9. Ellen collects comic books. She has grouped her collection into several categories, as shown.

Type	Number of Comics
Super-hero	80
Fantasy	35
Comedy	40
Graphic novels	16
Horror	26
Other	12

a) Enter the data into a spreadsheet program.
b) Create a graph.
c) Explain your choice of graph in part b).

10. a) Use the Internet or a library to find the population of each of Canada's provinces.
b) Use a spreadsheet to create a graph to illustrate the data.
c) Explain why you chose the type of graph you did.

11. Use an organizer of your choice to compare spreadsheets and databases. Show similarities and differences.

12. a) Pick a topic that interests you. Design a survey to collect numeric data about this topic. Ask three or four questions.
b) Survey several students. Collect and organize the data.
c) Enter the data into a spreadsheet.
d) Create two or three effective graphs for your data.
e) Explain why you chose the types of graphs that you did.

Extend

13. a) Explore other types of graphs that you can produce with a spreadsheet.
b) Pick one type of graph that interests you. What is it called?
c) For what kind of data would this type of graph be suitable?
d) Describe some advantages of using this type of graph.
e) Find a suitable set of data and use a spreadsheet to create this type of graph. Explain why your graph is effective.

Making Connections

What do databases have to do with sports reporting?

The commentators on televised professional sports events seem to know a lot about the teams and athletes involved. How can they remember all those facts and figures?

Sports statisticians work behind the scenes. They retrieve interesting data and relay it quickly to the commentators. For example, suppose an NHL player is having a tremendous game, scoring a lot of points. The sports statistician will quickly search a database to find the most points ever scored by one player in an NHL game.

Did You Know?

Darryl Sittler of the Toronto Maple Leafs scored 10 points in one game on February 7, 1976! This included 6 goals and 4 assists. No NHL player has ever beaten this record.

CHAPTER 9

Review

Key Words

For questions 1 to 5, copy the statement and fill in the blanks. Use some of these words.

primary data — *frequency table*
secondary data — *pie chart*
stem-and-leaf plot — *circle graph*
spreadsheet — *database*

1. Sarah used a _____ on the Internet to look up hockey statistics. This type of data is called _____.
2. Data can be organized into stems and leaves using a _____.
3. Randy conducts a survey about sports. He records tally marks in a _____. This type of data is called _____.
4. A _____ is a software tool that lets you display data as different types of graphs.
5. A _____ is another name for a circle graph.

9.1 Collect and Organize Data, pages 274–279

6. The cook at a school cafeteria conducts a survey to find out which weekly special is the most popular.

Meal	Tally	Frequency
Hamburger	𝍸	
Chili		
Submarine sandwich	𝍸 |	
Pizza	𝍸 𝍸 ||||	
Fish and chips	𝍸 𝍸	

a) Complete the frequency table.
b) Draw a bar graph to display the data.
c) Which weekly special would you suggest the cook replace? Why?

7. The pictograph shows the total flight time of four pilots.

Total Flight Time

Yamaguchi
O'Connor
Lindgren
Ziffareto

represents 10 h

a) How many hours has Yamaguchi flown?
b) Which pilot has the most flight experience? How many hours is this?
c) Approximately how many more hours has O'Connor flown than Ziffareto? How can you tell?

9.2 Stem-and-Leaf Plots, pages 280–285

8. Test scores, as percents, are shown.

71 62 83 76 49 60 73 55 89 62
91 58 63 70 81 50 66 62 73 80

a) Create a stem-and-leaf plot to display the data.
b) What is the most common score?
c) How many students scored at Level 3 (70% to 79%)?

9. The stem-and-leaf plot shows the number of matches won by tennis club members.

Stem (tens)	Leaf (ones)
2	8 9
3	0 4 4 7
4	1 3

a) Two players won the same number of matches. How many matches did each win?
b) How many matches did the best player win? Explain.
c) How many more matches did the top player win than the person ranked eighth?

9.3 Circle Graphs, pages 286–291

10. Three friends worked together on a geography project. Kelly did 33% of the work. Vaughn did 25% of the work. Martika did the rest.

a) Draw a circle graph to show each person's effort.

b) What percent of the project did Martika do? Explain how you found this.

11. Drago is preparing for grade 9 exams. Draw a circle graph to show a breakdown of Drago's study time.

Course	Study Time
English	30%
Mathematics	35%
Geography	25%
Physical education	10%

9.4 Use Databases to Find Data, pages 292–297

Go to www.mcgrawhill.ca/links/math7 and follow the links to access E-STAT.

12. Use E-STAT to find data about the average amount spent on books per household by province.

- From the People section of the Table of Contents Web page, select **Personal finance and household finance.**
- On the next page, select **Data.**
- Then, under **CANSIM**, select **Consumer spending.**
- Finally, select table 203-0011.

a) On the Table 203-0011 Web page, what choices need to be selected to retrieve the data asked for?

b) Display the data in a bar graph. What does the graph tell you?

9.5 Use a Spreadsheet to Display Data, pages 298–303

Test results for a class are shown. Use the data for question 13 or 14.

	A	B	C	D	E
1	< Level 1	1			
2	Level 1	4			
3	Level 2	5			
4	Level 3	9			
5	Level 4	6			
6					
7					

13. a) The heading "< Level 1" represents "below Level 1." How many students achieved below Level 1? Identify the cell where you found this.

b) How many students wrote the test? Explain how you know.

14. a) Use a spreadsheet to display the data.

b) Which type of graph is best suited to display the data? Explain why you think so.

15. a) Use examples to explain the difference between a database and a spreadsheet. How are they similar?

b) Describe a situation in which you would use a database.

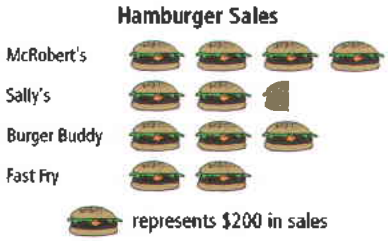
c) Describe a situation in which you would use a spreadsheet.

Practice Test

Strand	NSN	MEA	GSS	PA	DMP
Questions	4, 5, 9, 10				1–10

Multiple Choice

For questions 1 to 6, select the correct answer.



1. According to the pictograph, which restaurant sold $400 in hamburgers?

A McRobert's **B** Sally's
C Burger Buddy **D** Fast Fry

The stem-and-leaf plot shows the number of goals scored by the forwards of a hockey team. Use the data to answer questions 2 to 4.

Stem (tens)	Leaf (ones)
0	7 9
1	1 4 4 9
2	0 2 6
3	3 8
4	8

2. How many forwards scored more than 30 goals?

A 2 **B** 3
C 4 **D** 5

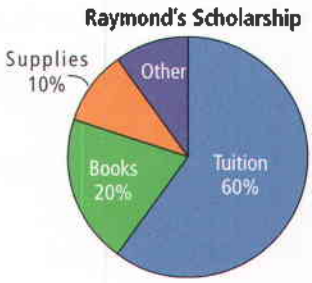
3. How many goals did the two lowest scoring forwards get in total?

A 7 **B** 9
C 14 **D** 16

4. Two forwards scored the same number of goals. How many?

A 9 **B** 14
C 38 **D** 48

The circle graph shows how Raymond spent a $2500 scholarship. Use the information to answer questions 5 and 6.



5. According to the circle graph, what did Raymond spend the most on?

A supplies **B** tuition
C books **D** other

6. According to the circle graph, how much did Raymond spend on "Other" items?

A $250 **B** $500
C $800 **D** $1200

Short Answer

7. The daily high temperatures, in degrees Celsius, for a two-week period in the summer are given.

27 31 28 33 30 25 24
19 27 27 34 31 29 22

a) Create a stem-and-leaf plot to show the data.

b) What was the most common daily high temperature? How many days had this as the daily high temperature?

8. a) Use an organizer to show the difference between a database and a spreadsheet.

b) Why did you choose that type of organizer?

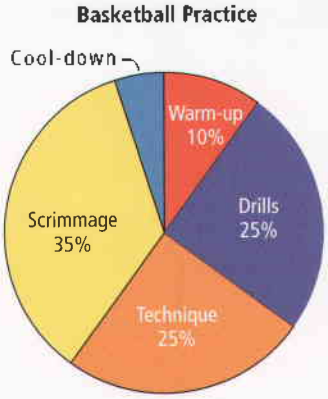
Extended Response

9. A group of 24 students were surveyed about their favourite colour.

Colour	Tally	Frequency
Blue	𝍸 |||	
Green	||||	
Red	𝍸 |	
Purple	|||	
Other	|||	

a) Copy and complete the frequency table.
b) Display the data using a bar graph.
c) Display the data using a circle graph.
d) Which graph displays the data best? Explain.

10. A basketball coach uses the circle graph to plan her team's practices. Practices run for 90 min.



a) Determine the amount of practice time spent on each activity. Round your answers to the nearest minute.
b) Write up a practice schedule that begins at 4:00 P.M. Include the start time for each activity.

Chapter Problem Wrap-Up

In question 18 on page 279, question 12 on page 291, and question 16 on page 297, you explored collecting and organizing data about books and magazines.

You are the publisher of a new magazine for students in grades 7 to 9. You are planning the first issue. Your editor has surveyed several grade 7 and grade 8 students. The results of the survey are shown.

1. Organize and display the data.

2. What organization method did you use, and why?

3. Did you use technology? Explain why or why not.

4. What information can you get from your data display?

Grade 7 Students

Topic	Tally
Global issues	|||
Entertainment	𝍸 𝍸 𝍸 ||
Health and fitness	𝍸
People and careers	𝍸 |||
Sports	𝍸 𝍸
Technology	𝍸 𝍸 ||

Grade 8 Students

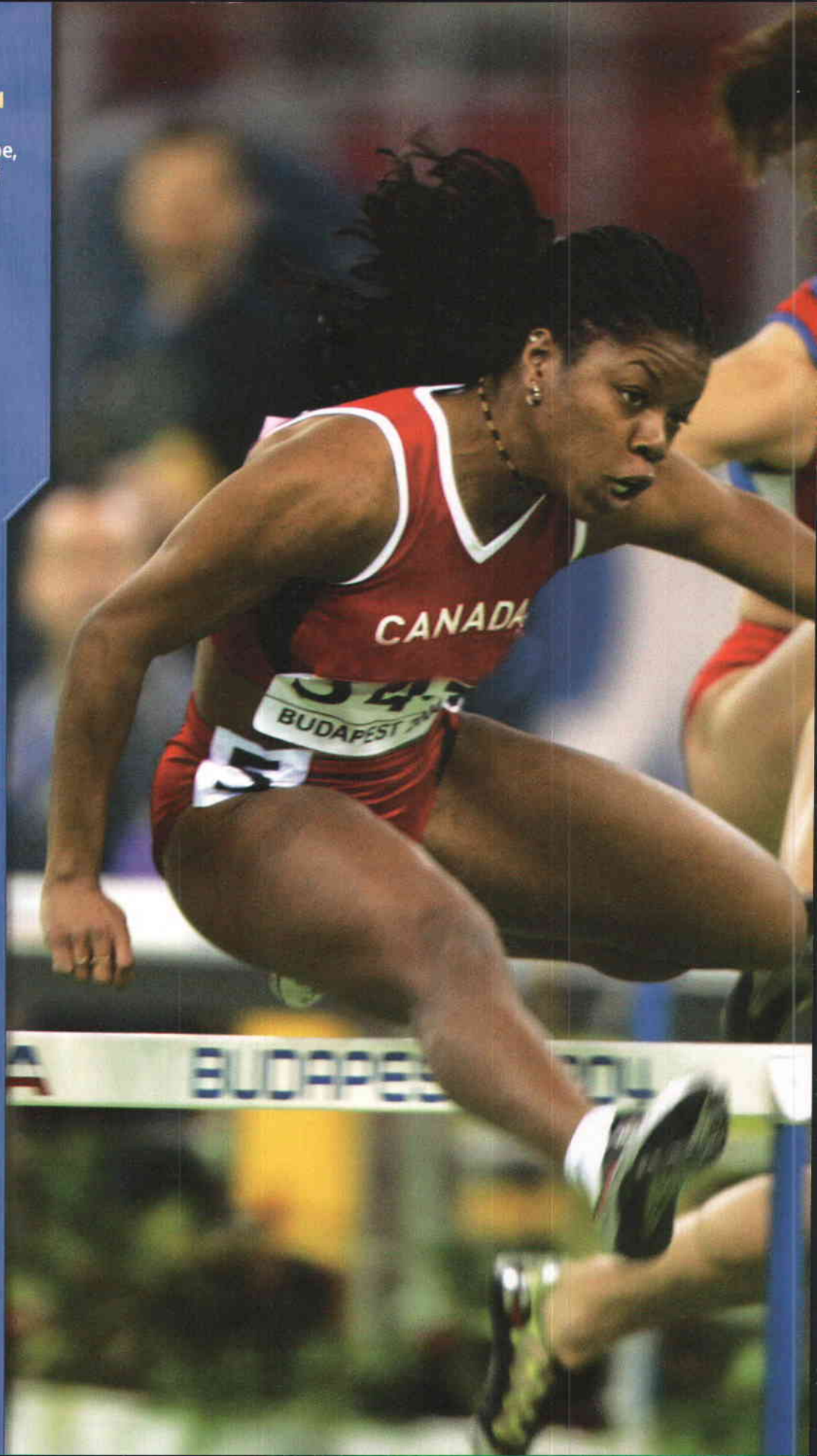
Topic	Tally
Global issues	𝍸
Entertainment	𝍸 𝍸 |||
Health and fitness	𝍸
People and careers	𝍸 ||||
Sports	𝍸 𝍸
Technology	𝍸 𝍸 |||

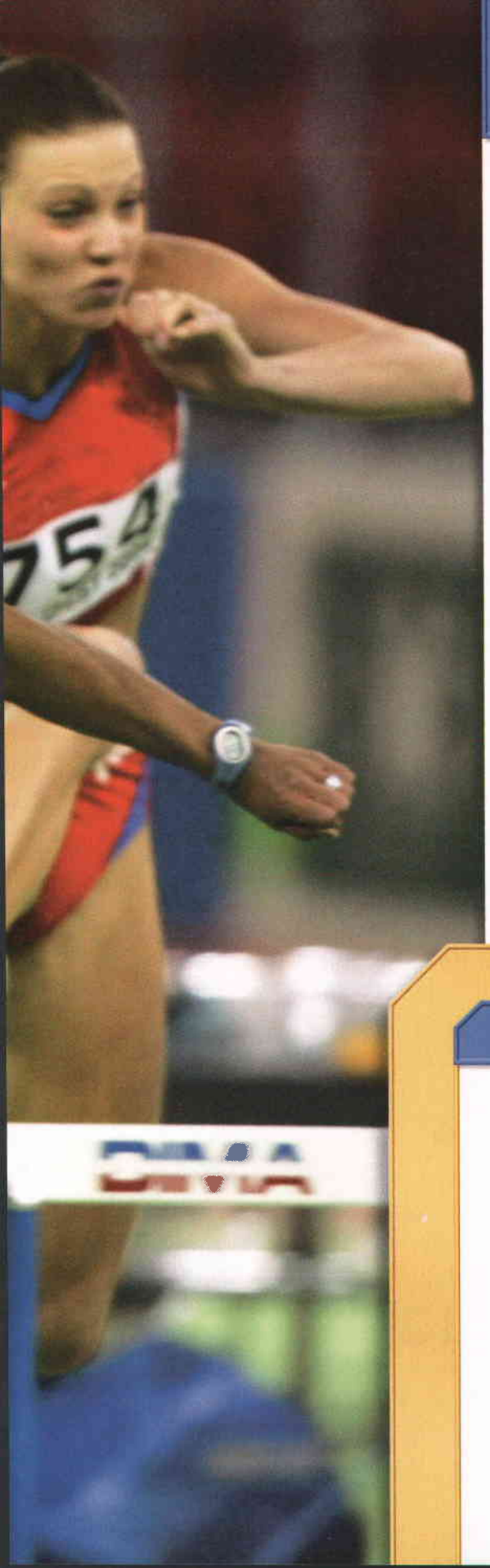
Data Management and Probability

- Collect, organize, describe, and interpret displays of data and present the information using mathematical terms.
- Evaluate data and make conclusions from the analysis of data.
- Identify and describe trends in graphs.
- Describe information presented on stem-and-leaf plots and frequency tables.
- Understand that each measure of central tendency gives different information about the data.
- Describe data using calculations of mean, median, and mode.
- Analyse bias in data-collection methods.
- Make inferences and convincing arguments that are based on data analysis.
- Evaluate arguments that are based on data analysis.

Key Words

measure of central tendency
mean
median
mode
bias





CHAPTER 10

Data Management: Analysis and Evaluation

Have you ever wondered how book and magazine publishers choose their covers? How do they decide on the right photo?

Magazine and book publishers collect, analyse, and evaluate data about their readers. This information can be used to make decisions about cover photos that will attract readers.

By the end of this chapter, you will be able to collect, analyse, and evaluate your own data. This skill will be useful in many subjects, including math, science, and geography. It will also help you make decisions around the school.

Chapter Problem

You are the publisher of a magazine for students in grades 7 to 9. You are planning a special sports issue for the spring. You decide to survey readers about possible cover photos.

Would you use this survey question? Explain.

> Perdita Felicien is an Olympic level athlete. I think we should put her on the cover. Don't you?
>
> YES NO

Get Ready

Frequency Tables

A frequency table is used to organize survey or experimental data. For example, six of the students surveyed chose "Go to the movies" as a fun Saturday activity.

Fun Saturday Activity	Tally	Frequency
Go to the movies	𝍸 |	6
Play a sport	𝍸 ||	
Go shopping	||||	
Play video games	||||	
Other	|||	

Write the total number of tallies here. This provides the frequency.

1. a) Copy and complete the frequency table for fun Saturday activities.
b) What was the most popular activity?
c) What was the least popular activity?

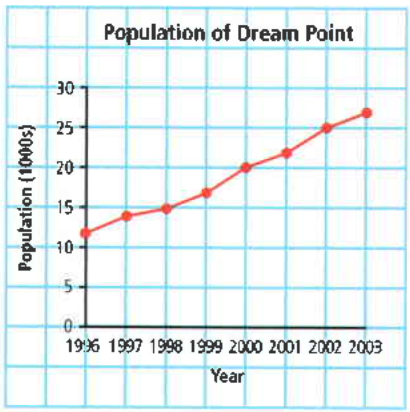
2. How many students were surveyed about their fun Saturday activities?

Line Graphs

A line graph is used to show changes in data over time. The line graph shows the changes in the population of a small town from 1996 to 2003.

Population of Dream Point

Year	Population (1000s)
1996	12
1997	14
1998	15
1999	17
2000	20
2001	22
2002	25
2003	27



Choose scales for the axes. Plot the points. Then, connect the points.

Label each axis. Add a title.

3. Look at the line graph for the population of Dream Point.

a) What does the graph tell you when it goes up to the right?

b) For how many years has the population been increasing?

c) Do you think the trend will continue? Explain.

4. The table shows the mass of a kitten over several months.

Age (months)	Mass (g)
1	100
2	150
3	220
4	280
5	320

a) Draw a line graph for the data.

b) How is the mass of the kitten changing?

c) Do you think this trend will continue?

d) How do you think the graph will eventually change? Explain why.

Mean of a Set of Data

A group of students compared their heights, in centimetres.

150 152 160 152 154 156 147

To calculate the mean, find the sum of all the values and then divide by the number of values.

$$\text{mean} = \frac{150 + 152 + 160 + 152 + 154 + 156 + 147}{7}$$

$$= \frac{1071}{7}$$

$$= 153$$

Add these first. Then, divide by 7.

Average is another word for mean.

The mean is 153 cm.

5. Calculate the mean of each set of data.

a) 10 15 12 10 13

b) 40 20 35 30 40 40 35

c) 75 68 57 68 78 82 62

d) 2.3 2.1 2.3 1.9 1.9 2.3 2.6

6. Several students want to compare their shoe sizes.

6 8 5 7 6 7 9 7 8

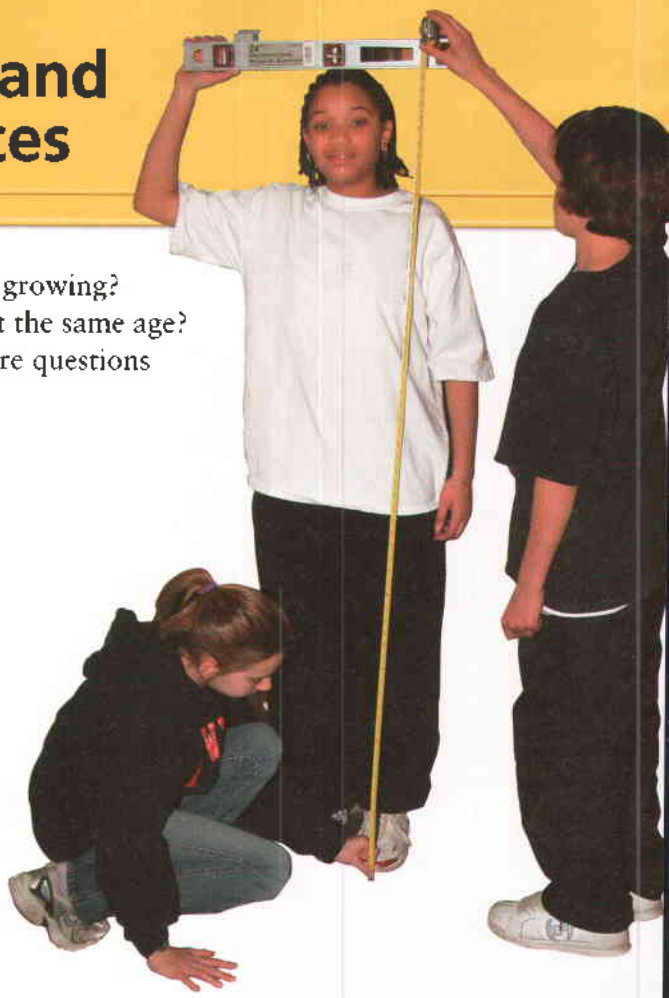
Find the mean of the shoe sizes.

10.1 Analyse Data and Make Inferences

Focus on...

