
Contents

| | | |
|------------------|---|-----|
| CHAPTER 0 | Highlights of Calculus | |
| 0.1 | Distance and Speed // Height and Slope | 1 |
| 0.2 | The Changing Slope of $y = x^2$ and $y = x^n$ | 9 |
| 0.3 | The Exponential $y = e^x$ | 15 |
| 0.4 | Video Summaries and Practice Problems | 23 |
| 0.5 | Graphs and Graphing Calculators | 45 |
| | | |
| CHAPTER 1 | Introduction to Calculus | |
| 1.1 | Velocity and Distance | 51 |
| 1.2 | Calculus Without Limits | 59 |
| 1.3 | The Velocity at an Instant | 67 |
| 1.4 | Circular Motion | 73 |
| 1.5 | A Review of Trigonometry | 80 |
| 1.6 | A Thousand Points of Light | 85 |
| | | |
| CHAPTER 2 | Derivatives | |
| 2.1 | The Derivative of a Function | 87 |
| 2.2 | Powers and Polynomials | 94 |
| 2.3 | The Slope and the Tangent Line | 102 |
| 2.4 | The Derivative of the Sine and Cosine | 109 |
| 2.5 | The Product and Quotient and Power Rules | 116 |
| 2.6 | Limits | 123 |
| 2.7 | Continuous Functions | 131 |

| | | |
|------------------|---|-----|
| CHAPTER 3 | Applications of the Derivative | |
| 3.1 | Linear Approximation | 138 |
| 3.2 | Maximum and Minimum Problems | 143 |
| 3.3 | Second Derivatives: Bending and Acceleration | 153 |
| 3.4 | Graphs | 160 |
| 3.5 | Parabolas, Ellipses, and Hyperbolas | 170 |
| 3.6 | Iterations $x_{n+1} = F(x_n)$ | 179 |
| 3.7 | Newton's Method (and Chaos) | 187 |
| 3.8 | The Mean Value Theorem and l'Hôpital's Rule | 197 |
| | | |
| CHAPTER 4 | Derivatives by the Chain Rule | |
| 4.1 | The Chain Rule | 204 |
| 4.2 | Implicit Differentiation and Related Rates | 211 |
| 4.3 | Inverse Functions and Their Derivatives | 216 |
| 4.4 | Inverses of Trigonometric Functions | 223 |
| | | |
| CHAPTER 5 | Integrals | |
| 5.1 | The Idea of the Integral | 229 |
| 5.2 | Antiderivatives | 234 |
| 5.3 | Summation versus Integration | 240 |
| 5.4 | Indefinite Integrals and Substitutions | 249 |
| 5.5 | The Definite Integral | 254 |
| 5.6 | Properties of the Integral and Average Value | 260 |
| 5.7 | The Fundamental Theorem and Its Applications | 267 |
| 5.8 | Numerical Integration | 275 |
| | | |
| CHAPTER 6 | Exponentials and Logarithms | |
| 6.1 | An Overview | 284 |
| 6.2 | The Exponential e^x | 292 |
| 6.3 | Growth and Decay in Science and Economics | 299 |
| 6.4 | Logarithms | 310 |
| 6.5 | Separable Equations Including the Logistic Equation | 317 |
| 6.6 | Powers Instead of Exponentials | 326 |
| 6.7 | Hyperbolic Functions | 336 |

| | | |
|-------------------|---|-----|
| CHAPTER 7 | Techniques of Integration | |
| 7.1 | Integration by Parts | 342 |
| 7.2 | Trigonometric Integrals | 348 |
| 7.3 | Trigonometric Substitutions | 355 |
| 7.4 | Partial Fractions | 362 |
| 7.5 | Improper Integrals | 367 |
| | | |
| CHAPTER 8 | Applications of the Integral | |
| 8.1 | Areas and Volumes by Slices | 373 |
| 8.2 | Length of a Plane Curve | 383 |
| 8.3 | Area of a Surface of Revolution | 388 |
| 8.4 | Probability and Calculus | 391 |
| 8.5 | Masses and Moments | 399 |
| 8.6 | Force, Work, and Energy | 406 |
| | | |
| CHAPTER 9 | Polar Coordinates and Complex Numbers | |
| 9.1 | Polar Coordinates | 412 |
| 9.2 | Polar Equations and Graphs | 416 |
| 9.3 | Slope, Length, and Area for Polar Curves | 421 |
| 9.4 | Complex Numbers | 425 |
| | | |
| CHAPTER 10 | Infinite Series | |
| 10.1 | The Geometric Series | 433 |
| 10.2 | Convergence Tests: Positive Series | 440 |
| 10.3 | Convergence Tests: All Series | 448 |
| 10.4 | The Taylor Series for e^x , $\sin x$, and $\cos x$ | 452 |
| 10.5 | Power Series | 458 |
| | | |
| CHAPTER 11 | Vectors and Matrices | |
| 11.1 | Vectors and Dot Products | 466 |
| 11.2 | Planes and Projections | 476 |
| 11.3 | Cross Products and Determinants | 486 |
| 11.4 | Matrices and Linear Equations | 496 |
| 11.5 | Linear Algebra | 507 |

| | | |
|-------------------|--|-----|
| CHAPTER 12 | Motion Along a Curve | |
| 12.1 | The Position Vector | 517 |
| 12.2 | Plane Motion: Projectiles and Cycloids | 525 |
| 12.3 | Curvature and Normal Vector | 531 |
| 12.4 | Polar Coordinates and Planetary Motion | 537 |
| | | |
| CHAPTER 13 | Partial Derivatives | |
| 13.1 | Surfaces and Level Curves | 545 |
| 13.2 | Partial Derivatives | 549 |
| 13.3 | Tangent Planes and Linear Approximations | 554 |
| 13.4 | Directional Derivatives and Gradients | 565 |
| 13.5 | The Chain Rule | 574 |
| 13.6 | Maxima, Minima, and Saddle Points | 582 |
| 13.7 | Constraints and Lagrange Multipliers | 592 |
| | | |
| CHAPTER 14 | Multiple Integrals | |
| 14.1 | Double Integrals | 599 |
| 14.2 | Change to Better Coordinates | 607 |
| 14.3 | Triple Integrals | 616 |
| 14.4 | Cylindrical and Spherical Coordinates | 622 |
| | | |
| CHAPTER 15 | Vector Calculus | |
| 15.1 | Vector Fields | 631 |
| 15.2 | Line Integrals | 637 |
| 15.3 | Green's Theorem | 646 |
| 15.4 | Surface Integrals | 657 |
| 15.5 | The Divergence Theorem | 667 |
| 15.6 | Stokes' Theorem and the Curl of \mathbf{F} | 674 |
| | | |
| CHAPTER 16 | Mathematics after Calculus | |

MIT OpenCourseWare
<https://ocw.mit.edu>

Resource: Calculus
Gilbert Strang

The following may not correspond to a particular course on MIT OpenCourseWare, but has been provided by the author as an individual learning resource.

For information about citing these materials or our Terms of Use, visit: <https://ocw.mit.edu/terms>.