

Chapter 4

Quadratic Functions and Rational Expressions

You have used linear and quadratic functions to model real-world situations. However, some situations, for example, in medicine, the life sciences, and business, are better modelled by rational functions.

Rational functions behave differently from other functions you have studied. You will need new algebraic skills to work with these functions.

In this chapter, you will

- review and extend your understanding of the quadratic function
- solve optimal value problems, with and without a graphing calculator
- relate the roots of quadratic equations to the zeros for the corresponding quadratic functions
- solve quadratic equations that do not have real roots by using complex numbers
- investigate and manipulate complex numbers
- graph the reciprocal function $f(x) = \frac{1}{x}$, investigate other examples of inverse variation, and fit a power function to inverse variation data
- use the graph of a function to sketch the graph of its reciprocal
- use a graphing calculator to explore the behaviour of functions near vertical and horizontal asymptotes
- add, subtract, multiply and divide rational expressions, and state restrictions on the variables
- add, subtract, and multiply polynomials

Visit the Nelson Mathematics student Web site at www.math.nelson.com. You'll find links to interactive examples, online tutorials, and more.

Connections



The Chapter Problem

Fundraising

Northern Heights Secondary School will celebrate its 25th anniversary next year. As part of the celebration, the student council decided to raise \$7000 for supplies for a local food bank. Megan, who is the treasurer of the student council, suggests selling commemorative T-shirts to students. She has contacted three T-shirt suppliers about costs. Each supplier charges a fee for designing and making the template for the logo, and each supplier's cost per T-shirt is different, as shown in the table.

Supplier	Logo Design and Template	Cost per T-shirt
Custom Cottons	\$250	\$3.90
Tailored Tees	\$400	\$2.80
Tops to Go	\$120	\$4.50

Megan has also surveyed 100 randomly chosen students. She asked each student what prices he or she would be willing to pay for a T-shirt. The school's student population is 1582.

Number of Students	93	78	64	42	21	15	9
Price of T-shirt (\$)	5.00	7.50	10.00	12.50	15.00	17.50	20.00

Which supplier should Megan choose? Will the target of \$7000 be reached? Prepare a proposal for the student council. In your proposal, recommend one supplier. Support your choice with a graphical analysis of the expected profit.

For help with this problem, see pages 317, 327, 333, 355, and 371.

Challenge 1

Find a function that has two parallel asymptotes that are

- (a) vertical
- (b) horizontal
- (c) oblique

Two parallel asymptotes divide the x - y plane into three regions.

For each type of parallel asymptotes—vertical, horizontal, and oblique—try to find a function that occupies

- i. three regions of the x - y plane
- ii. two regions of the x - y plane
- iii. one region of the x - y plane

Write each function and sketch its graph.

Challenge 2

Find the dimensions of the isosceles triangle with the smallest area and whose incircle has radius 2 units.

Web Challenge

For a related Internet activity, go to www.math.nelson.com.

