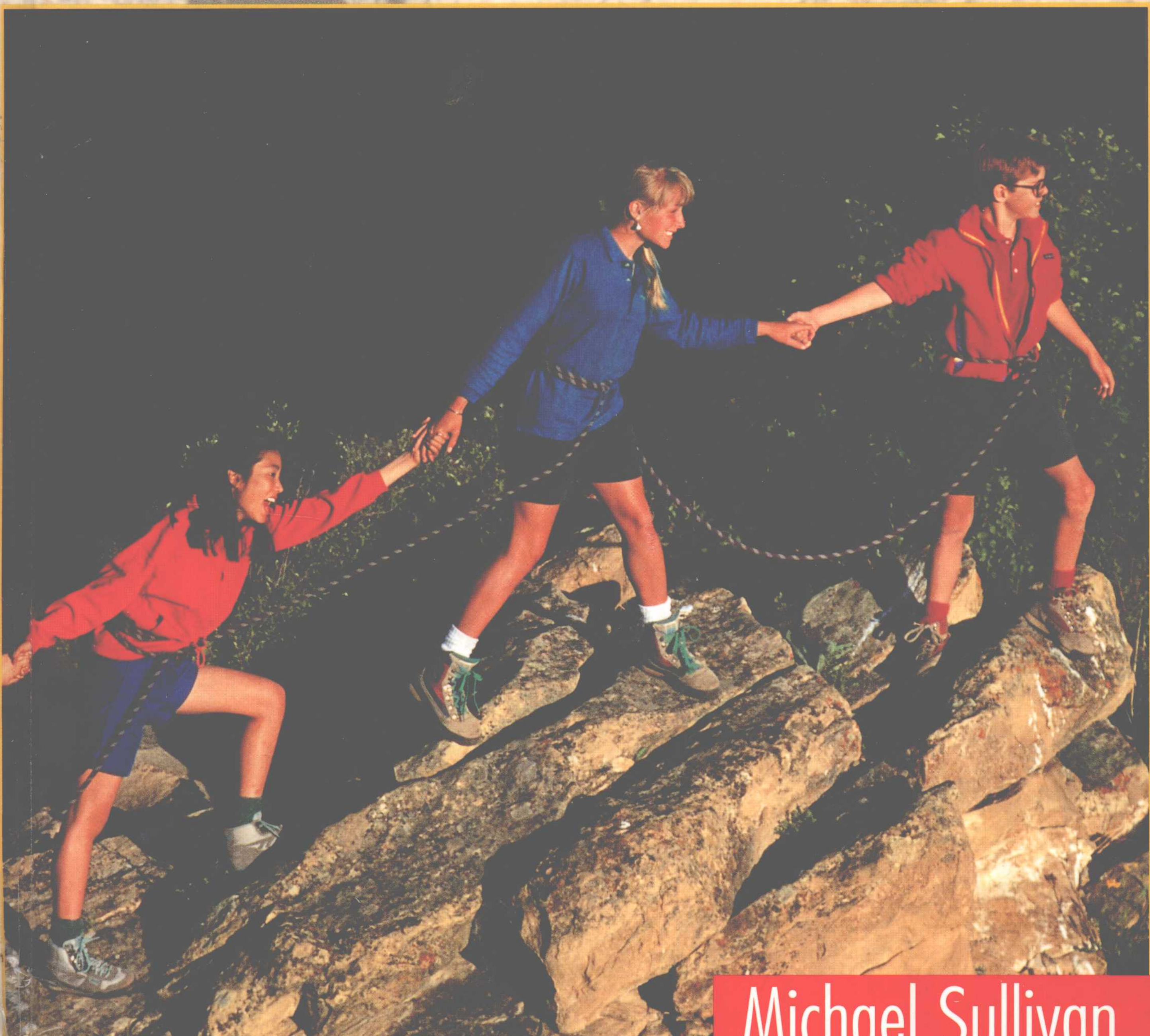
FIFTH EDITION

College Algebra



Michael Sullivan

College Algebra

Fifth Edition

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PREFACE TO THE INSTRUCTOR

As a professor at an urban public university for over 30 years, I am aware of the varied needs of college algebra students who range from having little mathematical background and a fear of mathematics courses to those who have had a strong education and are extremely motivated. For some of your students, this will be their last course in mathematics, while others may decide to further their mathematical education. I have written this text for both groups. As the author of precalculus, engineering calculus, finite math and business calculus texts, and, as a teacher, I understand what students must know if they are to be focused and successful in upper level mathematics courses. However, as a father of four, I also understand the realities of college life. I have taken great pains to insure that the text contains solid, student-friendly examples and problems, as well as a clear writing style.

