Enlargements and Reductions

4.1

***MathLinks 9*, pages 130–138**

Suggested Timing
80–100 minutes

Materials
- tracing paper
- ruler
- grid paper
- computer with Internet access (optional)

Blackline Masters
Master 2 Communication Peer Evaluation
Master 8 Centimetre Grid Paper
Master 9 0.5 Centimetre Grid Paper
Master 10 2 Centimetre Grid Paper
BLM 4–3 Chapter 4 Warm-Up
BLM 4–5 Section 4.1 Extra Practice
BLM 4–6 Section 4.1 Math Link

Mathematical Processes
- ☑ Communication (C)
- ☑ Connections (CN)
- ☐ Mental Math and Estimation (ME)
- ☑ Problem Solving (PS)
- ☑ Reasoning (R)
- ☑ Technology (T)
- ☑ Visualization (V)

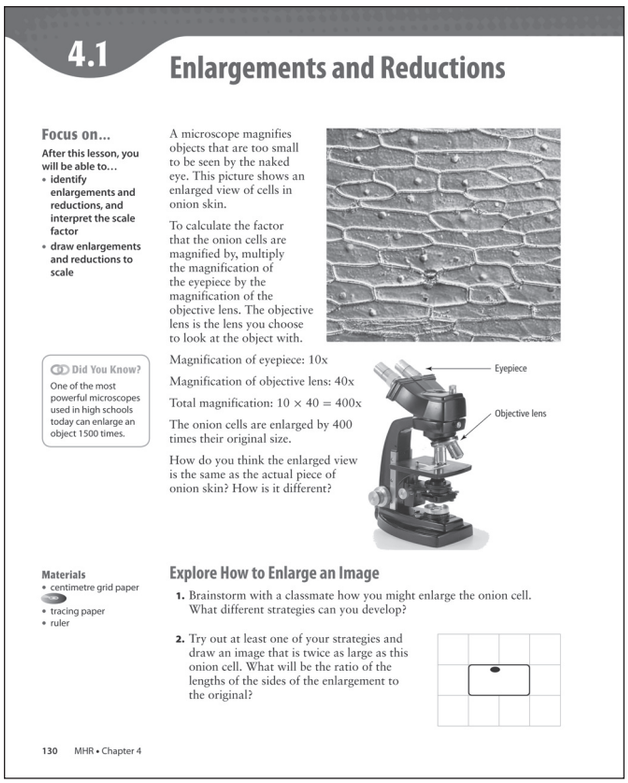
Specific Outcomes
SS4 Draw and interpret scale diagrams of 2-D shapes.

Category	Question Numbers
Essential (minimum questions to cover the outcomes)	#1, 2, 4a) *or* b), 6a) *or* b), 7, 9, Math Link
Typical	#1, 2, 4a) *or* b), 6a) *or* b), 7, 9, 11, 13, Math Link
Extension/Enrichment	#1, 2, 13, 15, 16 or 14 and 17, Math Link

Planning Notes

Have students complete the warm-up questions on **BLM 4–3 Chapter 4 Warm-Up** to reinforce material learned in previous sections.

In this section, students identify and draw enlargements and reductions to scale and interpret the scale factor.



4.1 Enlargements and Reductions

Focus on…
After this lesson, you will be able to…
- identify enlargements and reductions, and interpret the scale factor
- draw enlargements and reductions to scale

A microscope magnifies objects that are too small to be seen by the naked eye. This picture shows an enlarged view of cells in onion skin.

To calculate the factor that the onion cells are magnified by, multiply the magnification of the eyepiece by the magnification of the objective lens. The objective lens is the lens you choose to look at the object with.

Did You Know?
One of the most powerful microscopes used in high schools today can enlarge an object 1500 times.

Magnification of eyepiece: 10x
Magnification of objective lens: 40x
Total magnification: 10 × 40 = 400x
The onion cells are enlarged by 400 times their original size.
How do you think the enlarged view is the same as the actual piece of onion skin? How is it different?

Eyepiece
Objective lens

Materials
- centimetre grid paper
- tracing paper
- ruler

Explore How to Enlarge an Image
1. Brainstorm with a classmate how you might enlarge the onion cell. What different strategies can you develop?
2. Try out at least one of your strategies and draw an image that is twice as large as this onion cell. What will be the ratio of the lengths of the sides of the enlargement to the original?

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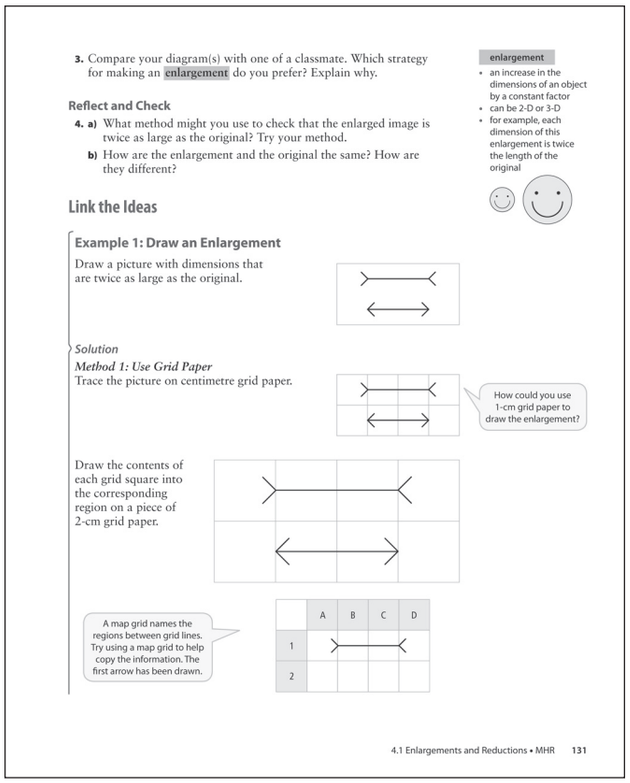
As a class, discuss the opening questions about using a microscope. Use students' ideas to gauge what students recall about magnification from earlier science courses. Direct them to the information about how to calculate total magnification. Discuss the Did You Know? about the magnification power of microscopes in the science lab. Depending on what your students recall, you may need to discuss terms so they are able to complete the Explore. Consider collaborating with a science teacher to demonstrate using a microscope to help make the connections for students.

