

# MATHEMATICS

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## Applying the Concepts

### Practice Masters

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**MATHEMATICS: Applying the Concepts 10  
Practice Masters**

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# To the Teacher

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## Tips for Learning Math

These first nine masters were designed to help students start the term with some insights into how to succeed at Math.

Emphasis is on

- examining attitudes toward Math
- identifying and using available resources
- being prepared for class and using class time wisely
- making time for and establishing a place to do homework
- doing homework daily
- staying on top of new learning
- seeking help and studying productively
- setting a goal for Math

You may wish to assign these masters to

- all students at the beginning of the term, to be completed the first week and showing a completed Goals master
- students who display a need for some assistance in any of the areas covered

While the masters are intended to be completed by individual students, you may wish to suggest that students work as partners to discuss the ideas on the masters.

Encourage students to keep the Tips for Learning Math masters to help them reach the goals they set.

## Look Back

Following the Tips for Learning Math are 14 pages of Look Back masters.

These masters

- provide reteaching and practice of readiness skills that are practised in the Get Ready at the beginning of each chapter in the student text
- can be assigned as needed

## Technology Readiness

Following the Look Back masters are 11 pages of Technology Readiness.

These masters

- provide instruction in basic skills for using *The Geometer's Sketchpad*®, spreadsheet software, and a TI-83 Plus as a spreadsheet
- can be assigned as needed

## Practice

In each chapter, there is a one-page Practice master for each numbered section and a one- or two-page Chapter Review master.

Each master

- provides additional practice with the skills and concepts in the section or chapter
- can be assigned as needed
- includes a variety of practice in four categories: knowledge/understanding, problem solving, communication, and application

## Answers

Answers are provided for all the masters at the end of the book.

The answers include

- numerical solutions
- word solutions
- diagram solutions
- graphical solutions

Permission to reproduce these pages is provided as you may wish to post answers for students to check their work.

## Installing and Using *MATHEMATICS: Applying the Concepts 10, Practice Masters* CD-ROM

To use the *MATHEMATICS: Applying the Concepts 10, Practice Masters* CD-ROM, you will need Adobe® Acrobat® Reader 4.0, which is included on the CD. If Acrobat® Reader is not already installed on your computer, insert the *MATHEMATICS: Applying the Concepts 10, Practice Masters* CD in the CD-ROM drive, then, follow these steps:

**Windows:** Navigate to your CD-ROM drive using Windows Explorer or My Computer; locate “ar405eng.exe” in the “WIN” directory, and double-click its icon.

**Macintosh:** If not already visible, open the CD-ROM in a window on your desktop by double-clicking the CD-ROM’s icon. Within that window, locate “ar405eng” in the “MAC” folder and double-click to launch.

After the installer launches, follow the on-screen instructions to complete the installation. When the installation is complete, restart your computer. The program is now ready to use. If you have questions regarding the use of Acrobat® Reader, click the Help button for online help.

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### Adobe® Acrobat® Reader 4.0 System Requirements

#### Windows

I486™ or Pentium® processor-based personal computer

Microsoft® Windows® 95, Windows® 98, or Windows® NT® 4.0 with Service Pack 3 or later

10 MB of available RAM on Windows® 95 and Windows® 98 (16 MB recommended)

16 MB of available RAM on Windows® NT® (24 MB recommended)

10 MB of available hard-disk space

50 MB of additional hard-disk space for Asian fonts (required for Acrobat® Reader® 4.0 CD-ROM, otherwise optional)

#### Macintosh

Apple Power Macintosh or compatible computer

MAC OS software version 7.1.2 or later

4.5 MB of available RAM (6.5 MB recommended)

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50 MB of additional hard-disk space for Asian fonts (required for Acrobat® Reader® 4.0 CD-ROM, otherwise optional)

## Getting Started

### *MATHEMATICS: Applying the Concepts 10*

Here you are starting into a new Math course. This page and the other **Tips for Learning Math** pages are just for you.

You are an important resource in your success in Math.

Take a look at your strengths and weaknesses when it comes to Math, and how you think and feel about Math.

*Complete each statement or circle the letter of the response that best suits you.*

1. When I hear the word *Math*, the first few things that come into my mind are

\_\_\_\_\_

2. What I like the least about Math is \_\_\_\_\_

\_\_\_\_\_

3. What I like the most about Math is \_\_\_\_\_

\_\_\_\_\_

4. In my last Math course, my mark was

a) better than                      b) worse than                      c) about the same as  
the marks I received in most of my other subjects.

5. In the last few years, my Math marks have been

a) staying about the same      b) getting worse                      c) getting better

6. I plan to take Math

a) never after this course      b) to the end of high school      c) at university or college

7. My attitude toward Math is

a) more positive than              b) less positive than              c) about the same as  
the attitude I had when I was in grade 7.

8. Something that I would like to change about my attitude to Math is \_\_\_\_\_

\_\_\_\_\_

But you are not alone. You have other resources.

9. Circle the letter of each resource that you feel you have available, and specify when appropriate.

a) my textbook: *MATHEMATICS: Applying the Concepts 10*

b) my Math teacher: \_\_\_\_\_

c) my classmates: \_\_\_\_\_

d) friends taking the same Math course, but in a different class: \_\_\_\_\_

e) friends or family who have already taken this level of Math: \_\_\_\_\_

f) computer and Internet access: \_\_\_\_\_

\_\_\_\_\_

## Know Your Textbook and How to Use It

### *MATHEMATICS: Applying the Concepts 10*

*MATHEMATICS: Applying the Concepts 10* was written for students your age, and, throughout the chapters, uses real information that will, hopefully, interest you.

*Find five introductions or problems with real information that interests you.*

1. Page \_\_\_\_\_ Topic \_\_\_\_\_
2. Page \_\_\_\_\_ Topic \_\_\_\_\_
3. Page \_\_\_\_\_ Topic \_\_\_\_\_
4. Page \_\_\_\_\_ Topic \_\_\_\_\_
5. Page \_\_\_\_\_ Topic \_\_\_\_\_

*Read pages ix to xvii in your textbook. Then, identify each statement as True or False.*

6. **Examples** with fully worked solutions are provided. \_\_\_\_\_
7. Many of the **Apply the Concepts** questions are connected to other subjects and other Math topics. \_\_\_\_\_
8. **Discuss the Concept** means that I have an opportunity to demonstrate my understanding of a topic. \_\_\_\_\_
9. Core sections are numbered and usually include a **Discover** to actively involve me in my own learning. \_\_\_\_\_
10. There are **Cumulative Review** sections at the end of Chapters 3, 6, 9, and 10 that I can use when studying. \_\_\_\_\_
11. Detailed instructions involving **Technology** are provided in an appendix at the back of the text to help me recall essential skills. \_\_\_\_\_
12. A **Glossary** is found near the end of the book to help me understand Math terms.  
\_\_\_\_\_
13. I can use the **Review** sections and **Practice Test** sections to test myself. \_\_\_\_\_
14. Circle the letter of each thing you can learn about when using *MATHEMATICS: Applying the Concepts 10*.
  - a) how Math is connected to other disciplines
  - b) how people use Math in their careers
  - c) how to use technology, such as calculators and computer spreadsheets
  - d) how different topics in Math are interconnected
15. Circle the letter of each worthwhile use of the **Answers** that appear near the end of the book.
  - a) verify whether my answers are right
  - b) if my answer is not right, work backward from the given answer to understand where I made my mistake, and then, correct it

## Classroom Learning

### *MATHEMATICS: Applying the Concepts 10*

Whether your Math class is 30 min or 75 min, you will gain the most from that time with your Math teacher and your classmates if you

- come to class prepared
- listen actively
- take clear notes
- use your time productively

1. Circle the letter of each thing that you bring to Math class.

- |   |                        |
|---|------------------------|
| a) textbook, <i>MATHEMATICS: Applying the Concepts 10</i> | b) notebook            |
| c) pens and/or pencils                                    | d) eraser              |
| e) ruler  | f) calculator          |
| g) diskette   | h) other tools _____   |
| i) completed and checked homework                         | j) a positive attitude |
| k) questions to ask about concepts that confuse me        | l) enthusiasm          |

2. Circle the letter of each way that you actively listen in Math class. Place an X beside the letter of each way you would like to try.

- a) anticipating what is coming next
- b) trying to connect new concepts with familiar concepts
- c) sketching diagrams to illustrate my understanding
- d) asking questions to clarify my understanding
- e) identifying when the teacher says something particularly important

3. Circle the letter of each way your Math teacher points out important information.

- a) says it directly
- b) implies with tone of voice
- c) repeats
- d) writes it on the board
- e) highlights it on the board, in a special place or in a special way
- f) other ways \_\_\_\_\_

4. Circle the letter of each technique that you use to make your Math notes clear. Place an X beside the letter of each technique you would like to try.

- a) record date
- b) record textbook page references
- c) start a new page
- d) write legibly
- e) make lists
- f) draw diagrams
- g) highlight key points
- h) other techniques \_\_\_\_\_

5. Circle the letter of each good reason for using your Math class time productively.

- a) The teacher is available to clarify and provide direction.
- b) Classmates are present to work with.
- c) Ideas are fresh.
- d) I will have less homework.

## Homework

### MATHEMATICS: Applying the Concepts 10

In a subject like Math, where the concepts build day after day and year after year, it is vital that you keep up daily. Always do your homework.

You must do your homework daily, and to get it done you need to

- make time for it
- have a work space
- be free of distractions to be able to concentrate

1. Circle the letter of each thing that competes with Math homework for your time.

- a) other homework
- b) special assignments or projects
- c) sports practices/games
- d) music lessons/practice
- e) watching television or videos
- f) listening to the radio
- g) playing video games or playing cards
- h) visiting with friends
- i) talking on the telephone
- j) household chores
- k) part-time job
- l) shopping
- m) others \_\_\_\_\_

2. Circle the letter of each work space that you use for doing your Math homework. Place an X beside the letter of a space you would like to try.

- |                         |                    |
|-------------------------|--------------------|
| a) own room             | b) a shared room   |
| c) the kitchen          | d) the dining room |
| e) another room at home | f) the library     |
| g) another space _____  |                    |

Whenever and wherever you do your Math homework, you must have all the tools you need, and you must have minimal distractions.

*Complete each statement.*

3. The best time of day for me to be alert and have enough time to complete my Math homework is \_\_\_\_\_

4. My distractions include \_\_\_\_\_

5. I can avoid

this distraction

by doing this

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Seeking Help

### *MATHEMATICS: Applying the Concepts 10*

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In a subject like Math, where the concepts build day after day and year after year, it is vital that you keep up daily. When you do not understand something, seek help immediately.

Use your textbook, *MATHEMATICS: Applying the Concepts 10*. The **Examples** in the numbered sections are typical questions that use the concepts and skills of the section. Detailed step-by-step solutions are provided for each.

Ask your Math teacher for help. When asking for help, prepare to use your time and your teacher's time productively. Identify the point at which you first became confused. Have specific questions about what you do not understand.

1. Find out when your Math teacher is available, and circle the letter of each time that applies.
  - a) during Math class
  - b) before Math class
  - c) after Math class
  - d) before school
  - e) after school
  - f) during lunch
  - g) other times \_\_\_\_\_

A different explanation from the one in the textbook or from what your teacher gives can sometimes help.

2. Circle the letter of each way that you currently work with others. Place an X beside the letter of each way you would like to try.
  - a) working in a group or with a partner in Math class
  - b) discussing problems with friends taking the same Math course, but in a different class
  - c) discussing problems with friends or family who have already taken this level of Math
  - d) working in a study group or with a study partner outside of Math class
  - e) other ways \_\_\_\_\_

## Preparing for Tests and Exams

### *MATHEMATICS: Applying the Concepts 10*

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You will be prepared for writing tests and exams if you

- develop good work habits in class and use class time productively
- do your homework every day
- seek help when you first become confused

The most important step in studying for a test or an exam is not one you can do the night before. It is staying on top of things right from the start.

When you are informed of a test or exam, you should find out all the specifics.

1. Circle the letter of each thing that you find out about a test or exam when you are informed of it. Place an X beside the letter of each thing you are going to start to find out about.

- a) exact date, time, and location
- b) exact content to be covered
- c) time allowed for it
- d) format—true/false, multiple choice, fill in the blanks, full solutions, combination
- e) resources that I should have with me and know how to use, such as a calculator
- f) value of it, relative to all tests, assignments, projects, and exams
- g) resources available to help me study

2. Circle the letter of each resource that you have used in the past to prepare for Math tests and exams. Place an X beside the letter of each resource you would like to try in the future.

- a) my notes
- b) **Examples** and **Solutions** in my textbook
- c) **Review** and **Practice Test** sections in my textbook
- d) **Cumulative Review** sections in my textbook
- e) *MATHEMATICS: Applying the Concepts 10, Practice Masters*
- f) teacher-provided old or sample tests or exams
- g) a study group or partner
- h) others \_\_\_\_\_

The amount of time you need to study depends upon

- how well you have already prepared by keeping on top of things, that is, your existing knowledge base
- the amount of material to be covered

Focus your time on the important concepts and skills and on what you are less confident about.

## Writing Tests and Exams

### *MATHEMATICS: Applying the Concepts 10*

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When you write a test or exam, your mind should be in top shape.

1. Circle the letter of each thing that you do before taking a test or exam to keep your mind sharp. Place an X beside the letter of each thing you would like to start doing.
  - a) getting a good sleep the night before
  - b) eating a nutritious breakfast
  - c) planning ahead and being prepared in order to be relaxed when I begin
  - d) other things \_\_\_\_\_

When writing a test or an exam, some people feel anxious.

2. Circle the letter of each technique that you have used to avoid test or exam anxiety in the past. Place an X beside the letter of each technique you would like to try.
  - a) being prepared
  - b) avoiding thoughts about past less-than-successful experiences
  - c) exercising
  - d) eating nutritious meals and snacks
  - e) learning deep breathing and other relaxation techniques
  - f) getting adequate, but not too much, sleep
  - g) other techniques \_\_\_\_\_

Just as in Math class, when you write a test or exam, you want to be prepared and use your time wisely.

3. Circle the letter of each strategy that you have used in the past to help you use the time for a test or exam wisely. Place an X beside the letter of each strategy you would like to try.
  - a) having everything I need, such as pencils, eraser, ruler, and calculator, ready for use
  - b) reading the entire test quickly to get an overview and opening my mind to ideas that could help with later questions
  - c) using the marking scheme to help me determine the relative importance of questions
  - d) pacing myself, not rushing, but getting down to work
  - e) reading the instructions, questions, and diagrams or graphs carefully to make sure I answer what is asked
  - f) identifying the questions that I am most confident about, and doing them first
  - g) if I do questions out of order, checking them off and numbering them carefully to avoid confusing myself and my teacher
  - h) predicting or estimating answers and recording them to check against my final answers
  - i) checking the reasonableness of my answers
  - j) showing all my work, step by step
  - k) writing legibly
  - l) marking questions that I want to return to
  - m) in multiple-choice questions, ruling out obviously wrong choices
  - n) if my answer is not the same as one of the choices in a multiple-choice question, working backward from choices that I have not ruled out

## Solving Word Problems

### MATHEMATICS: Applying the Concepts 10

Almost every time you learn a new Math skill, you have opportunities to use it in applied situations.

When you learned to solve equations like the following, you were also presented with problems that required creating and solving an equation from given information.

$$6x = 48$$

$$\frac{6x}{6} = \frac{48}{6}$$

$$x = 8$$

#### Problem

Including taxes, the cost of Yvonne's new sweater, \$40.25, is 1.15 times the ticket price. What is the ticket price of the sweater?

If this problem is presented to you after you have learned to solve equations, it is reasonable to write and solve an equation in order to solve the problem.

1. What are you asked to find? \_\_\_\_\_

2. Complete this statement.

Let  $x$  represent \_\_\_\_\_

3. What operation does times suggest? \_\_\_\_\_

4. Write an equation relating the known values and  $x$ .

5. Solve the equation.

6. Is your answer reasonable—is it less than the cost including taxes? \_\_\_\_\_

Check your work if it is not.

7. Write a final statement answering the question asked.

\_\_\_\_\_

\_\_\_\_\_

## Goals

### MATHEMATICS: Applying the Concepts 10

You can put what you have read in these **Tips for Learning Math** pages into practice. Set a goal for yourself in Math this term.

A goal must be measurable.

*I am going to improve my Math mark by 10% this term.*

*I am going to get at least a B on every Math test this term.*

1. Write *your* goal.

A goal must be supported by actions.

*I will always be prepared for class.*

*I will do my homework daily.*

*I will join a study group.*

*When I miss a class, I will catch up within one day.*

2. Write *your* actions.

A goal will have obstacles. Identify them up front.

*I am on the soccer team. Two close friends are not. They will want me to do things with them when I should be doing homework and getting caught up after missed classes.*

3. Write *your* obstacles.

Obstacles need to be met head on.

*I am going to set aside time right after dinner to do homework and I am going to tell my friends that I will not be available until later.*

*I will ask my two friends who are not on the soccer team to help me get caught up after missed classes.*

4. Write how *you* are going to confront your obstacles.



## Look Back: Ratio and Rate

### MATHEMATICS: Applying the Concepts 10

A **ratio** compares like quantities, and the units are not included.

If one movie is 113 min long and a second is 125 min long, the ratio of the length of the first movie to the length of the second movie is 113 to 125 or 113:125 or  $\frac{113}{125}$ , and the ratio of the

length of the second movie to the length of the first movie is 125 to 113 or 125:113 or  $\frac{125}{113}$ .

The order must agree with what is being discussed, and the units must be the same.

A **rate** is a comparison of unlike quantities, and units are included.

If 4 oranges cost \$3, the rate of number of oranges per cost in dollars is 4 oranges per \$3 or 4 oranges/\$3, and the rate of cost in dollars per number of oranges is \$3 per 4 oranges or \$3/4 oranges. The order must agree with what is being discussed, and the units are included.

Write the ratio of 5 mL of green paint to 1 L of white paint in simplest form.

green to white  
= 5 to 1000

Identify the order.

Change to the same units. 1 L = 1000 mL

= 1 to 200 or 1:200 or  $\frac{1}{200}$

Identify the greatest common factor, 5, and divide each term by it.

1. Which are rates?

- a) 15 to 13 to 4      b) 85 km/h      c) 128 people/km<sup>2</sup>      d) 1:9:3:2

2. Write each ratio in simplest form using a colon (:) and the order given.

- a) 8 questions correct to 4 questions wrong      b) 10 items less than \$1 to 15 items \$1 or more

- c) 12 special items to 12 regular-priced items      d) 15 tulip bulbs to 10 daffodil bulbs to 5 crocus bulbs

- e) 9 fruit that are oranges to 12 fruit that are apples to 6 fruit that are plums to 9 fruit that are pears

- f) 50 min to 2 h

- g) 9 days to 3 weeks to 12 days

- h) 25 cm to 2 m

- i) 45 mg to 3 g

## Look Back: Percent

### MATHEMATICS: Applying the Concepts 10

A **percent** is a special ratio. Its second term is 100. It is written with the percent sign, %.

To work with percents, it is usually easiest to express them as decimals.

Express each percent as a decimal.

$$\begin{aligned} \text{a) } 5\% &= \frac{5}{100} \\ &= 0.05 \end{aligned}$$

The meaning of percent.

To divide by 100, move the decimal point two places to the left.

Think: 5¢ is \$0.05

$$\begin{aligned} \text{b) } 0.5\% &= \frac{0.5}{100} \\ &= 0.005 \end{aligned}$$

Think: 0.5¢ is \$0.005

$$\begin{aligned} \text{c) } 105\% &= \frac{105}{100} \\ &= 1.05 \end{aligned}$$

Think: 105¢ is \$1.05

$$\begin{aligned} \text{d) } 5.25\% &= \frac{5.25}{100} \\ &= 0.0525 \end{aligned}$$

Think: 5.25¢ is \$0.0525

$$\begin{aligned} \text{e) } 500\% &= \frac{500}{100} \\ &= 5.00 \end{aligned}$$

Think: 500¢ is \$5.00

Percents with  $\frac{1}{3}$  and  $\frac{2}{3}$  are usually easier to work with as fractions.

Express  $33\frac{1}{3}\%$  as a fraction.

$$\begin{aligned} 33\frac{1}{3}\% &= \frac{33\frac{1}{3}}{100}\% \\ &= \frac{1}{3} \end{aligned}$$

$33\frac{1}{3}$  is  $\frac{1}{3}$  of 100.

1. Express each percent as a decimal.

a) 75%

b) 40%

c) 15%

d) 7%

e) 8.5%

f) 125%

g)  $6\frac{1}{4}\%$

h) 1000%

i) 9.75%

j)  $12\frac{3}{4}\%$

2. Express  $66\frac{2}{3}\%$  as a fraction.

## Look Back: Integers

### MATHEMATICS: Applying the Concepts 10

To multiply and divide integers, 

- remember:  $+(-) \rightarrow -$  and  $-(-) \rightarrow +$
- determine the sign of the product
- determine the number part

$$3(7) = 21$$

$$3(-7) = -21$$

$$-3(7) = -21$$

$$-3(-7) = 21$$

$$42 \div 7 = 6$$

$$-42 \div 7 = -6$$

$$42 \div (-7) = -6$$

$$-42 \div (-7) = 6$$

$$4(-6)(-1) = 24 \quad \text{because } -(-) \rightarrow +$$

$$-4(-6)(-1) = -24 \quad \text{because } -(-) \rightarrow + \text{ and then } +(-) \rightarrow -$$

To add and subtract integers, 

- use the sign rules:  $+(-) \rightarrow -$  and  $-(-) \rightarrow +$  to eliminate double signs
- combine the positives and combine the negatives
- combine the final two integers

$$5 - 3 + (-9) + 1 - (-2)$$

$$= 5 - 3 - 9 + 1 + 2$$

$$= 8 - 12$$

$$= -4$$

5 and 1 and 2 is 8;  $-3$  and  $-9$  is  $-12$

The difference is 4, but the sign is  $-$  because  $-12$  is farther from 0 than 4.

$$-7 - (-5) + 8 + (-3)$$

$$= -7 + 5 + 8 - 3$$

$$= -10 + 13$$

$$= 3$$

$-7$  and  $-3$  is  $-10$ ; 5 and 8 is 13

The difference is 3, and the sign is  $+$  because 13 is farther from 0 than  $-10$ .

#### 1. Simplify.

a)  $3 \times (-5) \times 2$

b)  $-72 \div 12 \times (-4)$

c)  $5 \times (-8) \div (-10)$

d)  $12 - (-4) + (-6) - 9$

e)  $-7 - (-3) + (-5) - 13 + 2$

f)  $-6 - 7 - 8 + (-2) + 9$

#### 2. Simplify.

a)  $8(-7) \div (-2)$

b)  $3 + (-8) - 5 - (-12)$

c)  $(-7)^2 + (-9)$

d)  $(-5 + 13) \times (-2)$

e)  $-3(-4)(5)$

f)  $-3 + (-4) + 5$

**Look Back: Rational Numbers****MATHEMATICS: Applying the Concepts 10**

To multiply and divide rational numbers,

- remember the sign rules for integers:  
+ (-) → - and - (-) → +
- remember dividing is multiplying by the reciprocal
- determine the sign of the product
- determine the fraction part

$$\begin{aligned}
 & -\frac{4}{5} \times \frac{3}{8} \div \left(-\frac{9}{10}\right) \\
 & = \frac{\cancel{4}^1 \times \cancel{3}^1 \times \left(-\frac{10}{\cancel{9}^3}\right)}{\cancel{5}_1 \times \cancel{8}_2} \times 1 \\
 & = \frac{1}{3}
 \end{aligned}$$

To add and subtract rational numbers,

- use the sign rules: + (-) → - and - (-) → + to eliminate double signs
- express using the lowest common denominator
- combine the positives and combine the negatives
- combine the final two numbers
- express in lowest terms

$$\begin{aligned}
 & \frac{4}{3} + \left(-\frac{8}{5}\right) - \frac{5}{6} \\
 & = \frac{4}{3} - \frac{8}{5} - \frac{5}{6} \\
 & = \frac{40}{30} - \frac{48}{30} - \frac{25}{30} \\
 & = \frac{40}{30} - \frac{73}{30} \\
 & = \frac{-33}{30} \\
 & = -\frac{11}{10}
 \end{aligned}$$

LCD of 3, 5, and 6 is 30.

-48 and -25 is -73.

The difference is 33, but the sign is - because -73 is farther from 0 than 40.

1. Simplify.

a)  $-\frac{5}{12} \div \frac{10}{13}$

b)  $\frac{4}{9} \times \left(-\frac{3}{4}\right)$

c)  $-\frac{7}{8} \div \left(-\frac{7}{3}\right)$

d)  $-\frac{9}{4} + \frac{7}{8}$

e)  $\frac{5}{3} - \left(-\frac{3}{4}\right)$

f)  $\frac{3}{2} + \left(-\frac{3}{5}\right) + \frac{9}{10}$

2. Simplify.

a)  $-\frac{7}{12} + \left(-\frac{5}{6}\right)$

b)  $-\frac{17}{8} \times \left(-\frac{4}{17}\right)$

c)  $\frac{32}{5} \div \left(-\frac{8}{15}\right)$

d)  $\frac{3}{16} - \frac{5}{8} + \frac{7}{2}$

e)  $-\frac{7}{12} \div \left(-\frac{14}{9}\right) \times \frac{2}{3}$

f)  $\left(\frac{7}{9} - \frac{3}{2}\right) \times \frac{5}{13}$

## Look Back: Order of Operations and Substitution

### MATHEMATICS: Applying the Concepts 10

The order of operations can be remembered using BEDMAS.

<b>B</b>	Brackets
<b>E</b>	Exponents
<b>D</b>	Division and multiplication in order
<b>M</b>	
<b>A</b>	Addition and subtraction in order
<b>S</b>	

Simplify  $20 - (11 + 4)^2 \div 25$ .

$$\begin{aligned} & 20 - (11 + 4)^2 \div 25 \\ &= 20 - 15^2 \div 25 \\ &= 20 - 225 \div 25 \\ &= 20 - 9 \\ &= 11 \end{aligned}$$

1. Simplify.

a)  $2(4)^2 - 13$                       b)  $5(9 - 12) + 15$                       c)  $\frac{1}{2}(8 + 12) \div 5$

d)  $5 + 27 \div (-9)$                       e)  $(3^2 - 2^3) \times 6$                       f)  $(16 - 8 + 24) \div (-8)$

To evaluate expressions when specific values are given for the variables,

- substitute the values for the variables in the expression, enclosing each in brackets
- simplify, following the order of operations

Evaluate  $ab - \frac{3}{2}a$  when  $a = -8$  and  $b = 5$ .

$$\begin{aligned} & ab - \frac{3}{2}a \\ &= (-8)(5) - \frac{3}{2}(-8) \\ &= -40 + 12 \\ &= -28 \end{aligned}$$

2. Evaluate each expression for the given values of the variables.

a)  $xy - 9$ , when  $x = 2$ ,  $y = 0$                       b)  $5n - 6$ , when  $n = -1$                       c)  $13p - 7q$ , when  $p = 2$ ,  $q = -3$

d)  $\frac{2}{3}k - 1$ , when  $k = -12$                       e)  $15 - w + 8$ , when  $w = -9$                       f)  $12g + h^2$ , when  $g = -1$ ,  $h = -2$

**Look Back: Algebra****MATHEMATICS: Applying the Concepts 10**

**Like terms** have exactly the same variables raised to exactly the same exponents.

To **simplify expressions**, collect like terms.

$$\begin{array}{r} \text{a) } x + 2y - 3 + 7 - 4x + 7y \\ \hline = -3x + 9y + 4 \end{array}$$

$$\begin{array}{r} \text{b) } 3a^2 + 2ab - 5ab + 12a^2 - 9 \\ \hline = 15a^2 - 3ab - 9 \end{array}$$

1. Simplify.

a)  $2a + 6 - 9 - 7a$

b)  $6p - 5q + p - 2q$

c)  $mn - n + 5m - 3mn$

d)  $-7w + 8 - 3w - 5$

e)  $13 + x^2 - 2x + 4x^2 - x$

f)  $8g - 3gh - h$

To **expand expressions**,

- remember the sign rules for integers:  
 $+(-) \rightarrow -$  and  $-(-) \rightarrow +$
- multiply each term in brackets by the factor outside the brackets

$$\begin{array}{r} \text{a) } -5(3 - y) \\ \hline = -15 + 5y \end{array}$$

$$\begin{array}{r} \text{b) } 4(-2(m + 3)) \\ \hline = -8(m + 3) \\ \hline = -8m - 24 \end{array}$$

2. Expand.

a)  $3(x - y)$

b)  $-2(w + 3)$

c)  $-9(2 - m)$

d)  $7(6(x - 1))$

e)  $-(5 - g)$

f)  $-(-2(n + 1))$

g)  $8(p - 2q)$

h)  $-3(2(7 - a))$

To **expand and simplify expressions**,

- expand the brackets
- collect like terms

$$\begin{array}{r} 5(4w - 7v) - 2(2v + 3w) \\ \hline = 20w - 35v - 4v - 6w \\ \hline = 14w - 39v \end{array}$$

3. Expand and simplify.

a)  $6(3x - 1) + 2(x + 5)$

b)  $9(a - 1) - (7a - 6)$

c)  $-2(p + 1) - 3(p + 4)$

d)  $5(7 + w) - (8 - 2w)$

## Look Back: More Algebra

### MATHEMATICS: Applying the Concepts 10

To **multiply powers** with the same base, add the exponents.

$$\begin{aligned}x^2y \times x^3y^5 &= x^{2+3}y^{1+5} \\ &= x^5y^6\end{aligned}$$

To **divide powers** with the same base, subtract the exponents.

$$\begin{aligned}m^8n^2 \div m^5n &= m^{8-5}n^{2-1} \\ &= m^3n\end{aligned}$$

To **raise a power to a power**, multiply the exponents.

$$\begin{aligned}(2a^3b)^4 &= 2^4a^{3(4)}b^{1(4)} \\ &= 16a^{12}b^4\end{aligned}$$

1. Simplify.

a)  $a^3 \times a$

b)  $(g^3)^2$

c)  $\frac{k^5}{k}$

d)  $x^2y \times xy^3$

e)  $\frac{m^7}{m^5}$

f)  $v^5 \times v^3$

g)  $\frac{m^5n^3}{m}$

h)  $(a^4b^5)^3$

Polynomials are classified by the number of terms they have when simplified.

Number of Terms	Name	Examples
1	monomial	$2, x, -3ab, 6x^2$
2	binomial	$x + 4, 3y - 5, a^2 - 16$
3	trinomial	$x^2 + 8x - 16, 2m - 4mn + 6m^2$

2. Classify each polynomial.

a)  $5x - 6y + 9$

b)  $-9$

c)  $m + 5$

d)  $x^2 - 6$

e)  $x^2 - 5x + 6$

f)  $3y - z$

g)  $-5a^2b$

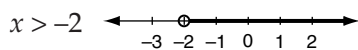
h)  $1 - 9b^2$

i)  $3mn - n + m$

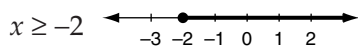
## Look Back: Inequalities and Number Lines

### MATHEMATICS: Applying the Concepts 10

Inequalities can be shown on a number line. If  $x$  is a real number,



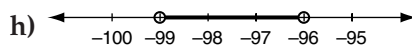
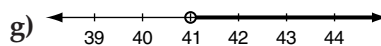
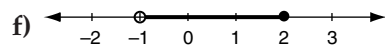
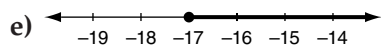
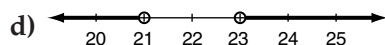
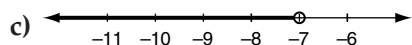
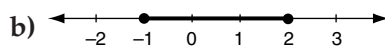
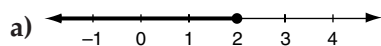
The open dot indicates that  $-2$  is not included.



The closed dot indicates that  $-2$  is included.



1. Write the inequality shown for real numbers.



2. Draw a number line for each inequality, where  $x$  is a real number.

a)  $x \leq 7$

b)  $x \geq -4$

c)  $x > -1$

d)  $x < 9$

e)  $-12 \leq x < -9$

f)  $x < -1$  or  $x > 2$

## Look Back: Squares and Square Roots

### MATHEMATICS: Applying the Concepts 10

$$5(5) = 25 \text{ or } 5^2 = 25, \text{ so } \sqrt{25} = 5.$$

1. Complete, where  $x$  is a whole number.

$x$	1			4	5		7			10	11	12
$x^2$		4	9			36		64	81			

2. Evaluate without using a calculator.

a)  $20^2$

b)  $50^2$

c)  $100^2$

d)  $200^2$

e)  $500^2$

When evaluating square roots, look for perfect square factors.

$$\begin{aligned} & \sqrt{2500} \\ &= \sqrt{25 \times 100} \\ &= \sqrt{25} \times \sqrt{100} \\ &= 5 \times 10 \\ &= 50 \end{aligned}$$

3. Evaluate without using a calculator.

a)  $\sqrt{1600}$

b)  $\sqrt{4900}$

c)  $\sqrt{400}$

d)  $\sqrt{900}$

4. Between which two whole numbers is each square root?

a)  $\sqrt{20}$

b)  $\sqrt{30}$

c)  $\sqrt{45}$

d)  $\sqrt{60}$

e)  $\sqrt{90}$

$\sqrt{\quad}$  means the principal or positive square root.

$$-5(-5) = 25, \text{ so } -\sqrt{25} = -5.$$

$$\begin{aligned} \text{If } x^2 = 25, \text{ then } x &= \sqrt{25} \text{ or } x = -\sqrt{25} \\ &= 5 \text{ or } x = -5 \end{aligned}$$

5. Solve.

a)  $m^2 = 81$

b)  $p^2 = 144$

c)  $g^2 = 36$

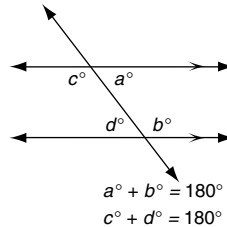
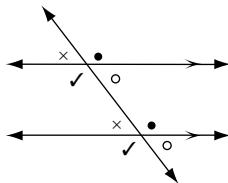
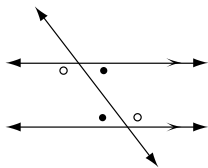
d)  $y^2 = 121$

# Look Back: Angles and Parallel Lines

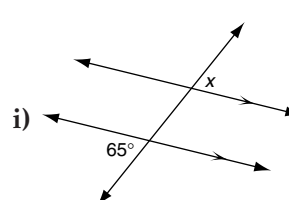
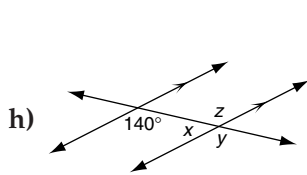
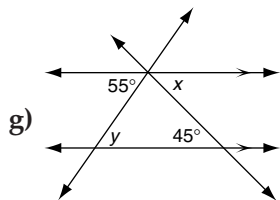
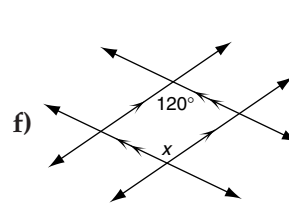
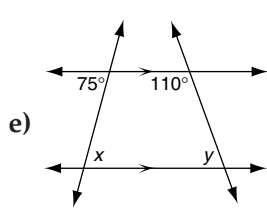
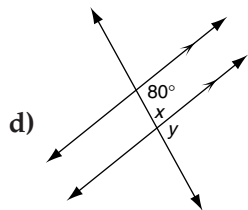
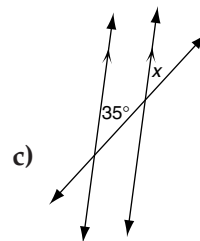
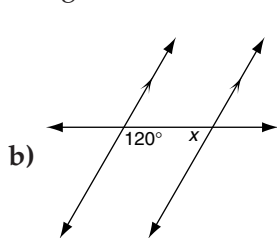
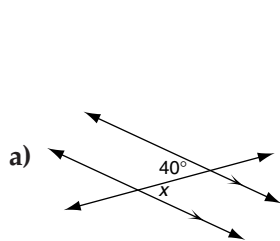
## MATHEMATICS: Applying the Concepts 10

When a transversal intersects two parallel lines,

- a) alternate angles are equal      b) corresponding angles are equal      c) co-interior angles add to  $180^\circ$



1. Find the measure of each unknown angle.

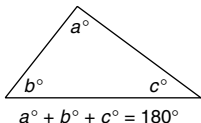


# Look Back: Angle Properties

*MATHEMATICS: Applying the Concepts 10*

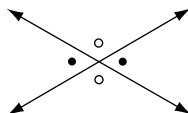
## Angles in a Triangle

The sum of the interior angles in a triangle is  $180^\circ$ .



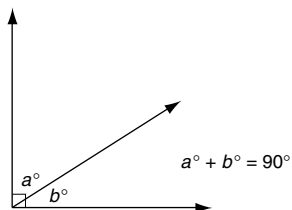
## Opposite Angles

Opposite angles are equal.



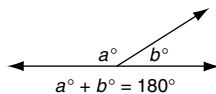
## Complementary Angles

Complementary angles have a sum of  $90^\circ$ .

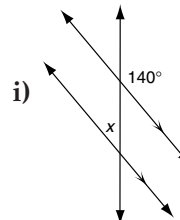
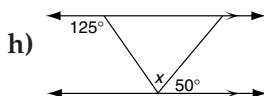
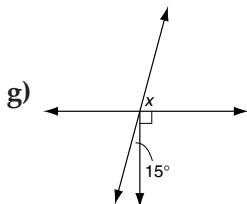
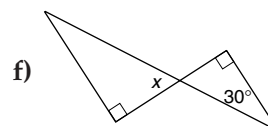
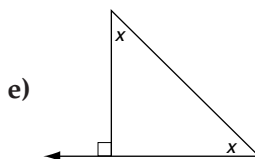
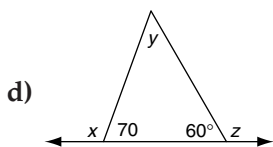
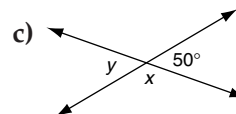
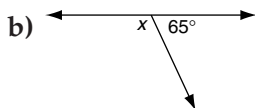
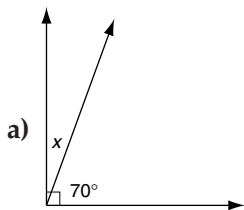


## Supplementary Angles

Supplementary angles have a sum of  $180^\circ$ .



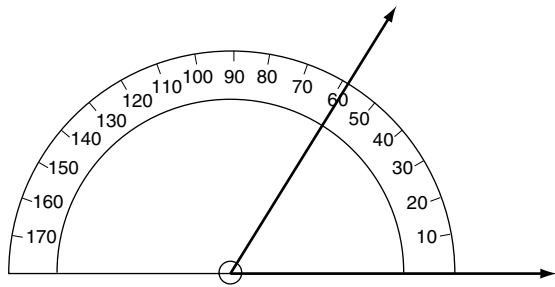
1. Find the measure of each unknown angle.



# Look Back: Measuring and Constructing Angles

## MATHEMATICS: Applying the Concepts 10

Use a protractor to measure angles in degrees.