In the Fifth Edition

The Fifth Edition builds upon a solid foundation by integrating new features and techniques that further enhance student interest and involvement. The elements of previous editions that have proved successful remain, while many changes, some obvious, others subtle, have been made. A huge benefit of authoring a successful series is the broad-based feedback upon which improvements and additions are ultimately based. Virtually every change to this edition is the result of thoughtful comments and suggestions made from colleagues and students who have used previous editions. I am sincerely grateful for this feedback and have tried to make changes that improve the flow and usability of the text. For example, some topics have been moved to better reflect the way teachers approach the course. In other places, problems have been added where more practice was needed. The testing package has been significantly upgraded with the addition of Testpro 3 online testing. The addition of Mathpro Explorer tutorial software and the Sullivan web site, www.prenhall.com/sullivan, represent a truly useful integration of learning technology.

Changes to the Fifth Edition

Each chapter now begins with an Internet Excursion involving a real world problem that can be analyzed utilizing the material found in the chapter and information found on the Web.

Many new exercises, problems, and examples utilize real data in table form.

Specific Organizational Changes

- Chapter 1: The section on Complex Numbers (1.9) has been removed and now appears as part of Section 5.6.
- Chapter 2: The section on Quadratic Equations with a Negative Discriminant (2.4) has been removed. The two sections (1.9) and (2.4) are combined and appear in Chapter 5 (5.6). [Section 5.6 can be covered at anytime after 2.3.]

- Chapter 4: Section 4.5, One-to-One Functions; Inverse Functions, has been removed and now appears as the first section of Chapter 6, Exponential and Logarithmic Functions.

  **The above changes are predicated on the belief that it is better to place material as close as possible to where it is actually needed than it is to cover it, set it aside, and then expect the student to remember it when it is needed.*
- Chapter 5: Sections 5.4–5.7 have been rewritten in a more concise way.
- Chapter 10: Section 10.1, Matrix Algebra, and Section 10.2, Partial Fraction Decomposition, now appear in Chapter 8, Systems of Equations and Inequalities. Section 10.3, Vectors, has been removed entirely.

Specific Content Changes

- Chapter 2: Problems have been added to the Chapter Review to more accurately represent the material of the chapter.
- Chapter 3: Scatter diagrams are used in Section 3.1 to further motivate the idea of rectangular coordinates. A new Section, 3.5 Linear Curve Fitting, explores the idea of linearly related data and fitting lines to scatter diagrams. This section is optional and does not require graphing calculators.
- Chapter 4: In Section 4.2, more emphasis is placed on the average rate of change of a function.
- Chapter 5: Section 5.1 contains a brief discussion of data that fits a quadratic function.
- Chapter 6: Section 6.4, Properties of Logarithms, contains a brief discussion of data that fits exponential or logarithmic functions. Section 6.7, Growth and Decay, now contains an example of Logistic Growth.

As a result of these changes, this edition will be an improved teaching device for professors and a better learning tool for students.

Acknowledgments

Textbooks are written by authors, but evolve from an idea into final form through the efforts of many people. Special thanks to Don Dellen, who first suggested this book and the other books in this series. Don's extensive contributions to publishing and mathematics are well known; we all miss him dearly.

There are many people we would like to thank for their input, encouragement, patience, and support. They have our deepest thanks and appreciation. We apologize for any omissions . . .

