

Contents

| | |
|----------------|------------|
| Preface | vii |
|----------------|------------|

| | |
|--|-----------|
| 1 Algebra and Geometry of Euclidean Space | 1 |
| 1.1 Vectors in the Plane and Space | 2 |
| 1.2 The Inner Product and Distance | 22 |
| 1.3 2×2 and 3×3 Matrices and Determinants | 39 |
| 1.4 The Cross Product and Planes | 46 |
| 1.5 n -Dimensional Euclidean Space | 60 |
| 1.6 Curves in the Plane and in Space | 73 |
| Review Exercises | 83 |
| 2 Differentiation | 91 |
| 2.1 Graphs and Level Surfaces | 92 |
| 2.2 Partial Derivatives and Continuity | 109 |
| 2.3 Differentiability, the Derivative Matrix, and Tangent Planes . . . | 124 |
| 2.4 The Chain Rule | 133 |
| 2.5 Gradients and Directional Derivatives | 146 |
| 2.6 Implicit Differentiation | 160 |
| Review Exercises | 166 |

| | |
|--|------------|
| 3 Higher Derivatives and Extrema | 171 |
| 3.1 Higher Order Partial Derivatives | 172 |
| 3.2 Taylor's Theorem | 182 |
| 3.3 Maxima and Minima | 190 |
| 3.4 Second Derivative Test | 201 |
| 3.5 Constrained Extrema and Lagrange Multipliers | 211 |
| Review Exercises | 221 |
| 4 Vector-Valued Functions | 227 |
| 4.1 Acceleration | 228 |
| 4.2 Arc Length | 235 |
| 4.3 Vector Fields | 241 |
| 4.4 Divergence and Curl | 249 |
| Review Exercises | 263 |
| 5 Multiple Integrals | 269 |
| 5.1 Volume and Cavalieri's Principle | 270 |
| 5.2 The Double Integral Over a Rectangle | 280 |
| 5.3 The Double Integral Over Regions | 291 |
| 5.4 Triple Integrals | 306 |
| 5.5 Change of Variables, Cylindrical and Spherical Coordinates | 318 |
| 5.6 Applications of Multiple Integrals | 339 |
| Review Exercises | 350 |
| 6 Integrals Over Curves and Surfaces | 355 |
| 6.1 Line Integrals | 356 |
| 6.2 Parametrized Surfaces | 374 |
| 6.3 Area of a Surface | 382 |
| 6.4 Surface Integrals | 398 |
| Review Exercises | 411 |

| | |
|--|------------|
| 7 The Integral Theorems of Vector Analysis | 415 |
| 7.1 Green's Theorem | 416 |
| 7.2 Stokes' Theorem | 429 |
| 7.3 Gauss' Theorem | 446 |
| 7.4 Path Independence and the Fundamental Theorems of Calculus | 458 |
| Review Exercises | 473 |
| Epilogue | 479 |
| Practice Examination 1 | 481 |
| Practice Examination 2 | 485 |
| Answers to Odd-Numbered Exercises | 489 |
| Index | 521 |