B.A. Program in Liberal Studies
Math 190A: Calculus
3 semester units
Fall Semester 2013

Instructor: Katie Kondo, M.S. expected 6/14
Class Meeting Times & Place: Week of August 12, 2013 – Week of December 2, 2013
Office Hours: Tuesday & Thursday, 8:00 am-9:00 am and by appointment
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Course Description: This is the first semester of a yearlong course that aims to apply and extend what students have learned in previous mathematics courses through the study of limits, derivatives, along with basic differentiating and integrating techniques. The course starts with five major problems that introduce the big ideas of calculus: limits, exponential functions, the relationship between distance and velocity, piecewise functions, and the Fundamental Theorem of Calculus. Each of these five major problems is revisited again later in Math 190B for students to solve using new calculus knowledge. In the first term, the focus will be on a beginning look at calculus concepts; rates, sums, limits, and continuity; slope and curve analysis; and the fundamental theorem of calculus. Students in Calculus will continue to use problem solving strategies, questioning, investigating, and explaining in conjunction with their knowledge of the connections among algebra, geometry and functions to analyze problems and formulate solutions. Throughout, they will also use these strategies to extend their current knowledge by making new connections. The course is a college level course and requires a significant amount of preparation for every class on the part of the student.

B.A. Program Learning Objectives:

- Critical and analytical thinking ability;
- The ability to understand issues from multiple perspectives;
- The ability to connect learning to lived experience;
- Social and intercultural awareness;
- Civic andcommunity engagement;
- Core competency in foundational skills: including, writing, quantitative reasoning, information literacy, technological literacy, oral communication, and research.

Learning Objectives:
Students successfully completing the course will be able to:

- Work with functions represented in a variety of ways (graphical, numerical, analytical, or verbal) and be able to explain the connections among these representations with respect to the first and second derivatives.
- Demonstrate an understanding of limits and their relationship to continuity

- Explain the relationship between variables of distance, velocity and acceleration and connect them to their graphical representations
- Articulate their understanding of the derivative in terms of a rate of change and local linear approximation, and should be able to use derivatives to explain and solve a variety of problems.
- Explain the relationship between the derivative and the elements of the curve, extending their understanding of the derivative in application to trigonometric functions

Evaluation Criteria:
The final evaluation will address the extent to which students have met the learning objectives listed above, as demonstrated in:

- Active contributions to small group and classroom discussion demonstrating constructive dialogue with peers
- Development of understanding of the selected texts and analytical skills over the course of the term, including in projects, quizzes, and exams.

Additionally, the specific components of the course grade are constructed as follows:

- Participation 5%
- Quizzes & Chapter Exams 35%
- Homework Assignments/Problem Sets 15%
- Other Written and Collaborative Projects 20%
- Final Exam 25%

The homework in the "Review & Preview" section of each lesson reinforces skills and concepts learned in the lesson, as well as practices and enriches previously introduced material and prepares students for upcoming topics. The homework problems also allow students to apply concepts and skills in new contexts and to deepen their understanding by solving the same type of problem in different ways.

Attendance Policy
Students are expected to attend all class sessions and participate as required in the syllabus. Students missing more than 4 class sessions must make up the missed time by completing assignments per instructors direction, students missing more than 10 class sessions will not receive credit for the course. See AULA General Catalog, 2010-2012 (p. 59) for university policy.

Incomplete Policy
Per University policy, students must complete all course work by the deadlines stated in the syllabus. If a student anticipates not being able to complete required work by the end of the term, the student may request an Incomplete from the instructor. Incompletes are awarded at the discretion of the instructor. See *AULA General Catalog, 2010-2012*, (p.63) for university policy.

Plagiarism Policy
Plagiarism – that is, the intentional or unintentional borrowing of another person's ideas, images, research, or data without citation -- is a serious breach of academic integrity that results in sanctions, including dismissal from the University. Please consult Purdue Online Writing Lab http://owl.english.purdue.edu/owl/resource/589/01/ for specific guidance on avoiding plagiarism while taking notes, summarizing, paraphrasing, and quoting from sources. Students committing plagiarism will be also be subject to disciplinary action from DaVinci Schools as well as from the University.

