CHAPTER

6

Quadratic Equations

Vocabulary

completing the square
quadratic equation
root
quadratic formula

Curriculum Expectations

Quadratic Relations of the Form $y = ax^2 + bx + c$

Solving Quadratic Equations

By the end of this chapter, students will

QR3.03 determine, through investigation, and describe the connection between the factors of a quadratic expression and the x-intercepts (i.e., the zeros) of the graph of the corresponding quadratic relation, expressed in the form $y = a(x - r)(x - s)$;

QR3.04 interpret real and non-real roots of quadratic equations, through investigation using graphing technology, and relate the roots to the x-intercepts of the corresponding relations;

QR3.05 express $y = ax^2 + bx + c$ in the form $y = a(x - h)^2 + k$ by completing the square in situations involving no fractions, using a variety of tools (e.g., concrete materials, diagrams, paper and pencil);

QR3.06 sketch or graph a quadratic relation whose equation is given in the form $y = ax^2 + bx + c$, using a variety of methods (e.g., sketching $y = x^2 - 2x - 8$ using intercepts and symmetry; sketching $y = 3x^2 - 12x + 1$ by completing the square and applying transformations; graphing $h = -4.9t^2 + 50t + 1.5$ using technology);

QR3.07 explore the algebraic development of the quadratic formula (e.g., given the algebraic development, connect the steps to a numerical example; follow a demonstration of the algebraic development [student reproduction of the development of the general case is not required]);

QR3.08 solve quadratic equations that have real roots, using a variety of methods (i.e., factoring, using the quadratic formula, graphing). (***Sample problems:*** Solve $x^2 + 10x + 16 = 0$ by factoring, and verify algebraically. Solve $x^2 + x - 4 = 0$ using the quadratic formula, and verify graphically using technology. Solve $-4.9t^2 + 50t + 1.5 = 0$ by graphing $h = -4.9t^2 + 50t + 1.5$ using technology.)

Solving Problems Involving Quadratic Relations

By the end of this chapter, students will

QR4.01 determine the zeros and the maximum or minimum value of a quadratic relation from its graph (i.e., using graphing calculators or graphing software) or from its defining equation (i.e., by applying algebraic techniques);

QR4.02 solve problems arising from a realistic situation represented by a graph or an equation of a quadratic relation, with and without the use of technology (e.g., given the graph or the equation of a quadratic relation representing the height of a ball over elapsed time, answer questions such as the following: What is the maximum height of the ball? After what length of time will the ball hit the ground? Over what time interval is the height of the ball greater than 3 m?).

Chapter Problem

The Chapter Problem is introduced in the Chapter 6 Opener. Have students discuss their understanding of how a circular cross section would look different from a parabolic one. Have students complete the Chapter Problem revisits that occur throughout the chapter. These questions are designed to help students move toward the Chapter 6 Problem Wrap-Up on page 317.

