DISTANCE CALCULUS @ RWU ROGER WILLIAMS UNIVERSITY

COURSE SYLLABUS

Course Title: **Introduction to Non-Euclidean Geometry**

Abbreviated Title As Appears on Transcript: `Intro Non-Euclidean Geometry`

Course Number: DMAT 288

Credit Hours: 4 credits [semester credit hours]

Course Description: A historical and rigorous introduction to the subject of Non-Euclidean Geometry, spanning from Euclid's Elements through the attempts to prove the Parallel Postulate, ultimately resulting in the intellectual blossoming of multiple geometric realities. Topics include Euclid's postulates, formulating axiomatic systems, rigorous geometric proofs, Neutral Geometry, multiple Parallel Postulates, Hyperbolic and Projective Geometry.

Prerequisite: Successful completion with grade C or higher in Precalculus or equivalent, or consent of instructor.

Course Workload: 4 semester credit hours • 3 student work hours per credit hour • 14 week Carnegie semester = 168 hours student course workload average

Examination Requirements: Proctored written and oral final examination must be passed at 70% or higher to earn passing grade in course. "B" and "A" grade paths have additional examinations and assignments. See https://www.distancecalculus.com/grades/ for more information.

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Accredited by New England Commission of Higher Education (NECHE).
See https://www.rwu.edu/academics/accreditation/ for more information.

E-Textbook:

Euclidean and Non-Euclidean Geometries, Development and History, 2nd Edition, by Greenberg.

Mathematical Software: None

ADA ACCOMMODATIONS

Roger Williams University has a continuing commitment to providing reasonable accommodations for

students with documented disabilities. Students with disabilities who need accommodations in order to fully participate in this class are urged to contact Student Accessibility Services, as soon as possible, to explore the arrangements needed to be made to assure access. Student Accessibility Services is open Monday through Friday from 8:00AM to 5:00PM Eastern Time; Email: sas@rwu.edu or Voice: 401-254-3841. For more information about SAS, visit https://www.rwu.edu/undergraduate/academics/student-academic-success/student-accessibility-services-sas

COURSE RULES

Academic Honesty

Academic Dishonesty in a Distance course includes copying or relying upon another person's work. Working with other students is good and encouraged, but the work you submit for this course must be genuinely your own work. Private tutors are allowed, but you must notify the instructor that you have obtained a private tutor to aid in your studies. Any documented instance of Academic Dishonesty will be grounds for immediate failure in this course.

Final (and Other) Examinations

A written and oral proctored final exam will occur at the student's location over video with the course professor; The student must score 70% or higher on this final exam to be eligible to earn a passing grade in the course.

Communication

Communication is the key to success in a Distance course. It is the student's responsibility to keep good communication channels with the instructors during the course; failure to participate in the course does not constitute "dropping" the course (Withdrawal from the course must be requested in writing to the instructors before the completion date deadline)

Roger Williams University Policies & Procedures

Roger Williams University has Policies & Procedures that all students must follow, including the Roger Williams University Student Handbook. Student must agree to follow all stated rules governing student conduct listed on the Roger Williams University website, and at the Roger Williams University Course Catalog

Course Completion 1 Year Rule

All Distance Calculus students are afforded 1 Year to finish their course from the Date of Enrollment. Students will be placed in the Academic Semester based upon their Date of Enrollment for academic records purposes. If a student does not finish the course, and does not request a Course Withdrawal for a W, then an "F" grade will be issued.

No Chatbots / AI

Students must pledge to **not** use any Chatbot/AI at all - **period**. Student must pledge to **limit** use of search engines (Google, Bing, etc) to a minimal level. Student must pledge to not engage in dishonest disguise of any Chatbot/AI/Search Engine source of information as student's own honest academic work. Verified chatbot usage will result in an "F" course grade, and will be referred to the Roger Williams University Academic Integrity Committee.

Learning Outcomes for DMAT 288 - Introduction to Non-Euclidean Geometry

1. To understand the historical development of the discovery of Non-Euclidean Geometry.
2. To understand the foundations of the axiomatic method
3. To understand rigorous geometric proofs
4. To understand the history and flaws of Euclid
5. To understand the statements of the Parallel Postulate
6. To understand the concepts of consistent geometry
7. To understand the foundations of Neutral Geometry
8. To understand the Non-Euclidean Parallel Postulate
9. To understand the historical relevance of the discovery of Hyperbolic Geometry

Syllabus Topics Outline for DMAT 288 - Introduction to Non-Euclidean Geometry

1. Getting Started
   - 1.1 Email and Chat
   - 1.2 Learning About the Course
   - 1.3 Required Hardware
   - 1.4 Software Fundamentals

2. Euclid's Geometry
   - 2.1 Origins of Geometry
   - 2.2 Axiomatic Method
   - 2.3 Undefined Terms
   - 2.4 Euclid's first four postulates
   - 2.5 The Parallel Postulate
   - 2.6 Attempts to Prove The Parallel Postulate

3. Logic
   - 3.1 Informal Logic
   - 3.2 Theorems and Proofs
   - 3.3 RAA Proofs
   - 3.4 Negation
   - 3.5 Quantifiers
   - 3.6 Implication
   - 3.7 Law of Excluded Middle
   - 3.8 Incidence Geometry
   - 3.9 Models
   - 3.10 Isomorphism of Models
   - 3.11 The Danger in Diagrams

4. Hilbert's Axioms
   - 4.1 Flaws in Euclid
   - 4.2 Axioms of Betweenness

- 4.3 Axioms of Congruence
- 4.4 Axioms of Continuity
- 4.5 Axiom of Parallelism

5. Neutral Geometry
   - 5.1 Geometry Without The Parallel Axiom
   - 5.2 Alternate interior angle theorem
   - 5.3 Exterior angle theorem
   - 5.4 Measure of angles and segments
   - 5.5 Saccheri-Legendre theorem
   - 5.6 Equivalence of parallel postulates
   - 5.7 Angle sum of a triangle

6. History of the Parallel Postulate
   - 6.1 Proclus
   - 6.2 Wallis
   - 6.3 Saccheri and Lambert
   - 6.4 Wolfgang Bolyai

7. The Discovery of Non-Euclidean Geometry
   - 7.1 János Bolyai
   - 7.2 Gauss
   - 7.3 Lobachevsky
   - 7.4 Hyperbolic geometry
   - 7.5 Angle sums (again)
   - 7.6 Similar triangles
   - 7.7 Parallels that admit a common perpendicular
   - 7.8 Limiting parallel rays
   - 7.9 Classification of parallels
   - 7.10 Strange new universe?

8. Independence of the Parallel Postulate
   - 8.1 Consistency of hyperbolic geometry
   - 8.2 The Beltrami-Klein model
   - 8.3 The Poincaré models
   - 8.4 Perpendicularity in the Beltrami-Klein model
   - 8.5 Inversion in circles
   - 8.6 The projective nature of the Beltrami-Klein model

9. Philosophical Implications
   - 9.1 What is the geometry of physical space?
   - 9.2 What is mathematics about?
   - 9.3 The controversy about the foundations of mathematics
   - 9.4 Perpendicularity in the Beltrami-Klein model
   - 9.5 The mess