Fractions, Decimals, and Percents

4

General Outcome
- Develop fraction and decimal sense/memory.

Specific Outcomes

N2 Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected) to solve problems.
N3 Solve problems involving percents from 1% to 100%.
N4 Demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions.

By the end of this chapter, students will be able to:

Section	Understanding Concepts, Skills, and Processes
4.1	✓ estimate percents as fractions
	✓ estimate percents as decimals
	✓ compare fractions, decimals, and percents
	✓ order fractions, decimals, and percents
	✓ estimate answers to percent problems
	✓ solve problems involving percent
4.2	✓ convert among fractions, decimals, and percents
	✓ estimate percent values
	✓ distinguish between terminating and repeating decimals
	✓ relate fractions to terminating decimals
	✓ relate fractions to repeating decimals
4.3	✓ estimate answers to percent calculations
	✓ solve percent problems

Assessment *as* Learning	Supported Learning
Use the Before column of **BLM 4–1 Chapter 4 Self-Assessment** to provide students with the big picture for this chapter and to help them identify what they already know, understand, and can do. You may wish to have students keep this master in their math portfolio and refer back to it during the chapter.	• As students complete each section of the chapter or complete the Chapter 4 Review, have them review the related parts of **BLM 4–1 Chapter 4 Self-Assessment**, fill in the appropriate part of the During column, and report what they might do about any items that they have marked either red or yellow.

Chapter 4 Planning Chart

Section Suggested Timing	Exercise Guide	Teacher's Resource Blackline Masters	Materials and Technology Tools
Chapter Opener • 20–30 minutes		BLM 4–1 Chapter 4 Self-Assessment BLM 4–2 Comparing Numbers	• magazines or newspapers, and/or Internet to show BMX racing or other sports (optional) • coins (optional) • paper • scissors • stapler
4.1 Connect Fractions, Decimals, and Percents • 120–150 minutes	**Essential:** 2, *two of* 1, 3, *or* 4, 5, 8, 9, 11, 12, 14, 16, Art Link **Typical:** 2, *two of* 1, 3, *or* 4, 5, 8, 9, 11, 12, 14, 16, 19–22, 26, 29, Art Link **Extension/Enrichment:** 2, *two of* 1, 3, *or* 4, 23–25, 27–30	Master 8 Centimetre Grid Paper Master 10 Hundred Grids BLM 4–1 Chapter 4 Self-Assessment BLM 4–3 Section 4.1 Extra Practice BLM 4–4 Section 4.1 Art Link	• cardboard or index card • ruler • scissors • 25-cm length of ribbon or paper strip (at least 1 cm wide) • felt marker • tape
4.2 Fractions, Decimals, and Percents • 80–100 minutes	**Essential:** 1, 2 *or* 3, 4, 5, 7, 8, 10, 12, 14, 17, Math Link **Typical:** 1, 2 *or* 3, 4, 5, 7, 8, 10, 12, 14, 16–19, Math Link **Extension/Enrichment:** 1, 2 *or* 3, 4, 20–22	Master 10 Hundred Grids BLM 4–1 Chapter 4 Self-Assessment BLM 4–5 Section 4.2 Extra Practice BLM 4–6 Section 4.2 Math Link	• calculator • place value charts • loading-strip model
4.3 Applications of Percents • 80–100 minutes	**Essential:** 1, 2 *or* 3, 4–6, 11, 14, 16, Math Link **Typical:** 1, 2 *or* 3, 4–6, 8–13, 15–17, Math Link **Extension/Enrichment:** 1, 2 *or* 3, 18–22	Master 3 Integer Number Lines Master 10 Hundred Grids BLM 4–1 Chapter 4 Self-Assessment BLM 4–7 Section 4.3 Extra Practice BLM 4–8 Section 4.3 Math Link	• loading-strip model • calculator
Chapter 4 Review • 40–50 minutes	Have students do at least one question related to any concept, skill, or process that has been giving them trouble.	BLM 4–1 Chapter 4 Self-Assessment BLM 4–3 Section 4.1 Extra Practice BLM 4–5 Section 4.2 Extra Practice BLM 4–7 Section 4.3 Extra Practice BLM 4–9 Chapter Review #10	• loading-strip model • number lines • calculator
Chapter 4 Practice Test • 40–50 minutes	Provide students with the number of questions they can comfortably do in one class. Choose at least one question for each concept, skill, or process. **Minimum:** 5, 8–10, 12, 14, 16	BLM 4–1 Chapter 4 Self-Assessment BLM 4–10 Chapter 4 Test	• loading-strip model • calculator
Chapter 4 Wrap It Up! • 40–50 minutes		Master 1 Project Rubric BLM 4–4 Section 4.1 Art Link BLM 4–6 Section 4.2 Math Link BLM 4–8 Section 4.3 Math Link BLM 4–11 Chapter 4 Wrap It Up!	
Chapter 4 Math Games • 40–50 minutes		BLM 4–12 Math's a Snap Playing Cards	
Chapter 4 Challenge in Real Life • 60–75 minutes		Master 1 Project Rubric	• paint, coloured pencils, and/or markers • materials to make converter (optional)

Chapter 4 Planning Chart (continued)

Section Suggested Timing	Exercise Guide	Teacher's Resource Blackline Masters	Materials and Technology Tools
Chapters 1–4 Review • 60–75 minutes	Provide students with the number of questions they can comfortably do in one class. Choose at least one question for each concept, skill, or process. **Minimum:** 1, 2, 4, 5, 7–11, 13–15, 17–21	Master 8 Centimetre Grid Paper	• ruler • compass • calculator
Task • 60–75 minutes		Master 1 Project Rubric Master 8 Centimetre Grid Paper BLM 4–13 Chapter 4 *MathLinks 7* Student Resource Answers BLM 4–14 Chapter 4 BLM Answers	• ruler • coloured pencils (optional) • calculator (optional)

Chapter 4 Assessment Planner

Assessment Options	Type of Assessment	Assessment Tool
Chapter Opener	Assessment *as* Learning (TR pages i, 123)	BLM 4–1 Chapter 4 Self-Assessment Chapter 4 Foldable
4.1 Connect Fractions, Decimals, and Percents	Assessment *as* Learning (TR pages 126, 129, 131) Assessment *for* Learning (TR pages 126, 127, 129, 130, 131)	Master 2 Two Stars and One Wish Math Learning Log (TR page 131) BLM 4–1 Chapter 4 Self-Assessment
4.2 Fractions, Decimals, and Percents	Assessment *as* Learning (TR pages 134, 137, 139) Assessment *for* Learning (TR pages 134, 135, 136, 137, 138, 139)	Math Learning Log (TR page 139) BLM 4–1 Chapter 4 Self-Assessment
4.3 Applications of Percents	Assessment *as* Learning (TR pages 142, 144, 145) Assessment *for* Learning (TR pages 144, 145)	Math Learning Log (TR page 145) BLM 4–1 Chapter 4 Self-Assessment
Chapter 4 Review	Assessment *for* Learning (TR page 146) Assessment *as* Learning (TR page 147)	Math Learning Log (TR page 147) BLM 4–1 Chapter 4 Self-Assessment
Chapter 4 Practice Test	Assessment *as* Learning (TR page 148) Assessment *of* Learning (TR page 149)	BLM 4–1 Chapter 4 Self-Assessment BLM 4–10 Chapter 4 Test
Chapter 4 Wrap It Up!	Assessment *of* Learning (TR page 148a)	Master 1 Project Rubric
Chapter 4 Math Game	Assessment *for* Learning (TR page 150)	
Chapter 4 Challenge in Real Life	Assessment *for* Learning (TR page 150a) Assessment *of* Learning (TR page 150a)	Master 1 Project Rubric
Chapters 1–4 Review	Assessment *for* Learning (TR page 154) Assessment *as* Learning (TR page 154)	Math Learning Log (TR page 154)
Task	Assessment *of* Learning (TR page 154a)	Master 1 Project Rubric

You may wish to use one or more of the following materials to help you assess student readiness for Chapter 4.

Assessment *for* Learning	Supported Learning
Method 1: Have students develop a journal to explain what they personally know about mentally finding numbers halfway between two given numbers and successfully placing numbers on a number line. **Method 2:** Have students complete **BLM 4–2 Comparing Numbers** to check their conceptual understanding. Remind students that you are looking for the scope of their knowledge.	• Students who require reinforcement of prerequisite skills may wish to complete the Get Ready materials available in the *MathLinks 7 Workbook* and at the **www.mathlinks7.ca** book site.

Key Words

percent
repeating decimal
terminating decimal

What's the Math?

This chapter is about interpreting the use of fractions, decimals, and percents. This involves converting between the different number representations as well as developing a sense for their relative size. Students use a loading-strip model to help visualize and compare fractions, decimals, and percents. They estimate and solve percent problems using conversions to and from fractions and decimals. Students also convert fractions to terminating and repeating decimal numbers.

Activity Planning Notes

Start by asking who has participated in an action sport. It may be necessary to identify *action sports*. Then, determine what is most important to participants in each action sport. Suggestions might include being well rested prior to the event, drinking plenty of fluids, and using appropriate equipment. Bring the discussion back to uses of fractions, decimals, and percents in action sports. Centre the discussion on BMX racing if students do not have their own action sports.

BMX racing has some interesting possibilities for using fractions, decimals, and percents. However, most examples are in decimal form and centre on the cost of gear, lap times to the nearest hundredth of a second, and travel and accommodation costs for going to competitions.

Mention that BMX racing will be added to the 2008 Beijing Olympics. Teams of four will race on a track with mounds, jumps, water, and mud. Heat winners will advance to the next round as is currently the practice in cycling events at the world level.

Math Link

Move from a discussion of the uses of fractions, decimals, and percents in action sports to the use of these numbers in the media.
     At the end of this chapter, students will make a poster showing how fractions, decimals, and percents are used in the print media. You may wish to read the Wrap It Up! for the chapter problem, which is on page 149. Students could start to gather headlines and articles that use fractions, decimals, and percents throughout the chapter. Emphasize that students should collect a variety of headlines and articles. Consider providing students with magazines and newspapers you have collected or with Internet access to online versions to help them get started.
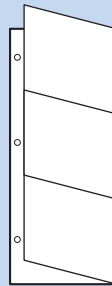
FOLDABLES™
Study Tool

Have students make the Foldable in the student resource to keep track of the information in the chapter. If you have a large stapler, you could have students open up their folded papers and place three staples in the middle fold. Students could use a large envelope or clear plastic folder in their binder to hold their Foldables.

You may wish to have students keep track of Key Words using a design specifically for that purpose. Students can make the following Foldable and write vocabulary terms on the front of each tab. Have them use the space beneath the tab to write definitions and provide examples.

Step 1 Fold a sheet of notebook paper in half along the long axis with the crease to the right. Fold only as far as the margin of the page.

Step 2 On one side, cut every 9 cm or along the line closest to 9 cm. Cut as far as the fold, creating tabs as you go. This will create three tabs.

Step 3 Label each tab with a math term. Write definitions and give examples underneath the tabs.

Assessment *as* Learning	Supported Learning
Chapter 4 Foldable As students work on each section in Chapter 4, have them keep track of any problems they are having under the What I Need to Work On tab in their chapter Foldable.	• As students complete each section, have them review the list of items they need to work on, and then have them check off any that have been handled.

Learning Style and Motor
• Consider creating a Foldable ahead of time to use as a model with students.

ESL and Language
• English language learners may have a difficult time working independently on the Math Link. It may be helpful to have students start the Math Link as a group brainstorm or project.

ESL
• Consider reading the opening text aloud as a class and check for understanding.
• English language learners may have difficulty with terms such as *race course*, *fluids*, *sweat*, *decrease,* and *dehydration*. Have students add any new words to their dictionary.

Meeting the Needs of All Learners
• Students who have a particular interest in the outdoors or the environment may find these topics more useful:
  – Loss of body heat. Discuss wind chill, falling through thin ice into water, and hypothermia.
  – Loss of body heat in polar bears. Polar bears lose body heat only through their noses. Consider the percent of heat loss they experience compared to people, who lose body heat from a larger area.
  – Statistics related to global warming.

4.1 Connect Fractions, Decimals, and Percents

Suggested Timing
120–150 minutes

Materials
- cardboard or index card
- ruler
- scissors
- 25-cm length of ribbon or paper strip (at least 1 cm wide)
- felt marker
- tape

Blackline Masters

Master 8 Centimetre Grid Paper

Master 10 Hundred Grids

BLM 4–1 Chapter 4 Self-Assessment

BLM 4–3 Section 4.1 Extra Practice

BLM 4–4 Section 4.1 Art Link

Mathematical Processes

- ☑ Communication
- ☑ Connections
- ☑ Mental Mathematics and Estimation
- ☑ Problem Solving
- ☑ Reasoning
- ☐ Technology
- ☑ Visualization

Focus on...

After this lesson, you will be able to...

- ☐ estimate percents as fractions or as decimals
- ☐ compare and order fractions, decimals, and percents
- ☐ estimate and solve problems involving percent

loading ... 25%

percent
- means "out of 100"
- 30% means 30 out of 100 or $\frac{30}{100}$ or 0.30.

Materials
- cardboard or index card
- ruler
- scissors
- 25-cm length of ribbon or paper strip (at least 1 cm wide)
- felt marker
- tape

Kim likes to do research on the Internet before he travels. He has found a video of orcas, or killer whales, migrating off the coast of British Columbia. The video is 20 megabytes, and 25% has already downloaded. How many megabytes is that?

Explore the Math

How can you estimate percents?

You can use a visual model like an Internet loading strip to help make reasonable estimates of percent and corresponding number values.

1. Cut a piece of index card or cardboard to make a rectangle that is 5 cm by 12 cm. Cut a slot 1.5 cm in from each end of your cardboard. Make each slot slightly longer than the width of the ribbon or paper strip you will use in step 3.

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Specific Outcomes

N3 Solve problems involving percents from 1% to 100%.
N4 Demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions.

Warm-Up

1. Plot the following points on a coordinate grid.
   A(0, 3), N(−6, −4), T(2, −3)

2. Place a decimal point in each answer without calculating. Show your thinking.
   a) 75.83 + 37.9 + 28 = 14173
   b) 296 cm + 38.7 cm + 429 cm = 76370

3. Draw a pair of parallel lines.

4. Explain how you know the lines in #3 are parallel.

5. Draw a pair of perpendicular lines.

Mental Math

Identify the place value of the circled parts of each of the following numbers.

6. 12⑦8.21

7. 39.⓪6

8. 501.6④

9. 121.⑦2

10. 300.0⑥

2. Use a ruler to draw a 10-cm line between the slots, just above the top end of the slots. Label 0% and 100%.

3. Draw a line at the 12.5-cm point on your ribbon or paper strip. Colour exactly one half of the ribbon with a marker, so you have a two-colour ribbon.

4. Thread the ribbon or paper strip through the slots. Connect the ribbon tightly at the back. You have now created a "loading-strip model." You can pull the coloured part of your ribbon loop back and forth to show different percents of coloured ribbon.

5. a) Set your loading-strip model to show 50%.
   b) What fraction of the ribbon shown is coloured? What is this fraction as a decimal number?

6. You can use your loading strip to estimate a percent of a number, such as 50% of 20.
   a) Write 0 below the 0% end of your loading strip.
   b) Write 20 below the 100% end of your loading strip.
   c) How could you use your answer to 5b) to estimate 50% of 20? Mark your estimate below the ribbon on your loading strip.

7. a) Set your loading-strip model to show 25%.
   b) What fraction of the ribbon shown is coloured? What is this fraction as a decimal number?
   c) How could you use your answer to #7b) to estimate 25% of 20?

Reflect on Your Findings

8. How could you use your loading-strip model to estimate 75% of 20?

75% is 50% + 25%.

4.1 Connect Fractions, Decimals, and Percents • MHR   125

Warm-Up

1.

2. a) $75 + 25 = 100 + 37 = 137$. Close to 141; 141.73
   b) $300 + 400 = 700 + 40 = 740$. Close to 760; 763.70

3.

4. When I fold across the line segments, they lie on top of each other.

5.