- recognizing trends in data
- describing trends in data

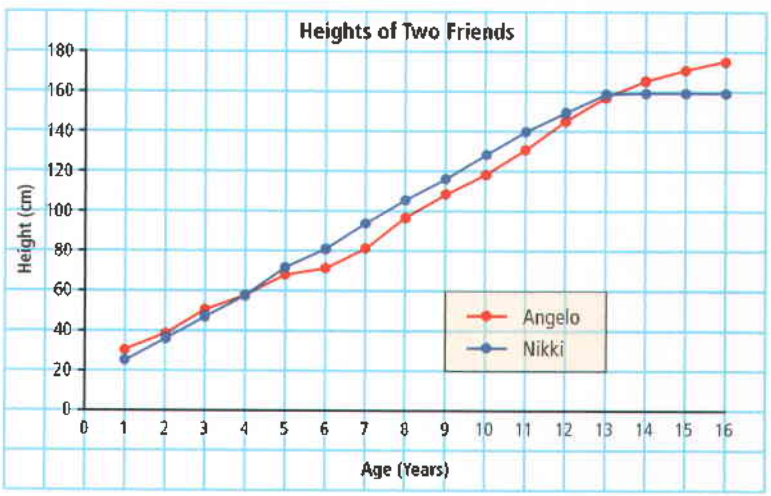
When do you think you will stop growing? Do boys and girls stop growing at the same age? How can graphs be used to explore questions like these?



Discover the Math

How can you recognize and describe trends in data?

The line graphs show the heights of two friends measured over time.



1. **a)** Describe how Angelo's height has changed.
   b) Describe how Nikki's height has changed.

2. **a)** How are these trends similar?
   b) How are they different?

3. **a)** Who was taller at age 6? Approximately how much taller was that person?
   b) Who was taller at age 15? Approximately how much taller was that person?

4. **a)** At what age were the two friends the same height?
   b) Explain how you found your answer.

5. **a)** Estimate how tall each friend was at birth.
   b) Explain how you found your answers.

6. **a)** Copy the graphs and then extend to age 25.
   b) Explain your predictions.

7. **Reflect** How does a line graph help you find trends in a data set?

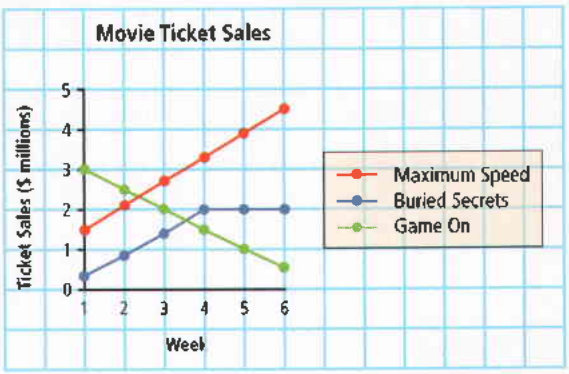
Example 1: Analyse a Trend

Analyse the sales trends for each movie.

a) Which movie is the most popular?

b) Which movie do you think will stop playing soon? Why?

c) Which movie slowly gained in popularity and then levelled off?



Solution

a) *Maximum Speed* is the most popular movie. Its ticket sales increased steadily.

b) *Game On* will probably stop playing soon. The ticket sales have been dropping steadily.

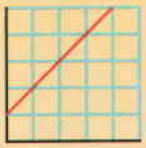
c) *Buried Secrets* increased in sales and then levelled off.

Literacy Connections

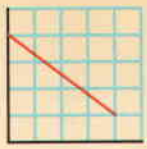
Identifying Trends in Graphs

A trend is the general direction that a line graph is going. The following graphs show the sales of computer games.

- Sales are increasing.

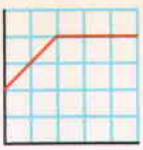


- Sales are decreasing.



- Sales are staying the same.

- Sales increased, then levelled off.



Example 2: Analyse a Data Set

Alysia has a baby-sitting job. She records how much she earns every week.

$25 $25 $23 $25 $26 $24 $25 $27 $26

a) Use a frequency table to organize the data.
b) Describe the data.
c) Estimate how much Alysia can earn in a month.

Solution

a)

Earnings ($)	Tally	Frequency
23	I	1
24	I	1
25	IIII	4
26	II	2
27	I	1

The smallest value is 23. The largest value is 27. The most common value is 25.

b) Alysia earns between $23 and $27 per week. She earns $25 most often.

c) $4 \times \$25 = \$100$
Alysia can earn about $100 in a month.

Most of the time Alysia earns $25 in a week. A month has about 4 weeks. So, multiply by 4.

Key Ideas

- Trends in line graphs can be analysed to solve problems and make predictions.
- A frequency table can be used to organize a set of data. This makes it easier to describe the data.

Communicate the Ideas

1. Which set of data can be represented by a line graph? Do you think drawing a line graph for the other data set would be meaningful? Explain.

A

Week	Plant Height
Week 1	1 cm
Week 2	2.2 cm
Week 3	3.4 cm
Week 4	4.2 cm
Week 5	4.5 cm

B

Animal	Population
Fox	2
Deer	15
Beaver	4
Raccoon	8
Porcupine	3

2. Sketch a line graph that shows each type of trend.
   a) does not change
   b) decreasing
   c) increasing
   d) decreased, then levelled off

3. The daily maximum temperatures for one month are recorded. How can this frequency table help you describe the data set?

Temperature (°C)	Tally	Frequency
23	||||	4
24	𝍸 |	6
25	𝍸 ||	7
26	𝍸 𝍸	10
27	|||	3

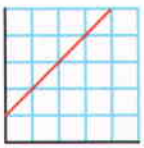
Check Your Understanding

Practise

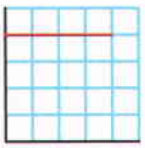
For help with questions 4 to 7, refer to Example 1.

4. Describe each trend.

a)

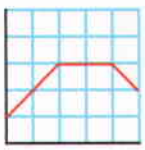


b)

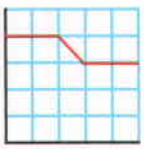


5. Describe each trend.

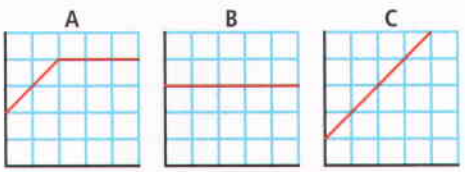
a)



b)

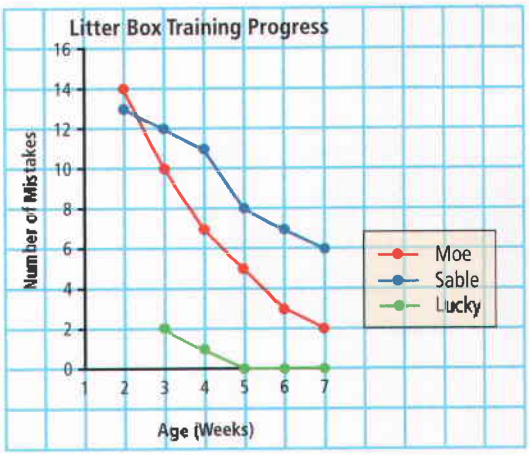


6. Match each description of a student's grade performance with the graph that shows each trend.



a) Karen has shown steady improvement.
b) Jacques's performance improved for a while, and then levelled off.
c) Lita's marks have not changed.

7. Sergio works at a pet store. Part of his job is to train new kittens to use a litter box. Sergio records their weekly progress.



a) How old was each kitten when it started litter box training?
b) Which kitten do you think was already litter trained before Sergio started keeping records?
c) Which of Moe and Sable seems to be the faster learner? Explain.

For help with questions 8 to 11, refer to Example 2.

8. Use the frequency table to describe the data set.

Male Student Heights (cm)	Tally	Frequency
147	𝍸	4
148	𝍸	3
149	𝍸 ||	7
150	𝍸	5
151	||	2

9. Use the frequency table to describe the data set.

Female Student Heights (cm)	Tally	Frequency
153	𝍸	5
154	𝍸	3
155	𝍸 |	6
156	𝍸	4
157	||	2

10. A group of teens worked for a farmer one day, picking cherries. The number of baskets each teen picked is shown in the table.

Number of Baskets	Tally	Frequency
9	|	1
10	|	1
11	𝍸	4
12	||	2
13		0
14	|	1

a) What is the least number of baskets picked by a teen?
b) What is the greatest number of baskets picked by a teen?
c) What is the most common number of baskets picked by the group of teens?

11. Dale's weekly baby-sitting earnings are shown.

$20 $20 $18 $22 $20 $24 $20

a) Create a frequency table for the data set.
b) What does the frequency table tell you about Dale's weekly baby-sitting earnings?

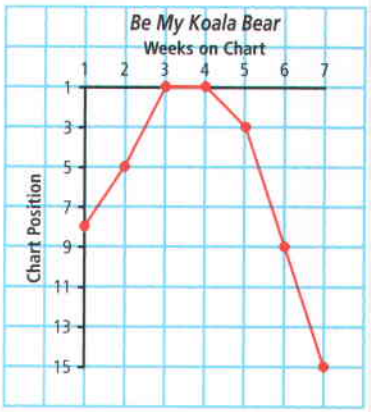
Apply

12. Charlie took a taxi to work and back home again. He did this for five days. Here are the fares for the 10 taxi rides.

$4.50 $5.00 $4.00 $4.50 $5.50
$3.50 $5.00 $4.50 $4.50 $4.50

a) Use a frequency table to describe the data set.
b) What is the most common taxi fare?
c) Estimate how much Charlie would spend on taxi fares per month. Explain how you solved this.

13. The graph shows a hit song's weekly chart position.



a) Describe the trend.
b) When did the song hit #1 on the chart?
c) How long did it stay at #1?
d) Look at the vertical scale of the graph. Why do you think the numbers are placed in reverse order?

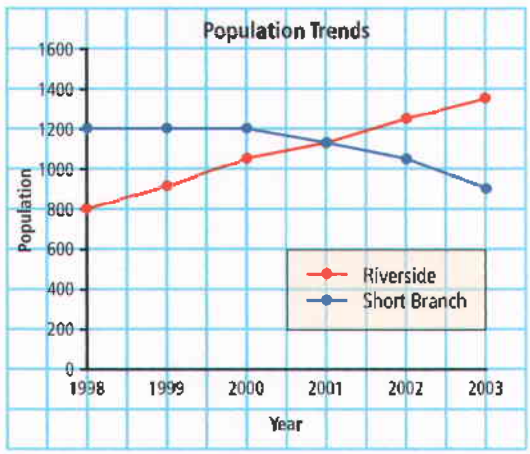
14. The graph shows T-shirt sales at Diane's T-Shop.

a) When do you think the T-shirt craze started?

b) When did T-shirt sales reach a peak? Describe what happened after this.

c) Explain why this kind of information is useful to the store owner.

15. The graph shows the population of two towns.



a) Describe the trend in each town's population.

b) Which town had a greater population in 1999?

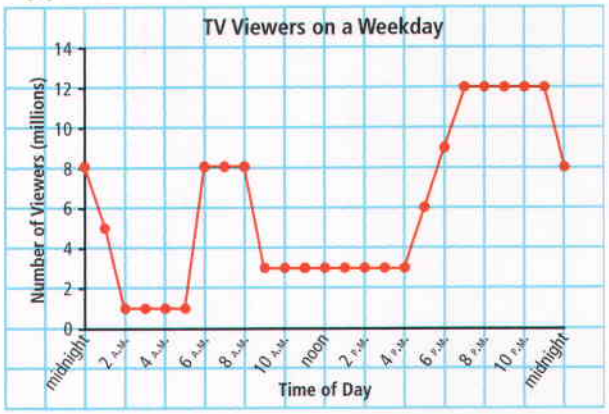
c) Which town had a greater population in 2002?

d) When did the two towns have an equal population?

e) Predict each town's population in 2005. Explain your predictions.

Try This!

16. The graph shows the number of television viewers on a typical weekday.



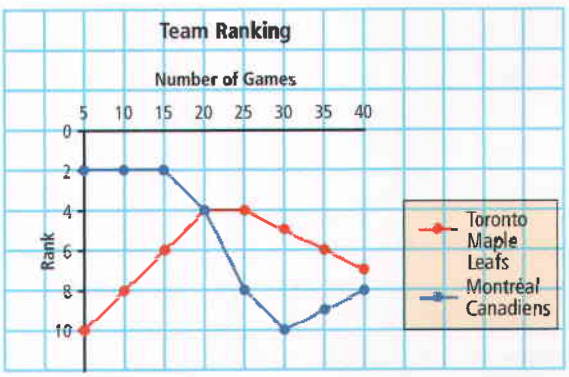
a) Which hours have the least number of viewers? Give a possible reason for this.

b) Describe the viewing trend from 4 P.M. to 11 P.M.

c) Advertisers usually pay more for commercial spots between 7 P.M. and 11 P.M. Why do you think this is?

Extend

17. The graph shows the ranking of two National Hockey League teams over the first half of the season.



Write a half-page news story that describes the performance of each team. Include in your story

- possible explanations for each trend
- predictions for the rest of the season (you must finish 8th or higher to make the playoffs)

10.2 Measures of Central Tendency

Focus on...

- understanding mean, median, and mode
- identifying which measure of central tendency best describes a data set

measure of central tendency

- a value that a data set tends to be centred around
- the mean, median, or mode

A group of Ms. Liza's science students are entering a challenge to build the tallest tower using simple materials.

The kind of information Ms. Liza's students are asking for is related to the overall performance of last year's group. Each is asking for a **measure of central tendency**.

Discover the Math

Materials

- centimetre cubes or interlocking cubes

What do the measures of central tendency tell you about a set of data?

Last year's tower-building results for students in Ms. Liza's class are shown.

1. Build the towers. Arrange them in order from tallest to shortest.

mode

- the value that appears most often in a set of data

2. Robert wants to know the height that occurred most often. This is called the **mode**. What is the mode for the towers?

median

- the middle value when a set of data is arranged in order

3. Monica asked about the middle height, which is the **median**. Carefully remove the tallest and shortest towers. Repeat this until there is only one tower left. What is the median height?

Competitor	Tower Height (cm)
Nora	19
Miguel	14
Asra	7
Ryan	16
Erika	14
Seth	15
Kaitlyn	24
Chen	21
Alexis	14

4. Devon asked for the **mean** height. You can find this by levelling out the towers until each is the same height.

a) Move blocks from the taller towers to the shorter towers. Make sure you keep all nine towers. Measure the height of the towers after they have been levelled out.

b) Calculate the mean height of the towers.

c) Compare the answer you got from levelling out the towers to the calculated mean.

mean

- the sum of the values divided by the number of values in a set

5. **Reflect** Compare the values of the mean, median, and mode for this set of data. What do these values tell you about the data?

Example 1: Use a Stem-and-Leaf Plot to Find the Mode and Median

Here are students' scores, in percent, for a report in Mr. McCuddle's English class.

74 76 65 66 72 81 57 85 71
87 71 82 91 53 71 66 80 48

a) Create a stem-and-leaf plot for the data.

b) Find the mode.

c) Find the median.

Solution

a)

Stem (tens)	Leaf (ones)
4	8
5	7 3
6	5 6 6
7	4 6 2 1 1 1
8	1 5 7 2 0
9	1

Use the tens digit for the stem. Then, the ones digit will be the leaves.

Stem (tens)	Leaf (ones)
4	8
5	3 7
6	5 6 6
7	1 1 1 2 4 6
8	0 1 2 5 7
9	1

Now arrange the leaves in increasing order.

b) The mode is 71. It appears three times.

c)

Stem (tens)	Leaf (ones)
4	8
5	3 7
6	5 6 6
7	1 1 1 2 4 6
8	0 1 2 5 7
9	1

Cross off pairs of least and greatest values until you reach the middle value(s).

There are two middle values, 71 and 72. The median is 71.5, halfway between them.

Example 2: Understand Median, Mode, and Mean

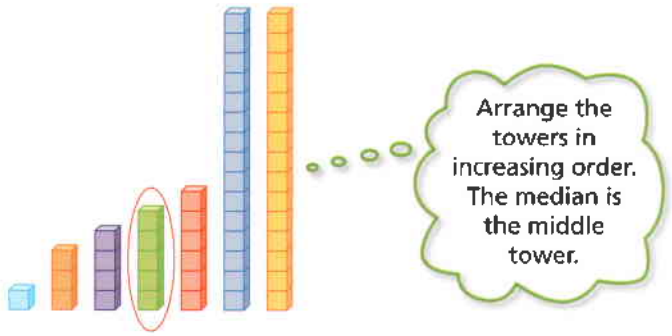
Sabra is teaching her puppy to catch a ball. For each training session, she records the number of tries it takes her puppy to catch the ball.

15 6 15 5 3 4 1

a) Find the median. Explain how you know.
b) Find the mode. Explain what this tells you.
c) Find the mean. Explain what the value tells you about the puppy's ball-catching skill.
d) Which measure of central tendency best describes the data? Explain.

Solution

a) ***Method 1: Use a Model***



The median is 5. This is the middle value.

Method 2: Arrange the Numbers

Arrange the data in increasing order.

1 3 4 5 6 15 15

The median is the middle value. Cross off pairs of least and greatest values until you reach the middle.

~~1~~ ~~3~~ ~~4~~ 5 ~~6~~ ~~15~~ ~~15~~

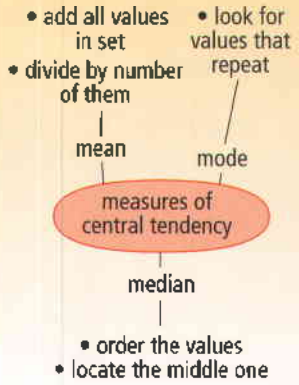
The median is 5. This is the middle value.

b) The mode is 15. In two cases, it took the puppy 15 tries.

Literacy Connections

Central Tendency

The mean, median, and mode are measures of central tendency. Each gives some sense of how a set of data is clustered around a centre.



c) *Method 1: Make a Model*

The mean is 7. This means that it took the puppy 7 tries, on average, to catch the ball.

Method 2: Calculate the Mean

To calculate the mean, add the data values and then divide by the number of values.

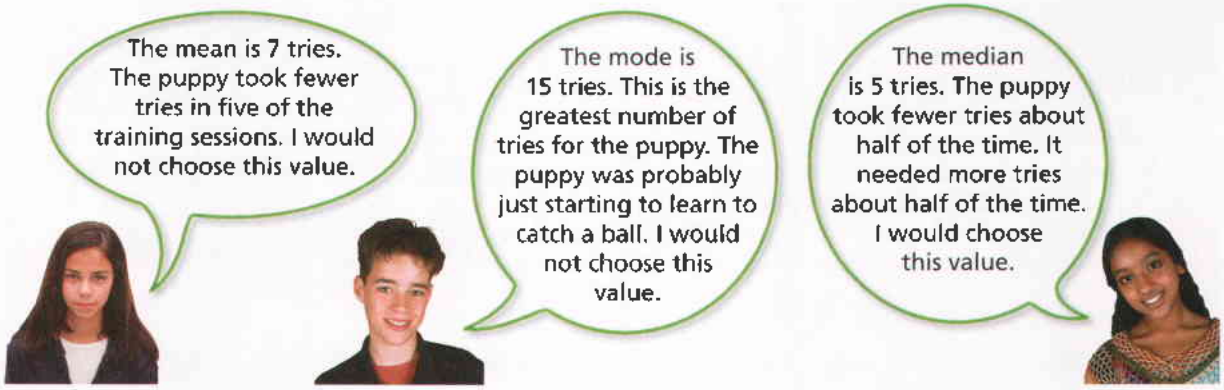
$$\text{mean} = \frac{15 + 6 + 15 + 5 + 3 + 4 + 1}{7}$$

$$= \frac{49}{7}$$

$$= 7$$

The mean is 7. This means that it took the puppy 7 tries, on average, to catch the ball.

d)

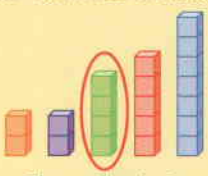


The median is the best measure of central tendency in this case. It describes a typical training session for Sabra's puppy.

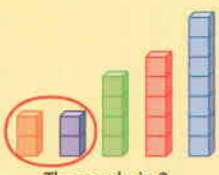
Key Ideas

- The three main measures of central tendency are the median, mode, and mean.

The median describes the middle value in a data set.



The mode describes the most common value in a data set.



The mean describes the average value of a data set.

Communicate the Ideas

1. Use an organizer to show what the median, mode, and mean show about a set of numeric data.

2. Cheryl says: "The mode for the towers in Key Ideas is 2. I think this value best describes the towers."
Michel says: "The median for the towers is 4. I think this value best describes the towers."
Fareeha says: "The mean for the towers is 4. I think this value best describes the towers."
Who is right? Explain.

Literacy Connections

Organizers
Tables, flow charts, and mind maps are useful organizers. There is a sample of a flow chart on page 238. A sample mind map is on page 320.

Check Your Understanding

Practise

For help with questions 3 to 6, refer to Example 2.

3. Model each set of data using blocks or a diagram. Then, find the median, mode, and mean.
   a) 4, 2, 9, 6, 4
   b) 11, 5, 8, 11, 10
   c) 4, 5, 8, 5, 6, 9, 5

Use the table to answer questions 4 to 6.

A basketball coach records the number of successful free throws for her teams. Each player gets 10 shots. The results are shown for nine boys and eight girls.

Boys' Team Baskets	6	4	8	7	6	9	5	6	2
Girls' Team Baskets	7	6	7	8	9	3	5	7	

4. **a)** Model the set of data for the boys' team using blocks or diagrams.
   b) Find the median, mode, and mean. Explain what each value tells you about the free-throw skills of the boys.

5. **a)** Model the set of data for the girls' team using blocks or diagrams.
   b) Find the mode, median, and mean. Explain what each value tells you about the free-throw skills of the girls.

6. **a)** Which team do you think has a better record?
   b) Compare the median, mean, and mode for each team.

For help with questions 7 to 9, refer to Example 1.

