I. Course Description

This course covers topics in Euclidean geometry including similarity and congruency, plane figures, right triangles, parallel and perpendicular lines, constructions, and applications, along with an introduction to trigonometry. Prerequisites: a placement recommendation for MTH 06 and algebra I or equivalent. Lecture 3 hours per week.

II. Specific Objectives

Upon completion of this course the student should be able to:

**CHAPTER ONE: LINE AND ANGLE RELATIONSHIPS**

**Section 1.1: Statements and Reasoning**

1. determine whether a collection of words/symbols forms a statement;
2. form the negation of a given statement;
3. form the conjunction, disjunction, or implication determined by two statements;
4. recognize the hypothesis/conclusion of a conditional statement;
5. state the three types of reasoning used in geometry;
6. determine the type of reasoning used in a specific situation; and
7. recognize/apply the Law of Detachment.

**Section 1.2: Informal Geometry and Measurement**

1. describe the terms point, line, and plane;
2. become familiar with geometric terms such as collinear, line segment, and angle;
3. measure a line segment with a ruler/make an angle with a protractor;
4. write equations based upon statements involving midpoint, bisect, and congruent;
5. recognize the terms right angle, straight angle, and perpendicular;
6. use the compass to construct a line segment of specified length; and
7. use the compass to determine the midpoint of a given line segment.

Section 1.3: Early Definitions and Postulates
1. know the parts of a mathematical system: undefined terms, definitions, postulates, and theorems;
2. recognize the need for/characteristics of a precise definition;
3. know the definition/symbol for line segment and its length;
4. accept and state the initial postulates involving lines and planes (in your own words);
5. use the Segment-Addition Postulate to write equations;
6. understand the concepts parallel lines and parallel planes; and
7. recognize the significance of term “unique” as it applies to geometry.

Section 1.4: Angles and Their Relationships
1. know the definition/symbol for angle and its measure;
2. understand/use terms related to angles (like sides, vertex, etc.);
3. state/apply postulates involving an angle(s):
4. recognize the type of angle shown/measured: acute, right, obtuse, and straight;
5. use the Angle-Addition Postulate to write equations;
6. know the classifications of pairs of angles: adjacent, congruent, complementary, supplementary, and vertical;
7. use the compass to construct an angle congruent to a given angle; and
8. use the compass to construct the bisector of a given angle.

Section 1.5: Introduction to Geometric Proof
1. demonstrate the two-column form of a proof;
2. understand the role of the Given, Prove, and Drawing for a proof problem;
3. provide reasons that justify statements supplied in partial proofs;
4. provide statements that are justified by the reasons supplied in partial proofs;
5. know/apply the definition of perpendicular lines in practice and proof;
6. understand/apply the reflexive, symmetric, and transitive properties of congruence;
7. construct the unique line perpendicular to a line at a point on the line; and
8. construct the unique perpendicular-bisector of a given line segment.
Section 1.6: The Formal Proof of a Theorem
1. state the hypothesis and conclusion of a given theorem;
2. state the five written parts of the formal proof of a theorem;
3. make the “Drawing” for the proof of a theorem based upon the hypothesis of the theorem;
4. write the “Given” for the proof of a theorem based upon its hypothesis and the “Drawing”;
5. write the “Prove” for the proof of a theorem based upon its conclusion and the “Drawing”;
6. state/apply theorems involving perpendicular lines, complementary angles, and so on; and
7. construct/complete the formal proof of a theorem.

Chapter Two: Parallel Lines
Section 2.1: The Parallel Postulate and Special Angles
1. construct the perpendicular line from a point not on a given line to that line;
2. recognize when two lines, a line and a plane, or two planes are perpendicular;
3. recognize when two lines, a line and a plane, or two planes are parallel;
4. define parallel lines and parallel planes;
5. understand/apply terms such as transversal, corresponding angles, etc.;
6. state/apply initial postulates involving parallel lines; and
7. state/complete/apply selected theorems involving given parallel lines.

Section 2.3: Proving Lines Parallel
1. state/apply/prove selected theorems establishing that lines are parallel; and
2. construct the line parallel to a given line through a point outside the line.

Section 2.4: The Angles of a Triangle
1. know definitions of triangle and related terms (vertices, sides, etc.);
2. classify triangles by their sides (scalene, isosceles, equilateral);
3. classify triangles by their angles (acute, right, obtuse, and equiangular);
4. know/apply the theorem, “The sum of angles of a triangle is 180°.”; and
5. state/apply/prove the corollaries of the theorem stated in (4).

Section 2.5: Convex Polygons
1. know the definitions of polygon and related terms;
2. classify polygons as convex/concave and by their numbers of sides;
3. determine the number of diagonals for a polygon of n sides;
4. state/apply theorems involving sums of angle measures of a polygon;
5. classify polygons as equiangular/equilateral/regular; and
6. recognize a figure that is a polygram/regular polygram.

