4 Quadratic Relations I

Strand
Mathematical Models

Student Text Pages
164–229

Suggested Timing
10–15 min

Related Resources
BLM A-4 Presentation Checklist

Key Terms

mathematical model
maximum
minimum
parabola
vertex
vertex form of a quadratic relation

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

Investigating the Basic Properties of Quadratic Relations

In this chapter, students will

MM1.01 construct tables of values and graph quadratic relations arising from real-world applications (e.g., dropping a ball from a given height; varying the edge length of a cube and observing the effect on the surface area of the cube)

MM1.02 determine and interpret meaningful values of the variables, given a graph of a quadratic relation arising from a real-world application

MM1.03 determine, through investigation using technology, and describe the roles of a, h, and k in quadratic relations of the form $y = a(x - h)^2 + k$ in terms of transformations on the graph of $y = x^2$ (i.e., translations; reflections in the x-axis; vertical stretches and compressions)

MM1.04 sketch graphs of quadratic relations represented by the equation $y = a(x - h)^2 + k$ (e.g., using the vertex and at least one point on each side of the vertex; applying on e or more transformations to the graph of $y = x^2$)

Teaching Suggestions

Chapter Opener

- Most game software uses what is known as a "physics engine" to control the motion of the objects in the game. The better the physics engine, the more realistic the game.
- You may wish to discuss the key terms. Focus on which terms are familiar to students and identify which terms may be new.
- Outline the expectations to give students a sense of what they will learn in this unit.

Career Profile

Have students discuss the differences between industrial design and interior design. As an extension, have students research a career in industrial design, 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 an industrial designer does.
- What type of education and training are needed for this career.
- How the course at the Ontario College of Art and Design (OCAD) differs from the one offered at Humber College.

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 4 Planning Chart

Section Suggested Timing	Student Text Page(s)	Teacher's Resource Blackline Masters	Assessment	Tools
Chapter 4 Opener • 10–15 min	164–165		• BLM A-4 Presentation Checklist	
Prerequisite Skills • 80 min	166–167	• BLM 4-1 Prerequisite Skills • BLM G-1 Grid Paper • BLM G-3 Four Quadrant Grids	• BLM 4-2 Prerequisite Skills Self-Assessment Checklist	• grid paper
4.1 Modelling With Quadratic Relations • 80–160 min	168–179	• BLM 4-3 Section 4.1 Modelling With Quadratic Relations • BLM G-1 Grid Paper • BLM G-3 Four Quadrant Grids	• BLM 4-4 Section 4.1 Achievement Check Rubric	• calculators • grid paper • graphing calculators • computers • *The Geometer's Sketchpad*®
4.2 The Quadratic Relation $y = ax^2 + k$ • 80–160 min	180–193	• BLM 4-5 Section 4.2 The Quadratic Relation $y = ax^2 + k$ • BLM G-1 Grid Paper • BLM G-3 Four Quadrant Grids • BLM T-2 *The Geometer's Sketchpad*® 3 • BLM T-3 *The Geometer's Sketchpad*® 4	• BLM A-6 Knowledge and Understanding General Scoring Rubric	• grid paper • graphing calculators • computers • *The Geometer's Sketchpad*®
4.3 The Quadratic Relation $y = a(x - h)^2$ • 80–160 min	194–203	• BLM 4-6 Section 4.3 The Quadratic Relation $y = a(x - h)^2$ • BLM G-1 Grid Paper • BLM G-3 Four Quadrant Grids	• BLM A-9 Communication General Scoring Rubric	• grid paper • graphing calculators • computers • *The Geometer's Sketchpad*®
4.4 The Quadratic Relation $y = a(x - h)^2 + k$ • 80–160 min	204–217	• BLM 4-7 Section 4.4 The Quadratic Relation $y = a(x - h)^2 + k$ • BLM G-1 Grid Paper • BLM G-3 Four Quadrant Grids	• BLM 4-8 Section 4.4 Achievement Check Rubric	• grid paper • graphing calculators • computers • *The Geometer's Sketchpad*®
4.5 Interpret Graphs of Quadratic Relations • 80–160 min	218–225	• BLM 4-9 Section 4.5 Interpret Graphs of Quadratic Relations • BLM 4-10 Section 4.5 Investigate • BLM G-1 Grid Paper		• grid paper • graphing calculators • computers • *The Geometer's Sketchpad*®
Chapter 4 Review • 80–160 min	226–227	• BLM 4-11 Chapter 4 Review • BLM G-1 Grid Paper • BLM G-3 Four Quadrant Grids		• grid paper
Chapter 4 Practice Test • 80 min	228–229	• BLM G-1 Grid Paper • BLM G-3 Four Quadrant Grids	• BLM 4-12 Chapter 4 Practice Test • BLM 4-13 Chapter 4 Test	• grid paper • pennies or counters
Chapter 4 Problem Wrap-Up • 40 min	229		• BLM 4-14 Chapter 4 Problem Wrap-Up Rubric	

