A Tour of Your Textbook

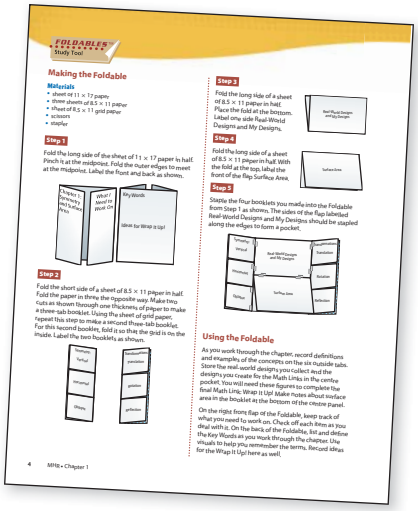
Chapter Opener

Each chapter begins with a two-page spread which introduces you to what you will learn in the chapter.

Foldables™

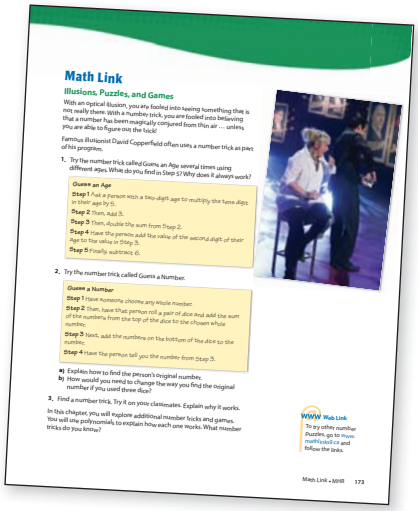
FOLDABLES™ Study Tool

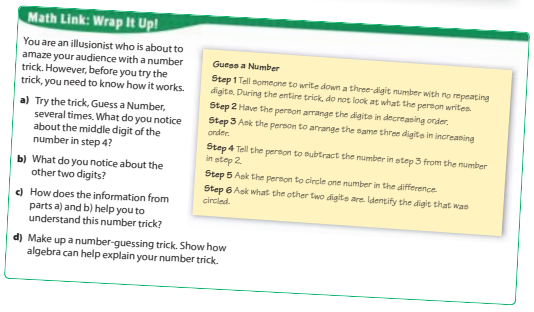
Each chapter includes a Foldable to help you organize what you are learning and keep track of what you need to work on. Instructions on where and how to record information on the Foldable will help you use it as a study tool.

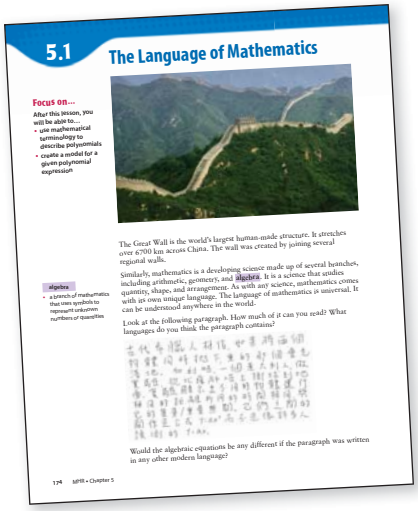


Math Link

Each chapter introduces a Math Link that helps you connect math and your own personal experiences. You will often revisit the Math Link at the end of a lesson. This is an opportunity for you to build concepts and understanding. The Math Link: Wrap It Up! at the end of each chapter gives you an opportunity to demonstrate your understanding of the chapter concepts.







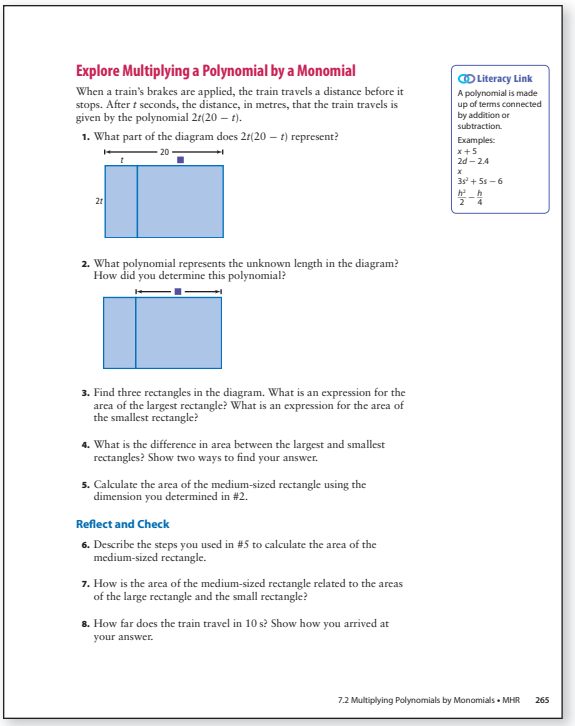
Numbered Sections

The numbered sections often start with a visual to connect the topic to a real setting. The purpose of this introduction is to help you make connections between the math in the section and the real world, or to make connections to what you already know.

