Name: _____

Math 7

Chapter 11 – Circle Graphs

Learning Outcome: Statistics and Probability (Data Analysis)

☐ I can construct, label and interpret graphs to solve problems.

Interpreting Circle Graphs

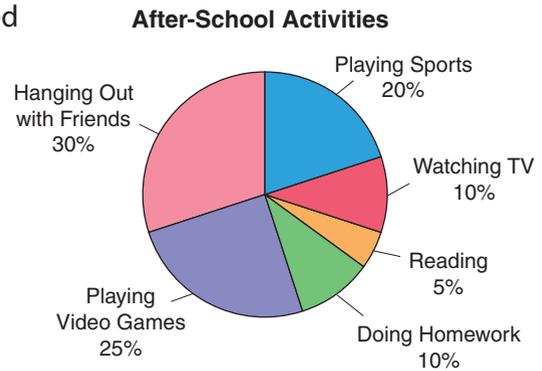We can apply what we have learned about circles to interpret a new type of graph.

Explore

Sixty Grade 7 students at l'école Orléans were surveyed to find out their favourite after-school activity. The results are shown on the circle graph.

Which activity is most popular? Least popular? How do you know this from looking at the graph? How many students prefer each type of after-school activity? Which activity is the favourite for about $\frac{1}{3}$ of the students? Why do you think so? Write 3 more things you know from looking at the graph.

After-School Activities

Playing Sports 20%
Hanging Out with Friends 30%
Watching TV 10%
Reading 5%
Doing Homework 10%
Playing Video Games 25%

Reflect & Share

Compare your answers with those of another pair of classmates.
What do you notice about the sum of the percents? Explain.

Connect

In a **circle graph**, data are shown as parts of one whole.
Each **sector** of a circle graph represents a percent of the whole circle.
The whole circle represents 100%.
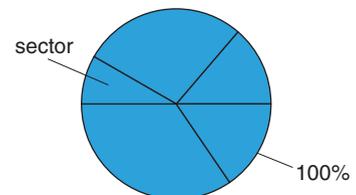
sector
100%

A circle graph has a title.

Each sector is labelled with a category and a percent.

A circle graph compares the number in each category to the total number.

That is, a fraction of the circle represents the same fraction of the total.

Sometimes, a circle graph has a **legend** that shows what category
each sector represents.

In this case, only the percents are shown on the graph.
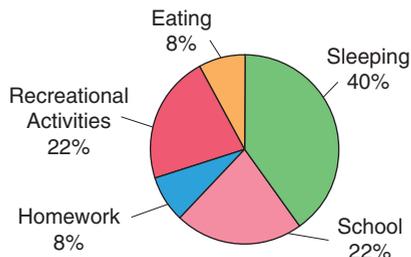
Favourite Sports of Grade 7 Students
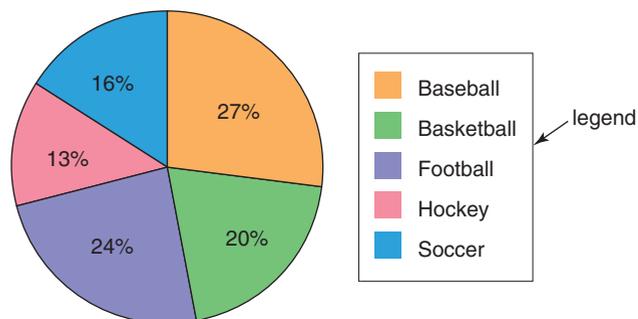
Example

This graph shows Nathan's typical day.

a) Which activity does Nathan do about $\frac{1}{4}$ of the time?

b) About how many hours does Nathan spend on each activity?
Check that the answers are reasonable.

Nathan's Typical Day

A Solution

a) Each of the sectors for "School" and "Recreational Activities"
is about $\frac{1}{4}$ of the graph. 22% is close to 25%, which is $\frac{1}{4}$.
So, Nathan is in school about $\frac{1}{4}$ of the day.
He also participates in recreational activities about $\frac{1}{4}$ of the day.

b) ➤ From the circle graph, Nathan spends 40% of his day sleeping.
There are 24 h in a day.
Find 40% of 24.
$40\% = \frac{40}{100} = 0.4$
Multiply: $0.4 \times 24 = 9.6$ **9.6 is closer to 10 than to 9.**
Nathan spends about 10 h sleeping.

