COLLEGE MATHEMATICS

Through Applications

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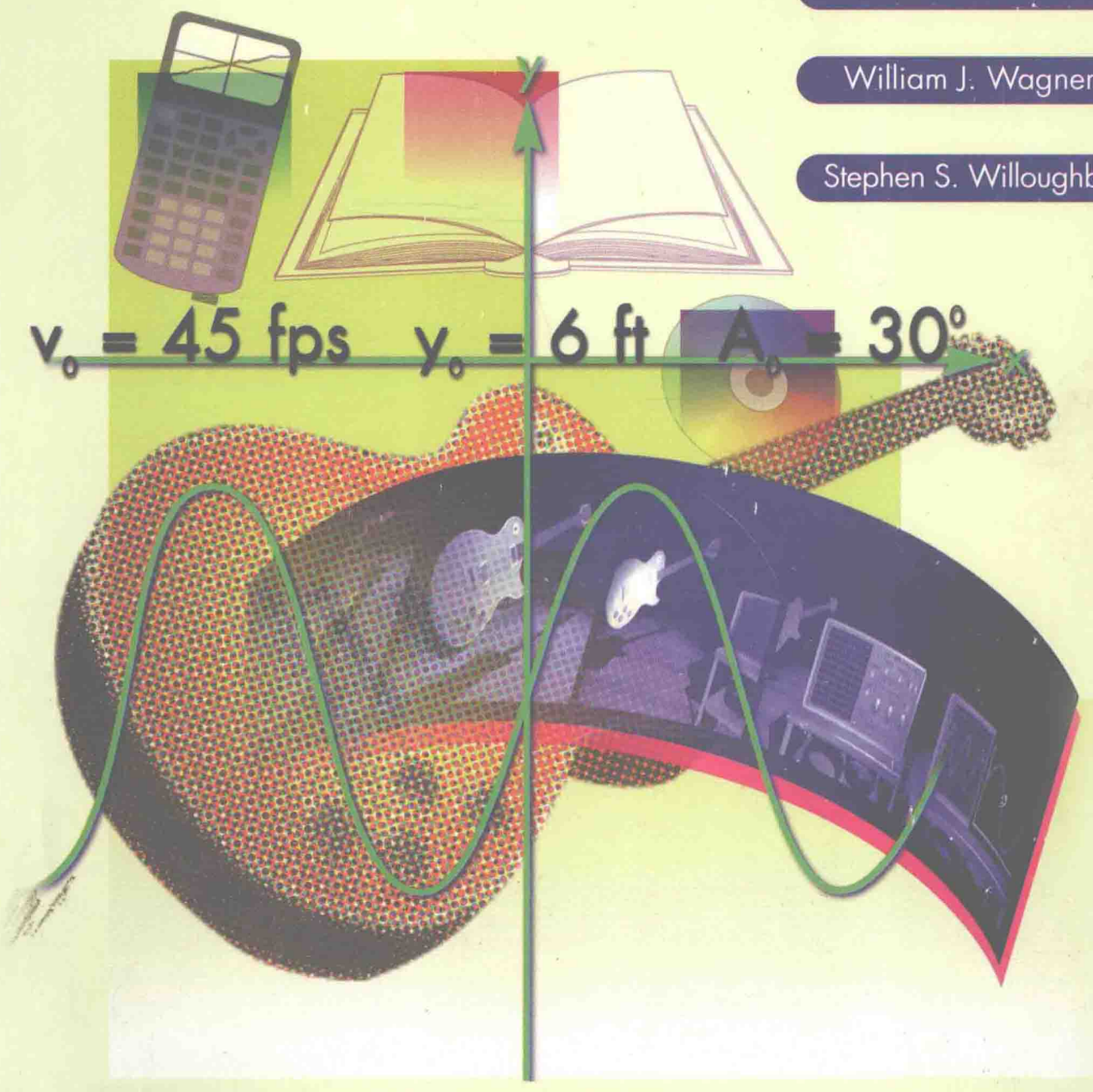

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PREFACE

Introduction

Students in technical and engineering technology programs require a mathematics curriculum that focuses on the real environments in which they will apply their knowledge and the tools they will employ there, without degenerating into a set of rules and algorithms. Their mathematics education should be intellectually challenging and should lay a foundation for further learning and development.

College Mathematics Through Applications has been developed to be the first text in a series that will focus on mathematics for these students. It covers advanced algebra, trigonometry, geometry, and intuitive calculus and explores these topics through applications. The series will use workplace-based applications as the cornerstone of the instruction and will involve students in developing solutions and methods. Inspired equally by the world of work and the current reform movement in mathematics education, we have looked hard at the traditional content of these courses and have chosen topics that are used in a wide variety of technical fields and that are intellectually rich. The presentation and classroom activities are designed to be interesting yet challenging to all students.

We expect that each student will have a graphing calculator, but just giving a calculator to students or letting calculators creep into the classroom doesn't bring the benefits. Therefore, we have fully integrated the calculator into this text. The use of technology cannot replace thinking, but it should reduce mathematical error.

Approach

The goals of our presentation are for students to

- Understand how mathematics is used in the workplace
- Understand the limitations of tools, simulations, and mathematical methods
- Develop intuition about whether results do or do not make sense
- Not be held back by traditional prerequisites or barriers
- Learn to apply mathematics in real settings
- Review prerequisite concepts in context
- Use available technology to develop deep understanding of concepts

To reach these goals we have laid the following philosophical and pedagogical foundations:

- Learning in the context of real applications promotes retention and understanding.
- Mathematical content should reflect actual workplace needs.
- Students learn better by doing, writing, and discussing.
- Mathematical instruction should use the technology to perform traditional computations.
- Calculators should take over much of the machinery of calculations, allowing students to concentrate on a problem and focus on concepts.
- Content should be presented using the "rule of four": ideas are presented and students work in symbolic, graphic, and numeric methods and are then asked to express their ideas and answers in writing.
- Students who communicate their mathematical understanding through written and oral responses to well-designed, thought-provoking questions and problems will gain valuable workplace skills.