A three-part lesson follows.

Explore

- An activity is designed to help you build your own understanding of the new concept and lead toward answers to the key question. This activity is often related to the opening visual and introductory text in the section.



Explore Multiplying a Polynomial by a Monomial

When a train's brakes are applied, the train travels a distance before it stops. After t seconds, the distance, in metres, that the train travels is given by the polynomial $2t(20 - t)$.

1. What part of the diagram does $2t(20 - t)$ represent?

2. What polynomial represents the unknown length in the diagram? How did you determine this polynomial?

3. Find three rectangles in the diagram. What is an expression for the area of the largest rectangle? What is an expression for the area of the smallest rectangle?

4. What is the difference in area between the largest and smallest rectangles? Show two ways to find your answer.

5. Calculate the area of the medium-sized rectangle using the dimension you determined in #2.

Reflect and Check

6. Describe the steps you used in #5 to calculate the area of the medium-sized rectangle.

7. How is the area of the medium-sized rectangle related to the areas of the large rectangle and the small rectangle?

8. How far does the train travel in 10 s? Show how you arrived at your answer.

Literacy Link

A polynomial is made up of terms connected by addition or subtraction.

Examples:

$x + 5$

$2d - 2.4$

x

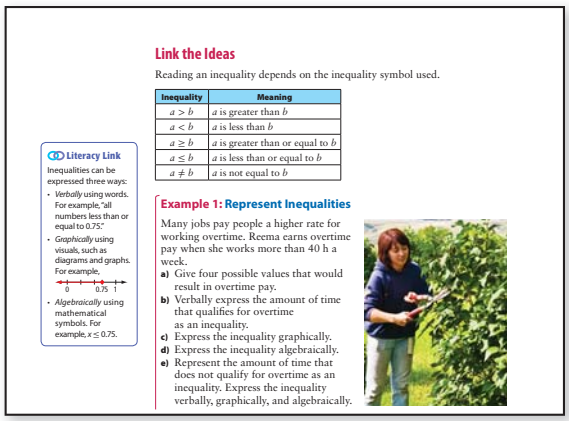
$3s^2 + 5s - 6$

$\frac{h^2}{2} - \frac{h}{4}$

7.2 Multiplying Polynomials by Monomials • MHR 265

Link the Ideas

- Some of these sections start with a piece of text that will help you connect what you did in the Explore to the **Examples**.
- **Examples** and **Solutions** demonstrate how to use the concept.



Link the Ideas

Reading an inequality depends on the inequality symbol used.

Inequality	Meaning
$a > b$	a is greater than b
$a < b$	a is less than b
$a \geq b$	a is greater than or equal to b
$a \leq b$	a is less than or equal to b
$a \neq b$	a is not equal to b

Literacy Link

Inequalities can be expressed three ways:

- *Verbally* using words. For example, "all numbers less than or equal to 0.75."
- *Graphically* using visuals, such as diagrams and graphs. For example,

- *Algebraically* using mathematical symbols. For example, $x \leq 0.75$.

Example 1: Represent Inequalities

Many jobs pay people a higher rate for working overtime. Reema earns overtime pay when she works more than 40 h a week.

a) Give four possible values that would result in overtime pay.

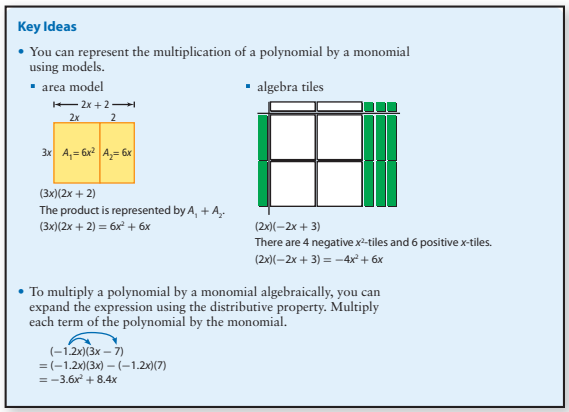
b) Verbally express the amount of time that qualifies for overtime as an inequality.

c) Express the inequality graphically.

d) Express the inequality algebraically.

e) Represent the amount of time that does not qualify for overtime as an inequality. Express the inequality verbally, graphically, and algebraically.

- A summary of the main new concepts is given in the **Key Ideas**.



Key Ideas

- You can represent the multiplication of a polynomial by a monomial using models.
  - area model

$(3x)(2x + 2)$

The product is represented by $A_1 + A_2$.

$(3x)(2x + 2) = 6x^2 + 6x$

  - algebra tiles

$(2x)(-2x + 3)$

There are 4 negative x^2-tiles and 6 positive x-tiles.

$(2x)(-2x + 3) = -4x^2 + 6x$

- To multiply a polynomial by a monomial algebraically, you can expand the expression using the distributive property. Multiply each term of the polynomial by the monomial.

