Math 351 – College Geometry
Course Syllabus

Course description: Survey of topics from classical Euclidean geometry, modern Euclidean geometry, projective geometry, transformational geometry and non-Euclidean geometries.

Credit hours: 3

Course Prerequisites and Corequisites: MTH 311

Outline of Suggested Topics: The following is a list of suggested topics to accompany the text *College Geometry, A Discovery Approach* by David C. Kay. The topics can be augmented or diminished, as long as the objectives for the course are practiced. Decisions concerning order of presentation are left to individual instructors.

Course outline: Approximate time spent

- **Basic Definitions and Axioms** 25%
  - Introduction to Axiomatics and Proof
  - Role of Examples and Models
  - Incidence Axioms
  - Distance Axioms
  - Angle Axioms
  - Plane Separation Postulate
- **Triangles, Quadrilaterals and Circles** 25%
  - Triangles, Congruence
  - SAS Axiom and Taxicab Geometry
  - ASA, SSS Congruence and Perpendicular Bisector Theorem
  - Inequality Theorems
  - Other Congruence Criteria (SsA, HA, HL, etc.)
  - Quadrilaterals
  - Circles (all results possible without accepting a parallel postulate)
- **Euclidean Geometry** 25%
  - Euclidean Parallel Postulate, Rectangles
  - Parallelograms and Parallel projection
  - Similarity
  - Right Angle Trigonometry
  - Circles With a Parallel Postulate
  - Area And Volume
- **Transformational Geometry** 10%
  - Reflections, Translations, Rotations and Other Isometries
  - Other Linear Transformations
- **Non-Euclidean Geometry** 10%
  - Hyperbolic Geometry
  - Models for Hyperbolic Geometry
- **Classroom Connections** 5%
  - Teaching Geometry in the High School Classroom

Student Learning Outcomes (SLO): At the end of the semester, successful students will be able to:

1. Use axioms, definitions and given theorems to prove properties of a geometry. [PLO: 1,3]
2. Show how a model for a geometry can serve to prove independence of a set of axioms. [PLO: 1,3,4,5]
3. Prove two triangles are congruent under varying sets of hypotheses (the traditional SAS, SSS, ASA, AAS proofs). [PLO: 1,3,4]
4. Use the Inequality Theorems for triangles to establish relationships between measures of sides and angles of triangles. [PLO: 1,3,4]
5. Use the properties and proven theorems concerning circles to establish congruence of triangles. [PLO: 1,3,4]
6. Understand that the difference between absolute, Euclidean, hyperbolic, and other classical geometries is the parallel postulate (or absence of one), and that this difference is what establishes the independence of the Euclidean Parallel Postulate. [PLO: 1,3,4,5]
7. Use parallel projection and similar triangles to prove congruence of angles or constance of ratios of sides. [PLO: 1,3]
8. Use the Pythagorean Theorem, Law of Sines, Law of Cosines and right triangle trigonometry. [PLO: 2]
9. Use and write mappings which describe translations, rotations, and other geometric transformations, and discuss the importance of these mappings in the high school classroom. [PLO: 2,4]
10. Prove theorems in a geometry besides Euclidean geometry (usually hyperbolic geometry) to understand their dependence on the accepted axiom set, and understand the implication of the axiom set in the high school classroom. [PLO: 1,3,4]

Program Learning Outcomes (PLO):

Students graduating from SFASU with a B.S. degree and a major in mathematics will:

1. Demonstrate comprehension of core mathematical concepts. [***Concepts***]
   (notion of theorem, mathematical proof, logical argument)
2. Execute mathematical procedures accurately, appropriately, and efficiently. [***Skills***]
   (calculus, algebra, routine, nonroutine, applied)
3. Apply principles of logic to develop and analyze conjectures and proofs. [***Logical Reasoning***]
   (quantifiers, breaking down mathematical statements, counterexamples)
4. Demonstrate competence in using various mathematical tools, including technology, to formulate, represent, and solve problems. [***Problem Solving***]
   (calculus tools, algebra tools, applied tools, nonstandard problem solving)
5. Demonstrate proficiency in communicating mathematics in a format appropriate to expected audiences. [***Communication***]
   (written, visual, oral)

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