

Circle Graphs

GOAL

You will be able to

- analyze and interpret data presented in a circle graph
- decide what kind of data is best displayed in a circle graph
- construct a circle graph using various methods

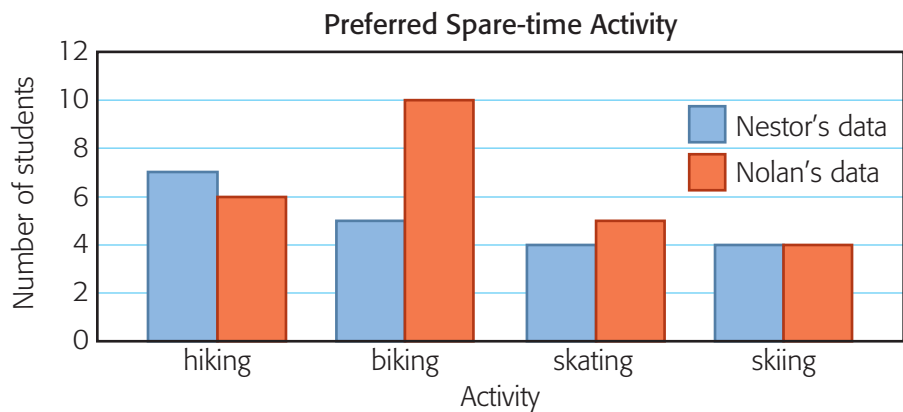


What can you determine from the circle graph?

Making Decisions

Nolan and Nestor conducted a survey to find out which activity, out of four different activities, their classmates would choose to do in their spare time.

They graphed their results.



What can you conclude about the data in the graph?

- How many students are in each class? How do you know?
- Which activity do Nolan's classmates prefer? Which activity do Nestor's classmates prefer?
- Create a table that shows the percent of each group that prefers each activity.

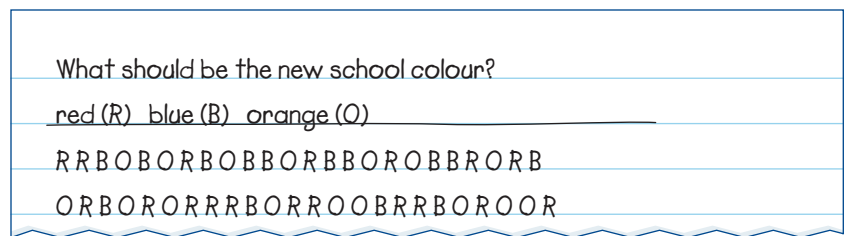
- D. Combine the two groups. What percent of the combined group prefers each activity?
- E. Which activity would you choose for each class if you had to plan a field day? Which activity would you choose for the combined classes? Explain.

What Do You Think?

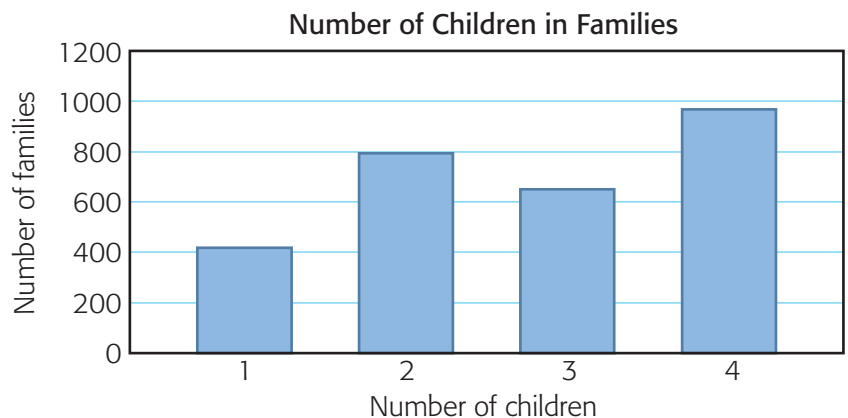
Decide whether you agree or disagree with each statement.

Be ready to explain your decision.

1. The results of a survey to choose a new school colour are easy to interpret quickly by looking at the data in the following chart.



2. A graph is always a good way to show how individual amounts relate to the whole.
3. When you change the vertical scale on a bar graph, the highest bar on the original graph may not be the highest bar on the new graph.
4. The number of people about whom data was collected can always be determined by looking at a bar graph.



11.1

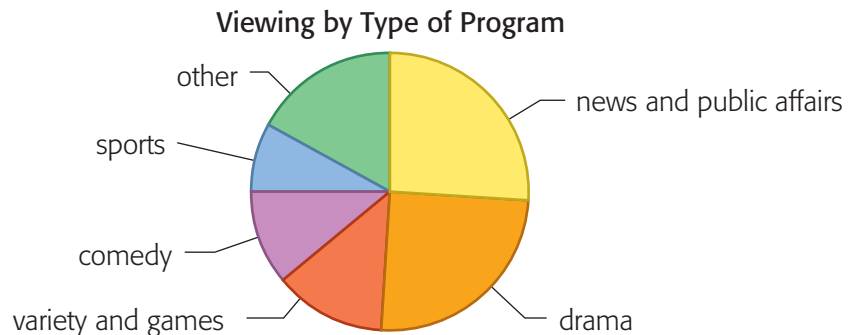
Interpreting Circle Graphs

GOAL

Read and analyze the information in a circle graph.

LEARN ABOUT the Math

A video download site surveyed a large group of people, then made the following graph using the data.



What can you learn from the data in the graph?