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

Chapter 6 Planning Chart

Section Suggested Timing	Student Text Pages	Teacher's Resource Blackline Masters	Assessment	Tools
Chapter 6 Opener • 10 min	260–261			
Get Ready • 70 min	262–263	• G–1 Grid Paper • G–3 Coordinate Grids • BLM 6–1 Factor Quadratic Expressions • BLM 6–2 Get Ready	• BLM 6–3 Get Ready Self-Assessment Checklist	**Tools** • grid paper **Technology Tools** • graphing calculator
6.1 Maxima and Minima • 70–140 min	264–273	• G–1 Grid Paper • G–2 Placemat • G–3 Coordinate Grids • T–4 *The Geometer's Sketchpad*® 3 • T–5 *The Geometer's Sketchpad*® 4 • BLM 6–4 Section 6.1 Practice Master		**Tools** • algebra tiles • grid paper **Technology Tools** • graphing calculator • computer • *The Geometer's Sketchpad*® • Algebra Tiles.gsp
6.2 Solve Quadratic Equations • 70 min	274–281	• T–7 The Computer Algebra System (CAS) on the TI-89 Calculator • BLM 6–5 Section 6.2 Practice Master	• BLM 6–6 Section 6.2 Achievement Check Rubric • A–6 Knowledge/Understanding General Scoring Rubric	**Technology Tools** • TI-89 calculator
6.3 Graph Quadratics Using the x-Intercepts • 70 min	282–291	• G–1 Grid Paper • G–3 Coordinate Grids • BLM 6–7 Section 6.3 Practice Master	• A–8 Application General Scoring Rubric • A–9 Communication General Scoring Rubric	**Tools** • grid paper **Technology Tools** • graphing calculator
6.4 The Quadratic Formula • 70 min	292–303	• G–1 Grid Paper • G–3 Coordinate Grids • BLM 6–8 Section 6.4 Practice Master	• BLM 6–9 Section 6.4 Achievement Check Rubric	**Tools** • grid paper **Technology Tools** • graphing calculator
6.5 Solve Problems Using Quadratic Equations • 140–210 min	304–315	• T–1 Corel® *Quattro Pro*® 8 • T–2 Corel® *Quattro Pro*® 10 • T–3 Microsoft® *Excel* • BLM 6–10 Section 6.5 Practice Master	• A–5 Problem Solving Checklist • A–18 My Progress as a Problem Solver	**Technology Tools** • graphing calculator • computer • spreadsheet software • Internet access
Chapter 6 Review • 70 min	316–317	• G–1 Grid Paper • G–3 Coordinate Grids • BLM 6–11 Chapter 6 Review	• A–16 My Progress as a Mathematician	**Tools** • algebra tiles • grid paper **Technology Tools** • graphing calculator
Chapter 6 Problem Wrap-Up • 30 min	317	• G–1 Grid Paper • G–3 Coordinate Grids	• BLM 6–12 Chapter 6 Problem Wrap-Up Rubric	**Tools** • grid paper **Technology Tools** • graphing calculator
Chapter 6 Practice Test • 70 min	318–319	• G–1 Grid Paper • G–3 Coordinate Grids • T–7 The Computer Algebra System (CAS) on the TI-89 Calculator	• BLM 6–13 Chapter 6 Practice Test • BLM 6–14 Chapter 6 Test • BLM 6–15 Chapter 6 Practice Test Achievement Check Rubric	**Tools** • grid paper **Technology Tools** • graphing calculator • TI-89 calculator
Chapters 4 to 6 Review • 70 min	320–321	• G–1 Grid Paper • G–3 Coordinate Grids	• A–14 Self-Assessment Recording Sheet • A–15 Self-Assessment Checklist	**Tools** • grid paper **Technology Tools** • graphing calculator
Task: Cari Sports Centre • 25–35 min	322	• G–1 Grid Paper • G–3 Coordinate Grids	• BLM 6–16 Task: Cari Sports Centre Rubric	**Tools** • grid paper **Technology Tools** • graphing calculator
Task: York Leisure Centre • 30–40 min	323	• G–1 Grid Paper • G–3 Coordinate Grids	• BLM 6–17 Task: York Leisure Centre Rubric	**Tools** • grid paper **Technology Tools** • graphing calculator
Task: Abbey Leisure Centre • 25–35 min	323	• G–1 Grid Paper • G–3 Coordinate Grids • BLM 6–19 BLM Answers	• BLM 6–18 Task: Abbey Leisure Centre Rubric	**Tools** • grid paper **Technology Tools** • graphing calculator