➤ Nathan spends 22% of his day in school.

Find 22% of 24.

$22\% = \frac{22}{100} = 0.22$

Multiply: $0.22 \times 24 = 5.28$

> **5.28 is closer to 5 than to 6.**

Nathan spends about 5 h in school.

Nathan also spends about 5 h doing recreational activities.

➤ Nathan spends 8% of his day doing homework.

Find 8% of 24.

$8\% = \frac{8}{100} = 0.08$

Multiply: 0.08×24

Multiply as you would whole numbers.

$$\begin{array}{r} 24 \\ \times\ \ 8 \\ \hline 192 \end{array}$$

Estimate to place the decimal point.

$0.1 \times 24 = 2.4$

So, $0.08 \times 24 = 1.92$

> **1.92 is closer to 2 than to 1.**

Nathan spends about 2 h doing homework.

Nathan also spends about 2 h eating.

The total number of hours spent on all activities should be 24, the number of hours in a day:

$9.6 + 5.28 + 5.28 + 1.92 + 1.92 = 24$

So, the answers are reasonable.

> **Add the exact times, *not* the approximate times.**

Practice

1. This circle graph shows the most popular activities in a First Nations school.
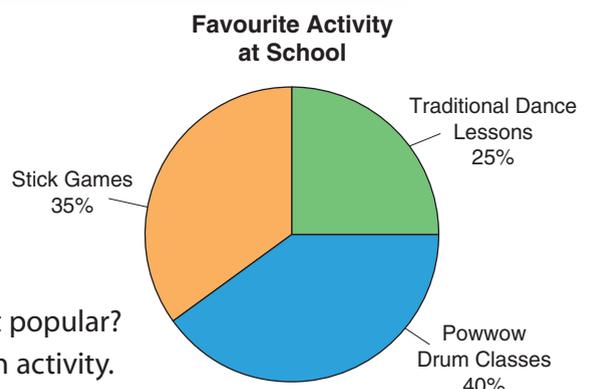There are 500 students in the school.
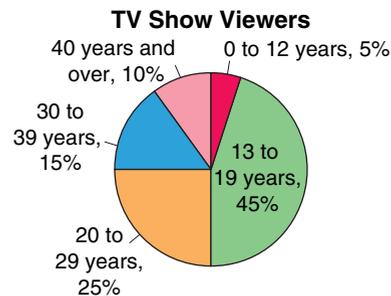All students voted.

a) Which activity did about $\frac{1}{4}$ of the students choose?
How can you tell by looking at the graph?

b) Which activity is the most popular? The least popular?

c) Find the number of students who chose each activity.

d) How can you check your answers to part c?

Favourite Activity at School

Traditional Dance Lessons 25%

Stick Games 35%

Powwow Drum Classes 40%

2. This circle graph shows the ages of viewers of a TV show.
One week, approximately 250 000 viewers tuned in.
a) Which two age groups together make up $\frac{1}{2}$ of the viewers?
b) How many viewers were in each age group?
    i) 13 to 19   **ii)** 20 to 29   **iii)** 40 and over

TV Show Viewers

40 years and over, 10%
0 to 12 years, 5%
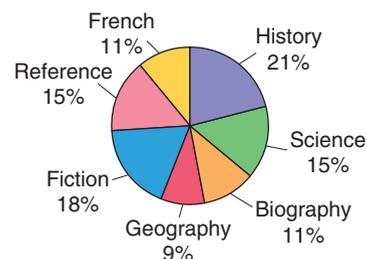30 to 39 years, 15%
13 to 19 years, 45%
20 to 29 years, 25%

3. This graph shows the world's gold production for a particular year.
In this year, the world's gold production was approximately 2300 t.
About how much gold would have been produced in each country?
a) Canada   **b)** South Africa

World's Gold Production

Canada, 7%
U.S., 11%
Russia, 15%
Other, 32%
South Africa, 35%
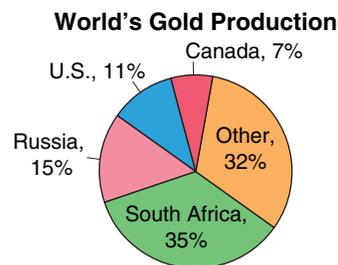
4. The school library budget to buy new books is $5000.
The librarian has this circle graph to show the types of books students borrowed in one year.
a) How much money should be spent on each type of book? How do you know?
b) Explain how you can check your answers in part a.