7. Find the median and the mode for each data set.

a)

Stem (tens)	Leaf (ones)
3	2 5
4	1 1 7 8
5	3 6 9

b)

Stem (tens)	Leaf (ones)
6	0
7	2 5 6
8	0 3 3

8. Find the median and the mode for each data set.

a)

Stem (tens)	Leaf (ones)
4	4 7
5	1 1 2 3
6	2 3 5 9

b)

Stem (tens)	Leaf (ones)
5	5
6	2 3 8
7	0 2 2 4

9. Create a stem-and-leaf plot for each data set.

a) 30, 45, 37, 42, 35, 47

b) 41, 53, 49, 67, 52, 41, 63

Apply

10. Pina plays defence for her school's hockey team. Her time on the ice for each game is recorded, in minutes.

21, 22, 19, 24, 23, 19, 20, 24

a) Find the median and mean.

b) In this case, there are two modes. What are they?

c) Which measure of central tendency best describes a typical game for Pina? Explain.

11. The final marks for a physical education class are given.

84	68	71	55	66	63	82
92	70	75	64	58	73	88
65	73	76	73	62	83	

a) Create a stem-and-leaf plot for the data.

b) Find the median, mode, and mean.

c) Which measure of central tendency best describes the marks? Explain.

Chapter Problem

12. The table shows the sales of your teen magazine in one sports store.

Month	Number
January	6
February	6
March	12
April	20
May	25
June	35

a) Find the median, mode, and mean. Explain what each value tells you about the monthly magazine sales.

b) Which measure of central tendency best describes the monthly magazine sales? Explain.

13. A clothing store needs to place a monthly order for winter jackets. The sizes that sold last month are shown in the table.

Size	Tally	Frequency
30	I	1
32	I	1
34	III	3
36	𝍸 II	7
38	IIII	4
40	II	2
42	I	1
44	I	1

a) Find the three measures of central tendency. Explain how you found them.

b) Which of these is the most important to the store manager? Explain why.

Try This!

14. Choose one of the following characteristics:

- height
- hand width
- arm span
- shoe size

a) Measure this characteristic for 10 to 20 friends and family members.

b) Display the data.

c) Find the measures of central tendency.

d) State any conclusions you can make from your findings.

Extend

15. Zack has five major tests in geography, all marked out of 50. His scores for the first four tests are 33, 42, 38, and 44.

a) What is Zack's current mean test score?

b) What score must Zack get on the last test to raise his mean score to 80%?

c) Explain how you solved part b).

Use Technology

Focus on...

- calculating mean, median, and mode

Use technology to find the measures of central tendency. This is another way of doing Example 1 on page 319.

Find Measures of Central Tendency With a Spreadsheet

Sabra is teaching her puppy to catch a ball. For each training session, she records the number of tries it takes her puppy to catch the ball.

15, 6, 15, 5, 3, 4, 1

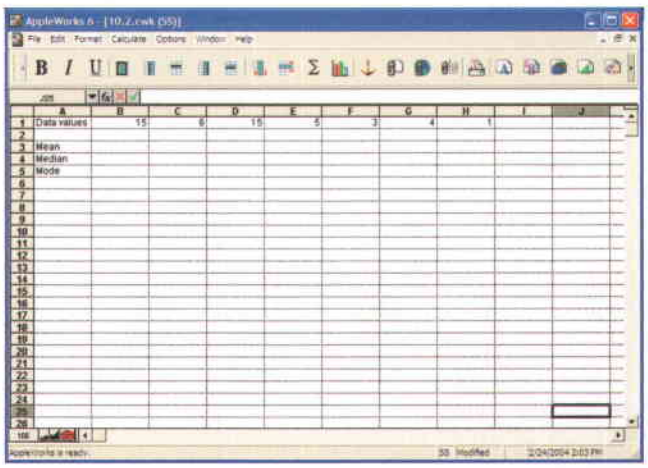
Materials

- AppleWorks 6.2 or other spreadsheet software
- computers

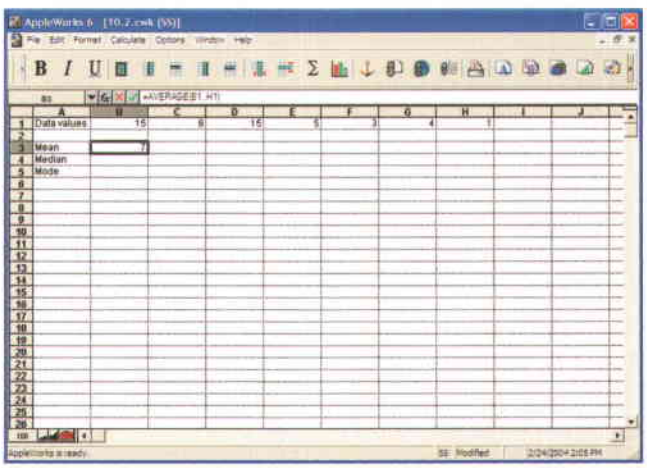
Optional

- TECH 10.2A Measures of Central Tendency (AppleWorks 6.2)
- TECH 10.2B Measures of Central Tendency (AppleWorks 5.0)
- TECH 10.2C Measures of Central Tendency (Quattro® Pro 10)
- TECH 10.2D Measures of Central Tendency (Microsoft® Excel 2002)

1. Open a new spreadsheet document in AppleWorks 6.2. Enter the text and values, as shown.
   - Click a cell.
   - Type in the text or value.
   - Press **Enter**.

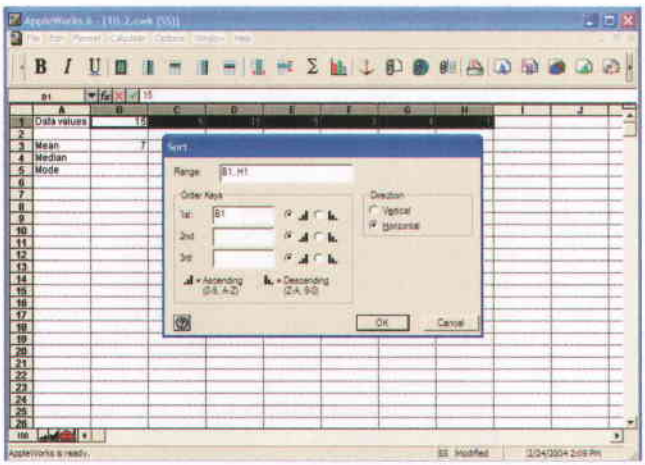


2. Use the AVERAGE function to calculate the mean of the data values.
   - Click cell B3.
   - Type **=AVERAGE(B1..H1)**.
   - Press **Enter**.

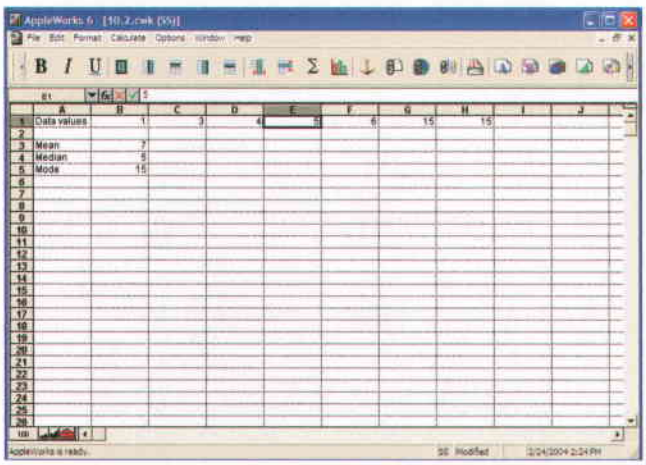


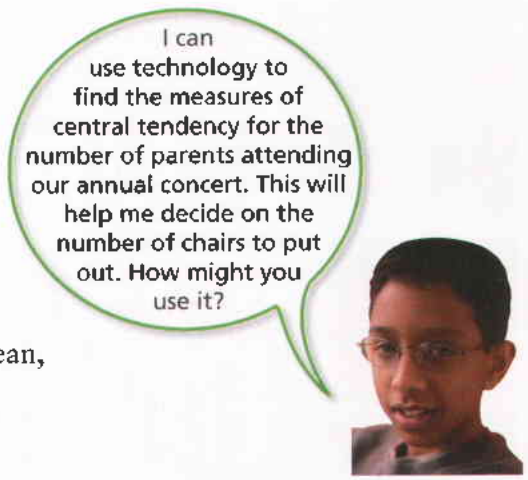
B1 is the cell location of the first data value. H1 is the cell location of the last data value.

3. Arrange the data values in increasing order.
   - Click cell B1.
   - Hold the Shift key down and click cell H1.
   - From the **Calculate Menu**, choose **Sort...**.
   - In the dialogue box, select **Horizontal**, then click **OK**.



4. Your data should now be sorted with B1 containing the smallest value and H1 the largest. Find the median and the mode of the data values.
   - The median is the middle value. There are seven data values. The median is the fourth value. Click cell B4. Type the value located in cell E1.
   - The mode is the most common value. Scan the sorted list. Notice that 15 occurs twice. Click cell B5. Type 15.

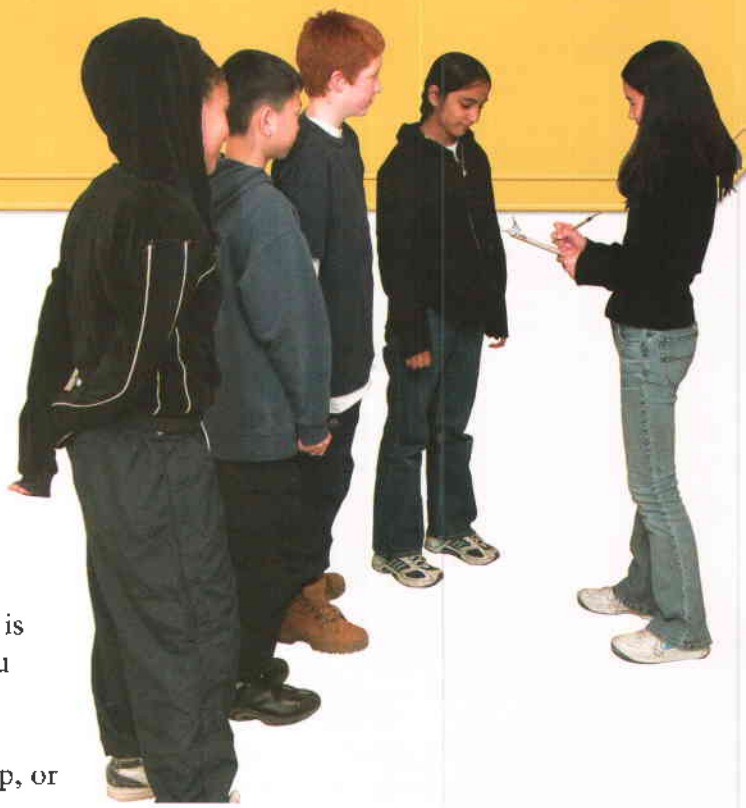




5. **Reflect** How can you use technology to calculate the mean, median, and mode of a data set?

10.3 Bias

Focus on...
- identifying bias in questions and responses
- rewording questions to remove bias



When conducting a survey, how can you make sure that the questions do not influence the responses?

Consider the following questions:
"Do you like my new hairstyle?"
"My brother's new band is really great! What do you think?"
"What's your favourite vegetable: broccoli, turnip, or Brussels sprouts?"

bias
- encourages a certain response by the wording of a question

The questions above contain **bias**. How each question is worded or the way that it is asked can affect the responses.

Discover the Math

How can you ensure that survey questions and responses are free of bias?

Example 1: Bias in Survey Responses

Ms. Mason is the school cafeteria cook. She decides to gather feedback on a new special.

Explain why Ms. Mason's survey on yesterday's special may get biased responses. What could she do to reduce the bias?

Solution

Students may not answer honestly. They do not want to hurt Ms. Mason's feelings. To reduce the bias, Ms. Mason could place survey cards on the cafeteria tables. Students could then put their responses into a box.

Example 2: Bias in Survey Questions

Read each survey question. Decide whether it contains bias. If there is bias, explain how it could be removed.

a)

What is your favourite sport?

A Hockey
B Golf
C Baseball
D Other _____

b)

Should schools have a more reasonable schedule by changing to a four-day week?

YES NO

c)

Do you think professional atheletes are paid too much, about right, or too little?

Solution

a) More people might select the three sports listed. This is easier to do than write in a different choice. This question contains bias. To remove the bias, ask the question without the choices: "What is your favourite sport?"

b) The first part of the question tries to make you think that the current school schedule is unreasonable. Then, more people might answer yes. This question contains bias. To remove the bias, reword the question: "Should schools change to a four-day-week schedule?"

c) The choices in this question seem to be fair. This question does not seem to contain bias.

Literacy Connections

Bias and Tone of Voice

Your tone of voice when asking a question can also show bias.

Ask the question from part c) of Example 2 using various tones of voice.

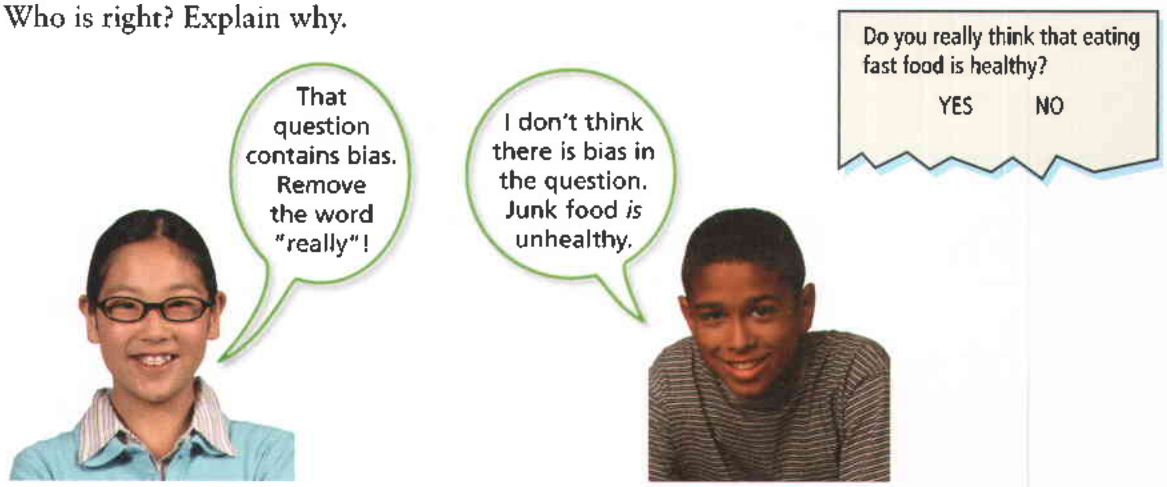
Emphasize different words to show bias.

Key Ideas

- Survey questions should be free from bias.
- How a question is asked can influence responses.
- The wording of a question can encourage certain responses more than others.

Communicate the Ideas

1. Who is right? Explain why.



2. Ms. Mason is the school cafeteria cook. She decides to gather feedback on a new special. She places survey cards on the cafeteria tables. Will the results be free from bias? Explain why or why not.

Check Your Understanding

Practise

For help with questions 3 to 6, refer to Example 1.

A middle school is having an art contest for a new school logo. Two grade 7 students, Wes and Faye, enter the contest. To get an idea of who might win, the following questions are asked of fellow students. How do you think the students will answer questions 3 to 6? Explain why.

3. Wes asks, "Do you like my design the best?"

4. A friend of Faye's asks, "Do you like my friend Faye's design?"

5. Faye asks, "Do you *really* like Wes's design?"

6. A friend of Wes's asks, "Which design do you like best?"

For help with questions 7 to 10, refer to Example 2.

7.

What is your favourite pet?

A Cat
B Dog
C Other _____

a) What choices do you think are expected?
b) How does the wording of this question influence your choice?

8.

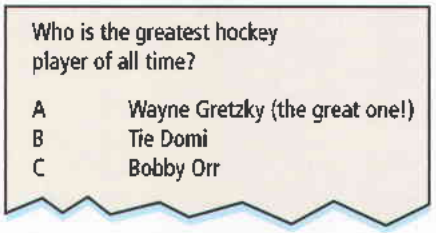
Should school cafeterias offer healthier choices by serving pizza every week?

YES NO

a) What answer do you think is expected?
b) How does the wording of this question encourage you to pick that answer?

9. What response is expected? Explain why.

10. What response is expected? Explain why.



Apply

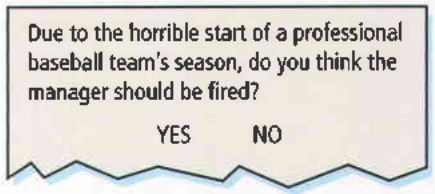
11. Consider the survey question shown.

a) Is this question free from bias? Why or why not?
b) Is it clear what the question is asking?
c) If your answers to parts a) and b) are both No, reword the question to remove the bias and make it easy to understand.

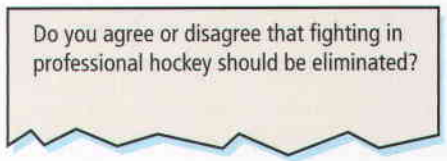
12. a) Describe a survey method that will produce biased responses.
b) Explain why you think the bias exists.
c) Describe how the bias can be removed.

13. Read each survey question. Decide whether it contains bias. If there is bias, rewrite the question to remove the bias.

a)



b)



c)

14. Consider the following three survey questions.

"Since they give students a sense of pride, should school uniforms be made mandatory?"

"Since they take away a student's freedom of expression, should school uniforms be made optional?"

"Should school uniforms be made optional or mandatory?"

a) Which questions contain bias? Explain.
b) Which question do you think was written by a teacher? Explain why.
c) Which question do you think was written by a student? Explain why.
d) Which is the best survey question to use? Explain why.

15. A television magazine conducts a survey to find out the most popular television show.

> What is your favourite television show?
>
> A *Survival*
> B *Neighbours*
> C *Last Laugh*
> D *Little Sister*
> E *The Sports Hour*
> F Other _____

a) Describe the bias in this survey question.
b) How might a television broadcasting station benefit from the bias in this survey question?
c) How could the question be changed to remove the bias?

Chapter Problem

16. Which question does not contain bias? Explain.

> Since Perdita Felicien is an Olympic athlete, should we have her on our cover?
>
> YES NO

> Should we put Perdita Felicien on our cover?
>
> YES NO

17. a) Create a short comic strip or cartoon that illustrates a biased survey question.
b) Trade with a classmate. Identify the bias in each other's survey question.

18. a) Write a survey question that contains bias.
b) What response(s) do you expect?
c) Conduct the survey with at least 10 friends, classmates, or family members. Use a table to record your results.
d) Compare your survey results with your answer to part b).
e) Reword your survey question to remove the bias.

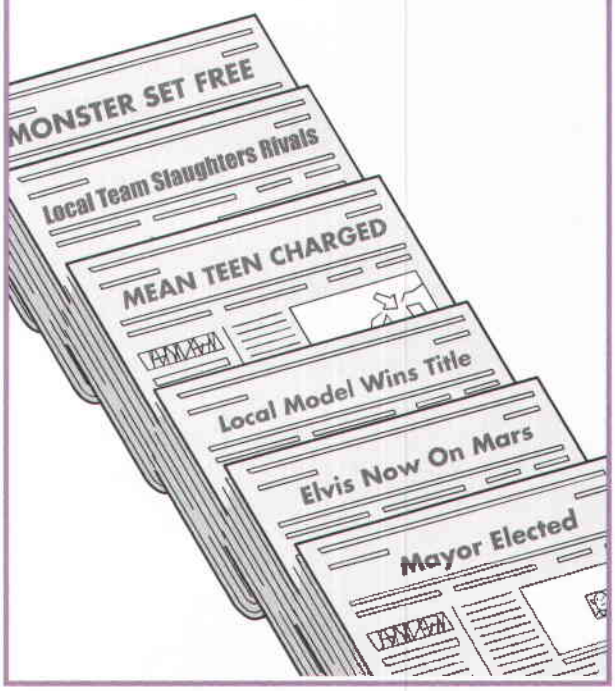
Extend

19. Search the Internet, newspapers, or magazines to find an article that contains a biased survey method. Identify the article, its location, and the type of bias present. Suggest how the bias could have been removed.

Making Connections

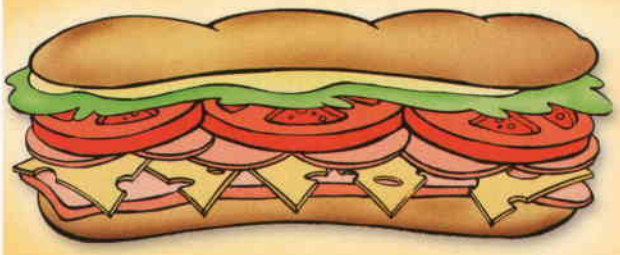
Media Bias

Many media stories include bias. Look at these sample news headlines. Which ones suggest bias? Explain.



10.4 Evaluate Arguments Based on Data

Focus on...
- evaluating statements based on data
- recognizing misleading graphs



SuperSub

Your low-fat alternative. Now with just 5 grams of fat and only 300 calories!*

* Addition of cheese or condiments alters nutritional value.

Some fast food restaurants now offer healthier menu choices. How do you know that the meal is actually healthier?

Advertisers sometimes make bold statements based on data. Often their goal is to convince you to buy something. Can you believe everything in an advertisement?

Discover the Math

How can you evaluate statements that are based on data?

Literacy Connections

Bias and Advertisements
Advertisements can show bias by providing misleading information. The information is not incorrect. It is displayed in a manner that gives an incorrect impression.

1. How is this advertisement trying to convince you to buy the sandwich shown?

2. **a)** Read the fine print at the bottom of the ad. What information does this tell you?
   b) Compare this information with the picture of the sandwich. What does this tell you about the advertiser's claim?

3. Suppose you add cheese and mayonnaise.
   a) Use the table to find the total fat content and number of calories of your sandwich.
   b) Compare the total fat content and number of calories with those claimed in the ad. By how much have these values changed?

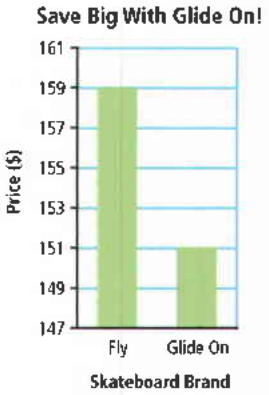
Item	Fat (g)	Calories
Basic Sub	5	300
Cheese	8	100
Mayonnaise	32	300
TOTAL		

4. **Reflect** In what ways do you think the advertisement misleads people? Why do you think the advertiser only used certain facts?

