

Read the following instructions carefully! It contains guidelines on handing in assignments for this course.

For solutions to all problem sets, please remember that when you are asked to find or calculate something you must justify that what you have found is correct and complete. You may certainly use results from your lecture to help in your justification. You are learning to present your results in a clear and convincing manner. Thus, you will be graded on your presentation and justification; we are not simply verifying whether you know the answer.

Present your solutions with complete sentences. Pretend the marker does **not** know how to solve the question. Before you start on your first assignment, read the handouts called “[How to Solve Problems](#)” and “[Writing Up Solutions](#)” from our course website.

Calculators Prohibited. Unless otherwise specified, do not use calculators in the problem sets. The questions are designed so that you can do all problems without a calculator; furthermore, this provides practice for your quizzes, term tests and final exam, where calculators are prohibited.

Required Information. The front page must include your name, student number, your tutorial code (which will be assigned to you when tutorial rooms are announced), and the name of your teaching assistant. *Failure to put your name and/or your student number will result in a zero in your assignment. Failure to put the name of your TA or your tutorial code will result in a 20% reduction of your assignment mark.* A cover page is not required as long as the necessary information is on the top of the first page.

Paper Size and Requirements. Assignments must be submitted on letter-sized (8.5×11 inch) paper. *Using ripped notebook paper is unacceptable and will result in a zero in your assignment mark.* Assignments that are more than one page in length must be stapled in the top left corner. *Failure to staple such assignments will result in a 20% reduction of your assignment mark.* Do not use clear plastic binders.

Submitting your assignment. You must hand your assignment to your instructor before the beginning of lecture, or deposit the assignment into the MAT 137Y Assignment Box located inside SS 1071. *The penalty for late assignments is zero for the assignment, regardless of the excuse. Assignments handed in after 6:10 p.m. on Thursday will not be accepted for any reason, even if it is one minute late!*

Policy on Plagiarism on Assignments. It is very helpful to have other students with whom to study, and we encourage you to work together. However, **it is extremely important that problem set solutions be written up independently, otherwise this constitutes plagiarism! Don't copy other people's work, and don't let others copy your work!** The teaching assistants will enforce this rule very strictly, and will apply severe penalties to any one in violation. In particular, the Department of Mathematics reminds all students that plagiarism, cheating, and all forms of academic misconduct will not be tolerated. Students in violation of the *Code of Student Conduct* will be dealt with severely by the Department of Mathematics and the Faculty of Arts & Science.

Supplementary Problems. A set of supplementary problems for this problem set is posted below, containing easier drill problems from the textbook by Salas, Hille, and Etgen (for which we will abbreviate as “SHE”) that you are expected to master. **Do not hand in the solutions to these problems.** Please do as many problems as time allows; the more practice you get, the better you will do on term tests and the final exam! Furthermore, *most of the quiz questions will be very similar to the supplementary problems.*

1. SHE 1.2: 23, 37, 39, 51, 53, 61, 63.
2. SHE 1.3: 5, 9, 13, 15, 19, 29, 35, 39, 53.
3. SHE 1.4: 5, 9, 15, 19, 23, 33, 37, 53.
4. SHE 1.5: 5, 9, 17, 23, 29, 43, 51.

Turn to the next page...

Required Problems. You are responsible for handing in solutions to all the problems below. Once again, SHE refers to the textbook by Salas, Hille, and Etgen (10th edition).

1. (i) SHE 1.3: 58.
(ii) SHE 1.4: 64.
(iii) SHE 1.5: 72.
2. Solve each of the following inequalities; give your answer in interval notation.
 - (i) $ax + b < c$, where a, b, c are all negative constants.
 - (ii) $x^4 + 2x^3 - 7x^2 - 8x + 12 < 0$.
 - (iii) $(x + 2)(2x - 3) < 1$.
 - (iv) $|\frac{2}{x} - 3| < 5$.
3. Suppose we define $\{x\}$ to be the distance from x to the nearest integer.
 - (a) Sketch the graph of $f(x) = \{x\}$.
 - (b) Sketch the graph of $g(x) = \{2x\}$.
 - (c) Sketch the graph of $h(x) = \{x\} + \frac{1}{2}\{2x\}$.
 - (d) Sketch the graph of all points (x, y) which satisfy $\{x\} + \{y\} = 1$.
 - (e) Sketch the graph of all points (x, y) which satisfy $|x| + |y| = 1$.

(Note: Whenever you see a question that asks you to sketch the graph, we are not asking you to plot as many points as possible and then connect the dots. Rather, we are asking you to figure out the sketch analytically, plotting as few points as possible. So, for example, in part (a), you may need to plot a few points to figure out how the function behaves, but you should then be able to provide an explanation of how the sketch of the entire function is derived.)

4. (a) Prove for all real numbers x and y that $2xy \leq x^2 + y^2$.
- (b) Let x_1, x_2, y_1, y_2 be arbitrary non-zero constants. Let

$$x = \frac{x_1}{\sqrt{x_1^2 + x_2^2}}, \quad y = \frac{y_1}{\sqrt{y_1^2 + y_2^2}}.$$

Show that

$$\frac{2x_1y_1}{\sqrt{x_1^2 + x_2^2}\sqrt{y_1^2 + y_2^2}} \leq \frac{x_1^2}{x_1^2 + x_2^2} + \frac{y_1^2}{y_1^2 + y_2^2}.$$

- (c) Derive a similar result to part (b), but this time with

$$x = \frac{x_2}{\sqrt{x_1^2 + x_2^2}}, \quad y = \frac{y_2}{\sqrt{y_1^2 + y_2^2}}.$$

- (d) Using the results of parts (b) and (c), prove that

$$x_1y_1 + x_2y_2 \leq \sqrt{x_1^2 + x_2^2}\sqrt{y_1^2 + y_2^2}.$$