Reasonable Accommodation for Students with Disabilities

Antioch University is committed to providing reasonable accommodations to qualified students with disabilities in accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 2008. Students with disabilities may contact the Disability Support Services office to initiate the process and request accommodations that will enable them to have an equal opportunity to benefit from and participate in the institution's programs and services. Students are encouraged to do this as early in the term as possible, since reasonable accommodations are not retroactive. The Disability Support Services office is available to address questions regarding reasonable accommodations at any point in the term.

For more information, please contact Josh Williams, Director of Student Affairs, extension 441, jwilliams10@antioch.edu, room A2041.

Antioch University Policies:

Antioch University is committed to building a vibrant and inclusive educational environment that promotes learning and the free exchange of ideas. Our academic and learning communities are based upon the expectation that their members uphold the shared goal of academic excellence through honesty, integrity, and pride in one's own academic efforts and respectful treatment of the academic efforts of others.

All students are expected to comply with Antioch University policies, including the Title IX Sexual Harassment and Sexual Violence Policy and the Student Conduct Policy.

To access academic, student, and other university policies are available online: http://aura.antioch.edu/au_policies/

Required Text:
Cho, C. (Ed.). (2010). *College Preparatory Mathematics: Calculus*. Sacramento, CA: CPM Educational Program.

Tentative **Schedule, Outline of Class Activities, Lessons, Assessments & Assignments:**

Chapter 1: A Beginning Look at Calculus

Weeks 1-3

Section	Lesson	Days	Lesson Objectives	Materials	Homework
1.1	1.1.1	1	Applying Rates and Distance	Lesson 1.1.1 Res. Pg.	1-2 to 1-10
1.2	1.2.1	1	Piecewise Functions and Continuity	None	1-20 to 1-28
	1.2.2	1	End Behavior and Horizontal Asymptotes	None	1-36 to 1-43
	1.2.3	1	Holes, Vertical Asymptotes, and Approach Statements	None	1-51 to 1-60
	1.2.4	1	Composite Functions and Inververse Functions	None	1-68 to 1-76
	1.2.5	1	Attributes of Even and Odd Functions	None	1-82 to 1-91
	1.2.6	1	Design a Flag (optional)	None	1-93 to 1-95
1.3	1.3.1	1	Finite Differences	None	1-101 to 1-109
	1.3.2	1	Slope Statements and Finite Differences of Non-Polynomials	None	1-113 to 1-121
	1.3.3	1	The Slope Walk	• CBL with Motion Detector or CBR • Distance/Time program • Overhead graphing calculator (or computer display)	1-125 to 1-132
1.4	1.4.1	1	Distance and Velocity	• CBL with Motion Detector or CBR	1-138 to 1-146
	1.4.2	1	Average Velocity on a Position Graph	• Lesson 1.4.2 Res. Pg. • Colored pencils	1-152 to 1-161
	1.4.3	1	Average Velocity on a Velocity Graph	None	1-167 to 1-175
	1.4.4	1	Acceleration	None	1-181 to 1-189
1.5	1.5.1	1	Area and Slope	Lesson 1.5.1 Res. Pg.	1-194 to 1-203
Chapter Closure			Varied Format Options		

Chapter 2: Rates, Sums, Limits, and Continuity
Weeks 3-5

Project: The students will build and analyze a Rube Goldberg Invention that will fulfill certain continuity requirements on its position graph. Students will also create an instruction manual that outlines their design, writes statements about the increasing/decreasing distance, velocity, and acceleration at different times, find instantaneous rates of change at different times, and in discontinuous situations, find limits of the velocity curve from the left and the right. These projects will be presented to a panel of judges (engineers, mathematics professors, and Da Vinci staff members).

Section	Lesson	Days	Lesson Objectives	Materials	Homework
2.1	2.1.1	1	Area Under the Curve Using Trapezoids	None	2-7 to 2-14
	2.1.2	1	Methods to Easily Calculate Area	None	2-20 to 2-28
	2.1.3	1	Area Under the Curve as a Riemann Sum	None	2-35 to 2-41
2.2	2.2.1	1	Introduction to Limits as Predictions	None	2-49 to 2-56
	2.2.2	1	Intuitive ideas of Continuity	None	2-64 to 2-72
	2.2.3	1	Definition of Continuity	None	2-81 to 2-88
	2.2.4	1	Evaluating Limits	None	2-95 to 2-101
2.3	2.3.1	1	Ramp Lab	• Ramps (wheel chair or long board) • Measuring taps or meter/yard sticks • Balls or marbles • Stop watch • Sticky notes	2-104 to 2-111
	2.3.2	1	Sudden Impact	None	2-114 to 2-121
	2.3.3	1	Local Linearity	None	2-125 to 2-131
2.4	2.4.1	1	Improving Approximation	None	2-136 to 2-145
Chapter Closure			Varied Format Options		

