Antioch University Los Angeles
Undergraduate Studies
Math 192: Calculus II
4 semester units

Instructor: Katie Kondo, M.S.
Class Meeting Times & Place: Week of January 11, 2016 – Week of June 6, 2016 (5 days per week)
Office Hours: Tuesday & Thursday, 8:00 am-9:00 am and by appointment
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Course Description: The course aims to apply and extend what students have learned in previous mathematics courses through the study of more derivative techniques and application, integration techniques and applications, derivatives and integrals of transcendental functions, polar and parametric functions, and sequences and series. The course begins with a wrapping up of derivative techniques from Math 191 and L'Hopital's rule. Students then work on integration applications like volumes and arc length. The course continues to integration techniques like integration by parts, partial fractions, and improper integrals. Students learn to work with, graph, differentiate, and integrate polar and parametric functions. The last part of the course includes a thorough treatment of sequences and series, including finding the sum of an infinite series and utilizing tests for convergence. Students in this course 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.

Undergraduate Studies 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 and community engagement;
- Core competency in foundational skills: including, writing, quantitative reasoning, information literacy, technological literacy, oral communication, and research.

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

- Students will understand and be able to explain the meaning 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.
    - Describe the relationship between rates of change for different scenarios. Solve for a rate of change given another related rate of change.
    - Graph differential equations and their solutions using slope fields and Euler's Method.
- Students will understand and be able to explain the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of change, and should be able to use

integrals to explain and solve a variety of problems.
    - Find the volume of a solid of revolution by accumulating the volume of circular slices.
    - Discover how to subdivide a solid of revolution into cylindrical shells and calculate the volume by accumulating the volumes of the shells.
    - Study solids formed with cross-sections and calculate their volumes by creating similar slices.
    - Determine the length of a curve.
    - Learn the *u-substitution* method of integration, which will enable you to easily integrate a wider variety of functions.
    - Learn how to use integration to solve special equations involving derivatives, called differential equations.
    - Integrate using integration by parts and partial fraction integration.
- Students will understand and be able to explain the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
- Students will understand and work with series.
    - Find Taylor and Maclaurin polynomials for common functions.
    - Approximate values of functions using these polynomials.
    - Determine the error for approximating function values.
    - Determine the radius and interval of convergence for Taylor series.
    - Prove l'Hôpital's Rule using Taylor series.
    - Extend your ability to test an infinite series for convergence or divergence by using the Divergence, Alternating Series, Integral, *p-Series,* Comparison, Limit Comparison, and Ratio Tests.
    - Analyze how a function can be approximated by a polynomial of high degree.
    - Model how change occurs in a fixed population using logistic curves.
    - Discover how to find the sum of an infinite geometric series, if one exists.
    - Learn the conditions that determine whether an infinite geometric series converges or diverges.
    - Analyze Zeno's Paradox and resolve it using an infinite geometric series.
- Students will understand and work with polar coordinates & curves and parametric coordinates & curves.
    - Learn about parameters and parametric equations.
    - Become acquainted with the definition of a vector and learn the notation and associated vocabulary.
    - Graph interesting new shapes called polar curves.
    - Find the area within a polar curve and the area bounded between two polar curves.
    - Investigate how to find the slope and length of a parametric curve.
    - Study motion with velocity and acceleration vectors.
    - Determine how to find the slope of a polar curve at a point.

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.

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

Prerequisite: Successful completion of MAT 191.

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

Chapter 7: Related rates and integration tools

Weeks 1-2

Project: Students will select an independent research topic of choice to build a model of a related rates situation, through a 3D digital model, animation, and analysis.