Chapter Three: Triangles
Section 3.1: Congruent Triangles
1. state the definition of congruent triangles;
2. determine the correspondences between parts of congruent triangles;
3. determine the included side (angle) for 2 angles (2 sides) of a triangle; and
4. know/apply these methods for proving congruence of triangles: SSS, SAS, ASA, and AAS.

Section 3.2: Corresponding Parts of Congruent Triangles
1. use CPCTC to symbolize “Corresponding parts of congruent triangles are congruent”;
2. recognize the types of conclusions that can be established by using CPCTC;
3. use markings on congruent triangles to indicate their corresponding parts;
4. state/apply the HL theorem; and
5. determine the method that establishes that triangles are congruent.

Section 3.3: Isosceles Triangles
1. distinguish between angle-bisector of angle of triangle, altitude of triangle, perpendicular-bisector of a side of triangle, and median of a triangle;
2. know that a triangle has three angle-bisectors/altitudes/medians/perpendicular-bisectors of sides;
3. decide whether an auxiliary line is determined/overdetermined/underdetermined;
4. state/use “If two sides of a triangle are congruent, the angles opposite these sides are congruent.”;
5. state/apply “If two angles of a triangle are congruent, the sides opposite these angles are congruent.”; and
6. state/apply the definition of perimeter of a triangle.

Chapter Four: Quadrilaterals
Section 4.1: Properties of a Parallelogram
1. state definitions for quadrilateral and parallelogram;
2. state/apply/prove selected theorems involving given parallelograms;
3. use angle measures of a parallelogram to determine its longer/shorter diagonal; and
4. determine speed/direction of an airplane whose motion is subject to the wind.

Section 4.2: The Parallelogram and Kite
1. recognize that the parallelogram/kite each have two pairs of congruent sides;
2. know that quadrilaterals with congruent opposite sides are parallelograms;
3. know that quadrilaterals with a pair of congruent and parallel sides are parallelograms;
4. know that quadrilaterals with diagonals that bisect each other are parallelograms;
5. know that the kite has one pair of opposite angles that are congruent;
6. know that the kite has a diagonal that is the perpendicular-bisector of the other diagonal; and

7. state/apply the theorem in which the midpoints of two sides of a triangle are joined.

**Section 4.3: The Rectangle, Square, and Rhombus**

1. state definitions for the rectangle, square, and rhombus;
2. state/apply/prove theorems involving the rectangle/square/rhombus;
3. state/apply/prove corollaries involving the rectangle/square/rhombus; and
4. know/apply the Pythagorean Theorem.

**Section 4.4: The Trapezoid**

1. know the terminology related to the trapezoid and isosceles trapezoid;
2. state/apply/prove selected theorems and corollaries involving trapezoids; and
3. state/apply “If three (or more) parallel lines intercept congruent segments on one transversal, then they intercept congruent segments on any transversal.”

**Chapter Five: Similar Triangles**

**Section 5.1: Ratios, Rates, and Proportions**

1. state/apply the terms ratio, rate, and proportion;
2. know the terminology (means, geometric mean, etc.) related to proportions;
3. state/apply the Means-Extremes Property (of a proportion); and
4. understand/apply further properties of proportions.

**Section 5.2: Similar Polygons and Triangles**

1. form an intuitive understanding of the concept “similarity of figures”;
2. determine the correspondences between the parts of similar polygons;
3. state/apply the definition of similar polygons;
4. state/apply the AA corollary; and
5. recognize/apply CSSTP, meaning “Corresponding sides of similar triangles are proportional.”

**Section 5.3: The Pythagorean Theorem**

1. state/prove/apply Theorem 5.5.1 in establishing later theorems;
2. state/prove theorems involving geometric means in the right triangle;
3. state/apply the Pythagorean Theorem and its converse;
4. determine whether (a, b, c) is a Pythagorean Triple; and
5. determine whether a triangle is acute, right, or obtuse based upon the lengths of sides.

**Section 5.4: Special Right Triangles**

1. state/apply/prove the 45° -45° -90° Theorem;
2. state/apply/prove the 30° -60° -90° Theorem; and
3. recognize/apply the equivalent theorems (Theorems 5.4.3 and 5.4.4).

**Section 5.5: Segments Divided Proportionally**

1. form an intuitive understanding of the concept “segments divided proportionally”;
2. state/apply the definition of segments divided proportionally;
3. state/apply/prove the theorem that establishes that parallel lines determine proportional segments on transversals; and
4. state/apply the theorem, “The angle-bisector in a triangle separates the opposite side into segments whose lengths have the same ratio as the lengths of the sides of the bisected angle.”

