



# BROWARD COLLEGE COURSE OUTLINE

**LAST REVIEW: 2009-10**  
*(i.e. 2003-2004)*

**NEXT REVIEW: 2014-15**  
*(i.e. 2008-2009)*

**STATUS: A**  
*(A, I, D)*

**COURSE TITLE: Methods of Teaching Mathematics in the Secondary School**

**COMMON COURSE NUMBER: MAE 4330**

**CREDIT HOURS: 3**

**CONTACT HOUR BREAKDOWN**  
*(per 16 week term)*

**CLOCK HOURS:**  
*(Voc. Course ONLY)*

Lecture: 48      Lab:  
Clinic:              Other: 15

**PREREQUISITE(S): EDF3280 and MAC2311**

**COREQUISITE(S):**

**PRE/COREQUISITE(S):**

**COURSE DESCRIPTION** *(750 characters, maximum):*

This course is designed to introduce methods and strategies that have been proven to be effective for teaching secondary school mathematics. This course will include topics in appropriate instructional techniques and selection of appropriate resources for diverse classroom activities. Additional topics include real world applications, the use of technology, understanding the diverse learner, multiple means of assessment and learning styles. In this course, the pre-professional educator learns principles of effective curriculum design and assessment and applies these principles by designing and developing interactive mathematics curriculum projects for high school students. This course addresses specific Sunshine State Standards subject matter competencies and pedagogy pertinent to the discipline. This course requires 20 hours of structured field experience.

## **UNIT TITLES**

- 1. Mathematics, Mathematics Teaching, and the Mathematics Student**
- 2. Research Based Strategies**
- 3. The Standards (NCTM, FSMCS, FEAPs, NCATE)**
- 4. Number and Operations**
- 5. Patterns**
- 6. Functions and Algebra**
- 7. Geometry and Measurement**
- 8. Data Analysis and Probability and Statistics**
- 9. Trigonometry, Calculus and other Advanced Mathematics Topics**
- 10. Apply Reflections, Strategies and Standards**

**EVALUATION:**

Please provide a brief description (250 characters maximum) that details how students will be assessed on the course outcomes.

**A. Task**

1. **Task 1 (FEAP 4.1, 4.2, 4.3):** This is a semester-long project in which the pre-service teacher builds a toolbox of research-based strategies to promote critical/creative thinking and problem solving skills.
2. **Task 2 (FEAP 8.2, 8.4):** The candidate will demonstrate his/her specific content knowledge in the areas of Numbers and Operations, Patterns, Functions and Algebra, Geometry and Measurement, Data Analysis and Probability and Advanced Topics.
3. **Task 3 (FEAP 4.8, 5.4, 7.6, 8.1, 12.7):** The candidate will teach a high school math lesson.
4. **Task 4 (FEAP 1.12, 2.10, 3.15, 4.10, 5.13, 7.7, 8.6, 9.12, 10.17, 11.10):** The candidate develops short and long term goals based on the current standards and the appropriate subject matter.

**B. Major Assignments**

1. **Assignment 1:** Each student will be required to submit a paper comparing and contrasting his/her reflections and research findings on the development of the high school and the 21<sup>st</sup> Century Student.
2. **Assignment 2:** Each student will be required to submit a paper comparing and contrasting a teacher-centered activity with a student-centered activity.
3. **Assignment 3:** Each student will analyze a lesson plan.
4. **Assignment 4:** Each student will develop a lesson plan for each of the five NCTM Standards.

**C. Portfolio**

Portfolio should include tabs for Numbers and Operations, Patterns, Functions and Algebra, Geometry and Measurement, Data Analysis and Probability and Advanced Topics.

**D. One Peer Group Presentation and Four Peer Evaluations**

**E. Exams**

1. Midterm and comprehensive final

Common Course Number: MAE 4330

## UNITS

### Unit 1. Mathematics, Mathematics Teaching, and the Mathematics Student

General Outcome:

- 1.0 The student shall: provide an overview about mathematics, mathematics teaching and the mathematics student.