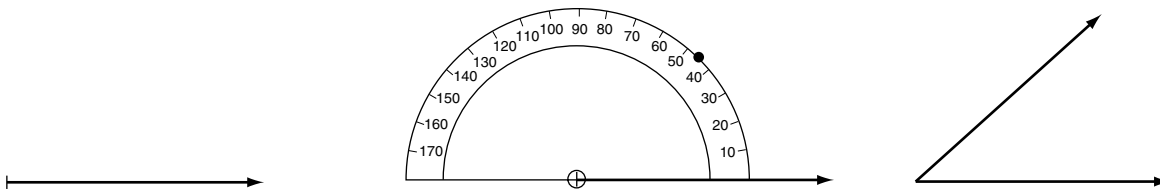


$\angle ABC = 58^\circ$

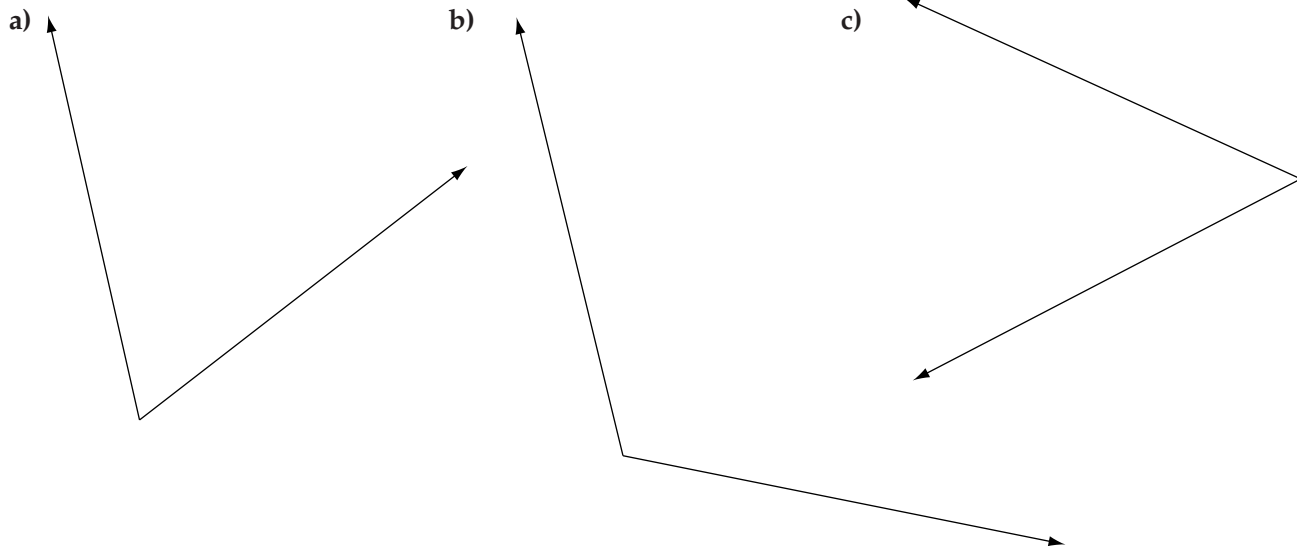
Use a protractor and a straightedge to construct angles.

- Construct one arm.
- Align the protractor and mark the number of degrees.
- Remove the protractor and draw the second arm.

Construct an angle measuring  $42^\circ$ .



1. Measure each angle, to the nearest degree.



2. Construct an angle measuring each number of degrees.

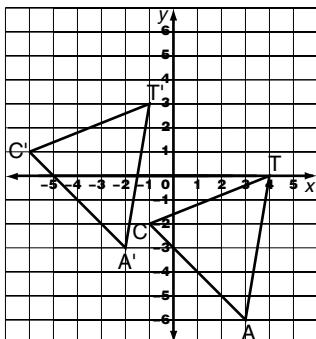
- a)  $85^\circ$       b)  $120^\circ$       c)  $65^\circ$       d)  $38^\circ$       e)  $150^\circ$

# Look Back: Translations and Reflections

*MATHEMATICS: Applying the Concepts 10*

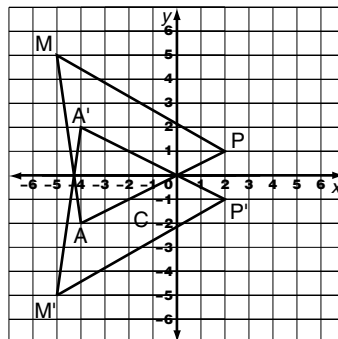
$\triangle CAT$  is translated 5 units to the left and 3 units upward.

$\triangle C'A'T'$  is the translation image.



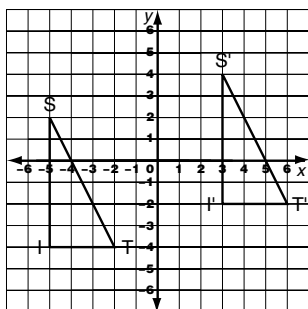
$\triangle MAP$  is reflected in the  $x$ -axis.

$\triangle M'A'P'$  is the reflection image.

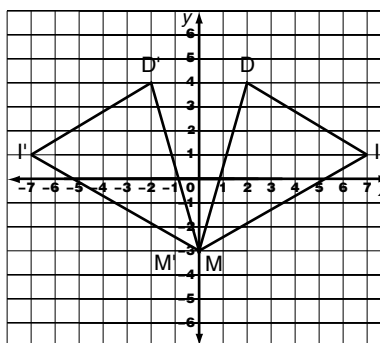


1. Describe each translation or reflection in words.

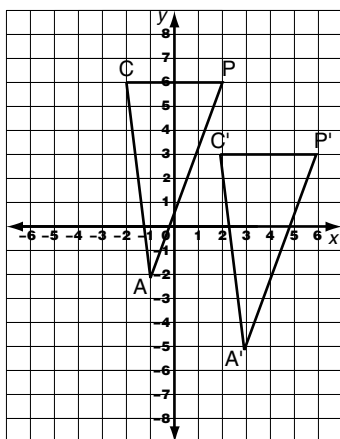
a)



b)



c)

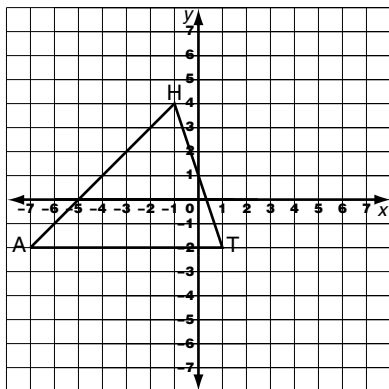


## Look Back: Translations and Reflections [Continued]

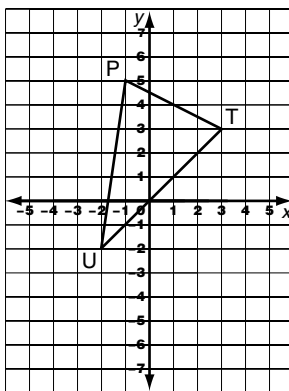
MATHEMATICS: Applying the Concepts 10

2. Give the coordinates of the image of each triangle.

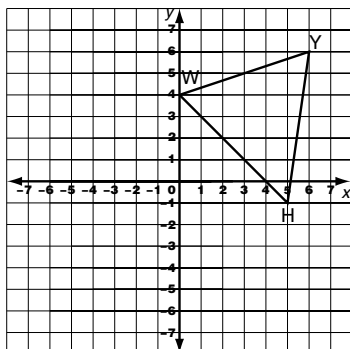
a)  $\triangle HAT$  is translated 4 units to the right and 4 units downward.



b)  $\triangle PUT$  is reflected in the  $x$ -axis.



c)  $\triangle WHY$  is translated 6 units to the left and 4 units downward.



## The Geometer's Sketchpad® Introductory Lesson

### MATHEMATICS: Applying the Concepts 10

Follow the steps in order.

#### 1. Review the Menu Bar

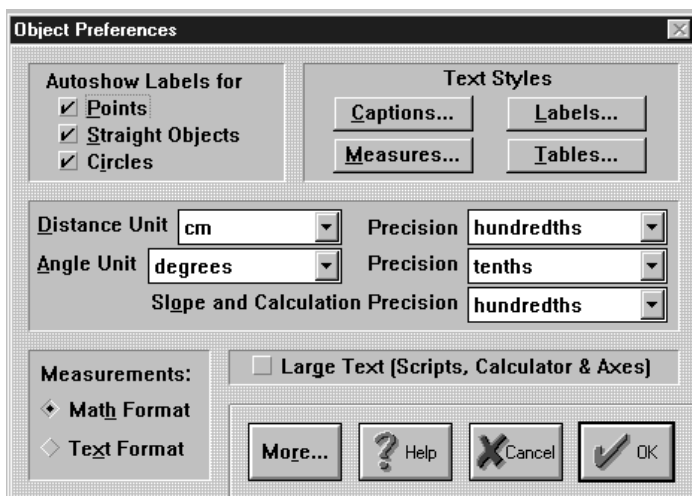
See page 398 in the Technology Appendix of *MATHEMATICS: Applying the Concepts 10*.

#### 2. Standardize the Preferences

a) Open *The Geometer's Sketchpad*®.

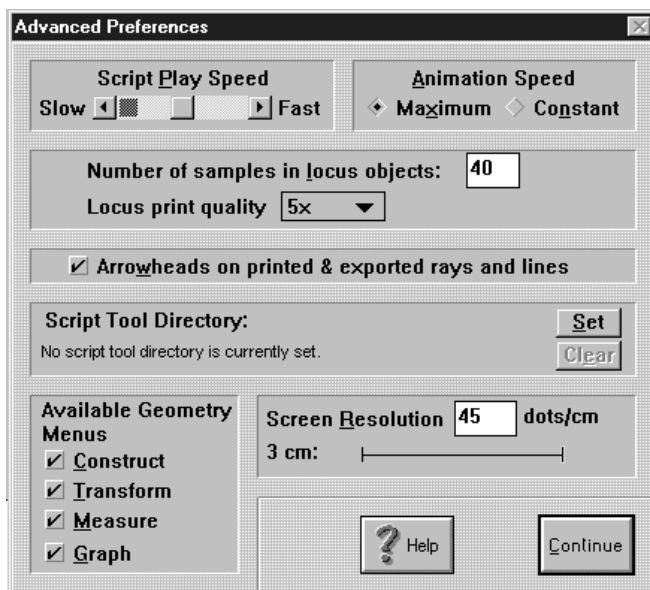
b) Under the **Display** menu, select **Preferences**.

c) Set the **Object Preferences** as shown.



d) In the same menu, press **More**.

e) Set the **Advanced Preferences** as shown.



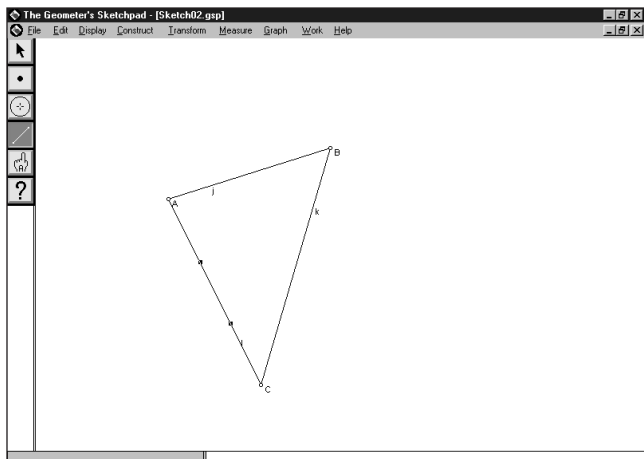
f) Click **Continue** and click **OK** to close the menus.

## The Geometer's Sketchpad® Introductory Lesson [Continued]

### MATHEMATICS: Applying the Concepts 10

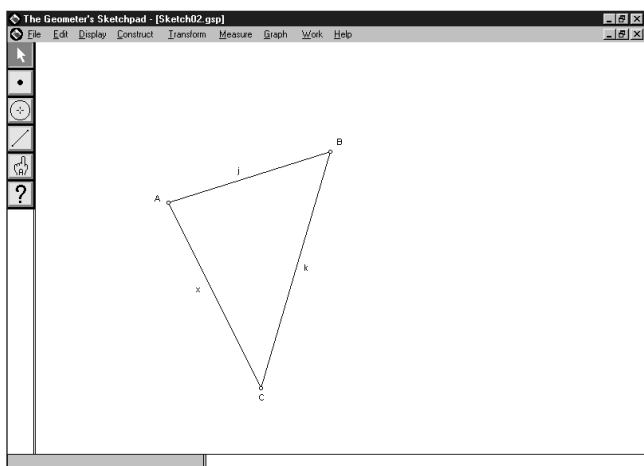
#### 3. Draw a Triangle

- Select the **Segment tool**.
- Click and drag (and release) in the open space. Immediately, click and drag (and release) again. Immediately, click and drag (and release) at the first point to complete the triangle.



#### 4. Labels

- Notice the labelling done by the software.
- Select the **Text tool** (pointing finger).
- Click and drag a point label.
- Click and drag a segment label.
- Move each point label to outside the triangle.
- Move each segment label to outside the triangle and near the middle of the segment.
- Double click any label.
- In the **Relabel** menu, type a different letter and click **OK**.



## The Geometer's Sketchpad® Introductory Lesson [Continued]

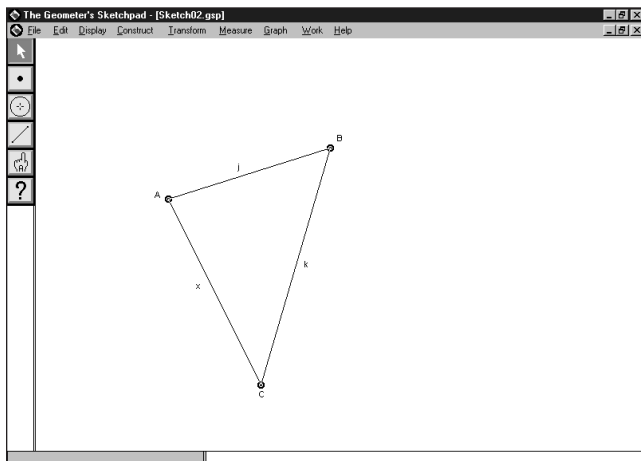
### MATHEMATICS: Applying the Concepts 10

#### 5. Select Single Objects

- Using the **Selection Arrow tool** (arrow pointer), click any point.
- Using the **Selection Arrow tool**, click any segment.

#### 6. Select and Deselect Multiple Objects

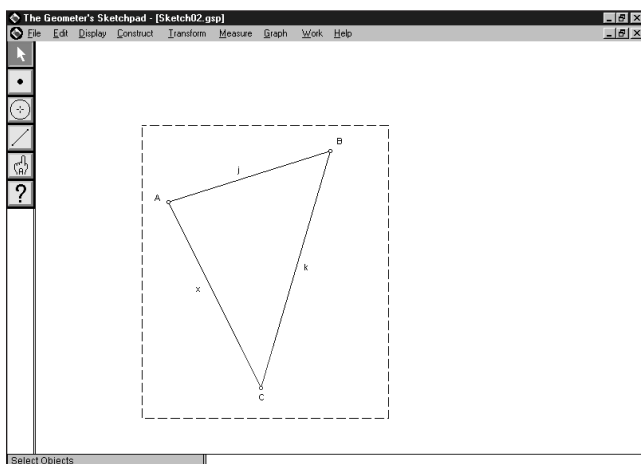
- Select a single point as in step 5.
- Holding down the **Shift** key, click each of the other points.



- Click in the open area to deselect all the points.
- Select a single segment as in step 5.
- Holding down the **Shift** key, click each of the other segments.
- Click in the open area to deselect all the segments.

#### 7. Select All Objects

- Using the **Selection Arrow tool**, click and drag from the open space to make a selection box around the entire triangle.



- Click in the open area to deselect all the objects.
- Under the **Edit** menu, select **Select All**.
- Click in the open area to deselect all the objects.

## The Geometer's Sketchpad® Introductory Lesson [Continued]

### MATHEMATICS: Applying the Concepts 10

#### 8. Translate

- Select the **Selection Arrow (and Translate) tool** (arrow pointer).
- Click and drag from the open space to make a selection box around the entire triangle.
- Click and drag any vertex.
- Click and drag any side.
- Click in the open area to deselect all the objects.

#### 9. Draw a Point

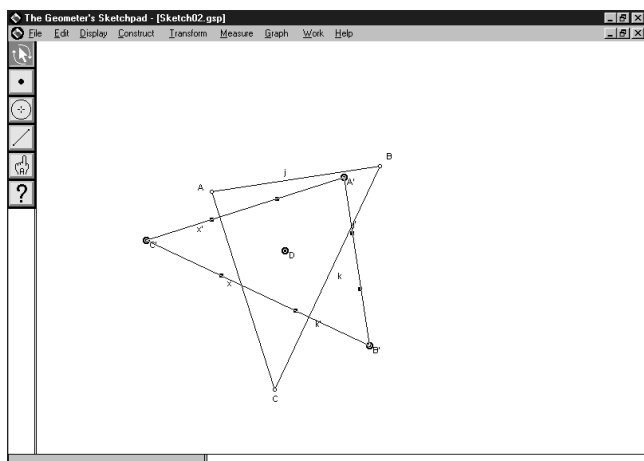
- Select the **Point tool**.
- Click inside the triangle.

#### 10. Rotate

- While the point just drawn is still selected, under the **Transform** menu, select **Mark Center**.
- Select the **Selection Arrow and Rotate tool** (arrow pointer with turn arrows).
- Click and drag from the open space to make a selection box around the entire triangle.
- Click and drag any vertex.
- Click and drag any side.
- Click in the open area to deselect all the objects.

#### 10. Rotate a Specific Number of Degrees

- Select the point inside the triangle.
- Under the **Transform** menu, select **Mark Center**.
- Click and drag from the open space to make a selection box around the entire triangle.
- Under the **Transform** menu, select **Rotate**.
- In the **Rotate** window, type  $-90$  and click **OK**. (Positive is counterclockwise and negative is clockwise.)



## The Geometer's Sketchpad® Introductory Lesson [Continued]

### MATHEMATICS: Applying the Concepts 10

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#### 11. Delete

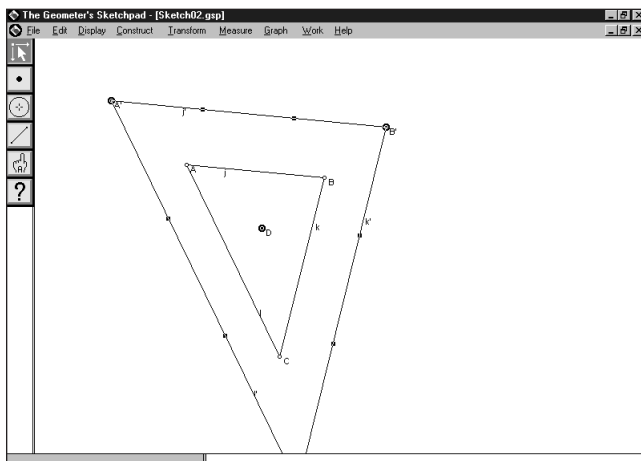
- Click and drag from the open space to make a selection box around both entire triangles.
- Press the **Delete** key. (Whatever is selected is deleted.)

#### 12. Dilate

- Draw a new triangle as in step 3.
- Draw a point inside the triangle as in step 9.
- While the point just drawn is still selected, under the **Transform** menu, select **Mark Center**.
- Select the **Selection Arrow and Dilate tool** (arrow pointer with stretch arrows).
- Click and drag from the open space to make a selection box around the entire triangle.
- Click and drag any vertex.
- Click and drag any side.
- Click in the open area to deselect all the objects.

#### 13. Dilate By a Specific Factor

- Select the point inside the triangle.
- Under the **Transform** menu, select **Mark Center**.
- Click and drag from the open space to make a selection box around the entire triangle.
- Under the **Transform** menu, select **Dilate**.
- In the **Dilate** window, type 2 as the **New Scale Factor** and click **OK**.



## The Geometer's Sketchpad® Introductory Lesson [Continued]

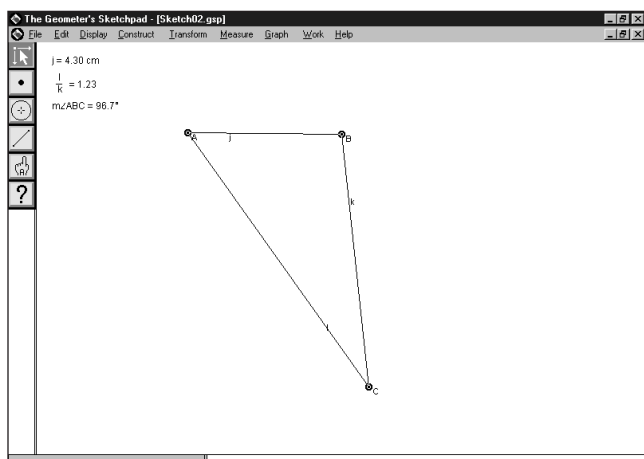
### MATHEMATICS: Applying the Concepts 10

#### 14. Measure Lengths and Ratios

- Delete the triangles as in step 11.
- Draw a new triangle as in step 3.
- Select one side of the triangle as in step 5.
- Under the **Measure** menu, select **Length**.
- Select two sides of the triangle as in step 6.
- Under the **Measure** menu, select **Length**.

#### 15. Select and Measure Angles

- Decide which angle you would like to measure.
- Select three vertices as in step 6, with the second one the vertex of the angle you want to measure.
- Under the **Measure** menu, select **Angle**.



- Using the **Selection Arrow tool**, click and drag a side.
- Using the **Selection Arrow tool**, click and drag a vertex.

- How can you tell when a segment is selected? when a point is?
- Delete the triangle and draw a quadrilateral.
- Mark one of its vertices as the centre. Then, rotate it  $45^\circ$ .
- Delete the quadrilateral, and draw a pentagon and a point inside it.
- Dilate the pentagon by a factor of 0.5.
- Delete the pentagon, and investigate the **Compass tool** (circle). Describe what it does.

## Spreadsheet Basics

### MATHEMATICS: Applying the Concepts 10

#### Examining the Spreadsheet Window

1. Open a spreadsheet and maximize the window.
2. Record the number at the end of each pointer beside the name of the corresponding part.

Cell

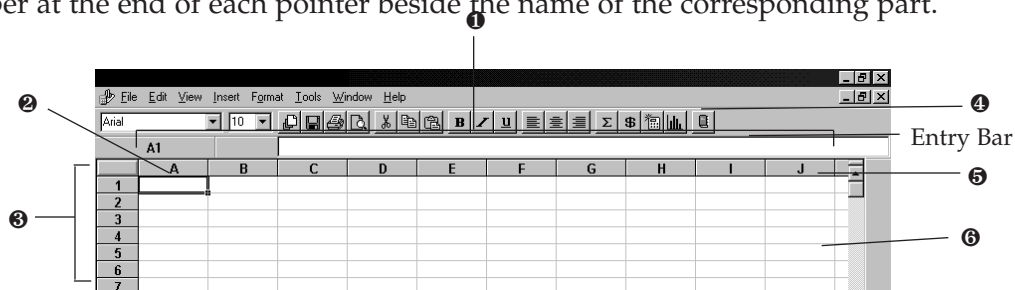
Active Cell

Cell Grid

Column Headings

Row Headings

Toolbar



There are many ways to move the cursor around in spreadsheets, including

- using the mouse
- using the scroll bars
- pressing (HOME), (Ctrl) + (HOME), (END), and (Ctrl) + (END)
- using the arrow keys
- pressing (TAB) and (SHIFT) + (TAB)

#### Entering and Editing Data

To enter data in a cell:

- Move to the cell where you want to enter the data.
- Type the data (which will appear in the entry bar).
- Click ✓ to confirm the data (which will appear in the cell).

To edit data in a cell:

- Move to the cell where you want to edit the data.
- Move the cursor to the entry bar.
- Make the changes to the data.
- Click ✓ to confirm the edited data.

To change the width of a column:

- Insert the cursor at the right edge of the column heading you want to change and click and drag.

1. Enter the following in your spreadsheet window.

2. a) Which columns did you have to make wider?

b) Are numerical data aligned on the left or right?

c) Are word data aligned on the left or the right?

	A	B	C	D
1	Crater	Approximate Age, MA	Diameter, km	Apparent Depth, km
2	Brent	450	3.8	0.5
3	Holleford	550	2.35	0.21
4	Slate Island	450	30	0.26
5	Sudbury	1850	250	unknown
6	Wanapitei	37	7.5	0.1

To select adjacent cells:

- Move to the first cell you want.
- Click and drag through the other cells.

To change from the default alignment:



- Select the cell or adjacent cells you want to have a specific alignment.
- Click , , or on the toolbar to align left, centre, or right.

## Spreadsheet Basics [Continued]

### MATHEMATICS: Applying the Concepts 10

3. Select cell D5. Align the word in the same way the numbers are aligned.
4. Select cell A1. Centre the heading in its cell.
5. Select cells B2 to B6. Centre the numbers in their cells.

To specify the number of decimal places:

- Select the cell or adjacent cells you want to have a specific number of decimal places.
- In Microsoft Excel, click  or  on the toolbar to increase or decrease the number of decimal places as needed.
- In ClarisWorks or Microsoft Works:
  - Click **Number** from the **Format** menu.
  - Click **Fixed**.
  - Tab to **Precision** (in ClarisWorks).
  - Type the number of decimal places if not 2.
  - Click **OK**.

6. Select cells C2 to C6 and D2 to D6. Format the numbers to show two decimal places. (The word "unknown" is unaffected.)
7. Select cells B2 to B6. Format the numbers to show one decimal place. Then, re-align the numbers at the right of their cells.

### Using Formulas

1. Predict which expression on the right goes with each formula.

- |                                    |   |
|------------------------------------|---|
| a) = B2-B6                         | i. $(450.0 + 550.0 + 450.0 + 1850.0 + 37.0) \div 5$ |
| b) = C5/C4                         | ii. $450.0 - 37.0$                                  |
| c) = SUM(C2..C6) or = SUM(C2:C6)   | iii. $3.80 + 2.35 + 30.00 + 250.00 + 7.50$          |
| d) = AVERAGE(B2..B6) or AVG(B2:B6) | iv. $2 \times (3.80 - 0.50)$                        |
| e) = 2*C2-D2                       | v. $250.0 \div 30.0$                                |

2. What do all the formulas have in common?
3. Answer each of the following questions by entering one of the formulas from question 1 in the cell specified. (Formulas are entered and edited like data.)
  - a) Although this is not a realistic calculation, what is the total of the diameters? C7
  - b) How many times as great as the diameter of the Slate Island crater is the diameter of the Sudbury crater? C9
  - c) What is the average approximate age of the craters? B8
  - d) How many millions of years older than the Wanapitei crater is the Brent crater? B9
  - e) How many kilometres wider than deep is the Brent crater? E2
4. Check your predictions by comparing the results with mentally estimated results.
5. Answer each of the following questions by creating and entering a formula in the cell specified.
  - a) What is the average diameter of the craters? C8
  - b) Although this is not a realistic calculation, what is the total of the approximate ages? B7
  - c) How much deeper than the least deep crater is the deepest crater? D9
  - d) How many kilometres wider than deep is the Holleford crater? E3
  - e) How many times as great as the diameter of the narrowest crater is the diameter of the widest crater? C10
  - f) How many millions of years older than the youngest crater is the oldest crater? B10
6. Use your research skills. Which of the craters is closest to where you live? farthest?

## Filling in Data

### MATHEMATICS: Applying the Concepts 10

#### Fill Down

1. Open a spreadsheet and maximize the window.
2. Enter the following in the cells shown in your spreadsheet window.

	A	B	C	D	E	F	G	H
1	Item	Regular Price, \$	Discount Rate, %	Discount, \$	Sale Price, \$	8% PST	7% GST	Total Cost, \$
2	1	18	=20	=0.2*B2	=B2-D2	=0.08*E2	=0.07*E2	=E2+F2+G2
3	=A2+1	46						
4		35						
5		12						

3. What shortcut formula could be used in cell H2?

You can use **Fill Down** to complete the table.

If you use **Fill Down** with the formula in

- A3, the value in each successive cell will increase by 1
- C2, the value after the equal sign, 20, will appear in each cell
- D2, the value in each cell will be the Discount for the row
- E2, the value in each cell will be the Sale Price for the row
- F2, the value in each cell will be the PST for the row
- G2, the value in each cell will be the GST for the row
- H2, the value in each cell will be the Total Cost for the row

To fill a column:

- Move to the cell with the formula in the column you want to fill.
- Click and drag down through the cells to be filled.
- Press **CTRL** + **D**

4. Use **Fill Down** to complete each column in the table.
5. Format Columns D to H to show two decimal places.

#### Fill Right

1. Open another spreadsheet and maximize the window.
2. Enter the following in your spreadsheet window.

	A	B	C	D	E	F
1	Week	Monday	Tuesday	Wednesday	Thursday	Friday
2	1	128	143	139	152	149
3	=A2+1	199	187	203	200	213
4		214	225	234	239	236
5	Total					
6	Average					

3. Enter formulas in the appropriate cells to sum the data in cells B2 to B4 and to average the data in cells B2 to B4.
4. Use **Fill Down** to complete Column A, and **Fill Right** to complete Rows 5 and 6. (**Fill Right** works like **Fill Down**. Press **CTRL** + **R** after selecting the cells.)
5. Format the numbers in Rows 5 and 6 to show one decimal place.

# Graphing Data

## MATHEMATICS: Applying the Concepts 10

1. Enter each set of data into a spreadsheet.

a)

Olympic Women's 100-m Freestyle	
Year	Winning Time, s
1972	58.59
1976	55.65
1980	54.79
1984	55.92
1988	54.93
1992	54.64
1996	54.50

b)

Percent of Expenditures Spent on Education	
Country	Percent
Australia	13.6
Canada	13.7
United Kingdom	11.4
United States	14.1

c)

Large Cheeseburger	
Component	Percent of Total Mass
Protein	15.5
Carbohydrates	20.6
Fat	16.0
Water	46.0
Other	1.9

2. Determine an appropriate type of graph for each set of data. Explain your choice.

To graph data and print the graph in Microsoft Excel:

- Select the cells containing the table.
- Click the **Chart Wizard** button on the toolbar.
- Work through the four steps of the **Chart Wizard**.
- Click **Page Setup** from the **File** menu, click **Portrait** or **Landscape**, click **Print**, and click **OK**.

To graph data and print the graph in ClarisWorks:

- Select the cells containing the table.
- Click **Make Chart** from the **Options** menu.
- Choose the type of graph and other options you want. Modify as needed.
- Click and drag a handle to make the graph the size you want.
- Click and drag the graph to position it below the cells containing the table.
- Click a row number above the graph but below the table, highlighting the entire row.
- Click **Add Page Break** from the **Options** menu.
- Click **Print Setup** from the **File** menu.
- Select **Portrait** or **Landscape** from the **Orientation** box and click **OK**.
- Click **Print** from the **File** menu.
- Select **All** in the **Print Range** box if it is not already selected.
- Deselect **Print Column Headings**, **Print Row Headings**, and **Print Cell Grids** to prevent the background from being printed and click **OK**.

To graph data and print the graph in Microsoft Works:

- Select the cells containing the table.
- Click the **Create New Chart** button on the toolbar.
- Choose the type of graph.
- Type a title and click **OK**.
- Click **Titles** from the **Edit** menu.
- Create labels for the axes and click **OK**.
- Click **Page Setup** from the **File** menu.
- Click the **Source, Size & Orientation** tab.
- Select **Portrait** or **Landscape** in the **Orientation** box and click **OK**.
- Click **Print** from the **File** menu and click **OK**.

3. Graph each set of data.

# TI-83 Plus as a Spreadsheet

## MATHEMATICS: Applying the Concepts 10

Determine the simple interest,  $I$ , and the amount,  $A$ , when the interest rate,  $r$ , is 5.5% per year and the time,  $t$ , is 2 years, for the following values of  $P$ .

$P = \$100, \$500, \$2000, \$8000, \text{ and } \$10\,000$

Use the simple interest formula  $I = Prt$  or  $I = P(0.055)(2)$  and the amount formula

$A = P + I$  with the given values of  $P$ .

### A Set up the Stat List Editor.

Press **STAT** **5** **ENTER**

### B Assign the variables to lists.

For this example,  $P$  in **L1**,  $I$  in **L2**, and  $A$  in **L3**.

### C Clear any previous data from the lists that will be used.

L1 is **2nd** **1**

For this example, clear lists **L1**, **L2**, and **L3**.

L2 is **2nd** **2**

Press **STAT** **4** **2nd** **1** **↓** **2nd** **2** **↓** **2nd** **3** **ENTER**

L3 is **2nd** **3**

### D Enter the data.

Access the lists screen, and for this example, enter the values for  $P$  in **L1**.

Press **STAT** **1** **100** **ENTER** **500** **ENTER** **2000** **ENTER**

**8000** **ENTER** **10000** **ENTER**

### E Enter the formulas and evaluate.

For this example,

- use the arrow keys to move to the heading **L2**
- enter the formula for  $I$  by entering "**L1**  $\times$  **.055**  $\times$  **2**"
- use the arrow keys to move to the heading **L3**
- enter the formula for  $A$  by entering "**L1**  $+$  **L2**"

Press **▶** **▲** **ALPHA** **+** **2nd** **1**  **$\times$**  **.055**  **$\times$**  **2** **ALPHA** **+** **ENTER**

**▶** **▲** **ALPHA** **+** **2nd** **1** **+** **2nd** **2** **ALPHA** **+** **ENTER**

- Use the arrow keys to move to 2000 in **L1**.
- Note the value in **L2** for  $I$  and the value in **L3** for  $A$  for \$2000.
- Change 2000 to 3000 by pressing 3000 **ENTER**
- Note the value in **L2** for  $I$  and the value in **L3** for  $A$  for \$3000.
- Use the arrow keys to move to the first blank line in **L1**.
- Enter 600 by pressing 600 **ENTER**
- Tell what happened.

" is **ALPHA** **+**

L1	L2	L3
100	-----	-----
500	-----	-----
2000	-----	-----
8000	-----	-----
10000	-----	-----
-----	-----	-----

L2 = "L1\*.055\*2"

L1	L2	L3
100	11	-----
500	27.5	-----
2000	220	-----
8000	1760	-----
10000	1100	-----
-----	-----	-----

L3 = "L1+L2"

L1	L2	L3
100	11	111
500	27.5	282.5
2000	220	2220
8000	1760	17760
10000	1100	11100
-----	-----	-----

L3(1)=111

2. Determine the areas of the triangles with the following dimensions, using  $A = 0.5bh$ .

$b$ (cm)	$h$ (cm)	$A$ (cm <sup>2</sup> )
5	6	
8	7	
12	4	
15	9	

Hint: Enter  $b$ -values in **L1** and  $h$ -values in **L2**, and write the formula for  $A$  in **L3** in terms of **L1** and **L2**.



## 1.1 Ratios and Proportions

*MATHEMATICS: Applying the Concepts 10, pages 4–8*

### Key Concept

- A ratio is a comparison of like quantities with the same units, which are not written.
- A proportion is a statement of equality between ratios.
- Equivalent ratios have the same simplest form.

*Solve each proportion for the unknown value.*

1.  $x:7 = 3:21$

2.  $y:10 = 6:8$

3.  $5:k = 4:2$

4.  $15:8 = 12:m$

*Write a proportion that can be used to solve for each unknown. Then, solve.*

5.  $4:1:7 = 12:k:n$

6.  $8:x:36 = y:5:9$

7. Mohammed raised \$75 and Sandi raised \$50 for a local charity. Their class raised \$1000. What is each ratio in simplest form?

a) the money raised by Mohammed to the money raised by Sandi

b) the money raised by Sandi to the money raised by Mohammed

c) the money raised by Mohammed to the money raised by the class to the money raised by Sandi

d) the money raised by Sandi and Mohammed together to the money raised by the class

8. If 6 mL of green paint is added to 1.5 L (1500 mL) of white paint, a very pale shade of green paint is produced. How much green paint would need to be added to 5 L of white paint to produce the same very pale shade of green paint?

9. The ratio of the number of teeth in gear A to the number of teeth in gear B is 6:5. If gear A has 30 teeth, how many teeth does gear B have?

10. A fertilizer contains nitrogen, phosphorus, and potassium in the ratio 10:6:4. Calculate the mass of each ingredient in a 50-kg bag of the fertilizer.

11. A garden soil mixture is made from 70 m<sup>3</sup> of topsoil, 10 m<sup>3</sup> of sand, and 8 m<sup>3</sup> of peat moss.

a) Express the garden soil mixture as a ratio in simplest terms.

b) How much of each ingredient, rounded to two decimal places, would be in a 5-m<sup>3</sup> pile?

## 1.2 Rates

*MATHEMATICS: Applying the Concepts 10, pages 9–13*

### Key Concept

- A rate is a comparison of unlike quantities. Because the quantities have different units, the units are included.
- To express a rate as a unit rate, divide the first term by the second term.

1. The population density of Manitoulin Island is 4.05 people/km<sup>2</sup>. Its population is 11 200. Describe the process you would use to determine the area of Manitoulin Island.

*Express the following as a unit rate, rounded to two decimal places, if necessary.*

2. \$5.50 for 8 L of gasoline

3. 1200 km driven in 20 h

4. 12 mm of rain in 36 h

5. \$24.95 for 12 golf balls

6. \$340 for \$500 US

7. Jason earns \$675 for a 36-h week.

a) What is his hourly wage?

b) How many hours, to the nearest half hour, does he need to work to earn \$1000?

8. Which is the lower unit price—12 tapes for \$19.99 or 20 tapes for \$32.99?

9. A local drugstore sells tissues at 3 boxes for \$2.50. A super discount warehouse sells the same tissues at 50 boxes for \$35.00. Under what circumstances would a family buy tissues from each store?

10. Chi Yu drove her car 150 km in 2.5 h. At the same speed, how long would it take her to drive 500 km?

11. Sean is buying Irish punts at an exchange rate of \$2.135/punt.

a) How much would 400 punts cost?

b) How many punts, rounded to two decimal places, could he get for \$1000?

c) What is the exchange rate expressed in punts per dollar (punts/\$), rounded to three decimal places?

## 1.3 One Number as a Percent of Another

*MATHEMATICS: Applying the Concepts 10, pages 14–18*

### Key Concept

- A percent is a two-term ratio where the second term is 100.
- To express one term as a percent of another, divide the first term by the second and multiply by 100.

$$\text{Percent} = \frac{\text{first number}}{\text{second number}} \times 100$$

*Express as a percent.*

1. 23 out of 25                      2. 400:50
3. 12 out of 16                      4. 75 to 20

*Find each percent increase.*

5. the increase from \$60 to \$90 as a percent of \$60
6. the increase from 125 kg to 250 kg as a percent of 125 kg

*Find each percent decrease. Round to one decimal place, if necessary.*

7. the decrease from \$50 to \$40 as a percent of \$50
8. the decrease from \$56.99 to \$49.99 as a percent of \$56.99
9. A box of cereal sells for \$3.69. It costs the retailer \$2.20. What is the markup, rounded to one decimal place, as a percent of the retailer's cost?

10. A \$900 stereo is advertised at \$849.99. What is the discount, rounded to one decimal place, as a percent of the regular price?

11. The population of a town increased from 4550 to 5135 people. The population of another town decreased from 5135 to 4550 people. Is the percent increase in population of the first town the same as the percent decrease of the second town? Explain.

12. A package of candies contains 12 red, 15 green, 10 orange, 6 yellow, and 3 purple candies. What percent of the total is each colour of candy, rounded to one decimal place?

