

How to Use this Reviewer

Hello! This is a compilation of solved exercises for Module 1 of MATH 51.4. All of these exercises are taken straight from Aldrich and Cisco's course notes, so you can expect tests to be very similar to the items given. However, there are certain items that are much more difficult than what they expect us to do, and are mostly for nerds like me to geek out about on documents like these. I'll note when these items show up, so that you don't spend energy that you don't really need to trying to understand them.

Normal items will look like this:

- 1** A very easy math problem. What's $1 + 1$?

whereas difficult problems will be soulless, like this:

- 2** A very difficult math problem. Prove that $\binom{2n}{n} < 2^{2n-2}$, $\forall n \geq 5$ using induction.

I might also include warnings in my **Nerd Interjections!**



Nerd Interjection!^a These sections are for me to remind you of some necessary information to solve the problems, elaborate on something that I think isn't all that clear with just pure math symbols, give a helpful theorem, be an annoying piece of shit, anything, really! Just think of it as a tips and tricks section.

^aImage from @Ellem... on Twitter.

I sometimes have another section called **Can we Prove it?**, where I include some interesting, not really necessary, but nonetheless relevant proofs.



Can we Prove it?^a This is just a random proof I yinked from our homeworks.

Proof. (\implies) Let $x \in (A \cap B) \setminus C$. Then, $x \in (A \cap B)$ and $x \notin C$.

Since $x \in (A \cap B)$, $x \in A$ and $x \in B$.

Since $x \in A$ and $x \notin C$, $x \in (A \setminus C)$.

Since $x \in B$ and $x \notin C$, $x \in (B \setminus C)$.

Thus, $x \in (A \setminus C) \cap (B \setminus C)$.

(\impliedby) Let $x \in (A \setminus C) \cap (B \setminus C)$. Then, $x \in (A \setminus C)$ and $x \in (B \setminus C)$.

Since $x \in (A \setminus C)$, $x \in A$ and $x \notin C$.

Since $x \in (B \setminus C)$, $x \in B$ and $x \notin C$.

Since $x \in A$ and $x \in B$, $x \in (A \cap B)$.

Thus, $x \in (A \cap B) \setminus C$.

Since both sides are true, it holds that $(A \cap B) \setminus C = (A \setminus C) \cap (B \setminus C)$. \square

^aThank you Mikh for this.

Finally, there are blue boxes to indicate when instructions aren't obvious from the question itself, or if there are similar items that can be grouped together.

For items #7 to #12, we need to reevaluate our life decisions.

It's very important to note that this is a *work in progress*! I am human, and I will make mistakes, and I cannot finish doing all the exercises within the span of one day. If you spot anything wrong, please feel free to message me; I will correct it as soon as possible.

As a final note, these are not replacements for the modules/paying attention in class, these are supplements for them. I won't explain all the topics here, and I'll assume that you at least have read the basics, so don't treat these reviewers as your only source of information. Our teachers spend a lot of time on the handouts, they're really good! (except when they're wrong) With that, though, I think I've covered all pertinent points. Good luck, and happy studying!

2.1.1: Divisibility Rules