Types of Books Borrowed

French 11%
History 21%
Reference 15%
Science 15%
Fiction 18%
Biography 11%
Geography 9%

5. **Assessment Focus** This circle graph shows the populations of the 4 Western Canadian provinces in 2005.
The percent for Saskatchewan is not shown.
a) What percent of the population lived in Saskatchewan? How do you know?
b) List the provinces in order from least to greatest population.
How did the circle graph help you do this?
c) In 2005, the total population of the Western provinces was about 9 683 000 people. Calculate the population of each province, to the nearest thousand.
d) What else do you know from looking at the circle graph? Write as much as you can.

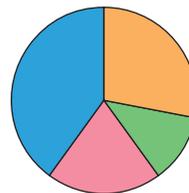**Population of Western Provinces 2005**

Manitoba 12%
Saskatchewan
British Columbia 44%
Alberta 34%
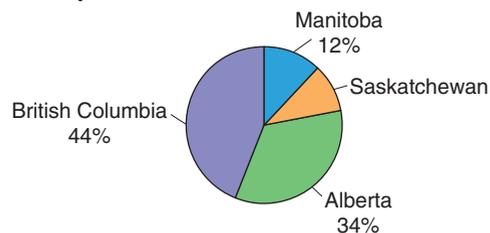
6. Gaston collected data about the favourite season of his classmates.

Favourite Season

Classmates' Favourite Season

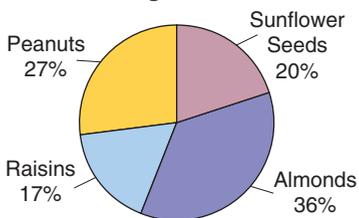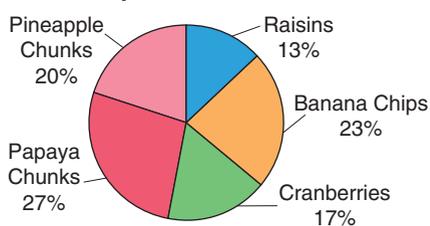| Season	Autumn	Winter	Spring	Summer
Number of Students	7	3	5	10

He recorded the results in a circle graph.
The graph is not complete.
a) How many students were surveyed?
b) Write the number of students who chose each season as a fraction of the total number of students, then as a percent.
c) Explain how you can check your answers to part b.
d) Sketch the graph. Label each sector with its name and percent. How did you do this?

7. These circle graphs show the percent of ingredients in two 150-g samples of different snack mixes.

Morning Snack Mix

Peanuts 27%
Sunflower Seeds 20%
Raisins 17%
Almonds 36%

Super Snack Mix

Pineapple Chunks 20%
Raisins 13%
Banana Chips 23%
Papaya Chunks 27%
Cranberries 17%

a) For each snack mix, calculate the mass, in grams, of each ingredient.
b) About what mass of raisins would you expect to find in a 300-g sample of each mix? What assumptions did you make?

Reflect

Search newspapers, magazines, and the Internet to find examples of circle graphs. Cut out or print the graphs. How are they the same? How are they different? Why were circle graphs used to display these data?

Using a Spreadsheet to Create Circle Graphs

Spreadsheet software can be used to record, then graph, data.
This table shows how Stacy budgets her money each month.

Stacy's Monthly Budget

Category	Amount ($)
Food	160
Clothing	47
Transportation	92
Entertainment	78
Savings	35
Rent	87
Other	28

Enter the data into rows and columns of a spreadsheet.
Highlight the data. Do not include the column heads.

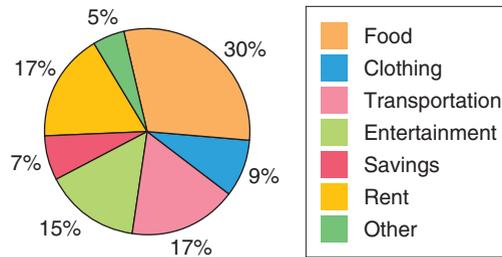|	A	B
1	Category	Amount ($)
2	Food	160
3	Clothing	47
4	Transportation	92
5	Entertainment	78
6	Savings	35
7	Rent	87
8	Other	28

Click the graph/chart icon. In most spreadsheet programs,
circle graphs are called **pie charts**. Select *pie chart*.
Investigate different ways of labelling the graph.
Your graph should look similar to one of the graphs on the
following page.