13. Ted's investment of \$800 amounted to \$836 after one year of earning simple interest.

a) How much simple interest was earned?

b) What was the rate of simple interest?

## 1.4 Percents of Numbers

*MATHEMATICS: Applying the Concepts 10, pages 19–23*

### Key Concept

To find a percent of a number,

- multiply the known number by the percent, or
- assign a variable to the unknown number and solve a proportion

To find a number when a percent of it is known, assign a variable to the number, and

- multiply the unknown number by the percent, or
- solve a proportion

1. Explain two ways to answer: What number is 20% of 70?

*Find the given percent of each number.*

2. 30% of 65

3. 8% of 24

4. 145% of 83

5. 3.1% of 75

6. 12.6% of 150

7. 0.02% of 15

*Find each number.*

8. 10% of what number is 40?

9. 25% of what number is 150 000?

10. 61.5% of what number is 49.2?

11. 34% of what number is 19.04?

12. A survey shows that 15% of a radio audience listens to a particular show.

a) If the radio audience is 120 000 people, how many listen to this show?

b) If 45 000 people listen to this show, what is the size of the radio audience?

13. A T-shirt that regularly sells for \$14.99 is on sale at 30% off.

a) What is the sale price?

b) What is the final price, including 8% PST and 7% GST?

14. One day the price of gasoline increased by 22% to \$0.767/L. What was the starting price, rounded to three decimal places? Hint: What percent of the starting price is the new price?

15. Find the simple interest earned on each investment.

a) \$500 at 4.5% per annum for 3 years

b) \$800 at 6.2% per annum for 5 years

16. A store advertises “We pay the taxes” on jeans with a regular price of \$35. Another store advertises the same jeans at 15% off the regular price of \$35. The final prices are different. Explain.

## 1.5 Interpret Scale Diagrams

*MATHEMATICS: Applying the Concepts 10, pages 24–28*

A scale diagram is a drawing that is

- an enlargement of a small object, or
- a reduction of a large object

$$\text{scale} = \frac{\text{diagram measurement}}{\text{actual measurement}}$$

1. Describe how to find the scale used when an actual measurement of 120 m is shown as 8 cm on a scale drawing.

*Find each unknown.*

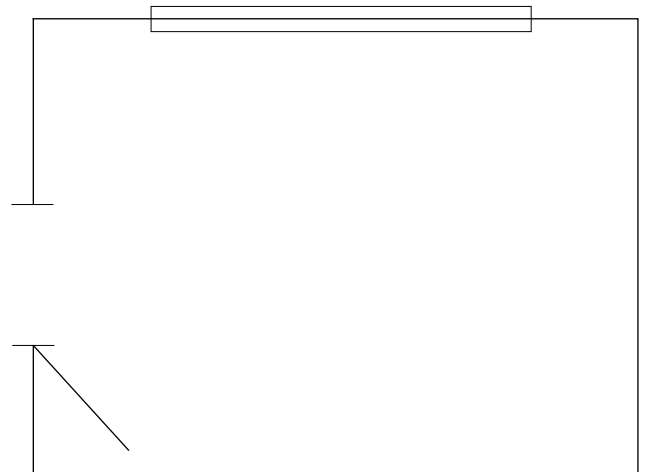
	Scale	Diagram Measurement	Actual Measurement
2.	1:200	5 cm	m
3.	1:500	cm	60 m
4.	600:1	mm	0.000 23 mm
5.	2 000 000:1	3 cm	mm
6.		15 cm	3 km
7.		10 cm	0.008 mm

8. A map has a scale of 1:25 000 000.

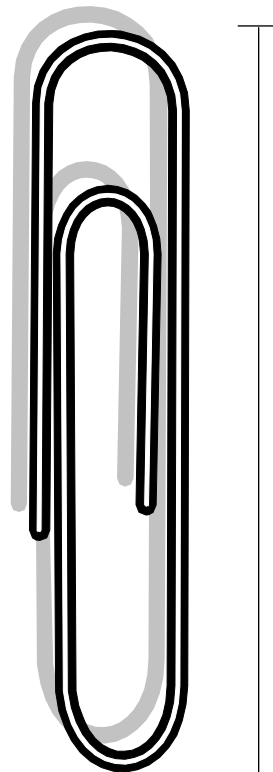
a) Explain what this scale means.

b) How many kilometres would be represented by 6 cm on the map?

9. What are the length and width of the room?  
Scale 1:50



10. If the length of the paper clip is 3.3 cm, what scale was used for this diagram?



## 1.6 Draw Scale Diagrams

*MATHEMATICS: Applying the Concepts 10, pages 29–33*

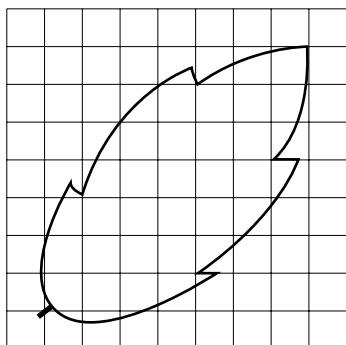
### Key Concept

- When drawing a scale diagram, determine a suitable scale by considering the space available.
- Both dimensions must change by the same scale factor in a scale diagram.
- In a distortion, the dimensions change by different scale factors.

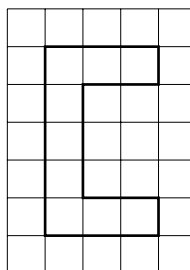
1. Determine a suitable scale to use to draw a scale diagram of a cat 90 cm long in a space 11 cm by 14 cm.

2. Measure the length and width of your calculator. Determine a suitable scale to use to draw a poster-sized diagram of your calculator on paper measuring 42 cm by 60 cm.

3. Draw a scale diagram of this leaf using a scale of 3:1.



4. Draw a distortion using a scale of 2:1 for the height and a scale of 1:2 for the width.



5. Use drawing software.

- Draw a simple shape.
- Enlarge the shape by a scale factor of 2. Describe the results.
- Reduce the shape by a scale factor of 0.5. Describe the results.
- Distort the shape using a scale of 1:2 for the height and a scale of 1:3 for the width. Describe the results.

# 1.7 Valid and Invalid Proportional Reasoning

*MATHEMATICS: Applying the Concepts 10, pages 34–37*

## Key Concept

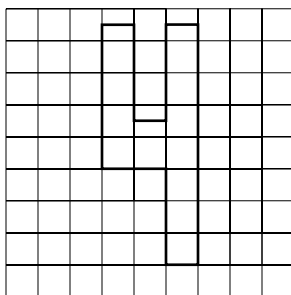
Proportions are often used in making predictions, estimates, and claims.

The validity of these depend upon

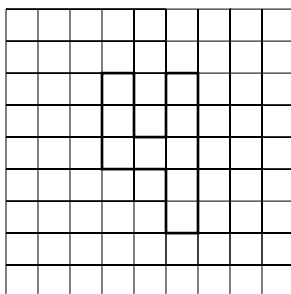
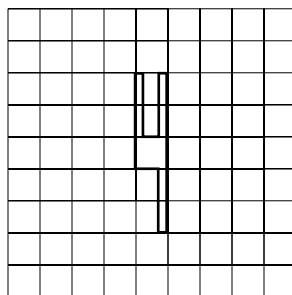
- the accuracy of the original data, and
- the reasonableness of any assumptions made

1. How is each figure a distortion of the one below?

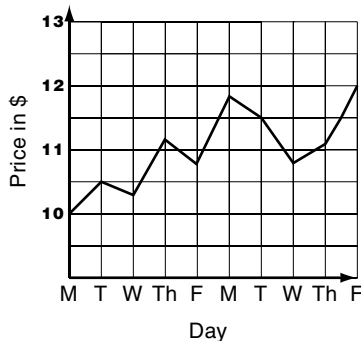
a)



b)



2. Why is the graph misleading?



*For each proportional reasoning situation in questions 3 and 4,*

- solve a proportion to draw a conclusion*
- comment on the strength of the original data*
- state any assumptions needed to draw the conclusion*
- comment on the reasonableness of the assumptions*
- assess the validity of the conclusion*

3. A baseball player hit 1 home run in the first 12 games of a season. How many home runs would you expect the player to hit in the 162-game season?

4. Two hundred raccoons in a park were captured, tagged, and released. Later, 40 raccoons were recaptured, and 15 of them had tags. How many raccoons would you expect to be in the park?

## Chapter 1 Review

*MATHEMATICS: Applying the Concepts 10, pages 40–41*

1. A pie filling contains strawberries, cream, flour, and sugar in the ratio 10:2:4:3.  
a) How many millilitres of each of the other ingredients are needed if 750 mL of strawberries are used?

b) For a filling with total volume of 1900 mL, how many millilitres of each ingredient are required?

2. Blank video cassettes cost 3 for \$11.95 at PriceBusters and 10 for \$35.50 at VideoMart. Which store offers the lower price per cassette? How much lower is its price? Explain when the lower price might not be the better buy.

3. Pierre took a speedreading course and is able to read an average of 20 pages in 8 min. How many pages would he be able to read in an hour?

4. Huong left a \$3.00 tip for a restaurant bill of \$28.37. What was the tip, rounded to one decimal place, as a percent of the bill?

5. Dimitri invested some money at 8.5% simple interest per annum. After a year it was worth \$596.75. How much was his initial investment?

6. It is estimated that 14% of the population are left-handed. In a survey, 49 people were left-handed. How many people would you expect to have been surveyed?

7. The sale price of a pair of pants is \$52.00. What is the regular price if the sale price is 20% off the regular price?

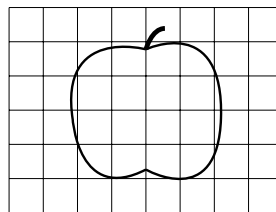
8. A scale diagram of a grasshopper measuring 5 cm in length is 15 cm long. What scale was used?

9. Measure the length of the car, in centimetres, to one decimal place. What is its actual length, in metres?



Scale 1:70

10. a) Draw a scale diagram of this apple using a scale of 3:1.



b) Draw a distortion using a scale of 1:2 for the height and 1:1 for the width.

11. Last year, Josie won the 100-m race in 11.30 s. This year, she won it in 11.14 s. Discuss the validity of using a proportion to determine her winning time next year.

## 2.1 One-Step Equations and Formulas

*MATHEMATICS: Applying the Concepts 10, pages 48–53*

### Key Concept

To solve a formula for a variable,

- substitute the known values, then solve for the unknown, or
- solve for the unknown, then substitute for the known values

To solve an equation or formula, isolate the variable by doing the opposite.

- If a quantity is added to the variable, subtract that quantity from each side.
- If a quantity is subtracted from the variable, add that quantity to each side.
- If a quantity is multiplied by the variable, divide each side by that quantity.
- If a variable is divided by a quantity, multiply each side by that quantity.

1. What would you add to each side to solve for  $m$ ?

a)  $m - 3 = 12$

b)  $m - 12.5 = 8.7$

c)  $3 = m - 4$

2. What would you subtract from each side to solve for  $c$ ?

a)  $c + 7 = 14$

b)  $c + 6.1 = 9.0$

c)  $52 = c + 12.3$

3. By what would you multiply each side to solve for  $k$ ?

a)  $\frac{k}{2} = 3$

b)  $\frac{k}{-15} = 20$

c)  $-4 = \frac{k}{3}$

4. By what would you divide each side to solve for  $y$ ?

a)  $2y = 10$

b)  $-6y = 12$

c)  $34 = -11.2y$

5. Solve.

a)  $x + 3 = 19$

b)  $k - 4 = 12$

c)  $a - 2.3 = 1.5$

d)  $1.8 = -3w$

e)  $2n = 8$

f)  $-3m = 15$

g)  $\frac{g}{5} = 12$

h)  $\frac{y}{-3} = -4$

i)  $4.5 = 3.4 + c$

6. Solve each formula for the variable indicated.

a)  $F = ma$  for  $m$  when  $F = 20$  and  $a = 4$

b)  $P = \frac{F}{A}$  for  $F$  when  $P = 120$  and  $A = 3$

c)  $V = 2\pi rh$  for  $h$  when  $V = 125$  and  $r = 8$ . Use  $\pi = 3.14$ , and round to one decimal place.

## 2.2 Two-Step Equations and Formulas

*MATHEMATICS: Applying the Concepts 10, pages 54–59*

### Key Concept

To isolate the variable in a two-step equation or formula,

- “undo” the operations in the reverse order

1. To isolate  $y$ , what would you do first? second?

a)  $2y - 1 = 7$

b)  $-y + 3 = 20$

c)  $4 = \frac{y}{5} - 6$

d)  $-3 = 6 + 7y$

e)  $\frac{y}{-3} + 4 = 8$

f)  $1.2y - 4 = -12$

g)  $ay - c = k$

h)  $g - \frac{y}{x} = m$

2. Solve. Then, check by substituting.

a)  $4a - 1 = 7$

b)  $5k - 6 = 24$

c)  $-3c - 2 = 7$

d)  $\frac{4x}{3} = -16$

e)  $-2 - 5n = -12$

f)  $\frac{w}{3} + 5 = 7$

g)  $12 = 12 - 3c$

h)  $-2 = -3 + \frac{g}{2}$

3. The cost of a plumber's services, before taxes, is given by the formula  $C = 50 + 40t$ .  $C$  is the cost, in dollars.  $t$  is the time worked, in hours.

a) Solve the formula for  $t$ .

b) How many hours did the plumber work if the cost was \$330?

4. The speed of an object accelerating at a constant rate is given by the formula  $s = i + at$ .  $s$  is the speed, in kilometres per hour.  $i$  is the initial speed, in kilometres per hour.  $a$  is the acceleration, in kilometres per hour per hour.  $t$  is the time, in hours.

a) Solve the formula for  $i$ .

b) What was the initial speed of a car travelling at 100 km/h that had accelerated at 60 km/h<sup>2</sup> for 1 min?

5. The total mass of fuel to be carried by a jet is given by the formula  $m = bt + r$ .  $m$  is the total mass of fuel, in tonnes.  $b$  is the rate that the fuel burns, in tonnes per hour.  $t$  is the expected flying time, in hours.  $r$  is the mass of the reserve fuel, in tonnes.

a) Solve the formula for  $t$ .

b) What is the expected flying time, in hours, rounded to one decimal place, when 40 t of fuel, of which 6 t are reserve fuel, are being burned at a rate of 9 t/h?

c) What is the expected flying time, in hours, rounded to one decimal place, when 50.2 t of fuel, of which 9.1 t are reserve fuel, are being burned at a rate of 9.4 t/h?

## 2.3 Equations and Formulas With More Than One Variable Term

*MATHEMATICS: Applying the Concepts 10, pages 60–64*

### Key Concept

When there is more than one variable term,

- expand the brackets if they exist
- combine the like terms that are on the same side of the equation
- collect and combine the variable terms on one side of the equation
- collect and combine the other terms on the other side

1. Describe the steps involved in solving each equation.

a)  $5x - 2x = -8 + 4$       b)  $a + 3 - 4a = 2(a - 5)$

c)  $2.3y - 3 = 4.7y + 2.8y - 5.1$

2. Write each equation without brackets.

a)  $7(y - 2) = 3(y + 6)$       b)  $-2(k + 9) = -(k - 1)$

c)  $4(m - 1) + 3m = -5(m + 1) - 8$

3. Solve. Then, check by substituting.

a)  $6w + 2 = 4w - 8$       b)  $7m - 12 = 4m + 2m$

c)  $4(k - 2) = 9k + 2$       d)  $8(x + 3) = 2(x - 3)$

e)  $5(g - 2) + 11 = 3g - 1$

f)  $7(y - 1) + 2(y + 2) = 2(y - 3) - 5$

4. Solve each formula for  $p$ .

a)  $2p - 5m = p + 6$       b)  $7p + 3q = 3p - q + 4$

c)  $2n = 5(p + 1)$

5. a) Solve the perimeter formula  $P = 2(l + w)$  for  $w$ .

b) Determine the value of  $w$  when  $P = 24$  and  $l = 9$ .

6. The total cost of renting a boat for a half day can be modelled using the formula  $C = n + 0.07n + 15$ .  $C$  is the total cost, in dollars.  $n$  is the rental charge, in dollars. 0.07 is the GST rate, 7%. 15 is the cost of a tank of gasoline, \$15. Find the rental charge if the total cost is \$68.50.

7. The total cost of an automobile oil change can be modelled using the formula  $C = (x + 15) + 0.08x + 0.07(x + 15) + 10$ .  $C$  is the total cost, in dollars.  $x$  is the cost of the oil, in dollars. 15 is the labour charge, \$15. 0.08 is the PST rate, 8%. 0.07 is the GST rate, 7%. 10 is the oil recycling tax, \$10. Find the cost of the oil when the total cost is \$37.55.

## 2.4 Multi-Step Equations and Formulas

*MATHEMATICS: Applying the Concepts 10, pages 65–70*

### Key Concept

To solve an equation that contains fractions, it is often useful to clear the fractions by multiplying each side by the least common denominator. Then, expand the brackets and follow the next steps in order.

- Collect and combine the variable terms if there is more than one.
- Collect and combine any other terms that are on the same side.
- Add to each side any quantity that is subtracted from the variable term, or subtract from each side any quantity that is added to the variable term.
- Multiply each side by any quantity by which the variable is divided, or divide each side by any quantity by which the variable is multiplied.

1. Describe the first step you would use to solve each equation.

a)  $\frac{x}{2} + \frac{x}{3} = \frac{1}{3}$

b)  $2x - 9x = 10 - 3x$

c)  $4(5x - 2) = -2(x + 1)$

2. Solve. Then, check by substituting.

a)  $\frac{2}{3}(y + 3) = 4$

b)  $-\frac{5}{3}(k - 1) = -10$

c)  $\frac{4}{3}(2 - x) = -4$

3. Solve. Then, check by substituting.

a)  $\frac{2}{3}a + \frac{5}{3}a = 14$

b)  $\frac{y}{4} - 1 = \frac{y}{3}$

c)  $\frac{p-1}{4} = \frac{p+5}{3}$

d)  $\frac{c}{2} + \frac{c+3}{3} = 6$

e)  $m + \frac{1}{2} = \frac{4}{3}m + \frac{11}{6}$

f)  $\frac{k}{5} - \frac{3}{2} = \frac{k}{2} - \frac{21}{10}$

4. The surface area of a cylinder can be found by using the formula  $A = 2\pi r(h + r)$ .  $A$  is the surface area, in square centimetres.  $h$  is the height, in centimetres.  $r$  is the radius, in centimetres.

a) Solve the formula for  $h$ .

b) Determine the height of a cylinder with surface area  $600 \text{ cm}^2$  and radius  $6 \text{ cm}$ . Use  $\pi = 3.14$ , and round to one decimal place.

5. The formula  $r = \frac{200NC}{P(n+1)}\%$  is used

to find the true interest rate when buying on instalment.  $r$  is the true interest rate, as a percent.  $N$  is the number of payments per year.  $C$  is the total interest, in dollars.  $P$  is the principal, in dollars.  $n$  is the number of payments.

a) Solve the formula for  $C$ .

b) What is the total interest, in dollars, rounded to the nearest cent, if the true interest rate is  $8\%$ , there are  $12$  payments per year for  $2$  years, and the principal is  $\$500$ ?

**Chapter 2 Review***MATHEMATICS: Applying the Concepts 10, pages 72–74**Solve.*

1.  $2y - 3 = 11$

2.  $5k + 2 = -13$

3.  $m - \frac{1}{2} = \frac{4}{5}$

4.  $5(x - 1) = -20$

*Describe the first step you would use to solve each equation.*

5.  $2x - 3x = 9$

6.  $3(g + 4) = 10$

7.  $2n - 6 = 7n + 5$

8.  $\frac{4}{5}w - \frac{1}{2} = \frac{3}{2}w + 6$

*Solve each formula for the variable indicated.*

9.  $C = \frac{Q}{V}$  for  $Q$

10.  $P = R - C$  for  $C$

11.  $I = Prt$  for  $t$

12.  $s = ut + \frac{1}{2}at^2$  for  $a$

*Solve. Then, check by substituting.*

13.  $4a + 1 = a - 5$

14.  $3w - 5 = 10w + 9$

15.  $6(y - 2) = 3y + 3$

16.  $k - (5 - k) = 3(k + 8)$

17.  $\frac{2}{3}x + 1 = \frac{3}{5}x$

18.  $\frac{m+2}{2} = \frac{m-1}{5}$

19.  $4(n + 1) - 10 = -(2n + 6)$

20.  $3(q - 2) = 17 + 5(q - 3)$

21.  $\frac{5}{6}b - \frac{9}{2} = -\frac{2}{3}b$

22.  $2(5g - 11) + 15 = 3(g - 7) - 7$

23. The cost of a taxi ride in a particular community can be modelled using the formula  $C = 12 + 1.5d$ .  $C$  is the charge, in dollars.  $d$  is the distance travelled, in kilometres. How many kilometres, rounded to one decimal place, can you travel in a taxi for \$50?

24. The total cost of one night of hotel accommodation can be modelled using the formula  $C = x + 0.05x + 0.07x$ .  $C$  is the total cost, in dollars.  $x$  is the hotel room charge, in dollars. 0.05 is the provincial tax rate, 5%. 0.07 is the GST tax rate, 7%. What is the hotel room charge when the total cost is \$224?

25. The formula  $F = G - \frac{Ed}{100}$  can be used to estimate the amount of fuel remaining in a car's gas tank.  $F$  is the fuel remaining, in litres.  $G$  is the initial amount of fuel in the tank, in litres.  $E$  is the fuel efficiency, in litres per 100 km.  $d$  is the distance driven, in kilometres. There are 10 L of fuel remaining in a car's tank after 350 km of driving. What is the fuel efficiency of the car, rounded to one decimal place, if there were 60 L of fuel in the tank initially?



### 3.1 Patterns and Ordered Pairs

*MATHEMATICS: Applying the Concepts 10, pages 80–86*

#### Key Concept

- On a Cartesian plane, the  $x$ - and  $y$ -axes intersect at the origin and divide the plane into four quadrants.
- If, as values of  $x$  increase by regular increments, the corresponding values for  $y$  also change by regular increments, then the relationship between the points is linear.
- If each  $x$ -value has only one corresponding  $y$ -value, the linear relation is called a linear function.

1. Plot each point on a Cartesian plane, and state which quadrant it is in.

a)  $A(4, 5)$                       b)  $B(-3, 2)$

c)  $C(-5, -1)$                       d)  $D(3, -4)$

e)  $E(5, 0)$                           f)  $F(0, 4)$

g)  $G(-3, 0)$                         h)  $H(0, -2)$

2. For each table of values, find the next three values of  $x$  and their corresponding  $y$ -values.

a)

$x$	$y$
0	3
1	5
2	7

b)

$x$	$y$
-2	1
0	-1
2	-3

c)

$x$	$y$
-4	2
-1	5
2	8

d)

$x$	$y$
1	4
3	0
5	-4

3. Determine if each set represents a linear function.

a)  $\{(2, 3), (3, 4), (4, 5), (5, 6)\}$

b)  $\{(-3, 2), (-1, 0), (1, -2), (3, -4)\}$

c)  $\{(-2, 3), (-1, 3), (0, 3), (1, 3)\}$

d)  $\{(-3, -2), (-3, -1), (-3, 0), (-3, 1)\}$

4. Plot each set of points on a Cartesian plane. Determine if their relationship is linear.

a)  $\{(1, 3), (3, 4), (5, 5)\}$

b)  $\{(-3, 2), (-1, 4), (1, 5)\}$

c)  $\{(-3, 2), (-1, -1), (1, -4)\}$

d)  $\{(-2, 1), (0, 1), (2, 2)\}$

5. Jamal earns \$8.00/h for delivering flyers.

a) Complete the table of values for his earnings.

$x$ (time in hours)	1	2	3	4	5	6	7
$y$ (earnings in dollars)	8	16	24				

b) Use the table of values to estimate Jamal's earnings for 3.5 hours of work.

6. Brandon is practising for a basketball game. He currently practises 0.5 h each day.

a) Complete the table of values for the practice time for up to 6 days.

$x$ (time in days)	1	2	3
$y$ (time in hours)	0.5	1.0	1.5

$x$ (time in days)			
$y$ (time in hours)			

b) Explain how you determined the successive  $x$ - and corresponding  $y$ -values.

## 3.2 Construct Tables and Sketch Graphs With Technology

*MATHEMATICS: Applying the Concepts 10, pages 87–91*

### Key Concept

- The  $\boxed{Y=}$  function on a graphing calculator is used to define equations for graphing.
- The starting  $x$ -value and incremental value for  $x$  in a table of values can be set with [TBLSET].
- A table of values and its graph can be viewed together by selecting **G–T** in the  $\boxed{\text{MODE}}$  settings.

1. Graph each line with the given equation using a graphing calculator. Use the standard window.

a)  $y = x + 1$

b)  $y = x - 2$

c)  $y = -x + 3$

d)  $y = -x - 4$

e)  $y = 2x - 3$

f)  $y = 3x + 1$

g)  $y = -2x + 2$

h)  $y = -3x + 1$

2. Use a graphing calculator to find a table of values for  $y = 3x + 2$ . Start from  $x = 0$  so that the incremental value for  $x$  in the table of values is

a) 2 units

b) 4 units

c) 0.5 units

d) 0.75 units

3. Use a graphing calculator. Display a graph and a table of values for each line simultaneously. Use the standard window.

a)  $y = 2x + 3$

b)  $y = -2x - 1$

c)  $y = 4x + 1$

d)  $y = -3x - 2$

4. a) Explain the steps that you would use to change a solid-line graph to a dotted-line graph on a graphing calculator.

b) Graph  $y = 2x + 3$  with a graphing calculator using a dotted line. Use the standard window.

5. a) Explain the steps that you would use to label a graph on a graphing calculator.

b) Graph and label  $y = 3x - 1$  using a graphing calculator. Use the standard window.

6. a) Explain the steps that you would use to estimate the value of  $y$ , correct to one decimal place, for a given value of  $x$ , for a given linear equation using a graphing calculator.

b) Use a graphing calculator to estimate the value of  $y$ , to one decimal place, if  $x = 2.3$ , for the line with equation  $y = 3x + 1.5$ .

7. a) Susan works in a record store. She earns \$250 per week plus 6% commission on her sales. Write an equation to represent her weekly salary,  $y$  (in dollars), if  $x$  is her total sales (in dollars).

b) Graph the relation representing her weekly salary using a graphing calculator. Use the window shown.

```

WINDOW
Xmin=0
Xmax=2000
Xscl=100
Ymin=0
Ymax=500
Yscl=25
Xres=1
  
```

### 3.3 Construct Tables and Sketch Graphs Without Technology

*MATHEMATICS: Applying the Concepts 10, pages 92–96*

#### Key Concept

- Given the equation of a line, it is possible to choose values for  $x$  that will make sketching the graph easier.
- A point  $(x, y)$  lies on a line if the  $x$ - and  $y$ -coordinates satisfy the equation of the line.

1. Each table of values represents a linear relation. Find the missing values.

a)

$x$	$y$
2	0
3	2
4	4
5	
6	
7	

b)

$x$	$y$
-3	
-1	6
1	3
3	0
6	
9	

c)

$x$	$y$
	1
	-1
	-3
3	-5
5	-7
7	-9

d)

$x$	$y$
-2	
1	-3
4	0
7	3
10	
13	

2. Complete each table of values.

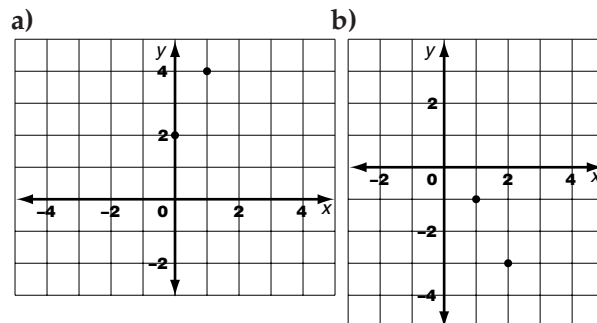
a)

$x$	$x + 1 = y$	$(x, y)$
0	$0 + 1 = 1$	$(0, 1)$
-1		
2		
5		
8		

b)

$x$	$-2x + 3 = y$	$(x, y)$
-4	$-2(-4) + 3 = 11$	$(-4, 11)$
-6		
	$-2(-8) + 3 = 19$	
-10		
		$(-12, 27)$

3. Find two other points that would be on the same line as the line containing the given points.



4. Determine if the point satisfies the equation of the line.

- a)  $A(2, -1); y = 2x - 5$       b)  $B(3, 1); y = -x + 2$
- c)  $C(-4, 3); y = 3x + 4$       d)  $D(-2, -2); y = 4x + 6$

5. A telephone carrier offers phone calls for 9¢/min to Scotland.

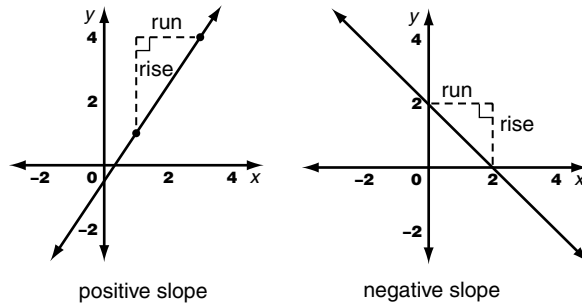
- a) Write an equation relating the cost,  $c$  (in dollars), to the time,  $t$  (in minutes).
- b) Develop a table of values for each minute up to 8 min of phone calls to Scotland.
- c) Graph the relation on a Cartesian plane.
- d) Is the relation a function? Explain.

### 3.4 Interpret Lines

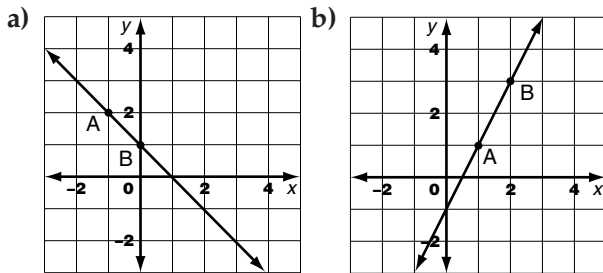
MATHEMATICS: Applying the Concepts 10, pages 97–103

**Key Concept**

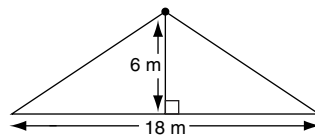
- For a straight line, slope =  $\frac{\text{rise}}{\text{run}}$ .
- When a line equation is in the form  $y = mx + b$ , the slope is  $m$  and the  $y$ -intercept is  $b$ .
- By changing one or both of the scales on the  $x$ - and  $y$ -axes, a line can appear to be steeper or flatter.



1. Use points A and B to determine the slope in each diagram.



4. Determine the slope of the roof.



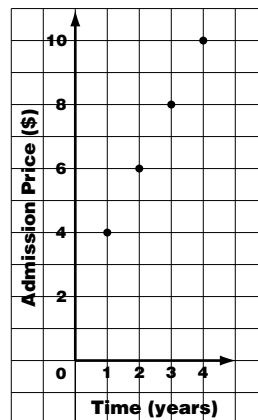
2. Find the slope of the line that passes through each pair of points.

- a)  $(4, -5)$  and  $(8, 11)$       b)  $(-3, 4)$  and  $(-5, -6)$

3. State the slope and  $y$ -intercept for each linear equation.

- a)  $y = 3x + 4$                       b)  $y = 2x - 3$
- c)  $y = -\frac{2}{3}x + 1$                     d)  $y = -0.5x - 2$

5. The graph shows the increase in the price of admission over a 4-year period. Change the scales on the axes in two different ways. Describe how the increase in the price of admission appears in each of your graphs.



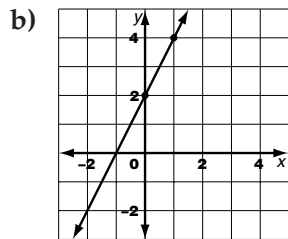
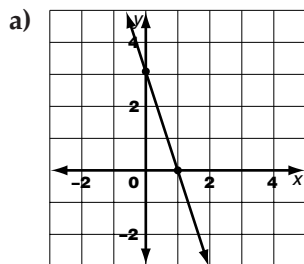
### 3.5 Write Linear Equations by Using Tables of Values

*MATHEMATICS: Applying the Concepts 10, pages 104–109*

#### Key Concept

- The equation of a line can be determined by finding the pattern between  $x$  and  $y$  in a table of values. Determine the slope,  $m$ , and the  $y$ -intercept,  $b$ , to generate an equation in the form  $y = mx + b$ .

1. Determine the slope and  $y$ -intercept for the graph of each line.



2. Find an equation in the form  $y = mx + b$  for the straight line represented by each table of values.

a) 

$x$	$y$
0	3
1	5
2	7

b) 

$x$	$y$
2	7
3	4
4	1

3. Determine the equation of a line given its slope,  $m$ , and  $y$ -intercept,  $b$ .

a)  $m = 3, b = 4$

b)  $m = 2, b = -3$

c)  $m = -5, b = 6$

d)  $m = -\frac{1}{2}, b = -\frac{3}{4}$

4. Graph the line represented by each table. Label the line with its equation.

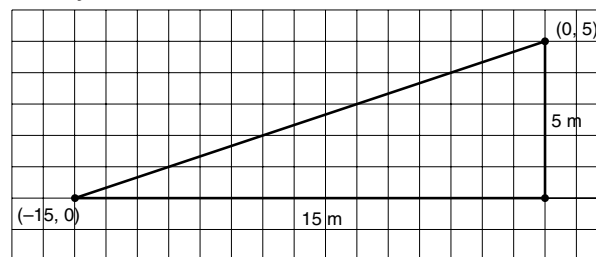
a) 

$x$	$y$
0	3
1	6
2	9

b) 

$x$	$y$
2	3
4	1
6	-1

5. For the ramp below, write an equation in the form  $y = mx + b$ .



6. BZB Parking charges \$3.00 for 1 h of parking, \$4.50 for 1.5 h of parking, and \$6.00 for 2 h of parking.

a) Write an equation that represents this relationship. Define your variables.

b) What do the slope and  $y$ -intercept represent?

c) Use the equation from part a) to predict the cost of 4 h of parking.

### 3.6 Write Linear Equations by Translating Written Descriptions

*MATHEMATICS: Applying the Concepts 10, pages 110–113*

#### Key Concept

- There are many English expressions that translate into the same mathematical operation.
- Variables used in your algebraic equation should be defined.

*Select the equivalent algebraic equation for each sentence.*

1. The result is five times a number.

- a)  $y = x + 5$                       b)  $y = \frac{1}{5}x$   
 c)  $y = 5x$                               d)  $y = 5 - x$

2. His height equals her height increased by three centimetres.

- a)  $y = 3x$                               b)  $y = x - 3$   
 c)  $y = \frac{1}{3}x$                               d)  $y = x + 3$

3. Her age is one half his age.

- a)  $y = x - 2$                           b)  $y = \frac{1}{2}x$   
 c)  $y = 2x$                               d)  $y = x + 2$

4. Bob's shoe size is four less than John's shoe size.

- a)  $y = \frac{1}{4}x$                               b)  $y = x + 4$   
 c)  $y = x - 4$                           d)  $y = 4x$

5. Express each sentence as an algebraic equation. Define your variables.

a) Chris earns fifty dollars less than Yuen does.

b) His age is one less than twice his daughter's age.

c) Her dog's mass is two kilograms more than three times his dog's mass.

d) Attendance at the show was three less than one half of the attendance at the previous show.

6. Describe each salary in terms of  $x$  and  $y$ . Define the variables.

a) A salesperson makes a straight commission of 40% of sales.

b) A telemarketer makes a salary of \$1000 per month plus \$10 for each successful sale.

c) A sales clerk makes a salary of \$200 per week plus a commission of 25% of sales.

7. A financial advisor currently has 20 clients per month. Her client base is growing at a rate of 5 per month.

a) Write a formula to describe the total number of clients that the financial advisor has as the months pass. Define the variables.

b) How long will it be before the financial advisor has doubled the number of clients that she currently has?

### 3.7 Rearrange Equations From One Form to Another

*MATHEMATICS: Applying the Concepts 10, pages 114–117*

#### Key Concept

- A linear equation can be written in different forms.
- The standard form of a linear equation is  $Ax + By + C = 0$ , where  $A$ ,  $B$ , and  $C$  are integers,  $A$  and  $B$  cannot both be zero, and variables  $x$  and  $y$  represent real numbers. Usually,  $A$  is positive.

1. State whether each equation is in standard form.

a)  $3x + 2y - 5 = 0$                       b)  $-2x - 3y + 5 = 0$

c)  $4x + 3y + \frac{2}{5} = 0$                       d)  $5x - 3y + 0.4 = 0$

e)  $4x + 7 = 0$                               f)  $-5y + 3 = 0$

2. The following equations are in standard form. State the values of  $A$ ,  $B$ , and  $C$ .

a)  $3x + y + 8 = 0$                       b)  $4x - y + 2 = 0$

c)  $4x + 5y + 3 = 0$                       d)  $7x - 5y + 8 = 0$

e)  $2x + 7 = 0$                               f)  $4y - 6 = 0$

3. Write each equation in standard form  $Ax + By + C = 0$ .

a)  $y = 3x + 5$                               b)  $y = -4x + 3$

c)  $y = \frac{2}{3}x - 4$                               d)  $y = -\frac{3}{4}x - 2$

e)  $y = 0.4x + 6$                               f)  $y = 1.3x - 7$

4. a) Determine the equation of the line passing through each pair of points.

b) State the  $y$ -intercept of the line.

c) Rewrite the equation in standard form  $Ax + By + C = 0$ .

i)  $(1, 3)$  and  $(3, 7)$                       ii)  $(-2, 7)$  and  $(-1, 5)$

iii)  $(-2, 1)$  and  $(2, 3)$                       iv)  $(3, 2)$  and  $(6, 0)$

5. Susan is offered a job where she will make \$250 per week and 5% commission on her total sales, where  $x$  is her total sales per week (in dollars) and  $y$  is her total salary per week (in dollars).

a) Write an equation to represent her total salary per week (in dollars) in terms of her total sales per week (in dollars).

b) Rewrite the equation from part a) in standard form.

6. An equation of a line is  $kx + 3y - 6 = 0$ . Find the value of  $k$  if the line passes through the point  $(3, -3)$ .

7. An equation of a line is  $x - ky + 5 = 0$ . Find the value of  $k$  if the line passes through the point  $(2, -5)$ .

