

Math 4513 homework

Homework Assignment #3 (first part due 2/11, weather permitting) Start developing a list of proofs illustrating the different methods that I discuss this week: direct argument, proving the contrapositive, proof by contradiction, and techniques involving quantified statements (I will also talk about induction, but probably not until next week.) Of course, if you google “proof by contradiction” or most any of our terminology, you will find tons of examples. But textbooks for courses you have taken, especially the more abstract courses, should also be rich sources of examples, perhaps some that mean more to you personally. Seek out examples that you happen to find especially interesting, beautiful, elegant, or just personally meaningful to you, and that are not unnecessarily complicated. More elementary topics— calculus and linear algebra— are generally better than advanced subjects (but there might be an advanced example that you just *really* like). The goal is seek out examples that can stay with you, and that can serve as prototypical arguments if you want to develop some of your own proofs, or teach others about mathematical proof. Also interesting might be examples where one can base proofs on more than one method (in fact, almost any argument can be formulated as a proof by contradiction, although generally there is no advantage in doing so). Or there might be a longer proof in which different portions use all the basic methods. Most long and complicated formal arguments are just shorter arguments that string together shorter arguments using these basic methods into a longer chain of reasoning.

I expect to give a writing assignment developing this further, perhaps due 2/18 or the following week, to write a few pages laying out the different proof methods and some examples. It will be mostly up to you to decide how you approach this. The goal is for you to clarify in your mind the standard patterns of argument, and to develop your own ways of thinking about them and specific examples that you like (especially if you have been uncomfortable with proofs in the past). We will discuss this more in class, but keep it in mind as you collect examples.

Homework Assignment #4 (due 2/21) Prepare for a class discussion starting 2/21, a retrospective of your undergraduate mathematics training. Begin by making a list of the courses you took and start analyzing them, in at least the following ways:

1. Which were prerequisites for others?
2. Which did you use in other mathematics courses, and which (if any) have you used in non-mathematics courses?
3. Which relate most directly to your future plans?
4. Which stand out as particularly formative for you (or perhaps particularly non-helpful)?
5. Which were well-taught and which could have been done better (how, specifically?). Please note: we will probably discuss the good and not-so-good work by past instructors, but we will only refer to “the instructor”, never specific names. One of our goals is to improve our own concept of teaching mathematical ideas (and everyone has occasion to teach, not just professional “teachers”), but it is not an appropriate time to laud or disparage individuals.

This will be a round-table discussion, rather than individual presentations. But everyone should participate, have something prepared that you want to share with the group, and have thought about the above questions.