Mathematics 1260—AP Calculus II

SYLLABUS - VERSION 5 - please discard all earlier versions!

Week	Date	Lecture	Topic	Textbook	Assignment
1	T 01/19/21	1	Introduction and technicalities, Review of 1250		hw1 op.
1	W 01/20/21	2	3-space	11.1	
1	F 01/22/21	3	Vectors	11.2	
2	M 01/25/21	4	The Dot Product	11.3	hw2 op.
2	T 01/26/21	5	The Cross Product	11.4	
2	W 01/27/21	6	Vector Valued Functions	11.5	
2	F 01/29/21	7	Lines and Tangents	11.6	hw1 cl.
3	M 02/01/21	8	Curvature and Acceleration	11.7	hw3 op.
3	T 02/02/21	9	Surfaces	11.8	
3	W 02/03/21	10	Cylindrical and Spherical Coordinates	11.9	
3	F 02/05/21	11	Ungraded Practice Exam on Chapter 11		hw2 cl.
4	M 02/08/21	12	Functions of several variables	12.1	hw4 op.
4	T 02/09/21	13	Partial Derivatives	12.2	
4	W 02/10/21	14	Limits and Continuity	12.3	
4	F 02/12/21	15	Review		hw3 cl.
5	M 02/15/21		**NO CLASS**		hw5 op.
5	T 02/16/21	16	Study Session		
5	W 02/17/21	17	Exam 1 on Chapter 11		
5	F 02/19/21	18	Differentiability	12.4	hw4 cl.
6	M 02/22/21	19	Directional Derivatives and Gradients	12.5	hw6 op.
6	T 02/23/21	20	The Chain Rule	12.6	
6	W 02/24/21	21	Tangent Planes and Approximation	12.7	
6	F 02/26/21	22	A primer on Taylor Series	9.8	hw5 cl.
7	M 03/01/21	23	Maxima and Minima	12.8	hw7 op.
7	T 03/02/21	24	Lagrange Multipliers	12.9	
7	W 03/03/21	25	Applications		
7	F 03/05/21		**NO CLASS**		hw6 cl.
8	M 03/08/21	26	Double and Multiple Integrals	13.1-2	hw8 op.
8	T 03/09/21	27	Non-rectangular Regions	13.3	
8	W 03/10/21	28	Double Integrals in Polar Coordinates	13.4	
8	F 03/12/21	29	Applications of Double Integrals	13.5	hw7 cl.
9	M 03/15/21	30	Review		hw9 op.
9	T 03/16/21	31	Study Session		
9	W 03/17/21	32	Exam 2 on Chapter 12		
9	F 03/19/21	33	Surface Area	13.6	hw8 cl.
10	M 03/22/21	34	Triple Integrals	13.7	hw10 op.
10	T 03/23/21	35	More triple integrals	13.8	
10	W 03/24/21	36	Change of variables	13.9	
10	F 03/26/21	37	Vector fields	14.1	hw9 cl.
11	M 03/29/21	38	Line Integrals	14.2	hw11 op.
11	T 03/30/21	39	Path Independence	14.3	
11	W 03/31/21	40	Green's Theorem	14.4	
11	F 04/02/21	41	More on Green's Theorem		hw10 cl.
12	M 04/05/21		**NO CLASS**		hw12 op.
12	T 04/06/21	42	More Vector Calculus	14.5-7	
12	W 04/07/21	43	Review		
12	F 04/09/21	44	Study Session		hw11 cl.
13	M 04/12/21	45	Exam 3 on Chapter 13		hw13 op.
13	T 04/13/21	46	Linear Homogeneous Differential Equations	15.1	
13	W 04/14/21	47	Nonhomogeneous Equations	15.2	
13	F 04/16/21	48	Applications	15.3	hw12 cl.

14	M 04/19/21	49	Review	hw14 op.
14	T 04/20/21	50	More Review	
14	W 04/21/21	51	Study Session	
14	F 04/23/21	52	Exam 4 on Chapter 14	hw13 cl.
15	M 04/26/21	53	Review	
15	T 04/27/21	54	Study Session, official end of classes	
15	W 04/28/21	55	optional Study Session, 10:30am	
15	F 04/30/21	56	optional Study Session, 10:30am	hw14 cl.
16	M 05/03/21	57	optional Study Session, 10:30am	
16	T 05/04/21	58	optional Study Session, 10:30am	
16	W 05/05/21	59	Final Exam, comprehensive, 10:30am-12:30pm	

Notes

Instructor: Peter Alfeld, pa@math.utah.edu.

