Introduction:

Objectives: Upon completion of this assignment, students will be able to...

- Apply complex numbers to real world problems.
- Define common mathematical proof terminology
- Construct a logical, consistent, and effective mathematical proof.

In this assignment, students will become familiar with common mathematical proof terminology and investigate various types of proof techniques before applying this information by creating a proof of their own for a theorem of their choice. Writing a proof is a clear choice in assessing student knowledge of proof techniques and notation, as they will have to use both extensively through the process, becoming more familiar with these building blocks of mathematical logic at the same time.

Instructions:

Mathematicians in the working world often end up producing proofs in their research, which is the primary job of many mathematicians. Coming up with a useful new theorem is great, but until it can be shown to work in a well defined subset of cases (or proven to work in all cases), it can't be applied. That's where proofs come in.

Reading on proof techniques and common notation (read through page 9, skim all of section 3, and skim section 4.1. We'll go over this in class) – https://math.berkeley.edu/~hutching/teach/proofs.pdf

In this assignment, you will be writing a proof on a theorem of your choice involving complex numbers in teams of 2–3 students. You may use a theorem we've gone over in class, but if you use one we've explicitly proven, you should come at it from another angle with a different kind of proof. You may also find or come up with another theorem you find interesting and prove it however you like.

Once you've chosen your theorem, determine if the theorem is true or not (hopefully it is!), then determine why it works and under what circumstances. Once you've figured out why and when it works, write a detailed mathematical proof defending your theorem and defining the cases where it holds (and why). You'll be presenting your proof in class, so make sure it's convincing!

Remember, a proof's main purpose is to convince an audience that something is true. You should include algebra and other supporting calculations you believe are necessary to convince your audience (your classmates and myself), but you can skip basic arithmetic and other simple steps since it's assumed the audience can follow. If you're unsure to include a step in your proof, ask yourself if one of your classmates would be able to follow the proof without the step. If not, you should include it.

Rubric:

Category (50 pts total)	Excellent	Proficient	Developing	Missing
Correctness (15 pts)	The proof shows the theorem is true and details under what cases it may be used. **(15 pts)**	The proof has minor algebraic or similar mistakes but is substantially correct. **(12 pts)**	The proof either does not show the theorem is true or fails to detail for which cases it applies. **(9 pts)**	The proof fails to provide any substantial information about the theorem's correctness or use cases. **(0 pts)**
Readability (15 pts)	The proof is well organized and provides enough algebraic detail without being overwhelming. **(15 pts)**	The proof may provide unnecessary steps or skim over important segments, but is still understandable with some effort. **(12 pts)**	The proof is out of order, skips major sections, or inundates the reader with far too much detail. **(9 pts)**	The proof is wholly incomprehensible or is written in crayon. **(0 pts)**
Technique (15 pts)	The proof uses an effective and efficient technique for the theorem and does not engage in any unnecessary work. **(15 pts)**	The proof uses an effective technique for the theorem, but may engage in some unnecessary work that could be avoided with a more efficient technique. **(12 pts)**	The proof uses a technique, though it uses far too much work that could easily be avoided by changing the strategy. **(9 pts)**	The proof does not follow any technique and may just be completely winging it. **(0 pts)**
Presentation (5 pts)	Presenters speak confidently, avoid sidetracking with extraneous information, and are capable of answering all questions. **(5 pts)**	Presenters may hesitate during particular sections, get slightly off topic, or miss answering a question or two. **(4 pts)**	Presenters seem unsure of the validity of their proof, go wildly off track, or cannot answer most questions. **(3 pts)**	Presenters are incoherent during the presentation or cannot answer any questions afterwards. **(0 pts)**