

## Writing Up Workshop Problems

One of the major tasks in first semester calculus at Rutgers is to develop the ability to present technical information in written form correctly and clearly. This document will attempt to explain *how* to do this (and will touch on *why* as well). The skills you learn in English 101 may also be helpful to you.

You will be graded on a scale of 0-20 for each workshop problem you turn in. The grade will indicate the correctness of the mathematical content *and the way in which the mathematics is presented*, 10 points for each, in your write-up. Since you may never have been graded on how you present your mathematical ideas, here are some guidelines.

- Use complete sentences.
- Display any complicated formulas.
- Use notation clearly and accurately, with special attention to the use of *variables*, and the *equality symbol* “=”.
- State the problem clearly before giving the solution, and include any relevant diagrams (with appropriate labels).
- Use *space* to make your presentation more readable. Important formulas should stand out quite visibly, and there should be considerable space between distinct steps (or parts) in your solution.

Look at one of the examples in the book. The author begins by writing a statement of the problem. He uses complete English sentences. He explains those steps which are not obvious to a calculus student (and he doesn't explain the steps that are obvious). If there's a graph, he labels it, and he discusses what can be deduced from the graph in the text of the example. At the end of the example, he states his conclusion.

Here are two common mistakes to avoid.

1) Do not forget to make your write-up a coherent, *self-contained* document. The person reading your write-up (who could be your workshop instructor, your lecturer, your peer mentor or yourself reviewing before an exam) shouldn't have to look back at the workshop sheet to understand your solution. The work should be organized so that the reader can see what steps you are taking and why. On the other hand, you don't have to comment on every step; if you are solving an equation for a variable, say so – don't put a comment for each algebraic step. When you use your calculator, state quite explicitly what you did, and what resulted. And reread your presentation once, putting yourself in the position of an ignorant reader!

2) The most common mistake is incorrect use of mathematical notation. Many symbols have *specific meanings* in mathematics. (The most troublesome one is the familiar “=”.) You should use such notation correctly in your write-ups: for example, use “=” to mean that the two expressions really are equal (have equal values) – not that one gives rise to the other. The following are two examples of BAD usage (and mathematical nonsense):

$$0 = x^2 - 1 = x = \pm 1; \quad \text{should be: } x^2 - 1 = 0, \text{ so } x = \pm 1$$

$$y = x^2 + x - 1' = 2x + 1 = 0 = -1/2;$$

should be :  $y = x^2 + x - 1$ ;  $y' = 2x + 1$ ; critical points are given by  $y' = 0$ ,  
so  $2x + 1 = 0$ , and  $x = -1/2$

A related mistake is to overuse the symbol  $\implies$  (the ‘implication’ symbol) as a substitute for a verbal explanation of what you are doing. In fact,  $\implies$  should not be used in mathematical writing at all, unless you are working on a blackboard. It is not really a mathematical symbol, but more like a form of shorthand.

Don’t be discouraged if your initial write-ups receive low grades because of poor exposition. With the suggestions we will provide and with your effort, you can improve. Because mathematics is used to solve problems *and explain the solutions to others*, writing clear solutions will be a good habit to develop. You can also tell future employers that you’ve had substantial practice in communicating technical ideas to others, and they will be suitably impressed. Put it on your resumé.

You can see a sample workshop writeup at the website

<http://www.math.rutgers.edu/courses/151-152/old/writeup.html> .

*Exercise.* This document attempts to convey some useful information, with some technical content. Does it succeed? Does it follow its own rules? Could it be improved?