Units of Area and Volume

2.1

***Mathematics 10,* pages 56–65**

Suggested Timing

100–120 min

Materials

- rulers or tape measures in imperial units

Blackline Masters

BLM 2–3 Chapter 2 Warm-Up
BLM 2–5 Chapter 2 Unit 1 Project
BLM 2–6 Section 2.1 Extra Practice

Mathematical Processes

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

Specific Outcome

M1 Solve problems that involve linear measurement, using:

- SI and imperial units of measure
- estimation strategies
- mental math strategies

Category	Question Numbers
Essential (minimum questions to cover the outcomes)	#1a), b), 2a), b), 4a), 5, 6, 8, 14–16
Typical	#1a), b), 2a), b), 3, 4a), 5–8, 11, 12, 14–16
Extension/Enrichment	#6, 8, 11–16

Planning Notes

Have students complete the warm-up questions on **BLM 2–3 Chapter 2 Warm-Up** to reinforce prerequisite skills needed for this section.

The day before the start of this section, you may wish to ask students to bring different methods of storing music to the next class. If possible, collect some older media from the library or your own personal collection. Try to have records of different sizes, as well as different types of music tapes. Encourage students to bring the most modern storage devices they have.

Start the class with a display and discussion of different music storage devices.

- What ones do students own?
- What ones have students used?
- Which ones pre-date student memories?

Encourage students to discuss their experiences with the different types of music storage devices. If you have students with music collections, encourage them to share their enthusiasm for the media of their choice.

Alternatively, start the class by accessing the material in the Web Link on page 57 and having students watch the video on how a vinyl record is made. This video could initiate a discussion on LP records. Ask students the following questions:

- Have you ever seen a vinyl record?
- Do your parents have any vinyl records stored away?
- Do you think that anyone still listens to vinyl records?
- What other early forms of music storage do you know about?

Lead from these discussions into the Investigate.

Investigate Units of Area

Unit Project

During this investigation, which is part of the unit project, students determine

- the lateral surface area of a cylindrical disk used to store music
- the circular area of both sides of an LP
- the jacket area of a record of their choice

In this Investigate, students use their knowledge of area to explore technologies for storing recorded music. Advancements in technology have resulted in several improvements in music storage methods. For example, early wax cylinders could hold two minutes of recorded sounds; modern MP3s and cell phones have a capacity to store thousands of songs.

Have students work with a partner or in small groups, possibly with three students in each group. Initially, students will determine the area of the wax cylinders used in the 1800s and the area of the more modern LP record. In the student resource, the wax cylinder dimensions are given in imperial units; LP record dimensions are provided in both imperial and SI units. You may wish to have students convert the wax cylinder dimensions to SI units and then answer #1 and 2 in both imperial and SI units. This will allow students to compare the amount of music storage on the wax cylinder and the LP record.

The wax cylinder pictured with #1 is one of the earliest recording devices. From studying the photo, have students visualize what this cylinder might have looked like. Ask the following questions:

- What dimensions do these wax cylinders have?
- What familiar item has a similar size?

Suggest that students make a net for the cylinder and then put together a scale model. This will give them a better idea of the size. Alternatively, they could draw a labelled sketch. Ask the following questions:

- On what part of this cylinder was the music recorded?
- What information do you need to determine the area of this part of the cylinder?
- How can you use that information to determine the area of this part of the cylinder?

Once students have determined the outside surface area of the cylinder, have them compare this area to the number of minutes of recorded music the cylinder holds.

For #2 students determine the circular area of both sides of an LP. Ask the following questions:

- How can you describe the recorded area using familiar shapes?
- What dimensions do you need to determine this area?
- How can your prior knowledge of areas help you determine the recorded area?

