MERCYHURST ⬥ UNIVERSITY

Math 170 – Calculus I
Course Syllabus · Spring 2019

Instructor:	Roger Griffiths	**Office Hours:**	
Office:	Old Main 305		Mon: 09:00 - 09:50
Email:	rgriffiths@mercyhurst.edu		Mon: 3:00 - 3:50
Phone:	824-2123		Tues: 08:50 - 09:20
Class Time:	Mon, Tues, Wed, Fri: 2:00 - 2:50, (4 semester credits)		(in Hirt M209)
Location:	Hirt M209		Thur: 08:00 - 09:20
Prerequisite:	M118 (Math for Nat Sci) or ALEKS Score 76 or higher		(in Hirt M209)
Web:	http://math.mercyhurst.edu/~griff/courses/m170/		Thur: 2:00 - 2:50
Text:	Calculus Early Transcendentals, (10th Edition) by Anton, Bivens, Davis;		Fri: 10:00 - 10:50

PREREQUISITES

To remain enrolled in this course, you must satisfy at least one of the following criteria:

- Score of 76 or better on the ALEKS Mathematics Placement Assessment.
- Passed Math for the Natural Sciences (Math 118), or transfer credit for equivalent.
- Passed both College Algebra (Math 111) and Trigonometry and Functions (Math 112), or transfer credit for equivalent.

If none of these apply, you should make arrangements to take the ALEKS Math Placement Assessment before the Add/Drop deadline on Friday, January 18th. **Students that do not meet the prerequisites by this deadline may be dropped from the course**.

COURSE CONTENT

This is the initial course in a sequence of courses on the fundamental ideas of the calculus of one variable. It is here that truly significant applications of mathematics begin. Topics included are functions, continuity of functions, the derivative, differentiation rules, applications of the derivative, and integration through the Fundamental Theorem of Calculus. The sections covered can be found in the tentative course schedule (below).

A goal of our time in class is to prepare you to do the homework but not necessarily show you how to work each individual type of problem. You will often have to work hard to take the material covered in class and discover how to apply this to seemingly unrelated problems in your homework. The learning occurs when you can move yourself into the unknown territory, when you make these discoveries. Mathematics is not about following directions, it's about making new directions.

LEARNING OBJECTIVES

There are really two sets of objectives for this course. The first set involves mastering the mathematical content of differential and beginning integral calculus. In particular, by the end of this course, students are expected to be able to:

- demonstrate understanding of the concept of a limit from intuitive, graphical and computational perspectives;
- evaluate a variety of limits;

- use the definition of the derivative, and understand the relationship between the various interpretations of the derivative;
- compute derivatives of functions using the definition of the derivative and then using the techniques and properties derived from the definition, specifically, find the derivative of sums, products, and quotients of composite polynomial, trigonometric, exponential, and logarithmic functions;
- use the derivative in problems involving optimization, curve sketching and approximations;
- apply differentiation procedures to solve related rates and extreme value problems;
- identify and evaluate limits involving indeterminate forms;
- compute definite and indefinite integrals using formulas and substitution;
- understand the relationship between the integral and the derivative; and
- read and interpret mathematical theorems, including checking that hypotheses are satisfied and reaching correct conclusions.

The second set of goals involves broader issues of learning, such as:
- develop a sense for modeling physical situations in order to solve problems (Mathematics is the art of explanation);
- improve study habits necessary for continued success in your subsequent science and mathematics courses,
- improve logical thinking and problem-solving skills;
- improve algebra skills, thus the ability to express mathematical thoughts;
- an increased understanding of The Language of Mathematics, bringing the students up to a mathematical, abstract, level of expression and understanding, and;
- communicate effectively, especially by writing precisely about technical things.

Textbook

Calculus, Early Transcendentals, 10th Edition, by Anton, Bivens, and Davis. You will need this textbook, and be sure to check the edition when purchasing your textbook; other editions have similar material, but the assigned problems may be different. No other materials are required for this class. You do NOT need to purchase a subscription to MyMathLab or pay to access any other online resources. If you prefer to purchase an electronic version of the text or the binder version, you're welcome to do so.

