

SYLLABUS FOR MATH 2200

Text: Larson and Edwards,
Calculus of a Single Variable, Early Transcendental Functions,
Fifth Edition (2011)
(Custom Edition for UGA)
Effective Summer, 2011

Introductory Words

The following description of the objectives of the course as described in CAPA:
This is an introductory calculus course. Students should understand the concept of limit and the meaning and import of continuity. The student should understand the concept of the derivative, and be able to calculate the derivatives of algebraic, exponential, logarithmic, and trigonometric functions. Students are expected to set up and solve maximum and minimum problems using the methods of calculus. Students should be able to use calculus to make approximations and sketch graphs. Students should also be able to calculate antiderivatives and solve some elementary differential equations. The student should in addition understand the meaning and application of the derivative in the context of economics.

The Mathematics Curriculum Committee believes that the following five topics are central to the course and should be covered (in depth) by everyone teaching the course.

- (1) The definition of the derivative: calculating it from the definition, its meanings (slope of the tangent line, velocity, rate of change)
- (2) Differentiation rules (including facility with the chain rule)
- (3) Reading, setting up, and solving word problems (extremum problems and related rates)
- (4) Conceptual skills with graphing—understanding the first and second derivative
- (5) Some experience with the “theoretical infrastructure” of calculus—some discussion of any or all of the following: continuity and the intermediate value theorem, maximum value theorem, mean value theorem.
- (6) Basic antidifferentiation with applications to separable differential equations and the mortgage problem

TEXT CONTENT (in recommended order): Sections 1.1–1.6: optional or review in context; sections 2.1–2.4, 3.1–3.5, 3.7, 4.1–4.4, 2.5 with 4.5, 4.6, 4.7, 4.8, Appendix F, 5.1, 6.2–6.3

ANCILLARY MATERIALS: Sections have the opportunity to offer homework exercises through WebAssign.

Outline of course

I. Prelude to calculus (2 1/3–2 2/3 weeks)

1.1–1.6 (Optional) Review Concepts from Precalc, Intro to WebAssign HW

2.1 Intro to Differential Calculus (boxes p. 63 and p. 65 tangent line problem)

2.2 Intro to Limits: Graphical and Numeric Understanding, including one-sided limits (from 2.4) (NO ϵ - δ)

Exercises (corresponding to those created in WebAssign) 2.2: #1, 2, 5, 7, 6, 19, 20, 21, 22, 25, 27, 28, 30, 31; 2.4: #14, 124, 33, 36

2.3 Symbolic work on Limits, including Trig and Squeeze, velocity as a limit (2.5 days)

Exercises 2.3A: #5, 7, 9, 12, 18, 19, 21, 20, 29, 32, 34, 38, 40, 53, 41, 46;

2.3B: #50, 58, 60, 65, 67, 70, 71, 75, 77, 91, 94, 96, 109, 111

2.4 The Concept of Continuity and IVT (2 days)

Exercises 2.4: #2, 5, 86, 87, 33, 39, 42, 43, 52, 18, 58, 59, 62, 69, 73, 103, 106, 118

II. The derivative: Rules of differentiation (3 2/3 weeks)

3.1 The Derivative and Tangent lines (2 days)

Exercises 3.1A: #1, 16, 18, 21, 23, 3.1B: #4, 60, 43, 20, 23, 25, 30, 33, 61, 93, 40, 84, 88

—EXAM 1—

3.1 When the derivative fails to exist (1/2 day)

3.2–3.3 Basic Differentiation Rules, higher order derivatives, and Rates of Change (3.5 days)

3.3: #1, 2, 4, 5, 6, 8, 10 p. 148 #85, 87, 120

Exercises 3.2: #2, 4, 6, 9, 13, 21, 27, 30, 34, 40, 41, 45, 49, 59, 64, 68, 72, 102, 101, 104, 112, 114;

3.3: #109, 111, 112, 83, 39, 54, 7, 12, 16, 21, 25, 28, 46, 49, 62, 95, 96, 104, 67, 70, 76, 85, 89

3.4 The Chain Rule (2 days)

Exercises 3.4: #1, 10, 15, 24, 28, 32, 34, 53, 59, 62, 68, 74, 76, 80, 84, 86, 94, 97, 109, 111, 126, 131, 143, 144, 161, 162, 168, 171

3.4 Derivatives of ln functions (1/2 day); note: $y = a^x$ and $y = \log_a x$ for bases other than e are in HW 3.4 #131, 143, 144 but not required to be memorized—for those two derivatives students are welcome to look up the rule.

