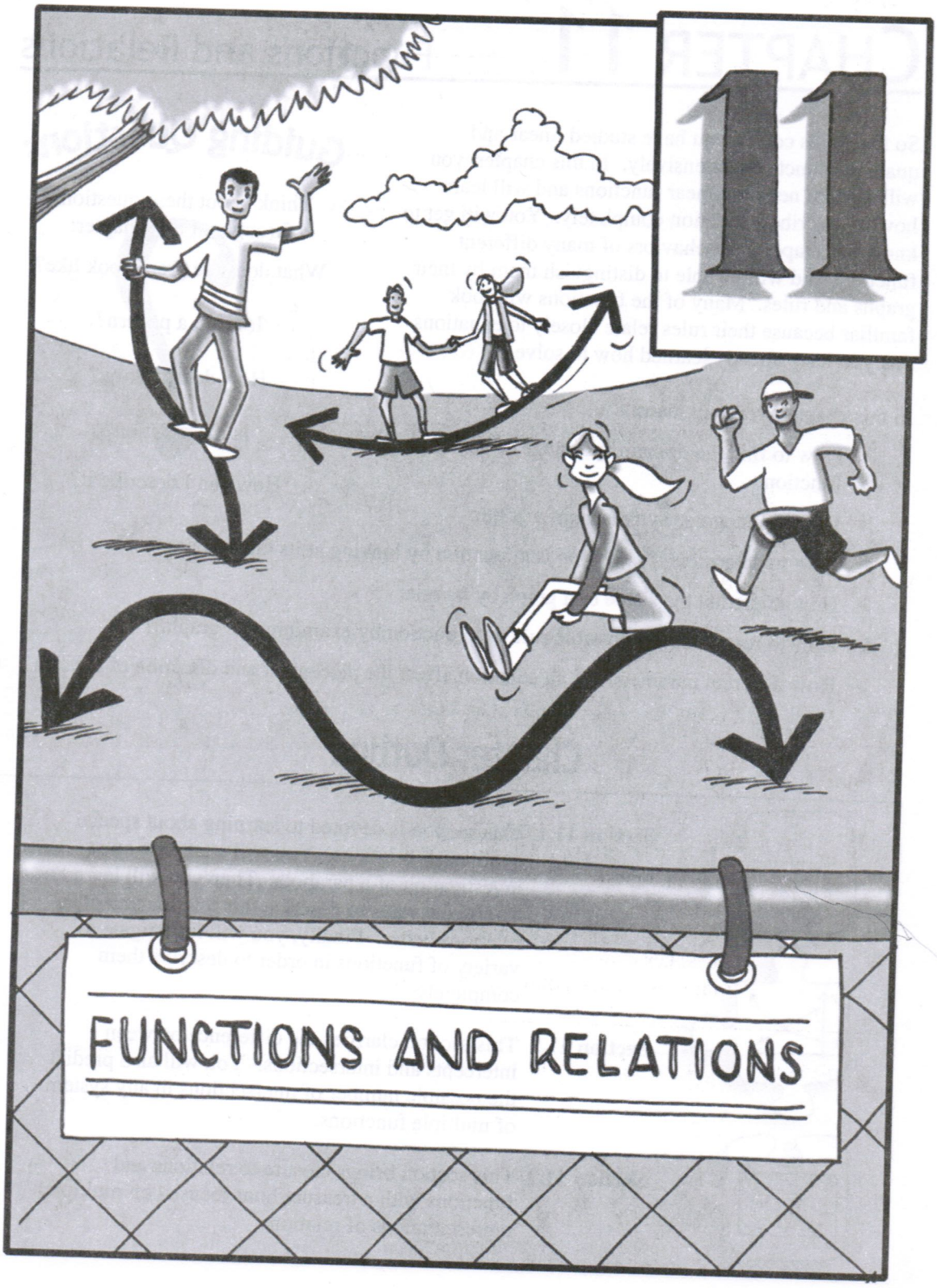

11
FUNCTIONS AND RELATIONS

CHAPTER 11 Functions and Relations

So far in this course you have studied linear and quadratic functions extensively. In this chapter, you will explore new nonlinear functions and will learn how to describe a function completely. You will get to know the shapes and behaviors of many different functions and will be able to distinguish them by their graphs and rules. Many of the functions will look familiar because their rules relate closely to equations that you have already learned how to solve.

Guiding Questions

Think about these questions throughout this chapter:

What does the graph look like?

Is there a pattern?

How does it grow?

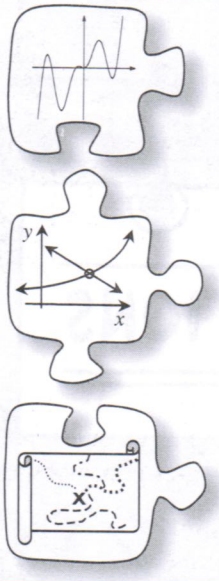
Is it a function?

How can I describe it?

In this chapter, you will learn:

- How to find the domain and range of a function.
- How to recognize symmetry in a graph.
- How to determine if a relation is a function by looking at its table or graph.
- How to predict the shape of a graph by its rule.
- How to recognize the possible rule of a function by examining its graph.
- How different parameters in an equation affect the placement and direction of a graph.

Chapter Outline

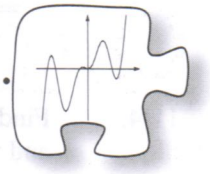


Section 11.1 This section is devoted to learning about special qualities of relations. You will start with an investigation of a parabola. Then you will learn about new ways to describe this relation and other relations better. Finally, you will investigate a variety of functions in order to describe them completely.

Section 11.2 This section clarifies the difference between intercepts and intersections. You will also predict the possible number of intersections in any system of multiple functions.

