# Data Analysis and Probability

The graph shows the world's projected population growth.

Suppose you hold a concert on Vancouver Island in the year 2010. The area of Vancouver Island is 31 285 km². If each person needs an area of 1 m², could the whole world attend your concert? Could the whole world attend in the year 2060?

Estimate the first year in which the whole world could not attend the concert. What assumptions have you made? Are your assumptions reasonable?
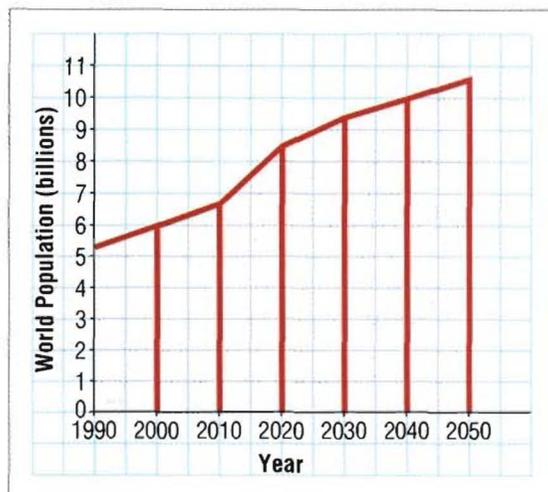
Canadian Weather Facts

The table shows the percent chance of different types of weather in some Canadian cities.

| Type of Weather	City							
	Vancouver	Edmonton	Regina	Winnipeg	Toronto	Montreal	Halifax	St. John's
January Thaw	100	96	84	54	98	98	100	100
10-cm Snowfall in January	38	17	3	27	49	81	72	84
Temperature of –20°C or Lower in Winter	0	100	100	100	89	100	76	23
April Gale	8	0	35	19	27	12	10	68
May Snowfall	0	58	43	53	9	21	44	79
June Frost	0	21	43	30	0	0	0	60
June Fog	23	41	58	50	85	69	100	100
At Least 10 Wet Days in July	21	96	51	72	40	77	68	84
Temperature of 35°C or more in Summer	0	0	64	43	32	9	0	0
September Frost	2	92	97	87	40	30	8	14
December Thunderstorm	7	0	0	7	21	11	13	11
Hail During the Year	69	83	89	82	64	68	36	25

Activity ❶

Use the table to answer these questions.

1. Which cities have the same chance of a January thaw?

2. Which city has the highest chance of a temperature of 35°C or more in summer?

3. Which city has the lowest chance of an April gale?

4. Is the chance of a December thunderstorm higher in Toronto or in Montreal?

5. Which 2 cities always get a January thaw and a June fog?

6. How many times higher is the chance of
a) a June frost in St. John's than a June frost in Winnipeg?
b) a September frost in Edmonton than a September frost in Vancouver?
c) a 10-cm snowfall in January in St. John's than a 10-cm snowfall in January in Regina?
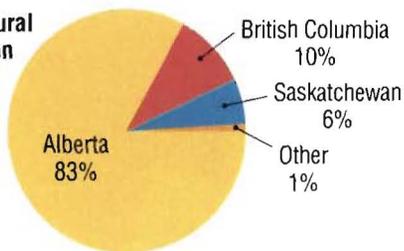
Activity ❷

Use the data in the table to write 3 more problems.
Have a classmate solve your problems.
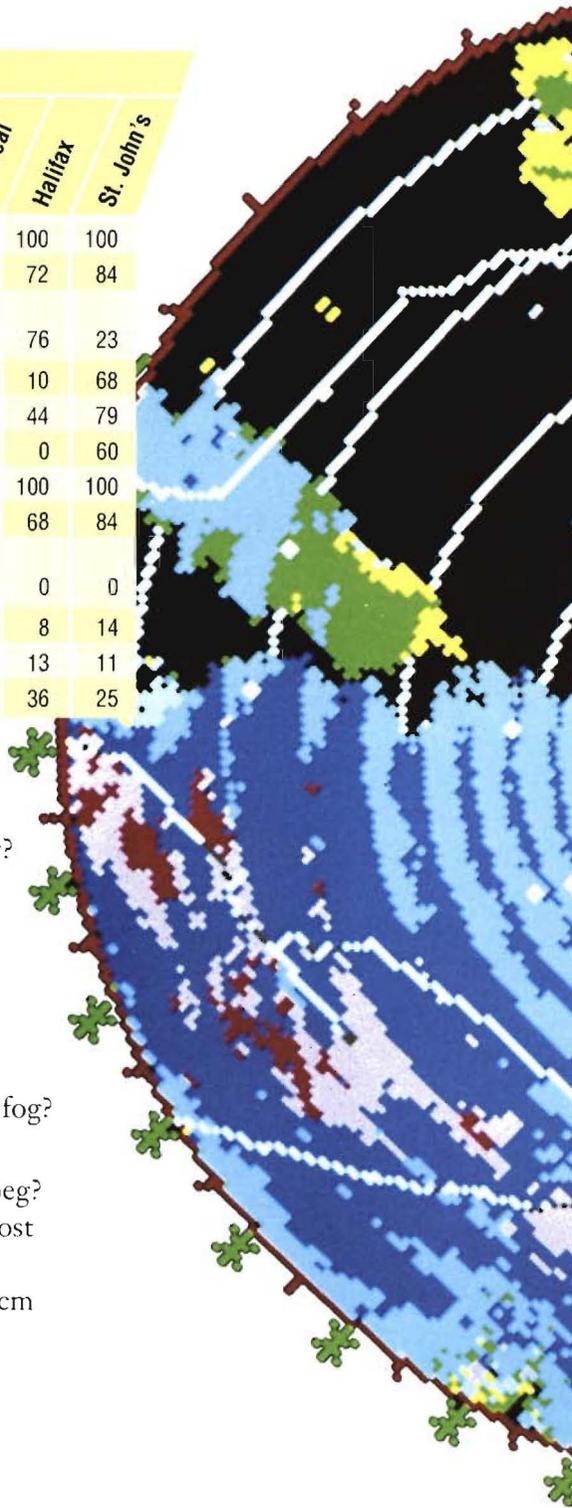
Warm Up

1. This circle graph shows data on volumes of natural gas produced in different provinces.

Canada's Natural Gas Production

- British Columbia 10%
- Saskatchewan 6%
- Alberta 83%
- Other 1%

a) Rank the provinces in decreasing order of natural gas production.

b) If approximately 100 000 000 000 m³ of natural gas are produced in Canada each year, how much is produced in Alberta? How much is produced in British Columbia and Saskatchewan together?

2. This table gives approximate distances a cheetah can run for certain lengths of time. A cheetah is able to keep up this pace for only a few hundred metres.

Time (s)	Distance (m)
1	30
2	60
3	90
4	120
5	150
6	180

a) Display the data on a line graph.
b) Describe the pattern in the graph.
c) Explain the pattern.

Multiply. Write each answer in simplest form.

3. $\frac{1}{4} \times \frac{3}{4}$ **4.** $\frac{1}{2} \times \frac{1}{6}$ **5.** $\frac{3}{8} \times \frac{1}{3}$

6. $\frac{5}{6} \times \frac{1}{4}$ **7.** $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$ **8.** $\frac{1}{3} \times \frac{3}{4} \times \frac{9}{10}$

9. $\frac{1}{10} \times \frac{3}{10} \times \frac{9}{10}$ **10.** $\frac{1}{2} \times \frac{5}{6} \times \frac{2}{3}$

Write each fraction as a percent. Round each answer to the nearest tenth, if necessary.

11. $\frac{1}{4}$ **12.** $\frac{4}{5}$ **13.** $\frac{1}{3}$ **14.** $\frac{3}{8}$ **15.** $\frac{2}{3}$ **16.** $\frac{1}{6}$

Mental Math

Calculate each product. Look for easy combinations.

1. $5 \times 2 \times 8$ **2.** $25 \times 4 \times 7$

3. $7 \times 5 \times 2$ **4.** $12 \times 4 \times 25$

5. $4 \times 6 \times 25$ **6.** $5 \times 18 \times 2$

Find each sum. Think quarters.

7. $12.75 + $8.25

8. $3.25 + $4.50

9. $2.75 + $4.50

10. $5.00 + $2.50 + $3.50

11. $6.25 + $2.75 + $5.50

12. $8.50 + $3.75 + $2.75

Find each sum. Look for sums of 50.

13. $21 + 34 + 16 + 19$

14. $27 + 35 + 23 + 10$

15. $42 + 19 + 6 + 31$

Estimate the total bill.

16. $0.69 + $1.89 + $1.49 + $0.87

17. $0.87 + $2.69 + $1.34 + $2.45

18. $2.59 + $1.89 + $5.99 + $3.49

19. $2.29 + $1.89 + $1.49 + $4.69

Estimate each product.

20. 6.02×4.07 **21.** 3.1×12.6

22. 42.8×9.8 **23.** 312×4.9

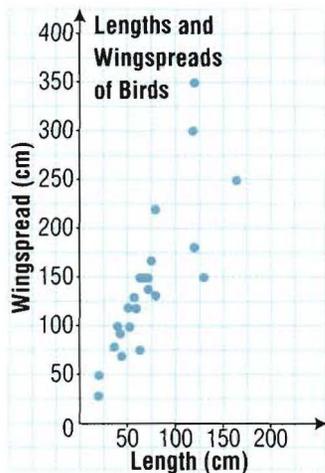*Estimate each sum.*

24. $3\frac{1}{3} + 4\frac{1}{4}$ **25.** $8\frac{2}{3} + 16\frac{1}{4}$

26. $5\frac{1}{3} + 2\frac{1}{2}$ **27.** $12\frac{3}{4} + 3\frac{3}{8}$

9.1 Reading Scatter Plots

A **scatter plot** can be used to show whether a relationship exists between two variables.

Activity: Interpret the Graph

The scatter plot shows the relationship between the lengths and wingspreads of 22 birds.

Inquire

1. a) Estimate the least wingspread shown.
b) Estimate the length of the bird with this wingspread.

2. a) Estimate the length of the bird with a wingspread close to 220 cm; 180 cm.
b) Estimate the wingspread of most birds that are about 50 cm long; 75 cm long.

3. a) Describe the pattern made by the points.
b) Describe any relationship you see between the lengths of birds and their wingspreads.
c) How does the scatter plot show this relationship?

Problems and Applications

1. The scatter plot shows the winning times for 5 races at the 1992 Olympics.
a) What was the approximate winning time for the 400-m race?
b) About how many times greater was the winning time for the 800-m race than for the 100-m race?
c) If there had been a 1000-m race, what winning time would you estimate for it?
**d)** Estimate how far a top male athlete can run in 3 min.

330
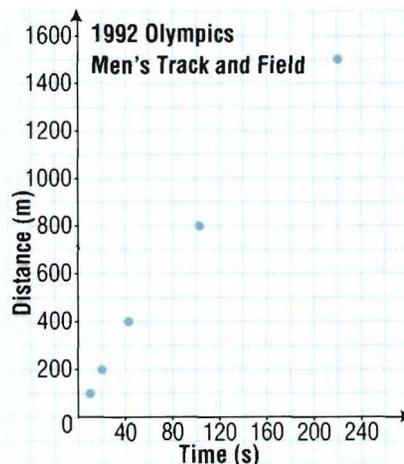
2. This scatter plot compares the masses and lengths of different kinds of bears.
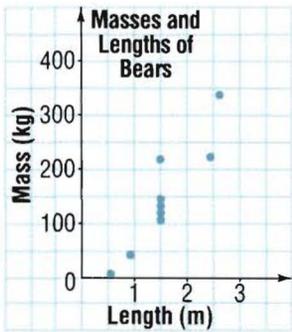
a) Estimate the length of the kind of bear that has the greatest mass.

b) What is the approximate length of the kind of bear with a mass of about 45 kg?

c) If a kind of bear had a mass of about 300 kg, about what length would you expect it to have?

d) What relationship between mass and length does the scatter plot suggest?

3. The scatter plot shows how the average temperature of the ocean changes with latitude in the southern hemisphere.
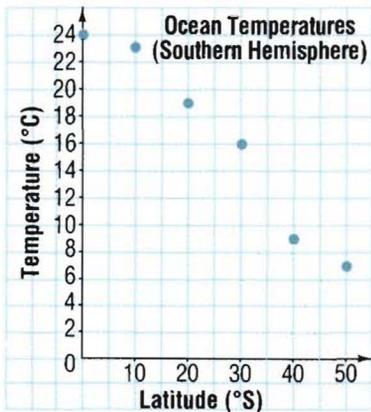
a) Describe the relationship between average ocean temperature and latitude in the southern hemisphere.

b) Estimate the average ocean temperature at a latitude of 35°S; 22°S.

c) Would you expect to see a similar relationship for the northern hemisphere? Explain.
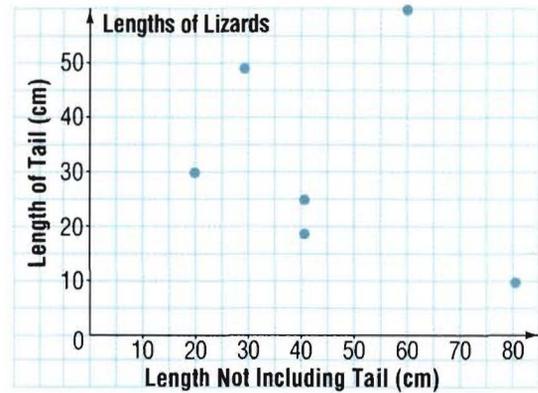
d) At what latitude is the border between the United States and Canada's Western Provinces?

e) What do you think is the average ocean temperature at this latitude? Explain.

4. The scatter plot shows the lengths of lizards, not including their tails, and the lengths of their tails.

a) Does the scatter plot suggest a relationship between the lengths of lizards and the lengths of their tails? Explain.

b) Do all scatter plots show a relationship? Explain.

5. a) How does a scatter plot show whether there is a relationship between two variables?

b) Refer to the scatter plot in question 2. Consider only the 5 points that represent kinds of bears with lengths of about 1.5 m. What relationship do these 5 points suggest between the lengths and masses of bears?

c) Is it possible for a scatter plot to mislead you about whether a relationship exists? Explain.

9.2 Drawing Scatter Plots

Activity: Study the Example

The table gives the prices of certain books in Canada and in the United States. To draw the scatter plot:

1. Draw and label the axes. Choose a scale that allows you to plot all the data.

2. Plot a point to represent the data for each book.

3. Give the graph a title.
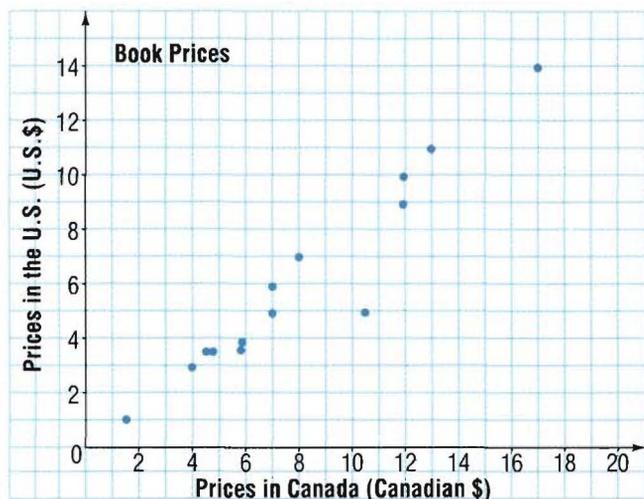
Book	Price	
	In Canada (Canadian $)	In the U.S. (U.S. $)
World's Most Amazing Puzzles	6.95	4.95
Jurassic Park	7.99	6.99
Card Games Around the World	10.50	4.95
The Big Four	4.75	3.50
Graphic and Op-Art Mazes	5.95	3.95
The Human Factor	6.99	5.99
1001 Wonders of Science	12.95	10.95
Mind-Boggling Mazes	5.75	3.50
Gold & Silver, Silver & Gold	11.95	8.95
Ransom	4.50	3.50
Solv-A-Crime Puzzles	1.50	1.00
A Brief History of Time	16.95	13.95
Sports Almanac	11.95	9.95
Great Adventures of Sherlock Holmes	3.99	2.99

Book Prices — scatter plot with Prices in the U.S. (U.S. $) on the vertical axis and Prices in Canada (Canadian $) on the horizontal axis.

Inquire

1. Do the data in the table suggest a relationship between the prices of the books in Canadian dollars and in U.S. dollars? Explain.

2. Describe any pattern you see in the points on the scatter plot.

3. Does the scatter plot suggest a relationship between the prices of the books in Canadian dollars and in U.S. dollars? Explain.

4. Do you find it easier to look for a relationship between variables on a scatter plot or in a table? Explain.

5. To compare the U.S. and Canadian prices for just one book, is it easier to use the scatter plot or the table? Explain.

6. You could label each point on the scatter plot with the name of the book it describes. What are the advantages and disadvantages of doing this?

7. If you see a relationship between the prices of the books in Canadian dollars and in U.S. dollars, give possible reasons why the relationship exists.

Problems and Applications

1. The table shows the speeds of the winners and the year of the Blue Riband Award for the fastest Atlantic crossing by a liner.

Year	Winner	Speed (km/h)
1840	Britannia	19.6
1863	Scotia	25.9
1882	Alaska	31.9
1897	Kaiser Wilhelm der Grosse	41.5
1909	Mauretania	48.0
1929	Bremen	51.7
1938	Queen Mary	58.7
1952	United States	66.0

Draw a scatter plot of speed versus year. Describe any relationship you see.

2. The table shows the lengths, from the nose to the end of the tail, and the masses of different types of cats.

Type of Cat	Length (cm)	Mass (kg)
Lion	300	180
Lioness	270	140
Cheetah	180	45
Mountain Lion	240	90
Jaguar	260	140
Leopard	265	70
Tiger	270	190
Tigress	240	135
Lynx	90	30

Display the data on a scatter plot of mass versus length. Describe any relationship you see.

3. The table shows the number of countries represented at the Summer Olympics in different years.

Year	1920	1924	1928	1932	1936	1948
Number of Countries	29	44	46	37	49	59

Year	1952	1956	1960	1964	1968	1972
Number of Countries	69	67	83	93	112	122

a) Draw a scatter plot of the number of countries versus the year. Describe any relationship you see.

b) Use your scatter plot to estimate the numbers of countries represented in 1976 and in 1984.

c) Research the actual numbers of countries represented in 1976 and 1984.

d) Compare your estimates from part b) with your findings from part c). Research the reasons for any differences.

4. The table shows the percent of Canadians under 20 years of age in different years.

Year	Percent of Canadians Under 20
1966	42
1971	39
1976	36
1981	32
1986	29
1991	27

a) Display the data on a scatter plot of percent versus year. Describe any relationship you see.

b) What does the scatter plot tell you about changes in the average age of Canadians from 1966 to 1991? Explain.

5. a) Different students travel to school in different ways — by car, on foot, and so on. Ask 10 students who travel to school in the same way as you to estimate the distance, in kilometres, from their home to the school. Also, ask them the average time, in minutes, the trip takes.

b) Use your data to draw a scatter plot of distance versus time. Describe any relationship you see.

c) Aside from the way in which a student travels and the distance from home to school, what factors can affect the length of time for the trip?

333

9.3 Lines of Best Fit

Activity: Use the Graph

The scatter plot shows the relationship between the areas and greatest depths of seas.

The line shown on the graph is called the **line of best fit**. This line is as close as possible to the points. There are about as many points above the line as there are below the line.

Areas and Depths of Seas

Inquire

1. a) Describe the relationship between the areas and greatest depths of seas.

b) How does the line of best fit help to show this relationship?

**2. a)** How well does the line of best fit match the points on the scatter plot?

b) In what ways does the line of best fit not match the points?

3. Is it possible to draw a different line of best fit for this scatter plot? Explain.

4. When you **interpolate**, you estimate values within the range of given values. Use the line of best fit to interpolate the greatest depth of a sea with an area of about 1 400 000 km^2.

5. When you **extrapolate**, you extend a line to estimate values outside the range of given values. Use the line of best fit to extrapolate the area of a sea with a greatest depth of about 9000 m.
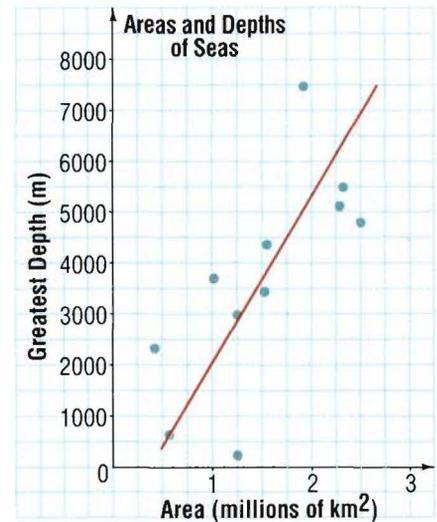
Example

The table shows winning times in the women's 400-m track and field event at the Olympics.

Year	Winner	Winning Time (s)
1964	Cuthbert (Australia)	52.0
1968	Besson (France)	52.03
1972	Zehrt (East Germany)	51.08
1976	Szewinska (Poland)	49.29
1980	Koch (East Germany)	48.88
1984	Brisco-Hooks (U.S.)	48.83
1988	Bryzguina (USSR)	48.65
1992	Perec (France)	48.83

Display the data on a scatter plot of winning time versus year. Draw a line of best fit.

Solution

Draw the scatter plot. Then, draw a straight line that is as close as possible to the points plotted on the grid.

Women's 400-m Winners
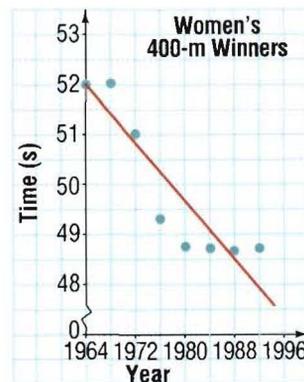
Problems and Applications

1. The table shows some winning times in the men's 110-m hurdles at the Olympics Games.

Year	Winner	Winning Time (s)
1956	Calhoun (U.S.)	13.5
1960	Calhoun (U.S.)	13.8
1964	Jones (U.S.)	13.6
1968	Davenport (U.S.)	13.3
1972	Milburn (U.S.)	13.24
1976	Drut (France)	13.30
1980	Munkelt (East Germany)	13.39
1984	Kingdom (U.S.)	13.20
1988	Kingdom (U.S.)	12.98
1992	McKoy (Canada)	13.12

a) Draw a scatter plot of winning time versus year. Draw a line of best fit.

b) Canada's Earl Thomson won the event in 1920. Extrapolate to estimate his winning time.

c) Earl Thomson's actual winning time was 14.8 s. Compare this time with your estimate.

d) Estimate the winning time in 2020; in 2060.

e) Are your estimates in part d) reasonable? Explain.

f) Display the data in the table on a broken-line graph. Does a line of best fit or a broken-line graph show more clearly the relationship between the winning time and the year? Explain.

2. The table shows, for a major video chain, the number of rentals of a particular video in each week the video has been available.

a) Draw a scatter plot of number of rentals versus the week. Draw a line of best fit for the data.

Week	Number of Rentals
1	642
2	635
3	762
4	695
5	564
6	508
7	455
8	293
9	215
10	160

b) Describe the relationship.

c) Estimate the number of rentals of the video in the 15th week.

3. The table shows the height and the circumference of a tree at different ages.

Age (years)	Height (m)	Circumference (cm)
1	1.1	15.2
2	1.1	18.2
3	2.4	20.7
4	2.5	23.2
5	3.1	27.0
6	4.3	29.5
7	4.5	32.0
8	5.3	33.9

a) Draw a scatter plot of height versus circumference. Draw a line of best fit.

b) Describe the relationship.

c) Estimate the circumference for a height of 2 m; 6 m.

d) Estimate the height for a circumference of 25 cm; 10 cm.

e) What other scatter plots could you construct from the data in the table?

f) Draw another scatter plot and use it to write 2 problems. Have a classmate solve your problems.

4. a) How can you decide whether interpolations based on a line of best fit are reasonable?

b) How can you decide whether extrapolations based on a line of best fit are reasonable?

5. a) Your arm stretch is the distance between your fingertips when your arms are fully extended. Measure the height and the arm stretch for 12 classmates. Record your results.

b) Draw a scatter plot of arm stretch versus height. Draw a line of best fit.

c) Describe the relationship between the arm stretch and the height. Does the relationship seem reasonable? Explain.

Scatter Plots

Activity ❶ Using a Computer Spreadsheet

A computer spreadsheet program can be used to draw a scatter plot.

1. The table shows forecasts for a September day. Open a spreadsheet and enter the data.

	A	B	C
1	**City**	**Low (°C)**	**High (°C)**
2	Amsterdam, Holland	10	19
3	Ankara, Turkey	5	21
4	Athens, Greece	23	30

b) Select the cells containing the data you want to display on the scatter plot. Choose the chart option. Select the scatter plot icon. Follow the instructions to create a scatter plot.

c) Format to make the changes you want to the type, labels, gridlines, and scales.

d) Draw a line of best fit for your scatter plot. You might use a draw feature on a toolbar or copy your chart into a word processing program and use its drawing feature. If you cannot draw the line of best fit with your computer, print the scatter plot and draw it with a pencil.

2. The table shows the average high or low in September for 6 cities in Western Canada. Use your line of best fit to complete the table.

City	Low (°C)	High (°C)
Edmonton, Alberta		17
Penticton, British Columbia	8	
Prince Rupert, British Columbia		15
Regina, Saskatchewan		19
Whitehorse, Yukon	3	
Winnipeg, Manitoba	6	

3. a) The highest temperature ever recorded in Regina in September was 37°C. Estimate the low temperature that day.

b) The lowest temperature ever recorded in Vancouver in September was 0°C. Estimate the high temperature that day.

	Temperature Forecasts	
City	**Low (°C)**	**High (°C)**
Amsterdam, Holland	10	19
Ankara, Turkey	5	21
Athens, Greece	23	30
Beijing, China	15	26
Berlin, Germany	4	19
Brussels, Belgium	9	19
Cairo, Egypt	21	33
Calgary, Canada	2	18
Geneva, Switzerland	9	18
Kingston, Jamaica	25	34
Lima, Peru	12	19
Lisbon, Portugal	14	22
London, England	11	21
Mexico City, Mexico	14	24
Miami, United States	25	33
New Delhi, India	23	34
Oslo, Norway	5	16
Rio de Janeiro, Brazil	20	25
Rome, Italy	15	22
Sydney, Australia	13	22
Stockholm, Sweden	4	16
Tokyo, Japan	18	25
Vancouver, Canada	12	21
Vienna, Austria	10	16
Yellowknife, Canada	5	17

4. a) Think of weather statistics that might be related. Examples might include data on temperatures or precipitation. Research the data. You might use an almanac, an encyclopedia, a CD-ROM, the Internet, the weather section of a newspaper, or a television weather report.

b) Draw a scatter plot. If a relationship exists, draw a line of best fit.

c) Write 2 problems based on your scatter plot. Have a classmate solve your problems.

Activity ❷ Using a Graphing Calculator

To use a graphing calculator to draw a scatter plot and a line of best fit, follow these steps.

- Specify the mode for graphing.
- Set the range for the coordinate plane. Xmin and Xmax are the minimum and maximum values of the *x*-axis. Ymin and Ymax are the minimum and maximum values of the *y*-axis.
- Set the scales on the axes. Xscl and Yscl are the scales on the *x*-axis and the *y*-axis.
- Clear the statistical memories.
- Input the *x* and *y* data.
- Draw the scatter plot and the line of best fit.

1. Use a set of at least 6 hockey cards issued in the same year. Draw a scatter plot of goals versus assists for the last year shown on each card. Draw a line of best fit.

2. a) Interpolate a value from your data. Make up a statement involving your value.

b) Extrapolate a value from your data. Make up a statement involving your value.

3. a) For the cards, select other data that you think might be related. You might choose all the data from one card or use different cards.

b) Create a scatter plot and line of best fit with your graphing calculator for these data. Is there a relationship? Explain.

4. Research sports statistics to be used for a scatter plot and line of best fit. Consider sports cards, an almanac, or a CD-ROM. Repeat steps 1 and 2 for your data.

5. a) What other kinds of graphs would be appropriate for displaying the data from steps 1, 3, or 4? Explain.

**b)** Can you create the kinds of graphs from part a) with your graphing calculator?

c) What kinds of graphs would not be appropriate for displaying these data? Explain.

Activity ❸ Making Comparisons

1. What are the advantages and disadvantages of drawing a scatter plot with

a) a spreadsheet program?   **b)** a graphing calculator?

2. Do you prefer to draw a scatter plot using a spreadsheet program, a graphing calculator, or grid paper? Explain.
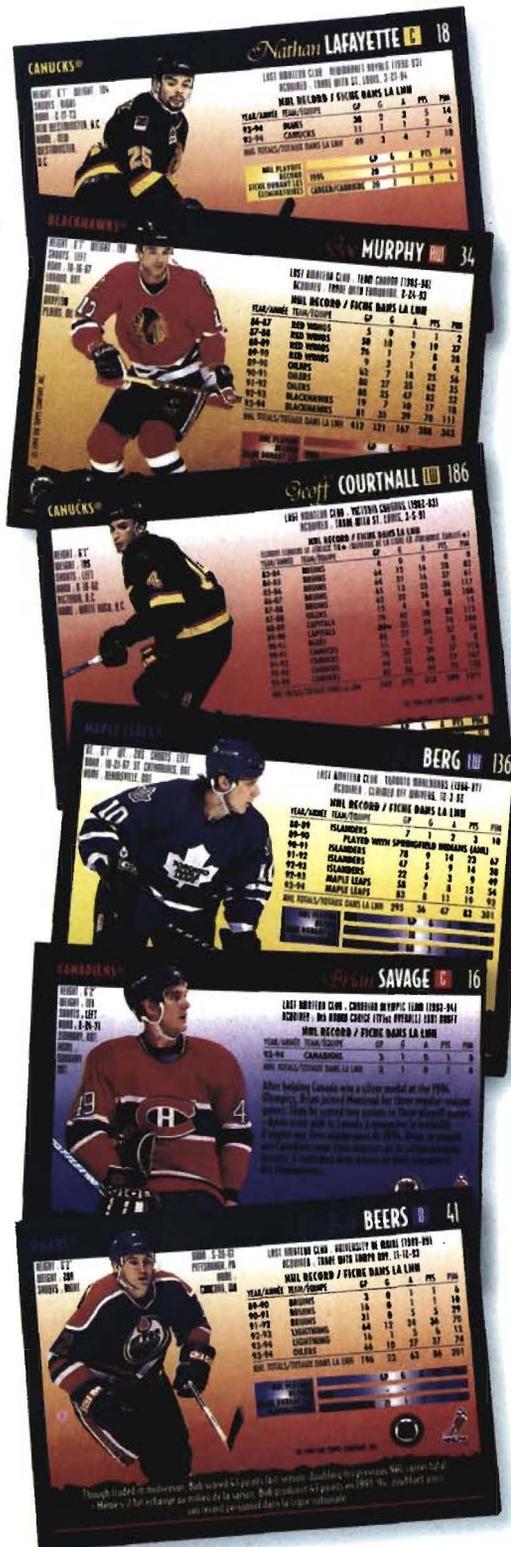
Estimating with a Line of Best Fit

Activity ❶ Mass and Volume

You will need a material, such as Plasticine, that can be made into pieces of different sizes. An alternative is a set of rubber stoppers of different sizes. Make sure that the material you use sinks in water. Also, make sure that the material does not soak up water, like a sponge or paper towel.

1. a) Measure the mass of a piece of the material.

b) Measure the volume of the same piece of material by using it to displace water in a graduated cylinder.

2. Repeat step 1 for 7 more different-sized pieces of the same material. Record your data in a table.

3. a) Draw a scatter plot of mass versus volume. Draw a line of best fit.

b) What relationship does the scatter plot suggest?

4. Choose a mass within the range of masses you measured. Interpolate to estimate the volume of a piece of the material with this mass.
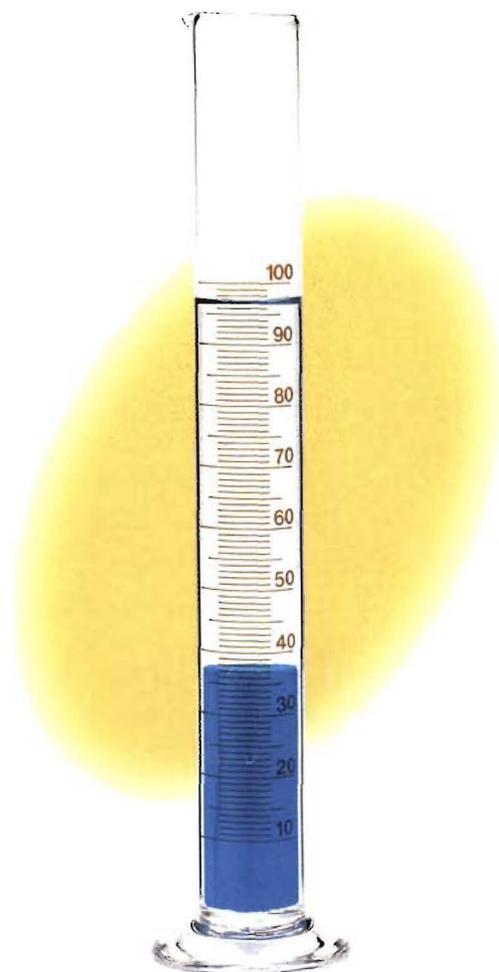
5. Choose a volume greater than any of the volumes you measured. Extrapolate to estimate the mass of a piece of the material with this volume.

6. a) If you used a material that floats in water, the volume measurements would be misleading. Explain why.

b) If you used a material that floats in water, how could you change the way the volume is measured to get accurate values?

Activity ❷ Basketball Shots

1. Use masking tape to mark a horizontal distance of 2 m from a basketball hoop. Have each member of your group shoot 10 baskets from this distance. Record the total number of successful shots for your group.

2. Repeat step 1 for 5 other distances from the basket. Use distances of 3 m, 4 m, 5 m, and so on.

3. Display the data on a scatter plot of successful shots versus distance. Draw the line of best fit.

4. Use the line of best fit to interpolate the number of successful shots from a distance of

a) 4.5 m   **b)** 6.5 m

5. Use the line of best fit to extrapolate the number of successful shots from a distance of

a) 1 m   **b)** 8 m

6. a) Compare your estimates from steps 4 and 5 with your classmates'.

b) Do you think that your estimates are reasonable? Explain.

7. a) Have each member of your group try 10 shots from each of the distances in steps 4 and 5.

b) Compare the results with your estimates. Explain any differences.

Activity ❸ Temperature

1. Record the outside temperature every hour on the hour as many times as possible over a two-day period.

2. Construct a scatter plot of temperature versus time of day for the two-day period. Draw a line of best fit.

3. a) What relationship does the line of best fit suggest between temperature and time of day?

**b)** Do you think that the relationship you described in part a) is reasonable? Explain.

4. a) Use the line of best fit to estimate the temperature in the middle of the night between the first and second days.

b) Do you think that your estimate from part a) is reasonable? Explain.

5. a) Describe some situations in which you can use a line of best fit to make reasonable estimates.

b) Do lines of best fit always give reasonable estimates? Explain.

c) What assumptions do you make when you use a line of best fit to make estimates?