## Chapter 3 Review

MATHEMATICS: Applying the Concepts 10, pages 120–121

1. Find the next three ordered pairs for each table of values.

a) 

$x$	-3	0	3
$y$	3	1	-1

b) 

$x$	-1	1	3
$y$	2	5	8

2. Complete each table of values.

a) 

$x$	$y$
-2	1
-4	4
-6	7
-8	0
-10	1

b) 

$x$	$y$
-3	
-2	
-1	2
4	
6	

3. Create a table of values for each linear relation. Use a minimum of three  $x$ -values in your tables of values. Use the tables of values to graph each function on a Cartesian plane.

a)  $y = 2x - 3$       b)  $y = -\frac{1}{2}x + 3$

4. Find the slope of the line that passes through each pair of points.

a)  $(3, -5)$  and  $(-4, 9)$       b)  $(-7, -1)$  and  $(5, 2)$

5. Find the linear equation represented by each table of values.

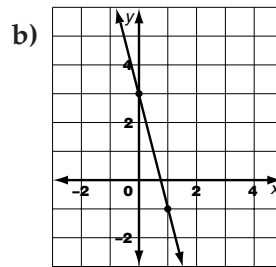
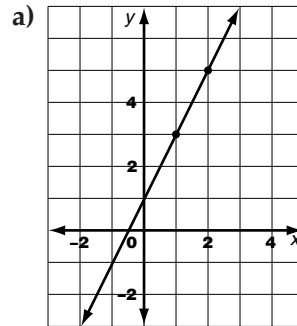
a) 

$x$	$y$
0	2
3	0
6	-2

b) 

$x$	$y$
-3	2
-1	-1
1	-4

6. Find the equation of the line shown in each graph.



7. State the slope,  $m$ , and the  $y$ -intercept,  $b$ , of each equation.

a)  $y = 3x + 5$       b)  $y = -\frac{3}{5}x - 4$

8. State the values of  $A$ ,  $B$ , and  $C$  for each equation in standard form.

a)  $2x + 5y - 3 = 0$       b)  $4x - 3y + 2 = 0$

9. Rearrange each equation in standard form into the slope and  $y$ -intercept form of a line equation.

a)  $3x + 2y + 7 = 0$       b)  $5x - 4y - 9 = 0$

10. Rearrange each equation in slope and  $y$ -intercept form into the standard form of a line equation.

a)  $y = 3x - 5$       b)  $y = -\frac{2}{3}x + \frac{3}{5}$

11. a) Use a graphing calculator to graph the linear equation  $y = 2.3x - 3.4$ . Use the standard window settings.

b) Use a graphing calculator to display a table of values for the linear equation  $y = 1.2x + 3$  for  $x = 0, 2, 4, 6, 8$ .

c) Use a graphing calculator to display the table of values and the graph of the function  $y = 3.1x + 2.7$  in the same viewing screen. Use the standard window settings.

12. Sheileen is a volunteer at a nursing home. Her volunteer time for one week is shown in the table.

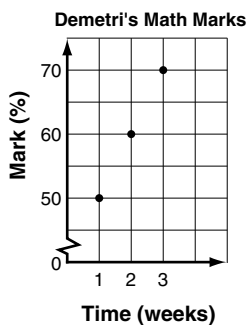
$x$ (time in days)	0	1	2
$y$ (volunteer time in hours)	0	4	8

a) Determine the next three points in the table of values.

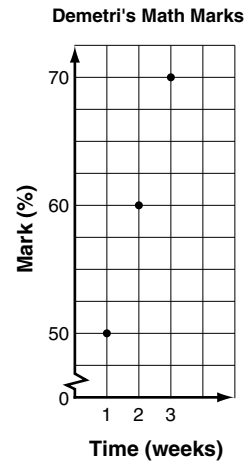
b) Use the table to estimate the number of hours that Sheileen will have volunteered by the end of 7 days.

13. The following three graphs show Demetri's tests marks in mathematics over a three-week period using different scales.

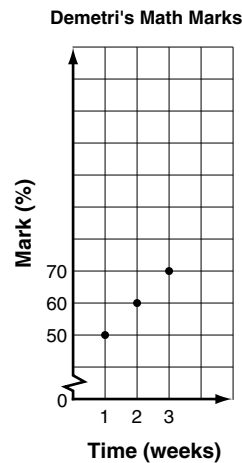
Graph A



Graph B



Graph C



Which graph might Demetri show his parents to convince them that he has really improved his mathematics mark? Explain.

14. The Talk-Away Cellular Phone Company charges \$9.95 per month plus 10¢/min of local air time.

a) Write an equation to represent the cost of a cellular phone from this company per month.

b) Create a table of values and plot a graph of the function on a Cartesian plane or by using a graphing calculator.

c) Find the total cost if 450 min of air time are used during a month on a cellular phone that has been purchased from this company.

## Cumulative Review, Chapters 1–3

*MATHEMATICS: Applying the Concepts 10, pages 124–127*

1. Solve each proportion for the unknown value.

a)  $x:4 = 6:8$                       b)  $3:x = 4:9$

c)  $5:6 = x:7$                       d)  $3:4 = 6:x$

2. Write a proportion that can be used to solve for each unknown. Then, solve.

a)  $2:3:6 = 7:a:b$                       b)  $3:4:m = 5:n:7$

3. Express each of the following as a unit rate. Round to two decimal places, if necessary.

a) \$33.28 for 13 boxes of staples

b) 15 km walked in 4 h

c) 2000 m in 15 min

4. Find each percent increase. Round to one decimal place, if necessary.

a) an increase from \$45 to \$56

b) an increase from 75°C to 85°C

5. Find each percent decrease. Round to one decimal place, if necessary.

a) a decrease from \$65 to \$56

b) a decrease from 75°C to 65°C

6. a) 58% of what number is 348?

b) 120% of what number is 720?

7. Find the number.

a) 35% of 800                      b) 15% of \$36

8. The commission for selling a house is \$8460, which is 6% of the selling price of the house. What is the selling price of the house?

9. Find the simple interest earned on each investment.

a) \$800 at 5% per annum for 3 years

b) \$1500 at 4.5% per annum for 2 years

c) \$1000 at  $6\frac{1}{4}\%$  per annum for 5 years

10. Solve each equation. Show your steps.

a)  $\frac{x}{5} = 7$                                       b)  $4a + 8 = 16$

c)  $-6 = -8 + 2m$                       d)  $-5 + d = -\frac{4}{5}$

e)  $\frac{a+6}{7} = 2$                                       f)  $\frac{a}{3} + \frac{a}{4} = \frac{7}{3}$

11. Plot each set of points on a Cartesian plane. Determine if their relationship is linear.

a)  $\{(3, 5), (1, 7), (-1, 9)\}$

b)  $\{(-2, 4), (0, -1), (2, -3)\}$

c)  $\{(-1, 3), (0, 3), (1, 3)\}$

12. Write each equation in the slope and  $y$ -intercept form.

a)  $5x + y - 3 = 0$                       b)  $2x - y + 8 = 0$

c)  $3x + 2y + 6 = 0$                       d)  $4x - 5y + 7 = 0$

13. Find the slope of the line that passes through each pair of points.

a) (4, 5) and (6, 8)      b) (-3, 7) and (2, -5)

c) (2, -6) and (-5, 7)

14. Determine the equation of a line given a point and its  $y$ -intercept,  $b$ .

a) (3, 0),  $b = 5$       b) (-5, 0),  $b = 4$

c) (2, 0),  $b = -2$       d) (-4, 0),  $b = -3$

15. Graph the line represented by each table. Determine the equation of the line in the slope and  $y$ -intercept form.

a) 

$x$	$y$
0	2
1	0
2	-2

b) 

$x$	$y$
-2	1
1	-3
4	-7

c) 

$x$	$y$
2	5
4	4
6	3

16. Solve for  $h$  in the formula for the volume of a box,  $V = lwh$ . Then, find the height for each set of values for the variables.

a)  $V = 105 \text{ cm}^3$ ,  $l = 7 \text{ cm}$ , and  $w = 3 \text{ cm}$

b)  $V = 1430 \text{ cm}^3$ ,  $l = 13 \text{ cm}$ , and  $w = 10 \text{ cm}$

c)  $V = 59.976 \text{ cm}^3$ ,  $l = 3.4 \text{ cm}$ , and  $w = 2.8 \text{ cm}$

17. Solve each equation. Then, check your answers by substituting.

a)  $4(5 + m) = 32$       b)  $\frac{a}{3} + \frac{a}{2} = 10$

c)  $\frac{y+3}{2} - 1 = \frac{2y-1}{3}$

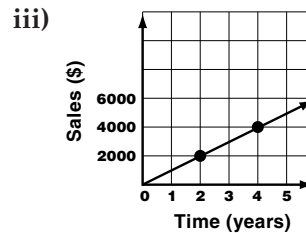
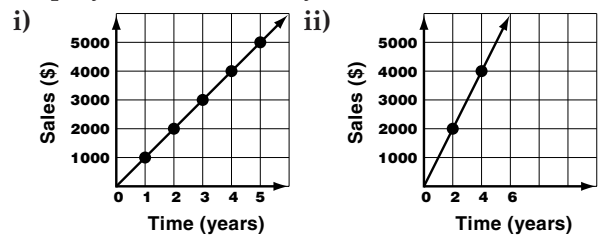
18. The cost to rent a pair of ice skates is \$25 plus \$3/h.

a) Write an equation that describes the cost of renting the skates. Use the slope and  $y$ -intercept form.

b) How much would it cost to rent the skates for 8 h?

c) For how many hours would the skates have been rented if the total cost to rent the skates was \$58?

19. The three graphs illustrate the sales for an employee for the last 5 years.



a) Determine the slope of each graph.

b) Which graph gives the impression of the greatest increase in sales?

c) Which graph gives the impression of the least increase in sales?

20. Graph each line using a graphing calculator. Use the standard window settings.

a)  $y = 3x + 2$       b)  $y = -2x + 3$



# 4.1 Explore Piecewise Linear Functions

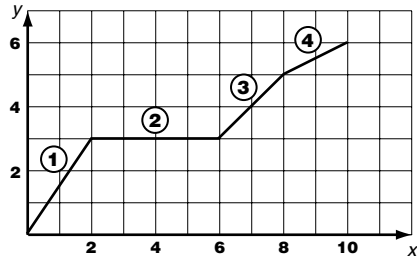
MATHEMATICS: Applying the Concepts 10, pages 132–138

## Key Concept

- The graph of a piecewise linear function can be made up of connected or separated line segments.

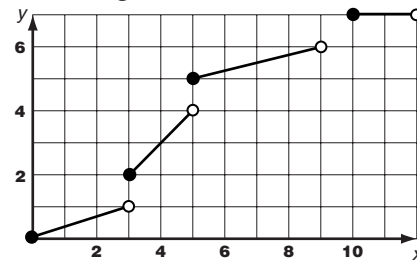
### Connected Piecewise Linear Function

- Made up of line segments.
- Must have two or more line segments.

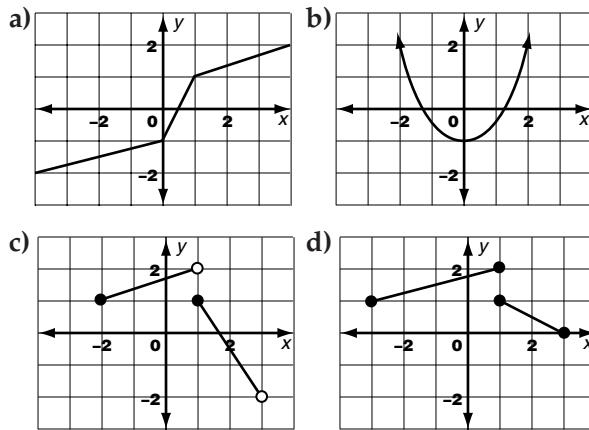


### Separated Piecewise Linear Function

- Made up of line segments.
- Must have two or more line segments.
- At each break, one line segment ends with an open circle and the next begins with a closed circle, or vice versa.
- The  $x$ -value of the break point belongs to one line segment but not to the next one.

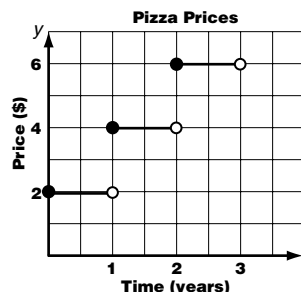


1. Identify which graphs are piecewise linear functions.



2. Write the intervals of the  $x$ -values for each segment of the piecewise linear function in question 1a).

3. The graph shows the price of a pizza at a local store over the last 3 years.

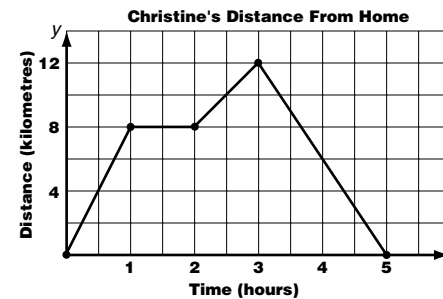


a) Does the graph represent a piecewise linear function? Explain.

b) Explain how the open and closed circles relate to the price of the pizzas.

c) Write the intervals for the  $x$ -values for each line segment in the graph.

4. The graph represents Christine's progress in a fundraising walk. She walked from home to a park and back.



a) Does the graph represent a piecewise linear function? Explain.

b) Write the intervals for the  $x$ -values for each line segment in the graph.

## 4.2 Construct Piecewise Linear Functions With Technology

*MATHEMATICS: Applying the Concepts 10, pages 139–145*

### Key Concept

- A graphing calculator can be used to graph a piecewise linear function with the setting of **Dot** from the **(MODE)** menu. The equations may be entered separately or together as one.
- The inequality symbols are found on the **[TEST]** menu.
- The graphing calculator does not display the open and closed circles necessary for a piecewise linear function composed of separated line segments. It is necessary for you to understand how to interpret the information provided in order to reach valid conclusions.

1. Rewrite each interval in the correct parentheses that you would have to use for graphing a function with the given intervals on a graphing calculator.

- a)  $0 \leq x \leq 8$                       b)  $3 < x \leq 6$   
 c)  $4 \leq x < 7$                          d)  $1 \leq x \leq 5$

2. Graph each piecewise linear function using a graphing calculator and the given window settings.

a)

x-values	Equation
$0 < x \leq 2$	$y = 1$
$2 < x \leq 4$	$y = 3$
$4 < x \leq 6$	$y = 5$

b)

x-values	Equation
$0 \leq x \leq 3$	$y = 2x - 3$
$3 \leq x \leq 5$	$y = x$
$5 \leq x \leq 6$	$y = -2x + 15$

```

WINDOW
Ymin=0
Xmax=6
Xscl=1
Ymin=0
Ymax=6
Yscl=1
Xres=1
  
```

3. a) When graphing piecewise linear functions on a graphing calculator, the **(MODE)** function must be set to **Dot**. Explain what happens to the graph of a piecewise linear function if this is not done.

b) Describe how you would use **(2nd)** **(MATH)** for **[TEST]** to enter the inequality symbols when graphing piecewise linear functions.

c) Describe how to enter the equations and intervals in the **(Y=)** screen to graph piecewise linear functions.

4. The postal rates for oversized items posted in Canada for delivery in the U.S.A., its territories, or possessions are shown in the table.

Mass (up to and including)	100 g	200 g	500 g
Cost	\$1.25	\$2.35	\$4.05

Let  $x$  represent the mass of the oversized item, in grams, and let  $y$  represent the postage, in dollars.

a) Create a table relating mass intervals to postage. Then, graph the piecewise linear function using the window shown.

b) Sketch the graph of the piecewise linear function from part a). Add the missing open and closed circles on the graph in the correct locations.

```

WINDOW
Xmin=0
Xmax=550
Xscl=50
Ymin=0
Ymax=4.25
Yscl=.25
Xres=1
  
```



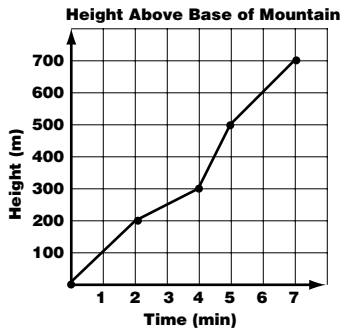
## 4.4 Interpolation and Extrapolation

*MATHEMATICS: Applying the Concepts 10, pages 153–158*

### Key Concept

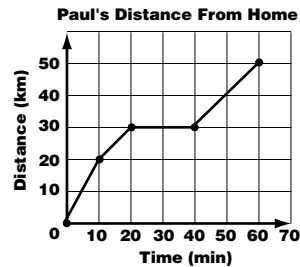
- Using a graph to estimate values between two known points is called **interpolation**.
- Extending the pattern of a graph to estimate values beyond the given points is called **extrapolation**.

1. A skier is going up the side of a mountain on a chair lift. The graph represents the height (in metres) of the skier above the base of the mountain over time (in minutes).



- Determine the height of the skier above the base of the mountain after 1 min.
- Determine the height of the skier above the base of the mountain after 4.5 min.
- Determine the time at which the skier is 500 m above the base of the mountain.
- Estimate the time at which the skier is 525 m above the base of the mountain.
- Determine the height of the skier above the base of the mountain after 8 min if the chair lift continues at the same speed.
- Determine the time at which the skier is 900 m above the base of the mountain if the chair lift continues at the same speed.

2. Paul went for a drive in his new car. His distance (in kilometres) from home at any time (in minutes) during a 1-h time interval is represented by the graph.

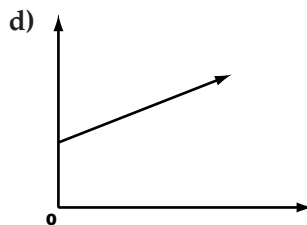
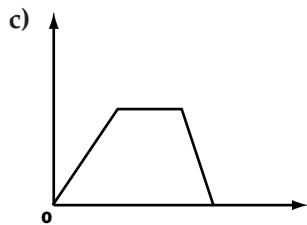
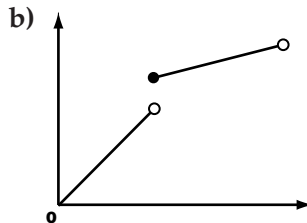
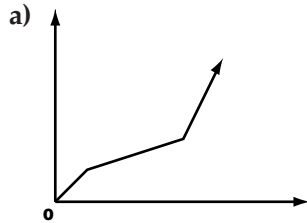


- After 10 min, how far was Paul from home?
- After 30 min, how far was Paul from home?
- When was Paul 25 km from home?
- When was Paul 40 km from home?
- If Paul continues at the same speed, how far will he be from home after 70 min?
- If Paul continues at the same speed, when will he be 80 km from home?

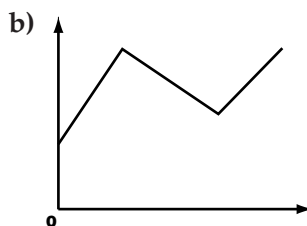
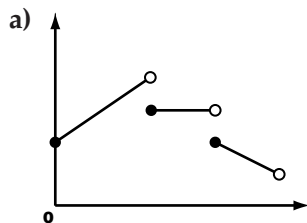
## Chapter 4 Review

*MATHEMATICS: Applying the Concepts 10, pages 160–161*

1. Identify which graphs are piecewise linear functions.



2. Identify which graph is a connected piecewise linear function and which graph is a separated piecewise linear function.



3. A parking lot charges \$2.50 for the first hour and an additional \$1.50 per hour or part of an hour.

a) Write an equation relating the time,  $x$  (in hours), to the parking fee,  $y$  (in dollars), for up to 5 h of parking.

b) Set up and complete a table of values relating the time and the parking fee for up to 5 h of parking.

c) Graph the piecewise linear function using a graphing calculator and the given window settings.

```

WINDOW
Xmin=0
Xmax=6
Xscl=1
Ymin=0
Ymax=9
Yscl=1
Xres=1
    
```

d) Sketch a graph of the function on a Cartesian plane. Add the missing open and closed circles on the graph in the correct places.

4. The table represents Annie's distance,  $y$  (in kilometres), from home after time,  $x$  (in hours).

Time (h)	Distance From Home (km)
$0 \leq x \leq 2$	$y = x + 1$
$2 \leq x \leq 3$	$y = 3$
$3 \leq x \leq 6$	$y = 2x - 3$

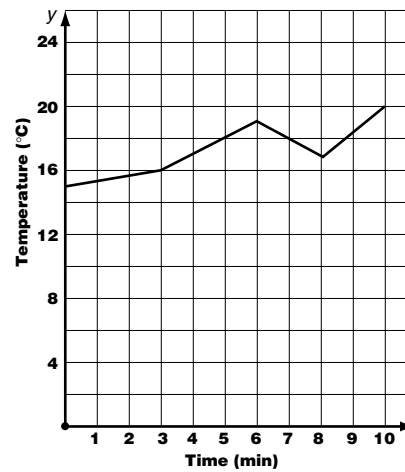
a) Create a table of values for the piecewise linear function.

b) Graph the piecewise linear function on a Cartesian plane.

c) Use the graph to determine her distance from home after 4 h.

d) Use the graph to determine how long it took her to get 7 km from home.

5. The graph relates time (in minutes) to temperature (in degrees Celsius).



a) Determine the temperature after 3 min.

b) Determine the time when the temperature was  $17^{\circ}\text{C}$ .

c) Assume that the graph continues after 10 min. Determine the temperature after 13 min.

d) Assume that the graph continues after 10 min. Determine at what time the temperature was  $23^{\circ}\text{C}$ .

## 5.1 Solve Linear Systems With Technology

*MATHEMATICS: Applying the Concepts 10, pages 168–174*

### Key Concept

- A graphing calculator can be used to solve a system of linear equations by using the **Intersect** operation from the [CALC] menu, or by using the **ZOOM** and **TRACE** instructions.
- Technology helps you to find solutions to problems. It is still necessary for you to understand how to interpret the information provided in order to reach valid conclusions.

1. Write each equation in the form  $y = mx + b$ .

a)  $2x + y = 7$

b)  $3x - y = 5$

c)  $3x + 5y = 8$

d)  $5x - 2y = 4$

e)  $5x - 3y = -2$

f)  $-7x + 3y = 6$

2. Solve each system of linear equations using a graphing calculator. Use the standard window settings. Check your solutions.

a)  $y = 4x + 5$   
 $y = 3x + 2$

b)  $y = 6x - 8$   
 $y = 3x - 2$

c)  $y = -3x + 5$   
 $y = 2x - 10$

d)  $y = -x + 2$   
 $y = x + 5$

3. Solve each system of linear equations using a graphing calculator. Use the standard window settings. Round your answers to two decimal places.

a)  $y = 5x + 3$   
 $y = 8x - 1$

b)  $y = 3x - 2$   
 $y = -\frac{1}{2}x + 4$

4. Solve each linear system using a graphing calculator. Use the standard window settings. Round your answers to two decimal places, if necessary. Check your solutions.

a)  $x + y = 3$   
 $3x + 2y = 5$

b)  $x - y = 4$   
 $4x + 3y = 5$

c)  $2x + 5y = 7$   
 $3x - 4y = 5$

d)  $-5x + 4y = 6$   
 $3x + 5y = -8$

5. Take-A-Cab-Home taxi company charges \$2.50 plus 75¢/km. Drive-Away-Today taxi company charges \$1.25 plus 95¢/km.

a) Write a system of equations to compare the cost,  $C$  (in dollars), of a taxi ride for a distance,  $d$  (in kilometres).

b) Graph the system of linear equations using a graphing calculator. Use the window settings shown.

```

WINDOW
Xmin=0
Xmax=15
Xscl=2
Ymin=0
Ymax=15
Yscl=2
Xres=1
  
```

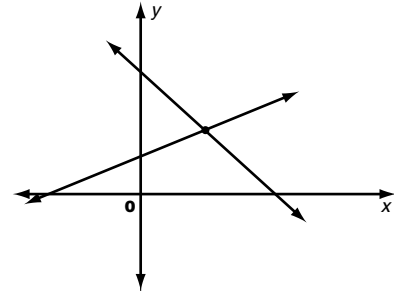
c) For what distance do the taxi rides cost the same? What is the cost?

## 5.2 Solutions to Linear Systems

*MATHEMATICS: Applying the Concepts 10, pages 175–181*

### Key Concept

- When a problem can be represented by two linear equations in two variables, you can graph the two lines to find their point of intersection. This point satisfies both equations. This can provide a solution to the problem.

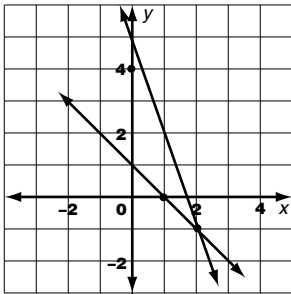


1. Which ordered pair is a solution to the given system of linear equations?

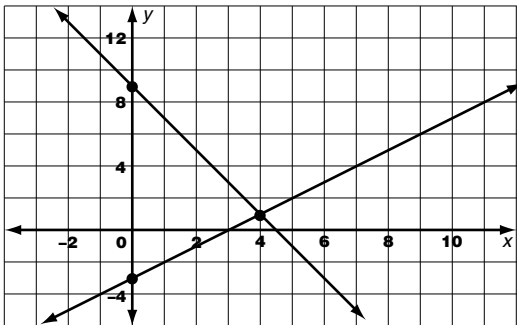
- a)  $x + y = 3$                       (2, 1) or (-1, 3)  
 $3x - y = 5$
- b)  $3x + 5y = 8$                     (1, 2) or (1, 1)  
 $5x - 2y = 3$
- c)  $2x - 4y = -2$                   (3, 2) or (2, 3)  
 $3x + 2y = 13$
- d)  $-3x + 5y = -27$               (3, -4) or (4, -3)  
 $4x - 2y = 22$

2. From the graph of each system of linear equations, determine the solution. Check your solution.

- a)  $x + y = 1$   
 $3x + y = 5$



- b)  $x - y = 3$   
 $2x + y = 9$



3. Solve each system of linear equations graphically. Check your solution.

- a)  $y = 2x + 6$                       b)  $x + 2y = 4$   
 $y = x + 7$                                $y = 2x - 3$

4. Trees-R-Trimmed Tree-Trimming Services charges \$30 for a service call plus \$10/h for labour. The Wooden Arborist Tree-Trimming Services charges \$35 for a service call plus \$8/h for labour.

a) Write an equation to represent the total cost of a repair for each company. Define your variables.

b) Graph the two equations on the same set of axes.

c) For how many hours is the cost the same to use either company?

d) When is it cheaper to use Trees-R-Trimmed Tree-Trimming Services? Explain.

e) When is it cheaper to use The Wooden Arborist Tree-Trimming Services? Explain.

## 5.3 Solve Linear Systems by Substitution

*MATHEMATICS: Applying the Concepts 10, pages 182–188*

### Key Concept

- The solution of a system of linear equations can be found algebraically by substitution.
- To solve a system of two equations in  $x$  and  $y$  by the substitution method, first solve one of the equations for  $x$  or  $y$ . Next, substitute the new expression for  $x$  or  $y$  into the remaining equation and solve. Finally, substitute the value for  $x$  or  $y$  back into one of the original equations to determine the value of the other variable.
- The point at which the cost to produce an item equals the revenue from sales of the item is the break-even point.

1. Solve for  $y$ .

a)  $3x + y = 5$

b)  $-4x + y = 7$

c)  $3x + 2y = 4$

d)  $5x - 3y = 8$

2. Solve for  $x$ .

a)  $x + 5y = 6$

b)  $x - 4y = 8$

c)  $3x + 7y = 9$

d)  $4x - 5y = 10$

3. Solve each linear system by substitution.

Check your solutions.

a)  $y = 2x + 3$

b)  $y = 4x - 5$

$3x - 5y = -8$

$2x + 3y = 13$

c)  $y = 3x + 4$

d)  $y = -2x + 1$

$x - y = 4$

$x + 3y = -2$

e)  $2x + y = 5$

f)  $4x - y = 6$

$3x - y = 10$

$3x + y = 8$

g)  $2x + 3y = 7$

h)  $3x + 5y = 3$

$3x - 2y = 4$

$2x + 3y = 2$

4. Solve each system of equations by graphing and by substitution.

a)  $x + y = 4$

b)  $2x - 3y = 6$

$x - y = 2$

$3x + 4y = 9$

5. A sales clerk is counting money at the end of the day. He has a total of 73 bills in tens and twenties. The total value of the money is \$1150. If the total number of \$10 bills is  $x$  and the total number of \$20 bills is  $y$ , the following equations represent the situation.

Total number of bills:  $x + y = 73$

Total value of the bills:  $10x + 20y = 1150$

a) Use the method of substitution to solve the system of equations. Check your solution.

b) What does the point of intersection represent?

c) How many \$10 bills and how many \$20 bills does the sales clerk have?

## 5.4 Solve Linear Systems by Elimination

*MATHEMATICS: Applying the Concepts 10, pages 189–195*

### Key Concept

- A system of two linear equations in two variables can be solved algebraically by elimination. This method involves the addition or subtraction of the equations in order to eliminate one variable. Then, substitution is used to find the value of the other variable.
- Multiplication can be used to rewrite a system of equations so that one variable can be eliminated by addition or subtraction.

#### 1. Add. Do not solve.

a)  $x + y = 8$                       b)  $5x + 3y = 7$   
 $x - y = 11$                                $4x - 3y = 2$

c)  $4x + 7y = 54$                       d)  $3x - 4y = 9$   
 $-4x + 2y = 6$                                $5x + 4y = 3$

#### 2. Subtract. Do not solve.

a)  $3x + y = 76$                       b)  $x + 6y = 10$   
 $x + y = 8$                                    $x + 4y = 8$

c)  $4x - 5y = 98$                       d)  $-7x + 4y = -5$   
 $4x - 3y = -5$                                $-7x + 2y = 4$

#### 3. Solve each system of equations by the algebraic method of elimination.

a)  $3x + y = 7$                       b)  $3x + 2y = 7$   
 $2x - y = 3$                                $5x - 2y = 1$

c)  $2x + 3y = 8$                       d)  $3x + 4y = 8$   
 $2x + y = 2$                                $3x + y = 5$

e)  $2x + 3y = 9$                       f)  $4x + 3y = 8$   
 $5x + 2y = -5$                                $3x - 5y = 6$

4. A music store had a sale on tapes and CDs. Tapes were on sale for \$8 each and CDs were on sale for \$12. During the sale, 38 tapes and CDs were sold. The cash receipts from the sale of the tapes and CDs, before taxes, were \$396. The following linear equations represent the situation, where  $x$  represents the number of tapes sold and  $y$  represents the number of CDs sold.

Number of tapes and CDs sold:  $x + y = 38$   
 Value of the tapes and CDs sold:  $8x + 12y = 396$

a) Solve the system of equations using the algebraic method of elimination. Check your solution.

b) What does the point of intersection represent?

c) How many tapes and how many CDs were sold during the sale?

## Chapter 5 Review

*MATHEMATICS: Applying the Concepts 10, pages 198–199*

1. Solve each system of linear equations graphically.

a)  $y = 2x + 3$   
 $y = x + 5$

b)  $3x + y = 6$   
 $2x + y = 2$

c)  $y = -x + 3$   
 $y = 2x + 6$

d)  $4x - 2y = 4$   
 $x - 2y = 1$

2. Use a graphing calculator to find the point of intersection for each system of linear equations. Round your answers to two decimal places, if necessary.

a)  $y = 3x + 1$   
 $y = x + 7$

b)  $y = 2x - 5$   
 $y = 4x + 3$

c)  $5x + y = 4$   
 $3x + 4y = 5$

d)  $4x + 5y = 75$   
 $x - 2y = 4$

e)  $6x - 4y = 5$   
 $2x - 3y = 4$

f)  $2x - y = 3$   
 $3x + y = 2$

3. Solve each system of linear equations by the algebraic method of substitution. Check your solutions.

a)  $y = 3x + 2$   
 $4x - y = 5$

b)  $2x + 3y = 7$   
 $4x + y = -1$

c)  $3x + 2y = 5$   
 $x + 3y = 4$

d)  $x + 7y = 6$   
 $3x + 2y = -1$

4. Solve each system of linear equations by the algebraic method of elimination. Check your solutions.

a)  $x + y = 6$   
 $x - y = 4$

b)  $5x + 4y = 6$   
 $2x - 4y = 8$

c)  $6x + 2y = 3$   
 $5x - 2y = 7$

d)  $3x + 5y = 7$   
 $2x + 3y = 5$

5. Megan is offered two salary plans: \$850 per week plus 4% commission or \$800 per week plus 6% commission. The two salary plans can be represented by the following system of equations.

Salary Plan A:  $y = 850 + 0.04x$

Salary Plan B:  $y = 800 + 0.06x$

a) Define each variable.

b) Solve the system of equations using a graphing calculator. Use the window settings shown.

```

WINDOW
Xmin=0
Xmax=6000
Xscl=500
Ymin=0
Ymax=1500
Yscl=100
Xres=1
  
```

c) What does the point of intersection represent?

d) For what amount of sales is Salary Plan A the better choice?

e) For what amount of sales is Salary Plan B the better choice?

6. Jennie works in a hardware store. She ordered 70 boxes of light bulbs. The total cost of the order before taxes was \$140.90. The order contained boxes of 60-W bulbs that cost \$1.95 per box and boxes of 100-W bulbs that cost \$2.15 per box. The situation is represented by the following system of equations, where  $x$  is the number of boxes of 60-W bulbs and  $y$  is the number of boxes of 100-W bulbs.

Total number of boxes of bulbs:  $x + y = 70$

Total cost of bulbs:  $1.95x + 2.15y = 140.90$

a) Solve the system of linear equations using the method of your choice. Check your solution.

b) How many boxes of each type of light bulb were ordered?



## 6.1 Explore Similar Triangles

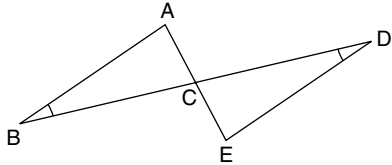
MATHEMATICS: Applying the Concepts 10, pages 206–214

### Key Concept

Two triangles are similar if

- the corresponding angles are equal
- the lengths of the corresponding sides are proportional

Complete the statements about the pair of similar triangles.



1.  $\frac{AC}{EC} = \frac{BC}{?}$

2.  $\frac{AB}{ED} = \frac{?}{CD}$

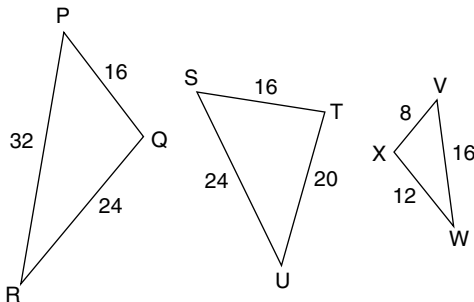
3.  $\frac{CB}{CD} = \frac{AB}{?}$

4.  $\angle CED = \angle ?$

5.  $\angle ACB = \angle ?$

6.  $\angle ABC = \angle ?$

7. a) Which two triangles are similar? Why?



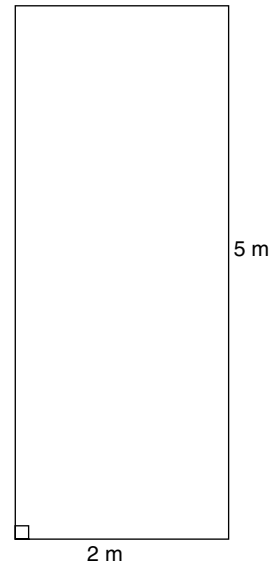
b) For the pair of similar triangles, state the pairs of corresponding sides and angles.

8. Most staircases have the same slope. Measure the rise and run of a staircase at home.

(Recall: slope =  $\frac{\text{rise}}{\text{run}}$ .)

Draw a scale diagram of the staircase. The scale diagram should fit onto about one quarter page of your notebook. Compare the slope of your staircase with those of other students.

9. The rectangle shown is a scale diagram of a window. It is to be divided into sections and the glass replaced with stained glass.



a) Divide the window into at least 4 sections made entirely of pairs of similar triangles. Label each vertex.

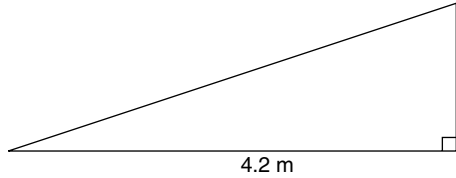
b) State the pairs of similar triangles, along with pairs of corresponding sides and angles.

## 6.2 Apply Similar Triangles

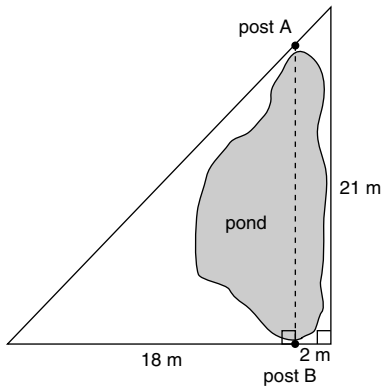
*MATHEMATICS: Applying the Concepts 10, pages 215–223*

1. A tall building casts a shadow 9.2 m long. At the same time, a 1.8-m tall person casts a shadow 0.4 m long. How tall is the building?

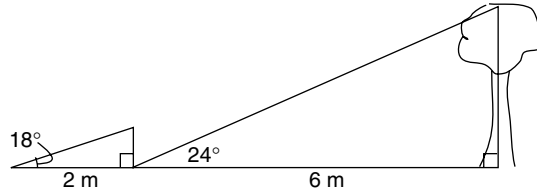
2. A loading ramp is built so that it rises 20 cm vertically for each metre horizontally. What is the vertical height of the ramp shown in the diagram?



3. A park designer placed survey posts as shown in the diagram below. Measurements were made as indicated. How far apart are the posts?



4. Explain why similar triangles cannot be used to measure the height of the tree in the diagram.



5. Observe your surroundings and identify a situation where similar triangles are used.
- Design a problem based on that situation. What do you need to solve your problem?
  - Draw an appropriate diagram.
  - Solve the problem.
  - Give your problem to a classmate to solve.

## 6.3 The Pythagorean Relation

*MATHEMATICS: Applying the Concepts 10, pages 224–230*

### Key Concept

- If  $c$  is the measure of the longest side (**hypotenuse**) of a right triangle and  $a$  and  $b$  are the measures of the other sides (**legs**), then

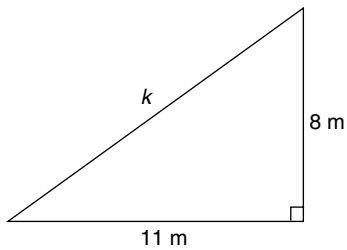
$$c^2 = a^2 + b^2.$$

*Round your answers to one decimal place, if necessary.*

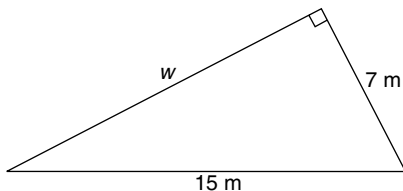
1. In a right triangle, which side is the hypotenuse? Use words and a diagram.

*For questions 2 and 3, use the Pythagorean Relation to solve for the unknown.*

2.

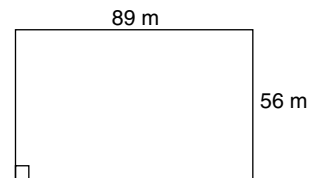


3.



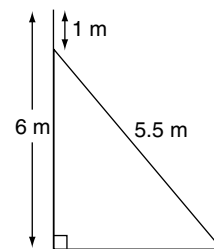
4. If  $c$  is the hypotenuse, find the measure of  $b$ , given  $a = 6$  and  $c = \sqrt{74}$ .

5. A field measures 56 m by 89 m. How much shorter is it to walk diagonally across the field than along two adjoining sides?



6. A cordless telephone will work if it is within 50 m of its base. If, while you are talking on the phone, you walk 15 m away from the base in a southerly direction, then, turn to face west and walk 42 m, will the phone still work?

7. A 6-m pole is to be stabilized by tying 6.5 m of steel cable from a stake in the ground to a point 1 m from the top of the pole. If 1 m of cable is to be used for tying purposes, how far from the base of the pole should the stake be placed?



