

# SYLLABUS

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**Code:** MATH 171

**Title:** CALCULUS I

**Institute:** STEM

**Department:** MATHEMATICS

**Course Description:** This is a first semester scientific calculus course and the topics include limits, continuity, derivatives and their applications, and integrals, including the Fundamental Theorems. Algebraic, trigonometric, inverse trigonometric, exponential, and logarithmic functions will be studied. Problems are approached from a variety of perspectives, including graphical, numerical, verbal, and algebraic. Computer software will be used extensively in class to gain a greater understanding of concepts as well as to consider non-routine problems.

**Section Information:** All tests will be proctored in person.

**Prerequisites:** A grade of C or higher in MATH 153 or equivalent.

**Credits:** 4

**Lecture Hours:** 4

**Lab:** 0

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**REQUIRED TEXTBOOK/MATERIALS:**

**See your instructor addendum for a complete list of required materials for your section.**

**1a. Textbook:** Stewart, James, Math 171/172/273 Brookdale Community College with EWA, Brooks/Cole Cengage Learning, 2009. This is a customized edition that is available at the College Bookstore only.

**Or 1b. Alternate textbook for students who are only taking MATH 171 and who are not taking MATH 172:** Stewart, James, Single Variable Calculus: Concepts and Contexts, 4<sup>th</sup> edition, Brooks/Cole Cengage Learning, 2010.

**Note:** WebAssign (EWA) will be required for online homework in some sections and can be purchased with an ebook. Check with your instructor. Textbook option 1a. includes an EWA access code.

2. Math Faculty, MATH 171 – Calculus I Supplement, Homework Assignments and Test Review Sheets, Brookdale Community College, 2009. Available on Canvas.
3. **Computer software** – working with Converge and Maple is required for this course. Your instructor will provide options for accessing Converge and Maple.

**Note:** In compliance with copyright law, the Mathematics Department cannot give students copies of software. The unauthorized copying and /or distributing of software owned by Brookdale Community College are **illegal**.

**RECOMMENDED MATERIALS:**

1. Graphing Calculator – If you are purchasing a new calculator, the TI-83 (any version) or TI-84 (any version) will be sufficient, but the TI-89 has more advanced capabilities. If you are considering buying one of these, talk to your instructor first.
2. Cole, Jeffrey A. and Flaherty, Timothy J., Student Solutions Manual for Stewart's Single Variable Calculus: Concepts and Contexts, 4th Edition, Brooks/Cole Cengage Learning, 2010.
3. Burton, Robert and Garity, Dennis, Study Guide for Stewart's Single Variable Calculus: Concepts and Contexts, 4<sup>th</sup> Edition, Brooks/Cole Cengage Learning, 2010.

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## **ADDITIONAL TIME REQUIREMENTS**

Projects are a required component of this course. You may need to allow some on-campus time during each unit to meet with your group to work on the projects. Some discussions can be done via email, but you may need some group meeting time and your group may need to meet with your instructor to discuss parts of the project. For information on Brookdale's policy on credit hour requirements and outside class student work refer to Academic Credit Hour Policy.

## **OTHER TIME COMMITMENTS:**

- In addition to the regular class hours, you will need to set aside time each week for homework. The weekly time will vary by topic and level of difficulty, but as an estimate, you should expect two homework hours for *each* class hour per week. For example, if your class meets for four hours per week, you should expect to spend about **eight** hours per week on homework.
- You will need to allow time (possibly on campus) to do homework and/or project problems that require the use of computer software.
- If you are having any difficulty with the course material, you may need to allow time to see your instructor during office hours or to get help in the Math Lab.

## **COURSE LEARNING OUTCOMES**

Upon completion of this course, students will be able to:

- Demonstrate the algebraic and calculus skills related to limit, continuity, the derivative, and the definite integral. (M)
- Understand and explain the concepts of limit, continuity, the derivative, and the definite integral. (M)
- Use calculus to solve application problems. (M)
- Explain the analysis and solution of application problems. (M)
- Use computer software to understand concepts and to explore and solve problems. (M)

*Learning Outcome(s) support the following General Education Knowledge Areas:*

- (M) Mathematics

## **GRADING STANDARD**

In this course, you will be evaluated by means of tests, projects, quizzes, and possibly homework or other assignments.

### **A. TESTS**

There will be three tests, one after each unit, graded on the basis of 100 points. All tests will be cumulative. Each test is made up of two parts: one part utilizing computer software and the graphing calculator and a second part without technology. All supporting work must be shown on tests in order for your instructor to properly assess your understanding of the material. The tests will be given in class and it is expected that you will be in class to take the test on the day it is given. If you are very ill (verifiable with a doctor's note) or you have some other emergency, you *must* contact your instructor immediately.