- Why do you think the video site used these categories of viewing to gather its data in the **circle graph**?
- Can you tell how many people were surveyed by looking at the graph? Does it matter how many people were surveyed?
- Which section in the graph is about three times as large as another section? What can the larger section tell you about these types of programs?
- List three other comparisons you can make using the data in the circle graph.

circle graph

a graph that shows how parts make up a whole

- E. Out of 1000 people, about how many watch drama? Explain how you made your estimate.
- F. What else can you conclude from the circle graph?

Reflecting

- G. How might someone use the data in the circle graph?
- H. Why is a circle graph a good way to communicate this kind of data?

WORK WITH the Math

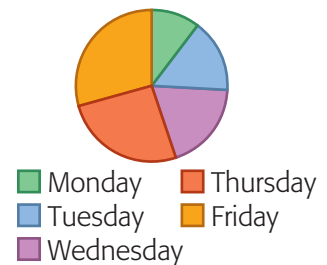
Example 1

Analyzing a circle graph



Kevin graphed the weekly sales of chocolate milk in his school. What can you determine from his circle graph?

Chocolate Milk Sold in a Week



Nayana's Solution

I determined the following:

- A different amount of chocolate milk is sold each day.
- The amounts sold increase every day from Monday to Friday.
- More than half the chocolate milk is sold on the last two days of the week.
- If you order for a week in which Friday is a holiday, reduce your order by $\frac{1}{4}$.
- If you order for a week in which Monday is a holiday, reduce your order by $\frac{1}{10}$.

The sections are different sizes.

The sections increase in size from Monday to Friday.

More than half the circle is for Thursday and Friday.

More than $\frac{1}{4}$ of the circle is for the amount sold on Friday.

About $\frac{1}{10}$ of the circle is for the amount sold on Monday.

Example 2

Calculating amounts from a circle graph

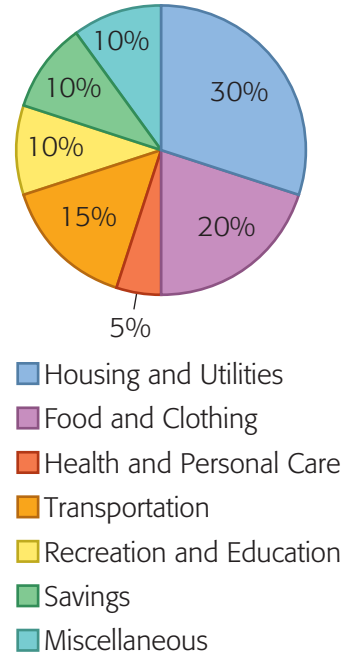
Ashley saw this circle graph in the newspaper.

Ashley's older sister has a monthly income of about \$2000. Ashley wants to know how much her sister should be spending in each budget category.



Ashley's Solution

Recommended Monthly Spending Budget



My sister should be spending the following amounts, based on the circle graph:

• **Recreation and Education:** \$200

I know that 10% of \$2000 is \$200 since 10% is $\frac{1}{10}$.

• **Housing and Utilities:** \$600

If 10% of \$2000 is \$200, then 30% of \$2000 is $3 \times \$200$.

• **Food and Clothing:** \$400

20% is $2 \times \$200$.

• **Health and Personal Care:** \$100

5% is half of 10%, which is $\$200 \div 2$.

• **Transportation:** \$300

15% is 10% + 5%, so 15% is $\$200 + \100 .

• **Savings:** \$200

Since the last two categories are 10%, each is \$200.

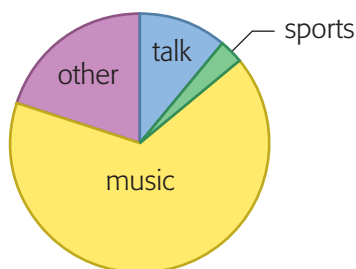
• **Miscellaneous:** \$200

A Checking

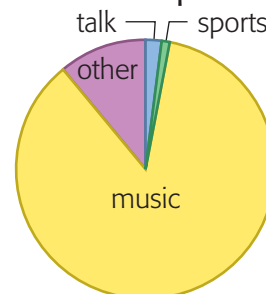
- This table shows the amount of time that Canadians listen to different types of radio programs, by percent. Which set of data does each circle graph match?

Type of radio program	a) Listening time for ages 12 to 17 (%)	b) Listening time for all ages (%)
talk	2.3	11.4
sports	0.6	2.5
music	86.3	66.1
other	10.8	20.2

Circle Graph A



Circle Graph B

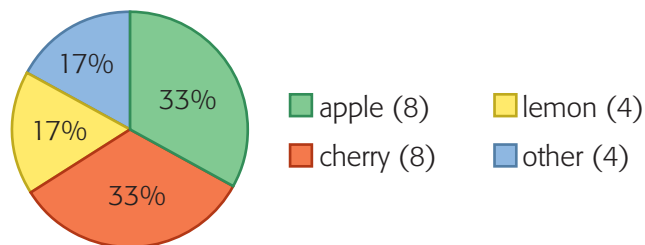


Reading Strategy

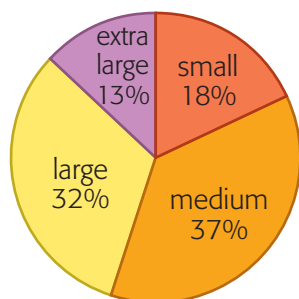
Write five statements about the circle graph. Share them with a partner. Ask your partner to agree or disagree with your statements.

- Robert surveyed all 24 family members at his family reunion about their favourite kind of pie. Then he prepared the following graph. What advice can Robert give his family members when they are deciding which pies to serve at the next family reunion?

