two ways: by conducting trials and collecting experimental data, and also by analyzing situations to determine theoretical probabilities. Students use fractions, decimals, and percents to describe how likely events are.

Students experiment with coins, number cubes, spinners, and paper cups. They will examine simple games of chance to determine whether the games are fair. Students will examine how probability is useful in predicting the likelihood of genetic traits, such as eye color and tongue-curling ability.

### **HELPING WITH HOMEWORK**

You can help with homework and encourage sound mathematical habits as your child studies this unit by asking questions such as:

- What are the possible outcomes that can occur for the events in this situation?
- How could you determine the experimental probability of each of the outcomes?
- Is it possible to determine the theoretical probability of each of the outcomes?
- If so, what are these probabilities?
- How can you use the probabilities to make decisions about this situation?

In your child's notebook, you can find worked-out examples from problems done in class, notes on the mathematics of the unit, and descriptions of the vocabulary words.

### **HAVING CONVERSATIONS ABOUT THE MATHEMATICS IN *HOW LIKELY IS IT?***

You can help your child with his or her work for this unit in several ways:

- Discuss examples of statements or situations in everyday experiences that relate to the likelihood of certain events.
- Look at sports statistics with your child and ask questions such as how a batting average or a free-throw average can be used to predict the likelihood that the player will get a hit the next time at bat or make a basket the next time at the free-throw line.
- Look over your child's homework and make sure all questions are answered and that explanations are clear.

A few important mathematical ideas that your child will learn in *How Likely Is It?* are given on the back. As always, if you have any questions or concerns about this unit or your child's progress in class, please feel free to call.

Sincerely,

| Important Concepts   |   | Examples  |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
|--|---|---|-------------|---------|-------|-------|-------------|-------|-------|-------------|-------|-------|-------------|-------|-------|-------------|---|------------|-------------|---------|-------|-------|-------------|-------|-------------|-------|-------|-------------|-------|-------------|
| <p><b>Probability</b><br/>A number between 0 and 1 that describes the likelihood that an event will occur.</p>   |   | <p>If a bag contains a red marble, a white marble, and a blue marble, then the probability of drawing a red marble is 1 out of 3 or <math>\frac{1}{3}</math>. We would write: <math>P(\text{red}) = \frac{1}{3}</math>.</p>   |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
| <p>Once we have a probability—theoretical or experimental—we can use it to make predictions and decisions.</p>   |   | <p>If a number cube is rolled 1000 times, we would predict that a 3 will occur about <math>\frac{1}{6}</math> of the time or about <math>\frac{1}{6} \times 1000</math>, or 167 times.</p>  |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
| <p><b>Theoretical Probability</b><br/>A probability obtained by analyzing a situation. If all the <b>outcomes</b> (possible results) are equally likely, you can find a theoretical probability of an event by first listing all the possible outcomes, then finding the ratio of the number of outcomes you are interested in to the total number of outcomes.</p>  |   | <p>If a number cube has six sides with the possible outcomes of rolling: 1, 2, 3, 4, 5, or 6, then the probability of rolling a “3” is 1 out of 6.</p> $P(\text{Rolling a 3}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$ $= \frac{1 \text{ (there is 1 number 3 on the cube)}}{6 \text{ (there are 6 possible outcomes)}}$ |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
| <p><b>Experimental Probability</b><br/>A probability found as a result of an experiment. This probability is the relative frequency of the <b>event</b> (a set of outcomes) that is the ratio of the number of times the event occurred compared to the total number of <b>trials</b> (one round of an experiment).</p>  |   | <p>If you tossed a coin 50 times and heads occurred 23 times, the relative frequency of heads would be <math>\frac{23}{50}</math>.</p> $P(\text{heads}) = \frac{\text{number of times the event occurred}}{\text{number of trials}}$ $= \frac{\text{number of heads}}{\text{total number of tosses}} = \frac{23}{50}$   |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
| <p><b>Random Events</b><br/>In mathematics, random means that any particular outcome is unpredictable, but the long-term behavior exhibits a pattern.</p>  |   | <p>Flipping a coin is a random event because we never know whether the next flip will be heads or tails, but we do know that in the long run we will have close to 50% heads.</p>   |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
| <p><b>Strategies for Finding Outcomes</b><br/>When situations involve more than one action, we need to generate the outcomes in a systematic way. Organized lists or tree diagrams are particularly useful.</p>  | <p><b>Organized List</b></p> <table border="1"> <thead> <tr> <th>First Coin</th> <th>Second Coin</th> <th>Outcome</th> </tr> </thead> <tbody> <tr> <td>heads</td> <td>heads</td> <td>heads-heads</td> </tr> <tr> <td>heads</td> <td>tails</td> <td>heads-tails</td> </tr> <tr> <td>tails</td> <td>heads</td> <td>tails-heads</td> </tr> <tr> <td>tails</td> <td>tails</td> <td>tails-tails</td> </tr> </tbody> </table> | First Coin  | Second Coin | Outcome | heads | heads | heads-heads | heads | tails | heads-tails | tails | heads | tails-heads | tails | tails | tails-tails | <p><b>Tree Diagram</b></p> <table border="1"> <thead> <tr> <th>First Coin</th> <th>Second Coin</th> <th>Outcome</th> </tr> </thead> <tbody> <tr> <td rowspan="2">heads</td> <td>heads</td> <td>heads-heads</td> </tr> <tr> <td>tails</td> <td>heads-tails</td> </tr> <tr> <td rowspan="2">tails</td> <td>heads</td> <td>tails-heads</td> </tr> <tr> <td>tails</td> <td>tails-tails</td> </tr> </tbody> </table> | First Coin | Second Coin | Outcome | heads | heads | heads-heads | tails | heads-tails | tails | heads | tails-heads | tails | tails-tails |
| First Coin   | Second Coin   | Outcome   |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
| heads  | heads   | heads-heads   |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
| heads  | tails   | heads-tails   |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
| tails  | heads   | tails-heads   |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
| tails  | tails   | tails-tails   |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |
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| <p><b>Law of Large Numbers</b><br/>Experimental data gathered over many trials should produce probabilities that are close to the theoretical probabilities. This idea is sometimes called the Law of Large Numbers.</p> <p>It is important for students to realize that a small amount of data may produce wide variation. It takes many trials to make good estimates for what will happen in the long run.</p> <p>The Law of Large Numbers does not say that when flipping a coin, we should expect exactly 50% heads in any given large number of trials. Instead, it says that as the number of trials gets larger, we expect the percentage of heads to be in a smaller range of around 50%.</p> |   |   |             |         |       |       |             |       |       |             |       |       |             |       |       |             |   |            |             |         |       |       |             |       |             |       |       |             |       |             |

On the [CMP Parent Web Site](http://PHSchool.com/cmp2parents), you can learn more about the mathematical goals of each unit, see an illustrated vocabulary list, and examine solutions of selected ACE problems. <http://PHSchool.com/cmp2parents>