Some Tips For Writing Mathematical Proofs

Adapted from `http://www.wikihow.com/Do-Math-Proofs`

1. Write down the information that you are given (also called the *hypothesis*) and what you are trying to prove. Another way of gathering this information is to ask yourself, 'What do I know?' and 'What am I trying to find out?' When writing a mathematical proof, you must start with the information that is given to you, and via other mathematical truths – such as definitions, theorems or computations – arrive at the desired conclusion. If you get stuck, it is often helpful to turn to definitions. Write down the definitions of each term in your hypotheses and you will often see the next step.

2. Every time you write a sentence or make a claim, ask yourself 'Why is this true?' and 'Is this statement ever false?' It can be easy to forget special cases, such as when a variable is equal to zero. Back up every statement with a mathematical reason and justify yourself!

3. Write your proof step-by-step, like a manual. The proof should begin with stating the assumptions you are making and work logically from that point. It is very frustrating for your reader if steps in the proof are skipped, so even if it seems simple or obvious you should include it. Like a good lawyer, you want to convince your reader that the proof is true beyond a reasonable doubt. The best proofs are ones which readers can understand.

4. A proof is a piece of writing. It should have correct grammar, punctuation, spelling and sentence structure. If you have mathematical computations in your proof, write only one equation at a time. A proof should not consist of a long line of computations. You can break up computations with phrases such as: 'Since $x+2=4$ it follows that $x=2$,' or 'via algebraic computations, $x^2-1=0$ and therefore $x=1$ or $x=-1$'. Also, it is bad form to begin a sentence with a mathematical symbol or equation. So rather than beginning a sentence with '$A\vec{x}=\vec{b}$ implies', write 'The equation $A\vec{x}=\vec{b}$ implies'.

5. Most mathematical proofs do not use the pronoun 'I'. Most proofs, when necessary, use 'we', referring to the writer and the reader. So it is OK to say things like, 'we see that', 'we will prove' or 'we have shown'.

6. Make the end of your proof obvious to the reader. You can do this by stating things like 'and thus it is proved' or 'therefore we have proved that'. Make sure your conclusion matches that of the proof. It is also common to see a small box, $\square$, at the end of a proof or the letters *Q.E.D.* (quod erat demonstrandum, which is Latin for "which was to be shown").

7. All of the things I ask you to prove are in fact true, so if you do not reach the desired conclusion go back and look over your work. It is also very likely that you can find a proof in another text book or on the internet. I think it is useless to ban you from consulting other sources altogether, but you must pass in a proof written in your own words. Trust me, most textbooks are written in a style very different from how you or I would write a proof - so I will notice! Also remember that there may be several ways to prove the same statement.

8. Above all, practice and be patient. Proofs are difficult and it takes time to become comfortable writing them.