6. $7 =$ tens

7. $0 =$ tenths

8. $4 =$ hundredths

9. $7 =$ tenths

10. $6 =$ hundredths

Activity Planning Notes

Check that students are familiar with computer downloading strips. If they are not, try to find a working example on the Internet. Alternatively, examine the screen shot of the orca video given in the student resource. An introduction to computer downloading strips will help students build their model of a downloading strip in Explore the Math.
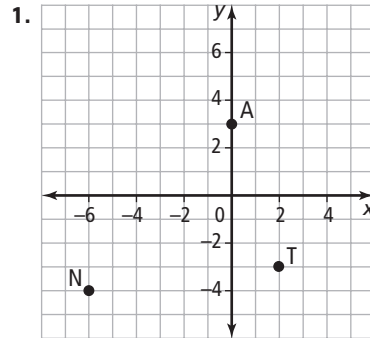
Explore the Math

Students should work individually to build their loading-strip model. The loading-strip model helps students visualize and compare percents, fractions, and decimal numbers. It provides a hands-on opportunity for students to "see" processes necessary in mentally performing percent calculations. Use a Smart Math approach with class discussion and record student responses.

Do not rush the process. It works well to use 10 to 15 minutes per day and to follow a sequence of benchmarks from 100%, 0%, 50%, 25%, $12\frac{1}{2}$%, 75%, $37\frac{1}{2}$%, and $62\frac{1}{2}$%. These benchmarks are developed from halving and combining various percent values.

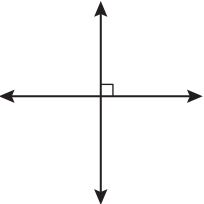### Explore the Math

5. b) $\frac{1}{2}$, 0.5

6. c) Answers will vary. For example: $\frac{1}{2}$ of 20 is equal to 10.

7. b) $\frac{1}{4}$, 0.25

   c) Answer will vary. For example: $\frac{1}{4} \times 20 = 5$

8. Answers will vary. For example: Place 75% halfway between 50% and 100%. The number that is halfway between 10 and 20 is 15.

Show You Know: Example 1

a) $22.90

b) $12.50

c) $7.24

Assessment *as* Learning	Supported Learning
Reflect on Your Findings Listen as students discuss and demonstrate how they could use the loading-strip model. This process allows them to generalize what they learned during the Explore the Math.	• Highlight the bubble that reminds students to consider 75% as 50% + 25%. • Review the Mental Math and Estimation box on page 126. Some students may find it useful to use their money skills to think about fractions, decimals, and percents. • Encourage students to continue to use the loading strip until they feel confident about working with percent.

Use your money skills to think about fractions, decimals, and percents.

$0.25 — $\frac{1}{4}$ of a dollar — 25% of a dollar

$0.50 — $\frac{1}{2}$ of a dollar — 50% of a dollar

$0.10 — $\frac{1}{10}$ of a dollar — 10% of a dollar

Example 1: Find a Percent of a Number

a) Four brothers bought their mother a birthday present for $84.60. They each paid 25% of the bill. How much was each brother's share?

b) Ten co-workers are buying Ted a going away present and will each pay 10%. They decide to buy him a backpack for $92.30, including tax. How much should each pay?

Solution

a) Find 50% of $84.60.
50% of $84.60 is half of $84.60.
Half of $84.60 is $42.30.

$84.60 ÷ 2 = $42.30

Now find 25% of $84.60.
25% is half of 50%.
Half of $42.30 is $21.15.

$42.30 ÷ 2 = $21.15

So, 25% of $84.60 is $21.15.

25% is also $\frac{1}{4}$. I could have divided by 4. $84.60 ÷ 4 = $21.15

Check:
$21.15 × 4 = $84.60
Each brother's share is $21.15.

b) Find 10% of $92.30.
Recall that 10% = $\frac{10}{100}$
= $\frac{1}{10}$

10% of $92.30 is one tenth of $92.30.
One tenth of $92.30 is $9.23.

$92.30 ÷ 10 = $9.23

Each co-worker should pay $9.23.

Show You Know

a) Find 50% of $45.80.

b) Find 25% of $50.00.

c) Find 10% of $72.40.

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ESL

• Have students work in pairs to complete the Explore the Math.

Motor

• Students may find it difficult to create a loading-strip model. Consider allowing students to use virtual manipulatives.

Meeting the Needs of All Learners

• Use cooperative learning groups for the Explore the Math. Use imagery and lots of guided practice with percents and fractions.

Example 1 encourages students to use either a fraction or a decimal to find the answer to percent problems. Encourage students to think through problems by asking questions leading to estimates of the answer. For example:

• What is an estimate of the answer?
• Is your estimate an overestimate or an underestimate?
• What is an overestimate for 10% of $92.30?

Assessment *for* Learning	Supported Learning
Example 1 Have students do the Show You Know related to Example 1.	• Encourage students to find percents of a number using fractions for a), decimals for b), and a method they prefer for c). • You may wish to provide additional questions for students who would benefit from them: **a)** Find 50% of $24.80 (Many students will find it easiest to use a fraction. $24.80 ÷ 2 = $12.40. Have them check their answer by multiplying. This reinforces what they did in Chapter 2.) **b)** Find 25% of $60 (Using their money skills, students will remember that 25% is 0.25 or $\frac{1}{4}$. They could divide by 4, or find half and then half again to get the answer $15. Many students may prefer this method because they can more easily do the calculations mentally.) **c)** Find 10% of $136 (Again using money skills, 10% is 0.10 or $\frac{1}{10}$. $136 ÷ 10 = $13.60.) Sit down and coach students through a), and then have them try b) and c) on their own.

Example 2: Find the Percent of a Number Mentally

What is 75% of 80?

Solution

Method 1: Use Percents You Know

50% of 80 is half of 80.
Half of 80 is 40.
25% is half of 50%.
Half of 40 is 20.

75% is 50% + 25%.

75% of 80 = 40 + 20
= 60

So, 75% of 80 is 60.

Method 2: Think of a Model

80 is [blocks].

75% is $\frac{3}{4}$, so divide the blocks into 4 groups.

Each group has [block], or 20.

Strategies
What other method could you use?

Count the number of blocks in 3 groups.

Three groups will have 3 × 20 or 60.

So, 75% of 80 is 60.

Show You Know

Use mental math to find each percent.
a) 75% of 16
b) 60% of 90
c) 40% of 80

4.1 Connect Fractions, Decimals, and Percents • MHR   127

Show You Know: Example 2

a) 12

b) 54

c) 32
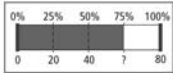
Common Errors

- Many students may be reluctant to think in mathematics and request processes and algorithms to help answer questions.

  R_x Encourage students to find answers using more than one method, and then discuss which method they prefer and why. Having students identify their preferred method(s) creates awareness of multiple methods and de-emphasizes the role of the teacher to show processes and preferred methods.

- Students may become confused when dealing with fractions, decimals, and percents.

  R_x Use appropriate pacing. Introduce the loading-strip model and encourage students to explain their thinking as they connect fractions, decimals, and percents.

Example 2 uses mental math skills to find percents by following multiple steps. You may prefer to begin by using the loading-strip model to support the mental math and estimation processes.

It is helpful to get students to explain alternative ways to find, say, 75% of 80. Two common ways include 50% + 25% and 100% − 25%. The goal is not necessarily to find the answer directly in one step, but rather to think through a series of known percent values to get the answer(s).

If students are asked to find 85% of 60, they could think 50% + 25% + 10%, or 100% − 10% − 5%, or 50% + 10% + 10% + 10% + 5%.

Assessment *for* Learning	Supported Learning
Example 2 Have students do the Show You Know related to Example 2.	• Encourage students to find percents of a number using percents they know for a), a model for b), and a method they prefer for c). • Students may find it helpful to use **Master 8 Centimetre Grid Paper** or **Master 10 Hundred Grids** to make models. • You may wish to provide additional questions for students who would benefit from them: a) Use mental math to find 40% of 70 (40% is 50% − 10%. 50% of 70 is half of 70 or 35. 10% of 70 is one tenth of 70 or 7. 35 − 7 = 28.) b) Use mental math to find 70% of 140 (Using a model, show 140 as 14 strips of 10. 70% is $\frac{7}{10}$, so divide the strips into 10 groups. Each group will have 1 strip and 4 squares. 70% is 7 of these groups. Seven groups will have 7 × 14 or 98.) c) Use mental math to find 30% of 120 (Using a model, show 120 as 12 strips of 10. 30% is $\frac{3}{10}$, so divide the strips into 10 groups. Each group will have 1 strip and 2 squares. 30% is 3 of these groups. Three groups will have 3 × 12 = 36.)

Show You Know: Example 3

a) $0.48 < \frac{1}{2} < 56\%$

b) $35\% < 0.36 < \frac{39}{100}$

Communicate the Ideas

1. a) Answers will vary. For example: $60\% = \frac{3}{5}$. Divide the 120 blocks into 5 groups of 24. Count the number of blocks in 3 groups. $24 \times 3 = 72$.

   b) Yes, you can use diagrams, a loading-strip model, or a number line.

2. a) Answers will vary. For example: Use diagrams, a loading-strip model, or a number line, or use the fraction/decimal form of the percent and multiply.
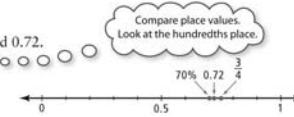
   b) Convert 12.5% to a decimal, 0.125, and multiply 0.125 by the number.

3. Answers will vary.

4. Divide the number by 100 by moving the decimal point two places to the left.

Literacy Link

Ascending order means from least to greatest.

Descending order means from greatest to least.

Example 3: Compare Fractions, Decimals, and Percents

Compare $\frac{3}{4}$, 70%, and 0.72. Write them in ascending order.

Solution

Express all three values in decimal form.

$\frac{3}{4}$ is 0.75.

70% is 0.70

0.72 is 0.72

Compare 0.75, 0.70, and 0.72.

0.70 < 0.72 < 0.75

So, $70\% < 0.72 < \frac{3}{4}$.

Compare place values. Look at the hundredths place.

Show You Know

Write each set of numbers in ascending order using the < symbol.

a) 56%, 0.48, $\frac{1}{2}$ b) 35%, $\frac{39}{100}$, 0.36
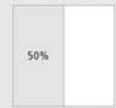
Key Ideas

- A visual model can help you solve problems involving percents.
- Every percent has an equivalent decimal and fraction value.
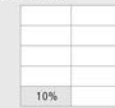
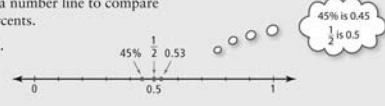25% is 0.25 or $\frac{1}{4}$ 50% is 0.50 or $\frac{1}{2}$ 10% is 0.10 or $\frac{1}{10}$

- You can use place value or a number line to compare fractions, decimals, and percents.

$\frac{1}{2}$ is between 45% and 0.53.

$45\% < \frac{1}{2} < 0.53$

45% is 0.45

$\frac{1}{2}$ is 0.5

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ESL, Language, and Memory

- Read the Literacy Link on page 128. Help students develop a memory device for remembering the difference between *ascending* and *descending*.
  – For *ascending*, think going upstairs (i.e., smallest to largest or lowest to highest).
  – For *descending*, think going downstairs because *descending* and downstairs both start with d (i.e., largest to smallest or highest to lowest).

In Example 3, students compare fractions, decimals, and percents. To do this comparison, students could use decimals or think of money. For example, $\frac{3}{4}$ of a dollar is 75¢, 70% of a dollar is 70¢, and $0.72 is 72¢. With this information, most students will be able to place the values in ascending order.

Some students may prefer to use fractions with denominators of 100. For example, $\frac{3}{4}$ is equivalent to $\frac{75}{100}$, 70% is $\frac{70}{100}$ by definition, 0.72 is $\frac{72}{100}$. Since the denominators are the same, they need to compare the numerators only: 75, 70, and 72.

Key Ideas

The Key Ideas emphasize using different ways to compare fractions, decimals, and percents. Students could prepare their own list of Key Ideas and put it in their chapter Foldable. It is quite acceptable to have more or less than what is included in the student resource.

Assessment *as* Learning	Supported Learning
Communicate the Ideas Rather than asking students to complete all four questions, you may wish to assign #2 and have them choose one or two other questions. This could be done individually or as a class.	• Discuss all of the questions as a class and summarize the main points after students have attempted the questions. • Have students record their work for #2 in their chapter Foldable as a reference for review. • Encourage students to use the loading-strip model to support their work. • Work with the class to develop criteria for judging each answer. For example, criteria for #1 might include – uses diagrams or loading-strip model – shows that 60% is made up of other easy-to-work-with percents – uses familiar percents to show the calculation – provides more than one way to do the calculation • Use **Master 2 Two Stars and One Wish** to have students critique other students' writing pieces. This master allows them to write two things they like about a piece and one thing they would like to improve.

Assessment *for* Learning	Supported Learning
Example 3 Have students do the Show You Know related to Example 3 on page 128.	• After trying both methods of expressing values, have students briefly explain which method they prefer and why. • You may wish to provide additional questions for students who would benefit from them: a) 22%, 0.24, $\frac{1}{4}$ (Have students use both decimals and fractions and compare their answers: 22% = 0.22, 0.24, $\frac{1}{4}$ = 0.25. 0.22 < 0.24 < 0.25; therefore, 22% < 0.24 < $\frac{1}{4}$. 22% = $\frac{22}{100}$, 0.24 = $\frac{24}{100}$, $\frac{1}{4}$ = $\frac{25}{100}$. $\frac{22}{100}$ < $\frac{24}{100}$ < $\frac{25}{100}$; therefore 22% < 0.24 < $\frac{1}{4}$.) b) $\frac{62}{100}$, 0.59, 60% (Have students use both decimals and fractions and compare their answers: $\frac{62}{100}$ = 0.62, 0.59, 60% = 0.60. 0.59 < 0.60 < 0.62; therefore, 0.59 < 60% < $\frac{62}{100}$. $\frac{62}{100}$, 0.59 = $\frac{59}{100}$, 60% = $\frac{60}{100}$. $\frac{59}{100}$ < $\frac{60}{100}$ < $\frac{62}{100}$; therefore, 0.59 < 60% < $\frac{62}{100}$.) Sit down and coach students through a), and then have them try b) on their own.

Supported Learning

ESL and Language

• Encourage students who struggle with reading and writing to answer the Communicate the Ideas using a combination of diagrams, oral explanations, and demonstrations of models.

• Partner English language learners with students who can provide them with good one-on-one discussion. This facilitates comprehension of vocabulary.

Communicate the Ideas

These questions allow students to explain their understanding of calculating the percent of a number using different methods.

Category	Question Numbers
Essential (minimum questions to cover the outcomes)	2, *two of* 1, 3, *or* 4, 5, 8, 9, 11, 12, 14, 16, Art Link
Typical	2, *two of* 1, 3, *or* 4, 5, 8, 9, 11, 12, 14, 16, 19–22, 26, 29, Art Link
Extension/Enrichment	2, *two of* 1, 3, *or* 4, 23–25, 27–30

Supported Learning

Learning Style, ESL, Language, and Memory

• You may wish to have students complete the Art Link to help prepare them for the chapter problem wrap-up titled Wrap It Up! at the end of the chapter.

• You may wish to have students complete **BLM 4–3 Section 4.1 Extra Practice** for extra practice.

ESL

• English language learners may have difficulty with terms such as *marble, min* (minute), *ascending, descending, bill, tip, audience, cost,* and *profit.* Have students add any new terms to their dictionary.

• In #28, English language learners may know how to calculate percent but be confused about terminology. Clarify the meaning of *60% occupied* and *520 empty*.

Gifted and Enrichment

• Have students update the flavours and prices in #30 using local information.

• Have students research the history of bubble tea. They may wish to report their findings to the class.