Favourite Kinds of Pie



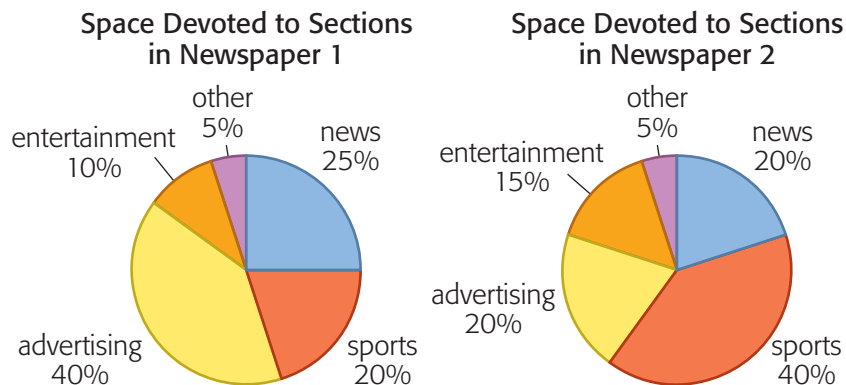
T-shirt Sizes Sold



B Practising

- Linda sold 200 T-shirts at her stall last weekend. The graph at the left shows what percent of each size was sold. How many medium T-shirts did Linda sell?

4. The following graphs show how much space two newspapers give to various sections.
- Why can't you tell which newspaper gets more income from advertising?
 - Can you tell which newspaper has more sports pages? Explain.



5. Today's editions of both newspapers in question 4 have 120 pages. Pick one of the newspapers. How many pages are in each section?
6. Erica surveyed her classmates about what superpower they would want if they could have only one.

Preferred Superpower



Superpower	Percent of total (%)
power to fly	29
super strength	21
invisibility	20
power to read minds	13
power to control weather	7
other	■

- What percent is "other"?
 - Copy the circle graph into your notebook. Label each section in the circle graph with a name and the percent.
7.
 - Write three questions you could ask about the data in question 6.
 - Exchange your questions with a classmate, and answer each other's questions.
8. What information can you not get from a circle graph?

11.2

Exploring Circle Graphs

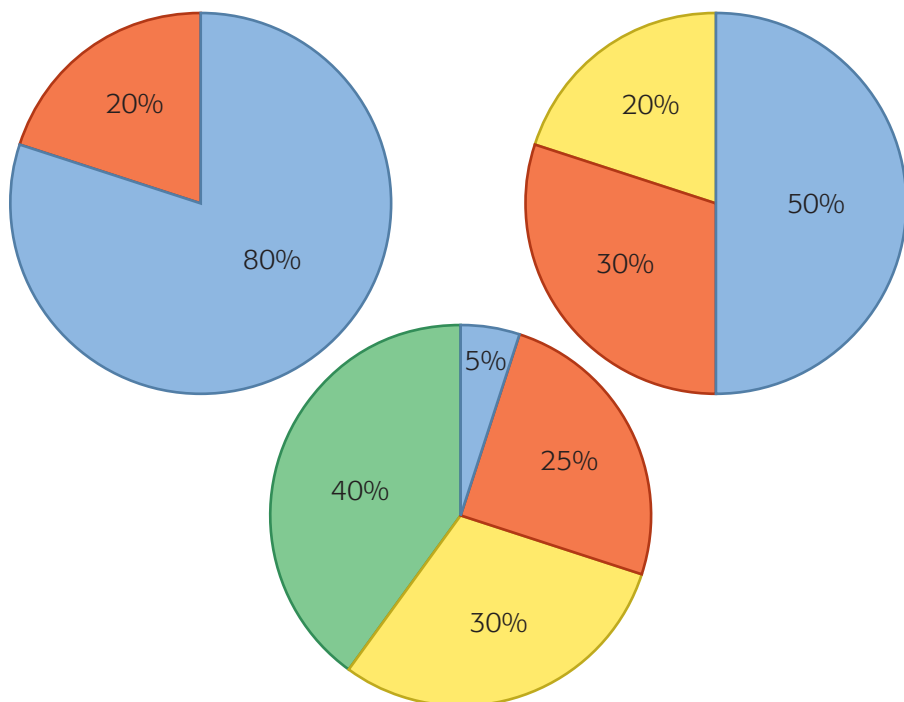
GOAL

Predict how data might be distributed.

EXPLORE the Math

Circle graphs are often a convenient way to display data.

Choose one of the circle graphs below. Think of some data you could collect about your class or school that might end up looking like the graph you chose. Collect the data.



Why do you think the data you collected did or did not end up looking like the graph you chose?

11.3

Constructing Circle Graphs

YOU WILL NEED

- a 100% circle template (Blackline Master)
- a compass
- a protractor
- a calculator

GOAL

Create a circle graph for a data set.

LEARN ABOUT the Math

Sarah asked a group of people what their favourite outdoor exercise is. She recorded her results.

Favourite exercise	Number of people
cycling	16
skateboarding	10
skating	10
skiing	4



How can you represent Sarah's results in a circle graph?

Example 1

Using a 100% circle template



I represented Sarah's results in a circle graph using a 100% circle template.

Megan's Solution



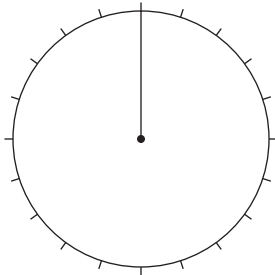
Favourite exercise	Number of people	Percent (%)
cycling	16	40
skateboarding	10	25
skating	10	25
skiing	4	10
Total	40	100

I wrote each number of people as a percent. There are 40 people in total.

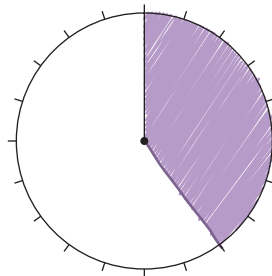
16 out of 40 is like 4 out of 10, or 40%.

10 out of 40 is like 1 out of 4, or 25%.

