Lesson 7-6
Find Probabilities of Compound Events

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I can...
find the probability of a compound event.

Solve & Discuss It!

Talia is playing a game in which she must choose Option 1 or Option 2 and then spin the game wheel, flip the coin, and roll the number cube labeled 1 through 6. For her to win a prize, all the conditions listed under the chosen option must occur. Which option should Talia choose? Explain.

Option 1	Option 2
• The game wheel lands on S.	• The game wheel lands on Z.
• The coin lands on tails.	• The coin lands on either side.
• An even number is rolled.	• The number 3 is rolled.

Look for Relationships
How can you use what you know about sample spaces to choose the best option?

Focus on math practices

Make Sense and Persevere Suppose an Option 3 was added to the game, with the conditions that the game wheel lands on Q, the coin lands on either side, and an odd number is rolled. Should Talia change her choice to Option 3? Explain.

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Essential Question How can a model help find the probability of a compound event?

EXAMPLE 1 Find the Probability of Compound Events Using a Table

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Sadie has one ticket left at the school fair and she hasn't yet won a prize. She decides between two games. Which game should she play?

Use Structure Does having more possible outcomes make it more likely or less likely that Sadie will win?

STEP 1 Use a table to determine the probability of winning a prize playing *Flip to Win*.

	Heads (H)	Tails (T)
Heads (H)	H, H	H, T
Tails (T)	T, H	T, T

There are 4 possible outcomes.

There is 1 favorable outcome: {H, H}.

$P(H, H) = \frac{1}{4}$, or 25%

STEP 2 Use a table to determine the probability of winning a prize playing *Flip 'n' Spin*.

	Heads (H)	Tails (T)
Red (R)	R, H	R, T
Yellow (Y)	Y, H	Y, T
Blue (B)	B, H	B, T
Green (G)	G, H	G, T

There are 8 possible outcomes.

There is 1 favorable outcome: {B, H}.

$P(B, H) = \frac{1}{8}$, or 12.5%

STEP 3 Compare the probabilities of winning each game.

The probability of winning a prize at *Flip to Win* is 25%.

The probability of winning a prize at *Flip 'n' Spin* is 12.5%.

Sadie is more likely to win a prize playing *Flip to Win*.

So, she should use her last ticket to play *Flip to Win*.

Try It!

The designer of *Flip 'n' Spin* creates a new game using a 5-section spinner, as shown. How does the new spinner change the probability of winning a prize?

Using the 5-section spinner, the probability of winning a prize is _____.

It is _____ likely that a player will win a prize when using the 5-section spinner than when using the 4-section spinner.

Convince Me! What generalization can you make about the number of sections on the spinner and the probability of winning a prize while playing the *Flip 'n' Spin* game?

3 × 2 = ~~8~~ total possible outcomes

EXAMPLE 2 Find the Probability Using a Tree Diagram

What is the probability that a coin flipped 3 times will land heads up exactly 2 times?

2 × 2 × 2

Each of the 8 outcomes is equally likely.
Three of the 8 outcomes are favorable.

$P(\text{exactly 2 heads}) = \frac{3}{8}$, or 37.5%

Try It!

Is it more likely that a coin flipped 3 times will land heads up exactly once, or will land heads up exactly 2 twice? Explain using probability.

EXAMPLE 3 Find the Probability Using an Organized List

The names of all middle school students with perfect attendance are entered into a drawing for one of two tickets to a baseball game. This year, Angie, Phil, Marc, Carly, and Josie attended school every day. What is the probability that Marc's name will be drawn to win one of the two tickets?

Make an organized list of possible outcomes for the winners of the two tickets.

If Angie wins the first ticket:
Angie and Phil
Angie and Marc
Angie and Carly
Angie and Josie

If Phil wins the first ticket:
Phil and Angie
Phil and Marc
Phil and Carly
Phil and Josie

If Marc wins the first ticket:
Marc and Angie
Marc and Phil
Marc and Carly
Marc and Josie

If Carly wins the first ticket:
Carly and Angie
Carly and Phil
Carly and Marc
Carly and Josie

If Josie wins the first ticket:
Josie and Angie
Josie and Phil
Josie and Marc
Josie and Carly

There are 20 possible outcomes. Of the 20 outcomes, 8 are favorable.

$P(\text{Marc wins one of the tickets}) = \frac{8}{20}$, or 40%

Try It!

Does Marc have a greater chance than Carly of winning the tickets to Carly? Explain using probability.

KEY CONCEPT

The probability of a compound event can be represented by a ratio of the number of favorable outcomes to the total number of possible equally likely outcomes. You can use an organized list, a table, or a tree diagram to determine the number of favorable outcomes and the total number of possible outcomes.