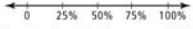*For help with #12 to #18, refer to Example 3 on page 128.*

12. Change each percent to a decimal number.
a) 57% b) 30% c) 5% d) 88%

13. Change each percent to a decimal number.
a) 42% b) 38% c) 15% d) 73%

14. Compare the numbers in each set. Write them in ascending order.
a) $14\%, \frac{1}{10}, 0.12$ b) $27\%, \frac{1}{4}, 0.24$
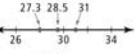c) $\frac{41}{100}, 40\%, 0.39$

15. Compare the numbers in each set. Write them in descending order.
a) $32\%, \frac{3}{10}, 0.35$ b) $76\%, 0.72, \frac{3}{4}$
c) $\frac{1}{2}, 45\%, 0.54$

16. Use the number line to help answer the questions below.
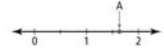
0 25% 50% 75% 100%

a) What is a fraction between 25% and 50%? How do you know?
b) What is a decimal number between 0% and 25%?
c) What is a decimal number between 75% and 100% that is closer to 75%?

17. On each number line, which number is correctly placed? How do you know?
a) 27.3 28.5 31
26 30 34
b) $\frac{1}{5}$ $\frac{7}{8}$ 0.18
0 1 2

18. What decimal number could be placed at A on the number line? Justify your answer.
0 1 A 2

Apply

19. In Australia, the GST is 10%. How would you estimate the GST on items you might buy on holiday in Australia?

20. According to an article in the newspaper, 35% of Regina residents like winter. If the population of Regina is 178 000, how many people like winter? Show two different ways to find the answer.

21. Your bill at a restaurant is $28. You want to leave a 15% tip. How could you calculate the amount mentally?

22. Carey found that 35% of the students in her school read fantasy books. If there are 840 students in the school, how many students read fantasy books?

23. John's mass was 62 kg last year. If his mass increased by 10% this year, what is his current mass?

24. Three years ago, Sam's height was 108 cm. Since that time he has grown 25% in height.
a) How much has he grown?
b) How tall is he now?

3 YEARS AGO TODAY

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Practise

For #8, ensure students show how they found their answers. Encourage students to use mental math strategies for #9 and #10, and to show their steps for #11. For #14 and #15, remind students to express all three numbers as fractions, decimals, or percents before comparing them.

Assessment *for* Learning	Supported Learning
Practise Have students do #5, #8, #9, #12, #14, and #16. Students who have no problems with these questions can do #11 and #18 before going on to the Apply questions.	• Students who have problems with #5 and #8 will need additional coaching with Example 1. Have students continue to use a loading-strip model until they feel more comfortable with this method. Coach students through #6a) and #7a), and then have them complete the remaining parts of each question on their own. • Students who have problems with #9 will need additional coaching with Example 2. Have students write down a list of the percents they are familiar with (e.g., 10%, 25%, 50%). Encourage them to use mental math to consider how they could use these percents in #9. Coach students through #10a), and then have them complete the remaining parts of the question on their own. • Students who have problems with #12, #14, and #16 will need additional coaching with Example 3. Make sure that students understand the difference between ascending and descending and can correctly use the symbols < and >. Coach students through #13a), #15a), and #17a), and then have them complete the remaining parts of each question on their own. • Check back with students several times to make sure that they understand the concepts.

Boxed textbook page (page 131)

25. Clare saved 25% more than Rita. How much did Clare save if Rita saved $288.60?

26. Arrange the following numbers in descending order. Show your answer using both a labelled number line and the > symbol.

$37\frac{1}{2}\%$, $\frac{1}{4}$, 0.41, and $\frac{4}{10}$

27. At a concert, 75% of the seats were filled. 60% of the audience was female. If there are 3200 seats in the concert hall, how many in the audience were female? Explain.

Extend

28. At a concert, 60% of the seats were occupied. 520 seats were empty. What is the total number of seats in the concert hall?

29. Figure ABCD is a rectangle with the dimensions shown. What percent of the figure is shaded? Justify your response.
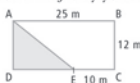
30. Brannon runs a bubble tea café in Winnipeg. The table shows the cost of ingredients for one drink. The prices are $3.50, $4.50, and $5.50 for each of the three different sizes.

| | Cost to Make | | |
Ingredient	Junior Size	Jumbo Size	Kong Size
Tapioca	10¢	20¢	25¢
Ice	2¢	4¢	6¢
Juice	30¢	50¢	80¢
Syrup	5¢	6¢	8¢

a) What is the cost for making each size drink?

b) What is the profit for each size of drink sold?

c) On an average day, Brannon sells 80 Junior size, 250 Jumbo size, and 120 Kong size drinks. What is the expected profit for the day?

WWW Web Link

Bubble tea originated in Taiwan in the 1980s and was first sold in Canada in the 1990s. For more information about the history of bubble tea, go to www.mathlinks7.ca and follow the links.

Art Link

Create a personal logo from two triangles, two rectangles, and two circles. Your logo can resemble a person, animal, or thing.
• You can cut any of the six shapes, but only into halves or quarters (50% or 25%) of the original shape.
• You must use all of the triangles, rectangles, and circles or their parts in your logo.
• Pieces may overlap.
• Decorate and colour your logo.
• Label each part shape with its fraction, decimal, or percent equivalent.

4.1 Connect Fractions, Decimals, and Percents • MHR   131

Apply and Extend

The Apply questions provide a variety of fairly straightforward contexts in which fractions, decimals, and percents are connected. Most of the problems can be solved in one step.

The Extend questions generally require multiple steps to solve. For #28, students need to understand that if $a + b = 100\%$ then $b = 100\% - a$ (i.e., if 60% of seats are occupied, then $100 - 60 = 40\%$ of the seats are empty).

Assessment *for* Learning	Supported Learning
Art Link The Art Link on page 131 allows students to apply their understanding of fractions, decimals, and percents using quarters, halves, and their combinations. It provides an opportunity for creativity and a useful logo for the poster students create for the chapter wrap-up titled Wrap It Up! on page 149.	• **Master 8 Centimetre Grid Paper** may help students who struggle with drawing, and assist them with their calculations. • Students who are having difficulty getting started could use **BLM 4–4 Section 4.1 Art Link**, which provides scaffolding for this activity.

Assessment *as* Learning	Supported Learning
Math Learning Log Have students answer the following question: • Why is it helpful to understand more than one way to find the answer to a question? Explain using examples.	• Encourage students to recognize the advantages of understanding more than one way to solve a problem. Reinforce that there are many ways to solve problems: some are simpler than others, but few are intrinsically better. • Have students check the What I Need to Work On tab of their chapter Foldable. Encourage them to keep track of the items that are giving them difficulty and to check off each item as the problem is resolved. • Keep a record of student reflections in their learning portfolio. You may wish to have them return to these reflections at the end of the chapter. • You may wish to have students review the part related to Section 4.1 in **BLM 4–1 Chapter 4 Self-Assessment**, fill in the appropriate part of the During column, and report what they might do about any items that they have marked either red or yellow.

WWW Web Link

For a site about bubble tea, go **www.mathlinks7.ca** and follow the links.

Supported Learning

Motor
• Students may struggle with cutting and manipulating shapes in the Art Link. Consider allowing students to use a computer drawing program.

ART LINK

This Art Link asks students to create their own personal logo using a variety of shapes. Ensure students cut at least some of their shapes into halves or quarters, and use all of the shapes for their logo.

4.2 Fractions, Decimals, and Percents

Suggested Timing
80–100 minutes

Materials
- calculator
- place value charts
- loading-strip model

Blackline Masters
Master 10 Hundred Grids

BLM 4–1 Chapter 4 Self-Assessment

BLM 4–5 Section 4.2 Extra Practice

BLM 4–6 Section 4.2 Math Link

Mathematical Processes

✓	Communication
✓	Connections
✓	Mental Mathematics and Estimation
✓	Problem Solving
✓	Reasoning
✓	Technology
✓	Visualization

4.2 Fractions, Decimals, and Percents

Focus on...

After this lesson, you will be able to…
- ❑ convert among fractions, decimals, and percents
- ❑ estimate percent values
- ❑ distinguish between terminating and repeating decimals
- ❑ relate fractions to terminating and repeating decimals

Individual statistics from sporting events are often reported as percents or decimal numbers. It may be necessary to convert among fractions, decimals, and percents to better understand these statistics.

Discuss the Math

How can you convert among fractions, decimals, and percents?

1. Look at the statistics in the table. Which hockey goalie do you think is having the best season? Why?

Goalie	Shots on Goal	Saves
A. Auld	673	606
M. Fernandez	586	545
M. Kiprusoff	797	726
D. Hasek	709	658

Sports Link
Although the statistic is called "save percentage," the result is a decimal number.

2. Goalies can be rated on "save percentage." This statistic is the ratio of saves to shots on goal.

$$\text{Save percentage} = \frac{\text{Number of saves}}{\text{Shots on goal}}$$

a) Copy the table into your notebook. Extend the table to include two more columns.

Specific Outcomes

N3 Solve problems involving percents from 1% to 100%.

N4 Demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions.

Warm-Up

1. Identify the coordinates of the vertices of the shape.

2. Estimate and then calculate.
   a) 1.75×3
   b) 68×3.5

3. Draw a line segment. Label it AB. Draw a line that is a perpendicular bisector of AB.

4. Find 10% of $92.

5. Find 15% of $36. Show your thinking.
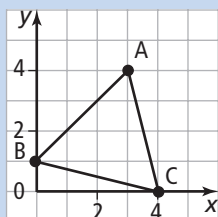
6. Compare $\frac{1}{4}$, 23%, 0.28. Write them in descending order.

Mental Math

7. Count by 10s from 80 to 150.

8. Find the percent mentally. Show your thinking.
   a) 55% of $20   b) 95% of $50

9. Estimate the following. Show your thinking.
   a) 2.9×5 b) 45×1

b) In the first new column, write the save percentage for each goalie as a fraction.

c) In the second new column, write the save percentage as a decimal to the nearest thousandth.

d) Decide which goalie is having the best season. Explain.

3. a) How does the save percentage help you determine a goalie's performance?

b) Is it better to have a higher or a lower save percentage? Explain why.

4. The save percentage is usually stated as a decimal.

a) How are the decimal and fraction forms of the save percentage related?

b) Which form is more useful? Why?

c) Is either form an actual percent value?

Reflect on Your Findings

5. Summarize methods you can use to

a) convert a fraction to a decimal

b) convert a decimal to a percent

Example 1: Convert From Fractions to Decimals and Percents

The following data were gathered one season for three National Basketball Association (NBA) teams.

Team	Wins	Losses
Miami	59	23
New Jersey	42	40
Los Angeles	34	48

A statistic called "team percentage" is the ratio of team wins to total games.

$$\text{Team percentage} = \frac{\text{Number of wins}}{\text{Total games played}}$$

a) What is the team percentage for each team? Leave your answer as a fraction.

b) Change each fraction to a decimal number rounded to the nearest thousandth.

c) Use your rounded decimal value to show the approximate percent value for each team.

Activity Planning Notes

Before reading the introduction, have students find out how statistics from sporting events are reported. Encourage them to find examples of statistics from their favourite teams expressed as fractions, decimals, and percents.

Discuss the Math

In this investigation, students begin to understand the connections in converting from fractions to decimals and percents. Students could work individually or in small groups. Either way, students should prepare their own answers to the questions. If there are hockey players in the class, keep them from dominating the discussion.

Example 1 emphasizes converting from fractions to decimals and to percents. Since the denominators are all greater than one digit, have students use calculators. Ask them to show their calculator keying sequences.

This section consistently requests that students round decimal values to tenths, hundredths, or thousandths to emphasize place value.

Warm-Up

1. A(3, 4), B(0, 1), C(4, 0)

2. a) $1 \times 3 = 3$; $2 \times 3 = 6$. Answer is between 3 and 6; 5.25

b) $70 \times 3 = 210$; $70 \times 4 = 280$. Answer is between 210 and 280; 238

3. Ensure students draw a line that is a perpendicular bisector to the line segment. The line should be at 90° to the segment, and it should divide the segment in half.

4. $\$92 \div 10 = \$9.20$

5. $\$36 \div 10 = \$3.60$; 5% is half of that $= \$1.80$
$\$3.60 + \$1.80 = \$5.40$

6. $\frac{1}{4} = 0.25$; $23\% = 0.23$; 0.28. $0.28 > 0.25 > 0.23$; therefore, $0.28 > \frac{1}{4} > 23\%$

7. 80, 90, 100, 110, 120, 130, 140, 150

8. a) 50% of $\$20 = \$20 \div 2 = \$10$; $10\% = \$20 \div 10 = \$2$
5% is half of that $= \$1$
$55\% = \$10 + \$1 = \$11$

b) 50% of $\$50 = \$50 \div 2 = \$25$; 25% is half of that $= \$12.50$; 10% of $\$50 = \$50 \div 10 = \$5$
$95\% = 50\% + 25\% + 10\% + 10\% = \$25 + \$12.50 + \$5 + \$5 = \$47.50$

9. a) $3 \times 5 = 15$

b) $45 \times 1 = 45$

Discuss the Math

1. a) Answers may vary. For example: M. Kiprusoff has the most shots on goal and the most saves.

2. a)–c)

Goalie	Shots on Goal	Saves	Save Percentage (Fraction)	Save Percentage (Decimal)
A. Auld	673	606	$\frac{606}{673}$	0.900
M. Fernandez	586	545	$\frac{545}{586}$	0.930
M. Kiprusoff	797	726	$\frac{726}{797}$	0.911
D. Hasek	709	658	$\frac{658}{709}$	0.928

d) Answers may vary. For example: Fernandez has the highest save percentage.

3. a) Answers may vary. For example: The save percentage gives a general idea of how often shots on goal are saved from scoring goals.

b) Answers may vary. For example: It is better to have a higher save percentage because that means the ratio of shots stopped to the total number of shots on goal is greater than those let in the net.

Discuss the Math

4. a) The decimal form is an approximate answer. The fraction form is an exact answer. The two forms of the save percentage are approximately equal to each other.

b) Answers may vary. For example: The decimal form is more useful because it is rounded to three decimal places. The fraction forms have different denominators, which are more difficult to compare.

c) Answers will vary. For example: Both forms can be changed to percent values. However, the decimal forms can be easily changed to percent values by moving the decimal points two places to the right.

5. Answers may vary. For example:

a) Divide the numerator by the denominator and round your answer to the indicated place value.

b) Multiply the decimal by 100; move the decimal point in the decimal number two places to the right.

Assessment *as* Learning	Supported Learning
Reflect on Your Findings Listen as students discuss and demonstrate how to convert from fractions to decimals, and from decimals to percents. This process allows them to generalize what they learned during Discuss the Math.	• Ask students who are having difficulty with this question to use the class responses as springboards to prepare similar responses of their own.

Supported Learning

Learning Style

• Encourage students to design a concept map for #5. Encourage them to develop their skills in this area.

ESL

• Students need to understand how to play hockey before being able to determine which goalie is having the best season. Ask volunteers to explain how to play the game and terms such as *goalie, shots on goal*, and *saves*.

• Review the term *digit*. Have students add this term to their dictionary.

Motor

• Give students extra time and a ruler to copy the table on page 132. Consider allowing students to use a computer to create the table.
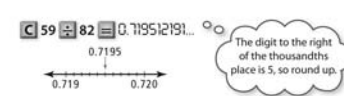

Solution

a) Total games = wins + losses

Miami:
Total games = 59 + 23
= 82
Team percentage = $\frac{59}{82}$

New Jersey:
Total games = 42 + 40
= 82
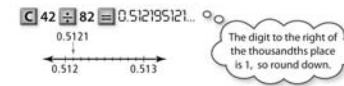Team percentage = $\frac{42}{82}$

Los Angeles:
Total games = 34 + 48
= 82
Team percentage = $\frac{34}{82}$
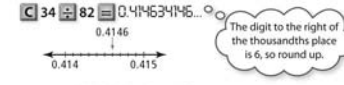
b) Convert each fraction to a decimal.

