# 1.4

# Solve Problems Using Similar Triangles

**Student Text Pages**
30–37

**Suggested Timing**
160 min

**Tools**
• computers
• Internet access
• long measuring tapes
• metre or yardsticks
• *The Geometer's Sketchpad ®*

**Related Resources**
BLM 1.4.1 Practice: Solve Problems Using Similar Triangles
BLM 1.4.2 Investigate: Find the Height of Your School's Flagpole
BLM A6 Group Work General Scoring Rubric
BLM T1 *The Geometer's Sketchpad ®* 4

## Specific Expectations
**Solving Problems Involving Similar Triangles**
In this section, students will
**MT1.03** solve problems involving similar triangles in realistic situations (e.g., shadows, reflections, scale models, surveying)
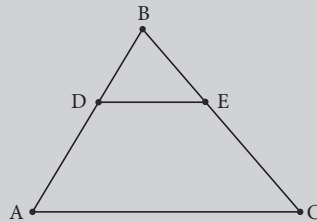
## Link to Get Ready
This section requires the knowledge learned in Section 1.3 and similar skills. These skills are reviewed in questions 3, 4, and 5 of the Get Ready.

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### Warm-Up
In the diagram, DE is parallel to AC. BD = 4, DA = 6 and DE = 5.
  **a)** State the similar triangles.
  **b)** Find AC to the nearest tenth.



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### Warm-Up Answers
  **a)** $\triangle ABC \sim \triangle DBE$
  **b)** $\dfrac{AB}{AC} = \dfrac{DB}{DE}$

   $\dfrac{10}{x} = \dfrac{4}{5}$
   $x = 12.5$

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## Teaching Suggestions
### Warm-Up
• Write the Warm-Up question on the board or on an overhead. Have students complete the question independently. Then, discuss the solutions as a class. (3–5 min)

### Section Opener
• Use the Section Opener along with the Warm-Up to review finding missing lengths in similar triangles. As a class, sketch and label a diagram of the situation described in the Section Opener.



known object height 3 ft

shadow 1 ft

totem pole

shadow 100 ft
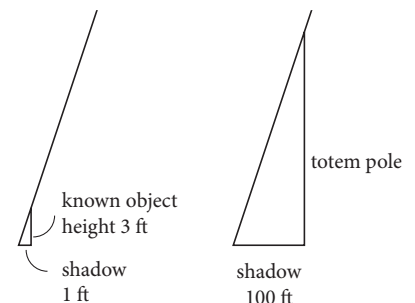
- Some students may not hold the metre stick or yardstick perpendicular to the ground.
$R_x$ Ensure students understand how to position the metre stick or yardstick.

- Some students may measure the linear distances inaccurately.
$R_x$ Remind students of the importance of accuracy in their measures.

### Ongoing Assessment

- This Investigate provides the opportunity to see how well students function in groups in a non-classroom environment. You may wish to use **BLM A6 Group Work General Scoring Rubric** to assist you in assessing your students.

### Accommodations

**Gifted and Enrichment**—Have students explain the mathematical reasoning for Discuss the Concepts question D1.

**Perceptual**—Students with perceptual problems may have difficulty seeing the similar triangles in Example 2. Redraw the two triangles for them so that the diagram resembles the Investigate.

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Ask students, "If the shadow of the totem pole is 100 ft tall, the known object is 3 ft tall, and the shadow of the known object is 1 ft long, how tall is the totem pole?" Label the diagram, and have the class solve the problem.

Answer:

$$\frac{x}{3} = \frac{100}{1}$$
$$x = 300 \text{ ft}$$

Ask students, "How long would the shadow of the 173-ft totem pole have been?"

Answer:

$$\frac{173}{3} = \frac{x}{1}$$
$$x \doteq 58 \text{ ft}$$

- Have interested students conduct research in the library or on the Internet for information on the Spirit of Lekwammen, the world's tallest totem pole. Have them report their findings to the class.

## Investigate

- If the school doesn't have a flagpole or it is inaccessible, any tall object on school property including the school itself can be substituted.
- Have students work in small groups. Distribute **BLM 1.4.2 Investigate: Find the Height of Your School's Flagpole** to each group. Have the group designate a recorder to be in charge of recording the measures. Remind students to be sure their metre stick or yardstick is perpendicular to the ground.
- You may wish to have some groups use metre sticks and others use yardsticks. If you choose this option, once the class has finished their calculations, have them convert their solutions.
- Discuss the Investigate as a class.
- If doing an activity outdoors is inappropriate, you may wish to adapt Example 3 as an alternative to the Investigate. Provide a mirror to each group in addition to the measuring tape and metre and/or yardsticks. Instruct the groups to place the mirror on the floor and measure the distance from the base of the classroom wall to the mirror. Have one member of the group stand behind the mirror and back up until they see the top of the wall in the mirror. Ensure that they stand up straight. Have another member of the group measure the distance that the student is from the mirror and the height of the student. Then, provide these questions:

  **1.** Sketch a diagram of the situation, and place your measures on the diagram.
  **2.** Explain how the triangles are similar.
  **3.** Find the height of the wall.

- Alternatively, have students work with a partner and find the height of their partner using the mirror method.
- Use **BLM 1.4.1 Practice: Solve Problems Using Similar Triangles** for extra practice or remediation.

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**Investigate Answers (page 30)**

**3.** Students' sketches will vary. Ensure that sketches are appropriately labelled.

**4.** Students' answers may vary. Possible answer: The triangles are similar because the angles are equal, and the side lengths are proportional.

**5.** Answers will vary.

## Examples

- Work through the Examples with the class before proceeding to Discuss the Concepts. Alternatively, have students attempt the Examples independently, or in groups before working through them as a class.
- Point out to students that Example 1 is identical in concept to the Investigate.
- Remind students that they have seen diagrams similar to Example 2 in Section 1.3, Example 2.

## Key Concepts

- Have students recall some of the applications of similar triangles they have seen and brainstorm others. Remind students of the MathConnect from Section 1.3 and how doctors use the properties of similar triangles in their treatment of cancer patients. This is an excellent lead-in to questions 1 and 2 of Practise the Concepts.

## Discuss the Concepts

- Give students time to formulate their ideas before conducting a class discussion.

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**Discuss the Concepts Suggested Answers (page 33)**

**D1.** Banyan would be taller.

**D2.** Answers will vary. Possible answers include: Find the shadow of an object with a known height, measure its shadow and the tree, then use the similar triangles to find the tree's height; measure your height, place a mirror on the ground and walk back until you see the top of the tree, measure the distance from the tree to the mirror and from you to the mirror, then use similar triangles to find the tree's height.

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## Practise the Concepts (A)

- You may wish to assign questions 1 and 2 immediately following Discuss the Concepts.
- Question 3 is a Literacy Connect. 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. Students will need access to a library or the Internet.

## Apply the Concepts (B)

- For questions 4, 5, 6, and 12, encourage students to refer back to the Examples before asking for assistance.
- Point out to students that the units of measure in questions 7 and 8 are feet, and encourage them to give the answer in feet and inches, not just as a fraction of a foot.
- Question 9 is a Chapter Problem. Remind students that the solution to this question will help them with their solution to the Chapter Problem Wrap-Up.
- Question 13 requires the use of *The Geometer's Sketchpad®*. When assigning this question, leave sufficient time for its completion based on the availability of the technology. You may wish to use **BLM T1** *The Geometer's Sketchpad® 4* for this activity.

**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.
- Encourage interested students to research more about Eratosthenes in the library or on the Internet and report their findings to the class.