SYLLABUS

Code: **MATH 176**   **Title**: **CALCULUS WITH BUSINESS APPLICATIONS**

Institute: **STEM**   **Department**: **MATHEMATICS**

Course Description: This course covers differential and integral calculus with applications in business, economics, and the life sciences. Topics include functions and their graphs, constructing mathematical models, the derivative and its applications, the integral and its applications, and exponential and logarithmic functions. Problems are approached from a variety of perspectives, including graphical, numerical, verbal, and algebraic through the use of computer software in class. This course is recommended for Business majors.

Section Information: All tests will be proctored in person.

Prerequisites: A grade of C or higher in MATH 156.

Credits: 4   **Lecture Hours:**   4   **Lab:** 0

REQUIRED TEXTBOOK/MATERIALS:
Textbook: Harshbarger/Reynolds, <u>Mathematical Applications for the Management, Life, and Social Sciences</u>, 12th Edition, Cengage, 2019.

Note: WebAssign (EWA) will be required for online homework in some sections. Check with your instructor. The College bookstore sells the textbook in a bundle which includes a WebAssign access code. You may also purchase the stand alone WebAssign access code (with ebook) at the College bookstore.

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.
2. **Computer software** – A spreadsheet is program is used in this course. Microsoft Excel or similar will be sufficient.

ADDITIONAL TIME REQUIREMENTS:
You will need to allow some on-campus time during each unit to meet with your group to work on each project. Some discussions can be done via email, but you will need some group meeting time and your group may need to meet with your instructor to discuss parts of the project.

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***

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hours per week on homework.
- You may need to allow time on campus to do homework 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 mathematical skills appropriate to this course. (M)
- Apply the concepts, techniques and tools of calculus to the solutions of application problems in the fields of business and economics. (M)
- Use language consistent with current business and economic practices to interpret and report solutions in the context of the problem. (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, quizzes (and possibly homework), and projects.

A. TESTS

There will be three tests, one after each unit. All supporting work must be shown on tests in order for your instructor to properly assess your understanding of the material. Computer software and/or graphing calculators are used on these tests, although there will be non-computer parts. 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.

B. QUIZZES/HOMEWORK

There will be periodic quizzes and your instructor may also choose to use certain homework assignments for evaluation.

C. PROJECTS

There are two group projects for the course, done outside of class. In each project, you will apply the concepts and skills learned in class to a problem situation, present the mathematics, write careful explanations, and interpret your results.

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GRADING

Your final course average is determined by a weighted average as follows:

Test 1 (Unit 1)	25%
Test 2 (Unit 2)	25%
Test 3 (Unit 3)	25%
Quizzes/Homework/ Projects	25%

FINAL GRADE

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: (TEXT SECTION)

Unit 1: In this unit, you will review linear, quadratic, cubic, square-root, piecewise defined, and rational functions and use them to create mathematical models for applied situations. You will be introduced to the concept of the limit of a function and will use limits to determine whether a function is continuous. You will study average rate of change and use limits to determine instantaneous rates of change. You will estimate instantaneous rates of change and use an algebraic process to find the derivative of a function. You will develop formulas for derivatives of functions and become proficient in finding derivatives.

Unit 1 Outcomes: You will:

o Review linear and absolute value functions (1.3, 2.4)
o Use technology or a graphing calculator to investigate properties of functions (1.2)
o Define the break-even point and the equilibrium point (1.1, 1.6)
o Review quadratic, cubic, and square-root functions and use technology or a graphing calculator to model business applications (2.4)
o Review rational and piecewise defined functions and use technology or a graphing calculator to model business applications (2.4)
o Use technology or a graphing calculator to construct polynomial models for applied situations (2.4)
o Understand the concept of a limit and use technology to estimate limits graphically and numerically (9.1)
o Find limits of functions algebraically (9.1)
o Use technology to determine the limit of a rational function (9.1)
o Use technology to determine the end behavior of a function (9.1)
o Discuss continuous functions and continuity and discontinuity at a point (9.2)
o Determine whether a piecewise defined function is continuous (9.2)
o Use Technology to determine continuity and discontinuity at a point (9.2)
o Find the average rate of change and instantaneous rate of change using a table, a graph, and an equation (9.3)
o Describe the differences between average rate of change and instantaneous rate of change (9.3)
o Use technology to sketch and find slopes of secant lines (9.3)
o Define the slope of a curve at a point (9.3)
o Define the derivative as the instantaneous rate of change (9.3)
o Use technology to estimate the instantaneous rate of change as a limiting value of average rates of change (9.3)
o Use algebraic methods to find derivatives (9.3)
o Define the situations when a derivative does not exist at a point (9.3)
o Interpret derivative statements in the context of an application (9.3)
o Learn and use derivative formulas for a linear function, a constant function, a power function (9.4)
o Learn and use the formulas for the derivative of a constant multiple of a function, the sum of two functions, and the difference of two functions (9.4)
o Apply derivatives to marginal analysis (9.4)