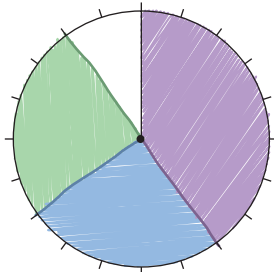
4 out of 40 is like 1 out of 10, or 10%.



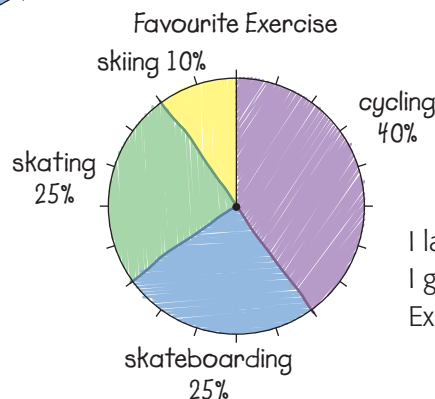
I drew a radius on the circle, from the centre to 0%, as a place to start.



Each mark on the template represents 5%. For 40%, I counted 8 marks. I drew a radius to complete the first section.



For 25%, I counted 5 marks and drew a radius. I did this twice. There were 2 marks left. They represented the last 10% of the data.



I labelled each section. I gave my circle graph the title "Favourite Exercise."



Example 2 Using central angles

I represented Sarah's results in a circle graph using central angles.

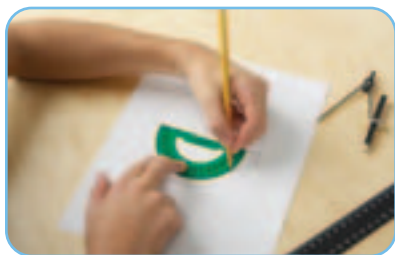
Nolan's Solution

Favourite exercise	Number of people	Percent (%)	Central angle ($^{\circ}$)
cycling	16	40	40% of $360 = 144$
skateboarding	10	25	25% of $360 = 90$
skating	10	25	25% of $360 = 90$
skiing	4	10	10% of $360 = 36$
Total	40	100	360

I wrote each number of people as a percent. Then I determined the central angle for each percent. There are 360° in a circle, so 100% of a circle is 360° .



I drew a circle and marked the centre. Since there are two sections with 90° angles, I drew a diameter and split it in half to represent these two sections.



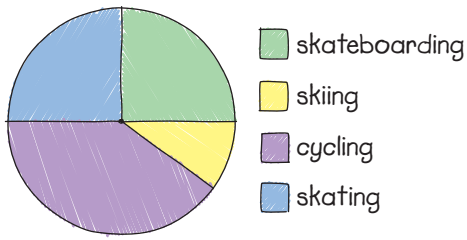
Then I marked a 36° angle for the skiing section.



I checked the remaining section. It should have a 144° angle.



Favourite Exercise



I gave the circle graph the title "Favourite Exercise" and made a legend.

Example 3 Using a spreadsheet

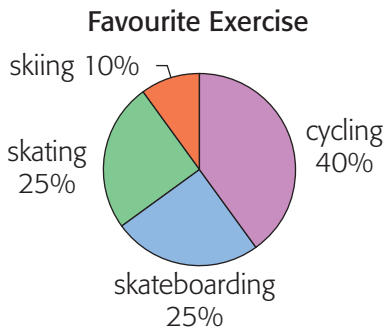


I represented Sarah's results in a circle graph using a spreadsheet.

Nestor's Solution

	A	B
1	cycling	16
2	skateboarding	10
3	skating	10
4	skiing	4

I entered Sarah's results in a spreadsheet.



I generated a circle graph for the data using the spreadsheet program.

Reflecting

- Why do you think circle graphs are sometimes called pie charts?
- How are the three methods for constructing a circle graph alike? How are they different?
- What kind of data would you use each method for?

WORK WITH the Math

A Checking

- Two groups of people at a mall were asked, “What was the first thing you bought here today?”

Group A

Item	Number of people	Percent (%)
clothing	20	■
books	16	■
CDs or DVDs	40	■
other	4	■

Group B

Item	Number of people	Percent (%)
clothing	30	■
books	24	■
CDs or DVDs	36	■
other	30	■

- Calculate the missing percents.
- Display the data using a 100% circle template. Explain what you did.
- Combine the two sets of data. Create a circle graph using a compass and a protractor to display the combined data.

B Practising

- Charlotte surveyed 150 people. Write each number of people as a percent. How many degrees does the central angle of each section have?
a) 50 b) 75 c) 20 d) 5
- Milk is 88% water, 5% carbohydrates, 3% fat, 3% protein, and 1% inorganic material. Represent the composition of milk in a circle graph.

4. The following table shows the flavours of ice cream that were sold at a school sports day.

Flavour	Percent sold (%)	Central angle (°)
vanilla	28	■
mint chocolate chip	6	■
chocolate	42	■
strawberry	12	■
bubble gum	12	■
Total	100	360°

- Complete this table.
- Display the data in a circle graph.
- Create a question about the data. Answer your question.

Activity	Percent (%)
cards	8
board games	5
video games	45
arcade	12
movies	30

5. The table at the left shows activities that were organized for birthday parties. Display the data in a circle graph.

6. This table shows the results of a survey of Canadian adults.

Education	Number (in thousands)
0 to 8 years	2.2
some high school	4.0
high school graduate	4.9
some post-secondary	2.5
post-secondary certificate or diploma	7.5
university degree	4.4
Total	25.5

- Enter the data in a spreadsheet.
 - Display the data in a circle graph using the spreadsheet.
 - What calculation do you think the spreadsheet program did to create the circle graph?
7. What are some ways you can check that your circle graph is correct?

11.4

Communicate about Circle Graphs

GOAL

Use data and graphs to support conclusions.

