1.5 Solving Problems Using the Sine Law

Study Guide and Exercise Book Pages
15 to 18

Tools
- geometry set
- strips of cardboard
- computer with dynamic geometry software
- graphing calculator

Related Resources
- T–2 *The Geometer's Sketchpad®* 4
- T–4 The TI-Nspire™ CAS Calculator
- T1–3 Understanding the Ambiguous Case Using TI-Nspire™ CAS
- T1–4 Understanding the Ambiguous Case Using *The Geometer's Sketchpad®*
- A–1 Problem Solving

Key Terms
- oblique angle
- ambiguous case
- sine law

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

Common Errors
- The ambiguous case is often confusing to students.

R_x Consider making models of some triangles using strips of cardboard cut to appropriate lengths. Show how one of the possible triangles can morph into the other while maintaining the lengths of the two sides and the given angle.

Teaching Suggestions

Key Concepts

- Have students add the definition and diagram of *oblique triangle* to their chapter reference sheet.
- Discuss the meaning of the word *ambiguous*.

Example

- The **Example** reviews the sine law.
- In addition to the sine law, discuss the ambiguous case with students. It will be confusing to some students. Work through a problem such as **question 8** or **9** with students. Test each case with actual side lengths and given angles.
- Remind students how the sides of a triangle are labelled: lower-case letters for the sides corresponding to the upper-case letters of the opposite angles.
- Instead of just memorizing the cases, build or draw each triangle to scale. Have students create the diagram the same way to avoid confusion—a horizontal base line first, and then the given angle in the left-hand corner.
- Have students swing the third side like a pendulum from the uppermost point in the diagram. They will see if zero, one, or two triangles can be created.
- Remind students that when using the sine law, the calculator gives an answer in quadrant I. If the triangle is oblique, the answer is subtracted from 180°.
- Remind students that the sine law can be applied only if the measures of two angles and one side or the measures of one angle and two sides (provided one side is opposite the given angle) are known.
- Have students add notes about the ambiguous case and the sine law to their chapter reference sheets.

Questions

- Note that some students may wish to solve a right triangle with the sine law, which is appropriate, but applying the Pythagorean theorem to a non-right triangle is not appropriate.
- Encourage students to always check for the ambiguous case. For **question 9b**), students should recognize that more than one answer is possible.
- For **questions 10** to **15**, students could work in groups using large grid paper to create diagrams for the questions, and post the diagrams for their classmates. Then, all students in the class could use the diagrams to solve the problems.
- For **question 12**, students should recognize that the shortest side of a triangle is always opposite the smallest angle.
- For **questions 12** and **13**, students could use materials to create scale models, instead of drawing diagrams, to represent the situations and then use the scale models to solve the problems. Students could also use *The Geometer's Sketchpad®* to illustrate the information given in the questions. Provide copies of **T–2 *The Geometer's Sketchpad®* 4**.
- **Question 15** helps students to think three-dimensionally, solve a right triangle, and solve an oblique triangle. Students who have trouble visualizing this problem may benefit from modelling it using straws, string, or tape.

Differentiated Instruction

- Make up a number of questions such as **questions 5b)**, **6b)**, and **7**. After the lesson, use **four corners** to test students' understanding. Write two lengths and one angle on the board. Give students 30 s to think/sketch and then move to the appropriate corner of the room. The corners are labelled "One triangle," "Two triangles," "No triangles," and "I need help."

Technology Suggestions

- For applets to explore the sine law, go to **www.mcgrawhill.ca/books/mct12** and follow the links.
- Students can use **T1–3 Understanding the Ambiguous Case Using TI-Nspire™ CAS** or **T1–4 Understanding the Ambiguous Case Using *The Geometer's Sketchpad*®**. Students construct an obtuse triangle and explore the relationship between a and the product of b sin A to determine whether a triangle can be formed, whether there is one solution or two solutions, and whether the triangle is right or oblique. Provide copies of T–4 The TI-Nspire™ CAS Calculator.
- To access a TI-Nspire™ CAS file or *The Geometer's Sketchpad*® file to help students investigate the ambiguous case, go to the Online Learning Centre at **www.mcgrawhill.ca/books/mct12**.
- To access a TI-Nspire™ CAS file or *The Geometer's Sketchpad*® file to help students investigate **question 12**, go to **www.mcgrawhill.ca/books/mct12** and access the Online Learning Centre.
- For **question 12**, students may wish to construct a diagram using a TI-Nspire™ CAS **Graphs & Geometry** page or *The Geometer's Sketchpad*®. An appropriate scale in this case is 1 unit to 2 ft.
  - Draw a horizontal line segment, 10 units long, using the scale specified.
  - Construct a point not on the segment.
  - Construct line segments joining the point to each end of the horizontal line segment.
  - Measure the angles formed by the horizontal line segment and each segment through the constructed point. Move the point so that these angles measure 32° and 65°.
  - Find the point of intersection of the line segments.
  - Measure the length of the shortest side. Use the scale to convert this length to the correct units.

Mathematical Process Expectations

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

Process Expectation	Selected Questions
Problem Solving	10–15
Reasoning and Proving	9
Reflecting	5–7, 14
Selecting Tools and Computational Strategies	3, 4, 8
Connecting	8–10
Representing	8, 9, 12, 13
Communicating	4, 12, 14

Ongoing Assessment

- Use **A–1 Problem Solving** to assess students' answers for **question 12**.