Section 11.3 This section brings closure to relations and functions with a treasure hunt focused on multiple representations of relations.

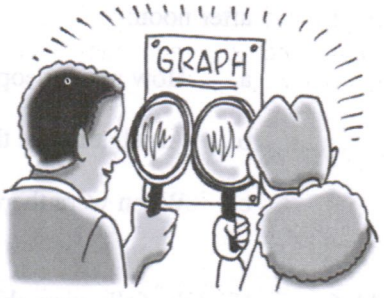
11.1.1 How can I describe a graph?



Describing a Graph

What does it mean to describe the graph of a rule completely? Today you will graph and investigate a new graph: $y = \sqrt{x}$.

11-1. DESCRIBING A GRAPH



Your teacher will assign your team one of the rules below. On graph paper, graph your rule for x-values between –3 and 9. When your team is convinced that your graph is correct, discuss all the ways you can describe this graph. Then write as many summary statements about the graph as you can, such as, *"We noticed that as x gets larger, ..."*

$y = \sqrt{x}$

$y = \sqrt{x} + 1$

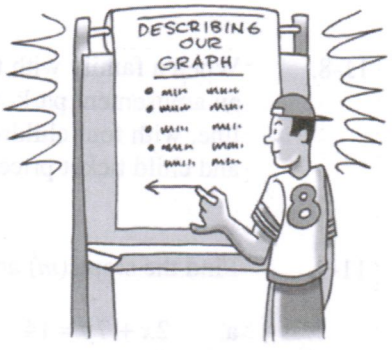
$y = \sqrt{x+2} - 1$

$y = \sqrt{x-1} + 3$

$y = -\sqrt{x}$

$y = -\sqrt{x} - 2$

11-2. PRESENT YOUR FINDINGS



With your team, create a poster that contains not only the graph of your rule but also all of your observations and summary statements from problem 11-1. Be thorough and complete. Remember that a main goal of this activity is to determine what items a "complete description" of a graph must contain, so be sure to include everything you can. Be prepared to present your poster to the class. Remember to give reasons for all statements that you make.

11-3. As a class, examine the posters that were presented by the teams. Create a list of all the ways to describe a graph. Then, next to each description, create a question that will prompt you to look for this quality in the graphs of other rules you encounter.

Once your list is complete, copy the questions into your Learning Log. Title this entry "Graph-Investigation Questions" and include today's date.

Review & Preview

11-4. Find the dimensions of the generic rectangle shown at right and write its area as a sum and a product.

$-6x$	4
$9x^2$	$-6x$

11-5. After noon, the number of people in Mal-Wart grows steadily until 6:00 PM. If the equation $y = 228 + 58x$ represents the number of people in the store x hours after noon:

a. How many people were in the store at noon?

b. At what rate is the number of shoppers growing?

c. When were there 402 shoppers in the store?

11-6. Find the following absolute values.

a. $|0.75|$ b. $|-99|$ c. $|4-2\cdot 3|$ d. $|\pi|$

11-7. Jacob discovered that the x-intercepts of a certain parabola are (3, 0) and (–1, 0), but now he needs to find the vertex. Can you get him started? What do you know about the vertex? Draw a sketch of this parabola to help you.

11-8. When a family with two adults and three children bought tickets for an amusement park, they paid a total of $56.50. The next family in line, with four children and one adult, paid $49.50. Find the adult and child ticket prices by writing and solving a system of equations.

11-9. Find the slope (m) and y-intercept (b) for each line below.

a. $2x + 7y = 14$ b. $y = 6 - \frac{x}{3}$

c. $y = \frac{10x-2}{2}$ d. $y = 3x$

11-10. Solve the following inequalities for x.

a. $4x - 1 \geq 7$ b. $3 - 2x < x + 6$

c. $2(x - 5) \leq 8$ d. $\frac{1}{2}x > 5$

11-11. Using your knowledge of exponents, rewrite each expression below so that there are no negative exponents or parentheses remaining.

a. $\frac{4x^{18}}{2x^{22}}$

b. $(s^4tu^2)(s^7t^{-1})$

c. $(3w^{-2})^4$

d. m^{-3}

11-12. Match each graph below with the correct inequality.

a. $y > -x + 2$

b. $y < 2x - 3$

c. $y \geq \frac{1}{2}x$

d. $y \leq -\frac{2}{3}x + 2$

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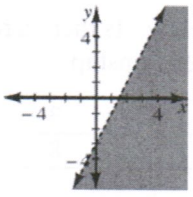

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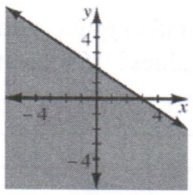

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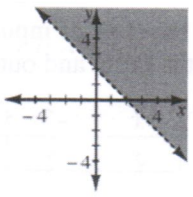

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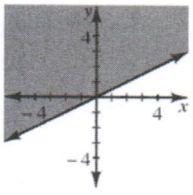

11-13. Add, subtract, multiply, or divide the following rational expressions. Simplify your answers if possible.

a. $\frac{12x^2+4x-1}{36x^2-12x+1} \cdot \frac{x^2-64}{2x^2+17x+8}$

b. $\frac{2x^2-10x}{x^2-4} \div \frac{x^2-5x}{x^2-4x-12}$

11-14. For the parabola $y = 2x^2 - 7x + 3$:

a. Give the coordinates of the y-intercept.

b. Give the coordinates of the two x-intercepts. Explain how you found them.

11-15. Simplify each expression using the laws of exponents.

a. $(x^2)(x^2y^3)$

b. $\frac{x^3y^4}{x^2y^3}$

c. $(2x^2)(-3x^4)$

d. $(2x)^3$