Marshall University
MTH 229H: Calculus 1 Honors (CT)

Semester and Year	Fall 2018
Course Title	Calculus 1 Honors
Course Number	MTH 229H
Section Number	101
CRN	3038
Days and Time	Monday, Wednesday : 2:00pm – 2:50pm Tuesday, Thursday : 2:00pm – 3:15pm
Location	WAEC 3119
Credit Hours	5
Prerequisites	ACT Math 27

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Office Hours	Mon, Wed: 12:30 - 1:30pm and Tues, Thurs: 9:30 - 11:30am other hours by appointment

University Policies

By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy by going to

http://www.marshall.edu/academic-affairs/policies/

Academic Dishonesty, Excused Absence Policy for Undergraduates, Computing Services Acceptable Use, Inclement Weather, Dead Week, Students with Disabilities, Academic Dismissal, Academic Forgiveness, Academic Probation and Suspension, Affirmative Action, and Sexual Harassment.

Course Description

MTH 229H - Calculus with Analytic Geometry I (Honors) (CT) An introduction to calculus and analytic geometry for honors students, emphasizing critical thinking. Limits, derivatives, and integrals of the elementary functions of one variable, including transcendental functions. 5 hours.

About this course

Math 229H is an introductory calculus course. The course teaches the fundamental concepts of calculus – limits, derivatives, and integrals – and their applications.

This honors course will also have a strong focus on verbal communication and on the underlying concepts of calculus, in addition to symbolic computation. This is an honors course, but that does not mean it is a more “theoretical" course. Instead, this course will focus on giving you a deeper understanding of the concepts of calculus.

There is no expectation that you have taken calculus already. If you have taken a calculus course in high school, you will probably find that this class is quite different. Besides a different grading system, the focus will be different than a typical high school calculus course. We will focus on interpreting and communicating the concepts of calculus just as much as we focus on computational skills. This may seem unfamiliar at first, but it will help you master the course material more deeply and develop critical thinking skills that will help you in more advanced classes in all subjects.

Math 229H is designated as a critical thinking (CT) course. You will receive 5 hours of CT credit towards your core curriculum. Every section of Math 229 and Math 229H is a CT course.

Topics

Calculus is a collection of techniques for understanding and analyzing changing quantities: changing position, changing velocity, changing force, changing density, changing population size etc. The topics of this course can be broken into four main parts.

Modeling Representing real-world situations via tables, graphs, symbolic formulas, and verbal expressions allows us to to analyze these situations mathematically.

Limits Limits measure the place where an object is projected to be at a particular time, or the value that a function that a is projected to have at a particular point, based on where it is at other times or on its values at other points.

Derivatives Derivatives measure the rate of change of a changing quantity. They have many applications for understanding how changing quantities behave and where their maximum and minimum values occur. Derivatives also allow us to express the behavior of changing functions via differential equations.

Integrals In algebra, we learn that if an object moves with constant speed, then the distance traveled is the speed multiplied by the change in time. Integrals allow us to solve similar problems when the speed is not constant. They also allow us to compute the areas of complicated regions and the mass of objects with non-constant density. Integrals have a central role in probability and statistics, as well.

Student Learning Outcomes

- Students will evaluate limits, derivatives, and integrals symbolically.
- Students will approximate limits, derivatives, and definite integrals from tabular and graphical data.
- Students will state and explain the definitions of limits, derivatives, and integrals; apply these definitions to test properties of these concepts; and produce verbal arguments and examples showing that basic properties hold or do not hold.
- Students will apply the techniques of calculus to answer questions about the analytic geometry of functions, including vertical and horizontal asymptotes, tangent lines, local extrema, and global extrema.
- Students will explain verbally the meaning of limits, derivatives, and integrals in their own words, both in general terms and in the context of specific problems.
- Students will select or construct an appropriate function to model an applied situation for which calculus is applicable, based on a verbal description of the situation.
- Students will apply techniques of calculus to solve applied problems from fields such as engineering and the sciences.
- Students will interpret symbolic and numerical results in real-world terms, and analyze the validity of their results in a real-world setting.
- Students will develop and enhance writing skills and strategies.

Each outcome will be practiced via discussions, low-stakes writing, team homework, on-line homework, in-class activities.

Each outcome will be assessed via course problems.

Requirements

Textbook *Calculus: Early Transcendentals*, eighth edition, by James Stewart.
ISBN: 978-1-285-74155-0.

You do not need to bring your textbook to class.

A copy of the textbook is available for short-term borrowing at the front desk of Drinko Library.

Computer access You must have consistent internet access. You should check MU Online and your official MU email account frequently for announcements. Web homework and practice problems will be given on the site:

http://webwork.marshall.edu

Calculator You will need to have a non-graphing scientific calculator for the course. Among the calculators that are permitted are the Casio fx-115 series and the Texas Instruments TI-36X series. Inexpensive modern scientific calculators such as these have 2-line displays, and I recommend them over older calculators with one-line displays. I will make the final decision about whether any particular device is allowed during a testing situation.