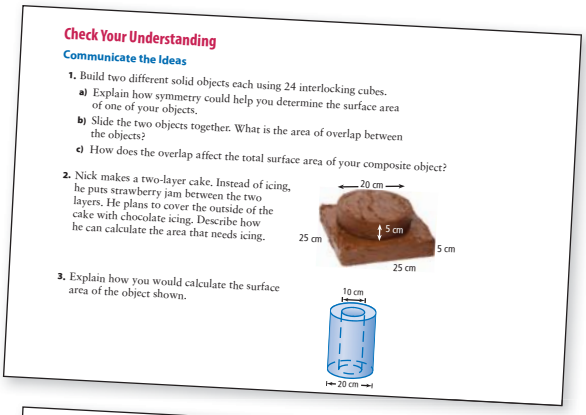
$(-1.2x)(3x - 7)$

$= (-1.2x)(3x) - (-1.2x)(7)$

$= -3.6x^2 + 8.4x$

Check Your Understanding

- **Communicate the Ideas:** These questions let you talk or write about the concepts and assess whether you understand the ideas.
- **Practise:** These are questions to check your knowledge and understanding of what you have learned.
- **Apply:** In these questions, you need to apply what you have learned to solve problems.
- **Extend:** These questions may be more challenging and may make connections to other lessons.



Check Your Understanding

Communicate the Ideas

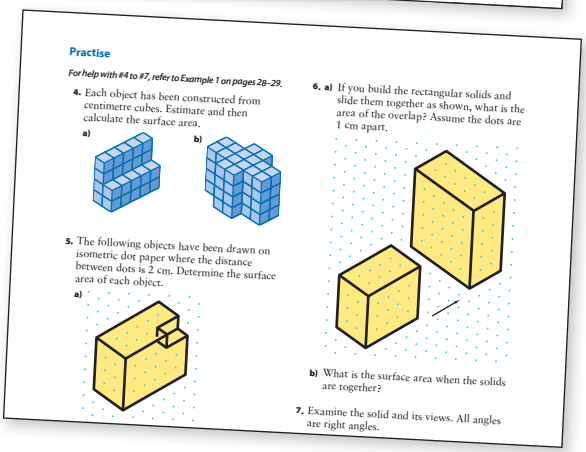
1. Build two different solid objects each using 24 interlocking cubes.
   a) Explain how symmetry could help you determine the surface area of one of your objects.
   b) Slide the two objects together. What is the area of overlap between the objects?
   c) How does the overlap affect the total surface area of your composite object?

2. Nick makes a two-layer cake. Instead of icing, he puts strawberry jam between the two layers. He plans to cover the outside of the cake with chocolate icing. Describe how he can calculate the area that needs icing.

20 cm, 5 cm, 25 cm, 5 cm, 25 cm

3. Explain how you would calculate the surface area of the object shown.

10 cm, 20 cm



Practise

For help with #4 to #7, refer to Example 1 on pages 28–29.

4. Each object has been constructed from centimetre cubes. Estimate and then calculate the surface area.

a) b)

5. The following objects have been drawn on isometric dot paper where the distance between dots is 2 cm. Determine the surface area of each object.

a)

6. a) If you build the rectangular solids and slide them together as shown, what is the area of the overlap? Assume the dots are 1 cm apart.

b) What is the surface area when the solids are together?

7. Examine the solid and its views. All angles are right angles.

How does *MathLinks 9* help you learn?

Understanding Vocabulary

Key Words are listed on the Chapter Opener. Perhaps you already know the meaning of some of them. Great! If not, watch for these terms the first time they are used in the chapter. The meaning is given close by in the margin.

A **Literacy Link** at the beginning of each chapter provides tips to help you read and interpret the chapter content.

Other **Literacy Links** throughout the chapter assist you in reading and interpreting items in math. These tips will help you in other subjects as well.

Key Words

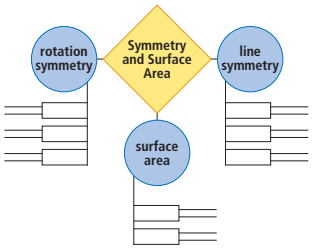
symmetry	rotation symmetry
line of symmetry	order of rotation
line symmetry	angle of rotation
centre of rotation	surface area

Literacy Link

A thematic map can help you understand and connect new terms and concepts.

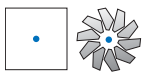
Create a thematic map in your math journal or notebook. Make each shape large enough to write in. Leave enough space to draw additional lines. As you work through the chapter, complete the thematic map.

