

# CHAPTER

# 11

## Probability

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# Get Ready

## Fractions, Decimals, and Percents

To change a fraction to a percent:

*Step 1:* Change the fraction to a decimal.

$$\frac{4}{5} = 4 \div 5 \quad \text{Divide the numerator by the denominator.}$$

$$= 0.8$$

*Step 2:* Change the decimal to a percent.

$$0.8 \times 100 = 80\% \quad \text{Multiply the decimal by 100 and add the percent sign.}$$

Multiplying by 100 is the same as moving the decimal 2 places to the right.

1. Complete the table.

Fraction	Decimal (numerator $\div$ denominator)	Percent (decimal $\times$ 100)
a) $\frac{1}{8}$	$1 \div \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$	$\underline{\hspace{2cm}} \times 100 = \underline{\hspace{2cm}}\%$
b) $\frac{3}{4}$	$\underline{\hspace{2cm}} \div 4 = \underline{\hspace{2cm}}$	$\underline{\hspace{2cm}} \times 100 = \underline{\hspace{2cm}}\%$

## Probability

### probability

- the chance that an event will happen
- probability =  $\frac{\text{number of favourable outcomes}}{\text{total number of possible outcomes}}$

**FOLDABLES™**  
Study Tool

### impossible event

- 0 or 0% probability (will not happen)

### certain event

- 1 or 100% probability (will definitely happen)

Find the probability that a coin will land heads up.

$$P(H) = \frac{\text{number of favourable outcomes}}{\text{total number of possible outcomes}}$$

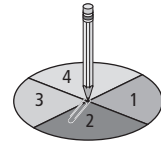
$$= \frac{1}{2} \leftarrow \frac{\text{number of heads}}{\text{total number of faces}}$$



What you want to happen.

The probability that the coin will land heads up is  $\frac{1}{2}$ , 0.5, or 50%.

2. You spin the spinner once. What is the probability of spinning a 2?  
Write the answer as a fraction, a decimal, and a percent.



$P(2) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$

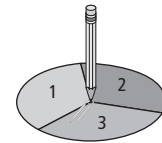
$P(2)$  means the probability of spinning a 2.

$= \frac{\boxed{\phantom{000}}}{4}$

The probability of spinning a 2 is  $\frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$ , 0. \_\_\_\_\_, or \_\_\_\_\_%.

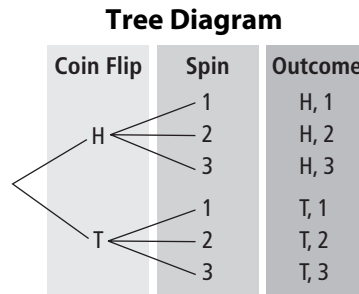
### Using Tables and Tree Diagrams

Flip a coin and spin the spinner.  
You can use a table and a tree diagram to organize the outcomes.



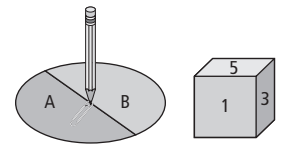
**Table**

Coin	Spinner		
	1	2	3
<b>Heads (H)</b>	H, 1	H, 2	H, 3
<b>Tails (T)</b>	T, 1	T, 2	T, 3



There are 6 possible outcomes: (H, 1), (H, 2), (H, 3), (T, 1), (T, 2), (T, 3).

3. a) Use a table to show the possible outcomes when you spin this spinner and roll a 6-sided die.



Spinner	Die					
	1	2	3	4	5	6
<b>A</b>	A, 1					
<b>B</b>						

- b) List the outcomes.

(\_\_\_\_\_, \_\_\_\_\_), \_\_\_\_\_

\_\_\_\_\_

# MATH LINK

## Probability Games

Many games use cards or dice.  
These games use probability.



- a) Name 1 game that uses cards.

\_\_\_\_\_

- b) Do your chances of winning the game depend on how the cards are dealt?  
Circle YES or NO.

- c) Explain how you use the cards in the game.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- d) Name 1 game that uses dice. \_\_\_\_\_

- e) Do your chances of winning the game depend on how you roll the dice?  
Circle YES or NO.

- f) Explain how you use the dice in the game.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- g) Share your answers with a classmate.  
Write 1 thing your classmate told you.

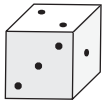
\_\_\_\_\_  
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# 11.1 Warm Up

1. Change the fractions to decimals and percents.

Fraction	Decimal (numerator ÷ denominator)	Percent (decimal × 100)
<b>Example:</b> $\frac{4}{9}$	$4 \div 9 = 0.4444444\dots$ or $0.\overline{4}$ The bar over the 4 shows a repeating decimal.	$0.444444\dots \times 100 = 44.\overline{4}\%$
a) $\frac{1}{3}$	_____ ÷ _____ = _____	_____ × 100 = _____%
b) $\frac{4}{6}$	_____ ÷ _____ = _____	_____ × 100 = _____%
c) $\frac{7}{9}$		
d) $\frac{3}{11}$		

2. You roll a 6-sided die. Find the probabilities. Write your answer as a decimal.



a)  $P(6) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$

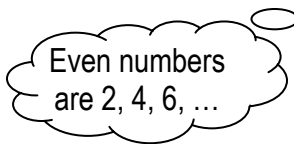
$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

= \_\_\_\_\_

b)  $P(\text{even number}) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

= \_\_\_\_\_



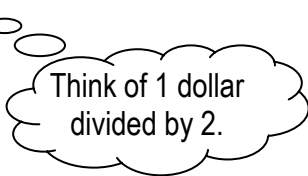
**M E** 3. Divide. Write your answer as a decimal.

a)  $1 \div 2 =$  \_\_\_\_\_

b)  $1 \div 4 =$  \_\_\_\_\_

c)  $1 \div 5 =$  \_\_\_\_\_

d)  $1 \div 10 =$  \_\_\_\_\_



# 11.1 Determining Probabilities Using Tree Diagrams and Tables

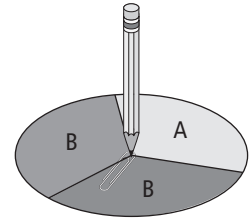
## Working Example 1: Determine Probabilities From a Tree Diagram



### independent events

- 2 or more events that do not affect each other
- example: spinning a spinner does not affect what happens if you also roll a die

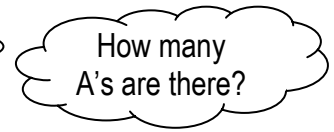
a) What is the probability of spinning A on the first spin?  
Write your answer as a fraction, a decimal, and a percent.



### Solution

There are 3 sections on the spinner: A, B, and B.

How many favourable outcomes are there? \_\_\_\_\_



$$P(A) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{1}}}{3}$$

$$\boxed{1} \div \boxed{3} = 0.3333333333$$

$$= 0.\bar{3}$$

The probability of spinning A is  $\frac{\boxed{\phantom{1}}}{3}$ , 0.\_\_\_\_\_, or  $33.\bar{3}\%$ .

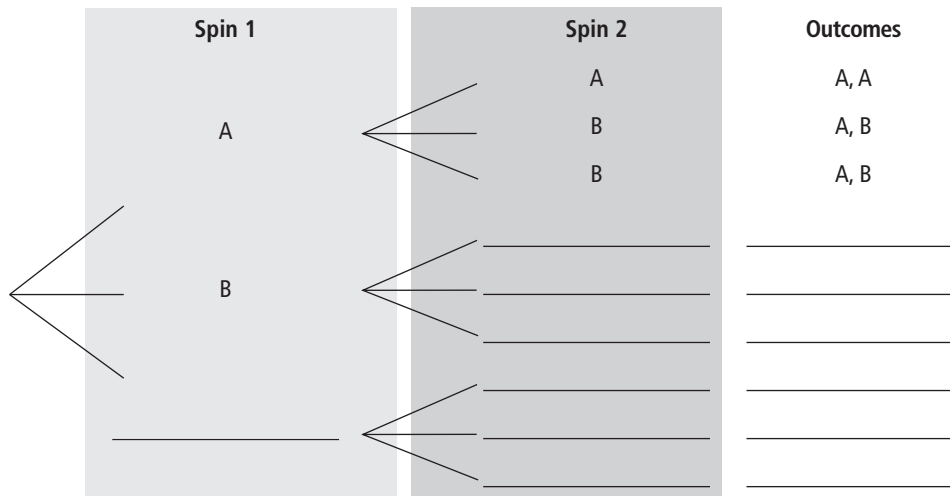
b) Draw a tree diagram to show the sample space when you spin the spinner twice.



### sample space

- all the possible outcomes of the event

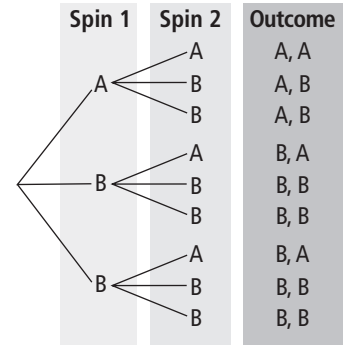
### Solution



- c) What is the probability of spinning A and then spinning B,  $P(A \text{ then } B)$ ?  
Write the answer as a fraction, a decimal, and a percent.

**Solution**

The favourable outcome is (A, B).  
Look at the tree diagram.  
How many times does (A, B) happen? \_\_\_\_\_



$$P(A \text{ then } B) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{000}}}{9}$$

$$\boxed{C} \ 2 \div 9 \equiv 0.222222222$$

Use bar notation to show a repeating decimal.

$$= \underline{\hspace{2cm}}$$

The probability of spinning A and then B is  $\frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$ , 0.\_\_\_\_\_, or \_\_\_\_\_%.

- d) Use the tree diagram to find the probability of getting the same letter on both spins,  $P(A, A)$  or  $P(B, B)$ . Write your answer as a fraction, a decimal, and a percent.

**Solution**

$$P(A, A) \text{ or } P(B, B) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{000}}}{9}$$

How many outcomes are (A, A) or (B, B)?  
Add the numbers.

$$= \underline{\hspace{2cm}}$$

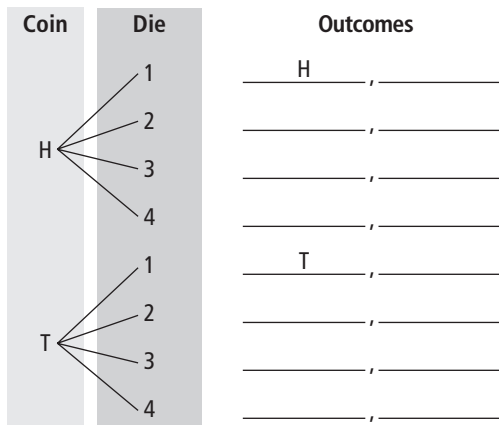
The probability of spinning the same letter is  $\frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$ , 0.\_\_\_\_\_, or \_\_\_\_\_%.

### Show You Know

You flip a coin and roll a 4-sided die numbered 1, 2, 3, and 4.



a) Complete the tree diagram to show the sample space.



b) How many outcomes are there? \_\_\_\_\_

c) What is  $P(H, 4)$ ?

$$P(H, 4) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{0000}}}{\boxed{\phantom{0000}}}$$

$$= \underline{\hspace{2cm}}$$

← decimal

$$= \underline{\hspace{2cm}}$$

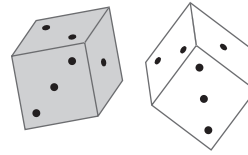
Multiply by 100 to change the decimal to a percent.

Sentence: \_\_\_\_\_



### Working Example 2: Determine Probabilities From a Table

You roll two 6-sided dice; 1 is white and 1 is grey.



- a) Make a table to show the sample space.

**Solution**

Complete the table to show all the possible combinations.

		Grey Die					
		1	2	3	4	5	6
White Die	1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
	2	2, 1	____, ____	2, 3	____, ____	2, 5	____, ____
	3	3, 1	____, ____	3, 3	____, ____	3, 5	____, ____
	4	4, 1	____, ____	4, 3	____, ____	4, 5	____, ____
	5	5, 1	____, ____	5, 3	____, ____	5, 5	____, ____
	6	6, 1	____, ____	6, 3	____, ____	6, 5	____, ____

- b) What is the probability of rolling a sum greater than 10?  
Write your answer as a fraction, a decimal, and a percent.

*Sum means add.*

**Solution**

Add the numbers in each cell.

