CHAPTER

4 Trigonometry

Vocabulary

angle of depression
angle of elevation
cosine law
sine law

Curriculum Expectations

Trigonometric Functions

By the end of this course, students will:

1.1 solve problems, including those that arise from real-world applications (e.g., surveying, navigation), by determining the measures of the sides and angles of right triangles using the primary trigonometric ratios

1.2 solve problems involving two right triangles in two dimensions

1.3 verify, through investigation using technology (e.g., dynamic geometry software, spreadsheet), the sine law and the cosine law (e.g., compare, using dynamic geometry software, the ratios $\frac{a}{\sin A}$, $\frac{b}{\sin B}$, and $\frac{c}{\sin C}$ in triangle ABC while dragging one of the vertices)

1.4 describe conditions that guide when it is appropriate to use the sine law or the cosine law, and use these laws to calculate sides and angles in acute triangles

1.5 solve problems that require the use of the sine law or the cosine law in acute triangles, including problems arising from real-world applications (e.g., surveying, navigation, building construction)

Chapter 4 Planning Chart

Section	Suggested Timing	Student Text Page(s)	Materials and Technology Tools
Chapter 4 Opener	10–15 min	182–183	
Prerequisite Skills	80 min	184–185	
4.1 Use Trigonometry to Find Lengths	80 min	186–191	• drinking straws • metre sticks or tape measures • protractors • string • tape • weights (e.g., paper clips)
4.2 Use Trigonometry to Find Angles	80 min	192–196	
4.3 Solve Problems Involving Two Right Triangles	80–160 min	197–201	• letter-sized paper • protractors • rulers
4.4 Investigate the Sine Law	80–160 min	202–209	• computers with *The Geometer's Sketchpad*® • protractors • rulers
4.5 Investigate the Cosine Law	80–160 min	210–215	• computers with *The Geometer's Sketchpad*®
4.6 Make Connections With the Sine Law and the Cosine Law	160 min	216–221	
Chapter 4 Review	80 min	222–223	
Chapter 4 Problem Wrap-Up	40 min	223	
Chapter 4 Practice Test	80 min	224–225	
Chapter 4 Task: Design Word Problems Using Trigonometry	80 min	226	• computers with *The Geometer's Sketchpad*® (optional)
Chapter 4 Task: Roof Truss	40 min	227	

Chapter 4 Blackline Masters Checklist

	BLM	Title	Purpose
Prerequisite Skills			
	BLM 4–1	Prerequisite Skills	Practice
	BLM 4–2	Prerequisite Skills Self-Assessment Checklist	Student Self-Assessment
4.1 Use Trigonometry to Find Lengths			
	BLM A–6	Knowledge and Understanding General Scoring Rubric	Assessment
	BLM A–11	Group Work Assessment Recording Sheet	Assessment
	BLM A–12	Group Work Assessment General Scoring Rubric	Assessment
	BLM 4–3	Section 4.1 Use Trigonometry to Find Lengths	Practice
4.2 Use Trigonometry to Find Angles			
	BLM A–8	Application General Scoring Rubric	Assessment
	BLM 4–4	Section 4.2 Use Trigonometry to Find Angles	Practice
	BLM 4–5	Section 4.2 Achievement Check Rubric	Assessment
4.3 Solve Problems Involving Two Right Angles			
	BLM A–7	Thinking General Scoring Rubric	Assessment
	BLM 4–6	Section 4.3 Solve Problems Involving Two Right Angles	Practice
4.4 Investigate the Sine Law			
	BLM T–2	*The Geometer's Sketchpad*® 3	Technology
	BLM T–3	*The Geometer's Sketchpad*® 4	Technology
	BLM A–9	Communication General Scoring Rubric	Assessment
	BLM 4–7	Section 4.4 Investigate the Sine Law	Practice
4.5 Investigate the Cosine Law			
	BLM T–2	*The Geometer's Sketchpad*® 3	Technology
	BLM T–3	*The Geometer's Sketchpad*® 4	Technology
	BLM A–17	Learning Skills Checklist	Assessment
	BLM 4–8	Section 4.5 Investigate the Cosine Law	Practice
4.6 Make Connections With the Sine Law and the Cosine Law			
	BLM A–4	Presentation Checklist	Assessment
	BLM 4–9	Section 4.6 Make Connections With the Sine Law and the Cosine Law	Practice
	BLM 4–10	Section 4.6 Achievement Check Rubric	Assessment
Chapter 4 Review			
	BLM 4–11	Chapter 4 Review	Practice
Chapter 4 Problem Wrap-Up			
	BLM 4–12	Chapter 4 Problem Wrap-Up Rubric	Summative Assessment
Chapter 4 Practice Test			
	BLM 4–13	Chapter 4 Practice Test	Diagnostic Assessment
	BLM 4–14	Chapter 4 Test	Summative Assessment
	BLM 4–15	Chapter 4 Practice Test Achievement Check Rubric	Assessment
Task: Design Word Problems Using Trigonometry			
	BLM T–2	*The Geometer's Sketchpad*® 3	Technology
	BLM T–3	*The Geometer's Sketchpad*® 4	Technology
	BLM 4–16	Chapter 4 Task Rubric: Design Word Problems Using Trigonometry	Assessment
Task: Roof Truss			
	BLM 4–17	Chapter 4 Task Rubric: Roof Truss	Assessment
	BLM 4-18	Chapter 4 BLM Answers	Answers