Example: Misleading Graphs

Glide On skateboards used the graph shown as part of an advertisement.

How does the graph exaggerate the savings if you buy a Glide On skateboard?

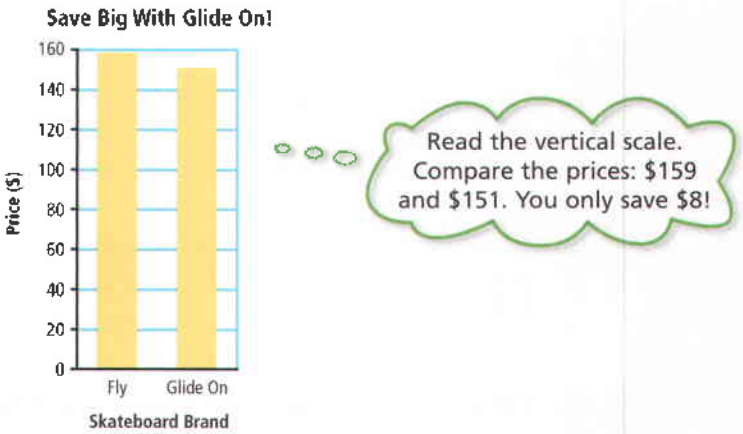


Solution

One bar looks more than three times as tall as the other. You might think that the savings are over 50%.

By showing just part of the vertical scale, the advertiser has exaggerated the difference in prices.

Here is the entire graph. It shows how small the price difference really is.



Key Ideas

- The media often make statements that are based on data. Sometimes important points are intentionally left out.
- A misleading graph can be used to exaggerate a point.

Communicate the Ideas

1. Is this graph misleading? Explain.

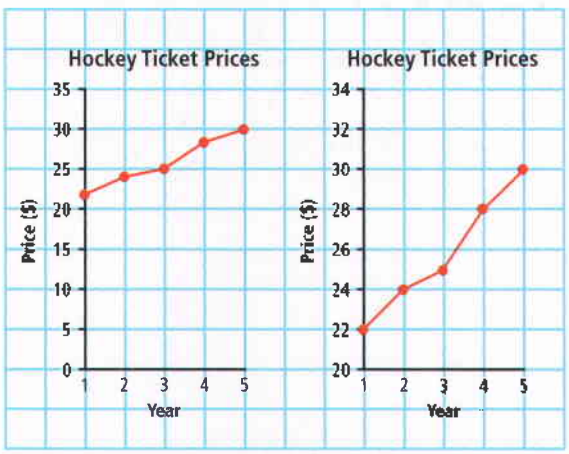
2. Why do you think an advertiser would use a misleading statement or graph?

Check Your Understanding

Practise

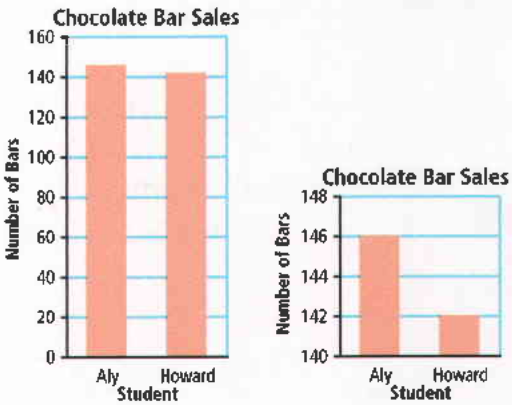
For help with questions 3 to 6, refer to the Example.

3. The two graphs show the increase in the price of hockey tickets over the past few years.



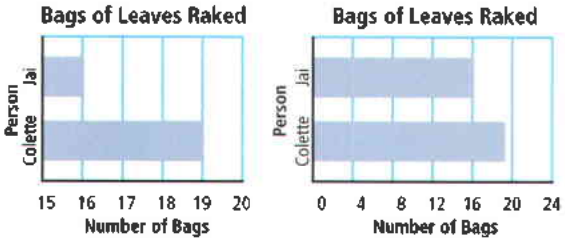
a) How are the graphs different?
b) What impression does each graph give about the price increases?

4. The two graphs show the number of chocolate bars sold by two students.



a) How are the graphs different?
b) What impression does each graph give about how many chocolate bars were sold?

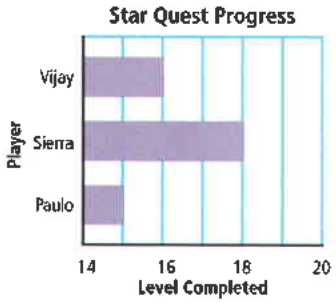
5. The two graphs show the number of bags of leaves raked by two friends.



a) How are the graphs different?

b) What impression does each graph give about how many bags of leaves were raked?

6. The graph shows the progress of friends playing a video game.



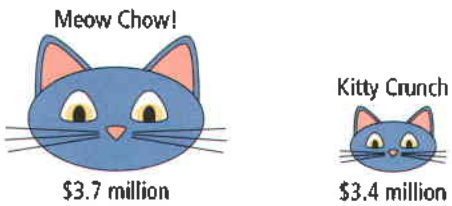
a) What impression does the graph give?

b) Explain why this graph is misleading.

Apply

7. Draw a new graph for the data in question 6 that is not misleading.

8. This graph was used in a cat food ad.



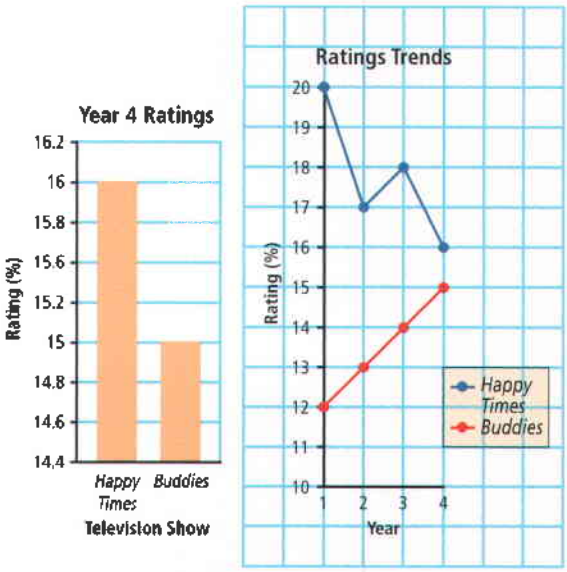
a) Which company do you think created this ad? Explain.

b) Why is this graph misleading? What effect has been achieved?

9. Two television show producers are competing for sponsorship from a major advertiser. The ratings are in the table below. The ratings are a percent of the entire viewing audience.

Show	Year 1	Year 2	Year 3	Year 4
Happy Times	20	17	18	16
Buddies	12	13	14	15

The advertiser is shown two different graphs, one prepared by each television producer.



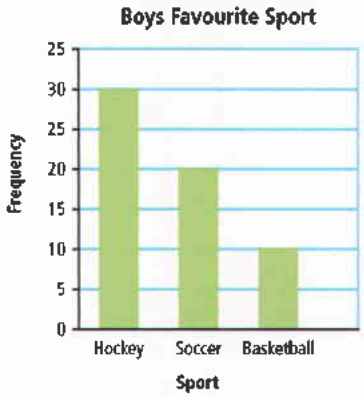
a) What rating information is presented in each graph?

b) Which graph do you think was created by the producer of *Happy Times*? Explain.

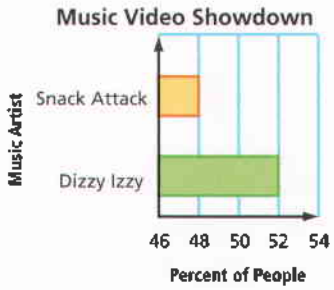
c) Which graph do you think was created by the producer of *Buddies*? Explain.

10. How might this graph mislead people?

11. Is this graph misleading? Explain.

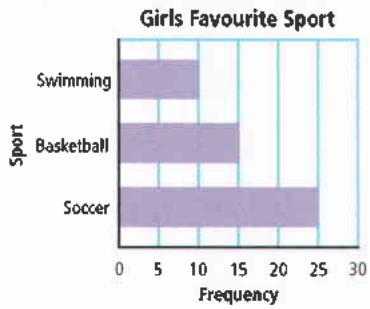


12. Results of a music video showdown are displayed for the television viewing audience.



a) What impression does the graph give?
b) Is this graph misleading? Explain.
c) Draw a new graph for the data that is not misleading.
d) Compare the two graphs. Describe what you notice.

13. Is this graph misleading? Explain.



14. A group of teens were surveyed about the amount of time they spend using a computer.

Time	Tally	Frequency
Daily	𝍸 𝍸 I	
1 to 6 times a week	𝍸 𝍸 𝍸	
Less often	𝍸 III	

a) Copy and complete the frequency table.
b) Draw a graph that does not distort the data.

15. Find some data that you are interested in.

a) Draw a graph that does *not* distort the data.
b) Explain why your graph is not misleading.

Extend

16. Look at the sports page of a newspaper, or use the Internet to find some current sports data. Pick a team.

a) Create a misleading graph based on the data you found. Make it look like the team is doing really well. Write one or two sentences based on your graph to explain why the team is doing so well.
b) Use the same data, or other data, and create a new misleading graph. Make it look like the team is doing poorly. Write one or two sentences based on your graph to explain why the team is struggling.
c) Show these graphs to a parent, guardian, or older sibling. Can you convince the person that you are right in both cases?

CHAPTER 10

Review

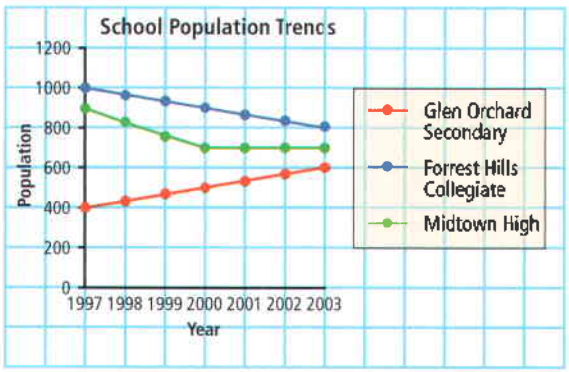
Key Words

For questions 1 to 5, copy the statement and fill in the blanks. Use some of these words: mode, mean, measures of central tendency, bias, median, unbiased

1. 6 is the _____ of 7, 2, 6, 8, 2.
2. 5 is the _____ of 7, 2, 6, 8, 2.
3. Questions that encourage you to answer a certain way contain _____.
4. Mean, median, and mode are all _____.
5. 2 is the _____ of 7, 2, 6, 8, 2.

10.1 Analyse Data, pages 312–317

Use the graph for questions 6 to 8.
The graph shows the population for the three high schools in a city.



6. **a)** Describe the trend for each high school population.
   b) Which school had the greatest population for the time period shown?

7. Predict which school will have the greatest population in two years. Justify your prediction.

8. Estimate the population of each high school for each year.
   a) 1999
   b) 2005

Use the data for questions 9 and 10.
Oswald grew tomatoes in his garden. He recorded the number of tomatoes picked from each plant.
8, 11, 9, 7, 8, 10, 6, 8, 9, 8

9. **a)** Create a frequency table for the data set.
   b) Use the frequency table to describe the data set.

10. **a)** How many tomatoes were picked in total?
    b) Oswald would like a total of 100 tomatoes next year. Estimate how many more tomato plants Oswald should plant. Explain your solution.

10.2 Measures of Central Tendency, pages 318–323

11. Phyllis books appointments at a dentist's office. She recorded the number of appointments that were made one week in a table.

Monday	Tuesday	Wednesday	Thursday	Friday
16	15	13	3	3

    a) Find the mean, median, and mode. Explain what each value tells you about the appointments.
    b) Which measure of central tendency best describes the appointments at the office? Explain your choice.

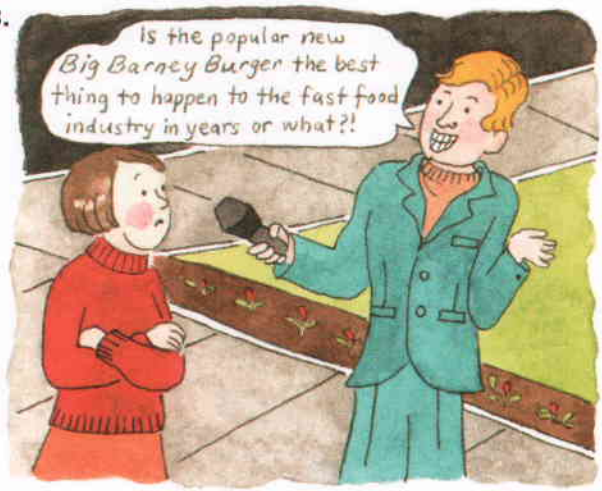
12. The final marks for a science project are shown.

78	74	80	66	65	75	47
68	60	85	77	92	61	84
81	55	87	53	62	67	92

a) Create a stem-and-leaf plot to organize the data.
b) Find the median and the mode.
c) Which value from part b) best describes the overall performance of the entire class? Explain.

10.3 Bias, pages 326–330

13.



a) Describe the bias in the interviewer's question.
b) Who do you think may have written the question? Explain.
c) Reword the question to remove the bias.

14. One of the judges in a talent show is also a parent of a child in the show.
a) Explain the possible bias in this situation.
b) Describe how the bias could be removed.

15.

a) Describe the bias in this survey question.
b) How could the question be changed to remove the bias?

10.4 Evaluate Arguments Based on Data, pages 331–335

16. The results of a bake-sale competition between a grade 7 and a grade 8 class are shown.

a) What impression does the graph give?
b) Is this graph misleading? Explain.

17. People were surveyed about their favourite submarine sandwich shop.

Shop	Tally	Frequency
Sub Lubber's	𝍸 𝍸 |	
Hungry Cat	𝍸 𝍸 ||	
Hero Plus	𝍸 |||	
Other	𝍸 ||	

a) Copy and complete the frequency table.
b) Draw a graph that exaggerates the popularity of Hungry Cat.
c) Draw a similar graph that does not distort the data.
d) Which graph might the owner of Hungry Cat use? Why?

CHAPTER 10

Practice Test

Strand Questions	NSN	MEA	GSS	PA	DMP 1–9

Multiple Choice

For questions 1 to 4, select the correct answer.

1. Which of the following is the best choice for displaying trends in data?

A circle graph
B bar graph
C pictograph
D line graph

Use the data for questions 2 to 4.
Greg recorded the number of hours he spent watching television each day last week.

3, 2, 1, 0.5, 1, 6, 4

2. What is the mean of the number of hours Greg spent watching television?

A 1
B 1.5
C 2
D 2.5

3. What is the mode of the number of hours Greg spent watching television?

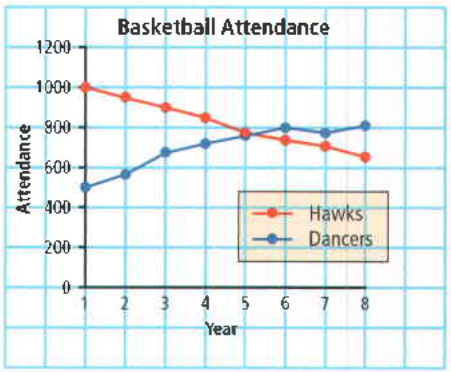
A 1
B 1.5
C 2
D 2.5

4. What is the median of the number of hours Greg spent watching television?

A 1
B 1.5
C 2
D 2.5

Short Answer

5. The graph shows game attendance for two basketball teams.

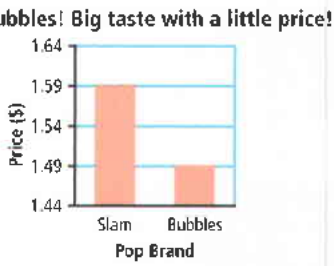


a) Describe the trend for each team's game attendance.
b) Predict the attendance for each team's next game.

6. Parents at a children's soccer game are asked to fill out a survey. The results will be used to pick players for an all-star game.

a) Describe the possible bias in this survey.
b) How could the bias be removed?

7. The company that makes Bubbles pop used the graph shown in an advertisement.



a) Is the graph misleading? Explain.
b) How do you think the company will benefit from this ad?

Extended Response

8. A group of teens worked for a farmer one day, picking cherries. The number of baskets each teen picked is recorded in the table.

Number of Baskets	Tally	Frequency
9	I	1
10	I	1
11	IIII	4
12	II	2
13		0
14	I	1

a) How many teens were picking cherries?
b) How many baskets did these teens pick, in total?
c) Estimate how many more workers the farmer should hire to get a total of 150 baskets per day. Explain your thinking.

9. Rena collected the mathematics test scores from 11 of her friends and added her own. This is the data set she collected. The test was out of 85.

66 80 68 72 75 64
81 73 73 74 75 75

a) Use a frequency table to describe the data set.
b) Rena received the mean score. What mark did she get?
c) Find the other two measures of central tendency.

10. Explain how a graph can be used to mislead the viewer. Create your own data and misleading graph to support your answer.

Chapter Problem Wrap-Up

You are the publisher of a magazine for students in grades 7 to 9. You need information to help you plan the magazine covers for future issues.

1. Design a reader survey.

2. Collect, organize, and display data from possible readers.

3. Analyse the data you have collected. What decisions might you make? Explain why.

Making Connections

What does data analysis have to do with saving animals at risk?

As our world changes, some species of animals and plants become extinct. Two species that are at risk in Ontario are the wolverine and the polar bear.

The wolverine is a tough member of the weasel family. It is about the size of a dog and lives in the forests of Northern Ontario. Logging and hunting are two possible factors in the decline of the wolverine population.

The polar bear spends much of its time hunting seals on ice caps. When the ice caps melt, the bear is forced to live on land, where it often goes hungry. Global warming, hunting, and pollution may also be factors in the decline of the polar bear.

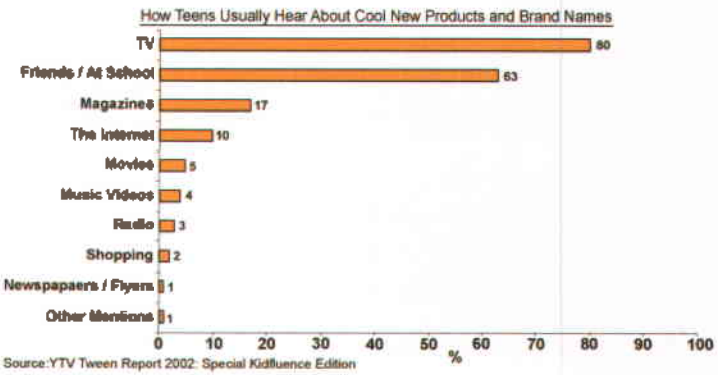
Wildlife researchers can use population data trends to track species at risk. Then, by making predictions, the researchers can make recommendations to protect these valuable creatures.

Internet Connect: Go to **www.mcgrawhill.ca/links/math7** and follow the links to find out more about animals and plants at risk in Ontario.

Making Connections

What do your buying habits have to do with trends in the consumer market?

The products you buy influence what products are available. There are about 2.5 million kids between the ages of 9 and 14 in Canada. They spend almost $2 billion themselves and influence over $20 billion in household purchases.



The Canadian youth television network YTV does research on Canadian kids. They collect information on topics such as leisure and sports activities, spending habits, and media habits.

Why would this information be useful to YTV?

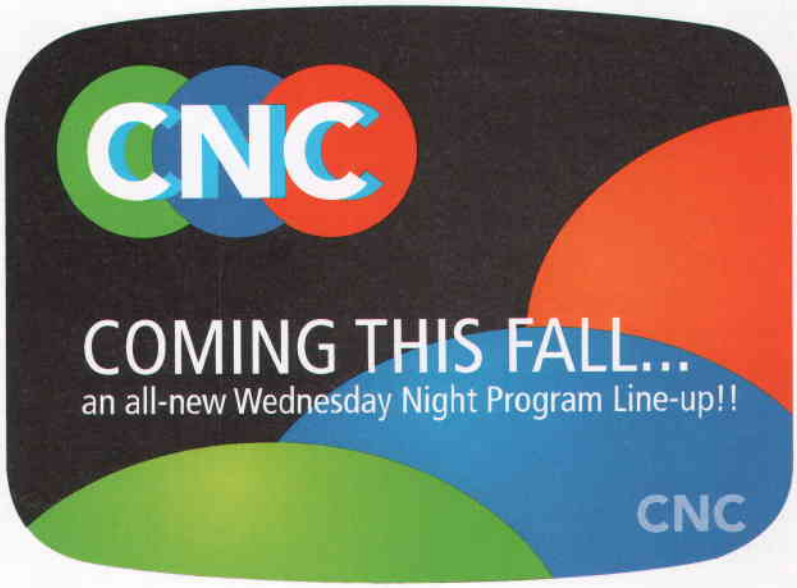
What other companies might find this information helpful?

Go to **www.mcgrawhill.ca/links/math7** and follow the links to find out more about "Kidfluence" and Kid Trends.

Plan a Television Schedule

TASK

You are the programmer for a television station. Your boss asks you to plan a new fall schedule for Wednesday evenings. Evening programming starts at 4 P.M. and ends at 10 P.M.



1. Design a survey to find out
   - what types of shows you might air
   - specific shows your audience would like to see
   - the best time slot for a news program
   - the best time slots to air other popular shows

2. Conduct your survey.

3. Organize and present your data. Be sure to use some measures of central tendency.

4. Based on your data, plan one evening's programming and provide a viewing guide.

5. After reading your viewing guide, your boss sent the following email.

FROM: KimikaR
TO: PaulG
SUBJECT: shows and viewers

- Why did you pick the shows you did?
- How did you come up with the time slots?
- Why do you think viewers will tune in to our station?
- What type of viewer will watch us?

Answer your boss's questions. Support your answers with appropriate data.

Number Sense and Numeration

- Compare and order integers.
- Represent integers using counters, a number line, and symbols.
- Add and subtract integers, with and without the use of manipulatives.
- Use a calculator to solve problems that involve large numbers.

Patterning

- Identify and use a pattern.

Data Management and Probability

- Make predictions from graphed data.
- Read and create bar graphs and scatterplots.