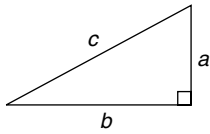
## 6.4 Similar Right Triangles: Pythagorean Triples

MATHEMATICS: Applying the Concepts 10, pages 231–235

### Key Concept

- Three natural numbers that satisfy the Pythagorean Relation  $a^2 + b^2 = c^2$  are called a **Pythagorean Triple**.
- A Pythagorean Triple is a **primary Pythagorean Triple** if the greatest common factor of the three numbers is 1. Other triples in the same family can be found by multiplying each number in the primary Pythagorean triple by the same constant.

1. Using the diagram, describe a Pythagorean Triple.



Determine whether or not each set of numbers is a Pythagorean Triple.

2. {3, 4, 6}                      3. {5, 12, 13}

4. {40, 42, 58}                5. {7, 15, 18}

Each set of numbers is a Pythagorean Triple. Find one other Pythagorean Triple in its family.

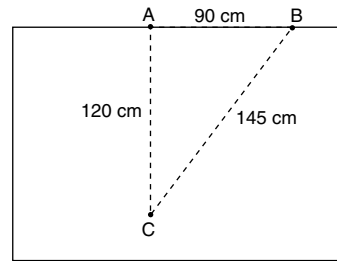
6. {9, 12, 15}                    7. {28, 45, 53}

8. {15, 20, 25}                9. {24, 45, 51}

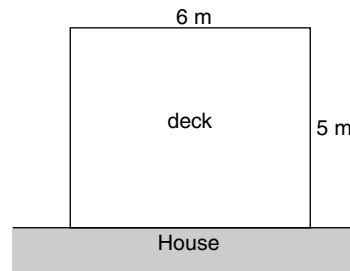
Find the missing value in each Pythagorean Triple.

10. {8, 15, ?}                    11. {15, ?, 39}

12. While laying carpet, the installer tries to make a right-angled cut. A mark (A) is made along the edge of the carpet. A second mark (B) is made 90 cm from the first, along one side. A third mark (C) is made 120 cm in from the edge. The second and third marks are 145 cm apart. Will a cut along the line through A and C be “square” to the edge of the carpet?



13. A deck is to be built along the wall of a house and is to measure 6 m by 5 m.

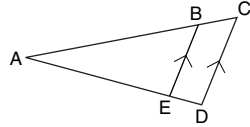


- a) Select an appropriate Pythagorean Triple to use in order to make sure the deck is “square” to the wall of the house.  
 b) Describe how the deck builder should use the Pythagorean Triple.

## Chapter 6 Review

MATHEMATICS: Applying the Concepts 10, pages 238–239

Complete the statements about the pair of similar triangles.



1.  $\frac{AB}{AC} = \frac{AE}{?}$

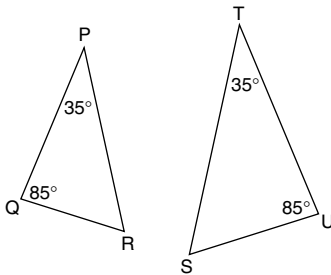
2.  $\frac{AE}{?} = \frac{EB}{DC}$

3.  $\angle ABE = \angle ?$

4.  $\angle ADC = \angle ?$

5.  $\triangle ABE \sim \triangle ?$

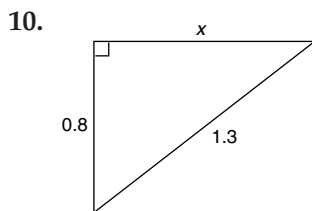
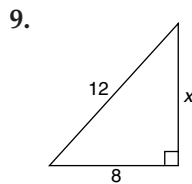
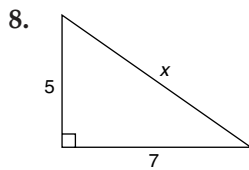
Questions 6 and 7 refer to  $\triangle PQR$  and  $\triangle TUS$ .



6. Explain why these two triangles are similar.

7. State the pairs of corresponding angles and sides.

Determine the length of the unknown side. Round to one decimal place, if necessary.



Determine whether each set of numbers is a Pythagorean Triple. Explain. For each triple, give two more in its family.

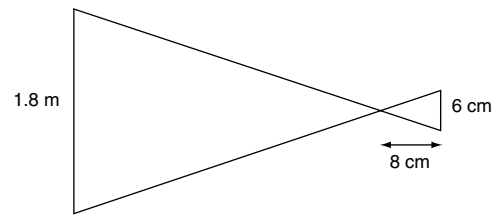
11. {6, 9, 12}

12. {13, 14, 27}

13. {22, 120, 122}

14. A tree's shadow is 3 m long. At the same time, a person who is 1.4 m tall casts a shadow that is 0.8 m long. How tall is the tree?

15. The film in a pinhole camera is 6 cm in height. It is 8 cm from the pinhole. How far from the camera must a 1.8-m tall person stand in order to be fully captured on film?



Note: diagram not to scale.

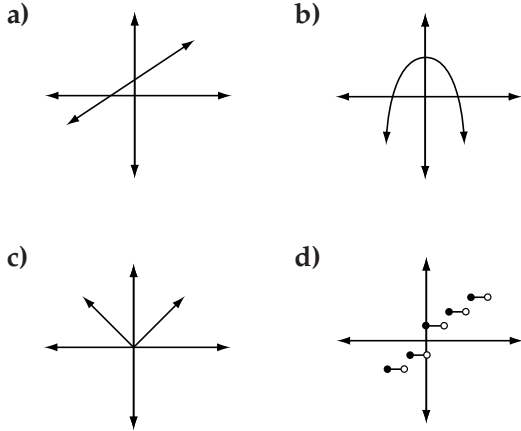
16. A rectangular field measures 120 m by 170 m. How much shorter is it to walk across it diagonally instead of along two adjoining sides?

17. A patio is to be built outward from a straight wall. Describe how to use Pythagorean Triples to make sure the patio is "square" to the wall.

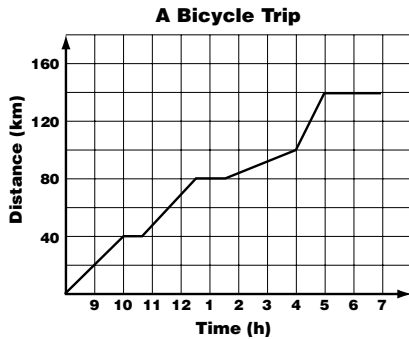
# Cumulative Review, Chapters 4–6

MATHEMATICS: Applying the Concepts 10, pages 242–245

1. Which of the graphs show piecewise linear functions?



2. The graph shows the distance travelled one day by a group of touring cyclists.



Interpret the graph. Write a description of the cyclists' day. When did they probably stop for lunch? When did they stop to visit an old church? When was the road more difficult for the cyclists?

3. Solve each system of linear equations by substitution. Then, check by graphing.

a)  $x + 4y = 6$   
 $2x - 3y = 1$

b)  $y = 2x - 13$   
 $x + 2y + 6 = 0$

4. The problem is to solve the linear system

$$3x + 2y = 2$$

$$4x + 5y = 12$$

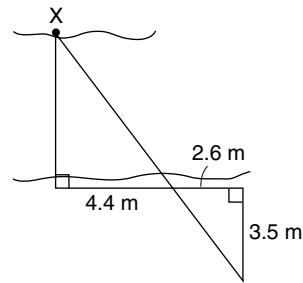
Two students compare their answers. Talia gets  $(2, -2)$  as her solution, while Fatima gets  $(-2, 4)$ .

a) Describe how you can check whether either of these solutions is correct.

b) How would you go about solving the system?

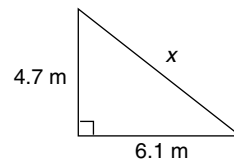
5. To find the width of a ravine, a large rock at point X on the opposite rim was used as a reference point to take measurements as recorded on the diagram.

Find the width of the ravine.

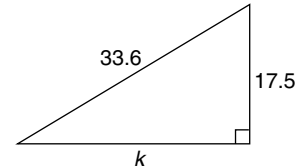


6. Use the Pythagorean Relation to find each unknown side length. Round answers to one decimal place.

a)



b)



7. Determine the missing number in each Pythagorean Triple. Tell whether the set is a primary Pythagorean Triple and, if not, find the primary triple.

a)  $\{14, \square, 50\}$       b)  $\{\square, 45, 53\}$   
 c)  $\{36, 48, \square\}$

## 7.1 Explore the Tangent Ratio

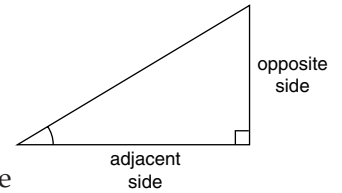
*MATHEMATICS: Applying the Concepts 10, pages 250–258*

### Key Concept

- In a right triangle, the **tangent ratio** of each non-right angle is given by

$$\text{tangent of angle} = \frac{\text{opposite side}}{\text{adjacent side}}$$

- To find an angle measure given its tangent ratio, use the correct key sequence on your calculator to get  $[\tan^{-1}]$ . Remember to set your calculator to Degree mode first.

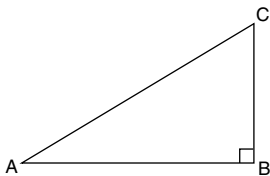


For each  $\angle A$ ,

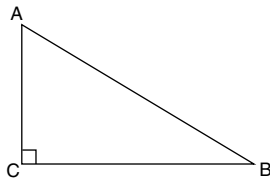
a) label the opposite side, adjacent side, and hypotenuse

b) state the tangent ratio

1.



2.



*Evaluate. Round your answer to four decimal places.*

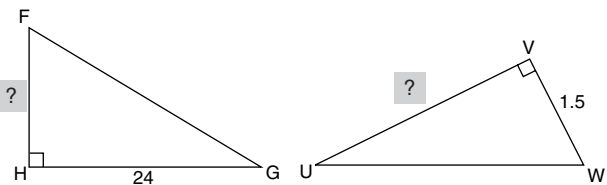
- |                      |                     |
|----------------------|---------------------|
| 3. $\tan 25^\circ$   | 4. $\tan 80^\circ$  |
| 5. $\tan 0^\circ$    | 6. $\tan 45^\circ$  |
| 7. $\tan 23.6^\circ$ | 8. $\tan 2.5^\circ$ |

*Calculate the measure of each angle. Round your answer to the nearest degree.*

- |                       |                        |
|-----------------------|------------------------|
| 9. $\tan X = 1.1918$  | 10. $\tan B = 11.4301$ |
| 11. $\tan Y = 0.2126$ | 12. $\tan P = 0.3719$  |

*Find the measure of the unknown side. Round your answer to the nearest unit, if necessary.*

- |                       |                     |
|-----------------------|---------------------|
| 13. $\tan G = 0.8333$ | 14. $\tan U = 0.75$ |
|-----------------------|---------------------|

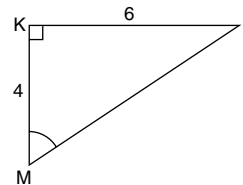


*For questions 15 to 17, refer to the right triangle shown.*

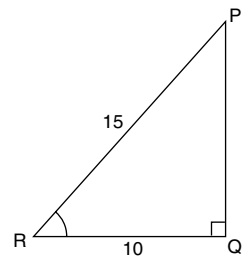
a) Use the Pythagorean Relation to find the length of the third side. Round to one decimal place, if necessary.

b) Determine the measure of the marked angle, to the nearest degree.

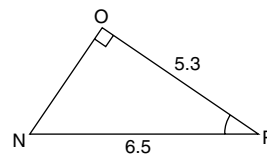
15.



16.



17.



18. The loading ramp to the back of a van makes an angle of  $15^\circ$  with the ground. The top of the ramp is 0.8 m above the ground. What is the horizontal distance from the lower end of the ramp to the back of the van? Round your answer to 1 decimal place.

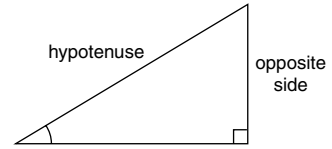
## 7.2 Explore the Sine Ratio

MATHEMATICS: Applying the Concepts 10, pages 259–265

### Key Concept

- In a right triangle, the **sine ratio** of each non-right angle is given by

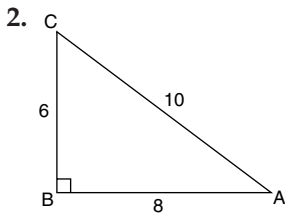
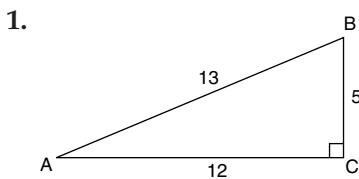
$$\text{sine of angle} = \frac{\text{opposite side}}{\text{hypotenuse}}$$



- To find an angle measure given its sine ratio, use the correct key sequence on your calculator to get  $[\sin^{-1}]$ . Remember to set your calculator to Degree mode first.

For each  $\angle A$ ,

- label the opposite side, adjacent side, and hypotenuse
- state the sine ratio



Evaluate. Round your answer to four decimal places.

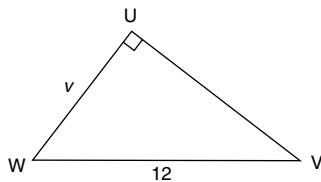
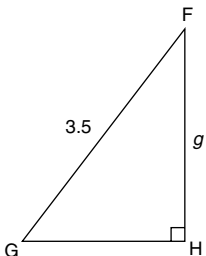
- |                    |                      |                     |
|--------------------|----------------------|---------------------|
| 3. $\sin 53^\circ$ | 4. $\sin 86^\circ$   | 5. $\sin 0^\circ$   |
| 6. $\sin 90^\circ$ | 7. $\sin 67.2^\circ$ | 8. $\sin 4.8^\circ$ |

Find the measure of each angle. Round your answer to the nearest degree.

- |                       |                       |
|-----------------------|-----------------------|
| 9. $\sin A = 0.7183$  | 10. $\sin C = 0.9781$ |
| 11. $\sin X = 0.1788$ | 12. $\sin H = 0.4321$ |

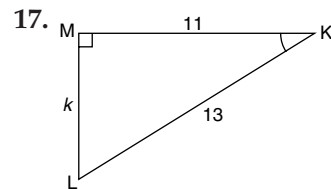
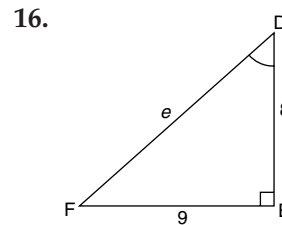
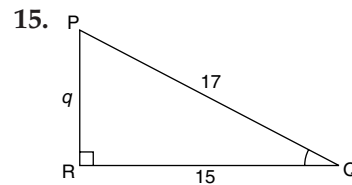
Find the measure of the unknown side. Round your answer to the nearest unit, if necessary.

- |                       |                     |
|-----------------------|---------------------|
| 13. $\sin G = 0.8667$ | 14. $\sin V = 0.75$ |
|-----------------------|---------------------|



For questions 15 to 17, refer to the triangles shown.

- Use the Pythagorean Relation to find the length of the third side. Round to one decimal place, if necessary.
- Find the sine ratio of the marked angle, to four decimal places.
- Determine the measure of the marked angle, to the nearest degree.



18. A 5-m post is leaning so that the top of the post is 0.2 m from the vertical. Through what angle must it be pushed to return it to the vertical? Round your answer to one decimal place.

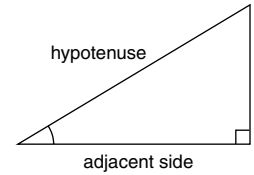
### 7.3 Explore the Cosine Ratio

*MATHEMATICS: Applying the Concepts 10, pages 266–273*

**Key Concept**

- In a right triangle, the cosine ratio of each non-right angle is given by

$$\text{cosine of angle} = \frac{\text{adjacent side}}{\text{hypotenuse}}$$



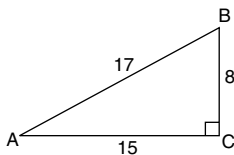
- To find an angle measure given its cosine ratio, use the correct key sequence on your calculator to get  $[\cos^{-1}]$ . Remember to set your calculator to Degree mode first.

For each  $\angle A$ ,

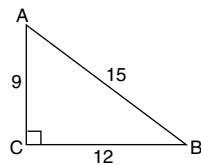
a) label the opposite side, adjacent side, and hypotenuse

b) state the cosine ratio

1.



2.



Evaluate. Round your answer to four decimal places.

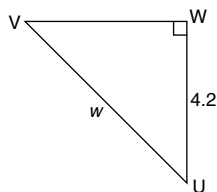
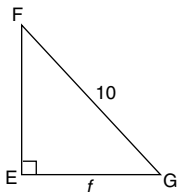
3.  $\cos 46^\circ$       4.  $\cos 81^\circ$       5.  $\cos 45^\circ$   
 6.  $\cos 90^\circ$       7.  $\cos 54.1^\circ$       8.  $\cos 2.8^\circ$

Find the measure of each angle. Round your answer to the nearest degree.

9.  $\cos A = 0.9135$       10.  $\cos M = 0.0349$   
 11.  $\cos Q = 0.7859$       12.  $\cos W = 0.9952$

Find the measure of the unknown side. Round to one decimal place, if necessary.

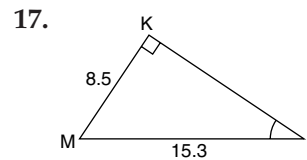
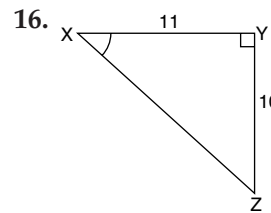
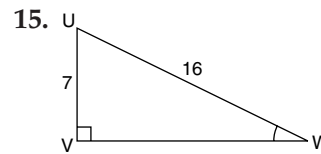
13.  $\cos G = 0.6667$       14.  $\cos U = 0.7059$



For questions 15 to 17, refer to the triangle shown.

a) Use the Pythagorean Relation to find the length of the third side. Round to one decimal place, if necessary.

b) Determine the measure of the marked angle, to the nearest degree.



18. The recommended safe angle for a firefighters' ladder to make with the ground is  $75^\circ$ . How far from the foot of a wall should the foot of a 5-m long ladder be placed? Round your answer to 1 decimal place.

## 7.4 Apply Trigonometry

MATHEMATICS: Applying the Concepts 10, pages 274–277

i) Draw a diagram for each problem, if one is not provided.

ii) Label your diagram.

iii) Use trigonometry to solve the problem, rounding to one decimal place where necessary.

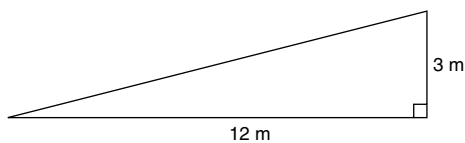
iv) Write a sentence to answer the problem.

1. A surveyor is at the top of one side of a gorge. The angle of depression from there to the base of the opposite side of the 300-m wide gorge is  $31.5^\circ$ . How deep is the gorge?

2. A weather balloon is tethered to a 500-m line. The angle of elevation of the line is  $68^\circ$ . What is the altitude of the balloon?

3. A 1.8-m tall botanist is standing 8.0 m away from a tall tree. The angle of elevation to the top of the tree is  $57^\circ$ . How tall is the tree?

4. A steel ramp is 12 m long and rises 3 m. What angle does the ramp make with the ground?

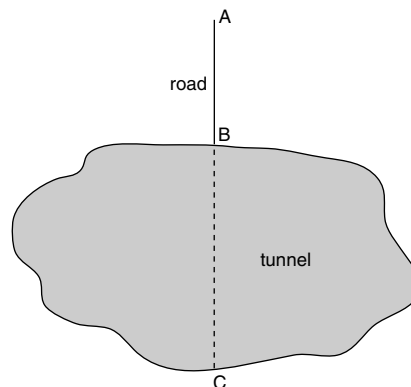


5. A road rises 8 m over a distance of 90 m along its surface. At what angle is the road climbing?

6. A 5-m ladder rests against a wall, with the foot of the ladder 1.5 m from the base of the wall. What angle does the ladder make with the ground?

7. For a safe angle of between  $70^\circ$  and  $80^\circ$  with the ground, how far from the base of a wall can the foot of a 10-m ladder be placed?

8. A tunnel needs to be drilled through the base of a mountain, as shown in the diagram. Describe the measurements a surveyor would take and how the surveyor could use trigonometry to determine the length of the tunnel.



## Chapter 7 Review

*MATHEMATICS: Applying the Concepts 10, pages 280–281*

*Find each value, to four decimal places.*

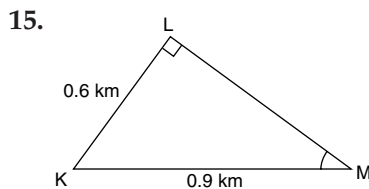
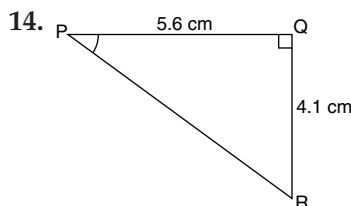
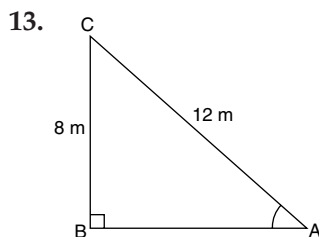
- |                      |                      |
|----------------------|----------------------|
| 1. $\tan 46^\circ$   | 2. $\sin 23^\circ$   |
| 3. $\cos 76^\circ$   | 4. $\tan 21^\circ$   |
| 5. $\cos 12.1^\circ$ | 6. $\sin 17.5^\circ$ |

*Find each angle, to the nearest degree.*

7.  $\sin X = 0.7314$
8.  $\cos B = 0.6972$
9.  $\tan Y = 1.9970$
10.  $\tan W = 0.0175$
11.  $\sin G = 0.2588$
12.  $\cos A = 0.2656$

*For questions 13 to 15, refer to the triangle shown.*

- a) Use the Pythagorean Relation to find the length of the third side. Round to one decimal place, if necessary.
- b) Label the hypotenuse, opposite side, and adjacent side of the indicated angle.
- c) Determine the tangent, sine, and cosine ratios of the indicated angle. Round to four decimal places.
- d) Use one of the ratios to calculate the measure of the indicated angle, to the nearest degree. Check using another ratio.



*For questions 16 to 18,*

- i) draw and label a diagram
- ii) use trigonometry to solve the problem, rounding to one decimal place, where necessary
- iii) write a sentence to answer the problem

16. An airplane is flying at an altitude of 2000 m. The angle of depression to an airstrip is  $12^\circ$ .

- a) What is the plane's horizontal distance from the airstrip?
- b) What is the direct distance from the plane to the airstrip?

17. A 60-m tower is supported by a guy wire attached to the top. If the wire has an angle of elevation of  $75^\circ$ , how long is it?

18. A sailboat is sailing toward a 15-m tall lighthouse. The sailor drops anchor 80 m from the base of the lighthouse. From this point, what is the angle of elevation from the boat to the top of the lighthouse?

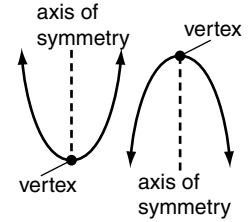


## 8.1 Introduce Quadratic Functions

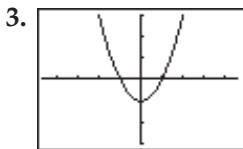
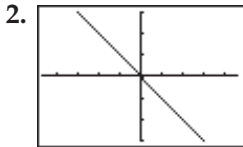
*MATHEMATICS: Applying the Concepts 10, pages 288–292*

### Key Concept

- The base equation that defines a quadratic function is  $y = x^2$ .
- The graph of a quadratic function is a U-shaped curve called a parabola.
- A quadratic function has a maximum, or minimum, value at its vertex.
- A quadratic function is symmetric about the vertical line that passes through the vertex. This line is called the axis of symmetry.



Indicate which are graphs of quadratic functions.



Determine the value of  $y$  when  $x = -2$ .

4.  $y = x + 5$

5.  $y = x^2 + 1$

6.  $y = -x^2 - 3$

Predict whether the graph of each relation is a parabola. Graph each one for integer values of  $x$  from  $-3$  to  $3$  to check.

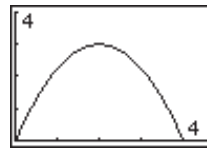
7.  $y = 2x$

8.  $y = 3x^2$

9.  $y = (x - 1)^2$

10.  $y = x^2 + 1$

11. The graph shows the path of a kicked soccer ball. The horizontal scale is the time, in seconds, since the ball was kicked. The vertical scale is the height above ground, in metres.



- How many seconds after it was kicked did the ball reach its maximum height?
- What was the maximum height reached by the ball?
- For how many seconds was the ball in the air?

12. The garden in front of a house is a square with side length 8 m. The owner has decided to plant flowers around the perimeter and have a square of grass in the centre. If the length of each side of the square of grass (in metres) is  $x$ , then the area of the flower beds (in square metres) is given by  $A = 64 - x^2$ .

- Use at least six possible values for  $x$  and construct a table of values for the relation between  $x$  and  $A$ .

b) Graph the relation. Use the window settings shown.

```

WINDOW
Xmin=0
Xmax=9.4
Xscl=1
Ymin=0
Ymax=80
Yscl=10
Xres=1
    
```

- Can  $x$  ever be negative? Explain.
- Can  $A$  ever be negative? Explain.
- What is the maximum value that  $x$  can ever be? Why? What values do you think would be reasonable here? Explain.

## 8.2 Quadratic Functions of the Form $y = ax^2$

MATHEMATICS: Applying the Concepts 10, pages 293–299

### Key Concept

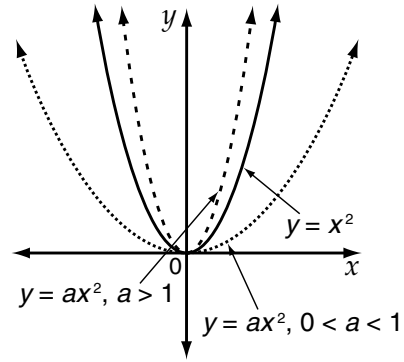
Compared to  $y = x^2$ , the graph of  $y = ax^2$  is

- stretched vertically, and thus narrower, if  $a > 1$
- compressed vertically, and thus wider, if  $0 < a < 1$

If  $a$  is positive, the parabola opens upward.

If  $a$  is negative, the parabola opens downward.

The vertex of  $y = ax^2$  is at  $(0, 0)$ .



Set up tables of values for integer values of  $x$  from  $-3$  to  $3$ . Graph each set of three quadratic functions on the same set of axes.

- $y = x^2$ ,  $y = 3x^2$ ,  $y = \frac{1}{3}x^2$
- $y = x^2$ ,  $y = -x^2$ ,  $y = -3x^2$
- $y = -x^2$ ,  $y = -\frac{1}{4}x^2$ ,  $y = -4x^2$
- $y = x^2$ ,  $y = 2x^2$ ,  $y = -2x^2$

State whether the parabola opens upward or downward, and whether its graph would be vertically stretched or compressed, as compared to  $y = x^2$ .

- $y = 6x^2$
- $y = -3.2x^2$
- $y = \frac{3}{4}x^2$
- $y = -\frac{2}{3}x^2$

Write an equation for each quadratic function using the transformation described.

- Stretch the graph of  $y = x^2$  vertically by a factor of 8.
- Compress the graph of  $y = x^2$  vertically by a factor of  $\frac{1}{5}$ .
- Stretch the graph of  $y = -x^2$  vertically by a factor of 6.
- Compress the graph of  $y = -x^2$  vertically by a factor of 0.5.

13. The speed that an object sinks to the bottom of an ocean can be expressed as a function of the object's diameter. The speed,  $s$ , in metres per second, is related to the diameter,  $d$ , in millimetres, by  $s = 0.0655d^2$ .

a) Graph the relationship for diameters up to 10 mm.

```
WINDOW
Xmin=0
Xmax=10
Xscl=1
Ymin=0
Ymax=10
Yscl=1
Xres=1
```

b) If the diameter of a pebble is 8 mm, how long does it take, to one decimal place, for it to sink to the bottom?

14. The approximate area,  $A$ , of an equilateral triangle is given by the formula  $A = 0.433x^2$ , where  $x$  is the length of each side.

a) Graph the relationship for lengths up to 10 cm.

```
WINDOW
Xmin=0
Xmax=10
Xscl=1
Ymin=0
Ymax=50
Yscl=5
Xres=1
```

b) Use your graph to find the approximate side length of an equilateral triangle with an area of  $35 \text{ cm}^2$ .

## 8.3 Quadratic Functions of the Form $y = x^2 + k$

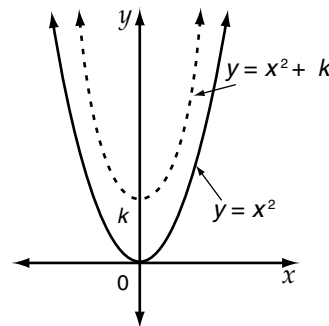
*MATHEMATICS: Applying the Concepts 10, pages 300–304*

### Key Concept

Given the equation for a quadratic function,  $y = x^2 + k$ ,

- the vertex of the parabola is at  $(0, k)$
- the value  $k$  is the  $y$ -intercept of the parabola
- its graph can be obtained from the graph of  $y = x^2$  by a vertical translation of  $k$  units

If  $k$  is positive, the graph is shifted upward and there are no  $x$ -intercepts. If  $k$  is negative, the graph is shifted downward and there are two  $x$ -intercepts.



*Set up tables of values for  $x$  from  $-3$  to  $3$ . Graph each set of three functions on the same set of axes.*

- $y = x^2, y = x^2 + 1, y = x^2 + 3$
- $y = x^2, y = x^2 - 2, y = x^2 - 4$
- $y = -x^2, y = -x^2 + 5, y = -x^2 - 1$
- $y = x^2, y = x^2 + 2, y = x^2 - 6$

*Determine the  $y$ -intercept and state the coordinates of the vertex for each parabola.*

- $y = x^2 + 8$
- $y = x^2 - 5$
- $y = -x^2 - 4$
- $y = -x^2 + 9$

*For each quadratic function,*

- find the  $y$ -intercept
- find the  $x$ -intercepts
- indicate whether the parabola is a translation upward or downward of  $y = x^2$  or  $y = -x^2$ , and by how much
- sketch the graph on grid paper
- check your work using a graphing calculator, with the standard window settings

- $y = x^2 - 1$
- $y = x^2 - 9$
- $y = -x^2 + 1$
- $y = x^2 - 0.64$
- $y = -x^2 + 4$
- $y = x^2 + 4$

15. The equations for two quadratic functions are given. Describe how the graphs in each pair are similar and how they are different. Check by graphing.

- $y = x^2 + 3, y = -x^2 + 3$
- $y = x^2 - 7, y = 3x^2 - 7$
- $y = -x^2 - 2, y = x^2 + 2$
- $y = x^2 + 3, y = 2x^2 + 1$

16. The shape of a parabolic mirror in a telescope is described by the equation  $y = 0.2x^2 - 15$ , where  $x$  and  $y$  are measured in centimetres.

a) Graph the shape using the given window settings.

```

WINDOW
Xmin=-10
Xmax=10
Xscl=1
Ymin=-15
Ymax=0
Yscl=1
Xres=1
  
```

- Determine the depth of the mirror.
- The distance between the  $x$ -intercepts represents the diameter of the mirror. Determine the diameter of the mirror.

17. Work with a partner to answer the following. Justify the method that you use.

- A parabola has a  $y$ -intercept of  $-9$  and passes through the point  $(2, -1)$ . Find an equation for the parabola in the form  $y = ax^2 + k$ .
- A parabola has a  $y$ -intercept of  $5$  and an  $x$ -intercept of  $3$ . Determine an equation for the parabola in the form  $y = ax^2 + k$ .

## 8.4 Quadratic Functions of the Form $y = (x - h)^2$

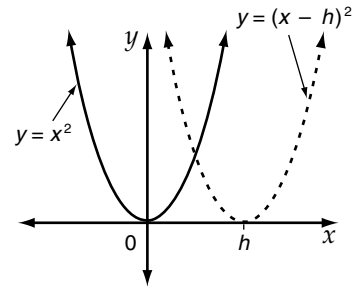
MATHEMATICS: Applying the Concepts 10, pages 305–311

### Key Concept

Given the quadratic function  $y = (x - h)^2$ ,

- the vertex of the parabola is at  $(h, 0)$
- the value  $h$  is the  $x$ -intercept of the parabola
- its graph can be obtained from the graph of  $y = x^2$  by a horizontal translation of  $h$  units

If  $h < 0$ , the shift is to the left. If  $h > 0$ , the shift is to the right.



State the  $x$ -intercept and write the coordinates of the vertex of each parabola.

1.  $y = (x - 5)^2$
2.  $y = (x + 4)^2$
3.  $y = (x - 9)^2$
4.  $y = (x + 11)^2$

Describe the translation that can be used to obtain a graph of each given the graph of  $y = x^2$ .

5.  $y = (x - 4)^2$
6.  $y = (x + 1)^2$
7.  $y = (x + 7.5)^2$
8.  $y = (x - 6)^2$

Write an equation for the quadratic function that can be drawn as follows.

9. Move the graph of  $y = x^2$  six units to the right.
10. Move the graph of  $y = x^2$  eight units to the left.
11. Move the graph of  $y = x^2$  five units to the left.
12. Move the graph of  $y = x^2$  two units to the right.

For each quadratic function,

- i) state the coordinates of the vertex
- ii) find the  $x$ -intercept(s)
- iii) find the  $y$ -intercept
- iv) indicate whether the parabola is a horizontal or vertical translation of  $y = x^2$  and by how many units in which direction
- v) sketch the graph on grid paper and check your work using a graphing calculator with standard window settings

13.  $y = (x - 2)^2$
14.  $y = (x + 3)^2$
15.  $y = (x - 1)^2$
16.  $y = x^2 - 1$
17.  $y = (x + 2)^2$
18.  $y = x^2 + 5$

19. A railway bridge built over a river has a supporting arch underneath. If the railway track is considered as the  $x$ -axis, then the arch can be represented by the function  $y = -0.2(x - 15)^2$ , where  $x$  is the horizontal distance, in metres. The value of  $y$  represents the distance, in metres, between the road and the arch.

a) Graph the arch for  $0 \leq x \leq 30$ . Use the window settings shown.

```

WINDOW
Xmin=0
Xmax=30
Xscl=5
Ymin=-50
Ymax=0
Yscl=5
Xres=1
  
```

- b) What is the distance across the river?
- c) How far below the railway track is the river?

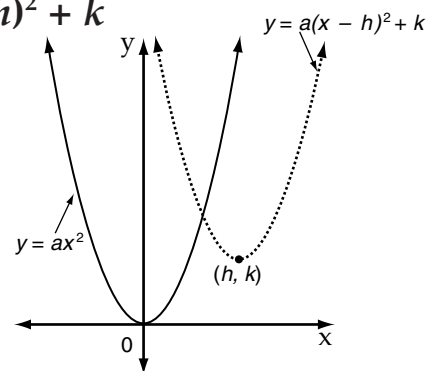
## 8.5 Quadratic Functions of the Form $y = a(x - h)^2 + k$

*MATHEMATICS: Applying the Concepts 10, pages 312–316*

### Key Concept

If the equation of a quadratic function is expressed in the form  $y = a(x - h)^2 + k$ , where  $a$ ,  $h$ , and  $k$  are real numbers and  $a$  is not zero, then the parabola

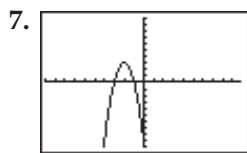
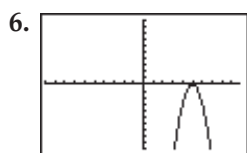
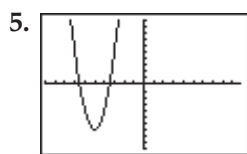
- has the same shape as  $y = ax^2$
- has its vertex at  $(h, k)$
- opens upward if  $a > 0$ , downward if  $a < 0$



*Give the coordinates of the vertex for each parabola.*

- $y = (x - 5)^2 + 8$
- $y = 3(x + 6)^2 - 2$
- $y = -2(x + 3)^2 + 7$
- $y = 4(x - 8)^2 - 3$

*The standard window was used to graph three quadratic functions. Each one has the same shape as  $y = 3x^2$ . Write the equation of each graph.*



*For each quadratic function,*

- state the coordinates of the vertex
- indicate whether the parabola opens upward or downward
- find the  $y$ -intercept
- sketch the graph on grid paper
- check your work using a graphing calculator

- $y = (x - 2)^2 - 3$
- $y = (x + 1)^2 + 5$

10.  $y = -(x + 4)^2 + 8$

11.  $y = 2(x - 1)^2 + 3$

12.  $y = -3(x - 2)^2 + 6$

13.  $y = 4(x + 1)^2 - 7$

14. The path of a volleyball can be approximated by the quadratic function  $h = -5(t - 6)^2 + 15$ , where  $t$  is time, in seconds, and  $h$  is height, in metres.

- After how many seconds of flight does the volleyball reach its maximum height?
- What is the maximum height reached by the volleyball?

15. The rate of fuel consumption of a certain aircraft is given approximately by the quadratic function  $C = 0.01(v - 250)^2 + 375$ , where  $C$  is the fuel consumption, in litres per hour, and  $v$  is the speed, in kilometres per hour.

- At what speed is the fuel consumption the lowest?
- Graph the function using the given window settings. What is the fuel consumption when the aircraft is travelling 400 km/h?

```

WINDOW
Xmin=0
Xmax=500
Xscl=50
Ymin=0
Ymax=1000
Yscl=100
Xres=1
    
```

## Chapter 8 Review

*MATHEMATICS: Applying the Concepts 10, pages 318–319*

1. Predict which relations are quadratic functions. Check by graphing.

a)  $y = 4x - 1$     b)  $y = 3x^2$     c)  $y = -1.5x^2 + 9$

2. Imagine the following six quadratic functions graphed on the same set of axes. Order them from widest to narrowest. Check by graphing.

$$y = \frac{1}{3}x^2, y = 3x^2, y = 0.2x^2,$$

$$y = x^2, y = 5x^2, y = \frac{1}{10}x^2$$

3. Write an equation for the quadratic function that can be drawn as follows.

a) Stretch the graph of  $y = x^2$  vertically by a factor of 6.

b) Compress the graph of  $y = x^2$  vertically by a factor of  $\frac{1}{4}$ .

c) Move the graph of  $y = x^2$  four units downward

d) Move the graph of  $y = -x^2$  seven units upward.

e) Move the graph of  $y = x^2$  five units to the right.

f) Move the graph of  $y = x^2$  twelve units to the left.

4. A parabolic reflector for picking up sound can be represented by the quadratic function  $y = 0.005x^2 - 18$ , where  $x$  and  $y$  are both measured in centimetres.

a) Graph the shape using the window settings shown.

```

WINDOW
Xmin=-80
Xmax=80
Xscl=10
Ymin=-20
Ymax=0
Yscl=2
Xres=1

```

b) The location of the vertex represents the depth of the reflector. How deep is the reflector?

c) The distance between the  $x$ -intercepts represents the diameter of the reflector. Determine the diameter.

