MathLinks 7

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Contents

A Tour of Your Textbook viii

Problem Solving xiv

CHAPTER 1

Coordinates and Design 2

1.1 The Cartesian Plane 4
1.2 Create Designs 12
1.3 Transformations 18
1.4 Horizontal and Vertical Distances 30
Chapter Review 36
Practice Test 38
Math Games: Going Fishing 40
Challenge in Real Life: Make an Animation 41

CHAPTER 2

Operations on Decimal Numbers 42

2.1 Add and Subtract Decimal Numbers 44
2.2 Multiply Decimal Numbers 52
2.3 Divide Decimal Numbers 60
2.4 Order of Operations and Decimal Numbers 68
Chapter Review 74
Practice Test 76
Math Games: Decimal Delights 78
Challenge in Real Life: Rounding Digits and High-Tech Crime 79

CHAPTER 3

Geometry and Measurement 80

3.1 Parallel and Perpendicular Line Segments 82
3.2 Draw Perpendicular Bisectors 89
3.3 Draw Angle Bisectors 94
3.4 Area of a Parallelogram 100
3.5 Area of a Triangle 108
Chapter Review 116
Practice Test 118
Math Games: Amazing Mazes 120
Challenge in Real Life: Bank Shots in the Game of Pool 121

CHAPTER 4

Fractions, Decimals, and Percents 122

4.1 Connect Fractions, Decimals, and Percents 124
4.2 Fractions, Decimals, and Percents 132
4.3 Applications of Percents 140
Chapter Review 146
Practice Test 148
Math Games: Math's a Snap 150
Challenge in Real Life: Fraction Converter for Everyday Life 151
Chapters 1–4 Review 152
Task: Create a Logo 155

CHAPTER 5

Probability 156

5.1 Probability 158
5.2 Organize Outcomes 165
5.3 Probabilities of Simple Independent Events 171
5.4 Applications of Independent Events 177
5.5 Conduct Probability Experiments 183
Chapter Review 190
Practice Test 192
Math Games: Is It a Match? 194
Challenge in Real Life: Crack the Code 195

CHAPTER 6

Introduction to Fraction Operations 196

6.1 Divisibility 198
6.2 Add Fractions With Like Denominators 210
6.3 Subtract Fractions With Like Denominators 217
Chapter Review 222
Practice Test 224
Math Games: It's Divisible 226
Challenge in Real Life: Green Mathematics, Math Mosaics 227

CHAPTER 7

Add and Subtract Fractions 228

7.1 Common Denominators 230
7.2 Add and Subtract Fractions With Unlike Denominators 237
7.3 Add Mixed Numbers 245
7.4 Subtract Mixed Numbers 252
Chapter Review 260
Practice Test 262
Math Games: Fraction Race 264
Challenge in Real Life: Magazine Design 265

CHAPTER 8

Circles 266

8.1 Construct Circles 268
8.2 Circumference of a Circle 273
8.3 Area of a Circle 280
8.4 Interpret Circle Graphs 287
8.5 Create Circle Graphs 292
Chapter Review 298
Practice Test 300
Math Games: Make Spinner Games 302
Challenge in Real Life: Winner's Circle 303
Chapters 5–8 Review 304
Task: Is This a Fair Game? 307

CHAPTER 9

Add and Subtract Integers 308

9.1 Explore Integer Addition 310
9.2 Add Integers 316
9.3 Explore Integer Subtraction 323
9.4 Subtract Integers 330
9.5 Apply Integer Operations 336
Chapter Review 342
Practice Test 344
Math Games: Integer Word Game 346
Challenge in Real Life: Virtual Reality 347

CHAPTER 10

Patterns and Expressions 348

10.1 Describe Patterns 350
10.2 Variables and Expressions 358
10.3 Evaluate Expressions 365
10.4 Graph Linear Relations 372
Chapter Review 382
Practice Test 384
Math Games: Puzzling Expressions 386
Challenge in Real Life: Your Life Line 387

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CHAPTER 11

Solving Equations 388

11.1 Expressions and Equations 390
11.2 Solve One-Step Equations: $x + a = b$ 395
11.3 Solve One-Step Equations: $ax = b$, $\frac{x}{a} = b$ 402
11.4 Solve Two-Step Equations: $ax + b = c$ 408
Chapter Review 414
Practice Test 416
Math Games: Equation Puzzles 418
Challenge in Real Life: Wrapping Gifts 419

CHAPTER 12

Working With Data 420

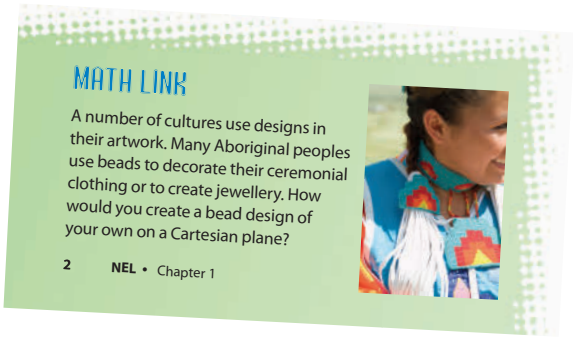
12.1 Median and Mode 422
12.2 Mean 428
12.3 Range and Outliers 434
12.4 The Effects of Outliers 440
12.5 Choose the Best Measure of Central Tendency 446
Chapter Review 452
Practice Test 454
Math Games: Data Duel 456
Challenge in Real Life: Managing a Business 457
Chapters 9–12 Review 458
Task: The Birthday Party 461

Answers 462
Glossary 499
Index 504

A Tour of Your Textbook

How is *MathLinks 7* set up?