In addition, the text has these common threads:

- Applications and real data are used whenever possible.
- Equations and functions are used as models of data.
- Students assess the accuracy and reasonableness of results.
- Technology provides alternative methods for approximating solutions.
- Technology is used in the classroom every day.
- Intuitive calculus is woven throughout.

Features

Chapters begin with a Project (usually workplace-based), and the goal of the chapter is to learn the mathematics necessary to solve the problems posed by this Project. The world of work doesn't present problems in a neat, organized way, so to better prepare students for the workplace, these projects are designed to force students to organize their thoughts and decide what the problem is asking them to do. Good problem solvers get information and skills as they need them, so at several points in the chapter students are asked to relate the mathematics they have learned to the solution of the Project. By the end of the chapter they will have learned how to complete the Project.

The chapters also include these additional features:

- Frequent Activities and Calculator Labs are designed to get students involved in performing experiments, collecting and analyzing data, and forming conclusions—as they will have to do in their future careers.
- Technology—graphing calculators and an interactive CD—is integrated throughout the text to allow students to explore more advanced mathematics concepts.
- Numerous examples and exercises show how the mathematics relates to different technical fields.
- A chapter summary, review exercises, and a chapter test conclude every chapter.
- Intuitive ideas underlying many mathematics concepts are used, including the intuitive foundations of calculus.
- Applications and actual data are used whenever possible to emphasize the usefulness of mathematics.
- The text uses a spiral approach to anticipate and reinforce instruction.

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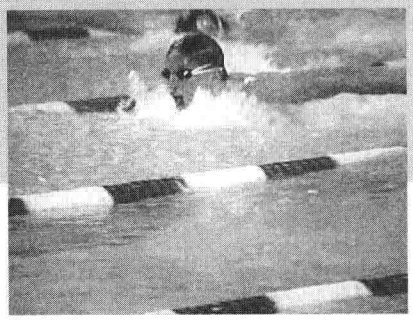
CHAPTER 1

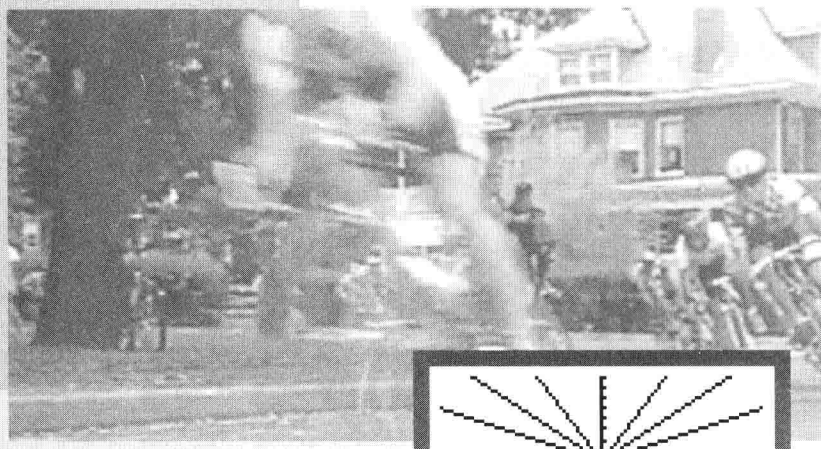
Linear Equations

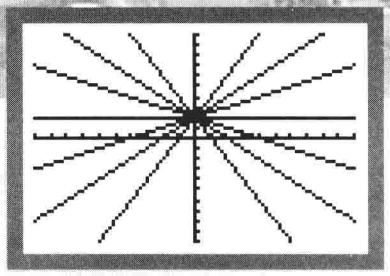
Making Mathematical Models of Data



Topics You'll Learn or Review

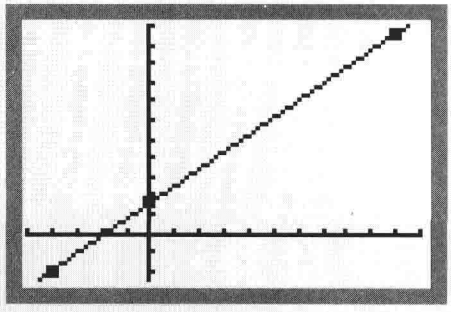
- Describing how the slope of a line is related to the graph of the line and the equation of the line
- Describing the trigonometric connection between the slope of a line and the angle the line makes with the *x*-axis
- Using the connection between a constant velocity experiment and the slope and *y*-intercept of the distance vs. time graph
- Writing the equation of a straight line given any of the following:
  - the slope and the *y*-intercept
  - one point and the slope
  - two points
  - one point and the inclination angle of the line
- Using a mathematical model to study real events and relationships; that is,
  - using a linear model of data to estimate missing values in the data
  - analyzing how well a linear model fits the data





Calculator Skills You'll Need

- Doing calculations on the home screen
- Using the 2nd key to reach calculator functions named in yellow
- Working with graphs to
  - enter a function in the Y= screen and graph it
  - turn graphs of functions on and off
  - use Trace to determine the coordinates of points
  - change screen dimensions with the WINDOW menu
- Using the MODE menu to switch between radians and degrees



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