CHAPTER

7

Trigonometry of Right Triangles

Vocabulary

congruent figures
similar figures
isometry
scale factor, k
slope angle
tangent of an angle
primary trigonometric ratios
angle of depression
angle of elevation

Curriculum Expectations

Trigonometry

Investigating Similarity and Solving Problems Involving Similar Triangles

By the end of this chapter, students will

TR1.01 verify, through investigation (e.g., using dynamic geometry software, concrete materials), the properties of similar triangles (e.g., given similar triangles, verify the equality of corresponding angles and the proportionality of corresponding sides);

TR1.02 describe and compare the concepts of similarity and congruence;

TR1.03 solve problems involving similar triangles in realistic situations (e.g., shadows, reflections, scale models, surveying). (***Sample problem:*** Use a metre stick to determine the height of a tree, by means of the similar triangles formed by the tree, the metre stick, and their shadows.)

Solving Problems Involving the Trigonometry of Right Triangles

By the end of this chapter, students will

TR2.01 determine, through investigation (e.g., using dynamic geometry software, concrete materials), the relationship between the ratio of two sides in a right triangle and the ratio of the two corresponding sides in a similar right triangle, and define the sine, cosine, and tangent ratios (e.g., $\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$);

TR2.02 determine the measures of the sides and angles in right triangles, using the primary trigonometric ratios and the Pythagorean theorem;

TR2.03 solve problems involving the measures of sides and angles in right triangles in real-life applications (e.g., in surveying, in navigating, in determining the height of an inaccessible object around the school), using the primary trigonometric ratios and the Pythagorean theorem.

Chapter Problem

The Chapter Problem is introduced in the Chapter 7 Opener. Ask if students have ever seen reality television shows such as *The Amazing Race* or *Lost*. The idea is similar here, but instead of physical challenges to solve for clues, they will need to solve mathematical problems involving similar triangles and right angle trigonometry. Have students complete the Chapter Problem revisits that occur throughout the chapter. These questions are designed to help students move toward the Chapter 7 Problem Wrap-Up on page 389.

Alternatively, only assign the Chapter Problem when students have completed the chapter. The Chapter Problem is a summative assessment.

Chapter 7 Planning Chart

Section Suggested Timing	Student Text Pages	Teacher's Resource Blackline Masters	Assessment	Tools
Chapter 7 Opener • 10 min	324–325			
Get Ready • 80 min	326–329	• G–1 Grid Paper • BLM 7–1 Great North American Trigonometry Race Map • BLM 7–2 Get Ready	• BLM 7–3 Get Ready Self-Assessment Checklist	**Tools** • grid paper • ruler
7.1 Investigate Properties of Similar Triangles • 80 min	330–335	• G–4 Protractor • BLM 7–4 Shed Drawing • BLM 7–5 Truss Bridge • BLM 7–6 Section 7.1 Practice Master	• A–4 Presentation Checklist • A–23 News Report Checklist	**Tools** • copy of shed drawing • ruler • protractor • tracing paper **Technology Tools** • Internet access
Use Technology: Create Designs With Similar and Congruent Figures Using Dynamic Geometry Software • 40–80 min	336–341	• T–4 *The Geometer's Sketchpad*® 3 • T–5 *The Geometer's Sketchpad*® 4		**Technology Tools** • computer • *The Geometer's Sketchpad*® • graphing calculator • Cabri® Jr.
7.2 Use Similar Triangles to Solve Problems • 80–160 min	342–351	• BLM 7–1 Great North American Trigonometry Race Map • BLM 7–7 Making a Clinometer • BLM 7–8 Section 7.2 Practice Master	• BLM 7–9 Section 7.2 Achievement Check Rubric • A–6 Knowledge/Understanding General Scoring Rubric • A–22 Report Checklist	**Tools** • ruler • metre stick
7.3 The Tangent Ratio • 160 min	352–365	• G–1 Grid Paper • G–4 Protractor • T–4 *The Geometer's Sketchpad*® 3 • T–5 *The Geometer's Sketchpad*® 4 • BLM 7–10 Section 7.3 Practice Master	• A–7 Thinking General Scoring Rubric • A–22 Report Checklist	**Tools** • grid paper • protractor • ruler **Technology Tools** • computer • *The Geometer's Sketchpad*® • graphing calculator • Cabri® Jr.
7.4 The Sine and Cosine Ratios • 80–160 min	366–377	• G–1 Grid Paper • G–4 Protractor • T–4 *The Geometer's Sketchpad*® 3 • T–5 *The Geometer's Sketchpad*® 4 • BLM 7–1 Great North American Trigonometry Race Map • BLM 7–11 Overlapping Triangles • BLM 7–12 Section 7.4 Practice Master	• BLM 7–13 Section 7.4 Achievement Check Rubric • A–7 Thinking General Scoring Rubric • A–9 Communication General Scoring Rubric	**Tools** • grid paper • protractor • ruler **Technology Tools** • computer • *The Geometer's Sketchpad*® • graphing calculator • Cabri® Jr.
7.5 Solve Problems Involving Right Triangles • 80 min	378–385	• BLM 7–14 Section 7.5 Practice Master	• A–5 Problem Solving Checklist • A–18 My Progress as a Problem Solver	
Chapter 7 Review • 80 min	386–389	• G–4 Protractor • BLM 7–15 Chapter 7 Review		**Tools** • protractor • ruler
Chapter 7 Problem Wrap-Up • 30–40 min	389	• G–4 Protractor • T–4 *The Geometer's Sketchpad*® 3 • T–5 *The Geometer's Sketchpad*® 4 • BLM 7–1 Great North American Trigonometry Race Map	• BLM 7–16 Chapter 7 Problem Wrap-Up Rubric	**Tools** • grid paper • protractor • ruler **Technology Tools** • computer • *The Geometer's Sketchpad*®