Explore How to Enlarge an Image

In the Explore, students investigate ways to make an enlargement. Before they begin, direct students to the margin definition for *enlargement* on page 131 in the student resource, and clarify that *constant factor* refers to multiplying each dimension by the same amount. Explain that each dimension of the enlarged smiley face is twice the length of the corresponding length of the original. Invite students to verify this using a ruler to measure the diameter and/or the radius.



3. Compare your diagram(s) with one of a classmate. Which strategy for making an enlargement do you prefer? Explain why.

enlargement
- an increase in the dimensions of an object by a constant factor
- can be 2-D or 3-D
- for example, each dimension of this enlargement is twice the length of the original

Reflect and Check

4. a) What method might you use to check that the enlarged image is twice as large as the original? Try your method.
   b) How are the enlargement and the original the same? How are they different?

Link the Ideas

Example 1: Draw an Enlargement

Draw a picture with dimensions that are twice as large as the original.

Solution

Method 1: Use Grid Paper

Trace the picture on centimetre grid paper.

How could you use 1-cm grid paper to draw the enlargement?

Draw the contents of each grid square into the corresponding region on a piece of 2-cm grid paper.

A map grid names the regions between grid lines. Try using a map grid to help copy the information. The first arrow has been drawn.

	A	B	C	D
1				
2				

4.1 Enlargements and Reductions • MHR 131

Method 1 Have students work with a partner to discuss #1. Encourage students to try any strategies that they can think of to make the enlargement. Have students work individually to complete #2. Make tracing paper and **Master 8 Centimetre Grid Paper** available. Circulate as students work and ask them to verify if their enlargement meets the ratio requirements. Prompt them to recall that a ratio of 2 : 1 means that each dimension of the enlargement is two times the length of the original.

For #3, have students compare their diagram(s) with their partner's, and then discuss their strategies and the advantages and disadvantages of each strategy with another pair of students before presenting their findings to the class. Have students work with their partner to discuss #4 before writing an individual response. As they work, circulate and prompt students to use math vocabulary when explaining their method.

Method 2 As a class, have students brainstorm strategies and then work in small groups to try out at least one of the strategies. Have groups present their strategies to the class and discuss their advantages and disadvantages.

Meeting Student Needs

- It may benefit concrete and kinesthetic learners to use a microscope and view an onion slide. You might use the eyepiece and the objective lens to point out the magnification on each, and then calculate the total magnification.
- For the images of the smiley face in the margin definition for enlargement, you might explain that although each 1-D measurement on the enlarged image is twice as large, the area is four times as large. You might invite students to find out if this is true.
- For the Explore, you might use a cell with more visible organelles for students who are interested. A paramecium and a planarian have simple shapes with easily reproducible details.
- Consider working through the Explore as a whole class.

ELL

- Some students may find it useful to remember that the term *enlargement* contains the word *large*. This may help them to remember that an enlargement is larger than the original.
- Some students may not be familiar with terms such as *magnifies*, *naked eye*, *enlarged*, *onion skin*, *magnification*, *eyepiece*, *objective lens*, *onion cell,* and *twice as large*. Explain each term in context and have students add any new terms to their personal dictionary.

Gifted and Enrichment

- Challenge students to find out how binoculars work and how the images seen relate to what they are learning about enlargements.

Answers

Explore How to Enlarge an Image

1. Examples:
- Multiply the length and width of the cell by the same number.
- Use an overhead projector to enlarge the image.

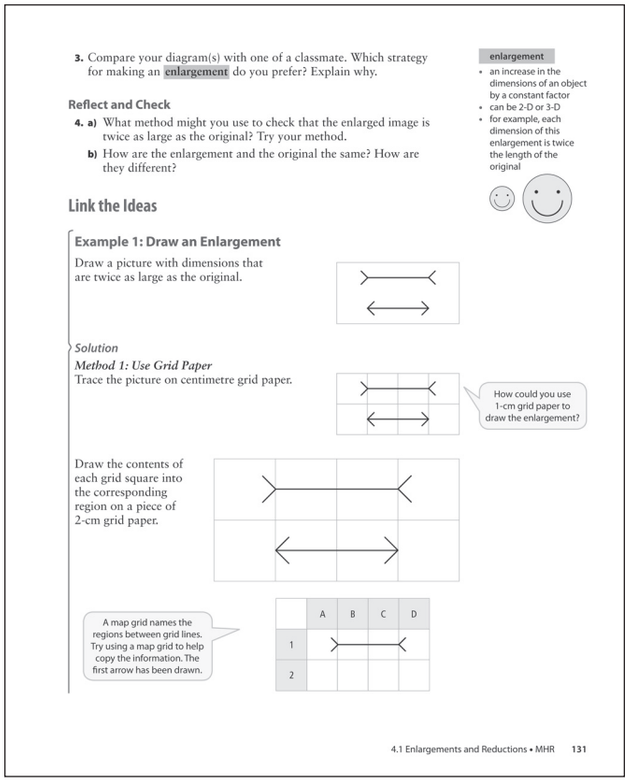
4. a) Example: Measure the length and the width of the image and divide each measurement by 2. The answers should correspond to the length and the width of the original.

b) Example:

Similarity:
- The enlargement and the original have the same proportions for length and width.

