

MAT 127: Calculus C, Fall 2009

Midterm I Information

Wednesday, 10/07, 8:30-10:00pm

L01,L02: Earth&Space (ESS) Bldg 001

L03,L04: Old Chemistry Bldg 116

General Information

- (1) It is **essential** that you show up to the location for the section you are registered in. All locations have limited seating, the proctors will have a limited number of exams at each location, and if your exam gets mixed in with a different section, your exam grade may not be recorded. *You must bring your Stony Brook ID card to the exam.*
- (2) Please show up no later than 8:25pm. The exam will begin at 8:30pm and you will not receive extra time if you show up after 8:25pm.
- (3) Please take every other seat starting with the front row. Once a row fills up, please take a seat *directly* behind another person (not diagonally from another person). You can put your bag and/or jacket on one of the seats next to you in the same row.
- (4) Blank paper will be provided, in addition to an exam booklet (4 sheets stapled together). The exam booklet should have sufficient space for solutions, but you can staple additional pages to it as needed. If you do so, please write your name and ID number on each additional sheet and indicate in the exam booklet where to find your solution. Any scrap paper that you not want to be graded should not be handed in (except separately from the exams, for recycling).
- (5) No notes, books, calculators, or cell phones may be used during the exam. Please bring pencils/pens and an eraser. The *only* items that may be on your desk are pencils/pens, an eraser, your exam booklet, and the scrap paper provided by the proctors.
- (6) When you receive the exam, please do not open it until the proctors say it is time to start. However, please do fill in your name and Stony Brook ID number and circle your section number on the front cover of the exam. The exact front cover of the exam is at the end of this handout.
- (7) All problems on the exam should be stated unambiguously. If you feel there is an issue with a statement of a particular problem, please let a proctor know; however, the proctor will not confirm whether your interpretation of the problem is correct.
- (8) Out of fairness to others, please do not open your exam booklet ahead of time and stop working when the time is over. Your exam score will be reduced by 5 points per minute of either violation.
- (9) When you are finished with the exam or when the time is called (whichever comes first), please take it to the front along with your Stony Brook ID card. Put the exam in the pile for your section and sign the photo roster under your picture immediately after.

(10) You can leave before the time is over, but please do so as quietly as possible and close the door very gently.

Before Midterm I

Note that PS5 is due two days earlier than usual (except in L01). This will make it possible to post solutions to PS5 before noon on Wednesday, 10/07.

The midterm will cover Sections 7.1-7.5 from the textbook and the *Notes on Second-Order Linear Differential Equations*. You should re-read these sections thoroughly, review *Course Summary I*, and study the solutions to PS1-5 (even if you did all/most problems correctly). Make sure you can do all problem set exercises from the above six sections and some other related problems from the textbook and the notes, especially from pp551-552 (these do not cover second-order differential equations though).

The first midterms from Fall 05 and Spring 06 are available on the course website, along with solutions. Please try doing these midterms in 90 minutes (each) before looking at the solutions. If you do not do well on them, this should be a serious wake-up call for you. The first midterm in this class will be similar in many aspects to these midterms (especially the one from Spring 06), though there will be some differences and your midterm will be slightly harder overall than the midterm from Spring 06. While the Fall 05 midterm contains a mixing problem (which will not appear on your exam), instead of an Euler's method problem (which will appear on your exam), you should still be able to do the Fall 05 midterm.

A lot of you have at least a rough idea as to what has been happening in the course, but some of you have difficulty implementing this in practice. As it is the latter which is important (and evaluated on the exams), it is essential to be able to the textbook problems correctly. The only way to do this is to try to do as many of them as possible and at the very least make every effort to do the assigned exercises.

If you have any questions, please come to office hours (lots of them on Wednesdays!), MLC, and/or a Residential Tutoring Center. If you do not do well on the first midterm, it will be harder to do reasonably later.

After Midterm I

Detailed solutions to the midterm will be available on the course website on Thursday morning; please print these out before the following lecture. If the solutions do not satisfactorily explain how your solution to a particular problem was graded, please check with the primary grader for the given problem (the primary graders for all problems will be listed on the website). If your total exam score was incorrectly tallied, please let your instructor know.

If you do not do sufficiently well on the first midterm, you should quickly consider your choices:

- (1) drop down to MAT 126. This might be the best option, especially if you have not yet received credit for MAT 126. If you have received credit for MAT 126, you will not receive credit again, but you might be more prepared to take MAT 127 in the spring.

- (2) drop down to MAT 132. This is a risky option, but might be better in the long run if it works out. MAT 132 moves faster than MAT 127, but starts earlier. So you'd see most of Section 7 again, but then MAT 132 will fly quickly through Section 8.
- (3) withdraw from MAT 127. You'd receive a W on your transcript.
- (4) put much more effort into MAT 127 in order to do much better on the second midterm and the final. Depending on how poorly you do the midterm, your schedule outside of MAT 127, and your priorities, this may not necessarily be a realistic option.

The deadline for (1) and (2) is Friday, October 23, and for (3) is Monday, November 2, but you might be better off not procrastinating. The second midterm is on November 4 and so is too late to help with your decision. Of course, it would be best to avoid getting faced with one of these choices in the first place, so try to get ready for the first midterm as much as possible.

If you have any questions, please come to office hours (lots of them on Wednesdays!), MLC, and/or a Residential Tutoring Center. If you do not do well on the first midterm, it will be harder to do reasonably well later.