Section	Lesson	Days	Lesson Objectives	Materials	Homework
7.1	7.1.1	1	Related Rates Introduction	• Yarn or String • Stapler and ruler	7-6 to 7-12
	7.1.2	1	Related Rates Application: The Pythagorean Theorem	None	7-17 to 7-24
	7.1.3	1	Related Rates Application: Similar Triangles	None	7-28 to 7-36
	7.1.4	1	Related Rates Application: Choosing the Best Formula	None	7-40 to 7-46
	7.1.5	1	Related Rates Application: Trigonometry	None	7-49 to 7-56
7.2	7.2.1	1	Undoing the Chain Rule	None	7-59 to 7-66
	7.2.2	1	Integration with *U*-Substitution	None	7-70 to 7-78
	7.2.3	1	Definite Integrals and *U*-Substitution	None	7-84 to 7-91
	7.2.4	1	Varied Integration Techniques	None	7-97 to 7-103
7.3	7.3.1	1	Solving Differential Equations	None	7-108 to 7-116
	7.3.2	1	The Soda Lab: Newton's Law of Cooling	• Thermometer or CBL with temperature probe • Cold soda	7-120 to 7-126
	7.3.3	1	Slope Fields with Parallel Tangents	• Lesson 7.3.3 A and B Res. Pgs.	7-132 to 7-139
	7.3.4	1	Slope Fields with Non-Parallel Tangents	• Lesson 7.3.4 A, B, and C Res. Pgs.	7-144 to 7-151
	7.3.5	1	Differential Equations and Slope Field Applications	None	7-156 to 7-164
Chapter Closure			Varied Format Options		

Chapter 8: Volume
Weeks 3-4
Project: Students will create a real-life model of the cross-sections of their 3D wire sculpture, originally built in September in their Art & Design class. They will use the slicing, shell, or cross-section method to find the volume of the art piece.

Section	Lesson	Days	Lesson Objectives	Materials	Homework
8.1	8.1.1	1	Volumes by Slicing	• Limes, lemons, hot dogs, potatoes, eggs, etc. • Plastic knives • Centimeter rulers	8-4 to 8-11
	8.1.2	1	The Disk Method	• Graphing calculators	8-18 to 8-24
	8.1.3	1	The Washer Method	• Graphing calculators	8-28 to 8-36
	8.1.4	1	Revolution About Horizontal and Vertical Lines	• Graphing calculators	8-41 to 8-48
	8.1.5	1	Revolving the same region About Various Lines.	• Graphing calculators	8-51 to 8-52
	8.1.6	1	Mixture of Disk and Washer Problems	• Graphing calculators	8-57 to 8-63
Chapter Closure			Varied Format Options		

Chapter 9: Introduction to Geometric Series, Parametric Functions, Vectors, & Polar Graphs

Weeks 5-6

Section	Lesson	Days	Lesson Objectives	Materials	Homework
9.1 (BC)	9.1.1	1	Infinite Geometric Series	None	9-8 to 9-17
	9.1.2	1	More Infinite Geometric Series	None	9-24 to 9-32
	9.1.3	1	Convergence and Divergence	None	9-39 to 9-46
9.2 (BC)	9.2.1	1	Parametric Equations	• Large graph paper (opt.) • Nickels (opt.)	9-50 to 9-58
	9.2.2	1	Parametric Equations Using a Graphing Calculator	• Graphing calculators	9-64 to 9-72
9.3 (BC)	9.3.1	1	Introduction to Vectors	• Lesson 9.3.1 Res. Pg.	9-80 to 9-88
	9.3.2	1	Vector Operations	• Lesson 9.3.1 Res. Pg.	9-95 to 9-104
9.4 (BC)	9.4.1	1	Polar Graphs	• Rope • Chalk • Polar angles marked off on the ground • Polar graph paper (Res. Pg.)	9-108 to 9-116
	9.4.2	1	Polar Curves Using a Graphing Calculator	• Graphing calculators • Polar graph paper	9-122 to 9-129
	9.4.3	1	Polar Families	• Large graph paper	9-131 to 9-139
Chapter Closure			Varied Format Options		