Calculators

Calculators are not required or even recommended for this course, and **you will not be permitted to use a calculator or computer on any quiz or exam**.

You are strongly encouraged to avoid using a calculator while working on homework. *All of our examinations are carefully designed to be taken "closed book" without the use of calculators, computers or "crib sheets"*. Examination problems will focus on the basic formulas and problem solving techniques which every student of calculus must know without a calculator or textbook. This policy reinforces our stated learning objectives, in particular, furthering our understanding of the language of mathematics. We will be interested in learning mathematics (the process) not in answers.

Evaluation

Your letter grade in this course will be based on:
- 100 points: **Quizzes**   Quiz average out of 100 points, will drop 1 quiz score
- 400 points: **Exams:**   4 exams at 100 points each
- 200 points: **Final Exam**   Comprehensive Final exam worth 200 points
- 700 points: **Total points** in the course

And assigned according to the following scale:

Total Class Points	Percent %	Letter Grade	Interpretation
630 - 700	90 to 100	A	Exceptional
609 - 629	87 to 89	B+	Outstanding
560 - 608	80 to 86	B	Very Good
539 - 559	77 to 79	C+	Good
490 - 538	70 to 76	C	Satisfactory
420 - 489	60 to 69	D	Unsatisfactory
0 - 419	Below 60	F	Failure

✓ Your overall performance in the course is measured by the total number of points you accumulate relative to the maximum 700 points possible. Your letter grade in this course will be based on the distribution above, the standard scale used in the Mathematics Department.

✓ These are the only points possible in this class, there is no extra credit (or 'make up'), your asking for extra credit is a clear indication that you have not read your contract (this syllabus).

COURSE POLICIES

✓ Every student is required to establish a *class contact*, that is, a fellow classmate that you may contact in case you are having a problem with a particular homework exercise at night/weekend or in the event you miss class, you can get the class notes from them.

✓ You are responsible for all that is announced or covered in class even if you are absent.

✓ You are responsible for all the material in a given section unless told otherwise, use the course schedule and suggested homework as a guide.

✓ A prerequisite for additional help outside the classroom is regular class attendance.

✓ If you miss class, you are responsible for getting the notes from your 'class contact' (see above).

✓ Email is great for **simple** communications, but more complex issues must be handled in person.

✓ Don't use email as an excuse to avoid personal contact.

✓ Due to the overwhelming amount of email I receive, any email requests that involve a complicated response may not get addressed in a timely fashion, please come see me in that case.

✓ I expect you to read this syllabus and get clarification of any items you do not understand during the first week of class. After that, if you send me an email asking me about something covered in this syllabus, that email will likely be disregarded.

HOMEWORK

I do not collect or grade your written homework. You will be held accountable for the mastery of homework problems via the quizzes (which can occur any day). As such, you get no credit for *merely attempting the homework*, your goal is to master each type of problem assigned.

HOMEWORK SUGGESTIONS

• The textbook exercises typically begin with several groups of problems that cover small pieces of the material covered in that section. The exercises near the end of that section often put those ideas all together, necessitating mastery of the low-numbered exercises before attempting the latter. However, working only the low-numbered exercises will not prepare a student sufficiently for the quizzes or exams.

- Most of science and mathematics (and, I believe most endeavors) is learning how to recover from little failures (our mistakes, incorrect assumptions, crashes, etc), until at last we succeed. Any endeavor worth doing takes much practice to become proficient. Think about snowboarding, the violin, chess, ice hockey, and so on; you can practice for years and continue to get better, learn new tricks, reach the next level of proficiency. People work that hard for the love of their sport, hobby, or profession. Mathematics as an art is no different. Although, most of you will probably always view mathematics as a tool or possibly the language of science. But most of the modern world is built on the back of that science and engineering, which is built on mathematics. It is for that reason that you should be willing to expend the necessary effort, work through your frustrations and failures, and, in the end, achieve success in this, and subsequent mathematics courses.

