

Content Refresher and Pedagogy Enhancement for Teachers: Calculus I

COURSE SYLLABUS: MTE 501—3 graduate credits

Prerequisites Knowledge of Calculus I content and an undergraduate degree.

General Description The primary goal of this class is for the student to begin to acquire the techniques necessary to effectively teach Calculus I at the secondary level. This course will focus on the investigation of materials, pedagogy, and technology to teach Calculus I and to refresh content knowledge in ways that conform to the National Council of Teachers of Mathematics (NCTM) standards. Students will examine strategies and skills to creatively engage secondary level mathematics students as they begin to master Calculus I.

Objectives This course is intended to provide appropriate training for the Calculus I teacher by providing opportunities to

- understand the core concepts of each content area through exploration of problems as they relate to teaching and learning strategies for the specific topics;
- develop an understanding of the role of investigative experiences in each content area which lead to the discovery of key mathematical relationships;
- gain an historical perspective on the development of mathematics in diverse cultures;
- develop specific methods, ideas, materials, models, and activities for teaching the different content that encourage flexible and resourceful problem solving;
- develop methods and ideas for appropriate uses of technology in both teaching and discovery;
- use the different content areas of mathematics as a source of mathematical models in the natural world;
- develop a strong understanding of the different content areas and their roles in the K–12 mathematics.

Text and Materials

Teaching Secondary Mathematics, Third Edition, Brumbaugh and Rock

Technology requirements: Computer access with internet with sufficient bandwidth to stream online videos (i.e.: DSL, Cable modem, or T1/T3); access to email account; DVD player (television or computer).

Blackboard: Students will be given access to the course website through Blackboard. The course materials will ONLY be accessible when you login to the course website. You must have an email address and update the site to include your active email. All questions and assignments should be emailed to the address provided on the website. All emails MUST have the subject with the course number followed by the student's last name, comma and first name (for example: MTE 502 Smith, John). **To protect the professor's computer from potential viruses, no email will be opened**

unless the subject is in the correct format. It is the student's responsibility to save all work until a final grade has been issued, in case assignments need to be resent.

DVDs: Four DVDs are provided that contain content information for this course. This information is supplemental and should be used by the student to review content information when necessary.

In addition, practice problem sets are located on the course website. They are representative of the content knowledge required on the quizzes and the final exam.

Graphing Calculator: The use of a graphing calculator is required. While participants may use any graphing calculator, the supplemental DVDs use the TI-83. The TI-84 is very similar and can easily be used as well. Knowledge and competence for use of other graphing calculators will be the sole responsibility of the participant.

Course Requirements

This course will be offered through Distance Education. Participating students may take up to nine months to complete all requirements. There are no scheduled class sessions or meetings. There is an Internet web site that contains practice problems, three activity packets, three quizzes and a cumulative final examination. Modules must be completed sequentially: each module (activity, practice problems, blog entries and quiz) must be COMPLETE prior to beginning the next module.

Each module includes a reading component. Students are expected to use the activity packet essay as a catalyst for analysis of reading content. The essay should reflect not only knowledge of the content but demonstrate a deep understanding of how this knowledge impacts the teaching of mathematics. The content of the reading will also be covered on the quizzes and the final exam.

Each module includes a set of practice problems (answers are included). These problems are recommended (but will not be submitted for grading) to assess the student's recall of the required level of mastery of the mathematical content. If the content knowledge is deficient, the student should use the DVDs to achieve this level since this content will be included on the quizzes and the final exam.

Some modules include AP Calculus problems from the College Board Website. These Problems correspond to the content in the module and should be completed to aid the student in gaining a rich understanding of the Calculus. As with the reading, the essay should include the analysis and synthesis of all of components of the module. This material will also be included on the quizzes and the final exam.



Course Timeline

I. Complete each module using the following sequence.

1. Complete practice problems – use DVDs to aid in mastery as needed
2. Complete readings and associated materials
3. Complete Activity Packet
4. Submit Essay (if assigned)
5. Complete online quiz - Essay must be submitted prior to taking the quiz.

II. Complete Final exam – all modules must be completed prior to taking the exam.

Course Policies

1. The participant must master the material assigned for each module.
2. Participants must complete the three activity packets and the four practice problem sets that are provided on the course web site.
3. Each of the four modules will have an accompanying timed quiz posted on Blackboard. The participant must complete each of these quizzes online.
4. There will be a cumulative final examination. The participants will complete the final exam in the presence of a school or district administrator, have the administrator sign the Proctor Form and mail the Proctor Form and pages used to work out problems on the exam to Tania McDuffie, 226 Hydrick Street, Spartanburg, SC 29306. Students should email the professor to approve an alternate proctoring situation.
5. Blog entries are intended to be an avenue for students to communicate with each other, as well as faculty. Students are encourage to use this tool to share ideas and facilitate discuss about course topics. While students will not be graded on their blog participation, we hope students will see the value in this component of the course and utilize it to enrich their experience.