Stacy's Monthly Budget

Other 5%
Food 30%
Rent 17%
Savings 7%
Clothing 9%
Entertainment 15%
Transportation 17%

Stacy's Monthly Budget

5%
30%
17%
7%
9%
15%
17%

■	Food
■	Clothing
■	Transportation
■	Entertainment
■	Savings
■	Rent
■	Other
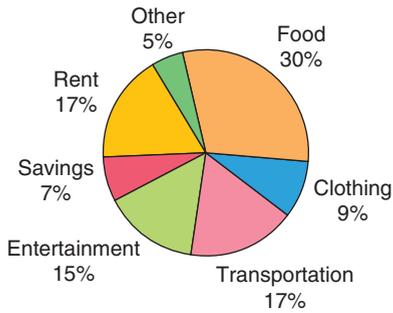
This circle graph shows a legend at the right. The legend shows what category each sector represents.

These data are from *Statistics Canada*.

1. a) Use a spreadsheet.
   Create a circle graph to display these data.
   b) Write 3 questions about your graph.
   Answer your questions.
   c) Compare your questions with those of a classmate. What else do you know from the table or the graph?

Population by Province and Territory, October 2005

| Region	Population
Newfoundland and Labrador	515 591
Prince Edward Island	138 278
Nova Scotia	938 116
New Brunswick	751 726
Quebec	7 616 645
Ontario	12 589 823
Manitoba	1 178 109
Saskatchewan	992 995
Alberta	3 281 296
British Columbia	4 271 210
Yukon Territories	31 235
Northwest Territories	42 965
Nunavut	30 133

4.7 Drawing Circle Graphs

Focus | Construct circle graphs to display data.

This is a **percent circle**.
The circle is divided into 100 congruent parts.
Each part is 1% of the whole circle.
You can draw a circle graph on a percent circle.
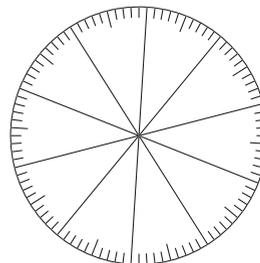
Explore

Your teacher will give you a percent circle.
Students in a Grade 7 class were asked
how many siblings they have.
Here are the results.

0 Siblings	1 Sibling	2 Siblings	More than 2 Siblings
3	13	8	1

Write each number of students as a fraction of the total number.
Then write the fraction as a percent.

Use the percent circle.
Draw a circle graph to display the data.
Write 2 questions you can answer by looking at the graph.

Reflect & Share

Trade questions with another pair of classmates.
Use your graph to answer your classmates' questions.
Compare graphs. If they are different, try to find out why.
How did you use fractions and percents to draw a circle graph?

Connect

Recall that a circle graph shows how parts of a set of data
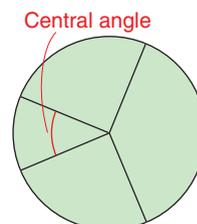compare with the whole set.
Each piece of data is written as a fraction of the whole.
Each fraction is then written as a percent.
Sectors of a percent circle are coloured to represent these percents.
The sum of the **central angles** is 360°.
A central angle is also called a **sector angle**.

Central angle

Example

All the students in two Grade 7 classes
were asked how they get to school each day.
Here are the results: 9 rode their bikes, 11 walked,
17 rode the bus, and 13 were driven by car.
Construct a circle graph to illustrate these data.

A Solution

➤ For each type of transport:
   Write the number of students as a fraction of 50,
   the total number of students.
   Then write each fraction as a decimal and as a percent.

Bike: $\frac{9}{50} = \frac{18}{100} = 0.18 = 18\%$ Walk: $\frac{11}{50} = \frac{22}{100} = 0.22 = 22\%$

Bus: $\frac{17}{50} = \frac{34}{100} = 0.34 = 34\%$ Car: $\frac{13}{50} = \frac{26}{100} = 0.26 = 26\%$

The circle represents all the types of transport.
To check, add the percents.
The sum should be 100%.
18% + 22% + 34% + 26% = 100%

Another Strategy
We could use a percent
circle to graph these data.

