

Contents

MATH 101A <i>Introduction to Calculus</i> (2007)	1
--	---

Part A. Functions, Limits, and Continuity 1

0. Overview	1
0.1 General Motivation	1
0.2 Main Topics	3
1. Functions (cf Textbook §1: Prelim Concepts for Calculus)	5
1.1 Composition of functions	7
1.2 Graphs	7
1.3 Summary	8
1.4 Intuition about continuity	8
2. Limits	9
2.1 Idea of a limit (cf. Textbook §2.1)	9
2.2 Evaluating limits (§2.2)	13
2.3 Infinite limits (§2.5)	19
2.4 Further problems with limits (§2.2)	24
3. Continuity	27
3.1 Definition of continuity (§2.6)	27

Part B. Differentiation 34

1. The derivative	34
1.1 Tangent lines (§2.7)	34
1.2 Definition of the derivative (§2.7, 3.1)	35
1.3 Basic rules	38
1.4 Trigonometric functions (Part I)	44

2. Chain rule	45
2.1 Chain rule	45
2.2 Trig Derivatives (Part II)	47
2.3 More chain rule examples	48
2.4 Inverse functions	49
3. Failure of differentiability	51
3.1 Examples of differentiability failure	51
4. Implicit differentiation	53
4.1 Implicit differentiation (§3.6)	53
4.2 Related rates problems (“modelling”) (§3.7)	55
5. Maximization and minimization	57
5.1 First optimization theorem (§4)	57
5.2 First and second derivative tests	60
6. Approximation of functions	68
6.1 Curve sketching (§4.4)	68
6.2 Linear estimation (§3.8)	74
6.3 Taylor’s theorem (§11.8)	76

Part C. Integration **80**

1. Anti-derivatives and areas	80
1.1 Areas and the definite integral	80
1.2 Evaluating area	84
1.3 A sample area calculation	88
2. Simple integration	90
2.1 Indefinite integrals (§4.1)	90
2.2 Simple anti-derivatives	90
2.3 Area calculations (§4.5)	92
2.4 Initial value problems (§4.1)	95
3. Techniques of integration	97
3.1 Integration by substitution (§4.2, 4.6)	97
3.2 Integration by parts (§7.2)	100
3.3 The logarithm and exponential functions (§6.1, 6.2)	104