

MATH U141 Fall 05- Syllabus for Calculus I

TEXT: Hughes-Hallett et al, *Applied Calculus*, 2nd ed. (2001)

ISBN #0471-20792-6, John Wiley & Sons, Chapters 1-5.

CLASSPAC: Math U141 Fall 05 (available at NU Reprographics by Sept. 12).

Prerequisites: Knowledge of basic algebra at the level of MTHU121, including an introduction to functions and their graphs. A placement quiz will be given at the start of the course: you can use the result to gauge your preparation.

Differential Calculus is the study of rate of change, and its uses.

Integral Calculus is the study of amount given the rate of flow.

Goals: To develop *graphical*, *numerical*, and *algorithmic* understanding of

1. The basic ideas of differential calculus, including
Average and instantaneous rates of change, Definition of the derivative of a function at a point, the Derivative function.
2. Basic functions – such as polynomial, exponential, logarithmic, trigonometric, using the graphing calculator as a tool.
3. Applying calculus to optimize functions (max and min), to motion problems, mathematical models of physical/biological processes.
4. The basic ideas of integral calculus: accumulated change, amount from flow, area under a curve (introduction).
5. *Students completing the course should be able to recognize and use the concepts and methods of calculus when they occur in their disciplines.*

Course webpage:

<http://www.math.neu.edu/~iarrobino/MathU141.F05>

Class Notes Webpage It will have specific assignments for AI sections.

<http://www.math.neu.edu/~iarrobino/AIMathU141.F05.classnotes>

Following is an overall syllabus, intended as a guide. Your instructor will make specific assignments from this syllabus and also from the Class Pac. * for Optional.

We will focus quickly on the concepts of average rate, instantaneous rate, and derivative function in Sections 1.3, 2.1-2.3. We will then broaden the types of functions studied (1.5-1.10) as we extend the differential calculus in Section 3, and apply the concepts in Chapters 4, 10. We introduce integral calculus in Section 5. (Integral calculus is studied in detail in the sequel course, Math U142.)

NOTE: R&OL=Read and Outline section: Please write 2-4 pages of outline and summary, giving the main ideas. Include any questions as to what might be unclear.

1. Functions; introduction to slopes and rates:

§1.1 Functions, (review). p. 4 #2,4,8,9,11,22.

§1.2 Linear functions p. 11 #2,7,9,15,22,23,26,29 WS #1A, 1B

§1.3 Average rate of change p. 19 #5,6,7,8,11,13,15,22b,c,24. WS #2A

§1.5 Exponential functions p. 37 #1a,d, 3,5,10-15 all.

Compound Interest: Read p. 82-86. p. 86 #1,2,5,8,9,12,13.

§1.6* Logarithm (review) p. 42 #11,12,24

§1.7 Exponential growth/decay p. 48 #1,3,4,10,11,14,16,17,21,24,31,32.

§1.8 Composites, shifts p. 54 #1,3,5,7,19,24,32,34.

§1.9* Proportion, polynomials p. 61 #13,19,20,29,31,33,34,35,39,40. (GC)

§1.10 Periodic, trig functions p. 67 #2,5,9,12,23,26,27,28,29,31.

Chapter 1 Review: p. 69 #14,16,18,20-28,30,31,32,33,47,48,49,50,51

Behavior at infinity*: Read p. 88-90. p. 91 #3,6,7,25,28. (GC)

2. Rate of change and derivative.

- §2.1 Instantaneous rate p. 99 #1,2,3,4,8,12,13,17,18,19,21. WS #2A,2B.
 §2.2 Derivative function p. 104 #1-4,5,15,17,18-21,27,29.
 §2.3 Interpreting the derivative p. 111 #4,5,6,9,22
 §2.4 Second derivative p. 115 #1,3,7-12,14,15,16,25.
 Chapter 2 Review p. 124 #1,2,3,,7-12,20,22,27,28,30,31.
 §2 Limits & derivative R&OL p.129-133. p.134 #1,2,3,5-8 (which f?),25-29

3. Derivative Formulas

- §3.1 Power rule p. 141 #5,9,13,17,19,23,25, 28,32,33,38,49,50.
 §3.2 Exponentials and Logarithm p. 145 Odd #1-23,28,31,33.
 §3.3 Chain rule p. 149 #Odd #1-29,32,37,39,40. WS #3A,B
 §3.4 Product, quotient rule p. 153 Odd #3-27,Even 8-16,32,34,36,39
 §3.5 Trig functions p. 156 Odd #1-17,23,24,25*.
 Chapter 3 Review: p. 157 #1-36,47-49, 54*,56.
 Deriving the rules* p.160-162. p. 162 #4-7.
 Practice p. 153 Student choice!

4. Using the derivative

- §4.1 Local maxima and minima p. 170 #5,6,9,10,11,12,15,20,21,23,26*.
 §4.2 Inflection points p. 175 #6,7,8,9,10,11,14,19,21,22,24,25.
 §4.3 Global max-min p. 179 #1,2,12,13,15-17,18*,19-21,23-25,27-28,30-31
 Applied Max-Min handout with problems. Also WS #4C-E, Also, MM1-3.
 §4.4 Max-min in profit/cost p. 187 #3,11,13-15.
 §4.7 Logistic growth p. 204 #3,8,9,11,12 (critique Math Model),13,16,17.
 §4.8* A model for drug concentration p. 210 #2,3,4,6,7,10,11.
 Chapter 4 Review: p. 213 #3,4-8,9-12,15,20,22,23,29,35,36. p.217 Proj. 2*

Special topics, further applications:

- §7.1 Antiderivative: p. 281 Odd #1-18,22,Odd#25-39,54,55,56.
Motion: position, velocity, acceleration WS #4A,4B, A1-A3
 §10.1 Differential equations as models p. 378 #1,3,5,6,7,9,12,14-18.
 §10.2* Solutions of a differential equation p. 382 #1,3,5,10,11,12.
 §10.4 Exponential growth, decay p. 394 #1,5,7,9,10,11,14,15. WS #5.
 §10.5* Modeling with DE p. 403 #1,3,13,19,20,22,24,25.
 Chapter 10 Review p. 414 # 1,5,15,19,22,23,27. p. 415 Proj 1*,2*.

Integral Calculus (basic ideas, some applications)

- §5.1 Accumulated Change: p. 224 #1-4,7-8,10-11,13-16.
 §5.2 Definite integral. p. 230 #1-4,7-8,11-12. 15 (also, use left and right Riemann sums, trapezoid sums for n=5,10,50 to estimate this integral).
 §5.3. Integral and area. p. 235 #1,2 (use R-sum),5-9,10-12,17-18,22,29
 §5.4. Using the integral: p. 240 #1-3,5-7,9,12-20,24.
 §5.5 Fundamental Theorem: p. 245 #9-12
 §7.3 Finding definite integrals: p. 289 #1-10,25,27,28,32,39-40.
 Chapter 5 Review p. 246 #1-4,5-6 (use Fund Thm),12-15,17,21-23,28,30-34.

HELP: is available from Office Hours; Tutoring is available free at the Math Center in Cahner's Hall (up to several hours/week), or you can request a tutor for the semester at the Tutoring Center in Snell Library.

Note: A comparison of Math U141 with other NU calculus courses is given at <http://www.math.neu.edu/~iarrobino/MathU141HP.htm>