➤ To find the sector angle for each type of transport,
   multiply each decimal by 360°.
   Write each angle to the nearest degree, when necessary.
   Bike 18%: 0.18 × 360° = 64.8° ≐ 65°
   Walk 22%: 0.22 × 360° = 79.2° ≐ 79°
   Bus 34%: 0.34 × 360° = 122.4° ≐ 122°
   Car 26%: 0.26 × 360° = 93.6° ≐ 94°

Check:
64.8° + 79.2° + 122.4° + 93.6° = 360°

➤ Construct a circle.
   Use a protractor to construct
   each sector angle.
   Start with the smallest angle.
   Draw a radius. Measure 65°.

   Start the next sector where
   the previous sector finished.
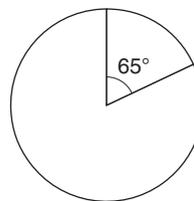   Label each sector with its name and percent.
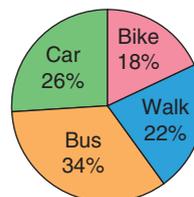   Write a title for the graph.

How Students Get to School

1. The table shows the number of Grade 7 students
with each eye colour at Northern Public School.

Eye Colour	Number of Students
Blue	12
Brown	24
Green	8
Grey	6

a) Find the total number of students.
b) Write the number of students with each eye colour
   as a fraction of the total number of students.
c) Write each fraction as a percent.
d) Draw a circle graph to represent these data.

2. In a telephone survey, 400 people voted for
their favourite radio station.

a) How many people chose EASY2?
b) Write the number of people who
   voted for each station as a fraction
   of the total number who voted.
   Then write each fraction as a percent.
c) Draw a circle graph to display the results
   of the survey.

Radio Station	Votes
MAJIC99	88
EASY2	?
ROCK1	120
HITS2	100

3. **Assessment Focus** This table shows the
method of transport used by U.S. residents
entering Canada in one year.

a) How many U.S. residents visited Canada
   that year?
b) What fraction of U.S. residents entered
   Canada by boat?
c) What percent of U.S. residents entered
   Canada by plane?
d) Display the data in a circle graph.
e) What else do you know from the table
   or circle graph?
   Write as much as you can.

United States Residents Entering Canada

| Method of Transport	Number
Automobile	32 000 000
Plane	4 000 000
Train	400 000
Bus	1 600 000
Boat	1 200 000
Other	800 000

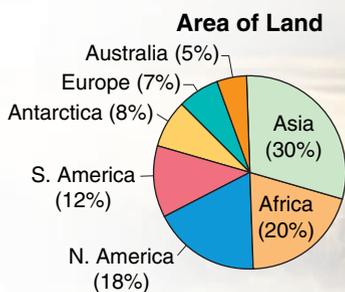**4.** Can the data in each table below be displayed in a circle graph? Explain.

a)

Educational Attainment of Canadians	
0 to 8 years of elementary school	10%
Some secondary school	17%
Graduated from high school	20%
Some post-secondary education	9%
Post-secondary certificate or diploma	28%
University degree	16%

b)

Canadian Households with These Conveniences	
Automobile	64%
Cell phone	42%
Dishwasher	51%
Internet	42%
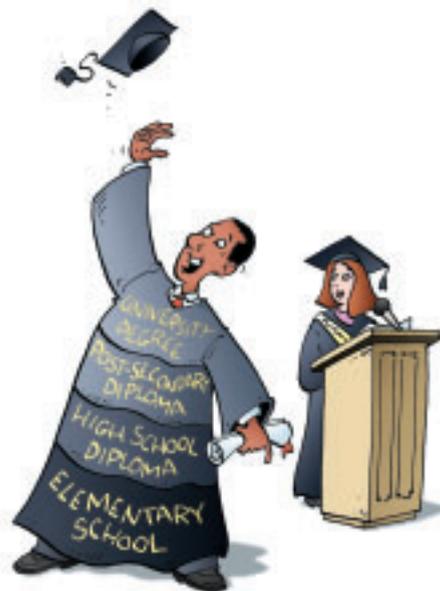
5. Take It Further This circle graph shows the percent of land occupied by each continent. The area of North America is approximately 220 million km². Use the percents in the circle graph. Find the approximate area of each of the other continents, to the nearest million square kilometres.

Area of Land

Australia (5%)
Europe (7%)
Antarctica (8%)
S. America (12%)
N. America (18%)
Asia (30%)
Africa (20%)

Reflect

When is it most appropriate to show data using a circle graph?
When is it not appropriate?