

MATHEMATICS 115 – LIFE SCIENCES CALCULUS 1
SYLLABUS FOR FALL 2009

In the following week-by-week syllabus for the course, we refer to several sources. The main textbook for the course is

Calculus for the Life Sciences, by Bittinger, Brand and Quintanilla [BBQ]

Some additional material, particularly on applications to the biosciences, is found on the following websites:

<http://www.math.duke.edu/education/ccp/index.html> [DE]

We will make use of this for applications of derivatives, integrals and differential equations, mainly in the second course, Math 116.

Notes developed by Professor Leah Keshet and colleagues at UBC for its life science calculus sequence are posted here:

<http://www.math.ubc.ca/~keshet> [CN]

These web materials contain a basic calculus sequence, with many interesting bio-science examples. Students will be able to use this as an additional reference and source of exercises.

1. OVERVIEW OF SYLLABUS

Using the chapters in [BBQ], here is a coarse breakdown of the material we intend to cover:

- Precalculus review - Chapter 1 and part of Chapter 4: 3 lectures / 1 lab
- Introduction to the derivative and its applications - Chapters 2 and 3: 14 lectures / 4 labs
- More applications, antiderivatives, definite integrals - part of Chapter 4, Chapter 5, part of Chapter 8: 16 lectures / 5 labs
- Differential equations - Chapter 8: 6 lectures / 3 labs

There will be a midterm examination after item two above, a second midterm after the third item, and a comprehensive final exam.

2. DETAILED SYLLABUS

Here are week-by-week listings of the lecture materials, and an outline of the weekly lab topics. **Please note that this syllabus is tentative.** It may be necessary to make changes to the topics and to the exam dates.

The sections refer to the main text *Calculus for the Life Sciences* [BBQ]; additional references are made to materials from the Duke DE Modeling website [DE] and the UBC Course Notes [CN].

- (1) **28 August - 2 Sept:** Chapter 1 and some of 4.1, 4.2: precalculus review.
Lab 1: more on functions, emphasis on exponential and log functions, exponential growth versus discrete compounding
- (2) **4 - 11 Sept:** §2.1 - 2.3: introduction to limits and difference quotients
No lab - Labor Day
- (3) **14 - 18 Sept:** §2.4 - 2.7: introduction to the derivative and basic rules for computing derivatives
Lab 2: rate of change examples, including pendulum and the day length problem
- (4) **22 - 26 Sept:** §2.8 - 2.9: chain rule and higher order derivatives; §4.1 - 4.2
Lab 3: review of differentiation methods
- (5) **28 Sept - 2 Oct:** §3.1 - 3.3: applications of the derivative – finding maxima and minima, curve sketching
Lab 4: graphing and optimization, including §3.6
- (6) **5 - 9 Oct:** §3.4 - 3.5, 4.1 - 4.2, and [CN] Ch 6: more applications, particularly optimization, and review of exponential/log functions
Lab 5: more applications of the derivative to optimization and modeling, [CN] Ch 6

Midterm Exam 1 – 9 Oct

- (7) **14 - 16 Oct:** §4.3 - 4.5: more applications with emphasis on exponential and log functions, exponential growth and decay, Newton's Law of Cooling, logistic growth
No lab - Fall Break
- (8) **19 - 23 Oct:** finish Chapter 4: additional models of populations and optimal foraging
Lab 6: to be determined

- (9) **26 - 30 Oct:** §5.1 - 5.3: introduction to antiderivatives and definite integrals, with Riemann sums and the Fundamental Theorem of Calculus
Lab 7: more on antiderivatives, including distance/velocity/accleration, population growth, and spread of influenza
- (10) **2 - 6 Nov:** §5.4 - 5.6: properties of definite integrals, integration by substitution, integration by parts
Lab 8: practice with finding areas defined by curves, substitution, [CN] Ch 4 example on hormone levels
- (11) **9 - 13 Nov:** §5.7 - 5.9: numerical integration; volumes of solids of revolution; improper integrals
Lab 9: numerical integration
- (12) **16 - 20 Nov:** §8.1: differential equations; review; and, Exam 3
Lab 10: review of integration methods

Midterm Exam 2 – 20 November

- (13) **23 - 25 Nov:** Selection of material from §8.2 - 8.4 and [CN] Ch 13
Lab 11: to be determined
- (14) **30 Nov - 7 Dec:** Selection of material from §8.2 - 8.4 and [CN] Ch 13
Lab 12: to be determined
No lab week of 7 Dec

Final Examination – Friday 11 December 8:30am - 11:00am
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