**Calculus with Applications to Business and Finance**

The University of Toledo

Mathematics & Statistics Department, College of Natural Sciences and Mathematics

MATH1730-0XX, CRN XXXXX

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**Instructor:** (Insert Name] **Class Location:** (Insert Building/Room)

**Email:** (Insert E-mail Address) **Class Day/Time:** (Insert Days/Time)

**Office Hours:** (Insert Days/Time) **Lab Location:** (Insert Building/Office #, if applicable)

**Office Location:** (Insert Building/Office Number) **Lab Day/Time:** (Insert Days/Time, if applicable)

**Office Phone:** (Insert Phone Number) **Credit Hours:** 5

**Term:** (Insert Semester and Year)

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**COURSE Description**

An introduction to differential and integral calculus. Topics include limits, derivatives, maxima/minima, indefinite and definite integrals with an emphasis on business applications and technology use.

**STUDENT Learning OUTCOMes**

The successful Math 1730 student should be able to apply the following competencies to a wide range of functions, including piecewise, polynomial, rational, algebraic, exponential and logarithmic.

1. Determine limits and discontinuities of functions.

* **Limits:** Determine limits analytically, numerically and graphically including one-sided limits and limits at infinity.
* **Continuity:** Analyze the limit behavior of a function at a point in its domain to determine if the function is continuous at that point. Determine intervals in which a function is continuous. Analyze and classify the discontinuities of a function.

2. Compute derivatives.

* **Derivative Definition:** Use the limit definition of the derivative to determine the existence and to find the derivative of a given function.
* **Derivative Formulas:** Find the derivative of a function by identifying and applying the appropriate derivative formula.
* **Higher Order Derivatives:** Find higher order derivatives.

3. Interpret derivatives and apply them to a business environment.

* **Rates of Change:** Interpret the derivative as a rate of change.
* **Tangent Lines:** Find the slope of the tangent line to the graph of a function at a given point.
* **Increasing/Decreasing:** Use the first derivative to determine intervals on which the graph of a function is increasing or decreasing and to determine critical points of the function.
* **Concavity:** Use the second derivative to determine intervals on which the graph of a function is concave upwards or concave downwards and to determine points of inflection.
* **Extrema:** Find and classify relative extrema and, on a closed interval, absolute extrema of a function.
* **Marginal Analysis:** Solve applied problems including marginal analysis applications and explain the relationship between marginal cost and average cost.
* **Elasticity:** Determine and interpret the elasticity of demand for a product (optional objective)

4. Find indefinite and definite integrals and apply them to business problems.

* **Anti-derivatives:** Construct anti-derivatives analytically.
* **Integrals and Substitution:** Find indefinite integrals using integration formulas and the method of substitution.
* **Integration by Parts:** Find indefinite integrals using integration by parts (optional topic)
* **Riemann Sums:** Estimate the numerical value of a definite integral using a Riemann sum (optional topic)
* **Definite Integrals:** Use the Fundamental Theorem of Calculus to evaluate definite integrals,
* **Areas:** Identify definite integrals of functions as the areas of regions between the graph of the function and the x-axis, and use definite integrals to calculate the area of the region under a curve and the area of the region between two curves.
* **Continuous Compound Interest:** Determine present value and future value for an investment with interest compounded continuously. Determine the average value of a function on an interval (optional topic)
* **Consumer/Producer Surplus:** For given supply and demand functions find and interpret the consumer’s surplus and the producer’s surplus.
* **Improper Integrals:** Evaluate improper integrals and apply to business problems (optional topic)

5. Solve optimization problems using functions of two variables (optional set of objectives)

* **Partial Derivatives:** Compute partial derivatives of functions of two variables algebraically. (optional objective)
* **Optimization:** Determine critical points for functions of two variables and use the second derivative test to determine the nature of critical points of a function of two variables. (optional objective)
* **Lagrange Multipliers:**  Use the method of Lagrange multipliers to determine extreme values

of functions of two variables subject to constraints. (optional objective)

**PrerequisiteS**

Minimum grade of C- in either Math 1320 or Math 1340 or College Algebra Placement 15 or ALEKS placement 68 or ACT Math 24 or SAT Mathematics 560 or Math Section Score 580 (new SAT).