**Note:** All tests will be proctored in person, see Instructor Addendum for more information.

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## B. QUIZZES/HOMEWORK/OTHER ASSIGNMENTS

There are periodic quizzes in the course and your instructor may also choose to use homework or other assignments for evaluation.

## C. PROJECTS

There will be three projects for the course, one per unit, to be done in groups. In the projects, you will apply the concepts and skills learned in class to problem situations, present the mathematics, write careful explanations, and interpret your results. You will be given specific guidelines for the projects. The final copy of each project will be kept by your instructor.

## GRADING

At the end of the semester, you will have three test grades and a project/quizzes/homework/other assignments grade. See your instructor addendum for how projects, quizzes, homework and other assignments will be averaged into your final grade. There are no grade curves applied in this course. Your final course average is determined by a weighted average as follows:

Test 1	25%
Test 2	30%
Test 3	30%
Projects/quizzes/homework/other assignments	15%

## FINAL GRADE

Your final grade is determined by your final course average, using only the above grades. There are no extra-credit options (e.g. research papers, special projects, essays, etc.) available for this course. Your final grade is determined as follows:

If your final course average is	Your final grade is
90 – 100	A
88 – 89	A-
86 – 87	B+
80 – 85	B
78 – 79	B-
76 – 77	C+
70 – 75	C
60 – 69	D**
Below 60	F

\*\* To use this course as a prerequisite for another mathematics course, you must have a grade of C or better.

## Incomplete

INC is only given at the discretion of your instructor. This may occur in documented cases of hardship or emergency. In this case, you must meet with the instructor to discuss the work that must be completed to earn a grade in the course. All work must be completed within 21 days after the end of the term, exclusive of official college closings.

## Withdrawal

You may withdraw from the course, without penalty, up to a date set by the College. If you do not withdraw from the course but stop attending, your grade at the end of the semester will be F.

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## COURSE CONTENT

**Unit 1:** In this unit, you will review functions and their properties and begin the study of calculus by investigating limits, continuity, and the derivative.

**Unit 1 Outcomes:** You will: (Text Section)

- Identify and know the properties of the following functions: linear, power, polynomial, rational, trigonometric, inverse trigonometric, exponential, and logarithmic. (1.1 – 1.6)
- Identify and perform transformations, compositions, and decompositions of functions. (1.3)
- Use Converge to investigate properties of functions. (1.1 – 1.6)
- Identify the questions that Calculus seeks to answer. (2.1)
- Identify the general strategies that are used to answer these questions. (2.1)
- Explain what it means to say  $\lim_{x \rightarrow a} f(x) = L$ . (2.2)
- If a limit does not exist, explain why. (2.2, 2.3, 2.5)
- Use Converge or a graphing calculator to provide numerical and graphical evidence about  $\lim_{x \rightarrow a} f(x)$  and explain how the evidence supports the conclusion. (2.2)
- Determine  $\lim_{x \rightarrow a} f(x)$ , given a graph of  $f(x)$ . (2.2)
- Use, write, and verbalize limit notation correctly. (2.2 – 2.5)
- Use limit laws (properties) to evaluate the limit of a function, rewriting the function where needed. (2.3)
- Know the definition of continuity. (2.4)
- Explain what it means to say that a function is continuous at a point. (2.4)
- Use the definition of continuity to determine whether a function is continuous at a point. (2.4)
- Determine the intervals where a given function is continuous. (2.4)
- Apply the Intermediate Value Theorem to continuous functions. (2.4)
- Explain what it means to say  $\lim_{x \rightarrow a} f(x) = \infty$  or  $\lim_{x \rightarrow a} f(x) = -\infty$ . (2.5)
- Explain what it means to say  $\lim_{x \rightarrow \pm\infty} f(x) = L$ . (2.5)
- Use limits to define vertical and horizontal asymptotes. (2.5)
- Given a function, evaluate  $\lim_{x \rightarrow \pm\infty} f(x)$  graphically and algebraically. (2.5)
- Find average rates of change in order to approximate instantaneous rates of change in the context of slope and velocity. (2.1)
- Use Converge to estimate the slope of a graph at a point. (2.1, 2.6)
- Explain how average rate of change leads to instantaneous rate of change. (2.6)
- Define the slope of the tangent line to the curve  $y = f(x)$  at the point  $(a, f(a))$ . (2.6)
- Define the instantaneous velocity of a moving object at time  $t_1$ . (2.6)
- Define the derivative of a function  $f$  at a number  $a$ . (2.6)
- Interpret the derivative in the context of slope, velocity, or instantaneous rate of change. (2.6)
- Given a function  $f(x)$ , define the derivative,  $f'(x)$ . (2.7)
- Given the graph of a function, sketch the graph of its derivative function. (2.7)
- Given a function defined by a table of values, approximate values of the derivative. (2.7)
- Given a function  $f(x)$ , use the definition of the derivative to find  $f'(x)$ . (2.7)
- Use, write, and verbalize derivative notation correctly. (2.7)
- Explain the connection between differentiability and continuity. (2.7)
- Explain how a function can fail to be differentiable at a point. (2.7)
- Define higher order derivatives of a function. (2.7)
- Interpret the second derivative of a position function as the acceleration function. (2.7)
- Use, write, and verbalize notation for higher order derivatives. (2.7)