- Use the boxes to record the key ideas for each section.
- Use the lines to explain the key ideas by recording definitions, examples, and strategies.
- Where possible, include a visual to support your definition.



centre of rotation
- the point about which the rotation of an object or design turns

rotation symmetry
- occurs when a shape or design can be turned about its centre of rotation so that it fits onto its outline more than once in a complete turn



Literacy Link

Parentheses is another name for brackets. They can be used in place of a multiplication sign. For example,

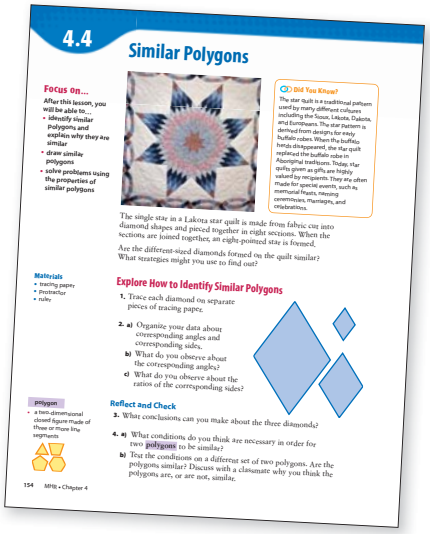
$-4 \times 1.5 = -4(1.5)$

Literacy Link

Klassen's winning time of 1:55.27 means 1 min, 55.27 s.

Understanding Concepts

The **Explore** activities are designed to help you construct your own understanding of new concepts. The key question tells you what the activity is about. Short steps, with illustrations, lead you to make some conclusions in the **Reflect and Check** question(s).



4.4 Similar Polygons

Focus on...

After this lesson, you will be able to...
- identify similar polygons and explain why they are similar
- draw similar polygons
- solve problems using the properties of similar polygons

Did You Know?

The star quilt is a traditional pattern used by many different cultures including the Sioux, Lakota, Dakota, and Europeans. The star pattern is derived from designs for sixty buffalo robes. When the buffalo herds disappeared, the star quilt replaced the buffalo robe in Aboriginal traditions. Today, star quilts given as gifts are highly valued by recipients. They are often made for special events, such as memorial feasts, blessing ceremonies, marriages, and celebrations.

The single star in a Lakota star quilt is made from fabric cut into diamond shapes and pieced together in eight sections. When the sections are joined together, an eight-pointed star is formed.

Are the different-sized diamonds formed on the quilt similar? What strategies might you use to find out?

Materials
- tracing paper
- protractor
- ruler

Explore How to Identify Similar Polygons

1. Trace each diamond on separate pieces of tracing paper.
2. a) Organize your data about corresponding angles and corresponding sides.
   b) What do you observe about the corresponding angles?
   c) What do you observe about the ratios of the corresponding sides?
3. What conclusions can you make about the three diamonds?

Reflect and Check

4. a) What conditions do you think are necessary in order for two polygons to be similar?
   b) Test the conditions on a different set of two polygons. Are the polygons similar? Discuss with a classmate why you think the polygons are, or are not, similar.

Polygon
- a two-dimensional closed figure made of three or more line segments

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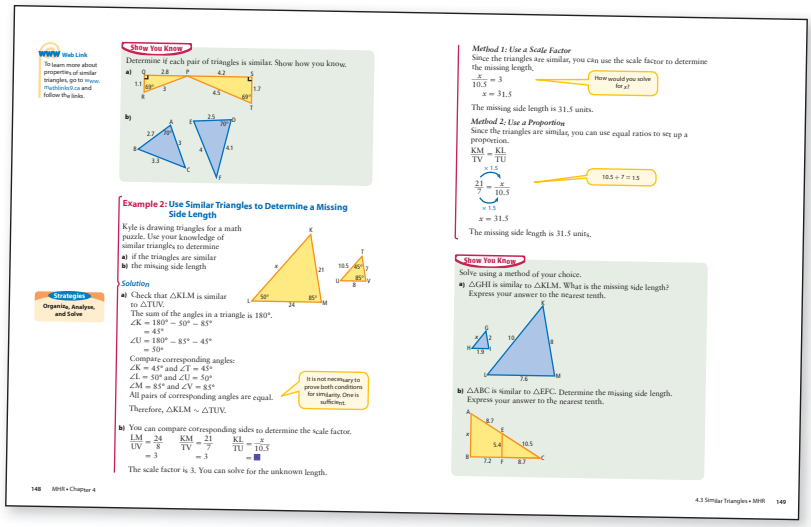
The **Examples** and their worked **Solutions** include several tools to help you understand the work.

- Notes in a speech bubble help you think through the steps.
- Sometimes different methods of solving the same problem are shown. One way may make more sense to you than the other. Or, you may develop another way that means more to you.
- **Problem Solving Strategies** are pointed out.
- Calculator key press sequences are shown where appropriate.
- Most Examples are followed by a **Show You Know**. These questions help you check that you understand the skill covered in the Example.



Web Link

To learn more about properties of similar triangles, go to www.mhlinks9.ca and follow the links.