5. State the coordinates of the vertex of each parabola, and tell whether it opens upward or downward.

a)  $y = (x + 3)^2$

b)  $y = (x - 1)^2$

c)  $y = -(x + 2)^2$

d)  $y = (x - 12)^2 + 5$

e)  $y = -4(x + 3)^2 - 1$

f)  $y = 2(x + 4)^2 + 7$

6. For each quadratic function,

i) state the coordinates of the vertex

ii) state the vertical stretch or compression factor

iii) sketch the graph on grid paper

iv) check your work using a graphing calculator with the standard window

a)  $y = 2(x + 3)^2 - 4$

b)  $y = -3(x - 2)^2 + 5$

c)  $y = \frac{1}{2}(x - 1)^2 - 2$

7. A bridge has a parabolic railing on each side of it. The railing can be described by the function  $y = -0.001(x - 50)^2 + 2.5$ , where  $x$  is the horizontal distance and  $y$  is the height. Both are measured in metres.

a) What is the maximum height of the railing?

b) If the railing starts at one end of the bridge and ends at the other, what is the length of the bridge?

## 9.1 Multiply Two Binomials

*MATHEMATICS: Applying the Concepts 10, pages 326–329*

### Key Concept

The product of two binomials can be found by

- multiplying each term in one binomial by each term in the other binomial

The product of two binomials can be checked

- by graphing the factors and the product, using a graphing calculator, and seeing that only one graph appears

*Expand and simplify. Check by graphing with a graphing calculator.*

1.  $(x + 4)(x + 5)$

2.  $(m + 3)(m - 8)$

3.  $(a - 2)(a - 3)$

4.  $(p - 7)(p + 4)$

5.  $(2y + 5)(y + 3)$

6.  $(3n - 6)(2 + n)$

*Find the product.*

7.  $(3k + 1)(k - 4)$

8.  $(4x - 3)(x - 5)$

9.  $(2v - 3)(2v + 3)$

10.  $(x + 7)(2x + 2)$

*For questions 11 and 12,*

*a) multiply the binomials to find a simplified expression for the area*

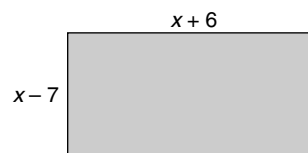
*b) substitute the value for  $x$  in the expression for the area from part a), and evaluate*

*c) substitute the value for  $x$  in the expressions for the dimensions given on the diagram and evaluate; calculate the area using these dimensions*

*d) check your work by comparing your answers to parts b) and c)*

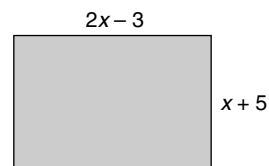
11. Swimming pool

$x = 15$  m



12. Garden

$x = 6$  m



## 9.2 Special Products

*MATHEMATICS: Applying the Concepts 10, pages 330–333*

### Key Concept

- The square of a binomial is the sum of the square of the first term, twice the product of the two terms, and the square of the last term.
- The product of a sum and a difference of the same two terms is the sum of the product of the first terms and the product of the last terms.

*Square each binomial. Check by graphing, using a graphing calculator.*

1.  $(x + 4)^2$

2.  $(p + 9)^2$

3.  $(2w + 7)^2$

4.  $(a - 3)^2$

5.  $(3f - 4)^2$

*Expand and simplify. Check by graphing, using a graphing calculator.*

6.  $(x - 5)(x + 5)$

7.  $(z + 12)(z - 12)$

8.  $(2p - 1)(2p + 1)$

9.  $(7d - 3)(7d + 3)$

10.  $(6 + 9t)(6 - 9t)$

11. Find the product of 62 and 58 using the product of a sum and a difference.

*Expand and simplify.*

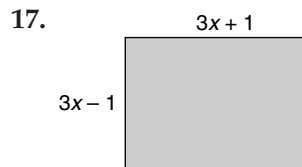
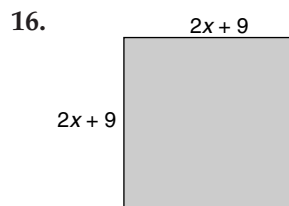
12.  $(m + 6)^2$

13.  $(v - 8)(v + 8)$

14.  $(6x - 5)^2$

15.  $(7y - 3)(3 + 7y)$

*Find a simplified expression for each area.*



## 9.3 Expand and Simplify Polynomial Expressions

*MATHEMATICS: Applying the Concepts 10, pages 334–337*

### Key Concept

To expand and simplify polynomial expressions,

- expand each product and collect like terms

If the expression involves a subtraction, such as  $-(x - 2)$  or  $-3(x - 2)$ ,

- multiply by the negative number,  $-1$  or  $-3$

If the expression involves a subtraction, such as  $-(x - 2)^2$  or  $-(x - 2)(x + 1)$ ,

- expand the binomials and then, multiply by  $-1$

*Expand and simplify.*

1.  $(x + 4)(x - 1) + (x + 6)(x + 1)$

2.  $(4n - 5)^2 + (2n - 5)(2n + 5)$

3.  $(3k + 2)(3k - 2) - 4(k - 6)$

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

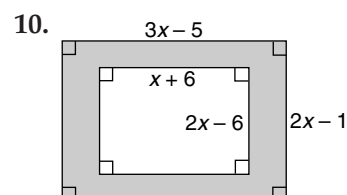
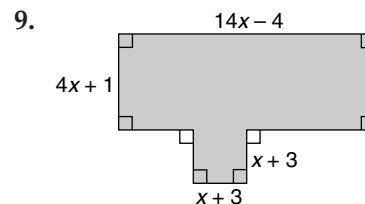
5.  $(4q - 3)(4q + 3) - (q^2 - 4q + 9)$

6.  $(3h - 4)(3h - 2) - (2h + 1)^2$

7.  $-(2 - w)(2 + w) - (w + 4)^2$

8.  $6k(2 + k) - 3(k - 4)^2$

*Write, expand, and simplify an expression for each shaded area.*



## 9.4 Common Factors

*MATHEMATICS: Applying the Concepts 10, pages 338–341*

### Key Concept

To factor a polynomial by finding common factors, identify the GCF

- of the numerical coefficients of the terms, and
- of the variable parts of the terms

*Factor each polynomial fully. Check by expanding.*

1.  $3x - 12$

2.  $12a + 30$

3.  $4a - 16b + 6$

4.  $60 + 24p + 36q$

5.  $2v^2 - 5v$

6.  $x^3 + 6x^2$

7.  $7z^3 - 15z^2 + z$

8.  $12s - 4s^2$

9.  $6m^2 + 9m^3$

10.  $8p^2 + 4p - 16p^3$

11.  $10t^2 - 5t + 30$

12.  $36c^2 + 18c^3 - 24c^5$

*Factor fully to find expressions for the dimensions of each rectangle.*



$A = 16x + 24y$



$A = 8w^2 + 32w - 16$



$A = 5t^3 - 3t^2 + 2t$



$A = 14p^3 - 7p^2 + p$

## 9.5 Factors of a Difference of Squares

*MATHEMATICS: Applying the Concepts 10, pages 342–344*

### Key Concept

To factor a binomial fully,

- if there is a GCF, factor it out
- check to see if the other factor is a difference of squares

To factor a difference of squares,

- express as the product of a sum and a difference

*Factor each difference of squares. Check by graphing, using a graphing calculator.*

1.  $m^2 - 64$

2.  $x^2 - 36$

3.  $v^2 - 100$

4.  $k^2 - 1$

5.  $4h^2 - 49$

6.  $81p^2 - 16$

7.  $9 - u^2$

8.  $121 - 25t^2$

*Factor fully. Check by expanding.*


9.  $20x^2 - 45$


10.  $48y^2 - 27$


11.  $63 - 7p^2$


12.  $64h^3 - 25h$

*Find expressions for the dimensions of each rectangle by factoring.*

13.   
 $A = 16x^2 - 1$

14.   
 $A = 36w^2 - 121$

15.   
 $A = a^2 - b^2$

16.   
 $A = u^2 - 100v^2$

## 9.6 Factors of Trinomials of the Form $x^2 + bx + c$

*MATHEMATICS: Applying the Concepts 10, pages 345–348*

### Key Concept

For a trinomial of the form  $x^2 + bx + c$ ,

- the factors are of the form  $(x + m)(x + n)$ , where  $m + n = b$  and  $mn = c$

If the constant term,  $c$ , is a perfect square,

- try using its positive square root for both  $m$  and  $n$  if the sign of the coefficient of the  $x$ -term,  $b$ , is positive
- try using its negative square root for both  $m$  and  $n$  if the sign of the coefficient of the  $x$ -term,  $b$ , is negative

*Factor each trinomial. Check by expanding and simplifying, or by graphing, using a graphing calculator.*

1.  $x^2 + 5x + 6$

2.  $y^2 + 13y + 42$

3.  $m^2 - 7m + 12$

4.  $a^2 - 12a + 20$

5.  $p^2 + 19p - 20$

6.  $b^2 + 3b - 18$

7.  $h^2 - 5h - 24$

8.  $s^2 - 2s - 8$

9.  $w^2 + 8w + 16$

10.  $k^2 - 15k + 50$

11.  $c^2 - 12c - 45$

12.  $g^2 - 2g - 48$

*Factor each trinomial fully. Check by expanding and simplifying.*


13.  $5x^2 + 15x - 20$

14.  $6v^2 - 6v - 120$

*Find expressions for the dimensions of each rectangle by factoring.*

15. 

$$A = x^2 + 12x - 28$$

16. 

$$A = y^2 - 14y + 49$$

## 9.7 Solve Quadratic Equations by Factoring

*MATHEMATICS: Applying the Concepts 10, pages 349–352*

### Key Concept

To solve a quadratic equation by factoring,

- expand it and express it as a polynomial equal to 0 if not already
- factor the polynomial fully
- set each factor equal to 0 and solve

*Solve by factoring.*

1.  $x^2 - 4x + 3 = 0$

2.  $m^2 + 3m - 10 = 0$

3.  $w^2 + 8w + 15 = 0$

4.  $p^2 - 7p - 30 = 0$

5.  $b^2 - 3b + 2 = 0$

6.  $t^2 + 5t - 14 = 0$

7.  $h^2 - 36 = 0$

8.  $n^2 + 6n - 16 = 0$

9.  $d^2 - 3d = 0$

10.  $y^2 + 2y = 15$

11.  $4u^2 - 25 = 0$

12.  $s(s - 9) = -14$

13.  $a^2 - 30 = 13a$

14.  $(x - 6)(x + 8) = 15$

15.  $(z - 5)(z - 6) = 42$

**16. Living room floor** The floor area of a rectangular living room can be modelled by  $x(x - 1) = 20$ . The length is  $x$  metres. The width is  $(x - 1)$  metres. Solve a quadratic equation to find the dimensions.

**Chapter 9 Review**

MATHEMATICS: Applying the Concepts 10, page 354

*Expand and simplify.*

1.  $(k + 5)(k - 3)$

2.  $(p - 7)(p - 4)$

3.  $(x + 2)(x + 9)$

4.  $(2w + 5)(w + 2)$

*Find each product.*

5.  $(v - 7)(v + 7)$

6.  $(k + 4)^2$

7.  $(x - 5)^2$

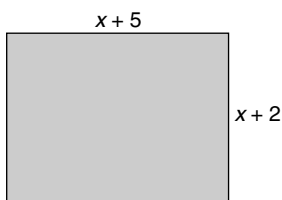
8.  $(2g - 1)(2g + 1)$

*Expand and simplify.*

9.  $2(x - 3)^2 + (x - 3)(x + 5)$

10.  $4(x + 3)(x + 4) - (x - 2)(x + 2)$

11. Write, expand, and simplify an expression for the rectangle.

*Factor fully by finding the GCF. Check by expanding.*

12.  $8h - 12$

13.  $6x^2 + 15x - 12$

14.  $5w^2 - 14w$

*Factor each binomial fully. Check by expanding.*

15.  $x^2 - 81$

16.  $16 - 25k^2$

*Factor each trinomial. Check by expanding.*

17.  $w^2 + 12w + 35$

18.  $s^2 + 6s + 9$

19.  $h^2 - 12h - 45$

20. Factor  $4x^2 + 40x + 100$  fully. Check by expanding.*Solve each quadratic equation by factoring.*

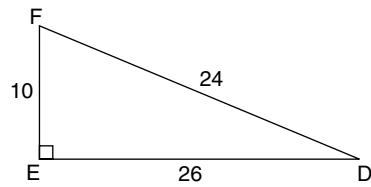
21.  $k^2 - 2k - 15 = 0$

22.  $w(w - 1) = 72$

## Cumulative Review, Chapters 7–9

MATHEMATICS: Applying the Concepts 10, pages 356–359

1. a) Write the tangent ratio for  $\angle D$ .

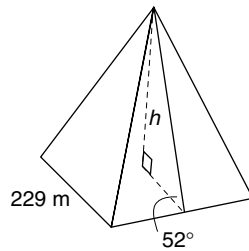


- b) Write the sine ratio for  $\angle D$ .

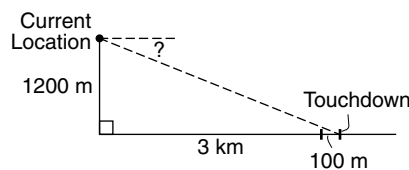
- c) Write the cosine ratio for  $\angle D$ .

- d) Determine the measure of  $\angle D$ , rounded to one decimal place.

2. The Great Pyramid of Giza has a square base, which is easily measured. The angle to its top can also be easily measured. Find the height,  $h$ , of the pyramid, rounded to one decimal place.

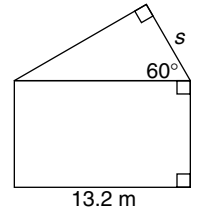


3. An airplane flying at an altitude of 1200 m and 3 km from



- the start of a landing strip begins descending. Its wheels are to touch the landing strip 100 m from the start. At what angle, rounded to the nearest degree, should it descend?

4. A house designed for solar heating has a roof shaped like a right triangle. Find the length,  $s$ , of the solar collectors.



5. A rocket takes off and accelerates such that its height,  $h$ , in metres, is related to time,  $t$ , in seconds, by  $h = 12.5t^2$ .

- a) Graph the function for  $t = 0$  to  $t = 10$ .

- b) How far has the rocket travelled after 8 s?

6. Compare the graphs of the parabolas  $y = x^2 - 6$  and  $y = (x - 6)^2$ , giving the coordinates of their vertices and their  $y$ -intercepts.

7. For each parabola, give the coordinates of the vertex, the direction of opening, and the  $y$ -intercept. Check your answers using a graphing calculator.

a)  $y = 3(x + 1)^2 - 2$

b)  $y = -2(x - 3)^2 + 4$

8. One part of the flight path of a plane is given by  $h = -5(t - 8)^2 + 15\,000$ , where  $t$  is time, in seconds, and  $h$  is height, in metres.

a) After how many seconds of flight will the plane reach its maximum height on this path?

b) What is the maximum height reached?

9. Expand and simplify.

a)  $(x + 5)(x + 3)$

b)  $(2x - 3)(x + 4)$

c)  $(7 - m)(3 - m)$

d)  $(2p + 3)^2$

e)  $(d - 9)(d + 9)$

f)  $(3w - 4)^2$

g)  $2(a + 3)^2 + 3(a - 1)(a + 3)$

h)  $3(x - 4)(x + 4) - (2x - 1)^2$

10. Factor fully.

a)  $4x^3 - 24x^2 + 12x$

b)  $x^2 + 14x + 40$

c)  $9x^2 - 49$

d)  $x^2 + 4x - 21$

e)  $x^2 - 16x + 64$

f)  $3x^2 - 30x - 168$

11. Solve by factoring.

a)  $a^2 - a - 6 = 0$

b)  $p^2 - 25 = 0$

c)  $n^2 + 5n - 24 = 0$

d)  $z^2 + 12z + 36 = 0$

e)  $x(x - 8) = 20$

f)  $(w - 9)(w - 5) = -3$

12. The area of a rectangular plot of farmland is modelled by  $x(x - 30) = 4000$ , where  $x$  represents the length of the plot and  $(x - 30)$  represents the width. Both measurements are in metres.

Determine the dimensions of the plot.

## 10.1 Relate Roots and Intercepts

MATHEMATICS: Applying the Concepts 10, pages 364–368

### Key Concept

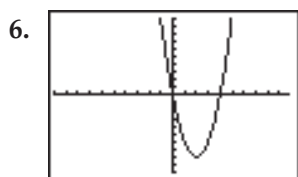
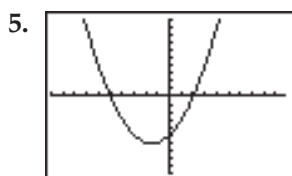
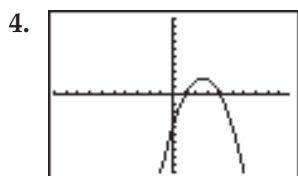
- The roots of the equation  $x^2 + bx + c = 0$  are the zeros, or  $x$ -intercepts, of the function  $y = x^2 + bx + c$ .

Determine the  $y$ -intercept of each quadratic function.

1.  $y = x^2 - 13x + 7$                       2.  $y = 2x^2 + 9x - 5$

3.  $y = -\frac{1}{3}x^2 - 10x - 3$

The graphs of three quadratic functions are shown in the standard window. What are the  $x$ -intercepts of each parabola?



For each of the following,

- state the  $y$ -intercept
- find the  $x$ -intercept(s)
- use the intercepts to sketch the graph
- check your work using a graphing calculator

7.  $y = x^2 - 5x + 6$

8.  $y = x^2 - 1$

9.  $y = x^2 + 6x + 8$

10.  $y = x^2 - 6x + 5$

11.  $y = x^2 - 6x + 9$

12.  $y = x^2 + 7x + 6$

For each of the following,

- state the  $y$ -intercept
- factor out the common factor, then, find the  $x$ -intercept(s)
- use the intercepts to sketch the graph
- check your work using a graphing calculator

13.  $y = -x^2 + 4x - 4$

14.  $y = 2x^2 + 4x - 6$

15.  $y = -3x^2 - 9x - 6$

16. The path of a football is given by  $y = -0.00625x^2 + 0.5x$ , where  $x$  is the horizontal distance from the point at which the ball is kicked and  $y$  is the height. Both variables are measured in metres.

- Determine the zeros of the function. Explain what each of the zeros means in this context.
- Use the zeros to help you graph the function.
- What is the maximum height reached by the ball?

17. Maria dives from a platform such that her path is described by  $y = -x^2 + 2x + 8$ , where  $x$  is her horizontal distance from the platform and  $y$  is her height above the water. Both variables are measured in metres.

- What does the  $y$ -intercept represent here?
- Factor to determine the zeros of the function. Graph the function. What is Maria's horizontal distance from the platform when she hits the water?
- What is her maximum height above the water?

## 10.2 Standard and General Forms of a Quadratic Function

MATHEMATICS: Applying the Concepts 10, pages 369–374

### Key Concept

- The equation of a quadratic function may be expressed in the form  $y = a(x - h)^2 + k$ . This is the standard form. From this form, you know that the vertex of the parabola is at  $(h, k)$ .
- The equation of a quadratic function may be expressed in the form  $y = ax^2 + bx + c$ . This is the general form. From this form, you know that the  $y$ -intercept of the parabola is  $c$ . The  $x$ -intercepts can be found by solving the equation  $ax^2 + bx + c = 0$ .
- By expanding and simplifying, you can change an equation from the form  $y = a(x - h)^2 + k$  to the form  $y = ax^2 + bx + c$ .

For each quadratic function,

a) state the coordinates of the vertex

b) expand and simplify to express in the form

$$y = ax^2 + bx + c$$

c) state the  $y$ -intercept

1.  $y = (x + 6)^2 + 10$

2.  $y = (x - 3)^2 - 4$

3.  $y = -(x - 5)^2$

4.  $y = 3(x + 7)^2 + 2$

5.  $y = 2(x - 8)^2 - 13$

6.  $y = -2(x + 1)^2 - 3$

For each quadratic function,

a) state the coordinates of the vertex

b) expand and simplify to express in general form

c) state the  $y$ -intercept

d) determine the  $x$ -intercepts

e) graph the parabola

7.  $y = (x - 2)^2 - 1$

8.  $y = (x + 1)^2 - 9$

9.  $y = (x + 2.5)^2 - 0.25$

10.  $y = -(x + 2)^2 + 9$

11.  $y = 2(x - 1)^2 - 8$

12.  $y = -3(x + 1)^2$

13. Jeremy threw a stone from the bank of a river such that its path was described by  $y = -0.03125(x - 8)^2 + 8$ , where  $x$  is the horizontal distance, in metres, of the stone from the bank and  $y$  is the height of the stone above the river.

a) Express the function in general form.

b) Use both forms of the function to help you choose a suitable window for graphing.

c) From what height was the stone thrown?

d) What was the maximum height of the stone?

e) How far from the bank did the stone enter the water?

14. The owner of a 500-seat movie theatre sells an average of 200 tickets per show at \$9 each. For each 10¢ decrease in price, the owner finds that 25 more tickets are sold. The revenue is represented by the function  $y = (200 + 25x)(9 - 0.1x)$ , where  $x$  is the number of 10¢ reductions and  $y$  is the revenue, in dollars.

a) Expand and simplify to express the function in general form.

b) Graph the function. What price should be charged to maximize the revenue?

## 10.3 Approximate Intercepts Graphically to Solve Problems

*MATHEMATICS: Applying the Concepts 10, pages 375–380*

### Key Concept

- A function in the form  $y = ax^2 + bx + c$  can be graphed and its zeros found by finding or approximating the  $x$ -intercepts.
- Two facts can be determined from the equation in this form, which help in choosing scales for the axes:
  - i) the  $y$ -intercept is  $c$
  - ii) the  $x$ -coordinate of the vertex is  $-\frac{b}{2a}$

*Determine the  $y$ -intercept and the  $x$ -coordinate of the vertex of each.*

1.  $y = x^2 + 8x - 3$

2.  $y = x^2 - 3x + 7$

3.  $y = 2x^2 + 12x - 9$

4.  $y = -x^2 + 5x + 21$

5.  $y = 3x^2 - 3x - 4$

6.  $y = -4x^2 - 2x + 11$

*Graph each parabola using the standard window. Find the  $x$ -intercepts, to one decimal place.*

7.  $y = x^2 - 6x + 7$

8.  $y = x^2 + 5x + 1$

9.  $y = x^2 - 7x + 4$

10.  $y = -x^2 + 3x + 2$

11.  $y = 3x^2 - 4x - 1$

12.  $y = -2x^2 + 10x - 3$

*For each of the following,*

- state the  $y$ -intercept*
- find the  $x$ -coordinate of the vertex*
- select an appropriate viewing window and graph*
- find the  $x$ -intercepts, to one decimal place*

13.  $y = x^2 - 11x - 6$

14.  $y = 6x^2 + 7x - 20$

15.  $y = -x^2 - 10x - 14$

16.  $y = 2x^2 - 25x + 77$

17.  $y = 2x^2 - 13x + 10$

18.  $y = -2x^2 + 5x + 13$

19. A basketball player attempts to pass the ball to a teammate using an overhand throw. The path of the ball is described by  $h = -0.06x^2 + 0.72x + 2.3$ , where  $x$  is the horizontal distance of the ball from the player and  $h$  is the height of the ball. Both are measured in metres.

a) Graph the function.

b) What is the maximum height reached by the ball?

c) After the ball reaches its maximum height, it is intercepted by a player on the opposing team, who catches the ball at a height of 2.8 m. How far is this player from the passer?

d) If nobody touches the ball after it is thrown, how far away from the passer will the ball hit the floor?

20. The path of a person diving off a cliff in Acapulco is given by the function

$h = -4.9t^2 + t + 35$ , where  $t$  is time, in seconds, and  $h$  is height, in metres, above the water.

a) How high is the cliff?

b) How long does it take the diver to enter the water?

## 10.4 Use Graphs to Solve Projectile Problems

*MATHEMATICS: Applying the Concepts 10, pages 381–387*

### Key Concept

The graph of a quadratic function can be interpreted to solve projectile problems.

- The  $y$ -coordinate of the vertex gives the maximum height reached.
- The  $y$ -intercept tells the height of the object at the start, when  $x = 0$ .
- The  $x$ -intercept tells when the function has value zero, which is when the object returns to the ground.
- You can trace the path of the parabola to give heights at other times.

1. A football player kicks a ball with an initial velocity of 20 m/s. The height of the ball,  $y$ , in metres, after  $x$  seconds is given by  
 $y = -4.9x^2 + 20x$ .

- What is the initial height of the ball?
- What is the maximum height of the ball?
- After how long does the ball land on the ground again?
- For how long is the ball more than 10 m above the ground?

2. A pitcher throws a ball toward home plate. The path of the ball is modelled by  
 $y = -4.9x^2 + 0.4x + 1.2$ , where  $x$  is time, in seconds, and  $y$  is height, in metres.

- If the ball is hit by a batter at a height of 0.6 m, how long does it take the ball to get there?
- If the batter and the catcher miss the ball, how long will it take to hit the ground?

3. If a coin is dropped from the observation deck of the CN Tower in Toronto, its height above the ground, in metres, after  $x$  seconds is given by the function  $y = -4.9x^2 + 350$ .

- What is the approximate height of the observation deck?
- How far has the coin fallen after 2 s?
- How long does it take the coin to reach the ground?

4. The force of gravity on the planet Mars is less than half that on Earth. Suppose a ball is thrown upward on the surface of Mars. Its height,  $y$ , in metres, after  $x$  seconds, can be modelled by  
 $y = -1.86x^2 + 15x + 2$ .

- From what height is the ball released?
- How long does it take to reach its maximum height? What is its maximum height?
- For what intervals is the height less than 5 m above the surface?
- How long does it take to hit the surface of the planet after being thrown?

5. The path of an emergency flare is given by  
 $y = -4.9x^2 + 45x + 0.5$ , where  $x$  represents time, in seconds, and  $y$  is the height of the flare, in metres.

- What is the maximum height of the flare?
- Because of nearby trees, the flare is only visible in a nearby town when it is at least 30 m above the ground. For what interval of time is the flare visible to someone in the town?

## Chapter 10 Review

*MATHEMATICS: Applying the Concepts 10, pages 390–391*

1. For each of the following,

- i) state the  $y$ -intercept
  - ii) find the  $x$ -intercept(s)
  - iii) sketch the graph and then, check using a graphing calculator
- a)  $y = x^2 + 6x + 5$                       b)  $y = x^2 + x - 6$   
 c)  $y = x^2 - 9$                                 d)  $y = x^2 - 7x + 10$   
 e)  $y = -x^2 + 2x + 8$                       f)  $y = x^2 - 5x - 6$

2. A steel arch bridge has a parabolic shape that can be modelled by the function

$y = -0.007x^2 + 1.4x$ , where  $x$  is the horizontal distance from one end of the arch and  $y$  is the height of the arch. Both are measured in metres.

- a) Find the zeros of the function. What is the distance between the ends of the arch?
- b) What is the height of the top of the arch?

3. For each quadratic function,

- i) state the coordinates of the vertex
  - ii) expand and simplify to express in general form
  - iii) state the  $y$ -intercept and, by symmetry, one other point on the parabola
  - iv) sketch a graph of the parabola and then, check using a graphing calculator
- a)  $y = (x - 3)^2 + 4$                       b)  $y = 2(x + 4)^2 - 5$   
 c)  $y = -3(x - 7)^2 + 1$

4. Erika springs off a diving board such that her path is described by the function

$y = -0.64(x - 1.5)^2 + 4$ , where  $x$  is her horizontal distance from the board and  $y$  is her height above the water. Both distances are measured in metres.

- a) What is Erika's maximum height above the water?
- b) How high is the diving board?
- c) What is Erika's horizontal distance from the end of the board when she enters the water?

5. Graph each of the following using the standard window. Find the  $x$ -intercepts, to one decimal place.

- a)  $y = x^2 - 5x + 3$
- b)  $y = -x^2 + 4x + 6$
- c)  $y = 2x^2 + 7x - 5$

6. For each of the following,

- i) state the  $y$ -intercept
  - ii) find the  $x$ -coordinate of the vertex
  - iii) select an appropriate viewing window and graph
  - iv) find the  $x$ -intercepts, to one decimal place
- a)  $y = x^2 + 10x - 14$   
 b)  $y = -2x^2 + 32x + 6$   
 c)  $y = 3x^2 - 66x + 16$

7. A water-skier slides up a ramp and flies off the end such that his height above the water is given by  $y = -4.9x^2 + 4x + 0.8$ , where  $x$  is the time, in seconds, after the skier leaves the ramp, and  $y$  is the height, in metres, of the skier above the water.

- a) How far above the water is the skier when he leaves the ramp?
- b) What is the maximum height of the skier?
- c) How long does it take the skier to hit the water after leaving the ramp?

## Cumulative Review, Chapters 1–10

*MATHEMATICS: Applying the Concepts 10, pages 393–397*

1. A mudpie contains sand and water in the ratio 5:2. The total volume of the mudpie is 714 mL. How much sand was used to make the mudpie?

2. A 250-mL container of honey sells for \$2.85, and a larger size of the same honey contains 450 mL and sells for \$4.79. Compare the unit cost of each size, in cents, rounded to two decimal places.

3. Find the total cost of an amplifier after the 8% sales tax and 7% GST are each calculated on the retail price of \$249.

4. Sam's rate of pay went up from \$10/h to \$11/h. By what percent did his hourly rate increase?

5. The scale on a builder's plan is 1:50. If the width of the kitchen on the plan is 4.3 cm, what will the width of the actual room be?

6. Solve. Then, check by substituting.

a)  $6n = 30$

b)  $y - 4 = 7$

c)  $\frac{3}{4} - k = \frac{7}{4}$

d)  $\frac{2m+1}{3} = 5$

e)  $3t + 5 = t - 7$

f)  $9p - 0.8 = 7p + 4.8$

g)  $5(2h - 1) = 40 + h$

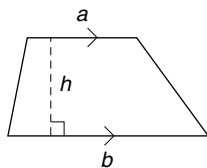
7. The formula  $A = \frac{(a+b)h}{2}$

gives the area of a trapezoid.

a) Solve the formula for the variable  $h$ .

b) Find  $h$  when  $A = 63$ ,  $a = 5$ , and  $b = 13$ .

c) Find  $h$  when  $A = 40$ ,  $a = 8$ , and  $b = 2$ .



8. Create a table of values to show at least three pairs of points that satisfy each linear equation. Graph the results.

a)  $y = x + 3$

b)  $y = -x - 1$

c)  $y = 0.5x - 2.5$

9. State the slope and the  $y$ -intercept of each line.

a)  $y = 2x + 5$

b)  $y = x - 3$

c)  $y = -\frac{2}{5}x + 1$

10. The table shows the cost,  $y$ , in dollars, of renting a canoe for each number of hours,  $x$ .

$x$ (number of hours)	1	2	3	4	5	6
$y$ (cost in dollars)	15	20	25	30	35	40

a) Determine an equation of the line represented by the table.

b) If Shana was charged \$50, for how long did she keep the canoe?

11. An airport parking lot charges \$6 for the first hour and an additional \$3 per half hour that a car remains on the lot. The daily maximum is \$30.

a) Copy and complete the table of values relating the time,  $x$ , in hours, to the parking fee,  $y$ , in dollars, for one day.

Time (hours)	Fee Equation
$0 < x \leq 1$	
$1 < x \leq 1.5$	
$1.5 < x \leq 2$	

b) Graph the piecewise linear function.

12. The same type of truck can be rented from two different companies. Company A charges \$100 per day, plus \$0.25/km. Company B charges \$80 per day, plus \$0.35/km. The following equations compare the cost,  $C$  (in dollars), of a one-day rental, for the two companies and driving a distance,  $d$  (in kilometres).

Company A:  $C = 100 + 0.25d$

Company B:  $C = 80 + 0.35d$

- Graph the system of equations.
- What does the point of intersection represent?
- When is it more economical to rent from company A?

13. Solve each linear system by substitution. Check your solution.

a)  $y = x + 1$   
 $y = 2x - 2$

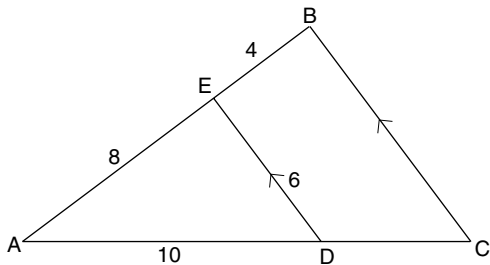
b)  $x + y = 4$   
 $x = y + 2$

14. Solve each linear system by elimination. Check your solution.

a)  $x + 2y = 1$   
 $2x + y = -1$

b)  $2x + y = 4$   
 $x - y = -3$

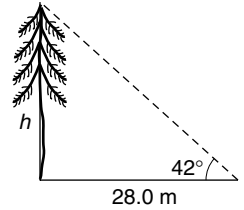
15. a) Name the similar triangles.



- Find the lengths of  $BC$ ,  $AC$ , and  $DC$ .
- Explain why the measure of  $\angle AED$  is  $90^\circ$ . What other angle is a right angle?

16. A badminton court measures 12 m by 6 m. What is the diagonal distance from corner to corner across the court, to one decimal place?

17. Ron measured a distance of 28.0 m away from the foot of a tree. From that point he measured the angle of elevation to the top of the tree to be  $42^\circ$ . What is the height of the tree, to one decimal place?



18. A mover's truck is parked on horizontal ground. The ramp up to the back of the truck is 5.8 m long. The top of the ramp is 0.74 m above the ground.

- Draw a diagram of the situation.
- Use a trigonometric ratio to find the angle that the ramp makes with the ground, to the nearest degree.

19. Give the coordinates of the vertex of each parabola and tell whether it opens upward or downward.

a)  $y = -2x^2$

b)  $y = (x - 4)^2$

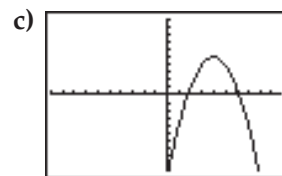
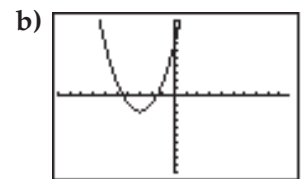
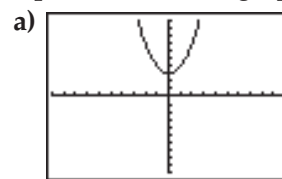
c)  $y = (x + 1)^2 + 5$

d)  $y = -(x + 4)^2 - 3$

e)  $y = 0.5(x + 7.5)^2$

f)  $y = -4(x - 8)^2 - 1$

20. Each parabola has the same shape as  $y = x^2$ . The standard window is used in each. Write an equation for each graph.



21. Expand and simplify.

- a)  $(m + 2)(m - 2)$       b)  $(t + 3)(2t + 1)$   
c)  $(k - 5)(k - 3)$       d)  $(3x + 1)^2$   
e)  $4(n - 4)(3n + 2)$       f)  $(y + 3)^2 - 5(y + 2)$

22. Factor each fully. Check by expanding.

- a)  $p^2 + 5p + 4$       b)  $x^2 + 10x + 25$   
c)  $z^2 - 3z - 28$       d)  $2k^2 + 6k - 20$   
e)  $5t^2 - 20$       f)  $n^2 + n - 30$

23. Solve each quadratic equation.

- a)  $x^2 - 8x + 12 = 0$       b)  $3x^2 - 12 = 0$   
c)  $x^2 + 5x - 14 = 0$

24. Find the  $x$ -intercepts of each function.

- a)  $y = x^2 + 7x + 12$       b)  $y = x^2 - 64$   
c)  $y = x^2 - 8x - 20$

25. An arched bridge built over a river can be described by the equation

$y = -0.2(x - 32)^2 + 3.5$ , where  $y$  is the height, in metres, of the arch above the water and  $x$  is the horizontal distance, in metres, across the river starting at one end of the bridge.

- a) What is the maximum height of the arch above the water?  
b) How wide is the river?

26. Karen dives out of a plane and her descent during free fall is given by  $y = -4.9x^2 + 3200$ , where  $x$  is the time, in seconds, after she has left the plane, and  $y$  is her height above the ground, in metres.

- a) From what height did Karen jump?  
b) If she wants to wait until she has fallen 1200 m before opening her parachute, how much free-fall time does she have?

27. During a fireworks display, a rocket is launched from the deck of a ship anchored in the lake. The path of the rocket is described by  $y = -4.9x^2 + 45x + 2.5$ , where  $x$  is the time, in seconds, after the rocket leaves the ship's deck and  $y$  is the height, in metres, of the rocket above water.

- a) When does the rocket reach its maximum height?  
b) During what time interval is the height greater than 50 m?  
c) For how long is the rocket in the air?

## Answers

### Look Back: Ratio and Rate

1. b and c  
2. a) 2:1      b) 2:3      c) 1:1      d) 3:2:1  
e) 3:4:2:3      f) 5:12      g) 3:7:4      h) 1:8  
i) 3:200

### Look Back: Percent

1. a) 0.75      b) 0.40      c) 0.15      d) 0.07  
e) 0.085      f) 1.25      g) 0.0625      h) 10.00  
i) 0.0975      j) 0.1275  
2.  $\frac{2}{3}$

### Look Back: Integers

1. a) -30      b) 24      c) 4      d) 1  
e) -20      f) -14  
2. a) 28      b) 2      c) 40      d) -16  
e) 60      f) -2

### Look Back: Rational Numbers

1. a)  $-\frac{13}{24}$       b)  $-\frac{1}{3}$       c)  $\frac{3}{8}$   
d)  $-\frac{11}{8}$       e)  $\frac{29}{12}$       f)  $\frac{9}{5}$   
2. a)  $-\frac{17}{12}$       b)  $\frac{1}{2}$       c) -12  
d)  $\frac{49}{16}$       e)  $\frac{1}{4}$       f)  $-\frac{5}{18}$

### Look Back: Order of Operations and Substitution

1. a) 19      b) -36      c) 2  
d) 2      e) 6      f) -4  
2. a) -9      b) -11      c) 47  
d) -9      e) 32      f) -8

### Look Back: Algebra

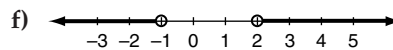
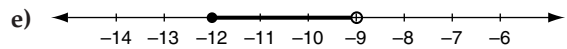
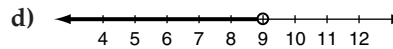
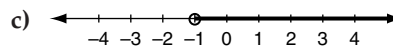
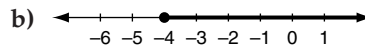
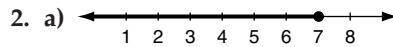
1. a)  $-5a - 3$       b)  $7p - 7q$       c)  $-2mn - n + 5m$   
d)  $-10w + 3$       e)  $13 + 5x^2 - 3x$       f)  $8g - 3gh - h$   
2. a)  $3x - 3y$       b)  $-2w - 6$       c)  $-18 + 9m$   
d)  $42x - 42$       e)  $-5 + g$       f)  $2n + 2$   
g)  $8p - 16q$       h)  $-42 + 6a$   
3. a)  $20x + 4$       b)  $2a - 3$   
c)  $-5p - 14$       d)  $27 + 7w$

### Look Back: More Algebra

1. a)  $a^4$       b)  $g^6$       c)  $k^4$       d)  $x^3y^4$   
e)  $m^2$       f)  $v^8$       g)  $m^4n^3$       h)  $a^{12}b^{15}$   
2. a) trinomial      b) monomial      c) binomial  
d) binomial      e) trinomial      f) binomial  
g) monomial      h) binomial      i) trinomial

### Look Back: Inequalities and Number Lines

1. a)  $x \leq 2$       b)  $-1 \leq x \leq 2$       c)  $x < -7$   
d)  $x < 21$  or  $x > 23$       e)  $x \geq -17$   
f)  $-1 < x \leq 2$       g)  $x > 41$       h)  $-99 < x < -96$



### Look Back: Squares and Square Roots

1. for  $x$ : 2, 3, 6, 8, 9; for  $x^2$ : 1, 16, 25, 49, 100, 121, 144  
2. a) 400      b) 2500      c) 10 000  
d) 40 000      e) 250 000  
3. a) 40      b) 70  
c) 20      d) 30  
4. a) 4 and 5      b) 5 and 6  
c) 7 and 8      d) 9 and 10  
5. a) 9 or -9      b) 12 or -12  
c) 6 or -6      d) 11 or -11

### Look Back: Angles and Parallel Lines

1. a)  $40^\circ$       b)  $60^\circ$   
c)  $35^\circ$       d)  $x = 100^\circ, y = 80^\circ$   
e)  $x = 75^\circ, y = 70^\circ$       f)  $120^\circ$   
g)  $x = 45^\circ, y = 55^\circ$       h)  $x = 40^\circ, y = 140^\circ, z = 140^\circ$   
i)  $65^\circ$

## Look Back: Angle Properties

1. a)  $20^\circ$                       b)  $115^\circ$   
c)  $x = 130^\circ, y = 50^\circ$       d)  $x = 110^\circ, y = 50^\circ, z = 120^\circ$   
e)  $45^\circ$                         f)  $60^\circ$   
g)  $75^\circ$                         h)  $75^\circ$   
i)  $40^\circ$

## Look Back: Measuring and Constructing Angles

1. a)  $65^\circ$                       b)  $115^\circ$                       c)  $52^\circ$

## Look Back: Translations and Reflections

1. a) translated 8 units to the right and 2 units upward  
b) reflected in the  $y$ -axis  
c) translated 4 units to the right and 3 units downward  
2. a)  $H'(3, 0), A'(-3, -6), T'(5, -6)$   
b)  $P'(-1, -5), U'(-2, 2), T'(3, -3)$   
c)  $W'(-6, 0), H'(-1, -5), Y'(0, 2)$

## The Geometer's Sketchpad® Introductory Lesson

1. When a segment is selected, it has two small solid squares on it. When a point is selected, it is a solid dot with a ring around it.  
6. This tool draws a circle with the centre where you click and the circumference where you drag to and release.