Prerequisite Skills

Student Text Pages
184–185

Suggested Timing
80 min

Related Resources
- BLM 4–1 Prerequisite Skills
- BLM 4–2 Prerequisite Skills Self-Assessment Checklist

Common Errors

- Some students may label the hypotenuse of a triangle as the adjacent side.

R_x Have students label the longest side as the hypotenuse first. Then draw a straight arrow to the opposite side and a curved arrow to the adjacent side.

- Some students may have difficulties with rearranging formulas.

R_x Review the order of operations and use a balance system to "undo" the formula.

Accommodations

Spatial–have students work with a partner to draw the triangles for **question 11**

Memory–have students prepare a glossary of terms, such as *hypotenuse, sine ratio,* and *complementary angle,* used in the Prerequisite Skills. Encourage students to sketch and label diagrams to illustrate the definitions.

Teaching Suggestions

- Remind students to make sure their calculators are in degree mode. Depending on the type of calculator they have, they should press DRG or MODE and set the calculator to degree mode.
- Provide a few examples of basic calculator trigonometry and the Pythagorean theorem, similar to those in **questions 1 to 6**.
- Have students draw right triangles. In each triangle, have them label one angle θ, then label the sides *opposite, adjacent,* and *hypotenuse*. This should reinforce to students that the opposite and adjacent sides are relative to the angle of interest.
- Remind students of how a triangle is labelled. Uppercase letters are used to label angles and lowercase letters are used to label the sides. Also, mention that the sides of triangles can be labelled with the uppercase letters at the vertices or with the lowercase letter of the angle opposite the side. For example, in $\triangle ABC$, the sides of the triangle are AB, AC, and BC or c, b, and a, respectively.
- For **question 13**, students may benefit from working through some examples of rearranging formulas.
- Review the vocabulary in the exercise, namely *supplementary angles*, *complementary angles*, *isosceles triangle*, *acute angle*, *right angle,* and *obtuse angle*.
- You may wish to have students work in pairs to complete the prerequisite skills exercise. Have them write the answers on the board and discuss their answers with the class.
- Use **BLM 4–1 Prerequisite Skills** for remediation or extra practice. To further reinforce the concepts, you may wish to refer students to specific skills in the **Prerequisite Skills Appendix** on student text pages 420–435.

Assessment

- Assess student readiness to proceed by informal observation as students are working on the questions. A formal test is inappropriate since this material is not part of the curriculum to be covered by this chapter.
- Student self-assessment is also an effective technique; students can place a checkmark beside topics in the Prerequisite Skills in which they feel confident with the necessary skills. Use **BLM 4–2 Prerequisite Skills Self-Assessment Checklist** as a self-assessment for students.
- Remedial action can be taken in small groups or with a whole-class skills review.

Chapter Problem

- The Chapter Problem is introduced in the Chapter 4 Opener. Have students discuss their understanding of the topic. You may wish to have students complete the Chapter Problem revisits that occur throughout the chapter. These questions are designed to help students move toward the Chapter 4 Problem Wrap-Up at the end of the Chapter 4 Review.
- Alternatively, you may wish to assign the Chapter Problem when students have completed the chapter. The Chapter Problem is a summative assessment.