Weeks 7-9

Section	Lesson	Days	Lesson Objectives	Materials	Homework
10.1	10.1.1	1 - 2	Convergence of Series	• Poster paper • Markers	Finish 10-2
	10.1.2	1	Divergence Test	None	10-8 to 10-15
	10.1.3	1	Alternating Series Test	None	10-19 to 10-24
	10.1.4	1	Integral Test for Convergence	None	10-29 to 10-36
	10.1.5	1	*P*-series Test for Convergence	• Hardcover books, all the same size	10-41 to 10-48
	10.1.6	1	Direct Comparison Test for Convergence	None	10-53 to 10-59
	10.1.7	1	Limit Comparison Test for Convergence	None	10-66 to 10-72
	10.1.8	1	Ratio Test for Convergence	None	10-77 to 10-84
10.2	10.2.1	1	Logistic Curves and Equations	• Random number generator	10-89 to 10-97
	10.2.2	1	Logistic Differential Equations	• Online logistic growth applet (optional)	10-101 to 10-108
10.3	10.3.1	1	Power Series Convergence	None	10-113 to 10-120
	10.3.2	1	Polynomial Approximations	None	10-124 to 10-130
Chapter Closure			Varied Format Options		

Weeks 10-12

Section	Lesson	Days	Lesson Objectives	Materials	Homework
11.1 (BC)	11.1.1	1	Area Bounded by a Polar Curve	• Scissors • Rulers • Lesson 11.1.1 Res. Pg.	11-6 to 11-14
	11.1.2	1	More Polar Area	• Graphing calculators	11-20 to 11-26
	11.1.3	1	Area Between Polar Curves	• Graphing calculators	11-31 to 11-39
11.2 (BC)	11.2.1	1	Velocity Vectors and Slope	• Graphing calculators	11-43 to 11-51
	11.2.2	1	Acceleration Vectors	None	11-57 to 11-62
	11.2.3	1	Slope of a Tangent Vector	None	11-67 to 11-75
	11.2.4	1	Arclength of Parametric Curves	None	11-83 to 11-90
11.3 (BC)	11.3.1	1	Derivatives of Polar Curves	None	11-95 to 11-104
	11.3.2	1	More Slopes of Polar Curves	None	11-109 to 11-117
11.4 (BC)	11.4.1	1-2	Battling Robots	• Lesson 11.4.1A-C Res. Pgs.	11-122 to 11-131
Chapter Closure			Varied Format Options		

Weeks 13-16

Section	Lesson	Days	Lesson Objectives	Materials	Homework
12.1 (BC)	12.1.1	1	Approximating with Polynomial Functions	• Graphing calculators	12-6 to 12-14
	12.1.2	1	Constructing Maclaurin Polynomials	• Graphing calculators	12-19 to 12-27
	12.1.3	1	Constructing Taylor Polynomials	None	12-34 to 12-41
	12.1.4	1	Taylor Series	• Less. 12.1.4 Res. Pg.	12-47 to 12-51
	12.1.5	1	Substitution with Taylor Polynomials	None	12-56 to 12-62
12.2 (BC)	12.2.1	1-2	Error of Taylor Polynomials	• Large graph paper (optional)	12-66 to 12-73
	12.2.2	1	Error Formula	None	12-77 to 12-83
	12.2.3	1	Interval of Convergence for Taylor Series	• Graphing calculators	12-90 to 12-97
	12.2.4	1	Indeterminate Forms Using Taylor Series	None	Finish 12-100
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.

Course and University Policies:

Application and Registration

All students new to AULA courses must apply online to AULA to receive a username and password and must register for all courses for the semester on myAntioch. Guidelines and procedures to be discussed in class beginning Week 2 of the course. **Registration is to be completed by Week 3 of the course. Failure to register for the course will result in the student losing the opportunity to earn college credit for the course through Antioch**

University Los Angeles.

Attendance Policy
Students are expected to attend all class sessions and participate as required. Students missing more than 4 class sessions must make up the missed time by completing assignments per instructor's direction. Students missing more than 10 class sessions will not receive credit for the course. See *AULA General Catalog, http://aulacatalog.antioch.edu/policiesregulationsandprocedures/academicpolicies/* 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, http://aulacatalog.antioch.edu/policiesregulationsandprocedures/academicpolicies/* for university policy.