Chapter 3: Slope and curve analysis
Weeks 6-9

Project: Students will select a real-life coastline and create a training program for coast guard members to find emergency situations. They will use a piecewise function to model the coastline and create clues using the derivative for the views and paths of a few ships and observers from different points along the coast. This will encourage the students to see the ways that the 1st and 2nd derivatives shape and practice with finding the derivatives of parent functions.

Section	Lesson	Days	Lesson Objectives	Materials	Homework
3.1	3.1.1	1	The Power Rule	• Lesson 3.1.1 A - C Res. Pgs. or poster sized graph paper	3-9 to 3-18
	3.1.2	1	Secants to Tangents, AROC to IROC	None	3-27 to 3-34
3.2	3.2.1	1	Definition of a Derivative	None	3-42 to 3-51
	3.2.2	1	Derivatives Using Multiple Strategies	None	3-58 to 3-67
	3.2.3	1	Derivatives of Sine and Cosine	Poster sized graph paper (optional)	3-73 to 3-81
3.3	3.3.1	1	Curve Constructor: Part I	• Sticky notes (optional)	3-87 to 3-95
	3.3.2	1	The Shape of a Curve	• Lesson 3.3.2 A - F Res. Pgs. (optional) • Colored pens or pencils • Poster board or paper	3-101 to 3-110
	3.3.3	1	Curve Sketching: Derivatives	• Lesson 3.3.3 Res. Pg. or poster sized graph paper • Markers or stickers (dots)	3-113 to 3-123
	3.3.4	1-2	The First and Second Derivative Tests	• Motion detectors	3-130 to 3-140
3.4	3.4.1	1	Conditions for Differentiability	• Overhead graphing calculator (optional)	3-147 to 3-155
	3.4.2	1	Curve Constructor: Part II	• Overhead graphing calculator (optional) • Sticky notes (optional)	3-161 to 3-169
	3.4.3	1	Differentiability of Specific Functions	None	3-174 to 3-181
	3.4.4	1	Intersection of Tangents	• Lesson 3.4.4 Res. Pg.	3-183 to 3-190
Chapter Closure			Varied Format Options		

Chapter 4: The Fundamental Theorem of Calculus
Weeks 10-13

Project: Students will participate in a mock trial, using their knowledge of velocity, position, and acceleration and the Fundamental Theorem of Calculus to build an argument for/against and solve a teacher's speeding violation case.

4.1	4.1.1	1	Definite Integrals	None	4-6 to 4-12
	4.1.2	1	Numerical Cases of Definite Integrals	Graphing calculator	4-18 to 4-26
	4.1.3	1	Properties of Definite Integrals	None	4-31 to 4-39
4.2	4.2.1	1	Deriving "Area Functions"	None	4-43 to 4-51
	4.2.2	1	Indefinite and Definite Integrals	None	4-56 to 4-64
	4.2.3	1	The Fundamental Theorem of Calculus	None	4-73 to 4-80
	4.2.4	1	The Fundamental Theorem of Calculus	None	4-86 to 4-94
4.3	4.3.1	1	Fast Times: Parts 1 & 2	None	4-98 to 4-105
	4.3.2	1	Fast Times: Parts 3 & 4	None	4-108 to 4-115
	4.3.3	1	Fast Times: Part 5	None	Closing Statement Write-up
4.4	4.4.1	1	Area Between Curves	None	4-123 to 4-130
	4.4.2	1	More Area Between Curves	None	4-135 to 4-144
	4.4.3	1 - 2	Multiple Methods for Finding Area Between Curves	Lesson 4.4.3 Res. Pg.	4-150 to 4-157
4.5	4.5.1	1	Newton's Method (optional)	Lesson 4.5.1 Res. Pg.	4-162 to 4-168
Chapter Closure		Varied Format Options			

Semester Review
Course Evaluation

Assessments:
Group Project Presentations
Final Exam

Further Readings:
Leithold, L. (1995). *The Calculus 7.* New York, NY: Harpercollins College Division.

Stewart, J. (2011). *Calculus.* Independence, KY: Brooks Cole.