Difference:
- The measurements of the lengths and widths are different.

Assessment	Supporting Learning
Assessment *as* Learning	
Reflect and Check Listen as students discuss what they discovered during the Explore.	• Some students may benefit from the class discussion as a springboard to develop their own response. • For #4a), record the methods on the board. Encourage students to include a summary of the methods in their Foldable. Consider having students verbalize their method to a classmate before recording it. • For #4b), remind students to refer to the original and enlarged images of onion cells to make the comparison.



3. Compare your diagram(s) with one of a classmate. Which strategy for making an enlargement do you prefer? Explain why.

enlargement
- an increase in the dimensions of an object by a constant factor
- can be 2-D or 3-D
- for example, each dimension of this enlargement is twice the length of the original

Reflect and Check

4. a) What method might you use to check that the enlarged image is twice as large as the original? Try your method.
   b) How are the enlargement and the original the same? How are they different?

Link the Ideas

Example 1: Draw an Enlargement

Draw a picture with dimensions that are twice as large as the original.

Solution

Method 1: Use Grid Paper

Trace the picture on centimetre grid paper.

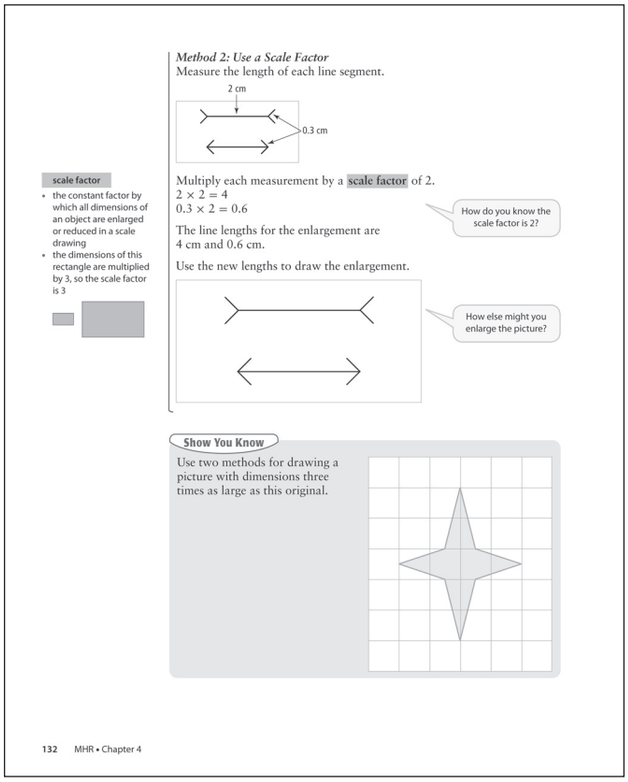
How could you use 1-cm grid paper to draw the enlargement?

Draw the contents of each grid square into the corresponding region on a piece of 2-cm grid paper.

A map grid names the regions between grid lines. Try using a map grid to help copy the information. The first arrow has been drawn.

	A	B	C	D
1				
2				

4.1 Enlargements and Reductions • MHR 131



Method 2: Use a Scale Factor

Measure the length of each line segment.

2 cm

0.3 cm

scale factor
- the constant factor by which all dimensions of an object are enlarged or reduced in a scale drawing
- the dimensions of this rectangle are multiplied by 3, so the scale factor is 3

Multiply each measurement by a scale factor of 2.

$2 \times 2 = 4$

$0.3 \times 2 = 0.6$

How do you know the scale factor is 2?

The line lengths for the enlargement are 4 cm and 0.6 cm.

Use the new lengths to draw the enlargement.

How else might you enlarge the picture?

Show You Know

Use two methods for drawing a picture with dimensions three times as large as this original.

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Link the Ideas

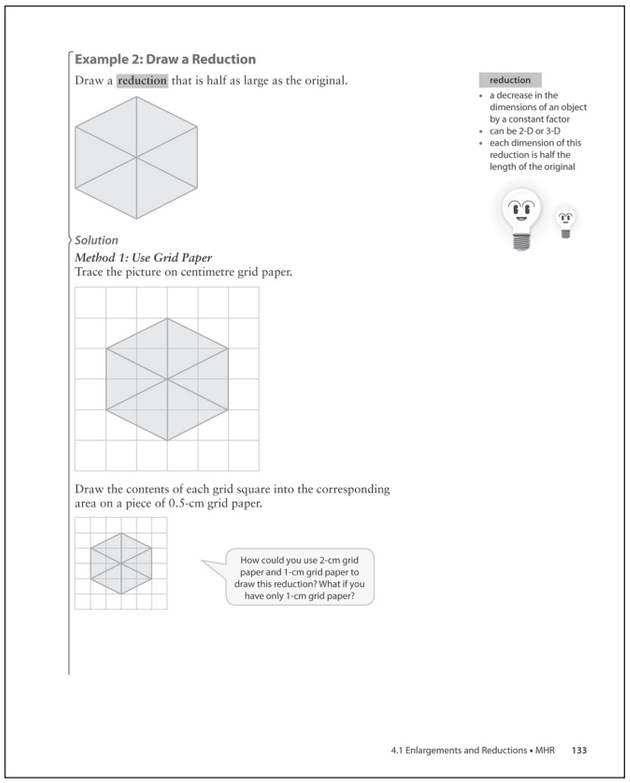
Example 1

Example 1 illustrates two methods for drawing an enlargement, namely, using grid paper and using a scale factor. Students may have discussed both of these methods during the Explore. If so, guide students to use these two methods and draw the picture shown in the student resource. If using a scale factor was not a strategy discussed during the Explore, walk through the method as a class.

