1.2 Conversions Between Metric and Imperial Systems

Strand
Measurement and Trigonometry

Student Text Pages
12–18

Suggested Timing
80 min

Tools
- calculators
- graduated cylinders or measuring cups with both fluid ounces and millilitres
- metre sticks
- scales with both pounds and kilograms
- thermometers with both Celsius and Fahrenheit
- yardsticks

Related Resources
BLM 1.2.1 Practice: Conversions Between Metric and Imperial Systems
BLM 1.2.2 Metric–Imperial Conversions
BLM 1.2.3 Achievement Check Rubric
BLM A10 Group Work Recording Sheet
BLM A8 News Report Checklist

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 convert measures between the imperial and the metric systems. This section requires the knowledge learned in Section 1.1 and similar skills. These skills are reviewed in questions 1 and 2 of the Get Ready.

Warm-Up

1. Convert these imperial measures.

a) 1 ft = ____ in.
b) 1 yd = ____ ft
c) 1 c = ____ fl oz
d) 1 pt = ____ c
e) 1 qt = ____ c
f) 1 gal = ____ qt
g) 1 tbsp = ____ tsp
h) 1 fl oz = ____ tbsp
i) 1 lb = ____ oz
j) 1 tn = ____ lb

2. Convert these metric measures.

a) 1 km = ____ m
b) 1 kg = ____ g
c) 1 t = ____ kg
d) 1 m = ____ mm
e) 1 m = ____ cm
f) 1 cm = ____ mm

Warm-Up Answers

1. a) 1 ft = 12 in.
b) 1 yd = 3 ft
c) 1 c = 8 fl oz
d) 1 pt = 2 c
e) 1 qt = 4 c
f) 1 gal = 4 qt
g) 1 tbsp = 3 tsp
h) 1 fl oz = 2 tbsp
i) 1 lb = 16 oz
j) 1 tn = 2000 lb

2. a) 1 km = 1000 m
b) 1 kg = 1000 g
c) 1 t = 1000 kg
d) 1 m = 1000 mm
e) 1 m = 100 cm
f) 1 cm = 10 mm

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

- Have students, working in groups, jot down references they have heard to distance, temperature, volume, and weight and mass. For example, miles and miles away, or tons of time. In a class discussion, challenge students to create equivalents for some of their references. For example, the movie *The Longest Yard* could be *The Longest Three Feet*.

Common Errors

- Some students may have trouble knowing which conversion fact to use and whether to multiply or divide.

R_x Explain the "rule of 1" to students. The unit being converted *to* must be a 1 before you multiply by the number you are converting *from*. For example, to convert 156 lb to kilograms:
2.205 lb = 1 kg and 1 lb = 0.453 kg.
Since it is kilograms we are converting *to*, it has to be the 1, so we use 1 lb = 0.453 kg, and multiply that by 156.
156 lb = 156 × 0.453 kg
156 lb = 70.668 kg

- Some students may not always recall conversion facts.

R_x Have students refer to **BLM 1.2.2 Metric–Imperial Conversions** for conversion facts.

- Some students may estimate the answers to all questions.

R_x Remind students that unless the question says to estimate, exact conversions are required.

Ongoing Assessment

- While students are working on the Investigate, circulate to assess how well students work in a group. You may wish to use **BLM A10 Group Work Assessment Recording Sheet** to assist you in assessing your students. Use this section to have students concentrate on organizational skills and good work habits. Encourage students to present material in table or chart form where appropriate.
- Have students write a brief report on Units of Measure from Home and School, compiling a list of things that are measured in different units, both imperial and metric. Have them add their report to their portfolios.

Accommodations

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

- Using the same references, ask students for a metric equivalent to an imperial title or an imperial equivalent to a metric title. Some examples of common metric or imperial references include: *Nine Inch Nails* (music group), *8 Mile*, *21 Grams* (movies), *Fahrenheit 69* (CD by BlowFly), *7800 Degrees Fahrenheit* (CD by Bon Jovi), *Scotland Yard* (police force or rap group), an ounce of prevention is worth a pound of cure (expression), and engine sizes are measured in litres (e.g., the Mustang GT has a 4.6 L engine).
- Have students research the question asked in the Section Opener, "How long is a league?" and report back to the class. (Answer: one league = 3.45233834 mi = 5.556 km)

Investigate

- Have students work in small groups for the Investigate. Consolidate students' findings by discussing their answers to the Investigate as a class.
- As a reference tool for the Examples and the questions in this section, distribute **BLM 1.2.2 Metric–Imperial Conversions**. You may wish to review **BLM 1.2.2 Metric–Imperial Conversions** with students and discuss how each is calculated.
- To save time, you may wish to have students complete the Investigate as an independent research activity using the Internet.
- Use **BLM 1.2.1 Practice: Conversions Between Metric and Imperial Systems** for extra practice or remediation.