- **Homework is far and away the single most important part of any mathematics course** because this is when most (all) of the learning takes place. Homework problems will be assigned regularly and I expect you to do them. If you are unable to do a problem I expect you to find out how to do it. You have at your disposal several means of meeting this expectation.
    - You can stick with it until you figure it out yourself.
    - You can discuss the problem with a classmate or several classmates (strongly encouraged).
    - You can work through the problem with one of the mathematics tutors available for this course; see: http://math.mercyhurst.edu/Tutoring/ for more information.
    - You can ask me about the problem in class (time permitting).
    - You can see me individually during my office hours. I am always happy to talk to you during my office hours or at any other time if not otherwise committed; when coming to my office, be prepared to show me what you've already tried.
    - You can discuss the problem with anyone who can and is willing to help you.

- In studying mathematics, you must be careful not to let a tutor or friend *think* for you. It is essential that you can work problems **completely on your own, without help from any resource,** by the time of a quiz or exam.

- Simply ignoring a problem that you are unable to solve is not **acceptable**.

- You should continue to work problems of a given type (even beyond the assigned problems) until you see the pattern yourself, without assistance of any type (i.e. without using your notes, worked examples, or any prior problems).

- Attending every class is not enough; mathematics can only be learned through practice (like anything worth mastering).

- Remember, the general rule of thumb for a college level class is that one should put in at least 2 hours of work outside class for every hour in class. This means that you should be working on this course for about eight hours a week outside of class.

Quizzes

- You will be given quizzes regularly. Keeping up with the homework, as detailed above, will ensure that you are prepared for the quizzes.

- The quizzes will be based largely on the suggested homework, and should be expected any day (if you are paying attention in class, I generally suggest when the next quiz will occur).

- Everyone is allowed to miss one quiz without penalty (for any reason); thus, there are NO make up quizzes. If you end up taking all of the quizzes, you may drop your low quiz score. Athletes or other individuals missing for school activities are to let me know BEFORE missing the quiz (or it lands above).

- The quizzes serve as an immediate assessment of the extent to which you mastered a particular assignment. Good quiz results should serve as positive feedback, but poor quiz results suggest that you must go back and master that material. Repeatedly failing quizzes will almost certainly lead to failing the course, you must take immediate and corrective action if you ever do poorly on a quiz.

EXAMS

- There will be four midterm exams given throughout the semester, in addition to the final exam. The material on the exams will be similar to topics covered on quizzes and homework.

- Students are required to take all exams at the scheduled hour as they appear on the syllabus and course schedule.

- There will be no late *'make-up'* exams, as this is unfair to the rest of the class. If you know in advance you are going to miss a scheduled exam, let me know well in advance of the exam. Athletes, carefully review our exam schedule looking for conflicts.

- A missed exam will result in the final exam being worth 300 points (you do not loose any points for the missed exam, those points simply roll into the final exam). A second missed exam will receive a grade of 0 (zero).

- Our goal is not simply a 'correct answer'. But rather, you are to demonstrate the extent to which you understand each problem, this means organizing your work, a good write-up includes: connecting your work, proper notation, and an explanation of steps as you see necessary.

- Important Dates to Remember:
    - Exam 1: Friday, February 15th.
    - Exam 2: Friday, March 15th.
    - Exam 3: Wednesday, April 10th.
    - Exam 4: Friday, May 3rd.
    - Final Exam: Wednesday, May 8th, 1:00-3:00.

Services:

Tutoring

Mercyhurst University and the Mathematics Department provide free tutoring for students enrolled in mathematics courses: *College Algebra* through *Calculus II* (including *Trig and Functions*). Be sure when you go that you have your course materials (book, notebook, pencil, paper, etc). The tutors will assist on a first-come, first-served basis. See: *http://math.mercyhurst.edu/Tutoring/*

Support of the Mercy Mission

This course supports the mission of Mercyhurst University by creating students who are intellectually creative. Students will foster this creativity by: applying critical thinking and qualitative reasoning techniques to new disciplines; developing, analyzing, and synthesizing scientific ideas; and engaging in innovative problem solving strategies.

