6 Geometry in Design

Strand
Geometry and Trigonometry

Student Text Pages
292–351

Suggested Timing
10–15 min

Related Resources
BLM A-4 Presentation Checklist

Key Terms

constraint
golden ratio
golden rectangle
isometric perspective drawing
net
orthographic drawings
orthographic projection
pattern
plan
scale model
tessellation

Additional information and teaching materials for this chapter are available on the McGraw-Hill Ryerson Web-site at *www.mcgrawhill.ca/books/foundations11*. You will need your password to access this material.

Chapter Curriculum Specific Expectations

Representing Two-Dimensional Shapes and Three-Dimensional Figures

In this chapter, students will

GT1.01 identify real-world applications of geometric shapes and figures, through investigation (e.g., by importing digital photos into dynamic geometry software), in a variety of contexts (e.g., product design, architecture, fashion), and explain these applications (e.g., one reason that sewer covers are round is to prevent them from falling into the sewer during removal and replacement)

GT1.02 represent three-dimensional objects, using concrete materials and design or drawing software, in a variety of ways (e.g., orthographic projections [i.e., front, side, and top views]; perspective isometric drawings; scale models)

GT1.03 create nets, plans, and patterns from physical models arising from a variety of real-world applications (e.g., fashion design; interior decorating; building construction), by applying the metric and imperial systems and using design or drawing software

GT1.04 solve design problems that satisfy given constraints (e.g., design a rectangular berm that would contain all the oil that could leak from a cylindrical storage tank of a given height and radius), using physical models (e.g., built from popsicle sticks, cardboard, duct tape) or drawings (e.g., made using design or drawing software), and state any assumptions made

Technology

- The curriculum expectations for this course require heavy use of technology. Strong support for technology use has been included in the lesson design.
- Activities involving technology in this chapter are heavily scaffolded. In addition, you can refer to the Technology Appendix in the student book and the related technology BLMs for help or review.
- See the McGraw-Hill Ryerson Web-site at *www.mcgrawhill.ca/books/foundations11* for additional materials such as tutorials, ready-made sketches, and other resources.
- Problems of access to technology occur in most schools. Every attempt has been made to provide alternative paper and pencil activities. Although these ensure that the content can be taught, it is important to use technology as frequently as possible.

Teaching Suggestions

Chapter Opener

- Ask students to identify geometric shapes that appear on clothing or accessories. Some examples include eyeglasses, MP3 players, cell phones, and backpacks.
- Refer students to the chapter opener photograph. Ask students to identify geometric shapes in the photograph. Look for small examples, like the sphere at the end of the microphone.

- Ask students to identify geometric shapes that they have seen in local construction: buildings, monuments, transit shelters, and so on.
- Ask students which occupations might require knowledge of geometry. Some examples are architect, construction worker, musician, artist, graphic designer, and fashion consultant.

Career Profile

Have students discuss what they know about graphic design. As an extension, have students research this career and other similar careers, and present their findings to the class. You may wish to use **BLM A-4 Presentation Checklist** to assess students' presentations.

Using their research, have students discuss:
- What a graphic designer does.
- What type of education and training are needed for this career.
- Another career that is similar.
- The differences in the training and education required for the similar career.

You may wish to have students include their research in their portfolios.

For more career resources for your students, see the McGraw-Hill Ryerson Web-site at *www.mcgrawhill.ca/books/foundations11*.