Chapter 6 Blackline Masters Checklist

	BLM	Title	Purpose
Get Ready			
	G–1	Grid Paper	Student Support
	G–3	Coordinate Grids	Student Support
	BLM 6–1	Factor Quadratic Expressions	Student Support
	BLM 6–2	Get Ready	Practice
	BLM 6–3	Get Ready Self-Assessment Checklist	Student Self-Assessment
6.1 Maxima and Minima			
	G–1	Grid Paper	Student Support
	G–2	Placemat	Student Support
	G–3	Coordinate Grids	Student Support
	T–4	*The Geometer's Sketchpad*® 3	Technology
	T–5	*The Geometer's Sketchpad*® 4	Technology
	BLM 6–4	Section 6.1 Practice Master	Practice
6.2 Solve Quadratic Equations			
	T–7	The Computer Algebra System (CAS) on the TI-89 Calculator	Technology
	BLM 6–5	Section 6.2 Practice Master	Practice
	BLM 6–6	Section 6.2 Achievement Check Rubric	Assessment
	A–6	Knowledge/Understanding General Scoring Rubric	Assessment
6.3 Graph Quadratics Using the x-Intercepts			
	G–1	Grid Paper	Student Support
	G–3	Coordinate Grids	Student Support
	BLM 6–7	Section 6.3 Practice Master	Practice
	A–8	Application General Scoring Rubric	Assessment
	A–9	Communication General Scoring Rubric	Assessment
6.4 The Quadratic Formula			
	G–1	Grid Paper	Student Support
	G–3	Coordinate Grids	Student Support
	BLM 6–8	Section 6.4 Practice Master	Practice
	BLM 6–9	Section 6.4 Achievement Check Rubric	Assessment
6.5 Solve Problems Using Quadratic Equations			
	T–1	Corel® *Quattro Pro*® 8	Technology
	T–2	Corel® *Quattro Pro*® 10	Technology
	T–3	Microsoft® *Excel*	Technology
	BLM 6–10	Section 6.5 Practice Master	Practice
	A–5	Problem Solving Checklist	Assessment
	A–18	My Progress as a Problem Solver	Student Self-Assessment

Chapter 6 Review			
	G–1	Grid Paper	Student Support
	G–3	Coordinate Grids	Student Support
	BLM 6–11	Chapter 6 Review	Practice
	A–16	My Progress as a Mathematician	Student Self-Assessment
Chapter 6 Problem Wrap-Up			
	G–1	Grid Paper	Student Support
	G–3	Coordinate Grids	Student Support
	BLM 6–12	Chapter 6 Problem Wrap-Up Rubric	Summative Assessment
Chapter 6 Practice Test			
	G–1	Grid Paper	Student Support
	G–3	Coordinate Grids	Student Support
	T–7	The Computer Algebra System (CAS) on the TI-89 Calculator	Technology
	BLM 6–13	Chapter 6 Practice Test	Diagnostic Assessment
	BLM 6–14	Chapter 6 Test	Summative Assessment
	BLM 6–15	Chapter 6 Practice Test Achievement Check Rubric	Assessment
Chapters 4 to 6 Review			
	G–1	Grid Paper	Student Support
	G–3	Coordinate Grids	Student Support
	A–14	Self-Assessment Recording Sheet	Student Self-Assessment
	A–15	Self-Assessment Checklist	Student Self-Assessment
Task: Cari Sports Centre			
	G–1	Grid Paper	Student Support
	G–3	Coordinate Grids	Student Support
	BLM 6–16	Task: Cari Sports Centre Rubric	Assessment
Task: York Leisure Centre			
	G–1	Grid Paper	Student Support
	G–3	Coordinate Grids	Student Support
	BLM 6–17	Task: York Leisure Centre Rubric	Assessment
Task: Abbey Leisure Centre			
	G–1	Grid Paper	Student Support
	G–3	Coordinate Grids	Student Support
	BLM 6–18	Task: Abbey Leisure Centre Rubric	Assessment
	BLM 6–19	BLM Answers	Answers

Get Ready

Student Text Pages
262–263

Suggested Timing
70 min

Tools
- grid paper

Technology Tools
- graphing calculator

Related Resources
- G–1 Grid Paper
- G–3 Coordinate Grids
- BLM 6–1 Factor Quadratic Expressions
- BLM 6–2 Get Ready
- BLM 6–3 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 have difficulties translating from language into algebra.

R_x Have students identify the verb and place the equal sign at that point. Then balance the equation by translating each phrase. (If the verb is at the end of the sentence, have students reword before translating.)

Accommodations

Motor—Provide students with graphing calculators to use when graphing quadratic relations.

Language—Encourage students to show steps when translating the words in a sentence into algebraic expressions.

Memory—Provide students with two sets of index cards, one with trinomials that are to be factored and one with the factored forms of the trinomials. Have them match the trinomials with the correct factored form.

ESL—Let students work in groups.

Teaching Suggestions

- Use the parts of the Get Ready as needed. Questions 1 through 4 are best completed before Section 6.1. Questions 5 and 6 should be completed before Section 6.2, and questions 7 and 8 should be completed before Section 6.5.
- Use **BLM 6–1 Factor Quadratic Expressions** to provide students with a copy of the factoring table shown in the Get Ready.
- Use **BLM 6–2 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. 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 6–3 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.