The first topic of Module 5 introduces students to **probability**. They start by using the **probability scale** to understand that the probability of an event is always a number between 0 and 1 (including 0 and 1). Throughout the topic, students collect data from various experiments, including experiments in which outcomes are equally likely (such as flipping a coin) and those in which outcomes are not equally likely (such as picking a cube from a bag containing 80 red cubes, 15 blue cubes, and 5 yellow cubes). By performing these experiments, students calculate the probability of each outcome. Later in the topic, students organize lists of possible outcomes in **tree diagrams** and then calculate the probability of **compound events**.

You can expect to see homework that asks your child to do the following:

- Decide whether events are impossible, unlikely, equally likely to occur or not to occur, likely, or certain.
- Perform experiments and calculate the probabilities of various outcomes that result from each experiment.
- Interpret graphs in order to calculate probabilities.
- Identify the **sample space** of an experiment.
- Draw and interpret tree diagrams.

**SAMPLE PROBLEMS (From Lesson 7)**

Draw a tree diagram showing the eight possible birth outcomes for a family with 3 children (no twins or triplets). Use the symbol **B** for the outcome of a boy and the symbol **G** for the outcome of a girl. Consider the first birth to be the first stage.

What is the **theoretical probability** of a family having 3 girls in this situation? Is that greater than or less than the probability of having exactly 2 girls in 3 births?

**The probability of having 3 girls, written as** $P(\text{GGG})$, **is 0.125 because** $(0.5)(0.5)(0.5) = 0.125$.

**The probability of having exactly 2 girls, written as** $P(\text{BGG}) + P(\text{GBG}) + P(\text{GGB})$, **is** $0.125 + 0.125 + 0.125$, **or 0.375**.

**The probability of having 3 girls, written as** $P(\text{GGG})$, **is less than the probability of having exactly two girls because 0.125 is less than 0.375**.

What is the probability of a family with 3 children having at least 1 girl?

**The probability of having at least 1 girl is found by subtracting the probability of having no girls (or all boys, $P(\text{BBB})$) from 1, or** $1 - 0.125 = 0.875$.

Additional sample problems with detailed answer steps are found in the Eureka Math Homework Helpers books. Learn more at GreatMinds.org.
**TERMS**

**Certain:** An event with a probability of 1, which means it will always occur. For example, it is certain we will pick a red cube from a bag containing only red cubes.

**Compound event:** A combination or series of two or more simple events. (A simple event is an event that has exactly one outcome, such as flipping a coin or rolling a die.)

**Equally likely to occur or not to occur:** An event with a probability of \( \frac{1}{2} \).

**Estimated probability:** The probability calculated from an experiment. For example, if a coin is flipped 10 times and lands on heads 7 times, the estimated probability of landing on heads is \( \frac{7}{10} \) even though we would expect the probability to be \( \frac{1}{2} \).

**Impossible:** An event with a probability of 0, which means it will never occur. For example, it is impossible to pick a blue cube from a bag containing only red cubes because no blue cubes are in the bag.

**Likely:** An event with a probability between \( \frac{1}{2} \) and 1, which means it has a good chance of occurring.

**Outcome:** The result of an experiment (event). For example, when someone rolls a 1 on a number cube (die), the outcome of that simple experiment is 1.

**Probability:** A number between 0 and 1 (including 0 and 1) that measures the chance that an event will occur. For example, when we flip a coin, the probability that it will land on heads is 1 in 2, or \( \frac{1}{2} \).

**Sample space:** The set of all possible outcomes. For example, the sample space when rolling a number cube is the set \{1, 2, 3, 4, 5, 6\}.

**Theoretical probability:** The probability calculated based on what we know about the sample space. For example, the theoretical probability that a flipped coin will land on heads is \( \frac{1}{2} \) because the coin has one head side (numerator), and the flip has two possible outcomes (denominator). (The sample space is heads and tails.)

**Unlikely:** An event with a probability between 0 and \( \frac{1}{2} \), which means it does not have a good chance of occurring. For example, it is unlikely that we would pick a blue cube from a bag containing 95 red cubes and 5 blue cubes because there are only a few blue cubes in the bag. The probability in this case is \( \frac{5}{100} \), or \( \frac{1}{20} \).

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**MODELS**

**Dot Plot**

```
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Sample Proportion
```

**Probability Scale**

```
0                Impossible
Unlikely
1/2              Equally Likely to Occur or Not Occur
Likely
1                Certain
```

**Tree Diagram**

```
Monday      Tuesday     Outcome
B          B             BB
            C            BC
                C        CB
```

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