339
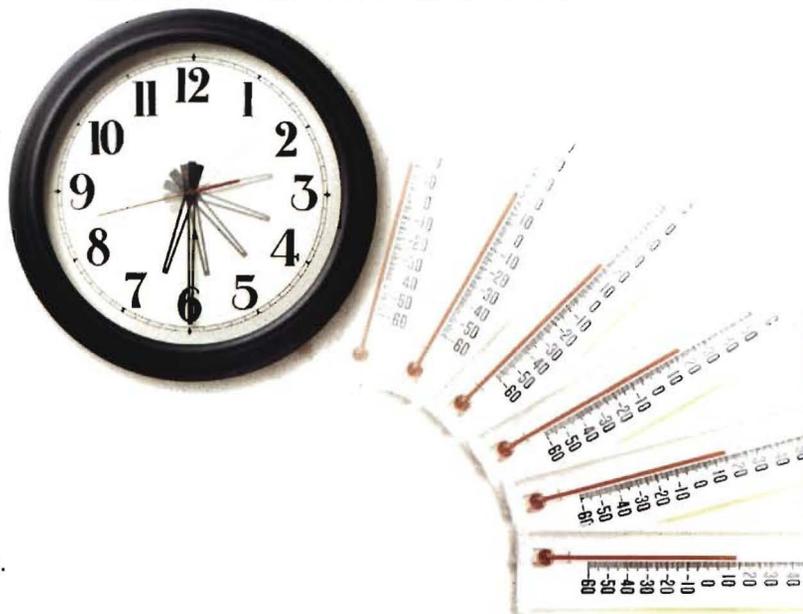
Misleading Statistics

Activity ❶ Data-Gathering Methods

If you gather your own data, you are using a **primary data-gathering method**. If you use someone else's data, you are using a **secondary data-gathering method**.

1. State whether each of the following is a primary or secondary source of data.
a) conducting a telephone survey
b) using a CD-ROM
c) performing an experiment
d) reading an opinion poll
e) using an almanac
f) interviewing people on the street

2. Explain one way data from a primary source could be misleading.

3. Explain one way data from a secondary source could be misleading.

Activity ❷ Populations and Samples

The entire set of items from which data are taken is the **population**. When a population is large, data might be gathered from a **sample** of the population. If you wanted to know the most popular car among grade 9 students in your school, you might survey a sample from among the whole population of grade 9 students.

Data are often used to draw conclusions about a population. For these conclusions to be reliable, a **representative sample** is needed. If you were trying to predict the results of the next student election in your school, you might survey a sample of students. Your representative sample would not include teachers, because teachers cannot vote in the election.

A magazine is doing a survey to present opinions of Canadians about whether they agree that federal government spending is appropriate.

1. If you were doing the survey, what population would you choose?

2. Describe 4 possible samples of the population.

3. How could a sample that is not representative result in misleading data?

Activity ❸ Bias

A sample should be random and unbiased. In a **random sample**, each member of the population has an equal chance of being chosen. In an **unbiased sample**, all groups in the population are fairly represented.

1. Describe 3 ways in which you could choose a random sample of grade 9 students in your school.

2. If you wanted to know the most popular sport at your school, why would you not just survey members of the swim team?

3. To avoid a biased result, what sample would you survey to find out
a) what brand of CD player is best?
b) the hours that video arcades should be open for business?

**4.** A **stratified sample** considers the different groups in a population. If there are 300 males and 350 females in grade 9, a stratified sample might include 30 males and 35 females. Would you use a random sample or a stratified sample for each of the following surveys? Explain.
a) What music should be played at a shopping mall?
b) Should pets be allowed in an apartment building?

Activity ❹ Misleading Presentations

1. A scatter plot can be used to misrepresent data. These 2 scatter plots display the same data in different ways.
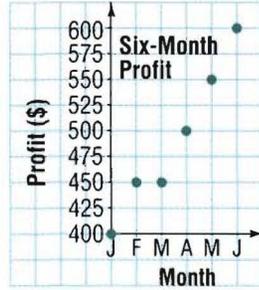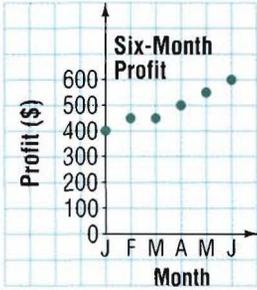
a) How are the scatter plots the same?

b) How are they different?

c) What impression is the second scatter plot intended to create?

2. In a newspaper, magazine, or computer source, find an example of a scatter plot or a different kind of graph that presents data in a misleading way. Write a report on how it is misleading.

3. Statements that distort the meaning of data may create news headlines. Find examples and report them to the class.

4. Why might a newspaper or other news medium present a misleading report?

5. Find examples of advertisers who use before-and-after pictures or graphs. Describe any examples that attempt to mislead.

6. How do commercials try to convince you to buy a product? Describe any techniques that are misleading. How could you change the commercials so that they are not misleading?

Activity ❺ Effective Statistics

Statistics are used to highlight the significance of events and to clarify their meaning. This headline

WORST STORM IN 100 YEARS

is more effective than this headline.

STORM CLOSES CITY

1. Find and describe examples of the effective use of statistics in the media.

2. How is the relationship between the headlines and the statistics made clear?

3. Explain how the statistics justify the headlines.

4. Are any important data missing from the story?

5. How might the data have been collected?

Millions lost in huge scam

Collecting Data

Technology provides many methods for finding and organizing data.

✏ Activity ❶ Databases

A database is a collection of data. Some databases, such as the Data Bank on pages 364 to 369 of this book, are not computerized. Computer databases are commonly found on computer discs and CD-ROMs.

1. Find an example of a database on a computer disc. Write a few sentences about the data on the disc.

2. Find an example of a database on a CD-ROM. Write a few sentences about the data on the CD-ROM.

3. CD-ROMs can use sounds and moving pictures that are not possible in books. How do these features of CD-ROMs help you to understand the data?

4. Compare CD-ROMs and computer discs for the storage of data. Describe the advantages and disadvantages of each.

5. Compare computerized and non-computerized databases for the storage of data. What are the advantages and disadvantages of each?

6. Give an example of a database that you would like for your own use. Explain why you would like it.
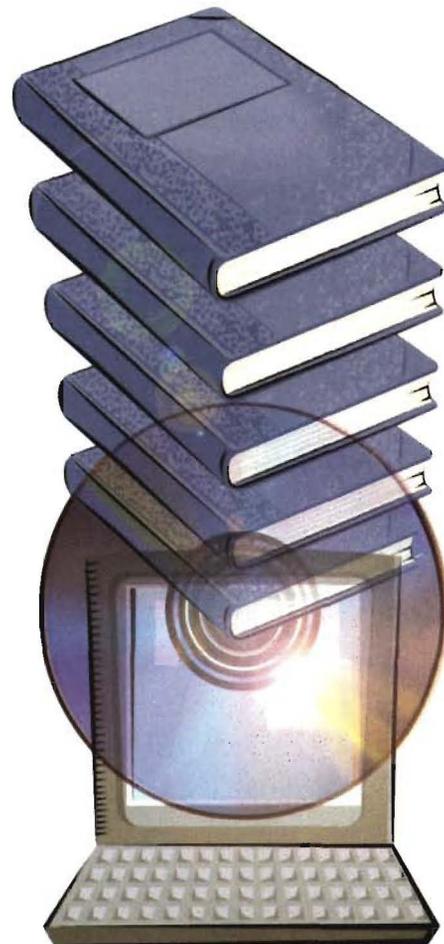
✏ Activity ❷ Database Managers

A database manager organizes data so that it can be retrieved easily. In a printed encyclopedia, the information on each subject makes up the database. The encyclopedia itself is the database manager. A library computer system that allows you to call up information about the resources in the library is a computerized database manager.

Features of database managers may include the following.

Find: Records can be located for viewing or updating.

Sort: Data can be sorted in different ways.

Copy: Data can be copied and pasted into other programs.

Calculate: Formulas can be used to make calculations with the data.

1. For a computer database of your choice, select a way to sort some data. What are the advantages and disadvantages of sorting data
a) electronically?   **b)** manually?

2. Describe how a computerized database manager might be used by
a) a firefighter   **b)** a doctor   **c)** a teacher
d) someone in a career of your choice

Activity ❸ The Internet

The Internet, or the net, is an electronic medium that gives access to people and databases around the world.

1. Research information about the Internet. Write a few sentences to describe your findings. Compare your findings with a classmate's.

2. Describe the advantages and disadvantages of using the Internet to collect data.

3. The Internet is constantly changing. Describe a recent change that improved the Internet as a way to collect data.

4. Predict a future change to the Internet. Describe an advantage or disadvantage of this possible change.

Activity ❹ Biased Data

1. Suppose you were doing research to find out who are the most popular world leaders.
a) If your data came from a CD-ROM database of surveys conducted in North America, do you think that your data could be biased? Explain.
b) Could you reduce any bias in the data by using the Internet to access databases in different countries? Explain why or why not.

2. If you used the data recorded by supermarket scanners to identify the most popular food products in Canada, could there be any bias in your data? Explain.

3. a) Choose a subject that interests you and describe how you could use technology to access information in databases.
b) Describe how you would try to obtain unbiased data.

4. Is there any way to be sure that data collected from databases are unbiased? Explain.

5. Compare your opinions with your classmates'.

Stylometry

Did Sir Francis Bacon write some of the plays attributed to Shakespeare? This is one of the questions a stylometer tries to answer. **Stylometry** is the science of measuring written words. It is used to show that one particular person has written something.

Authors, like burglars, leave "fingerprints." The "fingerprints" of an author are verbal. From year to year, a certain author uses roughly the same proportion of 5-letter words in written pieces. The same is true for words of any other length. But the proportion of 5-letter words will likely differ from one author to another. When analyzing writing, the first task of a stylometer is to graph how someone writes.

The following excerpt is from a piece by Canadian humorist Stephen Leacock (1869–1944).

"I've been reading some very interesting statistics," he was saying to the other thinker.

"Ah, statistics!" said the other; "wonderful things, sir, statistics; very fond of them myself."

"I find, for instance," the first man went on, "that a drop of water is filled with little...with little...I forget just what you call them...little — er — things, every cubic inch containing — er — containing...let me see..."

"Say a million," said the other thinker, encouragingly.

"Yes, a million, or possibly a billion...but at any rate, ever so many of them."

"Is it possible?" said the other. "But really, you know, there are wonderful things in the world. Now, coal...take coal...."

"Very good," said his friend, "let us take coal," settling back in his seat with the air of an intellect about to feed itself.

"Do you know that every ton of coal burnt in an engine will drag a train of cars as long as...I forget the exact length, but say a train of cars of such and such a length, and weighing, say so much...from...from...hum! for the moment the exact distance escapes me...drag it from..."

"From here to the moon," suggested the other.

"Ah, very likely; yes, from here to the moon. Wonderful, isn't it?"

"But the most stupendous calculation of all, sir, is in regard to the distance from the earth to the sun. Positively, sir, a cannon-ball — er — fired at the sun..."

"Fired at the sun," nodded the other, approvingly, as if he had often seen it done.

"And travelling at the rate of...of..."

"Of three cents a mile," hinted the listener.

"No, no, you misunderstand me — but travelling at a fearful rate, simply fearful, sir, would take a hundred million — no, a hundred billion — in short would take a scandalously long time in getting there — "

Activity ❶

1. To draw the graph of how Stephen Leacock wrote, copy and complete the following table for the excerpt.

Word Length in Letters	Frequency	
	Number of Words	Percent of Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13+		

2. Graph the percent of total values versus the word length values.
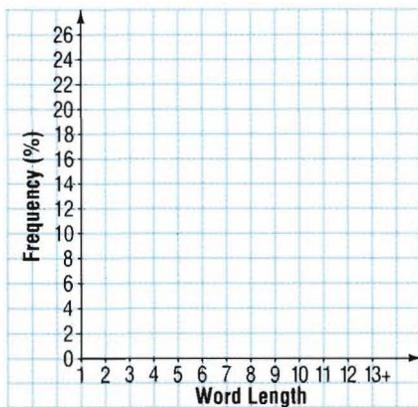
Activity ❷

1. Construct the graph for a newspaper article. Do not count any proper names.

2. Compare the graph with the graph you drew for Stephen Leacock.

Activity ❸

1. Construct the graph for something you have written. Do not count any proper names.

2. Compare your graph with Stephen Leacock's.

3. Compare your graph with your classmates'.

4. Why might the graphs for Stephen Leacock's writing and your writing not be as accurate as they could be?

Making Decisions

☼ Activity ❶ Choosing Numbers

**1.** Choose a kind of lottery or a game in which people select numbers. Describe how you think people use calculations, experiments, guesswork, experience, or other methods to select numbers.

2. Answer the following questions to plan a survey to find out how people choose the numbers. Give reasons for your answers.

a) Will you use a primary data-gathering method or a secondary data-gathering method?

b) What is the population?

c) Will you survey the whole population or a sample?

d) If you plan to survey a sample, how will you find a representative sample of the population?

e) How can you ensure that your sample is unbiased?

f) Should the sample be random or stratified?

3. a) Write the questions you will ask. Include questions on how people choose numbers and what people think of the methods they use.

b) Carry out your survey. Record the results in a suitable way.

4. Organize your results. Use your results to make conclusions. Include answers to the following questions.

a) What methods do people use to choose numbers?

b) What do people think of their own methods for choosing numbers?

c) Did you introduce any biases into your survey? Explain.

d) If you did introduce biases, do you think that they are important? Explain.

5. Present your conclusions orally, in writing, or in a combination of these two ways.

Activity ❷ Other Decisions

1. How do you decide where to sit? Describe how your decision varies with the place. Consider, for example, a theatre, a classroom, a stadium, and your home. Describe how your decision is influenced by other people. What other factors affect your decision? Find out how other people decide where to sit.
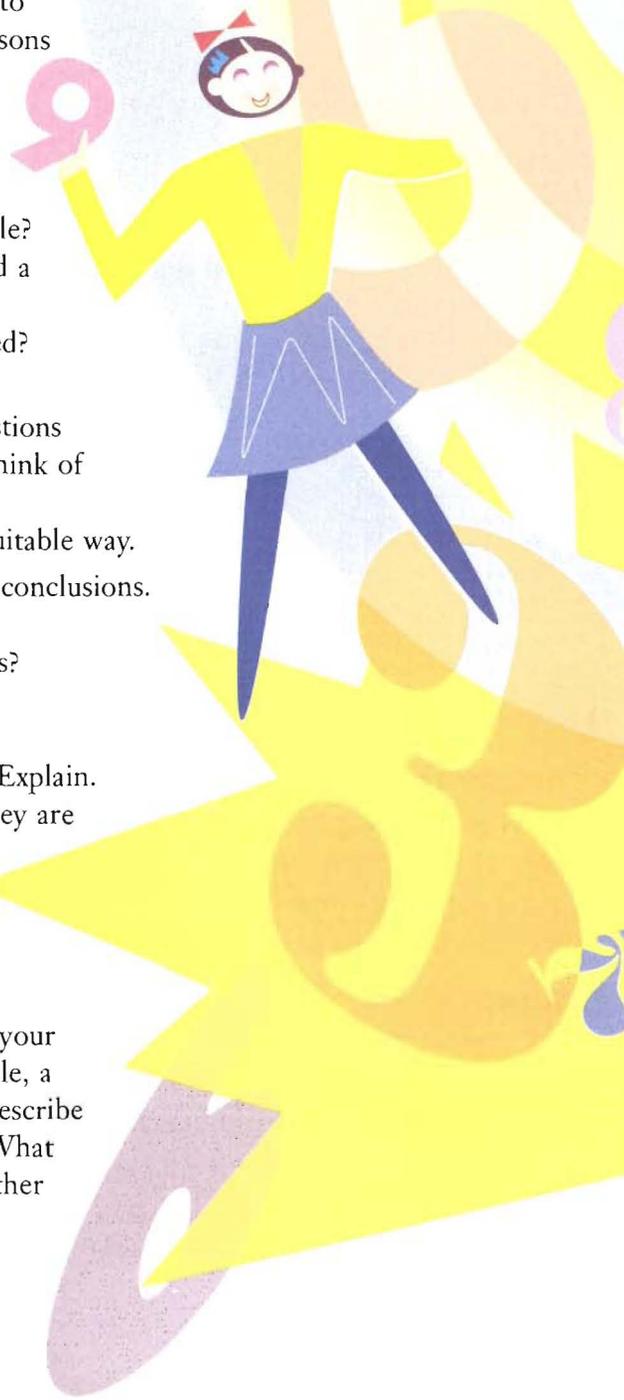
2. Describe to a classmate the effect that the weather forecast has on the activities you plan for a summer weekend. Are your decisions affected by the source of the weather forecast or by how many days before the weekend you hear the forecast? How do your past experiences influence your decisions? What other factors influence your decisions?

Activity ❸ The Game Show

Gerry was the contestant on a television game show called *It's Your Move*. Gerry answered all the questions correctly. He then had the chance to win the big prize, a new car.

The host led Gerry to three doors on the stage. The doors were numbered 1, 2, and 3. The host explained that there was a new car behind one of the doors and nothing behind the other two. The host said that she knew which door hid the car.

The host asked Gerry to pick a door. Gerry chose door number 2. The host then walked over to the doors and opened door number 3. There was nothing behind door number 3. Then the host asked Gerry if he would like to change his mind about door number 2 and take door number 1.

Gerry thought for a minute and said, "I will take door number 1."

1. a) Did Gerry make the choice that gave him the best chance to win the car? Explain why you think Gerry should or should not have changed his mind.

b) Compare your decision with your classmates'.

2. Test whether Gerry was right to change his mind. Work in groups and set up the game. You could use cups for the doors and a piece of chalk for the car. Choose a host, a contestant, and a recorder. Play the game and have the recorder write the result in a table, like the one shown.

Gerry should have changed his mind.	Gerry should not have changed his mind.

3. Take turns at being the host, the contestant, and the recorder. Play the game a total of 20 times. Record all the results. Use the results to decide whether Gerry was right.

9.4 The Probability Formula

Activity: Use the Pattern

The possible outcomes of an experiment are often called the
sample space. When you roll a die, the sample space is 1, 2,
3, 4, 5, and 6. Each of the 6 outcomes has an equal chance of
happening or is **equally likely**. So, the chance or **probability**
of rolling a 3, $P(3)$, is 1 out of 6.

$$P(3) = \frac{1}{6}$$

Number of ways to get a 3
Total number of possible outcomes

Inquire

1. What is the probability of each of the following outcomes?

a) $P(6)$ **b)** $P(\text{even number})$

c) $P(\text{prime number})$ **d)** $P(\text{number divisible by 3})$

e) $P(\text{number divisible by 7})$ **f)** $P(\text{number less than 3})$

2. a) What is the sample space for the toss of a coin?
b) What is the probability of each outcome?

When all the outcomes are known and equally likely, the
probability of a single outcome is given by the **probability
formula**.

Probability of an outcome $= \dfrac{\text{number of favourable outcomes}}{\text{total number of possible outcomes}}$

Example

Find the probability of each
of the following outcomes
for this spinner. Express
each answer as a percent.

a) a 4
b) an odd
number
c) a 4 or a 7
d) a 9
e) a number from 1 to 8
f) the colour green

Solution

There are 8 equal sectors on the spinner.

a) There is one 4.
So, $P(4) = \frac{1}{8}$ or 12.5%

b) There are 4 odd numbers.
So, $P(\text{odd}) = \frac{4}{8}$ or $\frac{1}{2}$ or 50%

c) There is one 4 and one 7.
So, $P(4 \text{ or } 7) = \frac{2}{8}$ or $\frac{1}{4}$ or 25%

d) There is no 9.
So, $P(9) = \frac{0}{8}$ or 0 or 0%

e) There are 8 numbers from
1 to 8.
So, $P(1 \text{ to } 8) = \frac{8}{8}$ or 1 or 100%

f) There are 4 green sectors.
So, $P(\text{green}) = \frac{4}{8}$ or $\frac{1}{2}$ or 50%

You can see from the above example that an impossible outcome
has a probability of 0, and a certain outcome has a probability
of 1. Outcomes that are neither impossible nor certain have
probabilities between 0 and 1 or between 0% and 100%.
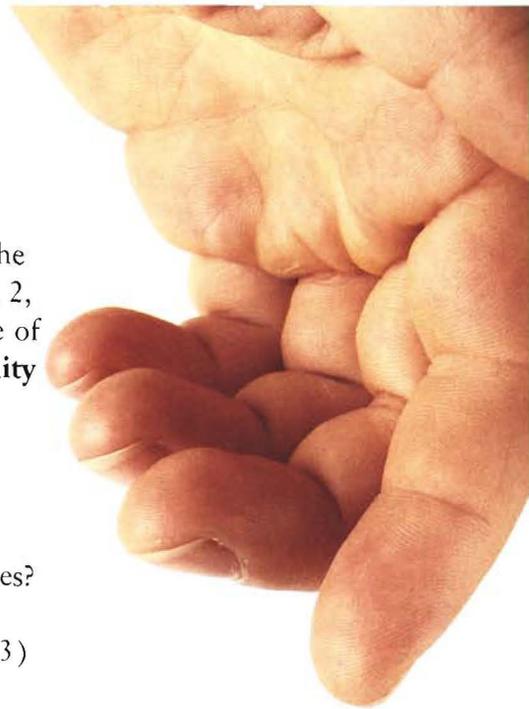
Practice

1. What is the probability of spinning each of the following numbers with this spinner?
a) 1
b) a prime number
c) 1, 2, 3, or 4
d) 6

2. Which number or numbers have these probabilities for the spinner in question 1?
a) 0   **b)** $\frac{1}{5}$ **c)** 1

3. What is the probability of rolling each of these numbers with a die? Express each answer as a percent.
a) 2   **b)** an odd number
c) 4, 5, or 6   **d)** a number from 1 to 6

Problems and Applications

4. a) On this spinner, what is P(blue)?
b) What is P(red)?
c) How many times more likely is the spinner to land on blue than on red?

5. There are 4 green, 15 red, 6 yellow, and 5 black marbles in a bag. You remove 1 marble without looking. State the probability that it is
a) red   **b)** black   **c)** purple
d) green, yellow, red, or black

6. Each letter of the word IMPOSSIBLE is on a different card. All the cards are the same size. The cards are placed face down and shuffled. State the probability that you will randomly draw each of the following letters. Write each answer as a decimal.
a) I   **b)** N   **c)** S   **d)** L

7. State the probability of drawing these cards from a standard deck of 52 playing cards.
a) the 2 of clubs   **b)** a black card
c) a heart   **d)** a red jack

8. If you add the probabilities of all the possible outcomes for a spinner or die, what is the result? Explain.

9. If the probability of spinning a 1 on a spinner is 0.2, what is the probability of not spinning a 1?

10. A driving instructor says that the probability of her students passing their driving test on the first try is 0.80.
a) If the instructor now has 25 students, how many do you expect to pass on the first try?
b) If you take lessons from this instructor, what is your chance of passing on the first try? Explain.

11. a) Draw a spinner that gives the following probabilities.

$P(\text{red}) = \frac{1}{8}$ $P(\text{blue}) = \frac{3}{8}$

$P(\text{green}) = \frac{1}{2}$ $P(\text{yellow}) = 0$

b) Describe your method and compare it with a classmate's.
c) Predict the outcomes from spinning the spinner 1200 times.

12. Design your own spinner and write a problem to be answered with it. Have a classmate solve your problem.

13. a) In a weather forecast on TV, how are the probabilities of different types of weather reported?
b) How accurate are the probabilities? Explain.
c) List other examples of the use of probabilities in the media. Compare your list with your classmates'.

9.5 Independent Events

Activity: Conduct an Experiment

Work with a partner and toss a penny and a nickel at the same time. Repeat another 19 times. Record the results of the 20 trials and calculate the probability of each outcome. Collect data from the rest of the class and calculate each probability using all the data.

Inquire

1. How many different outcomes are possible when 2 coins are tossed at the same time?

2. What is the sample space when 2 coins are tossed at the same time?

3. What is the probability of throwing

a) 2 heads?   **b)** 2 tails?

c) a head and a tail?   **d)** 2 heads or 2 tails?

4. Write each probability from question 3 as a percent.

When 2 coins are tossed simultaneously, the outcome for one coin has no effect on the outcome for the other. The events are said to be **independent** of each other.

In the Activity, you found probabilities by performing an experiment. A probability found in this way is called an **experimental probability**. In Example 1, below, no experiment is performed. The probability calculated in this example is called a **theoretical probability**.

Example 1

A coin is tossed and a die is rolled at the same time. What is the probability of getting a head and a 6?

Coin   Die   Outcome

Solution 1

Construct a **tree diagram** to show the sample space. There is only 1 favourable outcome out of 12 equally likely outcomes.

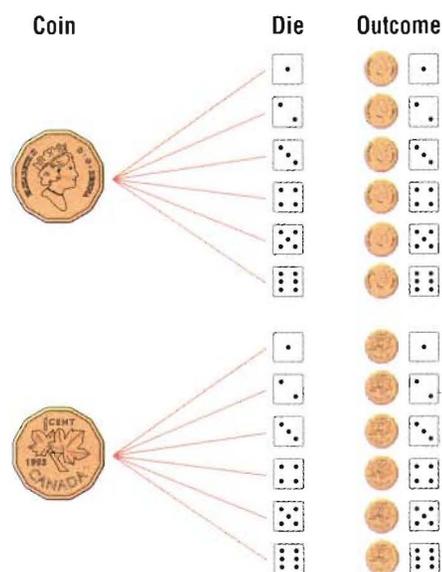$P(H, 6) = \frac{1}{12}$

Solution 2

For a toss of a coin, $P(H) = \frac{1}{2}$

For a roll of a die, $P(6) = \frac{1}{6}$

$P(H, 6)$ is $\frac{1}{2}$ of $\frac{1}{6} = \frac{1}{2} \times \frac{1}{6}$

$\qquad\qquad\quad = \frac{1}{12}$

Note from Example 1 that the probability of a set of independent events is the product of the probabilities of the individual outcomes.

$P(A \text{ and } B) = P(A) \times P(B)$

Example 2

Without looking, Tibor took one card from each of 3 decks. What is the probability that the 3 cards he took are the jack of clubs, the ace of spades, and the 7 of diamonds?

Solution

Tibor chose each card from a different deck of cards, so his choices were independent. There are 52 cards in a deck.

There is only one jack of clubs, so $P(J\clubsuit) = \frac{1}{52}$.

There is only one ace of spades, so $P(A\spadesuit) = \frac{1}{52}$.

There is only one 7 of diamonds, so $P(7\diamondsuit) = \frac{1}{52}$.

$$P(J\clubsuit \text{ and } A\spadesuit \text{ and } 7\diamondsuit) = \frac{1}{52} \times \frac{1}{52} \times \frac{1}{52}$$
$$= \frac{1}{140\ 608}$$

The probability that Tibor took the jack of clubs, the ace of spades, and the 7 of diamonds is $\frac{1}{140\ 608}$ or about 0.0007%.

Problems and Applications

1. The spinner and the die are used for an experiment. Estimate each probability.
a) spinning red
b) rolling a 5
c) spinning red and rolling a 5
d) rolling an odd number and spinning green
e) rolling an even number and not spinning blue
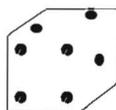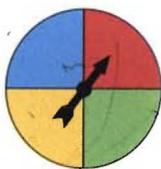
2. A red die and a green die are rolled. What is the probability of each outcome?
a) 6 on the red die and 1 on the green die
b) 6 on each die
c) an even number on the red die and an odd number on the green die

3. A bag contains 3 red and 2 blue cubes. Each cube is replaced after it is drawn. What is each probability?
a) a red cube then a blue cube
b) 2 red cubes

4. For the spinners, which game would you rather play? Why?

a) If you play on the numbered spinner, you win if you spin a 1.
b) You win on the second spinner if, in 2 turns, you spin red then blue.

5. A nickel, a dime, and a penny are tossed.
a) What is the sample space?
b) Are all the outcomes equally likely?
c) What is the probability of tossing 3 heads?
d) What is the probability of tossing 2 heads and a tail?

351

6. A red die, a blue die, and a white die are rolled.

Calculate each probability.

a) a number greater than 3 on the red die, an even number on the blue die, and a prime number on the white die

b) a 5 on all 3 dice

c) a different number on each die

7. What is the probability of choosing a club from each set of cards from a 52-card deck?

a) the full deck

b) all the black cards

c) all the red cards

8. Three cards are chosen from a deck. Each card is replaced before the next card is chosen. What is each probability?

a) 3 aces   **b)** 3 hearts

c) a diamond, a club, and a spade
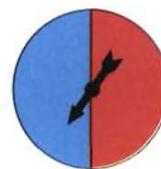
d) 4♠, 3♦, and king♥   **e)** 9♦, jack♣, and 9♦

9. A bag contains a red marble, a blue marble, and a yellow marble. Each marble is replaced before the next one is drawn. What is each probability?

a) 3 draws that give a red marble, a blue marble, and a yellow marble

b) 2 draws that give 2 yellow marbles

c) 3 draws that give 3 yellow marbles

d) 4 draws that give 4 yellow marbles

10. Beans are drawn from a bag containing 3 red beans, 2 blue beans, and 1 yellow bean. Each bean is replaced before the next one is drawn. What is each probability?

a) blue, then red

b) blue, then another blue

c) red, then blue, then red

d) yellow, then blue, then red

e) red, then blue, then yellow

f) 5 blue beans in a row

g) green

11. In questions 9 and 10, each object was replaced before the next one was drawn. Explain why.

12. Find each theoretical probability.

a) a child being female for any birth in a family

b) in a family with 2 children, both are girls

c) in a family with 3 children, all 3 are boys

13. The activity involves picking a card from a bag, spinning the spinner, and tossing a coin.
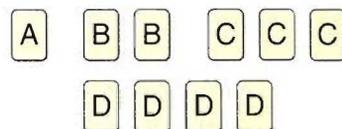
What is each probability?

a) D and 3 and a head

b) C and 2 and a tail

c) A and 3 and a head

d) D and 2 and a head

e) B and 1 and a tail

f) A and 1 and a head

14. If you toss a coin and it shows a head, what is the probability of tossing a tail on the next toss? Explain.

15. Design a spinner so that, when you toss a coin then spin the spinner, the probability of "a head then red" is

a) $\frac{1}{10}$ **b)** $\frac{1}{6}$ **c)** 0

16. a) Design an experiment that involves finding the probability of independent events. Have a classmate perform your experiment.

b) Is the probability from part a) a theoretical probability or an experimental probability? Explain.

Simulation Experiments

A **simulation** is an experiment that acts like another experiment. Suppose you do not have a die but you want to find the experimental probability of rolling a 4. A simulation experiment might involve six cards, numbered 1 to 6, in a bag. You could draw a card, record the outcome, and return the card to the bag. The outcomes from a number of draws could be used to calculate the experimental probability of drawing or rolling a 4.

One way to simulate experiments is to use random numbers. Research how to generate random numbers with a graphing calculator and with a computer.

Activity ❶ Coin Tosses

1. a) List the possible outcomes when 3 coins are tossed.
b) Calculate the theoretical probability of each outcome.

2. To simulate the experiment, set up your graphing calculator to generate the digits 1 and 2 randomly.

3. Let 1 represent a head and 2 represent a tail. Generate a set of three random digits and record how many heads it represents. Carry out the simulation a total of 40 times. Tabulate your results.

4. Use your data to calculate the experimental probability of each outcome. Compare your results with the theoretical probabilities.

Number of Heads	Tally	Frequency
0		
1		
2		
3		

Activity ❷ A Combination Lock

A lock on a briefcase has three independent dials, each numbered from 0 to 9.

1. How many possible combinations are there for the lock?

2. If you forgot the combination, what would be the probability of guessing the combination and opening the lock? Explain.

3. Describe how you could use a graphing calculator to determine the experimental probability of guessing the combination.

4. Do you see any difficulties in carrying out the method you described in step 3? Explain.

5. How might a computer help you to overcome any difficulties you described in step 4?
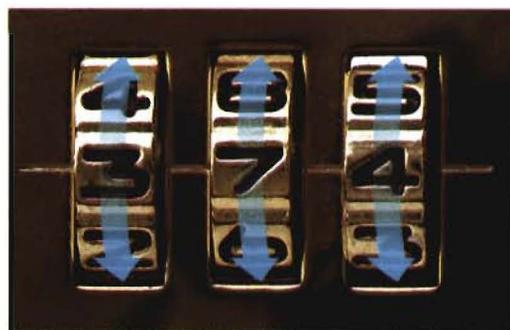
Experimental Probability

For some events, such as tossing a coin or rolling a die, you can determine the probability of an outcome mathematically, without doing the experiment. For other events, you must determine the probability of an outcome by experiment.

Activity ❶ The Paper Cup

When you throw a paper cup, there are 3 ways it can land: on its side, on its top, and on its bottom.

1. Estimate the probability of a tossed cup landing in each of the 3 positions.

2. Toss a paper cup 25 times and record your results in a table, like the one shown.

Outcome	Tally
Side	
Top	
Bottom	

3. Combine your results with your classmates'.

4. Use the class results to find the experimental probability of a cup landing in each of the 3 positions.

5. Compare the experimental results with your estimates.
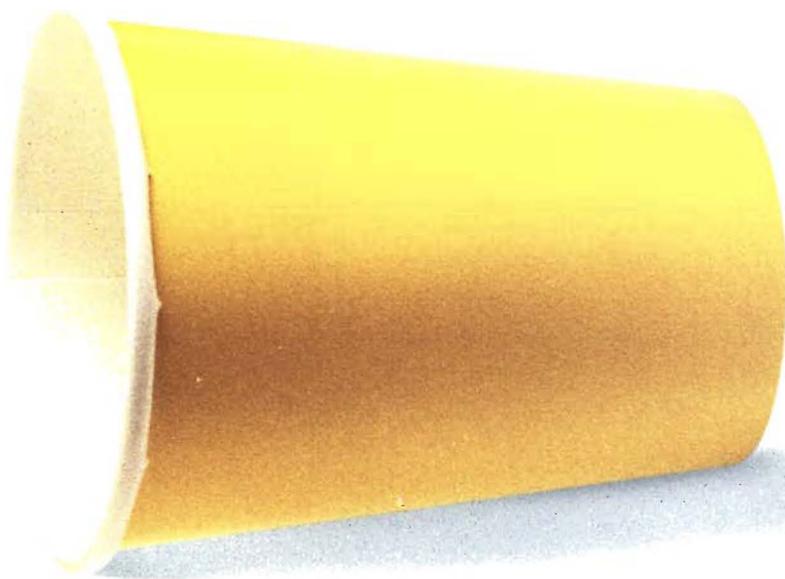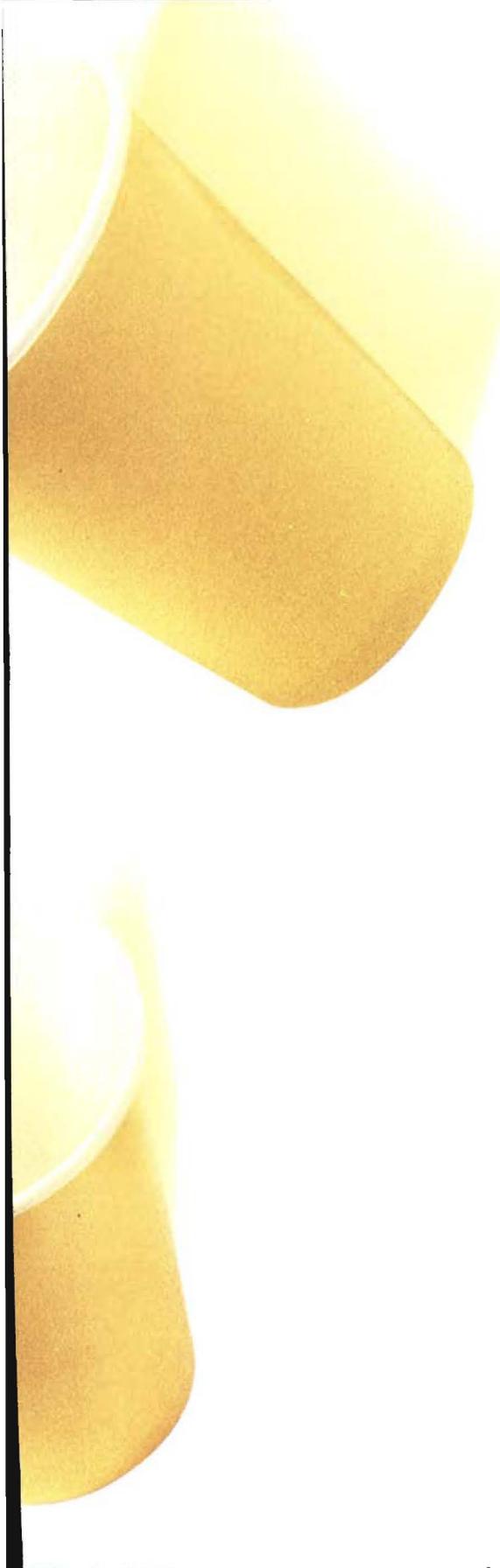
Activity ❷ Dropping Cubes

Set up an experiment to determine the probability of dropping a plastic cube into a container, such as a paper bag. To perform the experiment, stand with the container behind you at your feet. Hold the cube over your shoulder and face forward. Each group in the class should use the same size of container.

