Mathematical Writing Tips

Writing mathematics takes practice—that's what you are here for. Discuss with your group what the best way is to write the solution to a problem. This should be as much of the process as solving the problem. If the other members of your group understand what you have written, you're on the right track. If not, talk about what would make it clearer or easier to read. Your written solution should be clear, complete, and informative; long enough, but not too long.

There is an important side effect to writing mathematics well. Good writing is the result of careful thinking. The person who writes a good solution to a problem has thought about the problem in more depth and understands it better than the person who writes carelessly.

SPECIFIC TIPS

- Avoid ambiguous notation. For example, $2/3x$ can be interpreted as $2/(3x)$ or as $(2/3)x$. In general, it's best not to use a slash $/$ for division. Write these as $\frac{2}{3x}$ and $\frac{2x}{3}$ or $\frac{2}{3}x$.

- Be sure to say what you mean. For example, -3^2 and $(-3)^2$ aren't the same. The first equals -9; the second equals 9.

- It's generally not good writing style to cross things out when they cancel. It makes it hard to read and to understand. If some quantities cancel, simply leave them out in the next line of your computation. If the cancelation is simple, the reader will understand where they go. If it's complicated, you should break it up into simpler steps or say something about it in words.

- Graphs should indicate the quantities and units on the axes when they are known. They should be drawn clearly, large enough, with appropriate scales on the axes. Graphs are meant to convey information. Be sure that yours convey as much as possible.

- Your solution should refer to the relevant information given in the problem. I often see "solutions" that don't mention essential parts of the assumptions given in the problem.

- Be sure not to begin an answer by assuming the desired conclusion. This is a common logical error.

- Writing mathematics well begins with writing English well. Write in complete sentences, use correct spelling, grammar, and punctuation, avoid run-on sentences. Begin each sentence with a capital letter and end it with a period. (Should I really have to say this?)

- Write with a particular audience in mind. For the group problems in this class, think of your audience as your peers—a student taking the same class, but perhaps in a different section (maybe even a different school!), should be able to read your paper and have it be informative. Part of your grade will be based on how well such a student would understand what you have written.

- An adequate solution to a mathematics problem includes an explanation of why the result is true. You should include relevant computations, graphs, mathematical arguments, and conclusions and observations if appropriate.

- Don't write too much! In any technical subject, the amount of detail the author should go into depends on the background of the intended audience. Since you should assume that your reader has the same background as you do, it's okay to leave out steps that are familiar from previous courses. (Be polite, however! Tell the reader you are leaving them out.) For example in Math 111 it's okay to write

    "If we apply the quadratic formula to $x^2 - x - 1 = 0$, we see that the roots are
    $$x = \frac{1}{2}(1 + \sqrt{5}) \qquad \text{and} \qquad x = \frac{1}{2}(1 - \sqrt{5})."$$

- In Math 112 you could write

    "To approximate $\int_0^2 e^{-x^2}\, dx$ using a left sum we need to find a bound for $|f'(x)|$, where $f(x) = e^{-x^2}$. Remembering to use the Chain Rule we have $f'(x) = -2xe^{-x^2}$."

- Get writing ideas by reading the text. When you read the text, think more than just about what it says. Also think about how it is written, especially how the mathematics and prose flow together. Texts are generally well-written, but if you find a sentence or paragraph that is particularly difficult to read, think about how you might reword it.

Tips for those who really want to improve their mathematical writing

- A really good solution is a conversation with the reader. It contains a statement of the problem to be solved and does not require the reader to have the assignment sheet or even a copy of the book in order to understand it.

- Write in present tense, as though you were actually talking to the reader.

- Long paragraphs full of mathematical notation are hard to read. Use displayed equations for complicated or important equations.

- Avoid nonstandard abbreviations.

- Mathematical symbols are often used as parts of speech. In "Let x be a number," the variable x is the subject of the sentence. In "We have that $x = 2$," the '$=$' is a verb. The symbols '$<$' and '$>$' are also often used as verbs. In general, it's appropriate to use a symbol as a part of speech if it sounds okay when read aloud.

- Don't use a symbol when a word is better. For example, "The whole is $=$ to the sum of the parts" is ugly. Instead, write "The whole is equal to the sum of the parts." Symbols such as $\therefore$, $\because$, $\implies$, $\exists$, and $\forall$ are more for blackboard use, and are generally considered to be poor taste in writing. Don't start a sentence with a symbol; it's jarring.

- Don't use words when symbols are better. Symbols are meant to be abbreviations for complex ideas that are inadequately, or at best awkwardly, expressed in words. Consider what mathematics used to be like before symbols were commonly used:

    If a straight line be cut into equal and unequal segments, the rectangle contained by the unequal segments of the whole, together with the square on the straight line between the points of section, is equal to the square on the half.

This is Euclid's geometric way of saying $(a + b)(a - b) = a^2 - b^2$. (He is really saying $(a + b)(a - b) + b^2 = a^2$. I can show you the picture of this if you are interested.) The Greeks did not have algebra in the way that we know it. Many of Euclid's propositions make more sense to us algebraically than geometrically.