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Michael Sullivan

PREFACE TO THE STUDENT

As you begin your study of College Algebra, you may feel overwhelmed by the number of theorems, definitions, procedures, and equations that confront you. You may even wonder whether or not you can learn all of this material in a single course. These concerns are normal. Keep in mind that the concepts of College Algebra are all around us as we go through our daily routines. Many of the concepts you will learn to express mathematically, you already know intuitively. For many of you, this may be your last math course, while for others, just the first in a series of many. Either way, this text was written with you in mind. I have taught college algebra courses for over thirty years. I am also the father of four college students who called home, from time to time, frustrated and with questions. I know what you're going through. So I have written a text that doesn't overwhelm, or unnecessarily complicate the concepts of College Algebra, but at the same time gives you the skills and practice you need to be successful.

This text is designed to help you, the student, master the terminology and basic concepts of College Algebra. These aims have helped to shape every aspect of the book. Many learning aids are built into the format of the text to make your study of the material easier and more rewarding. This book is meant to be a "machine for learning," one that can help you focus your efforts and get the most from the time and energy you invest.

Please do not hesitate to contact me, through Prentice Hall, with any suggestions or comments that would improve this text.

Best Wishes!

Michael Sullivan

CHAPTER 4

Functions and Their Graphs

Imagine yourself as an expert for the EPA and sitting in congressional policy meetings having to explain the importance of balancing energy resources with environmental protection. On the following page is the Internet Excursion placing you in exactly that position and asking the tough questions a member of Congress might ask. Use the Sullivan website at:

www.prenhall.com/sullivan

to link to the Internet resources needed to answer the questions asked.

PREPARING FOR THIS CHAPTER

Before getting started on this chapter, review the following concepts:

Domain of a Variable *(p. 17)*

Graphs of Certain Equations *(Example 2, p. 175; Example 3, p. 176; Example 4, p. 176; Example 11, p. 182)*

Tests for Symmetry of an Equation *(p. 180)*

Procedure for Finding Intercepts of an Equation *(p. 178)*

Steps for Setting up Applied Problems *(p. 99)*

OUTLINE

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CHAPTER OPENERS

Each chapter begins with Preparing for this Chapter, which serves as a "just-in-time" review, while Chapter Outlines provide students with a basic road map of the chapter.

Students will already have an understanding of which concepts are most important before beginning the chapter.

INTERNET PROJECTS

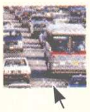
Exploration in each chapter starts right from the beginning with optional Internet Projects inviting students to use the Sullivan Web site to gather information and real data to solve mathematical problems.

Students can see what a useful and accessible tool the Internet is. Likewise, they will also be able to see algebra as a valuable tool for understanding the world outside the classroom.

Internet Projects also help foster active learning and participation in lecture.

Back | Forward | Home | Reload | Images | Open | Print | Find | Stop

Netsite: http://www.prenhall.com/sullivan/



HOW LONG WILL THE OIL LAST?

The global supply of oil and other sources of energy is more than adequate to meet present needs, but most of this supply is outside the United States. Currently, oil supplies about 40 percent of the world's energy, with the United States being the biggest consumer. Since oil is a nonrenewable energy resource, plans must be made for the eventuality of diminishing supply.

Suppose that you were a consultant for the EPA and members of Congress asked you to sit on the Energy Policy Steering Committee as an expert analyst. You must convince the committee of the importance of environmental concerns in planning the global energy system. You are very aware of the fact that present modes of energy use and production threaten serious environmental deterioration. Your plan is to create a set of "what if" functions that will allow your committee to model many possible scenarios for their policy guidelines.

1. $E(t)$, the first function that you create, will allow you to model United States oil consumption over a period of time. Make a scatter diagram using the EPA Data on United States energy consumption per capita from 1950–1990. Since oil provides 40 percent of the energy consumed, adjust your figures to get oil consumption per capita. Use the LINear REGression tool on your graphing utility to find the linear function $E(t)$ of best fit for modeling the data. Does this seem like a good model?
2. Your second function, $P(t)$, is a population modeling tool. From the United States Census Data, make a scatter diagram, and then use a QUADratic REGression to model the data. Next, let $O(t) = E(t) \cdot P(t)$. What does $O(t)$ model? Graph $O(t)$. Compare to the actual figures from BP Petroleum.