1. Estimate the probability of your group dropping the cube into the container.

2. Have each member of the group try the experiment 10 times. Combine the results.

3. Use the results to find the experimental probability of your group dropping the cube into the container.

4. Compare the probability for your group with the probabilities found by other groups.

Activity ❸ Thumbtacks

When you roll a thumbtack, there are 2 ways it can stop: point down or point up.

1. Estimate the probability of a rolled thumbtack stopping in each position.

2. Roll 10 thumbtacks 10 times and record your results.

3. Combine your results with the results of your classmates.

4. Use the class results to find the experimental probability of a rolled thumbtack stopping in each position.

5. Compare the experimental results with your estimates.

Activity ❹ Other Experimental Probabilities

A sports commentator knows the probability of a certain baseball player getting a hit because of the number of "experiments" the hitter has conducted. List 5 other events for which the probability is found by experiment or on the basis of actual happenings.

Review

1. The scatter plot shows the winning times in the women's 200-m run at the Olympic Games in different years.
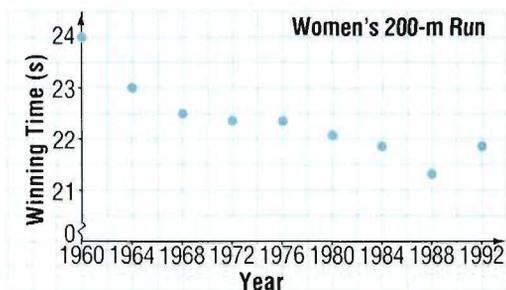
a) Describe the relationship between the winning time and the year.

b) What was the approximate winning time in 1976, when the Olympics were held in Montreal?

c) In what year was the winning time closest to 22.5 s?

d) About how many seconds longer did the race take in 1960 than it did in 1988?

2. The table shows the total population of Canada's four Western Provinces in different years.

Year	Population (nearest 0.1 million)
1941	3.2
1951	3.7
1961	4.8
1971	5.7
1981	7.0
1991	7.9

a) Display the data on a scatter plot of population versus year. Draw a line of best fit.

b) Describe the relationship between the population and the year.

c) Estimate the total population of the four Western Provinces in 1966; in 2001.

3. The table shows the wingspans and lengths of airplanes.

Plane (Year built)	Length (m)	Wingspan (m)
Flyer (1903)	6.43	12.29
June Bug (1908)	9.1	13.89
Demoiselle (1909)	6.1	5.5
Blériot XI (1909)	8	7.8
Deperdussin Racer (1912)	6.1	6.65
Grand (1913)	20.02	28.02
Junkers J-1 (1915)	9.04	16.8
Fokker DVII (1918)	7.01	8.94
Ford Trimotor (1926)	15.19	22.6
Lockheed Vega (1927)	8.38	12.5

a) Display the data on a scatter plot of wingspan versus length.

b) Draw a line of best fit.

c) Interpolate the wingspan of an airplane with a length of 10 m.

d) Extrapolate the length of an airplane with a wingspan of 30 m.

4. Find each probability.

a) $P(H)$

b) $P(H$ or $I)$

c) $P($blue$)$

d) $P($yellow$)$

e) $P($blue or green$)$

f) $P(G, H,$ or $I)$

g) $P(G, H, I, J, K,$ or $L)$
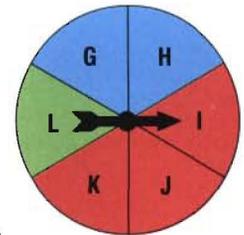
5. A bag contains 3 red cubes, 5 blue cubes, and 2 green cubes. What is the probability of drawing each of the following if each cube is replaced before the next draw?

a) a red cube, then another red cube

b) a yellow cube

c) a blue cube, then a red cube, then a green cube

6. This spinner is used for an experiment in which you toss a dime, roll a die, and spin the spinner.

a) How many possible outcomes are there?
b) What is the probability of tossing a head, rolling a 4, and spinning a 4?
c) What is the probability of tossing a tail, rolling an odd number, and spinning an odd number?

d) What is the probability of tossing a tail, rolling an even number, and spinning an even number?

7. Three cards are drawn from a 52-card deck of playing cards. What is the probability of drawing the following if each card is replaced before the next draw?
a) 3 kings   **b)** 3 clubs
c) a queen, then a jack, then an ace
d) a heart, then a diamond, then a club
e) 1♥, then 2♣, then a red card
f) ace♠, then 5♥, then queen♠
g) 6♦, then 6♦, then 6♦

Group Decision Making
The SCAMPER Technique

The writer B. Eberle used the mnemonic SCAMPER to help people expand their thinking during brainstorming sessions. The letters in SCAMPER each represent a different idea to think about.

S : Substitute – What if a thing or a person takes another's place?

C : Combine – What if you put things together or combine purposes?

A : Adapt – What if you adjust something? What else is this?

M : Modify, Magnify, Minify – What if you change the purpose? the size? the colour? the sound? the speed?

P : Put to Other Uses – What other uses are there?

E : Eliminate – What if you get rid of a part? a whole?

R : Rearrange – What if you change the order? turn something around? backwards? upside down?

Suppose you were designing a home entertainment centre. You might consider the following questions.
a) What if you *substitute* 8 television screens for 1?
b) What if you *combine* the entertainment room and a gym so you can be actively involved in the music or movies?
c) What if you *adapt* the ceiling to become television screens?
d) What if you *modify* the roof of your house so that it holds 4 satellite dishes?
e) What if you *eliminate* the walls of one room in the house?
f) What if you *rearrange* the floors in the house so that the top floor becomes the bottom floor?

1. In home groups, use this technique to design a classroom or a movie theatre.

2. Present your design to the class and explain how you used the SCAMPER technique.

3. Evaluate the technique.

Chapter Check

1. The scatter plot shows how the world's annual fresh water consumption changed over 50 years.
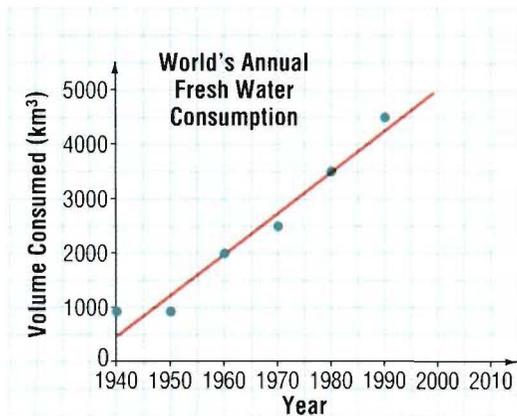
a) About how much fresh water was used in 1940? 1965? 1980? 1995?

b) During which year was about 3000 km^3 of water used?

c) About how many times more fresh water was used in 1990 than in 1940?

d) Estimate the world's fresh water consumption in 2015.

e) What relationship does the scatter plot show?

2. The table shows the percent of the world's land and the percent of the world's population on each continent.

Continent	Percent of Land	Percent of Population
Africa	20	12
Antarctica	9	0
Asia	30	60
Australia	5	0.3
Europe	7	14
N. America	16	8
S. America	12	5

a) Display the data on a scatter plot of percent of population versus percent of land.

b) Is there a relationship between the percent of population and the percent of land? Explain.

c) Which continents have a greater percent of the world's population than they have of the world's land?

d) Which are the 2 least crowded continents? Explain.

3. Find the number of possible outcomes when you roll a die, spin the spinner, and toss a coin.
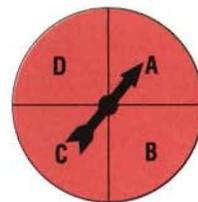
4. Find each probability.

a) $P(1)$

b) $P(\text{yellow})$

c) $P(1 \text{ or } 2)$

d) $P(\text{white})$

e) $P(5 \text{ or } 6)$

f) $P(\text{red, green, or yellow})$

g) $P(1, 2, 3, 4, 5, \text{ or } 6)$

h) $P(\text{odd number})$
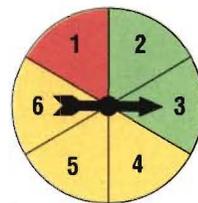
5. A box contains 4 white marbles, 5 green marbles, and 3 blue marbles. Each marble is replaced before the next draw. What is the probability of drawing each of the following?

a) a white marble

b) a green marble, then a blue marble

c) 3 blue marbles

d) a blue marble, then a green marble, then a white marble

Using the Strategies

1. Copy the diagram. Place the numbers from 1 to 10 in the circles so that the numbers on each side of the pentagon total 14. The 5 has been placed for you.
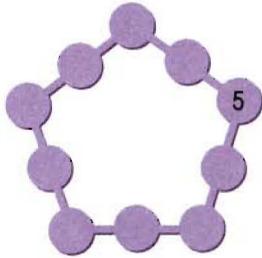
2. A block of cheese, covered with wax, measures 12 cm by 12 cm by 10 cm. The block is cut into 2-cm cubes.
a) How many cubes are there?
b) How many cubes have wax on 3 faces?
c) How many cubes have wax on 2 faces?
d) How many cubes have no wax on them?

3. The diagram shows how 20 sheep have been placed in 8 pens so that there are 6 sheep in each row of 3 pens.
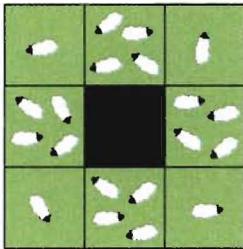
Rearrange the sheep so that there are 7 sheep in each row of 3 pens.

4. You are standing in line at the cafeteria. You are seventh from the front and eighth from the end. How many people are in the line?

5. The number 9 has 3 different factors, 1, 3, and 9. Find all the positive integers less than 50 that have an odd number of different factors.

6. A team gets 2 points for a win, 1 point for a tie, and no points for a loss. The Bears have played 28 games. They have 27 points and 7 losses. How many wins do they have?

7. The perimeter of the figure is 12 units.
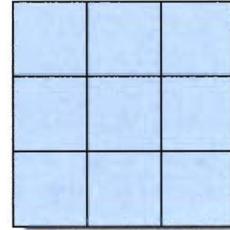
Sketch your answers to the following.
a) Remove 1 square and keep the perimeter the same.
b) Remove 2 squares and keep the perimeter the same.
c) Remove 1 square and increase the perimeter by 2.
d) Remove 2 squares and increase the perimeter by 2.
e) Remove 2 squares and increase the perimeter by 4.

8. Sketch a graph of the time needed to decorate the gym for a graduation dance versus the number of people who volunteer to help.

9. If 2 months in a row have a Friday the 13th, what months are they? Explain.

DATA BANK

1. A plane left Calgary at 16:00 and flew to Montreal at a speed of 700 km/h. At what time did it land in Montreal?

2. When you travel from east to west across the International Date Line, do you lose a day or gain a day?

Estimate, then calculate to the nearest tenth.

1. $\sqrt{50}$ **2.** $4\sqrt{18}$ **3.** $\sqrt{5} + 2\sqrt{10}$

4. The area of a triangle, whose base and height are the same, is 60 cm². What is the base, to the nearest centimetre?

Evaluate each expression for $m = -1$, $n = 2$.

5. $3m^2 - 2mn$ **6.** $m^3 + 3n^2$

Evaluate.

7. $9^2 - 2^3$ **8.** $2^8 \div 4^2$ **9.** $5^2 \times 2^4$

Simplify.

10. $b^7 \times b^2$ **11.** $3^6 \div 3^3$ **12.** $(n^2)^5$

Find the value of x.

13. $5^3 \times 5^x = 5^8$ **14.** $(10^3)^x = 10^9$

15. $w^x \times w^4 = w^{10}$ **16.** $b^5 \div b^x = b^3$

Estimate, then calculate. Write each answer in scientific notation.

17. $(5.2 \times 10^2) \times (1.9 \times 10^4)$

18. $(9.12 \times 10^3) \div (4.8 \times 10^5)$

19. $(1.4 \times 10^{-2}) \times (8 \times 10^{-3})$

20. $(8.2 \times 10^{-5}) \div (4.1 \times 10^{-3})$

Evaluate.

21. $(-2.5)^2(-2.5)^4$ **22.** $(-6)^5 \div (-6)^3$

23. $3^4 + 3^0$ **24.** 2^{-1} **25.** $3^{-1} - 3^{-2}$

26. $4^{-2} \times 4^0$ **27.** $(2^3)^2$ **28.** $(-1)^{21}$

Simplify.

29. $m^{-2} \times m^3$ **30.** $x^{-3} \div x^{-4}$ **31.** $(2m^2)^4$

32. $\left(\frac{-2x}{y}\right)^3$ **33.** $\frac{w^{-4} \times w^{-3}}{w^{-9}}$ **34.** $(3xy)^2(-xy)^3$

Evaluate for $x = 3$.

35. $5x$ **36.** $3x + 1$

Simplify.

37. $2m - 6m + 5m$ **38.** $2w + 5z - 3w + z$

39. The diagonal of a square can be found using the formula
$$d = \sqrt{2A},$$
where A is the area of the square. Determine the diagonals of squares with the following areas. Round each answer to the nearest tenth of a unit.

a) 38 cm²   **b)** 150 m²   **c)** 14.5 cm²

Write an equation for each statement.

40. A number multiplied by four is twelve.

41. A number increased by two is eight.

42. A number decreased by five and then multiplied by four is eight.

Solve.

43. $m - 5 = 2$ **44.** $1 = x - 6$

45. $a + 2 = 5$ **46.** $m + 3 = 7$

Solve.

47. $5n = 25$ **48.** $4m = 8$ **49.** $2b = 2.4$

50. $\frac{x}{3} = 4$ **51.** $\frac{y}{5} = 4$ **52.** $\frac{a}{11} = -3$

Solve.

53. $3x + 4 = 7$ **54.** $3m + 2.4 = 3.9$

55. $1.2n - 3.2 = 1.6$ **56.** $2x + 4.3 = -2.1$

Solve and check.

57. $4y + 22 = 2y$ **58.** $3x - 12 = 5x + 2x$

59. $4y = 12.7 - y + 2.8$

Expand and simplify.

60. $3(4m + 5n - 7)$ **61.** $3(x + 4) - (x - 9)$

Solve.

62. $3(x - 5) - 6 = 4 - 2x$

63. $2(x + 1) + 3x - 7 = 3(x + 4) - 2$

64. $2.5x + 1.5 = 10.75$ **65.** $\frac{x}{7} - 5 = 3 - 1$

66. $\frac{3x}{5} - 4 = \frac{x}{5} + 6$ **67.** $\frac{x - 2}{3} = \frac{x - 2}{4}$

68. Toni, Bianca, and Gemma have three consecutive whole numbers of dollars. The total amount of money they have is $66. How much money does each person have?

69. The table shows the distances covered by a grey fox at top speed in different lengths of time.

Distance (m)	18.5	37	55.5		
Time (s)	1	2	3	4	5

a) Copy and complete the table.
b) Write a formula to calculate the distance covered, d, from the time, t.

70. The total rainfall in Victoria and Edmonton in June is about 107 mm. Edmonton has 53 mm more rainfall than Victoria in June. How much rainfall does each city have in June?

71. Sophia can paint a room in 3 h. Kuhiko can paint the same room in 2 h. How long will it take them to paint the room if they paint it together?

Solve each inequality and graph the solution on a number line.

72. $5x - 4 \geq 3x - 2$ **73.** $7x - 4 < 4x - 13$

74. $6x - 5 > 4x + 1$ **75.** $3x - 1 \leq 5x + 3$

State the degree of each polynomial.

76. $3xy + 2x$ **77.** $2y^3 + 3y - 2$

Arrange the terms in each polynomial in ascending powers of x.

78. $3x - 2x^3 + 7x^4 + 5$ **79.** $2x^3 + 3xy - x^4y^5 + y^2$

Simplify.

80. $(5x^2 + 3x - 4) + (-x^2 + x + 2)$

81. $(4x^2 - 2x - 1) - (2x^2 - x + 5)$

Add.

82. $2x^2 + 4x - 2$ **83.** $x^2 - 6x - 1$
$\quad\;\; 3x^2 - 2x + 1$ $\quad\;\; 5x^2 + \;\; x - 4$

Subtract.

84. $2x^2 - 7x + 4$ **85.** $5x^2 + \;\; x - 7$
$\quad\;\; x^2 + 3x + 1$ $\quad\; -4x^2 - 2x + 3$

Multiply.

86. $(3x)(5y)$ **87.** $(-6s)(2t)$

88. $(2m^3)(3y^2)$ **89.** $-3y^4(-5x^2y^3)$

Divide.

90. $\dfrac{49x^5y^3}{14x^3y}$ **91.** $10a^2b^5c^4 \div (-5ab^2c^2)$

Find the GCF.

92. 12, 30   **93.** 25, 45

94. $8y^2$, $20y^3$ **95.** $6mn^3$, $18m^3n^4$

Factor.

96. $7y + 14$ **97.** $3p^2q - 12p^2q^2$

98. $10a^2b + 35ab^2$ **99.** $14x^2y - 7xy^2 + 28x^3y^3$

Simplify.

100. $2y(y - 3)$ **101.** $2m(m - 1) + 3(m + 2)$

102. $-2x(x^2 + 2x + 5)$

Divide.

103. $\dfrac{4pq^3 - 6p^2q^2 + 2p^3q^4}{-2pq^2}$

104. $\dfrac{-22y^2z + 66y^4z^3 - 11y^3z}{22yz}$

Expand.

105. $(a - 4)(a + 2)$ **106.** $(3m + 2)(2m + 5)$

107. $(y + 1)(y - 1.5)$ **108.** $1.5(n + 1)(n - 2)$

Factor.

109. $x^2 + 18x + 32$ **110.** $x^2 - 2x - 35$

Factor fully.

111. $2x^2 - 4x - 12$ **112.** $4x^2 + 28x + 40$

Expand.

113. $(m + 5)(m - 5)$ **114.** $(3y - 2)(3y + 2)$

Factor.

115. $y^2 - 16$

116. $100w^2 - 4z^2$

Square.

117. $(w - 3)^2$

118. $(2x + 5)^2$

119. $(3z + a)^2$

120. $(2p - 3q)^2$

Expand and simplify.

121. $(x - 2)(x^2 + 3x + 1)$

122. $(3w^2 - 4w + 2)(2w + 1)$

123. Determine the area of the figure.
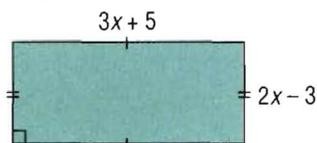
Simplify.

124. $\dfrac{x^2 y}{y^2} \times \dfrac{xy}{x}$

125. $\dfrac{w^5 z^3}{9} \div \dfrac{w^2 z^2}{15}$

126. $\dfrac{3}{x} + \dfrac{5 + x}{x}$

127. $\dfrac{2(y + 2)}{3} - \dfrac{y - 1}{4}$

Are these pairs of triangles congruent? If so, give the case and list all the corresponding equal parts.

128.

129.

130.

131.
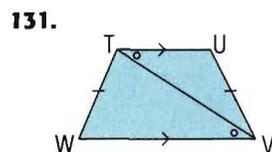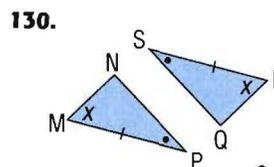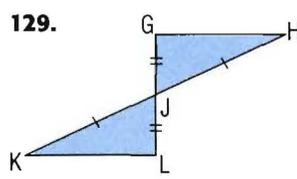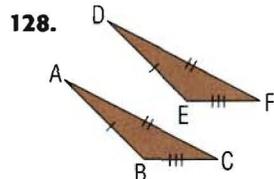
132. Find the value of y.
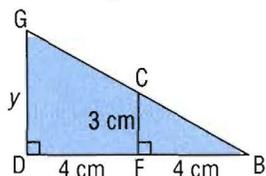
Find d to the nearest tenth of a unit.

133.

134.
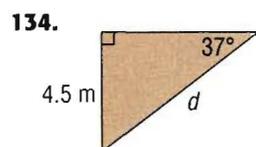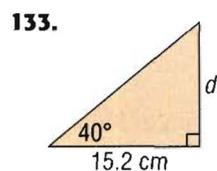
Find the measure of $\angle A$ to the nearest degree.

135.

136.
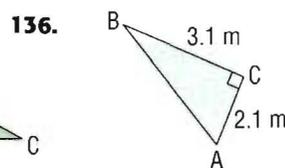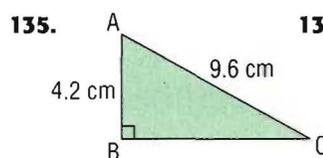
Solve each triangle. Round each side length to the nearest tenth of a unit and each angle to the nearest degree.

137.

138.
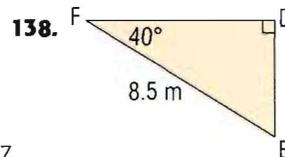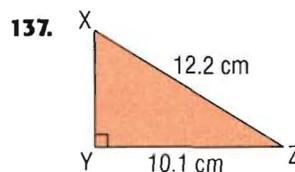
Calculate each area to the nearest tenth of a square unit.

139.

140.

141.

142.

143.

144.
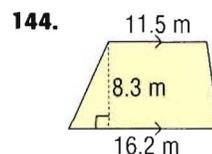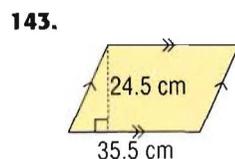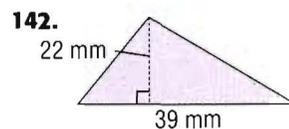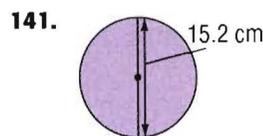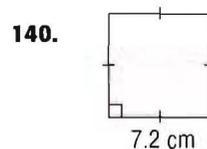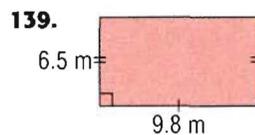
Calculate the area of each shaded region to the nearest tenth of a square unit.

145.

146.
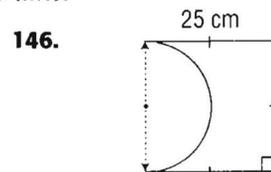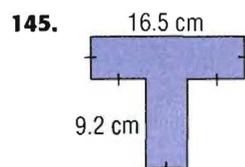
Estimate, then calculate the surface area and volume of each solid to the nearest square or cubic unit.

147.

148.

149.

8 cm
10 cm
12 cm
12 cm

150.

5.5 cm
9.7 cm
12 cm
8 cm

151.

19.5 cm
27.5 cm
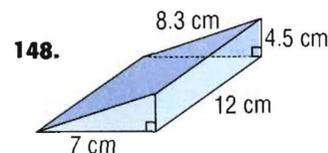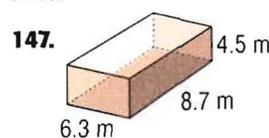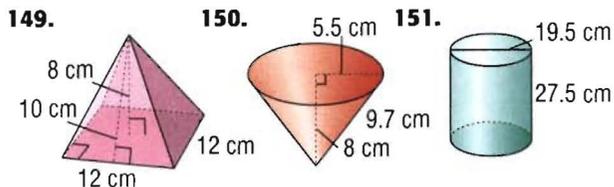
Describe each translation in words.

152. $(x, y) \rightarrow (x - 2, y + 5)$ **153.** $[-4, -4]$

154. $(x, y) \rightarrow (x + 7, y + 3)$ **155.** $[3, -5]$

156. The vertices of $\triangle$MNP are M(–3, 5), N(5, 5), and P(–3, –4). The vertices of $\triangle$M′N′P′, the translation image of $\triangle$MNP, are M′(1, 4), N′(9, 4), and P′(1, –5). Find the translation that maps $\triangle$MNP onto $\triangle$M′N′P′.

Draw each triangle on grid paper. Draw the image after the reflection in the reflection line m.

157.

158.
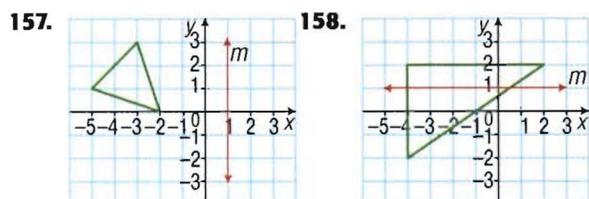
159. a) Draw the graph of the line $x - y = -3$.
b) Reflect the line in the x-axis.
c) Reflect the line in the y-axis.

160. Parallelogram WXYZ has vertices W(–2, 2), X(3, 2), Y(1, –4), and Z(–4, –4). Draw the image of the parallelogram after a 90° turn counterclockwise about the origin.

161. Rectangle KLMN has vertices K(–1, 1), L(3, 1), M(3, –1), and N(–1, –1). Find the image of rectangle KLMN under the mapping $(x, y) \rightarrow (2x, 2y)$.

162. Copy the figure onto grid paper and reduce it by a scale factor of $\frac{1}{3}$.
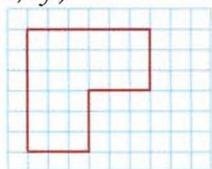
163. How many lines of symmetry does this figure have?
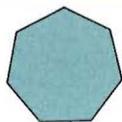
164. Draw the figure on grid paper. Add parts to each of the other 3 quadrants so that the figure has
a) 1 line of symmetry
b) 0 lines of symmetry
c) rotational symmetry of order 4
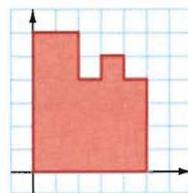
165. What is the order of turn symmetry of this figure?

166. Portage La Prairie, Manitoba, lies at a latitude of 50°N. The table shows the sunset times in April and May one year in Portage La Prairie.

Date	Time
April 15	19:53
April 22	20:04
April 29	20:15
May 6	20:26
May 13	20:36
May 20	20:46
May 27	20:55

a) Display the data on a scatter plot of sunset times versus date. Draw a line of best fit.
b) Interpolate the sunset times in Portage La Prairie on April 18 and May 25.
c) Extrapolate the sunset times in Portage La Prairie on March 3 and June 19. What assumptions have you made?
d) Could you use your line of best fit to extrapolate the sunset time in Portage La Prairie on August 30? Explain.

167. A card is drawn from a deck of playing cards. What is each probability?
a) a spade **b)** an ace **c)** queen of hearts

168. A coin is tossed and a die is rolled. Calculate each probability.
a) $P(6, \text{head})$ **b)** $P(\text{even number, tail})$

169. A box contains 3 blue cubes, 2 red cubes and 1 black cube. A cube is replaced after each choice. If you choose 3 cubes from the box, what is each probability?
a) $P(2 \text{ red cubes, 1 blue cube})$ **b)** $P(3 \text{ blue cubes})$
c) $P(1 \text{ red cube, 1 blue cube, 1 black cube})$

TIME ZONES

+1 +2 +3 +4 +5 +6 +7 +8 +9 +10 +11 +12 −11

+5

+8

+2
Helsinki
Stockholm
Gorki
Moscow
Sverdlovsk
+3 +4 +5 +6
Novosibirsk
Irkutsk
+7 +8 +9 +10 +11 −11
Yakutsk
Anadyr
−10

Add | Subtract
one | one
day | day
Monday | Sunday

Tashkent
Vladivostok
Athens +3
Beijing
Seoul
Tel Aviv +2
Teheran
Tokyo
Cairo
+4 +4½
New Delhi
+8
Shanghai
Riyadh
Karachi
SUN TIME
Calcutta
Hong Kong
Khartoum
Bombay +5½
Manila
+1 +2 +3
+6½
+5½
Ho Chi Minh City
+9
Caroline Islands
Andaman and Nicobar Islands
Nauru
+11½

International Date Line

Singapore
Jakarta
Johannesburg
+8 +9½ +10
Norfolk Island
Perth
Adelaide
Sydney
+11½

Wellington
+12

+1 +2 +3 +4 +5 +6 +7 +8 +9 +10 +11 +12 −11

365

FLYING DISTANCES BETWEEN CANADIAN CITIES

From	To	(km)
Calgary	Edmonton	248
	Montreal	3003
	Ottawa	2877
	Regina	661
	Saskatoon	520
	Toronto	2686
	Vancouver	685
	Victoria	725
	Winnipeg	1191
Charlottetown	Ottawa	976
	Toronto	1326
Edmonton	Calgary	248
	Ottawa	2848
	Regina	698
	Saskatoon	484
	Toronto	2687
	Vancouver	826
	Winnipeg	1187
Halifax	Montreal	803
	Ottawa	958
	Saint John	192
	St. John's	880
	Sydney	306
	Toronto	1287
Montreal	Calgary	3003
	Fredericton	562
	Halifax	803
	Moncton	707
	Ottawa	151
	Saint John	614
	St. John's	1618
	Toronto	508
	Vancouver	3679
	Winnipeg	1816
Ottawa	Calgary	2877
	Charlottetown	976
	Edmonton	2848
	Halifax	958
	Montreal	151
	Toronto	363
	Vancouver	3550
	Winnipeg	1687
Regina	Calgary	661
	Edmonton	698
	Saskatoon	239
	Toronto	2026
	Vancouver	1330
	Winnipeg	533
St. John's	Halifax	880
	Montreal	1618
	Toronto	2122

From	To	(km)
Toronto	Calgary	2686
	Charlottetown	1326
	Edmonton	2687
	Halifax	1287
	Montreal	508
	Ottawa	363
	Regina	2026
	St. John's	2122
	Vancouver	3342
	Windsor	314
	Winnipeg	1502
Victoria	Calgary	725
	Vancouver	62
Windsor	Toronto	314
Winnipeg	Calgary	1191
	Edmonton	1187
	Montreal	1816
	Ottawa	1687
	Regina	533
	Saskatoon	707
	Toronto	1502
	Vancouver	1862

DRIVING DISTANCES BETWEEN CANADIAN CITIES

From \ To	Edmonton	Halifax	Montreal	Ottawa	Quebec	Regina	Saint John	St. John's	Saskatoon	Toronto	Vancouver	Victoria	Whitehorse	Winnipeg
Calgary	299	4973	3743	3553	4014	764	4664	6334	620	3434	1057	1162	2385	1336
Edmonton		5013	3764	3574	4035	785	4704	6367	528	3455	1244	1349	2086	1357
Halifax			1249	1439	982	4228	309	1503	4485	1788	6050	6154	7099	3656
Montreal				190	270	2979	940	2602	3236	539	4801	4905	5850	2408
Ottawa					460	2789	1130	2792	3046	399	4611	4715	5660	2218
Quebec						3249	673	2363	3507	809	5071	5176	6120	2678
Regina							3919	5581	257	2670	1822	1926	2871	571
Saint John								1727	4176	1479	5741	5845	6790	3347
St. John's									5839	3141	7403	7775	8452	5010
Saskatoon										2927	1677	1782	2614	829
Toronto											4492	4596	5528	2099
Vancouver												105	2697	2232
Victoria													2802	2337
Whitehorse														3524

AREAS AND POPULATIONS OF CANADIAN PROVINCES

Province	Area (km²)	Population
Newfoundland and Labrador	405 720	568 474
New Brunswick	73 440	723 900
Nova Scotia	55 491	899 942
Prince Edward Island	5660	129 765
Quebec	1 540 680	6 895 963
Ontario	1 068 582	10 084 885
Manitoba	649 950	1 091 942
Saskatchewan	652 330	988 928
Alberta	661 190	2 545 553
British Columbia	947 800	3 282 061

WORLD BRIDGE RECORDS

Cable Suspension
Akashi Kaikyo, Japan (under construction)
890 m
1780 m

Cable Suspension
Humber, United Kingdom 1980
890 m
1410 m

Stone Arch
Pennsylvania, USA 1901
1161 m

Cantilever
Quebec, Canada 1917
549 m

Covered
New Brunswick, Canada 1899
391 m

Steel Arch
West Virginia, USA 1977
518 m

Widest Long-span
Sydney Harbor, Australia 1932
503 m
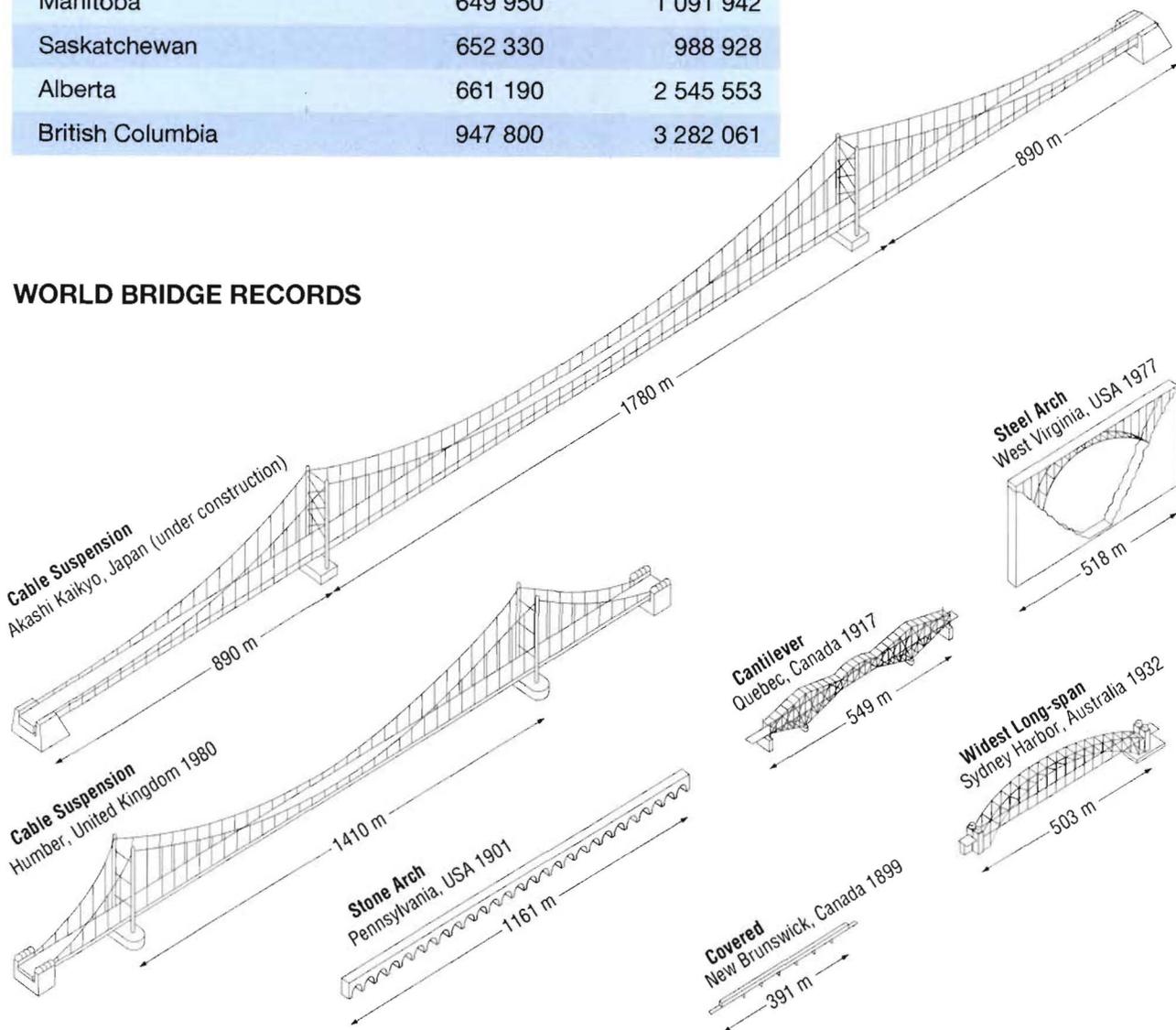
(Bridge widths are exaggerated for the purpose of this diagram.)