LEARN ABOUT *the Math*

Jessica wants her mother to increase her allowance. She decides to convince her mother that she needs a larger allowance by putting together a report that shows her spending and saving habits. She makes a circle graph to display how she uses her allowance. She asks Ashley to comment on her report.



How can Jessica improve her report?



Jessica's Report

Ashley's Comments

	Amount	Amount	Amount	Amount	Amount
Allowance	earned	spent on entertainment	spent on food	spent on clothes	spent on music
\$40	\$60	\$29	\$31	\$14	\$12

My Spending Habits

Category	Percentage
food	31%
entertainment	29%
clothes	14%
savings	14%
music	12%

I organized *my* data in a spreadsheet. Then I used the graphing program on *my* computer to construct a circle graph.

I chose a circle graph to show *my* spending and saving habits.

I gave *my* graph a title and labelled the sections of the graph with percents.

I showed that almost 31% of *my* allowance goes to food, which I need, so I really have only 69% of *my* allowance for other expenses.

From *my* graph, I can conclude that I spend *more* than I save.

← Is this a typical month?

← How did you use the spreadsheet program?

← Why did you use a circle graph?

← You didn't say why you need more allowance.

Communication Checklist

- ✓ Did you include all the important details?
- ✓ Did you make reasonable conclusions?
- ✓ Did you justify your conclusions?

- A. Which of Ashley's comments do you think is most important for improving Jessica's report? Why?
- B. What additional suggestions can you make to help Jessica improve her report?

Reflecting

- C. Do you think Jessica presented a convincing argument for increasing her allowance?

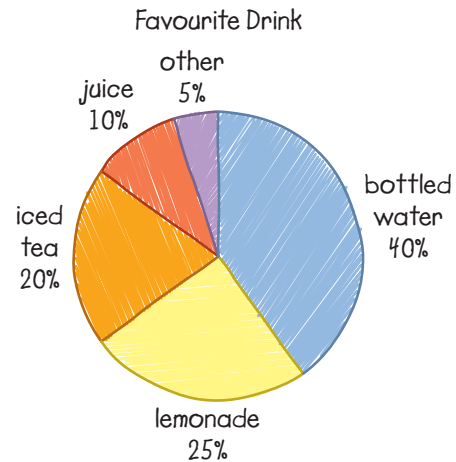
WORK WITH the Math

Example Using a circle graph to support a conclusion

Nick surveyed 40 students after gym class about what kind of drink they like best after exercising. He prepared a report to show the kinds of drinks that should be sold in the school cafeteria. He asked Pavlo to read his report and make suggestions for improvements.



Pavlo's Editing



To gather information about the kinds of drinks that should be sold in the school cafeteria, I surveyed 40 students. 85% of these students preferred bottled water, lemonade, or iced tea.

Add "who were coming out of gym class, since they had just finished exercising and would be thirsty."

Since 40% preferred bottled water, it should definitely be sold.

I agree - it's the most popular.

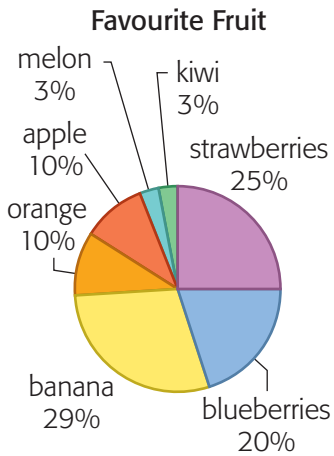
A total of 45% preferred either iced tea or lemonade.

This is more than the number of students who preferred water, so water should not be the only drink offered.

Good point!

Juice should also be offered for students who want a nutritional choice.

Add a conclusion:
"I recommend that bottled water, lemonade, iced tea, and juice should be sold."

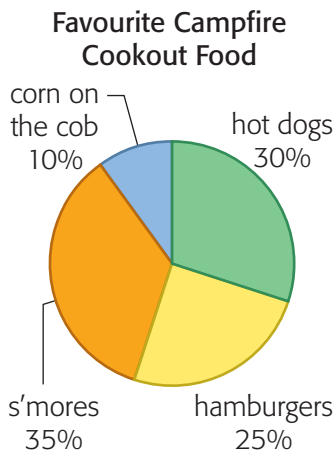
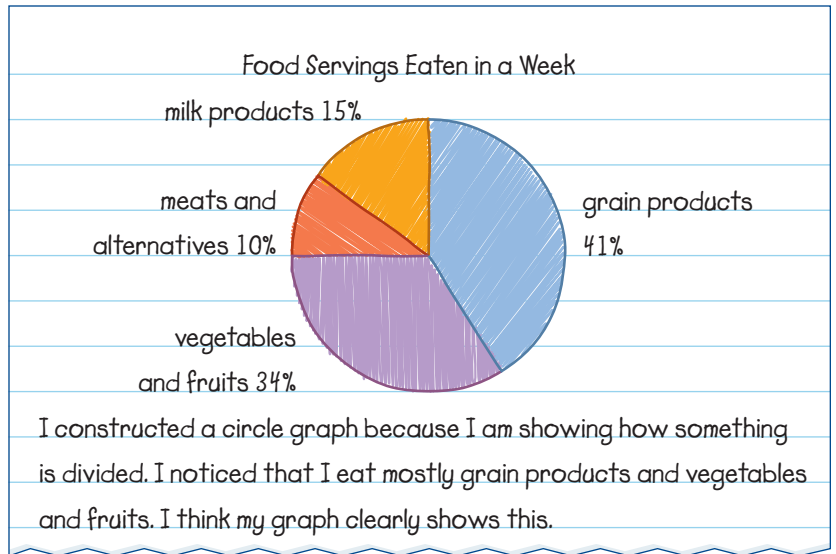


A Checking

- Petra surveyed 40 students at the school picnic about their favourite fruit. She concluded that berries should not be served at the next picnic, since less than half of the graph is berries. What do you think about Petra's interpretation of the data?