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4.2 MORE ABOUT FUNCTIONS

1 Find the Average Rate of Change of a Function
2 Determine Where a Function Is Increasing and Decreasing
3 Determine Even or Odd Functions from a Graph
4 Identify Even or Odd Functions from the Equation
5 Graph Certain Important Functions
6 Graph Piecewise-defined Functions

Average Rate of Change

1 In Section 3.3 we said the slope of a straight line could be interpreted as the average rate of change. Often, we are interested in the rate at which functions change. To find the average rate of change of a function between any two points on its graph, we calculate the slope of the line containing the two points.

EXAMPLE 1 Finding the Average Rate of Change of a Function

TABLE 3

Time, t (Seconds)	Distance, s (Feet)
0	0
1	16
2	64
3	144
4	256
5	400
6	576
7	784

Suppose that you drop a ball from a cliff 1000 feet high. You measure the distance s that the ball has fallen after time t using a motion detector and obtain the data in Table 3.

(a) Draw a scatter diagram of the data, treating time as the independent variable.
(b) Draw a line from the point (0, 0) to (2, 64).
(c) Find the average rate of change of the ball between 0 and 2 seconds, that is, find the slope of the line in (b).
(d) Interpret the average rate of change found in (c).
(e) Draw a line from the point (5, 400) to (7, 784).

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SECTION OBJECTIVES

Each section begins with a bulleted synopsis of the topics it contains.

Students have a clear idea of which concepts they will cover, enhancing their comfort level as new topics are introduced.

OPTIONAL GRAPHING UTILITIES AND TECHNIQUES

FIGURE 36

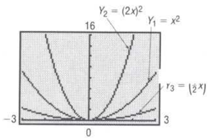
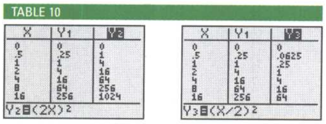


TABLE 10



(a) (b)

If the argument x of a function $y = f(x)$ is multiplied by a positive number k, the graph of the new function $y = f(kx)$ is obtained by multiplying each x-coordinate of $y = f(x)$ by $1/k$. A **horizontal compression** results if $k > 1$ and a **horizontal stretch** occurs if $0 < k < 1$.

Let's look at an example.

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Graphing utilities are optional in this text and their use is clearly identified by the use of a graphing utility icon. At appropriate places, graphing utilities are used for Exploration, Seeing the Concept, and Checks, often using TI-83 screen shots. Optional graphing utility exercises and examples also appear.

Graphing utilities allow students to explore algebraic concepts visually, promoting more thorough understanding of key objectives.

SUMMARY OF GRAPHING TECHNIQUES

Table 12 summarizes the graphing procedures we have just discussed.

TABLE 12

To Graph:	Draw the Graph of f and:	Functional Change to $f(x)$
Vertical shifts		
$y = f(x) + c, \quad c > 0$	Raise the graph of f by c units.	Add c to $f(x)$.
$y = f(x) - c, \quad c > 0$	Lower the graph of f by c units.	Subtract c from $f(x)$.
Horizontal shifts		
$y = f(x + c), \quad c > 0$	Shift the graph of f to the left c units.	Replace x by $x + c$.
$y = f(x - c), \quad c > 0$	Shift the graph of f to the right c units.	Replace x by $x - c$.
Compressing or stretching		
$y = kf(x), \quad k > 0$	Multiply each y coordinate of $y = f(x)$ by k.	Multiply $f(x)$ by k.
$y = f(kx), \quad k > 0$	Multiply each x coordinate of $y = f(x)$ by $\frac{1}{k}$.	Replace x by kx.
Reflection about the x-axis		
$y = -f(x)$	Reflect the graph of f about the x-axis.	Multiply $f(x)$ by -1.
Reflection about the y-axis		
$y = f(-x)$	Reflect the graph of f about the y-axis.	Replace x by $-x$.

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OVERVIEW

Now work Problem 33.