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**Unit 2:** In this unit, you will develop derivative rules and formulas and use them to differentiate a wide variety of functions. You will use the derivative to write equations of tangent lines, to interpret rates of change in applied situations, and to solve related rate problems.

**Unit 2 Outcomes:** You will:

- Use derivative notation and vocabulary correctly (3.1 – 3.8)
- Know and use the rules for derivatives of sums and constant multiples (3.1)
- Know and use the formulas for the derivatives of power functions, polynomial functions, and exponential functions. (3.1)
- Find the equation of the tangent line to a curve at a specified point. (3.1, 3.2, 3.3, 3.4, 3.5, 3.7)
- Illustrate the graph of a curve and its tangent line at a point using computer software (3.1, 3.2, 3.3, 3.4, 3.5, 3.7)
- Differentiate products and quotients of functions. (3.2)
- Know and use the rules for derivatives of trigonometric functions. (3.3)
- Differentiate sums, products, and quotients involving the trig functions. (3.3)
- Use the Chain Rule to differentiate composite functions (3.4)
- Define parametric equations and explore their graphs with computer software (1.7)
- Algebraically determine intercepts of parametric curves. (1.7)
- Sketch graphs of parametric equations indicating the direction of the trace (1.7)
- Find the slope of a line tangent to a curve defined parametrically. (3.4)
- Identify an implicit equation and differentiate it. (3.5)
- Know and use the rules for derivatives of inverse trig functions. (3.6)
- Differentiate sums, products, and quotients involving the inverse trig functions. (3.6)
- Know and use the rules for derivatives of logarithmic functions. (3.7)
- Differentiate sums, products, and quotients involving logarithmic functions. (3.7)
- Use logarithmic differentiation when needed (3.7)
- Model and use rates of change in applications (3.8)
- Interpret results in the context of the applications (3.8)
- Analyze and solve related rate problems and interpret the results in the context of the problem. (4.1)
- Explain the analysis and solution of a related rate problem. (4.1)

**Unit 3:** In this unit, you will apply the derivative to the properties of the graph of a function and the solution of applied optimization problems. You will also explore the antiderivative, the definite integral, the Fundamental Theorem of Calculus, and integrate using the Substitution Rule.

**Unit 3 Outcomes:** You will: (Text Section)

- Define *absolute* and *relative* extrema and *critical number*. (4.2)
- Use the Extreme Value Theorem to determine whether a function has an absolute maximum or minimum on an interval. (4.2)
- Find the absolute maximum and absolute minimum of a continuous function on a closed interval. (4.2)
- Use the first derivative to find the intervals where a graph is increasing and decreasing. (2.8, 4.3)
- Use the second derivative to find the intervals where a graph is concave up and concave down. (2.8, 4.3)
- Use given information about limits, and first and second derivatives of a function to sketch a graph of the function. (2.8)
- Use the appropriate derivatives and tests to locate any extrema and inflection points for a graph. (4.3)
- Use domain, intercepts, symmetry, asymptotes, relative extrema, concavity and inflection points to conduct an analysis of the graph of a function and sketch its graph. (4.3)

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- Use Maple as a tool in curve-sketching analysis. (4.3)
- Give a geometric interpretation of the Mean Value Theorem. (4.3)
- Analyze and solve applied optimization problems and interpret the result in the context of the problem. (4.6)
- Explain the analysis and solution of an applied optimization problem. (4.6)
- Use differential notation (3.9)
- Know the formulas for the indefinite integrals of the basic functions. (4.8)
- Use properties of indefinite integrals to find the general antiderivative for a function. (4.8)
- Find a specific function when given one or more derivatives and initial conditions. (4.8)
- Use rectangles to find an approximation for the area under a curve over an interval and explain how to improve the approximation. (5.1)
- Use Converge to obtain successive approximations to the area under a curve. (5.1)
- Define the area under  $f(x)$ ,  $f(x) \geq 0$ , as the limit of a Riemann Sum. (5.1)
- Define the definite integral. (5.2)
- Use correct notation and vocabulary for definite integrals. (5.2 – 5.3)
- Use the properties of the definite integral. (5.2)
- Use the Evaluation Theorem and the properties of definite integrals to evaluate definite integrals. (5.2, 5.3)
- Distinguish between definite and indefinite integrals. (5.3)
- Explain the Fundamental Theorem of Calculus. (5.4)

## DEPARTMENT POLICIES

The Math Department wants you to be successful in this course. Because of this, we have compiled a list of strategies and behaviors.