Specific Measureable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 1.1 Define Mathematics from three different authors or perspectives.
- 1.2 Explain why we teach mathematics.
- 1.3 Describe the High School Concept, submit a paper comparing and contrasting his/her reflection and findings on the High School Concept using at least two sources.
- 1.4 Discuss the Evolution of the 21<sup>st</sup> Century Student.
- 1.5 Compare and contrast student-centered and teacher-centered lessons.

**Unit 2. Research Based Strategies**

General Outcome

- 2.0 Each student will discuss at least five Research Based Strategies for learning.

Specific Measureable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 Discuss the Art of Questioning and what to do in the First Five Minutes of Class
- 2.2 State and apply a strategy involving Similarities and Differences
- 2.3 State and apply a strategy involving Nonlinguistic Representation
- 2.4 State and apply a strategy involving Cooperative Learning
- 2.5 State and apply a strategy involving Generating and Testing Hypotheses
- 2.6 State and apply a strategy involving Cues, Questions, and Advanced Organizers

**Unit 3. The Standards (NCTM, FSMCS, FEAPs, NCATE)**

General Outcome:

- 3.0 The student shall discuss the current standards in education on the state and national level.

Specific Measureable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1 Locate and summarize the development of the National Council of Teachers of Mathematics (NCTM) documents from 1989 beginning with the *Curriculum and Evaluation Standards*, to 1991 the *Professional Standards for Teaching Mathematics* to 1995 the *Assessment Standards of School Mathematics*.
- 3.2 Locate and apply the Florida Subject Matter Competencies and Skills – Mathematics (FSMCS) to his/her lesson plans
- 3.3 Locate and discuss the twelve Florida Educator Accomplished Practices (FEAPs) and how they relate to the middle school mathematics classroom.
- 3.4 Locate and define the National Council for Accreditation of Teacher Education (NCATE) and explain why it was developed in 1954.

**Unit 4. Numbers and Operations**

General Outcome:

- 4.0 The student shall collect strategies and techniques for teaching numbers and operations in high school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1 Increase their knowledge and understanding in the numbers and operations on the high school level (M1.1-M1.24)
- 4.2 Develop a repertoire of student-centered teaching strategies and skills that can be used regarding numbers and operations on the high school level. (E) \*See last page for explanation of symbols.
- 4.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections. (Apply Multiple Representation Theory) (MG 2.1)
- 4.4 Collect real world application problems about numbers and operations. (M 1.18, M1.24)
- 4.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach numbers and operations. (M 14.1)
- 4.6 Broaden their understanding of the diversity of learners, learning styles, and behaviors and ways to make numbers and operations accessible to all (E); and
- 4.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching numbers and operations. (M 15.1 and M 15.2)

Common Course Number: MAE 4330

**Unit 5. Patterns**

General Outcome:

- 5.0 The student shall collect strategies and techniques for teaching patterns in high school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1 Increase their knowledge and understanding in the area of patterns on the high school level (M1.1-M1.24)
- 5.2 Develop a repertoire of student-centered teaching strategies and skills that can be used regarding patterns on the high school level. (E) \*See last page for explanation of symbols
- 5.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections. (Apply Multiple Representation Theory) (MG 2.1)
- 5.4 Collect real world application problems about patterns. (M 1.18, M1.24)
- 5.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach patterns. (M 14.1)
- 5.6 Broaden their understanding of the diversity of learners, learning styles, and behaviors and ways to make patterns accessible to all (E); and
- 5.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching patterns. (M 15.1 and M 15.2)

**Common Course Number: MAE 4330**

## **Unit 6. Functions and Algebra**

General Outcome:

- 6.0 The student shall collect strategies and techniques for teaching functions and algebra in high school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 6.1 Increase their knowledge and understanding functions and algebra on the high school level. (M1.1-M1.24)
- 6.2 Develop a repertoire of student-centered teaching strategies and skills that can be used regarding functions and algebra on the high school level. (E) \*See last page for explanation of symbols
- 6.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections (Apply Multiple Representation Theory) (MG 2.1)
- 6.4 Collect real world application problems about functions and algebra (M 1.18, M1.24)
- 6.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach functions and algebra (M 14.1)
- 6.6 Broaden their understanding of the diversity of learners, learning styles, and behaviors and ways to make functions and algebra accessible to all (E); and
- 6.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching functions and algebra. (M 15.1 and M 15.2)

**Unit 7. Geometry and Measurement**

General Outcome:

- 7.0 The student shall collect strategies and techniques for teaching geometry and measurement in high school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 7.1 Increase their knowledge and understanding geometry and measurement on the high school level. (M 3.1-3.20 and M 4.1-4.5)
- 7.2 Develop a repertoire of student-centered teaching strategies and skills that can be used in geometry and measurement on the high school level. (E)
- 7.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections (Apply Multiple Representation Theory) (MG 2.1)
- 7.4 Collect real world application problems in geometry and measurement. (E)
- 7.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach geometry and measurement. (M 14.1)
- 7.6 Broaden their understanding of the diversity of learners, learning styles, and behaviors and ways to make geometry and measurement accessible to all (E); and
- 7.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching geometry and measurement. (M 15.1 and M 15.2)

Common Course Number: MAE 4330

**Unit 8. Data Analysis and Probability**

General Outcome:

- 8.0 The student shall collect strategies and techniques for teaching data analysis and probability in high school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 8.1 Increase their knowledge and understanding data analysis and probability on the high school level. (M 6.1-6.6 and M 7.1-7.5)
- 8.2 Develop a repertoire of student-centered teaching strategies and skills that can be used data analysis and probability on the high school level. (E)
- 8.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections (Apply Multiple Representation Theory) (MG 2.1)
- 8.4 Collect real world application problems in data analysis and probability. (E)
- 8.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach data analysis and probability. (M 14.1)
- 8.6 Broaden their understanding of the diversity of learners, learning styles, and behaviors and ways to make data analysis and probability accessible to all (E); and
- 8.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching data analysis and probability. (M 15.1 and M 15.2)

**Unit 9. Trigonometry, Calculus and Other Advanced Mathematics Topics**

General Outcome:

- 9.0 The student shall collect strategies and techniques for teaching trigonometry, calculus and other advanced mathematics topics in high school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 9.1 Increase their knowledge and understanding of trigonometry, calculus and other advanced mathematics topics on the high school level. (M 5.1-5.5)
- 9.2 Develop a repertoire of student-centered teaching strategies and skills that can be used in trigonometry, calculus and other advanced mathematics high school topics. (E)
- 9.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections. (Apply Multiple Representation Theory) (MG 2.1)
- 9.4 Collect real world application problems in trigonometry, calculus and other advanced mathematics topics. (M 5.4)
- 9.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach trigonometry, calculus and other advanced mathematics topics. ((M 14.1)
- 9.6 Broaden their understanding of the diversity of learners, learning styles, and behaviors and ways to make trigonometry, calculus and other advanced mathematics topics accessible to all (E); and
- 9.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching trigonometry, calculus and other advanced mathematics topics. (M 15.1 and M 15.2)

**Unit 10. Apply Reflections, Strategies and Standards**

General Outcome:

10.0 The student shall apply his/her reflections, strategies and standards.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

10.1 Critique a mathematics lesson plan and lesson plan presentation.

10.2 Teach a mathematics lesson plan.

10.3 Develop short and long term personal and professional goals related to knowledge of the subject matter.

**Supplement:**

Here are some of the skills listed in the “Competencies and Skills Required for Teacher Certification in Florida, 12<sup>th</sup> Edition” that are met by some of our units and subunits. Our course outlines exceed these minimum competencies and skills.

Next to the given unit or subunit, if there is a number (e.g., MG 1.1), please refer to the list below to see the competency that it complies with. (Note: “(E)” means that the given unit or subunit exceeds the minimum competencies and skills.)