Class Home Page: Most of the information for this class will be available only on Canvas. However, some information, specifically links to notes and this syllabus, will also be available on our home page:

`http://www.math.utah.edu/~pa/1260`

Course Information: Math 1260 is a 4 credit course. It is the second semester of our AP Calculus Sequence 1250-1260.

Prerequisite Information: Prerequisites: C or better in MATH 1250 OR AP Calculus BC score of at least 4.

Course Description: Completion of MATH 1260 is equivalent to completing the entire three-semester Calculus I, II, III sequence. Vectors in the plane and in 3-space, differential calculus in several variables, integration and its applications in several variables, vector fields, and line, surface and volume integrals. Green's and Stokes' Theorems.

Time and Place: Our class will meet

MTWF 10:45-11:35am on Zoom.

I expect everybody to come to class, and to know at every stage of the semester what we have so far discussed in class.

Study Sessions: We will also have several weekly study sessions to be scheduled after the semester starts.

Office Hours: I am planning to stay after class and answer questions. If you wish to talk with me privately you could either wait until everybody else's questions have been answered, or we can make an appointment.

Important Dates: First day of class: Tuesday, January 19. Last day to add this class without a permission code: Friday, January 22. Last day to delete this class (without being charged tuition): Friday, January 29. Last day to withdraw from this class: Friday, March 12. (If you withdraw, the class will show up as "W" on your transcript, it will not contribute to your GPA, and the University will charge you tuition.) Last day of classes: Tuesday, April 27.

Textbook: The textbook is the same as for Math 1250 (and also 1210-1220-2210): Varberg/Purcell, Calculus with differential equations, 9th edition, Prentice Hall, 2007, ISBN-10: 0132306336 or ISBN-13: 978-0132306331. There are various printed supporting materials for sale, but I don't recommend that you purchase any of those. We will cover chapters 11–15. You do need to have access to the textbook. We will follow it, and I will refer to it regularly.

Grading: Grading will be based on the following assignments:

Assignment	weight	total weight
hw 1–14	3% each	42%
4 midterm exams	8% each	32%
final exam	26%	26%
Total		100%

Fixed Scale: Grading is according to the following scale.

≥ 90%	≥ 85%	≥ 80%	≥ 75%	≥ 70%	≥ 65%	≥ 60%	≥ 55%	≥ 50%	≥ 45%	≥ 40%	**else**
A	**A−**	**B+**	**B**	**B−**	**C+**	**C**	**C−**	**D+**	**D**	**D−**	**E**

The fact that this scale is fixed means that you are not competing with your class mates. You won't get a worse grade only because somebody else is getting a better grade.

Class Notes: I prepare for class by writing notes before class. These will be online and you can look at them before class. They will contain gaps that we will fill in together, during class. I'll share my screen with you and you'll be able to see my writing as I complete the notes during class. Later that day I will put the annotated notes online.

The One Point Contest. I want this course to be perfect. Therefore, if you find a mathematical or factual error on any of the home work assignments, the exams or their solutions, or this syllabus, and you bring it to my attention before I can fix it I will add one percentage point to your overall score in this class. Depending on the significance of the error I may also notify the whole class and mention your name to them. I appreciate if you bring other errors, like misspellings or grammatical mistakes, to my attention, but there is no point for errors like that. The daily class notes, and the mathematical discussion during class, are developed on the fly and are not eligible for the contest. However, I do appreciate if you bring any error in those items to my attention as well, during or after class. So, clearly, to get an A in this course, you don't need to attend class, you don't have to do the home work, you don't need to participate in the exams or discussion sessions. All you have to do is find 90 mistakes that I make! Just kidding.

Home Work: The primary purpose of the home work assignments is to give you a guided opportunity to reinforce your understanding, and to hone and improve your skills. In this class you will receive personalized home work assignments that you do on the web at a time that's convenient for you. If you give the wrong answer your computer will tell you so, you can figure out what went wrong, and then you can try again. That way you will receive immediate feedback. The underlying software is called WeBWorK. You may already be familiar with WeBWorK, but if not it will be easy to learn. A new home work will open every Monday morning, one minute past midnight. It will close 12 days later on Fridays, 1 minute before midnight. Usually a home work will cover material from the few days before it opens, and the first day or two that it is open. The first home work is largely geared towards familiarizing yourself with WeBWorK and a review of Calculus I, and the last home work will provide a review of the whole semester. You should finish your work on each home work **before the next set opens** but if you fall behind you have a few days to catch up if necessary.