### **Attendance and class participation**

- If you want to be successful in this course, attend every class.
- Come to class on time, and stay for the entire class period. If you are late or leave during class, you will miss important class material and you will also distract your classmates and your instructor. (See the Student Conduct Code)
- Turn off your cell phone during class. You and your classmates need to be free from distractions. (See the Student Conduct Code)
- Bring your book, supplement and graphing calculator (if you have one) to every class.
- Respect your classmates and your instructor. Listen carefully to questions asked and answers given. Treat all questions with respect.
- Participate fully in class. Volunteer answers, work problems, take careful notes, and engage in discussions about the material. Use computers only for designated work. Above all, stay on task.
- Contribute your share to all group work and projects and do your best to make the group experience a positive one for all members.
- Do your own work on tests and quizzes. Cheating will not be tolerated. (See the Academic Integrity Code.)

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## Homework

- Homework is the way you practice the ideas and skills that are introduced in class. To be successful on the tests, you must do the homework. Homework may be collected and homework questions may be included on quizzes or tests. The homework assignments are in the homework assignment portion of the MATH 171 – Calculus I Supplement, Homework Assignments and Test Review Sheets booklet that you purchase in the bookstore. Homework may be online and may be graded.
- When you do the homework, write down all supporting work. Using the correct process is at least as important as getting the correct answer, so your work and steps are very important.
- Remember to check your answers. They will be in the back of the text or in the student's solutions manual.
- If there are questions you can't get or don't understand, ask about them at the beginning of the next class. If you have trouble with more than a few problems, try starting your homework in the Math Lab, where help is available.

## Absence

- If you are sick and an absence is unavoidable, please call or email your instructor. You are still responsible for all material that was covered during your absence. You are expected to read the textbook and do the homework.
- Make time to see your instructor when you return so that you can get any papers you missed.
- Remember that you are expected to be in class for the tests and quizzes. You will not be able to make up tests or quizzes.

## Getting Help

After you have tried the homework, there are ways to get help:

- Look in your text and your class notes for examples similar to the problems you are finding difficult.
- See your instructor during office hours or make an appointment. Bring the work you have done.
- Go to the **Math Lab** to get extra help on your homework or simply go and do your homework there. Someone will be there if you get stuck. You don't need an appointment to use the Math Lab.
- Form a **study group** with other class members. Working with other students can be a great way to learn. If you have a group to work with, consider meeting and working together in the Math Lab.
- Your textbook may have a complete solutions manual available in the Math Lab, which can be used in the Math Lab.
- You can use the computers in the computer lab within the Math Lab to do work related to your math course.
- In the Math Lab, you can get help on how to use your calculator.

Visit the [Math Lab website](#) to view hours and other useful information about the Math Lab.

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## **COLLEGE POLICIES:**

As an academic institution, Brookdale facilitates the free exchange of ideas, upholds the virtues of civil discourse, and honors diverse perspectives informed by credible sources. Our College values all students and strives for inclusion and safety regardless of a student's disability, age, sex, gender identity, sexual orientation, race, ethnicity, country of origin, immigration status, religious affiliation, political orientation, socioeconomic standing, and veteran status. For additional information, support services, and engagement opportunities, please visit [www.brookdalecc.edu/support](http://www.brookdalecc.edu/support).

For information regarding:

- ◆ Brookdale's Academic Integrity Code
- ◆ Student Conduct Code
- ◆ Student Grade Appeal Process

Please refer to the [BCC STUDENT HANDBOOK](#) AND [BCC CATALOG](#).

## **NOTIFICATION FOR STUDENTS WITH DISABILITIES:**

Brookdale Community College offers reasonable accommodations and/or services to persons with disabilities. Students with disabilities who wish to self-identify must contact the Disabilities Services Office at 732-224-2730 (voice) or 732-842-4211 (TTY) to provide appropriate documentation of the disability, and request specific accommodations or services. If a student qualifies, reasonable accommodations and/or services, which are appropriate for the college level and are recommended in the documentation, can be approved.

## **MENTAL HEALTH:**

- Mental Health Crisis Support: From a campus phone, dial 5555 or 732-224-2329 from an external line; off-hours calls will be forwarded to BCC police (2222 from a campus phone)
- Psychological Counseling Services: 732-224-2986 (to schedule an appointment during regular hours)