MAT 162 Calculus with Analytical Geometry II

Syllabus **Dr. R.L. Herman** **Spring 2019**

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Course Content:

Required Text: *Calculus: Early Transcendentals*, 8th edition, by Stewart (2016).

We will cover chapters 7-11 and 17 in the text. In this course we will extend the notions of the derivative and the integral to cover applications beyond the first course. We will begin with a review and then look at techniques of integration. One of the biggest applications of calculus is to modeling real world phenomena as differential equations, which will be the third topic of study. We will end the course with investigations into other tools, such parametric equations, conic sections, and sequences and series.

Course Philosophy:

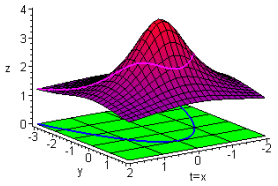
"The teaching of calculus ought to have as one of its major aims the total psychological grasp by the student of the processes, techniques, and ideas that will enable him [her] to do something with what he [she] has learned ..." [R. Weinstock, American Journal of Physics 31 108-112 (1963)]

Most students leave the traditional calculus sequence with very little sense as to the role that calculus plays in the modern world. Calculus is useful in the social sciences, as well as the biological and physical sciences. Optimization is a key to efficiency in the business world. However, it is not enough to just tell you these things; you must experience them. It is hoped that you will leave this course with the perception that calculus is useful, exciting, and alive in the modern world.

In this class you will be expected to learn calculus at three different levels: Applications, Basics, and Computation. These ABC's of the course will be covered through the completion of labs and regular homework problems.

This is thesecond course in the calculus sequence. Hopefully this will be the most interesting of the sequence. As you have seen in your previous calculus class you will often be called upon to use all of the mathematics, which you have learned up to this point: algebra, trigonometry, geometry, differentiation and integration. You will be asked to solve application problems, which can be just as challenging as the calculus concepts.

Success in calculus stems from working at it. Nobody can do well in this course if they just sit passively and watch the instructor scribble some equations on the board. You need to attend every class, pay attention, ask questions, talk to other students and keep up by reading the text and working problems before coming to class. You should plan to study the material at least two hours outside of class for every hour that you are in class.



Calculus does entail a few rules; however, there is no way that you can come away with any understanding of the subject, unless you can see how it is used in the real world. As technology has become more abundant in our society, it seems fitting that preparation for the twenty-first century should entail the use of computers. You will be exposed to some technology to sharpen your skills in critical thinking. However, you still need to be able to manipulate algebraic expressions by hand in order to fully internalize the material you are learning.

At the same time, you need to develop communication skills, especially in science and mathematics. Some of the grammatical rules for writing in mathematics are unfamiliar to students. With the abundance of word processors on the market today, professional reports are much easier to prepare. In this course you will have the opportunity to improve your communication skills by writing reports.

A diabolical new testing technique: math essay questions.

Student Learning Outcomes:

Upon completing MAT 162, students should be able to:

- use graphical, numerical, analytical and verbal representations of integrals, differential and parametric equations, sequences and infinite series (CR 1)
- use correct mathematical syntax to explain solutions in both written and graphic forms (CR 1, 4)
- use technology to help solve problems, experiment, interpret results, and verify and communicate conclusions (CR 3, 4)
- use techniques of integration and differential equations to solve problems involving two or more STEM disciplines (CR 2, 3, 4)
- demonstrate understanding of the properties of conic sections and other curves in polar and parametric form
- demonstrate understanding of convergence properties of sequences and series
- model real-world problems using the concepts of calculus (CR 1, 2, 3, 4)
- analyze and articulate the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement. (CR 3, 4)

Group Work:

In this course you will work with other students to complete a task. In most cases these will be labs. For many of you group work will be a new experience. In order to make this experience both productive and enjoyable, we offer the following suggestions:

- Start the project/lab as soon as it is assigned. Do not put it off until the last minute. Some assignments take time and groups may have scheduling difficulties.
- Read over the entire assignment, carefully before discussing or completing any part of it.
- Initially, you may have no idea as to how to get started. Don't panic! Discuss the lab with the group and generate some ideas.
- Group work is not always as straightforward as standard homework assignments. You may need to make some assumptions and later justify these assumptions, indicating how they affect your results.
- The final report should be thoughtful, well-written and neatly organized. It should summarize your approach to the problem, present your results and conclusions, and be furnished with full explanations.
- If you have investigated the project/lab as far as possible and still have questions, or there is a need for clarification of some point, then discuss them with your instructor before writing the report.

Course Requirements:

Homework: Homework assignments will be collected on a regular basis and you will be told when the work is due. There will be a penalty of 10% for each class that it is late. As doing homework is very important for learning the material in this course, it will count as 30% of your grade.

Labs/Projects: Labs and projects will be an integral part of this course. You will use computers as tools for data acquisition, analysis, and exploration. You will report your findings in a format consisting of short lab reports. This part of the course will count 10% of the grade.

Attendance: YOU ARE EXPECTED TO ATTEND ALL OF THE CLASSES! After five excused absences there will be a penalty of 1% for each absence from your total grade.