Students then determine the ratio of the circular area to the number of minutes of music. There are several things to consider and discuss when working on this part of the question. You may wish to discuss these things ahead of time or let students make assumptions and later discuss what assumptions groups made when answering #2b). Consider the following discussion points:

- Do both sides of the LP hold the same amount of music?
- Is the entire surface area of the record used to store music?
  - The visuals with #3 indicate that the centre of a record is not used to store music. There is a hole for placing the record on the record player and place for a label. Labels have a diameter of approximately 10 cm.
  - Students who are familiar with LP records may point out that the outside area of each record has no grooves for storing music, nor does the inside area closest to the label. Will they consider this area as part of the recording area or not? If not, what approximate diameter will they assess for this part of the record?
  - In their calculations, how will they deal with any parts of the record surface that do not hold recorded music?)

For #3, have students refer to the diagram of the different records and their diameters. Discuss the meaning of rpm, which refers to the number of revolutions per minute. There are different ways to organize answering this part of the Investigate.

- You may wish to have each group choose one size and do the related calculations. If you do this, have students provide the answers in both imperial and SI units. Ask students what the relationship is between the linear measurement they have used in SI and imperial systems.
- If you have groups of three, you may wish to have students in each group divide out the record sizes so that the group handles each size. Ask how the size of the record affects the jacket design.

Have students complete the Reflect and Respond questions within their groups and then have the groups report to the whole class. You may wish to provide some or all of the following information during class discussion.

- Some music enthusiasts prefer the sound from a vinyl record to that of a digital recording.
- There may also be some genres of music that are better suited to the visual allure of a vinyl record.
- Record companies are concerned with the amount of downloaded music taken from the internet. LP records are one way of curbing this revenue loss.
- LP record jackets have a larger surface area than the outside of a CD jewel case. This allows more room for advertising such as artwork or graphics and information about the music group.
- One advantage of the wax cylinder was that the owner could have it wiped clean and a new recording placed on it. When the sound of the recording diminished, they simply made a new recording.

Technology has played a huge part in the change of storage devices. The drive to have music storage technology as small as possible has made this a big business. In the brainstorming for #4b), encourage students to include discussions of the latest music devices, the size of each device, how difficult or easy each is to use, and the number of songs that can be stored.

Meeting Student Needs

- Help students recall how to determine the area of a cylinder.
- Help students recall the formula for the area of a circle.

ELL

- Have actual sample CDs and records available. Use samples of each record to clarify the meaning of LP, 78, and 45. Explain that the designations LP ($33\frac{1}{3}$), 78, and 45 refer to a record's rotational speed in revolutions per minute (rpm).

Enrichment

- Challenge students to compare the density of storage among the 45, 78, and LP. In particular, you can invite them to consider how the speed of rotation of each type of vinyl record might affect the amount of storage.
- Have interested students research the type of storage and playback devices currently being developed and report to the class. They may wish to report on the minutes of recording per surface area and compare their findings to the ratios for the wax cylinder and LP record.
- Machines have been developed by Dr. Ian Foulds of the University of Victoria that are smaller than the diameter of a human hair and have the potential of being inserted into the human body via a needle. Ask students to research the ways in which very small objects can be measured accurately and have them report on the units used to work with such objects.

Common Errors

- Students may confuse linear measurement units with area units.

R_x Emphasize that area is always measured in square units, such as square millimetres, square centimetres, square metres, and square kilometres that can cover a surface. Some students may need to see this visually. Provide them with centimetre grid paper. Have them draw a rectangle four centimetres by eight centimetres. Ask them to count the number of squares in the rectangle. When they count 32, model what they just did:

Area of rectangle = (4 cm)(8 cm)
= 32 cm^2

Discuss how the 32 cm^2 refers to the number of squares within the rectangle. This is math terminology for the amount of space the rectangle covers, or area. Have students use a think aloud to explain this idea using a rectangle with different dimensions.

- Students may struggle with conversions within and between SI and imperial systems of measurement.

R_x Encourage students to make a chart showing common linear and area conversions within SI and imperial systems. For example,

12 in. = 1 ft so 1 ft^2
= (12 in.)(12 in.)
= 144 $in.^2$

Include square inches to square feet to square yards and vice versa. Suggest that they use visuals to help make each conversion clear.