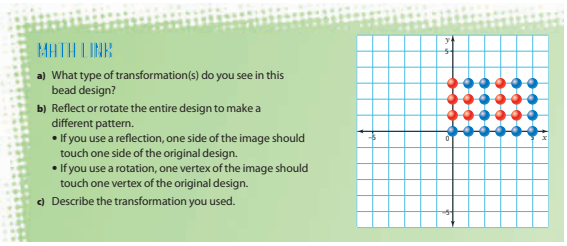
Each chapter starts off with a Chapter Problem called a **Math Link** that connects math and your world. You will be able to solve the problem using the math skills that you learn in the chapter.


MATH LINK

A number of cultures use designs in their artwork. Many Aboriginal peoples use beads to decorate their ceremonial clothing or to create jewellery. How would you create a bead design of your own on a Cartesian plane?

2 NEL • Chapter 1

You are asked to answer questions related to the problem throughout the chapter. These questions appear in **Math Link** boxes.

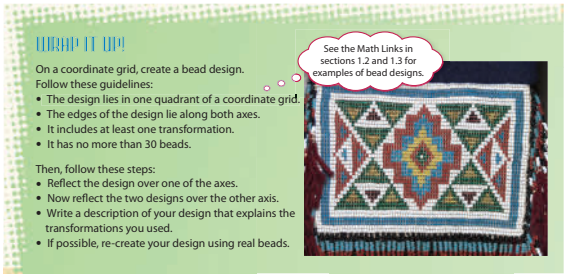

MATH LINK

a) What type of transformation(s) do you see in this bead design?

b) Reflect or rotate the entire design to make a different pattern.
- If you use a reflection, one side of the image should touch one side of the original design.
- If you use a rotation, one vertex of the image should touch one vertex of the original design.

c) Describe the transformation you used.

The **Wrap It Up!** is at the end of the chapter, on the second Practice Test page.

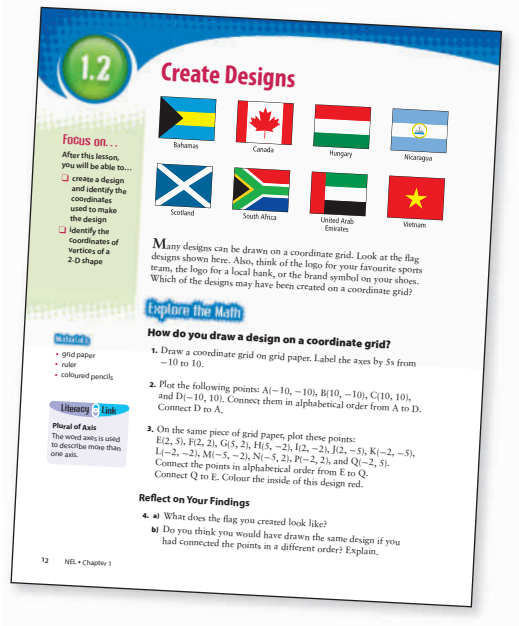

WRAP IT UP!

On a coordinate grid, create a bead design.
Follow these guidelines:
- The design lies in one quadrant of a coordinate grid.
- The edges of the design lie along both axes.
- It includes at least one transformation.
- It has no more than 30 beads.

Then, follow these steps:
- Reflect the design over one of the axes.
- Now reflect the two designs over the other axis.
- Write a description of your design that explains the transformations you used.
- If possible, re-create your design using real beads.

See the Math Links in sections 1.2 and 1.3 for examples of bead designs.

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.


1.2 Create Designs

Focus on...
After this lesson, you will be able to...
- create a design and identify the coordinates used to make the design
- identify the coordinates of vertices of a 2-D shape

Bahamas, Canada, Hungary, Nicaragua, Scotland, South Africa, United Arab Emirates, Vietnam

Many designs can be drawn on a coordinate grid. Look at the flag designs shown here. Also, think of the logo for your favourite sports team, the logo for a local bank, or the brand symbol on your shoes. Which of the designs may have been created on a coordinate grid?

Explore the Math

Materials
- grid paper
- ruler
- coloured pencils

Literacy Link
Plural of Axis
The word axes is used to describe more than one axis.

How do you draw a design on a coordinate grid?

1. Draw a coordinate grid on grid paper. Label the axes by 5s from −10 to 10.
2. Plot the following points: A(−10, −10), B(10, −10), C(10, 10), and D(−10, 10). Connect them in alphabetical order from A to D. Connect D to A.
3. On the same piece of grid paper, plot these points: E(2, 5), F(2, 2), G(5, 2), H(5, −2), I(2, −2), J(2, −5), K(−2, −5), L(−2, −2), M(−5, −2), N(−5, 2), P(−2, 2), and Q(−2, 5). Connect the points in alphabetical order from E to Q. Connect Q to E. Colour the inside of this design red.

Reflect on Your Findings

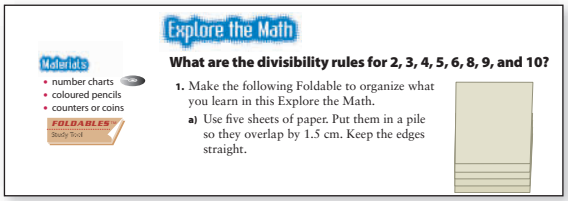
4. a) What does the flag you created look like?
b) Do you think you would have drawn the same design if you had connected the points in a different order? Explain.

12 NEL • Chapter 1

A three-part lesson follows.

The first part helps you find answers to the key question.

- An activity is designed to help you build your own understanding of the new concept and lead toward answers to the key question.