Miami:
$\frac{59}{82} \approx 0.720$ C 59 ÷ 82 = 0.719512191...   The digit to the right of the thousandths place is 5, so round up.
0.7195
0.719   0.720

New Jersey:
$\frac{42}{82} \approx 0.512$ C 42 ÷ 82 = 0.512195121...   The digit to the right of the thousandths place is 1, so round down.
0.5121
0.512   0.513

Los Angeles:
$\frac{34}{82} \approx 0.415$ C 34 ÷ 82 = 0.414634146...   The digit to the right of the thousandths place is 6, so round up.
0.4146
0.414   0.415

c) To convert to a percent, multiply the decimal by 100.
Miami team percentage = 0.72 × 100%
= 72%
New Jersey team percentage = 0.512 × 100%
= 51.2%
Los Angeles team percentage = 0.415 × 100%
= 41.5%

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Assessment *for* Learning	Supported Learning
Example 1 Have students do the Show You Know related to Example 1 on page 135.	• You may need to review rounding to different place values. For example, to round to the nearest tenths, check the digit in the hundredths place. Encourage visual learners to circle the digit they are using to help them round, and then place an arrow from that to the digit they are rounding. • You may wish to provide additional questions for students who would benefit from them: Convert each fraction to a decimal number. Round each decimal to the indicated place value. Then, convert to a percent. **a)** $\frac{35}{66}$ (tenths) (Students will see 0.530303M on their calculator. To round, they note the 3 in the hundredths position. The rounded answer is 0.5. As a percent, this would be 50%. Note that it is more usual to round to hundredths when working with percents because percent refers to part of 100.) **b)** $\frac{439}{500}$ (hundredths) (Students will see 0.878 on their calculator. To round, they note the 8 in the thousandths place. The rounded answer is 0.88 or 88%. You may wish to review how to change a decimal to a percent by moving the decimal place two spaces to the left, which is the same as multiplying by 100.) **c)** $\frac{1697}{3004}$ (thousandths) (Students will see 0.5649134M on their calculator. To round, they note the 9 in the ten thousandths place. The rounded answer is 0.565 or 56.5%.) Sit down and coach students through a) and then have them try b) and c) on their own.

Show You Know

Convert each fraction to a decimal number. Round each decimal number to the indicated place value. Then, convert to a percent.

a) $\frac{27}{56}$ (tenths)   **b)** $\frac{125}{396}$ (thousandths)   **c)** $\frac{1496}{2005}$ (hundredths)

Example 2: Change Fractions to Repeating Decimals

Some common fractions may change to repeating decimal numbers. These decimal numbers contain one or more digits that repeat over and over without ending.

Use a calculator to change each fraction to a repeating decimal.

a) $\frac{1}{3}$ **b)** $\frac{5}{9}$ **c)** $\frac{5}{6}$

repeating decimal
- a decimal number with a digit or group of digits that repeats forever
- repeating digits are shown with a bar, e.g., 0.777 ... = 0.$\overline{7}$

Solution

a) $\frac{1}{3} = 1 \div 3$

$= 0.\overline{3}$

`C` `1` `÷` `3` `=` 0.333333333

Use a bar over the 3 to show the repeating part.

b) $\frac{5}{9} = 5 \div 9$

$= 0.\overline{5}$

`C` `5` `÷` `9` `=` 0.555555556

The calculator shows the final digit as 6 because it rounds up. It would show more 5s if it had a larger display.

c) $\frac{5}{6} = 5 \div 6$

$= 0.8\overline{3}$

`C` `5` `÷` `6` `=` 0.833333333

Place a bar over only the 3 since the 8 does not repeat.

Show You Know

Show the following fractions as repeating decimals.

a) $\frac{2}{3}$ **b)** $\frac{7}{9}$

Show You Know: Example 1

a) 0.5; 50%

b) 0.316; 31.6%

c) 0.75; 75%

Show You Know: Example 2

a) 0.$\overline{6}$

b) 0.$\overline{7}$

Example 2 emphasizes converting to repeating decimals, and then expressing the answers using a shortcut bar notation. You may wish to have students use paper and pencil techniques in this example and Show You Know, since one outcome for grade 7 students includes paper-and-pencil division by one-digit divisors. Alternatively, have students use a calculator because it is much quicker and easier to see the repeating pattern of digits. Have students write repeating decimals using bar notation and convert from bar notation to expanded decimal form.

Assessment *for* Learning	Supported Learning
Example 2 Have students do the Show You Know related to Example 2.	• Ensure students understand that the bar goes over only the repeating digit or digits. • You may wish to provide additional questions for students who would benefit from them: Show the following fractions as repeating decimals. **a)** $\frac{2}{9}$ (Students will see 0.2222222M. Have them circle the repeating part and then write the decimal. **b)** $\frac{1}{6}$ (Students will see 0.1666666M. Have them circle the repeating part and then write the decimal. Coach students through a) and then have them try b) on their own. Encourage them to develop a memory device to help them remember which digits to put the bar over. • Encourage students to remember the most common fractions with repeating decimals, such as $\frac{1}{3}$ and $\frac{2}{3}$.

Common Errors

• When converting a fraction to a decimal, students may incorrectly divide the denominator by the numerator.

R_x Encourage students to apply number sense to the result. If the original fraction was proper, the resulting decimal should be less than 1.

• Students may incorrectly use repeating decimal notation.

R_x Remind students that they should write the repeating digit(s) one time, and then place a bar over only the repeating digit(s).

• Students may incorrectly change terminating decimals to fractions.

R_x Review concepts related to decimal place values. Show students that the correct naming of a decimal number leads directly to its fraction equivalent.

Show You Know: Example 3

a) Estimate is between 25% and 30%, but closer to 30%.
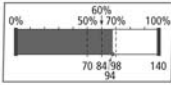
b) Estimate is between 75% and 80%, but closer to 75%.

Show You Know: Example 4

a) $\dfrac{48}{100}$ b) $\dfrac{78}{1000}$

Assessment *for* Learning	Supported Learning
Example 3 Have students do the Show You Know related to Example 3.	• Encourage students to use estimating skills. They might round each fraction so it is easier to work with, or use front-end estimation. • You may wish to provide additional questions for students who would benefit from them: Estimate each of the following as a percent. a) 35 out of 90 (Using front-end rounding, the answer will be around 33.3%, likely a little higher: 50% of 90 = 90 ÷ 2 = 45; 10% of 90 = 90 ÷ 10 = 9; 40% = 45 − 9 = 36 (a little high); 5% of 90 = 9 ÷ 2 = 4.5; 35% = 36 − 4.5 = 31.5 (a little low).The answer is between 35% and 40%, but closer to 40%.) b) 538 out of 652 (Using front-end rounding, the answer will be around 83.3%: 50% of 652 = 652 ÷ 2 = 326; 25% of 652 = 326 ÷ 2 = 163; 10% of 652 = 652 ÷ 10 = 65.2; 85% = 326 + 163 + 65.2 = 554.2 (a little high); 80% = 10 × 65.2 = 521.6 (a little low). The answer is between 80% and 85%, but closer to 85%.) Coach students through a) and then have them try b) on their own. Encourage them to use the original estimation to provide a starting point and to check that their answers are reasonable.

Example 3: Estimate Percents

Paige has answered 94 questions correctly out of 140 questions. Estimate her mark as a percent.

Solution

Think: What is 50% of 140?
Half of 140 is 70.

Think: What is 10% of 140?
$140 \div 10 = 14$

Add 50% and 10% parts together to estimate.

$50\% + 10\% = 60\%$ of 140
$70 + 14 = 84$ Too low.

$50\% + 10\% + 10\% = 70\%$ of 140
$70 + 14 + 14 = 98$ Too high.

The answer is between 60% and 70% but closer to 70%.

Strategies
Guess and Check
Refer to page xvi.

Show You Know
Estimate each of the following as a percent.
a) 23 out of 80   b) 421 out of 560

Example 4: Change Terminating Decimal Numbers to Fractions
a) What fraction of a dollar is $0.75?
b) Change 0.652 to a fraction.

Solution

terminating decimal
• a decimal number in which the digits stop
• examples include 0.4, 0.86, 0.125

a) The decimal number 0.75 is a terminating decimal. The last digit is in the hundredths place, so the denominator is 100.

$0.75 = \dfrac{75}{100}$

So, $0.75 is $\dfrac{75}{100}$ of a dollar or $\dfrac{3}{4}$ of a dollar.

$0.75 is 75¢
3 quarters

b) The 2 is in the thousandths place, so the denominator is 1000.

$0.652 = \dfrac{652}{1000}$

Show You Know
Change each terminating decimal number to a fraction.
a) 0.48   b) 0.078

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Example 3 requires students to estimate relatively complex fractions as percents. The intent is for students to use halving techniques and percent benchmarks to determine an over- and underestimate. For example, what percent is 46 out of 140?

50% of 140 is 70   ($50\% = \dfrac{1}{2}$; divide by 2; $140 \div 2 = 70$)

25% of 140 is 35 ($25\% = \dfrac{1}{2}$ of 50%; divide by 2; $70 \div 2 = 35$)

10% of 140 is 14 ($10\% = \dfrac{1}{10}$; divide by 10; $140 \div 10 = 14$)

Now, $25\% + 10\% = 35\%$ of 140, which is $35 + 14 = 49$.

The answer is between 25% and 35% and much closer to 35%, since $35 < 46 < 49$. We could use a 5% benchmark (half of 10%) to show that the answer is between 30% and 35% and slightly closer to 35%.

Example 4 requires students to change terminating decimals to fractions. Some students will need to review the division pattern for dividing by powers of 10.

$\dfrac{27}{1} = 27 \div 1 = 27$ $\dfrac{27}{10} = 27 \div 10 = 2.7$

$\dfrac{27}{100} = 27 \div 100 = 0.27$ $\dfrac{27}{1000} = 27 \div 1000 = 0.027$

If students understand the patterns in division by powers of 10, the task in this example is to reverse the process. You may wish to refer to the place value pattern.

The easiest way to change from terminating decimals to fractions is to read the decimal using its place value equivalence. For example,

- 0.27 is read as 27 hundredths or $\dfrac{27}{100}$

- 0.027 is read as 27 thousandths or $\dfrac{27}{1000}$

- 0.2 is read as 2 tenths or $\dfrac{2}{10}$

Key Ideas

The Key Ideas summarize converting fractions to decimals, using bar notation, and expressing terminating decimal numbers as fractions. Students could prepare their own list of Key Ideas and put it in their chapter Foldable.

Communicate the Ideas

These questions allow students to review their understanding of the concepts presented in the Key Ideas.

Assessment *for* Learning	Supported Learning
Example 4 Have students do the Show You Know related to Example 4 on page 136.	• Encourage students to use place value to determine the denominator of the fraction (e.g., one digit after the decimal place, the denominator is 10; two digits, the denominator is 100; three digits, the denominator is 1000). • You may wish to provide additional questions for students who would benefit from them: Change each terminating decimal number to a fraction. **a)** 0.651 (Three digits after the decimal place. The denominator is 1000.) **b)** 0.92 (Two digits after the decimal place. The denominator is 100.) Coach students through a) and then have them try b) on their own. • Add similar questions to your Mental Math warm-up at the beginning of the next several math classes.

Assessment *as* Learning	Supported Learning
Communicate the Ideas Have all students work in small groups to do #1 and #4, and either #2 or #3. Encourage them to explain their answers orally and listen to each other's explanations.	• Encourage visual learners to use an Internet loading strip for #2 and #3. • Review how to estimate percents with students who have problems with either #2 or #3, and then have them do the alternative question.

Supported Learning

Learning Style and Language

- Encourage students to share their understanding of the Key Ideas during group discussion.

Category	Question Numbers
Essential (minimum questions to cover the outcomes)	1, 2 *or* 3, 4, 5, 7, 8, 10, 12, 14, 17, Math Link
Typical	1, 2 *or* 3, 4, 5, 7, 8, 10, 12, 14, 16–19, Math Link
Extension/Enrichment	1, 2 *or* 3, 4, 20–22

7. A baseball player's batting average is the ratio of number of hits to times at bat. It is usually expressed as a decimal number.

$$\text{Batting average} = \frac{\text{Number of hits}}{\text{Times at bat}}$$

The following data are for one baseball season.

Player	Times at Bat	Hits
A	605	194
B	624	197

a) What is the batting average for each player? Round each answer to the nearest thousandth.

b) Which player had a better batting average for the season? Justify your response.

For help with #8 to #11, refer to Example 2 on page 135.

8. Write each repeating decimal number using bar notation.
   a) 0.5555555...   b) 0.090909...
   c) 0.1877777...   d) 2.0151515...

9. Write each repeating decimal number using bar notation.
   a) 0.4444444...   b) 0.2666666...
   c) 0.1851851...   d) 1.0626262...

10. Change each fraction to a repeating decimal. Then use bar notation to show the repeating part.
    a) $\frac{5}{6}$ b) $\frac{2}{3}$ c) $\frac{45}{99}$ d) $\frac{7}{11}$

11. Change each fraction to a repeating decimal. Then use bar notation to show the repeating part.
    a) $\frac{1}{6}$ b) $\frac{3}{7}$ c) $\frac{25}{99}$ d) $\frac{4}{11}$

For help with #12 and #13, refer to Example 3 on page 136.

12. Estimate each of the following as a percent.
    a) 36 out of 70   b) 125 out of 300

13. Estimate each of the following as a percent.
    a) 275 out of 500   b) 46 out of 90

For help with #14 and #15, refer to Example 4 on page 136.

14. Change each decimal number to a fraction.
    a) 0.95   b) 0.3   c) 0.243   d) 0.08

15. Change each decimal numbers to a fraction.
    a) 0.80   b) 0.2   c) 0.18   d) 0.455

Apply

16.

a) Express the value of each coin as a fraction of a dollar. Write the fractions in ascending order.

b) Express the value of each coin as a decimal number. Write the decimal numbers in ascending order.

c) Write a statement using percent that compares the three coins.

17. For each of the following statements, rewrite each percent or decimal as a fraction.
    a) 0.71 of Earth's surface is covered with water or ice.
    b) Matthew's batting average is .421.
    c) Nitrogen makes up approximately 78% of the air we breathe.

Learning Style and Language

• Allow students to answer the Communicate the Ideas questions orally or in written form, or using a combination of both.

Motor

• The buttons on most calculators are typically too small and close together for some students to use accurately. Students may benefit from using a calculator with oversized keys.

Practise

For #5 and #6, have students use a calculator. Remind students to divide the numerator by the denominator. For #8 to #11, review using bar notation. For #12 and #13, encourage students to use mental math to estimate percents.

Assessment *for* Learning	Supported Learning
Practise Have students do #5, #8, #10, #12, and #14. Students who have no problems with these questions can do #7 before going on to the Apply questions.	• Students who have problems with #5 will need additional coaching with Example 1. Coach students through #6a), and then have them complete the remaining parts of the question on their own. • Students who have problems with #8 and #10 will need additional coaching with Example 2. Coach students through #9a) and #11a), and then have them complete the remaining parts of the questions on their own. • Students who have problems with #12 will need additional coaching with Example 3. Coach students through #13a), and then have them complete b) on their own. • Students who have problems with #14 will need additional coaching with Example 4. Coach students through #15a), and then have them complete the remaining parts of the question on their own. • Check back with students several times to make sure that they understand the concepts.

The boxed textbook page content:

18. There are 81 girls and 59 boys in River City Day Care.
  a) Estimate the percent of the children in the day care that are girls.
  b) Show how you made your estimate.

19. A small town in southern British Columbia has a population of 270. Of these people, 85 are over the age of 60.
  a) Estimate the percent of the town's population that is older than 60.
  b) Show the number of people over 60 as a fraction of the town's population. Express your fraction as a decimal number correct to 3 decimal places.
  c) What is your decimal value from b) expressed as a percent? How does this value compare with your estimate in a)?

20. Rachel and Tim notice a pattern when changing ninths into decimal numbers. Here is what they see on their calculator.

$$\frac{1}{9} = 0.11111111 \qquad \frac{2}{9} = 0.22222222$$

$$\frac{3}{9} = 0.33333333$$

  a) Without dividing, what do you think $\frac{4}{9}$ is as a decimal number? Write your answer using bar notation.
  b) Predict the decimal equivalent for $\frac{8}{9}$. Check your answer using a calculator.

Extend

21. Look at each repeating decimal and its fraction equivalent.

$$0.363636... = \frac{36}{99} = \frac{4}{11}$$

$$0.545454... = \frac{54}{99} = \frac{6}{11}$$

$$0.636363... = \frac{63}{99} = \frac{7}{11}$$

  a) What would the fraction equivalent be for 0.272727...? 0.909090...? 0.818181...?
  b) Write a rule to convert each repeating decimal to a fraction. Hint: Write the repeating decimals using bar notation.
  c) Write four other repeating decimals that would follow the same pattern.

