CHAPTER

1 Quadratic Functions

Vocabulary

axis of symmetry
domain
first differences
function
integer
mapping diagram
parabola
quadratic function
range
real number
relation
second differences
transformation
translation
vertex
vertical compression
vertical line test
vertical stretch

Curriculum Expectations

Quadratic Functions

By the end of this course, students will:

2.1 explain the meaning of the term *function*, and distinguish a function from a relation that is not a function, through investigation of linear and quadratic relations using a variety of representations (i.e., tables of values, mapping diagrams, graphs, function machines, equations) and strategies

2.2 substitute into and evaluate linear and quadratic functions represented using function notation, including functions arising from real-world applications

2.3 explain the meanings of the terms *domain* and *range*, through investigations using numeric, graphical, and algebraic representations of linear and quadratic functions, and describe the domain and range of a function appropriately

2.4 explain any restrictions on the domain and the range of a quadratic function in contexts arising from real-world applications

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

2.6 sketch graphs of $g(x) = a(x - h)^2 + k$ by applying one or more transformations to the graph of $f(x) = x^2$

3.1 collect data that can be modelled as a quadratic function, through investigation with and without technology, from primary sources, using a variety of tools, or from secondary sources, and graph the data

3.2 determine, through investigation using a variety of strategies, the equation of the quadratic function that best models a suitable data set graphed on a scatter plot, and compare this equation to the equation of a curve of best fit generated with technology

3.3 solve problems arising from real-world applications, given the algebraic representation of a quadratic function

Chapter 1 Planning Chart

Section	Suggested Timing	Student Text Page(s)	Materials and Technology Tools
Chapter 1 Opener	10–15 min	**2–3**	
Prerequisite Skills	30–45 min	**4-5**	• grid paper • graphing calculators (optional) • computers with spreadsheet software (optional)
1.1 Identify Functions	75–110 min	**6-14**	• grid paper and rulers • graphing software (optional) • computers with spreadsheet software and *The Geometer's Sketchpad*® (optional)
1.2 Domain and Range	75 min	**15–22**	• grid paper • graphing calculators (optional) • graphing software (optional)
1.3 Analyse Quadratic Functions	120–150 min	**23–30**	• grid paper • graphing calculators • computers with spreadsheet software (optional) • paper and scissors (optional) • linking cubes (optional)
1.4 Stretches of Functions	75 min	**31–39**	• grid paper • graphing calculators • computers with *Fathom*™ • computers with Internet access • *The Geometer's Sketchpad*® (optional) • Computer-Based Ranger (CBR) (optional) • tennis balls (optional)
1.5 Translations of Functions	75 min	**40–46**	• grid paper • graphing calculators • computers with *Fathom*™ • computers with Internet access • *The Geometer's Sketchpad*® (optional) • CBR (optional)
1.6 Sketch Graphs Using Transformations	75 min	**47–53**	• grid paper • graphing calculators • computers with *Fathom*™ • computers with Internet access • *The Geometer's Sketchpad*® (optional) • CBR (optional)
Chapter 1 Review	45–75 min	**54–55**	• grid paper and rulers • graphing calculators
Chapter 1 Problem Wrap-Up	15–30 min	**55**	• graphing calculators
Chapter 1 Practice Test	45–75 min	**56–57**	• grid paper • graphing calculators
Chapter 1 Task: How High Can My Plane Fly?	45–75 min	**58–59**	• grid paper • graphing software (optional)

Chapter 1 Blackline Masters Checklist

	BLM	Title	Purpose
Prerequisite Skills			
	BLM G-1	Grid Paper	Student Support
	BLM G-5	Second Differences Tables	Student Support

