LESSON 8

Objective

Find the probability of a compound event; make an organized list.

Common Core State Standards

- **7.SP.6** Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*
- **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.

Compound Events: Making an Organized List

Experience with experiments helps students build on their intuitive sense about probability. In this lesson, students make an organized list to identify outcomes in a sample space and make predictions about their occurrences. Comparing theoretical predictions and observational data enables students to draw new insights and adjust their thinking accordingly.

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

Talk About It

Discuss the Try It! activity.

- **Ask:** *What fraction do you use to compute the probability of an event?* Point out that the fraction is the number of favorable outcomes over the number of possible outcomes.
- **Ask:** *Besides using an organized list, how else might you find the number of possible outcomes?* If appropriate, elicit that the possibilities include drawing a picture and making a tree diagram.

Solve It

Reread the problem with students. Have them find and write the probability for each single event in the form of a fraction. Guide students to multiply these fractions to find the probability of the compound event. Have students compare the experimental and theoretical probabilities. Ask students to tell how the favorable outcomes would differ if Deana wanted to roll a number greater than 5 OR toss yellow.

More Ideas

For other ways to teach about probabilities of compound events—

- Have students conduct the experiment using a 1–8 spinner instead of the die.
- Use Color Tiles. Place six yellow and four red tiles in a bag. Have students draw one tile, record the color, replace the tile, and repeat. Each draw is a single event. The two draws are a combined event. Have students find the experimental and theoretical probabilities of drawing a yellow tile first and a red tile second.

Formative Assessment

Have students try the following problem.

Johann rolls a number cube with the numbers 1–6. He also tosses a coin. What is the probability that he will roll an even number and toss tails?

A. $\frac{1}{2}$ **B.** $\frac{1}{3}$ **C.** $\frac{1}{4}$ **D.** $\frac{1}{12}$

Try It! 30 minutes | Groups of 4

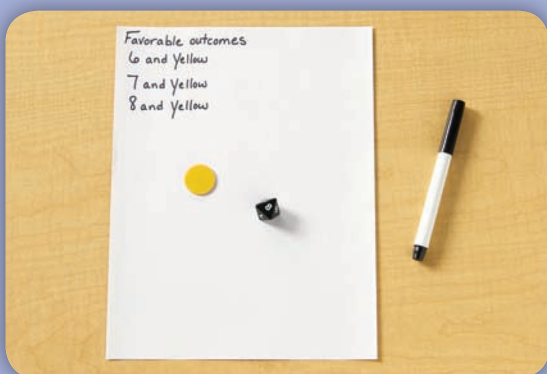
Here is a problem about the probability of a compound event.

Deana has a polyhedral die with faces labeled 1–8 and a counter with one yellow and one red face. What is the probability that she will roll a number greater than 5 and toss a counter yellow-face up?

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

Materials

- Octahedral Dice (1 per group)
- Two-Color Counters (1 per group)
- cup (optional for rolling die and counters; 1 per group)
- paper (2 sheets per group)



1. Ask: *What are the favorable outcomes for each single event—that is, for just the number and for just the color? What are the favorable outcomes for the compound event?* Have students record the favorable outcomes for the compound event.

2. Guide students to list all the possible outcomes for the compound event. Then have them perform at least 50 trials for this event and record their results. **Ask:** *What are the experimental and theoretical probabilities for the compound event?*

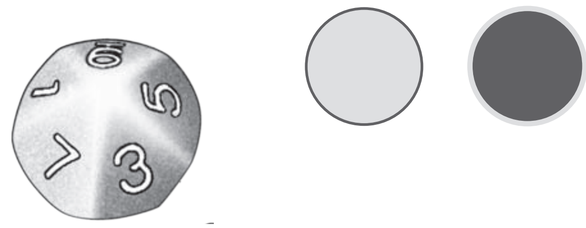
3. Guide students to see that they can determine the number of possible and favorable outcomes by using the Counting Principle. Show how this leads to the rule *P*(*A* and *B*) = *P*(*A*) × *P*(*B*).

Look Out!