B Practising

- Kevin wrote a report about the food he ate in a week. He used a circle graph. What questions would you ask to help Kevin draw more conclusions in his report?



- The circle graph at the left shows favourite foods at a campfire cookout. Write a report based on the data in the graph. Share your report with a classmate, and ask for ways to improve it.
- Look on the Internet or in newspapers and magazines to find circle graphs that show similar information. Explain how the circle graphs are similar and how they are different.
- When you are studying a circle graph, what kind of questions should you ask yourself about the information it shows?

MATH GAME

Race to 100%

Number of players: 2 or more

YOU WILL NEED

- a bag
- different-coloured counters
- a compass

How to Play

1. Assign each player a different colour of counter. Put all the counters in the bag.
2. One player reaches into the bag and pulls out a handful of counters. This player then draws a circle graph as follows:
 - Draw a circle and place the counters around it, equally spaced. Place all the counters of each colour together.
 - Draw line segments from the centre of the circle to the places on the circumference where the colours change. Label each section with its colour and percent, to the nearest 1%.
 - Record the percent for each colour in a table.
3. Players take turns pulling counters from the bag and drawing a circle graph. Players add the percents for each turn to the percents for the previous turn.
4. The first player to accumulate 100% or more wins.



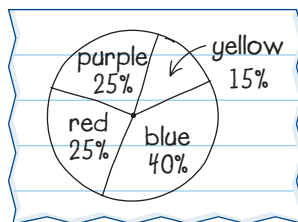
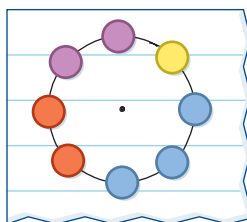
Denis's Circle Graph

I had the second turn.

I pulled out three blues, one yellow, two reds, and two purples.

I drew the circle graph and recorded the percents.

Now I'm tied for first.



Chad:	Denis:	Jonge:	Akeela:
red	yellow	blue	purple
30%	40%	10%	20%
55%	55%	50%	45%

Graphs of Different Shapes

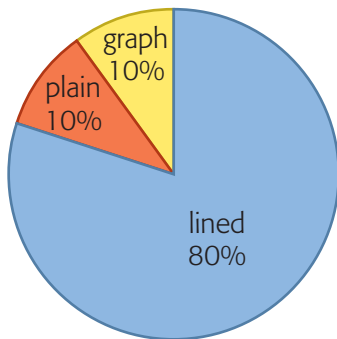
A circle graph is used to represent data as parts of a whole.

Could you use a triangle, a square, a rectangle, or any other shape to represent the same kind of data?

The following table and circle graph show the types of paper students bought for school at a local store on one day.

Type of paper	Number of packages
lined	64
plain	8
graph	8

Types of Paper Purchased



1. Draw a rectangle with 10 squares that are the same size. Colour the rectangle to represent the percents of types of paper bought.

2. Represent the same data using a different shape. Explain your choice.
3. Is one shape easier to use than the other for drawing a graph? Explain.

Chapter Self-Test

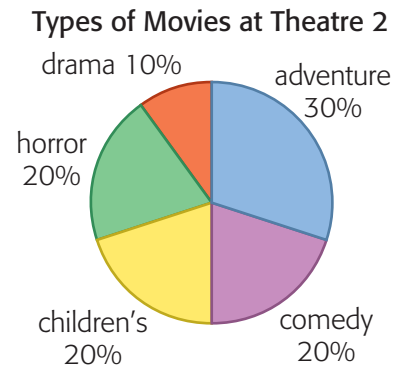
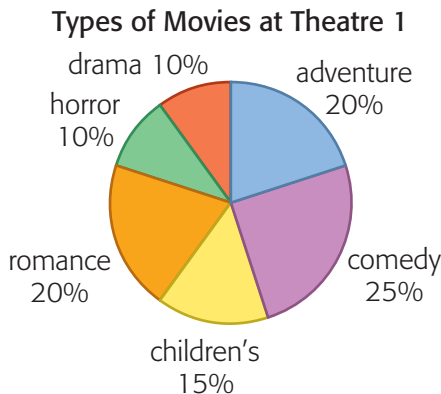
1. A Grade 7 class surveyed 500 students, asking which language their mother speaks. They displayed the data they gathered in the following table.

Language Mother Speaks at Home

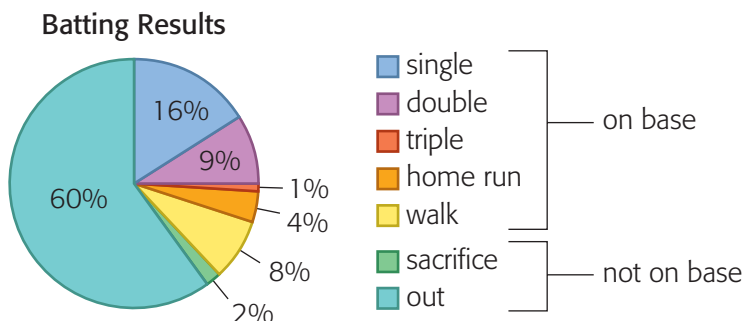
Language	Number of mothers
Arabic	30
Chinese	90
English	100
French	90
Hindi	60
Ukrainian	80
other*	50

*includes Cree, Punjabi, Japanese, Korean, and more

- a) Display these data in a circle graph.
 b) What are some facts you can learn from your graph?
2. Suppose that you manage two movie theatres. The following circle graphs show the percents of different types of movies shown each year at your theatres. Theatre 1 is more successful than Theatre 2. What changes might you make to the movies shown at Theatre 2 to increase its audiences? Explain any assumptions you make.