Before students use grid paper to enlarge the picture, you may wish to use a simple shape such as a rectangle superimposed on centimetre grid paper and demonstrate how to copy the contents of each grid square onto the corresponding square of 2-cm grid paper.

Make **Master 8 Centimetre Grid Paper** and **Master 10 2 Centimetre Grid Paper** available to students. As they work, circulate and check that students are drawing the contents of squares correctly.

You might introduce Method 2 by asking students how they would draw an enlargement if grid paper was not available (measure line segments). Have students measure to check the length of the line segments. Discuss the definition for *scale factor* and then ask them to draw the rectangle that contains both arrows, twice as large. Ask them to identify the scale factor of the enlarged rectangle (2). Then, guide them to use the measurements of the original and enlarged rectangles to determine the position of the arrows and the measurement of the arrows in the enlarged rectangle.



Example 2: Draw a Reduction

Draw a reduction that is half as large as the original.

reduction
- a decrease in the dimensions of an object by a constant factor
- can be 2-D or 3-D
- each dimension of this reduction is half the length of the original

Solution

Method 1: Use Grid Paper

Trace the picture on centimetre grid paper.

Draw the contents of each grid square into the corresponding area on a piece of 0.5-cm grid paper.

How could you use 2-cm grid paper and 1-cm grid paper to draw this reduction? What if you have only 1-cm grid paper?

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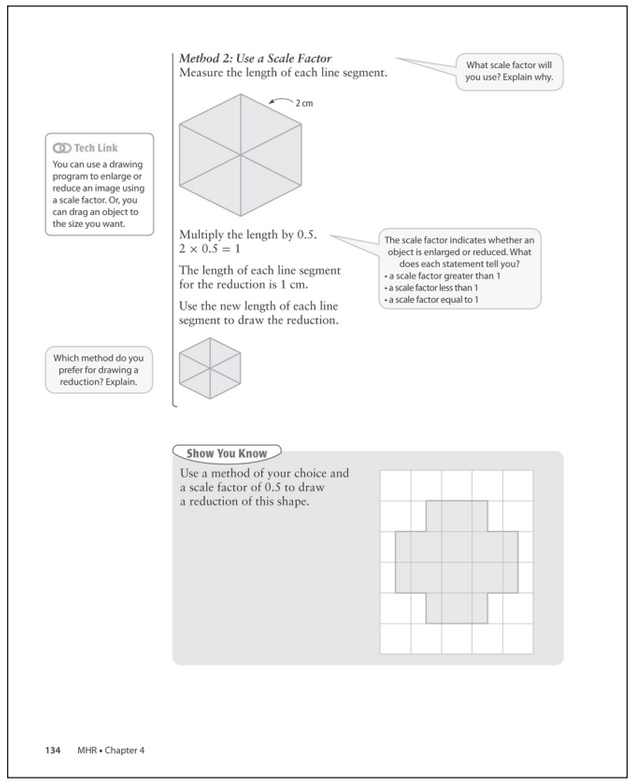

Method 2: Use a Scale Factor

Measure the length of each line segment.

What scale factor will you use? Explain why.

2 cm

Tech Link

You can use a drawing program to enlarge or reduce an image using a scale factor. Or, you can drag an object to the size you want.

Multiply the length by 0.5.

$2 \times 0.5 = 1$

The length of each line segment for the reduction is 1 cm.

Use the new length of each line segment to draw the reduction.

The scale factor indicates whether an object is enlarged or reduced. What does each statement tell you?
- a scale factor greater than 1
- a scale factor less than 1
- a scale factor equal to 1

Which method do you prefer for drawing a reduction? Explain.

Show You Know

Use a method of your choice and a scale factor of 0.5 to draw a reduction of this shape.

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Have students work individually on the Show You Know, and then exchange their enlargement with that of a classmate. Have them verify whether the image is an accurate enlargement by checking whether each dimension is three times larger.

Have students work individually on the Show You Know, and then exchange their reduction with a classmate's. Have them check whether the image is an accurate reduction by checking that each dimension is half as large.

Example 2

Example 2 illustrates two methods for drawing a reduction, namely, using grid paper and using a scale factor. Before beginning, discuss the definition for *reduction* and ask students for applications of reductions that they are familiar with.

Similar to the process for Example 1, guide students to work through the example. Make **Master 8 Centimetre Grid Paper** and **Master 9 0.5 Centimetre Grid Paper** available.

For Method 2, mention that multiplying by 0.5 or $\frac{1}{2}$ is the same as multiplying by 2.

Discuss the thought bubble that describes using the scale factor to determine if an object is a reduction or an enlargement.