Explore the Math

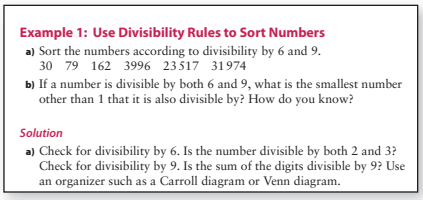
Materials
- number charts
- coloured pencils
- counters or coins

FOLDABLES Study Tools

What are the divisibility rules for 2, 3, 4, 5, 6, 8, 9, and 10?

1. Make the following Foldable to organize what you learn in this Explore the Math.
   a) Use five sheets of paper. Put them in a pile so they overlap by 1.5 cm. Keep the edges straight.

- **Examples** and **Solutions** demonstrate how to use the concept.



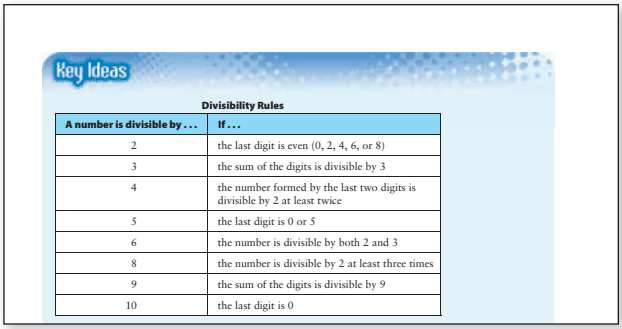
Example 1: Use Divisibility Rules to Sort Numbers

a) Sort the numbers according to divisibility by 6 and 9.
30 79 162 3996 23 517 31 974

b) If a number is divisible by both 6 and 9, what is the smallest number other than 1 that it is also divisible by? How do you know?

Solution

a) Check for divisibility by 6. Is the number divisible by both 2 and 3? Check for divisibility by 9. Is the sum of the digits divisible by 9? Use an organizer such as a Carroll diagram or Venn diagram.

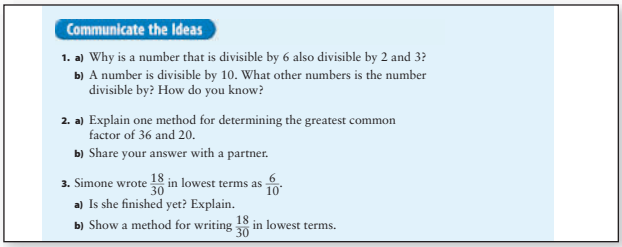


Key Ideas

Divisibility Rules

A number is divisible by . . .	If . . .
2	the last digit is even (0, 2, 4, 6, or 8)
3	the sum of the digits is divisible by 3
4	the number formed by the last two digits is divisible by 2 at least twice
5	the last digit is 0 or 5
6	the number is divisible by both 2 and 3
8	the number is divisible by 2 at least three times
9	the sum of the digits is divisible by 9
10	the last digit is 0

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



Communicate the Ideas

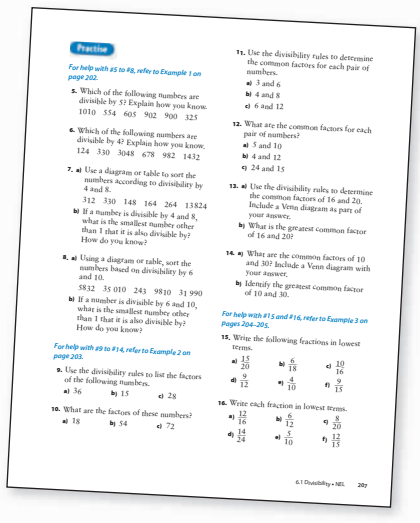
1. a) Why is a number that is divisible by 6 also divisible by 2 and 3?
   b) A number is divisible by 10. What other numbers is the number divisible by? How do you know?

2. a) Explain one method for determining the greatest common factor of 36 and 20.
   b) Share your answer with a partner.

3. Simone wrote $\frac{18}{30}$ in lowest terms as $\frac{6}{10}$.
   a) Is she finished yet? Explain.
   b) Show a method for writing $\frac{18}{30}$ in lowest terms.

- Questions in the **Communicate the Ideas** section 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.



Practise

For help with #5 to #8, refer to Example 1 on page 202.

5. Which of the following numbers are divisible by 5? Explain how you know.
1010 554 605 902 900 325

6. Which of the following numbers are divisible by 4? Explain how you know.
124 330 3048 678 982 1432

7. a) Use a diagram or table to sort the numbers according to divisibility by 4 and 8.
312 330 148 164 264 13 824
b) If a number is divisible by 4 and 8, what is the smallest number other than 1 that it is also divisible by? How do you know?

8. a) Using a diagram or table, sort the numbers based on divisibility by 6 and 10.
5832 35 010 243 9810 31 990
b) If a number is divisible by 6 and 10, what is the smallest number other than 1 that it is also divisible by? How do you know?

For help with #9 to #14, refer to Example 2 on page 203.

9. Use the divisibility rules to list the factors of the following numbers.
a) 36 b) 15 c) 28

10. What are the factors of these numbers?
a) 18 b) 54 c) 72

11. Use the divisibility rules to determine the common factors for each pair of numbers.
a) 3 and 6
b) 4 and 8
c) 6 and 12

12. What are the common factors for each pair of numbers?
a) 5 and 10
b) 4 and 12
c) 24 and 15

13. a) Use the divisibility rules to determine the common factors of 16 and 20. Include a Venn diagram as part of your answer.
b) What is the greatest common factor of 16 and 20?