22. a) Use a calculator to find repeating decimal numbers for
$$\frac{1}{7}, \frac{2}{7}, \frac{3}{7}, \frac{4}{7}, \frac{5}{7}, \text{ and } \frac{6}{7}.$$
  b) Add the numbers in the first half of each repeating part to the numbers in the last half. For example,
$$\frac{1}{7} = 0.\overline{142857}, \text{ so add 142 to 857.}$$
  c) What pattern did you find?
  d) What do you think will happen with $\frac{7}{13}$? $\frac{4}{11}$? Do you get the same results?

MATH LINK

Each of the headlines shown contains a fraction, a decimal, or a percent.

Which headlines would be better written using a different representation? Rewrite them with a more appropriate representation. Explain your reasoning.

Headlines
- Baseball Ticket Sales Up 0.06
- Profits Fall 31%
- $\frac{22}{100}$ of Young Teens See Parents as Role Models
- Bicycle Helmets Can Prevent $\frac{4}{5}$ Serious Head Injuries
- Prices Increase by 0.25
- Almost 0.5 Canadians Read a Daily Newspaper

4.2 Fractions, Decimals, and Percents • MHR   139

Assessment *as* Learning	Supported Learning
Math Learning Log Have students answer the following question: • What do you know about changing fractions to decimals and vice versa? Explain.	• Have students check the What I Need to Work On tab of their chapter Foldable. Encourage them to keep track of the items that are giving them difficulty and to check off each item as the problem is resolved. • You may wish to have students review the part related to Section 4.2 in **BLM 4–1 Chapter 4 Self-Assessment**, fill in the appropriate part of the During column, and report what they might do about any items that they have marked either red or yellow.

Supported Learning

Learning Style, ESL, Language, and Motor
• Consider allowing students to use a computer for the Math Link rather than rewriting the headlines by hand.

Learning Style and Memory
• Provide **BLM 4–5 Section 4.2 Extra Practice** to students who need extra practice with the skills in this section.

Apply and Extend

Students who are able to complete #16 to #19 demonstrate a good understanding of problem solving.

For #21 and #22, students need to use pencil and paper and a calculator to explore the rules involved with repeating decimals.

Assessment *for* Learning	Supported Learning
Math Link The Math Link on page 139 is intended to help students work toward the chapter problem wrap-up titled Wrap It Up! on page 149. Use this opportunity to remind students to continue collecting headlines for the Wrap It Up!	• You may wish to have students do this Math Link in order to apply their skills of converting fractions, decimals, and percents. Have students compare their answers with a partner. As they work, observe and have them self-observe for how well they resolve the discrepancies in solutions. • Students who are having difficulty getting started could use **BLM 4–6 Section 4.2 Math Link**, which provides scaffolding for this activity.

MATH LINK

This Math Link asks students to rewrite the headlines provided using a more appropriate representataion. Ensure students explain their reasoning.

4.3 Applications of Percents

Suggested Timing
80–100 minutes

Materials
• loading-strip model
• calculator

Blackline Masters
Master 3 Integer Number Lines
Master 10 Hundred Grids
BLM 4–1 Chapter 4 Self-Assessment
BLM 4–7 Section 4.3 Extra Practice
BLM 4–8 Section 4.3 Math Link

Mathematical Processes

☑ Communication
☑ Connections
☑ Mental Mathematics and Estimation
☑ Problem Solving
☑ Reasoning
☑ Technology
☑ Visualization

4.3 Applications of Percents

Mike's mother is taking him with his friends Tran and Gerry to a go-kart track in Saskatoon for his birthday.

Focus on...
After this lesson, you will be able to...
❑ estimate answers to percent calculations
❑ solve percent problems

Discuss the Math

How can you apply percents to solve problems?

1. The sign shows the cost of go-karting. What is the cost per lap if you purchase the 20-lap package?

   Welcome To Funtrack $1.75/lap or 20 laps for $30.00

2. Tran was not sure if he will like go-karting so he asks for tickets for 5 laps only. The other three each choose the 20-lap tickets. Estimate, and then calculate, the total cost of the tickets before tax.

3. An adult and three children qualify for the 25% family discount.
   a) Calculate the amount of the discount.
   b) What is the total cost of the tickets after the discount?

4. GST is added to the cost of go-karting.
   a) What percent is the GST in Canada?
   b) Use your knowledge of percent to estimate the amount of GST.
   c) Use a calculator to find the exact amount of the GST to be added to the go-karting bill.
   d) What is the total cost of the tickets, including tax?

Literacy Link
GST means Goods and Services Tax. PST means Provincial Sales Tax.

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Specific Outcomes

N3 Solve problems involving percents from 1% to 100%.

Warm-Up

1. Translate this figure 7 units to the left and 3 units down.

2. Estimate and then calculate. Tell whether your estimate is high or low, and why.
   a) $59.52 \div 0.8$
   b) $36.848 \div 4$

3. Show as decimal numbers.
   a) $\frac{5}{8}$ (thousandths)   b) $\frac{1}{2}$ (tenths)

4. Show as decimal numbers.
   a) $\frac{14}{25}$ (hundredths)   b) $\frac{55}{60}$ (hundredths)

5. Write each repeating decimal using bar notation.
   a) $0.444444 \ldots$ b) $0.187777 \ldots$
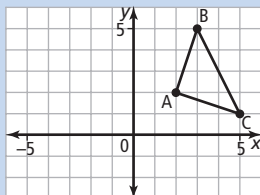
Mental Math

6. Find the percent mentally. Show your thinking.
   a) 85% of 30   b) 70% of 110

7. Estimate the following. Show your thinking.
   a) 2.9×5 b) 45×1.2

8. Estimate the difference. Show your thinking.
   $399.99 - $248.90

9. One dog has a mass of 40 kg. Another is 1.7 times that size. Estimate the mass of the second dog. Show your thinking.

10. Estimate to place the decimal point. Show your thinking. $5.92 \div 0.4 = 148$

5. Each person is required to wear a helmet. Helmet rental is $5.00 plus GST and PST.

    a) What is the cost to rent four helmets before tax?

    b) The PST in Saskatchewan is 5%. How much PST and GST is charged to rent four helmets?

    c) What is the cost to rent four helmets, including tax?

6. What is the total cost for go-karting?

Reflect on Your Findings

7. **a)** What total amount of tax is charged in your area?

    b) Describe how you could estimate the total tax on a purchase in your area. Would your estimate be high or low?

    c) How could you estimate and calculate a discount?

Example: Use Percents to Make Comparisons

Lauren bought and planted two packages of flower seeds to use in her science fair project. Package A contained 44 seeds of which 32 grew into plants. Package B contained 36 seeds of which 27 grew into plants. Which package of seeds was better?

Solution

Method 1: Estimate the Percents

Use mental math techniques to estimate the percent of growth.

Package A:
32 out of 44 seeds grew.
50% of 44 is half of 44.
Half of 44 is 22.
25% is half of 50%.
Half of 22 is 11.
50% + 25% = 75%
   22 + 11 = 33   A little high.

A little less than 75% of the seeds from Package A grew.

Package B:
27 out of 36 seeds grew.
50% of 36 is half of 36.
Half of 36 is 18.
25% is half of 50%.
Half of 18 is 9.
50% + 25% = 75%
   18 + 9 = 27

Exactly 75% of the seeds from Package B grew.

Package B was better than Package A.

Activity Planning Notes

After reading the introduction, consider asking students to begin the Discuss the Math. Alternatively, use the Literacy Link on page 140 to initiate a discussion about GST and PST (if it applies), before students start the investigation.

Discuss the Math

Have students work in small groups to complete the questions, and then have a class discussion.

Ensure that all students know the GST rate. The ability to estimate the GST (and PST, if applicable) is an important skill for students. Do not rush through these concepts. Encourage students to explore more than one way to estimate GST and/or PST. For example, if the GST is 6%, students could find 5% (half of 10% or 10% ÷ 2) plus 1% ($\frac{1}{100}$ of total or total ÷ 100), or they could estimate 5% (underestimate).

Warm-Up

1.
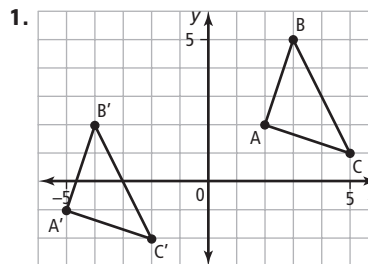
2. **a)** 60 ÷ 1 = 60; underestimate because rounded both numbers up; 74.4

    b) 36 ÷ 4 = 9; underestimate because rounded number was divided into; 9.212

3. **a)** 0.625 **b)** 0.5

4. **a)** 0.56 **b)** 0.92

5. **a)** $0.\overline{4}$ **b)** $0.18\overline{7}$

6. **a)** 10% of 30 = 30 ÷ 10 = 3; 5% of 30 = half of that = 1.5. 85% = 100% − 15%
    15% of 30 = 3 + 1.5 = 4.5
    85% of 30 = 30 − 4.5 = 25.5

    b) 10% of 110 = 110 ÷ 10 = 11. 70% = 7 × 10%
    70% of 110 = 7 × 11 = 77

7. **a)** 3 × 5 = 15 **b)** 45 × 1 = 45

8. $400 − $250 = $150

9. 40 kg × 1 = 40 kg; 40 kg × 2 = 80 kg. The answer is between 40 and 80 kg, and probably closer to 80 kg. Alternatively: 1.7 is close to 1.5 = 40 kg + 20 kg = 60 kg

10. How many halves are in 5? 10; 14.8

Discuss the Math

1. $1.50

2. Estimate: $100; Actual: $98.75

3. **a)** $24.69 **b)** $74.06

4. **a)** 6%
    b) Answers may vary. For example: $3.75
    c) $4.44
    d) $78.50

5. **a)** $20.00
    b) PST = $1, GST = $1.20
    c) $22.20

6. $100.70

7. **a)** Answers will vary by province or territory.
    b) Answers may vary. For example: Calculate 10% of the purchase price, then 5% of the purchase price, and then add the two amounts together.
    c) Answers will vary depending on the discount amount.

Communicate the Ideas

1. a) Answers will vary.

   b) Answers may vary. For example: Find the middle point of the door and label it 50%. Find the middle point of the bottom half of the door and label this point 25%. Find the middle point of the top half of the door and label this point 75%. Label the top of the door 100% and the bottom of the door 0%. Stand beside the door and estimate your height as a percent and a fraction of the height of the door.

   c) Answers may vary. For example: Percent: Divide your height by the height of the door and then multiply the result by 100%. Fraction: Write a fraction with your height in the numerator and the door's height in the denominator.

   d) Answers will vary.

2. a) $\frac{26}{40}$; 0.65; 65%

   b) Percent. Answers may vary. For example: Percents are easier for most people to understand because they allow you to compare a number to 100%.

3. a) Carly: $\frac{23}{25}$; 0.92; 92%; Shannon: $\frac{18}{20}$; 0.9; 90%

   b) Percent. Answers may vary. For example: Percents can be expressed as fractions with denominators equal to 100 and are easy to compare, but fractions may have different denominators, so you have to find common denominators and form equivalent fractions to compare them.

Method 2: Calculate the Percents

Package A:

$\boxed{C}$ 32 ÷ 44 = 0.727272727

$\frac{32}{44} = 0.\overline{72}$

When you round a decimal value, the number becomes approximate.

≈ 0.727 to 3 decimal places

$0.727 = 72.7\%$

Package A had 72.7% growth.

Package B:

$\boxed{C}$ 27 ÷ 36 = 0.75

$\frac{27}{36} = 0.75$

$0.75 = 75\%$

Package B had 75% growth.

Since 75% > 72.7%, Package B was better than Package A.

Key Ideas

- Decimal numbers and percents are often easier to compare than fractions.
- When you round a decimal value, the number becomes approximate. Fractions are exact numbers.

Communicate the Ideas

1. a) Measure the heights of yourself, a friend, and the classroom door.

   b) Explain how to estimate your height as a percent and as a fraction of the door height.

   c) How can you calculate your height as a percent and as a fraction of the door height?

   d) Check your suggestions for b) and c) with the height of your friend. Do they work?

2. Bruce is practising throwing darts. He hits the bulls-eye 26 times out of 40 shots.

   a) Show this result as a fraction, a decimal number, and a percent.

   b) Which type of number do you think is best to explain his results? Justify your response.

3. Carly and Shannon are practising their free-throw shots. Carly makes 23 out of 25 shots. Shannon makes 18 out of 20 shots.

   a) Show each girl's result using a fraction, a decimal number, and a percent.

   b) Which type of number is best to compare their results? Explain why.

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Supported Learning

ESL

- Explain terms such as *go-kart, rent, lap*, and *helmet* to English language learners who may have difficulty with these terms. Have students add any new terms to their dictionary.

- Make sure all students understand GST.

ESL and Language

- English language learners may require support when reading through the Discuss the Math.

Students could also use a multiple-halving strategy: 50% is $\frac{1}{2}$ of 100%, 25% is $\frac{1}{2}$ of 50%, $12\frac{1}{2}$% is $\frac{1}{2}$ of 25%, and 6% is about $\frac{1}{2}$ of $12\frac{1}{2}$% (overestimate).

This section provides an opportunity to reinforce that there are different ways to represent numbers. Depending on the context, it may be advantageous to use percents, decimals, or fractions.

Assessment *as* Learning	Supported Learning
Reflect on Your Findings Listen as students discuss the question. This process allows them to generalize what they learned during Discuss the Math.	• Work with students to develop an estimating strategy for the total tax charged in your area. • If your students have tax-exempt status, you may need to discuss who pays which taxes and when they might use this information. For example, many store employees have to calculate taxes when they make out bills. It is useful to be able to estimate the tax to check reasonableness. • Students may also find it useful to know how to estimate a tip. Many people leave 15% tips for servers. To estimate this, take 10% of a meal charge and then add half of that. So a 15% tip on a $7.50 meal would be $0.75 (10% of $7.50) + $0.38 (half of 10%) or about $1.15. • Discounts are estimated in the same way as taxes. You might wish to discuss an example with students, and then have them find a local sale and calculate the discount. For example, 25% off a $20 shirt would be $\frac{1}{4}$ or $5 off the price.

Practise

4. Estimate which percent is larger. Then calculate each percent.
 a) 50% of 184 or 25% of 208
 b) 10% of 640 or 1% of 325
 c) 35% of 140 or 70% of 60

5. 1% of a number is $5.40.
 a) What is 10% of the number?
 b) What is 25% of the number?
 c) What is 100% of the number?
 d) How is the answer in c) related to the answer in b)?

For help with #6 and #7, refer to the Example on pages 141–142.

6. Melissa's father bought two groups of chicken eggs to hatch for his kindergarten class. First he bought 28 eggs of which 14 hatched. Then he bought 36 eggs of which 20 hatched. Which group of eggs was better?

7. A school librarian placed two orders for new books. There were 68 books in the first order of which 24 were adventure novels. There were 82 books in the second order of which 35 were adventure novels. Which order of books had the greater percent of adventure novels?

Apply

8. Natalie volunteers in the community library. On Tuesday, 378 people visited the library, and 342 people signed out books. On Thursday, 480 people visited the library, and 420 people signed out books. On what day did a greater percent of people sign out books?

9. Desmond wants to list the foods shown in descending order according to the percent of protein content.

Food	Protein (g)	Mass of Food (g)
Roast turkey	18	84
Ground beef	30	142
Almonds	10	45
Tuna	32	150

 a) What is the percent of protein for each food? Give your answers to the nearest tenth of a percent.
 b) Arrange the foods in descending order of their percent of protein content.

10. A vacation package at a travel agency costs $1240. The package is advertised at 20% off. What is the new price of the package? Show your reasoning.

11. A snowboard shop is clearing last year's stock at 35% off.

 a) Estimate the amount of discount for boots that were regularly priced at $199.99.
 b) Calculate the amount of discount.
 c) What is the final sale price before tax?