**CLASS MEETINGS:** 5 hours per week including lecture, lab, and recitation time.

**TextBOOK:** You do not need to purchase anything for this course. The text/course materials will be provided and the cost ($111.49) is included in your course fees. This course includes an e-text copy of *Calculus and Its Applications*, *A Custom Edition for the University of Toledo*, by Bittinger, Ellenbogen, and Surgent, along with MyLab Math software.

**UNIVERSITY POLICIES:**

**POLICY STATEMENT ON NON-DISCRIMINATION ON THE BASIS OF DISABILITY (ADA)**

The University is an equal opportunity educational institution. Please read The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.

**ACADEMIC ACCOMMODATIONS**

The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the Student Disability Services Office (Rocket Hall 1820; 419.530.4981; studentdisabilitysvs@utoledo.edu) as soon as possible for more information and/or to initiate the process for accessing academic accommodations. For the full policy see: <http://www.utoledo.edu/offices/student-disability-services/sam/index.html>

**ACADEMIC POLICIES:**

**Student Privacy**

Federal law and university policy prohibits instructors from discussing a student's grades or class performance with anyone outside of university faculty/staff without the student's written and signed consent.  This includes parents and spouses.  For details, see the “Confidentiality of student records (FERPA)” section of the University Policy Page at <http://www.utoledo.edu/policies/academic/undergraduate/index.html>

**Missed Class POLICY**

If circumstances occur in accordance with “The University of Toledo Missed Class Policy” (found at <http://www.utoledo.edu/policies/academic/undergraduate/index.html>) result in a student missing a quiz, test, exam or other graded item, the student must contact the instructor in advance by phone, e-mail or in person, provide official documentation to back up his or her absence, and arrange to make up the missed item as soon as possible.

**Academic Dishonesty**

Any act of academic dishonesty as defined by the University of Toledo policy on academic dishonesty (found at <http://www.utoledo.edu/dl/students/dishonesty.html>) will result in an F in the course or an F on the item in question, subject to the determination of the instructor.

**Grading**

Grades will be based on the following scale:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Grade | |  |  | | --- | --- | | A | A- | | |  |  |  | | --- | --- | --- | | B+ | B | B- | | |  |  |  | | --- | --- | --- | | C+ | C | C- | | |  |  |  | | --- | --- | --- | | D+ | D | D- | | F |
| Minimal Percentage Required | |  |  | | --- | --- | | 93% | 90% | | |  |  |  | | --- | --- | --- | | 87% | 83% | 80% | | |  |  |  | | --- | --- | --- | | 77% | 73% | 70% | | |  |  |  | | --- | --- | --- | | 67% | 63% | 60% | | <60% |

**Assessment of Learning**

Student learning will be assessed using graded online and written homework, quizzes, a class participation score, three tests and a final examination. All tests and final exams are written by the department. The final exam is comprehensive and mandatory. Tests, quizzes and the final exam should together comprise 80% of the grade.

**Attendance**

Students are expected to attend all classes and recitations from beginning to end and attendance will be tracked.

**IMPORTANT DATES**

\*The instructor reserves the right to change the content of the course material if he perceives a need due to postponement of class caused by inclement weather, instructor illness, etc., or due to the pace of the course.

**MIDTERM EXAM:**

**FINAL EXAM:**

**OTHER DATES**

The last day to drop this course is: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The last day to withdraw with a grade of “W” from this course is: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**STUDENT SUPPORT SERVICES**

1. Free math tutoring on a walk-in basis is available in the **Math Learning and Resources Center** located in Rm B0200 in the lower level of Carlson Library (phone ext 2176). The Center operates on a walk-in basis. MLRC hours can be found at <http://www.math.utoledo.edu/mlrc/MLRC.pdf>