14. a) What are the common factors of 10 and 30? Include a Venn diagram with your answer.
b) Identify the greatest common factor of 10 and 30.

For help with #15 and #16, refer to Example 3 on Pages 204–205.

15. Write the following fractions in lowest terms.
a) $\frac{15}{20}$ b) $\frac{6}{18}$ c) $\frac{10}{16}$
d) $\frac{9}{12}$ e) $\frac{4}{10}$ f) $\frac{9}{15}$

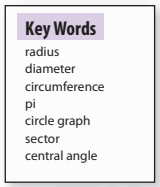
16. Write each fraction in lowest terms.
a) $\frac{12}{16}$ b) $\frac{6}{12}$ c) $\frac{8}{20}$
d) $\frac{14}{24}$ e) $\frac{5}{10}$ f) $\frac{12}{15}$

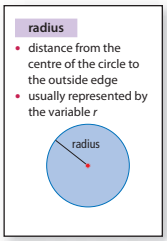
6.1 Divisibility • NEL 207

How does *MathLinks 7* help you learn?

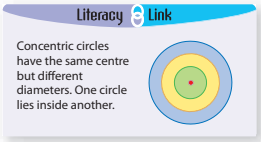
Understanding Vocabulary

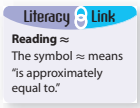
Key Words are listed on the Chapter Opener. Perhaps you already know the meaning of some of them. Great! If not, watch for these terms highlighted the first time they are used in the chapter. The meaning is given close by in the margin.





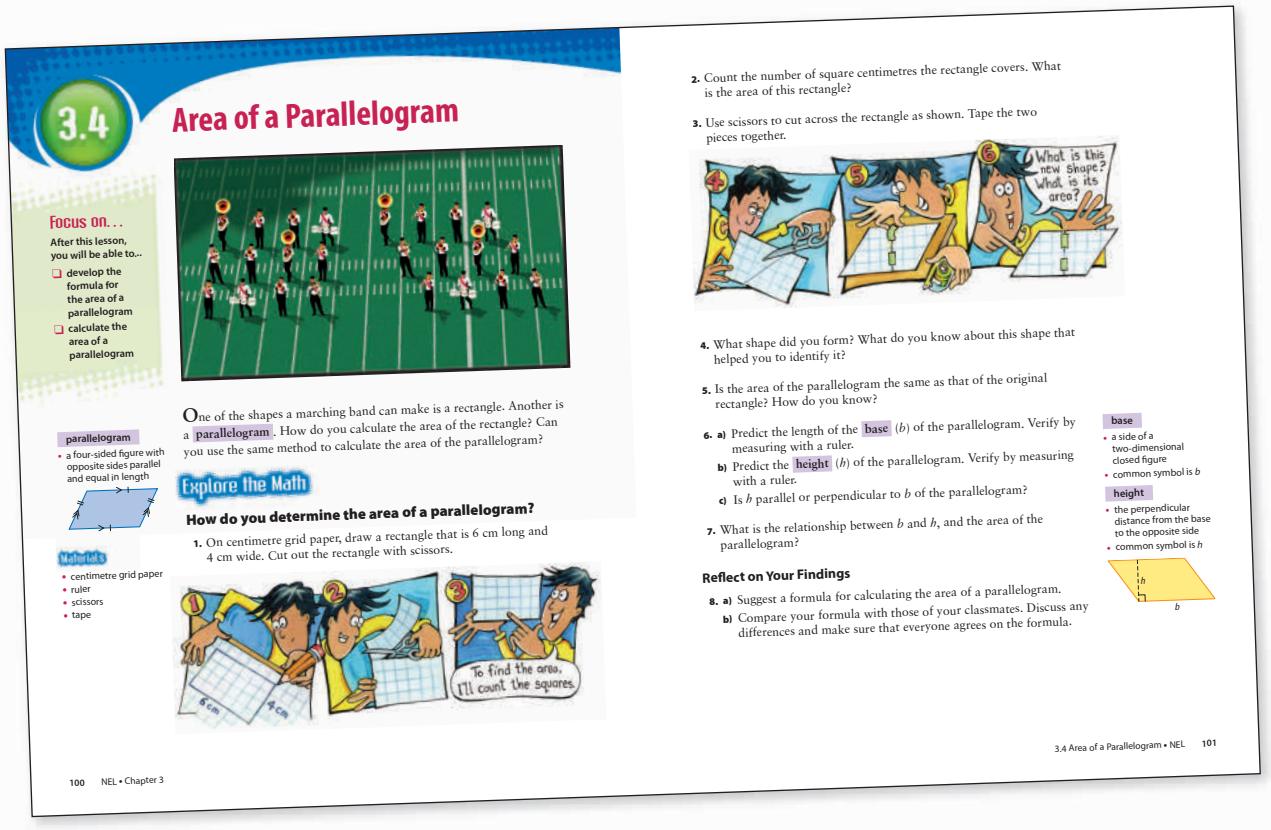
Literacy Links provide tips to help you read and interpret items in math. These tips will help you in other subjects as well.

