Mathematics 1210—23 Calculus I Spring 2024

SYLLABUS - VERSION 8 - please discard all earlier versions!

Week	Date	Lecture	Topic	Textbook	Assignment
1	M 01/08/24	1	Introduction		hw 1 op.
1	T 01/09/24	2	What is Calculus? And what can it be used for?		
1	W 01/10/24	3	Introduction to Limits	1.1	
1	F 01/12/24	4	Rigorous Study of Limits	1.2	
2	M 01/15/24		**NO CLASS**		hw 2 op.
2	T 01/16/24	5	Limit Theorems	1.3, 1.5	
2	W 01/17/24	6	Trigonometric Functions	0.7	
2	F 01/19/24	7	Limits Involving Trigonometric Functions	1.4	hw 3 op.
3	M 01/22/24	8	Continuity	1.6	hw 1 cl.
3	T 01/23/24	9	More on Continuity		
3	W 01/24/24	10	Average and Instantaneous Velocity	2.1	hw 2 cl.
3	F 01/26/24	11	Derivatives	2.2	
4	M 01/29/24	12	Differentiation Rules	2.3-4	hw 4 op.
4	T 01/30/24	13	The Chain Rule	2.5	
4	W 01/31/24	14	Review		hw 3 cl.
4	F 02/02/24	15	Exam 1 on Chapter 1		
5	M 02/05/24	16	More Differentiation		hw 5 op.
5	T 02/06/24	17	The Onion Method of Differentiation		
5	W 02/07/24	18	Higher Order Derivatives	2.6	hw 4 cl.
5	F 02/09/24	19	Implicit Differentiation	2.7	
6	M 02/12/24	20	More Implicit Differentiation		hw 6 op.
6	T 02/13/24	21	Related Rates	2.8	
6	W 02/14/24	22	More on Related Rates		hw 5 cl.
6	F 02/16/24	23	Differentials and Approximation	2.9	
7	M 02/19/24		**NO CLASS**		hw 7 op.
7	T 02/20/24	24	Maxima and Minima	3.1	
7	W 02/21/24	25	Monotonicity and Concavity	3.2	hw 6 cl.
7	F 02/23/24	26	Local and Global Extrema	3.3	
8	M 02/26/24	27	Applications	3.4	hw 8 op.
8	T 02/27/24	28	More Applications		
8	W 02/28/24	29	Review		hw 7 cl.
8	F 03/01/24	30	Exam 2 on Chapter 2		
9	M 03/04/24		**NO CLASS**		
9	T 03/05/24		**NO CLASS**		
9	W 03/06/24		**NO CLASS**		
9	F 03/08/24		**NO CLASS**		
10	M 03/11/24	31	Review and Discussion of Exam 2		hw 9 op.
10	T 03/12/24	32	Graphing Functions Using Calculus, MVT	3.5-6	
10	W 03/13/24	33	Solving Equations Numerically	3.7	hw 8 cl.
10	F 03/15/24	34	Antiderivatives	3.8	
11	M 03/18/24	35	Differential Equations	3.9	hw 10 op.
11	T 03/19/24	36	Introduction to Area	4.1	
11	W 03/20/24	37	The Definite Integral	4.2	hw 9 cl.
11	F 03/22/24	38	The Fundamental Theorem of Calculus	4.3	
12	M 03/25/24	39	More on the FToC	4.4	hw 11 op.
12	T 03/26/24	40	Yet more on the FToC		
12	W 03/27/24	41	The Mean Value Theorem for Integrals	4.5	hw 10 cl.
12	F 03/29/24	42	The Area of a Plane Region	5.1	
13	M 04/01/24	43	Volumes of Solids	5.2	hw 12 op.
13	T 04/02/24	44	Review		
13	W 04/03/24	45	More Review		hw 11 cl.
13	F 04/05/24	46	Exam 3 on Chapters 3 and 4		

14	M 04/08/24	47	More Volumes	5.3	hw 13 op.
14	T 04/09/24	48	Length of a Plane Curve	5.4	
14	W 04/10/24	49	Work	5.5	hw 12 cl.
14	F 04/12/24	50	Center of Mass	5.6	
15	M 04/15/24	51	Calculus of Exponential Functions (Preview)		hw 14 op.
15	T 04/16/24	52	Topic TBA		
15	W 04/17/24	53	Review		
15	F 04/19/24	54	Review		
16	M 04/22/24	55	Review		hw 13 cl.
16	T 04/23/24	56	Review, Classes end		
16	W 04/24/24	57	Reading Day		hw 14 cl.
16	F 04/26/24	58	no class, study session		
17	M 04/29/24	59	Comprehensive Final Exam, 10:30am-12:30pm		

Notes

General Course Information: Math 1210 Calculus I is a 4 credit course. It is the first semester of a three semester introduction (Math 1210-1220-2210) to Calculus.