What happens if the argument x of a function $y = f(x)$ is multiplied by a positive number k, creating a new function $y = f(kx)$. To find the answer, we look at the following Exploration.

Exploration On the same screen, graph each of the following functions:

$$Y_1 = f(x) = x^2$$
$$Y_2 = f(2x) = (2x)^2$$
$$Y_3 = f\left(\frac{1}{2}x\right) = \left(\frac{1}{2}x\right)^2$$

You should have obtained the graphs shown in Figure 36. The graph of $Y_2 = (2x)^2$ is the graph of $Y_1 = x^2$ compressed horizontally. Look at Table 10(a). Notice that (1, 1), (2, 4), (4, 16), and (16, 256) are points on the graph of $Y_1 = x^2$. Also, (0.5, 1), (1, 4), (2, 16), and (8, 256) are points on the graph of $Y_2 = (2x)^2$. Thus, the graph of $Y_2 = (2x)^2$ is obtained by multiplying the x-coordinate of each point on the graph of $Y_1 = x^2$ by $\frac{1}{2}$. The graph of $Y_3 = \left(\frac{1}{2}x\right)^2$ is the graph of $Y_1 = x^2$ stretched horizontally. Look at Table 10(b). Notice that (0.5, 0.25), (1, 1), (2, 4), (4, 16) are points on the graph of $Y_1 = x^2$. Also, (1, 0.25), (2, 1), (4, 4), (8, 16) are points on the graph of $Y_3 = \left(\frac{1}{2}x\right)^2$. Thus, the graph of $Y_3 = \left(\frac{1}{2}x\right)^2$ is obtained by multiplying the x-coordinate of each point on the graph of $Y_1 = x^2$ by a factor of 2.

FIGURE 36

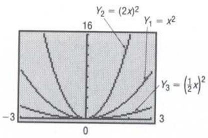

TABLE 10

X	Y1	Y2
0	0	0
.5	.25	1
1	1	4
2	4	16
4	16	64
8	64	256
16	256	1024

Y2=(2X)²

(a)

X	Y1	Y3
0	0	0
.5	.25	.0625
1	1	.25
2	4	1
4	16	4
8	64	16
16	256	64

Y3=(X/2)²

(b)

If the argument x of a function $y = f(x)$ is multiplied by a positive number k, the graph of the new function $y = f(kx)$ is obtained by multiplying each x-coordinate of $y = f(x)$ by $1/k$. A **horizontal compression** results if $k > 1$ and a **horizontal stretch** occurs if $0 < k < 1$.

Let's look at an example.

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"NOW WORK" PROBLEMS

Blue "Now Work" icons appear at appropriate places within each section, sending the student to work specific exercises as topics are introduced.

Students are able to test their understanding as they study, rather than waiting until the end of the section and trying to determine where they may have missed a concept.

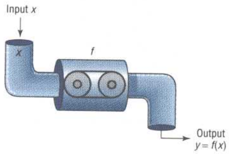
A hidden benefit of the "Now Work" problems is that they enable students to ask more specific questions in class, because they know exactly in which areas they need help.

A CLEAR WRITING STYLE

Sullivan's accessible writing style is apparent throughout.

An author who writes clearly makes potentially difficult concepts intuitive. Class time is infinitely more productive when students have the support of a well-written text.

FIGURE 3



The restrictions on this input/output machine are

1. It only accepts numbers from the domain of the function.
2. For each input, there is exactly one output (which may be repeated for different inputs).

For a function $y = f(x)$, the variable x is called the **independent variable**, because it can be assigned any of the permissible numbers from the domain. The variable y is called the **dependent variable**, because its value depends on x.

EXAMPLE 4 Finding Values of a Function

For the function G defined by $G(x) = 2x^2 - 3x$, evaluate:

(a) $G(3)$ (b) $G(x) + G(3)$ (c) $G(-x)$
(d) $-G(x)$ (e) $G(x + 3)$

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MISSION POSSIBLE

"Saving the Economic Future of Krispy Krunchy Candy Co."