*A cell is 1 box from the table.*

		Grey Die					
		1	2	3	4	5	6
White Die	1	1 + 1 = 2	1 + 2 = 3	1 + 3 = 4	1 + 4 = 5	1 + 5 = 6	1 + 6 = 7
	2	2 + 1 = 3	2 + 2 = 4	2 + 3 = 5	2 + 4 = 6	2 + 5 = 7	2 + 6 = 8
	3	3 + 1 = 4	3 + 2 = 5	3 + 3 = 6	3 + 4 = 7	3 + 5 = 8	3 + 6 = 9
	4	4 + 1 = 5	4 + 2 = 6	4 + 3 = 7	4 + 4 = 8	4 + 5 = 9	4 + 6 = 10
	5	5 + 1 = 6	5 + 2 = 7	5 + 3 = 8	5 + 4 = 9	5 + 5 = 10	5 + 6 = ____
	6	6 + 1 = 7	6 + 2 = 8	6 + 3 = 9	6 + 4 = 10	6 + 5 = ____	6 + 6 = ____

$$P(\text{sum} > 10) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

*> means greater than*

$$= \frac{\boxed{3}}{36} = 3 \div 36 = 0.083333333$$

$$= 0.08\bar{3}$$

*How many cells add to more than 10?*

The probability of a sum greater than 10 is  $\frac{3}{36}$ , 0.\_\_\_\_\_, or  $8.\bar{3}\%$ .

- c) What is the probability that the number on the white die is 1 larger than the number on the grey die?

Write your answer as a fraction, a decimal, and a percent.

**Solution**

In the table, shade all the outcomes where the white die number is 1 larger than the grey die number.

		Grey Die					
		1	2	3	4	5	6
White Die	1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
	2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
	3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
	4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
	5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
	6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

$$P(\text{white die 1 number larger than grey die}) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{0000}}}{36}$$

**C** 5 **÷** 36 **=** 0.13888888

$$= \underline{\hspace{2cm}}$$

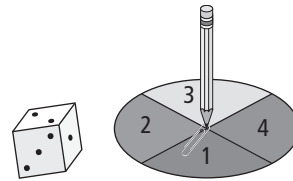
The probability of the white die number being 1 number larger than the grey die number

is  $\frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$ , 0. \_\_\_\_\_, or \_\_\_\_\_%.

**Show You Know**

You spin the spinner and roll a 6-sided die.

a) Complete the table to show the sample space.



		Die					
		1	2	3	4	5	6
Spinner	1	1, 1					
	2						
	3						
	4						

b) What is  $P(4, 4)$ ?

$$P(4, 4) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{0000}}}{24}$$

$$= \underline{\hspace{2cm}} \quad \leftarrow \text{decimal}$$

$$= \underline{\hspace{2cm}} \quad \leftarrow \text{percent}$$

c) What is  $P(\text{sum} > 5)$ ? *> means greater than.*

		Die					
		1	2	3	4	5	6
Spinner	1	$1 + 1 = 2$	$1 + 2 = 3$	$1 + 3 = 4$	$1 + 4 = 5$	$1 + 5 = 6$	$1 + 6 = 7$
	2	$2 + 1 = \underline{\hspace{1cm}}$	$2 + 2 = \underline{\hspace{1cm}}$	$2 + 3 = \underline{\hspace{1cm}}$	$2 + 4 = \underline{\hspace{1cm}}$	$2 + 5 = \underline{\hspace{1cm}}$	$2 + 6 = 8$
	3	$3 + 1 = \underline{\hspace{1cm}}$	$3 + 2 = \underline{\hspace{1cm}}$	$3 + 3 = \underline{\hspace{1cm}}$	$3 + 4 = \underline{\hspace{1cm}}$	$3 + 5 = \underline{\hspace{1cm}}$	$3 + 6 = 9$
	4	$4 + 1 = \underline{\hspace{1cm}}$	$4 + 2 = \underline{\hspace{1cm}}$	$4 + 3 = \underline{\hspace{1cm}}$	$4 + 4 = \underline{\hspace{1cm}}$	$4 + 5 = \underline{\hspace{1cm}}$	$4 + 6 = 10$

$$P(\text{sum} > 5) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{0000}}}{24}$$

$$= \underline{\hspace{2cm}} \quad \leftarrow \text{decimal}$$

$$= \underline{\hspace{2cm}} \quad \leftarrow \text{percent}$$

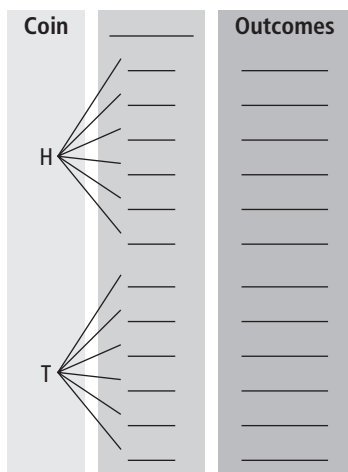
**Communicate the Ideas**

1. John flips a coin and rolls a 6-sided die.

a) What does  $P(H, 3)$  mean?

\_\_\_\_\_

b) John starts to draw a tree diagram to find the probability of flipping heads and rolling a 3. Explain what John has to do next to complete his tree diagram.



\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Monique missed class today.

a) Explain how to use the table to show the sample space when you flip 2 coins.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

		Coin 2	
		Heads	Tails
Coin 1	Heads		
	Tails		

b) What does favourable outcome mean? Give 1 example using the table.

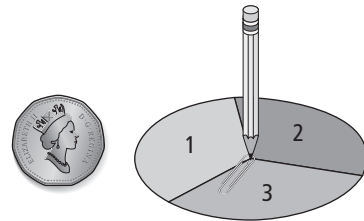
\_\_\_\_\_

\_\_\_\_\_

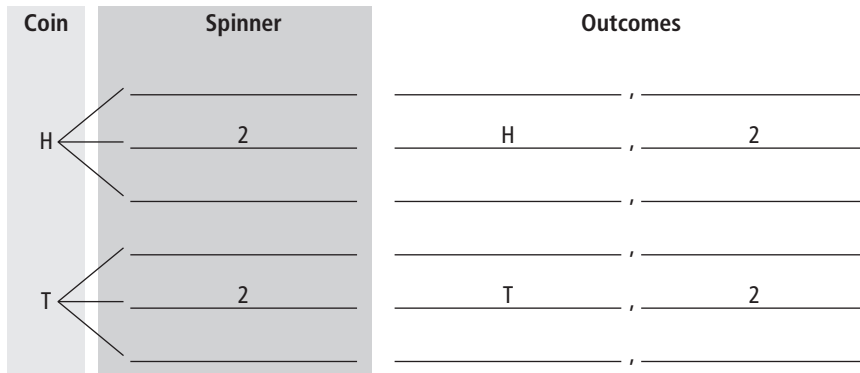
# Check Your Understanding

## Practise

3. Damien flips a coin and spins the spinner.



a) Complete the tree diagram to show the sample space.



b) List the sample space. (\_\_\_\_\_, \_\_\_\_\_), (\_\_\_\_\_, \_\_\_\_\_), \_\_\_\_\_

c) What is the  $P(H, 2)$ ? Write your answer as a fraction, a decimal, and a percent.

$$P(H, 2) = \frac{\boxed{\phantom{000}}}{6} \leftarrow \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \underline{\hspace{2cm}} \leftarrow \text{decimal}$$

$$= \underline{\hspace{2cm}} \leftarrow \text{percent}$$

d) What is  $P(T, \text{odd number})$ ?  
Write your answer as a fraction, a decimal, and a percent.

$$P(T, \text{odd number}) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} \leftarrow \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

Odd numbers  
end in 1, 3, 5, ...

= \_\_\_\_\_

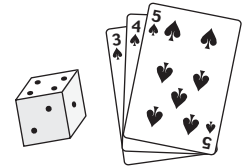
← decimal

= \_\_\_\_\_

← percent

4. Ali chooses 1 card and rolls a 6-sided die.

a) Complete the table to show the sample space.



		Die					
		1	2	3	4	5	6
Cards	3	3, 1					
	4						
	5						

b) What is the probability that both numbers are the same?  
Write your answer as a fraction, a decimal, and a percent.

$$P(\text{both same number}) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} \leftarrow \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \underline{\hspace{2cm}} \leftarrow \text{decimal}$$

$$= \underline{\hspace{2cm}} \leftarrow \text{percent}$$

c) What is the probability that the sum of the die and the card is equal to 6?  
Write your answer as a fraction, a decimal, and a percent.

$$P(\text{sum is 6}) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} \leftarrow \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \underline{\hspace{2cm}} \leftarrow \text{decimal}$$

$$= \underline{\hspace{2cm}} \leftarrow \text{percent}$$

d) What is the probability that the number on the die is larger than the number on the card?  
Write your answer as a fraction, a decimal, and a percent.

$$P(\text{larger number on die}) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} \leftarrow \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \underline{\hspace{2cm}} \leftarrow \text{decimal}$$

$$= \underline{\hspace{2cm}} \leftarrow \text{percent}$$

**Apply**

5. Lucy is fishing. She has an equal chance of catching a whitefish, a trout, an arctic char, or losing a fish off the hook. What might she catch if she pulls her hook out twice?

a) Complete the table to show all the possible combinations.

		Second Catch			
		_____	_____	_____	_____
First Catch	Whitefish (W)				
	Trout (T)				
	_____				
	_____				

There are \_\_\_\_\_ possible combinations.

b) What is the probability she will catch 2 arctic char:  $P(\text{char, char})$ ?

Sentence: \_\_\_\_\_

c) What is  $P(\text{whitefish, char})$  in either order?

Sentence: \_\_\_\_\_

d) What is the probability she will catch nothing at all?

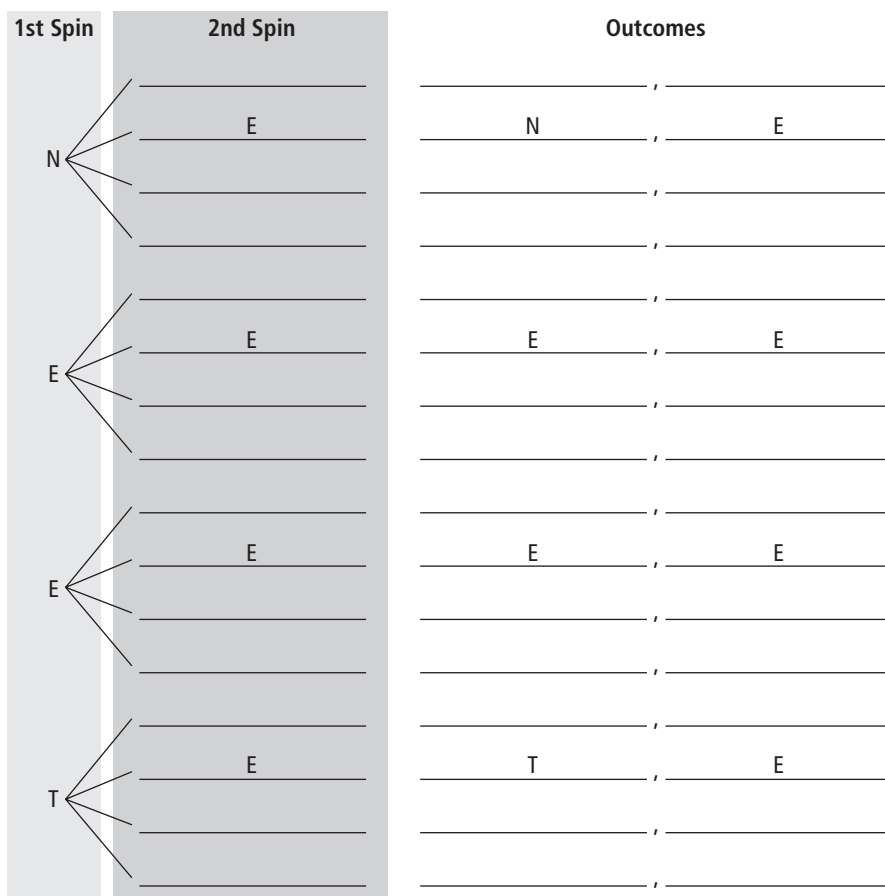
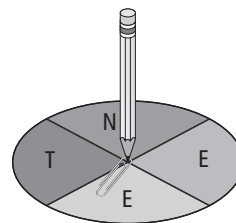
Sentence: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

6. You spin the spinner twice.

a) Complete the tree diagram to show the sample space.



There are \_\_\_\_\_ possible outcomes.

b) What is the probability of spinning 2 E's?

Sentence: \_\_\_\_\_

c) What is  $P(\text{same letter on both spins})$ ?

Sentence: \_\_\_\_\_



# MATH LINK

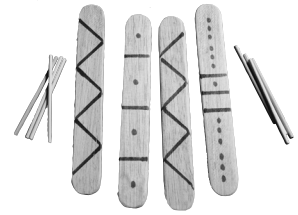
A game uses 4 sticks.

One side is bare and the other side is decorated.