Grading

Participation as demonstrated through:

Three Activity Essays60%
 Quizzes.....25%
 Final Exam15%

Grade Range:

93–100.....A
 90–92.....A-
 87–89.....B+
 83–86.....B
 80–82.....B-
 77–79.....C+
 73–76.....C
 70–72.....C-
 Below 70F

Course Topics

The topics of this course are arranged by content. While students are expected to have prior knowledge of these specific topics, they will be reviewed on the DVDs and embedded in the pedagogy components of each module.

Module #1

List of Topics	Complete the following assignments in sequential order. <u>All</u> prior material will be covered on the quiz.
1) Limits 2) Limits at infinity 3) Limits which are infinite 4) Continuity 5) Rates of Change and Tangent Lines 6) Introduction to Derivatives (definition) 7) Differentiation of Polynomial-like functions	Required: 1. Brumbaugh and Rock: read Chapters 1 and 2 2. Read the Overview of NCTM Standards for Grades 9–12, http://standards.nctm.org/document/chapter7/index.htm 3. Problems on AP Calculus AB Examination * 2008: 6d 4. Activity #1: Conjectures Through Graphing Activity 5. Recommended (but not required): DVD Refresher Content Calculus I Unit I 6. Content Practice Problems – on website 7. Complete Quiz #1

NOTE: You must submit your Activity Essay for activity #1 and take quiz #1 BEFORE you can start Module #2.

Module #2

List of Topics	Complete the following assignments in sequential order. <u>All</u> prior material will be covered on the quiz.
1) Differentiation Techniques: products, quotients and chain rules 2) Differentiability versus continuity 3) Higher Order Derivatives 4) Velocity and acceleration 5) Implicit differentiation 6) Derivatives of Trig Functions 7) Derivatives of Inverses 8) Derivatives of Inverse Trig Functions 9) Derivatives of Exponential and Log Functions	Required: 1. Brumbaugh and Rock: read Chapters 6 and 7 2. Problems on AP Calculus AB Examination * 2003: 2a, 3a, 6a, 6c 2006: 6 2007: 3d, 6a 2008: 6a, 6d 3. Activity #2: Derivatives Activity

	<p>4. Recommended (but not required) DVD Refresher Content Calculus I Unit I</p> <p>5. Content Practice Problems – on website</p> <p>6. Complete quiz #2</p>
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NOTE: You must submit your Activity Essay for activity #2 and take quiz #2 BEFORE you can start Module #3.

Module #3

List of Topics	Complete the following assignments in sequential order. All prior material will be covered on the quiz.
<p>1) Extreme values (absolute and relative) of functions</p> <p>2) Graphing</p> <p>3) Connecting the graph of f, f' and f''</p> <p>4) Extreme value problems (word problems)</p> <p>5) Mean Value Theorem</p> <p>6) Related Rates</p> <p>7) Linearization and Newton's Method</p>	<p>Required</p> <p>1. Brumbaugh and Rock: read Chapter 14</p> <p>2. Problems on AP Calculus AB Examination* 2003: 4a, 4b, 5, 2005: 4a, 4b 2007: 3a, 3b, 4, 5a, 5b, 6b, 6c, 2008: 3a, 3b, 6b, 6c</p> <p>3. Activity #3: Mastering the Art of Effective Question Construction Activity</p> <p>4. Recommended (but not required) DVD Refresher Content Calculus I Unit I</p> <p>5. Content Practice Problems – on website</p> <p>6. Complete Quiz #3</p>

NOTE: You must submit your Activity Essay for activity #3 and take quiz #3 BEFORE you can start Module #4.

Module #4

List of Topics	Complete the following assignments in sequential order. All prior material will be covered on the quiz.
<p>1) Definite Integrals</p> <p>a) Estimating with rectangles</p> <p>b) Trapezoidal Rule</p> <p>c) Simpson's Rule</p> <p>2) Antiderivatives</p> <p>3) The Fundamental Theorems of Calculus</p> <p>4) Slope Field</p>	<p>Required</p> <p>1. Problems on AP Calculus AB Examination* 2003: 1a, 3c, 3d 2004: 2a, 6a, 6b 2005: 1a, 1b, 6 2006: 1a, 5 2007: 1a, 3c, 5c, 5d, 2008: 1a, 1b, 5, 2009: 4a</p> <p>2. Recommended (but not required) - DVD Refresher</p>

	Content Calculus I Unit I 3. Content Practice Problems – on website 4. Complete Quiz # 4
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* The Problems on AP Calculus AB Examination can be found at http://apcentral.collegeboard.com/apc/members/exam/exam_questions/1997.html

For example, to find problem 3 on the 2005 Calculus AB Examination, follow the list below.

Click on 2005.

In the table labeled 2005: Free-Response Questions click on All Questions to read the problem. After you have worked on the problem, click on Scoring Guidelines to view the solution along with the actual grading rubric. These problems are to be completed for practice and not to be turned in.