Graphing calculators, phones, tablets, laptops, smart watches, and cellular or networked devices are not permitted during testing situations. You are welcome to use these devices outside of testing situations, as well as software such as Mathematica and Wolfram Alpha.

Writing materials You should bring your calculator, paper, and a pen or pencil to every class meeting.

Assignments

This course will use a form of standards based grading. Sixty percent of your grade will be based on completing a predetermined set of Course Problems. The remainder of the grade will come from team homework and from low-stakes writing.

Course problems

These are a collection of 22 problems, each of which relates to a particular collection of calculus skills. There are many versions of each problem that cover the same skills at a comparable level of difficulty. The full list of problem descriptions is at the end of this syllabus.

- As shown on the course schedule, there will be eight Problem Opportunity Days, seven in class and the final exam. The final exam period is also an opportunity to complete Course Problems.
- On each Problem Opportunity Day, you will be given a set of problems, each of which is a version of a Course Problem. More Course Problems will be given as the semester progresses. In general, Course Problems will begin to appear after they have been discussed in class.
- Course Problems will be graded based on successful completion. There is no partial credit, but I will give feedback on your attempted solutions. To receive credit, each solution must be at what would normally be an “A" level.
- Once you complete a Course Problem successfully, you have credit for it for the rest of the semester, and you do not need to attempt it again. You should choose which problems to solve on each Problem Opportunity Day so that you have credit on as many as possible by the end of the semester.
- If you have credit for all the Course Problems, you must still attend class and complete the other assignments, but you no longer need to attend on Problem Opportunity Days.
- Your grade on the Course Problems will be the percentage of Course Problems for which you have credit at the end of the semester. For example, if you have credit for 18 out of 22 problems, your course problem grade will be 82%. Your course problems grade is one of three components of your final letter grade.

On each Problem Opportunity Day, you can do as few or as many problems as you like. To stay on track, you need to successfully complete an average of 3 problems each Problem Opportunity Day. There will be time to attempt more problems than that, so you will have the ability to attempt many problems more than once. You can attempt each problem up to three times during in-class Problem Opportunity Days. All problems can be attempted on the Final Exam. There is no penalty for incorrect answers, but you must earn credit on problems to contribute towards your course grade.

Team homework

These assignments will require you to work with a team of other students to provide an in-depth, written analysis of three to four problems. There will be six Team Homework assignments during the semester, as shown in the course schedule. Partial credit will be given on team homework assignments. The team homework system in this course is modeled on the one used for calculus at the University of Michigan.

Low-stakes writing

These assignments ask you to write a short response to a given question. Their goal is simply for you to think about the question and say something reasonable. The term “low-stakes" means that full credit is given for any response that shows engagement with the question. These problems will be posted on MUOnline and answered outside of class.

On-line practice problems

Online practice problems will be provided using the WebWork system at http://webwork.marshall.edu/. These problems consist of one problem set for each section of the text. Each problem set has its own due date after we discuss the section in class. If you earn credit on 90% of the WebWork problems, I will give you a credit of one course problem.

MUOnline upload

You will be required to upload one of your team homework assignments to the MUOnline system. The university uses these uploads to assess the general education curriculum (CT) and the Writing Across the Curriculum program (WI).

Final exam

The final exam period will be Thursday, December 13, from 12:45pm to 2:45pm. This is the final Problem Opportunity Day. All Course Problems can be attempted. If you have credit on all the Course Problems, you are not required to come during the final exam period.

Attendance policy

I expect you to attend each class, with the same standards for absences you would use for a professional job. I will record attendance each day. If you need to be absent from class, you should contact me promptly – before the absence, except in case of emergency, just as with a professional job. I will excuse absences that are covered by the university’s excused absence policy. I may ask for documentation for repeated absences.

Because there are numerous Problem Opportunity Days, and none on its own can lower your grade, there will be no make ups for single, isolated absences on these days. Lengthy or repeated absences, which always require documentation, will be handled on a case by case basis.

Team homework is a group assignment, so one member's absence will not prevent the assignment from being submitted. Because there are numerous team homework assignments, no make up assignments will be given for them. Team members can ordinarily participate with an assignment even if they cannot attend on the day it is due. If a team member is unable to participate on a particular team assignment due to a lengthy documented absence, that team homework assignment will not be counted toward the student's grade.

In cases of extremely prolonged excused absences, special accommodations will be made. In some cases, a large number of absences may lead me to recommend withdrawal from the course.

Grading Policy

Your final grade in the course will be a weighted average of your low-stakes writing grade, your average team homework grade, and the percentage of course problems that you complete successfully.

Course problems 60%
Team homework 35%
Low-stakes writing 5%

Percentage ranges for final grades are as follows:

A = 90-100% B = 80-89% C = 70-79% D = 60-69% F = 0-59%

Academic honesty policy

Plagiarism of any kind is not permitted. Students who plagiarize on an assignment will receive a zero for that assignment, and the university-wide plagiarism policy will be followed. Repeated or especially serious violations may lead to a failing course grade or suspension from the university.