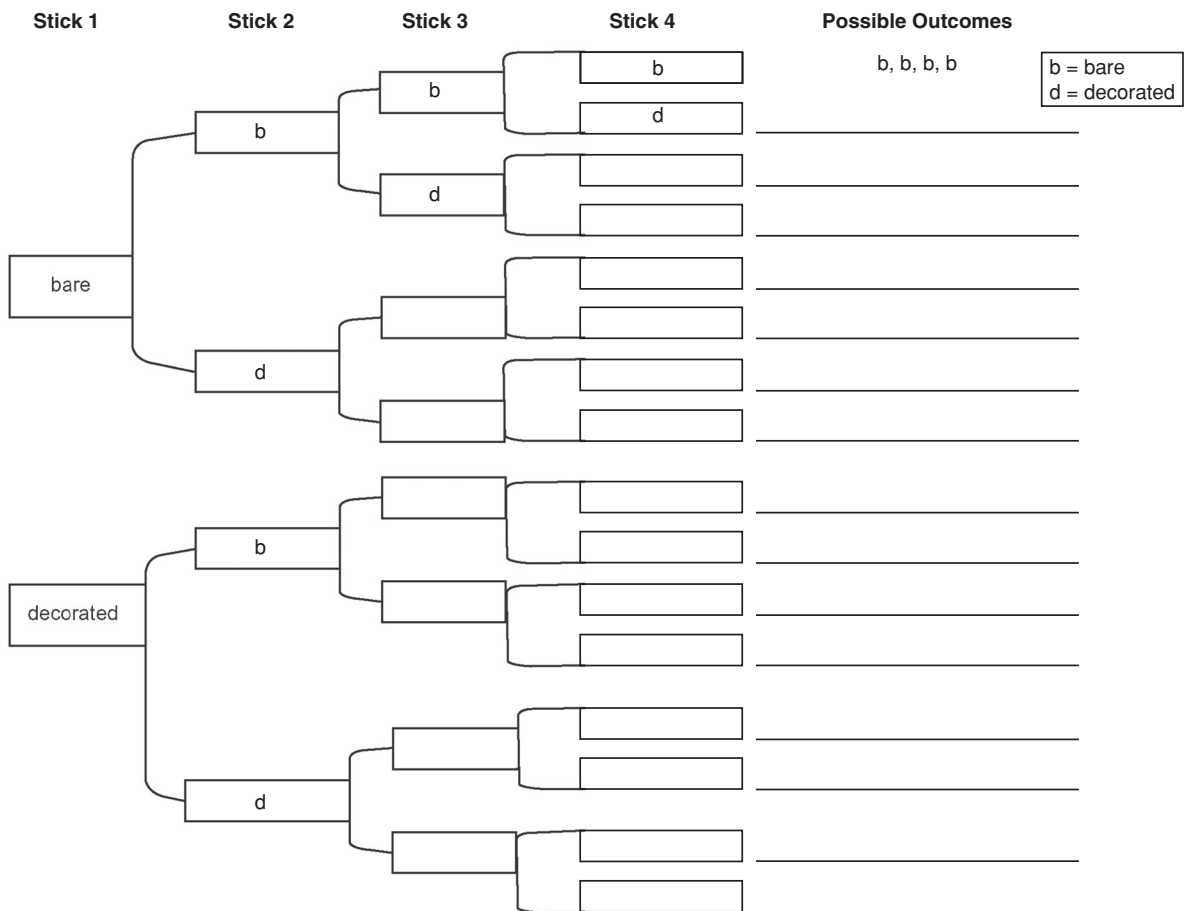
Toss the sticks in the air.

They will land either decorated side up or bare side up.

Your score depends on the number of times the decorated side lands face up.



a) Complete the tree diagram to find all the possible outcomes when you toss 4 sticks.



b) What is the probability that exactly 3 sticks will land decorated side up?

$P(d, d, d) =$

The probability of 3 sticks landing decorated side up is  $\frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$ .

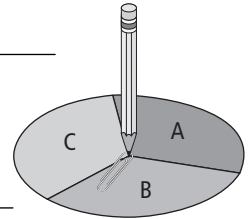
## 11.2 Warm Up

1. List the possible outcomes of each event.

a) rolling a 6-sided die \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

b) flipping a coin \_\_\_\_\_, \_\_\_\_\_

c) spinning this spinner \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_



2. How many possible outcomes are there?

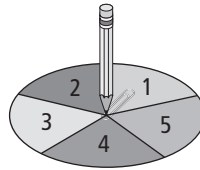
a) rolling a 4-sided die \_\_\_\_\_



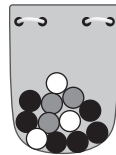
b) choosing a card \_\_\_\_\_



c) spinning this spinner \_\_\_\_\_



d) choosing a marble \_\_\_\_\_



**M E** 3. Multiply.

a)  $5 \times 8 =$  \_\_\_\_\_

b)  $6 \times 10 =$  \_\_\_\_\_

c)  $4 \times 12 =$  \_\_\_\_\_

d)  $3 \times 7 =$  \_\_\_\_\_

4. Find the total value of each combination of coins.

a) a quarter, a dime, and a nickel \_\_\_\_\_

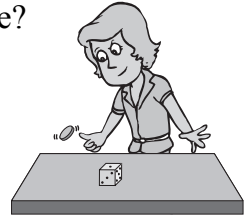
b) a loonie, a quarter, and a penny \_\_\_\_\_

c) a dime, a nickel, a loonie, and a penny \_\_\_\_\_

## 11.2 Outcomes of Independent Events

### Working Example 1: Determine the Total Number of Outcomes From Two Events

Carrie flips a coin and rolls a 6-sided die. How many possible outcomes are there?



**Solution**

*Method 1: Create a Table*

Complete the table.

		Number on Die					
		1	2	3	4	5	6
Coin Flip	H (head)	H, 1	H, 2				
	T (tail)	T, 1	T, 2				

There are \_\_\_\_\_ possible outcomes.

*Method 2: Use Multiplication*

Total number of possible outcomes = possible outcomes on die × possible outcomes on coin

$$= \text{_____} \times 2$$

$$= \text{_____}$$

There are \_\_\_\_\_ possible outcomes.

### Show You Know

The sandwich choices at the cafeteria are egg salad (E) or turkey (T).  
 You can have white (W), rye (R), or brown (B) bread.  
 Show 2 ways to find the total number of possible outcomes.

*Create a Table:*

		Types of Bread		
Sandwich Filling				

There are \_\_\_\_\_ possible outcomes.

*Use Multiplication:*

Total number of possible outcomes = number of different fillings × number of types of bread

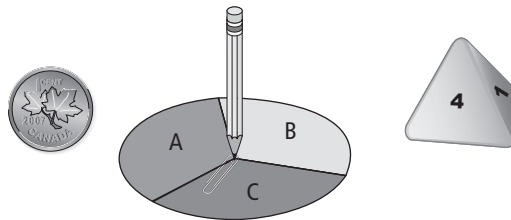
$$= \text{_____} \times \text{_____}$$

$$= \text{_____}$$

There are \_\_\_\_\_ possible outcomes.

### Working Example 2: Determine the Total Number of Outcomes From Three or More Events

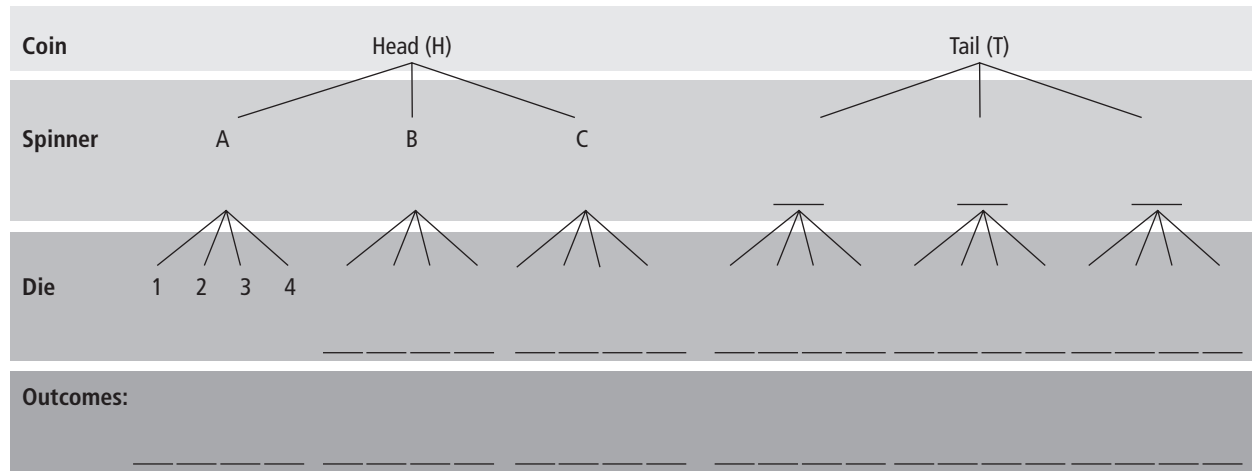
You flip a coin, spin the spinner, and roll a 4-sided die.



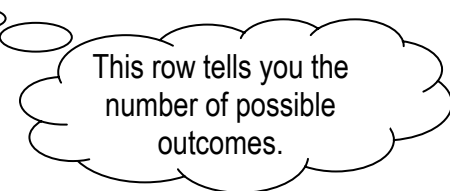
a) How many possible outcomes are there?

**Solution**

*Method 1: Use a Tree Diagram*



The tree diagram shows \_\_\_\_\_ possible outcomes.



*Method 2: Use Multiplication*

Number of possible outcomes for

- a coin: \_\_\_\_\_
- the spinner: \_\_\_\_\_
- a 4-sided die: \_\_\_\_\_

Total possible outcomes

= possible outcomes for coin × possible outcomes for spinner × possible outcomes for die

= \_\_\_\_\_ × \_\_\_\_\_ × \_\_\_\_\_

= \_\_\_\_\_

There are \_\_\_\_\_ possible outcomes.

b) Why would it be difficult to show the sample space for this experiment in a table?

**Solution**

You can use a table for 2 events.

You can show 1 event in the columns and 1 event in the \_\_\_\_\_.

For 3 events, you would need more than 1 table to show all of the outcomes.

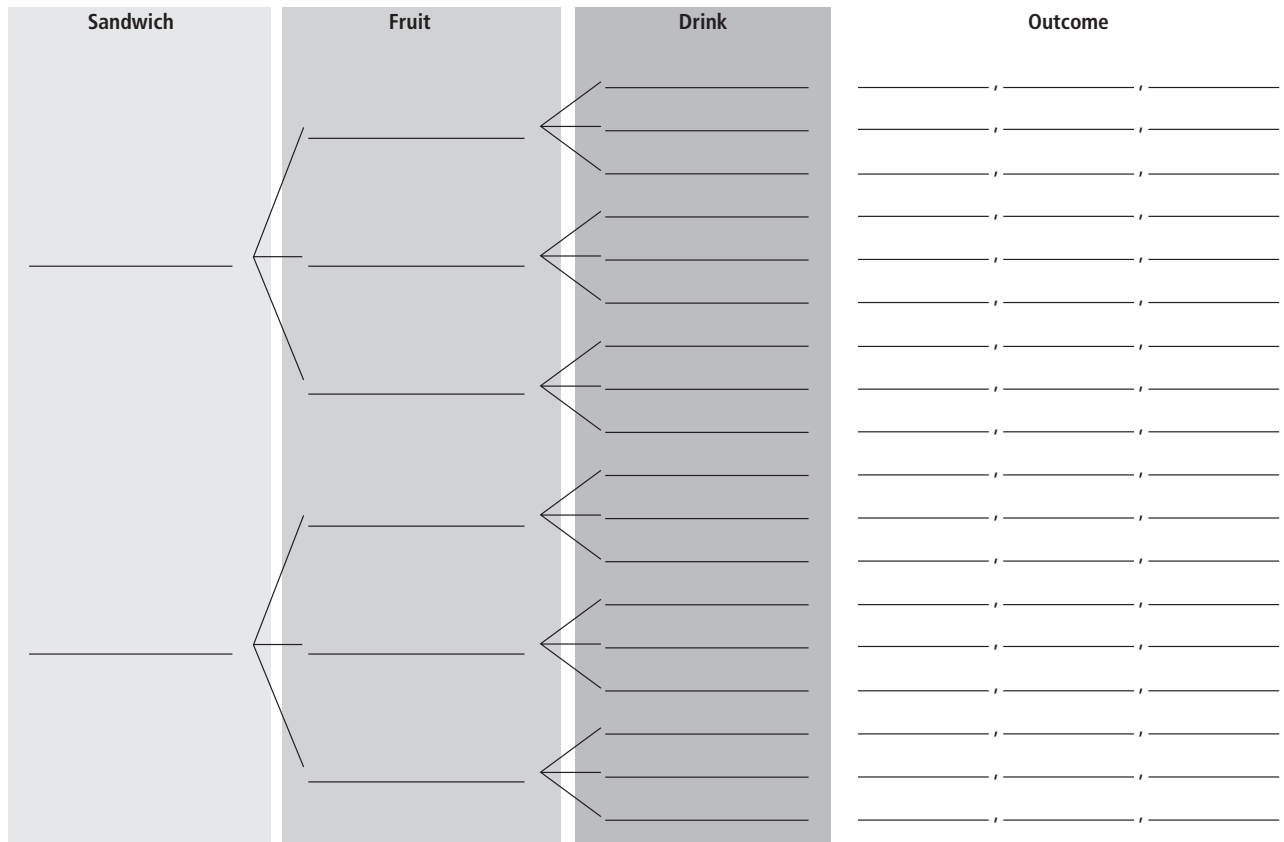
**Show You Know**

You are going to buy your lunch at school.  
 You can choose 1 of each of the following:

- 1 sandwich: cheese or chicken
- 1 fruit: orange, apple, or banana
- 1 drink: juice, water, or milk

How many different possible combinations are there? Show your answer 2 ways.