How to make the most of the home work: I recommend that you work on the home work problems soon after the set opens. Work the answers out carefully on paper, and then transfer them to WeBWorK. If the answer is a complicated expression you may find it useful to edit the expression in a text editor and then cut and paste it into WeBWorK. There will be many simple one step problems that require you to apply one of the new formulas we discussed in class. There will also be some more complicated problems that require several steps for their solution, and that make it necessary that you recognize those steps and their sequence. It is useful to work on both kinds of problems with class mates. I encourage you to find one or two class mates, form a study group, meet regularly online or perhaps in person, study together, and work on the home works together. Talk about the problem, how it fits with what we've discussed in class, and how to solve it. Explain to each other what at first you don't understand. All the problems require for their solution only that you understand the prerequisites for this class (AP Calc I, algebra, trigonometry, some basic facts, and common sense), but you may have to figure out how to put together these concepts in a way that you have not thought of before. Make sure you understand every step, and every aspect, of the solution. You may be able to get the correct answer in ways that will not help your understanding, for example by guessing an answer, asking someone for the answer, searching online for the answer, or getting the answer via some online facility. Avoid shortcuts that do not help your understanding of the subject and the answer of the specific problem. The main purpose of doing the home work is to build your skills and your mastery of the subject. It's nice to get the score, and see things turn green on your WeBWorK page, but that's all secondary!

Exams: Exams will be online, during our regular time slots, as listed. I will make a pdf file available via Canvas, you answer the questions on the pdf file, either by printing it and writing on it or by annotating it

on your computer, and you send me the pdf file. You'll get extra time for printing and uploading. If you have any computer issues let me know. We'll practice the process on February 5 when we'll have an ungraded practice exam on Math 1250. You will need to work the exams by yourself without the help of people or electronic devices (except that of course you may write on a table or laptop if you have that facility). Exams lag our Zoom discussions since they take place when the last home work covering them is in its final stages (i.e., it closes on the day of the exam). Exams take place on Fridays. (I'm hoping to be able to get the exams graded over the weekend so I can return them in a timely manner.) Before each exam we will have a review session and one or two question and answer session to prepare for the exam. After each exam you will receive a detailed answer set.

The **Final Exam** will cover the entire semester. Otherwise its format will be like that of the midterms: closed books and notes, and no calculator or other electronic devices. Final exams are scheduled by the University to avoid timing conflicts. Our final exam will be via Canvas on

Wednesday, May 5, 10:30am-12:30pm.

This is at the very end of the final exam period which gives us a whole week to prepare. I'll schedule additional question and answer sessions and you'll have an opportunity to consult with me privately before the exam as well.

Make ups: You should make every effort to participate in all exams. If you have to miss an exam for a legitimate reason, then talk to me, preferably before, but no later than one week after the exam. I will add the weight of what you missed to the weight of your final. Thus effectively you will get the same percentage on the missed exam as you will on the final. That's reasonable since the final is comprehensive. As far as the home works are concerned, since you will have a five day grace period for each homework, there will be no make-ups or deadline extensions for home works. Any make-up or substitute for the final exam will be an oral exam, and will be available only in exceptional circumstances. Note that exams are online, so you can take them anywhere.

All that being said, however, the University—and me in particular—recognize that the present circumstances are particularly difficult and challenging. If you find yourself in a particularly difficult situation talk to me and we'll figure out what we can do to help you make it through the semester.

Electronic Aids and online resources: I own several computers (and many calculators) and use them and many apps and software packages all the time. I also spend good amounts of time surfing and searching the internet. Nowadays we do have great computational problem solving aids. However, there are pitfalls. Suppose you prepare to climb a mountain and your training program calls for jogging around the block a few times every day. You'd defeat the purpose if you used your car to drive around the block, even though that appears easier at the moment. Calculators and computers are like cars, if overused they will reduce your mental fitness. The skills you will learn in this class will enable you to solve problems of a complexity and scope that will amaze and gratify you, and that are quite inaccessible to mere computations. To build up to these skills you'll be asked to do simple exercises that you could in fact do on a computer or calculator. This includes, for example, the symbolic computation of derivatives or integrals. But just getting the answer by entering some command in a computer would deprive you of an opportunity to learn. To avoid such distractions, and to encourage your deeper understanding of the subject, the exam problems will be set up so that you won't need a calculator or computer, and you'll have to do the exams without one. Your numerical answers should consist of simplified mathematical expressions. For example, write

$$\frac{2+\sqrt{2}}{3}$$

and just don't worry about the fact that rounded to 7 digits this expression happens to equal 1.138071.

