

**What is this course *really* about?
aka My aim for this course**

According to Underwood Dudley, there are at least eight levels of mathematical understanding:

1. Being able to do arithmetic
2. Being able to substitute numbers in ‘formulas’/ being able to state or use elementary properties of concepts
3. Given ‘formulas’/ elementary properties of a concept, being able to get other ‘formulas’/ elementary properties
4. Being able to understand hypotheses and conclusions of theorems
5. Being able to understand the proofs of theorems, step by step
6. Being able to *really* understand proofs of theorems: that is, seeing why the proof is as it is, and comprehending the underlying ideas of the proof and its relation to other proofs and theorems
7. Being able to generalize and extend theorems
8. Being able to see new relationships, and discover and prove entirely new theorems.

Levels 5 and 6 would be considered basic mathematical ability for Math majors. Non-trivial applications of Mathematics would lie in-between levels 6 and 7. While levels 7 and 8 constitute research in Mathematics. A lot of engineering and physics is deep applied mathematics and requires understanding at or beyond levels 6 and 7.

Calculus courses focus on a mixture of 1 and 2. Math 230 (Introduction to Discrete Mathematics) focuses on 3 and 4. Math 332 (Elementary Linear Algebra) focuses on 3 and 4 with a bit of 5. In this course (Math 454), the focus is more on the upper part of levels 3, 4, 5, and 6. The aim is give you a firm foundation in levels up to 6, so that you can go onto levels 7 and 8, both as mathematicians and engineers (through non-trivial applications of graph theory).

I hope this course will help you make progress through these levels of mathematical understanding, and mathematical maturity. I would consider this a successful course, if you gain confidence in your ability to read, understand, and write proofs, especially as compared to the beginning of the semester.

with best wishes,
Hemanshu Kaul