Do You Understand?

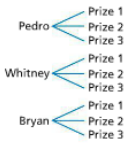
1. **Essential Question** How can a model help find the probability of a compound event?

2. **Generalize** What do you know about the outcomes of a compound event displayed in an organized list, a table, or a tree diagram?

3. How does finding the probability of a compound event compare with finding the probability of a simple event?

Do You Know How?

4. One of three contestants will be randomly selected to win a prize. One of three different prizes will be randomly awarded to the contestant whose name is selected to win. The tree diagram shows all possible outcomes of this contest.



What is the probability that Whitney will win Prize 2?

5. The table shows all the possible outcomes for flipping a coin and spinning the pointer of a spinner with four equal-sized sections labeled 1 through 4.

	1	2	3	4
heads	heads, 1	heads, 2	heads, 3	heads, 4
tails	tails, 1	tails, 2	tails, 3	tails, 4

a. What is the probability that the pointer will stop on 3 and the coin will land on heads?

b. What is the probability that the pointer will stop on an odd number and the coin will land on heads?

Name: _____

Practice & Problem Solving

4 × 2 = 8

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Leveled Practice In 6 and 7, find the probability of each event.

6. A fair coin is tossed twice in succession. The sample space is shown, where H represents heads up and T represents tails up. Find the probability of getting exactly one tail.

(Toss 1, Toss 2)	
(H, H)	(T, H)
(H, T)	(T, T)

There are ____ outcomes that have exactly one tail. There are ____ possible outcomes, which are equally likely.

P(exactly one tail) = ____, or ____%

7. The tree diagram shows the sample space of two-digit numbers that can be created using the digits 2, 6, 7, and 9. What is the probability of choosing a number from the sample space that contains both 9 and 6?

4 × 3

There are 2 outcomes that include both 9 and 6. There are 12 possible outcomes, which are equally likely

P(9 and 6) = $\frac{2}{12} = \frac{1}{6}$, or 16.6666...% ≈ 17%

26 27 29 72 76 79 92 96 97 62 67 69

8. The table shows the possible outcomes of spinning the given spinner and flipping a fair coin. Find the probability of the coin landing heads up and the pointer landing on either 1, 2, or 4.

	1	2	3	4	5
H	H, 1	H, 2	H, 3	H, 4	H, 5
T	T, 1	T, 2	T, 3	T, 4	T, 5

9. The organized list shows all the possible outcomes when three fair coins are flipped. The possible outcomes of each flip are heads (H) and tails (T).

What is the probability that at least 2 fair coins land heads up when 3 are flipped?

≥ 2

2 or 3

Sample Space

HHH
HHT
HTH
HTT
THH
THT
TTH
TTT

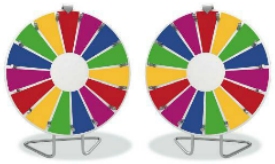
P = $\frac{4}{8} = \frac{1}{2} = 0.5 = 50\%$

1st Flip 2nd 3rd

H T

2 × 2 × 2 = 8

10. Look for Relationships Gary spins two game wheels at the carnival. He will win a prize if both of the wheels land on any red section. How does the chance of winning change if different game wheels are used with more sections that aren't red?



11. Model with Math Each week, a clothing store gives away a shirt to a lucky customer. The shirts vary by sleeve type (Long, Short, No Sleeve) and color (Gray, Blue, Pink). Draw a tree diagram to represent the sample space. What is the probability that the free shirt will have either long or short sleeves and be either pink or blue?

see notes

12. Higher Order Thinking The table shows the sample space of picking a 2-character password using the letters Y, B, R, O, G, and P. If double letters are not allowed, what is the probability of choosing a password with no Y's? With no O's? Is one probability greater than the other? Explain.

Possible Combinations					
Y, B	B, R	R, O	O, G	G, P	P, Y
Y, R	B, O	R, G	O, P	G, Y	P, B
Y, O	B, G	R, P	O, Y	G, B	P, R
Y, G	B, P	R, Y	O, B	G, R	P, O
Y, P	B, Y	R, B	O, R	G, O	P, G

Assessment Practice

13. A single number cube is rolled twice and the two numbers are added.

PART A

How can you determine the total number of possible outcomes?

First Roll \ Second Roll	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

PART B

Find the probability of rolling two numbers that have a sum equal to 10.

11)

S, S
L, G
L, B ✓
L, P ✓
S, G
S, B ✓
S, P ✓
N, G
N, B
N, P

$P = \frac{4}{9}$

$P = 0.\overline{444}...$

$P \approx 44.4\%$