Of course, you may use any tools you like, including calculators and computers, for your **homework**. However, to prepare for the exams you should use these facilities only if you really need to. In any case, you **always** want to think about a calculation before you reach for your calculator. If your answer is numerical you should estimate it mentally before calculating it.

Having said that, you do want to be aware of modern resources and be able to use them when appropriate. In particular you may wish to explore the languages *Maple*, *Matlab*, or *Mathematica*. The University has site licenses for each of these programs and you can use them for free as long as you are a member of our University.

Subject Matter: You have taken Math 1250, or an equivalent, and you know about limits, sequences, and series. You also know about derivatives and integrals, and the fact that one is the opposite of the other. You have seen how Calculus can be applied to a vast range of problems that would be very hard to solve without Calculus. The main part of this class will consist of redeveloping the kind of Calculus you are familiar with in the context of several, dependent or independent, variables.

Word Problems: Calculus was invented (more than 300 years ago) to solve word problems (particularly and specifically in physics). Educational systems everywhere in the world make you and millions of others take mathematics, and Calculus in particular, not because it builds character, but because it enables you in a general and a specific sense to solve problems outside of mathematics. Word problems usually aren't popular with students because they present an additional layer of difficulty: You have to penetrate the words to get to the mathematics. But learning how to solve word problems is the reason why you are here, and word problems will constitute a substantial part of the home works and exams. Overstating the matter only slightly, note that mathematics is the only subject where some problems are **not** word problems! Relevant information for specific problems will be given in class or with the problem. The most important ingredient in translating the words into mathematics will be common sense. I am hopeful that you will actually get *excited*, if you aren't already, about what you can do with the mathematics you will learn in this class.

Student Information: You may be curious to know what I know about you. The instructors in our department have access to the following information about the students registered in their classes: Name, preferred name (if entered in your CIS account), your student ID number, your contact info, and your photograph (to help us learn your names) on your University ID card. Most of us, and I in particular, do not have access to other parts of your University Record.

What it Takes

Taking any math class is a serious enterprise that requires your commitment, time, and energy. Obviously, we are all busy, and there are many competing claims to our attention, all of which are legitimate. It's not a moral problem if you don't have enough time to dedicate to this class. But it is a fact of life that understanding new mathematics takes a great deal of time and effort, and if you are not prepared to spend that time and effort you will not understand the mathematics. As a guide-line, when taking a math class on a subject you are not yet familiar with, you should count on spending about three hours out of class studying and doing homework, for every hour in class. So for this 4 unit class you should count on spending a total of about 16 hours per week, approximately and on average. Moreover, you should be able to spend that time in good sized chunks without distractions[−1−]. If you are unable to spend that kind of time during this semester, you are better off taking Calculus during another semester when you do have the time.

I'm not a math person. Many people feel they are intrinsically unable to learn mathematics. This feeling is usually sincere, but it's also irrational, a poor excuse, and unnecessarily self-limiting. You may not be able to make mathematics your career, but anybody can study mathematics successfully. If you follow the suggestions given here in the next few paragraphs you will succeed.

Make sure you have the prerequisites: Mathematics proceeds in a logical sequence, and you can't understand new mathematics if you don't understand what underlies it. For this class this means **you must understand the basic concepts covered in chapters 1 through 6 of our textbook: limits, derivatives, integrals, the Fundamental Theorem of Calculus, the differentiation and integration of polynomials and trigonometric functions, implicit differentiation, the product, quotient and chain rules, and some of the applications of derivatives and integrals.** A very brief initial review will be given in class during the first week. If you find that you do not understand these topics then you would be spending your time inefficiently and unproductively in this class, and you should go back and prepare yourself better for taking Calculus. If you have any doubts about your preparation for this class I'd be pleased to talk with you and make suggestions for your course of action.

[−1−] One of the most amazing conversations I ever had was with a student who stated that the only time she had to study was when she was stuck in traffic or stopped at a red light. She obviously had no idea about learning mathematics but she seemed sincere.

