Common Core Standards:
7.SP.8.a, 7.SP.8.b, 7.SP.8.c

Compound Events

Getting the Idea

A **compound event** is a combination of two or more events. Compound events can be dependent or independent. Events are **independent** when the outcome of one event does not affect the outcome of a second event. When the outcome of one event affects the outcome of a second event, the events are **dependent**.

As with simple events, the probability of a compound event is the ratio of favorable outcomes to total outcomes in the sample space for which the compound events occur. You can use tables, organized lists, and tree diagrams to find the probability of compound events, or you can use the rules below.

To find the probability of two independent events, multiply the probability of the first event by the probability of the second event.

$P(\text{two independent events}) = P(\text{first event}) \times P(\text{second event})$

Example 1

Adriana tosses a number cube with faces numbered 1 through 6 and spins the spinner shown below at the same time.

What is the probability of tossing a number greater than 2 on the cube and spinning red on the spinner? Express the probability as a fraction, as a percent, and as a decimal.

Strategy **Find the probability of each event and multiply them together.**

Step 1 Decide if the events are dependent or independent.

The outcome on the number cube does not affect the outcome on the spinner.

The events are independent.

Step 2 Find the probability of the number cube landing on a number greater than 2.

A number cube has 6 possible outcomes.

Four outcomes (3, 4, 5, 6) are greater than 2.

$$P(>2) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}} = \frac{4}{6} = \frac{2}{3}$$

Step 3 Find the probability of spinning red on the spinner.

Three of the 4 sections are labeled "red."

$P(\text{red}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}} = \frac{3}{4}$

Step 4 Multiply the two probabilities.

$\frac{2}{3} \times \frac{3}{4} = \frac{6}{12} = \frac{1}{2}$

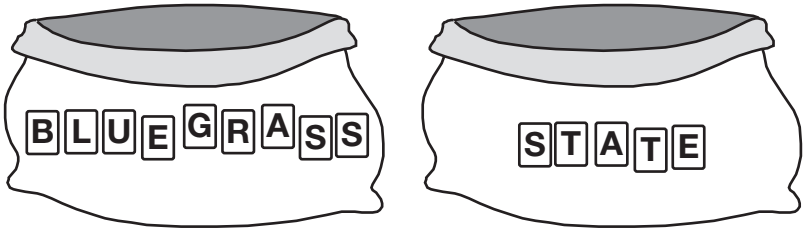
Step 5 Express the probability as a fraction, decimal, and percent.

$\frac{1}{2} = 0.5 = 50\%$

Solution **The probability of the cube landing on a number greater than 2 and the spinner landing on red is $\frac{1}{2}$, 0.5, or 50%.**

Example 2

Dion wrote the letters of the Kentucky state nickname on a set of same-sized cards and placed the cards into two bags as shown below.



He will choose one card from each bag without looking. What is the probability that he will choose the letter A from each bag?

Strategy **Find the probability of each event and multiply.**

Step 1 Decide if the events are dependent or independent.

The letter drawn from the first bag does not affect the letter drawn from the second bag.

The events are independent.

Step 2 Find the probability of choosing an A from the first bag.

One of the 9 letters is an A.

$P(A)$ for first bag $= \frac{1}{9}$

Step 3 Find the probability of choosing an A from the second bag.

One of the 5 letters is an A.

$P(A)$ for second bag $= \frac{1}{5}$

Step 4 Multiply the probabilities.

$\frac{1}{9} \times \frac{1}{5} = \frac{1}{45}$

Solution **The probability that Dion will choose an A from each bag is $\frac{1}{45}$.**

When you need to find the probability of a compound event, sometimes it is necessary to make a tree diagram, an organized list, or a table to find the number of possible outcomes.

You can also use the **fundamental counting principle** to find the number of possible outcomes. If event A can occur in m ways and event B can occur in n ways, then events A and B can occur in $m \times n$ ways.

Example 3

A deli has a lunch special that consists of a sandwich, soup, and a dessert for $6.99. The choices are shown below.

sandwich: cheese, roast beef, turkey
soup: yellow pea, chicken noodle
dessert: cookie, fruit

How many lunch specials are there?

Strategy **Make an organized list.**

Step 1 List all possible outcomes. There are 3 choices of sandwich, 2 choices of soup, and 2 choices of dessert.

cheese, yellow pea, cookie	cheese, yellow pea, fruit
cheese, chicken noodle, cookie	cheese, chicken noodle, fruit
roast beef, yellow pea, cookie	roast beef, yellow pea, fruit
roast beef, chicken noodle, cookie	roast beef, chicken noodle, fruit
turkey, yellow pea, cookie	turkey, yellow pea, fruit
turkey, chicken noodle, cookie	turkey, chicken noodle, fruit

Step 2 Use the fundamental counting principle to check.

$3 \times 2 \times 2 = 12$

Solution **There are 12 lunch specials.**

Coached Example

Chris tosses two number cubes labeled 1 to 6. What is the probability of rolling double 4s?

Does the outcome on one number cube affect the outcome on the other number cube? ____

Are the events dependent or independent? _____

Complete the table below to show the sample space. Use ordered pairs to represent each outcome in the table.