The Krispy Krunchy Candy Company is facing a financial crisis because the cost of shipping cocoa beans from Ghana has increased. The CEO has decided that the way to stay afloat would be to reduce the size of their GIANT KRISPY KRUNCHY BAR by 10% but keep the price the same. He doesn't want to lose any customers, however. Therefore, he wants the change in size to be as unobtrusive as possible. The present dimensions of the GIANT KRISPY KRUNCHY BAR are 12 centimeters (cm) in length, 7 cm in width, and 3 cm in thickness. The CEO has asked your consulting firm to come up with the best way to shrink the candy bar. Because millions of dollars are riding on this decision, you will need to find all answers in centimeters to 3 decimal places and all percents to 5 significant digits.

1. Make a sketch of the candy bar, roughly to scale, and label it.
2. What is the present volume of the candy bar?
3. What would be the new volume after a 10% reduction?
4. What would be the new volume if each dimension were reduced by 10%. Is this the same as your answer to question 3? (It shouldn't be.) Explain the difference.
5. Consider reducing two of the dimensions by the same number of centimeters, while holding the third dimension fixed. (There are three possibilities; in each case, the new volume is to be 90% of the original volume.)
6. Consider reducing two (but not three) of the dimensions by the same percent. What would the new dimensions be in each case? (There are three possibilities; in each case you want the new volume to be 90% of the original volume.)
7. Consider reducing all three of the dimensions by the same percent. What would the new dimensions be?
8. Within your group, make a decision about which of the seven possibilities that you found would be the best one to recommend to the CEO of Krispy Krunchy. Write out two or three sentences to justify your choice.
9. Would you mind if you discovered that your favorite candy bar had been reduced in size while the price stayed the same? Do you think a candy company might actually do this to improve their financial standing? What is your protection as a consumer from being fooled?

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MISSION POSSIBLES

In every chapter, there is a full-page collaborative project, a Mission Possible. These multi-tasked projects, written by Hester Lewellen, one of the co-authors of the University of Chicago High School Mathematics Project, will help your students learn through and with each other.

The collaborative format has been shown to increase student motivation and interest.

298 **Chapter 4** Functions and Their Graphs

36. Federal Income Tax Two 1997 Tax Rate Schedules are given in the accompanying table. If x equals the amount on Form 1040, line 37, and y equals the tax due, construct a function f for each schedule.

1997 TAX RATE SCHEDULES

SCHEDULE X—IF YOUR FILING STATUS IS SINGLE

If the amount on Form 1040, line 37, is: Over—	But not over—	Enter on Form 1040, line 38	of the amount over—
$ 0	$ 24,650	$ 0 + 15%	$ 0
24,650	59,750	3,698 + 28	24,650
59,750	124,650	13,526 + 31	59,750
124,650	271,050	33,645 + 36	124,650
271,050		86,349 + 39.6	271,050

SCHEDULE Y-1—USE IF YOUR FILING STATUS IS MARRIED FILING JOINTLY OR QUALIFYING WIDOW(ER)

If the amount on Form 1040, line 37, is: Over—	But not over—	Enter on Form 1040, line 38	of the amount over—
$ 0	$ 41,200	$ 0 + 15%	$ 0
41,200	99,600	6,180 + 28	41,200
99,600	151,750	22,532 + 31	99,600
151,750	271,050	38,699 + 36	151,750
271,050		81,647 + 39.6	271,050

37. Inscribing a Cylinder in a Sphere Inscribe a right circular cylinder of height h and radius r in a sphere of fixed radius R. See the illustra-

38. Inscribing a Cylinder in a Cone Inscribe a right circular cylinder of height h and radius r in a cone of fixed radius R and fixed height H

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SOURCED DATA

Sullivan provides students with applications that employ sourced real-world data.

Students find it difficult to get into hypothetical "widget" problems. Real data allows students to see the relevancy of algebra outside the classroom.