Chapter 6 Planning Chart

Section Suggested Timing	Student Text Page(s)	Teacher's Resource Blackline Masters	Assessment	Tools
Chapter 6 Opener • 10–15 min	292–293		• BLM A-4 Presentation Checklist	
Prerequisite Skills • 40–80 min	294–295	• BLM 6-1 Prerequisite Skills Practice	• BLM 6-2 Prerequisite Skills Self-Assessment Checklist	
6.1 Investigate Geometric Shapes and Figures • 80 min	296–305	• BLM 6-3 Section 6.1 Investigate Geometric Shapes and Figures • BLM 6-4 Section 6.1 Pattern Block Template • BLM G-1 Grid Paper • BLM G-6 Centimetre Grid Paper • BLM T-2 *The Geometer's Sketchpad® 3* • BLM T-3 *The Geometer's Sketchpad® 4* • BLM 6-5 Section 6.1 Literacy Connect	• BLM 6-6 Section 6.1 Achievement Check Rubric • BLM A-18 Opinion Piece Checklist	• copy of Leonardo da Vinci's painting *Mona Lisa* • rulers • computers • *The Geometer's Sketchpad®* • centimetre grid paper • coloured pencils or markers • pattern blocks, pentominoes, or tangrams • pattern block applet • grid paper • size A4 paper
6.2 Perspective and Orthographic Drawings • 80 min	306–317	• BLM 6-7 Section 6.2 Perspective and Orthographic Drawings • BLM G-4 Square Dot Paper • BLM G-5 Isometric Dot Paper • BLM T-2 *The Geometer's Sketchpad®3* • BLM T-3 *The Geometer's Sketchpad®4*	• BLM A-7 Thinking General Scoring Rubric	• isometric dot paper • linking cubes • rulers • coloured pencils • grid paper • computers • *The Geometer's Sketchpad®* • square dot paper
6.3 Create Nets, Plans, and Patterns • 80–160 min	318–326	• BLM 6-8 Section 6.3 Create Nets, Plans, and Patterns • BLM 6-9 Section 6.3 Net for an Octahedron • BLM 6-10 Section 6.3 Net for Question 5 • BLM 6-11 Section 6.3 Net for a Dodecahedron • BLM T-2 *The Geometer's Sketchpad®3* • BLM T-3 *The Geometer's Sketchpad®4*	• BLM A-18 Opinion Piece Checklist	• empty cereal boxes • scissors • rulers • tape • empty tissue roll • old T-shirts or other simple items of clothing • newsprint • computers • *The Geometer's Sketchpad®*
6.4 Scale Models • 80 min	327–334	• BLM 6-12 Section 6.4 Scale Models • BLM 6-13 Section 6.4 Use the Transform Menu in *The Geometer's Sketchpad®* • BLM G-4 Square Dot Paper • BLM G-5 Isometric Dot Paper • BLM T-2 *The Geometer's Sketchpad®3* • BLM T-3 *The Geometer's Sketchpad®4*	• BLM A-8 Application General Scoring Rubric	• scissors • protractors • rulers • tape • square dot paper • computers • *The Geometer's Sketchpad®* • isometric dot paper
6.5 Solve Problems With Given Constraints • 80–160 min	335–345	• BLM 6-14 Section 6.5 Solve Problems With Given Constraints • BLM G-4 Square Dot Paper • BLM G-5 Isometric Dot Paper • BLM T-2 *The Geometer's Sketchpad®3* • BLM T-3 *The Geometer's Sketchpad®4*	• BLM 6-15 Section 6.5 Achievement Check Rubric	• square dot paper • isometric dot paper • computers • *The Geometer's Sketchpad®*

Section Suggested Timing	Student Text Page(s)	Teacher's Resource Blackline Masters	Assessment	Tools
Chapter 6 Review • 80 min	346–347	• BLM 6-16 Chapter 6 Review • BLM G-4 Square Dot Paper		• linking cubes • square dot paper
Chapter 6 Practice Test • 40–80 min	348–349	• BLM G-4 Square Dot Paper • BLM G-5 Isometric Dot Paper	• BLM 6-17 Chapter 6 Practice Test • BLM 6-18 Chapter 6 Test	• square dot paper • isometric dot paper
Chapter 6 Problem Wrap-Up • 80 min	349	• BLM G-4 Square Dot Paper • BLM G-5 Isometric Dot Paper	• BLM 6-19 Chapter 6 Problem Wrap-Up Rubric	• square dot paper • isometric dot paper
Chapters 4 to 6 Review • 80 min	350–351	• BLM G-1 Grid Paper • BLM G-4 Square Dot Paper • BLM G-5 Isometric Dot Paper	• BLM A-13 Self-Assessment Recording Sheet • BLM A-14 Self-Assessment Checklist	• grid paper • square dot paper • isometric dot paper

Chapter 6 Blackline Masters Checklist

	Title		Purpose
Chapter 6 Opener			
	BLM A-4	Presentation Checklist	Assessment
Prerequisite Skills			
	BLM 6-1	Prerequisite Skills	Practice
	BLM 6-2	Prerequisite Skills Self-Assessment Checklist	Self-Assessment
6.1 Investigate Geometric Shapes and Figures			
	BLM 6-3	Section 6.1 Investigate Geometric Shapes and Figures	Practice
	BLM 6-4	Section 6.1 Pattern Block Template	Student Support
	BLM 6-5	Section 6.1 Literacy Connect	Literacy
	BLM 6-6	Section 6.1 Achievement Check Rubric	Assessment
	BLM G-1	Grid Paper	Student Support
	BLM G-6	Centimetre Grid Paper	Student Support
	BLM T-2	*The Geometer's Sketchpad® 3*	Technology Support
	BLM T-3	*The Geometer's Sketchpad® 4*	Technology Support
	BLM A-18	Opinion Piece Checklist	Assessment
6.2 Perspective and Orthographic Drawings			
	BLM 6-7	Section 6.2 Perspective and Orthographic Drawings	Practice
	BLM G-4	Square Dot Paper	Student Support
	BLM G-5	Isometric Dot Paper	Student Support
	BLM T-2	*The Geometer's Sketchpad® 3*	Technology Support
	BLM T-3	*The Geometer's Sketchpad® 4*	Technology Support
	BLM A-7	Thinking General Scoring Rubric	Assessment
6.3 Create Nets, Plans, and Patterns			
	BLM 6-8	Section 6.3 Create Nets, Plans, and Patterns	Practice
	BLM 6-9	Section 6.3 Net for an Octahedron	Student Support
	BLM 6-10	Section 6.3 Net for Question 5	Student Support
	BLM 6-11	Section 6.3 Net for a Dodecahedron	Student Support
	BLM T-2	*The Geometer's Sketchpad® 3*	Technology Support
	BLM T-3	*The Geometer's Sketchpad® 4*	Technology Support
	BLM A-18	Opinion Piece Checklist	Assessment
6.4 Scale Models			
	BLM 6-12	Section 6.4 Scale Models	Practice
	BLM 6-13	Section 6.4 Use the Transform Menu in *The Geometer's Sketchpad®*	Technology Support
	BLM G-4	Square Dot Paper	Student Support
	BLM G-5	Isometric Dot Paper	Student Support
	BLM T-2	*The Geometer's Sketchpad® 3*	Technology Support
	BLM T-3	*The Geometer's Sketchpad® 4*	Technology Support
	BLM A-8	Application General Scoring Rubric	Assessment

