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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™ 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.

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

### 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.

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

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

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. 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.
   a) 

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.
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).

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.

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.

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.

Did You Know?
These are interesting facts related to math topics you are learning.

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.

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

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.

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.
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

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.

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.
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?

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
- 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.
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?

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Example</th>
</tr>
</thead>
</table>
| **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. 
\[
1(35) + 2(35) = 35 + 70 = 105 \quad \text{Too high}
\]
You can organize further estimates in a chart. |
<table>
<thead>
<tr>
<th>Small</th>
<th>Large</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>25</td>
<td>45 + 2(25) = 95 Too low</td>
</tr>
<tr>
<td>40</td>
<td>30</td>
<td>40 + 2(30) = 100 Too high</td>
</tr>
<tr>
<td>43</td>
<td>27</td>
<td>43 + 2(27) = 97 Too low</td>
</tr>
<tr>
<td>41</td>
<td>29</td>
<td>41 + 2(29) = 99 Correct!</td>
</tr>
</tbody>
</table>

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. 
\[
\begin{align*}
    n + 2(70 - n) &= 99 \\
    n + 140 - 2n &= 99 \\
    140 - n &= 99 \\
    -n &= -41 \\
    n &= 41
\end{align*}
\]
The number of $1 beads Leisa purchased was 41. |
Problem 2

In a community in northern Manitoba, \(\frac{1}{4}\) of the school population is grade 9 students. Of these grade 9 students, \(\frac{3}{5}\) are boys. There are 18 grade 9 boys in the school. How many students are there in the school in total?

**Strategy**

**Draw a Diagram**

The rectangle represents the entire school population. The grade 9 students represent \(\frac{1}{4}\) of the rectangle.

Divide the \(\frac{1}{4}\) section into five parts. Label three parts to show that \(\frac{3}{5}\) are boys.

Since 18 grade 9 boys fill three boxes, 6 students must be in each box.

The rectangle has 20 parts altogether. So, \(20 \times 6 = 120\). There are 120 students in the school.

**Solve a Simpler Problem**

First, determine the fraction of grade 9 boys in the school.

The number of grade 9 students is \(\frac{1}{4}\) of the school population. The number of grade 9 boys is \(\frac{3}{5}\) of the grade 9 students. So, the number of grade 9 boys in the school is \(\frac{1}{4} \times \frac{3}{5} = \frac{3}{20}\).

Now, use \(\frac{3}{20}\) to determine the school population. The number of grade 9 boys is 18. So, \(\frac{3}{20}\) of the school population is 18. That means the school population is \(18 \div \frac{3}{20}\).

\[
18 \div \frac{3}{20} = 18 \times \frac{20}{3} = \frac{360}{3} = 120
\]

There are 120 students in the school.
Problem 3  Damien is going to cut a Saskatoon berry pie into four equal slices. If he cuts the pie into six equal slices, each slice will have a mass that is 40 g less. What is the mass of the whole pie?

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Example</th>
</tr>
</thead>
</table>
| **Draw a Diagram** | Draw two circles of the same size. Divide one into four equal sections and shade \( \frac{1}{4} \) blue. Divide the other into six equal sections and shade \( \frac{1}{6} \) blue.

Since \( \frac{1}{4} = \frac{3}{12} \), and \( \frac{1}{6} = \frac{2}{12} \), divide the circles into 12 sections. Now \( \frac{3}{12} \) of one circle is blue and \( \frac{2}{12} \) of the other circle is blue.

Shade \( \frac{2}{12} \) of each circle yellow.

Note that \( \frac{1}{12} \) of the \( \frac{1}{4} \) section is blue.

This \( \frac{1}{12} \) represents the difference in size between the two pieces. This difference has a mass of 40 g. So, \( \frac{1}{12} \) of the pie is 40 g.

\[
40 \times 12 = 480
\]

Therefore, the mass of the whole pie is 480 g.

| **Use an Equation** | Let \( m \) represent the mass of the whole pie.

The mass of a slice from a four-slice pie can be represented by \( \frac{1}{4} m \). The mass of a slice from a six-slice pie can be represented by \( \frac{1}{6} m \). The two slices differ by 40 g.

Solve using a common denominator.

\[
\begin{align*}
\frac{1}{4}m - \frac{1}{6}m &= 40 \\
\frac{3}{12}m - \frac{2}{12}m &= 40 \\
\frac{1}{12}m &= 40 \\
\frac{1}{12}m \times 12 &= 40 \times 12 \\
m &= 480
\end{align*}
\]

The mass of the whole pie is 480 g.
Problem 4

Two dancers start at point O on a stage. They move in a straight line to A. Then, the first dancer moves along the circumference of the circle to point B, and the second dancer moves to point C. The first dancer will now dance along BC to the second dancer. How far is this distance?

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Example</th>
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<tbody>
<tr>
<td><strong>Organize,</strong> Sketch the circle and label the given information.</td>
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</table>
| **Analyze,** Develop a plan to find the length of BC. WC and WB are equal segments of BC. Find the length of either WC or WB. Choose WC. \( \triangle OWC \) is a right triangle. Determine the length of WC using the Pythagorean relationship. You need to know the lengths of OC and OW. OC is a hypotenuse of the right triangle. OC = 10 m OW is a leg of the right triangle. Determine the length of OW. OW and WA are segments of OA. OA = radius of the circle, WA = 4 m \[
= 10 
\]
\[
OW + WA = OA \\
OW + 4 = 10 \\
OW = 6 
\]
Apply the Pythagorean relationship to find WC. \[
OW^2 + WC^2 = OC^2 \\
6^2 + WC^2 = 10^2 \\
36 + WC^2 = 100 \\
WC^2 = 64 \\
WC = 8 
\]
| **and Solve,** Now that you have the length of WC, determine the length of WB. \( WC = WB \) \( WC = 8 \), so \( WB = 8 \) Determine the length of BC. \( BC = WC + WB \) \[
= 8 + 8 \\
= 16 
\]
The distance from the first dancer to the second is 16 m.