Key Words

integer
positive integer
negative integer
opposite integers
zero principle

CHAPTER 11

Integers

Have you ever felt warm one moment and then colder because of a gust of wind? The change in temperature was caused by wind chill. For example, the thermometer may report a temperature of 5°C on a bright winter day. But if there is a wind, it can *feel* as cold as –2°C.

Internet Connect Understanding integer concepts will help you to read and understand wind chill values. Go to www.mcgrawhill.ca/links/math7 and follow the links to find out more about wind chill.

Chapter Problem

The thermometer reads –10°C. The wind is from the northwest at 25 km/h. The radio weather forecaster says that this gives a wind chill of –19. This means it feels as cold as it would on a calm day with a temperature of –19°C.

What patterns or trends can you see in the wind chill chart? Start by looking down the –10°C temperature column and across the 25 km/h wind speed row.

Wind Chill Chart

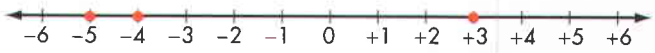
Wind Speed (km/h)	Air Temperatures (°C)							
	5	0	–5	–10	–15	–20	–25	–30
5	4	–2	–7	–13	–19	–24	–30	–36
10	3	–3	–9	–15	–21	–27	–33	–39
15	2	–4	–11	–17	–23	–29	–35	–41
20	1	–5	–12	–18	–24	–31	–37	–43
25	1	–6	–12	–19	–25	–32	–38	–45
30	0	–7	–13	–20	–26	–33	–39	–46
35	0	–7	–14	–20	–27	–33	–40	–47
40	–1	–7	–14	–21	–27	–34	–41	–48
45	–1	–8	–15	–21	–28	–35	–42	–48
50	–1	–8	–15	–22	–29	–35	–42	–49
55	–2	–9	–15	–22	–29	–36	–43	–50
60	–2	–9	–16	–23	–30	–37	–43	–50

Get Ready

Identify Integers

A debt of \$5 can be represented by the integer −5.
A temperature of 3°C above freezing can be represented by the integer +3.
A depth of 4 m below sea level can be represented by the integer −4.

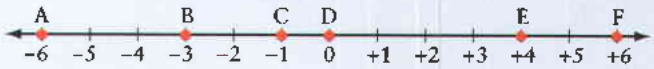
These integers are shown on the number line.



1. Represent each situation using an integer. Show the integers on a number line.
a) a loss of \$6
b) a temperature of 5°C below freezing
c) sea level
d) a gain of 2 kg

2. Write a simple situation that each integer might represent. Use a different type of situation for each.
a) −10 **b)** +3 **c)** −17

3. What integer is represented by each point on the number line?



4. Describe how the positions of the integers in each pair are related to 0.
a) +1 and −1
b) −5 and +5

Compare and Order Numbers

Earth has one moon. The table shows the number of moons other planets have.

You can use one of the symbols >, <, or = to compare the number of moons that Jupiter and Uranus have. Jupiter has more moons than Uranus. 16 > 11.

The numbers of moons written in increasing order are 0, 2, 11, 16, 18.

Planet	Number of Moons
Jupiter	16
Mars	2
Saturn	18
Uranus	11
Venus	0

5. Compare the numbers in each pair using > or <.
a) 12 ■ 15 **b)** 32 ■ 23
c) 20 ■ 0 **d)** 33 ■ 42
e) 29 ■ 30 **f)** 4 ■ 40

6. Write the numbers in each set in increasing order.
a) 8, 10, 5, 19, 2
b) 20, 11, 35, 6, 0, 12
c) 16, 27, 30, 1, 23, 15, 12

Find the Mean of a Set of Data

Ten students were asked how many hours of television they watch per week.
Their responses were 15, 12, 0, 4, 18, 7, 12, 6, 7, 3
Calculate the mean number of hours.

$$\text{Mean} = \frac{\text{sum of data}}{\text{number of pieces of data}}$$
$$= \frac{15 + 12 + 0 + 4 + 18 + 7 + 12 + 6 + 7 + 3}{10}$$
$$= \frac{84}{10}$$
$$= 8.4$$

The mean number of hours of television watched per week is 8.4.

7. Calculate the mean of each set.
- **a)** 2, 0, 3, 7, 8
- **b)** 10, 30, 50, 40, 30, 40, 10
- **c)** 27, 13, 22, 46, 18, 55, 0, 19
- **d)** 5.2, 6.3, 8.2, 10.8, 11.5

8. Calculate the mean of each set of data.
- **a)** Marks, in percent: 78, 56, 92, 43, 66
- **b)** Ages, in years: 3, 5, 3, 7, 6, 10, 3, 2, 6, 5
- **c)** Cost of a hamburger, in dollars: 1.49, 1.35, 2.79, 0.99, 2.45, 1.25, 1.85, 2.29

Find the Median of a Set of Data

The price of a movie ticket in seven cities is recorded.
\$7.50, \$10.00, \$9.50, \$8.00, \$8.50, \$9.00, \$8.50
What is the median price?

Arrange the prices in increasing order.
\$7.50, \$8.00, \$8.50, \$8.50, \$9.00, \$9.50, \$10.00

The median price of a movie ticket is \$8.50.

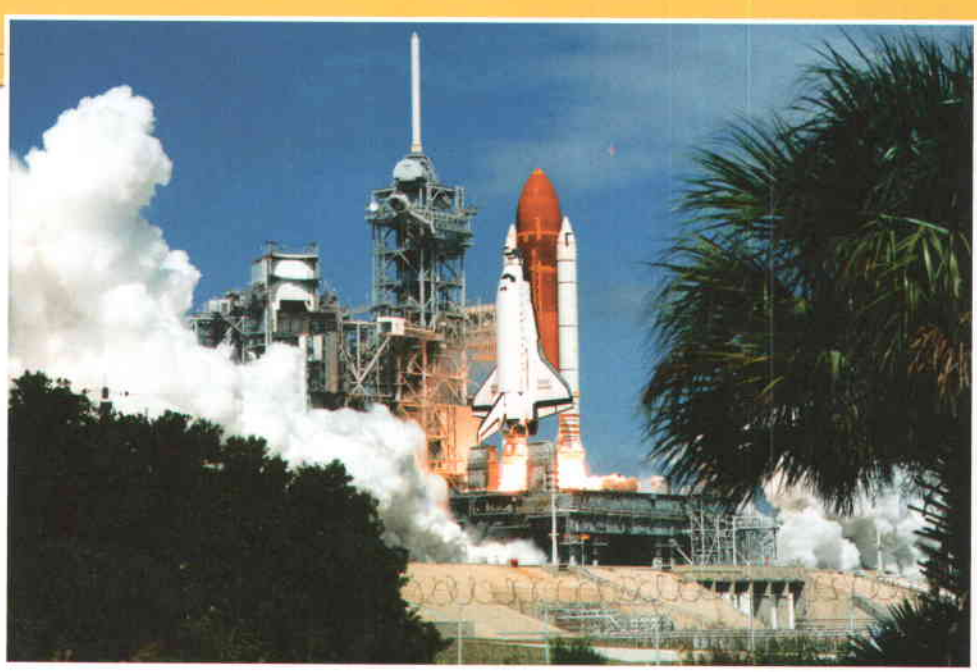
The **median** is the middle value. There are seven pieces of data. The median is the fourth piece.

9. Find the median of each set.
- **a)** 3, 5, 1, 0, 8
- **b)** 12, 10, 9, 15, 10, 15, 14
- **c)** 33, 41, 87, 93, 54, 50, 22, 50
- **d)** 35, 96, 10, 64, 100, 56

10. Find the median of each set of data.
- **a)** Heights, in metres: 89, 105, 77, 95, 121
- **b)** Test scores, out of ten: 7, 9, 6, 5, 10, 7, 9, 8, 8, 10, 7, 8, 9, 6, 9
- **c)** Cost of one dozen eggs, in dollars: 1.95, 1.89, 1.90, 2.05, 1.97, 1.85, 1.98

11.1 Compare and Order Integers

Focus on...
- comparing integers
- ordering integers
- using a number line to represent integers



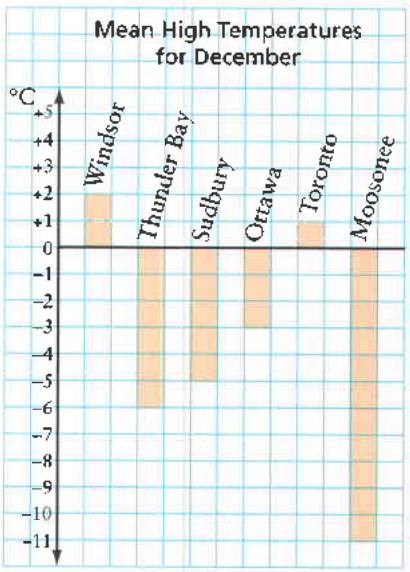
When a spacecraft is about to be launched, you may hear the ground crew say something like "T minus 10 minutes." What does this phrase mean? How can the phrase be represented by an integer?

integers
- one of the numbers ..., −3, −2, −1, 0, +1, +2, +3, ...

Discover the Math

How can you compare integers?

The bar graph shows the mean high temperatures, during the month of December, for six Ontario cities.



1. **a)** Which of the six cities is the coldest in December?
   b) Which city is the warmest?

2. **a)** Order the cities from coldest to warmest.
   b) List the temperatures in increasing order.

3. Which city do you think is farthest north? Why?

4. **a)** Waterloo's mean high temperature in December is 0°C. Which of the six cities are colder than Waterloo?
   b) The mean high temperature in Ottawa last December was –4°C. Was it colder or warmer than usual?

5. **a)** How many degrees warmer is Thunder Bay than Moosonee?
   b) How many degrees colder is Ottawa than Toronto?

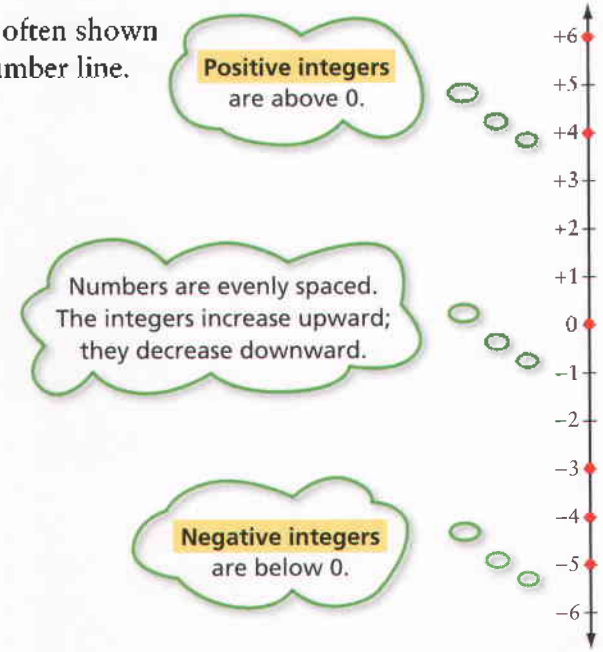
6. **Reflect** Think about the process you use to compare and order integers.
   a) You are asked to compare three integers. One integer is negative, one is positive, and one is zero. How do you arrange the three integers in order from the least to the greatest?
   b) Describe the steps you would use to arrange six different integers in increasing order.

Example 1: Use a Vertical Number Line

Use a number line to show the temperatures +4, –3, –4, +6, 0, and –5. List the temperatures from the coldest to the warmest.

Solution

Temperature is often shown on a vertical number line.



Listed from coldest to warmest, the temperatures are –5, –4, –3, 0, +4, +6.

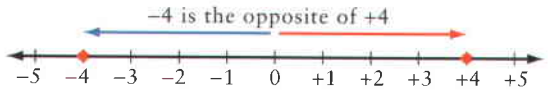
positive integer
- one of the numbers +1, +2, +3, ...

negative integer
- one of the numbers –1, –2, –3, ...

Literacy Connections

Reading Vertical Number Lines
You see a vertical number line in some types of thermometer.

–4 and +4 are **opposite integers**. They are an equal distance to the left and right of zero on an integer number line.

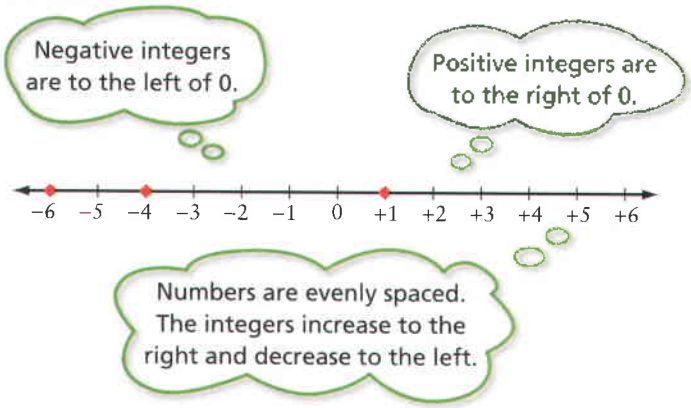


opposite integers
- two integers with the same numeral but opposite signs

Example 2: Use a Horizontal Number Line

Compare the integers –6, –3, and +1 with the integer –4. Use a number line, words, and symbols.

Solution



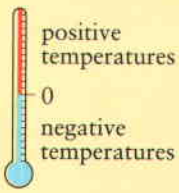
Words	Symbols
–6 is less than –4	–6 < –4
–3 is greater than –4	–3 > –4
+1 is greater than –4	+1 > –4

Literacy Connections

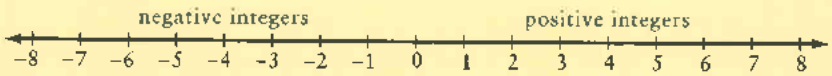
Reading > and <
The symbol > is wider on the left. So, a number to the left of > is larger than a number to the right. You read 10 > 8 as "ten is greater than eight."

Key Ideas

- A thermometer uses a vertical number line.



- A horizontal number line is a useful tool for comparing and ordering integers. Numbers are evenly spaced to the left and right of 0.



- Opposite integers are an equal distance to the left and right of 0.
- You can compare two different integers using the symbols > and <. For example, –3 < 0 means –3 is less than 0.

Communicate the Ideas

1. On a horizontal integer number line, do the numbers increase or decrease from left to right? Explain.
2. No sign is used in front of the number 0. Why?
3. Use a number line to show one pair of opposite integers. Explain how you know that they are opposite integers.
4. Gus suggested a rule for comparing integers: "The number farthest from zero on the number line is always the greatest." Comment on the accuracy of his rule.

Check Your Understanding

Practise

For help with questions 5 to 7, refer to Example 1.

5. Four temperatures are shown.
   a) Which temperatures are greater than 0?
   b) Which temperatures are less than 0?
   c) List the temperatures in increasing order.
   d) Which temperatures are opposite integers?

6. True or false? Justify your answers.
   a) $+5 > +1$
   b) $-2 > -5$
   c) $-2 > +1$
   d) $-5 < +5$

7. Write the temperatures in each set in order, from coldest to warmest.
   a) 8°C, 0°C, −5°C, 20°C, 15°C
   b) −21°C, 12°C, 17°C, 8°C, −30°C, 0°C
   c) 32°C, 11°C, −2°C, −8°C, −1°C, 19°C

For help with questions 8 to 12, refer to Example 2.

8. Five integers are shown on a number line.

   a) Which integers are greater than 0?
   b) Which integers are less than 0?
   c) Write the integers in order from least to greatest.
   d) Which numbers are opposite integers?

9. a) Which of the following integers are greater than −4?
   −2, −5, +1, −8
   b) Which of the following integers are greater than −10?
   −9, 0, +5, +11

10. a) Which of the following integers are less than +2?

$-2, 0, -5, +6$

b) Which of the following integers are less than −6?

$-5, -7, +5, +7$

11. Which is farther left on a number line?

a) −10 or −30
b) +12 or −12
c) 0 or −5
d) −7 or −6
e) −43 or 27
f) −14 or −2

12. Use words to compare the integers in each pair. Then, use a < or > symbol.

a) −10, −30
b) +12, −12
c) 0, −5
d) −7, −6
e) −43, 27
f) −14, −2

Apply

13. Use integers to represent the following. Show the integers on a number line.

a) 2 min before liftoff, 7 min after liftoff
b) a loss of $1, a gain of $6
c) 8 m above sea level, 3 m below sea level, sea level
d) ground level, 6 floors up, 4 floors down

Did You Know?

Ancient civilizations used various symbols for counting numbers. Symbols for negative numbers were probably first used by the Chinese during the first century A.D. They used red rods to represent positive numbers and black rods to represent negative numbers.

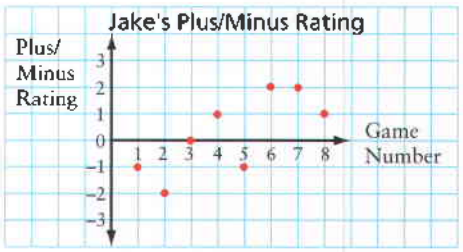
14. a) If two integers have opposite signs, which one is greater? Explain.
b) If two integers are both negative, which one is greater? Explain.

15. "It is colder today than yesterday."

a) Give an example, using negative temperatures, of this situation.
b) Compare your temperatures using a < or > symbol.
c) Show the temperatures on a number line.

16. When Sandy turned on the radio she heard the announcer say "T minus 15 seconds." Mario walked past the TV just as a commentator said "T minus 20 seconds." Who heard the report closer to liftoff time?

17. In hockey, players get +1 if they are on the ice when their team scores. They get −1 if they are on the ice when the other team scores. The sum of these +1 values and −1 values is a player's plus/minus rating. The scatterplot shows Jake's plus/minus rating for his first eight games.



a) What does the ordered pair (3, 0) represent?
b) What does the ordered pair (1, −1) represent?
c) Jake says he has been playing better in recent games. What might he say to support his claim?

Chapter Problem

18. One morning the air temperature was −10°C. The table shows how the wind chill value changes as the wind speed increases.

Wind Speed (km/h)	Wind Chill Value (for air temperature −10°C)
5	−13
10	−15
15	−17
20	−18
25	−19
30	−20
35	−20
40	−21
45	−21
50	−22
55	−22
60	−23

a) What is the wind chill value when the wind speed is 5 km/h? What if the wind speed is 10 km/h?

b) Make a scatterplot to show how the wind chill values change as the wind increases. Describe the pattern.

Try This!

19. The mean temperature was recorded each day during the first week of February in Pembroke.

Day	1	2	3	4	5	6	7
Temperature (°C)	0	−2	−3	1	−4	−10	−8

a) Make a scatterplot of these data.

b) Which days were colder than February 2?

c) Which days were warmer than February 5?

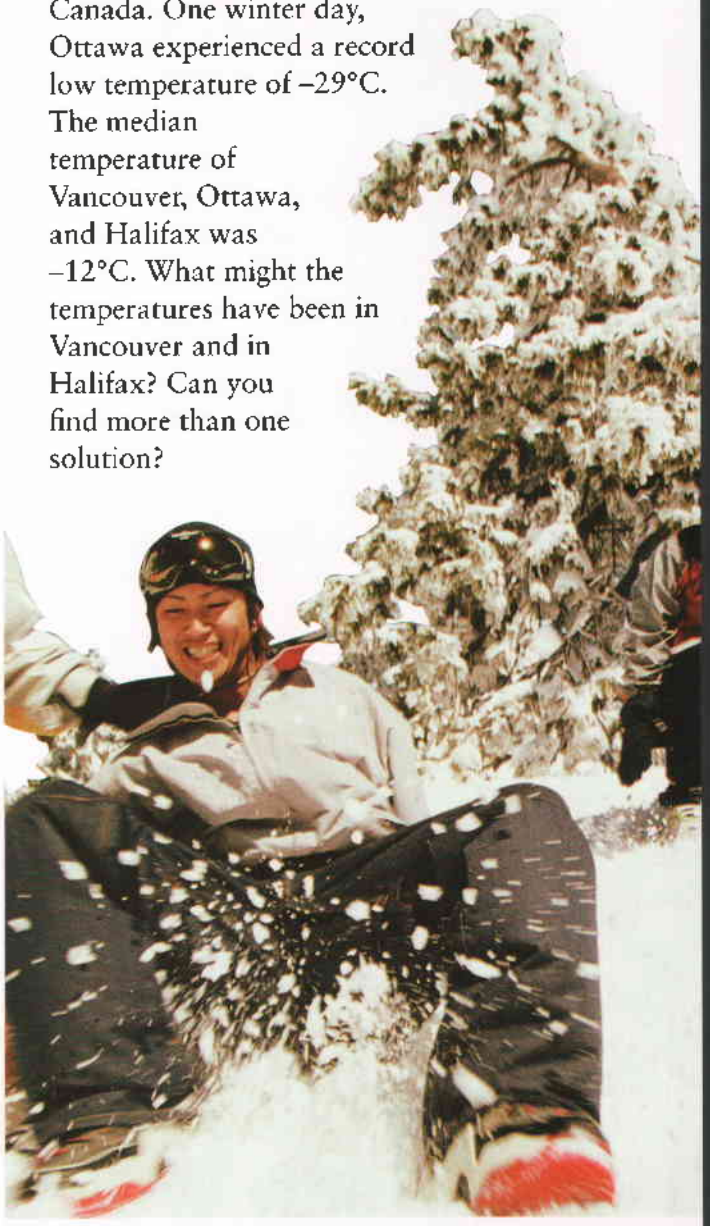
d) How much colder was the temperature on February 6 than on February 5?

e) What was the median temperature? On which day was it?

f) Describe any trend in the temperature over the week.

Extend

20. On any given day, the temperature can vary greatly depending on where you are in Canada. One winter day, Ottawa experienced a record low temperature of −29°C. The median temperature of Vancouver, Ottawa, and Halifax was −12°C. What might the temperatures have been in Vancouver and in Halifax? Can you find more than one solution?



Did You Know?

The record wind chill in Ottawa is −48, on January 23, 1976. The air temperature was −31°C with a wind speed of 35 km/h. For Thunder Bay, the record is −58, on January 10, 1982. The air temperature was −36°C with a wind speed of 54 km/h.

11.2 Explore Integer Addition

Focus on...

- representing integers using manipulatives
- representing integer addition

In many situations colour is used to provide information. When booster cables are used to jump-start a car, the red cable ends must be attached to the positive terminal of the car battery. The convention is that red means positive and black means negative.

Discover the Math

Materials

- 20 chips (10 red and 10 blue)

How can you represent integers using coloured chips?

