1.4 Solving Problems Using Primary Trigonometric Ratios

Study Guide and Exercise Book Pages
11 to 14

Tools
- geometry set
- grid paper
- metre stick or tape measure
- computer with dynamic geometry software
- graphing calculator

Related Resources
- T–2 *The Geometer's Sketchpad®* 4
- T–4 The TI-Nspire™ CAS Calculator
- A–7 Communicating

Key Terms
- angle of declination
- angle of depression
- angle of elevation
- angle of inclination
- clinometer

Definitions of Key Terms can be found on the Online Learning Centre at **www.mcgrawhill.ca/books/mct12**.

Common Errors
- When solving application problems, students sometimes draw incorrect diagrams.

R_x Encourage students to use grid paper, draw diagrams to scale, and use a protractor.

- Some students use their calculator immediately. Writing down a rounded answer and then completing the question may affect the final answer.

R_x Encourage students to do as much as possible by hand before using the calculator.

Teaching Suggestions

Key Concepts

- Have students add new terminology and diagrams to their chapter reference sheet.
- Have students discuss other situations in which *angle of elevation* and *angle of depression* are used in the real world.

Example

- Encourage students to sketch a diagram that is sized appropriately.
- Have students solve for the required variable before using their calculator. Discuss how rounding in the intermediate steps will affect the final answer.
- After completing the **Example**, you may wish to model a three-dimensional problem in the classroom. Pretend that the top left corner of a wall in your classroom is the top of a building, and a mini person is located at the bottom right corner of the same wall. Have students measure the height of the "building." Have students calculate the angle of depression from the top of the "building" to the mini person. Ask students to explain how they can find the angle of depression another way (without measuring the height).

Questions

- In **question 1** and **2**, ensure that students solve for x and θ properly when these variables appear in the denominator.
- In **question 3**, students are required to solve a triangle. Remind students that this means to find all the angle measures and all the side lengths. Review with students how to name the angles and the sides in triangles when they are drawing diagrams. Remind students that, by convention, the angles are labelled with upper-case letters and the sides with lower-case letters.
- For all the word problems in this section, encourage students to sketch a diagram, and to check that their answer is reasonable. Students could work in groups to pace out measurements and use large protractors to measure angles when creating diagrams and scale models.
- Students must read **questions 7** and **12** very carefully. Have them label their diagrams carefully also.
- For **question 8**, refer students to the **Example**.
- For **question 11**, you may need to explain to students what a clinometer is and how it is used.
- Students use their algebra skills in **questions 20** and **21**. They must work with two equations and two unknowns. A student with average ability may have some difficulty solving these problems independently.

Differentiated Instruction

- Use **cooperative task groups** to complete the application questions. Students can draw diagrams for each word problem individually, and then share their diagram with their group. They can then solve the problem on their own before sharing answers with the group.

Technology Suggestions

- Provide copies of **T–2 *The Geometer's Sketchpad*® 4** and **T–4 The TI-Nspire™ CAS Calculator.**
- For **questions 4** and **5**, students may wish to construct a diagram using a TI-Nspire™ CAS **Graphs & Geometry** page or *The Geometer's Sketchpad*®. Alternatively, they could use *The Geometer's Sketchpad*® to verify measurements. For **question 5**, it would be helpful to scale their construction so that 1 unit equals 4 m.
- For **question 9**, it may be helpful to use three-dimensional rendered images. Go to **www.mcgrawhill.ca/books/mct12** and follow the links. Students can choose a square-based pyramid and enlarge its view to fill the screen. They can rotate and change the orientation of the object in three dimensions.
- For **question 13**, students may wish to construct a diagram using a TI-Nspire™ CAS **Graphs & Geometry** page or *The Geometer's Sketchpad*®. Construct a point to represent the lighthouse. For the northeast angle, ensure the angle is 45° east of north. For the southeast angle, ensure that the angle is 45° east of south. Plot points on lines and drag them to the correct length to represent boat A and boat B. Construct and measure a line segment between the boats.
- For **question 16**, students may wish to construct a scale diagram using TI-Nspire™ CAS or *The Geometer's Sketchpad*®. An appropriate scale is 1 unit to 5 feet. Construct the angles of elevation, 25° and 35°, using points. Recall that the steeper angle should be closer to the building. Ensure students construct lines, not line segments, to represent the angles of elevation through the points plotted. Find the intersection point for the two lines of sight. Construct and measure the length of a perpendicular line from the point of intersection to the ground to determine the height of the building.

Mathematical Process Expectations

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

Process Expectation	Selected Questions
Problem Solving	9, 10, 13–21
Reasoning and Proving	19
Reflecting	1, 2, 6, 15
Selecting Tools and Computational Strategies	12, 14
Connecting	3, 10, 14, 15
Representing	3–5, 8, 10
Communicating	6, 11, 19

Ongoing Assessment

- Use **A–7 Communicating** to assess students' answers for **question 11**.