1.1 Imperial Measure

Specific Expectations
Solving Problems Involving Surface Area and Volume, Using the Imperial and Metric Systems of Measurement
In this section, students will
MT3.01 use the imperial system when solving measurement problems (e.g., problems involving dimensions of lumber, areas of carpets, and volumes of soil or concrete)

Link to Get Ready
Students will learn about the imperial measurement system in this section. This system uses fractions more than the metric system. Have students complete questions 1 and 2 of the Get Ready before proceeding with Section 1.1.

Warm-Up
1. What tools would you use to measure
   a) your height?
   b) your weight?
   c) the amount of water in a glass?

2. How would you find the area of a rectangle?

3. If there are 30 students in a class, how many packages of rulers will the teacher need to buy to give one ruler to each student if there are 4 rulers in a package? Explain.

Warm-Up Answers

1. a) Possible answers: yardstick, metre stick, tape measure
   b) scale
   c) measuring cup

2. Measure the length and the width, then multiply.
3. 8 packages

Teaching Suggestions
Warm-Up
• Write the Warm-Up questions on the board or on an overhead. Have students complete the questions independently. Then, discuss the solutions as a class. (5–10 min)

Section Opener
• Read the questions from the Section Opener to the class. Ask students who knows their height in feet and inches. Ask who knows their height in metres and centimetres. Then, ask who knows the temperature in degrees Fahrenheit. Ask who knows the temperature in degrees Celsius. As a class, discuss why imperial is preferred for some things and metric for others.

- Some students may have difficulty with the two different ounce concepts: ounces and fluid ounces.
- R$_x$ Explain the difference between a fluid ounce as a unit of volume and an ounce used as a measure of weight.

- Some students may have difficulty remembering which is smaller, the teaspoon or tablespoon.
- R$_x$ Point out that the word teaspoon is smaller than tablespoon and so is the measure.

- Some students may incorrectly name the fractional markings on the ruler.
- R$_x$ Provide a sheet showing the inch markings labelled as $\frac{1}{16}, \frac{1}{8}, \frac{1}{4}, \frac{1}{2}$ or spend some time reviewing the various markings and their correct names.

Ongoing Assessment

- Consider using Practise the Concepts question 7 as a class discussion, and assess students' communication skills. You may wish to use **BLM A3 Communication General Scoring Rubric** to assist you in assessing your students.

- While students are working on the Investigate, circulate to see how well each student works within a group. This may be an opportunity to begin observing and recording the individual student's learning skills: group work, work habits, organization, and initiative.

- Briefly discuss the two opening paragraphs in the Section Opener. You may wish to distribute **BLM 1.1.2 Investigate: The Relationships Among Imperial Units**, and have students refer to the Key Term definitions.

Investigate

- Have students work in small groups. Distribute **BLM 1.1.2 Investigate: The Relationships Among Imperial Units** before students begin the Investigate. Have students keep their completed sheet to refer to as they work through the rest of Chapter 1.
- You may wish to assign Investigate Part C question 3c) as homework.
- To save time, consider having each group work on a different part of the Investigate and report their findings back to the class. Or, have students research the relationships in one or more parts of the Investigate on the Internet and report their findings back to the class.
- You may wish to have students complete the Investigate before handing out **BLM 1.1.2 Investigate: The Relationships Among Imperial Units.**
- Before students begin work on Part B, have them read the MathConnect. Remind them that they will be working with U.S. imperial units in this text. Conduct a class discussion about which imperial units are more valuable to learn as Canadians: American or British?
- Consolidate student's findings by discussing the answers to **BLM 1.1.2 Investigate: The Relationships Among Imperial Units**.
- Use **BLM 1.1.1 Practice: Imperial Measures** for extra practice or remediation.

Investigate Answers (page 6)

Part A

1. **a)** There are 12 in. in 1 ft. There are 3 ft in 1 yd.

   b) $\frac{1}{16}$ in. is the smallest fraction of an inch shown on the yardstick.

   Extend
   There are 36 in. in one yard.
   There are 5280 ft in one mile.
   There are 1760 yd in one mile.

Part B

2. There are 8 fl oz in one cup.
   There are 2 c in one pint.
   There are 2 pt in one quart.
   There are 4 c in one quart.
   There are 4 qt in one gallon.
   There are 3 tsp in one tablespoon.
   There are 2 tbsp in one fluid ounce.

