EASTERN UNIVERSITY

HON204: Mathematics in the Western Tradition
3 Credits
Mathematics
Department of Mathematics, Templeton Honors College
Spring 2016
TTH 10:00 a.m. - 11:20 p.m.
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Office Hours: MWF 1:00-2:00, TTh 12:00-1:00
In addition to these posted hours I am often available at other times. Please do not hesitate to make an appointment with me. I can be contacted best via email or voice mail.

Course Prerequisites: Sophomore standing in the THC; junior standing otherwise.

Course Description: This course engages in a study of mathematical thought in the Western Tradition from Euclid, through modernity and to the present. Attention is paid both to the mathematical work of key figures, and the relationship between their mathematical system and the concurrent development of philosophical thought. Students will read the primary texts of mathematicians and philosophers, learn fundamental mathematical skills, and explore the ways in which mathematical thought has influenced, and been influenced by the broader tradition.

Course Goals and Objectives: This course aims to:

1. Explore the mathematical systems of Euclid, Descartes, Newton, Cantor.
2. Place the different mathematical worlds of these key figures within the narrative of both Christianity and the Western Tradition, making connections with the important thinkers discussed elsewhere in the THC curriculum.
3. Demonstrate the importance of mathematics to the Great Books canon.
4. Cultivate students' mathematical thinking skills, including proof writing, geometry, set theory and logic. This will included exposure to symbolic axiomatic systems.
5. Broadening students' reading, writing, and critical thinking skills by developing these talents in a uniquely mathematical context.

The course supports the broader university general education goals related to proficiency in quantitative reasoning. Furthermore, this course fits into the strand of scientific thought within the Templeton Honors College curriculum.

Course Delivery Format: This is an on ground course.

Texts: Euclid, *Elements,* Fitzpatrick's translation of Heiberg. (An additional helpful resource may be found at http://aleph0.clarku.edu/~djoyce/java/elements/elements.html).
Descartes, *Discourse on Method, Optics Geometry and Meteororology*
Readings (provided)

Newton, *Mathematical Principles of Natural Philosophy,* selections from *Quadratura Curvarum, Reflections, Refractions, Inflections and Colours of Light*
Leibniz, *A New Method for Maxima and Minima*
Johannes Wallis, *Algebra*
Cantor, *Contributions to the Founding of the Theory of Transfinite Numbers*
Gödel, *On Formally Undecidable Propositions of* Principia Mathematica *and Related Concepts*

Devaney, selections from, *A First Course in Chaotic Dynamical Systems*
Augustine, *On Free Choice of the Will*
Aquinas, *How we Know One Simple God by Many Concepts*
Ernest, *Social Constructivism as a Philosophy of Mathematics*

Attendance Policy: Your attendance is absolutely essential to your success in this class. If you know you are going to be absent, please notify the professor. 10% of your course grade depends on class participation and your attendance is critical for this portion.

Policy for Students with Disabilities: If you have any documented special educational needs, you are encouraged to work with the Cushing Center for Counseling and Academic Support to prepare a written request for the accommodations you need in this course. In order to receive an accommodation for this course, the instructor must receive a written request from CCAS a t the beginning of the course or as soon as the disability is diagnosed.

College Policies: Please note that all University policies pertaining to academic dishonesty, drop/add procedures, and grade appeal should be followed by students enrolled in this class. Consult the undergraduate catalog or speak to the instructor if you have any questions about these University policies.

Course Continuation/Completion Policy: In the event of unforeseen circumstances that would prohibit the class from being completed in an on ground manner, the remainder of the course will be conducted electronically through http://eastern.brightspace.com**.**

Course Requirements and Assignments:

1. Assignments
    - *Euclid Problem Presentations*: Students will be assigned a set of problems related to Book I of Euclid's *Elements* (see below). Students will be arranged into small groups to present one of the problems from the set. Students are expected to prepare a presentation carefully articulating the steps taken to move from the propositions to the conclusion, and explaining the argument well to the rest of the class. The presenters are expected to be the experts on the proof that day, fielding questions about the argument from classmates and the professor. The students will also be required to cite and understand all of the definitions and propositions required in the justification of their proof prior to engaging in the assigned proposition.
    - *Writing Assignments*: A series of three 4-6 page papers (12 pt. font, 1 inch margins, double spaced) will be completed by the student over the course of the semester. Students should feel free to extend the arguments of the papers beyond the requirements of the prompts.
        i. Paper #1 – In the first paper students will engage with Euclid's mathematical world. The paper should articulate the differences between Euclid's view of reality and our own, and discuss the strengths and weaknesses of Euclid's mathematical system.
        ii. Paper #2 – In the second paper students are expected to give an accessible and mathematical articulation of both a geometric (Euclidean) and algebraic (Cartesian) proof of the Pythagorean Theorem. Both of these arguments should be presented in both a mathematically accurate and easy to understand form. The purpose of this paper is to both understand these two unique proofs, and practice presenting mathematical arguments in clear common language. Alternatively, consider the impact the development of the Calculus had on the Enlightenment understanding of the cosmos.

iii. Paper #3 – In the third paper, students are required to discuss the changes in our epistemic optimism in the Western Tradition throughout the history of mathematics. The paper may include a discussion of how chaos theory affects our understanding the world vs. the understanding that Newton or Descartes brought.

- *Problem Sets*: The course will include a series of 4 graded homework assignments. The homework is meant to evaluate the students' comprehension of the specifically mathematical content of the course.
  i. Homework #1 – Euclidean style proofs of geometric proposition not included in Euclid's *Elements*.
  ii. Homework #2 – Cartesian style proofs of geometric problems.
  iii. Homework #3 – Calculus problems from Newton's calculus and a cardinality proof akin to Cantor's proof of the cardinality of (0,1).
  iv. Homework #4 – A non-technical description chaotic properties of the Cantor set.

Participation: This course will be composed of both seminar style and lecture based classes. Students are expected to participate in class discussions, contributing both insights and questions to the ongoing discussion. In order to develop positions, formulate arguments, and write well on course material, students must engage in enquiry and dialog in the classroom. In addition, a student's arguments assist other class members in understanding material and developing positions. For the sake of both the student and her peers, participation is necessary for success in this class.

Grading Policy: Letter grades will be given using the following breakdown:

93-100	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
63-66	D
60-62	D-
<60	F

Grading will be based on the following percentage scheme:

Euclid Presentation	10%
Papers	40%
Problem Sets	40%
Attendance & Participation	10%

Course Schedule:

Date	Topic	Homework
Week 1	Introduction, Hersh's 4-cube exercise, Pythagoreans	
	Foundational Elements, Plato's *Republic*, the Parallel Postulate	Read *The Republic*, Book VII, *Elements* Book I, Definitions and Common Notions
Week 2	Book I, Definitions and Common Notions	Read Book I, Propositions 1-30.
	Book I, The Propositions	Read Book I, Propositions 30-48.
Week 3	Book I, The Propositions Continued	
	Book I, Presentations	Euclid Problem Set Due. Presentations 1-3
Week 4	Book I, Presentations cont.	Presentations 4-6.
	Book I, Presentations cont.	Presentations 7-9.
Week 5	Meno	Read *Meno* Handout
	From Euclid to Descartes	
Week 6	Descartes: Discourse of Method	Read *Discourse on Method* Parts 2,4
	Descartes Geometry	Read *Geometry* Book I
Week 7	Descartes Geometry cont.	
	Rationalism, Empiricism	Paper #1 due
Week 8	Spring Break - No Class	
	Spring Break - No Class	
Week 9	Newton's Calculus	Read Newton

	Newton's Calculus	
Week 10	Leibniz's Calculus	Read Leibniz
	Leibniz's Calculus	
Week 11	Cantor's Transfinite Numbers	
	Cantor's Transfinite Numbers	Homework #2 due. Read Cantor sections 1-5
Week 12	Cantor's Transfinite Numbers	Paper #2 due. Read Cantor sections 5-12
	Godel, MU Puzzle	Read Godel p.37-72
Week 13	Godel, Social Constructivism	Read Ernest Ch 1-3
	Introduction to Chaos	Homework #3 due
Week 14	Chaos	
	Chaos	
Week 15	The Cantor Set	
	The Cantor Set	Homework #4 due, Paper #3 due