Learning Differences

Mercyhurst University is committed to making reasonable accommodations to assist individuals with disabilities in reaching their academic potential. Students with disabilities requiring accommodations should complete and submit this form and the required documentation to the Director of Equal Opportunity Programs (DEOP), aagnew@mercyhurst.edu. Accommodations will not be granted prior to approval by the DEOP and will not be provided retroactively. Further information is available by visiting the Learning Differences website: http://www.mercyhurst.edu/academics/learning-differences-program.

Additional (Free) Resources

- **Khan Academy Algebra II**: https://www.khanacademy.org/math/algebra2
  Includes material on manipulating functions, polynomials, rational functions, complex numbers, and modeling.

- **Wolfram Alpha**: http://www.wolframalpha.com
  A great way to check your work. Free, with subscription available to access step-by-step solutions to problems.

- **College Algebra Textbook**: http://stitz-zeager.com/szca07042013.pdf
  Free textbook by Carl Stitz and Jeff Zeager. Covers functions, graphing, polynomials, rational functions, modeling, exponential and logarithmic functions, and more, with practice exercises and some solutions.

- **Precalculus Textbook**: http://www.opentextbookstore.com/precalc/1.5/Precalc.pdf
  Free textbook by David Lippman and Melonie Rasmussen. Covers just about everything in Math 170, in the same sequence.

Math 170 · Calculus I Tentative Course Schedule · Spring 2019

Monday	Tuesday	Wednesday	Friday
Jan 14 Course Introduction	Jan 15 § 0.1: Functions	Jan 16 §§ 0.2: New Functions from Old	Jan 18 § 0.3: Families of Functions
Jan 21 No Class	Jan 22 § 0.4: Inverse Functions	Jan 23 § 0.5: Exponential and Logarithmic Functions	Jan 25 § 1.1: Limits, An Intuitive Approach (1)
Jan 28 § 1.1: Limits, An Intuitive Approach (2)	Jan 29 § 1.2: Computing Limits (1)	Jan 30 Classes Canceled Cold Weather	Feb 1 § 1.3: Limits at Infinity (1)
Feb 4 §§ 1.3: Limits at Infinity (2) § 1.5: Continuity (1)	Feb 5 § 1.5: Continuity (2)	Feb 6 § 1.6: Limits of Trig Functions (1)	Feb 8 § 1.6: Limits of Trig Functions (2)
Feb 11 § 2.1: Rates of Change § 2.2: The Derivative (1)	Feb 12 § 2.2: The Derivative (2)	Feb 13 § 2.3: Techniques of Differentiation	Feb 15 **Exam 1**
Feb 18 § 2.4: The Product and Quotient Rules	Feb 19 § 2.5: Derivatives of Trig Functions	Feb 20 § 2.6: The Chain Rule (1)	Feb 22 § 2.6: The Chain Rule (2)
Feb 25 § 3.1: Implicit Differentiation (1)	Feb 26 § 3.1: Implicit Differentiation (2)	Feb 27 § 3.2: Derivatives of Logarithmic Functions	Mar 1 § 3.3: Derivatives of Exponential & Inverse Trig Functions
Spring Break			
Mar 11 § 3.4: Related Rates (1)	Mar 12 § 3.4: Related Rates (2)	Mar 13 § 3.5: Local Linear Approximation	Mar 15 **Exam 2**
Mar 18 § 3.6: L'Hôpital's Rule; Indeterminate Forms (1)	Mar 19 § 3.6: L'Hôpital's Rule; Indeterminate Forms (2)	Mar 20 § 3.6: L'Hôpital's Rule; Indeterminate Forms (3)	Mar 22 § 4.1: Increase, Decrease, Concavity
Mar 25 § 4.2: Relative Extrema, Graphing Polynomials (1)	Mar 26 § 4.2: Relative Extrema, Graphing Polynomials (2)	Mar 27 § 4.3: Rational Functions (1)	Mar 29 § 4.3: Rational Functions (2)
Apr 1 § 4.4: Absolute Extrema	Apr 2 Advising day	Apr 3 § 4.5: Applied Max/Min Problems (1)	Apr 5 § 4.5: Applied Max/Min Problems (2)
Apr 8 § 4.6: Rectilinear Motion	Apr 9 § 4.7: Newton's Method	Apr 10 **Exam 3**	Apr 12 *Last day to withdraw* § 5.1: An Overview of the Area Problem
Apr 15 § 5.2: The Indefinite Integral (1)	Apr 16 § 5.2: The Indefinite Integral (2)	Apr 17 § 5.3: Integration by Substitution (1)	Apr 19 No Class: Easter Break
Apr 22 No Class: Easter Break	Apr 23 § 5.3: Integration by Substitution (2)	Apr 24 § 5.5: The Definite Integral	Apr 26 § 5.6: The Fundamental Theorem of Calculus
Apr 29 § 5.9: Evaluating Definite Integrals by Substitution (1)	Apr 30 § 5.9: Evaluating Definite Integrals by Substitution (2)	May 1 § 5.9: Evaluating Definite Integrals by Substitution (3)	May 3 **Exam 4**
		Wednesday May 8th	**Final Exam 1:00 - 3:00**