3. Gary's older brother weighs 80 kg. His body consists of 39.8 kg of muscle, 14.9 kg of fat, 14.2 kg of bone, and 11.1 kg of other tissue. Display the data in a circle graph.
4. A major league baseball player's record of outcomes for his first 600 times at bat is shown in the following graph.



- a) How many times did the player get on base?
 - b) How many home runs did he get?
5. For a probability experiment, Hoshi grabbed coloured counters from a bag three times.

Colour	First handful	Second handful	Third handful
blue	6	4	2
red	4	5	5
brown	2	3	4
green	5	4	3
orange	3	2	2
yellow	2	2	4

- a) Construct a circle graph for each handful.
- b) What is the central angle of each section in your third circle graph?

What Do You Think Now?

Revisit What Do You Think? on page 467. How have your answers and explanations changed?

Frequently Asked Questions

Q: How do you read a circle graph?

A: Look at the title of the graph, the relative sizes of the individual sections, and the labels on these sections.

For example, consider the graph at the left.

The title of the graph gives an overview of the information displayed in the graph.

Each section represents one part of the whole. The size of each section represents its fraction of the whole.

The label on each section gives the category name and a percent, so that you know the size of the section.

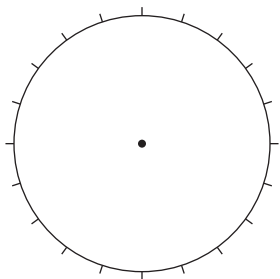
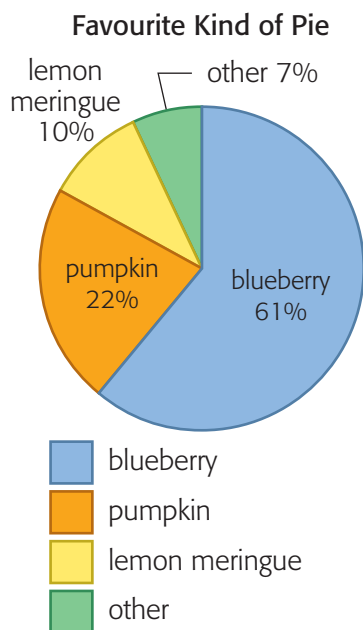
There may be a legend that identifies the categories by colour.

Q: How can you draw a circle graph?

A1: Calculate the number of degrees the central angle for each section should be by multiplying the percent value, expressed as a decimal, by 360° . Then draw the sections using a ruler and a compass. Colour each section, label it with the category and percent, and give the graph a title.

A2: Convert each amount into a percent of the whole. Then use a 100% circle template with benchmark percents to draw sections based on the percents you calculated. Colour each section, label it with the category and percent, and give the graph a title.

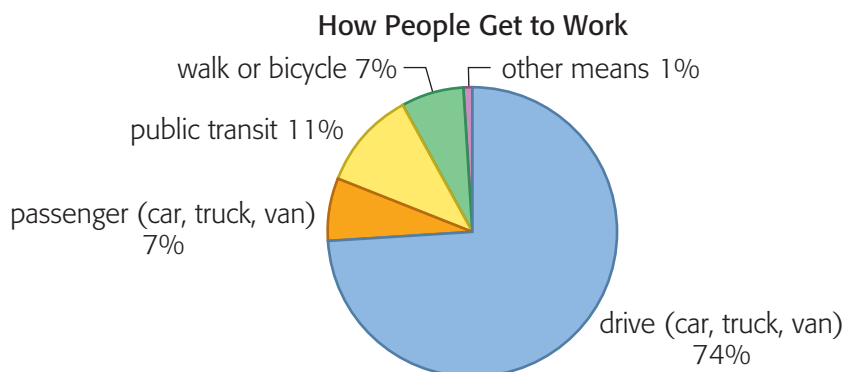
A3: Enter the data into a spreadsheet program, and use the program to create a circle graph. Give the graph a title.



Practice

Lesson 11.1

1. A company surveyed 4000 employees about how they get to work. The data collected are shown in the following circle graph.



- a) How many employees walk or ride a bicycle to work?
- b) How many people use a car, truck, or van to get to work?
- c) What could “other means” of transportation be?

Lesson 11.3

2. Anne recorded the colours of 100 cars in the parking lot of a supermarket.

Colour of car	Number of cars of each colour
white	20
silver	32
black	18
red	12
blue	18

- a) Why would a circle graph be an appropriate way for Anne to display her data?
 - b) Display Anne’s data in a circle graph.
3. A 300 g container of yogurt contains 228 g of water, 54 g of carbohydrates, 12 g of protein, and 6 g of fat.
 - a) Display the data in a circle graph.
 - b) Create a problem based on your graph. Exchange your problem with a classmate, and solve each other’s problem.

Source	Revenue (\$)
registration	25 000
dances	3 500
ticket sales	2 750
sponsors	6 000

4. The revenue of a local hockey team for a season is shown at the left.
- What was the club's total revenue for the season?
 - Create a circle graph that displays the club's sources of revenue.
 - Approximately what percent of the club's revenue came from sponsors?
 - How do the revenues from ticket sales and sponsors compare?
 - What three sources provide about 85% of the revenue?

Lesson 11.4

5. The following database shows the lunchtime drink choices of the Grade 7 and 8 students in a school:

Type of drink	Grade 7	Grade 8
bottled water	12	20
milk	19	12
apple juice	11	13
orange juice	13	27
grapefruit juice	20	4
no drink	5	8

- Which grade has a greater percent of students who prefer juice?
 - Which three drinks should be sold in the school cafeteria? Present your opinion in a letter to the principal. Include a circle graph to make your letter convincing.
6.
 - Look on the Internet or in newspapers and magazines for data that can be displayed using a circle graph. Create a circle graph to display the data.
 - Write a statement that explains what the data suggests, and support your statement with your graph.
 - Trade statements with a classmate. Give each other suggestions on how to improve your statements.