*Use a Tree Diagram:*



Sentence: \_\_\_\_\_

*Use Multiplication:*

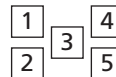
Total possible outcomes

= \_\_\_\_\_ × \_\_\_\_\_ × \_\_\_\_\_

= \_\_\_\_\_

Sentence: \_\_\_\_\_

## Communicate the Ideas



1. Jasmine has 5 tiles numbered from 1 to 5 and a coin. She chooses 1 tile and flips the coin. What are all the possible outcomes?

- a) Use 3 different methods to show how to find the number of possible outcomes.

*Tree Diagram:*

*Table:*

		Tiles				
Coins						

*Multiplication:*

- b) Which method do you like best? Give 1 reason for your answer.

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2. Explain why you cannot use 1 table to find the possible outcomes when you have 3 or more events. Use an example to help you explain your answer.

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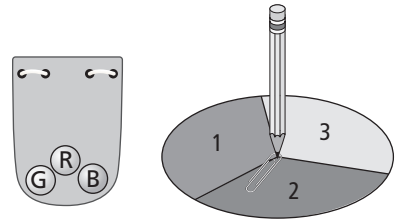


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# Check Your Understanding

## Practise

3. A bag holds 3 marbles—1 red, 1 green, and 1 blue. A spinner has 3 equal sections labelled 1, 2, and 3. You choose a marble and spin the spinner.



- a) Complete the table to show the sample space.

		Spinner		
		1	2	3
Marbles	Red (R)			
	Green (G)			
	Blue (B)			

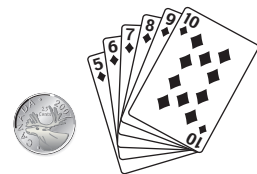
- b) How many possible outcomes does the table show? \_\_\_\_\_

- c) Write a multiplication statement to show the outcomes.

\_\_\_\_\_ × \_\_\_\_\_ = \_\_\_\_\_

There are \_\_\_\_\_ possible outcomes.

4. Flip a coin and choose a card.



- a) Complete the table to show all the possible outcomes.

		Cards				
		5	_____	_____	_____	_____
Coin	Heads (H)					
	Tails (_____)					

There are \_\_\_\_\_ possible outcomes.

- b) Use multiplication to check the number of possible outcomes.

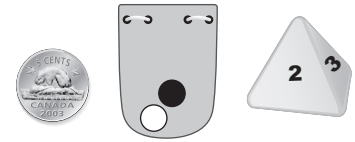
\_\_\_\_\_ × \_\_\_\_\_ = \_\_\_\_\_

There are \_\_\_\_\_ possible outcomes.

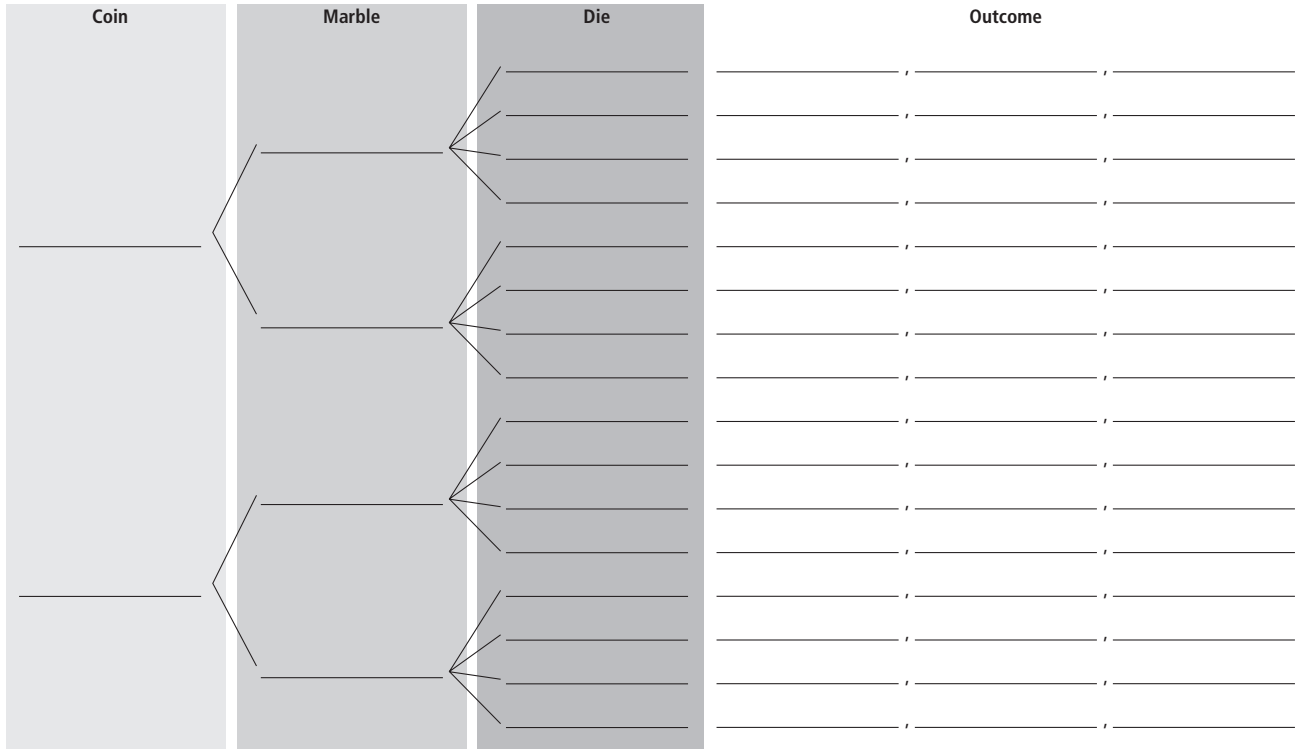
Name: \_\_\_\_\_

Date: \_\_\_\_\_

5. You flip a coin, roll a 4-sided die, and choose a marble from a bag. Show the number of possible outcomes 2 different ways.



Tree Diagram:



Multiplication: \_\_\_\_\_ × \_\_\_\_\_ × \_\_\_\_\_ = \_\_\_\_\_

There are \_\_\_\_\_ possible outcomes.

**Apply**

6. You have a nickel, a dime, and a loonie in your left pocket, and a penny and a quarter in your right pocket.

a) If you choose 1 coin from each pocket, how many different combinations could you get?

		Left Pocket		
		Nickel (N)	Dime (D)	Loonie (L)
Right Pocket	Penny (P)			
	Quarter (Q)			

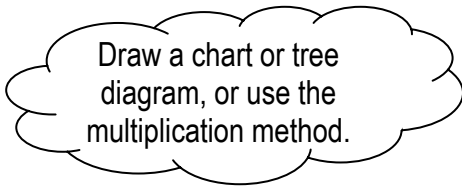
Sentence: \_\_\_\_\_

b) You choose 1 coin from each pocket. What is the largest sum of money you could get?

Sentence: \_\_\_\_\_



7. Tony has 3 pairs of jeans and 4 shirts.  
 How many different combinations can he wear?  
 Show your work.



8. The birthday menu at the Blue Bird Restaurant gives you 1 choice from each category:  
 Drinks: 3 choices  
 Meal: 4 choices  
 Dessert: 2 choices  
 How many possible combinations are there?  
 Show your work.

## MATH LINK

In the stick game, each stick can land decorated or bare side up.



- a) Find the total number of possible outcomes when you toss 4 sticks.  
 Use multiplication.  
 Each stick has 2 sides or \_\_\_\_\_ possible outcomes.

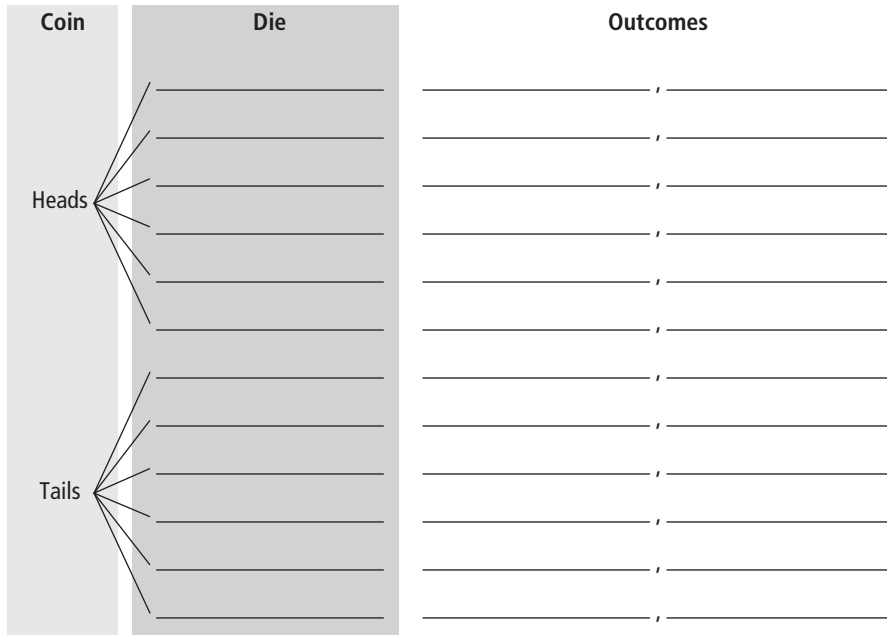
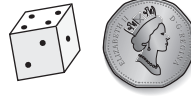
$$\begin{array}{ccccccc}
 \text{Stick 1} & \times & \text{Stick 2} & \times & \text{Stick 3} & \times & \text{Stick 4} & = & \text{total possible outcomes} \\
 \hline
 \text{(possible} & & \text{(possible} & & \text{(possible} & & \text{(possible} & & \\
 \text{outcomes)} & & \text{outcomes)} & & \text{outcomes)} & & \text{outcomes)} & & \\
 \hline
 & \times & & \times & & \times & & = & \hline
 \end{array}$$

- b) If you used 5 sticks, how many possible outcomes would there be?

\_\_\_\_\_

# 11.3 Warm Up

1. Erv flips a coin and rolls a 6-sided die.  
Show the sample space using a tree diagram.




2. Multiply the fractions. **Example:**  $\frac{1}{3} \times \frac{1}{2} = \frac{1 \times 1}{3 \times 2} = \frac{1}{6}$

a)  $\frac{1}{2} \times \frac{1}{4}$

$$= \frac{1 \times \boxed{\phantom{000}}}{2 \times \boxed{\phantom{000}}}$$


$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

b)  $\frac{2}{3} \times \frac{1}{7}$

3. Change the fractions to decimals. 

a)  $\frac{4}{10} = \underline{\hspace{2cm}}$

b)  $\frac{9}{25} = \underline{\hspace{2cm}}$

-  4. Circle the decimal that has a larger value.

a) 0.15 or 0.12

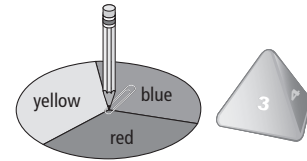
Think about money!

b) 1.2 or 1.02

### 11.3 Determining Probabilities Using Fractions

#### Working Example 1: Calculating Probabilities Using a Table and Multiplication

Mackenzie spins a spinner and rolls a 4-sided die.



- a) Complete the table to show the sample space.  
How many possible outcomes are there?

**Solution**

Spinner	Die			
	1	2	3	4
Blue (B)	B, 1	B, 2	B, 3	B, 4
Red (R)				
Yellow(Y)				

Number of possible outcomes: \_\_\_\_\_.

- c) Use multiplication to find  $P(\text{blue}, 2)$ .

**Solution**

Find each probability separately.

$$P(B) = \frac{\text{number of blue sections on spinner}}{\text{total number of sections on spinner}}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

- b) What is  $P(B, 2)$ ?  
Write your answer as a fraction.

**Solution**

Shade the cells that have a B and a 2.

$$P(B, 2) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{000}}}{12}$$

The probability of getting blue and 2 is \_\_\_\_\_.

Multiply the probabilities of the single events.

$$P(\text{blue}, 2) = P(B) \times P(2)$$

$$= \frac{\boxed{\phantom{000}}}{3} \times \frac{\boxed{\phantom{000}}}{4}$$

$$= \frac{\boxed{\phantom{000}}}{12}$$

$$P(2) = \frac{\text{number of 2s on die}}{\text{number of sides on die}}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

- d) Using the information in the table, what is  $P(\text{red or blue}, 4)$ ?  
Write your answer as a fraction.