Exams and Grades: There will be four fifty minute exams and a final for this course. The exams will cover the basic material in the text. There will be no makeup exams without prior permission. The **tentative dates of the exams** and chapters covered are

Exam	Chapter	Date
1	7-8	Feb 8
2	9, 17	Feb 27
3	10	Mar 25
4	11	Apr 24
Final	7-11, 17	May 6, 8:00 AM

Your final grade will be based on the following

Hour Exams	40%
Homework	30%
Labs/Projects	10%
Final	20%

90-100	A
80-89.5	B
70-79.5	C
60-69.5	D

In some cases, borderline grades may be modified by a plus, or a minus, if the instructor determines that such grades are earned.

Web Pages/Email:

This syllabus as well as a variety of other relevant information for this class will be posted on the Internet. You are encouraged to log onto this page at least weekly and send me email. The pages can be found at the following web site:

people.uncw.edu/hermanr/mat162

You can email me for hints to homework questions, after working on them. I will try to get back to you with an answer and may post the hints at the web site. Watch for additions, changes, and announcements for the class.

Advice for Success:

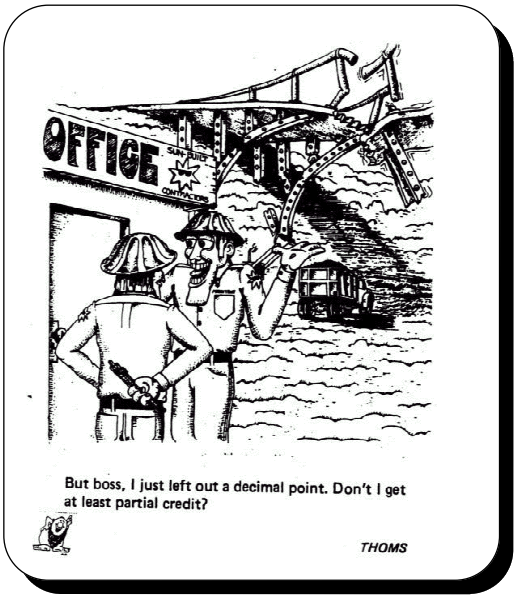
In order to learn the material in this course and earn a good grade, you need to put in some effort. Do not put off assignments or reading. If you do not understand something, ask the instructor. Come to office hours, use the email, ask knowledgeable students, or go to the library/internet and find supplementary material. The instructor can only cover the basics in class. You are not expected to know the material by only listening to the lectures. You need to work problems and think about what you are doing. **You are expected to spend a minimum of two hours outside class for every hour you are in class.**

Academic Honor Code Students are expected to adhere to the UNCW Honor code found at http://www.uncw.edu/odos/honorcode/. In particular, you will become familiar with what plagiarism is, as this is one from of academic dishonesty which is covered by the code.

Student DisabilitiesUNCW Disability Services supplies information about disability law, documentation procedures and accommodations that can be found at http://uncw.edu/disability/. To obtain accommodations the student should first contact Disability Services and present their documentation to the coordinator for review and verification.

Campus Respect CompactUNCW has a Respect Compact to affirm our commitment to a civil community, characterized by mutual respect. That Compact is affixed to the wall of each classroom and can be accessed at: http://uncw.edu/diversity/documents/ApprovedSeahawkRespectCompact8x10.08.09.pdf .

THIS SYLLABUS IS SUBJECT TO CHANGE!



First Homework Assignments*:

#	Sec.	Pg	Problems	Due
1		267	1 2 3 8 25 33 45 56	1/17
		422	3 8 11 14 18 20 24 27 33	
2	7.1	476	3 4 7 9 14 18 27 33 38 56	1/22
	7.2	484	1 4 7 10 19 20 24 43 46 47	
3	7.3	491	1 2 4 6 11 12 32 34	1/25
	7.4	501	1 7 9 12 19 22 39 54 58 60	
4	7.5	507	1 2 9 18 24 38	1/30
	7.6	512	6 12 14 18 39 42	
	7.7	524	3 7 29 33	
5	7.8	534	5 6 11 14 21 25 62	2/04
	8.1	548	1 5 6 10 14 33 42	
6	8.2	555	5 7 9 14 15 27 31	2/07
	8.3	565	1 23 25 29	

*** More problems are posted at the web site.**

Learning takes place outside the classroom.