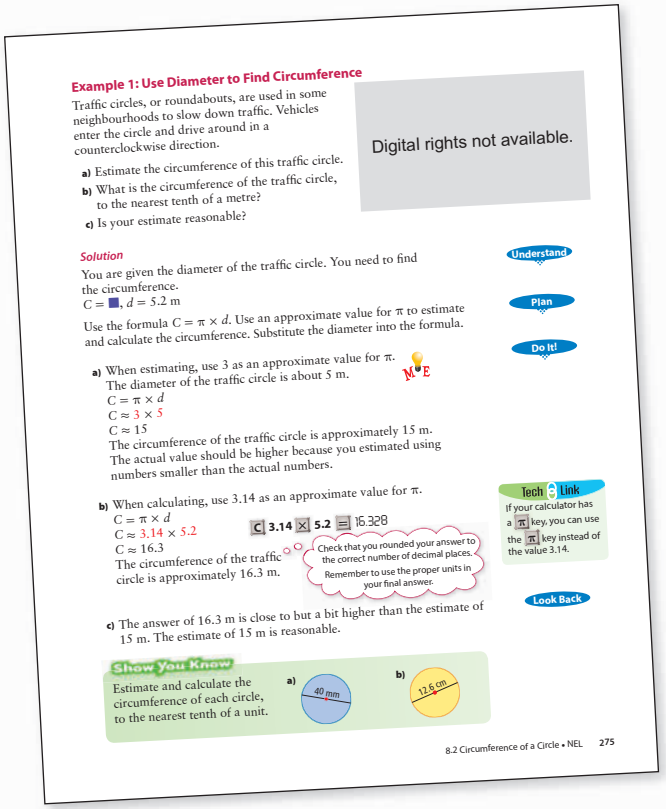




Understanding Concepts

The **Explore the Math** and **Discuss the Math** 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 on Your Findings** question.





Example 1: Use Diameter to Find Circumference

Traffic circles, or roundabouts, are used in some neighbourhoods to slow down traffic. Vehicles enter the circle and drive around in a counterclockwise direction.

Digital rights not available.

a) Estimate the circumference of this traffic circle.
b) What is the circumference of the traffic circle, to the nearest tenth of a metre?
c) Is your estimate reasonable?

Solution

Understand

You are given the diameter of the traffic circle. You need to find the circumference.
$C = \blacksquare$, $d = 5.2$ m

Plan

Use the formula $C = \pi \times d$. Use an approximate value for π to estimate and calculate the circumference. Substitute the diameter into the formula.

Do It!

a) When estimating, use 3 as an approximate value for π.
The diameter of the traffic circle is about 5 m.
$C = \pi \times d$
$C \approx 3 \times 5$
$C \approx 15$
The circumference of the traffic circle is approximately 15 m.
The actual value should be higher because you estimated using numbers smaller than the actual numbers.

b) When calculating, use 3.14 as an approximate value for π.
$C = \pi \times d$
$C \approx 3.14 \times 5.2$
$C \approx 16.3$
The circumference of the traffic circle is approximately 16.3 m.

C 3.14 × 5.2 = 16.328

Check that you rounded your answer to the correct number of decimal places.
Remember to use the proper units in your final answer.

Tech Link
If your calculator has a π key, you can use the π key instead of the value 3.14.

Look Back

c) The answer of 16.3 m is close to but a bit higher than the estimate of 15 m. The estimate of 15 m is reasonable.

Show You Know

Estimate and calculate the circumference of each circle, to the nearest tenth of a unit.

a) 40 mm
b) 12.6 cm

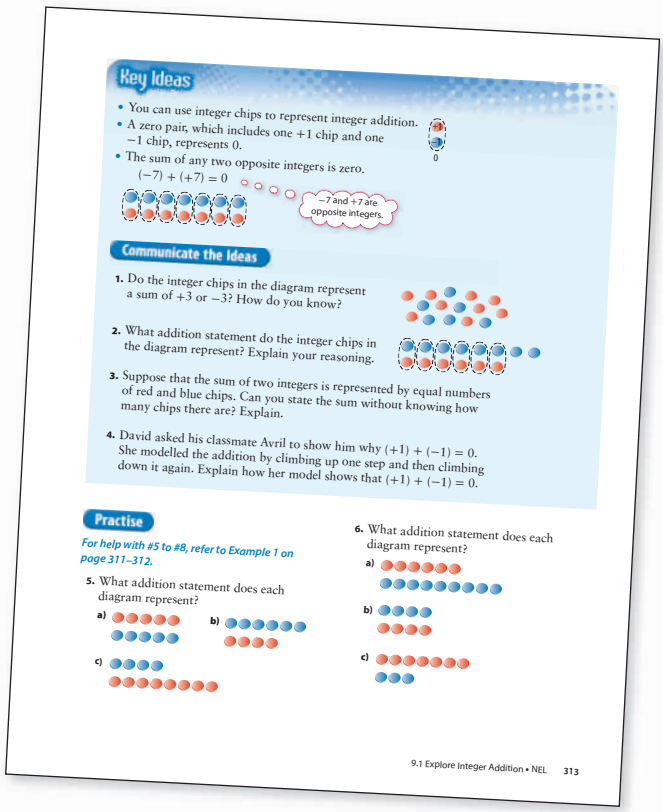
8.2 Circumference of a Circle • NEL 275

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

- Notes in a thought 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.
- **Problem Solving Strategies** are pointed out.
- Calculator key press sequences are shown where appropriate.
- Many Examples are followed by a **Show You Know**. These questions help you check that you understand the skill covered in the Example.

The exercises begin with **Communicate the Ideas**. These questions focus your thinking on the **Key Ideas** you learned in the section. By discussing these questions in a group, or doing the action called for, you can see whether you understand the main points and are ready to start the exercises.

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



Key Ideas

- You can use integer chips to represent integer addition.
- A zero pair, which includes one +1 chip and one −1 chip, represents 0.
- The sum of any two opposite integers is zero.
  $(-7) + (+7) = 0$

0

−7 and +7 are opposite integers.