Make sure you do not fall behind: This is the most important suggestion in these pages! If you miss just one key idea now you will not properly understand what we are doing later, and your subsequent time and effort will be wasted. Saving two hours today may result in wasting days and weeks later. In particular, as described above, do the home works right after they open!

Come to class each time: I will keep reminding you of the big picture, point out what parts of the subject are crucial, explain the key ideas, and make suggestions for your study. If you have to miss class on occasion make sure you study the relevant section in the textbook and ask a friend or myself what happened in class. We will be following the textbook, but only in a general sense, the examples and the emphasis in class will often differ from the textbook.

Before attending class: read the relevant section of the textbook. Enabling you to do this is the main reason for giving you the tentative schedule at the beginning of this syllabus. You will receive updates if the schedule changes. Even if you spend as little as ten minutes on this task, and you don't understand everything at your prior reading, the discussion in class will be much clearer for you, and overall you will save time.

After attending class: make sure you understand what we did. Go over your notes, do examples, choose and work exercises (see below), think about the big picture, question assertions made in class or in the textbook, try different arguments to get the same result, check things for plausibility and consistency.

Team Work: One of the most effective ways to be successful in any math class is to meet with fellow students in the same class on a regular basis to study together, and to work on the home work together. Don't be shy to ask! Everybody in the class is in the same boat and has the same objectives as you. I will try to help facilitate your meeting other students in the class. It's OK if you and your partner or partners have different levels of experience or ability. One of you will benefit from explaining something and the other from having something explained again in a different way. Another benefit of forming a study group is that you will meet new people and learn new ways of looking at things, which is one of the most enjoyable and valuable parts of your experience as a student here.

More Help: Your first source of help should be your study group, Liz's and Scott's discussion sessions, and myself. I'll be pleased to talk with you via Zoom. If you have a question on a WeBWorK problem please use the "email instructor" button on the problem page. WeBWorK will give you a chance to ask your question, and send the question to me with a lot of additional information. In particular I will receive a link that will take me directly to your problem page and shows me exactly what you are seeing, including your past answers. You can also email me, Liz, or Scott with questions. Please send your query to just one of us, rather than all three of us. Liz and Scott may forward your query to me. You'll find that I usually answer my mail very quickly. Beyond that, the math department offers free tutoring. Usually this takes place in our Math Center which is located on President's Circle between JWB and LCB. However, because of the Pandemic these services are currently online. For more information consult

`http://www.math.utah.edu/ugrad/mathcenter.html`

You may also email Lisa Penfold, our Director of Student Services at penfold@math.utah.edu . The Associated Students of the University of Utah (ASUU) runs a learning center ,

`https://learningcenter.utah.edu/`

which offers several facilities, including free and paid tutoring.

Focus on understanding the subject rather than memorizing recipes for doing simple things. You understand a piece of mathematics if you can explain it in terms of simpler mathematics, you can make multiple logical connections between different facts and concepts, and you can figure out how to apply the mathematics you do understand to solve new problems, inside and outside of mathematics. Too much teaching of mathematics is directed towards memorizing and rehearsing the application of simple recipes to narrow classes of problems. Focusing on the underlying connections and learning how to figure things out is vastly more efficient and empowering than trying to memorize countless formulas.

Exercises: You can learn mathematics only by doing mathematics. In this class you will of course do many exercises in the context of WeBWorK, but you have to go beyond that. Which and how many additional

exercises you should do depends on your background, your current understanding, and your interests. Rather than giving you a list of exercises I believe you are better served by your picking the exercises yourself and me giving you just some general guidelines. The best way to find good exercises is to make them up yourself, but there are also a great many (more than 6,500) exercises in the book, ranging from very simple problems letting you practice just one specific technique to quite sophisticated and deep questions. But, don't hesitate to make up your own exercises! Ask yourself "what if ..." and see where it takes you. Follow these guide-lines:

- It's more useful to do a few involved exercises carefully and thoroughly than rushing through a large number of routine problems.
- Particularly useful are the "Concept Reviews" in the book where you are asked to respond with true or false. These aren't really "problems", rather they are statements designed to check and improve your understanding. In every section that we cover you should go through these and if it isn't obvious to you whether a statement is true or false then go back to your notes and the text and figure out the correct answer (and *why* it's correct).
- Regarding the other exercises you should be *able* to do any of them unless they call for some mathematics that we didn't cover, or there are some arcane details of a word problem that you are unfamiliar with.
- However, this does not mean you should do all of those problems. Instead, look over the problems. If it's obvious how to do a particular problem, and it's not otherwise interesting to you, skip it. If you are not sure, start the problem, and either finish it, or once it becomes clear what's happening, drop it. If you have no idea how to do a problem, and your difficulties are related to the math we are doing, then go back over your notes, talk with people, figure out what you are missing, and then return to the problem.