Chapter 4 Blackline Masters Checklist

	Title		Purpose
Chapter 4 Opener			
	BLM A-4	Presentation Checklist	Assessment
Prerequisite Skills			
	BLM 4-1	Prerequisite Skills	Practice
	BLM 4-2	Prerequisite Skills Self-Assessment Checklist	Self-Assessment
	BLM G-1	Grid Paper	Student Support
	BLM G-3	Four Quadrants	Student Support
4.1 Modelling With Quadratic Relations			
	BLM 4-3	Section 4.1 Modelling With Quadratic Relations	Practice
	BLM 4-4	Section 4.1 Achievement Check Rubric	Assessment
	BLM G-1	Grid Paper	Student Support
	BLM G-3	Four Quadrant Grids	Student Support
4.2 The Quadratic Relation $y = ax^2 + k$			
	BLM 4-5	Section 4.2 The Quadratic Relation $y = ax^2 + k$	Practice
	BLM G-1	Grid Paper	Student Support
	BLM G-3	Four Quadrant Grids	Student Support
	BLM T-2	*The Geometer's Sketchpad*® 3	Technology Support
	BLM T-3	*The Geometer's Sketchpad*® 4	Technology Support
	BLM A-6	Knowledge and Understanding General Scoring Rubric	Assessment
4.3 The Quadratic Relation $y = a(x - h)^2 + k$			
	BLM 4-6	Section 4.3 The Quadratic Relation $y = a(x - h)^2 + k$	Practice
	BLM A-9	Communication General Scoring Rubric	Student Support
	BLM G-1	Grid Paper	Assessment
	BLM G-3	Four Quadrant Grids	Student Support
4.4 The Quadratic Relation $y = a(x - h)^2 + k$			
	BLM 4-7	Section 4.4 The Quadratic Relation $y = a(x - h)^2 + k$	Practice
	BLM 4-8	Section 4.4 Achievement Check Rubric	Assessment
	BLM G-1	Grid Paper	Student Support
	BLM G-3	Four Quadrant Grids	Student Support
4.5 Interpret Graphs of Quadratic Relations			
	BLM 4-9	Section 4.5 Interpret Graphs of Quadratic Relations	Practice
	BLM G-1	Grid Paper	Assessment
	BLM 4-10	Section 4.5 Investigate	Assessment
Chapter 4 Review			
	BLM 4-11	Chapter 4 Review	Review
	BLM G-1	Grid Paper	Student Support
	BLM G-3	Four Quadrant Grids	Student Support
Chapter 4 Practice Test			
	BLM 4-12	Chapter 4 Practice Test	Diagnostic Assessment
	BLM 4-13	Chapter 4 Test	Summative Assessment
	BLM G-1	Grid Paper	Student Support
	BLM G-3	Four Quadrant Grids	Student Support
Chapter 4 Problem Wrap-Up			
	BLM 4-14	Chapter 4 Problem Wrap-Up Rubric	Summative Assessment
	BLM G-3	Four Quadrant Grids	Student Support

Prerequisite Skills

Student Text Pages
166–167

Suggested Timing
80 min

Tools
- grid paper

Related Resources
BLM 4-1 Prerequisite Skills
BLM 4-2 Prerequisite Skills Self-Assessment Checklist
BLM G-1 Grid Paper
BLM G-3 Four Quadrant Grids

Common Errors

- Some students may have problems adding with negative numbers. For example, some students may think $-11.3 + 3.6 = 14.9$.

R_x Have students place the first number on a number line and then add (move to the right) the appropriate number of places.

- Some students may forget to follow the order of operations when evaluating an expression, such as $y = 9(x - 12)^2 - 20$ for a given value of x.

R_x Have students discuss the proper order of operations rules.

Accommodations

Perceptual—for question 11, provide students with a handout of the graphs with one relation per grid

Gifted and Enrichment—provide students with several more complex transformations to try

Language—allow students to explain answers orally

Motor—provide students with enlarged copies of the tables

Teaching Suggestions

- The Prerequisite Skills section is a review of algebraic operations, linear relations, and transformations, topics students will need to be successful in when working with quadratic relations.
- You may wish to use the Prerequisite Skills as a diagnostic assessment to identify skills with which students need help so they can be successful in this chapter.
- You may wish to provide students with copies of **BLM G-1 Grid Paper** or **BLM G-3 Four Quadrant Grids** for **question 9**.
- For **question 12**, you may need to remind students of the four types of transformations. The three that preserve size are translations (slides), rotations (turns), and reflections (flips). Dilatations enlarge or reduce an image.
- 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 4-2 Prerequisite Skills Self-Assessment Checklist** as a self-assessment for students.

Extra Practice

- Use **BLM 4-1 Prerequisite Skills** for extra practice or remediation.

Chapter Problem

- The Chapter Problem is introduced on page 167. 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 on page 229.
- Alternatively, you may wish to assign the Chapter Problem questions and Chapter Problem Wrap-Up when students have completed the chapter, as part of a summative assessment.