Spinner	Die			
	1	2	3	4
Blue (B)	B, 1	B, 2	B, 3	B, 4
Red (R)	R, 1	R, 2	R, 3	R, 4
Yellow(Y)	Y, 1	Y, 2	Y, 3	Y, 4

**Solution**

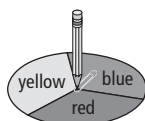
In the table, circle (R, 4) and (B, 4).

$$P(\text{R or B}, 4) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{0000}}}{12}$$

- e) Use multiplication to check your answer in part d).

**Solution**



$$P(\text{R or B}) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{0000}}}{3}$$

$$P(4) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{0000}}}{4}$$

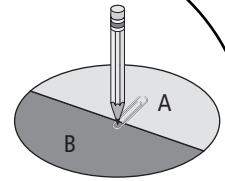
Multiply the probabilities of the 2 events.

$$P(\text{R or B}) \times P(4) = \frac{\boxed{\phantom{0000}}}{3} \times \frac{\boxed{\phantom{0000}}}{4}$$

$$= \frac{\boxed{\phantom{0000}}}{12}$$

### Show You Know

You roll a 4-sided die and spin the spinner.  
 Find the probability of rolling a number less than 4 and spinning A.  
 Check your answer using multiplication.



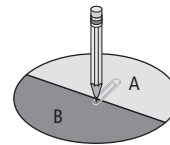
Complete the table.

Spinner	Die			
	1	2	3	4
A				
B				

$$P(\text{number less than 4 and A}) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

Check using multiplication.



$$P(\text{number less than 4}) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{000}}}{4}$$

$$P(A) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

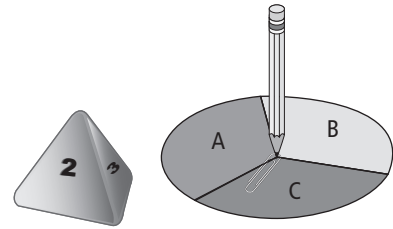
$$= \frac{\boxed{\phantom{000}}}{2}$$

$$P(\text{number less than 4}) \times P(A) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} \times \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

## Working Example 2: Calculating Probabilities Using a Tree Diagram and Multiplication

Jason rolls a 4-sided die and spins the spinner.  
 What is the probability of rolling an even number and spinning a B?  
 Show your answer using a tree diagram and multiplication.



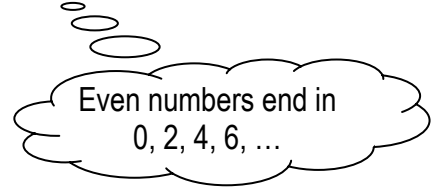
**Solution**

*Tree Diagram:*

Die	Spinner	Outcomes
1	A	1, A
	B	1, B
	C	1, C
2	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____
	_____	_____

There are \_\_\_\_\_ possible outcomes.

There are \_\_\_\_\_ favourable outcomes (look for even numbers with Bs).



$$P(\text{even number and B}) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

*Multiplication:*

Die:  $P(\text{even number}) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$

$$= \frac{\boxed{\phantom{000}}}{4}$$

Spinner:  $P(B) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$

$$= \frac{\boxed{\phantom{000}}}{3}$$

$$P(\text{even number, B}) = P(\text{even number}) \times P(B)$$

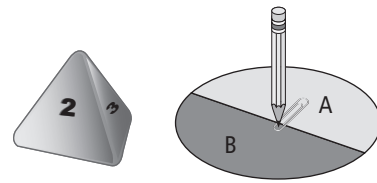
$$= \frac{\boxed{\phantom{000}}}{4} \times \frac{\boxed{\phantom{000}}}{3}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

Both methods give the same result.

**Show You Know**

You roll a 4-sided die and spin the spinner.  
 Find the probability of rolling a 4 and spinning B.  
 Check your answer using multiplication.



Tree diagram:

Die	Spinner	Outcomes
1	A	1, A
	B	1, B
2		

$$P(4, B) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

Multiplication:

$$\text{Die: } P(4) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{000}}}{4}$$

$$\text{Spinner: } P(B) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{000}}}{2}$$

$$P(4) \times P(B) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} \times \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

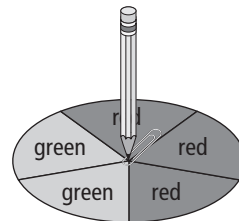
### Working Example 3: Simulations



#### simulation

- using an experiment instead of a real situation

Gina uses a simulation to show the probability that both traffic lights will be red on her way to soccer practice.



- a) What is the experimental probability that both lights are red?  
Write your answer as a fraction, a decimal, and a percent.



#### experimental probability

- the chance of an event occurring based on the results of an experiment
- experimental probability =  $\frac{\text{number of favourable outcomes}}{\text{number of trials}}$

#### Solution

Gina records her results from spinning the spinner twice.  
Complete the chart.

Trial	Results From Experiment		
	First Light (Green or Red)	Second Light (Green or Red)	Both Lights Red? (yes or no)
1	R	R	yes
2	G	G	no
3	R	G	
4	G	R	
5	R	R	
6	R	G	
7	R	R	
8	G	G	
9	G	R	
10	G	G	

The chart shows \_\_\_\_\_ favourable outcomes.

How many are yes?

$$P(\text{both lights red}) = \frac{\boxed{\phantom{00}}}{10}$$

$$= \underline{\hspace{2cm}}$$

The experimental probability that both lights are red is  $\frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$ , 0.\_\_\_\_\_, or \_\_\_\_\_ %.



b) What is the theoretical probability that both lights are red?

**theoretical probability**

- the calculated chance that an event will occur
- theoretical probability =  $\frac{\text{number of favourable outcomes}}{\text{total number of possible outcomes}}$
- example: the probability of tossing heads on a coin is  $\frac{1}{2}$



**Solution**

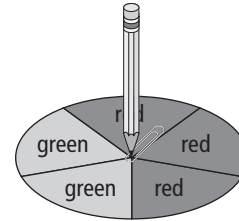
The probability that 1 light will be red on the spinner is  $\frac{3}{5}$ .

$$P(\text{both lights red}) = P(\text{first light red}) \times P(\text{second light red})$$

$$= \frac{3}{5} \times \frac{3}{5}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

$$= \underline{\hspace{2cm}} \quad \leftarrow \text{decimal}$$



The theoretical probability that both lights are red is  $\frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$ , 0.\_\_\_\_\_, or \_\_\_\_\_%.

c) Compare the experimental and theoretical probabilities.

**Solution**

These probabilities are close, but not exactly the same.

The experimental probability is \_\_\_\_\_ than the theoretical probability.  
(higher or lower)

If Gina did the experiment more times, the experimental and theoretical probabilities would likely be closer.

### Show You Know

Andrew flips 2 coins 100 times to show the chance of having a boy or girl in a family with 2 children. Heads means a girl and tails means a boy. The table shows the results of his experiment.

Coin Outcomes	HH	HT	TH	TT
Child outcomes	2 girls	girl, boy	boy, girl	2 boys
Number of results	27	24	27	22

a) Look at the table. What is the experimental probability of getting 2 boys?

$$\text{experimental probability} = \frac{\text{number of favourable outcomes}}{\text{number of trials}}$$

$$P(2 \text{ boys}) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

The experimental probability of getting 2 boys is  $\frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$ , 0.\_\_\_\_\_, or \_\_\_\_\_%.

b) What is the theoretical probability of getting 2 boys?

$$P(2 \text{ boys}) = P(T \text{ on first coin}) \times P(T \text{ on second coin})$$

A coin has 2 outcomes.

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} \times \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

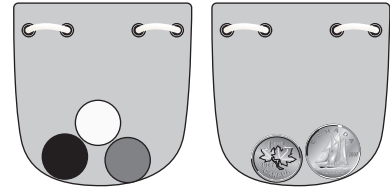
$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

$$= \underline{\hspace{2cm}}$$

The theoretical probability of getting 2 boys is  $\frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$ , 0.\_\_\_\_\_, or \_\_\_\_\_%.

### Communicate the Ideas

1. A bag holds 1 black, 1 white, and 1 grey marble. Another bag holds 1 penny and 1 dime. Explain how to use multiplication to find the probability of choosing 1 grey marble and 1 penny [ $P(\text{grey and penny})$ ].




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2. Describe what a simulation is. Give an example of when you could use a simulation.

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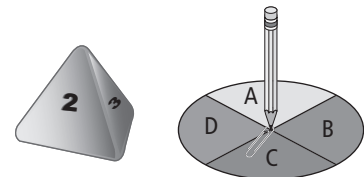


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### Check Your Understanding

#### Practise

3. Brittany spins the spinner and rolls a 4-sided die.



- a) Complete the table to show the sample space.

Die	Spinner			
	A	B	C	D
1				
2				
3				
4				

- b) What is  $P(2, A)$ ?

$$P(2, A) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$= \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$$

- c) Use multiplication to find  $P(2, A)$ .

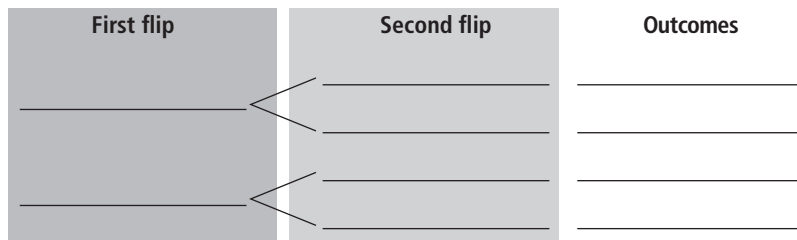
$$P(2, A) = P(2) \times P(\text{_____})$$

$$= \frac{1}{4} \times \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$$

$$= \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$$

4. You flip a coin twice.

a) Complete the tree diagram to show the sample space.



b) What is  $P(H, H)$ ?

c) Check your answer using multiplication.

$$P(\text{_____}, \text{_____}) \qquad P(H, H) = P(\text{_____}) \times P(\text{_____})$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

5. Grade 8 students are planting 4 types of flowers: daisy (D), marigold (M), rose (R), and tulip (T). The students can plant them in 4 places: school (S), flowerpot (F), park (P), and hospital (H). Tamira does an experiment to see where the different flowers will be planted. The sample space is (M, F), (R, H), (D, S), (M, F), (T, H), (T, P), (D, H), (R, P), (M, P), (R, F).

a) What is the experimental probability of getting  $P(\text{marigold, flowerpot})$ ?

$$P(M, F) = \frac{\boxed{\phantom{000}}}{10} \leftarrow \frac{\text{number of favourable outcomes}}{\text{number of trials}}$$

b) Use multiplication to find the theoretical probability of  $P(\text{marigold, flowerpot})$ .

$$P(\text{marigold}) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} \qquad P(\text{flowerpot}) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

$$P(\text{marigold, flowerpot}) = P(\text{marigold}) \times P(\text{flowerpot})$$

**Apply**

6. Josh is ordering pizza for his soccer team.  
There are 3 specials: Peppy Pepperoni, Happy Hawaiian, and Cheery Cheese.  
He can choose from 2 types of crust: regular or thin.
- a) How many different combinations of pizza are there? Show your thinking.

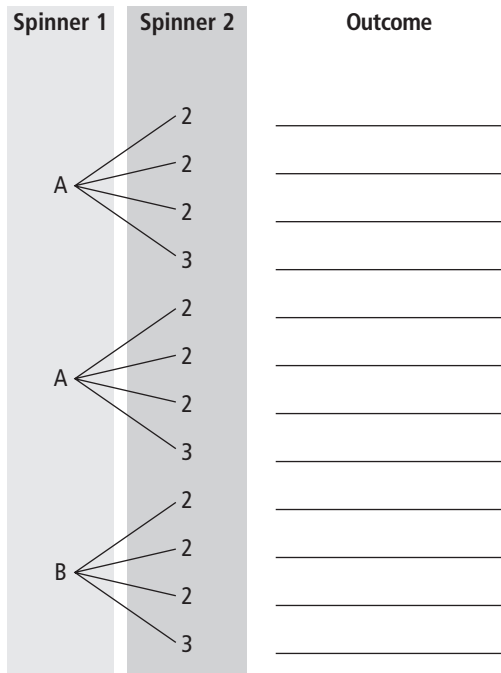
Sentence: \_\_\_\_\_

- b) What is the probability he will choose Happy Hawaiian with thin crust?  
Use 2 different ways to show your answer.

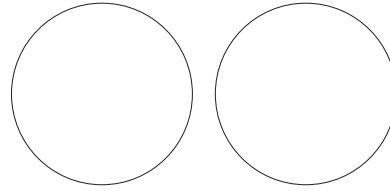
- c) Josh finds out 1 of the players is allergic to pepperoni.  
How many combinations of pizza are there without pepperoni?

Sentence: \_\_\_\_\_

7. a) Complete the tree diagram to find the outcomes for 2 spinners.