Show You Know

Determine if each pair of triangles is similar. Show how you know.

a)

b)

Example 2: Use Similar Triangles to Determine a Missing Side Length

Kyle is drawing triangles for a math puzzle. Use your knowledge of similar triangles to determine
a) if the triangles are similar
b) the missing side length

Strategies
Organize, Analyze, and Solve

Solution

a) Check that $\triangle KLM$ is similar to $\triangle TUV$.
The sum of the angles in a triangle is 180°.
$\angle K = 180° - 50° - 85°$
$= 45°$
$\angle U = 180° - 85° - 45°$
$= 50°$
Compare corresponding angles:
$\angle K = 45°$ and $\angle T = 45°$
$\angle L = 50°$ and $\angle U = 50°$
$\angle M = 85°$ and $\angle V = 85°$
All pairs of corresponding angles are equal.
Therefore, $\triangle KLM \sim \triangle TUV$.

It is not necessary to prove both conditions for similarity. One is sufficient.

b) You can compare corresponding sides to determine the scale factor.
$\frac{LM}{UV} = \frac{24}{8}$ $\frac{KM}{TV} = \frac{21}{7}$ $\frac{KL}{TU} = \frac{x}{10.5}$
$= 3$ $= 3$ $=$ ■
The scale factor is 3. You can solve for the unknown length.

Method 1: Use a Scale Factor

Since the triangles are similar, you can use the scale factor to determine the missing length.

$\frac{x}{10.5} = 3$

How would you solve for x?

$x = 31.5$

The missing side length is 31.5 units.

Method 2: Use a Proportion

Since the triangles are similar, you can use equal ratios to set up a proportion.

$\frac{KM}{TV} = \frac{KL}{TU}$

$\frac{21}{7} = \frac{x}{10.5}$ (×1.5)

10.5 ÷ 7 = 1.5

$x = 31.5$

The missing side length is 31.5 units.

Show You Know

Solve using a method of your choice.

a) $\triangle GHI$ is similar to $\triangle KLM$. What is the missing side length? Express your answer to the nearest tenth.

b) $\triangle ABC$ is similar to $\triangle EFC$. Determine the missing side length. Express your answer to the nearest tenth.

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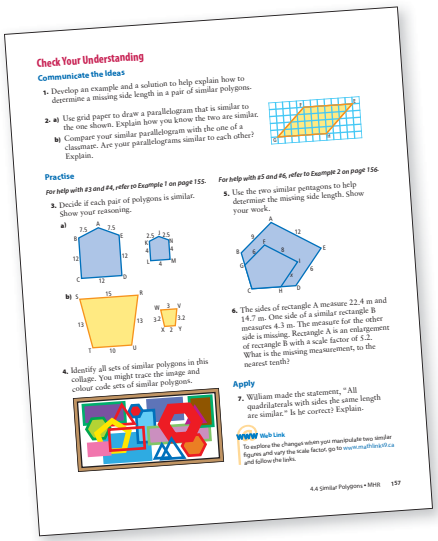
4.3 Similar Triangles • MHR 149



Check Your Understanding

Communicate the Ideas

1. Develop an example and a solution to help explain how to determine a missing side length in a pair of similar polygons.
2. a) Use grid paper to draw a parallelogram that is similar to the one shown. Explain how you know the two are similar.
   b) Compare your similar parallelogram with the one of a classmate. Are your parallelograms similar to each other? Explain.

Practise

For help with #3 and #4, refer to Example 1 on page 155.

3. Decide if each pair of polygons is similar. Show your reasoning.

a)

b)

4. Identify all sets of similar polygons in this collage. You might trace the image and colour code sets of similar polygons.

For help with #5 and #6, refer to Example 2 on page 156.

5. Use the two similar pentagons to help determine the missing side length. Show your work.

6. The sides of rectangle A measure 22.4 m and 14.7 m. One side of a similar rectangle B measures 4.3 m. The measure for the other side is missing. Rectangle A is an enlargement of rectangle B with a scale factor of 5.2. What is the missing measurement, to the nearest tenth?

Apply

7. William made the statement, "All quadrilaterals with sides the same length are similar." Is he correct? Explain.

Web Link

To explore the changes when you manipulate two similar figures and vary the scale factor, go to www.mcgrawhill.ca/links/sh9.ca and follow the links.

