

# ALGEBRA AND TRIGONOMETRY

WITH MODELING AND VISUALIZATION

FIFTH EDITION



R O C K S W O L D

5th edition

# Algebra and Trigonometry

with Modeling & Visualization

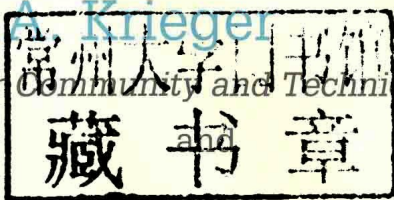
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# Showing Why Math Matters

Rockswold teaches algebra and trigonometry in context, answering the question, "Why am I learning this?"



## Creating a Social Network

Although it may not be obvious, math is essential for social networks to operate properly. Matrices are used to keep track of relationships between people on Facebook, Twitter, or Spotify. Also, a matrix can be used to describe links to and from websites on the Internet. (See the Chapter 9 Opener on page 700, Example 2 on page 755, and Example 9 on page 762.)

## Starting Up Your Own Company

If you are starting up a small business, you might be interested in a payment startup called Square that allows businesses to swipe credit cards on iPhones and Android devices. Square's dramatic growth during recent years can be analyzed with the aid of a linear inequality. (See the Introduction to Section 2.3 on page 104 and Example 3 on pages 107-108.)



## Getting the Jitters?

The side effects of caffeine include either headaches or the jitters. However, with the aid of a system of linear inequalities, we can identify the levels of caffeine intake where neither side effect occurs. (See the Introduction to Section 9.2 on page 719.)

## Determining a Margin of Error

Whether a person is being shot out of a cannon or manufacturing an iPhone, the concept of a margin of error is essential. To determine accurate margins of error, we need the concept of an absolute value inequality. (See the Introduction to Section 2.5 on page 134 and Example 7 on page 140.)





### Modeling Half-Life of a Facebook Link

A typical Facebook link experiences half of its engagements, or hits, during the first 3 hours. By using exponential functions we can estimate how many hits a Facebook link might experience in a given period of time. (See the Chapter 5 Opener on page 348 and Example 12 in Section 5.3 on pages 390-391.)

### Classifying Tornadoes

The intensity of a tornado is often classified using the Fujita scale: the greater the wind speed of a tornado, the greater its Fujita number. To use this scale we need the concept of a piecewise-constant function. (See the discussion in Section 2.4 on page 121.)

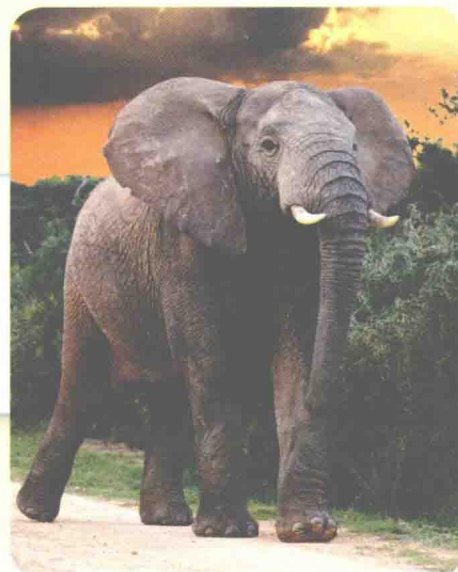


### Diminishing Returns and Overfishing

If there are only a few fishing boats in a large body of water, each boat might catch its limit. However, as the number of boats increases, there is a point of diminishing returns, where each boat starts to catch fewer and fewer fish. We can analyze this situation with a piecewise-polynomial function. (See Example 7 in Section 4.2 on pages 250-251.)

### Understanding Size in Biology

Larger animals tend to have slower heart rates and larger birds tend to have bigger wings. To understand size and physical characteristics in nature, we need to study power functions. (See the discussion and Example 10 in Section 4.8 on pages 326-328.)



*In memory of a kind man who said to me,*

*“Have joy wherever you go.”*

*Marvin, 1914–2010*



# Foreword

In today's dynamic society, students need to understand mathematics regardless of their major. However, at every level, students continue to have difficulty learning and retaining mathematics. In order to both learn and retain mathematics, students must see a connection between the concepts and their real-life experiences. *Algebra and Trigonometry with Modeling and Visualization*, Fifth Edition, addresses these issues by appropriately connecting applications, modeling, and visualization to mathematical concepts and skills. This text consistently gives meaning to the equations and demonstrates that mathematics *is* relevant. It allows students to learn mathematics in the context of their experiences. Students learn mathematics more fully when concepts are presented not only symbolically but also visually. By complementing a symbolic approach with an emphasis on visual presentations, this text allows students to absorb information faster and more intuitively.



The concept of a function is the unifying theme in this text with an emphasis on the rule of four (verbal, graphical, numerical, and symbolic representations). A flexible approach allows instructors to strike their own balance of skills, rule of four, applications, modeling, and technology. Rather than reviewing all of the necessary intermediate algebra skills in the first chapter, this text integrates required math skills seamlessly by referring students “just in time” to Chapter R, “Basic Concepts from Algebra and Geometry.” Instructors are free to assign supplemental homework from this chapter. Students also have additional opportunities to review their skills in the MyMathLab® course when needed. Here personalized homework and quizzes are readily available on a wide variety of review topics.