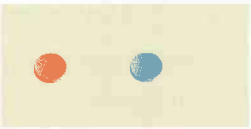
You can use coloured chips to represent integers.
One red chip represents +1.
One blue chip represents −1.

1. Look at the photo.

a) What integer is Maria showing?
b) What integer is Gabe showing?

2. Use coloured chips to model each integer.
a) +2
b) −2
c) −5
d) +7

3. a) Explain why one red chip and one blue chip together represent zero.
b) Select 3 red chips and 3 blue chips. What integer is represented by each group of chips? What is the total value if you put the six chips together? Explain why.
c) Select 5 blue chips and 5 red chips. What integer is represented by each group of chips? What is the total value if you put the ten chips together? Explain why.



4. a) Select 5 red and 3 blue chips. How many of the chips cancel each other out? How many chips remain? What colour are they?
b) What integer sum have you shown?

5. a) Select 6 red and 4 blue chips. How many of each colour remain after cancelling zero pairs?
b) What integer sum have you shown?

6. Consider the following chips. How many chips remain if you cancel out zero pairs? What integer sum have you shown?
a) 7 red and 7 blue **b)** 7 red and 2 blue **c)** 5 red and 8 blue

Strategies
Which strategies are you using in steps 6 and 7?

7. Reflect Look for a pattern. Describe how you can model the sum of two integers using coloured chips.

Example 1: Use Integer Chips to Model Addition

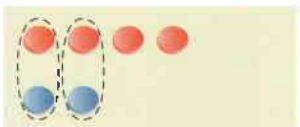
Use integer chips to represent each sum. Give each result.
a) (+6) + (–6) **b)** (+4) + (–2) **c)** (–5) + (+4)

Solution

a)

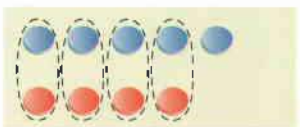
(+6) + (–6) = 0

b)



(+4) + (–2) = +2

c)



(–5) + (+4) = –1

Example 2: Modelling Sums

Write an integer sum to represent each situation.
Model the sum using integer chips. Interpret the result.

a) Kahil earns $8 and then loses $2.

b) Etta owes her sister $6 and she owes her mother $5.

Solution

a) earns $8 → +8 loses $2 → −2

(+8) + (−2) = +6
Kahil has gained $6.

b) owes $6 → −6 owes $5 → −5

(−6) + (−5) = −11
Etta owes a total of $11.

Key Ideas

- Integer chips can be used to model integer addition. This textbook uses red for positive and blue for negative.

- Two chips of opposite colours cancel each other out. Each pair of cancelled chips equals zero. This is called the **zero principle**.

zero principle
- (+1) + (−1) = 0

Communicate the Ideas

1. What integers are represented by each group of chips? What sum do they represent?

2. Use integer chips to show that (+2) + (−5) has the same result as (−5) + (+2).

Check Your Understanding

Practise

For help with questions 3 to 9, refer to Example 1.

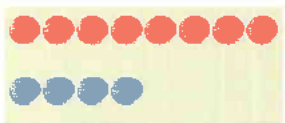
3. Interpret each group of integer chips. Write the addition statement for each.

a)

b)

4. What integer sum is modelled? Give each result.

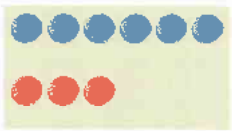
a)



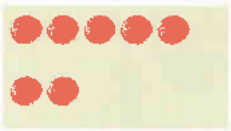
b)

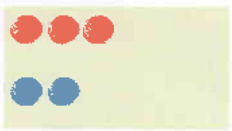
5. What integer sum is modelled? Give each result.

a) 

b) 

6. What integer sum is modelled? Give each result.

a) 

b) 

7. What integer sum is modelled? Give each result.

a) 

b) 

c) 

8. Use integer chips to model each sum. Give each result.

a) (+2) + (−3)
b) (−2) + (+3)
c) (−2) + (−3)
d) (−10) + (+8)
e) (+8) + (−10)
f) (−4) + (−3)

9. Use integer chips to represent each addition statement. Give each result. What do you notice about the results? Explain why this happens.

a) (+5) + (−5)
b) (−4) + (+4)
c) (+4) + (−4)
d) (−8) + (+8)

Apply

For help with question 10, refer to Example 2.

10. Use an integer sum to represent each situation. Model the sum using integer chips. Interpret the result.

a) Ali was in a game show. He gained 6 points in the first round, but then he lost 9 points in the second round.
b) Mae lost $2, but then she found $5.
c) The temperature was 5°C and dropped 8°C over night.
d) Brian trained hard and lost 4 kg in March. Then, he was injured and gained 7 kg in April.
e) A dive to 3 m below sea level is followed by a further dive of 6 m down.

11. Make up an example, similar to those in question 10, for each addition expression. Use integer chips to model the expression and find the sum. Interpret the result.

a) (+5) + (−8)
b) (−2) + (+4)
c) (−3) + (−7)
d) (+10) + (−10)

Extend

12. On the stock market, prices regularly go up and down. The daily changes are recorded using positive and negative numbers. If a price changes +$0.89 on Monday and −$1.42 on Tuesday, is the net change for the two days positive or negative? Explain.

Making Connections

Shake and Spill

Work with a partner and take turns. Use a paper cup and six coins. Let heads represent +1 and tails represent −1. Shake the coins in the cup and spill them onto your desk. Record the integers that you see and their sum. After you have each had at least 10 turns, try to answer these questions:

- What are all the possible ways that the coins can land?
- How would the outcomes change if there were seven coins instead of six?

11.3 Adding Integers

Focus on...
- adding integers using a number line
- describing addition statements

Some sports use integers in their statistical data. In ice hockey, each goal scored by the team while a player is on the ice is recorded as +1 and each goal against is recorded as –1. The overall sum of these goals for and against is called the player's plus/minus rating.

While Inga was on the ice, her team scored 2 goals and the opposing team scored 1 goal. What was Inga's plus/minus rating for the game?

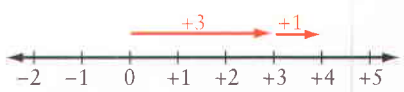
Discover the Math

How can you find the sum of two integers?

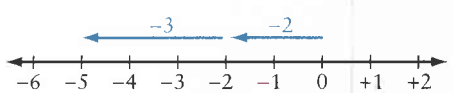
1. Paula used integer chips to model four integer sums. Greg says he prefers to show the sums on a number line. Compare the two methods. What sum is represented in each case?

Integer Chips | **Number Line**

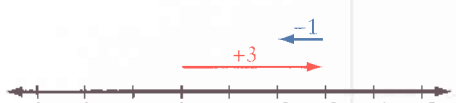
a)



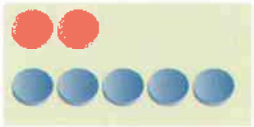
b)

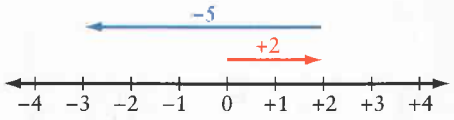


c)



d)





2. Look carefully at each number line model in step 1.

a) How do you show the first integer in the sum? Where do you start? Which way do you go?

b) How do you show the second integer in the sum?

c) How do you know what the answer is?

3. **Reflect** Explore more sums, using integer chips or a number line. Look for patterns in the results. Copy and complete the following statements using negative, positive, or zero.

a) The sum of two positive integers is always ▬.

b) The sum of two negative integers is always ▬.

c) The sum of two opposite integers is always ▬.

Example 1: Add Integers Using a Number Line

Use a number line to add each pair of integers.

a) (+3) + (+5) **b)** (−2) + (−3)

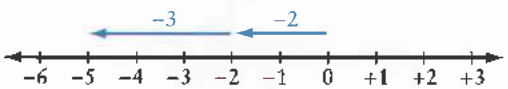
c) (+4) + (−4) **d)** (+5) + (−8)

Solution

a)

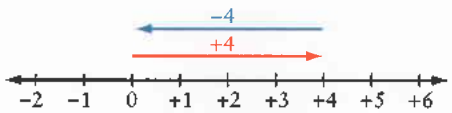
(+3) + (+5) = +8

b)



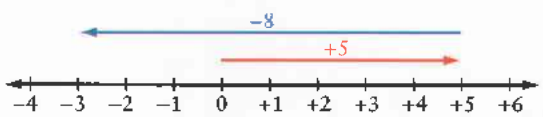
(−2) + (−3) = −5

c)



(+4) + (−4) = 0

d)



(+5) + (−8) = −3

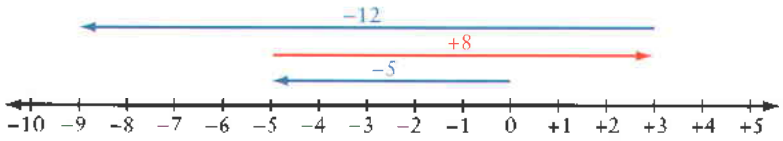
Example 2: Describe Gains and Losses

a) Describe the addition statement $(-5) + (+8) + (-12)$ in money terms.
b) Show the sum on an integer number line.
c) Find the sum numerically and interpret the result.

Solution

a) $(-5) + (+8) + (-12)$ represents a loss of \$5, followed by a gain of \$8, and then a loss of \$12.

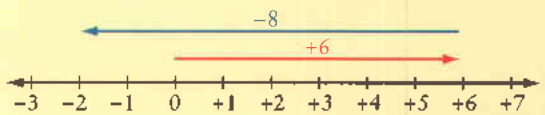
b)



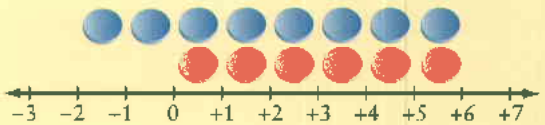
c) $(-5) + (+8) + (-12)$
$= (+3) + (-12)$
$= -9$
The result is an overall loss of \$9.

Key Ideas

- You can use an integer number line to show the sum of integers.



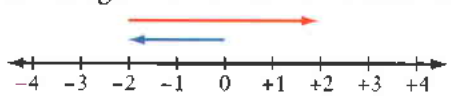
- You can also use integer chips to show the sum of integers.



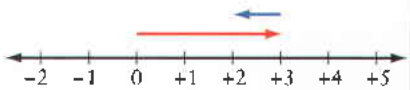
Communicate the Ideas

1. What integer sum is shown on each number line?

a)



b)



2. Tell whether each sum has a positive or a negative answer. Explain your reasoning.
a) $(+5) + (+5)$ **b)** $(-3) + (-4)$
c) $(+8) + (-6)$ **d)** $(-7) + (+2)$

3. On a quiz, Leanne provided the following solutions.
a) $(-10) + (+7) = -3$ **b)** $(+10) + (-7) = -3$
Are Leanne's solutions correct? If you feel that she has made an error, explain why and give a correct solution.

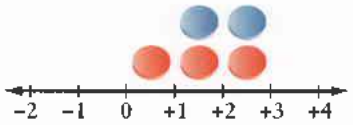
Check Your Understanding

Practise

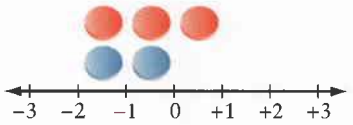
For help with questions 4 to 8, refer to Example 1.

4. What integer sum is shown? Give each result.

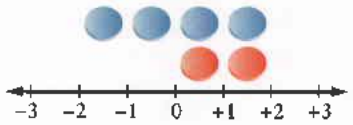
a)



b)



c)

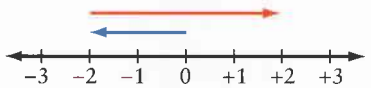


5. What integer sum is shown? Give each result.

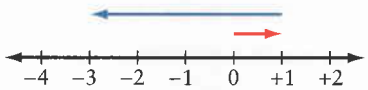
a)

b)

c)

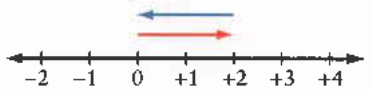


d)

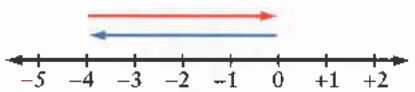


6. What integer sum is shown? What do you notice about the results? Explain why this happens.

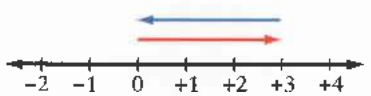
a)



b)



c)



7. Use a number line to model each sum.

a) (+2) + (+7)
b) (−3) + (−5)
c) (−9) + (+3)
d) (−4) + (+1)
e) (−6) + (+6)
f) (+8) + (−2)

8. Use integer chips or a number line to model each sum.

a) (+3) + (−9)
b) (−2) + (−4)
c) (−5) + (+7)
d) (+1) + (−9)
e) (+3) + (+2)
f) (−6) + (−4)

9. Decide whether each sum is positive, negative, or 0.

a) Two positive integers are added.
b) Two opposite integers are added.
c) A large positive integer is added to an integer that is just less than 0.
d) A small positive integer is added to an integer that is much less than 0.
e) Two negative integers are added.

10. Use mental arithmetic to find each sum.

a) (+6) + (−4)
b) (+5) + (−8)
c) (−5) + (−7)
d) (−3) + (−4)
e) (−7) + (+10)
f) (−9) + (+5)

11. Find each sum.

a) (+7) + (+9)
b) (+18) + (−18)
c) (−14) + (+14)
d) (−53) + (+55)
e) (−20) + (−20)
f) (+100) + (−105)

For help with questions 12 to 14, refer to Example 2.

12. Find each sum. Use integer chips or a number line if you need them.

a) (–2) + (–3) + (–5)
b) (–6) + (+4) + (+7)
c) (+8) + (+2) + (–5)
d) (+7) + (+6) + (–13)
e) (–10) + (–7) + (+5)
f) (–21) + (+17) + (–16)
g) (+15) + (–5) + (+18)
h) (–3) + (–4) + (+29)

Apply

13. Represent each situation as the sum of two integers. Find the result.

a) Kajan owed $20 and then he earned $15 cutting lawns.
b) The Rockets basketball team scored 89 points but they had 95 points scored against them.
c) Sylvie parked 3 floors below ground level and then took the elevator up 10 floors.
d) The kite rose 83 m but then dropped 23 m.

14. Describe each addition statement in money terms. Find and interpret each sum.

a) (+6) + (–5)
b) (–10) + (–20)
c) (–12) + (+8)
d) (+50) + (–20)

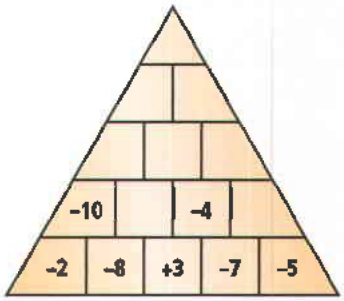
15. The sum of two integers is –3. What are the integers? Give three possible answers.

16. The sum of two integers is –8. What are the integers? Give three possible answers. Compare your answers with a classmate.

17. Write an integer addition expression for each situation. Then, find the sum.

a) The temperature is 12°C and then drops 15°C.
b) Last season, when Jason was on the ice, 25 goals were scored by his team and 32 goals were scored by the other team.
c) An elevator goes up 18 floors and then down 11 floors.

18. Copy and complete the pyramid. What number belongs in the top triangle?



19. Stephanie made up a coding system using integers.

A	B	C	D	E	F	G	H	I
–12	–11	–10	–9	–8	–7	–6	–5	–4

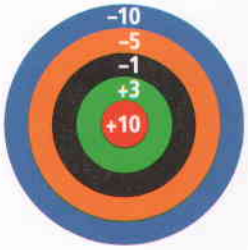
J	K	L	M	N	O	P	Q	R
–3	–2	–1	0	+1	+2	+3	+4	+5

S	T	U	V	W	X	Y	Z
+6	+7	+8	+9	+10	+11	+12	+13

To code a word she adds the value of each letter. For example, ME = 0 + (–8), or –8. Use her code to find the value of each of the following names.

a) VY
b) DON
c) PAT
d) ZACK
e) LENA
f) *your* name

20. In a darts game, each ring is given a positive or a negative score.



Ring	Colour	Value
Centre	Red	+10
First	Green	+3
Second	Black	−1
Third	Orange	−5
Outer	Blue	−10

Each player throws four darts. Find each person's score if their darts land as follows.

a) Jack: green, blue, black, green
b) Fiona: blue, black, black, red
c) Rohan: orange, orange, orange, blue
d) Anika: red, green, blue, black
e) Who won this round? Explain.

Try This!

21. Make up a situation or puzzle that involves integer addition. Provide a solution.

Extend

22. Refer to question 21. If Mona scored a total of 0 points, where did her four darts land? Provide three possible solutions.

23. In a magic square, each row, column, and diagonal has the same total.

a) Place the numbers −4, −3, −2, −1, 0, +1, +2, +3, and +4 in a three-by-three magic square so that the magic sum is zero.
b) Another three-by-three magic square has −9 as its magic sum. What nine numbers should be used, and where should they be placed?

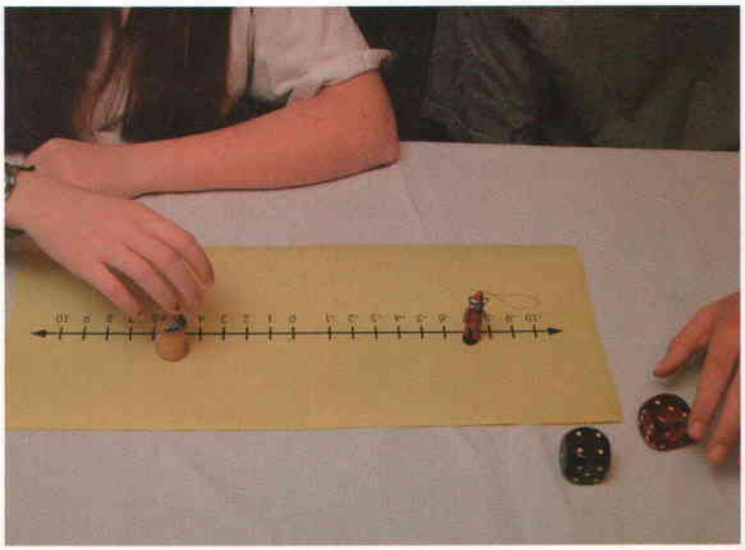
Making Connections

Materials

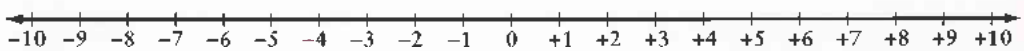
- two different-coloured dice (one for positive numbers, one for negative numbers)
- position markers (e.g., coin, button, eraser)
- a number line clearly labelled from −10 to +10

Integer Game

- Each player places a marker on any integer between −6 and +6.
- Take turns rolling the dice and adding the two integers represented. For a positive sum, the player moves that many steps to the right. For a negative sum, the player moves that many steps to the left.
- The first player to reach either end of the number line wins the game.



Play the game with a partner. Is there a best place to start from? Explain.



11.4 Explore Integer Subtraction

Focus on...
- identifying when to subtract integers
- using integer chips to model subtraction of integers

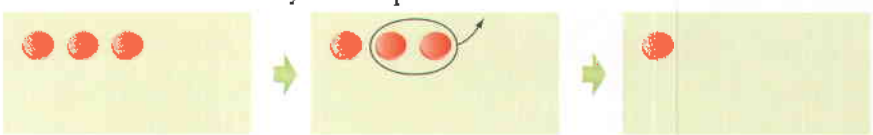
What is the difference in the temperatures shown on the thermometer? What is another situation where you need to subtract integers?

Discover the Math

Materials
- 20 chips (10 of one colour and 10 of another colour)

How can you model subtraction using integer chips?

1. Subtraction can be described as taking away. What integer subtraction is modelled by the steps shown?



2. Use integer chips to demonstrate each subtraction.

a) $(+4) - (+3)$ **b)** $(-4) - (-2)$ **c)** $(-4) - (-4)$

3. **a)** Try to demonstrate (+2) – (+5). What happens?

b) Remember that each pair of opposite chips is zero. Add zero pairs until you have enough red chips to be able to take away 5. These steps are shown below.

How does adding three zero pairs help? Finish the subtraction. What is the result of (+2) – (+5)?

c) Describe, in words, the strategy used to model (+2) – (+5). Why do you need to add 3 red and 3 blue chips in the second step?

4. Use your strategy from step 3 to model each subtraction.

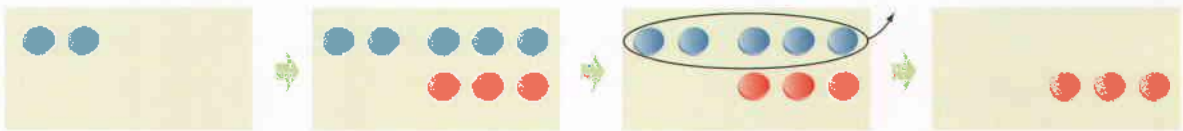
a) (+2) – (+6)

b) (+3) – (+4)

c) (+1) – (+3)

5. **a)** Try to demonstrate (–2) – (–5). What happens?

b) The following steps show how to model (–2) – (–5).



c) Describe the strategy used.

6. Use your strategy from step 5 to subtract.

a) (–1) – (–3)

b) (–3) – (–4)

c) (–2) – (–3)

7. **a)** Use integer chips to model (–2) – (+5). What strategy did you use?

b) Use integer chips to model (+2) – (–5). What strategy did you use?

8. Use your strategies to subtract.

a) (–1) – (+6)

b) (–3) – (+4)

c) (+4) – (–3)

9. **Reflect** Summarize how to model subtraction using integer chips. When do you need to add zero pairs? How do you determine how many zero pairs you need to use?