Communicate the Ideas

1. Do the integer chips in the diagram represent a sum of +3 or −3? How do you know?
2. What addition statement do the integer chips in the diagram represent? Explain your reasoning.
3. Suppose that the sum of two integers is represented by equal numbers of red and blue chips. Can you state the sum without knowing how many chips there are? Explain.
4. David asked his classmate Avril to show him why $(+1) + (-1) = 0$. She modelled the addition by climbing up one step and then climbing down it again. Explain how her model shows that $(+1) + (-1) = 0$.

Practise

For help with #5 to #8, refer to Example 1 on page 311–312.

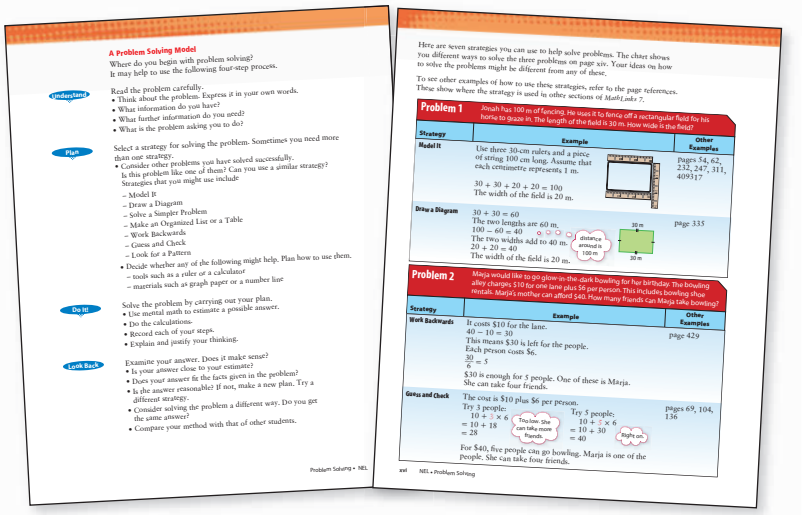
5. What addition statement does each diagram represent?
   a)
   b)
   c)
6. What addition statement does each diagram represent?
   a)
   b)
   c)

9.1 Explore Integer Addition • NEL 313

What else will you find in *MathLinks 7*?

Problem Solving

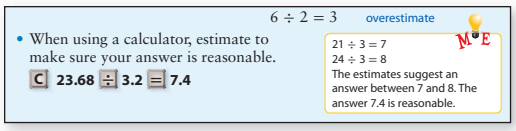
At the beginning of the student resource there is an overview of the four steps you can use to approach **Problem Solving**. Samples of 7 problem solving strategies are shown. You can refer back to this section if you need help choosing a strategy to solve a problem. You are also encouraged to use your own strategies.



Mental Math and Estimation

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

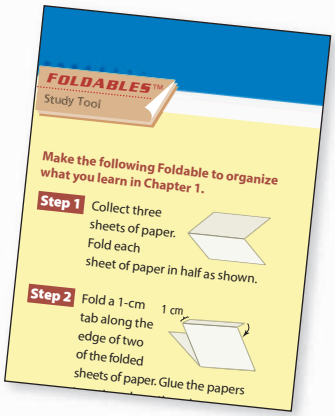
1. It signals where you can use mental math and estimation.
2. It provides useful tips for using mental math and estimation.



Foldables™

FOLDABLES™ Study Tool

Each chapter opener describes how to make a **Foldable** to help organize what you learn in the chapter. The last part of each Foldable encourages you to keep track of what you need to work on.



Other Features

Did You Know?

The colours of the Olympic rings were chosen because at least one of these colours is found in the flag of every nation. The five interlocking rings represent the union of the five major regions of the world—the Americas, Africa, Asia, Oceania, and Europe.

Did You Know?

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

Geography Link

The rainfall recorded for Terrace, BC is correct. You may wish to learn more about the geography of Terrace that makes it such a wet place.

Subject Links

This feature links the current topic to another subject area.

WWW Web Link

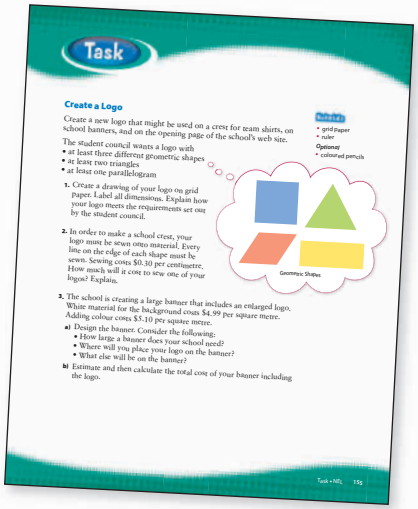
To learn more about pi, go to www.mathlinks7.ca and follow the links.

Web Links

You can find extra information related to some questions on the Internet. Log on to **www.mathlinks7.ca** and you will be able to link to recommended Web sites.

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.


Task

Create a Logo

Create a new logo that might be used on a crest for team shirts, on school banners, and on the opening page of the school's web site.

The student council wants a logo with
- at least three different geometric shapes
- at least two triangles
- at least one parallelogram

1. Create a drawing of your logo on grid paper. Label all dimensions. Explain how your logo meets the requirements set out by the student council.

2. In order to make a school crest, your logo must be sewn onto material. Every line on the edge of each shape must be sewn. Sewing costs $0.30 per centimetre. How much will it cost to sew one of your logos? Explain.