Background Material

You should be familiar with and know how to use the two FTCs, chain and product rules, integration-by-parts and change-of-variables formulas, and partial fractions. You may also encounter integrals like

$$\int xe^{rx} dx, \quad \int \frac{1}{x(x+1)} dx.$$

If you encounter an integral you cannot compute quickly, you may instead want to replace it by an anti-derivative and continue on, but be as specific as possible about your choices. For example, if you cannot compute the second integral above, you may want to write something like:

$$\text{for } x > 0, \text{ let } F(x) = \int_1^x \frac{du}{u(u+1)}.$$

You also need to be able to sketch graphs of standard functions, such as $\sin x$, e^x , as well as various modifications of these, such as $1 - 2e^{5x}$.

Types of Problems to Expect

The first midterm will have five problems, not necessarily of equal weight, with most problems sub-divided into parts of specified weight. Your midterm will be similar in many aspects to the first midterms in Fall 05 and Spring 06, but there will be some differences and your midterm will be slightly harder overall than the midterm in Spring 06. The list below should fairly accurately describe the problems that will appear on the exam; item (0) is a collection of fundamental concepts that will be spread out throughout the exam, instead of constituting a single problem. Items (1)-(5) below are listed in the order they have appeared in the course, which is not necessarily the order in which they will appear on the exam. The problems on the midterm will not state what type they are; this will be up to you to figure out. Some problems may require minor algebraic manipulations

to put them into the standard form for the type they are. For example a second-order differential equation may be written with some terms on RHS, or a first-order differential equation may become separable after moving some terms to RHS and factoring RHS. If you are asked to sketch anything, label the coordinate axes correctly; missing and incorrect labels will result in identical penalties. The problems on your midterm will be similar in style to the problems in the textbook and in *Notes on Second-Order Linear Differential Equations*, not to the letter problems on the problem sets; however, understanding solutions to the letter problems might be helpful.

- (0) *Fundamental Concepts*: verify a given function is a solution to a first- or second-order differential equation or initial-value problem; qualitative behavior of solutions of a first-order differential equation (constant solutions, increasing/decreasing, graphs); special properties of direction fields and solutions of autonomous equations. Examples: 7.1 1-12; 7.2 17,18; 7.CC 1,2; 7.TF 1-2,5.
- (1) Graphics question of one (or more) of the following forms: match solution curves or direction fields to differential equations; given a direction field, sketch solution curves with specified initial conditions; given a differential equation, sketch its direction field and/or some solution curves. Examples: 7.2 1-18, 7.CC 3; 7.RE 1-3a; Mif05 2; MIs06 4.
- (2) *Euler's method*: you will be asked to use Euler's method to estimate the value of the solution to an initial-value problem at some specified value of the independent variable greater than the initial value. Either the number of steps or the step size will be specified. You will need to show the intermediate steps and carry out the computations using simple fractions (so $5/4$, not 1.25). You also need to understand the geometric meaning of Euler's method (Figures 12-15 in 7.2). Examples: 7.2 19-24; 7.CC 6; 7.RE 3b, 4; MIs06 2.
- (3) *Separable equations*: find the general solution to a separable equation (or an equation that becomes separable after simple algebraic manipulations), without omitting the constant solutions; find the solution to an initial-value problem involving a separable equation. Examples: 7.3: 1-14, 17-22; 7.CC 5; 7.TF 3,4; 7.RE 5-8; Mif05 1; MIs06 5.
- (4) *Applications (of separable equations)*: find an equation of the curve of specified slopes or orthogonal trajectories to a family of curves; exponential growth/decay and logistic growth equations. Due to time constraints, a mixing problem will not appear on the first midterm, but may well appear on the final. You may choose to memorize the exponential growth and logistic growth equations (equations (2) on p525 and (4) on p539) and simply state them on the exam. If you follow this route, you must state the general form and specify what each of the symbols means before plugging in specific values, in order to receive full credit. Alternatively, you can obtain these formulas by re-solving the relevant separable equation. In either case, your final answer must have the correct physical units if appropriate. Examples: 7.3 15,16,23-26; 7.4 1-20; 7.5 1-8; 7.CC 6,7; 7.RE 9-16; Mif05 3; MIs06 1.
- (5) *Second-order linear differential equations*: find the general solution to a second-order homogeneous linear differential equation with constant coefficients (or an equation that becomes such after simple algebraic manipulations); find the solution to an initial-value problem involving such an equation. Examples: Notes 1-16; Mif05 5; MIs06 3.

Above 7.CC, 7.TF, 7.RE refer to the *Concept Check*, *True-False Quiz*, and *Review Exercises* at the end of Chapter 7; Mif05, MIs06, and Notes refer to the first midterms from Fall 05 and Spring 06 and to *Notes on Second-Order Linear Differential Equations* (all available from the course website).

MAT 127

Midterm I

October 7, 2009
8:30-10:00pm

Name: _____

ID: _____

Section: L01 L02 L03 L04 (circle yours)
 MWF 9:35-10:30am MW 5:20-6:45pm TuTh 2:20-3:40pm TuTh 5:20-6:40pm

DO NOT OPEN THIS EXAM YET

Instructions

- (1) This exam is closed-book and closed-notes; no calculators, no phones.
- (2) Please write legibly. Circle or box your final answers.
- (3) Show your work. Correct answers only will receive only partial credit.
- (4) Simplify your answers as much as possible.
- (5) Leave your answers in exact form (e.g. $\sqrt{2}$, not ≈ 1.4).
- (6) If you need more blank paper, ask a proctor.
- (7) Please write your name and ID number on any additional sheets you'd like to be graded and staple them to the back of the exam (stapler provided); indicate in the exam that the solution continues in the attached sheets.
- (8) Anything handed in will be graded; incorrect statements will be penalized even if they are in addition to complete and correct solutions. If you do not want something graded, please erase it or cross it out.

Out of fairness to others, please **stop working and close the exam as soon as the time is called**. A significant number of points will be taken off your exam score if you continue working after the time is called. You will be given a two-minute warning before the end.