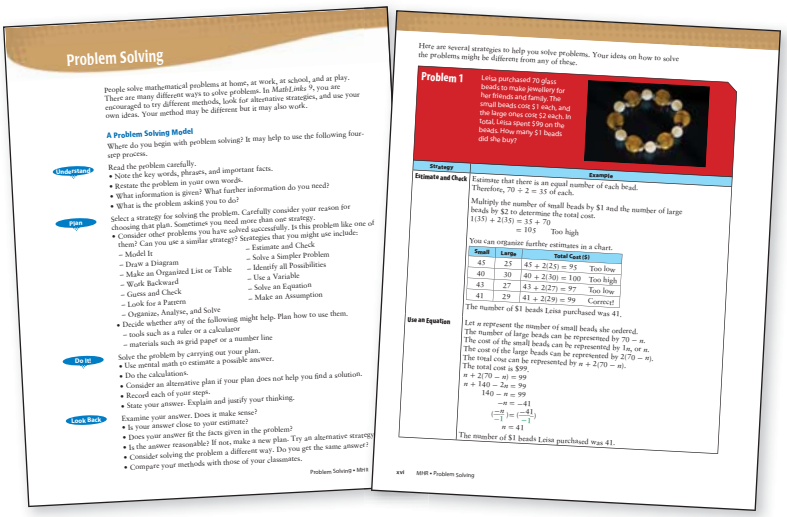
4.4 Similar Polygons • MHR 157

The **Check Your Understanding** exercises begin with **Communicate the Ideas**. These questions focus your thinking on the **Key Ideas** you developed in **Link the Ideas**. By discussing these questions in a group, or doing the action called for, you can see whether you understand the main points of the lesson.

The first few questions in the **Practise** can often be done by following one of the worked Examples.

Problem Solving

At the beginning of the student resource there is an overview of the four steps you can use to approach **Problem Solving**. Samples of problem solving strategies are shown. You can refer back to this section if you need help choosing a strategy to solve a problem. You are also encouraged to use your own strategies.


Problem Solving

People solve mathematical problems at home, at work, at school, and at play. There are many different ways to solve problems. In MathLinks 9, you are encouraged to try different methods, look for alternative strategies, and use your own ideas. Your method may be different but it may also work.

A Problem Solving Model

Where do you begin with problem solving? It may help to use the following four-step process.

Understand

Read the problem carefully.
- Note the key words, phrases, and important facts.
- Restate the problem in your own words.
- What information is given? What further information do you need?
- What is the problem asking you to do?

Plan

Select a strategy for solving the problem. Carefully consider your reason for choosing that plan. Sometimes you need more than one strategy.
- Consider other problems you have solved successfully. Is this problem like one of them? Can you use a similar strategy? Strategies that you might use include:
  - Model It
  - Draw a Diagram
  - Make an Organized List or Table
  - Work Backward
  - Guess and Check
  - Look for a Pattern
  - Organize, Analyse, and Solve
  - Estimate and Check
  - Solve a Simpler Problem
  - Identify all Possibilities
  - Use a Variable
  - Solve an Equation
  - Make an Assumption
- Decide whether any of the following might help. Plan how to use them.
  - tools such as a ruler or a calculator
  - materials such as grid paper or a number line

Do It!

Solve the problem by carrying out your plan.
- Use mental math to estimate a possible answer.
- Do the calculations.
- Consider an alternative plan if your plan does not help you find a solution.
- Record each of your steps.
- State your answer. Explain and justify your thinking.

Look Back

Examine your answer. Does it make sense?
- Is your answer close to your estimate?
- Does your answer fit the facts given in the problem?
- Is the answer reasonable? If not, make a new plan. Try an alternative strategy.
- Consider solving the problem a different way. Do you get the same answer?
- Compare your methods with those of your classmates.

Problem Solving • MHR

Here are several strategies to help you solve problems. Your ideas on how to solve the problems might be different from any of these.

Problem 1

Leisa purchased 70 glass beads to make jewellery for her friends and family. The small beads cost $1 each, and the large ones cost $2 each. In total, Leisa spent $99 on the beads. How many $1 beads did she buy?

Strategy	Example
Estimate and Check	Estimate that there is an equal number of each bead. Therefore, $70 \div 2 = 35$ of each. Multiply the number of small beads by $1 and the number of large beads by $2 to determine the total cost. $1(35) + 2(35) = 35 + 70$ $= 105$ Too high You can organize further estimates in a chart.

Small	Large	Total Cost ($)	
45	25	$45 + 2(25) = 95$	Too low
40	30	$40 + 2(30) = 100$	Too high
43	27	$43 + 2(27) = 97$	Too low
41	29	$41 + 2(29) = 99$	Correct!

The number of $1 beads Leisa purchased was 41.

Use an Equation

Let n represent the number of small beads she ordered.
The number of large beads can be represented by $70 - n$.
The cost of the small beads can be represented by $1n$, or n.
The cost of the large beads can be represented by $2(70 - n)$.
The total cost can be represented by $n + 2(70 - n)$.
The total cost is $99.

$n + 2(70 - n) = 99$
$n + 140 - 2n = 99$
$140 - n = 99$
$-n = -41$
$\frac{-n}{-1} = \frac{(-41)}{-1}$
$n = 41$

The number of $1 beads Leisa purchased was 41.

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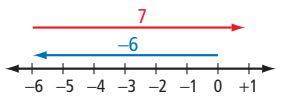
Mental Math and Estimation

This **Mental Math and Estimation** logo does one of two things:

1. It signals where you can use mental math and estimation.
2. It provides useful tips for using mental math and estimation.

How does the number line show the estimate?



Other Features

Did You Know?