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Section	Exercises
Day One	→ Carefully RE-READ and UNDERSTAND the Syllabus ←
§ 0.1: Functions	1-3, 7, 9(a, d, e), 15, 16, 23, 25, 29, 31
§ 0.2: New Functions from Old	3, 5, 7, 10, 15, 29, 35, 41, 47, 53-56(just the diff quotient), 61, 63
§ 0.3: Families of Functions	1, 5(parameterized in x_0), 11, 15, 17, 19, 29, 31, 33(a, b) & Chapter Review: 1, 2, 11, 20
§ 0.4: Inverse Functions	1, 3, 5, 7, 10, 11, 14, 29, 38, 39, 41, 58
§ 0.5: Exp & Log Functions	1, 5, 6, 9, 10, 11, 13, 15, 16, 22, 23, 30, 32, 50, 57
§ 1.1: Limits, An Intuitive Approach (1)	1, 3, 5, 7, 9, 11, 17-20, 21
§ 1.1: Limits, An Intuitive Approach (2)	6, 8, 10, 23, 25, 26, 31
§ 1.2: Computing Limits (1)	1, 3-17(odd), 29, 32, 37, 41
§ 1.2: Computing Limits (2)	2, 6, 10, 16, 19, 21, 25, 31, 40
§ 1.3: Limits at Infinity (1)	1, 3, 5, 9, 15-25(odd), 33, 37
§ 1.3: Limits at Infinity (2) § 1.5: Continuity (1)	4, 27, 29, 32, 35, 39 1, 3, 11, 13, 17, 21, 29, 35(a, b)
§ 1.5: Continuity (2)	5, 7, 19, 31, 44, 45, 47
§ 1.6: Limits of Trig Functions (1)	1, 4, 12, 14, 17, 19, 21, 23, 27, 28, 31, 33, 37, 38, 49, 67
§ 1.6: Limits of Trig Functions (2)	6, 7, 24, 30, 32, 35, 40, 65 & Chapter 1 Review: 8, 10, 11, 15, 16
§ 2.1: Rates of Change § 2.2: The Derivative (1)	3, 11-14, 23, 24 1, 7-10, 13, 15(use defn 2.2.1), 21, 23, 25(a, c), 34
§ 2.2: The Derivative (2)	2, 3, 6, 14, 20(use defn 2.2.1), 29
Exam 1	
§ 2.3: Techniques of Differentiation	3, 5, 6, 7, 9-15(odd), 16, 18, 20, 23, 29, 37, 38, 39, 43, 45, 46
§ 2.4: The Product and Quotient Rules	1, 5, 7, 8, 11, 14, 15, 21, 23, 27, 29, 31, 33, 39
§ 2.5: Derivatives of Trig Functions	1, 5, 8, 11, 15, 17, 21, 24, 25(a, b), 27, 31, 43(a, c)
§ 2.6: The Chain Rule (1)	5, 9, 11, 15, 21, 23, 24, 27, 29, 35, 37, 45, 51, 75
§ 2.6: The Chain Rule (2)	20, 22, 26, 28, 39, 40, 49, 53, 56, 69, 77
§ 3.1: Implicit Differentiation (1)	1, 5, 9, 11, 13, 16, 17, 27
§ 3.1: Implicit Differentiation (2)	1, 5, 9, 11, 13, 16, 17, 27
§ 3.2: Derivatives of Log Functions	1, 3, 4, 7, 9, 10, 19, 21, 23, 27, 30, 35, 37, 41
§ 3.3: Derivatives of Exponential	15, 17, 18, 19, 23, 25, 43, 47, 50, 52, 54, 65, 72
§ 3.4: Related Rates (1)	1, 3, 5, 12, 15, 17, 22, 30, 37, 43