4.3 Applications of Percents • MHR **143**

Common Errors

- Students may forget which way to move the decimal point when changing from a percent to a decimal.

R_x Remind students that every time they change from a percent to a decimal value, in effect they divide by 100, so the answer gets smaller. For example, 30% is the equivalent of $\frac{30}{100}$ or 0.30. Students will do better by thinking this concept through, rather than by memorizing rules to help with such conversions. Mathematics is much easier for students who generally use number sense rather than memorization.

- Students may not know where to begin when solving a problem.

R_x Reinforce the first step of the problem solving process. You may wish to review Problem Solving starting on page xiv in the student resource. Provide basic strategies to enhance understanding, such as
 – read the entire question
 – identify what is asked
 – identify key information
 – rephrase the problem in simpler terms

- Students may choose a strategy that doesn't work.

R_x Point out that problem solving is a process and that the first strategy chosen doesn't always work. When this happens, encourage students to try another strategy. Refer students to the different strategies in the Problem Solving section starting on page xiv in the student resource.

On pages 141 and 142, the Example shows how to use percents to make comparisons. Method 1 models estimating percents and Method 2 models calculating percents.

Encourage students to realize that it is easier to compare numbers in real-life applications using percents rather than fractions. Have students experiment with estimating, and then calculating percent as shown in Method 1 and Method 2.

Key Ideas

Have students prepare their own list of Key Ideas and put it in their chapter Foldable. It is important that students distinguish between exact and approximate values. For example, $\frac{2}{3}$ is exact, but 0.666 is only an approximate value of $\frac{2}{3}$. However, 0.6 with a bar over the 6 is considered exact. Similarly, $\frac{3}{4}$ and 0.75 are both exact values. Numbers become approximate when they are rounded.

Communicate the Ideas

In #1, students use data from measurements they take to calculate percent and fractions. The hands-on activity helps them make conclusions about which type of numbers is best to compare results. It also allows them to compare the validity of an exact answer with a rounded answer. In #2 and #3, students generate fractions, decimals, and percents from real-world contexts.

Supported Learning

Learning Style

- You may wish to have students use the loading-strip model they made in Section 4.1 as they work through the example.

ESL

- Explain terms such as *bulls-eye, darts,* and *free-throw shots* to English language learners. Have students add any new terms to their dictionary.

Chapter 4 • **MHR** **143**

Assessment *as* Learning	Supported Learning
Communicate the Ideas Rather than asking students to complete all three questions, you may wish to assign #1 and give students a choice of completing either #2 or #3, since they are similar. For #1, have students work in pairs, and then compare their answers for parts b) and c) with other groups.	• Check each student's responses to the questions. These are key questions; make sure that they have the concepts. • Encourage students to use a table to organize their answers for #2 and #3. • Students who have difficulty with #2 or #3 will need additional coaching with the Example. Then, if they have tried only one of the questions, they can do the other one.

Category	Question Numbers
Essential (minimum questions to cover the outcomes)	1, 2 *or* 3, 4–6, 11, 14, 16, Math Link
Typical	1, 2 *or* 3, 4–6, 8–13, 15–17, Math Link
Extension/Enrichment	1, 2 *or* 3, 18–22

12. A transit company wants to raise its fares by 15% beginning April 1st. Current ticket prices are $1.90 for adults and $1.40 for students.
   a) What is the exact value of each increased ticket price?
   b) Transit officials want to have ticket prices ending in 0 or 5. Do you think this is a good idea? Explain.
   c) What are the increased ticket prices rounded to the nearest multiple of 5?

13. Naomi is the manager of a restaurant in Yellowknife. Her annual salary is $40 691.00. After a performance review, her boss awards her a pay raise of 8.5%.
   a) What is the amount of her salary increase?
   b) What is her new annual salary?

14. The chart shows the weekly pay for a number of part-time workers. Each worker gets a pay raise as shown.

Worker	Weekly Pay	Weekly Pay Raise
Meagan	$210.00	$30.00
Carl	$378.95	$45.50
Billi	$410.50	$41.55

   a) Which worker received the largest dollar increase?
   b) What is the percent increase for each worker? Give each answer to the nearest tenth of a percent.
   c) Which worker received the largest percent increase?

15. The chart gives the lengths of some Western Canadian rivers.

River	Length (km)
Churchill	1608
Fraser	1368
MacKenzie	1800
North Saskatchewan	1392
Thelon	904

   a) What is the length of the Fraser River as a percent of the length of the MacKenzie River? Round your answer to the nearest whole percent.
   b) Estimate the length of the Thelon River as a percent of the length of the Churchill River. Express your estimate as a whole percent.

16. The table shows the number of boys and girls in a school who wear glasses.

	Wear Glasses	Total Population
Girls	120	420
Boys	136	450
Total	256	870

   a) Estimate the percent of girls who wear glasses.
   b) What percent of the boys wear glasses? Give your answer to the nearest tenth of a percent.
   c) What percent of all the students who wear glasses are boys? Give your answer to the nearest tenth of a percent.
   d) What is the number of girls who do not wear glasses as a percent of the total school population? Give your answer to the nearest tenth of a percent.

Practise

All students should complete #4 and #5, as these questions are important indicators of student understanding of concepts.

Assessment *for* Learning	Supported Learning
Practise Have students do #4 and #5. Students who have no problems with these questions can do #6.	• Students who have problems with #4 and #5 will need additional coaching with estimating and calculating percents. Coach them through some additional similar questions to reinforce their understanding of percents, estimating percents, and calculating percents. • Students who have no difficulty with #6 can go on to the Apply questions. • Students who have difficulty with #6 should work through the correct answer as a group, review the Example, and then try #7 before going on to the Apply questions. • Check back with students several times to make sure that they understand the concepts.

(Textbook page excerpt, shown on page 145)

17. Alicia is planning a trip to the beach while visiting relatives abroad. She needs to buy each item shown.

$21.87 $5.49 (Sun Screen Lotion) $11.99

a) Estimate her total cost before tax.
b) The country she is visiting charges 5% tax on purchases. Estimate her total cost after tax.

18. A northern airline flies passengers and freight from Winnipeg to Baker Lake with stops in Churchill and Rankin Inlet. One plane can carry up to 50 passengers with no freight. To each location along the flight, the plane carries a different amount of freight.

Amount of Load as Freight

Location	Percent	Decimal	Fraction
Winnipeg	10%		
Churchill		0.50	
Rankin Inlet			$\frac{1}{4}$
Baker Lake		0.75	

a) Copy and complete the table showing the amount of load that is carried as freight to each location along the flight.
b) For each location, what percent of the load is carried as passengers?

Extend

19. 81 is 45% of what number?

20. 30% of a number is 48.
   a) What is 80% of the same number?
   b) What is the number?

21. Emon spends 80% of his income and saves the rest. He saves $11 000 a year. What is his annual income before any deductions?

22. There were 760 girls and 740 boys who wrote a grade 6 achievement test. 65% of the girls and 55% of the boys scored more than 60%. What percent of the population that wrote the test scored 60% or less? Give your answer to the nearest whole percent.

MATH LINK

Collect at least ten headlines or advertisements that use fractions, decimals, or percents from newspapers, magazines, the Internet, or signs.

Copy and complete this table in your notebook. Use it to show the numbers in each headline in three different ways.

Sentence or Phrase	Source	Fraction	Decimal	Percent
Almost 60%, or 700 000 tonnes, of Canada's beef is produced in Alberta.	http://www.mysource	$\frac{60}{100} = \frac{3}{5}$	0.60	60%
Sunglasses 25% off	store window	$\frac{25}{100} = \frac{1}{4}$	0.25	25%

4.3 Applications of Percents • MHR   145

Apply and Extend

The Apply questions provide a variety of contexts in which percents are used. Most students should not need to do all of the questions. You may wish to have students choose four or five questions in addition to #16. For #16, encourage students to think about the denominator of the fraction needed to find each percent.

The Extend questions introduce students to slightly more complex types of percent problems than those in the Apply section.

Assessment *for* Learning	Supported Learning
Math Link The Math Link on page 145 is designed to help students work toward the chapter problem wrap-up titled Wrap It Up! on page 149.	• You may wish to have students do this Math Link in order to apply their skills of converting from fractions to decimals to percents and vice versa. • Remind students to collect newspaper headlines or advertisements showing fractions, decimals, or percents. You may wish to provide folders and encourage students to place collected items in their folder. During the week, pick items at random from various students' folders, have the class convert the number references on the headlines, and discuss the meaning of the numbers. • Students who are having difficulty getting started could use **BLM 4–8 Section 4.3 Math Link**, which provides scaffolding for this activity.

Assessment *as* Learning	Supported Learning
Math Learning Log Have students connect what they know about percents to the real world. Have students write one statement using data from the classroom for each multiple of 10% beginning at 0% and ending at 100%. For example, they might write: "0% of our classmates have white hair," "10% of students have a cat as a pet," …	• In small groups, have students brainstorm suggestions for each percent. Post one idea from each group, and then have students develop their own statements using the models as springboards. • Students might wish to start with the easier numbers. For example, "About 50% of the students in our class are girls." • You may wish to have students review the part related to Section 4.3 in **BLM 4–1 Chapter 4 Self-Assessment**, fill in the appropriate part of the During column, and report what they might do about any items that they have marked either red or yellow.

Supported Learning

Learning Style and Memory
• Provide **BLM 4–7 Section 4.3 Extra Practice** to students who need extra practice with the concepts in this section.

ESL
• Explain terms such as *signed out books, protein content, discount, transit company, fares, performance review,* and *freight* to English language learners. Have students add any new terms to their dictionary.

Motor
• Have students use **BLM 4–8 Section 4.3 Math Link** to assist them with the Math Link activity.

MATH LINK

This Math Link asks students to collect newspaper headlines or advertisements showing fractions, decimals, or percents. Ensure students show the numbers in each headline in three different ways.

Suggested Timing
40–50 minutes

Materials
• loading-strip model
• number lines
• calculator

Blackline Masters
BLM 4–1 Chapter 4 Self-Assessment

BLM 4–3 Section 4.1 Extra Practice

BLM 4–5 Section 4.2 Extra Practice

BLM 4–7 Section 4.3 Extra Practice

BLM 4–9 Chapter Review #10

Supported Learning

Learning Style and Memory
• Students who require more practice on a particular topic may refer to **BLM 4–3 Section 4.1 Extra Practice**, **BLM 4–5 Section 4.2 Extra Practice**, and **BLM 4–7 Section 4.3 Extra Practice**.

Learning Style
• Allow students to complete the chapter review using any combination of oral and written answers.

ESL, Language, and Memory
• Allow students to practise the vocabulary terms using flash cards. Have students quiz each other on the Key Words for the chapter.

Motor
• For #10, provide the blank table on **BLM 4–9 Chapter Review #10**.

Gifted and Enrichment
• Students may already be familiar with the skills handled in this review. To provide enrichment and extra challenge for gifted students, go to **www.mathlinks7.ca** and follow the links.

Activity Planning Notes

Students could work independently or in pairs to complete the Chapter 4 Review. Students should check their answers and then revisit any question with which they had difficulty. Encourage students to refer to the information in their chapter Foldable and then to the specific section in the student resource and/or their notebooks. Once they have found a suitable strategy, they should include it in the appropriate section of their chapter Foldable.

Assessment *for* Learning	Supported Learning
Chapter 4 Review The chapter review provides an opportunity for students to assess themselves by completing selected questions in each section and checking their answers against the answers in the back of the student resource.	• Tell students to check the contents of the What I Need to Work On tab of their chapter Foldable. Have students do at least one question related to any concept, skill, or process that has been giving them trouble. • Have students revisit any section they are having difficulty with prior to working on the Chapter 4 Practice Test.

14. Randy got 86 out of 120 on a test.
   a) Estimate the percent.
   b) How did you make your estimate?
   c) Calculate the actual percent. Give your answer to the nearest tenth of a percent. Show your thinking.

15. Express each decimal number as a fraction.
   a) 0.8
   b) 0.35
   c) 0.167

4.3 Applications of Percents, pages 140–145

16. The town of Tofino, on the west coast of Vancouver Island, hosted a beach concert for young people and their families. The following table provides information on those who attended.

	Younger Than 21	Age 21 and Older	Total
Male	472	398	870
Female	380	345	725
Total	852	743	1595

   a) Estimate the percent of males younger than 21 who attended the concert. Show your thinking.
   b) What percent of females younger than 21 attended the concert?
   c) What percent of all attendees were female?

17. Which quarterback has better passing statistics? Show how you know.
   • Jason Maas completed 302 passes out of 450 attempts.
   • Ricky Ray completed 247 passes out of 375 attempts.

18. Catriona saved 654 shots and let in 26 goals in a hockey season. Becky saved 532 shots and let in 16 goals. Which goalie had a better season? Show how you know.

19. Some Manitoba researchers measured wheat heights to see how the height was affected by fertilizer application. A crop with no fertilizer reached a height of 79.4 cm, and one that received fertilizer reached a height of 102.4 cm. What was the percent increase with the fertilizer application? Give your answer to the nearest hundredth of a percent.

20. Tess bought a DVD for $22 and a sweat shirt for $36. She received a 25% discount.
   a) What is the dollar value of the discount Tess received?
   b) What did the DVD and sweat shirt cost her before tax?

21. In Kimmirut, Nunavut, the sun is up for 20% of the day on December 21. How many hours of the day does the sun shine?

Assessment *as* Learning	Supported Learning
Math Learning Log Once students have completed the chapter review, have them reflect on their progress and complete a journal entry for each statement: – I am comfortable with the following parts of the chapter ... – I am having difficulty with ... – Here's how I worked on some of the areas I originally had difficulty with ... – Here's how I plan to address the areas I am still having difficulty with ...	• Have students refer back to the What I Need to Work On section of their chapter Foldable and answer these questions from the contents of that section. • You may wish to have students refer to **BLM 4–1 Chapter 4 Self-Assessment** when they report on what they are comfortable with, what they continue to have difficulty with, and what they plan to do about it.

Suggested Timing
40–50 minutes

Materials
• loading-strip model
• calculator

Blackline Masters
BLM 4–1 Chapter 4 Self-Assessment

BLM 4–10 Chapter 4 Test

Assessment *as* Learning	Supported Learning
Chapter 4 Self-Assessment Have students review their earlier responses on **BLM 4–1 Chapter 4 Self-Assessment**.	• Have students use their responses on the Chapter 4 Practice Test and work they completed earlier in the chapter to complete the After column of this self-assessment. • Before the Chapter 4 Test, coach them in the areas in which they are having problems.

4 Practice Test

For #1 to #4, choose the best answer.

1. Which number is largest?

A 65% B $\frac{3}{5}$ C $\frac{2}{3}$ D 0.7

2. Which statement is true?

A $6 < 9 < 8.9$

B 1.47 is between 79% and $1\frac{1}{2}$

C $12\frac{1}{2}\% = 12.5$

D $\frac{3}{8}$ can be converted to a repeating decimal

3. Which number is halfway between 9.5 and 9.6?

A 9.49 B $9.\overline{5}$ C 9.55 D 9.7

4. Which of the following has the same value as 80% of 90?

A 90% of 70 B 90% of 80

C 40% of 200 D 60% of 150

Complete the statements in #5 to #7.

5. The decimal equivalent of $\frac{14}{99}$ is ■.

6. 20% of $3500 is ■.

7. A decimal number that could be placed at T on the number line is ■.

Short Answer

8. A hiking club has 75 members. If 24 members are male, what percent of the members are female?

9. Model planes are on special at two for $39.90. Model cars are on special at three for $90.

a) What is the cost of one model plane?

b) What is the cost of one model car?

c) Show the cost of the model plane as a percent of the cost of the model car.

10. a) Arrange the numbers 14.7, 14.71, and 14.709 in ascending order.

b) Arrange the numbers 28%, $\frac{1}{4}$, and 0.3 in descending order.

11. Find 75% of 120 in two different ways.

12. Matthew said his calculator changed $\frac{2}{3}$ into 0.6666667, which is not a repeating decimal. Therefore, it must be a terminating decimal. Is Matthew correct? Explain.

