Quadratics

General Outcome

Develop algebraic and graphical reasoning through the study of relations.

Specific Outcomes

RF1 Factor polynomial expressions of the form:
- $ax^2 + bx + c, a \neq 0$
- $a^2x^2 - b^2y^2, a \neq 0, b \neq 0$
- $a(f(x))^2 + b(f(x)) + c, a \neq 0$
- $a^2(f(x))^2 - b^2(g(y))^2, a \neq 0, b \neq 0$

where a, b and c are rational numbers.

RF3 Analyze quadratic functions of the form $y = a(x - p)^2 + q$ and determine the:
- vertex
- domain and range
- direction of opening
- axis of symmetry
- x- and y-intercepts.

RF4 Analyze quadratic functions of the form $y = ax^2 + bx + c$ to identify characteristics of the corresponding graph, including:
- vertex
- domain and range
- direction of opening
- axis of symmetry
- x- and y-intercepts

and to solve problems.

RF5 Solve problems that involve quadratic equations.

What's Ahead

In Unit 2, students explore quadratic functions in standard and vertex form. They analyse equations and graphs of quadratic functions to determine characteristics of the graphs of quadratic functions including the vertex, domain and range, axis of symmetry, maximum or minimum value, and *x*-intercepts and *y*-intercepts. Students learn how to convert quadratic functions from standard to vertex form by completing the square. They extend their factoring skills and use a variety of strategies to determine the roots of quadratic equations. Students apply the quadratic formula and use the discriminant to determine the number of real roots for quadratic equations. Throughout the unit, students model situations and solve problems involving quadratic functions using a variety of methods.

Planning Notes

Introduce Unit 2 by reading the opening paragraph on page 138 of the student resource with the class. Have students share what they know about the situations presented.

Invite students to talk about the photo collage, which shows several situations that can be modelled using quadratic functions: a teen shooting a basketball, an avalancher preparing to set off a controlled avalanche, the shape of radio frequency telescopes, and parabolic arches in architecture and nature.

The Looking Ahead box at the bottom of page 138 identifies the types of problems students will solve throughout the unit. You may wish to reactivate students' knowledge of topics, such as linear functions and factoring that lead to learning about quadratic functions.

Unit 2 Project

For the Unit 2 project, students explore quadratic functions that occur in areas such as science, sports, art, architecture, and nature.

In Chapter 3, the Project Corner boxes located at the end of some numbered sections provide information about where quadratic functions arise in situations that are familiar to students. In Chapter 4, the Project Corner boxes focus specifically on the subject of avalanche control. At the end of the unit, students will choose between two options:
- Examine real-world situations that can be modelled using quadratic functions. For this option, students will mathematically determine the accuracy of the model and investigate reasons for the quadratic nature of the situation.
- Apply the skills they have learned to the subject of projectile motion and the use of mathematics in avalanche control.

For either option, students will showcase what they have learned about quadratic relationships by modelling and analysing real situations involving quadratic functions.

With the class, read and discuss the introductory notes for the Unit 2 project. You may wish to point out the Project Corners in Chapter 3 and 4. Note that these features are not mandatory but are recommended because they provide helpful information about the Unit 2 Project. You may wish to provide students with **BLM U2–1 Unit 2 Project Checklist**. Students can use the checklist as they prepare their project.

Have students collect all their work for the Unit 2 project in a portfolio.

For additional information on the Unit 2 Project, see pages 139 and 263 in the student resource or pages 168 and 169 in this Teacher's Resource.