5.6 Solve Problems Involving Quadratic Relations

Student Text Pages
276–285

Suggested Timing
80 min

Tools
- graphing calculators
- grid paper

Related Resources
BLM 5-11 Section 5.6 Solve Problems Involving Quadratic Relations
BLM 5-12 Section 5.6 Achievement Check Rubric
BLM G-3 Four Quadrant Grids

Link to Prerequisite Skills

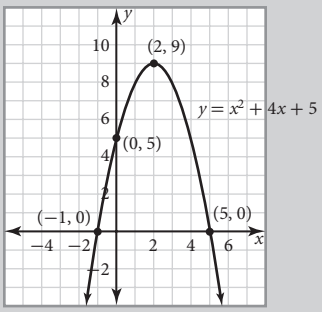
Students should have completed all the Prerequisite Skills questions prior to starting this section.

Warm-Up

1. Graph the quadratic relation $y = -x^2 + 4x + 5$. Determine the x-and y-intercepts and the maximum or minimum.

Warm-Up Answers

1.



y-intercept 5; x-intercepts –1 and 5; maximum 9 at $x = 2$

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

- Read the introduction aloud. As a class, discuss some applications of projectile motion.

Examples

- In Example 1, ensure students understand that the x-coordinate of the vertex of any quadratic relation is midway between the zeros (or any pair of points with equivalent y-values) because parabolas are symmetrical.
- For Example 2, part c), discuss with students why only positive values of the variables are realistic in this context.

Key Concepts

- Have students explain how to determine the x-coordinate of the maximum or minimum point.

Discuss the Concepts

- Allow the students to discuss the answers to these questions with a partner before discussing them as a class.

Discuss the Concepts Suggested Answers (page 280)

D1. The standard form gives the *y*-intercept. The vertex form gives the coordinates of the vertex. The intercept form gives the *x*-intercepts.

D2. If a quadratic relation has one or more zeros, they can be used to find the maximum or minimum. If the relation has two zeros, the *x*-coordinate of the maximum or minimum is halfway between the zeros. If the relation has one zero, it is the *x*-coordinate of the maximum or minimum.

Practise (A)

- Encourage students to review the Examples before asking for assistance.
- **Questions 1** to **3** provide students with more practice finding the zeros of quadratic relations. You may also wish to ask students to find the coordinates of the maximum or minimum points.
- In **question 4, part d)**, students must use the graph to find the axis of symmetry since the relation has no zeros. Some students may use the graph for all parts of the question, rather than using the zeros.
- Distribute copies of **BLM G-3 Four Quadrant Grids**.

Apply (B)

- For **question 10**, students should start by choosing values of a for a quadratic relation in intercept form, $y = a(x - 1)(x + 5)$, then expand and simplify to express the relation in standard form.
- In **question 11**, students may be able to solve both **parts a)** and **b)** without using quadratic relations. Encourage these students to check their answers using quadratic relations.
- **Question 15** assumes that the height of Danny's take-off and landing are even with the top of the wall (that is, the top of the wall is $h = 0$). Go to *www.mcgrawhill.ca/books/foundations11* and follow the links for more information about Danny Way's stunt.
- **Question 16** links to the Chapter Problem. For **part b)**, to find this distance, students must first find the equation of the left fountain in intercept form to find out how wide it is. They can then use the 3 m and the fact that the width of the right fountain will be exactly the same, to find the position of the nozzle of the right fountain. Remind students to keep the solution to this question handy as the methods they used may help them with the Chapter Problem Wrap-Up.
- **Question 17** is an Achievement Check question. It can be used as a diagnostic or formative assessment, or assigned as a small summative assessment piece. You may wish to use **BLM 5-12 Section 5.6 Achievement Check Rubric** to assess students' responses.

Extend (C)

- Assign the Extend question to students who are not being challenged by the Apply questions.
- In **question 18**, you may want to use *The Geometer's Sketchpad*® file **5.5 cannon.gsp** to help students approximate the answer. Then have them use the equation to check. Although there are many possible answers, an angle of 45° and velocity of 30 m/s will work exactly. Go to *www.mcgrawhill.ca/books/foundations11* and follow the links to download the file.

Common Errors

- Some students may have trouble finding the halfway point between zeros that have opposite signs.

R_x Have students calculate the mean of the zeros.

Accommodations

Gifted and Enrichment—use motion detectors to analyze the motion of a ball that is thrown or kicked

Language—provide a reading buddy to assist with understanding of problem contexts

Achievement Check Answers (page 285)

17. a) 14.44 m

b) $h = -0.04d^2 + 1.52$, $h = -0.04d(d - 38)$

c) 38 m

d) Yes, the ball will be 4.2 m high when it is 35 m away from the goalposts.

Literacy Connections

- Encourage students to make a glossary of terms associated with quadratic relations.

Mathematical Process Expectations

Process Expectation	Questions
Problem Solving	10–12, 17, 18
Reasoning and Proving	4, 7, 11, 12, 18
Reflecting	12
Selecting Tools and Computational Strategies	1–3, 5–18
Connecting	15
Representing	6, 7, 10, 14, 17
Communicating	12, 13

Extra Practice

- You may wish to use **BLM 5-11 Section 5.6 Solve Problems Involving Quadratic Relations** for remediation or extra practice.