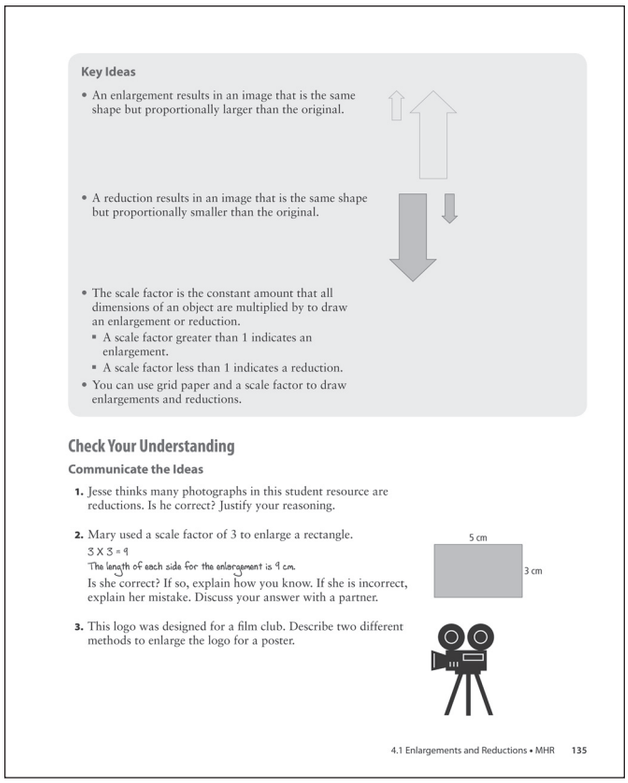
As a class, have students discuss the method they prefer for making reductions and explain why.

Key Ideas

The Key Ideas define enlargements and reductions and how to draw them, as well as scale factors and how to interpret them. Have students use their Foldable to make their own summary of the key ideas about enlargements and reductions, and provide their own example of using grid paper and a scale factor to enlarge and reduce an image to scale.

Meeting Student Needs

- Consider working through Examples 1 and 2 as a whole class and having students work in pairs to complete the Show You Knows.
- For Method 1 in both examples, some students may find it helpful to use a copy of the picture already superimposed on grid paper, so they do not have to trace it.



Key Ideas

- An enlargement results in an image that is the same shape but proportionally larger than the original.
- A reduction results in an image that is the same shape but proportionally smaller than the original.
- The scale factor is the constant amount that all dimensions of an object are multiplied by to draw an enlargement or reduction.
  - A scale factor greater than 1 indicates an enlargement.
  - A scale factor less than 1 indicates a reduction.
- You can use grid paper and a scale factor to draw enlargements and reductions.

Check Your Understanding

Communicate the Ideas

1. Jesse thinks many photographs in this student resource are reductions. Is he correct? Justify your reasoning.
2. Mary used a scale factor of 3 to enlarge a rectangle.
   3 X 3 = 9
   The length of each side for the enlargement is 9 cm.
   Is she correct? If so, explain how you know. If she is incorrect, explain her mistake. Discuss your answer with a partner.

3. This logo was designed for a film club. Describe two different methods to enlarge the logo for a poster.

4.1 Enlargements and Reductions • MHR 135

- Some students may benefit from using a map grid by numbering each square on the grid of the original and each corresponding square on the grid of the image. Point out the example of the map grid on page 131 in the student resource. You might have students note how a map grid is different from a coordinate grid. (A coordinate grid names the intersections of grid lines.)
- For Example 1, instead of using 1-cm and 2-cm grid paper, consider having students use 1-cm grid paper for the entire activity, For example, if a line segment on the original is 2 cm in length, draw a line segment 4 cm in length on the image.
- For Example 2, consider having students trace the original on 2-cm grid paper, and then draw the contents on 1-cm grid paper.
- Some students may benefit from completing an additional Show You Know related to each example. For Example 1, have students draw an enlargement of a hexagon on a 1-cm grid using a scale factor of 4. For Example 2, have students draw a reduction of a hexagon on a 2-cm grid using a scale factor of 0.25.

ELL

- Teach the following words in context: *grid lines, constant, half as large*, and *line segment*.

Common Errors

- Some students may not enlarge or reduce all dimensions of the original picture when drawing the image.

R_x Clarify that each dimension must be enlarged or reduced using the same scale factor.

Answers

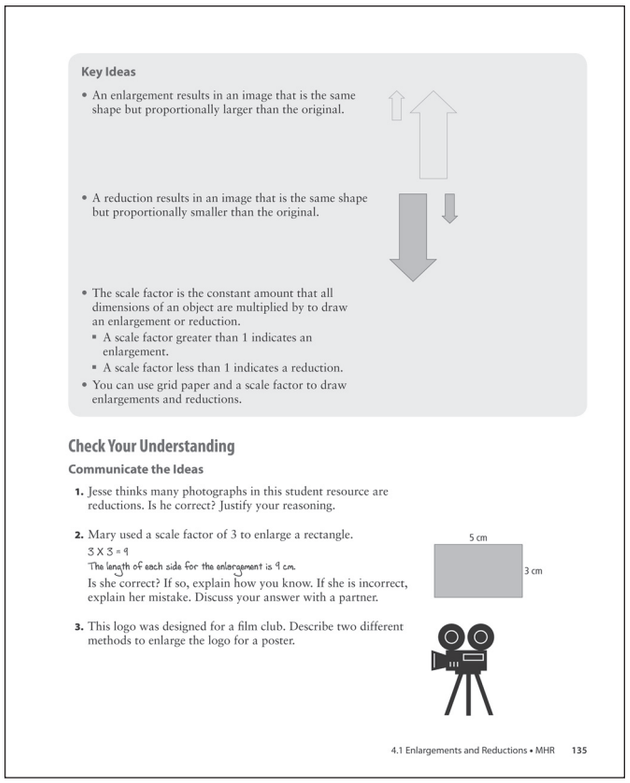
Example 1: Show You Know

Look for a drawing for each of two methods. Example:
- Multiplying each measurement by a scale factor of 3, and using the new lengths to draw the enlargement.
- Using 1-cm grid paper and drawing the contents of each square in 3 squares.