Simplify Your Problem: A major problem solving technique that is often ignored by students is simplification. You will not solve a difficult problem on the first attempt. When a problem seems hopeless, then simplify it until you reach a problem that's still related to the original problem but that you can solve. Then solve the simpler problem and use what you learned in the process for the solution of the more difficult problem. We'll see many applications of this idea in the course of the semester.

Always Check your Answers: Everybody makes mistakes, and you simply have to recognize this fact and guard against it. You should always check your answers. The answers to odd numbered problems are in the book, but that should not discourage you from working even numbered problems or making up your own[−2−]. You can check your answers by computing the same result in different ways, by checking for plausibility and consistency, or by using more specific techniques such as substituting in the original function or equation, checking integration by differentiation, drawing a graph, or making sure that physical units are consistent. (For example, if your analysis calls for adding two seconds to one square foot then something must have gone wrong.) One major checking technique deserves it own paragraph:

Always Have Expectations: Before you enter into any calculations think about what kind of answer you expect. When you are through compare your answer to your expectations. There are several possibilities. Your answer may meet your expectations. That's great, it will give you a warm and gratifying feeling, even though you may not have learned a lot. If the answer differs from your expectations then there are two possibilities: You may have made a mistake and you are now alerted to that fact, and you can figure out what went wrong. Or, and this is the more exciting, if perhaps less likely, case, there is something you misunderstood before you began work on this problem, and now you can improve and correct your understanding, and learn something new!

Hostile Testing: When checking your answers, to be effective in finding errors, apply what the air and space industry calls *hostile testing*[−3−]. This means that you approach your answer with the expectation that it's wrong and you try to prove that it is wrong. That way, if you fail, then maybe your answer is actually correct! Apply the same attitude to your textbook and to what your teacher tells you. (If you think I'm making a mistake in class, don't hesitate to speak up!) You are more likely to find errors, and you end up processing what you read or hear with a much higher degree of awareness and effectiveness.

How to take Exams: There is only one fundamental way to prepare for an exam: make sure you understand the material. Rather than worrying about what specific problems might or might not be on the

[−2−] If you are not sure of an answer to an even numbered problem, or one you made up, talk to me.

[−3−] This is not the testing we inflict upon our students!

exam, just make sure the mathematics covered by the exam make sense to you, following the suggestions above. If you understand the math you'll be able to handle anything that might appear on the exam. Here are some more suggestions specifically with respect to exams:

- **Cramming does not work**. That is particularly true in mathematics. Instead study steadily throughout the semester, and **relax** and do something fun the day or the night before the exam.
- Make sure you are ready for the exam well rested and with time to spare.
- When you actually receive the exam, relax, and read all the instructions and all the problems, **before** you start working on any of them.
- Then do those problems that are easy or obvious. Not only does that give you a good start but also it may teach you or remind you of something that's useful for the other problems. There is rarely a good reason to do the problems in exactly the sequence in which they appear on your piece of paper.
- If you get stuck put that problem aside and return to it after you are done with the more tractable problems.
- When you are through and there is time left, **don't leave!** Instead, check your answers and make sure they are correct. You've spent a lot of time and money getting to the stage where you are taking that exam, and a lot is riding on it. Being able to correct a mistake you made far outweighs the benefits of being able to spend 20 minutes more on whatever else you like to do.
- Even if you feel you don't understand a question, or several questions, at all, don't just leave. Write what you do understand and spend all the time you have available trying to figure out even those problems that appear hopeless.
- After the exam go over the answers (which you will receive as you walk out the door). The exam is not an end in itself, you are here to learn the subject, and reading and thinking about problems you have just wrestled with is extremely helpful in this process.

Study-Guide: Go to Google, type the phrase "understanding mathematics", and pick the first (non-Ad) item that you will see. This will resolve all your math issues.

Great Math Book: The book by Courant and Robbins: "What is Mathematics" (566 pages, 2nd edition, August 1996, Oxford Univ Press, ISBN: 0195105192) was first published in the 1940s. The book has been phenomenally successful and is still in print. It has turned on untold numbers of youngsters to mathematics (including myself some time ago). It's available as an inexpensive and highly recommended paperback.