Answers

Investigate Units of Area

1. a) SA = 28.27 $in.^2$ or 182.4 cm^2

b) 0.071 min of music/$in.^2$ or 0.011 min of music/cm^2

2. a) Example: The imperial diameter of the LP was picked up from the visual with #3 in the student resource. All area answers are rounded to hundredths. The circular area of an LP would be 1413.72 cm^2 or 226.19 $in.^2$. The diameter of a label would be approximately 10 cm or 3.94 in. The circular area of the label is 157.08 cm^2 or 24.38 $in.^2$. Therefore, the recording area of an LP would be 1256.64 cm^2 or 201.81 $in.^2$.

b) 0.036 min of music/cm^2 or 0.223 min of music/$in.^2$

3. a) Example: Assuming a square with side lengths the same size as the record's diameter

Speed (RPM)	Diameter (in.)	Jacket Area ($in.^2$)	Jacket Area (cm^2)
33-1/3	12	144	929.0
78	10	100	645.2
45	7	49	316.2

b) Look for a design that reflects the artist(s) and songs, including visuals, graphics, and text.

Answers

4. a) Example:

Type	Advantages	Disadvantages
Wax Cylinder	• re-recordable	• poor sound reproduction • sensitive to ambient temperature changes • loss of song detail over time • difficult to store
Vinyl Records	• excellent sound reproduction • tolerant to ambient temperature changes • easy to store	• scratch easily • can warp in extreme heat • over time, develop random popping noises • non re-recordable

c) Look for the name of modern advances and information such as the recording time, the number of songs, and the size of the storage device.

Assessment	Supporting Learning
Assessment *for* Learning	
Unit 1 Project Have students complete the Investigate.	• Consider having students work in pairs. • Listen as students discuss how to solve the problems. As you circulate, clarify any misunderstandings. • Help students recall what they learned in earlier courses about calculating area and making conversions between linear SI and imperial units. Provide coaching to students who need it. • You may wish to provide students with **BLM 2–5 Chapter 2 Unit 1 Project**, and have them finalize their answers. • Remind students to store all project-related materials in a portfolio for that purpose.
Assessment *as* Learning	
Reflect and Respond Listen as students discuss the advantages and disadvantages of vinyl records and wax cylinders, and brainstorm advances in music storage. Encourage them to consider the size of modern storage devices compared to the amount of music they hold.	• Some students may benefit from making a model of a wax cylinder and seeing an actual LP record to help them assess the advantages and disadvantages of each. Also have them consider the characteristics of the material. What happens, for example, when wax gets warm? • Some students may benefit from comparing the size of modern storage devices to the number of minutes of recorded music they hold.

Link the Ideas

You might have students recall what they know about linear conversions between SI and imperial units of measure. How can this knowledge help them with area and volume calculations? Have students discuss their thoughts in pairs.

Ask each pair to join up with a second pair to make a group of four. Have the pairs share what they discussed in their original groups. After time for discussion, ask the following questions:

- What did you learn by sharing your ideas with another pair?
- How did this sharing allow you to modify your ideas?
- What did you learn?
- What, if any, misconceptions did you correct?

Example 1

As a class, work through both methods for calculating the area. Have students compare the two methods for solving the problem. Ask the following questions:

- Which method do you find easier? Why?
- Which method leads more naturally to a mental math approach? Explain.

- How can you use mental math to determine measurements that are in square centimetres, in square metres, and vice versa?

Have students visualize areas. Ask the following questions:
- How many 1 cm by 1 cm squares are inside a square that is 1 m by 1 m?
- How many 1 mm by 1 mm squares are inside a square that is 1 m by 1 m?
- How can you use this information to help you if you want to figure out how many square centimetres are in a square metre? square millimetres in a square metre?

Have students do the Your Turn questions. Afterward, have students work with a partner and explain how they determined the areas.

Example 2

Consider introducing the problem by having students recall the linear conversion factors that they already know. The mental math box with the solution to a) shows the relationship between a square foot and an approximation in square centimetres. It may be useful to recall and discuss other linear conversions and approximations at this time. How can students use these to determine the area of various objects?