Instructors:

Peter Alfeld: In these notes, first person pronouns like "I" or "me" refer to Peter Alfeld (since I wrote the bulk of this syllabus). You can usually find me in JWB 127 or JWB 236, and you can email me at pa@math.utah.edu. You may wonder how to address me. It makes me feel young when people of your age address me by my first name, and you are very welcome to do so. However, if you are more comfortable calling me professor or Mr. Alfeld, or just professor, that's fine too. Math professors do many things, but my favorite activity is teaching classes like this one to eager and ambitious students like yourselves! I am thrilled to be here!

Andy Liu: Andy is a 5th year PhD student who has taught Calculus several times before, so he is very familiar with teaching the material. Do not hesitate to bring up any questions with him during study sessions, through email, or through WeBWorK. He loves working with students who show excitement in the material and are active participants, so ask plenty of questions! We are very excited to work together to teach you all!

LAs: Our class is supported by Lab sessions that take place on Thursdays. The Lab sessions are conducted by Learning Assistants (LAs). You sign up for one of the lab sessions (Math 1210-024 through math 1210-030) and you are automatically enrolled in Math 1210-4. In each lab you will form groups and work through a set of problems with your group. One person in your group will upload your group's answers to Canvas. Part of the score for your lab work is based on attendance. The two lowest lab scores will be dropped. Each remaining lab score counts for 1% of your grade. All Labs take place on Thursdays. The LAs will regularly attend class so they know what's happening in class. They will also each hold two small group study/office hours where you can meet with them and have your questions answered.

Contact Info: Here is a table with our names, email, and office space (if available).

Name	Office	Email
Peter Alfeld	JWB 127	pa@math.utah.edu
Andy Liu	LCB 308	aliu@math.utah.edu
Liza Roberts		eliza.roberts@utah.edu
Mia Sheneman		u1470305@utah.edu
Alex Brett		u1298353@utah.edu

Working together: I will be responsible for design and running most of the lectures, writing and grading the exams, determining your grades, and holding weekly office hours. Andy will come to class at least once a week (and more during the first couple of weeks), he will hold three scheduled weekly study sessions for anybody who is interested, and he will respond to homework questions sent directly through WeBWorK (see below). He will also occasionally teach the class. He will not participate in the determination of your grade (so you can be completely frank when you talk with him). My office hours and Andy's study sessions will be scheduled after we poll your availability and interest. The LAs are your guides to working together during the Lab sections and they will also be available for consultations. A schedule of all events will be published on Canvas when

it becomes available, some time during the first week of the semester. All of us are also available for private consultations by appointments.

Schedule of Events: On our Canvas home page there is a link that takes you to a weekly schedule of events. These include 4 lectures, 3 study sessions, 8 office hours, and 7 labs. Make use of everything this class has to offer!

Course Contents: Here is a list of topics: Functions and their graphs, limits, differentiation of polynomial, rational and trigonometric functions, velocity and acceleration, geometric applications of the derivative, minimization and maximization problems, the indefinite integral, an introduction to differential equations, the definite integral and the Fundamental Theorem of Calculus, applications of integration. To whet your appetite: by the end of this course you will be able to figure out how fast you have to take off from earth to travel from here to infinity, and the following formula will make perfect sense to you:

$$\frac{\mathrm{d}}{\mathrm{d}x}\int_a^x f(t)\mathrm{d}t = f(x).$$

Recognizing the contents of this formula is one of the greatest accomplishments of the human species, no kidding!

Time and Place: Our class will meet MTWF 10:45-11:35am in JTB 310. **I expect everybody to come to class, and to know at every stage of the semester what we have so far discussed in class.** I will hold regular weekly office hours. Andy will hold three weekly study sessions where he will answer questions and re-explain class material from more perspectives. Lab sessions will take place on Thursdays, and LAs will hold weekly office hours. All available help sessions will start during the second week of the semester, and we will determine a suitable schedule during the first week of the semester. All or us are also available for individual meetings by appointment.

Office Hours: As mentioned above, I will schedule formal office hours during the first week of classes, after we find out more about your scheduling preferences. However, I am pretty accessible and you are welcome to just drop by my office (JWB 127 or 236) if you want to talk with me. Of course, I might not be there, or busy with somebody else. If you want to be sure I am available, or you need to make a special trip to see me, we can make an appointment. Email me, or talk with me briefly after class, and we'll set up a time and place.

Important Dates: Last day to delete this class (without being charged tuition): Friday, January 19, 2024. Last day to withdraw from this class: Friday, March 1, 2024. (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. Withdrawing after the deadline is much more difficult and requires an appeal to the Dean of your major.)