Example: Use Integer Chips to Subtract Integers

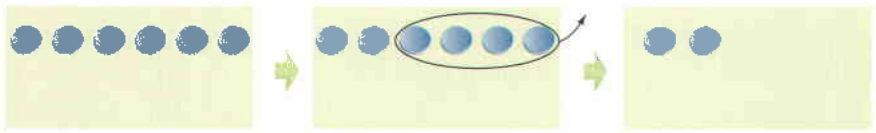
Use integer chips to find each difference.

a) $(-6) - (-4)$ **b)** $(-2) - (-7)$

c) $(+4) - (-2)$ **d)** $(-3) - (+1)$

Solution

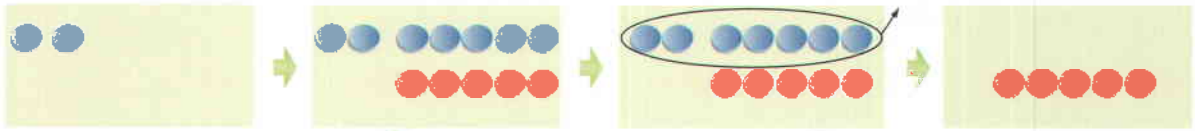
a)



To subtract (–4), remove 4 blue chips.

$(-6) - (-4) = -2$

b)



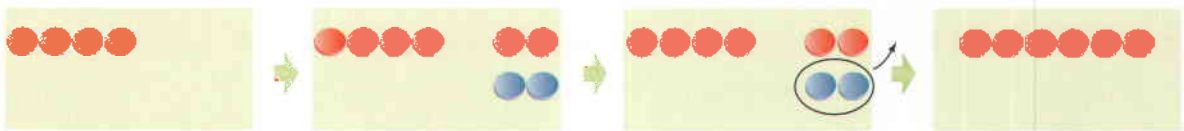
There are not enough blue chips to take away 7 of them.

Add zero pairs until you can take away 7 blue chips. Add 5 blue and 5 red chips.

To subtract (–7), remove 7 blue chips.

$(-2) - (-7) = +5$

c)



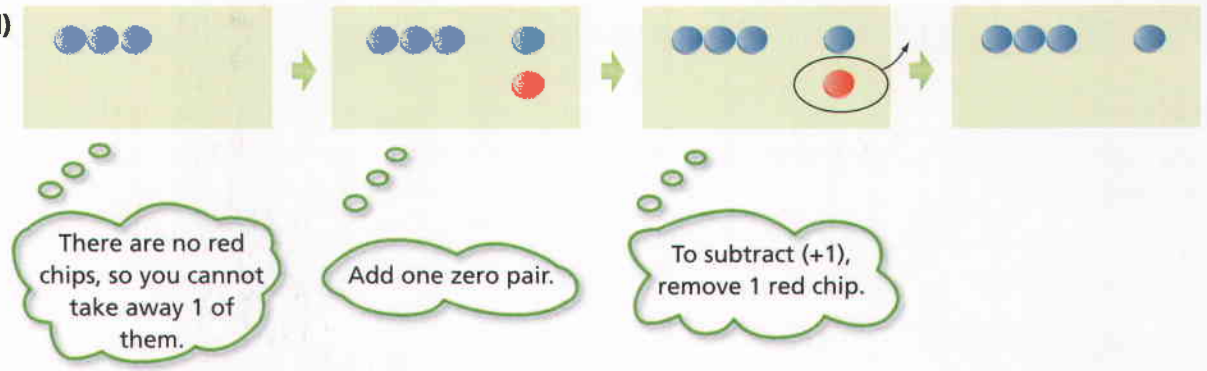
There are no blue chips, so you cannot take away 2 of them.

Add two zero pairs.

To subtract (–2), remove 2 blue chips.

$(+4) - (-2) = +6$

d)



$(-3) - (+1) = -4$

Key Ideas

- When using integer chips to model subtraction of integers, you may need to add extra chips.
  - If so, add the same number of positive and negative chips. You can do this because you are adding zero pairs.
  - Then, take away the appropriate number of chips to represent the subtraction.
  - The chips remaining represent the final result.

Communicate the Ideas

1. To model $(+3) - (-3)$, Theo places 3 red chips on the desk. To subtract (-3), he knows he must take away 3 blue chips. What should his next step be?

2. Kelly used the steps shown to model $(-5) - (+3)$. What should her next step be?

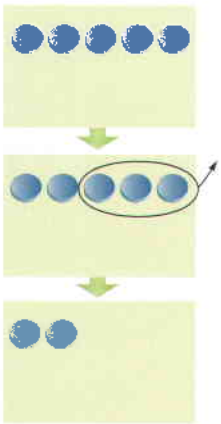
Check Your Understanding

Practise

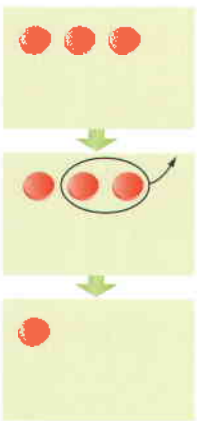
For help with questions 3 to 7, refer to the Example.

3. Write the subtraction statement that is modelled by each sequence.

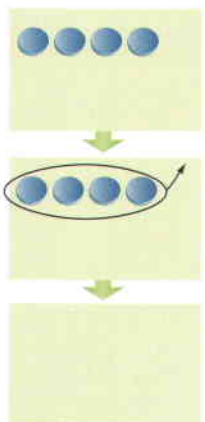
a)



b)

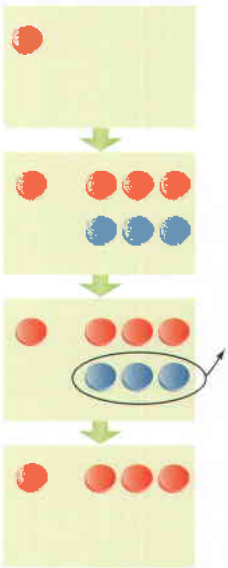


c)

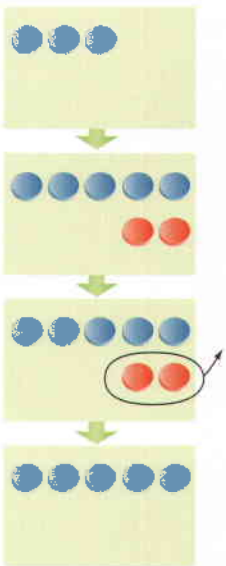


4. Write the subtraction statement that is modelled by each sequence.

a)



b)



5. Use integer chips to model each subtraction statement.

a) $(+9) - (+5)$
b) $(-3) - (-1)$
c) $(-4) - (+8)$
d) $(+3) - (-2)$

6. Find the result of each subtraction.

a) $(+5) - (+10)$
b) $(-5) - (+10)$
c) $(+5) - (-10)$
d) $(-5) - (-10)$

7. Find each result. Use integer chips if necessary.

a) $(+6) - (+8)$
b) $(+3) - (+7)$
c) $(-2) - (+5)$
d) $(-4) - (+4)$
e) $(+6) - (-3)$
f) $(-5) - (-2)$

8. Find each result.

a) $(+4) - (-6)$
b) $(-10) - (+4)$
c) $(+1) - (-9)$
d) $(-4) - (-12)$
e) $(+10) - (-5)$
f) $(+9) - (+11)$

9. Which expressions can you simplify mentally? Find each result, using integer chips when necessary.

a) $(-2) - (-9)$
b) $(+7) - (+3)$
c) $(+4) - (-9)$
d) $(-6) - (-2)$
e) $(+3) - (+8)$
f) $(-1) - (-1)$

Apply

10. Write each situation as an integer subtraction statement. Then, model it using integer chips. Interpret the result.

a) The temperature was 4°C, but it fell by 8°C.
b) A slug climbed 2 m, but then fell 3 m.
c) Waleed borrowed $7, but paid off a previous debt of $5.

11. Does $(-3) - (-5)$ give the same result as $(-5) - (-3)$? Explain using words and diagrams.

12. Using any of the integers +2, −2, +7, and −7, two at a time, list all the subtraction statements that result in a difference of −5.

13. The table shows the high and low temperatures one day in six cities.

City	High (°C)	Low (°C)
Vancouver	+8	−1
Edmonton	−5	−10
Ottawa	+3	−5
Trois-Rivières	0	−7
Fredericton	−3	−5
Saint John	−2	−9

a) Find the temperature difference for each city.
b) Which city had the greatest change in temperatures?
c) Which city had the least change in temperatures?

14. Which is greater, $(-2) - (+5)$ or $(+5) - (-2)$? Explain using words and diagrams.

Extend

15. Use the four integers −3, −5, +4, and +7, and the addition or subtraction operation, to write an expression that has each result.

a) +5
b) −19

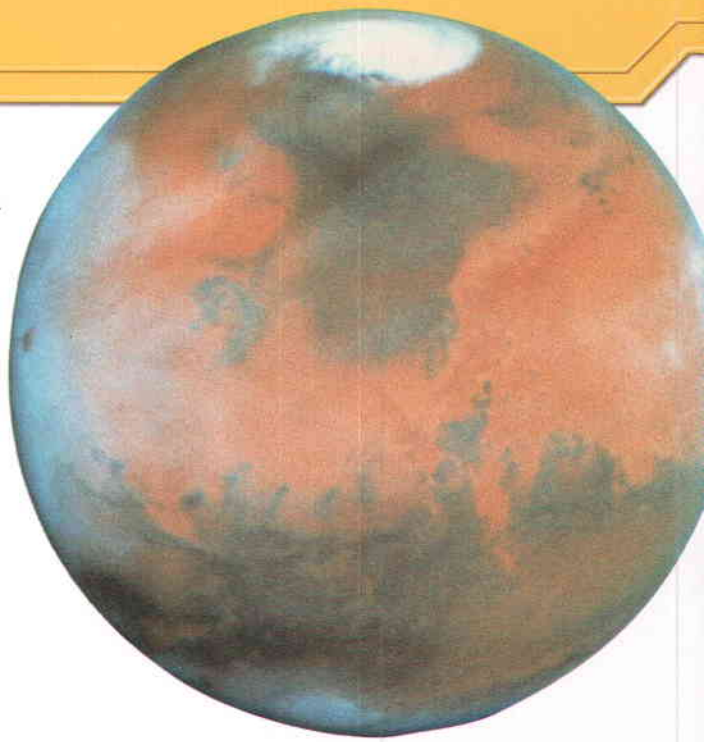
16. a) Evaluate each integer expression. Describe the pattern in the results.
$(-1) - (-2) =$ ■
$(-1) - (-2) - (-3) =$ ■
$(-1) - (-2) - (-3) - (-4) =$ ■
$(-1) - (-2) - (-3) - (-4) - (-5) =$ ■

b) What is the result of $(-1) - (-2) - (-3) - \ldots - (-15)$?

11.5 Extension: Subtracting Integers

Focus on...
- subtracting integers
- comparing subtraction and addition of integers

Temperatures in space can be much hotter or colder than on Earth. The mean temperature on Earth is 15°C. The mean temperature on Mars is –63°C. What is the difference between the mean temperatures on Earth and on Mars?

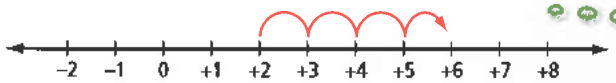


Discover the Math

Materials
- 20 chips (10 of one colour and 10 of another colour)

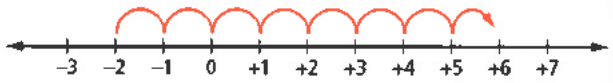
Is there another way to subtract integers?

1. You know that 6 – 2 = 4. You can show this difference on a number line.



From 2 to 6 is 4 steps to the right.
6 – 2 = +4.

You can also use a number line to find (+6) – (–2).



a) Why do you start counting steps from –2?
b) How many steps is it from –2 to +6? Which direction are you moving?
c) What is the result of (+6) – (–2)?

2. The difference (–5) – (–1) is shown on the number line.

a) Why do you start counting steps at (–1) and end at (–5)?
b) How many steps is it? In which direction?
c) What is the result of (–5) – (1)? Check using integer chips.

3. The difference (–2) – (+3) is shown on the number line.

a) Why do you start counting steps at (+3) and end at (–2)?
b) How many steps is it? In which direction?
c) What is the result of (–2) – (+3)? Check using integer chips.

4. Use integer chips or a number line to find each difference and each sum. What patterns do you see?

	Difference	Sum
a)	(+7) – (+3)	(+7) + (–3)
b)	(–5) – (–5)	(–5) + (+5)
c)	(–4) – (+6)	(–4) + (–6)
d)	(–2) – (–3)	(–2) + (+3)
e)	(+6) – (–1)	(+6) + (+1)

5. **Reflect** Describe another way to subtract an integer, by using a related sum. Provide two examples of your own to show how the method works.

Example 1: Find Differences

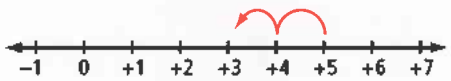
Find each difference in two ways.
- using a number line
- by adding the opposite

a) (+3) – (+5) b) (+2) – (–4) c) (–2) – (+3)

Solution

Method 1: Use a number line

a)

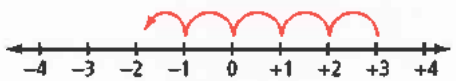


(+3) – (+5) = –2

b)

(+2) – (–4) = +6

c)



(–2) – (+3) = –5

Method 2: Add the opposite.

(+3) – (+5) = (+3) + (–5)
= –2

(+2) – (–4) = (+2) + (+4)
= +6

(–2) – (+3) = (–2) + (–3)
= –5

Example 2: Find Temperature Differences

The table shows the minimum temperatures on Monday and Tuesday in five cities.

a) Find the change in temperature from Monday to Tuesday for each city.

b) Which city had the greatest increase in temperature?

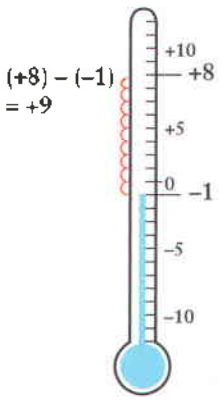
c) Which city had the greatest decrease in temperature?

City	Monday Temperature (°C)	Tuesday Temperature (°C)
Halifax	−1	+8
Saint John	−10	−5
Ottawa	+5	−3
London	−7	0
Trois-Rivières	+7	+4

Solution

a) Visualize the difference between the temperatures on the thermometer. Or, rewrite each subtraction statement as a related addition statement.

City	Change in Temperature (°C) Tuesday − Monday
Halifax	$(+8) - (-1) = (+8) + (+1)$ $= +9$
Saint John	$(-5) - (-10) = -5 + (+10)$ $= +5$
Ottawa	$(-3) - (+5) = (-3) + (-5)$ $= -8$
London	$0 - (-7) = 0 + (+7)$ $= +7$
Trois-Rivières	$(+4) - (+7) = (+4) + (-7)$ $= -3$

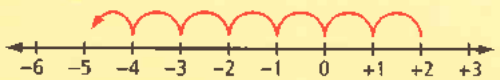


b) Halifax had the greatest increase in temperature.

c) Ottawa had the greatest decrease in temperature.

Key Ideas

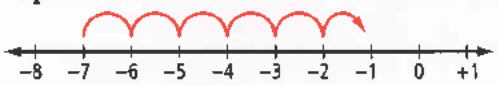
- Subtraction of integers can be modelled using integer chips or a number line.
- On a number line, the difference is the distance and direction from the second integer to the first. For example, $(-5) - (+2) = -7$.



- Subtraction of integers can be expressed as addition of the opposite integer. For example, $(-5) - (+2) = (-5) + (-2)$
  $= -7$

Communicate the Ideas

1. The number line shows (–1) – (–7). What is the result? Rewrite the expression as an addition statement. Do you get the same result?



2. The number line shows (–7) – (–1). What is the result? Rewrite the expression as an addition statement. Do you get the same result?

3. Compare and discuss the different ways you can use to find the result of (+3) – (–4). Which method do you prefer? Why?

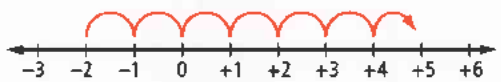
Check Your Understanding

Practise

For help with questions 4 to 7, refer to Example 1.

4. Write the opposite of each integer.
   - **a)** –2
   - **b)** +5
   - **c)** –8
   - **d)** –15
   - **e)** +12
   - **f)** –10

5. The number line shows (+5) – (–2).



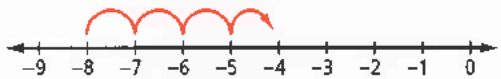
   a) What is the result?

   b) Copy and complete the related sum:

   (+5) – (–2) = (+5) + ■

   = ■

6. The number line shows (–4) – (–8).



   a) What is the result?

   b) Copy and complete the related sum:

   (–4) – (–8) = (–4) + ■

   = ■

7. Find each difference.
   - **a)** (+10) – (+6)
   - **b)** (+2) – (+9)
   - **c)** (–3) – (+11)
   - **d)** (–15) – (+2)
   - **e)** (+9) – (–3)
   - **f)** (+14) – (–6)
   - **g)** (–3) – (–7)
   - **h)** –20 – (–15)

For help with question 8, refer to Example 2.

8. Copy and complete the table to find the change in temperature for each city one January 1.

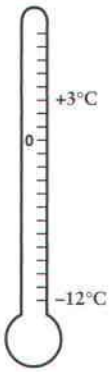
City	Day's High (°C)	Day's Low (°C)	Change (°C) (Low – High)
Kingston	+3	–8	
Kenora	–10	–18	
Sudbury	–15	–22	
Oshawa	0	–11	

9. Add or subtract as indicated.
   - **a)** (+2) + (–3)
   - **b)** (–9) – (+5)
   - **c)** (+5) – (+9)
   - **d)** (+8) – (+9)
   - **e)** (–1) + (–7)
   - **f)** (+2) – (+8)
   - **g)** (–6) – (–5)
   - **h)** (+5) – (–4)

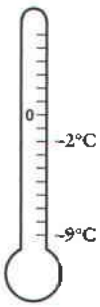
Apply

10. Each thermometer has two temperatures shown. Write each as a subtraction statement. Subtract the lower temperature from the higher temperature.

a)



b)



11. Find the missing integer in each.

a) $-6 - \blacksquare = -9$ **b)** $-2 - \blacksquare = 3$
c) $5 - \blacksquare = -7$ **d)** $7 - \blacksquare = -9$
e) $-4 - \blacksquare = 0$ **f)** $\blacksquare - 3 = -7$
g) $\blacksquare - (-5) = 6$ **h)** $\blacksquare - (-10) = 5$

12. The main part of a home refrigerator should be kept at +3°C. The freezer part should be −17°C. How much colder is it in the freezer compartment?

13. Write each of the following as an integer subtraction statement. Give the outcome of each statement.

a) Tekesha deposited $8, and then wrote a cheque for $15.
b) The temperature was −8°C, and then dropped by 15°C.
c) A gain of 4 points was followed by a loss of 7 points.
d) Yan dived to 5 m below sea level, then dove a further 4 m.
e) Jo's mother lost $100 on the stock market, then lost another $600.
f) Muhammad owed $20, but his friend reduced the debt by $5.

14. Write a situation describing each subtraction statement, similar to those in question 13. Use a different type of situation for each.

a) $(-40) - (+25)$ **b)** $(+10) - (+12)$
c) $(+15) - (-8)$ **d)** $(-6) - (-2)$

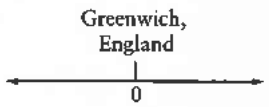
15. Evaluate.

a) $(+6) - (+13) - (-15)$
b) $(-12) - (+12) - (-12)$
c) $(+15) - (+20) - (+25)$
d) $(-34) - (-24) - (+10)$

16. Time zones are often listed as GMT + or − a number of hours. GMT stands for Greenwich Mean Time, which refers to Greenwich, in England. The table gives the time zone references for four cities.

City	Time Zone
Charlottetown, PE	−4
Rainy River, ON	−6
Beijing, China	+8
Tel Aviv, Israel	+2

a)



Copy and extend the number line to show the position of the four cities.
b) If it is 6:00 p.m. in Tel Aviv, what time is it in Beijing?
c) If it is 3:00 a.m. in Rainy River, what time is it in Tel Aviv?
d) If it is 11:30 p.m. in Beijing, what time is it in Charlottetown?
e) If it is 10:45 a.m. in Rainy River, what time is it in Beijing?

Did You Know?

China is almost as large as Canada and should have five time zones. However, all of China uses the same time.

Chapter Problem

17. One day the wind speed is light, at 10 km/h. However, the temperature is falling. The chart shows the change in wind chill values.

Wind Chill Chart

Wind Speed (km/h)	Air Temperatures (°C)							
	5	0	−5	−10	−15	−20	−25	−30
10	3	−3	−9	−15	−21	−27	−33	−39

a) When the wind speed is 10 km/h and the air temperature is −15°C, what is the wind chill value?

b) Find the change in the wind chill values when the air temperature falls from 0°C to −15°C.

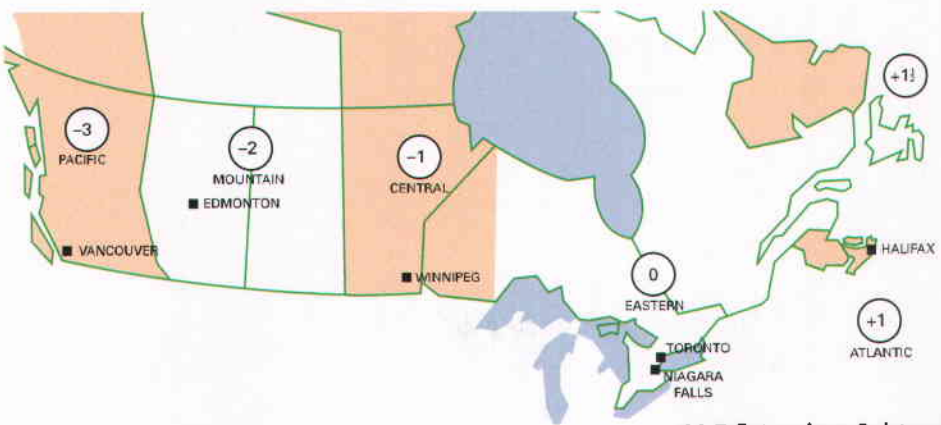
c) Look across the row of wind chill values. Describe the pattern.

18. Canada is so large that it has several time zones. The map shows how time changes relative to Eastern Standard Time. For example, when it is noon in Toronto, it is one hour earlier, or 11 a.m., in Winnipeg, Manitoba.

a) How does the time in Vancouver compare to the time in Ontario? When it is noon in Toronto, what time is it in Vancouver?

b) How does the time in Halifax compare to the time in Ontario? When it is 9 a.m. in Niagara Falls, what time is it in Halifax?

c) How does the time in Edmonton compare to the time in Halifax?



Try This!