3. The school is creating a large banner that includes an enlarged logo. White material for the background costs $4.99 per square metre. Adding colour costs $5.10 per square metre.
   a) Design the banner. Consider the following:
      - How large a banner does your school need?
      - Where will you place your logo on the banner?
      - What else will be on the banner?
   b) Estimate and then calculate the total cost of your banner including the logo.

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, 8, and 12. Each of these special reviews is followed by a Task.

Task

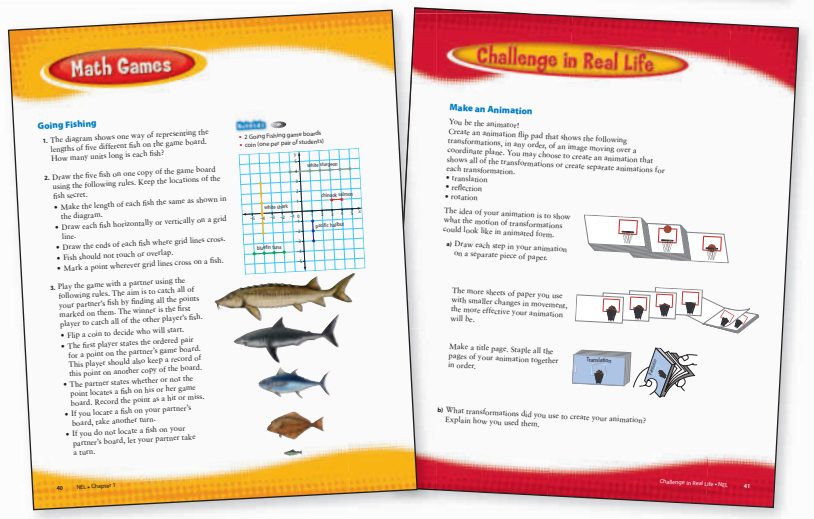
These tasks require you to use skills from more than one chapter. You will also need to use your creativity.

Math Games and *Challenge in Real Life*

The last two pages of each chapter provide **Math Games** and a **Challenge in Real Life**.

Math Games provide an interesting way to practise the skills you learned during the chapter. Most games can be played with a partner. Some can be played with a larger group. Enjoy them with your friends and family.

The **Challenge in Real Life** provides an interesting problem that shows how the math you learned in the chapter relates to jobs, careers, or daily life.


Math Games

Going Fishing

1. The diagram shows one way of representing the lengths of five different fish on the game board. How many units long is each fish?

2. Draw the five fish on one copy of the game board using the following rules. Keep the locations of the fish secret.
   - Make the length of each fish the same as shown in the diagram.
   - Draw each fish horizontally or vertically on a grid line.
   - Draw the ends of each fish where grid lines cross.
   - Fish should not touch or overlap.
   - Mark a point wherever grid lines cross on a fish.

3. Play the game with a partner using the following rules. The aim is to catch all of your partner's fish by finding all the points marked on them. The winner is the first player to catch all of the other player's fish.
   - Flip a coin to decide who will start.
   - The first player states the ordered pair for a point on the partner's game board. This player should also keep a record of this point on another copy of the board.
   - The partner states whether or not the point locates a fish on his or her game board. Record the point as a hit or miss.
   - If you locate a fish on your partner's board, take another turn.
   - If you do not locate a fish on your partner's board, let your partner take a turn.

Challenge in Real Life

Make an Animation

You be the animator!
Create an animation flip pad that shows the following transformations, in any order, of an image moving over a coordinate plane. You may choose to create an animation that shows all of the transformations or create separate animations for each transformation.
- translation
- reflection
- rotation

The idea of your animation is to show what the motion of transformations could look like in animated form.

a) Draw each step in your animation on a separate piece of paper.

The more sheets of paper you use with smaller changes in movement, the more effective your animation will be.

Make a title page. Staple all the pages of your animation together in order.

b) What transformations did you use to create your animation? Explain how you used them.

Answers

Answers are provided for all Practise, Apply, and Extend questions, as well as Reviews. 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

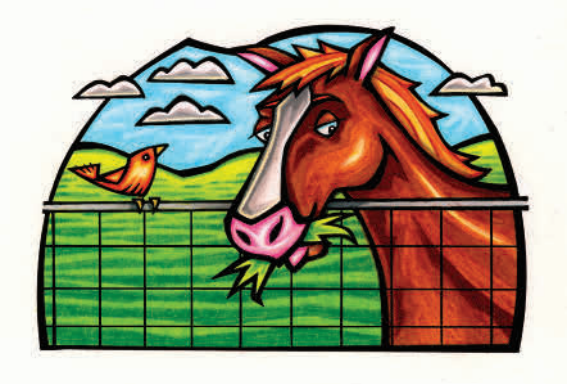
Refer to the illustrated **Glossary** at the back of the student resource if you need to check the exact meaning of mathematical terms.

Problem Solving

How can you solve problems like the three below? Compare your ideas with the strategies that are shown on the following pages.

Problem 1

Jonah has 100 m of fencing. He uses it to fence off a rectangular field for his horse to graze in. The length of the field is 30 m. How wide is the field?

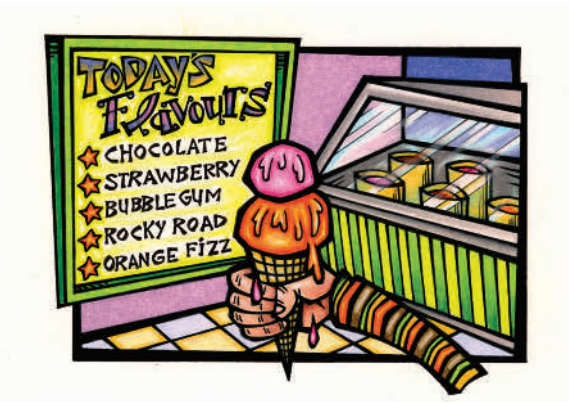


Problem 2

Marja would like to go glow-in-the-dark bowling for her birthday. The bowling alley charges $10 for one lane plus $6 per person. This includes bowling shoe rentals. Marja's mother can afford $40. How many friends can Marja take bowling?