367

PLANETS: DISTANCES, ORBITS, MOONS

Mercury
Distance from the sun: 58 000 000 km
Time to orbit sun: 88 d
Number of moons: 0

Venus
Distance from the sun: 108 000 000 km
Time to orbit sun: 225 d
Number of moons: 0

Earth
Distance from the sun: 150 000 000 km
Time to orbit sun: 1 year
Number of moons: 1

Mars
Distance from the sun: 228 000 000 km
Time to orbit sun: 687 d
Number of moons: 2

Jupiter
Distance from the sun: 779 000 000 km
Time to orbit sun: 12 years
Number of moons: 16

Saturn
Distance from the sun: 1 425 000 000 km
Time to orbit sun: 29.5 years
Number of moons: 18

Uranus
Distance from the sun: 2 870 000 000 km
Time to orbit sun: 84 years
Number of moons: 15

Neptune
Distance from the sun: 4 497 000 000 km
Time to orbit sun: 165 years
Number of moons: 8

Pluto
Distance from the sun: 5 866 000 000 km
Time to orbit sun: 248 years
Number of moons: 1

ELEVATIONS OF THE TEN HIGHEST CITIES

City	Elevation (m)
Bogotá, Colombia	2 639
Addis Ababa, Ethiopia	2 450
Mexico City, Mexico	2 309
Nairobi, Kenya	1 820
Johannesburg, South Africa	1 734
Calgary, Canada	1 045
São Paulo, Brazil	776
Ankara, Turkey	686
Edmonton, Canada	666
Madrid, Spain	655

WORLD'S TOP TEN GOLD PRODUCERS

Country	Annual Production (t)
South Africa	621
United States	205
Australia	152
Canada	128
Brazil	100
Philippines	43
Colombia	33
Papua New Guinea	33
Chile	23
Venezuela	16

WORLD'S LARGEST RESERVOIRS

Location	Capacity (million kL)
Owem Falls, Uganda	2 700 000
Kariba, Zambia	180 600
Bratsk, Russian Federation	169 270
Aswan, Egypt	168 900
Akosombo, Ghana	148 000
Daniel Johnson, Canada	141 852
Guri, Venezuela	138 000
Krasnoyarsk, Russian Federation	73 300
Bennett, WAC, Canada	70 309
Zeya, Russian Federation	68 400

BEAUFORT WIND SCALE

Beaufort Number	Name	Speed (km/h)	Effect on Land
0	Calm	less than 1	Calm; smoke rises vertically.
1	Light air	1-5	Weather vanes inactive; smoke drifts with air.
2	Light breeze	6-11	Weather vanes active; wind felt on face; leaves rustle.
3	Gentle breeze	12-19	Leaves and small twigs move; light flags extend.
4	Moderate breeze	20-28	Small branches sway; dust and loose paper blow about.
5	Fresh breeze	29-38	Small trees sway; waves break on inland waters.
6	Strong breeze	39-49	Large branches sway; umbrellas difficult to use.
7	Moderate gale	50-61	Whole trees sway; difficult to walk against wind.
8	Fresh gale	62-74	Twigs broken off trees; walking against wind very difficult.
9	Strong gale	75-88	Slight damage to buildings; shingles blown off roof.
10	Whole gale	89-102	Trees uprooted; considerable damage to buildings.
11	Storm	103-117	Widespread damage; very rare occurrence.
12-17	Hurricane	more than 117	Violent destruction.

WIND CHILL CHART

Wind Speed	Thermometer Reading (degrees Celsius)														
	4	2	−1	−4	−7	−9	−12	−15	−18	−21	−23	−26	−29	−32	−34
Calm	4	2	−1	−4	−7	−9	−12	−15	−18	−21	−23	−26	−29	−32	−34
8 km/h	3	1	−3	−6	−9	−11	−14	−17	−21	−24	−26	−29	−32	−36	−37
16 km/h	−2	−6	−9	−13	−17	−19	−23	−26	−30	−33	−36	−39	−43	−47	−50
24 km/h	−6	−9	−12	−17	−21	−24	−28	−32	−36	−40	−43	−46	−51	−54	−57
32 km/h	−8	−11	−16	−20	−23	−27	−31	−36	−40	−43	−47	−51	−56	−60	−63
40 km/h	−9	−14	−18	−22	−26	−30	−34	−38	−43	−47	−50	−55	−59	−64	−67
48 km/h	−11	−15	−19	−24	−28	−32	−36	−41	−45	−49	−53	−57	−61	−66	−70
56 km/h	−12	−16	−20	−25	−29	−33	−37	−42	−47	−51	−55	−58	−64	−68	−72
64 km/h	−13	−17	−21	−26	−30	−34	−38	−43	−48	−52	−56	−60	−66	−70	−74

Legend: Cold ▢ Very Cold ▢ Bitterly Cold ▢ Extremely Cold

Answers

Exploring Math

Problem Solving p. xii

1. 12   **2.** 14   **3.** 8 more, not counting rotations of the square   **4.** 8   **6.** 4

Mathematics as Communication p. xiii

Activity 1:   **1.** 12 km, 12 km, 12 km, 12 km, 12 km
2. Anywhere on the line segment joining A and B.
Activity 2:   **1.** 16 km, 14 km, 16 km, 12 km, 20 km
2. At the camp located at B.   **Activity 3:**
1. Anywhere on the line segment joining B and C.
2. At the camp located at C.   **Activity 4:**
1. Anywhere on the line segment joining the middle two camps.   **2.** At the middle camp.

Mathematics as Reasoning p. xiv

Activity 1:   **1.** $4 \times 5 + 8 \div 2$ **2.** $(7 - 4) \times (4 + 4)$
3. $(7 - 4 + 4) \times 4$ **Activity 2:**   **1.** Sari: blue
MATHPOWER; Terri: green
COMPUTERPOWER; Dmitri: black
SCIENCEPOWER

Algebra p. xvi

Activity 1:   **1. a)** 2, 4; 3, 6; 4, 8   **b)** The square
must represent a number twice that of the triangle.
2. a) 1, 3; 2, 6; 3, 9   **b)** 1, 1; 2, 2; 3, 3   **c)** 2, 2; 4, 3;
6, 4   **d)** 3, 2; 6, 4; 9, 6   **e)** 0, 0; 2, 2; no other whole
number pairs   **f)** 0, 0; no other whole number pairs
Activity 2:   **1.** 7   **2.** 12   **3.** 2   **4.** 6   **5.** 20   **6.** 2
Activity 3:   **1.** 10   **2.** 3   **3.** 3   **4.** 4   **5.** 0

Functions p. xvii

Activity 1:   **1. b)** 4, 8, 12, 16, 20, 40, 400   **c)** The
perimeter equals 4 times the figure number.
2. a) 4, 6, 8, 10, 12, 22, 202; the perimeter equals 2
times the figure number, plus 2.   **b)** 8, 12, 16, 20,
24, 44, 404; the perimeter equals 4 times the figure
number, plus 4.   **c)** 8, 10, 12, 14, 16, 26, 206; the
perimeter equals 2 times the figure number, plus 6.
Activity 2:   **1.** y equals x less 8; x equals y plus 8
2. y equals x divided by 2; x equals 2 times y
3. y equals 20 less x; x equals 20 less y **4.** y equals 2
times x plus 1; x equals the quantity y less 1, divided
by 2

Trigonometry p. xx

Activity :   **2. a)** 1.96   **b)** equal   **3.** 11.2 m

Probability p. xxii

Activity 1:   **1. a)** This is the ratio of the number of
red marbles to the total number of marbles.   **b)** $\frac{2}{10}, \frac{5}{10}$
2. 50%   **3.** 50   **Activity 3:** $\frac{1}{8}, \frac{1}{16}, \frac{1}{256}$

Mathematics and Counting p. xxiii

Activity 1:   **1.** 12   **Activity 2:** 8   **Activity 3:** 12
Activity 4:   **1.** 18, 22, 26   **2.** 63, 127, 255
3. 6, 2, $\frac{2}{3}$ **4.** 29, 47, 76

Investigating Limits p. xxiv

Activity 1:   **2.** 1   **Activity 2:**   **5.** 78.5 cm^2
7. Yes; the errors in the approximations would
decrease.

Mathematical Structure p. xxv

Activity 1:   **1.** 05:00   **2.** 20 h   **3. a)** 8   **b)** 6   **c)** 4
d) 1   **e)** 6   **f)** 4   **g)** 10   **h)** 7   **Activity 2:**   **1. a)** yes
b) no   **c)** yes   **d)** no   **2. a)** 2   **b)** 3   **c)** 0   **d)** 2   **e)** 0
3. a) yes   **b)** no

Chapter 1

Getting Started pp. 2–3

Activity 1:   **1.** 3, 5; 5, 7; 11, 13; 17, 19; 29, 31;
41, 43; 59, 61; 71, 73   **2.** 3, 5, 7   **3. a)** $24 = 11 + 13$
b) $30 = 7 + 23$ **c)** $42 = 19 + 23$ **d)** $100 = 41 + 59$
Mental Math   **1.** 115   **2.** 144   **3.** 49   **4.** 121
5. 330   **6.** 80   **7.** 133   **8.** 412   **9.** 1600   **10.** 6969
11. 17   **12.** 12.3   **13.** 31   **14.** 61   **15.** 3342   **16.** 50
17. 0.95   **18.** 60   **19.** 30   **20.** 32   **21.** 578   **22.** 695
23. 498   **24.** 821   **25.** 210   **26.** 705   **27.** 165
28. –82   **29.** 149   **30.** –895   **31.** 32   **32.** –2   **33.** 79
34. 19   **35.** 9   **36.** –7   **37.** 20   **38.** 37   **39.** 48
40. –26   **41.** 50   **42.** 10   **43.** 80   **44.** 38   **45.** 196
46. 34   **47.** 36   **48.** 36   **49.** 150   **50.** –20

Learning Together pp. 4–5

Activity 1:   **1.** c   **2. a)** yes   **b)** yes   **3.** Integers are
made up of positive and negative whole numbers.
Whole numbers are made up of the natural numbers
plus 0.   **Activity 2:**   **1.** $\frac{1}{2}, \frac{1}{4}, \frac{5}{8}, -\frac{1}{5}, -\frac{3}{4}, -\frac{17}{20}$
2. terminating decimal   **3. a)** No; often the result is

another fraction or decimal number. **b)** No; integers do not include decimal numbers. **Activity 3:**
1. 0.666..., –0.6363..., 0.1666..., –0.555... **2. a)** no
b) a bar over the repeating digits **3.** $0.\overline{6}$, $-0.\overline{63}$, $0.1\overline{6}$, $-0.\overline{5}$ **4.** Natural numbers inside the whole numbers, which are inside the integers, which are inside the rational numbers. **5.** Rational numbers can be written in the form $\frac{a}{b}$, where a is any integer and b is any integer except 0. **Activity 4:**
1. a) true **b)** false. Integers do not include decimal numbers. **c)** false. Natural numbers do not include negative digits. **d)** false **e)** true **f)** false. It is a non-terminating, non-repeating decimal. **2.** 2 can be written as the fraction $\frac{2}{1}$, is positive, and is greater than 0. **3.** –10 can be written as the fraction $-\left(\frac{10}{1}\right)$. Since it is a negative integer, it cannot be a whole number. **4.** All negative integers. **5.** No; it is a non-terminating, non-repeating decimal.
Activity 5: **1. a)** $\frac{1}{3}$ **b)** $\frac{1}{8}$ **c)** $-\frac{1}{10}$ **d)** $-\frac{1}{7}$ **2. a)** $\frac{1}{2}$
b) $\frac{1}{3}$ **c)** $-\frac{1}{5}$ **d)** $-\frac{1}{8}$

Learning Together pp. 6–7
Activity 1: **1. a)** 64 **b)** 100 **c)** 1 000 000
Activity 2: **1.** 15, 21, 28 **3.** a square number
Activity 3: The locker doors that are closed are numbered by perfect squares: 1, 4, 9, 16,..., 900, 961
Activity 4: Answers may vary. **1. a)** $33 = 5^2 + 2^2 + 2^2$
b) $42 = 5^2 + 4^2 + 1$ **c)** $77 = 6^2 + 5^2 + 4^2$ **d)** $88 = 8^2 + 4^2 + 2^2 + 2^2$ **e)** $153 = 12^2 + 3^2$ **f)** $212 = 14^2 + 4^2$
g) $208 = 12^2 + 8^2$ **h)** $903 = 23^2 + 19^2 + 3^2 + 2^2$

Section 1.1 pp. 10–11
Practice **1.** –7, 7 **2.** –9, 9 **3.** –11, 11 **4.** –25, 25
5. –0.8, 0.8 **6.** –0.1, 0.1 **7.** –1.4, 1.4 **8.** –0.5, 0.5
9. 5 **10.** 10 **11.** 15 **12.** 16 **13.** 13 **14.** 0.6
15. 0.2 **16.** 1.1 **17.** 0.9 **18.** 5 **19.** 8 **20.** 10
21. 30 **22.** 30 **23.** 60 **24.** 90 **25.** 200 **26.** 900
27. 0.9 **28.** 0.9 **29.** 0.2 **30.** 0.2 **31.** 0.2
32. 0.05 **33.** 0.09 **34.** 0.02 **35.** 0.01 **36.** 0.02
37. 6, 5.6 **38.** 7, 6.6 **39.** 8, 7.9 **40.** 9, 8.9
41. 10, 10.0 **42.** 10, 14.4 **43.** 30, 33.5
44. 100, 142.1 **45.** 300, 293.3 **46.** 400, 449.6
47. 4.4 **48.** 0.9 **49.** 9.9 **50.** 28.8 **51.** 2.4
52. 18.2 **53.** 1.7 **54.** 0.2 **Problems and Applications** **55. a)** 4 **b)** 5 **c)** 6 **d)** 7 **e)** –10 **f)** 8
g) 20 **h)** –9 **i)** 51.1 **56. a)** 20.8 cm **b)** 14.1 m
57. a) 16.2 cm² **b)** 113.9 cm² **58. a)** 6.0 cm
b) 10.1 m **c)** 28.4 mm **d)** 45.1 cm **59.** 629 m
60. c) Results are equal since $\sqrt{8} = \sqrt{4 \times 2} = 2\sqrt{2}$

61. They are opposites. **62.** 6.5 cm – half the side length of the square **63.** An error. Negative numbers do not have square roots. **64.** One possible answer is (0, 7) and (7, 0). **65. a)** 17, 24, 28, 33 **b)** The sum of the first n odd numbers is n^2.

Section 1.2 p. 13
Practice **1.** 7, 6.8 **2.** 20, 17.4 **3.** –9, –9.5
4. 40, 40.6 **5.** –63, –65.7 **6.** 13, 12.5 **7.** 69, 65.2
8. 100, 106.5 **9.** 4.7, 4.5 **10.** 11, 10.8 **11.** 1.4, 1.4
12. 2.8, 2.9 **Problems and Applications**
13. a) 5.0 cm **b)** 20.0 cm **14. a)** 15.0 m **b)** 60.0 m
15. a) 7.4 m **b)** 29.6 m **16. a)** 9.5 cm **b)** 38 cm
17. a) 14.1 m **b)** 56.4 m **18. a)** 28.3 cm **b)** 113.2 cm
19. a) 100 m by 100 m **b)** 50 m by 50 m
20. a) 7.3 km/h, 10.1 km/h **b)** 18.5 km/h, 15.6 km/h
21. a) 340 m/s **b)** 330 m/s **c)** 324 m/s
22. Approximately 11 000 km/h

Section 1.3 p. 15
Problems and Applications **1.** 6 **2.** 9 **3.** 78, 79,
80 **4.** 46, 48, 50, 52 **5.** 55 **6.** 4 **7.** 2 **8.** 17 m
× 13 m **9.** 25 m, 31 m **10.** 16 **11.** 7 **12.** 8 cm
× 7 cm × 6 cm **13.** 6 kg cashews, 18 kg peanuts
14. Companion–15, Officer–46, Member–92

Section 1.4 pp. 17–18
Practice **1.** 5; 3 **2.** 10; 7 **3.** x; 5 **4.** t; 2
5. 2 **6.** –7 **7.** 13 **8.** –1 **9.** 4^6 **10.** 6^4 **11.** m^5
12. r^3 **13.** 5×5 **14.** $1 \times 1 \times 1 \times 1 \times 1 \times 1$
15. $2 \times 2 \times 2 \times 2 \times 2$ **16.** $10 \times 10 \times 10 \times 10$
17. $0 \times 0 \times 0$ **18.** $y \times y \times y \times y$ **19.** $5 \times x \times x \times x \times x$
20. $2m \times 2m \times 2m$ **21.** $x \times x \times x \times y$ **22.** $x \times y \times y \times y$
23. $xy \times xy \times xy$ **24.** $ab \times ab \times ab \times ab$ **25.** 8 **26.** 81
27. 125 **28.** 100 000 **29.** 2^2 **30.** 4^3 **31.** x^3
32. y^2 **33.** 10^2 **34.** 10^3 **35.** 10^5 **36.** 10^6 **37.** 10^8
38. 10^7 **39.** 32 **40.** 125 **41.** 256 **42.** 343
43. 10 000 000 **44.** 729 **45.** 0.25 **46.** 1.331
47. 0.0001 **48.** 2^2 **49.** 3^3 **50.** 2^4 **51.** 5^3 **52.** 5^2
53. equal **54.** 2^3 **55.** 58 **56.** 48 **57.** 24 **58.** 8
59. 0.1 **60.** 0.005 12 **61.** 1.6 **62.** 0.001 **63.** 76
64. 60 **65.** 32 **66.** 4 **67. a)** –64 **b)** 11 **c)** 73
d) 64 **68. a)** 13 **b)** –1 **c)** –35 **d)** 14 **e)** –150 **f)** 105
Problems and Applications **69. a)** 2000 **b)** 8000
c) 64 000 **70. a)** 2^7 **b)** 2^{10} **71. a)** 25 m, 45 m, 40 m
b) 6 s **72. a)** Each number may be written as a power with the same number base and exponent.
b) 5^5, 10^{10} **73.** $4a$ **74.** $6a$ **75. a)** 49 **b)** 301 **c)** 1
76. a) sometimes true **b)** always true **c)** never true
77. a) 8, 16, 32, 64 **b)** approx. 1.8×10^{13} km

Section 1.5 p. 21

Practice 1. 5^7 2. 2^{10} 3. 7^{10} 4. 10^7 5. 4^{11} 6. 3^7 7. y^6 8. x^9 9. a^7 10. 4 11. 2 12. 6 13. 1 14. 3 15. 2 16. 3 17. 1 18. 4^2 19. 3^1 or 3 20. 9^0 or 1 21. 10^1 or 10 22. 4^6 23. 5^0 or 1 24. m^1 or m 25. x^2 26. 4 27. 2 28. 7 29. 10 30. 1 31. 9 32. 4 33. 5 34. 2^{12} 35. 3^{10} 36. 4^{14} 37. 10^{15} 38. 5^{16} 39. x^{20} 40. y^9 41. t^{42} 42. m^5 43. 2 44. 3 45. 4 46. 2 47. 3 48. 3 49. 5 50. 1 **Problems and Applications** 51. 10^5 or 100 000 52. **a)** multiplied bases; added exponents when bases were not equal **b)** 72 53. **a)** divided bases; subtracted exponents when bases were not equal **b)** 54 54. smallest is 1^{23456}

Section 1.6 p. 23

Problems and Applications 1. $2589.00; assuming $215.75/month 2. 860; assuming 20 cases per member 3. 200; assuming equal proportions 4. 75 km; assuming average speed of 15 km/h 5. A reduction of 0.1 s per week training 6. Assuming a representative survey 7. 26 m 8. **a)** 2 **b)** 3 9. 2 419 200 s; assuming 28 days 10. **a)** 7 h; assuming driving at the speed limit **b)** 23:45 11. **a)** 12.5, 6.25, 3.125 **b)** 32, 39, 47 **c)** 63, 127, 255 12. 31.5 s 13. $33 554 432.00; assuming an initial price of $0.50. Alternative solution is to expand 2^{25}.

Section 1.7 p. 25

Practice 1. $4.5 \times 10\ 000$, 4.5×10^4; 85 000, 8.5×10^4; 110 000, 1.1×10^5; 978 000 000, $9.78 \times 100\ 000\ 000$; 20 300 000, $2.03 \times 10\ 000\ 000$ 2. 3 3. 6 4. 4 5. 7 6. 5 7. 8 8. 770 000 9. 67 000 10. 7.6×10^6 11. 9.8×10^8 12. 35 13. 2.3×10^4 14. 6.7×10^3 15. 130 000 16. 1.7×10^{10} 17. 4.8×10^{15} 18. 5.963×10^{14} 19. 6×10^{12} 20. 6.3×10^{14} 21. 1.5×10^3 22. 1×10^2 **Problems and Applications** 23. **a)** 9.1×10^4 **b)** 8×10^{23} **c)** 9.5×10^7 24. **a)** 2.2×10^{16} **b)** 2325.4 years 25. Since 56 is larger than 10.

Section 1.8 pp. 28–29

Practice 1. $\frac{1}{2}$ 2. -5 3. 1 4. -9 5. 5 6. 2 7. 0 8. 1 9. $\left(\frac{1}{4}\right)^3$ 10. $(-3)^5$ 11. p^5 12. $(-n)^4$ 13. $3^4 \times (-2)^3$ 14. $(-2)(-2)(-2)(-2)(-2)$ 15. $-2 \times 2 \times 2 \times 2 \times 2$ 16. $\left(-\frac{1}{x}\right)\left(-\frac{1}{x}\right)\left(-\frac{1}{x}\right)$ 17. 9 18. 9 19. 1 20. -1 21. -125 22. -125 23. -0.125 24. 1.4641 25. 6.25 26. 5^9 27. $(-8)^5$

28. $(-2)^7$ 29. $\left(\frac{1}{2}\right)^7$ 30. $(-2.1)^8$ 31. $(-0.2)^5$ 32. 5^1 33. 6^6 34. $(-0.4)^2$ 35. $(-9)^5$ 36. 2^6 37. $(-3)^{28}$ 38. $\left(-\frac{1}{5}\right)^6$ 39. $(-6)^{15}$ 40. $(-4)^{42}$ 41. $(-2.3)^{12}$ 42. x^6 43. $\left(\frac{1}{y}\right)^7$ 44. z^7 45. $(-m)^{10}$ 46. s^8 47. $(-r)^6$ 48. $(-5)^5$, -3125 49. 6^7, 279 936 50. $(-2)^{10}$, 1024 51. $(-1)^{12}$, 1 52. $(-3.1)^8$, 8528.9 53. $(-3)^2$, 9 54. $(-10)^4$, 10 000 55. $(-4)^1$, -4 56. 16 57. 729 58. -3125 59. 729 60. -64 61. 256 62. 256 63. -243 64. 64 65. 36 66. 64 67. -384 68. 324 69. 26 70. 781 71. -2592 72. -10.125 73. 6400 74. 27.04 75. -0.018 76. **a)** $0.0\overline{2}$ **b)** -4.5 **c)** 1702 **d)** 9 77. **a)** -8 **b)** 405 **c)** 5 **d)** -72 **e)** -125 **f)** 25 **g)** -13.5 **h)** -47 **i)** -216 **Problems and Applications** 78. **a)** 4 **b)** 9 **c)** 4 **d)** 10 **e)** 4 **f)** -1.3 or 1.3 **g)** 4 **h)** -0.6 79. **a)** 2 **b)** 3 **c)** 6 **d)** 64 **e)** 3 **f)** 2 80. 10 cm, 8 cm; 125 cm^3, 343 cm^3, 74.088 cm^3 81. **a)** 160, 320, 640, 1280, 2560 **b)** 163 840 **c)** 10×2^{40} 82. positive 83. negative 84. Length must be positive. 85. **a)** yes **b)** no **c)** yes

Learning Together pp. 30–31

Activity 1: 1. The digits 2, 4, 8, 6 repeat in this order. 2. 6 3. **a)** 6 **b)** 2 **c)** 4 4. 8 **Activity 2:** 1. The digits 3, 9, 7, 1 repeat in this order. 2. 1 **Activity 3:** 3 **Activity 4:** 1. 6 2. constant 3. Any base whose ones digit is a 6, for example, 16 **Activity 5:** 1. **a)** 6 **b)** 4 2. The digits 4, 6 repeat in this order 3. Any base whose ones digit is a 4, for example, 34 **Activity 6:** 1. Use the table method but this time draw the graph of the last two digits.

Section 1.9 p. 34

Practice 1. x^2 2. a^3 3. p^5 4. n^4 5. t^6 6. $-y^6$ 7. x^6 8. y^6 9. m^4 10. n^{12} 11. x^9 12. y^6 13. z^{12} 14. m^{20} 15. p^{36} 16. s^{20} 17. $-x^{31}$ 18. 1 19. x^2y^2 20. a^3b^3 21. x^2y^2 22. m^4n^4 23. p^3q^3 24. $4x^2t^2$ 25. $16x^2y^2$ 26. $-8a^3x^3$ 27. $-27r^3s^3$ 28. x^6y^6 29. x^4y^6 30. a^6b^3 31. a^2b^6 32. m^3n^3 33. a^2b^4 34. j^6k^8 35. x^4y^2 36. -1 37. $8x^6$ 38. $9y^6$ 39. $16x^8$ 40. $25y^4$ 41. m^4 42. $-n^6$ 43. $-8n^6$ 44. $9y^4$ 45. $9p^2q^2r^2$ 46. $-27y^3z^3$ 47. $-64x^6y^9$ 48. $-9x^2$ 49. $\frac{m^4}{16}$ 50. $\frac{r^8}{t^8}$ 51. $-\frac{d^5}{p^5}$ 52. $\frac{8b^3}{125c^3}$ 53. $-\frac{8x^3}{y^6}$ 54. $\frac{9s^8}{4q^6}$ 55. $4x^6y^7$ 56. $-12x^3y^3$ 57. $24x^5y^8$ 58. $-200a^4b^3c^3$ 59. $-540a^9b^8$ **Problems and Applications** 60. **a)** $4x^2y^2$ **b)** $16x^4y^6$ 61. **a)** $27x^6y^3$ **b)** $125y^6$ 62. 157 464 63. **a)** no **b)** yes

Section 1.10 p. 35

Problems and Applications **1.** 10 **2.** 10 000 000
3. 12.25 days, or during the 13th day

Section 1.11 pp. 38–39

Practice **1. a)** $\frac{1}{9^8}$ **b)** $\frac{1}{1^4}$ **c)** $\frac{1}{0.5^6}$ **d)** $\frac{1}{-7^6}$ **e)** 5^4
f) $(-3)^5$ **2. a)** 8^{-2} **b)** 7^{-3} **c)** 9^{-4} **d)** 2^{-2} **e)** 3^{-3} **f)** 2^{-6}
or 4^{-3} **g)** 3^{-5} **3.** 1 **4.** 64 **5.** $\frac{1}{3}$ **6.** $\frac{-1}{1000}$ **7.** 1000
8. $\frac{1}{729}$ **9.** 3 **10.** 16 **11.** -3 **12.** 7^9 **13.** 9^2
14. 8^{-8} **15.** 6^4 **16.** 5^{-5} **17.** 4^{-8} **18.** 3^{12} **19.** 9^{-8}
20. 8^5 **21.** -2^6 **22.** 2^3 **23.** 3^{-6} **24.** 5^{-2} **25.** 8^1
26. $(-2)^{-6}$ **27.** $(-3)^0$ **28.** 81 **29.** 16 **30.** $\frac{1}{25}$
31. $\frac{1}{36}$ **32.** 7 **33.** 1 **34.** 10 000 **35.** 100 **36.** $\frac{1}{2}$
37. 1 **38.** 28 **39.** 15.5 **40.** 134 **41.** $\frac{5}{4}$ **42.** 9
43. $\frac{1}{9}$ **44.** $\frac{1}{2}$ **45.** 7 **46.** $\frac{3}{2}$ **47.** $\frac{-4}{9}$ **48.** 3 **49.** $\frac{1}{25}$
50. 1 **51.** 100 **52.** $-\frac{27}{8}$ **53.** $\frac{16}{9}$ **54.** x^7 **55.** x
56. y^{-4} **57.** t^4 **58.** m^8 **59.** b^2 **60.** m^8 **61.** t^{-8}
62. y^{10} **63.** m^5 **64.** a^{-8} **65.** t^{-2} **66.** y^{-1} **67.** t^8
71. a) 6 **b)** $\frac{45}{256}$ **72. a)** $\frac{2}{x^6 y}$ **b)** $\frac{3x^{11}}{y^2}$ **73. a)** 8 **b)** 81
c) 1 **d)** $\frac{1}{8}$ **e)** $\frac{1}{9}$ **f)** $\frac{1}{16}$ **g)** $\frac{1}{36}$ **h)** -1 **i)** $\frac{1}{25}$ **74.** 2^{-3}
is greater **75. a)** 3 **b)** 4 **c)** 0 **d)** -2 **e)** -3 **f)** 3
g) 2 **h)** 10 **76. a)** 1 **b)** $\frac{27}{8}$ **c)** $\frac{-8}{9}$ **d)** $\frac{7}{16}$ **e)** $\frac{25}{16}$
f) $\frac{9}{25}$ **77. a)** $\frac{1}{32}$ **b)** 2^{-5} **c)** $\frac{1}{2^5}$ **d)** 39 900 years
78. a) sometimes true **b)** sometimes true **c)** always
true **79. b)** $\frac{1}{4}$

Technology pp. 40–41

Activity 1: 0, 1, 10, 11, 100, 101, 110, 111,
1000, 1001, 1010, 1011, 1100, 1101, 1110, 1111
Activity 2: **1.** 1, 10, 100, 1000, 10000, 100000,
1000000, 10000000 **2.** equal **Activity 3:**
1. 10100 **2.** 100101 **3.** 111000 **4.** 1001110
5. 10010011 **Activity 4:** **1.** 21 **2.** 25 **3.** 42
4. 51 **Activity 5:** **1.** 8, 16, 32
2. 7.205 759 4 $\times 10^{16}$ codes, 197 418 066 years

Section 1.12 pp. 42–43

Practice **1.** 4.5×10^6 **2.** 8.9×10^{-2} **3.** 2.0×10^{-1}
4. 5.5×10^{-5} **5.** 4.5×10^8 **6.** 3.4×10^5
7. 3.3×10^{-7} **8.** 1.0×10^{-8} **9.** 6.0×10^{-9}
10. 1.0×10^{-12} **11.** 230 000 000 **12.** 0.000 004 7
13. 0.000 000 007 **14.** 0.000 001 **15.** 2.3×10^7
16. 4.5×10^{-8} **17.** 5×10^{-6} **18.** 10^{-10} **19.** 7.8×10^8
20. 6.8×10^{-7} **21.** 8×10^{-11} **22.** 10^{-8} **23.** 1.25×10^{-6}

24. 9.6×10^{-6} **25.** 1.312×10^{-4} **26.** 2.6×10^5
27. 5.0×10^{-2} **Problems and Applications**
28. a) 4.35×10^{-3}, 4.3×10^{-3}, 10^{-3}, 8.4×10^{-4} **b)** $5.6 \times$
10^{-8}, $\frac{1}{10^8}$, 5.6×10^{-9}, 10^{-9} **c)** 10^{-2}, 2.12×10^{-3},
2.1×10^{-3}, $\frac{1}{1000}$ **29.** 4.0×10^{41} **30. a)** 2.0×10^6 J
b) 8.0×10^{-4} J **c)** 1.5×10^6 J **31.** 0.23 is not larger
than 1 **32.** 5×10^0 **33. a)** 1×10^{-14}, 1×10^9

Technology pp. 44–45

Activity 1: **1. b)** in order of appearance
Activity 2: **1. b)** no **2. b)** brackets first, then
exponents **3.** brackets exponents division
multiplication addition subtraction **7.** -116

Section 1.13 p. 47

Problems and Applications **1. a)** 25 m **b)** 44.8 m
c) 60 m **d)** 76.8 m **2.** $v = 5.5b$ **3. a)** $c = 3.5 + 1.4d$,
(d in km) **b)** $14.00 **4.** $30.80 **5.** $5.90 **6.** 4.4 s
7. a) 11.9 years **b)** 0.2 years **c)** 84.1 years

Section 1.14 p. 49

Problems and Applications **1. a)** 1330 km
b) 1822 km **c)** 492 km **3.** 21:45 **4.** $-47°$C
5. 18:00 on July 1 **6. a)** 6050 km **b)** 67 h **7.** 1.4
8. Prince Edward Island, Nova Scotia, New
Brunswick, Ontario, Quebec, Alberta, British
Columbia, Manitoba, Saskatchewan, Newfoundland,
and Labrador.

Connecting Math and Archaeology
pp. 50–51

Activity 1: Percent of C-14 remaining: 100, 50, 25,
12.5, 6.25, 3.13, 1.56, 0.78 **Activity 2:**
1. about 23 000 years **2.** about 13 200 years
3. about 12 800 years **4.** about 24 600 years
5. about 18 900 years

Review pp. 52–53

1. 25 **2.** 49 **3.** 144 **4.** 961 **5.** 0.4 **6.** 9 **7.** 11
8. 20 **9.** 36 **10.** 74 **11.** -56 **12.** 11 **13.** 5, -5
14. 6, -6 **15.** 8, -8 **16.** 12, -12 **17.** 7.7 **18.** 19.3
19. 35.7 **20.** 202.7 **21.** 2.2 **22.** 0.1 **23.** -0.4
24. 12.4 **25.** 0.4 **26.** 13.6 **27.** 1.9 **28.** 0.6 **29.** 2^8
30. 5^4 **31.** 2^8 **32.** 7^{12} **33.** 3^9 **34.** 6^4 **35. a)** 1
b) -138 **c)** 61 **36.** 2.73×10^7 **37.** 1.93×10^{-8}
38. 25 300 000 **39.** 0.000 971 **40.** 7.75×10^8
41. 2.294×10^{-1} **42.** 3.44×10^{14} **43.** 243 **44.** 144
45. -125 **46.** 160 **47.** 1 **48.** 1 **49.** 0.5 **50.** $0.\overline{1}$
51. $0.\overline{296}$ **52.** $2.\overline{7}$ **53.** 9 **54.** 40 **55.** $-0.\overline{6}$

56. 0.375 **57.** 2^{-2} **58.** n^2 **59.** 3^{-8} **60.** $-x^{-5}$
61. 0.4^{-8} **62.** 4^{-2} **63.** 15 625 **64.** 8 **65.** 36
66. 4096 **67.** 0.5 **68.** 16 **69.** 0.031 25 **70.** $0.\overline{1}$
71. a) 36 **b)** −32 **c)** 36 **d)** 125 **e)** 172 **f)** 36
72. 471.6 **73.** 16 930 **74.** 0.063 **75.** 0.123 94
76. $-8x^6y^9$ **77.** $25x^4y^4$ **78.** $-8a^3b^3c^{12}$ **79.** $2x^8y^7z^8$
80. $-27a^{12}b^4x^4$ **81.** $\dfrac{f^3}{27}$ **82.** $-\dfrac{r^7}{q^7}$ **83.** $\dfrac{25m^2}{49n^2}$
84. a) 20 cm by 20 cm **b)** 10 000 cm² **c)** 400 cm
85. a) 0.5×10^{-2} km² per person **b)** 71 m **86. a)** The decimal point should be after the digit 4.
b) 4.5×10^6 **87. a)** 341 m/s **b)** 348 m/s **c)** 305 m/s assuming a temperature of −40°C **88.** \$3.20

Chapter Check p. 54

1. 6 **2.** 20 **3.** −11 **4.** 9.6 **5.** 17.7 **6.** 0 **7.** −35
8. 7.5 **9.** 5 **10.** 16 **11.** 81 **12.** 125 **13.** 3^9
14. 2^4 **15.** 5^8 **16.** 4.5×10^7 **17.** 2.13×10^5 **18.** 81
19. 1 **20.** 1 **21.** 0.2 **22.** $0.\overline{012345679}$ **23.** $0.\overline{1}$
24. −8 **25.** 0.49 **26.** −4 **27.** 0.2 **28.** 0.75
29. 16 **30.** 4.0×10^{-4} **31.** 2.31×10^{-12} **32.** 0.0046
33. 0.000 003 21 **34.** 4.845×10^{-7} **35.** 3.3×10^3
36. $(-3)^{-1}$ **37.** s^{-3} **38.** 2^3 **39.** 3^{-2} **40. a)** 48
b) −27 **41.** 231 km by 231 km **42.** $-27x^{12}y^9$
43. $9x^8y^8$ **44.** $\dfrac{g^2}{64}$ **45.** $-\dfrac{b^9}{d^9}$ **46.** $\dfrac{16y^4}{81k^4}$ **47. a)** \$237.50
b) \$512.50

Using the Strategies p. 55

1. 253×14 or 154×23 **2.** 7 cm, assuming the cardboard has dimensions 21 cm by 14 cm
3. 0, 4, or 8 **4.** 47, 48, 49 **6. a)** 25 **b)** 51
7. a) 20 cm² **b)** 5 cm² **8.** 13 **9. b)** $33 + 34 + 35 + 36$
10. 12, considering both a.m. and p.m. **Data Bank**
1. 1241 km **2.** −7°C with the wind at 32 km/h (−23°C versus −21°C)

Chapter 2

Getting Started pp. 58–59

Activity 1: **1.** The third number in the column is the sum of the first two numbers in the column, while the fourth is their product. **2.** The second number is twice the first; the third is twice the second; the fourth is twice the third less the first. **3.** The first number is the third less the fourth; the second is the product of the third and fourth. **4.** The first number is the product of the second and third; the fourth number is the third less the second.

