- Opening Notes
- Why real maths?
- 6 Habits
    - Discussing Definitions
    - Producing Examples and Counter-Examples
    - Being wrong and admitting
    - Evaluating many possible consequences of a claim
    - Teasing out Assumptions under a claim
    - Scaling the ladder of abstraction

- Be wary of “the obvious”

1.) Discussing “Definitions”

Kun: “mathematicians obsess over the best and most useful meaning of every word they use.”

Kun: “the most common question a mathematician has when encountering a new topic is, “What exactly do you mean by that word?’”

1.) Discussing “Definitions”

Choose one word that should be defined in either question. Then, come up with as concise a definition as possible.

“Is your algorithm correct?”

2.) Producing Examples and Counter-Examples

Kun: “When encountering a new existing definition, the first thing every mathematician does is write down examples and counterexamples to help them understand it better”

2.) Producing Examples and Counter-Examples

“Performing x*y is faster than (x+x+x…+x) with y x’s”

Example:

Counterexample:

“sqrt(xx + yy) and x*sqrt(1+(y/x)(y/x) do the same thing”

Example:

Counterexample:

3.) Being Wrong Often and Admitting It

Kun: “Mathematicians, regardless of who is actually right, [are] not only willing to accept they’re wrong, but eager enough to radically switch sides when they see the potential for a flaw in their argument.”

“Mathematicians leave their ego at home”

3.) Being Wrong Often and Admitting It

Kun: “Mathematicians, regardless of who is actually right, [are] not only willing to accept they’re wrong, but eager enough to radically switch sides when they see the potential for a flaw in their argument.”

“Mathematicians leave their **insecurities** at home”

4.) Evaluating many possible consequences of a claim

Kun: “Exploring the limits of a claim can also be used as a litmus test for deciding which arguments are worthwhile to understand in detail.”

Kun: “Often, you simply realize you were wrong. So this habit is a less formal variation on being wrong often, and coming up with counterexamples.”

4.) Evaluating many possible consequences of a claim

Claim: “Proving code correct takes 10x longer than writing the code itself.”

Consequences:

Making code shorter and more logical so we have more time for proving

Coders should plan out everyhting ahead for their proof

Don’t bother proving things

5.) Teasing apart the assumptions underlying a claim

Teasing Apart the Assumptions Underlying a Claim

Kun: “When someone makes a claim in mathematics (out loud), they’re usually phrasing it in a way that they hope will convey the core idea to another human as easily as possible. That usually means they’re using words in ways one might not expect.”

5.) Teasing apart the assumptions underlying a claim

Claim: “Java is the best language to teach in CS 2110”

Assumptions:

Claim: “UVA graduates get better jobs than those who do not go to school”

Assumptions:

6.) Scaling the ladder of abstraction

“Mathematicians regularly scale this ladder, particularly in the later stages of graduate school”

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“Mathematicians regularly scale this ladder, particularly in the later stages of graduate school”

And in 2150

6.) Scaling the ladder of abstraction

Which is more abstract?

[Additionally, are these statements equivalent?]

“All monkeys are in love”

“For any monkey P, there exists monkey Q such that P ≠ Q and P loves Q and Q loves P.”

Be wary of the "obvious." When familiar or truly obvious facts are needed in a proof, it's OK to label them as such and to not prove them. But remember that what's obvious to you may not be—and typically is not—obvious to your reader.

Most especially, don't use phrases like "clearly" or "obviously" in an attempt to bully the reader into accepting something you're having trouble proving. Also, go on the alert whenever you see one of these phrases in someone else's proof.

Lehman, Eric, F. Thomson Leighton, and Albert R. Meyer. *Mathematics for computer science*. Technical report, 2006. Lecture notes, 2010.

https://www.vice.com/en_us/article/8xwm54/number-theorist-fears-all-published-math-is-wrong-actually

http://www.brettforrest.com/shattered-genius