## Spreadsheet Basics

### Examining the Spreadsheet Window

2. ❶ Column Headings    ❷ Active Cell  
❸ Row Headings    ❹ Toolbar  
❺ Cell    ❻ Cell Grid

### Entering and Editing Data

2. a) all                      b) right                      c) left

### Using Formulas

1. a) ii                      b) v                      c) iii  
d) i                        e) iv  
2. start with equal sign, use cell names, have no spaces  
3. a) 293.65 km                      b) 8.333 333 333  
c) 667.4 Ma                        d) 413.0 Ma

- e) 3.3 km  
5. a) 58.73 km                      b) 3337.00 Ma  
c) 0.40 km                        d) 2.14 km  
e) 106.382 978 7                      f) 1813.0 Ma

## Filling in Data

### Fill Down

3. =SUM(E2..G2) or =SUM(E2:G2)

### Fill Right

3. =SUM(B2..B4) or =SUM(B2:B4) or =B2+B3+B4 in cell B5 and =AVERAGE(B2..B4) or AVG(B2:B4) or =(B2+B3+B4)/3 in cell B6

## TI-83 Plus as a Spreadsheet

2. 15, 28, 24, 67.5

## CHAPTER 1 Proportional Reasoning

### 1.1 Ratios and Proportions

1. 1  
2. 7.5  
3. 2.5  
4. 6.4  
5.  $\frac{k}{1} = \frac{12}{4}, k = 3; \frac{n}{7} = \frac{12}{4}, n = 21$   
6.  $\frac{x}{5} = \frac{36}{9}, x = 20; \frac{y}{8} = \frac{9}{36}, y = 2$   
7. a) 3:2                      b) 2:3                      c) 3:40:2                      d) 1:8  
8. 20 mL                                      9. 25  
10. 25 kg nitrogen, 15 kg phosphorus, 10 kg potassium  
11. a) 35:5:4  
b)  $3.98 \text{ m}^3$  topsoil,  $0.57 \text{ m}^3$  sand,  $0.45 \text{ m}^3$  peat moss

### 1.2 Rates

1. Answers will vary. Let  $x$  be the area in square kilometres. Write a proportion of people to kilometres using the given information and  $x$ . Cross multiply. Divide by 4.05. Round to the nearest whole number. Write a conclusion.  
2. \$0.69/L                                      3. 60 km/h  
4. 0.33 mm/h                                      5. \$2.08/golf ball  
6. \$0.68/US\$  
7. a) \$18.75                                      b) 53.5 h  
8. 20 tapes for \$32.99  
9. Answers will vary. A family that is large, has a lot

of colds, has a lot of allergies, has a lot of storage space, has enough money to pay for the large quantity, lives near the warehouse store and/or has other purchases to make at it might buy from the warehouse store. A family in the opposite circumstances might buy at the local drugstore.

10. 8.3 h or 8 h 20 min

11. a) \$854      b) 468.38 punt      c) 0.468 punts/\$

### 1.3 One Number as a Percent of Another

1. 92%      2. 800%      3. 75%      4. 375%

5. 50%      6. 100%      7. 20%      8. 12.3%

9. 67.7%      10. 5.6%

11. No, the change, 585, as a percent of 4550 is not the same as, but greater than, the change as a percent of 5235.

12. 26.1% red, 32.6% green, 21.7% orange, 13.0% yellow, 6.5% purple

13. a) \$36      b) 4.5%

### 1.4 Percents of Numbers

1. Let  $x$  be the number. Write and solve a proportion of part to total using the given information and  $x$ :

$\frac{20}{100} = \frac{x}{70}$ . Another way is to write the mathematical statement given by the information,  $\frac{20}{100} \times 70$ , and evaluate it.

2. 19.5      3. 1.92      4. 120.35      5. 2.325

6. 18.9      7. 0.003      8. 400      9. 600 000

10. 80      11. 56

12. a) 18 000      b) 300 000

13. a) \$10.49      b) \$12.07

14. \$0.629

15. a) \$67.50      b) \$248

16. The final price at the “We pay the taxes” store is \$35. The final price at the other store is less because the sale price is 85% of \$35, and the sale price plus 15% of it is less than \$35.

### 1.5 Interpret Scale Diagrams

1. Express 120 m as 12 000 cm. Write a ratio of diagram measurement to actual measurement, in centimetres. Express the smaller term as 1 by dividing the larger term by the smaller term, 12 000 by 8, to get 1:1500.

2. 10      3. 12      4. 0.138

5. 0.000 015      6. 1:20 000      7. 12 500:1

8. a) 1 cm on the map represents 25 000 000 cm or 250 km.

b) 1500 km

9. 4 m and 3 m      10. 3:1

### 1.6 Draw Scale Diagrams

1. 1:7

2. Answers will vary. For a TI-83 Plus, 3:1.

### 1.7 Valid and Invalid Proportional Reasoning

1. a) The figure is 1.5 times as tall.

b) The figure is  $\frac{1}{3}$  as wide.

2. The vertical scale does not start at 0.

3. a) 13 or 14      b) sound

c) The performance of the player is relatively consistent and the player has about the same number of at bats in future games.

d) reasonable      e) valid

4. a) 533      b) fairly sound

c) The original capture, tag, and release process represented the entire park. The 40 recaptured raccoons were from the same season and represented the entire park.

d) fairly reasonable      e) Valid, but might be better if it was known that a number of random samples were recaptured, rather than just the 40.

### Chapter 1 Review

1. a) 150 mL cream, 300 mL flour, 225 mL sugar

b) 1000 mL strawberries, 200 mL cream, 400 mL flour, 300 mL sugar

2. VideoMart; \$0.43; Answers will vary. If one does not need that many, or does not have the money to buy that many, or that store is much farther away, it would not be the better buy.

3. 150 pages      4. 10.6%      5. \$550      6. 350

7. \$65      8. 3:1      9. 4.34 m

11. Answers will vary. Using proportional reasoning, her time would be expected to decrease by 1.4% next year. Not enough is known about Josie—her training, if she has peaked—to even decide if she will improve next year. It is not reasonable to expect the same annual percent decrease in time.

## CHAPTER 2 Equations and Formulas

### 2.1 One-Step Equations and Formulas

- a) 3                      b) 12.5                      c) 4
- a) 7                        b) 6.1                        c) 12.3
- a) 2                        b) -15                        c) 3
- a) 2                        b) -6                         c) -11.2
- a) 16                        b) 16                         c) 3.8
- d) -0.6                    e) 4                         f) -5
- g) 60                        h) 12                        i) 1.1
- a) 5                        b) 360                        c) 2.4

### 2.2 Two-Step Equations and Formulas

- a) Add 1. Divide by 2.
- b) Subtract 3. Divide by -1.
- c) Add 6. Multiply by 5.
- d) Subtract 6. Divide by 7.
- e) Add 4. Multiply by -3.
- f) Add 4. Divide by 1.2.
- g) Add  $c$ . Divide by  $a$ .
- h) Subtract  $g$ . Multiply by  $-x$ .
- a) 2                      b) 6                        c) -3
- d) -12                    e) 2                        f) 3
- g) 0                        h) 2
- a)  $t = \frac{C-50}{40}$                       b) 7 h
- a)  $i = s - at$                       b) 99 km/h
- a)  $t = \frac{m-r}{b}$                       b) 3.8 h                      c) 4.4 h

### 2.3 Equations and Formulas With More Than One Variable Term

- a) Combine  $5x$  and  $-2x$ . Combine  $-8$  and  $4$ . Divide each side by 3.
- b) Combine  $a$  and  $-4a$  and expand  $2(a-5)$ . Subtract  $2a$  from each side. Subtract 3 from each side. Divide each side by  $-5$ .
- c) Combine  $4.7y$  and  $2.8y$ . Subtract  $7.5y$  from each side. Add 3 to each side. Divide each side by  $-5.2$ .
- a)  $7y - 14 = 3y + 18$                       b)  $-2k - 18 = -k + 1$
- c)  $4m - 4 + 3m = -5m - 5 - 8$ , or simplified  $m - 4 = -5m - 13$
- a) -5                      b) 12                        c) -2
- d) -5                      e) -1                        f)  $-\frac{8}{7}$

- a)  $p = 6 + 5m$                       b)  $p = 1 - q$
- c)  $p = \frac{2n-5}{5}$
- a)  $w = \frac{P+2I}{2}$                       b) 3
- \$50                                      7. \$10

### 2.4 Multi-Step Equations and Formulas

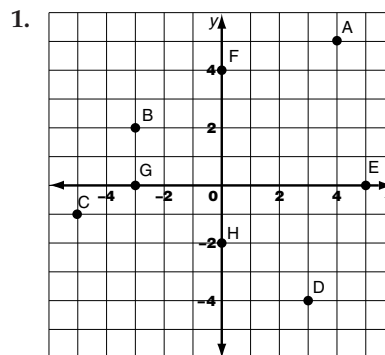
- a) Multiply each side by the LCD, 6.
- b) Combine  $2x$  and  $-9x$ .
- c) Expand both sets of brackets.
- a) 3                        b) 7                        c) 5
- a) 6                        b) -12                    c) -23
- d) 6                        e) -4                    f) 2
- a)  $h = \frac{A-2\pi r^2}{2\pi r}$  or  $h = \frac{A}{2\pi r} - r$
- 9.9 cm
- a)  $C = \frac{rP(n+1)}{200N}$                       b) \$41.67

### Chapter 2 Review

- 7                      2. -3                      3. 1.3                      4. -3
- Combine  $2x$  and  $-3x$ .
- Expand  $3(g+4)$ .
- Subtract  $7n$  from each side.
- Multiply each side by 10.
- $Q = CV$
- $C = R - P$
- $t = \frac{I}{Pr}$                       12.  $a = \frac{2(s-ut)}{t^2}$                       13. -2
- 2                      15. 5                      16. -29
- 15                      18. -4                      19. 0
- 4                      21. 3                      22. -3
- 25.3 km                      24. \$200                      25. 14.3 L/100 km

## CHAPTER 3 Linear Functions

### 3.1 Patterns and Ordered Pairs



- a) I                      b) II                      c) III                      d) IV  
 e) x-axis                f) y-axis                g) x-axis                h) y-axis

2. a)

x	y
3	9
4	11
5	13

b)

x	y
4	-5
6	-7
8	-9

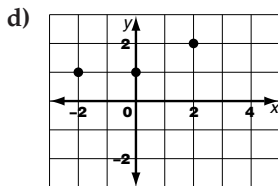
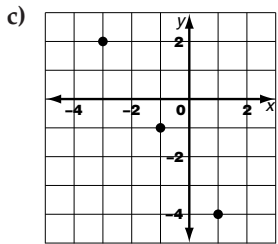
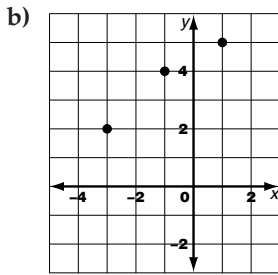
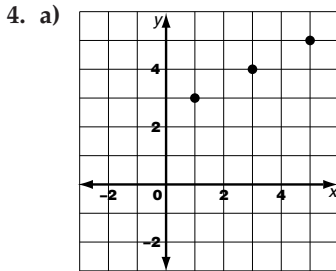
c)

x	y
5	11
8	14
11	17

d)

x	y
7	-8
9	-12
11	-16

3. a) yes                      b) yes                      c) yes                      d) no



- a) yes                      b) no                      c) yes                      d) no

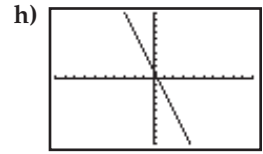
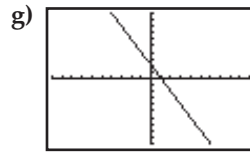
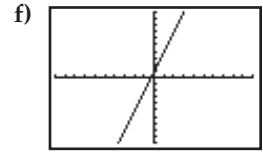
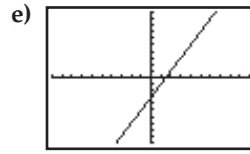
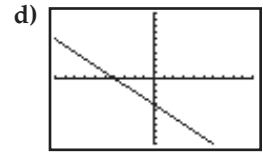
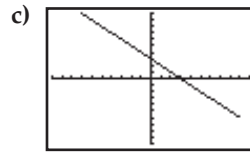
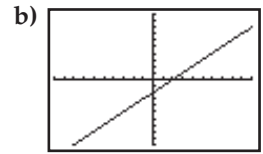
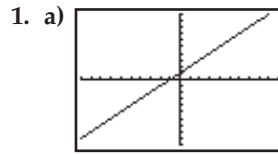
5. a) 32, 40, 48, 56

b) \$28

6. a) x-values: 4, 5, 6; y-values: 2.0, 2.5, 3.0

b) Each x-value is 1 more than the previous one; each y-value is 0.5 more than the previous one.

### 3.2 Construct Tables and Sketch Graphs With Technology



2. a)

X	Y1
0	2
4	14
8	26
12	38
16	50
20	62
24	74

b)

X	Y1
0	2
4	14
8	26
12	38
16	50
20	62
24	74

c)

X	Y1
0.0	2.0
.5	2.5
1.0	3.0
1.5	3.5
2.0	4.0
2.5	4.5
3.0	5.0
3.5	5.5
4.0	6.0

d)

X	Y1
0.00	2.00
.75	4.25
1.50	6.50
2.25	8.75
3.00	11.00
3.75	13.25
4.50	15.50

3. a)

X	Y1
0.00	2.00
1.00	5.00
2.00	8.00
3.00	11.00
4.00	14.00
5.00	17.00
6.00	20.00

b)

X	Y1
0.00	-1.00
1.00	-3.00
2.00	-5.00
3.00	-7.00
4.00	-9.00
5.00	-11.00
6.00	-13.00

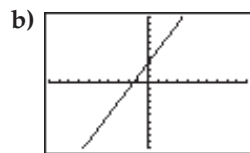
c)

X	Y1
0.00	1.00
1.00	5.00
2.00	9.00
3.00	13.00
4.00	17.00
5.00	21.00
6.00	25.00

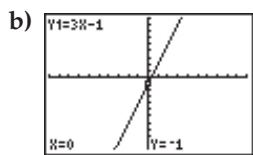
d)

X	Y1
0.00	-2.00
1.00	-5.00
2.00	-8.00
3.00	-11.00
4.00	-14.00
5.00	-17.00
6.00	-20.00

4. a) Press  $(Y=)$ . Cursor left to the symbol in front of Y1. Press  $(\text{ENTER})$  repeatedly until the symbol shows a dotted line. Then, cursor to the next point of input.



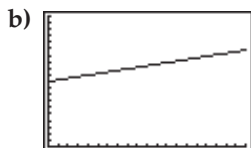
5. a) Press  $\text{2nd}$   $\text{ZOOM}$  for [FORMAT]. Choose **ExprOn**. Press  $\text{ENTER}$ . Press  $\text{Y=}$  and enter the equation. Press  $\text{GRAPH}$   $\text{TRACE}$ . The labelled graph will appear.



6. a) Press  $\text{MODE}$ . To select one decimal place, cursor down to **Float**, right to **1**, and then, press  $\text{ENTER}$ . Press  $\text{Y=}$  and input the equation. Press  $\text{GRAPH}$ . Then, press  $\text{TRACE}$ . Enter the given value of  $x$  and press  $\text{ENTER}$ . The corresponding value of  $y$  is the required value.

b) 8.4

7. a)  $y = 0.06x + 250$

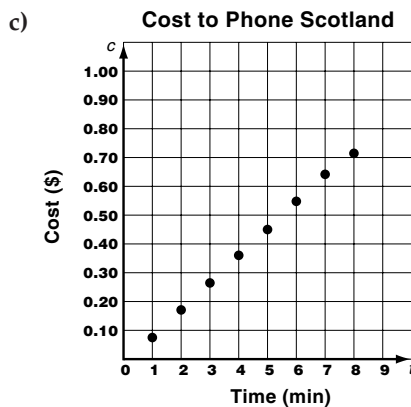


### 3.3 Construct Tables and Sketch Graphs Without Technology

- a) 6, 8, 10      b) 9, -3, -6  
c) -3, -1, 1      d) -6, 6, 9
- a)  $-1 + 1 = 0$ ,  $(-1, 0)$ ;  $2 + 1 = 3$ ,  $(2, 3)$ ;  
 $5 + 1 = 6$ ,  $(5, 6)$ ;  $8 + 1 = 9$ ,  $(8, 9)$   
b)  $-2(-6) + 3 = 15$ ,  $(-6, 15)$ ;  $-8$ ,  $(-8, 19)$ ;  
 $-2(-10) + 3 = 23$ ,  $(-10, 23)$ ;  $-12$ ,  $-2(-12) + 3 = 27$
- Answers may vary. For example,  
a)  $(-1, 0)$  and  $(-2, -2)$       b)  $(0, 1)$  and  $(3, -5)$   
4. a) yes      b) no      c) no      d) yes  
5. a)  $c = 0.09t$

b)

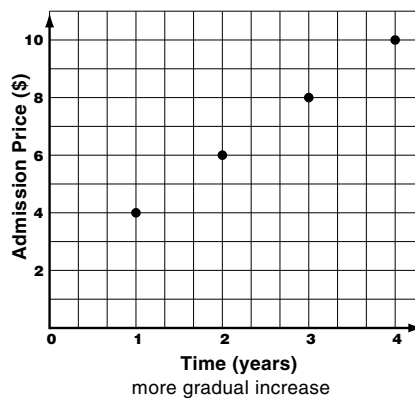
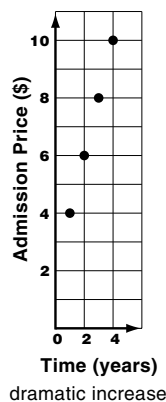
$t$	$c$
1	0.09
2	0.18
3	0.27
4	0.36
5	0.45
6	0.54
7	0.63
8	0.72



d) Yes; for each value of  $t$  there is one, and only one, value of  $c$ .

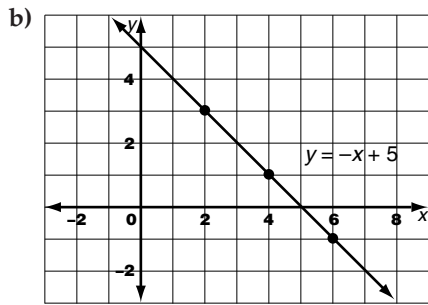
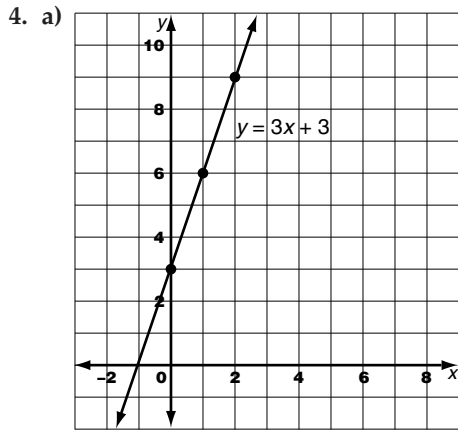
### 3.4 Interpret Lines

- a) -1      b) 2
- a) 4      b) 5
- a) slope: 3;  $y$ -intercept: 4  
b) slope: 2;  $y$ -intercept: -3  
c) slope:  $-\frac{2}{3}$ ;  $y$ -intercept: 1  
d) slope: -0.5;  $y$ -intercept: -2
- $\frac{2}{3}$
- Answers may vary.



### 3.5 Write Linear Equations by Using Tables of Values

- a) slope: -3;  $y$ -intercept: 3      b) slope: 2;  $y$ -intercept: 2
- a)  $y = 2x + 3$       b)  $y = -3x + 13$
- a)  $y = 3x + 4$       b)  $y = 2x - 3$   
c)  $y = -5x + 6$       d)  $y = -\frac{1}{2}x - \frac{3}{4}$



5.  $y = \frac{1}{3}x + 5$

6. a)  $y = 3x$

- b) the slope represents the hourly rate of parking, the  $y$ -intercept represents the charge for 0 h of parking  
 c) \$12

### 3.6 Write Linear Equations by Translating Written Descriptions

1. c      2. d      3. b      4. c
5. a) Let  $c$  be Chris's earnings and  $y$  be Yuen's earnings.  $c = y - 50$   
 b) Let his age be  $f$  and his daughter's age be  $d$ .  
 $f = 2d - 1$   
 c) Let her dog's mass be  $a$  and his dog's mass be  $b$ .  
 $a = 3b + 2$
6. a) Let  $y$  be the total salary (in dollars) and  $x$  be the amount of sales (in dollars).  $y = 0.4x$   
 b) Let  $y$  be the total salary (in dollars) and  $x$  be the number of successful sales.  $y = 10x + 1000$   
 c) Let  $y$  be the total salary (in dollars) and  $x$  be the amount of sales (in dollars).  $y = 0.25x + 200$   
 d) Let this year's attendance be  $y$  and last year's attendance be  $x$ .  $y = \frac{1}{2}x - 3$
7. a) Let  $y$  be the total number of clients per month and  $x$  be the time (in months).  $y = 5x + 20$   
 b) 4 months

### 3.7 Rearrange Equations From One Form to Another

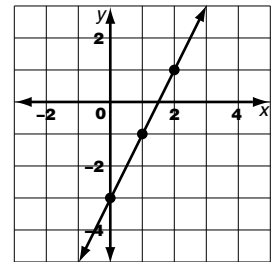
1. a) yes   b) no   c) no   d) no   e) yes   f) yes
2. a)  $A = 3, B = 1, C = 8$    b)  $A = 4, B = -1, C = 2$   
 c)  $A = 4, B = 5, C = 3$    d)  $A = 7, B = -5, C = 8$   
 e)  $A = 2, B = 0, C = 7$    f)  $A = 0, B = 4, C = -6$
3. a)  $3x - y + 5 = 0$    b)  $4x + y - 3 = 0$   
 c)  $2x - 3y - 12 = 0$    d)  $3x + 4y + 8 = 0$   
 e)  $2x - 5y + 30 = 0$    f)  $13x - 10y - 70 = 0$
4. i) a)  $y = 2x + 1$    b) 1   c)  $2x - y + 1 = 0$   
 ii) a)  $y = -2x + 3$    b) 3   c)  $2x + y - 3 = 0$
- iii) a)  $y = \frac{1}{2}x + 2$    b) 2   c)  $x - 2y + 4 = 0$
- iv) a)  $y = -\frac{2}{3}x + 4$    b) 4   c)  $2x + 3y - 12 = 0$
5. a)  $y = 0.05x + 250$    b)  $x - 20y + 5000 = 0$
6.  $k = 5$
7.  $k = -\frac{7}{5}$

### Chapter 3 Review

1. a)  $(6, -3), (9, -5), (12, -7)$    b)  $(5, 11), (7, 14), (9, 17)$
2. a) 10, 13      b) -2, 0

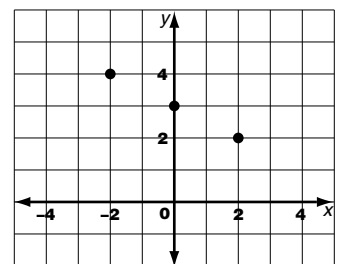
3. a)

$x$	$y$
0	-3
1	-1
2	1



b)

$x$	$y$
-2	4
0	3
2	2



4. a) -2   b)  $\frac{1}{4}$

5. a)  $y = -\frac{2}{3}x + 2$       b)  $y = -\frac{3}{2}x - \frac{5}{2}$

6. a)  $y = 2x + 1$       b)  $y = -4x + 3$

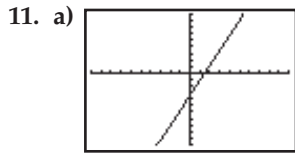
7. a) slope: 3;  $y$ -intercept: 5

b) slope:  $-\frac{3}{5}$ ;  $y$ -intercept: -4

8. a)  $A = 2, B = 5, C = -3$

b)  $A = 4, B = -3, C = 2$

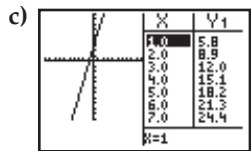
9. a)  $y = -\frac{3}{2}x - \frac{7}{2}$       b)  $y = \frac{5}{4}x - \frac{9}{4}$   
 10. a)  $3x - y - 5 = 0$       b)  $10x + 15y - 9 = 0$



b) 

X	Y1
0	3
2	5.4
4	7.8
6	10.2
8	12.6
10	15
12	17.4

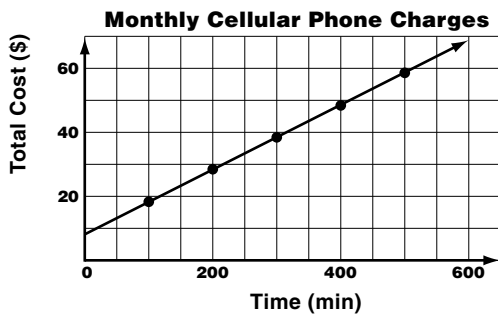
  
 $X=0$



12. a)  $x$ -values: 3, 4, 5;  $y$ -values: 12, 16, 20    b) 28 h  
 13. The slope of graph B appears to be steeper, so it gives the impression of a greater increase, and thus, greater improvement.  
 14. a)  $c = 9.95 + 0.1t$ , where  $c$  is the total cost (in dollars) and  $t$  is the total time (in minutes).

b) 

$t$ (minutes)	$c$ (dollars)
100	19.95
200	29.95
300	39.95
400	49.95
500	59.95



X	Y1
400.0	40.0
401.0	40.5
402.0	41.0
403.0	41.5
404.0	42.0
405.0	42.5
406.0	43.0

 $X=400$

c) \$54.95

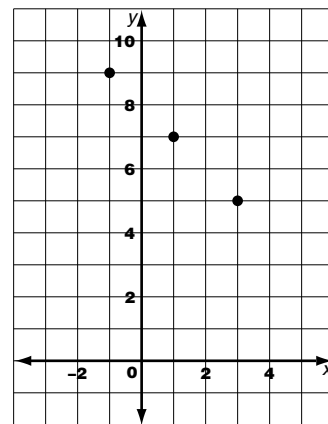
### Cumulative Review, Chapters 1–3

1. a) 3      b)  $6\frac{3}{4}$       c)  $5\frac{5}{6}$       d) 8  
 2. a)  $\frac{a}{3} = \frac{7}{2}$ ,  $a = 10\frac{1}{2}$ ;  $\frac{b}{6} = \frac{7}{2}$ ,  $b = 21$

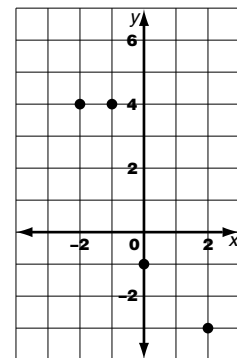
b)  $\frac{m}{7} = \frac{3}{5}$ ,  $m = 4\frac{1}{5}$ ;  $\frac{n}{4} = \frac{5}{3}$ ,  $n = 6\frac{2}{3}$

3. a) \$2.56 per box      b) 3.75 km/h  
 c) 133.3 m/min  
 4. a) 24.4%      b) 13.3%  
 5. a) 13.8%      b) 13.3%  
 6. a) 600      b) 600  
 7. a) 280      b) \$5.40  
 8. \$141 000  
 9. a) \$120      b) \$135      c) \$312.50  
 10. a) 35      b) 2      c) 1  
 d)  $4\frac{1}{5}$       e) 8      f) 2

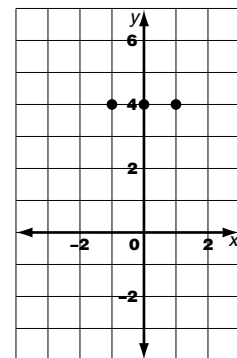
11. a) linear



b) non-linear



c) linear



12. a)  $y = -5x + 3$       b)  $y = 2x + 8$   
 c)  $y = -\frac{3}{2}x - 3$       d)  $y = \frac{4}{5}x + \frac{7}{5}$

13. a)  $\frac{3}{2}$       b)  $-\frac{12}{5}$       c)  $-\frac{13}{7}$

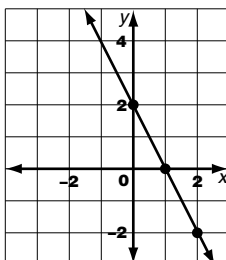
$y = -\frac{5}{3}x + 5$

b)  $y = \frac{4}{5}x + 4$

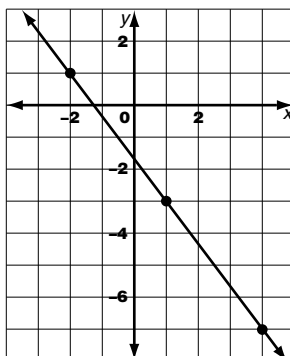
c)  $y = x - 2$

d)  $y = -\frac{3}{4}x - 3$

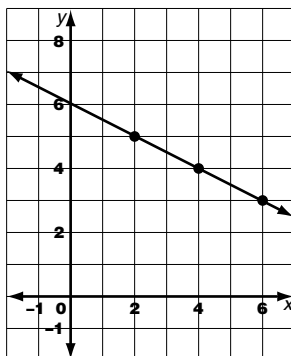
15. a)  $y = -2x + 2$



b)  $y = -\frac{4}{3}x - \frac{5}{3}$



c)  $y = -\frac{1}{2}x + 6$



16.  $h = \frac{V}{lw}$     a) 5 cm    b) 11 cm    c) 6.3 cm

17. a) 3    b) 12    c) 5

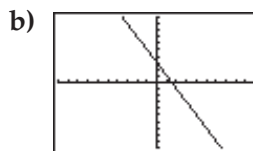
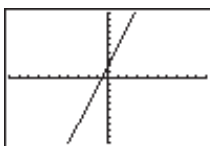
18. a)  $y = 3x + 25$     b) \$49    c) 11 h

19. a) The slope of all three graphs is 1000.

b) ii

c) iii

20. a)



## CHAPTER 4 Piecewise Linear Functions

### 4.1 Explore Piecewise Linear Functions

1. a) yes    b) no    c) yes    d) no

2.  $-4 \leq x \leq 0, 0 \leq x \leq 1, 1 \leq x \leq 4$

3. a) Yes; there is more than one line segment, each segment begins with a closed circle and ends with an open circle.

b) The closed circle means the price is included for that year; the open circle means the price is excluded for that year.

c)  $0 \leq x < 1, 1 \leq x < 2, 2 \leq x < 3$

4. a) Yes; there is more than one line segment, and the segments are connected.

b)  $0 \leq x \leq 1, 1 \leq x \leq 2, 2 \leq x \leq 3, 3 \leq x \leq 5$

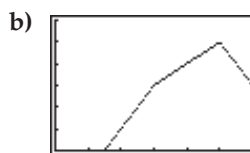
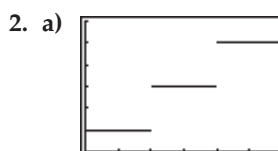
### 4.2 Construct Piecewise Linear Functions With Technology

1. a)  $(0 \leq x), (x \leq 8)$

b)  $(3 < x), (x \leq 6)$

c)  $(4 \leq x), (x < 7)$

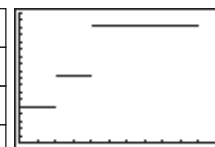
d)  $(1 \leq x), (x \leq 5)$



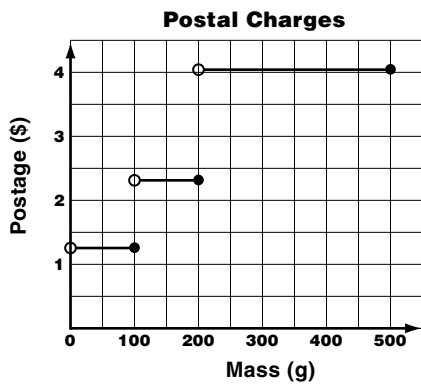
3. Answers may vary. See Section 4.2 on student text pages 140 to 143.

4. a)

Mass (g)	Postage (\$)
$0 < x \leq 100$	1.25
$100 < x \leq 200$	2.35
$200 < x \leq 500$	4.05



b)



### 4.3 Construct Piecewise Linear Functions Without Technology

1. i) a)

$x$	$y$	$(x, y)$
0	1	(0, 1)
2	3	(2, 3)
4	5	(4, 5)
5	7	(5, 7)
6	9	(6, 9)
7	10	(7, 10)
10	13	(10, 13)

b)

$x$	$y$	$(x, y)$
0	4	(0, 4)
3	4	(3, 4)
6	1	(6, 1)
7	1	(7, 1)
8	5	(8, 5)
9	5	(9, 5)
10	5	(10, 5)

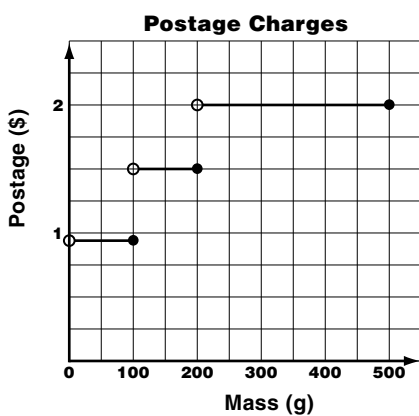
(ii) a) connected b) separate

2. a) closed b) open c) closed d) open

3. a)

Mass (g)	Postage (\$)
$0 < x \leq 100$	0.92
$100 < x \leq 200$	1.50
$200 < x \leq 500$	2.00

c)



### 4.4 Interpolation and Extrapolation

1. a) 100 m b) 400 m c) 5 min

d) 5.25 min e) 800 m f) 9 min

2. a) 20 km b) 30 km c) after 15 min d) after 50 min

e) 60 km f) after 90 min

### Chapter 4 Review

1. a) yes b) yes c) yes d) no

2. a) separated b) connected

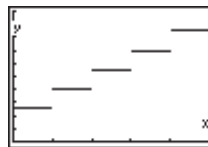
3. a)

Time (h)	Parking Fee (\$)
$0 < x \leq 1$	2.50
$1 < x \leq 2$	4.00
$2 < x \leq 3$	5.50
$3 < x \leq 4$	7.00
$4 < x \leq 5$	8.50

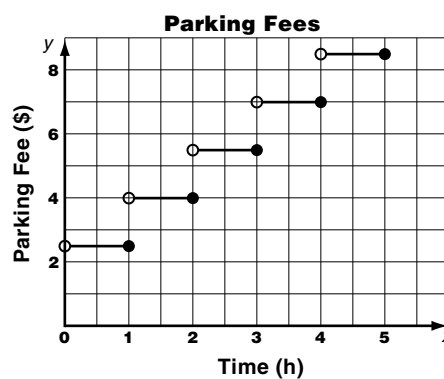
b)

$x$	$y$
0.5	2.50
1.0	2.50
1.5	4.00
2.0	4.00
2.5	5.50
3.0	5.50
3.5	7.00
4.0	7.00
4.5	8.50
5.0	8.50

c)



d)





4. a) (15, 23)  
 b) the number of CDs and tapes that total 38 and have a total value of \$396  
 c) 15 tapes and 23 CDs

## Chapter 5 Review

1. a) (2, 7) b) (4, -6) c) (-1, 4) d) (1, 0)  
 2. a) (3, 10) b) (-4, -13)  
 c) (0.65, 0.76) d) (13.01, 4.54)  
 e) (-0.1, -1.4) f) (1, -1)  
 3. a) (7, 23) b) (-1, 3) c) (1, 1) d) (-1, 1)  
 4. a) (5, 1) b) (2, -1)  
 c)  $\left(\frac{10}{11}, -\frac{27}{22}\right)$  d) (4, -1)  
 5. a)  $y$  is the total weekly salary (in dollars),  $x$  is the total sales (in dollars)  
 b) (2500, 950)  
 c) the amount of total sales that gives the same weekly salary for each plan  
 d) for sales less than \$2500  
 e) for sales more than \$2500  
 6. a) (48, 22) b) 48 boxes of 60-W bulbs, 22 boxes of 100-W bulbs

## CHAPTER 6 Similar Triangles

### 6.1 Explore Similar Triangles

1. DC  
 2. CB  
 3. ED  
 4. CAB  
 5. ECD  
 6. EDC  
 7. a)  $\triangle PQR \sim \triangle VXW$ ; because the ratio of corresponding pairs of sides is the same, 2:1  
 b)  $\frac{PQ}{VX} = \frac{QR}{XW} = \frac{RP}{WV}$ ,  $\angle P = \angle V$ ,  $\angle Q = \angle X$ ,  $\angle R = \angle W$   
 8. Answers may vary.  
 9. Answers may vary.

### 6.2 Apply Similar Triangles

1. 41.4 m  
 2. 84 cm  
 3. 18.9 m  
 4. The triangles are not similar because they have different shape: the acute angles are not the same in

- both.  
 5. Answers may vary.

### 6.3 The Pythagorean Relation

1. In a right triangle, the hypotenuse is the longest side. It is the side opposite the right angle.  
 2.  $k = 13.6$  m    3.  $w = 13.3$  m    4.  $b = 6.2$   
 5. 39.8 m    6. yes    7. 2.3 m

### 6.4 Similar Right Triangles: Pythagorean Triples

1. A Pythagorean Triple is three numbers,  $a$ ,  $b$ , and  $c$ , that represent the sides of a right triangle, where  $c$  is the hypotenuse.  
 2. no  
 3. yes  
 4. yes  
 5. no  
 6.–9. Answers may vary. One possible answer is given for each.  
 6. {3, 4, 5}  
 7. {56, 90, 106}  
 8. {3, 4, 5}  
 9. {8, 15, 17}  
 10. 17  
 11. 36  
 12. no  
 13. a) Use the {3, 4, 5} Pythagorean Triple.  
 b) Answers may vary.