Information Literacy and Research Requirements
All students are expected to develop an understanding of how to find and use resources appropriate for academic inquiry and scholarship. General instruction and guidance will be provided in class; students are also encouraged to attend office hours for help and support with research and for information literacy instruction.

Student Conduct and Class Policies

- All students are expected to be on time to every class and bring all necessary materials.
- Students are expected to conduct themselves professionally and interact respectfully with instructor and peers at all times.
- Students must turn in all assignments on time (on Edmodo by the due date, or at the beginning of the class period they are due *unless* other arrangements are made with the instructor *in advance*).
- Late work, including projects, are only accepted at the instructor's discretion. Late work and lack of preparation for class will also lead to a reduction in a student's accountability grade.
- Essays and projects may be revised and re-submitted with instructor consent; students must attend office hours to discuss the work and re-submit within two weeks of receiving the initial grade.
- If a student is going to be absent on the day of a quiz or exam, it is his or her responsibility to arrange a date to make up the exam. If a student does not make arrangements *in advance*, the instructor may not be able to accommodate the request.
- If a student misses class, all material covered during the student's absence and work assigned remain the student's responsibility.
- Students who miss class are expected to attend office hours as soon as possible.
- Important announcements and assignments will be communicated via Edmodo.com. All students must have a username and password, and log in regularly. (Instructions and access code will be given the first week of the semester.)

Respectful conduct is expected of students on the campus at all times, both inside and outside the classroom. See *AULA General Catalog, http://aulacatalog.antioch.edu/policiesregulationsandprocedures/studentconduct/* for further

details re: Antioch University Los Angeles policy. Students are expected to respect and adhere to all Da Vinci Science rules and policies at all times as well.

Academic Integrity & Plagiarism Policy
AULA and DaVinci Schools expect all students to adhere to the highest standards of academic honesty. In all academic activities—including, but not limited to papers, oral presentations, and reports—students must submit their own original work accompanied by citations acknowledging words, facts, or ideas borrowed from any other source, including electronic sources.

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. University policy describes plagiarism as "the representation of someone else's writing, graphics, research, or ideas as one's own. Paraphrasing an author's ideas or quoting even limited portions of the work of others without proper citation are also plagiarism, as is cutting and pasting materials from the Internet into one's academic papers. Extreme forms of plagiarism include submitting a paper written by another person or purchased from a commercial source. Students should be aware that AULA has access to software for detecting plagiarism.

Please consult the 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. For history courses, additional information will be provided for citations using the Chicago/Turabian format.
Students committing plagiarism or academic dishonesty 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 who need to request disability accommodations should email studentaffairs.aula@antioch.edu at the outset of their enrollment, if possible, since reasonable accommodations are not retroactive.

Sexual Harassment Policy

The Undergraduate Studies Division is firmly committed to each student's dignity and to eliminating all forms of sex discrimination and harassment of students. No student should have her or his learning experience at AULA contaminated by the experience of being treated as a sexual object by an instructor or any other employee. We strongly urge any student who believes that an Antioch employee has crossed the line to speak to your advisor, to the Undergraduate Studies Division leadership, the Director of Human Resources, or the Provost about your concerns.

Antioch University's policy "Title IX, Sex Discrimination, Sexual Harassment, and Sexual Violence" provides definitions of prohibited and inappropriate behaviors, the process for reporting and investigating complaints, and the sanctions levied against those employees or

students found to be in violation of these policies. This policy can be found in the Antioch University Resource Archive at http://aura.antioch.edu/policies_400_6x/12/.

Additionally, please see the *AULA General Catalog* for the policy on dual relationships: http://aulacatalog.antioch.edu/policiesregulationsandprocedures/universitypolicies/relationshipsintheworkplace/.

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. Respectful conduct is expected of students on the campus at all times, both inside and outside the classroom.

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