**Middle Grades 5-9 (MG):**

- 2.1 Identify appropriate representations or models for mathematics operations or situations using written, concrete, pictorial, graphical, or algebraic methods.
- 2.2 Interpret results as illustrated by the use of mathematical representations.
- 2.3 Select appropriate manipulatives, mathematical models, or technology for teaching particular mathematics concepts.

**Mathematics 6-12 (M):****1. Knowledge of algebra**

- 1.1 Identify graphs of linear inequalities on a number line.
- 1.2 Identify graphs of linear equations and inequalities in the coordinate plane.
- 1.3 Identify or interpret the slope and intercepts of a linear graph or a linear equation.
- 1.4 Determine the equation of a line, given the appropriate information such as two points, point-slope, slope-intercept, or its graph.
- 1.5 Solve problems involving the use of equations containing rational algebraic expressions.
- 1.6 Factor polynomials (e.g., the sum or difference of two cubes).
- 1.7 Rewrite radical and rational expressions into equivalent forms.
- 1.8 Perform the four basic operations on rational and radical expressions.
- 1.9 Solve equations containing radicals.
- 1.10 Multiply or divide binomials containing radicals.
- 1.11 Solve quadratic equations by factoring, graphing, completing the square, or using the quadratic formula, including complex solutions.
- 1.12 Solve problems using quadratic equations.
- 1.13 Use the discriminant to determine the nature of solutions of quadratic equations.
- 1.14 Determine a quadratic equation from known roots.
- 1.15 Identify the graphs of quadratic inequalities.
- 1.16 Solve real-world problems using direct and inverse variations.
- 1.17 Solve systems of linear equations or inequalities.
- 1.18 Formulate or identify systems of linear equations or inequalities to solve real-world problems.
- 1.19 Solve equations or inequalities involving absolute value.
- 1.20 Expand given binomials to a specified positive integral power.
- 1.21 Determine a specified term in the expansion of given binomials.

**3 Knowledge of geometry from a synthetic perspective**

- 3.1 Determine the change in the area or volume of a figure when its dimensions are altered.
- 3.2 Estimate measurements of familiar objects using metric or standard units.
- 3.3 Determine the relationships between points, lines, and planes, including their intersections.
- 3.4 Classify geometric figures (e.g., lines, planes, angles, polygons, solids) according to their properties.

- 3.5 Determine the measures of interior and exterior angles of any polygon.
- 3.6 Determine the sum of the measures of the interior angles and the sum of the measures of the exterior angles of convex polygons.
- 3.7 Identify applications of special properties of trapezoids, parallelograms, and kites.
- 3.8 Solve problems using the definition of congruent polygons and related theorems.
- 3.9 Solve problems using the definition of similar polygons and solids and related theorems.
- 3.10 Apply the Pythagorean theorem or its converse.
- 3.11 Use 30-60-90 or 45-45-90 triangle relationships to determine the lengths of the sides of triangles.
- 3.12 Calculate the perimeter, circumference, and/or area of two-dimensional figures (e.g., circles, sectors, polygons, composite figures).
- 3.13 Apply the theorems pertaining to the relationships of chords, secants, diameters, radii, and tangents with respect to circles and to each other.
- 3.14 Apply the theorems pertaining to the measures of inscribed angles and angles formed by chords, secants, and tangents.
- 3.15 Identify basic geometric constructions (e.g., bisecting angles or line segments, constructing parallels or perpendiculars).
- 3.16 Identify the converse, inverse, and contrapositive of a conditional statement.
- 3.17 Identify valid conclusions from given statements.
- 3.18 Classify examples of reasoning processes as inductive or deductive.
- 3.19 Determine the surface area and volume of prisms, pyramids, cylinders, cones, and spheres.
- 3.20 Identify solids and their related nets.