Textbook: The textbook **used for all of our Math1210/1220/2210 courses** is: Calculus, with Differential Equations, by Varberg, Purcell, and Rigdon, 9th edition published by Pearson. ISBN-10: 0132306336 — ISBN-13: 978-0132306331. For information on purchasing the textbook go to

https://www.math.utah.edu/resources/bookinfo.php

We will cover chapters 1–5. We will follow the textbook, and **you need to have a copy available for your study throughout the semester.**

Grading: Grading will be based on the following assignments:

Assignment	**weight**	**total weight**
Assessment Test	2%	2%
hw 1–14	2% each	28%
3 midterm exams	10% each	30%
Lab Scores	12%	12%
final exam	28%	28%
Total		100%

Fixed Scale: Grading is according to the following scale.

$\geq 90\%$	$\geq 85\%$	$\geq 80\%$	$\geq 75\%$	$\geq 70\%$	$\geq 65\%$	$\geq 60\%$	$\geq 55\%$	$\geq 50\%$	$\geq 45\%$	$\geq 40\%$	**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.

Study Sessions: Andy will hold three weekly study sessions where he will answers questions anyone might have and re-explain class material from different angles to help with your learning. This is your chance to see a different view, to have things explained in a different way, and to discuss things with Andy and your class mates.

The One Point Contest: I want this course to be perfect. Therefore, if you find a mathematical or factual error on any of the official materials (this syllabus, the homework assignments, the exams and their solutions), and bring it to my attention before I can fix it (by changing the online information or sending out an announcement) 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 (see the next point) are written and annotated specifically for this class, and do not qualify for the one point contest. The 1PC shows on Canvas as counting 100 points and zero percent. The number 100 is not meaningful, and the zero percent means your current 1PC score does not contribute to your overall percentage as currently shown on Canvas. I will make the appropriate adjustments only at the end of the course.

Class Notes: I prepare for class by writing notes before class. These will be published on Canvas and you can look at them before class. They will contain gaps that we will fill in together, during class. I plan to project those notes onto a screen and fill them in by writing on my computer. Later that day I will add the annotated versions of the notes to Canvas as well. The main purpose of making my notes available in this fashion is to enable you to pay full attention to our discussion without being distracted by having to take detailed notes yourself. However, otherwise these notes come without warranties expressed or implied. The notes may contain errors (that hopefully will be recognized and corrected in class), and I may deviate from them during class. In particular, these notes are not eligible for our one point contest.

Class Recordings: Our regular class meetings will usually be recorded and made available to the class. The recordings will show whatever is happened on my iPad, and there will be audio of of my voice. There will be no video of the classroom. Your questions and comments during class may be audible, but usually they will be too soft to be understood. The purpose of the recordings is to give you the opportunity to revisit our class discussion during your studies and work on the home works, and to watch the recording in the rare instances that you need to miss class. You should still come to class regularly. During class I will solicit feedback from the class, and answer questions from the class. Also, based on past experience, sometimes there are technical issues with the recording, or I might forget to start it. It is my intent to record each section, but there is no guarantee for any particular meeting that this will actually happen.

Assessment Test: Dr. Matt Cecil, the course coordinator for our Calculus sequence, will run a WeBWorK based self assessment test during the first week of the semester. You will get a 2% credit towards your final grade for participating in that test. It's purpose is to give you some information on your preparedness for this class. Details will be announced.

Homework: The primary purpose of the homework 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 homework 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 homework will open every Monday morning, one minute past midnight. It will usually close 10 days later on Wednesdays, 1 minute before midnight. Usually a homework will cover material from the few days before it opens, and the first day or two that it is open. The first homework is largely geared towards familiarizing yourself with WeBWorK and a review of Calculus I, and

the last homework will provide a review of the whole semester. Since students can join the class freely at any time during the first two weeks of the semester the first homework will be open longer than usual. Similarly, homework 13 will stay open a little longer since otherwise it could not cover the last few items in our subject matter. You should finish your work on each homework **before the next set opens** but if you fall behind you have a couple of days to catch up if necessary.

How to make the most of the homework: I recommend that you work on the homework 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 or techniques 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. Talk about the problem, how it fits what we've discussed, 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 (College Algebra, Trigonometry, some basic facts, and common sense) and what we have discussed so far in the class, but you may have to figure out how to put together these concepts in a way that you had 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 homework 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!

Midterm Exams: Exams will be written, during our regular classroom meetings, as listed. They will be closed books and notes, and no calculators or other electronic devices. You'll answer the questions on the exam itself and you'll receive a detailed solution set after each exam. Exams lag our classroom discussion since they take place when the last homework covering them has closed. 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 at least one review session.

