LESSON 9

Objective

Find the probability of a compound event; make a tree diagram.

Common Core State Standards

- **7.SP.8a** Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
- **7.SP.8b** Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.

Statistics and Probability

Compound Events: Making a Tree Diagram

Students have probably noticed a discrepancy between the theoretical probability of a simple event occurring and their actual experimental results. They should understand by now that generally, the more trials one performs, the closer the experimental results will be to the theoretical outcome. This activity lays the foundation for ensuring that the theoretical probability for compound events is correctly calculated.

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- **Ask:** *How many different combinations of colors and numbers do you think there are for the spinner and the die?*
- **Ask:** *What are the possible outcomes for a spin of the spinner? What are the possible outcomes for a roll of the die? Does the outcome of Jackie's spin affect the outcome of Jeff's roll of the die? Does the outcome of Jeff's roll of the die affect the outcome of Jackie's spin?*

Solve It

Have students explain in writing how likely Jeff and Jackie are to spin and roll a red 4. Are their chances of spinning a red 4 different from their chances of spinning and rolling any other combination?

More Ideas

For other ways to teach about probabilities of compound events—

- Have students extend this activity by finding the probabilities of other outcomes such as *P*(red, 3), *P*(blue, 1), *P*(green, 3), and so forth. Gradually increase the complexity to outcomes such as *P*((red, 4) *or* (red, 2)), *P*((green, 3) *or* (blue, 2)), and *P*((yellow, 3) *and* (blue, 4)).
- Have students conduct a similar experiment using two number cubes. Students can find the probability of rolling an odd number, then an even number.

Formative Assessment

Have students try the following problem.

A family has three children. What is the probability that two of the children are boys?

A. $\frac{1}{4}$ **B.** $\frac{1}{3}$ **C.** $\frac{3}{8}$ **D.** $\frac{1}{2}$

Try It! 30 minutes | Pairs

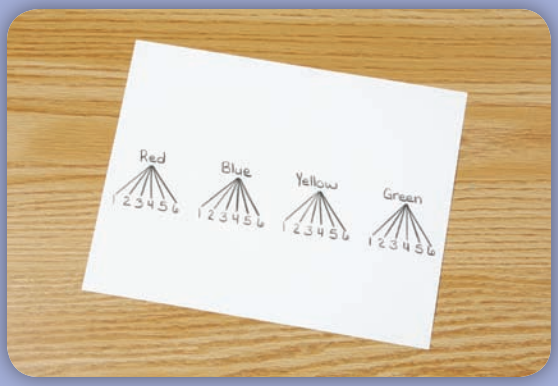
Here is a problem about the probability of a compound event.

Jeff has a spinner that is divided into four equal sections: red, yellow, green, and blue. Jackie has a 6-sided die. They decide to make up a game of their own in which Jeff must call out a number and Jackie must call out a color. If they call out "red" and "4," what is the probability that they will spin and roll that particular outcome?

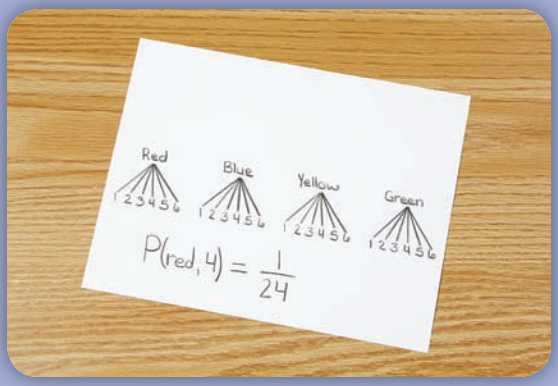
Introduce the problem. Then have students do the activity to solve the problem. Distribute the materials.

Materials
- Spinners
- Number Cube

1. Have students simulate the game by spinning and rolling until they get "red" and "4." Have them record how many trials it took them to get that result. **Ask:** *How many trials did it take?*



2. Next, have students create a tree diagram, starting with the spinner colors. Then have them complete the tree diagram with the numbers on the die. **Ask:** *What is the probability that you will get "red" and "4" on your first try?*



3. Discuss the tree diagram with students. **Ask:** *How many spins and rolls should it take, on average, to get "red" and "4"?*

⚠ Look Out!

