The following advice for writing a mathematical document is adapted from guidelines written by Prof. David Clark (clarkdav@gvsu.edu) and other instructors in the University of Minnesota Talented Youth Math Program (UMTYMP).

Writing math for real people. Despite the saying that "mathematics is the universal language", no one in the world actually speaks *math*. Mathematical ideas must be written out in a natural language and read by real people. We've all had the frustration of trying to understand a poorly written textbook. The burden of communication lies with *you*, the writer, not with the reader. Here are some basic principles which help with writing math for real people.

General Writing Tips.

(1) **Be concise, but complete**. Write a solution in the most direct way. This can be surprising: The best way to write up a solution may be completely different than the way that you initially found it. You may have to completely restructure and rewrite your first solution to a problem. **DO IT!** Readers should be able to easily see that your work is correct, and *not* have to follow the twists and turns of your own discovery process.

(2) **Use complete sentences** with capital letters, periods, proper punctuation, nouns, and verbs. Mathematical equations included in sentences are part of the sentence as well. For instance "As a result, $x = 2$." is a complete sentence, beginning with a capital, ending with a period.

(3) **Give your objects meaningful names.** Be aware of naming conventions. There is nothing technically wrong with the following line:

$$\text{Suppose } x(f) = \theta f^2 + \xi f + X = 0. \text{ Then } f = \frac{-\xi \pm \sqrt{\xi^2 - 4\theta X}}{2\theta}.$$

However, this would confuse any reader. We expect f to be the name of a function, and x to be the variable. We also expect θ to be an angle, not the leading coefficient in a quadratic polynomial, and at this point in your studies you may be totally unfamiliar with the Greek letter ξ. Finally, using a capital X as a constant in an equation which already has x is confusing. These choices make it harder for readers to understand your ideas and follow your work. Make life easier for you and your reader, and write:

$$\text{Suppose } f(x) = ax^2 + bx + c = 0. \text{ Then } x = \frac{b \pm \sqrt{b^2 - 4ac}}{2a}.$$

(4) **Don't confuse words and symbols:** Never use a mathematical symbol when you mean the word for which it stands. For example, say "The area is 5" or "Then $A = 5$", but *never* say "So the area $= 5$."

(5) **Show appropriate work.** Provide enough structure to your writing to allow your reader to reconstruct your work on their own without undue burden. On the other hand, know your audience. When writing in Math 3283W, you don't need to explain arithmetic in great detail.

(6) **Clearly state your hypothesis and conclusions**, both in proofs and in examples. Ignoring these is like writing an essay without an introduction or conclusion and makes examples very hard to follow.

(7) Similarly, **define all functions and variables**. This may be done with a sentence ("Let b be the length of the base of triangle T."), in an equation ("Let $A = \pi r^2$, where r is the radius of circle C"),

or visually in a figure (in which case, state in a sentence that "Let n be defined as in Figure 1.1"). A very common mistake is to assume that certain commonly used names for variables and functions have inherent, universal meaning. Do *not* assume that s refers to the limit of whatever sequence you are working with, or that your readers will automatically know this. Instead, define it!

(8) A short chain of equalities can be written on one line, like this:

$$n^2 = (2k)^2 = 4k^2.$$

If a chain of equalities is longer, write each equality on its own line, and line up the "="s:

$$\begin{aligned} xy - 5y - 2x + 10 &= y(x-5) - 2x + 10 \\ &= y(x-5) \cdot 2(x-5) \\ &= (y-2)(x-5) \end{aligned}$$

This makes it easier to follow each step. In class this was referred to as the "Oklahoma Rule" because of the shape of the resulting block of mathematics.

(9) Include diagrams and figures when necessary. They become "necessary" when you find yourself spending more lines describing a situation than the figure would take up on its own! It is often said that "a picture is worth a thousand words," and in math this is especially true.

(10) Revise, revise, revise! Never hand in the first copy of *anything*. Step back for an hour, reread your solution, rethink it, and rewrite it in a better way.

Specific Tips for Typed Documents.

(1) Italicize all mathematical variables and functions. This is a visual hint that you're looking at math, not text. **This seemingly minor typesetting issue can make a huge difference in the quality of your document.** You may never have realized this, but the mathematics in your textbooks is italicized and often written in a different font with different spacing. Notice how 2x+3y+4z=6 looks odd; it should be typeset as $2x + 3y + 4z = 6$. See the difference?

If you write in LaTeX or use the equation editors in Microsoft Word or Google Docs, the italicizing will be done automatically for you. But it can be a shock to realize that you need to use the equation editor for every single mathematical expression, even if you just mention the variable x in passing.

(2) Give important equations their own line (and number them if you need to refer to them later). Less important equations, or intermediate calculations, can be typed inline.