Miami Dade College

Course Description

MTG3214 | Euclidean Geometry | 4.00 credits

This course encompasses a range of geometry topics and pedagogical ideas for the teaching of geometry including properties of shapes, defined and undefined terms, postulates and theorems, logical thinking and proofs, constructions, patterns, and sequences, the coordinate plane, axiomatic nature of Euclidean geometry, and basic topics of non-Euclidean geometries. Prerequisite: MAC1147.

Course Competencies:

Competency 1: The student will be able to demonstrate knowledge of logical reasoning skills and an understanding of the structure of axiomatic systems of geometry by:

1. Identifying the features of axiomatic systems, including undefined terms, defined terms, postulates, and theorems
2. Utilizing an inductive thinking process to observe data, recognize patterns in the data, and make conjectures about the patterns in the data
3. Exploring and applying logical sequences and sequences in found in nature (such as Fibonacci and the golden ratio)
4. Explaining and presenting examples of the concepts of set-inclusion and non-inclusion, conditional statements, compound statements and their negations, equivalence or non-equivalence of statements, and valid or invalid arguments
5. Stating the converse, inverse, and contrapositive of a statement
6. Creating and explaining truth tables
7. Utilizing logical reasoning to distinguish between an argument's validity and the truth
8. Applying deductive logic to construct proofs of theorems
9. Construct direct proofs (two-column form, flow chart form, paragraph form) and indirect proofs
10. Using various problem-solving strategies (drawing diagrams, making charts, writing equations, solving a more straightforward problem, etc.) and teaching tools (geometric shapes, technology, etc.) to solve problems involving geometric concepts
11. Providing verbal and written justification for all construction procedures
12. Determining whether a solution is reasonable in the context of the original situation

Competency 2: The student will be able to demonstrate knowledge of points, lines, angles, and planes by:

1. Finding the lengths and midpoints of line segments in a two-dimensional coordinate system
2. Copying and bisecting segments using a compass and straight edge, patty paper, or a drawing
3. program (such as Geometer's Sketchpad)
4. Constructing parallel and perpendicular lines to a given line using a compass and straight edge, patty paper, or a drawing program
5. Classifying angles
6. Constructing congruent angles using a compass and straight edge, patty paper, or a drawing program.
7. Bisect angles using a compass, straight edge, patty paper, or a drawing program
8. Identifying and applying relationships between two angles, such as vertical, adjacent, supplementary, complementary, and congruent, to geometric and real-world problems
9. Identifying and applying relationships between angles formed by the intersection of parallel lines and a transversal to geometric and real-world problems

Competency 3: The student will be able to demonstrate knowledge of polygons and other plane figures by:

1. Classifying figures using their properties
2. Identifying convex, concave, regular, and irregular polygons
3. Solving for unknown sides using properties of congruent or similar figures
4. Determining the number of diagonals of convex polygons
5. Using coordinate geometry to prove properties of congruent, regular and similar polygons
6. Using properties of congruent and similar polygons to solve mathematical or real-world problems

7. Determining the measure of interior and exterior angles of polygons
8. Explaining the derivation of formulas for perimeter and area of polygons
9. Applying the formulas for perimeter and area of polygons to solve mathematical or real-world problems
10. Explaining how changes in one or two dimensions of a polygon affect its perimeter and its area

Competency 4: The student will be able to demonstrate knowledge of triangles by:

1. Classifying, describing, and constructing triangles that are right, acute, obtuse, scalene, isosceles, equilateral, and equiangular
2. Defining, identifying, and constructing altitudes, medians, angle bisectors, perpendicular bisectors, orthocenter, centroid, incenter, and circumcenter
3. Applying properties of a triangle's orthocenter, centroid, incenter, and circumcenter to solve problems
4. Constructing triangles congruent to given triangles using a compass and straight edge, patty paper, or a drawing program
5. Using properties of congruent and similar triangles to solve problems involving lengths and areas
6. Solving real-world problems by applying theorems involving segments divided proportionally
7. Constructing proofs related to the similarity or congruency of triangles
8. Using properties of corresponding parts of congruent triangles to construct proofs and to solve mathematical or real-world problems
9. Applying triangle inequality theorems to mathematical and real-world situations
10. Using coordinate geometry to prove properties of congruent, regular, and similar triangles
11. Proving and applying (in geometric and real-life problems) the Pythagorean Theorem and its converse
12. Solving for parts of right triangles using the Pythagorean Theorem
13. Applying trigonometric ratios to solve mathematical and real-life problems
14. Stating and applying the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle
15. Using special right triangles (30o – 60 o – 90 o, 45 o – 45 o – 90 o) and applying their properties in solving geometric and real-life problems

Competency 5: The student will be able to demonstrate knowledge of quadrilaterals by:

1. Describing, classifying, and comparing quadrilaterals: parallelograms, rectangles, squares, rhombuses, trapezoids, kites
2. Determining the area and perimeter of quadrilaterals
3. Construct proofs (including those involving coordinate geometry) related to similarity, congruency, or other properties of quadrilaterals

Competency 6: The student will be able to demonstrate knowledge of circles by:

1. Identifying and defining circumference, radius, diameter, arc, arc length, chord, secant, tangent, concentric circles, central angles, inscribed angles, and angles formed by the intersections of secants and tangents
2. Calculating and explaining the value of pi
3. Proving theorems related to circles, including related angles, chords, tangents, and secants, and applying them to solve problems
4. Determining and applying measures of arcs and related angles (central, inscribed, and those formed by the intersections of secants and tangents)
5. Solving real-world problems using the formulas for circumference, arc length, and areas of circles and sectors
6. Find the equation of a circle (in center-radius form) and sketch it in the coordinate plane when its center and its radius are given
7. Find the center and radius of a circle and sketch it when its equation (in center-radius form) is given
8. Determining the center of a circle using a compass and straight edge, patty paper, or a drawing program
9. Constructing a circle, given three points not on a line, using a compass and straight edge, patty paper, or a drawing program
10. Constructing tangents to circles using a compass and straight edge, patty paper, or a drawing program
11. Circumscribing and inscribing circles about and within triangles and regular polygons using a compass and straight edge, patty paper, or a drawing program

Competency 7: The student will be able to demonstrate knowledge of transformations by:

1. Recognizing and performing rigid transformations or isometries (reflections, rotations, translations) on plane figures
2. Identifying shapes that tessellate and performing tessellations
3. Calculating coordinate transformation in the Cartesian plane

Competency 8: The student will be able to demonstrate knowledge of solids by:

1. Describe and make regular and non-regular polyhedra and sketch the net for a given polyhedron
2. Sketching three-dimensional geometric objects by hand
3. Explain and use formulas for the lateral area, surface area, and volume of solids such as prisms, pyramids, right circular cylinders, and right circular cones
4. Explaining and using formulas for the surface area and volume of spheres
5. Describing the relationship between faces, edges, and vertices of polyhedra (Euler's formula)
6. Identifying and using properties of congruent and similar solids
7. Determining how changes in dimensions affect common geometric solids' surface area and volume

Competency 9: The student will be able to demonstrate knowledge of the historical background, development, and foundation of geometry by:

1. Citing historical events in geometry and identifying individuals who contributed to the development of geometry
2. Identifying the contributions of Euclid to the development and systemization of mathematical thought
3. Identifying the contributions of Saccheri, Bolyai, Lobachevsky, Poincare, and Riemann in the historical development of non-Euclidean geometries
4. Describing, visually and verbally, topics from spherical and hyperbolic geometry
5. Describing, visually and verbally, topics from topology (e.g., Mobius strip, Kline bottle)

Learning Outcomes:

- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information
- Use computer and emerging technologies effectively