Direct students' attention to the abbreviations for imperial units of measure in the margin. Have them note the period in *in.*, the abbreviation for inches. The period helps avoid confusion with the word *in*.

For part b), have students outline an area of the classroom that is eight feet by four feet. Discuss what area this might compare to in their home or apartment. For example, it is the same size as a sheet of panelling. Some students may have a galley kitchen or a hallway this size.

Before they see the solution, discuss with students how to solve this question. Then, have them work through the solution. As you do, either have students model to each other what they understand by talking through what they are thinking or provide guiding questions such as the following:
- How can you convert eight feet to centimetres?
- How can you convert four feet to centimetres?
- Is there another way to do this?
- If you converted four feet to centimetres first, how could you determine the length of eight feet in centimetres?
- How can you determine the area of the tile layer in centimetres?
- How can you determine the area of the tile layer in metres?

To provide a referent for a square metre, you may wish to have students measure and tape a one-metre square on the floor or wall. Have them measure the area in centimetres and post the linear length in both metres and centimetres. For example:

One square metre = (1 m)(1 m)
= (100 cm)(100 cm)
= 10 000 cm^2.

Have students model for each other how they can use this information to determine 29 728.97 cm^2 in square metres.

For Your Turn part a), prompt students to recognize that the number will be smaller going from square centimetres to square feet.

Have students use strategies of their choice to solve the Your Turn questions, then, have them discuss their work with a classmate and compare their procedures and preferences. Which procedures are more efficient?

Example 3

Introduce the problem by inviting students to consider the conversion 1 $m^3 \approx 35$ ft^3. This is likely to be surprising to them, and you may want to discuss or consider a model in order to help them integrate this fact. You might also appeal to their knowledge of linear conversions and volumes to consider a cube of length 1 m and convert each length to feet.

Before having students consider the solution, you may wish to have them use their own strategies to solve the problem. Ask the following questions:
- How did you determine the volume?
- How else could you determine the volume?
- When did you convert from SI to imperial? Why did you do it at this point?

Have students do the Your Turn questions using the method of their choice and then, explain their method to a classmate.

Key Ideas

You may wish to use the following prompts to promote a discussion about what students learned:
- How were your skills with conversions between linear units important in this section?

- What other methods do you use for conversions?
- How can you use mental math when making unit conversions?

Have student pairs talk through the sample conversions within the SI and imperial systems. Have them verbalize their understanding of these conversions. How do they work?

Have students use index cards to prepare their own summary of the Key Ideas. Encourage them to record an example of how they would convert

- an area in metres squared to square centimetres
- an area in SI linear units to imperial units

Make sure that students use linear conversions only when converting from one measurement system to another. They need to do these conversions *before* calculating area or volume.

Meeting Student Needs

- The worked examples assume that students are quite familiar with unit conversions. Some students may benefit from a flash card activity to review SI and imperial unit conversions. Pair students and have them use index cards to make up four conversion questions each: two with SI units and two with imperial units. Have them write the correct answer on the back of each card. Then, have students flash each other.
- For Example 1, help students recall the area formula for a square and how answers are expressed in square units.
- For Example 3, help students recall the volume formula for a right rectangular prism and how answers are expressed in cubic units.
- Some may have difficulty visualizing the comparison between SI and imperial units. Provide them with a tape measure, which has both SI and imperial units, to visually compare centimetres and inches, centimetres and feet, and metres and yards. You may wish to display coloured-ribbon representations of each of these lengths. Use one colour for SI and another for imperial. Label each length with its respective unit. Consider including the conversion to the alternative unit.

ELL

- Explain that a *mural mosaic* is a design constructed from smaller pieces and is displayed on a wall. You may wish to provide a visual of an example, such as one of the murals in Chemainus, BC. Visuals of these are readily available online or through BC Tourism.

Common Errors

- Students may confuse units of area and volume.

R_x Remind students that area is always measured in square units. Volume is always measured in cubic units since volume involves three dimensions.