Section Suggested Timing	Student Text Pages	Teacher's Resource Blackline Masters	Assessment	Tools
Chapter 7 Practice Test • 60–80 min	390–391	• G–4 Protractor • BLM 7–20 BLM Answers	• BLM 7–17 Chapter 7 Practice Test • BLM 7–18 Chapter 7 Test • BLM 7–19 Chapter 7 Practice Test Achievement Check Rubric	**Tools** • protractor • ruler

Chapter 7 Blackline Masters Checklist

	BLM	Title	Purpose
Get Ready			
	G–1	Grid Paper	Student Support
	BLM 7–1	Great North American Trigonometry Race Map	Student Support
	BLM 7–2	Get Ready	Practice
	BLM 7–3	Get Ready Self-Assessment Checklist	Student Self-Assessment
7.1 Investigate Properties of Similar Triangles			
	G–4	Protractor	Student Support
	BLM 7–4	Shed Drawing	Student Support
	BLM 7–5	Truss Bridge	Student Support
	BLM 7–6	Section 7.1 Practice Master	Practice
	A–4	Presentation Checklist	Assessment
	A–23	News Report Checklist	Assessment
Use Technology: Create Designs With Similar and Congruent Figures Using Dynamic Geometry Software			
	T–4	*The Geometer's Sketchpad*® 3	Technology
	T–5	*The Geometer's Sketchpad*® 4	Technology
7.2 Use Similar Triangles to Solve Problems			
	BLM 7–1	Great North American Trigonometry Race Map	Student Support
	BLM 7–7	Making a Clinometer	Student Support
	BLM 7–8	Section 7.2 Practice Master	Practice
	BLM 7–9	Section 7.2 Achievement Check Rubric	Assessment
	A–6	Knowledge/Understanding General Scoring Rubric	Assessment
	A–22	Report Checklist	Assessment
7.3 The Tangent Ratio			
	G–1	Grid Paper	Student Support
	G–4	Protractor	Student Support
	T–4	*The Geometer's Sketchpad*® 3	Technology
	T–5	*The Geometer's Sketchpad*® 4	Technology
	BLM 7–10	Section 7.3 Practice Master	Practice
	A–7	Thinking General Scoring Rubric	Assessment
	A–22	Report Checklist	Assessment

