What Distinguishes This Text from Others

1. It employs universal design principles in how information is presented. Some examples of this are: simplicity and consistent use of common notation, careful explanation of mathematical ‘jargon’, vertical rather than horizontal arrangements of visual or tabular information, and avoidance of symbols with multiple meanings.
2. Develop marketable skills applicable in a business environment – whether it be a company or organization comprising of one individual, 50 individuals, or a thousand. Many of the lessons include applicable spreadsheet activities that enable the student to visualize the mathematical principles which help to answer meaningful questions.
3. With practice, the student will develop confidence toward being able to communicate accurately using mathematical models, formulas, and data tools. Instead of emphasizing procedures, the emphasis is on extrapolation, interpretation, analysis, and critical thinking.
4. With the emergence of large language models and intelligent systems, the need for computation and algebraic manipulation will be less relevant. Tools like Mathway, Cymath, and Desmos are constantly improving as the training data and prompt engineering improves. Given that these automations are still developing and still are prone to errors, it will be more necessary than ever before to be able to assess and evaluate information that is presented, determine its reliability, and finally to assess its application (when, how, and to whom).
5. The inclusion of a Chapter Zero offers the student more than just elementary mathematical concepts. These foundational concepts are put in context which enriches and broadens the learner’s perspective. Numbers are not just objects to be plugged into a formula. They actually mean something contextually. A fraction isn’t just a fraction, but a means to engage in commerce or calculate the frequency of a leap year. In a typical semester course, Chapter Zero is not included in the Syllabus. It is there for the student to review basic concepts as needed or desired.

Outline

Chapter 0: Foundations of Mathematical Reasoning and Expression

Section 0.1 The Real Number System

Real, Rational and Integer Number Systems

Words We Use for Numbers

Section 0.2 What’s the Big Deal About Fractions?

Pieces of Eight

Unit Fractions and Other Notation

Ratio as a Fraction

Leap Year Calculations

Section 0.3 From Fractions and Decimals to Percents

What the % Symbol Means

Some Applications of Percent

Section 0.4 How Big or Small; High or Low; Near or Far

Measurement and Size

Context Used to Interpret Scale of Something

Definition of Magnitude and Distance

Section 0.5 Direction and the Rectangular Coordinate System

Coordinates on a Flat Surface

Distance and Direction

Quadrants in the Coordinate System

Chapter 1: Functions and Linear Models

Section 1.1 Definitions and Terminology of Functions

Continuous versus Discrete Sets of Numbers

Functions and Function Notation

Multiple Representations (graphical, tabular, description, formulaic)

Section 1.2: Characteristics of Functions

Domain and Range

Predictor variable and Response variable

Section 1.3: Rates of Change and Bivariate Behavior

How two quantities correlate

Analyzing average rate of change

Patterns in relationships (Increasing/decreasing)

Section 1.4: Linear Models

Definition of a Linear Function and Implications

Characteristics of Linear Relationships

Section 1.5: Graphs of Linear Functions

Extracting Meaning From a Graph

Creating a Graph From Data or an Equation

Section 1.6: Interpreting With Linear Models

Use Verbal Descriptions In Linear Relationships

Applications

When Time is the Predictor Variable

When the Response is Cost, Revenue, or Profit

Supply and Demand

Section 1.7: Fitting a Linear Model From Data

Choosing the Predictor and Response

Why Domain Matters

Interpolation and Extrapolation

Chapter 2: Input/Output Analysis (Matrices in Economic Systems)

Section 2.1: Matrix Representation

System of Equations and Matrix Equivalent

Using Technology to Solve a System

Interpreting and Analyzing the Results

Section 2.2: A Problem in Industrial Production

Connecting Verbal Descriptions To Equations

Understand The Situation Using Multiple Representations

Section 2.3: A Problem in Conglomerate Production

Connecting Verbal Descriptions To Equations

Understand The Situation Using Multiple Representations

Chapter 3: Optimization With Multiple Variables (Linear Optimization – A Case Study)