Emphasize that both events must have favorable outcomes to satisfy the conditions: rolling a 2 and yellow is not a favorable outcome because the outcome is not favorable for one of the two single events. Students may think that the theoretical probability and the experimental probability should be the same. Stress that the two results may not be the same.

Use the decahedral die and a Two-Color Counter to model each probability. Find the probability of each compound event. (Check students' work.)

1. 10-sided die numbered 0 to 9 and 1 Two-Color Counter



P(1 and red) $\frac{1}{20}$

P(8 and red) $\frac{1}{20}$

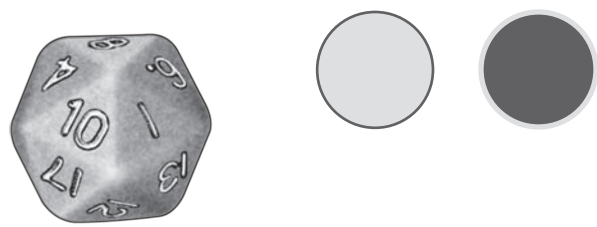
P(4 and not yellow) $\frac{1}{20}$

P(6 and yellow) $\frac{1}{20}$

P(7 or 8 and red) $\frac{1}{10}$

Using a die and a Two-Color Counter, model each probability. Find each probability.

2. 20-sided die numbered 1 to 20 and 1 counter



P(1 and yellow) $\frac{1}{40}$

P(12 and red) $\frac{1}{40}$

P(4, not red) $\frac{1}{40}$

3. 6-sided die numbered 1 to 6 and 1 counter

P(2 and red or yellow) $\frac{1}{6}$

P(not 3, red) $\frac{5}{12}$

P(2 and yellow) $\frac{1}{12}$

P(not 4 or 5, yellow) $\frac{1}{3}$

Find each probability.

4. 8-sided die numbered 1 to 8 and 1 counter

P(1 and yellow) $\frac{1}{16}$

P(7, not red) $\frac{1}{16}$

P(not 9, not yellow) $\frac{1}{2}$

P(5 or 6, red) $\frac{1}{8}$

5. 12-sided die numbered 1 to 12 and 1 counter

P(12 and yellow) $\frac{1}{24}$

P(13 and red) $\frac{1}{2}$

P(not 1, not yellow) $\frac{11}{24}$

P(4 and red or yellow) $\frac{1}{12}$

Answer Key

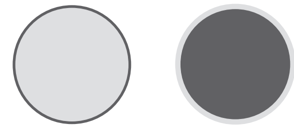
Challenge! What does the word *compound* mean when finding the probability of an event?

Challenge: (Sample) A compound event is an event with two parts that are independent of each other.

Name ______________________

Use the decahedral die and a Two-Color Counter to model each probability. Find the probability of each compound event.

1. 10-sided die numbered 0 to 9 and 1 Two-Color Counter



P(1 and red) ____________

P(8 and red) ____________

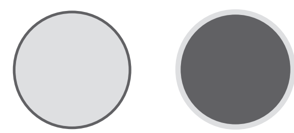
P(4 and not yellow) ____________

P(6 and yellow) ____________

P(7 or 8 and red) ____________

Using a die and a Two-Color Counter, model each probability. Find each probability.

2. 20-sided die numbered 1 to 20 and 1 counter



P(1 and yellow) ____________

P(12 and red) ____________

P(4, not red) ____________

3. 6-sided die numbered 1 to 6 and 1 counter

P(2 and red or yellow) ____________

P(not 3, red) ____________

P(2 and yellow) ____________

P(not 4 or 5, yellow) ____________

Find each probability.

4. 8-sided die numbered 1 to 8 and 1 counter

P(1 and yellow) ____________

P(7, not red) ____________

P(not 9, not yellow) ____________

P(5 or 6, red) ____________

5. 12-sided die numbered 1 to 12 and 1 counter

P(12 and yellow) ____________

P(13 and red) ____________

P(not 1, not yellow) ____________

P(4 and red or yellow) ____________

Name ___________________________________

Challenge! What does the word *compound* mean when finding the probability of an event?