# Solve Problems Involving Right Triangles

## Teaching Suggestions

• Begin the class with a discussion on where students have seen mathematics being used in movies or television series. Some examples are *Numbers* (television drama show), *Good Will Hunting* (movie), *A Beautiful Mind* (movie), and *CSI* (television drama show). Ask the class how they think trigonometry might be used to piece together clues at a crime scene. Later in this section, they will have the opportunity to see an example, provided courtesy of the Ottawa Police Service. (5 min)

## Examples

• Discuss the **Examples** as a class. (20–25 min)
• **Example 1** introduces two important terms used in trigonometry problems, "angle of depression" and "angle of elevation." Ensure that students understand that both of these terms are used in relation to a horizontal line.
• **Example 2** poses a trigonometry problem in three dimensions. In this case, two triangles in perpendicular planes are linked by a common side. Some students may have trouble visualizing the two triangles and how they are related spatially. Use two different-coloured triangle cutouts and hold them at right angles along the common side.
• Students should also become aware of the necessity for naming sides using two letters in situations where one letter could lead to confusion. Use the comments in the Literacy Connections feature on page 379 to help explain this idea.

## Communicate Your Understanding

• Review the vocabulary in this section (angle of depression, angle of elevation) before discussing the **Communicate Your Understanding** questions as a class or in small groups. (5 min)
• Use these questions to check if students understand angles of elevation and depression. Also see if they understand how to name sides using the two-letter method.
• Use **A–5 Problem Solving Checklist** to assist you when assessing students. Alternatively, have students use **A–18 My Progress as a Problem Solver** as a self-assessment tool.
• Use **BLM 7–14 Section 7.5 Practice Master** for remediation or extra practice.

## Common Errors

- Some students may have trouble starting a problem.

$R_x$ Have students write down anything that they are given or can infer. Start with a diagram, or try to simplify a given diagram. Start with one part that can be solved and work from there.

- Some students may present an incomplete solution.

$R_x$ Remind students to always look back at the question after solving it. This is also a good time to check the reasonableness of the answer.

## Accommodations

**Gifted and Enrichment**—Challenge students to learn more about the areas in which the primary trigonometric ratios are applied and to present their findings in a report to their classmates.

**Perceptual**—Encourage students to make a three-dimensional model to represent the information for the questions in which they are required to solve a three-dimensional problem.

**Spatial**—Let students work together to construct a paper model of an octahedron.

**ESL**—Allow students to work in groups to complete the questions in this section.

## Practise

- **Questions 3** through **8** involve more than one triangle. Some students may benefit from representing the situation with a single sketch augmented by a sketch in which the two triangles are drawn separately.

- **Questions 9** through **23** typically involve a high reading component and can be challenging for many students. Have them work with a partner on some of these questions.

- In **question 10**, assume that all shots produce the distances given in the table. Some golfers in the class may propose alternative interesting strategies. Encourage them to share their ideas and knowledge of the game with the class.

- In **question 12**, Lucy's fate may depend on how the final answer is rounded. This could invoke some lively discussion about the accuracy of final answers.

- In **question 13**, connections are made to the speed-distance-time relationship. Part b) can be solved using the Pythagorean theorem.

- For **question 15**, remind students that the angle of depression is measured with respect to the horizontal (not vertical).

- For **question 17**, provide concrete materials, such as Polydron™ pieces, for students to build and explore a tetrahedron model, if available.

- **Question 18** involves three dimensions. The added complexity comes into play realizing that the ground is not flat. An example of a topographic map may be a helpful instructional aid, if available.

- For **questions 14**, **20** through **22**, **29**, and **30**, encourage students to begin by drawing a diagram and labelling given information.

- Students may have difficulty visualizing the various measures in **question 23**. A physical model may be helpful, ideally using a combination of Polydron™ solid and framework pieces. Use the solid pieces to illustrate lengths along the surface of the pyramid and the hollow framework pieces to point out the vertical height within the solid structure.

- **Questions 25** and **26** refer to the crime scene investigation reference made in the introduction of this section. For **question 25**, students need to recognize the F pattern formed by the two parallel impact lines and the line along the floor through BC. Note that prior to hitting the ground, the drop is assumed to be spherical, so $d$ is the same length in all directions inside the drop. **Question 26** requires the application of the relationship established in **question 19**.

## Literacy Connections

Draw attention to the marginal items on page 378. These define the angles of depression/declination and elevation/inclination.

The Literacy Connections on page 379 suggests a method for accurately identifying triangles when there are several triangles involved.

Add "angle of elevation," "angle of depression," "angle of inclination," and "angle of declination" to the Word Wall.

## Mathematical Processes Integration

The table shows questions that provide good opportunities for students to use the mathematical processes.

| Process Expectations | Selected Questions |
| --- | --- |
| Problem Solving | 6, 8, 9, 17, 18, 22–26, 28, 30–32 |
| Reasoning and Proving | 9, 10, 12, 16–18, 22, 24–26, 28, 30, 32 |
| Reflecting | 16 |
| Selecting Tools and Computational Strategies | 1–15, 17–32 |
| Connecting | 1–3, 5–30, 32 |
| Representing | 6, 9, 13, 14, 17, 20–30, 32 |
| Communicating | 9, 10, 12, 18, 25 |

## Ongoing Assessment

- Chapter Problem question 24 can also be used as an assessment tool.
- Communicate Your Understanding questions can be used as quizzes to assess students' communication skills.