Part C

3. **a)** There are 16 ounces in one pound.
   b) There are 2000 lb in one ton.

Examples

- Work through the three Examples as a class. Alternatively, have students complete the Examples independently or in small groups before reviewing them as a class.
- For Example 1, bring in a variety of bolts, screws, or other objects for students to measure.
- For Example 2, some students may need help solidifying why you multiply by 2 and not by $\frac{1}{2}$.

ESL—Encourage students to use their dictionary or translators to check unfamiliar words.

Gifted and Enrichment—Encourage students to help others. Assign Extend the Concepts questions to challenge students.

Memory—Suggest students use their completed **BLM 1.1.2 Investigate: The Relationships Among Imperial Units** as a memory aid.

Perceptual—Encourage students having difficulty reading the calibrations on yardsticks and measuring cups to seek assistance from you or from other students.

- For Example 3, an alternate method of finding square yards is to first divide the lengths by 3 to convert to yards, then multiply.
- Discuss with students how multiplying by 1.14 provides the final answer directly. Show the class how the alternate method of multiplying by 0.08 and by 0.06, then adding also provides the same answer. Some students may find this method easier:

$$544 \times 0.08 = 43.52$$
$$544 \times 0.06 = 32.64$$
$$544 + 43.52 + 32.64 = 620.16$$

- As an extension, have students research how carpet is sold. Do most stores sell by the square yard or square foot? Do stores sell a fraction of a square yard or square foot? What is the usual width of carpet sold by the square yard or square foot?

Key Concepts

- Have students refer to their completed **BLM 1.1.2 Investigate: The Relationships Among Imperial Units** for a class discussion of the Key Concepts.

Discuss the Concepts

- Have students read the questions and record their solutions before starting a class discussion.
- If you assign the Extend questions in **BLM 1.1.2 Investigate: The Relationships Among Imperial Units**, you may wish to postpone the discussion until students have completed their research.

Discuss the Concepts Suggested Answers (page 9)

D1. a) inch, in. or "; foot, ft or '; yard, yd; mile, mi

    b) teaspoon, tsp; tablespoon, tbsp; fluid ounce, fl oz; cup, c; pint, pt; quart, qt; gallon, gal

    c) ounce, oz; pound, lb; ton, tn

    d) degree Fahrenheit, °F

D2. There are 12 in. in one foot, 3 ft in one yard, 36 in. in one yard (Possible additional answers: 5280 ft in one mile, 1760 yd in one mile).

D3. There are 16 oz in one pound, 2000 lb in one ton.

Practise the Concepts (A)

- Encourage students to refer back to the Examples before asking for assistance.
- For question 1, ensure students have access to a ruler calibrated in inches.
- For questions 2, 3, and 5, challenge students to write their answer as a decimal and as a fraction for those conversions that are not exact.
- For question 7, have students make notes on their discussion. This question may be used as a class discussion. Remind students to use imperial measures for their discussion instead of metric.

Apply the Concepts (B)

- For question 9, open a dialogue on whether cloth is purchased by the yard or metre. Ask for a volunteer to phone fabric retailers to find out and report back.
- Question 11 refers to the differences in American and Canadian football field lengths. Explain to students that the widths also differ (the width of the Canadian field is $53\frac{1}{3}$ yd and the width of the American field is 65 yd), as well as end zone, goal-post placement, and more.
- Question 12 is a two-step problem. You may need to provide scaffolding for some students indicating the two steps that are required.
- Question 13 is a Literacy Connect. As a class, discuss possible reasons why the U.S. has not adopted the metric system. Literacy Connect questions offer the opportunity to explore literacy issues in the mathematics classroom and within the context of mathematics. This supports general Think Literacy strategies. For more information visit http://www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy.
- Question 14 links to the Chapter Problem. Remind students to keep the solution to this question handy as it may help them with the Chapter Problem Wrap-Up.

Extend the Concepts (C)

- Assign the Extend the Concepts questions to students who are not being challenged by questions in Apply the Concepts.
- Extend the Concepts questions can be used as a diagnostic assessment for those students considering a university-level course in grade 11.