13. a) Calculate 35% of 40, 18% of 80, 60% of 60, and 20% of 200.

b) Arrange your answers in descending order.

14. Write a fraction, a decimal, and a percent for each situation.

a) 18 out of 30 workers eat their lunch at Joe's diner.

b) Barry ate one sixth of the apple pie.

c) Raina sold 45 of the 60 T-shirts she ordered for her store.

d) Kala ate 14 chocolates from a box that had 21 chocolates.

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Study Guide

Question(s)	Section(s)	Refer to	I can …
1, 3, 7, 10	4.1	Example 3	✓ order fractions, decimals, and percents
2	4.1 4.2	Example 3 Examples 1, 2, 4	✓ order fractions, decimals, and percents ✓ convert among fractions, decimals, and percents ✓ distinguish between terminating and repeating decimals
4, 6, 11	4.2	Example 3	✓ estimate percent values
5, 14	4.2	Example 1	✓ convert among fractions, decimals, and percents
8, 9	4.1	Examples 1, 2	✓ estimate and solve problems involving percent
12	4.2	Examples 2, 4	✓ distinguish between terminating and repeating decimals
13	4.1	Examples 1, 2, 3	✓ estimate and solve problems involving percent ✓ order fractions, decimals, and percents
15, 16, 17	4.3	Examples 1, 2	✓ estimate answers to percent calculations ✓ solve percent problems

Activity Planning Notes

This practice test can be assigned as an in-class or take-home assignment. These are the minimum questions that will meet the related curriculum outcomes: #5, #8–#10, #12, #14, and #16.

Answers to the Chapter 4 Practice Test are provided on **BLM 4–13** *MathLinks 7* **Student Resource Answers**.

Assessment *of* Learning	Supported Learning
Chapter 4 Test After students complete the practice test, you may wish to use **BLM 4–10 Chapter 4 Test** as a summative assessment.	• Consider allowing students to use their chapter Foldable. • Consider using the Math Games on page 150 or the Challenge in Real Life on page 151 to assess the knowledge and skills of students who have difficulty with tests.

Wrap It Up!

WRAP IT UP!

Create a poster reporting on how fractions, decimals, and percents are used in the media. Your poster should include
• a catchy heading
• a variety of headlines
• an analysis of how each headline attracts readers

What story do you want your poster to tell?
How can you attract reader attention?
When is it better to use decimals? fractions? percents?

Practice Test • MHR   149

Suggested Timing
40–50 minutes

Blackline Masters
Master 1 Project Rubric

BLM 4–4 Section 4.1 Art Link

BLM 4–6 Section 4.2 Math Link

BLM 4–8 Section 4.3 Math Link

BLM 4–11 Chapter 4 Wrap It Up!
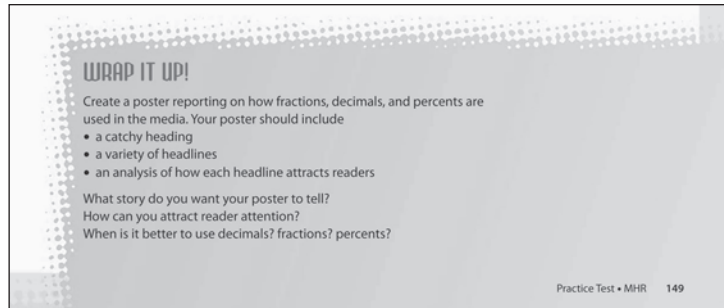
Specific Outcomes

N2 Demonstrate an understanding of the addition, subtraction, multiplication and division of decimals (for more than 1-digit divisors or 2-digit multipliers, the use of technology is expected) to solve problems.

Common Errors

• Students may have too many headlines and/or articles and struggle with which ones to use.

R_x Emphasize the need for variety in the poster. Encourage students to select one or two examples of fractions, decimals, and percents that are most interesting to them or their friends. Alternatively, they could select newspaper headlines that they believe best show the use of fractions, decimals, and percents.

• Some students may spend too much time on the artistic aspects of making their poster.

R_x Discuss the assessment rubric with students before they begin the Wrap It Up! Emphasize the importance of accuracy.

Supported Learning

Motor

• Consider allowing students to use a computer drawing program to create the poster.

Activity Planning Notes

Introduce the problem and clarify the assessment criteria. This chapter problem allows students to consider how decimals, fractions, and percents are used in the media. It is important for students to research actual headlines and use them in their poster. It would be useful for students to have done the Art Link on page 131 because it provides a useful logo for the poster. If students choose not to use the logo on the poster, remind them to include other visuals, since visual communication is such an important feature of posters.

Assessment *of* Learning	Supported Learning

Wrap It Up!
Encourage students to choose a theme or story line for their poster. It is important for students to justify when it is better to use decimals, fractions, and percents in media pieces. **Master 1 Project Rubric** provides a holistic descriptor that will assist you in assessing student work on this Wrap It Up! Page 149a provides notes on how to use the rubric for this activity.
	• If students have not completed the Art Link or the Math Links earlier in the chapter, you may wish to provide them with **BLM 4–4 Section 4.1 Art Link**, **BLM 4–6 Section 4.2 Math Link**, and **BLM 4–8 Section 4.3 Math Link**.
	• This chapter problem can be simplified to meet the needs of the class. For example, you could have students create the poster without providing any analysis.
	• You may wish to have students
	  – explain how each headline attracts reader attention
	  – describe the story that their poster tells
	  – explain how they tried to attract reader attention
	• Consider using the analysis that students provide as a cross-curricular application of their Language Arts courses.
	• Some students may benefit from using **BLM 4–11 Chapter 4 Wrap It Up!**, which provides scaffolding for the chapter problem wrap-up.
	• Observe how well students design, explain, and justify the poster they have made.

The chart below shows **Master 1 Project Rubric** for tasks such as that in the Wrap It Up! and provides notes that specify how to identify the level of specific answers for this project.

Score/Level	Holistic Descriptor	Specific Question Notes
5 **(Standard of Excellence)**	❏ Applies/develops **thorough** strategies and mathematical processes making **significant** comparisons/connections that demonstrate a **comprehensive** understanding of how to develop a complete solution ❏ Procedures are **efficient and effective** and may contain a **minor mathematical error** that does not affect understanding ❏ Uses **significant** mathematical language to explain their understanding and provides **in-depth** support for their conclusion	• provides a complete and correct solution including an analysis of how each headline attracts the reader
4 **(Above Acceptable)**	❏ Applies/develops **thorough** strategies and mathematical processes for making **reasonable** comparisons/connections that demonstrate a **clear** understanding ❏ Procedures are **reasonable** and may contain a **minor mathematical error** that may hinder the understanding in one part of a complete solution ❏ Uses **appropriate** mathematical language to explain their understanding and provides **clear** support for their conclusion	• provides a complete poster with appropriate and eye-catching headlines, with an incomplete or weak analysis *or* • provides a complete solution, with a weak link between a heading and what it represents *or* • provides a complete solution and addresses all parts of the question, but does not link how the contents of the poster are used in the media
3 **(Meets Acceptable)**	❏ Applies/develops **relevant** strategies and mathematical processes making **some** comparisons/connections that demonstrate a **basic** understanding ❏ Procedures are **basic** and may contain a **major error or omission** ❏ Uses **common** language to explain their understanding and provides **minimal** support for their conclusion	• provides a poster with visuals and at least one headline for fractions, decimals, and percents *or* • provides a poster basic in design with no particular part standing out, and with weak or no analysis
2 **(Below Acceptable)**	❏ Applies/develops **some relevant** mathematical processes making **minimal** comparisons/connections that lead to a **partial solution** ❏ Procedures are **basic** and may contain **several major mathematical errors** ❏ Communication is **weak**	• includes visuals in the poster, but the work does not proceed beyond the selection of titles *or* • includes fractions, decimals, and percents in poster headings, but with many errors or omissions present
1 **(Beginning)**	❏ Applies/develops an **initial start** that may be **partially correct** or could have led to a correct solution ❏ Communication is **weak or absent**	• makes an initial start to part of the poster

Math Games

Suggested Timing
40–50 minutes

Blackline Masters
BLM 4–12 Math's a Snap Playing Cards

Assessment *for* Learning	Supported Learning
Math's a Snap Have students play this game with a partner of similar math ability. Note that more than two players can play the game. Again, you may wish to make sure that all players have similar math ability.	• Monitor students to make sure they can convert from fraction to decimal to percent. • Before playing, have students discuss what information they need to know to be successful at this game. • You may wish to have students develop some crib notes showing common equivalents, such as $\frac{1}{4}$, 0.25, and 25%.

Math's a Snap

In the card game called Snap, players take turns flipping cards until the last two cards flipped are a match. They can match in value (e.g., two 8s) or in pictures (e.g., two queens). The first player to say "snap" wins all the cards that have been flipped.

You will now play a different type of Snap using number cards. Instead of a regular deck with 4 sets of 13 cards each, you will use 3 sets of 18 cards. The 3 sets are made up of fractions, decimals, and percents. The aim is to identify matching values when the cards are flipped.

For example, $\frac{4}{5}$, $\frac{8}{10}$, 0.8, and 80% all have the same value.

These are the rules for Math's a Snap:
• Play the game with a partner.
• One player shuffles the cards.
• With the deck face down, each player draws a card.
  The player with the higher-value card is Player 1. The player with the lower-value card is Player 2. If the two cards have the same value, try again.
• Player 1 again shuffles the cards and deals all of them, face down. Each player gets 27 cards.
• Beginning with Player 2, the players take turns flipping the top card from their stack.
• If the last two cards flipped have the same value, the first player to say "Snap!" wins all the flipped cards.
• If a player says "Snap!" when the last two flipped cards do not match, the other player wins all the flipped cards.
• The first player to run out of cards loses the round.
• Play as many rounds as you choose to decide who wins the game.

Materials
• one deck of Math's a Snap cards per pair of students

WWW Web Link
For a suitable set of playing cards to use for this game, go to www.mathlinks7.ca and follow the links.

Specific Outcomes

N3 Solve problems involving percents from 1% to 100%.

@ WWW Web Link
For a site that provides a set of suitable playing cards, go to **www.mathlinks7.ca** and follow the links.

Common Errors

• Some students may be less successful playing this game because they do not easily calculate equivalent expressions.

R_x Have students practise converting a percent to a fraction and a decimal number.

Activity Planning Notes

Note: You may wish to photocopy the cards onto suitable stock and have students cut them out. Cards could be kept for repeated use.

Read through the game with students. You should mention that when students turn a card over, they must do it so that all the players see the card at the same time. Make sure that one player does not see it before another player.

For example, if the top card shows 80% and someone puts a card with 0.8 on top of it, anyone can shout "snap." The first player to shout "snap" wins the whole pile. The person who won the pile of cards then starts again by laying the first card of a new pile in the middle of the table.

If there are no snaps, no one wins, the cards are reshuffled, and the game starts again.

Challenge in Real Life

Suggested Timing
60–75 minutes

Materials
• paint, coloured pencils, and/or markers
• materials to make converter (optional)

Blackline Masters
Master 1 Project Rubric

Mathematical Processes

☑ Communication

☑ Connections

☑ Mental Mathematics and Estimation

☐ Problem Solving

☑ Reasoning

☐ Technology

☐ Visualization

Specific Outcomes

N3 Solve problems involving percents from 1% to 100%.
N4 Demonstrate an understanding of the relationship between positive repeating decimals and positive fractions, and positive terminating decimals and positive fractions.

Activity Planning Notes

You may wish to use the following steps to introduce and complete this challenge:

1. During part of one Math class, read through Fraction Converter for Everyday Life. Have students consider how often people might need to convert between fractions, decimals, and percents in their jobs. Ask students to interview friends, family members, and neighbours about how and when they might use such conversions. For example, sales people might convert from a fraction to a percent to advertise a sale (25% off; $\frac{1}{4}$ off). Chefs who need to adjust recipes or consider nutritional value of various foods often convert fractions and percents, as do dieticians. Layout artists also work with both fractions and percents, often converting back and forth between them. Encourage students to find several examples of careers that use these types of conversions.

Supported Learning

Learning Style and Motor
• You may wish to provide a tape recorder for students to record interviews.

ESL and Language
• Consider allowing students to work in pairs to research careers.

Memory
• Encourage students to build a fraction converter and use it to help them make conversions.

Gifted and Enrichment
• Encourage students to develop a converter for a larger number of fractions, decimals, and percents, and to possibly develop one with moving parts.

2. After providing some time for student research, develop a class table that provides some examples of the information students have researched. You may wish to use an organizer.

3. Have students work in groups to make a group table with the conversions used in the jobs they researched.

4. Brainstorm different ways students might build a converter to help people work with these conversions. Have students design and possibly build such a converter.

5. Clarify that the task is to
- interview people from different careers or research those careers in another way to find out how they involve fractions, decimals, and percents
- organize the related fractions, decimals, and percents in a table or other organizer
- design a fraction converter
- build a fraction converter (optional)

6. Review **Master 1 Project Rubric** with students so that they will know what is expected.

This challenge can be used for either Asessment *for* Learning or Assessment *of* Learning.

Assessment *for* Learning	Supported Learning
Fraction Converter for Everyday Life Discuss the challenge with the class. Discuss the types of converters shown in the student resource, and then have students research how people use fractions, percents, and decimals in their jobs and daily lives. Students can develop a group plan for a converter, but should build individual units. Note that these can be simple. The objective is for students to practise conversions as they develop the converter.	• Review with students how to convert among fractions, decimals, and percents. • With the class or a small group, develop a list of questions to ask friends, family members, and neighbours. • You may wish to develop a sample organizer with some students. • For a second challenge, complete with teaching notes and student exemplars, go to **www.mathlinks7.ca**, access the Teachers' site, go to Assessment, and then follow the links.

Assessment *of* Learning	Supported Learning
Fraction Converter for Everyday Life Discuss the challenge with the class. Discuss the types of converters shown in the student resource, and then have students research how people use fractions, percents, and decimals in their jobs and daily lives. Students can develop a group plan for a converter, but should build individual units. Note that these can be simple. The objective is for students to practise conversions as they develop the converter.	• Use **Master 1 Project Rubric** to assist you in assessing student work. Page 151a provides notes on how to use this rubric for this challenge. • To view student exemplars, go to **www.mathlinks7.ca**, access the Teachers' site, go to Assessment, and then follow the links.

The chart below shows the **Master 1 Project Rubric** for tasks such as that in the Challenge in Real Life and provides notes that specify how to identify the level of specific answers for this project.

Score/Level	Holistic Descriptor	Specific Question Notes
5 (Standard of Excellence)	❑ Applies/develops **thorough** strategies and mathematical processes making **significant** comparisons/connections that demonstrate a **comprehensive** understanding of how to develop a complete solution ❑ Procedures are **efficient and effective** and may contain a **minor mathematical error** that does not affect understanding ❑ Uses **significant** mathematical language to explain their understanding and provides **in-depth** support for their conclusion	• provides a complete and correct solution with a functional and logical converter design
4 (Above Acceptable)	❑ Applies/develops **thorough** strategies and mathematical processes for making **reasonable** comparisons/connections that demonstrate a **clear** understanding ❑ Procedures are **reasonable** and may contain a **minor mathematical error** that may hinder the understanding in one part of a complete solution ❑ Uses **appropriate** mathematical language to explain their understanding and provides **clear** support for their conclusion	• provides a complete solution with a variety of careers, but the solution may contain up to two calculation errors or a few logic errors in the converter design. **Note:** Logic refers to conversions following an increasing or decreasing order so it is easy to use.
3 (Meets Acceptable)	❑ Applies/develops **relevant** strategies and mathematical processes making **some** comparisons/connections that demonstrate a **basic** understanding ❑ Procedures are **basic** and may contain a **major error or omission** ❑ Uses **common** language to explain their understanding and provides **minimal** support for their conclusion	• provides adequate career research and a converter, with some errors in conversions, or conversions are incomplete and limited in number, and may not be logically ordered *or* • provides adequate career research, with no converter. **Note:** Groups may have similar careers and use similar fractions, which limit the complexity of the chart.
2 (Below Acceptable)	❑ Applies/develops **some relevant** mathematical processes making **minimal** comparisons/connections that lead to a **partial solution** ❑ Procedures are **basic** and may contain **several major mathematical errors** ❑ Communication is **weak**	• fails to meet requirements for researching careers and/or conversions have errors and may be incomplete or fail to reflect the research about careers *or* • fails to meet requirements for researching careers and makes no attempt to design a converter
1 (Beginning)	❑ Applies/develops an **initial start** that may be **partially correct** or could have led to a correct solution ❑ Communication is **weak or absent**	• makes an initial attempt to outline some careers, but fails to complete

Chapters 1-4 Review

Suggested Timing
60–75 minutes

Materials
• ruler
• compass
• calculator

Blackline Masters
Master 8 Centimetre Grid Paper

Supported Learning

Learning Style
• Allow students to complete the review using any combination of oral or written answers, including diagrams.
• For #4, allow visual learners to cut out shape A and physically move it to the B, C, and D positions to identify the transformation. Similarly, for #5 and #6, allow them to cut out and move the shapes.
• Instead of #11, you may wish to provide a store flyer and shopping list for concrete learners.