The Métis flag shown in part a) is a white infinity symbol on a blue background. The infinity symbol can represent that the Métis nation will go on forever. It can also be interpreted as two conjoined circles, representing the joining of two cultures: European and First Nations.

Did You Know?

These are interesting facts related to math topics you are learning.

WWW Web Link

To explore more about symmetry, go to www.mathlinks9.ca and follow the links.

Web Links

You can find extra information related to some questions on the Internet. Log on to **www.mathlinks9.ca** and you will be able to link to recommended Web sites.

Tech Link

The key for entering a negative sign may look different on different calculators, for example, [+/−], [+/−] or [(−)]. It is not the subtraction key, [−]. Experiment with calculations involving negative signs on your calculator.

Tech Links

Some Tech Links show what calculator keys to use for certain types of questions. Keys and key sequences may vary depending on the calculator make and model. Experiment to find out what works on yours.

Tech Link

You can use a spreadsheet program to create the graph.

Other Tech Links suggest that you could use computer applications to do certain activities.

Still other Tech Links refer you to the *MathLinks 9* Online Learning Centre where you can use software to extend your understanding of a concept.

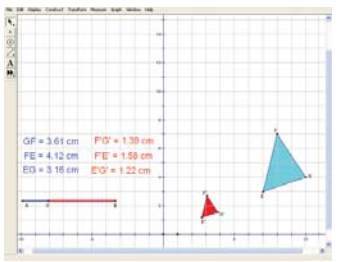
Tech Link

Similarity and Scale Factors

In this activity, you can use dynamic geometry software to explore similarity and scale factors. To use this activity, go to www.mathlinks9.ca and follow the links.

Explore

1. Slide point X along line segment AB and describe what happens to the image drawing.
2. How do the measures of the corresponding sides of the drawing change relative to each other? Explain.
3. Compare the scale factor to the lengths of the sides of the original drawing and the image drawing. Create and complete a table similar to the one below with measurements taken at different locations. Discuss your findings with a classmate.
   Hint: In the table, *m* means *the measure of*.



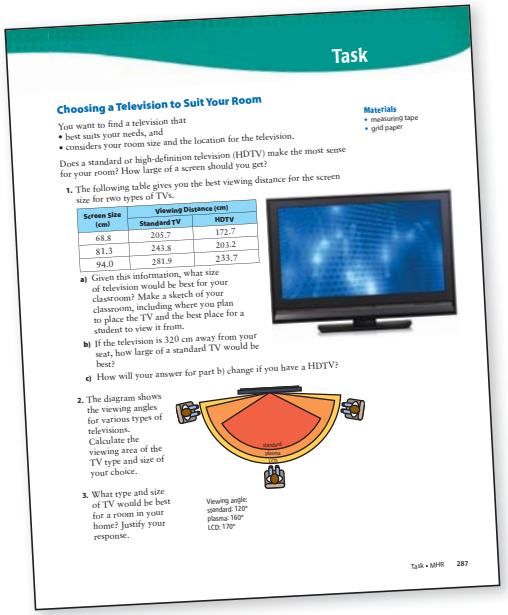
*m*FE	*m*F′E′	$\frac{m\text{AX}}{m\text{XB}}$

Chapter Review and *Practice Test*

There is a **Chapter Review** and a **Practice Test** at the end of each chapter. The chapter review is organized by section number so you can look back if you need help with a question. The test includes the different types of questions that you will find on provincial tests: multiple choice, numerical response, short answer, and extended response.

Cumulative Review

To help you reinforce what you have learned, there is a review of the previous four chapters at the end of Chapters 4, 7, and 11. The reviews at the end of Chapters 4 and 7 are followed by a Task.


Task

Choosing a Television to Suit Your Room

You want to find a television that
- best suits your needs, and
- considers your room size and the location for the television.

Does a standard or high-definition television (HDTV) make the most sense for your room? How large of a screen should you get?

Materials
- masking tape
- grid paper

1. The following table gives you the best viewing distance for the screen size for two types of TVs.

Screen Size (cm)	Viewing Distance (cm)	
	Standard TV	HDTV
68.8	205.7	172.7
81.3	243.8	203.2
94.0	281.9	233.7

a) Given this information, what size of television would be best for your classroom? Make a sketch of your classroom, including where you plan to place the TV and the best place for a student to view it from.

b) If the television is 320 cm away from your seat, how large of a standard TV would be best?

c) How will your answer for part b) change if you have a HDTV?

2. The diagram shows the viewing angles for various types of televisions. Calculate the viewing area of the TV type and size of your choice.