Problem 3

The corner store has five flavours of ice cream: chocolate, strawberry, bubble gum, rocky road, and orange fizz. How many different two-scoop cones are possible?



People solve mathematical problems at home, at work, and at play. There are many different ways to solve problems. In *MathLinks 7*, you are encouraged to try different methods and to 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.

- Think about the problem. Express it in your own words.
- What information do you have?
- What further information do you need?
- What is the problem asking you to do?

Plan

Select a strategy for solving the problem. 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
  - Solve a Simpler Problem
  - Make an Organized List or a Table
  - Work Backwards
  - Guess and Check
  - Look for a Pattern
- Decide whether any of the following might help. Plan how to use them.
  - tools such as a ruler or a calculator
  - materials such as graph 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.
- Record each of your steps.
- Explain and justify your thinking.

Look Back

Examine your answer. Does it make sense?

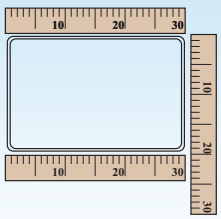
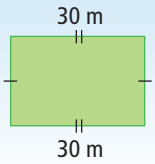
- Is your answer close to your estimate?
- Does your answer fit the facts given in the problem?
- Is the answer reasonable? If not, make a new plan. Try a different strategy.
- Consider solving the problem a different way. Do you get the same answer?
- Compare your method with that of other students.

Here are seven strategies you can use to help solve problems. The chart shows you different ways to solve the three problems on page xiv. Your ideas on how to solve the problems might be different from any of these.

To see other examples of how to use these strategies, refer to the page references. These show where the strategy is used in other sections of *MathLinks 7*.

Problem 1

Jonah has 100 m of fencing. He uses it to fence off a rectangular field for his horse to graze in. The length of the field is 30 m. How wide is the field?

Strategy	Example	Other Examples
Model It	Use three 30-cm rulers and a piece of string 100 cm long. Assume that each centimetre represents 1 m. $30 + 30 + 20 + 20 = 100$ The width of the field is 20 m. 	pages 54, 62, 232, 247, 311, 409
Draw a Diagram	$30 + 30 = 60$ The two lengths are 60 m. $100 - 60 = 40$ The two widths add to 40 m. $20 + 20 = 40$ The width of the field is 20 m. distance around is 100 m 	page 317

Problem 2

Marja would like to go glow-in-the-dark bowling for her birthday. The bowling alley charges $10 for one lane plus $6 per person. This includes bowling shoe rentals. Marja's mother can afford $40. How many friends can Marja take bowling?

Strategy	Example	Other Examples
Work Backwards	It costs $10 for the lane. $40 - 10 = 30$ This means $30 is left for the people. Each person costs $6. $\frac{30}{6} = 5$ $30 is enough for 5 people. One of these is Marja. She can take four friends.	page 429
Guess and Check	The cost is $10 plus $6 per person. Try 3 people: $10 + 3 \times 6$ $= 10 + 18$ $= 28$ Too low. She can take more friends. Try 5 people: $10 + 5 \times 6$ $= 10 + 30$ $= 40$ Right on. For $40, five people can go bowling. Marja is one of the people. She can take four friends.	pages 69, 104, 136

Problem 3

The corner store has five flavours of ice cream: chocolate, strawberry, bubble gum, rocky road, and orange fizz. How many different two-scoop cones are possible?

Strategy	Example	Other Examples

Solve a Simpler Problem

What if the only two choices were chocolate and strawberry? There are only 3 possible two-scoop cones: chocolate with strawberry, double chocolate, or double strawberry.

OK, this gets me started. Now I will make an organized list of the possible pairs for five choices. I don't think the order of scoops of different flavours matters.

pages 238, 246, 248, 251, 253

Make an Organized List or a Table

I could also show this list in a tree diagram.

1. chocolate + strawberry
2. chocolate + bubble gum
3. chocolate + rocky road
4. chocolate + orange fizz
5. strawberry + bubble gum
6. strawberry + rocky road
7. strawberry + orange fizz
8. bubble gum + rocky road
9. bubble gum + orange fizz
10. rocky road + orange fizz

There are 10 different combinations of two scoops. A person might choose two scoops of the same flavour. That makes 5 more possibilities.

The choices could also be shown in a table.

	chocolate	strawberry	bubble gum	rocky road	orange fizz
chocolate	x	x	x	x	x
strawberry		x	x	x	x
bubble gum			x	x	x
rocky road				x	x
orange fizz					x

Fifteen different two-scoop cones are possible using the five flavours.

pages 69, 172, 173, 338, 352, 359, 367, 374, 376

Look for a Pattern

loop means double

	Possibilities
1 flavour C	1 double = 1
2 flavours C — S	1 mixed + 2 doubles = 3
3 flavours C — S, R	3 mixed + 3 doubles = 6
4 flavours C — S, R, B	6 mixed + 4 doubles = 10

From 1 to 3 add 2, 3 to 6 add 3, 6 to 10 add 4. The increase between numbers is one more each time. The next number in the pattern is 10 + 5.

Look for a pattern: 1, 3, 6, 10, … .
Fifteen different two-scoop cones are possible using the five flavours.

pages 103, 112, 201