Example 2: Show You Know

Look for a drawing using a method that students choose. Example: Drawing the contents of each square on 0.5-cm grid paper

Assessment	Supporting Learning
Assessment *for* Learning	
Example 1 Have students do the Show You Know related to Example 1.	• Encourage students to verbalize their thinking. • You may wish to have students work with a partner. • Some students may benefit from using a ruler. • Encourage students to start with the method they are most comfortable with. Have them compare methods with a partner. • List the methods on the board.
Example 2 Have students do the Show You Know related to Example 2.	• Encourage students to verbalize their thinking. • You may wish to have students work with a partner. • Some students may benefit from using a ruler. • Encourage students to start with the method they are most comfortable with. Have them compare methods with a partner. • List the methods on the board. • Have students discuss and make notes about what a scale factor of 1, less than 1, or greater than 1 means.



Key Ideas

- An enlargement results in an image that is the same shape but proportionally larger than the original.
- A reduction results in an image that is the same shape but proportionally smaller than the original.
- The scale factor is the constant amount that all dimensions of an object are multiplied by to draw an enlargement or reduction.
  - A scale factor greater than 1 indicates an enlargement.
  - A scale factor less than 1 indicates a reduction.
- You can use grid paper and a scale factor to draw enlargements and reductions.

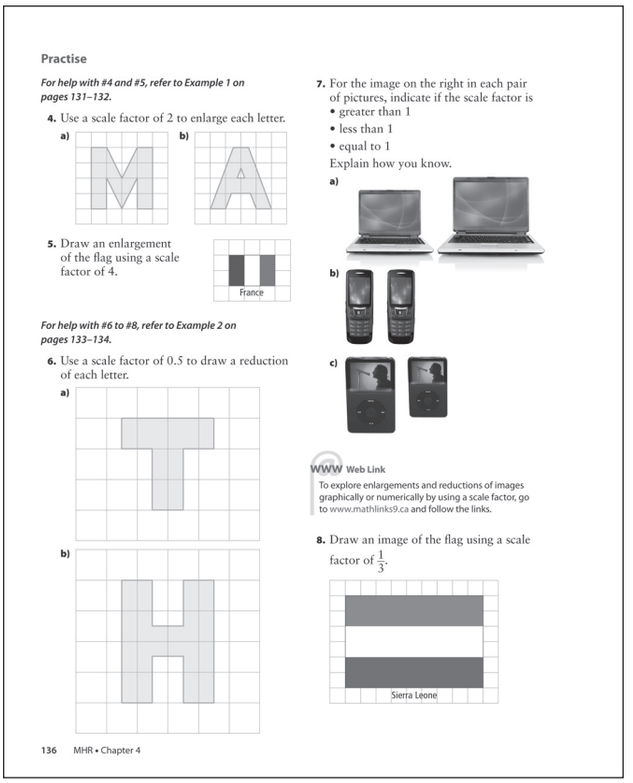
Check Your Understanding

Communicate the Ideas

1. Jesse thinks many photographs in this student resource are reductions. Is he correct? Justify your reasoning.
2. Mary used a scale factor of 3 to enlarge a rectangle.
   3 X 3 = 9
   The length of each side for the enlargement is 9 cm.
   Is she correct? If so, explain how you know. If she is incorrect, explain her mistake. Discuss your answer with a partner.

3. This logo was designed for a film club. Describe two different methods to enlarge the logo for a poster.

4.1 Enlargements and Reductions • MHR 135



Practise

For help with #4 and #5, refer to Example 1 on pages 131–132.

4. Use a scale factor of 2 to enlarge each letter.

a) b)

5. Draw an enlargement of the flag using a scale factor of 4.

For help with #6 to #8, refer to Example 2 on pages 133–134.

6. Use a scale factor of 0.5 to draw a reduction of each letter.

a) b)

7. For the image on the right in each pair of pictures, indicate if the scale factor is
   - greater than 1
   - less than 1
   - equal to 1

   Explain how you know.

a) b) c)

WWW Web Link

To explore enlargements and reductions of images graphically or numerically by using a scale factor, go to www.mathlinks9.ca and follow the links.

8. Draw an image of the flag using a scale factor of $\frac{1}{3}$.

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Check Your Understanding

Communicate the Ideas

These questions provide an opportunity for students to explain their understanding of enlargements, reductions, and interpreting the scale factor. Have students provide an individual response to all questions.

Have students work individually to answer #1 and 2, and then discuss their reasoning with a partner or small group.

For #1, students explain their understanding of reductions. Encourage students to use math vocabulary.

For #2, students identify an error in using a scale factor to make an enlargement. Encourage students to draw the enlargement to check the answer.

For #3, students describe two methods for making an enlargement. Encourage students to use diagrams in their response. They may find it easier to trace the logo on grid paper. Some students may benefit from describing both methods to a partner before writing their response.

Practise

Note that #4 and 5 and #6 and 8 are sets of similar questions. Consider giving students a choice to do one question from each set initially to demonstrate their understanding.

Make **Master 8 Centimetre Grid Paper**, **Master 9 0.5 Centimetre Grid Paper**, and **Master 10 2 Centimetre Grid Paper** available to students.

Encourage students to use the method of their choice to draw enlargements or reductions.

For #7, have students explain their reasoning to a classmate.