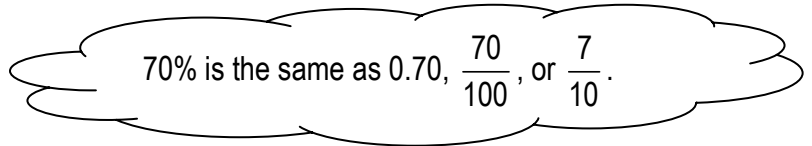
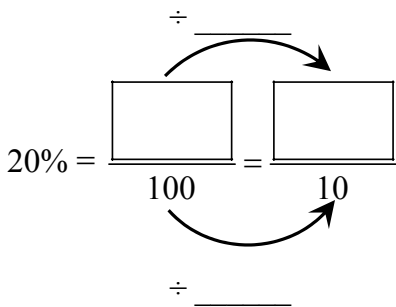
b) Draw a picture of each spinner.



c) What is  $P(A, 3)$ ?

Sentence: \_\_\_\_\_  
 \_\_\_\_\_

8. The weather forecaster predicts that there is a 70% chance of rain in Victoria and a 20% chance of rain in Calgary. What is the probability that it will rain in both cities?



$$P(\text{rain in Victoria, rain in Calgary}) = P(\text{Victoria}) \times P(\text{Calgary})$$

$$= \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}} \times \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$$

$$= \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$$

Sentence: \_\_\_\_\_

# MATH LINK

You toss 3 sticks.



- a) What is the theoretical probability that all 3 of them land decorated side up?

$$P(\text{decorated, decorated, decorated}) = P(\text{decorated}) \times P(\text{decorated}) \times P(\text{decorated}).$$

$$P(\text{_____, _____, _____}) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} \times \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}} \times \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

- b) Create a simulation to find the experimental probability of 3 sticks landing decorated side up.

*Step 1:* Use a coin, because it has 2 possible outcomes.

*Step 2:* Do 10 or more trials.

*Step 3:* Draw a chart to record your results. Use the headings below.

Let heads represent the decorated side and tails represent the bare side.

Trials	Stick 1 (First toss)	Stick 2 (Second toss)	Stick 3 (Third Toss)	All Three Decorated Side Up? (yes or no)
1				
2				

*Step 4:* What is the experimental probability that all 3 sticks landed decorated side up?

$$P(\text{_____, _____, _____}) = \frac{\text{favourable outcomes}}{\text{total number of trials}}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

- c) Compare the experimental and theoretical probabilities.

\_\_\_\_\_

# 11 Chapter Review

## Key Words

For #1 to #5, unscramble the letters. Use the clues to help you.

1. ENITPDENEDN TSVEEN \_\_\_\_\_  
2 or more events that do not affect each other (2 words)
2. MELAPS PEACS \_\_\_\_\_  
all the possible outcomes of an event (2 words)
3. ONMISULIAT \_\_\_\_\_  
an experiment used instead of trying to re-create the real situation
4. YPORBTLIBIA \_\_\_\_\_  
the chance of an event happening
5. VFABEALOUR CMOETUO \_\_\_\_\_  
what you want to happen (2 words)

### 11.1 Determining Probabilities Using Tree Diagrams and Tables, pages 590–601

6. Leah rolls two 6-sided dice.
  - a) Complete the table to show the sample space.

		Die 2					
		1	2	3	4	5	6
Die 1	1	1, 1	1, 2			1, 5	
	2	2, 1			2, 4		2, 6
	3	3, 1	3, 2	3, 3			
	4	4, 1		4, 3		4, 5	
	5	5, 1		5, 3		5, 5	5, 6
	6	6, 1	6, 2			6, 5	

- b) What is the probability that the 2 numbers are the same?
- c) What is the probability that the sum of the 2 numbers is 10?

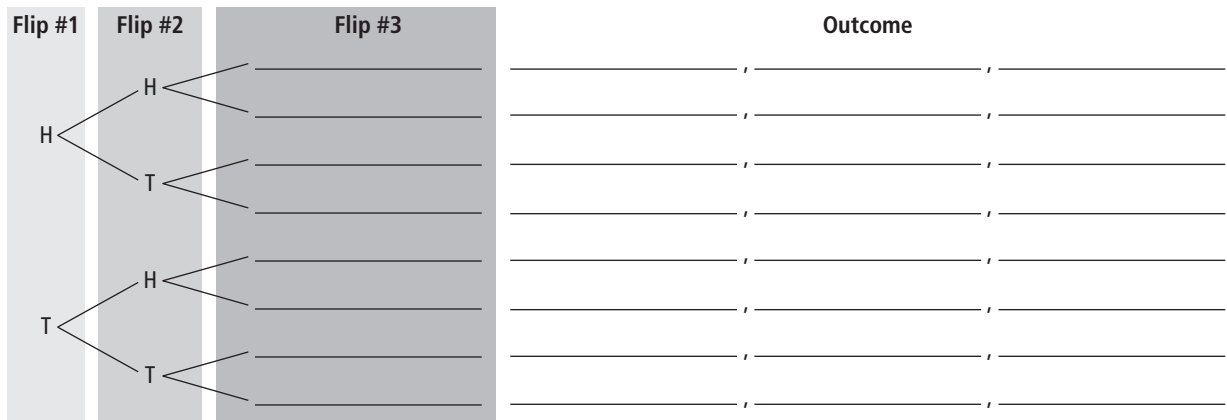
$$P(2 \text{ numbers the same}) = \frac{\text{favourable outcomes}}{\text{possible outcomes}}$$

$$P(\text{sum is } 10) =$$



7. You flip a coin 3 times.

a) Complete the tree diagram to show the sample space.



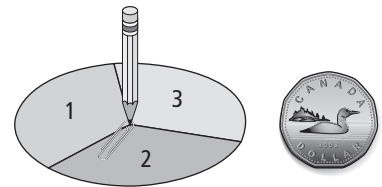
b) What is the probability that all 3 flips will be heads?

c) What is the probability of flipping exactly 2 heads and 1 tail in any order?

$$P(H, H, H) = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

**11.2 Outcomes of Independent Events, pages 603–609**

8. You flip a coin and spin the spinner.



a) Use a table to find the total number of possible outcomes.

		Spinner		
		_____	_____	_____
Coin	_____			
	_____			

The total number of possible outcomes is \_\_\_\_\_.

b) Use multiplication to check your answer.

$$\begin{aligned} \text{Total possible outcomes} &= \text{possible outcomes for coin} \times \text{possible outcomes for spinner} \\ &= \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \end{aligned}$$

9. Janessa wins a contest on the radio.  
 She can choose 1 item from each category for her prize package:  
 • 4 T-shirt choices      • 3 CD choices      • 2 concert ticket choices

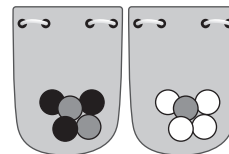
How many different packages can she choose from? Show your work.

$$\begin{aligned} \text{Total possible outcomes} &= \text{shirt possible outcomes} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \end{aligned}$$

Sentence: \_\_\_\_\_

### 11.3 Determining Probabilities Using Fractions, pages 611–623

10. There are 2 bags of marbles.  
 One bag has 3 black marbles and 2 grey marbles.  
 The other bag has 4 white marbles and 1 grey marble.  
 You choose 1 marble from each bag.



- a) What is the probability that you will choose a black marble?

$$\begin{aligned} P(\text{black marble}) &= \frac{\text{number of black marbles}}{\text{total number of marbles in bag}} \\ &= \frac{\boxed{\hspace{1cm}}}{\boxed{\hspace{1cm}}} \end{aligned}$$

- b) What is the probability that you will choose a white marble?

$$P(\text{white marble}) = \frac{\boxed{\hspace{1cm}}}{\boxed{\hspace{1cm}}}$$

- c) What is  $P(\text{black marble, white marble})$ ?

$$\begin{aligned} P(\text{black marble, white marble}) &= P(\text{black marble}) \times P(\text{white marble}) \\ &= \frac{\boxed{\hspace{1cm}}}{\boxed{\hspace{1cm}}} \times \frac{\boxed{\hspace{1cm}}}{\boxed{\hspace{1cm}}} \\ &= \frac{\boxed{\hspace{1cm}}}{\boxed{\hspace{1cm}}} \end{aligned}$$

11. You roll a 6-sided die 3 times.  
Use multiplication to find the probability of rolling 3 even numbers.



How many even numbers are on a die? \_\_\_\_\_

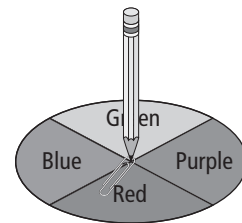
How many possible outcomes are there on each die? \_\_\_\_\_

$$P(3 \text{ even numbers}) = P(\text{even}) \times P(\text{even}) \times P(\text{even})$$

Sentence: \_\_\_\_\_

12. You spin the spinner 20 times. The table shows the results.

Red	Purple	Green	Blue
4	5	8	3



- a) What is the theoretical probability of the spinner landing on blue?  
Write your answer as a decimal.

$$P(\text{blue}) = \frac{\text{favourable outcomes}}{\text{possible outcomes}} \leftarrow \frac{\text{number of blues on 1 spinner}}{\text{total number of colours on 1 spinner}}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

$$= \underline{\hspace{2cm}} \leftarrow \text{decimal}$$

- b) Look at the chart. What is the experimental probability of the spinner landing on blue?  
Write your answer as a decimal.

$$P(\text{blue}) = \frac{\text{number of favourable outcomes}}{\text{number of trials}} \leftarrow \text{total number of spins}$$

$$= \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

$$= \underline{\hspace{2cm}} \leftarrow \text{decimal}$$

- c) Why are the answers to parts a) and b) different?

# 11 Practice Test

**For #1 to #3, circle the correct answer.**

You roll two 4-sided dice.

The table shows the sample space for the possible outcomes.

Use the table to answer #1 to #3.

		Die 1			
		1	2	3	4
Die 2	1	1, 1	1, 2	1, 3	1, 4
	2	2, 1	2, 2	2, 3	2, 4
	3	3, 1	3, 2	3, 3	3, 4
	4	4, 1	4, 2	4, 3	4, 4

1. What is the probability that the same number is on each die?

A  $\frac{8}{16}$

B  $\frac{4}{16}$

C  $\frac{2}{16}$

D  $\frac{1}{16}$

2. What is the probability that the sum of both numbers is 6?

A  $\frac{1}{16}$

B  $\frac{2}{16}$

C  $\frac{3}{16}$

D  $\frac{6}{16}$

3. What is the probability that neither die has a 2 showing?

A  $\frac{2}{16}$

B  $\frac{7}{16}$

C  $\frac{8}{16}$

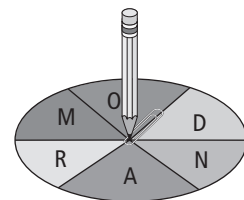
D  $\frac{9}{16}$

*Sum* is the answer when you add.

**For #4 and #5, fill in the blanks using the coin and spinner.**

4. The total number of possible outcomes is

$$\frac{\text{coin possible outcomes}}{\text{coin possible outcomes}} \times \frac{\text{spinner possible outcomes}}{\text{spinner possible outcomes}} = \frac{\text{total possible outcomes}}{\text{total possible outcomes}}$$



5. To find the probability of the coin landing heads up and the spinner landing on A, multiply

$$\frac{\boxed{\phantom{0000}}}{\boxed{\phantom{0000}}} \text{ and } \frac{\boxed{\phantom{0000}}}{\boxed{\phantom{0000}}}$$

$P(H)$  and  $P(A)$ .

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Short Answer

6. a) What is the total number of possibilities if you choose 1 drink, 1 meal, and 1 dessert from the menu? Show your work.

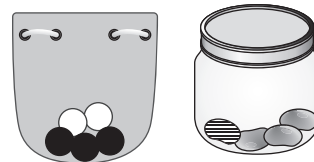


Sentence: \_\_\_\_\_

- b) What is the probability that you would choose milk, chicken strips, and ice cream?

Sentence: \_\_\_\_\_

7. A bag has 3 black marbles and 2 white marbles.  
A jar has 1 striped jellybean and 3 grey jellybeans.  
You choose 1 marble and 1 jellybean.



- a) What is the probability of choosing a striped jellybean?

Sentence: \_\_\_\_\_

- b) What is the probability of choosing a black marble and a grey jellybean?

Sentence: \_\_\_\_\_

Name: \_\_\_\_\_ Date: \_\_\_\_\_

8. David wants to see who the students will vote for in the next school election. He decides to survey the next 30 people who walk into the library. The table shows his results.

Candidates	Jesse	Maria	Marcus	Angela
Votes	11	7	4	8

- a) What is the experimental probability that students will vote for Maria? Write your answer as a fraction, a decimal, and a percent.

Number of favourable outcomes = \_\_\_\_\_

Number of possible outcomes = \_\_\_\_\_

$P(\text{votes for Maria}) =$

Sentence: \_\_\_\_\_

- b) What is the experimental probability that students will vote for either Marcus or Angela?

Number of favourable outcomes = \_\_\_\_\_

Number of possible outcomes = \_\_\_\_\_

$P(\text{votes for Marcus or Angela}) =$

Sentence: \_\_\_\_\_

**WRAP IT UP!**

a) Make a set of 4 sticks for a stick game. Decorate 1 side of each stick.

b) Play the stick game.