Section 3.1: Description of a Problem

Connecting Verbal Descriptions To Equations

Understand The Situation Using Multiple Representations

Naming the Function To Be Optimized

Section 3.2: Matrix Representations

From System of Equations To Matrix

Section 3.3: Finding Solutions

Using Software To Do the Dirty Work

Meaning Behind the Numbers

Section 3.4: Interpretation and Analysis

Chapter 4: Polynomials As Models

Section 4.1: Quadratic Models

Definition of a Quadratic Function and Implications

Characteristics of Quadratic Type Relationships

Section 4.2: Graphs of Quadratic Functions

Extracting Meaning From a Graph

Creating a Graph From Data or an Equation

Section 4.3: Interpreting With Quadratic Models

Use Verbal Descriptions In Quadratic Relationships

Applications

When time is the predictor variable

When the response is cost, revenue, or profit

Section 4.4: Polynomial Models

Definition of a Polynomial Function and Implications

Characteristics of Polynomial Type Relationships

Chapter 5: Exponential and Logarithm As Models

Section 5.1: Exponential Models

Definition of an Exponential Function and Implications

Characteristics of Exponential Relationships

Exponential Growth and Decay

Section 5.2: Graphs of Exponential Functions

Extracting Meaning From a Graph

Creating a Graph From Data or an Equation

Section 5.3: Logarithm Models

Definition of a Logarithm Function and Implications

Characteristics of Logarithmic Relationships

Logarithm in Population Growth Models

Section 5.4: Graphs of Logarithm Functions

Extracting Meaning From a Graph

Creating a Graph From Data or an Equation

Section 5.5: Applications of Exponential and Logarithm Models

Population Growth and Decay Case Studies

Compound Interest

Applying a Logarithmic Scale to Stock Market Data

Chapter 6: Finance

Section 6.1: Simple and Compound Interest

Section 6.2: Annuities

Section 6.3: Payout Annuities

Section 6.4: Loans and Amortization

Section 6.5: Putting It All Together

Chapter 7: Sets and Probability

Section 7.1: Basics of Set Notation and “Belonging”

Section 7.2: Venn Diagrams and Applications (Survey Problems)

Section 7.3: Events and Outcomes

Section 7.4: Basic Probability

Probability of a Single Event

Complement Rule For Probability

Addition Rule in Probability

Section 7.5: Conditional Probability and Contingency Tables

Section 7.6: Expected Value

Application: Insurance Premiums

Application: Warranties

Application: Game Theory

Chapter 8: Descriptive Statistics

Section 8.1: Sampling and Data Collection

Section 8.2: Visualization With Data

Section 8.3: Summarization of Data

Section 8.4: Discrete Distributions

Section 8.5: Continuous Distributions

Section 8.6: Central Limit Theorem

How it Applies to Population Proportions

How it Applies to the Mean of a Distribution

Section 8.7: Probabilities With the Normal Distribution

Chapter 9: Calculus of the Derivative

Section 9.1: Review of Functions, Toolkit Functions

Properties of Each Type of Function

Recognizing Patterns

Section 9.2: The Derivative – Slope Introduction

What “slope” means on a curved graph

Intuitive definition of a tangent line to a curve

Approximating slope from the graph

Section 9.3: More Estimation of the Derivative at a Point

Intuitive definition of a secant line

Using secant lines to estimate the derivative

Intuitive development of the concept of a limit

Section 9.4: Average Rate of Change on an Interval

Example from the NYSE

Connection to the Derivative

Applications

Section 9.5: Marginal Cost and Revenue

Interpreting Meaning from Equations

Using the derivative in marginal cost/revenue situations

Section 9.6: More Applications of the Derivative

Cost, Revenue, and Profit

Decisions About “What Math to Use”

Possible Chapter 10

Intuitive Development of Area (Integration)

Probability Density Functions and Area as Probability of a Continuous Random Variable

More Applications of the Derivative in Optimization

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