Memory
• Review with students how to use front-end estimation to estimate the addition, subtraction, multiplication, and division of decimal numbers. Reinforce how this is important for checking the reasonableness of answers.
• You may wish to review the meaning of *parallel line, perpendicular line, angle bisector,* and *perpendicular bisector.*


Chapters 1-4 Review

Chapter 1 Coordinates and Design

1. **a)** Plot the following points on a coordinate grid: A(−3, 5), B(−1, 3), C(0, 2), D(1, 3), E(2, 0), F(3, −1).
   b) Which one point seems out of place?
   c) The coordinates of the other five points follow a pattern. Name and plot two new points G and H that follow the pattern.

2. Create square DEFG on a coordinate grid. Start at (2, −2). The square must have a perimeter of 16 units. The points must lie in all four quadrants. Label the vertices. What are the ordered pairs?

3. Nicholas is drawing plans for his garden on a coordinate grid. The coordinates of three vertices of a rectangular flower bed are (5, 2), (−3, 2), and (−3, −3). What are the coordinates of the fourth vertex?

4. **a)** What transformation would move parallelogram A to parallelogram B?
   b) What transformation would move parallelogram A to parallelogram C?
   c) What transformation would move parallelogram A to parallelogram D?
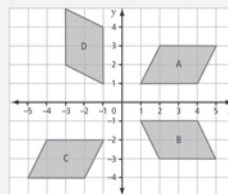
5. Construct △ABC with vertices at A(0, 0), B(4, 0), and C(0, 4). Rotate △ABC 90° clockwise about the centre of rotation at (0, 0). Then, reflect △A′B′C′ in the y-axis.
   a) Draw △A′B′C′. What are the coordinates of the vertices?
   b) Draw △A″B″C″. What are the coordinates of the vertices?
   c) Describe the horizontal and vertical distance between vertex B and B″.

6. A cheerleading squad forms a square with vertices at T(−2, −4), E(−2, −7), A(−5, −7), and M(−5, −4). The cheerleaders rotate the square 90° counterclockwise about the centre of rotation R(−2, −1). Then, they move square T′E′A′M′ 2 units horizontally left and 3 units vertically up to form square T″E″A″M″.
   a) What are the coordinates of vertices T″, E″, A″, and M″?
   b) Describe the horizontal and vertical distances between vertex E and E″.

Chapter 2 Operations on Decimal Numbers

7. Without calculating the answer, place the decimal point in the correct position. Show your thinking.
   a) $0.458 + 0.319 + 0.2 = 9770$
   b) $48.31 − 27.65 = 2066$
   c) $5.9 ÷ 0.314 = 187898$
   d) $24 × 0.083 = 19920$

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Study Guide

Question(s)	Section(s)	Refer to	I can …
1	1.1	Examples 1, 2	✓ identify and plot points on a coordinate grid
2, 3	1.2	Example 2 Example 1	✓ create a design on a coordinate grid ✓ identify the coordinates of the vertices of a 2-D shape
4	1.3	Examples 1–3	✓ use a translation, reflection, and rotation
5, 6	1.4	Example 2	✓ determine the horizontal and vertical distance between two points ✓ describe how the vertices of a 2-D shape change position when they are transformed one or more times
7	2.1 2.2 2.3	Example 1 Example 1 Example 1	✓ use front-end estimation to place the decimal in a sum and a difference ✓ use estimation to place a decimal point in a product ✓ use estimation to place a decimal point in a product
8, 10, 11, 12	2.1 2.2 2.3	Example 2 Examples 2, 3 Examples 2, 3	✓ estimate and solve problems using addition and subtraction of decimal numbers ✓ estimate and multiply decimal numbers with and without a calculator ✓ estimate and divide decimal numbers with and without a calculator
9	2.4	Example 1	✓ use the order of operations with decimal numbers
13	3.1	Examples 1, 2	✓ draw line segments that are parallel to each other ✓ draw line segments that are at right angles to each other

8. Estimate and then calculate.
a) $6.7 + 1.15$ b) $9.6 - 2.8$
c) 2.6×3.7 d) $4.06 \div 0.7$

9. Calculate the value of each expression.
a) $4.2 + 0.6 \div 3 - 0.3 \times 4$
b) $17.5 - (1.5 \times 2) \div 5 + 2.8$

10. During summer vacation, Remi and Kali each earn $10.25 per hour for doing odd jobs. One weekend, they each worked 9.5 h. How much did they earn altogether?

11. On a shopping trip for school supplies you buy a package of coloured pencils, 7 scribblers, a ruler, a calculator, and 12 pencils.

Glue Stick	$1.97
Coloured pencils	$7.46
Calculator	$8.77
Pencils	6@$1.97
Erasers	$1.87
Ruler	$0.94
Scribbler	$1.97
Pencil case	$3.96

a) Estimate the total cost before tax. Is your estimate over or under the total?
b) What is the total cost of all your items?
c) What is the total bill including any PST and GST?
d) You give the cashier two $20 bills. How much change should you receive?

12. Audra and Tom are working in the school kitchen on Soup Day. Their job is to make 8 L of chicken noodle soup in a large pot. They have only small cans (0.284 L) of soup. They will add 1 can of water for each can of soup.
a) How many small cans of soup are needed to make 8 L?
b) How many students could be served if each student received 0.190 L of the soup?
c) Small cans of soup each cost $0.97. The school sells soup at $1.00 a bowl. What is the profit on the 8 L of soup?
d) What assumptions do you need to make to answer part c)?
e) What other costs might be involved in the sale of soup?
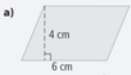
Chapter 3 Geometry and Measurement

13. a) Using only parallel line segments and perpendicular line segments, construct a rectangle with a base of 15 cm and a height of 10 cm.
b) Show how the rectangle can be made into a parallelogram with a base of 15 cm and height of 10 cm.
c) Show how the rectangle can be made into two triangles with a base of 15 cm and a height of 10 cm.

14. Using only perpendicular bisectors and angle bisectors, construct the following:
a) a T that is 10 cm high and 10 cm wide
b) an arrow that is 10 cm high and 6 cm wide

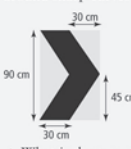| Question(s)	Section(s)	Refer to	I can …
14	3.1 3.2 3.3	Example 3 Example Example	✓ draw line segments that are at right angles to each other ✓ draw a line that divides a line segment in half and is at right angles to it ✓ draw lines that divide angles in half
15, 16	3.4 3.5	Example 1 Example 2	✓ calculate the area of a parallelogram ✓ calculate the area of a triangle
17	4.1	Example 3	✓ order fractions, decimals, and percents
18, 19	4.2	Example 2 Example 4	✓ distinguish between terminating and repeating decimals ✓ relate fractions to terminating decimals ✓ relate fractions to repeating decimals
20, 21, 22	4.1 4.2 4.3	Examples 1, 3 Example 1 Example	✓ order fractions, decimals, and percents ✓ convert among fractions, decimals, and percents ✓ solve percent problems

Math Learning Log

Once students have completed the Chapters 1–4 Review, have students reflect on their progress and complete a journal entry for each statement:

– I continue to have difficulty with ...

– Here's how I plan to address what I am having difficulty with ...

• Encourage students to clear up any problems they have had during the past four chapters. Work with them to provide the necessary coaching.

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15. What is the area of each shape?

a)

4 cm
6 cm

b)

3 cm
8 cm

16. The road sign shown is a chevron (arrowhead). This warning sign is posted in groups to guide drivers around sharp curves in the road.

30 cm
90 cm
45 cm
30 cm

a) What is the area of the black chevron?

b) What is the total area of the yellow triangles?

Chapter 4 Fractions, Decimals, and Percents

17. Draw a number line. Place each of the following numbers on your number line.

$62\frac{1}{2}\%$ 0.6 $\frac{2}{3}$

18. Show each fraction as a repeating decimal.

a) $\frac{4}{9}$ **b)** $\frac{3}{11}$ **c)** $\frac{2}{7}$
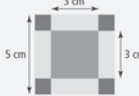
19. Show each terminating decimal as a fraction.

a) 0.35   **b)** 0.2   **c)** 0.025

20. Three brands of recordable CD-ROMs are checked for defects.

Brand	Number Tested	Number Passed
Electro-Zip	20	15
Ultraback	10	7
A-Retrieve	30	23

a) What fraction of each brand passed the test? What percent of each brand passed?

b) Which brand of CD-ROM seems most reliable? Justify your answer.

21. Jeremy sold 220 out of 250 newspapers. Maria sold 85% of her 260 newspapers.

a) Who sold the most newspapers? How many did that person sell?

b) Who sold the greatest percent of newspapers? What was the percent?

22. At a fairground game, you can throw a dart at the square target to win a prize.

3 cm
5 cm   3 cm

a) Which do you think is easiest to hit: red, yellow, or blue? Explain your choice.

b) Every dart that lands in one of the coloured regions is a winner. What fraction of the total area is each colour? What percent of the total area is each colour?

c) Rank the colours in order from greatest to least area. Which colour should get the best prize, and why?

Assessment *for* Learning	Supported Learning
Chapters 1–4 Review This cumulative review provides an opportunity for students to assess themselves by completing selected questions in each section and checking their answers against the answers in the back of the student resource.	• Have students review the tests from each chapter and any challenges related to those chapters, identify the items that they had problems with, and do the questions related to those items. Have students do at least one question that tests skills from each chapter. • Have students revisit any chapter section they are having difficulty with.

Activity Planning Notes

Students might work independently to complete the questions, and then in pairs to compare solutions. Alternatively, you may wish to assign the Chapters 1–4 Review for reinforcing skills and concepts they have learned so far. If students encounter difficulties, they could discuss strategies with other students. Encourage them to refer to the information in the student resource and/or their notebooks. Once they have found a suitable strategy, students should include it in the appropriate section of their chapter Foldable.

These are the minimum questions that will meet the curriculum requirements: #1, #2, #4, #5, #7–#11, #13–#15, and #17–#21.

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?
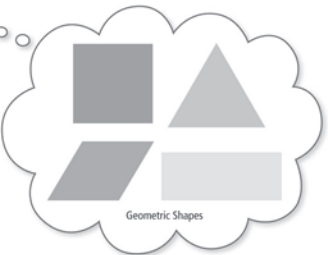b) Estimate and then calculate the total cost of your banner including the logo.

Materials
• grid paper
• ruler
Optional
• coloured pencils

Geometric Shapes

Task • MHR **155**

Suggested Timing
60–75 minutes

Materials
• ruler
• coloured pencils (optional)
• calculator (optional)

Blackline Masters
Master 1 Project Rubric

Master 8 Centimetre Grid Paper (optional)

Mathematical Processes
- ✓ Communication
- ✓ Connections
- ✓ Mental Mathematics and Estimation
- ✓ Problem Solving
- ✓ Reasoning
- ✓ Technology
- ✓ Visualization

Specific Outcomes

N2 Demonstrate an understanding of the addition, subtraction, multiplication, and division of decimals to solve problems.
N3 Solve problems involving percents between 1% and 100%.
SS2 Develop and apply a formula for determining the area of:
• triangles
• parallelograms
• circles.

Activity Planning Notes

Introduce the task in a large group. Students might discuss their logos with a partner, and then complete their designs and reports individually. You may wish to use #3 as a small-group activity to be completed after the individual logos are finished.

You may wish to use the following steps to introduce and complete this task:
1. Discuss the problem and the possible shapes.
2. Clarify that the task is to:
• develop a logo using the required geometric shapes
• calculate the cost of sewing a logo for a school crest

Learning Style and Motor

• Concrete and kinesthetic learners may want to develop templates for the various shapes and move them around to help them develop different logo designs. Students may find it useful to make their logo on **Master 8 Centimetre Grid Paper**.

Gifted and Enrichment

• Challenge students to design a banner that includes a specified percent of colour or costs more or less than a specified dollar amount.

• design a banner, including the logo
• estimate and calculate the total cost of banner, including the logo

3. Review **Master 1 Project Rubric** with students so that they will know what is expected.

Some students may have trouble getting started. Others may feel that they have finished after having completed only #1. Help students by using prompts such as the following ones:

• Look at the shapes in your logo. Do they meet the criteria of the student council?
• What parts of the logo do you need to sew in order to make it into a crest? What strategies can you use to find the lengths of these parts?
• How large is your banner? How much colour did you add? How can you calculate the area?
• How much will it cost to make your banner? How can you find out?

Assessment *of* Learning	Supported Learning
Create a Logo Discuss the Task as a class. Have students discuss their logo designs with a partner, and then develop individual designs and reports.	• Use **Master 1 Project Rubric** to assist you in assessing student work. Page 155a provides notes on how to use this rubric for this Task. • To view student exemplars, go to **www.mathlinks7.ca**, access the Teachers' site, go to Assessment, and then follow the links. • For a second task, complete with teaching notes and student exemplars, go to **www.mathlinks7.ca**, access the Teachers' site, go to Assessment, and then follow the links.

The chart below shows the **Master 1 Project Rubric** for tasks such as this one and provides notes that specify how to identify the level of specific answers for this project.

Score/Level	Holistic Descriptor	Specific Question Notes
5 (Standard of Excellence)	❏ Applies/develops **thorough** strategies and mathematical processes making **significant** comparisons/connections that demonstrate a **comprehensive** understanding of how to develop a complete solution ❏ Procedures are **efficient and effective** and may contain a **minor mathematical error** that does not affect understanding ❏ Uses **significant** mathematical language to explain their understanding and provides **in-depth** support for their conclusion	• provides a response that addresses all parts of the question, but there may be one missing shape
4 (Above Acceptable)	❏ Applies/develops **thorough** strategies and mathematical processes for making **reasonable** comparisons/connections that demonstrate a **clear** understanding ❏ Procedures are **reasonable** and may contain a **minor mathematical error** that may hinder the understanding in one part of a complete solution ❏ Uses **appropriate** mathematical language to explain their understanding and provides **clear** support for their conclusion	• provides a correct and complete response, with weak or no explanation or justification *or* • provides a correct and complete response, with a calculation error *or* • provides a correct and complete response, but consistently uses incorrect units or omits units *or* • provides a correct response, but omits the total cost
3 (Meets Acceptable)	❏ Applies/develops **relevant** strategies and mathematical processes making **some** comparisons/connections that demonstrate a **basic** understanding ❏ Procedures are **basic** and may contain a **major error or omission** ❏ Uses **common** language to explain their understanding and provides **minimal** support for their conclusion	• correctly completes #1 and #2 *or* • correctly completes #1 and #2 and draws the banner *or* • completes #3 based on incorrect #1 and #2 *or* • correctly calculates perimeter, area, and costs, with no explanations or conclusions
2 (Below Acceptable)	❏ Applies/develops **some relevant** mathematical processes making **minimal** comparisons/connections that lead to a **partial solution** ❏ Procedures are **basic** and may contain **several major mathematical errors** ❏ Communication is **weak**	• draws logo and calculates perimeter *or* • draws banner and calculates area
1 (Beginning)	❏ Applies/develops an **initial start** that may be **partially correct** or could have led to a correct solution ❏ Communication is **weak or absent**	• makes a correct initial step