264 **Chapter 4** Functions and Their Graphs

(b) Draw a line from the point (0, 24,000) to (25,27,750) on the scatter diagram found in (a).
(c) Find the average rate of change of the cost between 0 and 25 bicycles.
(d) Interpret the average rate of change found in (c). In economics, this is called **marginal cost.**
(e) Draw a line from the point (190, 42,750) to (223, 46,500) on the scatter diagram found in (a).
(f) Find the average rate of change of the cost between 190 and 223 bicycles.
(g) Interpret the average rate of change found in (f).

79. Revenue from Selling Bikes The following data represent the total revenue that would be received from selling x bicycles at Tunney's Bicycle Shop.

output does Tunney's Bicycle Shop's profits stop increasing?

80. Cost of Tuition The following data represent the average cost of tuition and required fees (in dollars) at public four-year colleges.

Year	Average Cost of Tuition
1990	2,035
1991	2,159
1992	2,410
1993	2,604
1994	2,822

Source: U.S. National Center for Education Statistics.

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OVERVIEW

4.5 MATHEMATICAL MODELS: CONSTRUCTING FUNCTIONS

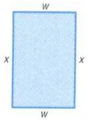
1 Construct and Analyze Functions

1 Real-world problems often result in mathematical models that involve functions. These functions need to be constructed or built based on the information given. In constructing functions, we must be able to translate the verbal description into the language of mathematics. We do this by assigning symbols to represent the independent and dependent variables and then finding the function or rule that relates these variables.

EXAMPLE 1 **Area of a Rectangle with Fixed Perimeter**

The perimeter of a rectangle is 50 feet. Express its area A as a function of the length x of a side.

FIGURE 46



Solution Consult Figure 46. If the length of the rectangle is x and if w is its width, then the sum of the lengths of the sides is the perimeter, 50.

$$x + w + x + w = 50$$
$$2x + 2w = 50$$
$$x + w = 25$$
$$w = 25 - x$$

The area A is length times width, so

$$A = xw = x(25 - x)$$

The area A as a function of x is

$$A(x) = x(25 - x)$$

Note that we used the symbol A as the dependent variable and also as the name of the function that relates the length x to the area A. As we men-

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MODELING

Students are asked to create and manipulate mathematical models.

The construction and interpretation of mathematical models is essential to better understanding of not only precalculus, but virtually any mathematics course that your students are likely to take during their college careers.

END-OF-SECTION EXERCISES

Sullivan's exercises are unparalleled in terms of thorough coverage and accuracy.

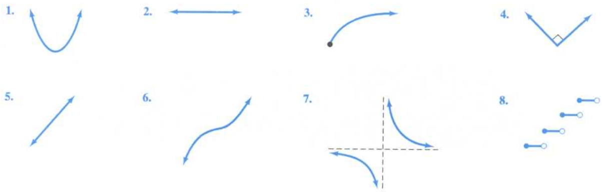
Well-executed problem sets better prepare students for exams.

Each end-of-section exercise set begins with visual and concept-based problems, starting students out with the basics of the section.

4.2 EXERCISES

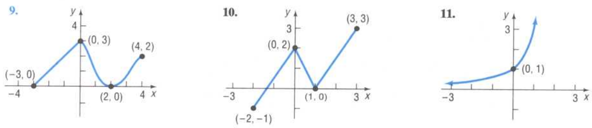
In Problems 1–8, match each graph to the function listed whose graph most resembles the one given.

A. Constant function *B. Linear function*
C. Square function *D. Cube function*
E. Square root function *F. Reciprocal function*
G. Absolute value function *H. Greatest integer function*



In Problems 9–22, the graph of a function is given. Use the graph to find

(a) Its domain and range
(b) The intervals on which it is increasing, decreasing, or constant
(c) Whether it is even, odd, or neither
(d) The intercepts, if any



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CHAPTER REVIEW

THINGS TO KNOW

Function

A relation between two sets of real numbers so that each number x in the first set, the domain, has corresponding to it exactly one number y in the second set. The range is the set of y values of the function for the x values in the domain.

x is the independent variable; y is the dependent variable.

A function f may be defined implicitly by an equation involving x and y or explicitly by writing $y = f(x)$.

A function can also be characterized as a set of ordered pairs (x, y) or $(x, f(x))$ in which no two distinct pairs have the same first element.