	BLM	Title	Purpose
7.4 The Sine and Cosine Ratios			
	G–1	Grid Paper	Student Support
	G–4	Protractor	Student Support
	T–4	*The Geometer's Sketchpad*® 3	Technology
	T–5	*The Geometer's Sketchpad*® 4	Technology
	BLM 7–1	Great North American Trigonometry Race Map	Student Support
	BLM 7–11	Overlapping Triangles	Student Support
	BLM 7–12	Section 7.4 Practice Master	Practice
	BLM 7–13	Section 7.4 Achievement Check Rubric	Assessment
	A–7	Thinking General Scoring Rubric	Assessment
	A–9	Communication General Scoring Rubric	Assessment
7.5 Solve Problems Involving Right Triangles			
	BLM 7–14	Section 7.5 Practice Master	Practice
	A–5	Problem Solving Checklist	Assessment
	A–18	My Progress as a Problem Solver	Student Self-Assessment
Chapter 7 Review			
	G–4	Protractor	Student Support
	BLM 7–15	Chapter 7 Review	Practice
Chapter 7 Problem Wrap-Up			
	G–4	Protractor	Student Support
	T–4	*The Geometer's Sketchpad*® 3	Technology
	T–5	*The Geometer's Sketchpad*® 4	Technology
	BLM 7–1	Great North American Trigonometry Race Map	Student Support
	BLM 7–16	Chapter 7 Problem Wrap-Up Rubric	Summative Assessment
Chapter 7 Practice Test			
	G–4	Protractor	Student Support
	BLM 7–17	Chapter 7 Practice Test	Diagnostic Assessment
	BLM 7–18	Chapter 7 Test	Summative Assessment
	BLM 7–19	Chapter 7 Practice Test Achievement Check Rubric	Assessment
	BLM 7–20	BLM Answers	Answers

Get Ready

Student Text Pages
326–329

Suggested Timing
80 min

Tools
- grid paper
- ruler

Related Resources
- G–1 Grid Paper
- BLM 7–1 Great North American Trigonometry Race Map
- BLM 7–2 Get Ready
- BLM 7–3 Get Ready Self-Assessment Checklist

TI-Navigator™

Go to **www.mcgrawhill.ca/books/principles10** and follow the links to the file for this section.

Common Errors

- Some students may identify co-interior angles as being equal, or alternate or corresponding angles as being supplementary, when looking at angles formed by parallel lines and a transversal.

R_x Have students consider whether the angles appear to be acute or obtuse. This should make it obvious which relationship applies.

- When writing a proportion, some students may reverse the order of the terms in one ratio.

R_x Have students write what the numerator and denominator of the fraction represent, to use as a guide when writing the terms of the proportion.

Accommodations

Perceptual—Encourage students to create mathematical models to illustrate transformations.

Spatial—Allow students to use *The Geometer's Sketchpad*® when working through the questions related to slope.

Memory—Let students use alternative forms of the Pythagorean theorem to solve for sides that are not the hypotenuse. For example: For $\triangle ABC$, where c is the hypotenuse, find side c by using $c^2 = a^2 + b^2$, side a by using $a^2 = c^2 - b^2$, and side b by using $b^2 = c^2 - a^2$.

Teaching Suggestions

- The section on Angle Properties challenges students' ability to reason and prove by thinking deductively. Have students work in pairs, either to come up with solutions collaboratively or to share their individual approaches.
- Students have seen the Pythagorean theorem in both grades 8 and 9, and should be fairly comfortable using it. Have students complete these questions independently. Encourage good mathematical form, consistency of units, etc.
- Students should also have had extensive experience in calculating slope, both in grade 9 and earlier in grade 10. Have students work independently on the questions in this section, emphasizing that rise and run must be expressed in common units, and that final answers can be expressed either as a fraction in lowest terms or a decimal.
- When working with ratios, it is important to express equivalent ratios with terms written in the correct sequence. For example, when working with a scale diagram or map, the actual distance must go either always in the numerator or always in the denominator. Suggests that students write these words as a fraction, as presented in the flea example. Use **BLM 7–1 Great North American Trigonometry Race Map** to support question 11.
- Students should be familiar with transformations, although it may have been a year or two since they did much work with them. Give a short demonstration or activity using *The Geometer's Sketchpad*®, which will prepare them for the Use Technology activity that follows Section 7.1.
- Use **BLM 7–2 Get Ready** for remediation or extra practice.

Assessment

Assess student readiness to proceed by informal observation as students are working on the exercises. A formal test would be inappropriate since this material is not part of the grade 10 curriculum for this chapter. Student self-assessment is also an effective technique; students can place a check mark beside topics in the Get Ready for which they feel confident of having the necessary skills. Use **BLM 7–3 Get Ready Self-Assessment Checklist** as a self-assessment for students. Remedial action can be taken in small groups or with a whole class skill review.