5. The second number is the product of the first and fourth; the third is the sum of the other three. **6.** The second number is three times the first; the third is the second plus one; the fourth is the sum of the second and third. **Activity 2:** **1.** 6 **2.** 4 **3.** 8 **4.** Count the number of factors. **Activity 3:** **1. a)** 8 white, 1 yellow **b)** 13 white, 2 yellow **c)** 21 white, 4 yellow **d)** 18 white, 3 yellow **e)** 29 white, 6 yellow **f)** 40 white, 9 yellow **Mental Math** **1.** 0 **2.** 10 **3.** −6 **4.** 6 **5.** −12 **6.** −30 **7.** −40 **8.** −25 **9.** −20 **10.** 10 **11.** 8 **12.** 9 **13.** −1 **14.** 1 **15.** −25 **16.** −1 **17.** 16 **18.** 4 **19.** −100 **20.** 27 **21.** −1 **22.** −1 **23.** 1 **24.** −27 **25.** −9 **26.** 30 **27.** −20 **28.** −50 **29.** −60 **30.** −24 **31.** 60 **32.** −1000 **33.** 200 **34.** −2 **35.** −3 **36.** −7 **37.** 2 **38.** 4 **39.** 4 **40.** 7 **41.** −7 **42.** 9 **43.** −3 **44.** −11 **45.** 10 **46.** 3^1 **47.** 2^3 **48.** 3^3 **49.** 6^2 **50.** 4^1 **51.** 5^2 **52.** 3^2 **53.** 4^2 **54.** 2^1 **55.** 2^3 **56.** 3^2 **57.** 4^2 **58.** 5^2 **59.** 6^1 **60.** 2^3

Section 2.1 p. 61

Problems and Applications **1.** 17, 20 **2.** 6, 4 **3.** 9, 6 **4.** 80, 160 **5.** 16, 8 **6. a)** 16 **b)** 19 **c)** 151 **7. a)** 9 **b)** 36 **c)** 100 **d)** The sum of the first cube is 1^2. To find the sum of the first 2 cubes, add 2 to the base of the previous result: 3^2. To find the sum of the first 3 cubes, add 3 to the base of the previous result: 6^2. etc. **e)** $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 = 45$, thus the sum of the first 9 cubes is $45^2 = 2025$. **8.** 1, 121, 12321, 1234321, 123454321, 12345654321 **9.** \$1 900 000 **10.** 5 **11.** 9 of the digit 0 and 19 of each of the digits 1 to 9 **12.** 65 **13.** 45 **14.** 156 **15.** 28 **16.** 54

Section 2.2 p. 63

Practice **1.** a **2.** c **3.** q **4.** b **5.** k **6.** t **7.** c; 10 **8.** a, b; −6 **9.** x, y; −3 **10.** x, y, z; 0.5 **11.** 2; 2, 3 **12.** 3; 7, 9 **13.** 3; −5, $\frac{1}{4}$ **14.** 2; 6, 11 **15. a)** 10 **b)** −25 **c)** 0 **d)** −20 **16. a)** 1 **b)** 4 **c)** 16 **d)** −8 **17. a)** −3 **b)** 3 **c)** −11 **d)** 19 **18. a)** 1 **b)** −4 **c)** −10 **d)** 12 **19. a)** 1 **b)** −24 **c)** −6 **d)** 10 **20. a)** 7.5 **b)** 3 **c)** 0 **d)** 9.8 **e)** 1.9 **f)** 4.5 **g)** 0.25 **h)** −10.25 **Problems and Applications** **21. a)** A **b)** 19 000 **22. a)** $290x + 360y + 210z$ **b)** 1975 kJ

Section 2.3 p. 65

Practice **1.** $8x$ **2.** $10t$ **3.** $-7b$ **4.** $-13y$ **5.** $21m$ **6.** $6p$ **7.** $9r$ **8.** $4t$ **9.** $2p$ **10.** $-4a$ **11.** $2y$ **12.** $-7q$ **13.** $t + 5$ **14.** $-3x - 7$ **15.** $5a - b$ **16.** $-10x + y$ **17.** $15y - 2z$ **18.** $-p - 10q$ **19.** $3c$ **20.** $8p - 3q$ **21.** $-2j - k$ **22.** $2a - 5b$ **23.** $r - s$ **24.** $4y$

25. $2x + 5y + 11$　**26.** $4a - 5b - 5$　**27.** $9x - 9z - 19$
28. $5p - 11q + 8r - 11$　**29.** $4c - 8x - 13w$　**30.** $2c - 23d + 15j$　**31.** $2p + 4q + r + 1$　**32.** $-13x - y + 2z$
33. $13q - 15r + 4s$　**34.** $7a - 3c - d - 21$　**Problems and Applications**　**35. a)** 20　**b)** 12　**c)** 28　**d)** 48
e) 13　**f)** 3　**36. a)** $m + m + n, 2m + n$　**b)** $z + z + z + z,$
$4z$　**c)** $f + f + f + q + q + q, 3f + 3q$　**d)** $x + x + y + y +$
$y + y, 2x + 4y$　**37. a)** $14c$　**b)** $2a + 2d + 4c$　**c)** $4e + 8f$
d) $2p + 6r + 2s$　**38.** The sum is meaningless. You are not adding like terms.　**39.** $2p + 2q$

Learning Together pp. 66–67

Activity 1: $6t$　**Activity 2:**　**1.** $b + 5$　**2.** $n - 1$
3. $q + 9$　**4.** $m - 2$　**5.** $w + 3$　**6.** $5x$　**7.** $6 - t$
8. $2 + y$　**9.** $3n$　**10.** $n + 1$　**11.** $n - 5$　**12.** $6n$　**13.** $\frac{n}{5}$
14. $2n + 3$　**15.** $10 - n$　**16.** $\frac{7}{n}$　**17.** $x + 4$　**18.** $7x$
19. $5x$　**20.** $\frac{3}{x}$　**21.** $x + 7$　**22.** $\frac{1}{2}x$　**23.** $x - 8$　**24.** $2x$
Activity 3:　**1.** $22, 33, 41, x - 23, y + 23, 3m - 23,$
$4t - 2, 6r + 18$　**2.** $12, 23, x - 4, m + 4, 5y - 4,$
$4t + 4, 3w + 4$　**3.** $78, 12, 6x, \frac{y}{6}, 6(m + 7), 6(3t + 8)$
Activity 4:　**1. a)** width　**b)** $x + 5$　**d)** $2(2x + 5)$
2. $x(x + 4)$　**3.** $4x$　**4.** $13, 18, x + 3, 10x + 3, 4x + 4$
b) 46 m, 130 m^2 ; 66 m, 270 m^2; $2(2x + 3), x(x + 3)$;
$2(20x + 3), 10x(10x + 3)$; $2(8x + 5), (4x + 1)(4x + 4)$
5. a) $17, 17, x + 7, y - 7, 3t + 7, 4n - 7, 5z + 11$
b) 54 m, 170 m^2 ; 82 m, 408 m^2; $2(2x + 7), x(x + 7)$;
$2(2y - 7), y(y - 7)$; $2(6t + 7), 3t(3t + 7)$; $2(8n - 7),$
$4n(4n - 7)$; $2(10z + 15), (5z + 4)(5z + 11)$

Section 2.4 p. 69

Practice　**1.** $3x = 18$　**2.** $y - 6 = 4$　**3.** $x + 4 = 18$
4. $x - 4 = 10$　**5.** $\frac{m}{4} = 18$　**6.** $4x = 20$　**7.** $\frac{x}{2} = 5$
8. $x + 6 = 15$　**9.** $x + 5 = 12$　**10.** $x - 6 = 10$
11. $x - 4 = 7$　**12.** $x^2 = 25$　**13.** $10 - x = 2$
14. $3x = 9$　**15.** $\frac{x}{5} = 10$　**16.** $x - 6 = -8$　**Problems and Applications**　**17.** $2b + 16 = 88$　**18.** $2p + 12 = 84$
19. $2c + 7 = 29$　**20.** $3a = 250\ 000\ 000$
21. $5.5c = 150\ 000\ 000$　**23. a)** $2(2x + 6) = 36$
b) $2(3x + 3) = 36$　**24.** \$90.00; \$180.00; \$30.00 +
(\$15.00 × x)　**25.** $n = \$15.00 + \$14.00(m - 1)$

Section 2.5 p. 71

Practice　**1.** 4　**2.** −1　**3.** 0　**4.** −2　**5.** 7　**6.** 5
7. −7　**8.** −3　**9.** −4　**10.** 4　**11.** −2　**12.** 10　**13.** 14
14. −8.　**15.** 7　**16.** 22　**17.** −7　**18.** 4　**19.** −3
20. −5　**21.** yes　**22.** no　**23.** yes　**24.** no　**25.** yes
26. yes　**27.** no　**28.** yes　**29.** 8　**30.** 4　**31.** 8
32. 6　**33.** 12　**34.** 7　**35.** 5　**36.** 2　**37.** 22　**38.** −2
Problems and Applications　**39.** 1.0　**40.** 6.0

41. 4.0　**42.** 2.4　**43.** 32　**44.** 3.1　**45.** 8.7　**46.** 7.4
47. 0.8　**48.** −6.5　**49.** 4 cm　**50.** 22 km^2　**51.** 3
52. a) $2x = 6$　**b)** $x + 6 = 2$　**c)** $x + 2 = 6$　**d)** $x - 2 = 6$
e) $\frac{x}{2} = 6$　**f)** $6x = 2$　**53. a)** −4, 4　**b)** −5, 5

Learning Together pp. 72–73

Activity 1:　**1. a)** $-2x$; −4, 6　**b)** $3x$; 6, −9　**c)** $2x^2 + 2x$;
12, 12　**d)** $-2x^2 + 3x$; −2, −27　**e)** $-3x + 4$; −2, 13
f) $x^2 - 2x - 4$; −4, 11　**g)** $-x^2 + 3x + 3$; 5, −15　**h)** $2x^2 - 4x - 2$;
−2, 28　**Activity 2:**　**1.** $-x + 1$, −2, 3; $-x^2 + 2x$, −3, −8;
$x^2 - 2$, 7, 2; $-2x^2 + 4$, −14, −4　**2. a)** 2 long white　**b)** 3
square green　**c)** 2 long green, 2 white　**d)** 3 square green,
1 long green　**e)** 1 square white, 3 long green, 4 white
f) 1 square green, 2 long white, 1 red
g) 1 long green, 2 white　**h)** 2 square white, 5 red

Section 2.6 p. 76

Practice　**1.** $x - 2 = 1$, 3　**2.** $x - 4 = 2$, 6
3. $x + 2 = 4$, 2　**4.** $x + 4 = 4$, 0　**5.** 3　**6.** 1　**7.** 7
8. −4　**9.** 10　**10.** 5　**11.** 6　**12.** 1　**13.** 2　**14.** 5
15. 3　**16.** 7　**17.** 1　**18.** 5　**19.** 4　**20.** −16　**21.** −8
22. 18　**23.** −6　**24.** 12　**25.** −12　**26.** −10　**27.** 15
28. −3　**29.** −2　**Problems and Applications**　**30.** 0
31. 2.0　**32.** 8.0　**33.** 6.0　**34.** 2.1　**35.** −3.0　**36.** 1.0
37. 0.8　**38.** 2.7　**39.** 5.8　**40.** 15.7　**41.** −7.7
42. −33.8　**43.** c, 5　**44.** a, 123　**45.** d, 2.0　**46.** 10
47. 7.1 km　**48.** no effect　**49. a)** −3, 3　**b)** −8, 8

Section 2.7 p. 79

Practice　**1.** $2x = 4$, 2　**2.** $\frac{x}{2} = 3$, 6　**3.** 6　**4.** 2
5. 7　**6.** 11　**7.** 6　**8.** 8　**9.** 3　**10.** 2　**11.** 7
12. 5　**13.** 4　**14.** 6　**15.** 5　**16.** −6　**17.** −2
18. −3　**19.** 4　**20.** 4　**21.** 12　**22.** −5　**23.** 3
24. 4　**25.** −8　**26.** 21　**27.** −12　**28.** 2　**29.** −2
30. 2　**31.** −6　**32.** 4　**33.** 4.2　**34.** −2.1　**35.** 12
36. −2　**37.** 0.7　**38.** 3　**39.** 6　**40.** −42　**Problems and Applications**　**41.** a, \$2　**42.** b, 12.6 cm
43. 360 cm　**44.** 70 kg　**45.** reduces the equation to
$0 = 0$　**46. a)** 0　**b)** no solution　**47. a)** −6, 6　**b)** −2, 2

Section 2.8 p. 81

Problems and Applications　**1.** Maria–grade 11,
Paula–grade 9, Shelly–grade 10　**2.** Al–golf,
Bjorn–swimming, Carl–running, Don–bowling
3. Susan–pilot, Irina–writer, Traci–doctor,
Debbie–dentist　**4.** 25 m　**5.** 3 quarters, 4 dimes,
4 pennies　**6.** 110 km　**7.** 20　**8.** 24　**9.** 23:59
10. Evans–artist, Thompson–plumber,
Smith–banker, DiMaggio–teacher

Learning Together pp. 82–83

Activity 1: 3; 2, 6; 4, 5; 7, 1 **Activity 2:** 3; 7, 8; 1, 9; 4, 5 **Activity 3:** 4; 3, 5; 1, 7; 6, 8 **Activity 4:** 6; 5, 4; 8, 9; 3, 1, 0

Section 2.9 p. 85

Problems and Applications **1.** 06:10 **2.** $48.00 **3.** $100.00 **4.** 06:15 **5.** $40.00 **6.** 10:15 **7.** 80 h **8.** 15 years **9.** 264 **10. a)** $32 000 **b)** $243 000 **11.** 3 500 000

Section 2.10 pp. 90–91

Practice **1.** Left side: Start, $5x + 2$, subtract 2, divide by 5, x, stop; Right side: Start, 22, subtract 2, divide by 5, 4, stop **2.** Left side: Start, $2x + 5$, subtract 5, divide by 2, x, stop; Right side: Start, 25, subtract 5, divide by 2, 10, stop **3.** 4 **4.** 7 **5.** –2 **6.** 4 **7.** –3 **8.** –7 **9.** 5 **10.** –2 **11.** –2 **12.** –3 **13.** –4 **14.** 4 **15.** 3 **16.** –20 **17.** –10 **18.** 16 **19.** 18 **20.** 6 **21.** 6 **22.** –20 **23.** –33 **24.** –4 **25.** –2 **26.** 1 **27.** 2 **28.** –6 **29.** 1 **30.** 2 **31.** –4 **32.** –1 **33.** –4 **34.** –7 **35.** 4 **36.** –2 **37.** 1 **38.** –4 **39.** 7 **40.** –3 **41.** 3.2 **42.** 2.2 **43.** 5 **44.** 5 **45.** –2 **46.** –3.2 **47.** –5 **48.** 7.8 **49.** –1.1 **50.** 2.0 **51.** –1.7 **52.** 1.7 **Problems and Applications** **53.** 17, 15, 8 **54.** 6 years **55. a)** 3 **b)** yes

Section 2.11 p. 93

Practice **1.** $3x = 2x + 4$, 4 **2.** $4x + 1 = 2x - 5$, –3 **3.** 6 **4.** 6 **5.** 3 **6.** –4 **7.** –3 **8.** 6 **9.** –1 **10.** 5 **11.** 10 **12.** 5 **13.** 3 **14.** –6 **15.** 0.05 **16.** 0.6 **17.** 1 **18.** 3 **19.** –4 **20.** 2 **21.** 4 **22.** 3 **23.** 2 **24.** –5 **25.** 1 **26.** 3 **27.** –2 **28.** 3 **29.** –5 **30.** –3 **31.** 4 **32.** 7 **33.** –4 **34.** 5 **35.** –3 **36.** –10 **37.** –2 **38.** 1 **39.** 4 **40.** 2 **41.** 6 **42.** –2 **Problems and Applications** **43.** 20 **44.** 6 **45. a)** $b + c + y - a$ **b)** $c - y - a + b$ **c)** $(c - y - b) + a$ **d)** $(c - y) + a + b$ **e)** $(a + b + y) + c$ **f)** $a(y - b - c)$ **46.** 14 km/h **47.** 6

Section 2.12 p. 95

Practice **1.** $5x + 5$ **2.** $3x - 6$ **3.** $4x + 8$ **4.** $2x - 6$ **5.** $7x - 7$ **6.** $5x + 15$ **7.** $2x + 12$ **8.** $4x - 20$ **9.** $7x + 21$ **10.** $3x - 12$ **11.** $10x + 20$ **12.** $9x - 27$ **13.** $6x + 4$ **14.** $9x + 3$ **15.** $10x + 5$ **16.** $8x + 12$ **17.** $12x - 6$ **18.** $15x - 10$ **19.** $14x + 7$ **20.** $18x + 12$ **21.** $-3x - 6$ **22.** $-8x - 4$ **23.** $-10x + 6$ **24.** $-9x + 6$ **25.** $-10x + 5$ **26.** $-10x + 6$ **27.** $-4x - 20$ **28.** $-2x + 1$ **29.** $-6x + 4y$ **30.** $-15x - 9y$ **31.** $-20x - 8y$ **32.** $-2x - y$

33. $5x - 5y$ **34.** $-7x + 21y$ **35.** $-6x - 14$ **36.** $-8x + 4y$ **37.** $-8x - 12y - 4z$ **38.** $15x - 6y + 6$ **39.** $-6x + 18y + 24$ **40.** $-2x + 3y - 5$ **41.** $6y - 4$ **42.** $7x - 4$ **43.** $x + 26$ **44.** 6 **45.** $12x - 12$ **46.** $-10x + 10$ **47.** $-5x + 12y - 4$ **Problems and Applications** **48.** $5x^2 + 12x + 1$ **49.** $6x^2 + 18x - 18$ **50.** $7y^2 + 7y - 18$ **51.** $8x - 18y + 35$ **52.** $-3x + 2$ **53.** 11 **54.** $14x - 17y + 12$ **55.** $x + 6y - 15$ **56.** $-x^2 + 6y^2 + 7$ **57.** $2x^2 + 8x - 8y - 10$ **58.** $8y^2 + 23y - 12$ **59. a)** $x + 3, x$ **b)** $x^2 + 3x$ **60. a)** $2 + y, y$ **b)** $2y + y^2$ **61.** $3x - x^2$ **62.** $15x - 3x^2$ **63. a)** $P + Prt$ **b)** $330

Section 2.13 p. 98

Practice **1.** 1 **2.** 4 **3.** 1 **4.** –6 **5.** –5 **6.** –7 **7.** 1 **8.** 3 **9.** 1 **10.** –2 **11.** –9 **12.** –3 **13.** 1 **14.** –1 **15.** 2 **16.** –2 **17.** 1 **18.** 2 **19.** –1 **20.** –2 **21.** 10 **22.** –1 **23.** 4 **24.** 5 **25.** 2 **26.** 2 **27.** –3 **28.** 1 **29.** –15 **30.** 2 **31.** 2 **Problems and Applications** **32. a)** 3 **b)** 4 **33. a)** 3 **b)** 11 by 7 **34.** 24%

Learning Together pp. 99–100

Activity 1: **1. a)** 2, 5 and 10 **b)** $5x + 10 = 15$, $2x + 4 = 6$, $x + 2 = 3$ **c)** the last one **d)** multiplying the equation by whole numbers **2. a)** $2x + 5 = 1$, $12x + 30 = 6$, $18x + 45 = 9$ **b)** $2x + 5 = 1$ **c)** –2 **d)** –2 **3. a)** $2x - 1 = 3$ **b)** $x + 3 = 10$ **c)** $2x - 5 = 23$ **d)** $7x - 25 = 70$ **Activity 2:** **1. a)** $15x + 7 = 37$ **b)** whole-number equation **c)** 2 **2. a)** 100 **b)** $p - 20 = 25$ **c)** 5 **Activity 3:** **1. a)** $\frac{1}{2}$ **b)** $\frac{3}{2}$ **c)** $\frac{1}{7}$ **d)** $\frac{5}{4}$ **2. a)** $\frac{2}{5}$ **b)** common denominator is 5 **c)** multiplying both sides of the equation by 5 **3.** $4x + 2 = 10$, $6x + 3 = 15$ **4.** yes **5.** the second one is 5 times the first, the third is 14 times the first **Activity 4:** **1.** yes **2.** $\frac{x}{3} + \frac{1}{3}$ **3.** b **4.** the second is 3 times the first, the third is 4 times the first **5. a)** the third **b)** 9.6

Section 2.14 pp. 102–103

Practice **1.** 0.6 **2.** 1.7 **3.** 0.3 **4.** –7.5 **5.** –3 **6.** –6.9 **7.** 1 **8.** –10 **9.** –3 **10.** 4 **11.** 2.4 **12.** –4 **13.** 0.4 **14.** –0.53 **15.** 1.09 **16.** –6 **17.** –11.8 **18.** 1 **19.** 2 **20.** 4 **21.** 4 **22.** –2 **23.** –3 **24.** –2 **25.** –6 **26.** 20 **27.** –1 **28.** 1 **29.** 15 **30.** –4 **31.** –2 **32.** 1 **33.** –9 **34.** 14 **35.** 4 **36.** –9 **37.** –2 **38.** 5 **39.** 2 **40.** 2 **Problems and Applications** **41.** 34 kg **42.** 0.04 or 4%

Connecting Math and Logic pp. 104–105

Activity 1: **2. a)** TL **b)** TL **c)** TL **d)** TR **e)** LR
f) TL **3. a)** 5 by 6 **b)** 3 by 3 **4.** 5 by 6 **5.** no
Activity 2: **2.** odd number **3.** even number
4. LR **Activity 3:** **2.** even number **3.** odd
number **4.** TL **Activity 4:** **2.** odd number
3. odd number **4.** TR **Activity 5:** **1. a)** The
ball will always stop in the lower right corner.
b) The ball will always stop in the top left corner.
c) The ball will always stop in the top right corner.
2. a) TL **b)** TR **c)** LR **d)** TR **e)** TL **f)** LR

Review pp. 106–107

1. 9 **2.** 16 **3.** 23 **4.** 15 **5.** −12 **6.** −8 **7.** −1
8. −9 **9.** −21 **10.** 30.5 **11.** $3x + 7y + 11$
12. $3a − 4b − 5$ **13.** $3q − 7r − a + 1$ **14.** $8 + x = 20$
15. $6x = 72$ **16.** $2c + 8 = 24$ **17.** $2p − 10 = 90$
18. $4t = 2400$ **19. a)** $3x + 4 = 64$ **b)** $4x + 4 = 64$
20. 4 **21.** 5 **22.** 6 **23.** 4 **24.** −3 **25.** 8 **26.** −7
27. −2 **28.** 0.6 **29.** −0.4 **30.** 10 **31.** −10 **32.** −9
33. 24 **34.** 6 **35.** 10 **36.** −15 **37.** 12 **38.** 6
39. 5 **40.** 2 **41.** −2 **42.** −5 **43.** −9 **44.** 9
45. −0.3 **46.** 10 **47.** 9 **48.** −1.0 **49.** −18 **50.** 24
51. 6 **52.** −16 **53.** −6 **54.** −4 **55.** 2 **56.** 3
57. −3 **58.** −7 **59.** 2 **60.** 2 **61.** −2 **62.** 2 **63.** 4
64. 13 **65.** −3 **66.** −8 **67.** −25 **68.** 3 **69.** −5
70. −3 **71.** −2 **72.** −3.2 **73.** 2 **74.** −0.8 **75.** 3
76. 1 **77.** −1 **78.** −8 **79.** −4 **80.** 4 **81.** −3
82. −10 **83.** −5 **84.** 16 **85.** 26

Chapter Check p. 108

1. 10 **2.** $y + 2$ **3.** $6a − b − 10c − 5$ **4.** $2a + 4 = 36$
5. 8 **6.** −3 **7.** 6 **8.** −9 **9.** 8 **10.** 20 **11.** −9
12. 11 **13.** 35 **14.** 12 **15.** −3 **16.** −2 **17.** 5
18. −2 **19.** −5 **20.** −1 **21.** −0.4 **22.** −2.9 **23.** −9
24. −3 **25.** 1 **26.** 3 **27.** −4 **28.** 2 **29.** 0.06

Using the Strategies p. 109

1. Each entry is the sum of at most the 3 entries
immediately above and to the left, that is $1 + 1 = 2$,
$1 + 2 + 3 = 6$, $3 + 6 + 7 = 16$, etc. **2.** 2 cm
3. two 14 years, three 15 years **4.** 15, 21, 28
5. 8 **6.** 06:35 **7.** 163 216, 255 025
8. a) $13 + 15 + 17 + 19 = 64$
b) $21 + 23 + 25 + 27 + 29 = 125$
c) $31 + 33 + 35 + 37 + 39 + 41 = 216$
d) It is the mean or median.
e) $43 + 45 + 47 + 49 + 51 + 53 + 55 = 343$
Data Bank **1.** 1264 m **2.** 12.5%

Chapter 3

Getting Started p. 112

Activity 1: **1.** prescription, Yin and Yang, no left
turn, poison, copyright, lane ends, male or Mars,
explosive, peace, Aquarius, thunderstorm, new
paragraph, hurricane, registered trademark, Gemini,
female or Venus, hospital, Pisces. **Activity 2:**
1. −2 **2.** −3 **3.** 5 **4.** 3 **5.** 14 **6.** 0 **7.** 6 **8.** −6
9. −10 **10.** 4 **11.** −4 **12.** −6 **13.** 3 **14.** 3
15. −5 **16.** 15 **17.** 4 **18.** −6 **19.** −10 **20.** 2
21. −4 **22.** 3 **23.** 4 **24.** 1 **25.** 12 **Activity 3:**
1. 12.4 cm **2.** 20.8 cm **3.** 24.6 cm **4.** 21.5 cm
5. 45.8 m **6.** 38 cm **7.** 18.7 cm² **8.** 22.09 cm²
9. 37 cm² **10.** 21 cm² **11.** 81 cm² **12.** 60 cm²
Mental Math **1.** 20 **2.** 30 **3.** 30 **4.** 50 **5.** 51
6. 61 **7.** 60 **8.** 70 **9.** 80 **10.** 30 **11.** 20 **12.** 50
13. 30 **14.** 59 **15.** 49 **16.** 69 **17.** 59 **18.** 49
19. 100 **20.** 1000 **21.** 20 **22.** 2000 **23.** 40
24. 4000 **25.** 36 **26.** 360 **27.** 3600 **28.** 7 **29.** 70
30. 5 **31.** 500 **32.** 400 **33.** 40 **34.** 11 **35.** 14
36. 40 **37.** 20 **38.** 12 **39.** 18 **40.** 15 **41.** 15
42. 22 **43.** 3 **44.** 13 **45.** 10 **46.** 16 **47.** 3
48. 20 **49.** 9 **50.** $\frac{5}{8}$ **51.** $\frac{4}{9}$ **52.** $\frac{7}{10}$ **53.** $\frac{3}{10}$ **54.** $\frac{2}{3}$
55. $\frac{1}{10}$

Section 3.1 pp. 116–117

Practice **1.** $x, 35 − x$ **2.** $x, 50 − x$ **3.** $x, 125 − x$
4. $x, 36 − x$ **5.** $x, 32 − x$ **6.** $x, 758 − x$
7. $x, 468 − x$ **8.** $x, 246 − x$ **9.** 10 m, 12 m, 13 m
10. 4 m, 5 m, 5 m **11.** 3 m, 6 m **12.** 5 m, 7 m
13. 2 m, 6 m **14.** 5 m, 7 m **Problems and**
Applications **15.** 17, 29 **16.** 3058 km, 4241 km
17. 25 m by 20 m **18.** 34, 35, 36 **19.** 155
20. 3 years **21. a)** 3 **b)** 38 **22.** 20 **23.** 10 m,
17 m, 17 m **24.** $0.75 **25.** 14 **26.** 7 nickels,
5 dimes **27.** 57 nickels, 83 dimes **28. a)** 20 cm
b) 37 cm by 32 cm **29.** 16, 23 **30.** 8, 3 **31.** 50
32. 67 $2 bills, 78 $5 bills **33.** 17 small, 21 large
34. 350 **35.** 3 m **36. a)** 2 cm **b)** 296 cm²

Section 3.2 p. 119

Problems and Applications **1. a)** 10.5 h
b) No; requires 12.5 h **2.** B3, C2, or D2
3. a) 365 050 km **b)** 403 790 km **4. a)** −28.3°C
b) −5°C **5.** Eiffel Tower: 319.9 m; CN Tower:
553.7 m; Washington Monument: 169.4 m
6. a) 1.25 m, 0 m **b)** 2.3 m, 4.2 m, 7.8 m, 1.2 m
c) 5.25 s

Section 3.3 p. 121

Practice **1. a)** 40 cm^2 **b)** 4 m **c)** 17 m
2. a) 62.8 cm **b)** 100 cm **3. a)** 24 cm^2 **b)** 20 cm
c) 6 m **4. a)** 30 m **b)** 14 m **c)** 37 m **5.** $w = \frac{A}{l}$
6. $b = \frac{2A}{h}$ **7.** $P = \frac{I}{rt}$ **8.** $r = \frac{C}{2\pi}$ **9.** $m = \frac{E}{c^2}$
10. $b = \frac{2A}{h} - a$ **Problems and Applications**
11. a) 200, 193, 181, 176, 159 **b)** 22 years, 49 years,
37 years **12. a)** 480 000 km, 700 000 km **b)** 3.25 h
13. 10 250, 12 375, 15 250, 16 500, 20 875 **14.** Paul

Learning Together pp. 122–123

Activity 1: **2.** 3, $\frac{1}{2}$; 4, 1; 6, 2; 8, 3; 6, 2; 5, $1\frac{1}{2}$;
7, $2\frac{1}{2}$; 8, 3; 4, 1; 5, $1\frac{1}{2}$; 9, $3\frac{1}{2}$ **3.** equal **4.** 3, 0.5;
4, 1; 5, 1.5; 6, 2; 7, 2.5; 8, 3; 9, 3.5 **5.** 4 square
units **6.** $A = \frac{1}{2}(P - 2)$ **8.** 48.5 square units
Activity 2: **2.** 10, 0, 4; 10, 1, 5; 10, 2, 6; 10, 3, 7;
10, 4, 8; 10, 5, 9; 10, 6, 10 **3.** The area increases by
1 square unit. **4.** 11 square units, 123 square units
5. $A = \frac{1}{2}(P - 2) + I$ **7. a)** 17.5 square units
b) 29 square units **c)** 23 square units

Section 3.4 p. 125

Practice **1.** 15, 18, 21; $b = 3a$ **2.** 10, 12, 14;
$m = n - 3$ **3.** 21, 20, 19; $t = \frac{a}{4}$ **4.** 16, $c = 4n$
5. 150, $w = 7.5n$ **6.** 120, $p = 0.2s$ **Problems and
Applications** **7.** $C = 100 + 3d$ **8.** $C = 3 + 1.5d$
9. a) Regions = Roads – Towns + 1 **b)** Towns =
Roads – Regions + 1 **c)** Roads = Regions + Towns – 1

Section 3.5 p. 127

Practice **1.** 180 km **2.** 170 km **3.** 45 km
4. 45 km **5.** 0.5 h **6.** 8 h **7.** 0.2 h **8.** 4.5 h
9. 100 km/h **10.** 80 km/h **11.** 90 km/h
12. 80 km/h **13.** 4.5 **14.** 195 **15.** 75 **16.** 80x
17. 90($x + 1$) **18.** 85($x - 1$) **19.** $\frac{200}{x}$ **20.** $\frac{400}{x}$
21. rt **22.** $\frac{D}{r}$ **23.** $\frac{D}{t}$ **Problems and Applications**
24. 5 h **25. a)** 3.75 h **b)** 20:15 **26. a)** 8 h **b)** 16:00
c) uniform motion **27. a)** 1.5 h **b)** 10:15 **28.** 1.25 h

Section 3.6 p. 129

Practice **1.** $\frac{1}{2}$, $\frac{1}{4}$ **2.** $\frac{1}{6}$, $\frac{1}{8}$ **Problems and
Applications** **3.** $2\frac{2}{5}$ min **4.** $1\frac{1}{5}$ h **5.** $\frac{1}{3}$ h
6. 12 min **7. a)** $4\frac{4}{9}$ h **b)** $80, $80, $80 **8.** 4 h
9. 6 h **10. a)** 20 min **b)** Each is occupied by a
separate task.

