

# HOMWORK GUIDELINES

## Munson, Math 900-3A, Summer 2004

We all know how frustrating it can be to listen to somebody's disconnected thoughts, follow incomprehensible lectures, or read a book whose neighboring sentences seem to have nothing to do with each other. Even a person with incredible intellect and originality of thought is rendered completely useless without the ability to communicate his or her ideas. All of this holds doubly true for communication of mathematics. Brilliant mathematicians can become burial grounds of great math because their papers are unreadable and lectures impossible to understand. But the same is true in reverse - great homework solutions, and even correctly solved exam problems, often receive a poor grade simply because the instructor cannot follow a student's reasoning and thus declares it incorrect. So let's focus on how you can help improve this interaction from your end. Most likely, the math you will be presenting to your instructor will be in the form of a written-up solution set for homework you were assigned. What follows, then, are some thoughts on what this bundle of papers should look like. But first, here are some reasons why you should keep reading:

- There is a larger picture here, believe it or not. Developing a habit of producing clear, clean, readable math requires understanding the problems first and thinking about how to solve them. Once you think you have the solutions, checking to see if they make sense is the next most important step (this step takes many forms, so I'll leave it vague). After you're sure they are correct (or after you found flaws in the logic, revised your thoughts, and even possibly realized that you actually didn't understand something), you should think about what to put down on paper and what form this should take. The very last step then is writing it all up in a way that allows the reader to focus on the content rather than on deciphering which problem is being done (often in sloppy handwriting, with arrows that point in indeterminate directions) or what the order of the loose pages might be. Poor explanations often mean poor understanding of the math so don't cheat yourself out of a chance to really figure out what's going on. But now take out the math part in the above and you'll see that it all applies to any situation where you're asked to think about something, write down your thoughts, and then let someone who is interested in what you have to say read it.

- Well, there is always that grade too. College professors who have been teaching the same calculus course for twenty years don't have much tolerance for unreadable homework (and who can blame them?). So why waste precious points on handwriting, skipping steps, not checking your work, excluding English entirely, and other easily avoided mathematical offenses? And besides, a good write-up will put you on a professor's good side in no time, even if your math is flawed, whereas perfect math and lousy exposition never will. Neatness and clarity show that you care, work hard, and, most importantly, have respect for the course, the subject matter, and the instructor.

- If you're still not convinced, think about yourself. Someday, say before an exam, you might want to go back to the homework you wrote a while ago and understand it. Final exams tend to be comprehensive, which means that you'll need to remind yourself of the work you did as much as three months earlier. Even worse, your major might require you to take a calculus course so you can learn the material which you will only need to use a couple of years later. So when you write the homework solutions, keep in mind that you might need all the details, written legibly, at some point down the road.

If you're willing to give it a shot, here are some suggestions:

0. Stick to the three basic rules:

1. Write using complete sentences.

2. Connect your ideas.
3. Write legibly

I will let you know which of the three you violate, and you will lose points for violating them. What follows is an elaboration and justification of these three rules, so you know what I mean, and you should read it carefully. Keep in mind that what makes sense to you doesn't necessarily make sense to others. The ability to do this at all times is at the very essence of what distinguishes the exceptional speakers and writers among us. They are the ones who always consider the audience, the ones who are able to step out of their own minds and into those of their listeners and readers. The skill of asking and answering the question Would this make sense to someone else? is acquired over a long time and after lots of hard work. It turns out that mathematics is a great place to develop this skill. Communication, after all, is simply a set of loose rules of logic, reasoning, and language. The problem is that there are too many of them, so no one knows them all, and no two people thus operate according to the same subset of these rules. Effective communication is the ability to either recognize exactly what set of rules a certain situation requires (which is often impossible to do) or to draw on as many rules as possible all the time, thus protecting yourself from appearing incoherent. This means that even if the logical jump from statement A to statement C might make perfect sense to you since you've gone through statement B in your head, it might not make sense to someone else because going through statement B didn't occur to this person. Good communication means remembering to mention the rules in between and consequently providing coherence to your thoughts as observed by others. Well, no other discipline relies more on following strict rules of logic and reasoning than mathematics. Furthermore, there are far fewer rules to worry about in solving a math problem than in most other situations in life. Once these rules are mastered, you will equip your mathematical thinking with a natural flow and logic and make it easily comprehensible to others. (Almost all the guidelines below actually fall under the umbrella of this one. You might want to think about that.)

1. Do not turn in the first draft. As a rule, first drafts are the sloppiest, most disorganized, most unreadable spills of our brain. That's why they're called first drafts, implying that there is something called a second draft. Amazingly, math homework rarely lives to see the second draft, but rather remains that incomprehensible initial brain goop all the way to the instructor's desk. While, at the same time, an English paper goes through several drafts before being typed, spellchecked, printed, and stapled. It doesn't make any sense at all. But the sloppiness of the first draft of a math homework is not as much of a problem as is the danger of it being filled with mistakes, often as simple as a forgotten minus sign or parenthesis, but sometimes showing a serious conceptual error. Proofreading and rewriting your work is the surest way to avoid such mistakes.

2. Use English. This is a big one. It's OK to use words in math. Actually, it's necessary to use words in math. A page of equations does not look impressive to a mathematician. On the contrary, a mathematician hates pages of equations, because he or she knows that it will be impossible to read them without the logical connectors that only the words can provide. You don't have to write essays explaining every step you make, but little pointers like now plug in..., now solve for..., from the graph we see that..., because..., and the answer is therefore..., make a world of difference. It will only take you a minute to incorporate a little English into your write-up and it will save the person grading your homework a lot of time and nerves (and when nerves go, so do points). The easiest way to incorporate this into your work is to make sure you are always writing complete sentences.

3. Write down all the steps. If you do, you will always get partial credit for problems on your homework, even if the final answer is wrong. The process of arriving at a solution is as important as the solution itself, and part of the grade is always reserved for evaluating the

logic that goes into this process. Consequently, you might get no credit, even if your answer is right, if you don't show the work. On the other hand, this is the guideline that you could benefit from the most: If the answer is incorrect, but you do supply all the steps, the person grading the homework can easily tell where you messed up, then point out what went wrong so you wouldn't do it again, and then decide exactly how much partial credit to give you.

#### 4. Practice neatness.

(a) Write legibly. The first prerequisite for reading is knowing which letters form which words, so it needs to be clear which letter that squiggle represents.

(b) Leave some space between the lines. The idea of homework, contrary to popular belief, is not to attach a number to your mathematical performance, but to help you absorb the material as painlessly as possible. The instructor's feedback on your progress is one of the most important parts of this interaction. A very simple but often overlooked technicality on this subject is that, well, you won't get any feedback if there's no room to write it anywhere.

(c) Staple the homework. Loose pages get shuffled and lost easily. A classic on the list of Stupid Ways to Lose Points.

(d) Mark what you're doing clearly. Label the problem, as well as the section and chapter it came from. Restate the question if it's not too long.

(e) Box in the answer, if it makes sense to do so. Even though you will get partial credit for incomplete work, getting to the right answer is still important. So make it look important.

(f) Put yours and your instructor's name in some visible place on the top page. Seems obvious, but you'd be surprised how many people forget to do it.