MA528—Introduction to Modern Geometry

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Text: Sibley, The Geometric Viewpoint

Material: We will cover most of the text. We will attempt to answer the question “What is geometry?” by discussing several different approaches to geometry: the axiomatic, the analytic, Euclidean vs. non-Euclidean, finite geometries. We will also discuss the transformations, isometries and symmetries of different geometries. At the end of the course, we will probably not have an answer to the basic question, but we will have a zoo of examples of different geometries.

Grading: There will be two take-home exams and a take-home final. Homework will count for 35% of your grade, each exam counts for 20%, and the final counts 25%. The exams will be given approximately 1/3 and 2/3 of the way through the semester.

Homework: The homework assignments are listed below. These exercises will be collected and graded one week after assigned. Solutions will be posted on my web page, so late homework will not be accepted.

Excused Absences: Tests may be made up, or incompletes given, only for substantiated medical reasons, family emergencies, or religious reasons.

Homework

Chapter 1/Section 1.1: Euclidean Geometry – Overview and History. Hwk: 1, 2, 3, 7, 10
Section 1.2: Constructions, Congruence, and Parallels. Hwk: 1, 2
Section 1.3: A Critque of Euclid. Hwk: 6, 7
Section 1.4: Axiomatic Systems. Hwk: 1, 4, 6
Section 1.5: Similar Figures. Hwk: 1, 4, 5
Projects for Chapter 1. Hwk: 23, 24 or 25 (1-2 pages)

Chapter 2/Section 2.1: Analytic Geometry – Overview and History. Hwk: 2, 3, 4
Section 2.2: Conics. Hwk: 3
Section 2.3: Further Topics. Hwk: 4, 5a-d, 12
Section 2.4: (Omitted)
Section 2.5: Higher Dimensional Analytic Geometry. Hwk: 2, 3
Chapter 2 Projects. Hwk: 8

Chapter 3/Section 3.1: Non-Euclidean Geometry – Overview and History. Hwk: 1, 2
Section 3.2: Lines and Omega Triangles. Hwk: 5
Section 3.3: Saccheri Quadrilaterals. Hwk: 1
Section 3.4: Area and Hyperbolic Designs. Hwk: 3, 4, 7
Section 3.5: Spherical and Elliptic Geometries. Hwk: 1, 2
Chapter 3 Projects. Hwk: 16 (1-2 pages)

Chapter 4/Section 4.1: Transformational Geometry – Overview and History. Hwk: 1, 4ab
Section 4.2: Isometrics. Hwk: 1, 3, 4, 5, 8, 10
Section 4.3: Algebraic Representation of Transformations. Hwk: 1, 3, 9
Sections 4.4 and 4.5: (Omitted)
Section 4.6: Inversions and the Complex Plane. Hwk: 2, 3, 7

Chapter 5/Section 5.1: Symmetry – Overview and History. Hwk: 1b, 5a, 7a
Section 5.2: Finite Plane Symmetry Groups. Hwk: 1a, 3abc
Section 5.3: Symmetry in the Plane. Hwk: 1ab, 2ab, 3ab
Sections 5.4 – 5.6: (Omitted)
Chapter 5 Projects. Hwk: 22 or 23 (1-2 pages)

Chapter 6/Section 6.1: Projective Geometry – Overview and History. Hwk: 2, 5
Section 6.2: Axiomatic Projective Geometry. Hwk: 2, 5
Section 6.3: Analytic Projective Geometry. Hwk: 1, 2, 3
Sections 6.4: Projective Transformations. Hwk: 1a, 2ab
Section 6.5: Subgeometries. Hwk: 3a
Sections 6.6: (Omitted)
Chapter 6 Projects. Hwk: 14 or 15 (1-2 pages)

Chapter 7/Section 7.1: Finite Geometries – Overview and History. Hwk: 1
Section 7.2: Affine and Projective Planes. Hwk: 4
Section 7.3: Design Theory. Hwk: 1, 6
Sections 7.4: Finite Analytic Geometry. Hwk: 1abc, 4