Section 3.7 p. 131

Problems and Applications **1.** driving from 08:00
until 09:00; at destination from 09:00 until 10:00;
driving from 10:00 until 11:00; at destination from
11:00 until 12:00; driving from 12:00 until 12:15;
stop for gas at 12:15; driving from 12:15 until 12:30;
at destination from 12:30 until 13:30; driving from
13:30 until 14:00; at destination from 14:00 until
16:00; driving from 16:00 until 17:00 **2.** Boat A
is not as old as boat B and costs more than boat B.
Boat B is faster than boat A and both boats have the
same length. **3.** Between A and B; car is travelling
at 100 km/h Between B and C: car is at rest Between
C and D: car is travelling at 50 km/h Between D
and E: car is travelling at 25 km/h

Section 3.8 pp. 134–135

Practice **1. a)** true **b)** true **c)** false **d)** true **e)** false
f) true **g)** false **h)** true **i)** true **j)** true **k)** false
l) true **2. a)** 3 **b)** −5 **c)** 1 **d)** 8 **e)** −1 **f)** 1 **g)** 7
h) −4 **3.** $x > 2$ **4.** $x < 5$ **5.** $x < 4$ **6.** $x > 7$
7. $y > 1$ **8.** $y < 1$ **9.** $z > 3$ **10.** $z < 3$ **11.** $x < 2$
12. $y > -4$ **13.** $m < 5$ **14.** $n < -4$ **15.** $s > 0$
16. $y \leq 3$ **17.** $p \leq -2$ **18.** $t \leq -3$ **19.** $b \leq 3$
20. $m > -3$ **21.** $n < -3$ **22.** $x > 3$ **23.** $y > 3$
24. $t \leq 6$ **25.** $y \geq 5$ **26.** $x \geq -3$ **27.** $x \geq -3$
28. $x < 5$ **29.** $y > -4$ **30.** $m < -2$ **31.** $n > 3$
32. $t \geq -3$ **33.** $s \geq 1$ **34.** $y \leq -2$ **35.** $x \leq 5$
36. $x \geq -1$ **37.** $x < 3$ **38.** $x > 6$ **39.** $y \geq 7$
40. $y \leq -9$ **41.** $t < -8$ **42.** $a > -2$ **43.** $n < -2$
44. $n > -3$ **45.** $x > 13$ **46.** $y < 3$ **47.** $m \geq 1$
48. $x > 1$ **49.** $y \leq -1$ **50.** $m < -2$ **51.** $x > -5$
52. $m < 5$ **53.** $b \geq -8$ **54.** $w \leq 4$ **55.** $p \geq 6$
56. $x \leq 5$ **57.** $x \geq -3$ **58.** $x < 2$ **59.** $y \leq 3$
60. $m < 3$ **61.** $x < -2$ **62.** $y \leq 3$ **63.** $t \geq -4$
64. $y > -2$ **65.** $x \leq 1$ **66.** $y < 10$ **67.** $t > -6$
68. $x > 2$ **69.** $x > -9$ **70.** $x \leq -2$ **71.** $x \leq -2$
72. $x \leq 5$ **73.** $x > -24$ **74.** $t \leq 23$ **75.** $m > 2$
76. $y \geq 2$ **77.** $x \geq 11$ **Problems and Applications**
78. 89 **79.** 59 **80.** $90 **81.** 20 min
82. a) $s \leq 100$ **b)** 0 km/h; standstill **83. a)** $x \leq 17$
b) $x > 3$; otherwise no triangle is possible
84. a) $x < 4$ **b)** $x > -1$; otherwise there is no rectangle

Connecting Math and Criminology
pp. 138–139

Activity 2: **3.** 1024 **Activity 3:** **3.** 25
Activity 4: **3.** 25 600

Review pp. 140–141

1. 6, 30   **2.** 8 m by 5 m   **3.** 60, 61, 62   **4.** 633 m by 211 m   **5.** 41 m, 42 m, 43 m   **6.** 12, 48   **7.** 17 g
8. a) 17 m, 18 m, 20 m   **b)** 9 m, 12 m   **9.** 38, 13
10. 11, 16   **11.** 75   **12.** 29   **13.** $x < 5$ **14.** $y > -5$
15. $x > 4$ **16.** $x < 2$ **17.** $x \geq 4$ **18.** $x \geq -1$
19. $x > -3$ **20.** $x < 1$ **21.** $x \geq -2$ **22.** $x \leq 3$
23. $x \leq 2$ **24.** $t \geq -3$ **25.** $x \leq -2$ **26.** $x < 3$
27. $t \geq 7$ **28.** $t > 1$ **29.** $s \leq -9$ **30.** $y \leq 5$ **31.** $x > -10$
32. $x \leq -7$ **33.** $x < 8$ **34.** $x < 3$ **35.** $m \leq 21$
36. a) 95 L, 131 L   **b)** 14 min   **37. a)** 125 L, 50 L
b) 13 min   **38. a)** $\frac{3}{4}$ h   **b)** 09:30   **39.** 5 h
40. a) 9 h   **b)** 19:00   **41.** 6 h   **42.** $1\frac{1}{5}$ h   **43.** $1\frac{5}{7}$ h

Chapter Check p. 142

1. 81   **2.** 26 m, 11 m   **3.** 33 m, 34 m, 35 m
4. $x < -7$ **5.** $x > -2$ **6.** $r > -1$ **7.** $x \geq -5$
8. $x > -10$ **9.** $x \leq 7$ **10.** 44 m   **11.** $b = \frac{2A}{b}$
12. 3 h   **13.** 2.5 h   **14.** $d = 330t$ **15.** $2\frac{2}{5}$ h

Using the Strategies p. 143

1. $\frac{1}{24}$ **2.** 126 cm   **3.** 15:55   **4.** 1125 m   **5.** 343 four cylinder, 142 six cylinder   **6.** 34   **7. a)** 14
b) 28 years   **Data Bank**   **1.** 01:00

Chapter 4

Getting Started p. 146

Activity 1:   **1. a)** from left to right: x^2, x, -1, x^2, x, x^2 **b)** 3 of the x^2 type, 2 of the x type and 1 of the 1 type   **2. b)** $3x^2 + 2x - 1$ **c)** 20   **Activity 2:**
3. a) $2x^2 + x + 2$; $-x^2 - x$ **b)** 12; -6 **Mental Math**
1. -664 **2.** 765   **3.** 868   **4.** -690 **5.** 787   **6.** 777
7. -313 **8.** 999   **9.** 434   **10.** -890 **11.** 213
12. 121   **13.** -883 **14.** 400   **15.** 111   **16.** 310
17. 12   **18.** 12   **19.** 6   **20.** 5   **21.** 23   **22.** 51   **23.** 11
24. 22   **25.** 306   **26.** 777   **27.** -8008 **28.** -6060
29. -6868 **30.** 4848   **31.** -9009 **32.** 176
33. 1111   **34.** 202   **35.** -2020 **36.** -321 **37.** 4321
38. 21   **39.** -103 **40.** -41 **41.** 15   **42.** 60
43. -4 **44.** 8   **45.** 0   **46.** 15   **47.** -7 **48.** -72

Section 4.1 p. 149

Practice   **1.** monomial   **2.** binomial   **3.** trinomial
4. binomial   **5.** monomial   **6.** trinomial   **7.** 1   **8.** 4
9. 0   **10.** 5   **11.** 7   **12.** 6   **13.** 4   **14.** 1   **15.** 4
16. 8   **17.** 2   **18.** 6   **19.** 7   **20.** $x^5 + x^3 + x^2 + 1$

21. $-3x^3 + 2x + 5$ **22.** $-x^2 + 2xy + 5y^2$
23. $-4x^4 - 5x^2y + 25xy^2 + 3xy^3$
24. $7b^2x^4 - 3x^3 + 4abx^2 + 5ax$
25. $-2 + x + 3x^2 - 2x^3 + 5x^5$ **26.** $5 - x + x^2 - 3x^3 + 4x^4$
27. $4xy^2 - 2x^2y^2 + 2x^3y - 3x^4$
28. $-3 + 2xy^3z + 5x^2yz^2 + 3x^3y^4z^2$
29. $z - xy + x^2$ **30.** $16 - 2xy + x^2 - 3x^3$
31. $3xy + 2x^3y - x^3$ **32.** $-1 + xy + 3x^3y^2 + x^4y$
Problems and Applications   **33. a)** monomial
b) binomial   **c)** monomial   **34. a)** binomial
b) binomial   **c)** trinomial   **d)** monomial   **35. a)** 2
of 50 cm², 2 of 100 cm², 2 of 200 cm²   **b)** 700 cm²
c) $2lw + 2lh + 2wh$ **36.** 3822 cm³

Section 4.2 pp. 151–152

Practice   **1.** $3x^2 + 6x + 3$ **2.** $-2x^2 - 2x - 3$
3. $x - 1$ **4.** $-x^2 - 2x + 1$ **5.** $2x$, $5x$; $3y$, $-2y$; $-4xy$, $6xy$ **6.** $2a$, $5a$; $-6b$, $8b$; $-2c$, $3c$ **7.** $3s^2$, $7s^2$; $5s$, s; -2, -3 **8.** $7x - 1$ **9.** $4x^2 - 2x - 2$
10. $y^2 + 14y - 9$ **11.** $-2y^3 - 8y^2 + 2$ **12.** $6x + 9$
13. $7y^2 + 9y + 19$ **14.** $8x - 8y + 15$ **15.** $7x^2 - 8x - 5$
16. $9x^2 - x + 2$ **17.** $5y^2 - 6$ **18.** $-z^2 - 2z + 10$
19. $7x^2 + 5y^2 - 16$ **20.** $2x^4 + 2x^3 - 5x^2 + 7x - 4$
21. $9x^2 - x + 5$ **22.** $5y^2 - 6$ **23.** $m^3 + 9m^2 + 10$
24. $3x^2 - x - 6$ **25.** $3x^2 - 2xy + 5y^2$ **26.** $3y^2 - 2y + 1$
27. $4x^2y - 2xy + 5y^2$ **Problems and Applications**
29. a) $12x + 12$ **b)** 60 cm   **30. a)** $10x + 4$ **b)** 74 cm
31. a) triangle   **b)** 786 m   **32.** $4x^2 - 2x - 3$ **33. a)** $8x$
b) $20x$

Section 4.3 p. 155

Practice   **1.** $-x^2 - 4x - 1$ **2.** $-x^2 + 2x + 3$
3. $-2x^2 - x + 5$ **4.** $3x^2 + 7x - 2$ **5.** $2x - 7$
6. $-2x + 6$ **7.** $2x + 7$ **8.** $2x - 9$ **9.** $3x^2 + 8x - 1$
10. $-5x^2 + 2x - 4$ **11.** $-x^2 - 8x + 11$ **12.** -5
13. $3x - 2$ **14.** $3x^3 - x^2 - x$ **15.** $-y - 11$ **16.** $7s^2 + 3$
17. $3y^2 - 12y - 2$ **18.** $-x^2 - 9x + 6$ **19.** $-7y^2 - 4y + 3$
20. $3t^2 - 2t + 7$ **21.** $-3n^2 - 8n - 5$ **22.** $1 - 3x + 6x^2$
23. $-4t^2 - 5$ **24.** $2x^2 + 12x - 8$ **25.** $4m^2 + 6m - 7$
26. $-2y^2 + 3y - 10$ **Problems and Applications**
28. $5x + 2$ **29. a)** $3x^2 - y^2$ **b)** $2t^2 + 5t + 8$
30. $2x^2 + x - 3$ **31.** 0   **32. a)** No   **b)** Yes; the results are opposite.

Section 4.4 p. 157

Problems and Applications   **1.** 4   **2.** 1   **3.** 19
4. 16   **5.** 9, assuming each width in times of 15 s and 12 s respectively.   **6.** 6, assuming we consider only who sits next to whom is of importance.   **7.** 6
8. 16   **9.** The farmer must make 7 trips across the river. He begins by taking the goat across and

returns. He then takes the wolf across and returns with the goat. He then takes the cabbages across and returns for the goat. **10.** 4

Learning Together pp. 158–159

Activity 1: 2. b) 6 **c)** 3, 2 **Activity 2: 3. a)** 2 x-tiles **b)** 2 and x **Activity 3: 2. a)** length = x, width = x **b)** a square **4. a)** x^2 **b)** x, x **Activity 4: 1.** $34x^2$ **2.** x, $3x$ **Activity 5: 1. a)** no **b)** the x-tile

Section 4.5 p. 161

Practice 1. $15xy$ **2.** $6mn$ **3.** $35st$ **4.** $24ab$ **5.** $6x^2y$ **6.** $20ab^2$ **7.** $12bc$ **8.** $6ab^2$ **9.** $18st$ **10.** $6xy$ **11.** $12ab$ **12.** $10x^2y^2$ **13.** $15abc$ **14.** $12xy$ **15.** $30xyz$ **16.** $6a^2b^2$ **17.** $9ab$ **18.** $35ab$ **19.** $-15x^2y^2$ **20.** $8at^3$ **21.** $-12abc^2$ **22.** $-24a^2y^2$ **23.** $25xyz$ **24.** $-48x^2y^2$ **25.** $14x^2y^2$ **26.** $10m^3n$ **27.** $-12s^3t^4$ **28.** $6a^3b^5xy$ **29.** $10s^6t^5$ **30.** $-20c^2x^5y^{10}$ **31.** $-15x^2y^2z^2$ **32.** $6cx^2y^2z^3$ **33.** $4x^2y^3z$ **34.** $-70x^2yz$ **35.** $-70xyz$ **36.** $90xyz^2t^2$ **37.** $-8a^2x^6y^2z^3$ **38.** $-6b^2x^2y^5z^3$ **39.** $10a^4b^5$ **40.** $-24a^3b^3c^3$ **41.** $4x^4y^4z^4$ **42.** $-24j^3k^3l^3$
Problems and Applications 43. a) $41x^2$ **b)** $28y^2$ **c)** $68c^2$ **d)** $16x^2$ **e)** $33x^2$ **f)** $20x^2$ **44. a)** the cost of making 24 hats **b)** \$36 **45. a)** $27a^3$ **b)** $42y^3$ **46.** $6x$

Section 4.6 p. 163

Problems and Applications 1. Multiply the number of listings on a typical page by the number of pages. **2.** Measure the thickness of 100 pages and divide by 100. **3.** Time yourself for 5 pages (say) and multiply by 50. **4.** 100 **5.** 10 000 **6.** 10 100 **7.** 40 **8.** 15 **9.** 324 **10.** 81 **11.** Time yourself for 1 min and multiply by 525 600. **12.** 2^{12} or 4096

Section 4.7 p. 165

Practice 1. $2x$ **2.** $-3a$ **3.** $3y$ **4.** $4m$ **5.** $-5x$ **6.** $-5y$ **7.** 3 **8.** -6 **9.** 24 **10.** 32 **11.** $-x$ **12.** $4m$ **13.** $3z$ **14.** $-3b$ **15.** 3 **16.** $-9bc$ **17.** $4x$ **18.** $-5s$ **19.** 5 **20.** 2 **21.** 7 **22.** 9 **23.** $12t$ **24.** $3j$ **25.** $4qr$ **26.** $17df$ **27.** $5xy$ **28.** $-3a^2b^3$ **29.** $-2j^3k^7$ **30.** $-5x^3y^{14}$ **31.** $-a^2bc$ **32.** $4xy$ **33.** $2a^2b$ **34.** $3xy$ **35.** $-3m^3$ **36.** $2xyz^2$ **37.** $\frac{4}{3}$ **38.** $-\frac{3}{2}x^2y^2$ **39.** $\frac{2}{x^2y^2}$ **40.** $-4a^2b^2$ **41.** $\frac{-4}{mn^3}$ **42.** $3x^9y$ **43.** $-\frac{4x}{3y^4}$ **44.** $\frac{9p^3q^{12}}{r^2}$
Problems and Applications 45. a) x **b)** p **c)** $2x^2$ **d)** $3b^4$ **46. a)** 16 cm by 10 cm **b)** 20 cm by 8 cm **47.** $\frac{x}{6}$ **48.** 1

Section 4.8 p. 167

Problems and Applications 1. 3285 **2.** 18 750 **3.** \$372 757.50 **4. a)** 315 km **b)** 280 km **c)** 90 km **5.** \$15.50 **6.** \$514.80 **7.** 9 397 728 000 000 km **9.** \$78.05 **10.** 450 000 000

Connecting Math and Astronomy pp. 168–169

Activity 1: 5. Mercury, 4847 km; Venus, 12 118 km; Mars, 6761 km; Jupiter, 142 867 km; Saturn, 119 906 km; Uranus, 51 024 km; Neptune, 48 473; Pluto, 2551 km **Activity 2:** (in millions of kilometres) **3.** Mercury, 58.3; Venus, 107.7; Mars, 227.4; Jupiter, 777.9; Saturn, 1421.2; Uranus, 2872.3; Neptune, 4503.0; Pluto, 5924.2

Review pp. 170–171

1. monomial, 3 **2.** monomial, 5 **3.** binomial, 3 **4.** binomial, 2 **5.** trinomial, 4 **6.** binomial, 5 **7.** trinomial, 4 **8.** trinomial, 3 **9.** binomial, 4 **10.** trinomial, 5 **11.** $-5x^3 + x^2 + 3x$ **12.** $y^4 + 2y^2 - 3y + 5$ **13.** $-m^4 + 6m^3 - 3m^2 + 2m + 6$ **14.** $x^4 + x^3 + x^2 + x + 3$ **15.** $-2y^7 + 5y^6 + y^5 - 4y^2 + 3y$ **16. a)** monomial **b)** trinomial **c)** binomial **d)** binomial **17. a)** 30 cm², 50 cm², 15 cm² **b)** 190 cm² **c)** $2(lh + hw + lw)$ **18.** $3m^2 - 2m + 2$ **19.** $4a^2 + 8a + 2$ **20.** $-b^2 - b + 6$ **21.** $2x^3 - 4x^2 + 8x$ **22.** $2x^2 - 8x + 2$ **23.** $a^2 + 2a - 4$ **24.** $9t^2 - 2t - 14$ **25.** $3a^2 - 6a - 1$ **26.** $-2m^2 + 3m + 2$ **27.** $2x^2 + x - 6$ **28.** $6x^2 - x - 2$ **29.** $-3x^2 + 2x + 2$ **30.** $5x^2 - 5x + 7$ **31.** $5x^2 - 3x - 8$ **32.** $-n^2 - 9n - 3$ **33.** $1 - 3x + 6x^2$ **34.** $-3p^2 + 2p - 7$ **35.** $5x^2 + 14x - 8$ **36.** $3m^2 + 6m - 6$ **37.** $y^2 + 2y - 13$ **38. a)** $4x - 8y - 3$ **b)** $2x^2 + 6x - 10$ **39.** $40xy$ **40.** $-150xy^2$ **41.** $12abx^2$ **42.** $10a^2bp$ **43.** $-15x^2y^2$ **44.** $4a^3b$ **45.** $-8x^3y^2z$ **46.** $-3s^5t^5$ **47. a)** $32x^2$ **b)** $60y^2$ **c)** $146c^2$ **d)** $33x^2$ **48.** $4xy^2$ **49.** $9xy$ **50.** $5a^2b^2$ **51.** $-2ab^7c^{-2}$ **52. a)** $4x^2y^2$ **b)** $5a^3b$

Chapter Check p. 172

1. trinomial, 2 **2.** binomial, 3 **3.** monomial, 3 **4.** monomial, 0 **5.** $x^5 + x^4 + x^3 + 1$ **6.** $-yx^4 + 5x^3 + 2xy$ **7.** $-3x^4 + x^3y - 2x^2y + 10xy^2$ **8.** $-5b^2x^3 + 5abx^2 + 3ax - 1$ **9.** $6a^2 - 4$ **10.** $b^3 - b^2 + y - 1$ **11.** $5y^2 - 12x + 6$ **12.** $-t^2 - t - 5$ **13.** $-x^2 - 7x + 6$ **14.** $5y^2 + 14y + 1$ **15.** $8x^2 - 9x - 12$ **16.** $-2x^2 + 10x + 1$ **17.** $10x^2 - 2x - 4$ **18.** $-4x^2 + 3x + 1$ **19.** $3x^2 - 8x + 8$ **20.** $8x^2 + 4x - 11$ **21.** $-50xy$ **22.** $45x^3y^3$ **23.** $-6b^2x^5yz$ **24.** $-15x^4y^2z^3$ **25. a)** $34x^2$ **b)** $26x^2$ **c)** $6y^2$ **26.** $\frac{-2}{a^3b^2}$ **27.** $\frac{3l^2}{j^2k}$

Using the Strategies p. 173

1. $\frac{5}{18}$ or approximately 0.3 h **2. a)** 81 **b)** 961
3. 36, 37, 38 **4.** 20 **5.** 84 **6.** 34 **7.** Sue: 16
years, Alex: 12 years **8. a)** more than 20 **b)** less
than 20 **c)** 20 **9.** 16 **10.** 5 **11.** 1681 **12. a)** 4
boxes of 6, 1 box of 20 **b)** 1 box of 9, 2 boxes of 6,
1 box of 20 **c)** 4 boxes of 9, 1 box of 6 or 2 boxes
of 9, 4 boxes of 6 or 7 boxes of 6 **d)** no **Data
Bank 1.** Saturday about 12:40 **2.** 484 m

Cumulative Review, Chapters 1-4
pp. 174–175

Chapter 1: 1. 9 **2.** 17 **3.** 9 **4.** 7 **5.** 163 **6.** 4
7. 27 **8.** 16 **9.** 25 **10.** 10 000 **11.** 82 **12.** $\frac{1}{2}$
13. $\frac{2}{9}$ **14.** 64 **15.** 1 **16.** −1 **17.** −125 **18.** 1
19. 3.73×10^7 **20.** 1.54×10^{-11} **21.** 340 000 000
22. 4 000 000 **23.** 8880 **24.** 30 100 000 000
25. $\frac{36}{49}$ **26.** $-\frac{s^5}{t^5}$ **27.** $\frac{27p^3}{64q^3}$ **28. a)** 10.0 cm **b)** 35.7 m
Chapter 2: 1. a) 1 **b)** −16 **c)** 1 **d)** −1 **2.** $3n = 15$
3. $n + 5 = 6$ **4.** $2n = n + 10$ **5.** $5(n+2) = 20$ **6.** 12
7. 12 **8.** 1 **9.** 4 **10.** 3 **11.** 4 **12.** 16 **13.** 15
14. 6 **15.** 1 **16.** 20 **17.** 55 **18.** −4 **19.** 1 **20.** 5
21. 9 **22.** 3 **23.** 4 **24.** 9 **25.** 3 **Chapter 3:**
1. 17 cm, 18 cm, 19 cm **2. a)** 20, 30, 40, 50
b) $A = 5b$ **c)** 75 cm^2 **3.** 40 min **4.** 2000 km
5. 9, 17 **6.** $x \geq 1$ **7.** $x < -2$ **8.** $x < 1$ **9.** $x \geq -3$
10. 2.01 s, 2.84 s, 3.48 s **Chapter 4: 1.** $4x^2 + 3x - 2$
2. $5y^2 - 4y$ **3.** $-x^2 - 2x - 9$ **4.** $-x^2 - 3$ **5.** $15xy$
6. $-12st$ **7.** $4x^2 - 3x + 3$ **8.** $7x^2 + 5x - 6$
9. $-4x^2 + 2x - 9$ **10.** $-3x^2 - 5x - 9$ **11.** $12x^2 - 2x - 5$
12. $-x^2 + 6x + 6$ **13.** $-9x^2 - 2x + 4$ **14.** $-x^2 - 6x - 17$
15. $20abx^2$ **16.** $12p^2wb$ **17.** $-35x^2y^2$ **18.** $25b^3a$
19. $-12x^4yz^2$ **20.** $-2p^6q^4$ **21.** $\frac{3}{x^3y}$ **22.** $-7a^2b^0$ **23.** $-\frac{2}{pq^4}$
24. $6x^{11}y^7$ **25.** $\frac{3}{2xy^5}$ **26.** $-\frac{5t^5}{7rs^3}$ **27.** $12x^2$ **28.** $13y^2$

Chapter 5

Getting Started pp. 178–179

Activity 1: 1. 1, 2, 3, 4, 6, 12 **2.** 1, 3, 5, 15
3. 1, 3, 7, 21 **4.** 1, 2, 4, 8 **5.** 1, 3, 5, 9, 15, 45
6. 1, 2, 3, 4, 6, 9, 12, 18, 36 **7.** 1, 2, 4, 13, 26, 52
8. 1, 17 **9.** 1, 2, 4, 5, 10, 20, 25, 50, 100 **10.** 1,
2, 3, 4, 6, 8, 12, 24 **11.** 1, 2, 4, 5, 8, 10, 16, 20,
40, 80 **12.** 1, 3, 13, 39 **13.** $2 \times 2 \times 2$ **14.** 3×5
15. $2 \times 2 \times 2 \times 3$ **16.** $2 \times 2 \times 5$ **17.** $2 \times 2 \times 3 \times 3$
18. $2 \times 3 \times 7$ **19.** $2 \times 2 \times 7$ **20.** 19 **21.** 2×13

22. −5, 6; 2, −35; −7, −18; −4, 20; 3, −3; −1, 9; 4, −12;
4, 5; −3, −4; 2, 10; −5, −6 **23.** 2 **24.** b **25.** 2
26. $-2x$ **27.** $3a$ **28.** $-2x$ **29.** $4y$ **30.** $-4x$ **31.** 2
32. $-6xy^2$ **33.** 1 **34.** $-4a$ **Activity 2: 1.** x^3 **2.** p
3. a^6 **4.** x^4 **5.** $-5t^3$ **6.** a^2 **7.** $-3x^3$ **8.** $-4a^3$ **9.** $5x^2$
10. $6mn$ **11.** $5ab$ **12.** $a + 2$ **13.** $3x - 2y$ **14.** $t - 3$
15. $3x - 2$ **16.** $3m - 2n + 1$ **17.** $2x^2 - 5x + 3$ **18.** $3a + 2b$
19. $4y^3 - 3x^2$ **Activity 3: 1.** 5 **2.** 11 **3.** 6 **4.** x
5. $2a$ **6.** $7x$ **7.** 4 **8.** 25 **9.** 81 **10.** $4x^2$ **11.** $9a^2$
12. $25x^6$ **Activity 4: 1.** $48x^3y^3$ **2.** $9x^2$ **3.** $6x^2$
4. $20x^2$ **5.** $x^2 + 3x + 2$ **6.** $x^2 + 3x$ **7.** $a^2 + 5a + 4$
8. $y^2 + 9y + 20$ **9.** $y^2 + 2y$ **10.** $a^2 + 11a + 30$
11. $x^2 + 5x + 10$ **12.** $y^2 + 5y + 9$ **Mental Math**
1. 15 **2.** 14 **3.** 16 **4.** 9 **5.** 34 **6.** 0 **7.** 9
8. 90 **9.** 25 **10.** 100 **11.** 25 **12.** 33 **13.** 6
14. 3 **15.** 54 **16.** 36 **17.** 26 **18.** 31 **19.** 13
20. 41 **21.** 6 **22.** $\frac{1}{6}$ **23.** $\frac{1}{20}$ **24.** 3 **25.** 2 **26.** $\frac{2}{3}$
27. $\frac{3}{4}$ **28.** 1 **29.** 2 **30.** $\frac{1}{3}$ **31.** $\frac{1}{2}$ **32.** $\frac{3}{2}$ **33.** $\frac{7}{5}$
34. $\frac{1}{12}$ **35.** $\frac{1}{4}$ **36.** 8 **37.** $\frac{3}{4}$ **38.** $\frac{1}{4}$ **39.** $\frac{1}{8}$ **40.** $\frac{2}{15}$
41. $\frac{1}{8}$ **42.** $\frac{3}{10}$ **43.** 9 **44.** $\frac{1}{3}$ **45.** $\frac{1}{2}$

Learning Together pp. 180–181

Activity 1: 3. 45 **4.** 45 **5.** equal **6.** Multiply
the middle number by 3. **8.** 11 **9.** 11
10. a) $x + 8$, $x + 9$; $x + 14$, $x + 15$, $x + 16$
b) $x - 8$, $x - 7$, $x - 6$; $x - 1$, $x + 1$; $x + 6$, $x + 7$, $x + 8$
c) $x - 14$, $x - 13$, $x - 12$; $x - 7$, $x - 6$, $x - 5$; $x + 1$, $x + 2$
Activity 2: 1. 5, 7, 9, 11; 7, 9, 11, 13; 9, 11, 13,
15; 11, 13, 15, 17 **3.** 44 **4.** yes **5.** the sum always
equals $a + b + c + d + e + f + g + h$

Section 5.1 p. 184

Practice 1. 2, 2, 3 **2.** 2, 2, 2, 2 **3.** 2, 2, 7 **4.** 3,
3, 7 **5.** 2, 2, 2, 2, 3, 3 **6.** 3, 3, 5, 5 **7.** $2 \times 2 \times x \times$
$y \times y$ **8.** $2 \times 3 \times 3 \times a \times a \times b \times b \times b$ **9.** $2 \times 2 \times 3 \times 3 \times$
$x \times x \times y \times z \times z$ **10.** $2 \times 5 \times x \times x \times y$ **11.** $2 \times 3 \times 3 \times 3 \times$
$x \times x \times x \times x \times x$ **12.** $5 \times 5 \times 5 \times a \times a \times a \times a \times b \times b$
13. 5 **14.** 8 **15.** 9 **16.** 14 **17.** 24 **18.** 32 **19.** $2a$
20. x **21.** $2m^2$ **22.** $3abc$ **23.** 2 **24.** 7 **25.** $5x$ **26.** xy
27. mn **28.** $2a^2$ **29.** $5bc$ **30.** $3xy$ **31.** 5 **32.** $2x$
33. $6a$ **34.** $5xy$ **35.** $7ab$ **36.** $4xy$ **37.** $4ab$ **38.** x^2y^2
39. $2x^2y$ **40.** $3xy^2$ **41.** $4ab^3$ **42.** $5s^3t^4$ **Problems
and Applications 43.** 6 **44.** x **45. a)** A–Shirley,
B–Gustav, C–Bob, D–Collete, E–Karin

Section 5.2 p. 186

Practice 1. 6 **2.** x **3.** a **4.** $5x$ **5.** $4ab$ **6.** 6
7. $7a$ **8.** a **9.** x, 3 **10.** $3a$, 2 **11.** $2a^2$, $5a$, 3
12. $3a^2b$, $2a$, 1 **13.** $3x$, $2y$ **14.** $3a^2$, $4b^3$ **15.** $5(2x + 3)$

16. $14(2y - 1)$ **17.** $n(2m - 1)$ **18.** $5x(x + 2)$
19. $4x^2(2 + x)$ **20.** $3a^2b(3ab - 2)$ **21.** $2xy^2(2x - 3z^2)$
22. $7b^2(2a^2b^2 - 3c^2)$ **23.** $6xy^2z(xy + 2)$ **24.** $3b^4(5a^2b - 3c^2)$
Problems and Applications   **25.** $3(3a - 2b + 1)$
26. $4(a - 2b + 4)$ **27.** $6x(2x^2 - x + 4)$ **28.** $5x(2x^2 - x + 3)$
29. $6x^2y(4x^2 - 3x + 2y)$ **30.** $8a(ab + 2b - 3)$
31. $5mn(5m^2 - 3mn + n^2)$ **32. a)** $2x + 2y, 2(x + y)$
b) $2(x + y)$ **33.** 12 cm by 11 cm   **34. a)** $(a + b)(x + y)$
b) $(x - 2)(x + 3)$ **c)** $(2x - 3)(x - 5)$ **d)** $(a - b)(2a + b)$
35. a) $5t(1 - t)$ **b)** 1.2 m

Section 5.3 p. 189

Practice   **1.** $x^2 + 2x$ **2.** $x^2 - 3x$ **3.** $a^2 + a$ **4.** $t^2 - t$
5. $y^2 + 4y$ **6.** $m^2 + 5m$ **7.** $x^2 - 5x$ **8.** $y^2 - 7y$
9. $a^2 - 10a$ **10.** $3x^2 + 6x$ **11.** $4b^2 - 44b$ **12.** $5t^2 + 15t$
13. $6x + 2x^2$ **14.** $7y^2 - 35y$ **15.** $-2x^2 - 8x$ **16.** $-x^2 - 2x$
17. $-y^2 + 3y$ **18.** $5x$ **19.** $2y^2 + y$ **20.** $2m^2 - 2m$
21. $x^2 + 2$ **22.** $3y^2 - 7y$ **23.** $3a^2$ **24.** $-3x$
25. $5x^2 + 16x$ **26.** $x^2 - x$ **27.** $9x^2 + 5x$ **28.** $-3y^2 + 5y$
29. $5a^2$ **30.** $-x^2 + 2x$ **31.** $22x$ **32.** $x^3 + 2x^2 + 3x$
33. $3x^2 + 6x - 15$ **34.** $5x^3 + 10x^2 - 35x$
35. $-x^2 + 3x + 1$ **36.** $4m^2 - 20m^2 + 24m$
37. $6y^3 - 12y^2 + 9y$ **38.** $-9b^3 + 15b^2 - 3b$
39. $-5z^3 + 10z^2 + 25z$ **Problems and Applications**
40. $2x^2 + 5x - 15$ **41.** $8x^3 + 13x - 35$ **42.** $2x^2 + 5x + 1$
43. $3x^3 - 3x^2 + 17x + 12$ **44.** $7m^2 - 26m + 24$
45. $y^2 - 7y + 9$ **46.** $x^2 - 8x$ **47. a)** $35y^2 - 20y$
b) $14x + 14xy + 9y$ **c)** $38x^2$ **d)** $7x^2 + 6x$

Section 5.4 p. 191

Practice   **1.** 3   **2.** −6   **3.** −4n   **4.** 6   **5.** 11   **6.** y
7. $4x$ **8.** $-3b^2$ **9.** $-6x$ **10.** $4x - 5y + 8$ **11.** $x^2 + 2x - 3$
12. $-y^3 - y^2 + 3$ **13.** $m^2 + 2m - 3$ **14.** $-3x^2 + 8x + 5$
15. $-j^4 - 2j^3 - 3j^2$ **16.** $-2x^2 - x + 3$ **17.** $3 - 2m + 3m^2$
18. $-2p + 3q - 5p^2q^2$ **19.** $-4a + 3b + 8a^2b^2$ **20.** $2x^2 - 3xy + 4y^2$ **21.** $2ac^3 - 3c^2 + 4bc$ **22.** $3y^2 + 4xy + 6x^2$
23. $5n^2 - 6mn - 5m^2$ **24.** $-5abc^3 + 8a^2bc^2 - 7a^4b^2c$
Problems and Applications   **25. a)** $4x + 1$
b) $4x^3 - 5x + 3$ **c)** $3xy - 6 + 7x$ **d)** $2x^2 + 3xy - 6y^3$

Connecting Math and Logic p. 192

Activity 2:   **2.** Two sides; not a Möbius strip.
Activity 3:   **3.** One two-sided, one one-sided; only one Möbius strip

Section 5.5 p. 194

Practice   **1.** $(x + 4)(x + 1)$, $x^2 + 5x + 4$ **2.** $(x + 2)(x + 2)$,
$x^2 + 4x + 4$ **3.** $(x + 5)(x + 1)$, $x^2 + 6x + 5$ **4.** $(x + 1)(x + 1)$,
$x^2 + 2x + 1$ **5.** $3x - 15$ **6.** $2x^2 + 3x$ **7.** $-14x + 42$
8. $12x^2 - 4x$ **9.** $15a^3 - 20a^2b$ **10.** $-6x^2 - 10xy$

11. $x^2 + 3x + 2$ **12.** $x^2 + 7x + 12$ **13.** $a^2 + 8a + 16$
14. $y^2 + 11y + 30$ **15.** $x^2 - 7x + 12$ **16.** $a^2 - 6a + 8$
17. $b^2 - 6b + 5$ **18.** $y^2 - 18y + 81$ **19.** $x^2 - 3x - 18$
20. $c^2 - 6c - 16$ **21.** $t^2 - 100$ **22.** $q^2 + 3q - 10$
23. $c^2 - c - 12$ **24.** $x^2 - 3x - 10$ **25.** $y^2 + 4y - 12$
26. $a^2 + 4a - 45$ **27.** $x^2 - 9$ **28.** $b^2 + 3b - 70$
29. $y^2 - 9y - 36$ **30.** $x^2 - 6x - 7$ **31.** $2x^2 + 11x + 5$
32. $3y^2 + 7y + 2$ **33.** $2x^2 - 3x + 1$ **34.** $-2a^2 + a + 15$
35. $5y^2 + 8y - 21$ **36.** $4x^2 - 17x - 15$ **37.** $-4x^2 + 4x + 3$
38. $15y^2 - 26y + 8$ **39.** $12x^2 - 17x - 5$ **40.** $10y^2 - 41y - 18$
41. $14y^2 - 55y + 21$ **42.** $-24x^2 - 31x - 10$ **Problems and Applications**   **43.** $x^2 + 2.5x + 1$ **44.** $x^2 + 1.8x - 3.6$
45. $x^2 - 12.5x + 25$ **46.** $x^2 - 0.9x - 6.3$ **47.** $2x^2 + 16x + 30$
48. $4x^2 - 16x - 180$ **49.** $-a^2 - a + 6$ **50.** $10x^2 + 20x - 350$
51. $18x^2 - 21x + 6$ **52.** $2x^3 - 6x^2 - 140x$ **53.** $0.5x^2 + x - 1.5$
54. $1.8x^2 + 3.6x + 1.8$ **55. a)** 21 cm² **b)** 14 cm² **c)** 7 cm²
56. a) $21 \neq 13$ **b)** $x^2 + 8x + 12$ **57. a)** $(x + 10)(x + 5)$
b) 750 m²   **58.** $1000 + 2000r + 1000r^2$ **b)** $1166.40