Language: A necessary part of understanding mathematics is mastering the relevant language. Don't skip over words you don't understand fully. Instead, pause to make sure you know what they mean. I recommend that you keep an ordinary dictionary handy during your studies. You may also want to purchase a mathematical dictionary like the excellent and inexpensive Harper Collins Dictionary of Mathematics, ISBN 0064610195.

TEX: During this semester you will receive a number of handouts (like this syllabus, exams, answer sets) containing **typeset** mathematics. I'm using the TEX typesetting system which is a true work of genius[−4−]. You can use it yourself easily, and you may enjoy learning about it. There are two versions of TEX, the original, now called *plain TEX*, and a newer version called LATEX. I have a bias towards plain TEX, but you are probably better off learning LATEX. It is now used much more widely than plain TEX. To get going borrow or purchase the book "LATEX: A Document Preparation System", 2nd ed., by Leslie Lamport, the author of LATEX. The TEX and LATEX software is free, you can use it on most University systems, and you can download it to your PC or Mac.

The Keynote Speech for this class is given by Sir Isaac Newton who lived 1643–1727 and was one of two independent inventors[−5−] of Calculus.

[−4−] The genius is Computer Science Professor Don Knuth of Stanford University. Calling TEX a work of genius is controversial, I have also seen it called a "hideous hack". I believe in my opinion, but you will have to form your own.

[−5−] the other was Gottfried Leibniz, 1646–1716. Newton invented Calculus first, but Leibniz published his work

A Vulgar Mechanick can practice what he has been taught or seen done,
but if he is in an error he knows not how to find it out and correct it,
and if you put him out of his road, he is at a stand; Whereas he that
is able to reason nimbly and judiciously about figure, force and motion,
is never at rest till he gets over every rub.

Isaac Newton to Nathaniel Hawes, 25 May 1694

That's how they talked and wrote in the 17th century. Obviously, the vulgar mechanic or he that is able to reason nimbly and judiciously may be a woman or a girl. But the upshot is clear: You want to learn how to reason nimbly and judiciously, rather than turn into a vulgar mechanick!

Basic Principle: I used to write long explanations of the dire consequences of waiting too long to begin work on a project, but after many years I managed to condense those treatises into three words. Believe me:

Procrastination is Hazardous!

You are going to learn some powerful stuff, and hopefully you'll even have some fun in this class, but get going right away and make sure you stay on top of things!

first. The two of them were bitter enemies who fought viciously about who should get credit. Despite being perhaps the greatest mathematician in history, Newton in particular was not an easy man to get along with. In his later years he served as the director of the English Mint, and in that capacity proved one William Chaloner guilty of high treason for counterfeiting, and got him executed.

Official Matters

I agree with all of the following items, but they are provided by the University, not by me personally. Note that while I have no special qualifications or expertise outside of mathematics I am also available to speak with you about any of the issues listed below (or in fact any other issues). Don't hesitate to contact me if you think this may be useful.

- **The Americans with Disabilities Act:** The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, 801-581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access.
- **Addressing Sexual Misconduct:** Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veterans status or genetic information. If you or someone you know has been harassed or assaulted on the basis of your sex, including sexual orientation or gender identity/expression, you are encouraged to report it to the Universitys Title IX Coordinator; Director, Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or to the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to police, contact the Department of Public Safety, 801-585-2677(COPS).
- **Campus Safety:** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu
- **University Counseling Center:** The UCC staff is committed to supporting the mental health needs of our campus community, while mitigating COVID-19 risks in our department. As of Wednesday, March 18th, the UCC is providing all services as telephone and secure video conference appointments. Their phone number is 801-581-6826, Monday-Friday, 8:00am-5:00pm. For after-hours emergencies, contact the 24/7 Crisis Line: 801-587-3000 . More information is at https://counselingcenter.utah.edu/ .
- **Office of the Dean of Students:** The Office of the Dean of Students is dedicated to being a resource to students through support, advocacy, involvement, and accountability. It serves as a support for students facing challenges to their success as students, and assists with the interpretation of University policy and regulations. The Office of the Dean of Students is currently closed for in person meetings, but their staff are still available to help you. To contact the Office of the Dean of Students, please email deanofstudents@utah.edu or call 801-581-7066. There is more information at https://deanofstudents.utah.edu/ .