Math 109: Calculus 1

Spring 2015

instructor:	landon rabern
email:	`lrabern@fandm.edu`
class webpage:	`bit.ly/calculus2015`
class meetings:	9:00 AM–9:50 AM MWF in STA 217 (lecture / group work)
	1:15 PM–2:05 PM T in HAC 412 (working problems)
office hours:	10:00 AM–10:50 AM MWF in STA 108
textbook:	*Calculus, Concepts and Contexts 4E*, by James Stewart

What is this class about?

You are driving your car down a lonely highway and out of pure boredom you start thinking about how far you have traveled and how long it has taken. You remember that semi an hour back that cut you off and made you let up on the gas, how much of your time did that waste? What about all the other times you have braked or accelerated? We can answer any such question by playing with functions. Say $d(t)$ is the distance you have traveled after t hours where $t = 0$ is when you got on the highway. Say $s(t)$ is the value on your speedometer at time t in miles per hour. When $s(t)$ is small (when you are driving slow) $d(t)$ increases more slowly and when $s(t)$ is large (when you are driving fast) $d(t)$ increases more quickly. So, to answer your original questions, what we need is a better understanding of the relationship between $d(t)$ and $s(t)$. This relationship is precisely what *Calculus* is about. We study a procedure for determining $s(t)$ given $d(t)$ similarly to how your speedometer works (computing your average speed over a short period of time); in fancy math words, this procedure is called *differentiation* and the function s is the *derivative* of the function d. We study this procedure for arbitrary functions. This might seem much more general, but if you move your foot just right on the gas pedal (and perhaps shift into reverse), you can make $d(t)$ any function you like. So, in reality, the whole course is just about driving your car.

The procedure for getting $d(t)$ given $s(t)$ is the main topic of Calculus 2, we will see a little of this at the end of the course. The idea is that if we add up our speed over time, we get how far we have traveled. Again switching to fancy math words, this adding up procedure is called *integration* and the function d is the *integral* of the function s. Differentiation and integration are inverses of each other. If we have $s(t)$ and apply our integration procedure,

we get $d(t)$. If we then apply our differentiation procedure we get $s(t)$ back. That the procedures "add speeds up" and "take average speed over short time period" are inverses of each other is The Fundamental Theorem of Calculus.

Homework

> I can only show you the door. You're the one that has to walk through it.

To achieve fluency in this subject, you will need to immerse yourself in the material. Working tons of problems is a great way to do this. How many problems? My recommendation would be to work problems of a given type until they become easy for you.

I will put a list of practice problems for each class period on the class webpage. These will not be collected. Each Wednesday, I will select a couple of the more interesting problems and assign them—due the following Wednesday. These will be graded both for correctness and clarity of exposition.

Quizzes

> Pop quiz, hotshot.

There will be tiny quizzes at random times throughout the course. I will set the random number generator so that the expected number of quizzes is 10. Quizzes are intended to reinforce basic concepts as well as encourage attendance. Unlike exams, quizzes will be closed-book. Your lowest three quiz scores will be dropped.

Exams

There will be two in-class exams and then a final exam during finals week. The purpose of the exams is to test your understanding of, and ability to reason about, the mathematical concepts. Since you can use your textbook as well as any other written material, no memorization is required; however, these exams occur in a finite time period, so rapid recall of facts will serve you well. All electronic devices should be stowed in your bag for the duration of the exam and any brain implants should be turned off.

Graded work breakdown

what	%	when
homework	20	weekly
quizzes	10	random times
in-class exam #1	15	Friday, February 13th
in-class exam #2	25	Friday, March 13th
final exam	30	TBA, in finals week

Help

If you need help or just want to know more about something, please come to my scheduled office hours or set up another time to meet. In addition to my office hours, there are several undergraduate mathematics teaching assistants who hold regular hours.

Attendance

Please be advised that Math Department and F&M policy state that penalties (including grade reduction and/or dismissal from the course) may be assessed for excessive, unexcused absences.

Tentative Schedule

Monday	Wednesday	Friday
Jan 12th	14th **1** 1.1, 1.2 review	16th **2** 1.3 review
19th Martin Luther King Day	21st **3** 2.1 tangents and velocity	23rd **4** 2.2 limits
26th **5** 2.3 limit laws	28th **6** 2.4 continuity	30th **7** 2.5 infinite limits
Feb 2nd **8** 2.6 rates of change	4th **9** 2.7 derivatives	6th **10** 2.8 what does the derivative tell us?
9th **11** exam #1 review	11th **12** exam #1 review	13th **13** **in-class exam #1**
16th **14** 3.1 derivatives of polynomials	18th **15** 1.5, 3.1 derivatives of exponentials	20th **16** 3.2 product and quotient rule

Monday	Wednesday	Friday
23rd **17** 3.3, Appendix C derivatives of trig functions	25th **18** 3.4 chain rule	27th **19** 3.5 implicit differentiation
Mar 2nd **20** 1.6, 3.6 derivatives of inverse trig functions	4th **21** 3.7 derivatives of logarithms	6th **22** Taylor series, imaginary numbers, and magic
9th **23** exam #2 review	11th **24** exam #2 review	13th **25** **in-class exam #2**
16th Spring Break	18th Spring Break	20th Spring Break
23rd **26** 4.2, 4.3 max and min values	25th **27** 4.2, 4.3 max and min values	27th **28** 4.2, 4.3 max and min values
30th **29** 4.6 optimization	Apr 1st **30** 4.6 optimization	3rd **31** 4.6 optimization
6th **32** 4.8 antiderivatives	8th **33** 5.1 areas and distances	10th **34** 5.2 definite integrals
13th **35** 5.2 definite integrals	15th **36** 5.3 evaluating definite integrals	17th **37** 5.3 evaluating definite integrals
20th **38** final exam review	22nd **39** final exam review	24th Reading Day
27th Reading Day	29th Finals week	May 1st Finals week