CONTENTS

1 FOUNDATION FOR CALCULUS: FUNCTIONS AND LIMITS 1

1.1 FUNCTIONS AND CHANGE 2
1.2 EXPONENTIAL FUNCTIONS 13
1.3 NEW FUNCTIONS FROM OLD 23
1.4 LOGARITHMIC FUNCTIONS 32
1.5 TRIGONOMETRIC FUNCTIONS 39
1.6 POWERS, POLYNOMIALS, AND RATIONAL FUNCTIONS 49
1.7 INTRODUCTION TO LIMITS AND CONTINUITY 58
1.8 EXTENDING THE IDEA OF A LIMIT 67
1.9 FURTHER LIMIT CALCULATIONS USING ALGEBRA 75
1.10 OPTIONAL PREVIEW OF THE FORMAL DEFINITION OF A LIMIT ONLINE
   REVIEW PROBLEMS ONLINE
   PROJECTS ONLINE

2 KEY CONCEPT: THE DERIVATIVE 83

2.1 HOW DO WE MEASURE SPEED? 84
2.2 THE DERIVATIVE AT A POINT 91
2.3 THE DERIVATIVE FUNCTION 99
2.4 INTERPRETATIONS OF THE DERIVATIVE 108
2.5 THE SECOND DERIVATIVE 115
2.6 DIFFERENTIABILITY 123
   REVIEW PROBLEMS ONLINE
   PROJECTS ONLINE

3 SHORT-CUTS TO DIFFERENTIATION 129

3.1 POWERS AND POLYNOMIALS 130
3.2 THE EXPONENTIAL FUNCTION 140
3.3 THE PRODUCT AND QUOTIENT RULES 144

For online material, see www.wiley.com/college/hughes-hallett.
7 INTEGRATION

7.1 INTEGRATION BY SUBSTITUTION 342
7.2 INTEGRATION BY PARTS 353
7.3 TABLES OF INTEGRALS 360
7.4 ALGEBRAIC IDENTITIES AND TRIGONOMETRIC SUBSTITUTIONS 366
7.5 NUMERICAL METHODS FOR DEFINITE INTEGRALS 376
7.6 IMPROPER INTEGRALS 385
7.7 COMPARISON OF IMPROPER INTEGRALS 394

PROJECTS ONLINE

8 USING THE DEFINITE INTEGRAL

8.1 AREAS AND VOLUMES 402
8.2 APPLICATIONS TO GEOMETRY 410
8.3 AREA AND ARC LENGTH IN POLAR COORDINATES 420
8.4 DENSITY AND CENTER OF MASS 429
8.5 APPLICATIONS TO PHYSICS 439
8.6 APPLICATIONS TO ECONOMICS 450
8.7 DISTRIBUTION FUNCTIONS 457
8.8 PROBABILITY, MEAN, AND MEDIAN 464

PROJECTS ONLINE

9 SEQUENCES AND SERIES

9.1 SEQUENCES 474
9.2 GEOMETRIC SERIES 480
9.3 CONVERGENCE OF SERIES 488
9.4 TESTS FOR CONVERGENCE 494
9.5  POWER SERIES AND INTERVAL OF CONVERGENCE  504
    REVIEW PROBLEMS  ONLINE
    PROJECTS  ONLINE

10  APPROXIMATING FUNCTIONS USING SERIES  513
    10.1  TAYLOR POLYNOMIALS  514
    10.2  TAYLOR SERIES  523
    10.3  FINDING AND USING TAYLOR SERIES  530
    10.4  THE ERROR IN TAYLOR POLYNOMIAL APPROXIMATIONS  539
    10.5  FOURIER SERIES  546
    REVIEW PROBLEMS  ONLINE
    PROJECTS  ONLINE

11  DIFFERENTIAL EQUATIONS  561
    11.1  WHAT IS A DIFFERENTIAL EQUATION?  562
    11.2  SLOPE FIELDS  567
    11.3  EULER’S METHOD  575
    11.4  SEPARATION OF VARIABLES  580
    11.5  GROWTH AND DECAY  586
    11.6  APPLICATIONS AND MODELING  597
    11.7  THE LOGISTIC MODEL  606
    11.8  SYSTEMS OF DIFFERENTIAL EQUATIONS  616
    11.9  ANALYZING THE PHASE PLANE  626
    11.10  SECOND-ORDER DIFFERENTIAL EQUATIONS: OSCILLATIONS  632
    11.11  LINEAR SECOND-ORDER DIFFERENTIAL EQUATIONS  640
    REVIEW PROBLEMS  ONLINE
    PROJECTS  ONLINE

APPENDICES
    A  ROOTS, ACCURACY, AND BOUNDS  ONLINE
    B  COMPLEX NUMBERS  ONLINE
    C  NEWTON’S METHOD  ONLINE
    D  VECTORS IN THE PLANE  ONLINE

Online