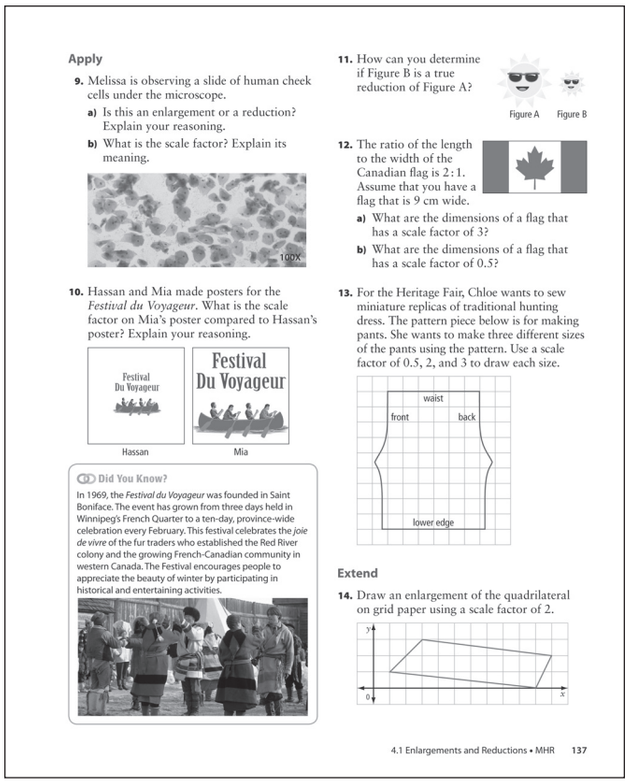
Apply

These questions allow students to apply their understanding of enlargements, reductions, and scale factors in a variety of contexts.

Use #9 and 11 to assess understanding of enlargements and reductions, and scale factors.

For #10, direct students to the Did You Know? that describes the Festival du Voyageur. You might explain that *joie de vivre* means joy of living.

For #13, make grid paper available to students.



Apply

9. Melissa is observing a slide of human cheek cells under the microscope.

a) Is this an enlargement or a reduction? Explain your reasoning.

b) What is the scale factor? Explain its meaning.

100X

10. Hassan and Mia made posters for the *Festival du Voyageur*. What is the scale factor on Mia's poster compared to Hassan's poster? Explain your reasoning.

Festival Du Voyageur

Hassan

Festival Du Voyageur

Mia

Did You Know?

In 1969, the *Festival du Voyageur* was founded in Saint Boniface. The event has grown from three days held in Winnipeg's French Quarter to a ten-day, province-wide celebration every February. This festival celebrates the *joie de vivre* of the fur traders who established the Red River colony and the growing French-Canadian community in western Canada. The Festival encourages people to appreciate the beauty of winter by participating in historical and entertaining activities.

11. How can you determine if Figure B is a true reduction of Figure A?

Figure A Figure B

12. The ratio of the length to the width of the Canadian flag is 2 : 1. Assume that you have a flag that is 9 cm wide.

a) What are the dimensions of a flag that has a scale factor of 3?

b) What are the dimensions of a flag that has a scale factor of 0.5?

13. For the Heritage Fair, Chloe wants to sew miniature replicas of traditional hunting dress. The pattern piece below is for making pants. She wants to make three different sizes of the pants using the pattern. Use a scale factor of 0.5, 2, and 3 to draw each size.

waist

front

back

lower edge

Extend

14. Draw an enlargement of the quadrilateral on grid paper using a scale factor of 2.

y

0

x

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15. Keita made a new bag for her laptop. Her cousin would like the pattern so she can make one. Draw a pattern using the actual measurements. You do not have to include the flap or the strap. Then, reduce the pattern so it will fit on a piece of notebook paper.

30 cm

42 cm

10 cm

16. Create a scale diagram of your classroom.

a) Measure the dimensions of the classroom and items that can be seen in a top view, including desks, tables, cupboards, and shelves.

b) Choose a scale factor and draw the scale diagram on grid paper.

c) What changes would you make to the layout of your classroom? Where would you place desks or tables? Draw a scale diagram of your new classroom layout.

17. Draw an image so that each line segment is

a) 40% of the original length

b) 2.5 times the original length

Math Link

Use what you have learned to design a project that requires a scale diagram. You may wish to choose one of the following projects:

- Design at least four different hopscotch patterns for a local recreational area.
- Design or enlarge a pattern for an outfit to wear at your school's fashion show. Assume that you have the instructions and the skills needed to construct the outfit.
- Design a modification of a car's blueprints for a project in your automotive course.
- Design a miniature version of a landmark in your province for display in a tourism project.
- Design a web page featuring a topic and related visuals of your choice. For example, you might feature contemporary drum designs.

a) What design project will you choose?

b) Research your project using the library or the Internet. Obtain or develop an initial design or drawing.

c) Using grid paper, draw an enlargement or a reduction of your design to scale.

Haida hand drum design

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Extend

The questions in this section allow students to make connections to real-life applications.

Make grid paper available to students.

For #15, students will need more than one sheet of 8.5 × 11 paper. Consider giving students an option to use a pattern in a craft magazine. Have them enlarge or reduce the pattern given to actual dimensions.

Since #14, 16, and 17 are similar questions, you might allow students to choose one of these questions; alternatively, you might assign one.

For #16, you might limit the number of items students need to include in the scale diagram.

For #17, students need to use percent to reduce the original lengths of line segments.

Literacy Link Direct students to the leg on their spider map entitled Enlargements and Reductions and have them complete definitions for *enlargement*, *scale factor*, and *reduction*, using words, diagrams, and mathematical expressions. Encourage them to include an example for each term.

Math Link

The Math Link allows students to apply their understanding of drawing enlargements and reductions to scale. It is important for all students to complete each Math Link throughout the chapter in order to complete the Wrap It Up! at the end of the chapter.