To help students visualize the difference between area and volume, you may wish to display a model of a large cube made from 1000 centimetre cubes. Provide the following label on the top of the cube:

Area = (10 units)(10 units)
= 100 units squared

Provide the following label beside the cube:

Volume = (10 units)(10 units)(10 units)
= 1000 units cubed

Use a think aloud to show why the model might be useful. Have students do their own think alouds to explain their understanding of the difference between area and volume.

WWW Web Link

To view enlarged details of each block on the mural mosaic for Example 1, go to www.mhrmath10.ca and follow the links.

Answers

Example 1: Your Turn

a) 42 500 cm^2 **b)** 0.00125 m^2

Example 2: Your Turn

a) 1.076 ft^2 **b)** 15 480 mm^2

Example 3: Your Turn

7.32 $in.^3$

Assessment	Supporting Learning
Assessment *for* Learning	
Example 1 Have students do the Your Turn related to Example 1.	• Help students recall that going from a larger unit of measure to a smaller unit results in a larger number and vice versa. • Have students summarize how to express metres in centimetres and millimetres in metres. Ask the following questions: – How is expressing millimetres in metres related to expressing centimetres in metres? (Encourage students to verbalize their understanding of the base 10 used for the SI system. It may be helpful for them to use a mnemonic such as that there are 100 cents in a dollar, so there are 100 centimetres in a metre. *Cent* refers to 100. Similarly, *milli* refers to 1000. There are 1000 mm in 1 m.) – How might expressing square millimetres in square metres relate to expressing square centimetres in square metres? (Example: They square the unit being used.) – Which do you find easier? Why? • Provide a similar problem to students who would benefit from more practice. Allow them to work with a partner and talk through their thinking.
Example 2 Have students do the Your Turn related to Example 2.	• It may benefit some students to cut a piece of cardboard measuring 1 ft^2, and then to label it with the following information: 1 ft^2 = 144 $in.^2$ = 929.03 cm^2 Post this as a handy referent. You may wish to have students display other referents as the need arises, for example, for 1 ft^2 and 1 m^2. • Give students a problem similar to Example 2 to solve before trying the Your Turn. Allow them to work with a partner and talk through their thinking. • Coach students who get confused when expressing measurements in different SI units by having them record units along with numbers in the proportion.
Example 3 Have students do the Your Turn related to Example 3.	• Give students a problem similar to Example 3 to solve before trying the Your Turn. Allow them to work with a partner and talk through their thinking. • Allow students to use the method they are most comfortable with. • It may benefit some students to build a metre cube, and then to label this with the following information: 1 m^3 = 10 000 cm^3 = (3.281 ft)(3.281 ft)(3.281 ft) ≈ 35 ft^3 Display this as a handy referent. You may wish to have students build and display other referents as the need arises, for example, for 1 ft^3 and 1 yd^3.

Check Your Understanding

Practise

These questions should be accessible to most students. For #1 and 2, remind students to note the units asked for.

Discuss how to use the conversion chart on page 61. Ask students how they can use the chart to convert 5 cm to in. and 5 in. to cm. Have them explain the difference between these two conversions. Then, ask which results in a larger number: going from in. to cm, or going from cm to in.

For #2, have the class brainstorm the different dimensions that could make an area 30 feet square. Divide the class into groups of four and have individual members of each group use a different set of dimensions for their work. Have students make the necessary conversions and show the area of their shapes in metres squared. Ask them what they notice about their answers and what this suggests about their shapes.

You may then wish to have students choose a partner and do parts b) and c) using a similar technique. Students discuss what dimensions could make the given area, choose a different set of dimensions, and use that set to determine the area in the units given.

For #3, refer students to the Did You Know? on the *Festival du Voyageur*.

For #3 to 5, discuss with students what conversions need to be made and when to make them.

Apply

It may not be necessary to assign all questions to all students. Allow students choice in determining the questions they need to do. In several questions, it would be easier for students to convert linear

measurements before calculating area or volume. You may wish to discuss the best time for making these conversions, or encourage students to try the question both ways and decide which way is more efficient. Remind students to read the problem carefully and note the given units of measure and the units of measure that are asked for.