Students frequently do not realize that mathematics is transforming our society. To communicate this fact, the author has established a website at [www.garyrockswold.net](http://www.garyrockswold.net). Here, several resources are available, including a number of invited addresses given by the author. These presentations are accessible to students and allow them to understand the big picture of how mathematics influences everyone's life.

*Gary Rockswold*

## Changes to the Fifth Edition

The Fifth Edition has an exciting new look that makes mathematics more visual and easier for students to understand. The following changes are the result of suggestions made by students, instructors, and reviewers.

- Several features have been added that allow graphs and tables to be labeled in a way that explains topics visually with fewer words.
- Hundreds of new real-world applications that relate to students' lives have been added.
- Approximately 1000 examples and exercises have been replaced or modified to better meet student needs.
- Real-world data has been added and updated to be more current and meaningful to students.
- Chapter 1 has been streamlined from five to four sections at the request of reviewers. As a result, the first two chapters can be covered more efficiently. Also at the request of reviewers, the definition of increasing and decreasing has been modified.
- Chapter 2 has been reorganized so that it begins with equations of lines in Section 2.1. Now additional modeling with linear functions occurs in Section 2.4.
- Chapter 3 includes new visual presentations and explanations for quadratic equations, quadratic inequalities, and transformations of graphs. Rules for the order of transformations have also been included.
- Chapter 4 includes a new subsection covering radical functions and their transformations. Several visuals have been added to help students understand polynomial behavior and graphs of rational functions.
- Chapter 5 has increased emphasis on transformations of exponential and logarithmic functions. It includes more visual explanations of logarithms.
- Chapter 6 has new visuals to explain angular velocity and transformations of sinusoidal graphs. Additional material covering other inverse trigonometric functions has also been added.
- Chapter 7 has improved clarity for students when they verify identities, simplify expressions, find reference angles, and solve trigonometric equations.
- Chapter 8 has additional examples for solving triangles using the law of sines and the law of cosines. New visuals have been added to the topic of vectors to help students understand this important concept better.
- Chapter 9 has a new subsection on social networks and matrices. Several application topics that relate to students' lives, such as the Internet, have been included.
- Chapter 10 has several new visuals that help students understand conic sections.
- Chapter 11 has an increased emphasis on explaining the distinction between sequences and series. More explanation of conditional probability is also given.
- Appendix D is new and explains how percentages, constant percent change, and exponential functions are related. These topics are important to students in their everyday lives.



## Features

**NEW!**

### ■ See the Concept

This new and exciting feature allows students to make important connections by walking them through detailed visualizations. Students use graphs, tables, and diagrams to learn new concepts in a concise and efficient way. This feature also promotes multiple learning styles and deepens every student's understanding of mathematics. (See pages 32, 109, 233, 290, and 373.)

**NEW!**

### ■ Comment Boxes

This new feature allows graphs, tables, and symbolic explanations to be labeled in such a way that a *concept is easier to understand*. The explanation is now tied closely to a graph, table, or equation. (See pages 26, 73, 214, 271, and 294.)

### ■ Chapter and Section Introductions

Many algebra and trigonometry students have little or no understanding of mathematics beyond basic computation. To motivate students, chapter and section introductions explain some of the reasons for studying mathematics. (See pages 1, 67, 134, and 232.)

### ■ Now Try

This feature occurs after each example. It suggests a similar exercise students can work to see if they understand the concept presented in the example. (See pages 17, 74, and 106.)

### ■ Getting Started

This feature occurs in selected examples that require multistep solutions. Getting Started helps students develop an overall problem-solving strategy before they begin writing a detailed solution. (See pages 6, 71, and 390.)

### ■ Algebra and Geometry Review Notes

Throughout the text, Algebra and Geometry Review Notes, located in the margins, direct students “just in time” to Chapter R, where important topics in algebra and geometry are reviewed. Instructors can use this chapter for extra review or refer students to it as needed. This feature *free*s instructors from having to frequently review material from intermediate algebra and geometry. (See pages 97 and 160.) In addition, quizzes and personalized homework on review skills are now embedded in MyMathLab.

### ■ Calculator Help Notes

The Calculator Help Notes in the margins direct students “just in time” to Appendix A, “Using the Graphing Calculator.” This appendix shows students the keystrokes necessary to complete specific examples from the text. This feature *free*s instructors from having to teach the specifics of the graphing calculator and gives students a convenient reference written specifically for this text. (See pages 6, 20, and 93.)

### ■ Class Discussion

This feature, included in most sections, poses a question that can be used for either classroom discussion or homework. (See pages 47, 157, and 236.)

### ■ Making Connections

This feature, which occurs throughout the text, shows students how concepts covered previously are related to new concepts being presented. (See pages 29, 94, 110, 136, and 175.)