**CHAPTER SIX: CIRCLES**

**Section 6.1: Circles and Related Segments and Angles**

1. become familiar with the terminology (radius, center, chord, arc, etc.) of the circle;
2. state/apply postulates related to the circle;
3. state/apply/prove selected theorems related to the circle; and
4. state/apply methods of measuring central and inscribed angles in the circle.

**Section 6.2: More Angle Measures in the Circle**

1. state definitions for terms such as tangent and secant (of a circle);
2. recognize when polygons are inscribed in/ circumscribed about circles;
3. recognize when circles are inscribed in/ circumscribed about polygons; and
4. state/apply/prove theorems that relate angle and arc measures in the circle.

**Section 6.3: Line and Segment Relationships in the Circle**

1. state/apply/prove theorems relating radii and chords of a circle;
2. recognize/use terminology involving tangent circles;
3. recognize/use terminology involving common tangents to circles; and
4. state/apply/prove theorems involving lengths of chords, tangents, and secants.

**Section 6.5: Locus of Points**

1. understand/state the definition of the term locus;
2. draw/construct/describe the locus of points for a selected condition(s);
3. recognize the locus of points equidistant from sides of angle/from endpoints of line segment;
4. recognize/describe the differences between a locus in a plane-space; and
5. verify the locus theorem by establishing two results.

**Section 6.6: Concurrence of Lines**
1. understand/state the definition of concurrent lines;
2. state/apply/prove the concurrence of the three angle-bisectors of a triangle;
3. state/apply/prove the concurrence of the perpendicular-bisectors of sides of a triangle;
4. state/apply the concurrence of the three altitudes of a triangle; and
5. state/apply the concurrence of the three medians of a triangle.

CHAPTER SEVEN: AREAS OF POLYGONS AND CIRCLES

Section 7.1: Area and Initial Postulates
1. develop an intuitive understanding of the area concept;
2. distinguish between units of length and units of area measurement;
3. state/apply the initial postulates involving areas of regions; and
4. prove/apply theorems involving area of a square, parallelogram, or triangle.

Section 7.2: Perimeter and Area of Polygons
1. state/apply perimeter formulas for selected polygons;
2. state/apply Heron’s Formula for the area of a triangle;
3. state/apply/prove formulas for the areas of trapezoid, rhombus, and kite; and
4. use the ratio between the lengths of corresponding sides of similar polygons to determine
   the ratio between their areas.

Section 7.3: Regular Polygons and Area
1. determine whether a given polygon can be inscribed in a circle;
2. determine whether a given polygon can be circumscribed about a circle;
3. perform constructions involving inscribed/ circumscribed polygons and circles;
4. calculate measure of central angle, radius, and apothem of a regular polygon; and
5. determine the area of a regular polygon by applying the formula \( A = \frac{1}{2}aP \).

Section 7.4: The Circumference and Area of a Circle
1. recall that \( \pi \) is the ratio of the circumference to the diameter of a circle;
2. know/apply the formulas \( C = \pi d \) and \( C = 2\pi r \) for circumference of a circle;
3. memorize the common approximations for \( \pi \);
4. understand/apply the formula for the length of an arc; and
5. state/apply the formula for the area of a circle.

CHAPTER TEN: INTRODUCTION TO TRIGONOMETRY

Section 10.1: The Sine Ratio and Applications
1. define/apply the sine ratio of an acute angle of a right triangle;
2. use a table/calculator to determine the sine ratio of an acute angle;
3. use a table/calculator to determine the acute angle whose sine ratio is known; and
4. understand/apply the notion angle of elevation/depression.

**Section 10.2: The Cosine Ratio and Applications**

1. define/apply the cosine ratio of an acute angle of a right triangle;
2. use a calculator to determine the cosine ratio of an acute angle;
3. use a calculator to determine the acute angle whose cosine ratio is known; and
4. know/apply/prove the identity \( \sin^2 \alpha + \cos^2 \alpha = 1 \).

**Section 10.3: The Tangent Ratio and Other Ratios**

1. define/apply the tangent ratio of an acute angle of a right triangle;
2. recognize which trigonometric ratio ( sine, cosine, tangent ) can be used to determine an unknown measure in a right triangle;
3. use a calculator to determine the tangent ratio of an acute angle of a right triangle;
4. use a calculator to determine an acute angle whose tangent ratio is known;
5. state/apply the definitions of the cotangent, secant, and cosecant ratios for an acute angle of a right triangle; and
6. define/determine \( \cot \theta \), \( \sec \theta \), and \( \csc \theta \) as reciprocals of \( \tan \theta \), \( \cos \theta \), and \( \sin \theta \) respectively.