- With a partner, take turns dropping all 4 sticks at once.
- Use the table to find the score of each drop.
- Play until 1 person reaches a score of 50.
- Record your results for each toss and keep a running score in the chart.

4 decorated sides up	5 points
3 decorated sides up	2 points
2 decorated sides up	1 point
1 decorated side up	2 points
0 decorated sides up	5 points

Me		Partner	
Decorated Sides Up	Score	Decorated Sides Up	Score

c) Use the tree diagram you made for the Math Link on page 601.

Find the theoretical probability for each of the following:

$$P(4 \text{ decorated sides up}) =$$

$$P(3 \text{ decorated sides up}) =$$

$$P(2 \text{ decorated sides up}) =$$

$$P(1 \text{ decorated side up}) =$$

$$P(0 \text{ decorated sides up}) =$$

d) Do you think the scoring system is fair? Give 1 reason for your answer.

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# Key Word Builder

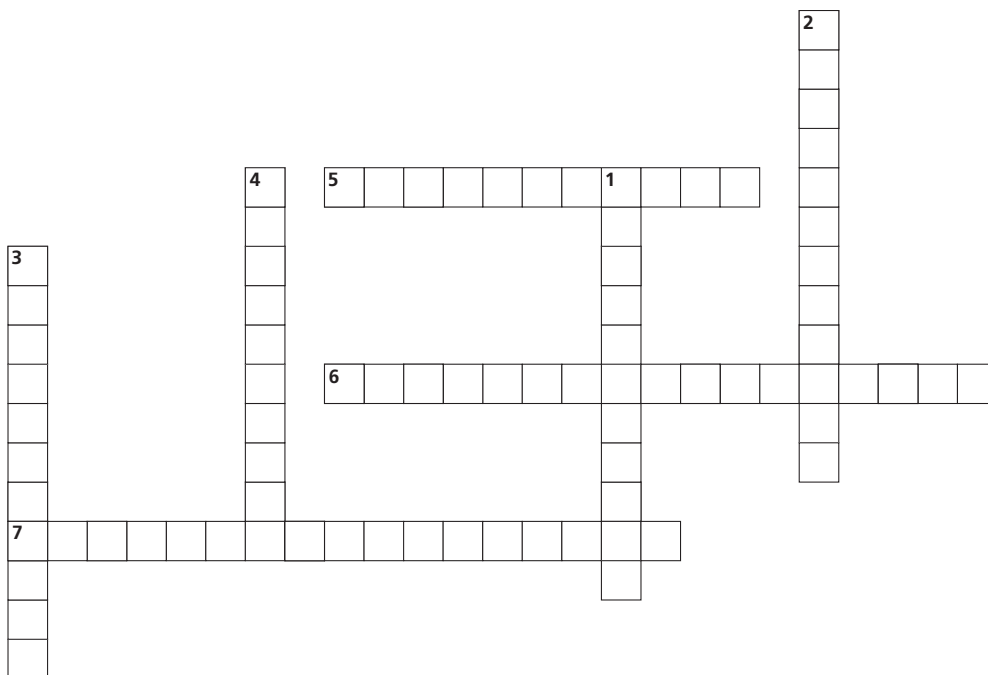
Use the clues to fill in the blanks. Then, complete the crossword puzzle.

## Across

5. The \_\_\_\_\_ includes all the possible outcomes of an event. (2 words)
6. The outcome you want to happen is called the \_\_\_\_\_  
\_\_\_\_\_. (2 words)
7. \_\_\_\_\_ do not affect the results of the other event. (2 words)

## Down

1. The chance of an event happening is called \_\_\_\_\_.
2. When you use an experiment to predict the probability of something happening, it is called \_\_\_\_\_ probability.
3. \_\_\_\_\_ probability is what should happen all of the time.
4. You can use a \_\_\_\_\_ to model the real situation.





# Math Games

## Play Fair!

A fair game means each player has an equal chance of winning the game. There are 2 games described below.

Play each game with a partner to see if each game is fair.

### Materials

- two 6-sided dice
- coin per pair of students
- Tally Charts BLM

### Game 1

#### Rules

- Flip a coin. Heads is Player A and tails is Player B.
- Player B goes first.
- Taking turns, roll 2 dice and add the values.  
Player A scores a point for each even total he or she rolls.  
Player B scores a point for each odd total he or she rolls.
- The first player to reach 10 points wins.  
Use a tally chart to keep track of your score.

Who won? Player \_\_\_\_\_

### Game 2

#### Rules

- Repeat Game 1, except Player A scores a point for every total that is 7 or less.
- Player B scores a point for each total that is 8 or more.
- Use a tally chart to keep track of your score.

Who won? Player \_\_\_\_\_

Which game do you think is *not* fair? Circle GAME 1 or GAME 2.

The table shows the sum of 2 die. Use the table to find the probability of winning each game.

		Die 2					
		1	2	3	4	5	6
Die 1	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

### Game 1

$$\text{Player A: } P(\text{even total}) = \frac{\boxed{\phantom{0000}}}{36}$$

$$\text{Player B: } P(\text{odd total}) = \frac{\boxed{\phantom{0000}}}{36}$$

### Game 2

$$\text{Player A: } P(7 \text{ or less}) = \frac{\boxed{\phantom{0000}}}{36}$$

$$\text{Player B: } P(8 \text{ or higher}) = \frac{\boxed{\phantom{0000}}}{36}$$

Which game is fair (both players have an equal chance of winning)? Explain how you know.

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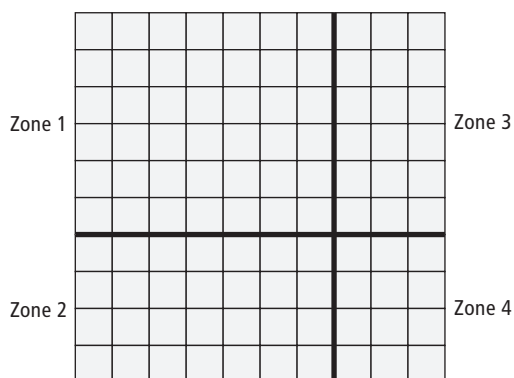
# Challenge in Real Life

## Treasure Hunt

### Materials

- coloured pencils

A group of treasure hunters found a map.  
The map shows treasure in an area that is 10 km by 10 km.  
It is divided into zones.



You be the treasure hunter. What are your chances of finding treasure?

- Use colours as clues on your map.
  - yellow is treasure
  - white is ice
  - brown is sand

There are 100 squares on the map.

The ratio of yellow squares : white squares : brown squares is 2 : 5 : 3.  
Show this ratio on the grid.

Multiply each ratio by 10 to find the number of squares to colour.

$$2 \times 10 \quad : \quad 5 \times 10 \quad : \quad 3 \times 10$$

\_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_ for 100 squares.

Yellow: \_\_\_\_\_ squares

White: \_\_\_\_\_ squares

Brown: \_\_\_\_\_ squares

Use your answers to randomly colour the right number of squares.

Use the correct  
colour.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

2. What is the theoretical probability of each colour on the map?

$$P(\text{yellow}) = \frac{\boxed{\phantom{000}}}{100}$$

$$P(\text{white}) = \frac{\boxed{\phantom{000}}}{100}$$

$$P(\text{brown}) = \frac{\boxed{\phantom{000}}}{100}$$

3. What is the theoretical probability of choosing each zone in the grid?

$$P(\text{Zone 1}) = \frac{\boxed{\phantom{000}}}{100}$$

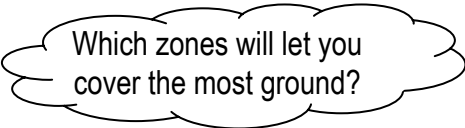
$$P(\text{Zone 2}) = \frac{\boxed{\phantom{000}}}{100}$$

$$P(\text{Zone 3}) = \frac{\boxed{\phantom{000}}}{100}$$

$$P(\text{Zone 4}) = \frac{\boxed{\phantom{000}}}{100}$$

4. You only have time to search 2 zones for the treasure.  
Which 2 zones will you search? Explain why you chose each zone.

Zone \_\_\_\_\_



\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Zone \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. Do you have a good chance of finding the treasures in the 2 zones you chose?  
Circle YES or NO.  
Give 1 reason for your answer.

\_\_\_\_\_

# Answers

## Get Ready, pages 586–587

1. a) 0.125; 12.5% b) 0.75; 75%

2.  $\frac{1}{4}$ ; 0.25, 25%

3. a)

Spinner	Die					
	1	2	3	4	5	6
A	A, 1	A, 2	A, 3	A, 4	A, 5	A, 6
B	B, 1	B, 2	B, 3	B, 4	B, 5	B, 6

b) (A, 1), (A, 2), (A, 3), (A, 4), (A, 5), (A, 6), (B, 1), (B, 2), (B, 3), (B, 4), (B, 5), (B, 6)

## Math Link

Answers will vary. Examples: a) Go Fish b) YES c) You have to get pairs of the same card. d) Monopoly® e) YES f) You roll the dice to see how many places you move on the board. g) Answers will vary.

## 11.1 Warm Up, page 589

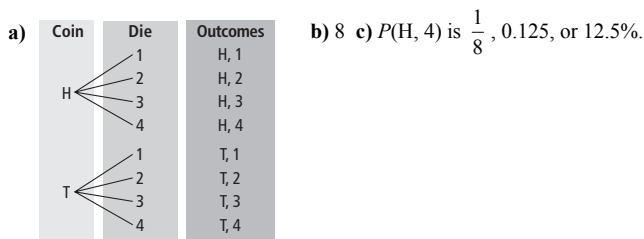
1. a)  $0.\bar{3}$ ;  $33.\bar{3}\%$  b)  $0.\bar{6}$ ;  $66.\bar{6}\%$  c)  $0.\bar{7}$ ;  $77.\bar{7}\%$  d)  $0.\bar{27}$ ;  $27.\bar{27}\%$

2. a)  $\frac{1}{6}$ ;  $0.\bar{16}$  b)  $\frac{3}{6}$ ; 0.5

3. a) 0.5 b) 0.25 c) 0.2 d) 0.1

## 11.1 Determining Probabilities Using Tree Diagrams and Tables, pages 590–601

### Working Example 1: Show You Know



### Working Example 2: Show You Know

a)

Spinner	Die					
	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6

b)  $P(4, 4)$  is  $\frac{1}{24}$ ,  $0.041\bar{6}$ , or  $4.1\bar{6}\%$ . c)  $P(\text{sum} > 5)$  is  $\frac{14}{24}$ ,  $0.58\bar{3}$ , or  $58.\bar{3}\%$ .

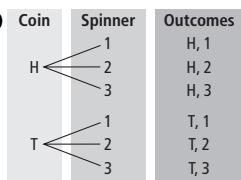
## Communicate the Ideas

1. Answers may vary. Example: a)  $P(H, 3)$  means the probability of flipping a head and rolling a 3. b) John has to label “Die” on the tree diagram next.

2. Answers may vary. Example: a) Write the choice from the row and column in each cell of the table. b) A favourable outcome is a successful result in an experiment. If you want 2 heads, (H, H) is a favourable outcome.