The photo with #6 was taken in the Museum of Civilization in Hull, Quebec. As of 2008, the Quilt of Belonging did not have a permanent residence because of its large size and the fact that it is still a work in progress.

There are a variety of ways to solve #6 and 7. You might have students compare their method with that of a classmate who solved the problem in a different way.

For #8, students determine the area of a circle with a radius of 2.5 mi in SI units that are not specified. This requires students to consider the most appropriate SI units (i.e., square kilometres) before proceeding.

For #9, have students sketch a diagram to help visualize what the question is asking. Explain that this is how a tile layer would approach this problem. Discuss the need for purchasing 10% extra material (e.g., breakage).

For #10, consider having students work in pairs and compare their answers. Does the timing of conversions make a difference? Why or why not?

For #11, you may wish to use a Think/Pair/Share. Have one student of each pair consider how to determine the volume for a) and the second how to determine the volume for b). After an agreed amount of time, have them share their thoughts with each other. Encourage students to listen to and reflect back what they hear. Also ask them to consider how well the method that is being explained works. Once students are satisfied with each other's explanations, have them separately do c) and then share their method and answer. Students may wish to discuss how their methods were the same/different, and how they used mental math.

Extend

The Extend questions require students to use their problem solving skills. In #12, students solve a problem involving acres and hectares, units that may be unfamiliar. These terms are likely more familiar to students who live in rural areas.

For #13, encourage students to work in pairs that each choose the same area. Have them do their calculations separately, and then compare their answers and methods.

Ask students when they might need to use such a skill. You may wish to discuss the difference in measurements systems between the United States and Canada. Many Americans visiting Canada do not understand the SI system. They need measurements expressed in the imperial system so that they can visualize the size. Similarly, many Canadians need the measurement in SI units. Being able to communicate in both systems aids in international communication.

Create Connections

These questions allow students to communicate their understanding about SI and imperial measurements.

For #14, consider having students work in pairs or small groups to brainstorm occupations that use both imperial and SI measurements. Some examples include architects, carpenters, civil engineers, landscape designers, metal fabricators, structural engineers, and tile layers. Have them explain how SI and imperial measurements are used in each occupation. Then, have students present their own summary orally or in written form. Alternatively, you might have students interview family members or friends involved in these occupations and ask about the conversions they use. Have students report back to the class.

For #15, students describe their preferred method for convering between SI and imperial measurements. Encourage students to use an example to help with their explanation.

For #16, students explain for which departments in a grocery store they would use measurement conversions. Consider having a class discussion and then have students use the ideas as a springboard to develop their own response. Students may also wish to interview their grandparents and neighbours who were adults when Canada used the imperial system. These people may have additional ideas that students who have been brought up in the SI system may not consider.

You might consider an alternative scenario to the grocery store such as a home improvement store or a woodworking or metal shop class. Students could then interview tradespeople who grew up using the imperial system.