### ■ Putting It All Together

This helpful feature at the end of each section summarizes techniques and reinforces the mathematical concepts presented in the section. It is given in an easy-to-follow grid. (See pages 98–99, 331–332, and 392–393.)

**■ Checking Basic Concepts**

This feature, included after every two sections, provides a small set of exercises that can be used as mixed review. These exercises require about 15 or 20 minutes to complete and can be used for collaborative learning exercises if time permits. (See pages 104, 133, and 188.)

**■ Exercise Sets**

The exercise sets are the heart of any mathematics text, and this text includes a large variety of instructive exercises. Each set of exercises covers skill building, mathematical concepts, and applications. Graphical interpretation and tables of data are often used to extend students' understanding of mathematical concepts. The exercise sets are graded carefully and categorized according to topic, making it easy for an instructor to select appropriate assignments. (See pages 80–85 and 183–188.)

**■ Chapter Summaries**

Chapter summaries are presented in an easy-to-read grid. They allow students to quickly review key concepts from the chapter. (See pages 224–227 and 337–341.)

**■ Chapter Review Exercises**

This exercise set contains both skill-building and applied exercises. These exercises stress different techniques for solving problems and provide students with the review necessary to pass a chapter test. (See pages 63–66 and 341–345.)

**■ Extended and Discovery Exercises**

Extended and Discovery Exercises occur at the end of selected sections and at the end of every chapter. These exercises are usually more complex and challenging than the rest of the exercises and often require extension of a topic presented or exploration of a new topic. They can be used for either collaborative learning or extra homework assignments. (See pages 65–66, 230, and 344–345.)

**■ Cumulative Review Exercises**

These comprehensive exercise sets, which occur after every two chapters, give students an opportunity to review previous material. (See pages 152–154 and 345–347.)

## Instructor Supplements

### ANNOTATED INSTRUCTOR'S EDITION

- Includes sample homework assignments indicated by problem numbers underlined in blue within each end-of-section exercise set.
- Sample homework assignments assignable in MyMathLab.
- Includes Teaching Examples, an extra set of examples for instructors to present in class, doubling the number of examples available for instructors. Solutions and Power Point Slides are available for these.
- Includes Teaching Tips, helpful ideas about presenting topics or teaching from the text
- Includes all the answers to the exercise sets, usually right on the page where the exercise appears

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### INSTRUCTOR'S SOLUTIONS MANUAL

- By David Atwood, *Rochester Community and Technical College*
- Provides complete solutions to all text exercises, excluding Writing about Mathematics

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- Includes resources to help faculty with course preparation and classroom management
- Provides helpful teaching tips correlated to the sections of text, as well as general teaching advice

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### POWERPOINT PRESENTATION (DOWNLOAD ONLY)

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## Student Supplements

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- By David Atwood, *Rochester Community and Technical College*
- Provides complete solutions to all odd-numbered text exercises, excluding Writing about Mathematics and Extended and Discovery Exercises

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## Technology Resources

### MyMathLab® MyMathLab Online Course (access code required)

MyMathLab delivers **proven results** in helping individual students succeed.

- MyMathLab has a consistently positive impact on the quality of learning in higher education math instruction. MyMathLab can be successfully implemented in any environment—lab-based, hybrid, fully online, traditional—and demonstrates the quantifiable difference that integrated usage has on student retention, subsequent success, and overall achievement.
- MyMathLab's comprehensive online gradebook automatically tracks your students' results on tests, quizzes, homework, and in the study plan. You can use the gradebook to quickly intervene if your students have trouble or to provide positive feedback on a job well done. The data within MyMathLab is easily exported to a variety of spreadsheet programs, such as Microsoft Excel. You can determine which points of data you want to export and then analyze the results to determine success.

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- **Multimedia Learning Aids:** Exercises include guided solutions, sample problems, videos, and eText clips for extra help at point-of-use.
- **Expert Tutoring:** Although many students describe the whole of MyMathLab as “like having your own personal tutor,” students using MyMathLab do have access to live tutoring from Pearson, from qualified math and statistics instructors.

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- Knowing that you are using a Pearson product means knowing that you are using quality content. That means that our eTexts are accurate and our assessment tools work. Whether you are just getting started with MyMathLab, or have a question along the way, we're here to help you learn about our technologies and how to incorporate them into your course.

#### Rockswold's MyMathLab course engages students and keeps them thinking.

- Author designated preassigned homework assignments are provided.
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- Interactive figures are available, enabling users to manipulate figures to bring hard-to-convey math concepts to life.
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- Create and assign their own online exercises and import TestGen tests for added flexibility.
- Maintain records of all student work tracked in MathXL's online gradebook.

With MathXL, students can:

- Take chapter tests in MathXL and receive personalized study plans and/or personalized homework assignments based on their test results.
- Use the study plan and/or the homework to link directly to tutorial exercises for the objectives they need to study.
- Access supplemental animations and video clips directly from selected exercises.

MathXL is available to qualified adopters. For more information, visit our website at [www.mathxl.com](http://www.mathxl.com) or contact your Pearson representative.



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Gary Rockswold



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