On team homework assignments, I expect you to work with your group, and you may ask me questions. If you work with anyone else on a problem – another student, a tutor, a parent, etc. – you need to indicate this on the problem, naming the individual.

Team homework assignments are expected to be your team's original work. Copying material from the internet, or asking others on the internet to solve the problems for you, goes against the spirit of the assignment, and will result in strict penalties. You must clearly attribute any sources that were consulted, and you must not plagiarize from other sources. Although it is not likely to be necessary very often, you should use quotation marks for direct quotes just as you would in any other kind of writing.

Other assignments, including low stakes writing and exams, are expected to be your own original

work. You may only use aids that are explicitly authorized by the instructor, such as permitted calculators.

Tentative Course Schedule

Week	**Dates**	Monday	Tuesday	Wednesday	Thursday
1	Aug 20 - 23	1.1	1.2, 1.3	writing	1.5
2	Aug 27 - 30	1.4, 1.5	2.1	POD 1	2.2
3	Sept 3 - 6	No Class	2.3	2.5	Team HW1
4	Sept 10 - 13	POD 2	2.6	Trig Limits	Inter Val Thm
5	Sept 17 - 20	2.7	3.10	2.8, 3.1	Team HW2
6	Sept 24 - 27	POD 3	3.2	3.7, 3.8	Higher Derivs
7	Oct 1 - 4	3.3	3.4	3.5	Team HW3
8	Oct 8 - 11	3.6	POD 4	3.9	3.9
9	Oct 15 - 18	4.1	writing	4.3	Team HW4
10	Oct 22 - 25	4.4	4.5	4.7	POD 5
11	Oct 29 - Nov 1	4.7	4.8	5.1	Team HW5
12	Nov 5 - 8	5.2	4.9	5.3	5.3
13	Nov 12 - 15	POD 6	5.4	5.5	Team HW6
	Nov 19 - 22				
14	Nov 26 - 29	Review	5.5	Integral Error	4.2
15	Dec 3 - 6	POD 7	2.4	2.4	TBD
16	Dec 10 - 14				12:45 - 2:45

University Schedule

The complete university schedule can be found at

http://www.marshall.edu/academic-calendar/fall-semester-2018/

Course Problems

This section of the syllabus gives a brief description of each of the 22 course problems. Problems marked (WI) require writing at least part of the answer in sentence form.

Modeling and Limits

1. (WI) Use graphical, tabular, and symbolic expressions of functions to interpret their behavior verbally. Distinguish between different families of functions.
2. Use graphical, tabular, and symbolic expressions of functions to compute function values, including transformations, compositions, and inverse functions.
3. Set up equations to model linear, quadratic, exponential, and logarithmic functions based on graphical, tabular, and verbal descriptions.
4. Set up the equations of motion for a rotating object such as a Ferris wheel, using trigonometric functions.
5. (WI) Explain the concepts of limits and continuity verbally, both in general terms and in the context of specific situations.
6. Compute algebraic and trigonometric limits using limit laws.
7. (WI) Compute limits at infinity algebraically and using L'Hopital's rule. Interpret your answers in concrete language, using units as appropriate.

Derivatives and applications

8. (WI) Explain the concept of derivatives verbally, both in general and in the context of specific situations.
9. (WI) Use linearization to estimate values of a function from the derivative, and to estimate values of the derivative from the function. Interpret the results in concrete language, using units as appropriate.
10. Approximate derivatives from graphical and tabular representations of functions.
11. Compute derivatives symbolically using the basic derivative rules, the product rule, and the quotient rule.
12. Compute derivatives using the chain rule and using implicit differentiation.
13. (WI) Use derivatives to reason about the shape of the graph of a function, and use the shape of the graph to reason about derivatives, using both graphical and tabular representations of the function. Explain your results in concrete language, using units as appropriate.
14. (WI) Use the method of related rates to compute derivatives in applied problems. Interpret your results in concrete terms, including units as appropriate.
15. Use the derivatives of a function, along with the first and/or second derivative test, to classify the behavior of a function at critical points and at the ends of the domain.

16. Solve applied optimization problems by:
    - Setting up an appropriate objective function
    - Identifying the domain
    - Using the method of critical points on the interior of the domain
    - Examine the endpoints of the domain, or compute the necessary limits to determine the end behavior of the objective function.

Integrals and applications

17. (WI) Explain the concept and definition of a definite integral, and use the definition to find the area of simple geometrical regions.
18. Use rectangular and trapezoidal approximations to estimate the value of definite integrals.
19. Compute straightforward integrals, both definite and indefinite, by guessing the appropriate antiderivative.
20. Compute definite and indefinite integrals using the substitution method.
21. (WI) Use integration to compute the net change in a function. Interpret your results in concrete terms, using units as appropriate.
22. (WI) Use the integration error formulas to analyze definite integrals, and justify your analysis verbally.