Coordination: All but four of the midterm and final exam questions will be identical, or almost identical, to homework problems, and examples we have done in class. I may change the numbers involved, or simplify a problem before incorporating it in the exam, but you will greatly benefit from going carefully over our class notes, and making sure you understand the solution of each of the homework problems! The four exceptions are four questions on the final exam that are determined jointly by this semester's instructors of Math 1210 to help facilitate some assessment of how Math 1210 is working during this semester. Other than those four questions, all exams and homeworks for our class are unique to our section of Math 1210, and written by me with help from Andy and the LAs.

Final Exam: The final exam will be in our regular classroom on

Monday, April 29, 2024, 10:30am-12:30pm.

It will cover the entire semester, about evenly. There will be no special emphasis on topics not covered by the midterms. Otherwise the format of the final will be like that of the midterms: closed books and notes, and no calculator or other electronic devices. The last week of the semester will be dedicated to reviewing the whole semester, and Andy and I will run a couple of additional study sessions before the exam during final's week.

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. Any make-up or substitute for the final exam will be an oral exam, and will be available only in truly exceptional circumstances. If you miss an exam because you are away on official University business and these procedures do not meet your needs please talk with me. Concerning the home work assignments, consider that you have ten days for each homework, you can work on the homework anywhere where you have an internet connection, and you should be

done with each homework long before the deadline. Therefore, makeups or deadline extensions for homework assignments will be available only in exceptional circumstances.

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 homeworks and exams. 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.

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. 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 need to understand College Algebra and Trigonometry.

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 homeworks 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. A lot of the information in this class will be given verbally in class! If you have to miss class on occasion make sure you study the notes and 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 detailed schedule on the first two pages of this handout. Also read through the notes for the specific class. They are available on Canvas. 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.

During Class: Have the current class notes available in a form (either printed or on your computer) that let's you write your own notes on them. Focus on what I am saying, rather than on taking detailed notes

yourself. Keep in mind that everything I write on my computer will show up on Canvas later that day, you do not need to copy it. However, you can of course write brief notes of your own. Ours is a huge class, but I welcome questions during class. Feel free to speak up if there is something that does not make sense to you.

After attending class: Make sure you understand what we did during class. 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. A very effective technique consists of writing down a detailed summary of the work in your own words.

Team Work: In my experience, 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 homework together. Don't be shy to ask! Everybody in the class is in the same boat and has the same objectives as you. I can 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: We offer a free tutoring service (see the next item) and there are three optional study sessions each week. Also don't hesitate to contact Andy or myself by e-mail or in person. We'll be pleased to talk with you.

The **T Benny Rushing Mathematics Student Center** is located on the President's Circle between the Widtsoe and Cowles buildings (JWB and LCB). It offers very pleasant study space (right next to our library), free tutoring, and a computer lab. My office is just down the hall from the center. For information on facilities and hours of the center call our director of student services, Lisa Penfold, at 801-585-9478, send her an e-mail at penfold@math.utah.edu, or check out

`https://www.math.utah.edu/undergraduate/mathcenter.php`

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[−1−]. 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 a 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 most exciting, if perhaps least 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*[−2−]. 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 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 work steadily throughout the semester, and **relax** and do something fun the day or the night before the exam.
- Make sure you arrive 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 it may also 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.

[−1−] If you are not sure of an answer to an even numbered problem, or one you made up, talk to me.
[−2−] This is not the testing we inflict upon our students!

- 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 it blank. Write what you do understand, and when you are done with the easier problems spend all the time you have available trying to figure out 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 item (after the sponsored items) 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 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[−3−]. 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[−4−] of Calculus. You want to learn how to reason nimbly and judiciously, rather than turn into a vulgar mechanick:

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 or judiciously may be a woman or a girl.)

[−3−] 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.

[−4−] The other was Gottfried Leibniz, 1646-1716. Newton invented Calculus first, but Leibniz published his work 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.

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!

Additional Information

Student Data: 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 major, your status as freshman, sophomore, junior, or senior, and your photograph (to help us learn your names) on your University ID card. Apart from your scores in our class, we do not have access to other parts of your University Record.

Wellness Statement: Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a students ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at www.wellness.utah.edu or 801-581-7776. (Note: While I have no special expertise in these matters please don't hesitate to talk with me privately about your personal circumstances if you believe 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, https://disability.utah.edu/. 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, veteran's status or genetic information. If you or someone you know has been harassed or assaulted on the basis of your sex, office for equal opportunity and affirmative action including sexual orientation or gender identity/expression, you are encouraged to report it to the University's Title IX Coordinator; Director, Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, https://oeo.utah.edu/contact-us/index.php or to the Office of the Dean of Students, 270 Union Building, 801-581-7066, https://deanofstudents.utah.edu/. 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), https://police.utah.edu/.

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. Their phone number is 801-581-6826. Their hours are 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. 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/.