19. Which is less (−7) − (+3) or (+3) − (−7)? Explain using diagrams.

Extend

20. Use the time zone map in question 18. Tina lives in Kingston, Ontario. It is noon on Thursday. Tina needs to talk to her uncle in Vancouver as soon as possible. She knows that he leaves for work at 8 a.m. and usually returns home at 6 p.m. What would be a good time for Tina to phone her uncle? Explain your reasoning.

21. You are in charge of keeping track of the financial records for your student council. You thought the student council had $50 in its account. When you checked your records, you found that the student council owed $50. This is recorded as −$50.

a) What is the difference in the two amounts?

b) Explain the error you could have made.

22. a) Write −14 as the sum of four consecutive numbers.

b) Write −14 as the difference of four consecutive numbers.

c) Are the numbers you used in part a) the same or different from those in part b)? Explain.

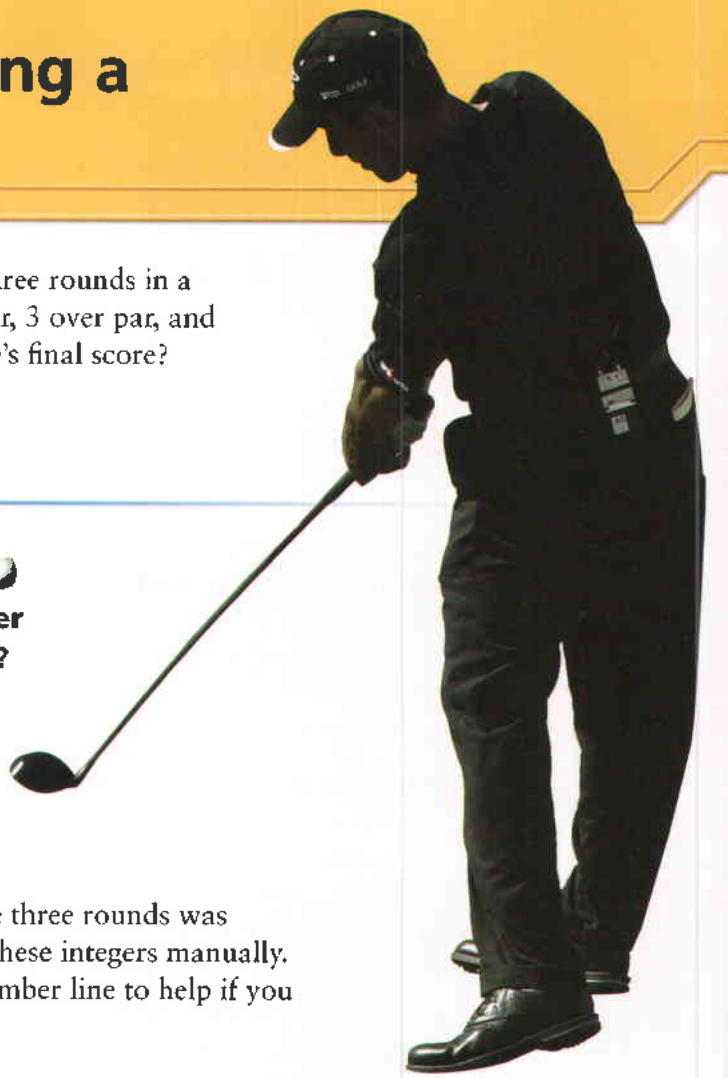
Did You Know?

Earth rotates once every 24 h. In 1 h, Earth turns through 360° ÷ 24 or 15°. Vancouver is 123°W and Halifax is 63°W, so the cities are 60° apart. When the sun rises in Halifax, it will not be seen until 4 h later in Vancouver. This is the idea behind time zones.

11.6 Integers Using a Calculator

Focus on...
- adding and subtracting integers using a calculator

Mike Weir's scores for the three rounds in a tournament were 2 under par, 3 over par, and 5 under par. What was Mike's final score?



Discover the Math

How can you find integer sums using a calculator?

Your calculator may have a (−) key or a +/− key that you can use to enter negative numbers.

1. Mike Weir's score for the three rounds was $(-2) + (+3) + (-5)$. Add these integers manually. Use integer chips or a number line to help if you need to.

2. Check the sum using a calculator.
   - If your calculator has a +/− key, use
     C 2 +/− + 3 + 5 +/− =
   - If your calculator has a (−) key, use
     C (−) 2 + 3 + (−) 5 =

3. **Reflect** Write brief notes to remind yourself how to enter negative integers on the calculator that you use.

Literacy Connections

Reading Positive Integers

Whenever you see a number with no sign in front of it, the number is positive. Similarly, a calculator assumes that a number entered is positive. You use the +/− or (−) key to tell the calculator that a number is negative.

Did You Know?

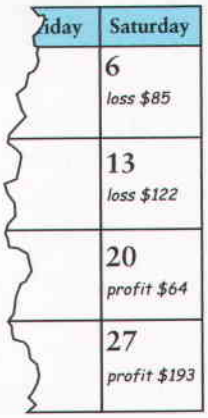
In golf, *par for the course* means the average number of strokes needed by an expert golfer to complete the round.

Example: Combine Profit and Loss

Zack operates a booth every Saturday at a flea market. For the first four weeks, he noted his profit or loss on a calendar.

a) Express Zack's overall profit and loss for the four weeks as an integer expression.

b) Use a calculator to find his overall profit or loss. Use estimation to check that your answer is reasonable.



Solution

a) (–85) + (–122) + 64 + 193

b) C 85 +/– + 122 +/– + 64 + 193 = 50

Estimate: (–85) + (–122) ≐ –200 and 64 + 193 ≐ 250

–200 + 250 = 50

The calculator answer is reasonable.

Zack's overall profit was $50.

Key Ideas

- Calculators can be used to help simplify integer expressions.
- Calculator keystrokes vary. To check how to enter negative integers on your calculator, use a simple sum that you can answer in your head.

Communicate the Ideas

1. Write the calculator keystrokes you would use to evaluate (–45) + 17 – (–12).

2. Which of the following would you do in your head and which would you use a calculator for? Explain your choice.

a) (–3) + (–2)

b) –42 + 44

c) 571 + (–363) – (–210)

3. To simplify longer integer sums, David rearranges them so that all the positives come first and then all the negatives. How would this method help? How would you apply his method to evaluate (–11) + 23 + 79 + (–18)?

Check Your Understanding

Practise

4. Use integer chips or a number line to model each sum. Use a calculator to check the results.

a) $(+3) + (-8)$ **b)** $(-2) + (-7)$
c) $(-5) + 12$ **d)** $16 + (-4)$

5. Use integer chips or a number line to model each difference. Use a calculator to check the results.

a) $(-5) - (-6)$ **b)** $11 - (-5)$
c) $(-1) - 4$ **d)** $-7 - (-7)$

6. Decide which of the following can be done without a calculator. Use a calculator where necessary to help evaluate each expression.

a) $6 + 10 - 18$
b) $(-3) - 7 + 4$
c) $(-1) - (-6) + 6$
d) $(-3) - 3 - 3 - 3 - 3 - 3$
e) $11 - 17 + 12 - 18$
f) $200 - 150 - 250 + 100 + 100$
g) $18 + (-20) - (-9) - 10$
h) $500 + 200 - 700 - (-300)$

7. Evaluate each expression.

a) $134 - 218 - (-317)$
b) $45 + (-47) - (-23) - 61$
c) $(-52) - 41 - (-17) + 19$
d) $(-122) + (-141) - 78 + 89$
e) $(-49) - 49 - 49 - 49$
f) $32 - (-16) + 48 - (-136)$

Apply

8. Write an integer expression to represent the overall results of each situation. Find each result using an appropriate tool.

a) Sam's bank balance was \$70. Then, he wrote a cheque for \$13 and a cheque for \$22.
b) Barbara borrowed \$4 from her mom and \$9 from her dad. She repaid \$10 of what she owed to her brother.
c) Sarah gained 5 points in a trivia game. She gained another 15 points before losing 25 points.
d) Wayne's plus/minus ratings in four games during a hockey tournament were +3, –4, +2, and –1.

9. Start with 1, subtract 2, add 3, subtract 4, add 5, and so on. Describe the pattern that results after each step.

10. Find the missing numbers. Explain your strategy.

a) $-2 + 7 - \blacksquare = -10$
b) $3 + \blacksquare + 4 = -6$
c) $5 - \blacksquare - 8 = -15$
d) $\blacksquare + 12 - 8 = -9$
e) $-14 - 3 - \blacksquare = 17$
f) $\blacksquare - 10 + 15 = 0$

11. Lori Kane is another famous Canadian golfer. Her scores in a tournament were 2 over par, 4 under par, 3 under par, and 5 under par. What was Lori's final score?

12. On a TV game show, contestants can win or lose money depending on whether they answer questions correctly or incorrectly. Tasneem played in a round against Yvonne and their results were as follows.

Tasneem: –\$100, –\$200, +\$50, +\$100, –\$300, +\$400, –\$500
Yvonne: +\$50, +\$100, –\$50, –\$200, +\$300, +\$350, –\$500, +250.
Who finished with the higher amount?

13. The integer –6 can be expressed as the sum of three consecutive numbers, $(-1) + (-2) + (-3) = -6$. Write each of the following as the sum of three consecutive numbers.

a) –12
b) –30
c) 0

14. Lizo recorded his daily profit or loss at his booth at a collector's fair.

Day 1	$320 profit
Day 2	$210 loss
Day 3	$165 loss
Day 4	$412 profit
Day 5	$382 profit

What was Lizo's overall profit or loss for the five-day fair?

15. Place the numbers –6, –5, –4, –3, –2, –1, 0, +1, and +2 into a magic square so that the sum of each row, column, and diagonal is –6.

16. The boiling points of substances vary.

liquid oxygen	–183°C
liquid nitrogen	–196°C
water	100°C
helium	–269°C
nickel	3278°C

a) How much colder is the boiling point of liquid nitrogen than that of liquid oxygen?
b) How much hotter is the boiling point of nickel than that of liquid nitrogen?
c) How much hotter is the boiling point of nickel than that of liquid oxygen?
d) How much colder is the boiling point of helium than that of water?

17. The table shows the temperature records.

	Canada	World
High temperature	45°C at Midale, Saskatchewan	58°C at Al'azizyal, Libya
Low temperature	–63°C at Snag, Yukon	–89°C at Vostok, Antarctica

a) What is the difference between the coldest world temperature and the coldest Canadian temperature?
b) How much greater is the record high temperature than the record low temperature, for Canada?

18. The table shows the profit or the loss of six companies at the end of two different years.

Company	Year 1 ($)	Year 2 ($)	Change ($) (Year 2 – Year 1)
Integers & Co.	230 000	212 000	
Geometry, Inc.	4 500 000		–5 500 000
Algebra, Ltd.	–50 000	–140 000	
Measures R Us	–150 000		60 000
Fractions, Ltd.		–41 500	–10 500

a) Copy and complete the table.
b) Rank the companies from the one with the greatest profit to the one with the greatest loss in year 1.

Extend

19. How do the results of the following expressions compare? What rule can you make about combining addition and subtraction of integers?

a) $2 - 3 + 4$ **b)** $2 + 4 - 3$
c) $4 + 2 - 3$ **d)** $-3 + 2 + 4$
e) $2 + (-3) + 4$ **f)** $4 + 2 - (+3)$

20. The nightly low temperatures one week in Fredericton, New Brunswick, were 4°C, –5°C, –2°C, 6°C, 3°C, –4°C, and –9°C. What was the mean nightly low temperature? Explain your solution.

CHAPTER 11

Review

Key Words

1. Match each term with an example.

Term	Example
a) positive integers	A -1 and -2
b) negative integers	B $(+1) + (-1) = 0$
c) opposite integers	C $+2$ and -2
d) zero principle	D $+1$ and $+2$

11.1 Compare and Order Integers, pages 346–351

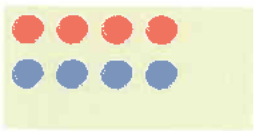
2. Use words, then one of the symbols $>$, $<$, or $=$, to compare the integers in each pair.
   a) $+3, -5$
   b) $-7, +7$
   c) $-6, -10$
   d) $0, -18$

3. a) Show the following integers on a number line.
   $-5, +2, 0, +8, -10, -3, -2, -8$
   b) List the integers in order, from least to greatest.

11.2 Explore Integer Addition, pages 352–355

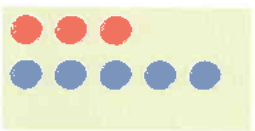
4. What integer sum is modelled? Give each result.

a)



b)

c)



5. Write an integer sum to represent each situation. Model the sum using integer chips. Interpret the result.
   a) A stock gained \$9, then lost \$3.
   b) The temperature was -8°C. Then, it increased by 6°C.
   c) Elizabeth's golf scores, for two rounds, were 3 over par and 4 under par.
   d) Keith earned \$7, but owed \$10 to his friend.
   e) Sunita counted 6 votes in favour and 8 votes against a candidate for student council.

11.3 Adding Integers, pages 356–361

6. Use a number line to find each sum.
   a) $(-4) + (-6)$
   b) $(+5) + (-5)$
   c) $(-7) + (+9)$
   d) $(+2) + (-9)$
   e) $(-12) + (-3)$

7. Ashraf has \$150 in his bank account. He owes \$45 to his sister, \$25 to his brother, and \$70 to his friend. How much money does he have to save, if he needs \$400 to buy a bike? Justify your answer.

8. What is the missing integer in each pattern?
   a) $-6, -3, \blacksquare, +3, +6, \ldots$
   b) $-11, -8, -5, \blacksquare, +1, \ldots$
   c) $-22, -17, -12, -7, \blacksquare, +3, \ldots$
   d) $-10, -6, -2, \blacksquare, +6, \ldots$
   e) $0, -7, \blacksquare, -21, -28, -35, \ldots$

11.4 Explore Integer Subtraction, pages 362–367

9. Find each result. Use integer chips, if necessary.

a) $(-5) - (-3)$ **b)** $(-3) - (+7)$
c) $(+4) - (+9)$ **d)** $(+6) - (-2)$

10. Does $(-2) - (+5)$ give the same result as $(+5) - (-2)$? Explain why using words and pictures.

11.5 Extension: Subtracting Integers, pages 368–373

11. $(+7) - (-5)$ gives the same result as $(+7) + (+5)$. Explain why using words and pictures.

12. Find each difference. Use integer chips or a number line, if necessary.

a) $(+8) - (+12)$ **b)** $(-5) - (+9)$
c) $(-6) - (+2)$ **d)** $(+6) - (-7)$
e) $(-20) - (-12)$ **f)** $(+15) - (+25)$

13. Find the missing integer in each.

a) $(+3) - \blacksquare = -7$
b) $-8 - \blacksquare = +2$
c) $\blacksquare - (+4) = +5$
d) $\blacksquare - (-1) = -4$

14. Evaluate.

a) $(+16) - (+10) - (+17)$
b) $(-5) - (-2) - (+8)$

15. Jenna's plus/minus ratings for her first six games of the hockey season were +1, –3, –2, +2, +1, and +2. What was Jenna's overall plus/minus rating?

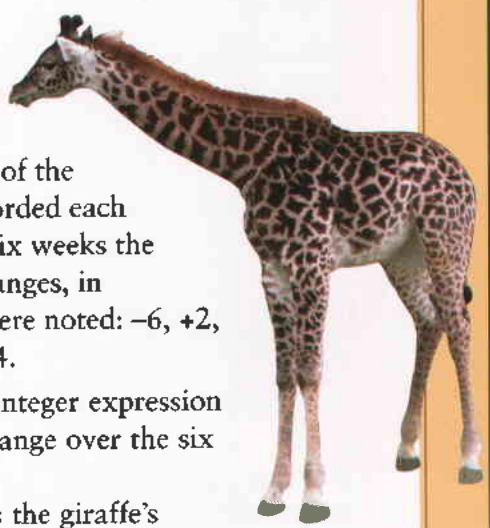
11.6 Integers Using a Calculator, pages 374–377

16. The table shows the elevations, relative to sea level, of six places.

Place	Elevation (m)
Death Valley, California	–86
Dead Sea, Israel/Jordan	–411
Valdez Peninsula, Argentina	–40
Lake Assal, Djibouti	–156
Mt. Everest, Tibet/Nepal	8863
Mt. Kilimanjaro, Tanzania	5895

a) What is the difference between the elevations of Death Valley and the Valdez Peninsula?
b) What is the difference between the elevations of Mt. Kilimanjaro and Lake Assal?
c) What is the difference between the highest and lowest elevations?

17. The zoo veterinarian suspects that a giraffe is ill. The mass of the giraffe is recorded each week. Over six weeks the following changes, in kilograms, were noted: –6, +2, +3, –4, –7, –4.



a) Write an integer expression for the change over the six weeks.
b) What was the giraffe's overall change in mass?

CHAPTER 11

Practice Test

Strand	NSN	MEA	GSS	PA	DMP
Questions	1–12			1–10	12

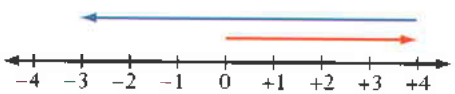
Multiple Choice

For questions 1 to 8, select the correct answer.

1. Which statement compares –3 and +2 correctly?

A –3 > +2
B +2 < –3
C –3 < +2
D None of these.

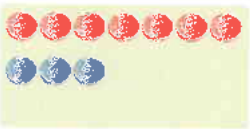
2.



The number line models

A a profit of $4 followed by a loss of $4
B a profit of $4 followed by a loss of $7
C a loss of $3 followed by a profit of $4
D a loss of $7 followed by a loss of $3

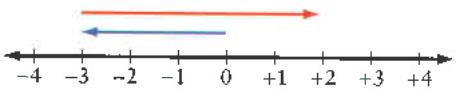
3.



The sum that is modelled is

A (+7) + (–3)
B (–7) + (–3)
C (+3) + (+7)
D (–7) + (+3)

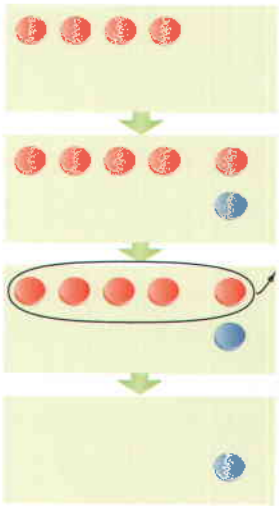
4.



The sum that is modelled is

A (–3) + (+2)
B (–3) + (–5)
C (+2) + (+5)
D (–3) + (+5)

5.



The subtraction that is modelled is

A (–4) – (–5)
B (–5) – (–4)
C (+4) – (+5)
D (–4) + (–5)

6. The result of (–10) + (+3) is

A –13
B –7
C +3
D +7

7. Which of the following does not have a result of 0?

A (–6) + (+6)
B (+6) – (–6)
C (–6) – (–6)
D (+6) – (+6)

8. The result of (–2) – (–8) is

A –10
B –6
C +6
D none of the above

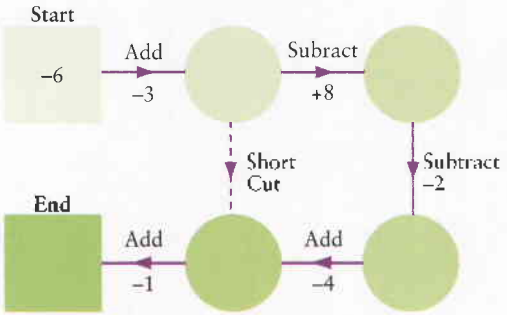
Short Answer

9. Evaluate. Use integer chips or a number line to help. Then, arrange the answers in order from least to greatest.

a) (–3) + (–6)
b) (–2) + (+7)
c) (+5) – (+12)
d) (+10) – (–6)
e) (–5) + (–5)

10. Jan went on a diving expedition in the St. Lawrence River. She went down 1 m every 2 s. The surface of the river is at an elevation of 8 m above sea level. What was Jan's depth, relative to sea level, after 30 s?

11.



a) Follow the path to find the number that belongs in the end square.

b) What instruction belongs beside the short cut?

Extended Response

12. The table shows the temperature taken every hour one night.

Time	Temperature, °C
10:00	6
11:00	4
12:00	2
1:00	0
2:00	−2
3:00	−6
4:00	−7
5:00	−4
6:00	−2

a) Find the drop in temperature from 11:00 p.m. to 3:00 a.m.

b) Which hour had the greatest drop in temperature? What was it?

c) Which hour had the greatest increase in temperature? What was it?

d) Plot a graph of the data.

e) Describe any trends in the graph.

f) Predict the change in temperature between 6:00 a.m. and 7:00 a.m. Justify your answer.

Chapter Problem Wrap-Up

In question 18 on page 351 and question 17 on page 373 you explored some parts of the wind chill chart.

What patterns or trends can you find in the wind chill chart? Describe them using

- integers
- words
- graphs, charts, or diagrams

Wind Chill Chart

Wind Speed (km/h)	Air Temperature (°C)							
	5	0	−5	−10	−15	−20	−25	−30
5	4	−2	−7	−13	−19	−24	−30	−36
10	3	−3	−9	−15	−21	−27	−33	−39
15	2	−4	−11	−17	−23	−29	−35	−41
20	1	−5	−12	−18	−24	−31	−37	−43
25	1	−6	−12	−19	−25	−32	−38	−45
30	0	−7	−13	−20	−26	−33	−39	−46
35	0	−7	−14	−20	−27	−33	−40	−47
40	−1	−7	−14	−21	−27	−34	−41	−48
45	−1	−8	−15	−21	−28	−35	−42	−48
50	−1	−8	−15	−22	−29	−35	−42	−49
55	−2	−9	−15	−22	−29	−36	−43	−50
60	−2	−9	−16	−23	−30	−37	−43	−50

Patterning and Algebra

- Relate whole numbers and variables.
- Evaluate expressions by substituting whole numbers.
- Translate simple statements into expressions or equations.
- Solve equations and problems giving rise to them, by inspection and systematic trial.
- Realize that a solution to an equation makes the equation true.
- Write statements to interpret simple formulas.
- Present and explain solutions to patterning problems.

Number Sense and Numeration

- Explain the problem solving process in mathematical language.

Measurement

- Describe measurement concepts in measurement language.

Key Words

variable

variable expression

solution