

Contents

| | |
|--|------------|
| <i>Preface</i> | ix |
| 1. Data Everywhere | 1 |
| 1.1 Data in the Real World | 1 |
| 1.2 Displaying Data | 8 |
| 1.3 Two-Variable Data | 12 |
| Virtual Laboratory 1 | 20 |
| 2. Functions Everywhere | 22 |
| 2.1 Functions in the Real World | 22 |
| 2.2 Describing the Behavior of Functions | 29 |
| 2.3 Representing Functions Symbolically | 40 |
| 2.4 Mathematical Models | 47 |
| 3. Linear Functions | 53 |
| 3.1 Fundamental Concepts of Linear Functions | 53 |
| 3.2 Modeling With Linear Functions | 66 |
| 3.3 Linear Functions and Data | 71 |
| 3.4 Linear Regression: Finding the Best Line | 87 |
| Virtual Laboratory 3.1: Biology | 110 |
| Virtual Laboratory 3.2: Physics | 111 |
| 4. More about Linear Functions | 114 |
| 4.1 Systems of Linear Equations | 114 |
| 4.2 Applications of Linear Equations | 124 |
| 4.3 Matrix Products and their Applications | 140 |
| 4.4 Linear Models with Several Variables | 152 |
| 5. Families of Nonlinear Functions | 166 |
| 5.1 Exponential Growth Functions | 166 |
| 5.2 Exponential Decay Functions | 183 |
| 5.3 Fitting Exponential Functions to Data | 195 |
| 5.4 Logarithmic Functions | 207 |
| 5.5 Modeling with Logarithmic Functions | 223 |
| 5.6 Power Functions | 232 |
| 5.7 Fitting Power Functions to Data | 247 |

| | |
|--|------------|
| 5.8 How Good Is the Fit? | 266 |
| Virtual Laboratory 5.1: Kepler's Third Law of Planetary Motion | 274 |
| Virtual Laboratory 5.2: Running Speed and Length of the Body | 275 |
| 6. Polynomial Functions | 277 |
| 6.1 Introduction to Polynomial Functions | 277 |
| 6.2 The Behavior of Polynomial Functions | 285 |
| 6.3 Modeling with Polynomial Functions | 303 |
| Virtual Laboratory 6.1: Biosciences and Social Sciences | 320 |
| Virtual Laboratory 6.2: Physics | 320 |
| 7. Extended Families of Functions | 322 |
| 7.1 Building New Functions from Old: Shifting, Stretching, and Shrinking | 322 |
| 7.2 Using Shifting and Stretching With Data | 335 |
| 7.3 The Central Limit Theorem and Confidence Intervals | 354 |
| 7.4 Functions of Several Variables: Tables, Contours, Formulas | 366 |
| Virtual Laboratory 7: Chemistry | 381 |
| 8. Modeling Periodic Phenomena | 383 |
| 8.1 The Sinusoidal Functions Sine and Cosine | 383 |
| 8.2 Modeling Periodic Behavior with the Sine and Cosine | 392 |
| 8.3 Solving Equations with Sine and Cosine | 414 |
| 8.4 Approximating the Sine and Cosine with Polynomials | 419 |
| Virtual Laboratory 8: Meteorology | 435 |
| Appendices | |
| Appendix A: Some Mathematical Moments to Remember | 437 |
| Appendix B: Statistical Calculations on TI Calculators | 439 |
| Appendix C: Statistical Calculations In Excel | 441 |
| Appendix D: The Algebra of Linear Functions | 443 |
| Appendix E: Solving Equations Graphically: Zoom-and-Trace | 448 |
| Appendix F: Linear Regression on TI Calculators | 451 |
| Appendix G: Linear Regression Using Excel | 454 |
| Appendix H: Where the Correlation Coefficient Formula Comes From | 457 |
| Appendix I: Solving Systems of Linear Equations Algebraically | 460 |
| Appendix J: Curve Fitting in Excel | 464 |
| Appendix K: Symmetry | 465 |
| Appendix L: The Arithmetic of Complex Numbers | 467 |
| Appendix M: World Population Data for 2009 | 470 |
| <i>Selected Short Answers</i> | 477 |
| <i>About the Authors</i> | 487 |
| <i>Index</i> | 489 |