6.5 Solve Problems With Given Constraint			
	BLM 6-14	Section 6.5 Solve Problems With Given Constraints	Practice
	BLM 6-15	Section 6.5 Achievement Check Rubric	Assessment
	BLM G-4	Square Dot Paper	Student Support
	BLM G-5	Isometric Dot Paper	Student Support
	BLM T-2	*The Geometer's Sketchpad® 3*	Technology Support
	BLM T-3	*The Geometer's Sketchpad® 4*	Technology Support
Chapter 6 Review			
	BLM 6-16	Chapter 6 Review	Review
	BLM G-4	Square Dot Paper	Student Support
Chapter 6 Practice Test			
	BLM 6-17	Chapter 6 Practice Test	Diagnostic Assessment
	BLM 6-18	Chapter 6 Test	Summative Assessment
	BLM G-4	Square Dot Paper	Student Support
	BLM G-5	Isometric Dot Paper	Student Support
Chapter 6 Problem Wrap-Up			
	BLM 6-19	Chapter 6 Problem Wrap-Up Rubric	Summative Assessment
	BLM G-4	Square Dot Paper	Student Support
	BLM G-5	Isometric Dot Paper	Student Support
Chapters 4 to 6 Review			
	BLM G-1	Grid Paper	Student Support
	BLM G-4	Square Dot Paper	Student Support
	BLM G-5	Isometric Dot Paper	Student Support
	BLM A-13	Self-Assessment Recording Sheet	Assessment
	BLM A-14	Self-Assessment Checklist	Assessment

Prerequisite Skills

Student Text Pages
294–295

Suggested Timing
40–80 min

Related Resources
BLM 6-1 Prerequisite Skills Practice
BLM 6-2 Prerequisite Skills Self-Assessment Checklist

Common Errors

- Some students may obtain incorrect answers through misuse of the calculator or pressing an incorrect key.

R_x Have students routinely estimate and record the expected answer before using a calculator.

- Some students may evaluate the operations in the incorrect order.

R_x When reviewing calculations involving the more complicated formulas, revisit BEDMAS. Remind students that scientific and graphing calculators are programmed to follow the BEDMAS rules. When in doubt, students should use brackets to enforce a desired operation.

- Some students may miss one or more faces of a three-dimensional figure when calculating the surface area.

R_x Have models of some of the common solids available. Students should count the number of faces on the model.

- Some students may incorrectly assign measurements in questions that do not include diagrams.

R_x Have students sketch a diagram, and mark given measurements as appropriate. Sketching a diagram should become standard procedure when working through design problems.

- Some students have difficulty entering a complicated formula, such as the formula for the surface area of a cylinder, into a calculator in one step.

R_x Review calculator skills before assigning the Prerequisite Skills. Reinforce the skills as part of the wrap-up after the exercise has been completed.

Accommodations

Memory—index cards with formulas may be helpful

Visual—provide assistance for drawing diagrams

Perceptual—provide concrete models of shapes and figures

Teaching Suggestions

- This is a good opportunity to review proper calculator procedures, specifically in questions that involve more complicated formulas, such as **question 9**. Students should be able to enter the formula correctly, and obtain the final answer, in one step.
- All BLMs referred to throughout this chapter can be found on the *Foundations for College Mathematics 11 Teacher's Resource* CD-ROM.

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 grade 11 curriculum for 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 6-2 Prerequisite Skills Self-Assessment Checklis**t as a self-assessment for students.
- Remedial action can be taken in small groups or with a whole-class skills review.

Extra Practice

- Use **BLM 6-1 Prerequisite Skills** for extra practice or remediation.

Chapter Problem

- The Chapter Problem is introduced on page 295. Have students discuss their understanding of the topic. Ask them to speculate on the types of tasks that Paul may be asked to complete during his co-op placement. The intent is to get students thinking about the connections between the mathematics they will learn in this chapter, and how the mathematics is used in a real-world situation. You may wish to have students complete the Chapter Problem revisits as they occur throughout the chapter. These questions are designed to help students move toward the Chapter 6 Problem Wrap-Up on page 349.
- Alternatively, you may wish to assign the Chapter Problem questions and Chapter Problem Wrap-Up after students have complete the chapter, as part of a summative assessment. Alert students to the format of the Wrap-Up a few days before you arrive at it. Since they must select a practical design project, they should be given an opportunity to look for possible candidates in their everyday surroundings and activities.