**Section 10.4: More Trigonometric Relationships**

1. state/apply the Reciprocal Identities;
2. state/apply the Quotient Relationships;
3. state/apply the Pythagorean Relationships;
4. state/apply the formula \( A = \frac{1}{2}bc \sin \alpha \);
5. state/apply the Law of Sines;
6. state/apply the Law of Cosines; and
7. use given measures to decide whether the Law of Sines/Cosines should be used to find an unknown measure in a triangle.

**A Look Beyond Chapter 10: Radian Measure of Angles**

1. know that a counterclockwise/clockwise rotation corresponds to an angle whose measure is positive/negative;
2. draw/measure angles that have any positive/negative degree measure; and
3. know/apply the fact that \( 180^\circ = \pi \) radians.

### III. Instructional Procedure
The primary method of instruction will be lecture with the use of the blackboard and overhead transparencies. Homework and some in class activities will be assigned. Students will be encouraged to participate in class by both asking and answering questions. There will be some “outdoor” geometry and trigonometric activities as time allows.

IV. Instructional Materials

1. Text:
   Title: Elementary Geometry for College Students, 2nd edition
   Authors: Alexander and Koeberlein
   Publisher: Houghton Mifflin Company, 1999
2. Compass
3. Protractor
4. Colored pencils (optional)
5. Scientific calculator. (Graphing calculator preferred if you plan to take additional math courses.)

V. Course Content

Chapter 1: Line and Angle Relationships (all)
Chapter 2: Parallel Lines (2.1,2.3-2.5)
Chapter 3: Triangles (3.1-3.3)
Chapter 4: Quadrilaterals (all)
Chapter 5: Similar Triangles (all)
Chapter 6: Circles (6.1-6.3, 6.5, 6.6)
Chapter 7: Areas of Polygon and Circles (7.1-7.4)
Chapter 10: Introduction to Trigonometry (all)

VI. Evaluation

There will be five 100 point tests and a 100 point final exam. The final exam score will be counted twice. Also, there will be 100 points worth of quizzes (announced/unannounced), projects, homework, etc. The lowest of these 8 grades will be dropped at the end of the semester.

A student’s grade for the class will be determined by averaging the highest 7 of these 8 grades.

There will be no make-up tests. Students missing a test (for whatever reason) will receive a zero score at that time and then this lowest grade will be dropped at the end of the semester. If a student has not missed a test, then the lowest non-zero score will be dropped.

The following grade scale will be used:
70 or above S (passing)
Below 70 U (unsatisfactory)
W (withdrawal - See college catalog for complete withdrawal policy.)
X (audit) Note: Attendance policy is still in effect.
A student or students involved in cheating on any graded material will receive a grade of 0 on the material and possible expulsion from the class and a grade of U for the course. Help on any graded assignment (inside or outside of classroom), unless authorized by the instructor, from any source will be considered cheating.

VII. Notebooks

Students should keep an organized, divided notebook with the following sections:
1. Class notes and homework, dated and documented.
2. Definitions (in your own words with any necessary diagrams)
3. Postulates and theorems (in your own words).

Be liberal with figures and diagrams in your notebooks.

All work must be done in pencil. Mechanical pencils (0.7 mm) recommended.
MTH 06 Course Plan
Page 11

ADDENDUM
MTH 06
Spring 2000

Instructor: Nelson Boan
Office: 119 Godbey
Phone: 674-3600 ext. 4414
E-Mail: nrboann@nr.cc.va.us
Office Hours: Posted on door of office and by appointment.

Attendance

I strongly encourage your regular and prompt attendance. Tardiness disrupts the class and missing class disrupts your learning process. Three tardies (or leaving “earlies”) will count as one absence. I do enforce the college’s attendance policy and I expect you to be in class every day unless you have mitigating circumstances.

If for some unavoidable reason you are tardy to class, please come into class quietly and take the first available seat. After class, it is your responsibility to inform me of your presence. If you fail to tell me immediately after class that you were tardy, an absence will be recorded for that day. Class begins on time and I expect you to be on time.

The student is responsible for all material covered during an absence. The amount of instructor’s assistance in making up work will correspond to the student’s justification for the absence (within reasonable demand on the instructor’s time).

Homework

The homework assignments are for your benefit and not necessarily be taken up or graded. However, this does not lesson their importance. I STRONGLY recommend that you attempt all problems assigned in order to keep pace with the class. If you have questions outside of class, then see me during an office hour or make an appointment, or get help from a tutor, or from another student.

Don’t wait until you are in over your head before seeking help!

Tentative Test Schedule (Tests will be about every 3 weeks.)

Test 1: Ch. 1
Test 2: Ch. 2
Test 3: Ch. 3 & 4
Test 4: Ch. 5
Test 5: Ch. 7 & 10

Final Exam: Tues., May 9, 1pm-3pm