Function notation

$y = f(x)$

f is a symbol for the function.

x is the argument, or independent variable.

y is the dependent variable.

$f(x)$ is the value of the function at x, or the image of x.

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HOW TO

Determine whether a relation represents a function

Find the domain and range of a function from its graph

Find the domain of a function given its equation

Determine algebraically whether a function is even or odd

Graph certain functions by shifting, compressing, stretching, and/or reflecting (see Table 12)

Given the graph of a function, determine where it is increasing or decreasing

Find the composite of two functions and its domain

Construct functions in applications, including piecewise-defined functions

FILL-IN-THE-BLANK ITEMS

1. If f is a function defined by the equation $y = f(x)$, then x is called the ______________ variable and y is the ______________ variable.
2. A set of points in the xy-plane is the graph of a function if and only if no ______________ line contains more than one point of the set.
3. A(n) ______________ function f is one for which $f(-x) = f(x)$ for every x in the domain of f; a(n) ______________ function f is one for which $f(-x) = -f(x)$ for every x in the domain of f.
4. Suppose that the graph of a function f is known. Then the graph of $y = f(x - 2)$ may be obtained by a(n) ______________ shift of the graph of f to the ______________ a distance of 2 units.
5. If $f(x) = x + 1$ and $g(x) = x^3$, then ______________ $= (x + 1)^3$.
6. For two functions f and g, $(g \circ f)(x) =$ ______________.

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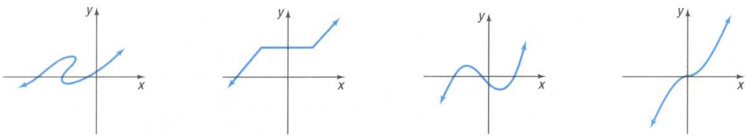
REVIEW EXERCISES

Blue problem numbers indicate the author's suggestions for use in a Practice Test.

1. Given that f is a linear function, $f(4) = -5$, and $f(0) = 3$, write the equation that defines f.
2. Given that g is a linear function with slope $= -4$ and $g(-2) = 2$, write the equation that defines g.
3. A function f is defined by
$$f(x) = \frac{Ax + 5}{6x - 2}$$
If $f(1) = 4$, find A.
4. A function g is defined by
$$g(x) = \frac{A}{x} + \frac{8}{x^2}$$
If $g(-1) = 0$, find A.
5. Tell which of the following graphs are graphs of functions.



(a) (b) (c) (d)

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CHAPTER REVIEW

The Chapter Review checks students' understanding of the chapter material in several ways. "Things to Know" gives a general overview of review topics. The "How To" section gives the student a concept-by-concept listing of the operations they are expected to perform. The "Review Exercises" then serve as a chance to practice the concepts presented within the chapter.

Students master and feel confident in knowing the chapter concepts before moving on to tackle more difficult mathematics. The Chapter Review section is also another excellent review for students when preparing for an exam or final.

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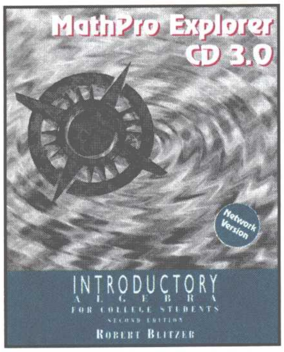

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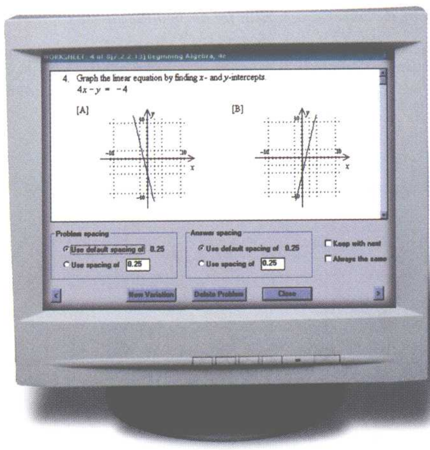

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LIST OF APPLICATIONS