Meeting Student Needs

- Allow students to work in pairs.
- Encourage students to use the conversion charts in their Foldable as a reference.
- For #7, be prepared to help students who struggle with determining whether to divide the difference in area by the area of the current bedroom or the area of the new bedroom.
- For #8, some students may benefit from coaching. You might use the following prompts:
  - What is the radius of the area the cell-phone tower covers?
  - What SI units might you convert this to? Explain your thinking.
  - How would you do this conversion?
  - How do you determine the area of a circle if you know the radius of the circle?
- Some students may approach #9 in a different way. Have students discuss their strategies in a small group or class discussion.
  (Example: 5'2" is (5)(12) + 2 = 62 in., so $\frac{62}{4}$ = 15.5 or 16 tiles are needed for the length;
  3'6' is (3)(12) + 6 = 42 in., so $\frac{42}{4}$ = 10.5 or 11 tiles are needed for the width;
  (16)(11) = 176 tiles
  To get the 10% extra material, students could multiply the partial tiles and then add 10% to that total.
  (15.5)(10.5) = 162.75
  Add 10% = 162.75 + 16.3
  = 179.05
  Purchase 179 tiles.
  Alternatively, they could add the 10% to their rounded total.
  (176)(1.1) = 193.6
  Purchase 194 tiles.
  You may wish to discuss with students how the timing of calculating the 10% extra material makes a difference to the amount needed.
- For #11, consider having students complete a placemat activity. Group students into groups of four and place a large sheet of paper in the centre (covering about two thirds of all four desks put together). Divide the sheet into four quadrants. Give the groups a volume unit conversion to do. Have each student copy the question and show their method for solving in one quadrant. Have students rotate the sheet around to see their neighbour's method for solving the same question; and then rotate one more time. Ask students to make up a volume unit conversion of their own and to show their method. Have them rotate and see their neighbours' approaches.
  As an extension, you might have students discuss the different methods and use the centre of the sheet to create a pros and cons list of the methods used.
- Provide **BLM 2–6 Section 2.1 Extra Practice** to students who would benefit from more practice.

Enrichment

- For #14, have students research occupations that use both SI and imperial measurement systems. They may find the Web Link about trades at the end of this section useful.

Gifted

- One hectare is approximately 2.56 acres. Challenge students to determine the answer to #12c) by going directly from acres to hectares. What methods might they try? Why? How can proportional reasoning help them solve this question?
- Challenge students to consider the mathematical claim that a circle has more area within its perimeter than any other figure with the same perimeter. Is there a way this claim can be investigated using their knowledge of area and/or by using grid paper? Have them draw a conclusion about the truth of the statement and describe their findings.

Common Errors

- Students may substitute dissimilar units when using a formula.

R_x Insist that students write the appropriate formula as step 1 in their solution, followed by the substitution of the correct units from the problem. Ensure that students do not mix units. Emphasize that any conversion to a common unit should occur prior to substitution. Consider having students write down the facts known in each problem, circle or highlight the units used, decide what to convert to, and then make the conversions before using any necessary formula. You may wish to model this process for them as you go through an example; then, have them talk through their thinking as they do an example.

Web Link

The Canadian Interprovincial Standards Red Seal program provides information about trades that use both measurement systems. Go to www.mhrmath10.ca and follow the links.

Assessment	Supporting Learning
Assessment *for* Learning	
Practise and Apply Have students do #1a) and b), 2a) and b), 4a), 5, and 6. Students who have no problems with these questions can go on to the remaining questions.	• Provide additional coaching with Example 1 to students who need coaching with #1a). Work with them to correct their errors and then have them try #2a). • Provide additional coaching with Example 2 to students who need coaching with #1b) and c). Work with them to correct their errors and then have them try #2b) and c). • Encourage students to use the method they are most comfortable with to make conversions. • Provide additional coaching with Example 3 to students who need support with #4a). Work with them to correct their errors and then have them try #4b) on their own. • For #4a), have students identify the steps needed to solve the problem (convert inches to centimetres; determine the volume). Work with them to correct their errors and then have them try part b) on their own. • For #5 and 6, invite students to explain their answers to a small group, or the whole class, with emphasis on the problem solving process. • For #6, encourage students to make a diagram of a quilt section.
Assessment *as* Learning	
Create Connections Have all students complete #14 to 16.	• Encourage students to verbalize their thinking. • Allow students to work with a partner to discuss the questions, and then have them provide individual responses orally or in written form. • For #14, it may be beneficial to brainstorm some occupations that use both SI and imperial measurement systems. Have students use these as a springboard to generate their own response. • For #15, help students identify different methods used to make conversions (e.g., using a proportion, using unit analysis). Help them explain their thinking about which method they find easier. Students could record their response in their Foldable. Encourage them to include a diagram and a worked example of their own that they can use as a study tool. • For #16, encourage students to walk through a grocery store and identify departments that use measurement conversions. Have students provide a sample conversion from each department.