Section 5.6 p. 197

Practice   **3. a)** 3, 4 **b)** 3, 5 **c)** 1, 12 **d)** 7, 11
e) −3, −5 **f)** −5, −5 **g)** −3, −4   **4. a)** −4, 3 **b)** −3, 4
c) −8, 5 **d)** 10, 15 **e)** −1, 5 **f)** −7, 6 **g)** −12, 5
5. $(x + 2)(x + 5)$ **6.** $(y - 3)(y - 5)$ **7.** $(w - 8)(w + 7)$
8. $(z - 5)(z + 8)$ **9.** $(x - 6)(x + 5)$ **10.** $(a - 1)(a - 16)$
11. $(x - 10)(x + 1)$ **12.** $(x + 2)(x + 10)$ **13.** $(x + 5)(x + 5)$
14. $(m - 3)(m - 6)$ **15.** $(a - 3)(a - 3)$ **16.** $(y + 5)(y + 6)$
17. $(x + 1)(x + 9)$ **18.** $(x - 16)(x + 1)$ **19.** $(a - 2)(a + 8)$
20. $(x + 4)(x + 5)$ **21.** $(a - 1)(a - 24)$ **22.** $(y - 2)(y - 7)$
23. $(y - 9)(y + 2)$ **24.** $(x - 9)(x + 8)$ **25.** $(s - 10)(s + 8)$
26. $(a - 9)(a - 9)$ **27.** $3(x - 4)(x - 3)$ **28.** $5(x - 2)(x + 1)$
29. $7(x + 2)(x + 3)$ **30.** not possible   **31.** $b(x - 3)(x - 25)$
32. not possible   **33.** $5j(x - 3)(x - 5)$ **34.** $3t(x + 2)(x + 2)$
35. $t(t - 3)(t + 4)$ **36.** $3k(k - 1)(k + 6)$ **Problems and Applications**   **37.** not possible   **38.** $(a - 8)(a + 1)$
39. $(b + 6)(b + 8)$ **40.** not possible   **41.** $(z - 10)(z - 10)$
42. not possible   **43.** not possible   **44.** $(y - 2)(y + 10)$
45. a) $(x + 4)(x + 5)$ **b)** $(x + 3)(x + 4)$ **c)** $x^2 + 7x + 12$
46. $x^2 + 12x + 20, x^2 + 12x + 36, x^2 + 12x + 27, x^2 + 12x + 32$

Section 5.7 p. 199

Practice   **1.** $a + 7$ **2.** $x - 2$ **3.** $3m + 7$ **4.** $9x - 8$
5. $x + y$ **6.** $2a - 3b$ **7.** $x^2 - 1$ **8.** $a^2 - 25$ **9.** $p^2 - 36$
10. $x^2 - 81$ **11.** $y^2 - 64$ **12.** $t^2 - 100$ **13.** $4x^2 - 1$
14. $9y^2 - 1$ **15.** $16a^2 - 9$ **16.** $36t^2 - 25$ **17.** $x^2 - y^2$
18. $100t^2 - 9$ **19.** $p^2 - q^2$ **20.** $9a^2 - b^2$ **21.** $x^2 - 36y^2$
22. $j^2 - 100r^2$ **23.** $x^4 - 9$ **24.** $k^4 - 81$ **Problems and Applications**   **25.** $(20 + 4)(20 - 4)$, 384;
$(50 - 3)(50 + 3)$, 2491; $(60 + 2)(60 - 2)$, 3596   **26.** 96
27. 216   **28.** 396   **29.** $(10 + 4)(10 - 4)$, 84
30. $(20 - 3)(20 + 3)$, 391   **31.** $(30 + 2)(30 - 2)$, 896
32. $x^4 - 1$ **33.** $a^4 - 16$ **34.** $x^4 - 6561$ **35.** $81x^4 - 16$

36. $x^8 - 1$ **37.** the new field has 2500 m² less area
38. 1 term, 5 terms

Section 5.8 p. 201

Practice   **1.** $x + 5$ **2.** $w - 10$ **3.** $k + 9$ **4.** $2a + 11$
5. $3 - 4x$ **6.** $x^2 - 6$ **7.** $(t - 2)(t + 2)$ **8.** $(x - 4)(x + 4)$
9. $(b - 3)(b + 3)$ **10.** $(m - 7)(m + 7)$ **11.** $(p - 5)(p + 5)$
12. $(w - 6)(w + 6)$ **13.** $(a - 9)(a + 9)$ **14.** $(q - 10)(q + 10)$
15. not possible   **16.** $(1 - c)(1 + c)$ **17.** $(8 - x)(8 + x)$
18. not possible   **19.** $(s - t)(s + t)$ **20.** $(z - x)(z + x)$
21. $(b - g)(b + g)$ **22.** $(p - q)(p + q)$ **23.** $(2a - 3b)$
$(2a + 3b)$ **24.** $(4p - 9)(4p + 9)$ **25.** $(5a - 7)(5a + 7)$
26. $(3b - 5)(3b + 5)$ **27.** $(4 - x)(4 + x)$ **28.** $(5 - 6b)$
$(5 + 6b)$ **29.** $(4 - 7x)(4 + 7x)$ **30.** $(9 - 2a)(9 + 2a)$
31. $(4x - 1)(4x + 1)$ **32.** $(12 - 11x)(12 + 11x)$
33. $(13 - 10t)(13 + 10t)$ **34.** $(15 - 7w)(15 + 7w)$
35. not possible   **36.** $(4y - 7)(4y + 7)$ **37.** $(3 - 2z)$
$(3 + 2z)$ **38.** $(5a - 6)(5a + 6)$ **39.** $(xy - 2)(xy + 2)$
40. not possible   **41.** $((a + b) - (a - b))((a + b) + (a - b))$
42. $(5 - 9pq)(5 + 9pq)$ **43.** $2(m - 5)(m + 5)$
44. $9(x - 2)(x + 2)$ **45.** $5(2r - 3)(2r + 3)$
46. $a(2a - 5)(2a + 5)$ **47.** $10(y - 10)(y + 10)$
48. $x(x - 1)(x + 1)$ **49.** $2(5y - 6)(5y + 6)$
50. $x(x - 3)(x + 3)$ **51.** $8(y - 1)(y + 1)$
52. $4(p - 2)(p + 2)$ **53.** $3(3k - 2)(3k + 2)$
54. $16(t - 1)(t + 1)$ **55.** $(8 - x)(8 + x)$
56. $2(5 - 3x)(5 + 3x)$ **57.** $3(2x - 5y)(2x + 5y)$
58. $2(5x - 7y)(5x + 7y)$ **Problems and Applications**
59. a) 91   **b)** 13 by 7   **c)** equal   **d)** 32, 8 by 4
e) $x^2 - y^2$, $x + y$ by $x - y$ **60. a)** $(x - 1)(x + 1)(x^2 + 1)$
b) $(x - 1)(x + 1)(x^2 + 1)(x^4 + 1)$ **c)** $(x - 5)(x + 5)(x^2 + 25)$

Section 5.9 p. 203

Practice   **1.** 49   **2.** 81   **3.** 36   **4.** 144   **5.** $4x^2$
6. $9a^2$ **7.** $121y^2$ **8.** x^2 **9.** $16y^2$ **10.** x^2 **11.** a^2
12. $4x^2$ **13.** $81t^2$ **14.** $100b^2$ **15.** $9y^2$ **16.** $49p^2$
17. $16j^2$ **18.** $36q^2$ **19.** $-6x$ **20.** $+16y$ **21.** $+2xy$
22. $-2ab$ **23.** $+12x$ **24.** $-40a$ **25.** $+12xy$ **26.** $-84p$
27. $y^2 - 20y + 100$ **28.** $9a^2 - 6a + 1$ **29.** $25x^2 + 20x + 4$
30. $9 - 6x + x^2$ **31.** $25 - 10y + y^2$ **32.** $25a^2 + 10ab + b^2$
33. $9x^2 + 6xy + y^2$ **34.** $16x^2 - 24xy + 9y^2$
35. $49a^2 - 28ab + 4b^2$ **36.** $16m^2 + 40mn + 25n^2$
Problems and Applications   **37.** $(x + 7)^2$
38. $(x - 8)^2$ **39.** $(2a + 3)^2$ **40.** $(3b - 4)^2$ **41.** $(8m - 2)^2$
42. $(9n + 5)^2$ **43.** $x^2 + 12x + 36$ **44.** $a^2 + 8a + 16$
45. $y^2 - 6y + 9$ **46.** $m^2 - 8m + 16$ or $m^2 - 4m + 4$
47. $2x^2 - 4x + 2$ or $4x^2 - 4x + 1$ **48.** $9y^2 + 12y + 4$
49. $16 \neq 10$ **50.** $a^2 + b^2 + c^2 + 2ab + 2ac + 2bc$

Section 5.10 p. 205

Practice   **1.** $3x^2 + 9x - 15$ **2.** $6a^2 - 10a + 14$

3. $2x^2 + 14x + 24$ **4.** $3a^2 + 21a + 30$ **5.** $5y^2 + 20y + 50$
6. $x^3 - 10x^2 + 25x$ **7.** $x^3 + 11x^2 + 28x$ **8.** $2a^3 + 8a^2 + 15a$
9. $4x^3 - 3x^2 - 4x$ **10.** $6x^3 - 23x^2 + 20x$ **11.** $x^3 + 3x^2 +$
$5x + 3$ **12.** $x^3 - x^2 - 5x + 2$ **13.** $x^3 + 5x^2 + 3x - 9$
14. $x^3 + 3x^2 - 13x - 15$ **15.** $x^3 - 12x^2 + 25x + 28$
16. $x^3 - 7x^2 + 16x - 12$ **17.** $x^3 + 5x^2 - 61x + 55$ **18.** $3a^3$
$-2a^2 + 4a - 5$ **19.** $5b^3 - 36b^2 + 5b + 14$ **20.** $2x^3 - 19x^2$
$+27x - 24$ **21.** $4x^3 - 23x^2 + 8x + 35$ **22.** $3x^3 - 11x^2 + 6x + 8$
23. $7a^3 - 8a^2 + 2a - 1$ **24.** $2y^3 - 5y^2 - 23y - 10$
25. $2x^3 + 13x^2 + 13x - 10$ **26.** $3a^3 + 4a^2 - 21a - 18$
27. $5b^3 - 2b^2 + 3b + 10$ **28.** $7w^3 - 8w^2 + 1$ **29.** $2y^3$
$-y^2 - 4y - 4$ **30.** $4t^3 - 22t^2 + 9t + 5$ **31.** $x^3 + 2x^2y + x^2$
$+2xy + xy^2 + y^2$ **32.** $x^3 - 3x^2y - 2x^2 + 6xy + xy^2 - 2y^2$
33. $xb^2 + 3b^2 - 3bxy - 9by - xy^2 - 3y^2$ **Problems and**
Applications   **34.** $15x^3 - 6x^2y + 10x^2 - 4xy + 3xy^2 + 2y^2$
35. $4y^4 - 16y^3 + 15y^2 + 14y - 35$ **36.** $28x^3 + 67x^2 - 3x$
$- 27$ **37.** $6a^3 - 23a^2 + 36a - 35$ **38.** $6y^3 + 11y^2 + 8y + 2$
39. $9a^3 - 33a^2 + 9a + 35$ **40. a)** $6a^2 - a - 2$
b) $2x^3 + x^2 - 4x + 1$ **c)** $7a^2 + ab - 2b^2$
41. a) $x^3 + 3x^2$ **b)** $24x^2 - 12x$ **c)** $6x^2 + 30x + 36$

Section 5.11 p. 208

Practice   **1.** 8   **2.** 24   **3.** 6   **4.** $21x$ **5.** $15a$
6. $24x$ **7.** $\frac{3}{y}$, $x \neq 0$, $y \neq 0$ **8.** $\frac{2}{y}$, $y \neq 0$ **9.** $3x$, $x \neq 0$
10. $2c$, $a \neq 0$, $b \neq 0$ **11.** $-2xy^2$, $x \neq 0$, $y \neq 0$
12. $-4ab$, $a \neq 0$, $b \neq 0$ **13.** $\frac{3}{2}$ **14.** $\frac{1}{2}$ **15.** 1   **16.** $\frac{4}{3}$
17. $\frac{1}{2}$ **18.** 1   **19.** x^2y **20.** $\frac{5xy^3}{3}$ **21.** $\frac{2pq^2}{r}$ **22.** $\frac{7a^2b^2}{2}$
23. xy^2 **24.** x **25.** $\frac{x^3}{4}$ **26.** $\frac{x^2y}{2}$ **27.** $\frac{19}{y}$ **28.** $\frac{x - 11}{a}$
29. $\frac{1}{4x}$ **30.** $\frac{9xy}{z}$ **31.** $\frac{5 - x}{x}$ **32.** $\frac{7}{3x^2}$ **33.** $\frac{x - 4}{x^2}$
34. $\frac{1 - x}{5x^2}$ **35.** $\frac{3x + 1}{4}$ **36.** $\frac{x + 10}{12}$ **37.** $\frac{5x - 2}{6}$
38. $\frac{2x - 9}{15}$ **39.** $\frac{9 - x}{12}$ **40.** $\frac{9x - 3}{10}$ **Problems and**
Applications   **41. a)** $4x(x + 1)$ **b)** $x(x + 1)$ **c)** $\frac{1}{4}$
42. a) $6(x + 1)(x + 2)$ **b)** $(x + 1)(x + 2)$ **c)** $\frac{1}{6}$

Connecting Math and Design pp. 210–211

Activity 2:   **1.** 314 m, 320.28 m, 326.56 m,
332.84 m, 339.12 m   **Activity 3:**   **1.** The sides
of the track must be 43 m.   **2.** 400 m, 406.28 m,
412.56 m, 418.84 m, 425.12 m

Review p. 212–213

1. a) 5   **b)** 7   **c)** 17   **d)** 24   **e)** $5a$ **f)** $4x$ **g)** $2ab$ **h)** $5xy$
2. a) $3xy$ **b)** 8   **c)** $9xy$ **3.** $5(x - 3)$ **4.** $6x(x - 3)$
5. $5a(b + 2c)$ **6.** $7a^2(1 + 5a)$ **7.** $4bc(2a - 3)$
8. $3(x^2 + 3y^2)$ **9.** $a(3a - 6b + 1)$ **10.** $2(x + 3y - 5z)$

11. $9x + 14$ 12. $7a + 14$ 13. $6y^2 - 19y - 10$
14. $-m^2 + m + 2$ 15. $-2z^2 - 4z + 5$ 16. $x^2 - 20x$
17. $-2y^3 + 6y^2 - 14y$ 18. $-3t + 6t^2 + 3t^3$
19. $4m^3 + 8m^2 - 12m$ 20. $-6x^3 + 12x^2 - 6x$
21. $2b^2 - 4ab + a^2$ 22. $-2abz^3 + 4abz^2$ 23. $x^2 - x - 6$
24. $x^2 + 3x - 28$ 25. $x^2 + 7x + 10$ 26. $x^2 - 5x + 6$
27. $x^2 + 8x - 20$ 28. $6x^2 - 19x + 10$
29. $10a^2 - 11a - 6$ 30. $12x^2 - 13x - 14$
31. $-21x^2 + 53x - 30$ 32. $10a^2 + 13ab - 3b^2$
33. $(x + 1)(x + 7)$ 34. $(x - 1)(x - 5)$ 35. $(y + 3)(y + 5)$
36. $(a + 2)(a + 6)$ 37. $(b + 4)(b + 6)$ 38. $(x - 1)(x - 6)$
39. $(x - 4)(x - 7)$ 40. $(a - 3)(a - 4)$ 41. $(a - 5)(a + 4)$
42. $(x - 6)(x + 5)$ 43. $(x - 7)(x + 2)$
44. $(m - 10)(m + 4)$ 45. $(x - 3)(x + 7)$
46. $(x - 2)(x + 12)$ 47. $(x - 5)(x + 7)$
48. $(x - 5)(x + 3)$ 49. $2(x + 2)(x + 10)$
50. $5(a - 4)(a - 4)$ 51. $4(w - 6)(w + 5)$
52. $3(r - 2)(r - 5)$ 53. $2(j^2 - 3j + 4)$
54. $3(t - 1)(t + 7)$ 55. $7(y - 4)(y + 5)$
56. $3(z - 6)(z - 7)$ 57. $(x - 1)(x + 1)$
58. $(y - 2)(y + 2)$ 59. $(2a - 3)(2a + 3)$
60. $(a - 2b)(a + 2b)$ 61. $(2x - y)(2x + y)$
62. $(2a - 3b)(2a + 3b)$ 63. $(3 - x)(3 + x)$
64. $(5 - 7x)(5 + 7x)$ 65. $2(a - 5)(a + 5)$
66. $5(x - 2)(x + 2)$ 67. $4(x - 3)(x + 3)$
68. $4(2a - 3)(2a + 3)$ 69. yes 70. no 71. no
72. yes 73. $x^2 + 4x + 4$ 74. $x^2 - 6x + 9$
75. $x^2 - 6x + 9$ 76. $y^2 + 12y + 36$
77. $x^3 - 5x^2 + 8x - 4$ 78. $x^3 - 8x^2 + 12x + 9$
79. $2x^3 - x + 1$ 80. $3x^3 + 14x^2 - 6x - 5$
81. $x^3 + 1$ 82. $x^3 + x^2 + x - 3$
83. $5x^3 - 25x^2 + 17x + 12$ 84. $4x^3 + 5x^2 - 13x - 14$
85. $\frac{5x - 11}{6}$ 86. $\frac{2x - 7}{15}$ 87. $\frac{x}{6}$ 88. $\frac{19x + 1}{42}$ 89. $\frac{2 - x}{x^2}$
90. $\frac{2x + 3}{7x^2}$ 91. $\frac{x - 17}{6}$ 92. $\frac{x + 17}{12}$ 93. $\frac{6x + 22}{7}$
94. $\frac{13x - 19}{42}$ 95. $\frac{2x - 9}{35}$ 96. $\frac{3x - 2}{28}$ 97. $\frac{2 + x}{2x}$ 98. $\frac{5}{x^2}$
99. a) $(x + 2)(x + 8)$ b) $(x + 4)(x + 10)$ c) $x^2 + 14x + 40$

Chapter Check p. 214

1. $3xy(y - 2a)$ 2. $12xy(2y + x)$ 3. $2x^2 - x + 9$
4. $-x^2 + 9x$ 5. $-3x^3 + 6x^2 - 3x$ 6. $4m^3 - 12m^2 - 20m$
7. $1 - 2y + 3y^2$ 8. $3a^2 - 2a + 1$ 9. $x^2 + 2x - 8$
10. $2x^2 + x - 21$ 11. $8a^2 - 18ab + 9b^2$ 12. $-2y^2 - 5y + 3$
13. $(x + 2)(x + 5)$ 14. $(x - 3)(x - 6)$ 15. $(x - 5)(x + 2)$
16. $(x - 5)(x + 7)$ 17. $(x + 4)^2$ 18. $(x - 17)(x - 1)$
19. $2(x - 2)^2$ 20. $5(x - 5)(x + 4)$ 21. $x^2 - 4x + 4$
22. $w^2 + 14w + 49$ 23. $(a - 2)(a + 2)$ 24. $(2x - 5)$
$(2x + 5)$ 25. $(9 - x)(9 + x)$ 26. $(1 - 2b)(1 + 2b)$
27. $2(t - 10)(t + 10)$ 28. $3(x - 2)(x + 2)$
29. $4(5 - 2t)(5 + 2t)$ 30. $2(1 - 3y)(1 + 3y)$
31. yes 32. no 33. yes 34. no 35. $5x^3y^2$

36. $5a^2$ 37. $\frac{5x + 19}{6}$ 38. $\frac{9x - 37}{35}$
39. a) $(x + 3)(x + 10)$ b) $(x + 2)(x + 12)$ c) $x^2 + 14x + 24$

Using the Strategies p. 215

1. Top Row: $\frac{8}{10}, \frac{1}{10}, \frac{6}{10}$, Middle Row: $\frac{3}{10}, \frac{5}{10}, \frac{7}{10}$,
Bottom Row: $\frac{4}{10}, \frac{9}{10}, \frac{2}{10}$ 3. $a = 3$, $b = 4$
4. 14, 42, 126 5. Saturday 6. a) 14 b) $2(n + 1)$
Data Bank 1. 43%

Chapter 6

Getting Started pp. 218–219

Warm Up 1. 180° 2. 50° 3. 36° 4. 120° 5. 21°
6. 60° 7. 75° 8. 45° 9. 25° 14. 2 15. 0.5 **Mental
Math** 1. 40 m 2. 24 m 3. 44 m 4. 38 m
5. 150 m² 6. 100 m² 7. 96 m² 8. 150 m² 9. 90
10. 50 11. 80 12. 70 13. 30 14. 40 15. 40

Learning Together pp. 220–221

Activity 1: 2. No **Activity 2:** 2. Yes, $\angle G$
and $\angle J$ could differ. **Activity 3:** 2. Yes, the
side lengths could differ. **Activity 4:** 2. No
Activity 5: 2. No **Activity 6:** 2. Yes, the other
side lengths could differ.

Section 6.1 pp. 224–225

Practice 1. BI = CA, BG = CT, IG = AT, $\angle B =$
$\angle C$, $\angle I = \angle A$, $\angle G = \angle T$ 2. HO = CA, HT = CR,
OT = AR, $\angle H = \angle C$, $\angle O = \angle A$, $\angle T = \angle R$
3. No 4. ASA 5. No 6. SSS 7. No 8. No
9. SAS 10. JC = EK OR $\angle A = \angle I$ 11. RK = PC
12. ASA; $\angle Q = \angle Y$, $\angle P = \angle X$, $\angle R = \angle Z$,
XY = PQ, XZ = PR, RQ = ZY 13. No 14. SSS;
$\angle A = \angle F$, $\angle B = \angle E$, $\angle C = \angle D$, AB = FE, AC = FD,
BC = ED 15. No 16. SAS; LU = LY, LJ = LJ,
JU = JY, $\angle U = \angle Y$, $\angle UJL = \angle YJL$, $\angle ULJ = \angle YLJ$
17. ASA; $\angle S = \angle Q$, $\angle SPR = \angle QRP$, $\angle SRP = \angle QPR$,
PS = RQ, PR = RP, SR = QP 18. No 19. No
20. SAS; $\angle P = \angle B$, $\angle PAT = \angle BTA$, $\angle PTA = \angle BAT$,
PT = BA, PA = BT, AT = TA **Problems and
Applications** 23. No 24. a) otherwise SSS
guarantees congruence b) may change just the
angles 25. a) sometimes congruent b) sometimes
congruent c) always congruent d) sometimes
congruent

Learning Together p. 227

Activity 2: 1. The length of the hypotenuse

squared is equal to the sum of the squares of the other two sides. **2.** $c^2 = a^2 + b^2$ **3. a)** 13 **b)** 5 **c)** 24 **d)** 6 **4. a)** 5.8 **b)** 13.6 **c)** 9.6 **d)** 8.3

Section 6.2 pp. 230–231

Practice **5.** $f = 8$ cm, $d = 14$ cm **6.** $r = 30$ cm, $s = 6$ cm **7.** $w = 6$ cm, $b = 7.5$ cm **8.** $p = 6.75$ cm, $r = 7.5$ cm **9.** $d = 12.5$ cm, $e = 15$ cm **10.** 8 cm **11.** 9 cm **Problems and Applications** **12.** 37.5 m **13.** 260 m **14.** 233 m **16.** 19 m **17. a)** false **b)** true

Connecting Math and Design pp. 234–235

Activity 1: **1. a)** complementary angles **2.** $\triangle FBD$ is isosceles. **Activity 2:** Maple Leaf Gardens: 39°, 42°, 45°; B.C. Place: 40°, 45°, 55°; O'Keefe Centre: 27°, 33°, 37°; Lansdowne Park: 44°, 50°, 58°

Section 6.3 p. 238

Practice **1.** 0.268 **2.** 1.881 **3.** 0.087 **4.** 0.577 **5.** 7.115 **6.** 1.000 **7.** 31° **8.** 40° **9.** 72° **10.** 79° **11.** 39° **12.** 41° **13.** 60° **14.** 59° **15.** 0.4 **16.** 1.0 **17.** 1.333, 53°, 0.75, 37° **18.** 1.875, 62°, 0.533, 28° **19.** 11.0 cm **20.** 6.0 cm **21.** 11.2 m **22.** 11.3 m **23.** 5.1 cm **24.** 13.1 cm **Problems and Applications** **25.** 5.1 cm **26.** 3.0 cm **27.** 2.1 m **28.** 93 m **29.** 12 m **30.** 35° **31.** 27°

Section 6.4 p. 241

Practice **1.** 0.707 **2.** 0.866 **3.** 0.602 **4.** 0.423 **5.** 0.000 **6.** 1.000 **7.** 30° **8.** 72° **9.** 45° **10.** 18° **11.** 86° **12.** 6° **13.** 42° **14.** 49° **15.** 30° **16.** 24° **17.** 7° **18.** 51° **19.** 0.455, 27° **20.** 0.2, 12° **21.** 13.1 cm **22.** 29.0 cm **23.** 48.1 cm **24.** 15.7 cm **25.** 18.3 cm **26.** 27.4 cm **27.** 13.1 cm **28.** 56° **29.** 16.2 cm **30.** 1.4 m **31.** 3.6 cm **32.** 4.1 m **33. a)** 0.629 **b)** $0.629 = \frac{a}{c}$ **c)** $a = 0.629 \times c$ **d)** $c = \frac{a}{0.629}$

Section 6.5 p. 244

Practice **1.** 0.866 **2.** 0.707 **3.** 0.5 **4.** 0.017 **5.** 1.000 **6.** 0.996 **7.** 0.946 **8.** 0.122 **9.** 70° **10.** 28° **11.** 52° **12.** 89° **13.** 43° **14.** 58° **15.** 80° **16.** 63° **17.** 56° **18.** 29° **19.** 20° **20.** 78° **21.** 0.5, 60° **22.** 0.3, 73° **23.** 7.6 cm **24.** 13.1 cm **25.** 8.2 cm **26.** 11.7 cm **27.** 12.2 cm **28.** 19.8 cm **29.** 10.4 cm **30.** 6.3 cm **Problems and Applications** **31.** 21.8 cm **32.** 9.3 cm **33.** 225.0 m **34.** 17.1 m **35.** $\angle X = 37° = \angle Y$, $\angle W = 106°$

Section 6.6 p. 247

Practice **1.** $\angle A = 30°$, $\angle C = 60°$, 7.5 cm **2.** $\angle H = 52°$, $\angle I = 38°$, 11.4 cm **3.** $\angle J = 56°$; $\angle L = 34°$, 3.3 cm **4.** $\angle R = 42°$, $\angle P = 48°$, 14.9 cm **5.** $\angle T = 42°$, $\angle R = 48°$, 24.1 m **6.** $\angle W = 28°$, $\angle Y = 62°$, 47.9 cm **7.** 57°, CD = 12.0 m, ED = 18.5 m **8.** 25°, BG = 32 cm, FG = 13.5 cm **9.** 29°, RP = 58.3 m, PM = 28.2 m **10.** 60°, XZ = 12 cm, YZ = 10.4 cm **11.** 36°, OS = 13.8 km, NO = 10.0 km **12.** 77°, XY = 2.9 m, MX = 12.7 m **13.** 51 m **14.** 23 m **15.** 76° **17. a)** 0.577, 0.5, 0.866, 0.577; 0.810, 0.629, 0.777, 0.810; 1.000, 0.707, 0.707, 1.000; 1.327, 0.799, 0.602, 1.327; 1.732, 0.866, 0.500, 1.732; 2.246, 0.914, 0.407, 2.246 **b)** the same

Review pp. 252–253

1. SAS; $\angle N = \angle S$, NP = RS, NM = QS, $\triangle NPM \cong \triangle RSQ$ **2.** SSS **3.** SAS **4.** SAS **5.** ASA **6.** $e = 10$ cm, $f = 6$ cm **7.** $q = 4$ cm, $w = 18$ cm **8.** $q = 6$ cm, $y = 10$ cm **9.** 44 m **10.** 10.5 cm **11.** 50.8 cm **12.** 14.8 m **13.** 53.9 m **14.** 18 mm **15.** 11 km **16.** $\angle A = 31°$, $\angle C = 59°$, 5.8 m **17.** $\angle E = 67°$, $\angle D = 23°$, 12 cm **18.** 40°, JH = 3.1 m, GJ = 2.5 m **19.** $\angle K = 58°$, $\angle M = 32°$, 39 mm **20.** $\angle Q = 58°$, NQ = 30 cm, PQ = 56.6 cm **21.** 35°, RT = 24.2 km, ST = 29.6 km **22.** 6° **23.** 47.3 m **24.** 58°

Chapter Check p. 254

1. SAS **2.** ASA **3.** SSS **4.** SSS **5.** $a = 10$ cm, $b = 8$ cm **6.** $r = 10$ cm, $w = 10.5$ cm **7.** congruent, ASA **8.** similar **9.** 14.5 cm **10.** 45.7 cm **11.** 19 km **12.** 58.7 m **13.** 16.0 cm **14.** 11.2 m **15.** ST = 24.2 m, PT = 7.5 m, $\angle S = 18°$ **16.** RX = 9.8 cm, WR = 13.9 cm, $\angle W = 35°$

Using the Strategies p. 255

1. 6 **2.** 35, 12, 23 **3.** 15:00 **4.** 2 × $5, 1 × $2, 1 × $0.25, 1 × $0.10, 1 × $0.05, 3 × $0.01 **6.** 78 **7.** The 35 cm pizza costs less per square centimetre. **8.** Take the middle full glass and empty it into the middle empty glass. **9.** 4 **Data Bank** **1.** Approximately 19 000 000 000 000 **2.** Manitoba and Saskatchewan; Saskatchewan is larger by 2380 km².

Chapter 7

Getting Started pp. 258–259

Activity 4: Small triangle, 1; square, parallelogram, medium triangle, 2; large triangle, 4   **Mental Math**
1. 31.4   **2.** 314   **3.** 3140   **4.** 31 400   **5.** 0.314
6. 0.0314   **7.** 0.003 14   **8.** 0.000 314   **9.** 0.125
10. 96   **11.** 98   **12.** 15   **13.** 120   **14.** 630   **15.** 52
16. 3.1   **17.** 3   **18.** 6   **19.** 18   **20.** 3   **21.** 5.5, 5.5
22. 4, 4   **23.** 6, 6   **24.** 10, 10   **25.** 12   **26.** 27
27. 75   **28.** 75   **29.** 18   **30.** 30   **31.** 90   **32.** 210
33. 24   **34.** 192   **35.** 3000   **36.** 375

Section 7.1 p. 261

1. 39.69 m^2 **2.** 36.12 cm^2 **3.** 113 cm^2 **4.** 88 cm^2
Problems and Applications   **5.** 44 m^2 **6.** 22.94 m^2
7. a) 32 cm^2 **b)** 6 m^2 **8. a)** 1.5 m^2 **b)** $29.99
9. 708 m^2 **10.** square   **11.** 25 m^2

Section 7.2 p. 264

Practice   **1.** 54 cm^2 **2.** 64 cm^2 **3.** 42 cm^2
4. 137.5 m^2 **5.** 93 m^2 **6.** 192 cm^2 **7.** 39 cm^2
8. 3 cm^2 **Problems and Applications**
9. a) 60 cm^2 **b)** 40 cm^2 **10.** 140 cm   **11.** Front or Back: 1120 cm^2, Side: 1504 cm^2 **12.** 4.5 cm
13. Area of each triangle is half the area of parallelogram or trapezoid.   **14.** 5 cm

Section 7.3 pp. 270–271

Practice   **1.** rectangular prism   **2.** triangular prism
3. square prism   **4.** triangular prism   **5.** square prism   **6.** triangular prism   **7.** 346 m^2 **8.** 43.6 cm^2
9. 150 cm^2 **10.** 958 m^2 **11.** 24 m^3 **12.** 180 cm^3
13. 1716 cm^3 **14.** 108 m^3 **15.** 278 m^2, 198 m^3
16. 685 m^2, 850 m^3 **17.** 12 000 cm^2, 60 000 cm^3
18. 150 cm^2, 112 cm^3 **19.** 132 200 m^2, 3 036 000 m^3
20. 1637 m^2, 3300 m^3 **Problems and Applications**
21. a) 9 m^2 **b)** 1.8 m^3 **22. a)** 94 m^2 **b)** 5
23. a) 4.6 m^2 **b)** $45.91 **c)** 27 227   **24.** 6 cm by 6 cm by 6 cm   **25. a)** 232 cm^2 **c)** rectangular prism
26. 5.44 m^3 **27.** 662 m^2, 841 m^3 **28. a)** 115 m^3
b) approximately 6 h 23 min

Section 7.4 p. 274

Practice   **1.** 161 cm^2 **2.** 72 m^2 **3.** 64 cm^2
4. 175 m^2 **5.** 50 cm^3 **6.** 15 m^3 **7.** 240 m^3
8. 900 cm^3 **Problems and Applications**
9. 360 cm^3 **10.** 2 574 467 m^3 **11. a)** doubles
b) triples **c)** doubles   **12.** 76 000 m^2 including the base

Section 7.5 p. 278

Practice   **1.** 641 cm^2 **2.** 144 cm^2 **3.** 283 cm^2
4. 703 cm^2 **5.** 157 m^3 **6.** 7598.8 cm^3 **7.** 1570 cm^3
8. 37.68 m^3 **9.** 100.48 m^2, 75.36 m^3 **10.** 75.36 cm^2, 37.68 cm^3 **Problems and Applications**
11. a) 6.7 cm **b)** 91 cm^2 **12.** 16.4 m^2 **13.** 2 L
14. 8 m^3

Learning Together pp. 288–289

Activity 3:   **5.** 78.5 m^2 **6. b)** 743 m^2

Review pp. 292–293

1–11. Estimates may vary.   **1.** 39.69 cm^2
2. 30.66 m^2 **3.** 26.32 cm^2 **4.** 66.03 m^2 **5.** 1385 m^2
6. 77 cm^2 **7.** 4.8 m^3 **8.** 3.52 cm^2 **9.** 125.12 m^2
10. 78 m^2 **11. a)** 76 m^2 **b)** $54.45   **12.** 288 cm^2
13. 21.4 m^2 **14.** 1734 m^2 **15.** 95.5 cm^2
16. 648 cm^3 **17.** 29 335.5 cm^3 **18.** 24.87 cm^2
19. 3014.4 m^2 **20.** 99 m^2 **21.** 1055.04 cm^2
22. 864 cm^3 **23.** 192 m^3 **24.** 707 m^3 **25.** 270 cm^3
26. 390 cm^3 **27. a)** 900 cm^2 **b)** 1220 cm^2
c) 1056 cm^3 **28.** 434 m^2 **29.** 334 cm^2 **30.** 62 m^2

Chapter Check p. 294

1. 900 cm^2 **2.** 100 cm^2 **3.** 27 cm^2 **4.** 314.16 m^2
5. 220 cm^2 **6.** 2512 cm^2 **7.** 3.84 m^2
8. 628 cm^2 **9.** 117 m^3 **10.** 1099 m^3 **11.** 22 m^3
12. 6 510 000 cm^3 **13.** 23 m^3 **14.** 88 m^2 **15. a)** 16
b) 1.78 m^2 **16. a)** 216 cm^2 **b)** 180 cm^3 **17.** 3 cm
18. 266.25 cm^3