## Practise

3. a)



b) (H, 1), (H, 2), (H, 3), (T, 1), (T, 2), (T, 3)

c)  $P(H, 2) = \frac{1}{6}$ ,  $0.\bar{16}$ , or  $16.\bar{6}\%$  d)  $P(T, \text{odd number}) = \frac{2}{6}$ ,  $0.\bar{3}$ , or  $33.\bar{3}\%$

4. a)

Cards	Die					
	1	2	3	4	5	6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6

b)  $P(\text{both same number}) = \frac{3}{18}$ ,  $0.\bar{16}$ , or  $16.\bar{6}\%$ .

c)  $P(\text{sum is 6}) = \frac{3}{18}$ ,  $0.\bar{16}$ , or  $16.\bar{6}\%$ .

d)  $P(\text{larger number on die}) = \frac{6}{18}$ ,  $0.\bar{3}$ , or  $33.\bar{3}\%$

## Apply

5. a)

First Catch	Second Catch			
	Whitefish (W)	Trout (T)	Arctic Char (A)	Losing a Fish (L)
Whitefish (W)	W, W	W, T	W, A	W, L
Trout (T)	T, W	T, T	T, A	T, L
Arctic Char (A)	A, W	A, T	A, A	A, L
Losing a Fish (L)	L, W	L, T	L, A	L, L

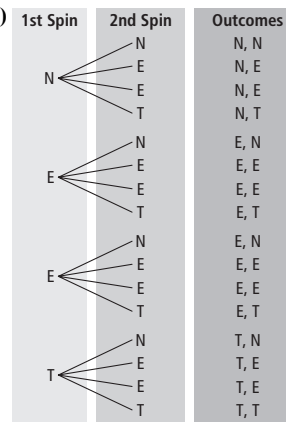
There are 16 possible outcomes.

b)  $P(\text{char, char}) = \frac{1}{16}$ , 0.0625, 6.25%

c)  $P(\text{whitefish, char}) = \frac{1}{8}$ , 0.125, 12.5%

d)  $P(\text{catch nothing}) = \frac{1}{16}$ , 0.0625, 6.25%

6. a)

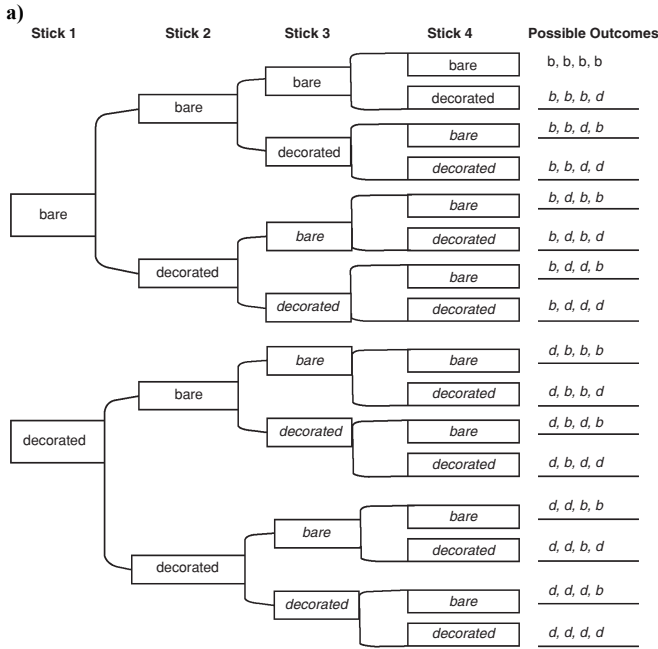


There are 16 possible outcomes.

b)  $P(\text{spinning 2 E's}) = \frac{4}{16}$ , 0.25, 25%

c)  $P(\text{Same letter on both spins}) = \frac{6}{16}$ , 0.375, 37.5%

**Math Link**



b)  $\frac{4}{16}$

**11.2 Warm Up, page 602**

1. a) 1, 2, 3, 4, 5, 6 b) heads, tails c) A, B, C  
 2. a) 4 b) 5 c) 5 d) 12  
 3. a) 40 b) 60 c) 48 d) 21  
 4. a) 40¢ b) \$1.26 c) \$1.16

**11.2 Outcomes of Independent Events, pages 603–609**

**Working Example 1: Show You Know**

		Types of Bread		
		White ( <i>W</i> )	Rye ( <i>R</i> )	Brown ( <i>B</i> )
Sandwich	Egg Salad ( <i>E</i> )	<i>E, W</i>	<i>E, R</i>	<i>E, B</i>
Filling	Turkey ( <i>T</i> )	<i>T, W</i>	<i>T, R</i>	<i>T, B</i>

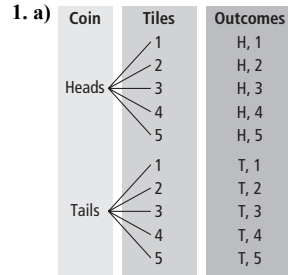
There are 6 possible outcomes.

**Working Example 2: Show You Know**

Sandwich	Fruit	Drink	Outcome
Cheese	Orange	Juice	Cheese, Orange, Juice
		Water	Cheese, Orange, Water
		Milk	Cheese, Orange, Milk
	Apple	Juice	Cheese, Apple, Juice
		Water	Cheese, Apple, Water
		Milk	Cheese, Apple, Milk
Banana	Juice	Cheese, Banana, Juice	
	Water	Cheese, Banana, Water	
	Milk	Cheese, Banana, Milk	
Chicken	Orange	Juice	Chicken, Orange, Juice
		Water	Chicken, Orange, Water
		Milk	Chicken, Orange, Milk
	Apple	Juice	Chicken, Apple, Juice
		Water	Chicken, Apple, Water
		Milk	Chicken, Apple, Milk
Banana	Juice	Chicken, Banana, Juice	
	Water	Chicken, Banana, Water	
	Milk	Chicken, Banana, Milk	

There are 18 possible outcomes.

**Communicate the Ideas**



		Tiles				
		1	2	3	4	5
Coin	Heads (H)	H, 1	H, 2	H, 3	H, 4	H, 5
	Tails (T)	T, 1	T, 2	T, 3	T, 4	T, 5

$5 \times 2 = 10$ . There are 10 possible outcomes.

b) Answers will vary.

2. Answers may vary. Example: You can only compare 2 things in 1 table because you can use rows for one and columns for the other.

3. a)

		Spinner		
		1	2	3
Marbles	Red (R)	<i>R, 1</i>	<i>R, 2</i>	<i>R, 3</i>
	Green (G)	<i>G, 1</i>	<i>G, 2</i>	<i>G, 3</i>
	Blue (B)	<i>B, 1</i>	<i>B, 2</i>	<i>B, 3</i>

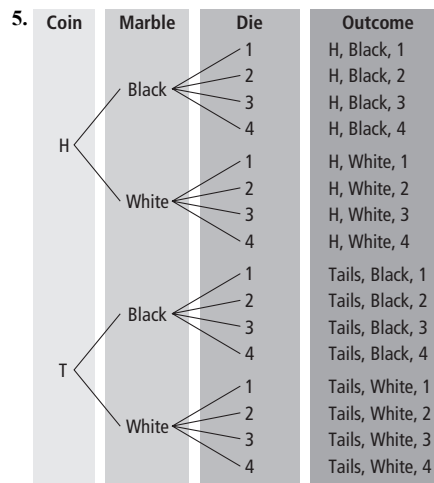
b) 9 c)  $3 \times 3 = 9$

4. a)

		Cards					
		5	6	7	8	9	10
Coin	Heads (H)	<i>H, 5</i>	<i>H, 6</i>	<i>H, 7</i>	<i>H, 8</i>	<i>H, 9</i>	<i>H, 10</i>
	Tails (T)	<i>T, 5</i>	<i>T, 6</i>	<i>T, 7</i>	<i>T, 8</i>	<i>T, 9</i>	<i>T, 10</i>

There are 12 possible outcomes.

b)  $2 \times 6 = 12$



$2 \times 2 \times 4 = 16$

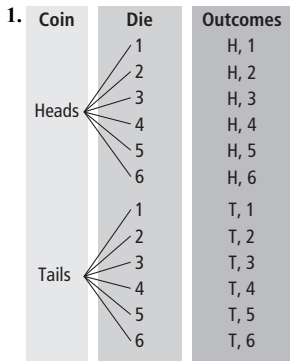
**Apply**

6. a) 6 b) \$1.25  
 7. 12  
 8. 24

**Math Link**

- a) 16 b) 32

11.3 Warm Up, page 610



1. a)  $\frac{1}{8}$  b)  $\frac{2}{21}$   
 2. a) 0.4 b) 0.36  
 3. a) 0.15 b) 1.2

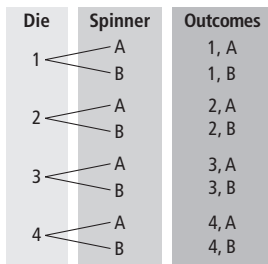
11.3 Determining Probabilities Using Fractions, pages 611–623

Working Example 1: Show You Know

Spinner	Die			
	1	2	3	4
A	A, 1	A, 2	A, 3	A, 4
B	B, 1	B, 2	B, 3	B, 4

$P(\text{numbers less than 4 and A}) = \frac{3}{8}$

Working Example 2: Show You Know



$P(4, B) = \frac{1}{8}$

Working Example 3: Show You Know

- a)  $\frac{22}{100}$ , 0.22, 22% b)  $\frac{1}{4}$ , 0.25, 25%

Communicate the Ideas

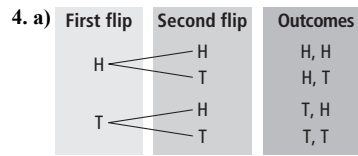
- Answers may vary. Example: Multiply the probability of selecting a grey marble by the probability of selecting a penny.
- Answers may vary. Example: A simulation is when you use an experiment to model a real situation. You might use a simulation of flipping coins to model the probability of it raining one day.

Practise

3. a)

Die	Spinner			
	A	B	C	D
1	1, A	1, B	1, C	1, D
2	2, A	2, B	2, C	2, D
3	3, A	3, B	3, C	3, D
4	4, A	4, B	4, C	4, D

b)  $P(2, A) = \frac{1}{16}$  c)  $P(2, A) = \frac{1}{16}$



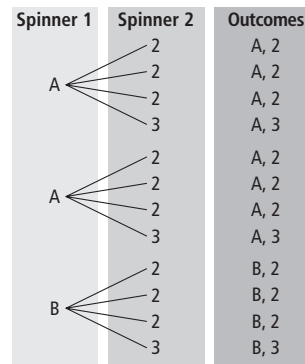
b)  $P(H, H) = \frac{1}{4}$  c)  $P(H, H) = \frac{1}{4}$

5. a)  $P(\text{marigold, flowerpot}) = \frac{2}{10}$  b)  $P(\text{marigold, flowerpot}) = \frac{1}{16}$

Apply

6. a) 6 b)  $\frac{1}{6}$ ,  $0.1\bar{6}$ ,  $16.\bar{6}\%$  c) 4

7. a)



b) c)  $P(A, 3) = \frac{2}{12}$ ,  $0.1\bar{6}$ ,  $16.\bar{6}\%$

8.  $\frac{14}{100}$ , 0.14, or 14%

Math Link

- a)  $\frac{1}{8}$  b) and c) Answers will vary.

Chapter Review, pages 624–627

- independent events
- sample space
- simulation
- probability
- favourable outcome

6. a)

		Die 2					
		1	2	3	4	5	6
Die 1	1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
	2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
	3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
	4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
	5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
	6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

b)  $P(2 \text{ numbers the same}) = \frac{6}{36}$  or  $\frac{1}{6}$

c)  $P(\text{sum is } 10) = \frac{3}{36}$  or  $\frac{1}{12}$

Flip #1	Flip #2	Flip #3	Outcomes
H	H	H	H, H, H
	H	T	H, H, T
H	T	H	H, T, H
	T	T	H, T, T
T	H	H	T, H, H
	H	T	T, H, T
T	T	H	T, T, H
	T	T	T, T, T

b)  $P(H, H, H) = \frac{1}{8}$  c)  $\frac{3}{8}$

8. a)

		Spinner		
		1	2	3
Coin	H	H, 1	H, 2	H, 3
	T	T, 1	T, 2	T, 3

The total number of possible outcomes is 6.

b)  $2 \times 3 = 6$

9. 24 packages

10. a)  $P(\text{black marble}) = \frac{3}{5}$  b)  $P(\text{white marble}) = \frac{4}{5}$

c)  $P(\text{black marble, white marble}) = \frac{12}{25}$

11.  $P(3 \text{ even numbers}) = \frac{27}{216}$  or  $\frac{1}{8}$

12. a)  $P(\text{blue}) = 0.25$  b)  $P(\text{blue}) = 0.15$  c) Answers may vary. Example: The experimental probability is based on an experiment, but the theoretical probability is based on what *should* happen.

**Practice Test, pages 628–630**

1. B 2. C 3. D 4.  $2 \times 6 = 12$  5.  $\frac{1}{2}, \frac{1}{6}$

6. a) 18 possible outcomes b)  $\frac{1}{18}$

7. a)  $\frac{1}{4}$  b)  $\frac{9}{20}$

8. a)  $\frac{7}{30}, 0.2\bar{3}$ , or  $23.\bar{3}\%$  b)  $\frac{12}{30}, 0.4$ , or  $40\%$

**Wrap It Up!, page 631**

a) and b) Answers will vary.

c)  $P(4 \text{ decorated sides up}) = \frac{1}{16}, P(3 \text{ decorated sides up}) = \frac{4}{16},$

$P(2 \text{ decorated sides up}) = \frac{6}{16}, P(1 \text{ decorated sides up}) = \frac{4}{16},$

$P(0 \text{ decorated sides up}) = \frac{1}{16}$  d) Answers will vary. Example: Yes, because you get more points for combinations that are less probable.

**Key Word Builder, page 632**

Across

5. sample space 6. favourable outcome 7. independent events

Down

1. probability 2. experimental 3. theoretical 4. simulation

**Math Games, page 633**

$P(\text{even total}) = \frac{18}{36}, P(\text{odd total}) = \frac{18}{36}, P(7 \text{ or less}) = \frac{21}{36},$

$P(8 \text{ or higher}) = \frac{15}{36}$

**Challenge in Real Life, pages 634–635**

1. yellow: 20 squares, white: 50 squares, brown: 30 squares

2.  $P(\text{yellow}) = \frac{20}{100}, P(\text{white}) = \frac{50}{100}, P(\text{brown}) = \frac{30}{100}$

3.  $P(\text{Zone 1}) = \frac{42}{100}, P(\text{Zone 2}) = \frac{28}{100}, P(\text{Zone 3}) = \frac{18}{100},$

$P(\text{Zone 4}) = \frac{12}{100}$

4. Answers will vary.

5. Answers will vary.