Investigate Answers (pages 12 to 14)

Part A

1. There are approximately 2.5 cm in one inch.

2. a) A yard is slightly shorter than a metre.
b) One metre = 1.09 yd

Part B

3. a) One kilogram is heavier than one pound.
b) There are approximately 2.2 lb in one kilogram.

4. There are approximately 450 g in one pound.

Part C

5. a) One litre is larger than one cup.
b) There are approximately 4.23 c in one litre.

6. There are approximately 236.59 mL in one cup.

Part D

7. a) Answers will vary.
b) Answers will vary. Students may try to double or triple a temperature in degrees Fahrenheit to find an equivalent Celsius temperature.

8. a) Answers will vary.
b) Answers will vary.

Examples

- Have students work through the Examples as a class before proceeding to Discuss the Concepts. Alternatively, have students complete the Examples independently or in small groups before reviewing them as a class.
- Example 1A provides an excellent opportunity to reinforce the inaccuracy of estimation. You may wish to use **BLM 1.2.1 Practice: Conversions Between Metric and Imperial Systems** to have students practice estimating and then calculating.

- For Example 1B, have students check that Beatta's method is the same as multiplying by 1.6.
- Example 2 relates to Discuss the Concepts question D1. Have students read Discuss the Concepts question D1 before reviewing Example 2.
- For Example 2 Part B, read the MathConnect to the class and have students consider the questions. (Answer: Measuring in kilograms or pounds will not provide an exact enough measure. More precise measures are important for accurate monitoring of proper infant growth, medicine dosages, etc.)
- Have students work through Example 3 using the estimating system provided. Then, have them use the exact conversion formula on **BLM 1.2.2 Metric–Imperial Conversions** and calculate the temperature in Fahrenheit.

Key Concepts

- Instruct students to use **BLM 1.2.2 Metric–Imperial Conversions** and also refer to the table of common metric and imperial abbreviations for the balance of the questions in this section and the rest of the chapter.

Discuss the Concepts

- After discussing question D1, have students prepare a report. Instruct students to research in the library or on the Internet incidents in which conversion error caused an accident and prepare a news report to share their findings. Refer students to http://www.mcgrawhill.ca/links/foundations10 for ideas, if necessary. You may wish to use **BLM A8 News Report Checklist** to assist you in assessing your students.

Discuss the Concepts Suggested Answers (page 16)

D1. a) Answers will vary. Possible answers include: driving in the U.S. and converting speed limits, distances, and cost of gas.

b) Answers will vary. Possible answers include: using medications, making complex machines, and in the space shuttle.

D2. Answers will vary. Possible answers include: I would use metric for distance and volume because it is easier to do fractions of it since it is all based on tens. I would use imperial for people's height and weight because that is what is most widely used in the media.

Practise the Concepts (A)

- Encourage students to keep **BLM 1.2.3 Metric–Imperial Conversions** handy for reference. Challenge them to try and recall the conversions and estimates before looking them up.
- Encourage students to refer back to the Examples before asking for assistance.
- For questions 2, 3, 4, and 5, refer students to their Investigate results for assistance.

Apply the Concepts (B)

- For question 6, encourage students to make notes as they are discussing the question.
- Question 8 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.

- Question 10 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 15 is an Achievement Check. It can be used as a form of diagnostic or formative assessment or assigned as a small summative assessment piece. This provides an opportunity for formative or self-assessment, using **BLM 1.2.3 Achievement Check Rubric**.

Achievement Check Answers (page 18)

15. a) Vpunch for $25 = 1.89 + 2(0.355) + 2(2)$
$= 6.6$

Vpunch for $85 = \frac{6.6}{25} \times 85$
$= 22.44$

For 85 guests, 22.44 L of punch are needed.

b) Look at a). 6.6 L container

c) $\frac{22.44}{4} = 5.61$

5.61 jugs are needed.

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.
- Questions 16 and 18 are similar and require conversions in two areas, volume and distance. Many students have a strong interest in cars and may find these questions interesting. You may wish to explain to interested students how to do a quick (although high) estimate: divide the number of litres by 4, multiply the kilometres travelled by 0.6, and divide miles by the gallons.
  For example:
  10 L/100 km
  $10 \div 4 = 2.5$ gal
  $100 \times 0.6 = 60$ mi
  1 gal $= 60 \div 2.5 = 24$ mpg
  Stress to students that this is a *high* miles per gallon estimate, and refer them to Example 1 to explain why.
- Question 17 requires conversions as well as the ability to work in fractions.