	BLM 1-1	Prerequisite Skills	Practice
	BLM 1-2	Prerequisite Skills Self-Assessment Checklist	Student Self-Assessment
1.1 Identify Functions			
	BLM G-1	Grid Paper	Student Support
	BLM 1-3	Section 1.1 Identify Functions	Practice
1.2 Domain and Range			
	BLM G-1	Grid Paper	Student Support
	BLM 1-4	Section 1.2 Domain and Range	Practice
1.3 Analyse Quadratic Functions			
	BLM G-1	Grid Paper	Student Support
	BLM G-5	Second Differences Tables	Student Support
	BLM 1-5	Section 1.3 Analyse Quadratic Functions	Practice
1.4 Stretches of Functions			
	BLM G-1	Grid Paper	Student Support
	BLM 1-6	Section 1.4 Stretches of Functions	Practice
	BLM 1-7	Section 1.4 Achievement Check Rubric	Assessment
	BLM 1-8	*GSP* for Section 1.4 Investigate	Alternative Investigate
1.5 Translations of Functions			
	BLM G-1	Grid Paper	Student Support
	BLM 1-9	Section 1.5 Translations of Functions	Practice
	BLM 1-10	*GSP* for Section 1.5 Investigate	Alternative Investigate
1.6 Sketch Graphs Using Transformations			
	BLM G-1	Grid Paper	Student Support
	BLM 1-11	Section 1.6 Sketch Graphs Using Transformations	Practice
	BLM 1-12	Section 1.6 Achievement Check Rubric	Assessment
Chapter 1 Review			
	BLM G-1	Grid Paper	Student Support
	BLM G-5	Second Differences Tables	Student Support
	BLM A-13	Self-Assessment Recording Sheet	Assessment
	BLM 1-13	Chapter 1 Review	Practice
Chapter 1 Problem Wrap-Up			
	BLM G-5	Second Differences Tables	Student Support
	BLM 1-14	Chapter 1 Problem Wrap-Up Rubric	Summative Assessment
Chapter 1 Practice Test			
	BLM G-1	Grid Paper	Student Support
	BLM 1-15	Chapter 1 Practice Test	Diagnostic Assessment
	BLM 1-16	Chapter 1 Test	Summative Assessment
	BLM 1-17	Chapter 1 Practice Test Achievement Check Rubric	Assessment
Chapter 1 Task: How High Can My Plane Fly?			
	BLM G-1	Grid Paper	Student Support
	BLM A-17	Learning Skills Checklist	Assessment
	BLM 1-18	Chapter 1 Task Rubric	Assessment
	BLM 1-19	Chapter 1 BLM Answers	Answers

Prerequisite Skills

Student Text Pages
4–5

Suggested Timing
30–45 min

Materials and Technology Tools
- grid paper
- graphing calculators (optional)
- computers with spreadsheet software (optional)

Related Resources
- BLM G-1 Grid Paper
- BLM G-5 Second Differences Tables
- BLM 1-1 Prerequisite Skills
- BLM 1-2 Prerequisite Skills Self-Assessment Checklist

Common Errors

- Some students may make errors when substituting negative values into equations.

R$_x$ Have students rewrite the equation with the number being substituted in brackets.

- Some students may have difficulty choosing an appropriate scale when graphing relations.

R$_x$ Have students consider the difference between the least and greatest values. Divide the difference by the number of ticks on the axes, and then round up to give the number of units per tick.

- Some students may make errors when calculating the first and second differences.

R$_x$ Have students subtract each *y*-value from the next *y*-value, but not vice versa. Ensure they know that the difference in the *x*-values must also be constant and that the sign of the result is important.

Accommodations

Visual–allow oral responses

Motor–provide students with copies of **BLM G-5 Second Differences Tables**; use technology for graphing

Teaching Suggestions

- Make graphing calculators available to students, if possible.
- Students can work alone or in small groups. This would be a good opportunity to set the stage for the entire course, given this would be the first or second day.
- Encourage students to make note of the *y*-values and first differences for linear and non-linear equations. This will help them to identify quadratics in Section 1.3.
- You may consider using spreadsheet software for creating tables of values and calculating first differences. Students may need a demonstration and/or assistance with the use of formulas in spreadsheets.
- For **questions 3 and 5**, ask students if they can predict the subsequent values without doing the calculations, to find out if they recognize a pattern.
- Use **BLM 1–1 Prerequisite Skills** for remediation or extra practice. To further reinforce the concepts, you may 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 1–2 Prerequisite Skills Self-Assessment Checklist** as a self-assessment for students.
- Remedial action can be taken in small groups or in a whole-class skills review.

Chapter Problem

- The Chapter Problem is introduced in the Chapter 1 opener. Have students discuss their understanding of the topic. For example, what would happen if the price is too high or too low? What other situations might provide a similar problem? Other examples include setting prices on goods, services, hotel rooms, or plane/train/bus tickets. 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 1 Problem Wrap-Up at the end of the Chapter 1 Review.
- Alternatively, you may wish to assign the Chapter Problem when students have completed the chapter. The Chapter Problem may be used as a summative assessment.