Task | Checklist

- ✓ Are your results in an appropriate form?
- ✓ Are your results easy to understand?
- ✓ Did you justify your conclusions?

Designing a Spinner

A game company wants to design a spinner that will work just like rolling two dice. In this game, there are three outcomes:

- If you roll a sum from 2 to 4, you get three counters and another roll.



- If you roll a sum from 5 to 8, you get two counters.



- If you roll a sum from 9 to 12, you get one counter.



How can you create a spinner that works just like dice?

- A. Calculate the theoretical probability of each outcome.
- B. Create a circle graph with three different sections. The sizes of the sections are determined by the theoretical probabilities you calculated in part A.
- C. Use your circle graph to build a spinner. Label the sections.
- D. Conduct an experiment to compare the outcomes on your spinner with the outcomes when rolling two dice. Record the data.
- E. Does your spinner work just like rolling two dice? Write a report to the game company, explaining why the company should use your spinner.

Cumulative Review

Note: Select ALL the correct answers to each question.

Cathie received the following marks on five quizzes: 93%, 76%, 85%, 93%, and 3%. Use these marks to answer questions 1, 2, 3, 4, and 5.

1. What is the range of Cathie's marks?
A. 3 **B.** 75 **C.** 90 **D.** 93
2. What is the mode of Cathie's marks?
A. 3% **B.** 76% **C.** 85% **D.** 93%
3. What is the median of Cathie's marks?
A. 3% **B.** 76% **C.** 85% **D.** 93%
4. What is the mean of Cathie's marks?
A. 70% **B.** 76% **C.** 87% **D.** 93%
5. What is the mean of Cathie's marks if the outlier is not included?
A. 70% **B.** 76% **C.** 87% **D.** 93%

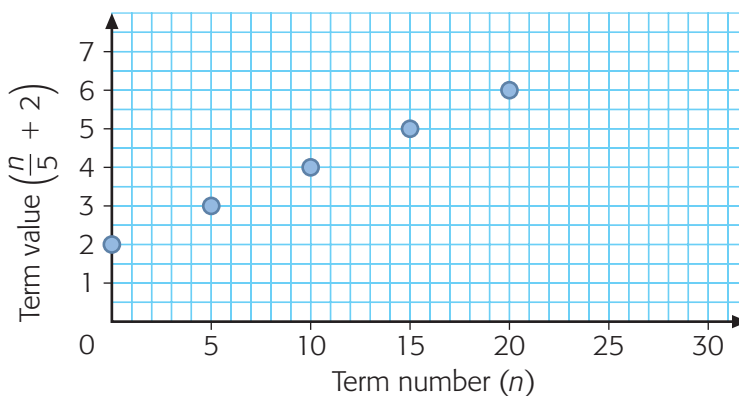


Questions 6, 7, and 8 refer to the spinner shown at the left.

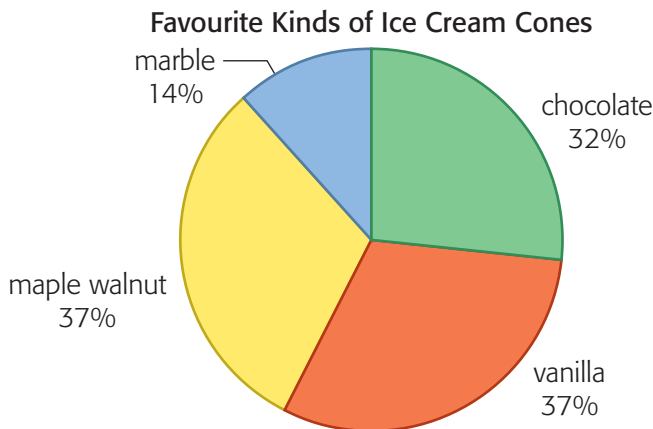
6. What is the theoretical probability of spinning a 5?
A. 5% **B.** 10% **C.** 20% **D.** 50%
7. What is the theoretical probability of spinning a multiple of 3?
A. $\frac{1}{3}$ **B.** $\frac{3}{10}$ **C.** $\frac{1}{5}$ **D.** $\frac{1}{10}$
8. What is the theoretical probability of spinning an even number and tossing a tail with a coin?
A. 0.2 **B.** 25% **C.** 0.5 **D.** 50%
9. Which solutions are correct?
A. $7n = 84; n = 77$ **C.** $q + 14 = 40; q = 26$
B. $c - 9 = 79; c = 88$ **D.** $4z + 4 = 52; z = 13$
10. What is the value of p in $13 = p - 27$?
A. -40 **B.** -14 **C.** 14 **D.** 40

11. Kim is 10 years old. Which expression tells how old Kim will be y years from now?
- A. $10 - y$ B. $10y$ C. $10 + y$ D. $\frac{y}{10}$
12. One pizza serves six people. Chris bought p pizzas for his party. Which expression tells how many people were served at Chris's party?
- A. $p - 6$ B. $6p$ C. $p + 6$ D. $\frac{p}{6}$
13. Solve $\frac{n}{5} + 2 = 7$ using the graph below.

Graph of $\frac{n}{5} + 2$



- A. $n = 13$ B. $n = 5$ C. $n = 1$ D. $n = 25$
14. Kale sold 200 ice cream cones at his stand last week. The following graph shows the percent of each kind he sold. How many vanilla ice cream cones did he sell?



- A. 32 B. 37 C. 74 D. 6