### Chapter 6 Review

1. AD  
 2. AD  
 3. ACD  
 4. AEB  
 5. ACD  
 6. Three pairs of angles are equal, so  $\triangle PQR \sim \triangle TUS$ .  
 7.  $\angle P = \angle T$ ,  $\angle Q = \angle U$ ,  $\angle R = \angle S$ ,  $\frac{PQ}{TU} = \frac{QR}{US} = \frac{PR}{TS}$   
 8. 8.6  
 9. 8.9  
 10. 1.0  
 11. no;  $12^2 \neq 6^2 + 9^2$   
 12. no;  $13^2 + 14^2 \neq 27^2$   
 13. yes;  $22^2 + 120^2 = 122^2$ ; {11, 60, 61}, {33, 180, 183}  
 14. 5.25 m  
 15. 2.4 m

16. 81.9 m  
 17. Answers may vary.

### Cumulative Review, Chapters 4–6

1. c, d  
 2. Answers may vary. The cyclists set out at 8 A.M. and cycled for 2 h at an average speed of 20 km/h. At 10 A.M. they stopped for half an hour, perhaps visiting the old church. They stopped at 12:30 P.M. for 1 h, probably for lunch. Between 1:30 P.M. and 4 P.M. they only travelled 20 km. Between 4 P.M. and 5 P.M. they sped up, travelling 40 km in this hour. At 5 P.M., they stopped for the day.  
 3. a) (2, 1)                      b) (4, -5)  
 4. a) Substitute the values for  $x$  and  $y$ , and check whether the left and right sides of both equations are true. Talia's solutions checks in  $3x + 2y = 2$  but not in the other equation. Fatima's solution checks in both equations.  
 b) Use either the elimination or the substitution method to solve the linear system.  
 5. 5.9 m  
 6. a) 7.7 m                      b) 28.7  
 7. a) 48; no; {7, 24, 25}    b) 28; yes  
 c) 60; no; {3, 4, 5}

## CHAPTER 7 Trigonometry

### 7.1 Explore the Tangent Ratio

1. a) opposite side: BC, adjacent side: AB, hypotenuse: AC  
 b)  $\tan A = \frac{BC}{AB}$   
 2. a) opposite side: BC, adjacent side: AC, hypotenuse: AB  
 b)  $\tan A = \frac{BC}{AC}$   
 3. 0.4663  
 4. 5.6713  
 5. 0  
 6. 1  
 7. 0.4369  
 8. 0.0437  
 9.  $50^\circ$   
 10.  $85^\circ$   
 11.  $12^\circ$

12.  $20^\circ$   
 13. 20  
 14. 2  
 15. a) 7.2                      b)  $56^\circ$   
 16. a) 11.2                     b)  $48^\circ$   
 17. a) 3.8                      b)  $35^\circ$   
 18. 3.0 m

### 7.2 Explore the Sine Ratio

1. a) opposite side: BC = 5, adjacent side: AC = 12, hypotenuse: AB = 13  
 b)  $\sin A = \frac{BC}{AB} = \frac{5}{13}$   
 2. a) opposite side: BC = 6, adjacent side: AB = 8, hypotenuse: AC = 10  
 b)  $\sin A = \frac{BC}{AC} = \frac{3}{5}$   
 3. 0.7986  
 4. 0.9976  
 5. 0  
 6. 1  
 7. 0.9219  
 8. 0.0837  
 9.  $46^\circ$   
 10.  $78^\circ$   
 11.  $10^\circ$   
 12.  $26^\circ$   
 13. 3  
 14. 9  
 15. a) 8                      b) 0.4706                      c)  $28^\circ$   
 16. a) 12.0                    b) 0.7474                    c)  $48^\circ$   
 17. a) 6.9                    b) 0.5329                    c)  $32^\circ$   
 18.  $2.3^\circ$

### 7.3 Explore the Cosine Ratio

1. a) opposite side: BC = 8, adjacent side: AC = 15, hypotenuse: AB = 17  
 b)  $\cos A = \frac{AC}{AB} = \frac{15}{17}$   
 2. a) opposite side: BC = 12, adjacent side: AC = 9, hypotenuse: AB = 15  
 b)  $\cos A = \frac{AC}{AB} = \frac{3}{5}$   
 3. 0.6947  
 4. 0.1564  
 5. 0.7071  
 6. 0

7. 0.5864
8. 0.9988
9.  $24^\circ$
10.  $88^\circ$
11.  $38^\circ$
12.  $6^\circ$
13. 6.7
14. 5.9
15. a) 14.4                      b)  $26^\circ$
16. a) 14.9                      b)  $42^\circ$
17. a) 12.7                      b)  $34^\circ$
18. 1.3 m

### 7.4 Apply Trigonometry

1. 183.8 m
2. 463.6 m
3. 14.1 m
4.  $14.0^\circ$
5.  $5.1^\circ$
6.  $72.5^\circ$
7. between 1.7 m and 3.4 m away
8. Answers may vary.

### Chapter 7 Review

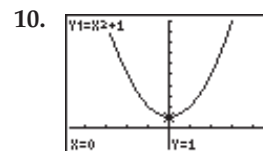
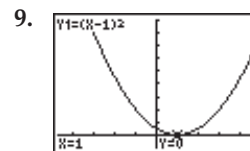
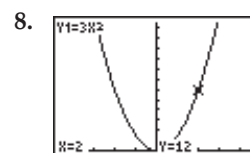
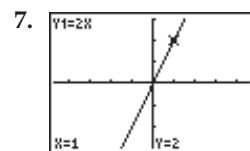
1. 1.0355
2. 0.3907
3. 0.9703
4. 0.3839
5. 0.9778
6. 0.3007
7.  $47^\circ$
8.  $44^\circ$
9.  $63^\circ$
10.  $1^\circ$
11.  $15^\circ$
12.  $75^\circ$
13. a) 8.9 m  
b) hypotenuse: AC = 12 m, opposite side: BC = 8 m, adjacent side: AB = 8.9 m  
c)  $\tan A = \frac{8}{8.9}$ ,  $\sin A = \frac{2}{3}$ ,  $\cos A = \frac{8.9}{12}$   
d)  $42^\circ$
14. a) 6.9 cm  
b) hypotenuse: PR = 6.9 cm, opposite side: QR = 4.1 cm, adjacent side: PQ = 5.6 cm

- c)  $\tan P = \frac{4.1}{5.6}$ ,  $\sin P = \frac{4.1}{6.9}$ ,  $\cos P = \frac{5.6}{6.9}$
- d)  $36^\circ$
15. a) 0.7 km  
b) hypotenuse: KM = 0.9 km, opposite side: KL = 0.6 km, adjacent side: LM = 0.7 km  
c)  $\tan M = \frac{0.6}{0.7}$ ,  $\sin M = \frac{0.6}{0.9}$ ,  $\cos M = \frac{0.7}{0.9}$   
d)  $42^\circ$
16. a) 9409.3 m                      b) 9619.5 m
17. 62.1 m
18.  $10.6^\circ$

## CHAPTER 8 Quadratic Functions

### 8.1 Introduce Quadratic Functions

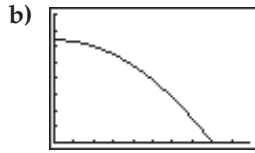
1. yes
2. no; linear
3. yes
4. 3
5. 5
6. -7



11. a) 2 s                      b) 3 m                      c) 4 s

12. a)

$x$	$A$
0	64
2	60
4	48
6	28
8	0



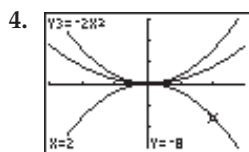
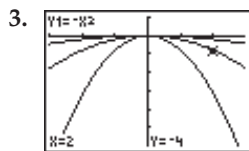
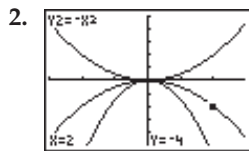
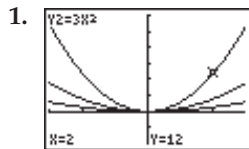
c) no;  $c$  represents a length

d) no;  $A$  represents an area

e) 8; this is the maximum length of the side of the square garden. If  $x$  is 7 m, then the flower border is 0.5 m wide, if  $x$  is 6 m, then the flower border is 1 m wide. Any value of  $x$  between 6 m and 7 m is reasonable in the garden context.

## 8.2 Quadratic Functions of the Form

$$y = ax^2$$



5. upward; stretched by factor 6

6. downward; stretched by factor 3.2

7. upward; compressed by factor  $\frac{3}{4}$

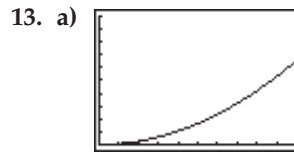
8. downward; compressed by factor  $\frac{2}{3}$

9.  $y = 8x^2$

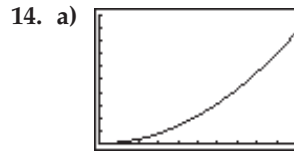
10.  $y = \frac{1}{5}x^2$

11.  $y = -6x^2$

12.  $y = -0.5x^2$



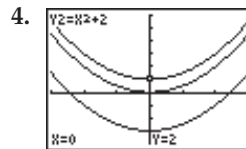
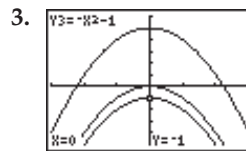
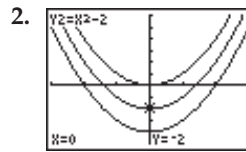
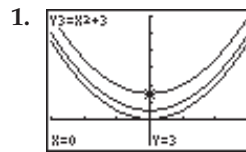
b) 4.2 s



b) 9 cm

## 8.3 Quadratic Functions of the Form

$$y = x^2 + k$$



5. 8; (0, 8)

6. -5; (0, -5)

7. -4; (0, -4)

8. 9; (0, 9)

9. i) -1 ii) 1 and -1 iii) translate  $y = x^2$  1 unit downward

10. i) -9 ii) 3 and -3 iii) translate  $y = x^2$  9 units downward

11. i) 1 ii) 1 and -1 iii) translate  $y = -x^2$  1 unit upward

12. i) -0.64 ii) 0.8 and -0.8 iii) translate  $y = x^2$  0.64 units downward

13. i) 4 ii) 2 and -2 iii) translate  $y = -x^2$  4 units upward

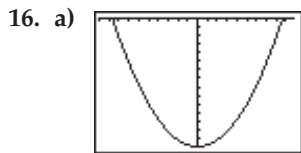
14. i) 4 ii) no  $x$ -intercepts iii) translate  $y = x^2$  4 units upward

15. a) Both parabolas have the same shape as  $y = x^2$ , and both have  $y$ -intercept 3.  $y = x^2 + 3$  opens upward,  $y = -x^2 + 3$  opens downward.

b) Both parabolas have  $y$ -intercept  $-7$  and open upward.  $y = 3x^2 - 7$  is 3 times as steep as  $y = x^2 - 7$ .

c) Both parabolas have the same shape as  $y = x^2$ .  $y = -x^2 - 2$  opens downward and has  $y$ -intercept  $-2$ ,  $y = x^2 + 2$  opens upward and has  $y$ -intercept 2.

d) Both parabolas open upward.  $y = x^2 + 3$  has  $y$ -intercept 3,  $y = 2x^2 + 1$  is twice as steep and has  $y$ -intercept 1.

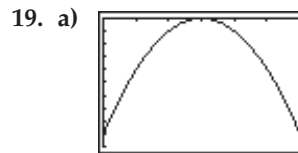


b) 15 cm                      c) approximately 17.3 cm

17. a)  $y = 2x^2 - 9$               b)  $y = -\frac{5}{9}x^2 + 5$

### 8.4 Quadratic Functions of the Form $y = (x - h)^2$

1. 5; (5, 0)
2.  $-4$ ;  $(-4, 0)$
3. 9; (9, 0)
4.  $-11$ ;  $(-11, 0)$
5. translate 4 units to the right
6. translate 1 unit to the left
7. translate 7.5 units to the left
8. translate 6 units to the right
9.  $y = (x - 6)^2$
10.  $y = (x + 8)^2$
11.  $y = (x + 5)^2$
12.  $y = (x - 2)^2$
13. i) (2, 0)              ii) 2                      iii) 4
- iv) horizontal, 2 units to the right
14. i)  $(-3, 0)$               ii)  $-3$                       iii) 9
- iv) horizontal, 3 units to the left
15. i) (1, 0)              ii) 1                          iii) 1
- iv) horizontal, 1 unit to the right
16. i) (0,  $-1$ )              ii) 1 and  $-1$               iii)  $-1$
- iv) vertical, 1 unit downward
17. i)  $(-2, 0)$               ii)  $-2$                       iii) 4
- iv) horizontal, 2 units to the left
18. i) (0, 5)              ii) no  $x$ -intercepts      iii) 5
- iv) vertical, 5 units upward

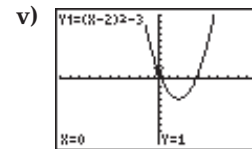


b) 30 m                      c) 45 m

### 8.5 Quadratic Functions of the Form $y = a(x - h)^2 + k$

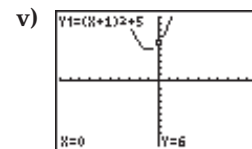
1. (5, 8)
2.  $(-6, -2)$
3.  $(-3, 7)$
4. (8,  $-3$ )
5.  $y = 3(x + 5)^2 - 7$
6.  $y = -3(x - 5)^2$
7.  $y = -3(x + 2)^2 + 3$
8. i) (2,  $-3$ )              ii) upward
- iii) 1

ii) upward



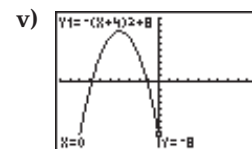
9. i)  $(-1, 5)$
- iii) 6

ii) upward



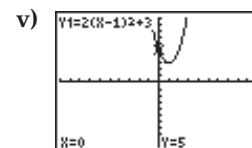
10. i)  $(-4, 8)$
- iii)  $-8$

ii) downward



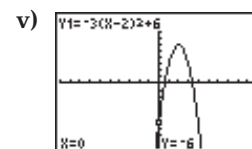
11. i) (1, 3)
- iii) 5

ii) upward



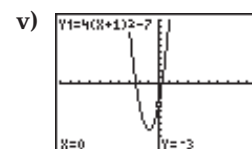
12. i) (2, 6)
- iii)  $-6$

ii) downward

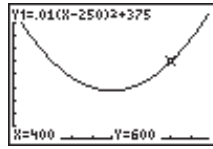


13. i)  $(-1, -7)$
- iii)  $-3$

ii) upward

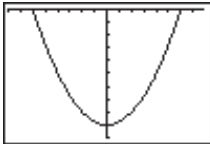


14. a) 6 s b) 15 m  
 15. a) 250 km/h  
 b) 600 L/h

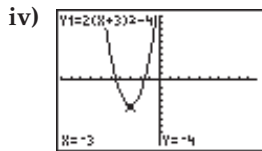


### Chapter 8 Review

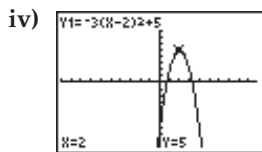
1. a) no b) yes c) yes  
 2.  $y = \frac{1}{10}x^2$ ,  $y = 0.2x^2$ ,  $y = \frac{1}{3}x^2$ ,  $y = x^2$ ,  $y = 3x^2$ ,  
 $y = 5x^2$   
 3. a)  $y = 6x^2$  b)  $y = \frac{1}{4}x^2$  c)  $y = x^2 - 4$   
 d)  $y = -x^2 + 7$  e)  $y = (x - 5)^2$  f)  $y = (x + 12)^2$



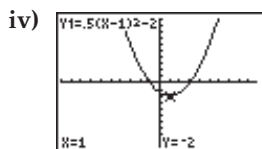
- b) 18 cm c) 120 cm  
 5. a)  $(-3, 0)$ , upward b)  $(1, 0)$ , upward  
 c)  $(-2, 0)$ , downward d)  $(12, 5)$ , upward  
 e)  $(-3, -1)$ , downward f)  $(-4, 7)$ , upward  
 6. a) i)  $(-3, -4)$  ii) vertical stretch by factor 2



- b) i)  $(2, 5)$  ii) vertical stretch by factor 3



- c) i)  $(1, -2)$  ii) vertical compression by factor  $\frac{1}{2}$



7. a) 2.5 m b) 100 m

## CHAPTER 9 Algebraic Expressions

### 9.1 Multiply Two Binomials

- |                                 |                       |
|---------------------------------|-----------------------|
| 1. $x^2 + 9x + 20$              | 2. $m^2 - 5m - 24$    |
| 3. $a^2 - 5a + 6$               | 4. $p^2 - 3p - 28$    |
| 5. $2y^2 + 11y + 15$            | 6. $3n^2 - 12$        |
| 7. $3k^2 - 11k - 4$             | 8. $4x^2 - 23x + 15$  |
| 9. $4v^2 - 9$                   | 10. $2x^2 + 16x + 14$ |
| 11. a) $x^2 - x - 42$           | b) $168 \text{ m}^2$  |
| c) 21 m, 8 m, $168 \text{ m}^2$ | d) same               |
| 12. a) $2x^2 + 7x - 15$         | b) $99 \text{ m}^2$   |
| c) 11 m, 9 m, $99 \text{ m}^2$  | d) same               |

### 9.2 Special Products

- |                      |                        |
|----------------------|------------------------|
| 1. $x^2 + 8x + 16$   | 2. $p^2 + 18p + 81$    |
| 3. $4w^2 + 28w + 49$ | 4. $a^2 - 6a + 9$      |
| 5. $9f^2 - 24f + 16$ | 6. $x^2 - 25$          |
| 7. $z^2 - 144$       | 8. $4p^2 - 1$          |
| 9. $49a^2 - 9$       | 10. $36 - 81t^2$       |
| 11. 3596             | 12. $m^2 + 12m + 36$   |
| 13. $v^2 - 64$       | 14. $36x^2 - 60x + 25$ |
| 15. $49y^2 - 9$      | 16. $4x^2 + 36x + 81$  |
| 17. $9x^2 - 1$       |                        |

### 9.3 Expand and Simplify Polynomial Expressions

- |                      |                       |
|----------------------|-----------------------|
| 1. $2x^2 + 10x + 2$  | 2. $20n^2 - 40n$      |
| 3. $9k^2 - 4k + 20$  | 4. $15w^2 + 8w + 10$  |
| 5. $15q^2 + 4q - 18$ | 6. $5h^2 - 22h + 7$   |
| 7. $-20 - 8w$        | 8. $3k^2 + 36k - 48$  |
| 9. $55x^2 + 4x + 5$  | 10. $4x^2 - 19x + 41$ |

### 9.4 Common Factors

- |                        |                           |
|------------------------|---------------------------|
| 1. $3(x - 4)$          | 2. $6(2a + 5)$            |
| 3. $2(2a - 8b + 3)$    | 4. $12(5 + 2p + 3q)$      |
| 5. $v(2v - 5)$         | 6. $x^2(x + 6)$           |
| 7. $z(7z^2 - 15z + 1)$ | 8. $4s(3 - s)$            |
| 9. $3m^2(2 + 3m)$      | 10. $4p(2p + 1 - 4p^2)$   |
| 11. $5(2t^2 - t + 6)$  | 12. $6c^2(6 + 3c - 4c^3)$ |
| 13. $8(2x + 3y)$       | 14. $8(w^2 + 4w - 2)$     |
| 15. $t(5t^2 - 3t + 2)$ | 16. $p(14p^2 - 7p + 1)$   |

### 9.5 Factors of a Difference of Squares

- |                     |                     |
|---------------------|---------------------|
| 1. $(m + 8)(m - 8)$ | 2. $(x + 6)(x - 6)$ |
|---------------------|---------------------|

3.  $(v + 10)(v - 10)$
5.  $(2h + 7)(2h - 7)$
7.  $(3 + u)(3 - u)$
9.  $5(2x + 3)(2x - 3)$
11.  $7(3 + p)(3 - p)$
13.  $(4x + 1)(4x - 1)$
15.  $(a + b)(a - b)$
4.  $(k + 1)(k - 1)$
6.  $(9p + 4)(9p - 4)$
8.  $(11 + 5t)(11 - 5t)$
10.  $3(4y + 3)(4y - 3)$
12.  $h(8h + 5)(8h - 5)$
14.  $(6w + 11)(6w - 11)$
16.  $(u + 10v)(u - 10v)$

### 9.6 Factors of Trinomials of the Form $x^2 + bx + c$

1.  $(x + 2)(x + 3)$
3.  $(m - 4)(m - 3)$
5.  $(p + 20)(p - 1)$
7.  $(h - 8)(h + 3)$
9.  $(w + 4)^2$
11.  $(c - 15)(c + 3)$
13.  $5(x + 4)(x - 1)$
15.  $(x + 14)(x - 2)$
2.  $(y + 7)(y + 6)$
4.  $(a - 10)(a - 2)$
6.  $(b + 6)(b - 3)$
8.  $(s - 4)(s + 2)$
10.  $(k - 10)(k - 5)$
12.  $(g - 8)(g + 6)$
14.  $6(v - 5)(v + 4)$
16.  $(y - 7)^2$

### 9.7 Solve Quadratic Equations By Factoring

1.  $x = 3$  or  $x = 1$
3.  $w = -5$  or  $w = -3$
5.  $b = 2$  or  $b = 1$
7.  $h = 6$  or  $h = -6$
9.  $d = 0$  or  $d = 3$
11.  $u = \frac{5}{2}$  or  $u = -\frac{5}{2}$
13.  $a = -2$  or  $a = 15$
15.  $z = 12$  or  $z = -1$
2.  $m = -5$  or  $m = 2$
4.  $p = 10$  or  $p = -3$
6.  $t = -7$  or  $t = 2$
8.  $n = -8$  or  $n = 2$
10.  $y = -5$  or  $y = 3$
12.  $s = 7$  or  $s = 2$
14.  $x = -9$  or  $x = 7$
16. 5 m by 4 m

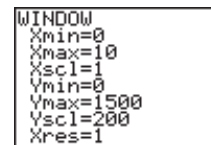
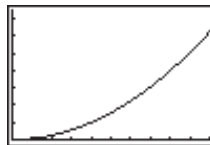
### Chapter 9 Review

1.  $k^2 + 2k - 15$
3.  $x^2 + 11x + 18$
5.  $v^2 - 49$
7.  $x^2 - 10x + 25$
9.  $3x^2 - 10x + 3$
11.  $x^2 + 7x + 10$
13.  $3(2x^2 + 5x - 4)$
15.  $(x + 9)(x - 9)$
17.  $(w + 7)(w + 5)$
19.  $(h - 15)(h + 3)$
21.  $k = 5$  or  $k = -3$
2.  $p^2 - 11p + 28$
4.  $2w^2 + 9w + 10$
6.  $k^2 + 8k + 16$
8.  $4g^2 - 1$
10.  $3x^2 + 28x + 52$
12.  $4(2h - 3)$
14.  $w(5w - 14)$
16.  $(4 + 5k)(4 - 5k)$
18.  $(s + 3)^2$
20.  $4(x + 5)^2$
22.  $w = 9$  or  $w = -8$

### Cumulative Review, Chapters 7-9

1. a)  $\frac{5}{12}$       b)  $\frac{5}{13}$       c)  $\frac{12}{13}$

- d)  $22.6^\circ$
2. 146.6 m
3.  $21^\circ$
4. 6.6 m
5. a)



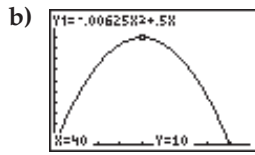
- b) 800 m
6. For  $y = x^2 - 6$ , its vertex is at  $(0, -6)$  and its  $y$ -intercept is  $-6$ . For  $y = (x - 6)^2$ , its vertex is at  $(6, 0)$  and its  $y$ -intercept is 36. Both open upward and have the same shape as  $y = x^2$ .
7. a)  $(-1, -2)$ ; upward; 1      b)  $(3, 4)$ ; downward;  $-14$
8. a) 8 s      b) 15 000 m
9. a)  $x^2 + 8x + 15$       b)  $2x^2 + 5x - 12$
- c)  $21 - 10m + m^2$       d)  $4p^2 + 12p + 9$
- e)  $d^2 - 81$       f)  $9w^2 - 24w + 16$
- g)  $5a^2 + 18a + 9$       h)  $-x^2 + 4x - 49$
10. a)  $4x(x^2 - 6x + 3)$       b)  $(x + 10)(x + 4)$
- c)  $(3x + 7)(3x - 7)$       d)  $(x + 7)(x - 3)$
- e)  $(x - 8)^2$       f)  $3(x - 14)(x + 4)$
11. a) 3,  $-2$       b) 5,  $-5$
- c)  $-8, 3$       d)  $-6$
- e) 10,  $-2$       f) 6, 8
12. 80 m by 50 m

## CHAPTER 10 Solve Problems: Quadratic Equations

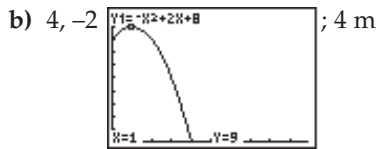
### 10.1 Relate Roots and Intercepts

1. 7
2.  $-5$
3.  $-3$
4. 1, 4
5. 2,  $-5$
6. 0, 4
7. a) 6      b) 2, 3
8. a)  $-1$       b) 1,  $-2$
9. a) 8      b)  $-2, -4$
10. a) 5      b) 1, 5
11. a) 9      b) 3
12. a) 6      b)  $-1, -6$
13. a)  $-4$       b)  $y = -(x^2 - 4x + 4)$ ; 2
14. a)  $-6$       b)  $y = 2(x^2 + 2x - 3)$ ; 1,  $-3$

15. a)  $-6$                       b)  $y = -3(x^2 + 3x + 2)$ ;  $-1, -2$   
 16. a)  $0, 80$ ; The ball is on the ground ( $x = 0$ ), then, after it is kicked, it travels through the air and lands on the ground again  $80$  m away ( $x = 80$ ).



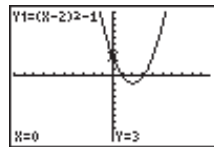
- c)  $10$  m  
 17. a) The  $y$ -intercept represents the height of the diving platform.



- c)  $9$  m

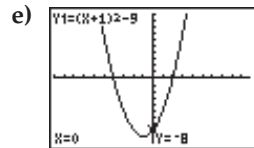
## 10.2 Standard and General Forms of a Quadratic Function

1. a)  $(-6, 10)$     b)  $y = x^2 + 12x + 46$     c)  $46$   
 2. a)  $(3, -4)$     b)  $y = x^2 - 6x + 5$     c)  $5$   
 3. a)  $(5, 0)$     b)  $y = -x^2 + 10x - 25$     c)  $-25$   
 4. a)  $(-7, 2)$     b)  $y = 3x^2 + 42x + 149$     c)  $149$   
 5. a)  $(8, -13)$     b)  $y = 2x^2 - 32x + 115$     c)  $115$   
 6. a)  $(-1, -3)$     b)  $y = -2x^2 - 4x - 5$     c)  $-5$   
 7. a)  $(2, -1)$     b)  $y = x^2 - 4x + 3$     c)  $3$   
 d)  $3, 1$



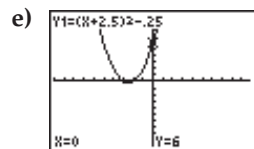
8. a)  $(-1, -9)$   
 c)  $-8$  d)  $2, -4$

b)  $y = x^2 + 2x - 8$



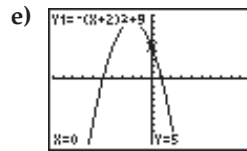
9. a)  $(-2.5, -0.25)$   
 c)  $6$  d)  $-2, -3$

b)  $y = x^2 + 5x + 6$

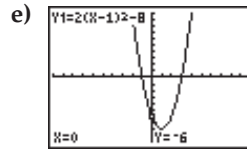


10. a)  $(-2, 9)$   
 c)  $5$

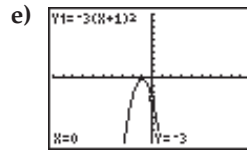
b)  $y = -x^2 - 4x + 5$   
 d)  $-5, 1$



11. a)  $(1, -8)$                       b)  $y = 2x^2 - 4x - 6$   
 c)  $-6$                                       d)  $3, -1$



12. a)  $(-1, 0)$                       b)  $y = -3x^2 - 6x - 3$   
 c)  $-3$                                       d)  $-1$



13. a)  $y = -0.03125x^2 + 0.5x + 6$

- b)                      c)  $6$  m

- d)  $8$  m                                      e)  $24$  m

14. a)  $y = -2.5x^2 + 205x + 1800$

- b) ;  $\$4.90$

## 10.3 Approximate Intercepts Graphically to Solve Problems

1.  $-3; -4$

2.  $7; 1.5$

3.  $-9; -3$

4.  $21; 2.5$

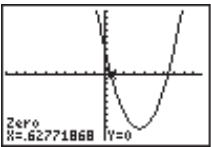
5.  $-4; 0.5$

6.  $11; -0.25$

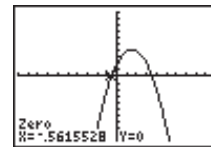
7. ;  $1.6, 4.4$

8. ;  $-0.2, -4.8$

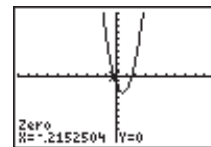
9. ; 0.6, 6.4



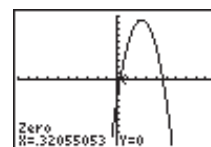
10. ; -0.6, 3.6



11. ; -0.2, 1.5

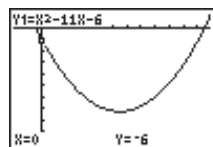
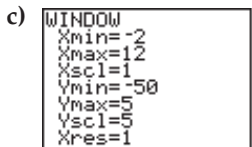


12. ; 0.3, 4.7



13. a) -6

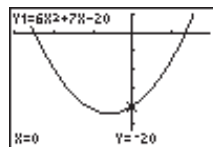
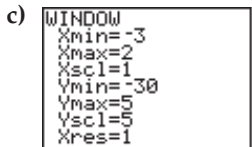
b) 5.5



d) -0.5, 11.5

14. a) -20

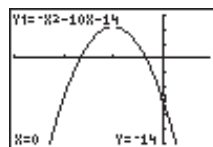
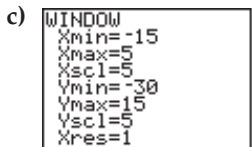
b)  $-\frac{7}{12}$



d) 1.3, -2.5

15. a) -14

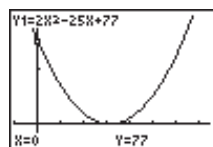
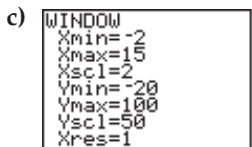
b) -5



d) -8.3, -1.7

16. a) 77

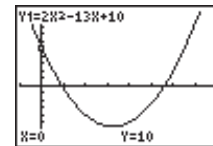
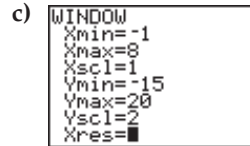
b) 6.25



d) 5.5, 7

17. a) 10

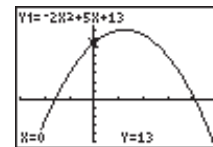
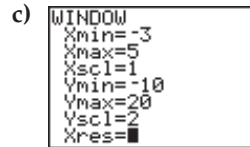
b) 3.25



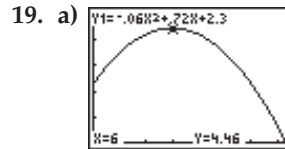
d) 0.9, 5.6

18. a) 13

b) 1.25



d) -1.6, 4.1



b) 4.46 m

c) 11.3 m

d) 14.6 m

20. a) 35 m

b) 2.8 s

## 10.4 Use Graphs to Solve Projectile Problems

1. a) 0 m    b) 20.4 m    c) 4.1 s    d) 2.9 s

2. a) 0.4 s    b) 0.5 s

3. a) 350 m    b) 19.6 m    c) 8.5 s

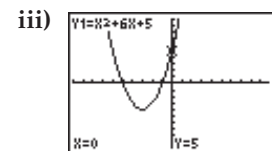
4. a) 2 m    b) 4.0 s, 32.2 m

c) 0 s to 0.2 s, 7.9 s to 8.2 s    d) 8.2 s

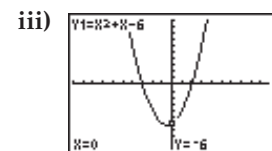
5. a) 103.8 m    b) 7.8 s

## Chapter 10 Review

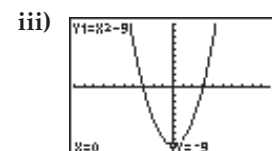
1. a) i) 5    ii) -1, -5



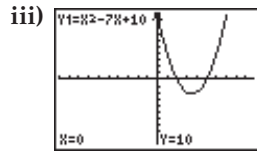
b) i) -6    ii) 2, -3



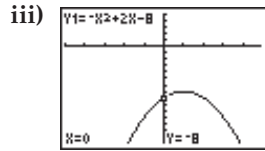
c) i) -9    ii) 3, -3



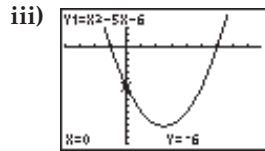
d) i) 10      ii) 2, 5



e) i) -8      ii) 4, -2



f) i) -6      ii) 6, -1



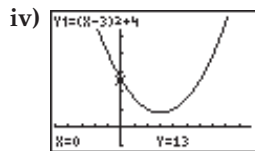
2. a) 0, 200; 200 m

b) 70 m

3. a) i) (3, 4)

ii)  $y = x^2 - 6x + 13$

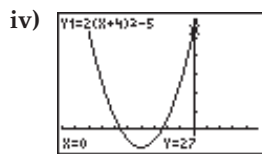
iii) 13, (6, 13)



b) i) (-4, -5)

ii)  $y = 2x^2 + 16x + 27$

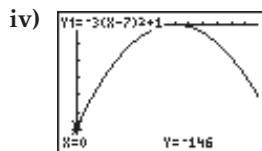
iii) 27, (-8, 27)



c) i) (7, 1)

ii)  $y = -3x^2 + 42x - 146$

iii) -146, (14, -146)



4. a) 4 m    b) 2.56 m    c) 4 m

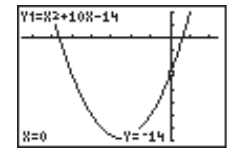
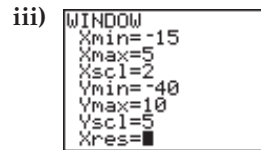
5. a) 0.7, 4.3

b) -1.2, 5.2

c) 0.6, -4.1

6. a) i) -14

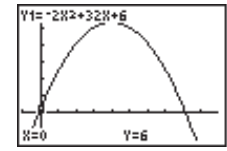
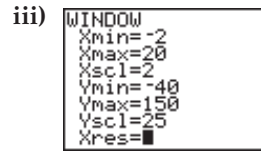
ii) -5



iv) 1.2, -11.2

b) i) 6

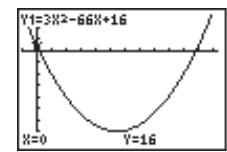
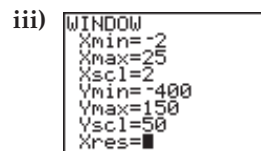
ii) 8



iv) -0.1, 16.2

c) i) 16

ii) 11



iv) 0.2, 21.8

7. a) 0.8 m    b) 1.6 m    c) 1.0 s

## Cumulative Review, Chapters 1-10

1. 510 mL

2. 1.14¢/mL, 1.06¢/mL

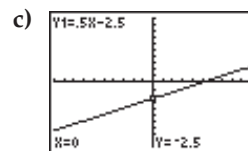
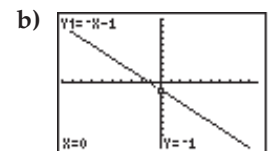
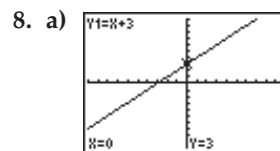
3. \$286.35

4. 10%

5. 2.15 m

6. a) 5    b) 11    c) -1    d) 7    e) -6    f) 2.8    g) 5

7. a)  $h = \frac{2A}{a+b}$     b) 7    c) 8

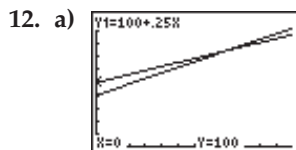
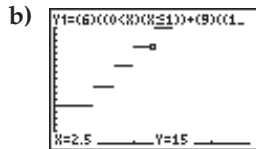


9. a) 2; 5    b) 1; -3    c)  $-\frac{2}{5}, 1$

10. a)  $y = 5x + 10$     b) 8 h

11. a)

Time (hours)	Fee Equation
$0 < x \leq 1$	$y = 6$
$1 < x \leq 1.5$	$y = 9$
$1.5 < x \leq 2$	$y = 12$
$2 < x \leq 2.5$	$y = 15$
$2.5 < x \leq 3$	$y = 18$
$3 < x \leq 3.5$	$y = 21$
$3.5 < x \leq 4$	$y = 24$
$4 < x \leq 4.5$	$y = 27$
$4.5 < x < 24$	$y = 30$



- b) The number of kilometres driven for which the rental fee is the same with both companies.  
 c) Company A is more economical when the distance driven is more than 200 km.

13. a) (3, 4)                      b) (3, 1)  
 14. a) (-1, 1)                    b) (-1, 2)  
 15. a)  $\triangle ADE \sim \triangle ACB$     b)  $BC = 9, AC = 15, DC = 5$   
 c) In  $\triangle AED, 8^2 + 6^2 = 10^2$ . So,  $\angle AED = 90^\circ; \angle ABC = 90^\circ$   
 16. 13.4 m  
 17. 25.2 m  
 18. b)  $7^\circ$   
 19. a) (0, 0); downward    b) (4, 0); upward  
 c) (-1, 5); upward        d) (-4, -3); downward  
 e) (-7.5, 0); upward      f) (8, -1); downward  
 20. a)  $y = x^2 + 3$             b)  $y = (x + 3)^2 - 2$   
 c)  $y = -(x - 4)^2 + 5$   
 21. a)  $m^2 - 4$                 b)  $2t^2 + 7t + 3$   
 c)  $k^2 - 8k + 15$             d)  $9x^2 + 6x + 1$   
 e)  $12n^2 - 40n - 32$         f)  $y^2 + y - 1$   
 22. a)  $(p + 4)(p + 1)$         b)  $(x + 5)^2$   
 c)  $(z - 7)(z + 4)$          d)  $2(k + 5)(k - 2)$   
 e)  $5(t - 2)(t + 2)$         f)  $(n + 6)(n - 5)$   
 23. a) 6, 2                      b) 2, -2                      c) 2, -7  
 24. a) -3, -4                    b) 8, -8                      c) 10, -2  
 25. a) 3.5 m                    b) 64 m  
 26. a) 3200 m                  b) 15.6 s  
 27. a) 4.6 s                      b) 1.2 s to 8.0 s    c) 9.2 s