In this Math Link, students choose a project that requires a scale diagram, research their project using the library or the Internet, and use grid paper to draw a scale diagram. Although a list of design projects is provided, encourage students to choose a topic of personal interest, such as decorating a wall using mosaic patterns, and then get your approval before proceeding. Emphasize to students that they will build on their project design throughout the chapter.

Provide students with access to the library and/or the Internet to help them select a design project, and make grid paper available for them to draw their design to scale.

Meeting Student Needs

- For #12, encourage students to draw the flag on grid paper.
- Provide **BLM 4–5 Section 4.1 Extra Practice** to students who would benefit from more practice.

ELL

- For #1 to 3, allow English language learners to discuss their ideas in their first language, and then develop their response in English. This offers them the opportunity to activate their knowledge using familiar language. Afterwards, it may be easier for them to ask for the missing vocabulary to express their thinking in English.
- For #7, explain that *indicate* means state.
- For #11, clarify that a *true reduction* means that Figure B is an accurate reduction of Figure A. In other words, each dimension of Figure B has been reduced by the same scale factor.
- For #13 and 15, explain that a pattern is a paper template of each part of an item, such as a laptop bag. The pattern pieces are traced onto fabric before cutting out and assembling the item.
- Ensure students understand the following terms: *human cheek cells*, *French Quarter*, *fur traders*, *Red River colony*, *Heritage Fair*, *hunting dress*, *hopscotch*, *recreational area*, *outfit*, *fashion show*, *automotive course*, *landmark tourism*, and *contemporary drum designs*. Have students add any new terms to their dictionary.

Gifted and Enrichment

- Challenge students to draw a reduction of a structure they are familiar with. For example, they might research the actual dimensions of a tipi and then use a scale factor to draw a scale diagram.
- Invite students to explore enlargements and reductions using a scale factor by accessing the Web Link described in the student resource on page 136.

Answers

Communicate the Ideas

1. Example: Yes, the photos are reduced from the original in order to fit on the page, but they retain the same proportions as the original.
2. Example: No, she is correct only for the enlargement of the side length that measures 3 cm. The enlargement for the 5-cm side length should be 15 cm.
3. Examples:
   - Use grid paper. Superimpose the logo on 0.5-cm grid paper. Then, draw the contents of each grid square into the corresponding region on larger-size grid paper. The area of the grid paper should match the space for the logo on the poster.
   - Use a scale factor. Measure the length and width of the logo. Measure the length and the width of the space for the logo on the poster. Determine the scale factor needed for the enlargement. Then, use the scale factor to enlarge each dimension of the logo.

Assessment	Supporting Learning
Assessment *as* Learning	
Communicate the Ideas Have all students complete #1 and 2.	• Encourage students to verbalize their thinking. • You may wish to have students work with a partner. • Students may benefit from drawing the rectangle in #2, and then enlarging it using a scale factor of 3 to check their answer. • You may wish to have students use **Master 2 Communication Peer Evaluation** to assess each other's responses to #1 and 2.
Assessment *for* Learning	
Practise and Apply Have students do #4a) *or* b), 6a) *or* b), 7, and 9. Students who have no problems with these questions can go on to the remaining Apply questions.	• Students who need assistance with #4 may benefit from additional coaching with Example 1. Have them use a ruler and work through #4a) together. Then, have them try #4b) on their own to check for understanding. • Students who need assistance with #6 may benefit from additional coaching with Example 2. Coach students through #6a). Then, have them try #6b) on their own. • For #7, provide coaching to students who need it. You might use an overhead and apply a scale factor of 1, less than 1, and greater than 1 to an image. For each image, have students identify whether it is an enlargement, reduction, or neither, and then make a connection to the scale factor used to create the image. • For #9, have students verbalize the meaning of *scale factor*. You might ask students to calculate the magnification for different objective lenses in a microscope. Prompt students to observe that as the magnification increases (scale factor increases), the image is enlarged.
Math Link The Math Link on page 138 is intended to help students work toward the chapter problem wrap-up titled Wrap It Up! on page 163.	• It is recommended that all students complete the Math Link. • Some students may benefit from being directed to web sites or library resources to gather ideas for their design project. • Some students may benefit from being provided with a start to the design of their choice. • Encourage students to make revised sketches of their design if they make revisions to the initial design. • Students who need help getting started could use **BLM 4–6 Section 4.1 Math Link**, which provides scaffolding.
Assessment *as* Learning	
Literacy Link By the end of section 4.1, have students complete definitions for *enlargement, scale factor,* and *reduction.*	• Some students may benefit from using their Foldable to record definitions for terms as they are introduced. Then, at the end of the section or the chapter, have them summarize the definitions in their own words and organize them on the spider map. • For the examples students include on their spider map, encourage them to use scale factors that are natural numbers to describe enlargements and reductions. This may help them to understand, for example, that a scale factor of 2 means the image is twice as large as the original. • Some students may find it helpful if you show them an actual enlargement and a reduction, and then have them describe each orally before writing a definition. Clarify any misunderstandings.
Math Learning Log Have students respond to the following questions: • How can you determine the scale factor used in an enlargement or a reduction? • How can you use the scale factor to draw an enlargement? • How can you use grid paper to draw a reduction?	• Encourage students to refer to their notes in their Foldable or spider map. • Encourage students to reference an example of an enlargement or reduction to help explain how to determine the scale factor. • Encourage students to use diagrams to help with their explanations. • Depending on students' learning styles, have them provide oral or written answers. • Encourage students to use the What I Need to Work On section of their Foldable to note what they continue to have difficulties with.