

## Writing Mathematical Proofs

1. Identify what is given and what it is that needs to be proven. These are called the “hypothesis” and the “conclusion”, respectively.
  - a. Statements that need to be proven are often in one of two formats
    - i. **If** (hypothesis), **then** (conclusion)
    - ii. (hypothesis/conclusion) **if and only if** (hypothesis/conclusion)
      1. In “if and only if” statements, you would need to prove both directions.
  - b. The goal is to start with the given/hypothesis and build a “proof”, or logical path, to the conclusion.
2. Start looking at already known concepts that relate to the given and/or conclusion. Use a series of some of the following concepts to build your proof. These will be the links from the given to the conclusion.
  - a. Definitions
  - b. Known/Already Proven Theorems
  - c. Axioms
  - d. Computations
3. The format should be formal, show step-by-step processes, and use clear and concise language. Every new line/statement should logically follow the last or can be reasoned by previously written statements. Avoid using only symbols and incorporate complete sentences.
  - a. Common statements found in proofs are
    - i. Since
    - ii. It follows that
    - iii. Therefore
    - iv. Thus
    - v. Implies
    - vi. We know/We see/We have shown/We now have
  - b. Finished proofs
    - i. End in “and thus it is proved that...” or “therefore, by (insert final link) we have proved...”
    - ii. A common “stamp” of a finished proof can be used after the last line of the proof.
      1. A square/box:  $\square$
      2. The abbreviated phrase “Quod Erat Demonstrandum”: **QED**
4. **Finally...**
  - a. Be patient. Check all statements and reasoning. Not all proofs will look exactly the same.