Exercises in 3.4 HW above, #84, 86, 94, 97, and see note on 131, 143, 144

3.5 Implicit Differentiation (no second derivative, no logarithmic differentiation) (2 days)

Exercises #2, 6, 7, 12, 16, 12, 19, 38, 39, 43, 49, 101, 102

III. The derivative: First Applications (1 week)

3.7 Related Rates (2 days)

Exercises 3.7: #1, 8, 14, 13, 15, 21, 25, 28, 29, 31, 33, 46

4.1 Maxima and Minima of Functions on Closed Intervals (1 day)

Exercises 4.1: #64, 1, 5, 11, 13, 15, 18, 25, 27, 31, 38, 72

—EXAM 2—

IV. Additional Applications of the Derivative: Mean Value Theorem and Curve Sketching
(2 2/3 weeks)

4.2 Mean Value Theorem and its consequences (No Rolle) (2 days)

Exercises 4.2: #42, 43, 48, 50, 70, 79, 82

4.3 Increasing and Decreasing Functions and the First Derivative Test (1.5 days)

Exercises 4.3: #2, 9, 19, 25, 36, 45, 54, 62, 101, 105

4.4 Concavity and curve sketching (Omit Second Derivative Test) (1.5 days)

Exercises 4.4: #4, 19, 30, 38, 96 and §4.6 # 17, 23, 29, 90 (note part (b) is worded wrong)

2.5 and 4.5 Limits involving infinity and asymptotes (2 days)

Exercises 2.5: #6, 5, 7, 14, 20, 27, 35, 37, 42, 50, 55, 61, 73; 4.5: #15, 18, 20, 30, 35, 98, 3, 74;
4.6: #6, 8, 98

4.6 Sketching wrap-up (1 day)

Exercises 4.3: #82, 83, 85; 4.6: #4, 3 additional UGA-coded problems in WebAssign

V. Additional Applications of the Derivative: Optimization, Differential Approximations, and Business Applications (2 2/3 weeks)

4.7 Applied Optimization Problems (3 days)

Exercises 4.7A: #5, 7, 9, 16, 17, 19, 20, 27; 4.7B: #60, 22, 23, 25, 29, 33, 39, 45, 49

—EXAM 3—

4.8 Differential Approximations (2 days)

Exercises 4.8: #2, 9, 12, 13, 17, 18, 19, 25, 27, 30, 31, 34, 36, 37, 40, 41

Appendix F Economics Applications, including marginal cost, average cost, diminishing returns, and optimization problems (3 days)

Exercises Appendix F: #30, 1, 25, 5, 6, 15, 9; 3.2: #114; 4.2: #34; 4.5: #96, 101; 4.7: #54;
4.8: #39, 1 additional UGA-coded problem in WebAssign

VI. Antiderivatives (2 weeks)

5.1 Antiderivatives and Initial Value Problems (including linear changes like $1/(2x-5)$ but NOT integration by substitution)

Exercises 5.1A: #5, 6, 9, 11, 12, 14, 18, 20, 23, 24, 26, 29, 31, 34, 35, 38, 39, 40, 3 additional UGA-coded problems in WebAssign;

5.1B: #3, 55, 63, 66, 68, 69, 71, 72, 77, 79, 80, 89, 92, 101, 93

6.2–6.3 Separable Equations and Applications (skip p. 407–408 and p. 410) (3 days)

Exercises 6.2: #18, 5, 7, 19, 2, 10, 13, 11, 22, 33, 41, 42, 50, 65, 69, 71, 73, 89, 90; 6.3 #1, 3, 7

—EXAM 4—

There will be a cumulative final exam.