3. What type and size of TV would be best for a room in your home? Justify your response.

Viewing angle: standard: 120° plasma: 160° LCD: 170°

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Task

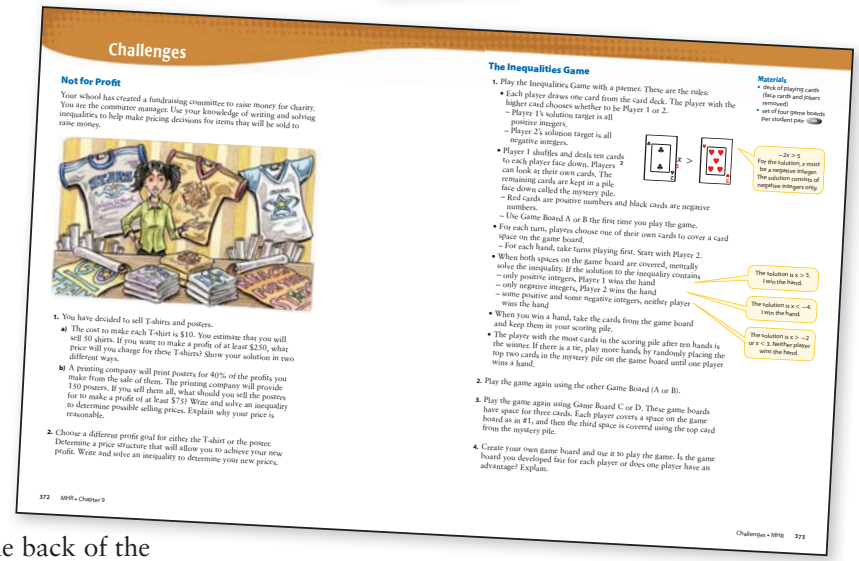
These tasks require you to use skills from more than one chapter. You will also need to use your creativity.

Challenges

The last two pages of each chapter provide **Challenges.** The **Challenges** provide interesting problems that show how the math you learned in the chapter relates to jobs, careers, or daily life. Some Challenges are games you can play, or make and play, with your friends and family.

Answers

Answers are provided for all Practise, Apply, Extend, and Review questions. Sample answers are given for questions that have a variety of possible answers or that involve communication. If you need help, read the sample and then try to give an alternative response. Answers are omitted for the Math Link questions and for Practice Tests because teachers may use these questions to assess your progress.


Challenges

Not for Profit

Your school has created a fundraising committee to raise money for charity. You are the committee manager. Use your knowledge of writing and solving inequalities to help make pricing decisions for items that will be sold to raise money.

1. You have decided to sell T-shirts and posters.
a) The cost to make each T-shirt is $10. You estimate that you will sell 50 shirts. If you want to make a profit of at least $250, what price will you charge for these T-shirts? Show your solution in two different ways.
b) A printing company will print posters for 40% of the profits you make from the sale of them. The printing company will provide 150 posters. If you sell them all, what should you sell the posters for to make a profit of at least $75? Write and solve an inequality to determine possible selling prices. Explain why your price is reasonable.

2. Choose a different profit goal for either the T-shirt or the poster. Determine a price structure that will allow you to achieve your new profit. Write and solve an inequality to determine your new prices.

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The Inequalities Game

1. Play the Inequalities Game with a partner. These are the rules:
- Each player draws one card from the card deck. The player with the higher-card chooses whether to be Player 1 or 2.
– Player 1's solution target is all positive integers.
– Player 2's solution target is all negative integers.
- Player 1 shuffles and deals ten cards to each player face down. Players can look at their own cards. The remaining cards are kept in a pile face down called the mystery pile.
– Red cards are positive numbers and black cards are negative numbers.
– Use Game Board A or B the first time you play the game.
- For each turn, players choose one of their own cards to cover a card space on the game board.
– For each hand, take turns playing first. Start with Player 2.
- When both spaces on the game board are covered, mentally solve the inequality. If the solution to the inequality contains
– only positive integers, Player 1 wins the hand
– only negative integers, Player 2 wins the hand
– some positive and some negative integers, neither player wins the hand
- When you win a hand, take the cards from the game board and keep them in your scoring pile.
- The player with the most cards in the scoring pile after ten hands is the winner. If there is a tie, play more hands by randomly placing the top two cards in the mystery pile on the game board until one player wins a hand.

Materials
- deck of playing cards (face cards and jokers removed)
- set of four game boards per student pair

$-2x > 5$
Fix the solution, x must be a negative integer. The solution consists of negative integers only.

The solution is $x > 5$. I win the hand.

The solution is $x < -4$. I win the hand.

The solution is $x > -2$ or $x < 2$. Neither player wins the hand.

2. Play the game again using the other Game Board (A or B).

3. Play the game again using Game Board C or D. These game boards have space for three cards. Each player covers a space on the game board as in #1, and then the third space is covered using the top card from the mystery pile.

4. Create your own game board and use it to play the game. Is the game board you developed fair for each player or does one player have an advantage? Explain.

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Glossary

Refer to the illustrated **Glossary** at the back of the student resource if you need to check the exact meaning of mathematical terms.

Index

If you want to find a particular math topic in *MathLinks 9*, look it up in the index, which is at the back of the student resource. The index provides page references that may help you review that topic.