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Section	Exercises
§ 3.4: Related Rates (2)	4, 7, 18, 25, 27, 32, 33, 39 (use radians for any angles)
§ 3.5: Local Linear Approximation	3, 7, 9, 23, 25, 29, 31(angle is in degrees, you must convert; $(x - x_0)$), 32, 43
Exam 2	
§ 3.6: L'Hôpital's Rule (1)	2, 7 - 11, 13, 16, 19, 23, 25, 47, 57, 59
§ 3.6: L'Hôpital's Rule (2)	20, 27, 29, 32, 33, 36, 38, 58(a,c), 60
§ 3.6: L'Hôpital's Rule (3)	12, 17, 21, 26, 28, 43, 44
§ 4.1: Increase, Decrease, Concavity	1, 3, 5, 6, 7, 9, 15, 23, 25, 31, 39
§ 4.2: Relative Extrema (1)	5, 7, 9, 11, 19, 21-24, 27, 31, 37, 41, 43, 45, 53(x=5 is one zero)
§ 4.2: Relative Extrema (2)	29, 33, 47, 57
§ 4.3: Rational Functions (1)	3, 5, 25, 31, 33, 47
§ 4.3: Rational Functions (2)	11, 32, 35, 49, 65
§ 4.4: Absolute Extrema	1, 3, 9, 11, 12, 23, 31, 32, 33, 43
§ 4.5: Applied Max/Min Problems (1)	3, 5, 14, 19, 21, 23, 24, 26
§ 4.5: Applied Max/Min Problems (2)	22, 27, 29, 31, 33, 55, 58
§ 4.6: Rectilinear Motion	4, 13, 17(a, b, c), 19(a,b,c), 33
Exam 3	
§ 4.7: Newton's Method	3, 7, 9, 12(1 soln, use $x_1 = 1$), 17(2 solns, use $x_1 = -0.5$, and $x_1 = 1.4$)
§ 5.1: The Area Problem	7, 9 (just work n=2, 5; then setup n=10); 13, 15, 17
§ 5.2: The Indefinite Integral (1)	2, 5, 13, 17, 19, 25, 31, 32, 33, 43, 53 [check your answers by differentiating]
§ 5.2: The Indefinite Integral (2)	14, 17, 27, 29, 35, 46, 54, 69
§ 5.3: Integration by Substitution (1)	3, 11, 15, 25, 29, 33, 34, 39, 47, 49, 53, 55, 70, 71 [check your answers by differentiating]
§ 5.3: Integration by Substitution (2)	27, 35, 36, 37, 45, 54, 56, 72
§ 5.5: The Definite Integral	13, 15, 20, 22-24, 27, 33, 37
§ 5.6: Fundamental Theorem of Calculus	15, 17, 20, 21, 24, 26, 29, 59, 63
§ 5.9: Definite Integrals by Substitution (1)	5, 10, 15, 20, 22, 31, 33, 35, 41, 44, 45, 49, 53
§ 5.9: Definite Integrals by Substitution (2)	16, 17, 32, 34, 36, 40, 43, 50
§ 5.9: Definite Integrals by Substitution (3)	37, 42, 46, 48
Exam 4	