Some notes on writing in mathematics

1. In mathematical writing, use the standard convention of complete sentences in paragraph form. Include each mathematical expression as part of a sentence. This includes both mathematical expressions within a regular line of text *and* mathematical expressions displayed on a separate line.

2. The choice of whether to write a mathematical expression within a regular line of text or to display it on a separate line is made by considering the complexity of the expression and the importance of the expression. Display complex or important expressions on a separate line; include simple expressions within a regular line of text.

3. The conventional style in mathematics is to write in the first person plural using the present tense. For example, use "We solve the equation to get $x = 5$." rather than "The equation was solved to get $x = 5$." or "I solved the equation and got $x = 5$." In the preferred style, "we" refers to the author and reader together. The present tense is used because the logic and reasoning are unfolding in real time. In contrast, science laboratory reports are often written in past tense because you are reporting on an experiment that has already taken place.

4. A central issue to confront in writing mathematics, and in most technical writing, is how much detail to include. Including too much detail (for example, lots of algebraic and arithmetic steps) obscures the main flow of logic and reasoning. Omitting too much detail forces the reader to work hard to connect steps. Consider omitting routine algebraic manipulations and arithmetic steps.

5. The appropriate level of detail depends on the audience. You should have an audience in mind for any writing you do. For this course, you should write for an audience of peers who have the same mathematical background as you but haven't thought about the specific problem at hand. You should give enough detail for a reader to follow the general flow of your reasoning and calculations on a first read and to reconstruct your thinking and work without too much effort. Include any main mathematical step or result in the body of the report rather than in an appendix or separate sheet of calculations.

6. Choose notation carefully. Always give a specific meaning for a new symbol before using that symbol. Remember that upper and lower case versions of the same letter are different symbols.

7. Avoid starting sentences with a symbol or number. For example, use "The slope m_1 is the negative reciprocal of $-4/3$." rather than "m_1 is the negative reciprocal of $-4/3$."

8. Use the words "equation" and "solve" only when these are relevant. A mathematical expression is not necessarily an equation; it may be a formula, an identity, or just an expression. Likewise, there are many mathematical actions other than "solving an equation." For example, one can "simplify an expression," "substitute on the right side of the equation," "factor a polynomial," or "calculate a value."

9. Distinguishing among *variable*, *parameter*, and *constant* can be useful.

10. Give the meaning for each of the variables/parameters/constants you introduce so your report is self-contained. Choose wording so that you introduce the meaning of each symbol *before* you use it in a mathematical expression rather than immediately after the expression.

11. Use "horizontal axis" and "vertical axis" rather than "x-axis" and "y-axis" if the variables are anything other than x and y.

12. In most situations, there is no need for quote marks or parenthesis around variable names. You can think of this as being similar to writing "my friend Bob" rather than "my friend "Bob"" or "my friend (Bob)".

> **Example:** …the density σ and the radius R…

13. Choose wording so that a colon is not needed to lead into a display line. A colon is *not* use before a displayed equation if the equation is needed to complete the sentence. Note that the sentence in the next example is not complete without the displayed expression.

> **Example**
> We can factor out constants to write this as
> $$N = 2\pi \int_0^R r\sigma \, dr.$$

14. Figures and tables are generally not included as parts of sentences. Instead, label each figure and table. Refer to each in your text.

> **Example:** …as shown in Figure 18.

Each figure or table should be place *after* the first reference to it in the text. One option is to put all figures and tables after the main body of the text.

15. Use "substitute" rather than "plug" in formal writing.

> **Example**
> We now use this to substitute for σ in our definite integral to get
> $$N = 2\pi\sigma_0 \int_0^R r\left(\sigma_0 - \frac{\sigma_0}{R}r\right) dr.$$

16. In a string of equalities across several lines, do not repeat the left-side of the expression.

> **Example**
> We now simplify to get
> $$\begin{aligned} N &= 2\pi\sigma_0\left(\frac{R^2}{2} - \frac{R^3}{3R}\right) \\ &= 2\pi\sigma_0\left(\frac{R^2}{6}\right) \\ &= \frac{1}{3}\pi R^2\sigma_0. \end{aligned}$$