	1	2	3	4	5	6
1	(1, 1)	(1, 2)				
2	(2, 1)					
3						
4						
5						
6						

How many total possible outcomes are there? _____

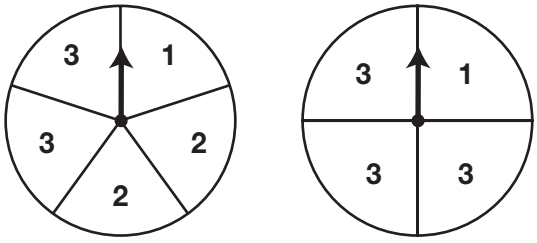
What is the probability of rolling double 4s? _____

The probability of rolling double 4s is _____.

Lesson Practice

Choose the correct answer.

Use the spinners below for questions 1 and 2.



1. What is the probability of spinning a 3 on both of the spinners?

A. 0.25
B. 0.3
C. 0.35
D. 0.4

2. What is the probability of spinning a sum of 4 when spinning both spinners at the same time?

A. 20%
B. 25%
C. 30%
D. 35%

3. Gabriel is doing a probability experiment. He is tossing a coin and spinning a spinner with 4 equal sections numbered from 1 through 4. How many possible outcomes are there?

A. 2
B. 4
C. 6
D. 8

4. There are 4 boys and 2 girls from the seventh grade and 3 boys and 5 girls from the eighth grade on the soccer team. Coach Hart will pick one captain from each grade. What is the probability that both captains will be girls?

A. $\frac{5}{24}$
B. $\frac{1}{4}$
C. $\frac{3}{10}$
D. $\frac{1}{2}$

5. Alexie tosses two dimes in the air. What is the probability that both dimes will land on heads?

A. $\frac{1}{2}$

B. $\frac{3}{8}$

C. $\frac{1}{4}$

D. $\frac{1}{6}$

6. Wendy is going to toss two number cubes with faces numbered 1 through 6 and a coin. How many possible outcomes are there for Wendy's experiment?

A. 14

B. 38

C. 72

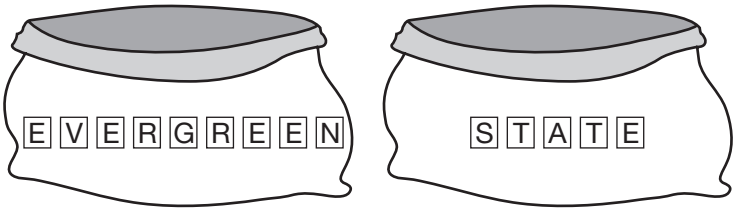
D. 216

7. Patrick tosses a penny and a number cube, with faces numbered 1 through 6, at the same time.

A. Are the events dependent or independent? Explain your thinking.

B. What is the probability that the penny will land on heads and the number cube will land on a multiple of 3? Show your work.

8. Tao wrote the letters of Washington's state nickname on a set of same-size cards and placed the cards into two bags as shown below. She will choose one card from each bag without looking. Select True or False for each statement.



A. The events of drawing a letter from Bag 1 and drawing a letter from Bag 2 are independent. ○ True ○ False

B. The probability of drawing an R from Bag 1 is $\frac{2}{9}$. ○ True ○ False

C. The probability of drawing a T from Bag 2 is 0.2. ○ True ○ False

D. The probability of drawing an R from Bag 1 and a T from Bag 2 is $\frac{4}{9}$. ○ True ○ False

E. The probability of drawing an E from Bag 1 and a T from Bag 2 is $\frac{8}{45}$. ○ True ○ False

9. Brian tossed 4 pennies. Circle the number that makes the statement true.

The probability that all 4 pennies landed on tails is $\boxed{\frac{1}{16} \quad \frac{1}{8} \quad \frac{1}{4} \quad \frac{1}{2}}$.

10. Is the number of possible outcomes for each experiment correct? Select Yes or No.

A. tossing two coins and a number cube labeled 1 through 6; number of possible outcomes = 24 ○ Yes ○ No

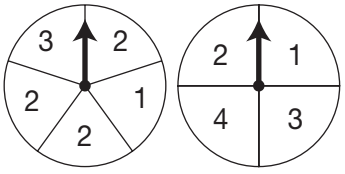
B. tossing three number cubes labeled 1 through 6; number of possible outcomes = 216 ○ Yes ○ No

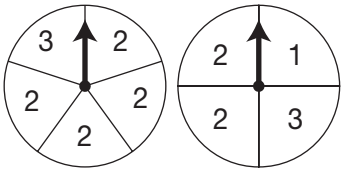
C. tossing two coins and two number cubes labeled 1 through 6; number of possible outcomes = 144 ○ Yes ○ No

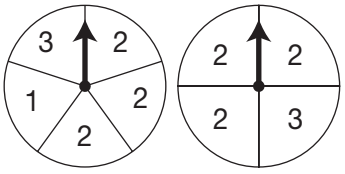
D. tossing a coin and spinning a spinner with 3 equal sections numbered 1 through 3; number of possible outcomes = 9 ○ Yes ○ No

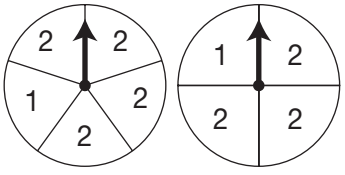
E. tossing three coins; number of possible outcomes = 16 ○ Yes ○ No

11. Find P(2 on both spinners) for each set of spinners. Draw a line from each set of spinners to its value.

A. 

B. 

C. 

D. 

$\frac{9}{20}$

$\frac{3}{20}$

$\frac{2}{5}$

$\frac{3}{5}$