5.5 The *x*-Intercepts of a Quadratic Relation

Student Text Pages
264–275

Suggested Timing
80 min

Tools
- graphing calculators
- grid paper

Related Resources
BLM 5-9 Section 5.5 The *x*-Intercepts of a Quadratic Relation
BLM 5-10 Section 5.5 Literacy Connect
BLM A-10 Observation General Scoring Rubric
BLM G-3 Four Quadrant Grids
BLM A-18 Opinion Piece Checklist

Link to Prerequisite Skills

Students should complete questions 5 to 7 prior to starting this section.

Warm-Up

1. Factor.

a) $x^2 + 15x + 36$ **b)** $x^2 - 5x - 14$ **c)** $5x^2 + 30x - 135$

Warm-Up Answers

1. a) $(x + 12)(x + 3)$ **b)** $(x - 7)(x + 2)$ **c)** $5(x + 9)(x - 3)$

Teaching Suggestions

Warm-Up

- Write the Warm-Up questions on the board or on an overhead. Have students complete the questions independently. Then, discuss the solutions as a class.

Section Opener

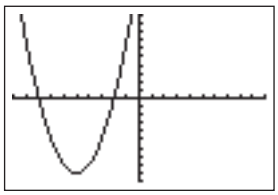
- On the DVD of the movie *The Man with the Golden Gun* there is a feature on the planning and execution of this stunt. In the more recent movie, *The Transporter 2*, a similar stunt was done using entirely computer-generated imagery (CGI), but did not look as good as the stunt in *The Man with the Golden Gun*.

Investigate

- You may want to use *The Geometer's Sketchpad*® file **5s5 Investigate zeros.gsp** to reinforce the concepts developed in the Investigate. Go to *www.mcgrawhill.ca/books/foundations11* and follow the links to download the file.

Investigate Answers (pages 264–265)

1. a)

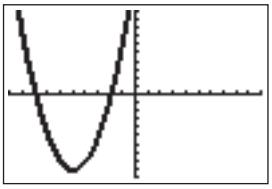


The *x*-intercepts are –2 and –8.

b) $y = (x + 2)(x + 8)$

c) The constants and the *x*-intercepts are the same.

d)



The graphs are the same.

2.

Relation	Factored Relation	x-intercepts
$y = x^2 + 10x + 21$	$y = (x + 3)(x + 7)$	–3 and –7
$y = x^2 - 8x + 15$	$y = (x - 3)(x - 5)$	3 and 5
$y = x^2 + 2x - 24$	$y = (x - 4)(x + 6)$	4 and –6
$y = x^2 - 49$	$y = (x + 7)(x - 7)$	7 and –7

3. The x-intercepts are the same as the ones found in question 2.

4. Given $y = x^2 + bx + c$, first factor the relation to express it in intercept form $y = (x - r)(x - s)$. The x-intercepts are r and s.

Examples

- In Example 1, students see quadratic relations that have two zeros, one zero, and no zeros. Have students use the equation to predict the number of zeros a relation will have. A relation with vertex below the x-axis that opens upward has two zeros. Similarly, a relation with vertex above the x-axis that opens downward has two zeros. A relation with vertex on the x-axis has one zero. A relation with vertex above (or below) the x-axis that opens upward (or downward) has no zeros.
- In Example 2, students identify the key information the different forms of the equations of a quadratic relation give.
- In Example 3, the a-value is a decimal. A good strategy for students is to always try to common factor out the a-value.

Key Concepts

- Ensure students understand the Key Concepts.

Discuss the Concepts

- Have students discuss these questions in small groups and take them up as a class before assigning the exercises.

Discuss the Concepts Suggested Answers (page 271)

D1. a) The vertex form, $y = a(x - h)^2 + k$, gives the coordinates of the vertex, (h, k).

b) The standard form, $y = ax^2 + bx + c$, gives the y-intercept, c.

c) The intercept form, $y = (x - r)(x - s)$, gives the x-intercepts, r and s.

D2. $y = 5(x - 5)(x + 3)$

$= 5(x^2 - 2x - 15)$

$= 5x^2 - 10x - 75$

Practise (A)

- Encourage students to review the Examples before asking for assistance.
- Distribute copies of **BLM G-3 Four Quadrant Grids**.
- For **questions 3 to 6**, have students identify the coordinates of the vertex and the direction of opening of each quadratic relation. They can use this information to find (or confirm) the number of zeros.

Apply (B)

- For **question 8**, students should recognize that the difference in the x-intercepts must be 1.3 or greater for the skateboarder to make it across the gap.
- For **question 10, part c)**, some students may recognize that the maximum or minimum is halfway between the zeros. Other students may need to make a table of values as in **question 8**.

Common Errors

- Some students may confuse the *x*- and *y*-intercepts.

R_x Have students review the proper labelling of the *x*- and *y*-axes.

Accommodations

Visual—allow students to use technology for graphing

Perceptual—photocopy graphs and add colour for *x*- and *y*-intercepts and the coordinates of key points

Language—read word problems aloud with the class to ensure understanding

Extend (C)

- Assign the Extend questions to students who are not being challenged by the Apply questions.
- In **question 14**, projectile motion is used. A general form of a projectile motion equation is $y = -4.9t^2 + vt + h_0$. This equation only models the vertical motion of a projectile. To model the actual path, the following equation can be used $y = \frac{-4.9}{(v\cos\theta)^2} + \tan\theta\, x + h_0$, where θ is the angle of launch, v is the initial speed in metres per second, and h_0 is the initial height in metres.
- To help explain **question 14**, you may want to use *The Geometer's Sketchpad*® file **5.5 Cannon.gsp**. Go to *www.mcgrawhill.ca/books/foundations11* and follow the links to download the file.

Literacy Connections

- Distribute copies of **BLM 5-10 Section 5.5 Literacy Connect**. Have students work in pairs to complete this read and understand opinion piece. You may wish to use **BLM A-18 Opinion Piece Checklist** to assess students' responses.

Mathematical Process Expectations

Process Expectation	Questions
Problem Solving	6, 8, 12
Reasoning and Proving	1, 2, 6
Reflecting	6, 11
Selecting Tools and Computational Strategies	3–5, 7–11
Connecting	10, 13
Representing	4, 5, 7–9
Communicating	8

Ongoing Assessment

- While students are working, circulate and see how well each person works. This may be an opportunity to continue observing and recording individual students' learning skills. Use **BLM A-10 Observation General Scoring Rubric**.

Extra Practice

- Use **BLM 5-10 Section 5.5 The *x*-Intercepts of a Quadratic Relation** for remediation or extra practice.