4.5 Quadratic Relations of the Form $y = a(x - r)(x - s)$

Student Text Pages
189–193

Suggested Timing
70 min

Tools
- grid paper

Related Resources
- G–1 Grid Paper
- G–3 Coordinate Grids
- BLM 4–11 Section 4.5 Practice Master
- A–7 Thinking General Scoring Rubric

TI-Navigator™

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

Teaching Suggestions

- As a class, read the opening description of the Dufferin Gate parabolic arch at the CNE. Explain that it is possible to write a quadratic relation in ways other than $y = a(x - h)^2 + k$. (5 min)

Investigate

- With the visual approach, students will catch on quickly to the new form of quadratics. This activity can easily be done with paper and pencil, or using a graphing calculator. Students may use the word "midpoint" to describe how to find the vertex. Suggest they use the term "median" of the x-coordinates instead. (20 min)

Examples

- Present **Examples 1** and **2**, or similar examples that include positive and negative values of a and an application to provide context. (20 min)

Communicate Your Understanding

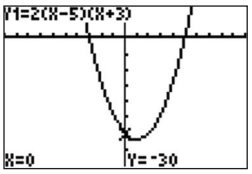
- Discuss the questions as a class before assigning homework exercises. Question C2 requires a deeper thought process to encourage students to justify their answers. (10 min)
- Use **BLM 4–11 Section 4.5 Practice Master** for remediation or extra practice.

Investigate Answers (page 189)

1.–2. Because the second differences are constant, it is a quadratic relation.

x	y	First Differences	Second Differences
–6	66		
–5	40	–26	
–4	18	–22	4
–3	0	–18	4
–2	–14	–14	4
–1	–24	–10	4
0	–30	–6	4
1	–32	–2	4
2	–30	2	4
3	–24	6	4
4	–14	10	4
5	0	14	4
6	18	18	4

3.



4. The x-intercepts are –3 and 5. These are the values where $y = 0$.

5. Coordinates: (1, –32). The value of the x-coordinate of the vertex is the average of the x-intercepts.

6. Find the x-intercepts from the graph. Then, to find the coordinates of the vertex, take the average of the x-intercepts to find the x-coordinate of the vertex, and substitute this value into the equation to find the y-coordinate of the vertex.

Common Errors

- Some students may write the equation by adding the x-intercepts, r and s, instead of subtracting.

R$_x$ Remind students that using the x-intercepts to write a quadratic equation is similar to the investigation of quadratics of the form $y = a(x - h)^2 + k$. Subtract r and s from x because the operation occurs before applying the multiplication. You could also have them make tables of values and graph the resulting parabolas.

Accommodations

Gifted and Enrichment—Challenge students to learn more about real-life situations that are modelled by parabolas, and to create questions involving these applications.

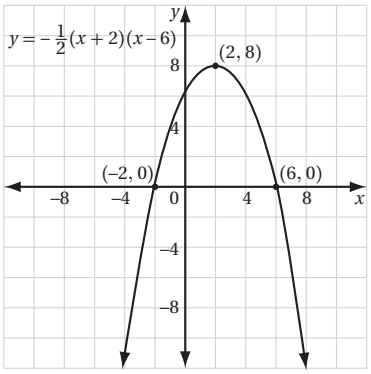
Visual—Encourage students to work together to complete the questions in this section.

Motor—If possible, have students work with someone who will act as a scribe once the student completes the questions.

Language, ESL—Encourage students to use their dictionaries and research any unfamiliar words on the Internet.

7. a) The graph of $y = -\frac{1}{2}(x + 2)(x - 6)$ has x-intercepts $x = -2$ and $x = 6$. The vertex is $(2, 8)$.

b)



Communicate Your Understanding Responses (page 191)

C1. Answers will vary.

C2. B is correct because the parabola has x-intercepts at $x = 3$ and $x = -1$, and opens upward.

Practise

- **Questions 1** and **2** are similar to the Investigate and are good examples for students who may still be having difficulties.
- Assign **questions 3** through **5** to all students. They provide good practice of the essential skills.
- **Questions 6** and **7** extend students' skills by looking at parabolas with a single x-intercept.
- **Questions 8**, and **10** through **13** are good applications. Assign a selection of these.
- **Question 9** has students look at parabolas that are symmetric about the y-axis. It is an excellent question to develop reasoning skills. Use **A–7 Thinking General Scoring Rubric** when assessing your students for this question.
- **Question 14** extends the concepts to polynomial relations of higher degree, by investigating their x-intercepts with a graphing calculator. The same procedures apply as with quadratics.
- **Question 15** is a good problem solving question that involves the use of the distance formula from Chapter 2 Analytic Geometry.

Literacy Connections

Add the new terms that appear in this section to the Word Wall.

Question 13 uses the word "venue," which may be new to some students. Spend time discussing the word and its origin. Have students include this term on the Word Wall.

Student Success

Have students construct a simple picture using equations with appropriate restrictions on the sets of values that x and y may take.

Use an inside/outside circle to have students describe how to graph quadratic relations in intercept form.

Refer to the introduction of this Teacher's Resource for more information about how to use an inside/outside circle strategy.

Mathematical Processes Integration

The table shows questions that provide good opportunities for students to use the mathematical processes.

Process Expectations	Selected Questions
Problem Solving	9, 15
Reasoning and Proving	6, 9, 14
Reflecting	1, 2, 9
Selecting Tools and Computational Strategies	9, 15
Connecting	8, 10–15
Representing	1–5, 8, 10–13
Communicating	1, 2, 14

Ongoing Assessment

- Communicate Your Understanding questions can be used as quizzes to assess students' communication skills.