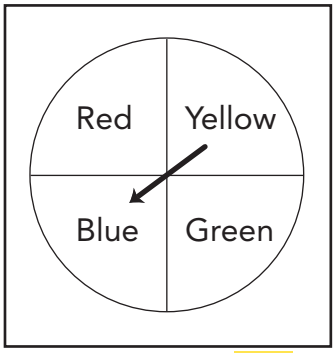
Students may want to stop drawing the tree diagram once they have reached the outcome (red, 4). They need to understand that in order to find the total number of possible outcomes, they will need to complete the entire tree diagram. Explain to them that the total provides them with the correct denominator for the fraction that represents *P*(red, 4).

Answer Key

Use the 4-section color spinner and a number cube to simulate a game. Make a tree diagram for all possible outcomes. Find each probability.

(Check students' work.)

1. Four-section spinner with red, blue, green, and yellow sections and a number cube labeled 1 to 6



Check students' tree diagram. The diagram should have four branches, one for each color and each branch should have six numbers, 1–6.

P(red and 1) $\frac{1}{24}$

P(green and an even number) $\frac{1}{8}$

Using the 6-section color spinner and a coin, make a tree diagram of all possible outcomes. Find each probability.

2.

Check students' tree diagram. The diagram should have six branches, one for each color and each branch should have 2 options, heads and tails.

P(yellow and heads) $\frac{1}{12}$

P(blue or green and heads) $\frac{1}{6}$

Find each probability given the two elements of chance.

3. 2 coins

P(two heads) $\frac{1}{4}$

P(heads and tails) $\frac{1}{2}$

4. 8-sided die labeled 1–8 and a coin

P(8 and heads) $\frac{1}{16}$

P(tails and odd) $\frac{1}{4}$

5. two-section spinner labeled red and blue, and a 4-sided die labeled 1–4

P(blue and 3) $\frac{1}{8}$

P(red and even) $\frac{1}{4}$

Answer Key

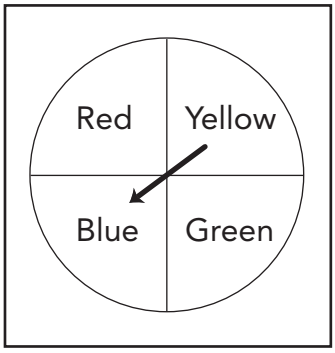
Challenge! Describe a tree diagram for three items of chance: coin, 4-section spinner, and a number cube. Does the number of possible outcomes vary depending on the order in which you make your diagram? Explain.

Challenge: (Sample) The diagram could be in any order of the items of chance. If the diagram is made in the order the items are named, there will be two branches, one heads and one tails. Each of these branches will have four branches, one for each color. Each of the color branches will have six number branches. The order of the branches does not affect the number of possible outcomes. In this case, any order of branches will produce 48 outcomes.

Name _____

Use the 4-section color spinner and a number cube to simulate a game. Make a tree diagram for all possible outcomes. Find each probability.

1. Four-section spinner with red, blue, green, and yellow sections and a number cube labeled 1 to 6



P(red and 1) _____ *P*(green and an even number) _____

Using the 6-section color spinner and a coin, make a tree diagram of all possible outcomes. Find each probability.

2.

P(yellow and heads) _____ *P*(blue or green and heads) _____

Find each probability given the two elements of chance.

3. 2 coins

P(two heads) _____

P(heads and tails) _____

4. 8-sided die labeled 1–8 and a coin

P(8 and heads) _____

P(tails and odd) _____

5. two-section spinner labeled red and blue, and a 4-sided die labeled 1–4

P(blue and 3) _____

P(red and even) _____

Name _____

Challenge! Describe a tree diagram for three items of chance: coin, 4-section spinner, and a number cube. Does the number of possible outcomes vary depending on the order in which you make your diagram? Explain.