#### **4 Knowledge of geometry from an algebraic perspective**

- 4.1 Solve distance and midpoint problems involving two points, a point and a line, two lines, and two parallel lines.
- 4.2 Identify the directrix, foci, vertices, axes, and asymptotes of a conic section where appropriate.
- 4.3 Determine the center and the radius of a circle given its equation, and identify the graph.
- 4.4 Identify the equation of a conic section, given the appropriate information.
- 4.5 Use translations, rotations, dilations, or reflections on a coordinate plane to identify the images of geometric objects under such transformations.

#### **5 Knowledge of trigonometry**

- 5.1 Identify equations of graphs of circular/trigonometric functions and their inverses.
- 5.2 Solve problems involving circular/trigonometric function identities.
- 5.3 Interpret the graphs of trigonometric functions (e.g., amplitude, period, phase shift).
- 5.4 Solve real-world problems involving triangles using the law of sines or the law of cosines.
- 5.5 Use tangent, sine, and cosine ratios to solve right triangle problems.

#### **6 Knowledge of statistics**

- 6.1 Interpret graphical data involving measures of location (i.e., percentiles, stanines, quartiles).
- 6.2 Compute the mean, median, and mode of a set of data.
- 6.3 Determine whether the mean, the median, or the mode is the most appropriate measure of central tendency in a given situation.
- 6.4 Interpret the ranges, variances, and standard deviations for ungrouped data.
- 6.5 Interpret information from bar, line, picto-, and circle graphs; stem-and-leaf and scatter plots; and box-and-whisker graphs.
- 6.6 Interpret problems involving basic statistical concepts such as sampling, experimental design, correlation, and linear regression.

### **7 Knowledge of probability**

- 7.1 Determine probabilities of dependent or independent events.
- 7.2 Predict odds of a given outcome.
- 7.3 Identify an appropriate sample space for an experiment.
- 7.4 Make predictions that are based on relative frequency of an event.
- 7.5 Determine probabilities using counting procedures, tables, tree diagrams, and formulas for permutations and combinations.

### **9 Knowledge of calculus**

- 9.1 Solve problems using the limit theorems concerning sums, products, and quotients of functions.
- 9.2 Find the derivatives of algebraic, trigonometric, exponential, and logarithmic functions.
- 9.3 Find the derivative of the sum, product, quotient, or the composition of functions.
- 9.4 Identify and apply definitions of the derivative of a function.
- 9.5 Use the derivative to find the slope of a curve at a point.
- 9.6 Find the equation of a tangent line or a normal line at a point on a curve.
- 9.7 Determine if a function is increasing or decreasing by using the first derivative in a given interval.
- 9.8 Find relative and absolute maxima and minima.
- 9.9 Find intervals on a curve where the curve is concave up or concave down.
- 9.10 Identify points of inflection.
- 9.11 Solve problems using velocity and acceleration of a particle moving along a line.
- 9.12 Solve problems using instantaneous rates of change and related rates of change, such as growth and decay.
- 9.13 Find antiderivatives for algebraic, trigonometric, exponential, and logarithmic functions.
- 9.14 Solve distance, area, and volume problems using integration.
- 9.15 Evaluate an integral by use of the fundamental theorem of calculus.

### **11 Knowledge of mathematics as communication**

- 11.1 Identify statements that correctly communicate mathematical definitions or concepts.
- 11.2 Interpret written presentations of mathematics.
- 11.3 Select or interpret appropriate concrete examples, pictorial illustrations, and symbolic representations in developing mathematical concepts.

### **13 Knowledge of mathematical connections**

- 13.1 Identify equivalent representations of the same concept or procedure.
- 13.2 Interpret relationships between mathematical topics.
- 13.3 Interpret descriptions, diagrams, and representations of arithmetic operations.

### **14 Knowledge of instruction**

- 14.1 Select appropriate resources for a classroom activity
- 14.2 Identify methods and strategies for teaching problem-solving skills and applications.

### **15 Knowledge of assessment**

- 15.1 Identify students' errors, including multiple errors that result in correct or incorrect answers.
- 15.2 Identify appropriate alternative methods of assessment.

### **Suggested Textbook**

Recommended Textbooks for this course:

National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA: The Council, 2000.