Unit 2: In this unit, you will review exponential, logarithmic, and logistic functions and use them to create mathematical models for applied situations. You will find the limits of exponential and logarithmic functions. You will study the derivatives of these two functions. You will use the derivative to find absolute and relative extrema of a function. The applications of the first derivative test will be discussed. You will learn how to determine concavity, and to find inflection points. Business applications such as elasticity of demand, relationship of elasticity of demand and revenue, and maximizing revenue

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and profit will be studied.

Unit 2 Outcomes: You will:

o   Learn and apply the derivatives of products and the derivatives of quotients (9.5)
o   Learn and apply the Chain Rule to differentiate a composition of two functions (9.6)

o   Review exponential and logarithmic functions and use technology or a graphing calculator to evaluate a function.
o   Review solving equations involving exponential and logarithmic functions and use technology or a graphing calculator to verify the solutions.
o   Use technology or a graphing calculator to construct exponential and logarithmic models for applied situations (Handout – Review 5.1, 5.2)
o   Take derivatives of exponential and logarithmic functions (11.1, 11.2)
o   Apply derivatives and the chain rule in the context of applications (11.1, 11.2)
o   Find relative extreme points using the first derivative test and use technology to verify these points (10.1)
o   Use the first derivative test in applications and interpret the meaning in the context of applications (10.1)
o   Use the second derivative to determine concavity and inflection points and use technology to verify these points (10.2)
o   Use the first and second derivative tests to sketch graphs of functions (10.1, 10.2)
o   Interpret the point of diminishing returns in economic applications (10.2)(optional)
o   Apply absolute extreme points of a function on an interval (10.3)
o   Find absolute extreme points and use technology to verify these points (10.3)
o   Apply absolute extreme points in the context of applications such as elasticity of demand, relationship of elasticity of demand and revenue, and maximum revenue (10.3, 11.5) (optional)
o   Learn several types of business applications involving revenue, maximizing profit, and maximizing yield (10.3)

Unit 3: In this unit, you will study the problem of finding the area of a region bounded by a curve, leading to the definition of the definite integral. You will also find antiderivatives of functions, evaluate and interpret definite integrals, and find the area of a region between two curves. You will study improper integrals and investigate applications of integration to business situations such as future value, producer and consumer surplus, market surplus, and equilibrium point.

Unit 3 Outcomes: You will:

o   Approximate the area under a curve using rectangles (13.1)
o   Find the accumulated change in a quantity by using technology to find the area between a graph and the horizontal axis (13.1)
o   Define antiderivatives (12.1)
o   Learn and use the formulas for antiderivatives for the power rule, a constant multiplier, the sum, and the difference of a function (12.1, 12.2)
o   Find a specific antiderivative in an applied situation (12.4)
o   Learn and use the formulas for antiderivatives of exponential and log functions (12.3)
o   Explain the Fundamental Theorem of Calculus (13.2)
o   Define and evaluate the definite integral (13.2)
o   Interpret a definite integral in the context of an application (13.4)
o   Calculate and interpret the area between two curves (13.3)
o   Find Lorenz curve, and the Gini Index (13.3) (optional).
o   Calculate and interpret the following economic quantities: producer and consumer surplus, market surplus and equilibrium point (13.4)

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o Calculate and interpret future values for a continuous income flow (13.4)

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 and calculator 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 your in-class group work and your 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.)

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.
- 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.

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.

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- 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.

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.

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)

The syllabus is intended to give student guidance in what may be covered during the semester and will be followed as closely as possible. However, the faculty member reserves the right to modify, supplement, and make changes as the need arises.