Calculus Review

Differentiation

$$
\begin{aligned}
f'(x) &= \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}\\
(cf(x))' &= cf'(x)\\
(f(x)+g(x))' &= f'(x)+g'(x)\\
(f(x)g(x))' &= f'(x)g(x)+f(x)g'(x)\\
\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) &= \frac{f'(x)g(x)-f(x)g'(x)}{[g(x)]^2}\\
\frac{d}{dx}\left(f(g(x))\right) &= f'(g(x))g'(x)
\end{aligned}
$$

Derivatives

Function	Derivative
a	0
x^n	nx^{n-1}
$\sqrt{x}$	$\frac{1}{2\sqrt{x}}$
e^{ax}	ae^{ax}
$\ln ax$	$\frac{1}{x}$
$\sin ax$	$a\cos ax$
$\cos ax$	$-a\sin ax$
$\tan ax$	$a\sec^2 ax$
$\csc ax$	$-a\csc ax\cot ax$
$\sec ax$	$a\sec ax\tan ax$
$\cot ax$	$-a\csc^2 ax$
$\sinh ax$	$a\cosh ax$
$\cosh ax$	$a\sinh ax$
$\tanh ax$	$a\operatorname{sech}^2 ax$
$\operatorname{csch} ax$	$-a\operatorname{csch} ax\coth ax$
$\operatorname{sech} ax$	$-a\operatorname{sech} ax\tanh ax$
$\coth ax$	$-a\operatorname{csch}^2 ax$

Integration

$$\int cf(x)\,dx = c\int f(x)\,dx$$

$$\int f(x)+g(x)\,dx = \int f(x)\,dx + \int g(x)\,dx$$

$$\int_a^b f(x)\,dx = F(b)-F(a) \text{ for } f(x)=F'(x) \text{ cont. on } [a,b]$$

Integrals

Function	Indefinite Integral
a	ax
x^n	$\frac{x^{n+1}}{n+1}$
e^x	e^x
$\frac{1}{x}$	$\ln x$
$\sin x$	$-\cos x$
$\cos x$	$\sin x$
$\tan x$	$\ln\lvert\sec x\rvert$
$\cot x$	$\ln\lvert\sin x\rvert$
$\sec x$	$\ln\lvert\sec x+\tan x\rvert$
$\sec^2 x$	$\tan x$
$\sinh x$	$\cosh x$
$\cosh x$	$\sinh x$
$\operatorname{sech}^2 x$	$\tanh x$
$\frac{1}{a+bx}$	$\frac{1}{b}\ln(a+bx)$
$\frac{1}{1+x^2}$	$\tan^{-1} x$
$\frac{1}{\sqrt{1-x^2}}$	$\sin^{-1} x$
$\frac{1}{x\sqrt{x^2-1}}$	$\sec^{-1} x$

Hyperbolic Functions

$$
\begin{aligned}
\sinh x &= \frac{e^x-e^{-x}}{2}\\
\cosh x &= \frac{e^x+e^{-x}}{2}\\
\tanh x &= \frac{\sinh x}{\cosh x}=\frac{e^x-e^{-x}}{e^x+e^{-x}},\\
\operatorname{sech} x &= \frac{1}{\cosh x}=\frac{2}{e^x+e^{-x}},\\
\operatorname{csch} x &= \frac{1}{\sinh x}=\frac{2}{e^x-e^{-x}},\\
\coth x &= \frac{1}{\tanh x}=\frac{e^x+e^{-x}}{e^x-e^{-x}}.\\
\sinh^{-1} x &= \ln\left(x+\sqrt{1+x^2}\right),\\
\cosh^{-1} x &= \ln\left(x+\sqrt{x^2-1}\right),\\
\tanh^{-1} x &= \frac{1}{2}\ln\frac{1+x}{1-x}.
\end{aligned}
$$

Trigonometric Identities

$$
\begin{aligned}
\sin^2\theta+\cos^2\theta &= 1\\
\tan^2\theta+1 &= \sec^2\theta\\
1+\cot^2\theta &= \csc^2\theta\\
\sin(A\pm B) &= \sin A\cos B\pm\sin B\cos A,\\
\cos(A\pm B) &= \cos A\cos B\mp\sin A\sin B.\\
\sin(2A) &= 2\sin A\cos B\\
\cos(2A) &= \cos^2 A-\sin^2 A\\
\sin^2 A &= \frac{1-\cos 2A}{2},\\
\cos^2 A &= \frac{1+\cos 2A}{2}.\\
\sin A\cos B &= \frac{1}{2}(\sin(A+B)+\sin(A-B)).\\
\cos A\cos B &= \frac{1}{2}(\cos(A+B)+\cos(A-B))\\
\sin A\sin B &= \frac{1}{2}(\cos(A-B)-\cos(A+B))
\end{aligned}
$$

Special Values

θ	$\cos\theta$	$\sin\theta$	$\tan\theta$
0	1	0	0
$\frac{\pi}{6}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{3}$
$\frac{\pi}{3}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\sqrt{3}$
$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1
$\frac{\pi}{2}$	0	1	undefined

Hyperbolic Identities

$$
\begin{aligned}
\cosh^2 x-\sinh^2 x &= 1\\
\tanh^2 x+\operatorname{sech}^2 x &= 1\\
\cosh(A\pm B) &= \cosh A\cosh B\pm\sinh A\sinh B\\
\sinh(A\pm B) &= \sinh A\cosh B\pm\sinh B\cosh A\ (1)\\
\cosh 2x &= \cosh^2 x+\sinh^2 x\\
\sinh 2x &= 2\sinh x\cosh x\\
\cosh^2 x &= \frac{1}{2}(1+\cosh 2x)\\
\sinh^2 x &= \frac{1}{2}(\cosh 2x-1)
\end{aligned}
$$