**CLASS SCHEDULE**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | Number of  Lecture Hours |
| Chapter | R | Functions Graphs and Models | (3 hours) |
|  | R.1 | Graphs and Equations | 0.5 |
|  | R.2 | Functions and Models | 0.5 |
|  | R.3 | Finding Domain and Range | 0.5 |
|  | R.4 | Slope and linear functions | 0.5 |
|  | R.5 | Nonlinear Functions and Models | 1.0 |
| Chapter | 1 | Differentiation | (11 hours) |
|  | 1.1 | Limits: A Numerical and Graphical Approach: ***Limits*** | 1.5 |
|  | 1.2 | Algebraic Limits and Continuity: ***Limits, Continuity*** | 1.5 |
|  | 1.3 | Average Rates of Change: ***Rates of Change*** | 1.5 |
|  | 1.4 | Differentiation Using Limits of Difference Quotients: ***Rates of Change*, *Derivative Definition, Tangent Lines*** | 1.5 |
|  | 1.5 | The Power and Sum-Difference Rules: ***Derivative Formulas*** | 1.5 |
|  | 1.6 | The Product and Quotient Rules: ***Derivative Formulas*** | 1.5 |
|  | 1.7 | The Chain Rule: ***Derivative Formulas*** | 1.0 |
|  | 1.8 | Higher-Order Derivatives: ***Higher Order Derivatives*** | 1.0 |
| Chapter | 2 | Applications of Differentiation | (8 hours) |
|  | 2.1 | Using First Derivatives to Find Max and Min Values: ***Increasing/Decreasing, Extrema*** | 2.0 |
|  | 2.2 | Using Second Derivatives to Find Max and Min Values, ***Increasing/Decreasing, Extrema, Concavity*** | 2.0 |
|  | 2.3 | Graph Sketching: Asymptotes and Rational Functions: ***Increasing/Decreasing, Extrema, Concavity*** | 1.0 |
|  | 2.4 | Using Derivatives to Find Absolute Max and Min Values: ***Extrema*** | 1.0 |
|  | 2.5 | Max-Min Problems: Business and Economic Applications: ***Extrema*** | 1.5 |
|  | 2.6 | Marginals (Differentials omitted): ***Marginal Analysis*** | 0.5 |
|  | 2.7 | Elasticity of Demand (optional): ***Elasticity*** |  |
| Chapter | 3 | Exponential and Logarithmic Functions | (5 hours) |
|  | 3.1 | Exponential Functions: ***Derivative Formulas*** | 1.0 |
|  | 3.2 | Logarithmic Functions: ***Derivative Formulas*** | 1.0 |
|  | 3.3 | Applications: Uninhibited and Limited Growth Models: ***Continuous Compound Interest*** | 1.0 |
|  | 3.4 | Applications: Decay: ***Continuous Compound Interest*** | 1.0 |
|  | 3.5 | The Derivatives of ax and logax: ***Derivative Formulas*** | 1.0 |
| Chapter | 4 | Integration | (8 hours) |
|  | 4.1 | Antidifferentiation: ***Antiderivatives, Integrals and Substitution*** | 2.0 |
|  | 4.2 | Antiderivatives as Areas: ***Riemann Sums*** | 1.0 |
|  | 4.3 | Area and Definite Integrals: ***Definite Integrals, Areas*** | 2.0 |
|  | 4.4 | Properties of Definite Integrals: ***Areas, Average Value*** | 1.5 |
|  | 4.5 | Integration Techniques: Substitution: ***Integrals and Substitution*** | 1.5 |
|  | 4.6 | Integration Techniques: Integration by Parts (optional): ***Integration by Parts*** |  |
| Chapter | 5 | Applications of Integration | (3 hours) |
|  | 5.1 | Consumer Surplus and Producer Surplus: ***Consumer/Producer Surplus*** | 1.5 |
|  | 5.2 | Applications of Integrating Growth and Decay Models: ***Integrals and Substitution, Continuous Compound Interest*** | 1.5 |
|  | 5.3 | Improper Integrals (optional): ***Improper Integrals*** |  |
| Chapter | 6 | Functions of Several Variables (optional) |  |
|  | 6.1 | Functions of Several Variables (optional) |  |
|  | 6.2 | Partial Derivatives (optional): ***Partial Derivatives*** |  |
|  | 6.3 | Maximum-Minimum Problems (optional): ***Optimization*** |  |
|  | 6.5 | Constrained Optimization (optional): ***Lagrange Multipliers*** |  |
|  |  | Total Number of Lecture Hours | 38.0 |