Using the Strategies p. 493

1. a) 9 **b)** 16 **c)** 25 **d)** 36 **e)** 625 **f)** 11 025
2. February, March   **3.** 1 cm^2 **4.** 47   **5.** 4624
6. 27   **7. a)** 6 **b)** 4 **c)** 2   **8.** 4 quarters; 3 quarters, 5 nickels; 2 quarters, 10 nickels; 1 quarter, 15 nickels; 20 nickels   **9.** 6   **10.** 32 cm   **11.** 05:55   **Data Bank**   **1.** approximately 50 times

Chapter 8

Getting Started pp. 298–299

Activity 2:   **1. a)** flip **b)** turn **c)** slide   **Activity 3:**
1. $\frac{1}{4}$ turn clockwise   **2.** vertical flip   **3.** horizontal flip   **4.** $\frac{1}{4}$ turn clockwise, horizontal flip   **5.** $\frac{1}{2}$ turn
6. slide   **7.** $\frac{1}{4}$ turn clockwise, vertical flip   **8.** $\frac{1}{4}$ turn counterclockwise   **Activity 4:**   **1. a)** flip

b) turn **c)** slide **d)** turn **2. a)** turn **b)** turn
c) flip **d)** slide **3. a)** slide **b)** turn **c)** turn **d)** flip
4. a) flip **b)** slide **c)** turn **d)** turn **5. a)** turn **b)** flip
c) turn **d)** slide **Mental Math 1.** 22 **2.** 20 **3.** 3
4. 4.5 **5.** 0.02 **6.** 60 000 **7.** 3 **8.** 1 **9.** $8.98
10. $7.75 **11.** $8.96 **12.** $10.94 **13.** $8.85
14. $3.44 **15.** $4.90 **16.** $8.20 **17.** –4 **18.** 2
19. 20 **20.** –12 **21.** –11 **22.** –4 **23.** –6 **24.** 10
25. $5.98 **26.** $11.92 **27.** $4.95 **28.** $59.94
29. $15.80 **30.** $29.88 **31.** $8.85 **32.** $9.90
33. $\frac{1}{6}$ **34.** $\frac{7}{8}$ **35.** $\frac{3}{5}$ **36.** $\frac{3}{10}$ **37.** 24 **38.** 21
39. 15 **40.** 0 **41.** 97 **42.** 56 **43.** 77 **44.** 29
45. 222 **46.** 69 **47.** 947 **48.** 87 **49.** 53 **50.** 145

Section 8.1 pp. 301–302

Practice 1. A, B, D, F **3. a)** [2, 0] **b)** [4, 4]
c) [1, –3] **4.** 3 units to the right and 2 units up
5. 1 unit to the left and 4 units up **6.** 2 units to the
left and 3 units down **7.** 5 units to the right and
1 unit down **8.** 6 units up **9.** 3 units to the left
10. 2 units to the right and 3 units down
11. 3 units to the left and 5 units up **12.** 4 units to
the left and 2 units up **13.** 1 unit to the right and
6 units down **22.** [4, –5] **23.** [–4, –3] **24.** (5, 7)
25. (–1, –3) **26.** (4, 3) **27.** (–7, 1) **28.** [4, 4]
29. [1, –1] **30.** [–1, –1] **31.** [4, –5] **32.** [–5, 8]
33. [–1, –6] **Problems and Applications**
37. A(1, 1), B(–2, 4), C(–4, –4) **38. b)** R′(7, 2),
S′(3, 7), T′(1, 3) **c)** R″(8, –3), S″(4, 2), T″(2, –2)
d) [5, –3] **40.** [0, –1], [–3, 0], [0, –4], [5, 0], [0, –3]

Section 8.2 pp. 304–305

Practice 1. A, B **16. a)** (1, –4), (–1, 4) **b)** (2, –3),
(–2, 3) **c)** (–1, 2), (1, –2) **d)** (–3, 2), (3, 2)
e) (–3, –2), (3, 2) **f)** (4, 0), (–4, 0) **17.** A′(–1, 1),
B′(–5, 2), C′(–3, 6) **18.** R′(2, –5), S′(–2, –4), T′(–1, 2)
Problems and Applications 19. a) A, H, I, O, T,
V, W, X, Y **b)** B, C, D, E, H, I, O, X **c)** H, I, O, X
d) 0, 3, 8 **26. a)** *x*-coordinate **b)** *y*-coordinate

Section 8.3 pp. 307–308

Practice 1. 90° ccw **2.** 180° cw **3.** 270° ccw
4. 90° cw, 270° ccw **5.** 180° cw, 180° ccw **6.** 90°
cw, 270° ccw **24.** (–6, 0), (0, –6), (6, 0) **25.** (0, –4),
(4, 0), (0, 4) **26.** (3, 0), (0, 3), (–3, 0) **27.** (–4, 3),
(–3, –4), (4, –3) **28.** (–3, –4), (4, –3), (3, 4)
Problems and Applications 32. parallelogram
33. a, b, and d **34. a)** T **b)** S, P, Q, R, T **35.** 90°
36. a) parallel **b)** equal **c)** The line $y = x$ passes
through the turn centre. **37. a)** 450° cw **b)** 270° ccw
38. the North Star

Section 8.4 pp. 310–311

Practice 1. 2 **2.** $\frac{1}{3}$ **9.** R′(6, 9), S′(–3, 12),
T′(–9, –6) **10.** D′(3, 2), E′(–1, 3), F′(–2, –2),
G′(2, –3) **Problems and Applications 13. b)** 8
c) P′(–6, 6), Q′(–6, –6), R′(6, –6) **d)** 72 **e)** P″(–1, 1),
Q″(–1, –1), R″(1, –1) **f)** 2 **g)** 72:8 or 9:1; 2:8 or 1:4
h) the square of the scale factor **15.** $\frac{1}{2}$ **16.** 2 **17.** 3
18. identical **19. b)** A′(4, 6), B′(–5, –6), C′(16, –9)

Section 8.5 p. 315

Practice 1. 2 **2.** 1 **3.** 4 **4.** 5 **5.** 3 **6.** 4 **7.** 2
8. 5 **Problems and Applications 9. a)** A, H, I,
M, O, T, U, V, W, X, Y **b)** B, C, D, E, H, I, K, O,
X **c)** H, I, O, X **d)** H, I, X, N, S, Z **10.** BOOK
11. CHEEK **14. a)** 2 **b)** 0 **c)** 5 **d)** 7

Learning Together pp. 316–317

Activity 1: 1. a) horizontal stretch **b)** vertical
stretch **2.** always a kite **3.** no; may be rectangular
Activity 2: a) vertical stretch and a reflection in
the *y*-axis **b)** horizontal stretch and a reflection in
the *x*-axis **Activity 3: a)** horizontal contraction
and vertical stretch **b)** horizontal stretch and vertical
contraction

Review pp. 320–321

1. [4, 2] **2.** [–4, 1] **3.** [–4, –2] **4.** [2, –4] **5.** 2
units to the right and 3 units up **6.** 3 units to the
left and 1 unit down **7.** 4 units to the left and 5
units up **8.** 6 units up **9.** [1, –2] **10.** [–4, 6]
11. [2, –3] **12.** A′(7, 5), B′(8, 2), C′(2, 4) **13.** R′(–5, 1),
I′(0, –2), K′(–1, –5) **14.** (4, 5), (–4, 5) **15.** (5, 2),
(–5, –2) **16.** (–3, –6), (3, 6) **17.** (–3, 2), (3, –2)
22. D′(2, –3), E′(5, –1), F′(4, –6) **23.** R′(–3, –1), S′(3, 2),
T′(4, –3) **30. a)** P″(0, 4), Q″(0, 2), R″(–3, 2) **b)** [–2, 3]
31. a) X″(2, –2), Y″(–1, –4), Z″(–2, –1) **32.** A′(4, 6),
B′(10, 0) **33.** C′(–3, 6), D′(9, –9) **34.** E′(2, 3),
F′(–3, –1) **35.** G′(–2, 0), H′(0, 2) **36.** P′(6, 4),
Q′(6, –2), R′(4, –4) **37.** A′(–3, 1), B′(–2, –3), C′(1, –4),
D′(3, 5) **38.** 4 **39.** 3 **40.** 2 **41.** 3 **42.** 2 **43.** 5

Chapter Check p. 322

1. A′(3, 4), B′(5, 1), C′(8, 2) **2.** P′(–2, 2), Q′(–4, 5),
R′(–7, 1) **3.** R′(–1, –1), S′(–3, –4), T′(–6, –3)
4. D′(–2, 4), E′(4, 1), F′(1, –3) **5.** J′(4, 0), K′(3, –5),
L′(0, 3) **6.** G′(0, 4), H′(3, 4), I′(2, 0) **7.** S′(0, 2),
T′(–6, 6), U′(8, –6) **8. b)** P′(6, 6), Q′(6, 12), R′(9, 3),
S′(3, –3) **9.** X″(–2, –1), Y″(2, –1), Z″(1, –3) **10.** 2
11. 4 **12.** 2 **13.** 5

Using the Strategies p. 323

1. 7 **2.** 221, 442 **3.** 11, 12, 13 **4.** forty
5. 112 cm **6.** 52 (53 in a leap year) **7.** 7 others
8. 1, 3, 5, 7, 19, 39, 199, $2n - 1$ **9.** $0.95, $9.05;
$1.85, $8.15; $3.65, $6.35; $4.55, $5.45

Cumulative Review, Chapters 5–8
pp. 324–325

Chapter 5: **1.** 7 **2.** $2t$ **3.** $7xy$ **4.** $3(x - 7)$
5. $5xy(x + y)$ **6.** $20xy$ **7.** $-6x + 2x^2$ **8.** $6x^2 - 9x$
9. $5x$ **10.** $-4x$ **11.** $1 - 2x + 3x^2$ **12.** $x^2 - 2x - 3$
13. $6x^2 - 7x + 2$ **14.** $(x - 8)(x + 1)$ **15.** $(a + 11)(a - 1)$
16. $(b - 1)(b - 1)$ **17.** $(y - 14)(y + 4)$
18. $2(x - 5)(x - 5)$ **19.** $3(x + 4)(x - 3)$
20. $4(a - 5)(a + 4)$ **21.** $5(a - 3)(a - 2)$ **22.** $x^2 - 49$
23. $9 - t^2$ **24.** $25p^2 - 1$ **25.** $36 - 81y^2$
26. $(x + 2)(x - 2)$ **27.** $(2p - 7)(2p + 7)$
28. $8(x + 3)(x - 3)$ **29.** x^3 **30.** $\frac{20 + 3x}{10}$
31. $4x^2 - 4x + 1$ **32.** $9 - 12y + 4y^2$
33. $p^2 - 6pq + 9q^2$ **34.** $(m + 5)(m + 5)$
35. $(2w - 3)(2w - 3)$ **36.** $2y^3 + 9y^2 + 9y$ **Chapter 6:**
1. SSS **2.** SAS **3.** SAS **4.** ASA **5.** f = 10.5 cm,
d = 13.5 cm **6.** 8.2 m **7.** 4.9 m **8.** 6.5 cm
9. 52°, AC = 10.2 cm, AB = 16.6 cm **10.** 65°,
XZ = 19.9 cm, YZ = 9.3 cm **11.** 1885 m
Chapter 7: **1–7.** Estimates may vary.
1. 169.75 cm² **2.** 38.44 cm² **3.** 962.11 cm²
4. 64.6 cm² **5.** 97.83 cm² **6.** 56.1 cm²
7. 72.96 cm² **8.** 240 m³, 248 m² **9.** 720 cm³,
332.8 cm² **10.** 563 cm², 804 cm³ **11.** 1627 m²,
4617 m³ **12.** 13.5 m³ **13.** 240 **Chapter 8:**
2. K(5, –1), L(5, –5), M(10, –1) **8. b)** 1 **9. b)** 6

Chapter 9

Getting Started pp. 328–329

Activity 1: **1.** Vancouver, Halifax, and St. John's;
Toronto and Montreal **2.** Regina **3.** Edmonton
4. Toronto **5.** Halifax and St. John's **6. a)** 2
b) 46 **c)** 28 **Warm Up** **3.** $\frac{3}{8}$ **4.** $\frac{1}{12}$ **5.** $\frac{1}{8}$ **6.** $\frac{5}{24}$
7. $\frac{1}{8}$ **8.** $\frac{9}{40}$ **9.** $\frac{27}{1000}$ **10.** $\frac{5}{18}$ **11.** 25% **12.** 80%
13. 33.3% **14.** 37.5% **15.** 66.7% **16.** 16.7%
Mental Math **1.** 80 **2.** 700 **3.** 70 **4.** 1200
5. 600 **6.** 180 **7.** $21.00 **8.** $7.75 **9.** $7.25
10. $11.00 **11.** $14.50 **12.** $15.00 **13.** 90
14. 95 **15.** 98 **16.** $5.00 **17.** $7.00 **18.** $14.00
19. $10.00 **20.** 24 **21.** 39 **22.** 400 **23.** 1500
24. 7 **25.** 25 **26.** 8 **27.** 16

Section 9.1 pp. 330–331

Problems and Applications **1–2.** Answers may
vary. **1. a)** 43.5 s **b)** 10 times **c)** about 120 s
d) 1400 m **2. a)** about 2.5 m **b)** 0.9 m **c)** about
2.5 m **3. a)** Temperature decreases as latitude
increases. **b)** about 12°C **4. a)** No **b)** not necessarily

Section 9.2 p. 333

Problems and Applications **4. b)** The average age
of Canadians has been increasing.

Section 9.3 p. 335

Problems and Applications **1. b)** 14.6 s **d)** 12.6 s
2. c) 0 **3. c)** 20 cm, 37 cm **d)** 3 m, less than 0

Learning Together pp. 340–341

Activity 1: **1. a)** primary **b)** primary **c)** primary
d) secondary **e)** secondary **f)** primary **Activity 2:**
1. representative **Activity 3:** **4. a)** stratified
b) random

Section 9.4 p. 349

Practice **1. a)** $\frac{1}{5}$ **b)** $\frac{3}{5}$ **c)** $\frac{4}{5}$ **d)** 0 **2. a)** none **b)** all
c) none **3. a)** $16\frac{2}{3}$% **b)** 50% **c)** 50% **d)** 100%
4. a) $\frac{1}{2}$ **b)** $\frac{1}{4}$ **c)** 2 **5. a)** $\frac{1}{2}$ **b)** $\frac{1}{6}$ **c)** 0 **d)** 1 **6. a)** 0.2
b) 0 **c)** 0.2 **d)** 0.1 **7. a)** $\frac{1}{52}$ **b)** $\frac{1}{2}$ **c)** $\frac{1}{4}$ **d)** $\frac{1}{26}$ **8.** 1;
one of the possible outcomes must occur **9.** 0.8
10. a) 20 **b)** 0.80

Section 9.5 pp. 351–352

Problems and Applications **1. a)** $\frac{1}{4}$ **b)** $\frac{1}{6}$ **c)** $\frac{1}{24}$
d) $\frac{1}{8}$ **2. a)** $\frac{1}{36}$ **b)** $\frac{1}{36}$ **c)** $\frac{1}{4}$ **3. a)** $\frac{6}{25}$ **b)** $\frac{9}{25}$ **4.** same
chance of winning either game **6. a)** $\frac{1}{8}$ **b)** $\frac{1}{216}$
7. a) $\frac{1}{4}$ **b)** $\frac{1}{2}$ **c)** 0 **8. a)** $\frac{1}{2197}$ **b)** $\frac{1}{64}$ **c)** $\frac{1}{64}$ **d)** $\frac{1}{140\,608}$
e) $\frac{1}{140\,608}$ **9. a)** $\frac{1}{27}$ **b)** $\frac{1}{9}$ **c)** $\frac{1}{27}$ **d)** $\frac{1}{81}$ **10. a)** $\frac{1}{6}$ **b)** $\frac{1}{9}$
c) $\frac{1}{12}$ **d)** $\frac{1}{36}$ **e)** $\frac{1}{36}$ **f)** $\frac{1}{243}$ **g)** 0 **12. a)** $\frac{1}{2}$ **b)** $\frac{1}{4}$ **c)** $\frac{1}{8}$
13. a) $\frac{1}{10}$ **b)** $\frac{1}{20}$ **c)** $\frac{1}{40}$ **d)** $\frac{1}{15}$ **e)** $\frac{1}{60}$ **f)** $\frac{1}{120}$ **14.** $\frac{1}{2}$;
The events are independent.

Technology p. 353

Activity 1: **1. a)** HHH, HHT, HTH, HTT, THH,
THT, TTH, TTT **b)** $\frac{1}{8}$ **Activity 2:** **1.** 1000
2. $\frac{1}{1000}$

Review pp. 356–357

1–3. Answers may vary. **1. b)** about 22 s **c)** 1968 **d)** about 2.5 s **2. c)** about 5 million, about 8.6 million **3. c)** 13 m **d)** 21 m **4. a)** $\frac{1}{6}$ **b)** $\frac{1}{3}$ **c)** $\frac{1}{3}$ **d)** 0 **e)** $\frac{1}{2}$ **f)** $\frac{1}{2}$ **g)** 1 **5. a)** $\frac{9}{100}$ **b)** 0 **c)** $\frac{3}{100}$ **6. a)** 60 **b)** $\frac{1}{60}$ **c)** $\frac{3}{20}$ **d)** $\frac{1}{10}$ **7. a)** $\frac{1}{2197}$ **b)** $\frac{1}{64}$ **c)** $\frac{1}{2197}$ **d)** $\frac{1}{64}$ **e)** $\frac{1}{5408}$ **f)** $\frac{1}{140\,608}$ **g)** $\frac{1}{140\,608}$

Chapter Check p. 358

1. Answers may vary. **a)** 1000 km^3, 2000 km^3, 3000 km^3, 4500 km^3 **b)** 1975 **c)** about 3 times **d)** about 5500 km^3 **2. c)** Asia and Europe **d)** Antarctica and Australia **3.** 48 possible outcomes **4. a)** $\frac{1}{6}$ **b)** $\frac{1}{2}$ **c)** $\frac{1}{3}$ **d)** 0 **e)** $\frac{1}{3}$ **f)** 1 **g)** 1 **h)** $\frac{1}{2}$ **5. a)** $\frac{1}{3}$ **b)** $\frac{5}{48}$ **c)** $\frac{1}{64}$ **d)** $\frac{5}{144}$

Using the Strategies p. 359

1. Beginning at the 5, place the numbers in the following order: 5, 6, 3, 10, 1, 9, 4, 8, 2, 7 **2. a)** 180 **b)** 8 **c)** 44 **d)** 48 **3.** Move two sheep into the top right pen, one from each of its neighbouring pens; move two sheep into the bottom left pen, one from each of its neighbouring pens. **4.** 14 **5.** 1, 4, 9, 16, 25, 36, 49 **6.** 6 **7. a)** remove any corner square **b)** remove any two corner squares **c)** remove any side square **d)** remove any corner square and nonadjacent side square **e)** remove two side squares **9.** February and March **Data Bank 1.** 22:18 **2.** gain

Cumulative Review, Chapters 1–9
pp. 360–363

1. 7.1 **2.** 17.0 **3.** 8.6 **4.** 11 cm **5.** 7 **6.** 11 **7.** 73 **8.** 16 **9.** 400 **10.** b^9 **11.** 3^3 **12.** n^{10} **13.** 5 **14.** 3 **15.** 6 **16.** 2 **17.** 9.88×10^6 **18.** 1.9×10^{-2} **19.** 11.2×10^{-5} **20.** 2.0×10^{-2} **21.** 244.14 **22.** 36 **23.** 82 **24.** 0.5 **25.** $\frac{2}{9}$ **26.** $\frac{1}{16}$ **27.** 64 **28.** −1 **29.** m **30.** x **31.** $16m^8$ **32.** $\frac{-8x^3}{y^3}$ **33.** w^2 **34.** $-9x^5y^5$ **35.** 15 **36.** 10 **37.** m **38.** $-w + 6z$ **39. a)** 8.7 cm **b)** 17.3 m **c)** 5.4 cm **40.** $4x = 12$ **41.** $x + 2 = 8$ **42.** $4(x - 5) = 8$ **43.** 7 **44.** 7 **45.** 3 **46.** 4 **47.** 5 **48.** 2 **49.** 1.2 **50.** 12 **51.** 20 **52.** −33 **53.** 1 **54.** 0.5 **55.** 4 **56.** −3.2 **57.** −11 **58.** −3 **59.** 3.1 **60.** $12m + 15n - 21$ **61.** $2x + 21$ **62.** 5 **63.** 7.5 **64.** 3.7 **65.** 49 **66.** 25 **67.** 2 **68.** $21, $22, $23 **69. a)** 74, 92.5 **b)** $d = 18.5 \times t$

70. Vancouver: 27 mm, Edmonton: 80 mm **71.** 1.2 h **72.** $x \geq 1$ **73.** $x < -3$ **74.** $x > 3$ **75.** $x \geq -2$ **76.** 2 **77.** 3 **78.** $7x^4 - 2x^3 + 3x + 5$ **79.** $-x^4y^5 + 2x^3 + 3xy + y^2$ **80.** $4x^2 + 4x - 2$ **81.** $2x^2 - x - 6$ **82.** $5x^2 + 2x - 1$ **83.** $6x^2 - 5x - 5$ **84.** $3x^2 - 11x + 3$ **85.** $9x^2 + 3x - 10$ **86.** $15xy$ **87.** $-12st$ **88.** $6m^3y^2$ **89.** $15y^7x^2$ **90.** $3.5x^2y^2$ **91.** $-2ab^3c^2$ **92.** 6 **93.** 5 **94.** $4y^2$ **95.** $6mn^3$ **96.** $7(y + 2)$ **97.** $3p^2q(1 - 4q)$ **98.** $5ab(2a + 7b)$ **99.** $7xy(2x - y + 4x^2y^2)$ **100.** $2y^2 - 6y$ **101.** $2m^2 + m + 6$ **102.** $-2x^3 - 4x^2 - 10x$ **103.** $-2q + 3p - p^2q^2$ **104.** $-y + 3y^3z^2 - \frac{1}{2}y^2$ **105.** $a^2 - 2a - 8$ **106.** $6m^2 + 19m + 10$ **107.** $y^2 - 0.5y - 1.5$ **108.** $1.5n^2 - 1.5n - 3$ **109.** $(x + 16)(x + 2)$ **110.** $(x - 7)(x + 5)$ **111.** $2(x^2 - 2x - 6)$ **112.** $4(x + 5)(x + 2)$ **113.** $m^2 - 25$ **114.** $9y^2 - 4$ **115.** $(y + 4)(y - 4)$ **116.** $(10w - 2z)(10 + 2z)$ **117.** $w^2 - 6w + 9$ **118.** $4x^2 + 20x + 25$ **119.** $3z^2 + 6za + a^2$ **120.** $4p^2 - 12pq + 9q^2$ **121.** $x^3 + x^2 - 5x - 2$ **122.** $6w^3 - 5w^2 + 2$ **123.** $6x^2 + x - 15$ **124.** x^2 **125.** $\frac{5}{3}w^3z$ **126.** $\frac{8 + x}{x}$ **127.** $\frac{5y + 19}{12}$ **128.** SSS **129.** ASA **130.** ASA **131.** No **132.** 6 cm **133.** 5.5 cm **134.** 7.5 m **135.** 64° **136.** 56° **137.** XY = 6.8 cm, $\angle Z = 34°$, $\angle X = 56°$ **138.** FD = 6.5 m, DE = 5.5 m, $\angle E = 50°$ **139.** 63.7 m^2 **140.** 51.8 cm^2 **141.** 181.4 cm^2 **142.** 429 mm^2 **143.** 869.8 cm^2 **144.** 115 m^2 **145.** 141.4 cm^2 **146.** 379.7 cm^2 **147.** 245 m^2, 247 m^3 **148.** 269 cm^2, 189 cm^3 **149.** 384 cm^2, 384 cm^3 **150.** 263 cm^2, 253 cm^3 **151.** 2281 cm^2, 8209 cm^3 **152.** 2 units to the left, 5 units up **153.** 4 units to the left, 4 units down **154.** 7 units to the right, 3 units up **155.** 3 units to the right, 5 units down **156.** [4, −1] **163.** 7 **165.** 4 **167. a)** $\frac{1}{4}$ **b)** $\frac{1}{13}$ **c)** $\frac{1}{52}$ **168. a)** $\frac{1}{12}$ **b)** $\frac{1}{4}$ **169. a)** $\frac{1}{18}$ **b)** $\frac{1}{8}$ **c)** $\frac{1}{36}$

Glossary

A

Acute Angle An angle whose measure is less than 90°.

Algebraic Expression An expression which includes numbers and variables.

Angle The figure formed by 2 rays or 2 line segments with a common endpoint called the vertex.

Angle of Depression The line of sight made with the horizontal as you look down towards an object.

Angle of Elevation The line of sight made with the horizontal as you look up towards an object.

Area The number of square units required to cover a surface.

Average The mean of a set of numbers, found by dividing the sum of the numbers by the number of numbers.

Axes The intersecting number lines on a graph.

B

Base (of a power) The number used as a factor for repeated multiplication. In 6^3, the base is 6.

BEDMAS An acronym which stands for **B**rackets, **E**xponents, **D**ivision, **M**ultiplication, **A**ddition, **S**ubtraction.

Binary System The number system that consists of the two digits 0 and 1.

Binomial A polynomial with 2 terms.

Bit A short form for binary digit.

Broken-line Graph A graph that represents data, using line segments joined end to end.

Byte A group of 8 bits.

C

Capacity The greatest volume that a container can hold, usually measured in litres or millilitres.

Centre of Rotation The point around which an object can be rotated.

Chord A line segment that joins 2 points on the circumference of a circle.

Circumference The perimeter of a circle: $C = 2 \times \pi \times r$ and $C = \pi \times d$.

Clockwise The same direction as the movement of a clock.

Coefficient A number that multiplies a variable.

Common Denominator A number that is a common multiple of the denominators of a set of fractions. The common denominator of $\frac{1}{2}$ and $\frac{1}{3}$ is 6.

Complementary Angles Two angles whose sum is 90°.

Composite Solid A solid made up of 2 or more prisms joined together.

Computer Spreadsheet A computer application that stores information in cells and allows a variety of computations to be performed using formulas.

Congruent Figures Figures with the same size and shape.

Coordinates An ordered pair, (x, y), that locates a point on a coordinate plane.

Corresponding Angles Angles that have the same relative positions in geometric figures.

Corresponding Sides Sides that have the same relative positions in geometric figures.

Cosine Ratio In a right triangle, the ratio of the length of the leg adjacent to the angle whose cosine is being calculated divided by the length of the hypotenuse: $\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$.

Counterclockwise The opposite direction as the movement of a clock.

Cube A polyhedron with 6 congruent square faces.

D

Data Facts or information.

Database An organized and sorted list of information.

Degree (measure of an angle) The unit for measuring angles: $1° = \frac{1}{360}$ of a complete turn.

Degree of a Monomial The sum of the exponents of the variables.

Degree of a Polynomial The largest sum of the exponents of the variables in any one term of the polynomial.

Denominator The number of equal parts in the whole or the group: $\frac{3}{4}$ has denominator 4.

Diagonal A line segment joining 2 nonadjacent vertices in a polygon.

Diameter A chord that passes through the centre of a circle.

Dilatation A transformation that changes the size of an object.

Distortion A transformation in which a figure has been stretched, shrunk, or turned in many directions.

Distributive Property A rule for expanding an expression with brackets by multiplying each term inside brackets by the term outside the brackets.

E

Enlargement A dilatation for which the image is larger than the original figure.

Equation A number sentence that contains the symbol =.

Equilateral Triangle A triangle with all sides equal.

Equally Likely Outcomes Outcomes of an experiment that have an equal chance of occurring.

Equivalent Fractions Fractions such as $\frac{1}{3}$, $\frac{2}{6}$, and $\frac{3}{9}$ that represent the same part of a whole or group.

Estimate An approximate answer.

Experimental Probability The probability of an outcome occurring, determined by conducting an experiment.

Exponent The raised number used in a power to show the number of repeated multiplications of the base. In 4^2, the exponent is 2.

Exponential Form A shorthand method for writing numbers expressed as repeated multiplications. $81 = 3 \times 3 \times 3 \times 3 = 3^4$

Expression A mathematical phrase made up of numbers and variables, connected by operators.

Extrapolation The process of extending a line to estimate points that lie outside a given range of values.

F

Face A plane surface of a polyhedron.

Factors The numbers multiplied to give a specific product.

Flow Chart An organized diagram that displays the steps in a problem's solution.

FOIL A rule used for multiplying two binomials. The acronym stands for <u>F</u>irst terms, <u>O</u>utside terms, <u>I</u>nside terms, and <u>L</u>ast terms.

Fraction A number that describes part of a whole or part of a group.

Frequency The number of times an item or event occurs.

Frequency Table A table that uses tallies to count data.

G

Greatest Common Factor (GCF) The largest factor that two or more numbers have in common. The GCF of 8, 12, and 24 is 4.

H

Hexagon A polygon with 6 sides.

Hypotenuse The side opposite the right angle in a right triangle.

I

Image The figure produced by a transformation.

Independent Events Events whose outcomes do not influence each other.

Inequality The statement that one expression is greater than, less than, or not equal to another expression.

Integers Numbers in the sequence ... , -3, -2, -1, 0, 1, 2, 3, ...

Interpolation The process of estimating values that lie within a given range of values.

Irrational Number A real number that cannot be expressed in the form $\frac{a}{b}$ where a and b are integers and $b \neq 0$.

Isosceles Triangle A triangle with 2 equal sides.

L

Like Terms Terms, such as x and $4x$, with the same variable raised to the same exponent.

Line of Best Fit A line on a graph that lies as close as possible to all the points on the graph. There are about as many points above the line as there are below the line.

Locus The set of all points in a plane that satisfy a given condition.

Lowest Common Denominator (LCD) The lowest multiple shared by two or more denominators. The LCD of $\frac{1}{8}$ and $\frac{1}{6}$ is 24.

M

Mapping A correspondence of points between an object and its image.

Mass The amount of matter in an object, usually measured in grams or kilograms.

Midpoint The point that divides a line segment into 2 equal parts.

Monomial A number, a variable, or a product of numbers and variables.

N

Natural Numbers Numbers in the sequence 1, 2, 3, ...

Net A pattern used to construct a polyhedron.

Non-repeating Decimal A decimal that does not repeat, such as 0.123 223 333 444 234 ... .

Non-terminating Decimal A decimal that continues without end, such as 0.333 333 333 ... .

Numerator The number of equal parts being considered in a whole or group: $\frac{5}{7}$ has numerator 5.

O

Open Sentence A statement or equation for which it is not possible to say whether it is true or false.

Order of Magnitude The approximate size of a quantity expressed as a power of 10.

Order of Operations The rules to be followed when simplifying expressions: **1.** brackets **2.** exponents **3.** division and multiplication **4.** addition and subtraction.

Ordered Pair A pair of numbers, (x, y), indicating the x and y coordinates of a point on a graph.

Origin The intersection of the horizontal and vertical axes on a graph. The origin has the coordinates (0, 0).

Outcome The result of an experiment.

P

Palindrome A number which reads the same forward or backwards.

Parallel Lines Lines in the same plane that never meet.

Parallelogram A quadrilateral with opposite sides parallel and equal in length.

Percent A fraction or ratio in which the denominator is 100.

Perimeter The distance around a polygon.

Perpendicular Lines Two lines that intersect at a 90° angle.

Perspective The different views of an object — top, bottom, side, front.

Pi (π) The quotient that results when the circumference of a circle is divided by its diameter.

Point Symmetry Rotational symmetry of order 2.

Polygon A closed figure formed by 3 or more line segments.

Polynomial A monomial or the sum of monomials.

Population The entire set of items from which data can be taken.

Power A number, such as 3^4, written in exponential form.

Primary Data Data that you collect yourself.

Prime Triplet Three consecutive odd numbers that are also prime.

Prism A polyhedron with 2 parallel and congruent bases in the shape of polygons. The other faces are parallelograms.

Probability The ratio of the number of ways an outcome can occur to the total number of possible outcomes.

Program A set of instructions that a computer carries out in order.

Protractor An instrument used to measure angles.

Pyramid A polyhedron with 1 base and the same number of triangular faces as there are sides on the base.

Pythagorean Theorem The area of the square drawn on the hypotenuse of a right triangle is equal to the sum of the areas of the squares drawn on the other 2 sides.

Q

Quadrant One of the 4 regions formed in the coordinate plane by the intersection of the x-axis and the y-axis.

Quadrilateral A polygon with 4 sides.

Quotient The result of dividing one number by the another number.

R

Radius The length of the line segment that joins the centre of a circle and a point on the circumference.

Random Sample A sample in which each member of the population has an equal chance of being selected.

Range The difference between the highest and lowest numbers in a set.

Rate A comparison of two measurements with different units: $\frac{9 \text{ m}}{2 \text{ s}}$.

Ratio A comparison of two numbers: 4:5 or $\frac{4}{5}$.

Rational Expression An expression that can be written as the quotient of 2 polynomials.

Rational Number A number that can be expressed as the ratio of 2 integers.

Real Numbers All the rational and irrational numbers.

Rectangle A quadrilateral with opposite sides parallel and equal in length, and four 90° angles.

Rectangular Prism A prism whose bases are congruent rectangles.

Reduction A dilatation for which the image is smaller than the original figure.

Reflection A flip transformation of an object in a mirror line or reflection line.

Restriction A condition or set of conditions placed on variables.

Right Angle An angle whose measure is 90°.

Right Triangle A triangle with 1 right angle.

Rotation A turn transformation of an object about a fixed point or turn centre.

Rotational Symmetry A figure has rotational symmetry if it maps onto itself more than once in a complete turn.

S

Sample A selection from a population.

Sample Size The number of items selected from the total population.

Scale Drawing An accurate drawing that is either an enlargement or a reduction of an actual object.

Scalene Triangle A triangle with no sides equal.

Scatter Plot A graph used to show the relationship between two variables.

Secondary Data Data that is gathered from another source.

Similar Figures Figures that have the same shape but not always the same size.

Simplest Form The form of a fraction whose numerator and denominator have no common factors other than 1.

Sine Ratio In a right triangle, the ratio of the length of the leg opposite the angle whose sine is being calculated divided by the length of the hypotenuse:
$\sin = \frac{\text{opposite}}{\text{hypotenuse}}$.

Square Root of a Number The number that when multiplied by itself gives the number.

Stratified Sample A population is subdivided into distinct groups.

Stylometry The science of measuring written words.

Substitution A specific value is assigned to a variable in an algebraic expression.

T

Tangent Ratio In a right triangle, the ratio of the length of the leg opposite to the angle whose tangent is being calculated divided by the length of the leg adjacent to the angle: $\tan = \dfrac{\text{opposite}}{\text{adjacent}}$

Terminating Decimal A decimal, such as 3.154, whose digits terminate.

Tessellation Another name for tiling pattern.

Theoretical Probability To determine the probability of an outcome mathematically without doing the experiment.

Tiling Pattern A repeated pattern of geometric figures that will completely cover a surface.

Translation A slide transformation of an object.

Trapezoid A quadrilateral with exactly 2 parallel sides.

Triangle A polygon with 3 sides.

Trigonometry The study of the relationships among the sides and angles of triangles.

Trinomial A polynomial with 3 terms.

Twin Primes Consecutive odd numbers that are also prime.

U

Unbiased Sample A sample in which all groups in a population are fairly represented.

Uniform Motion Movement at a constant speed.

Unlike Terms Terms, such as $2x$, $3y$, and $2z$, with different variables or with the same variable raised to different exponents.

V

Variable A letter or symbol used to represent a number.

Vertex The common endpoint of 2 rays or line segments.

Volume The number of cubic units contained in a space.

W

Whole Numbers Numbers in the sequence 0, 1, 2, 3, 4, 5, ...

X

x-axis The horizontal number line in the Cartesian coordinate plane.

Y

y-axis The vertical number line in the Cartesian coordinate plane.

Index

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