

# TEACHING STATEMENT

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I think the primary role of a teacher is to motivate students and help them learn how to think on their own. Students are not always motivated in math classes, as learning a new math concept is not so easy. In order to get them interested in the subject and really understand the material, I find that it is important to present the course material in the clearest way, as well as to actively engage students in the class.

**How I teach the course material.** I have lead recitation classes for Math 1a: Calculus of One Variable (2 quarters, once as a head TA) and Math 3: Introduction to Probability and Statistics at Caltech. In those recitation classes I have always tried to teach the course material focusing on three things: intuition, techniques, and examples.

When learning a new math concept, especially when it is abstract, getting a good intuition of it is crucial. However, intuition is not something that can be easily found in text books. That is why I focus a lot on explaining the intuition behind various concepts and theorems. For instance, I have seen that a lot of students get intimidated by the  $\epsilon$ - $\delta$  definition of the limit when they first see it. I would then explain how it fits to our intuition of limit, by thinking of  $\epsilon$  as a kind of an error bound, and  $\delta$  as the precision of our measurement; a limit exists when we can make the error ( $\epsilon$ ) arbitrarily small by making our measurement precise enough ( $\delta$  small enough). I found that once students get the intuition, they get more comfortable with thinking about the concept or theorem they learned.

Once the students get a grasp on the new concept, I introduce them the main techniques to prove statements and solve problems. This is especially important in classes for the first year students, such as the first course in Calculus, where most students are not yet familiar with the notion of mathematical rigor, let alone how to write a rigorous mathematical proof. Students who haven't learned how to write a mathematical proof struggle to write a good proof, and they tend to just list a bunch of formulas without any words and often write a proof in the completely opposite order. It is hard to overemphasize the importance of the role of the teacher at this stage. Just like learning the grammar is important in learning a new language, it is crucial to learn the "grammar" of mathematical writing. This is why I try my best to get the students familiar with standard patterns of proof and the techniques they can use over and over to solve various kinds of problems.

Last but not least, I always provide the students with enough examples. Especially when the concept is abstract, I think it is very important to have the students keep in mind a few concrete examples. When it comes to applying a new theorem or technique, I find that many students enjoy seeing concrete example problems, and this is when I can have the students actively engaged in the class, by giving them some time to solve those example problems among themselves.

**Getting students actively engaged.** Whether it is a recitation class or an office hour, my primary goal is to nurture the students' mathematical creativity – the ability to think mathematically on their own. For this purpose, I always give the students a few example

problems in my recitation classes and let them have some time to think and solve the problems in small groups. While the students are discussing in small groups, I check how each group is doing and sometimes give them encouragement or hints if they seem to be struggling. At the end of each problem session, I give the students the opportunity to present their solutions in front their peers. I encourage students who haven't presented before to present their solutions, in order to make sure everyone is involved. Having such problem sessions has the advantage of not only making the students practice their mathematical thinking skill but also building a collaborative atmosphere.

My approach to office hours is the same. Students coming to my office hours usually ask for help in their homework problems, but I never tell them the solution in any direct way. Instead, I would first ask them what they have tried. If they already have some ideas on how to approach the problem, a small hint or encouragement is enough. If they seem to be stuck, then I would ask them smaller questions or give them an easier but related problem. This way, I have been able to “[*help*] guide students to answers without outright showing [*them*]” [1] and “[*make them*] think on [*their*] own” [2], to quote some comments from my students.

**On grading.** One of my main duty as a teaching assistant at Caltech was to grade homework and exams. While grading can be easily dismissed as a boring job that can be done without much care, I consider grading as an extension of teaching. When writing up solutions to post on course website, I try to write in a clear and concise way, in order to help the students who are still learning the grammar of mathematical writing. I would also point out some common mistakes. Students learn through mistakes, and it is especially helpful for them when they are provided with “*instructive feedback*” [3] for their mistakes in homework.

Getting positive feedback from the students, such as the ones quoted below, gave me confidence in my approach in teaching. Of course, this doesn't mean my approach is perfect, and I strive to improve and grow as a teacher, as I teach more and more students.

#### QUOTED STUDENT COMMENTS<sup>1</sup>

- [1] “Sunghyuk is great. He answers emails quickly and will have a long dialogue to help you if you don't understand something. Only a few people show up at his office hours, but he's super helpful! He's always prepared with a whiteboard and helps guide students to answers without outright showing us.”

–Math 1a: Calculus of One Variable student at Caltech, Fall 2020

- [2] “I mainly went to your office hours, and I liked how you did not reveal how to the problem and made me think on my own. I was frustrated at first, but they were very helpful when approaching the midterm and final exam. You were very clear at explaining the material. Good job!”

–Math 1a: Calculus of One Variable student at Caltech, Fall 2020

- [3] “Great TA, very instructive feedback on HW.”

–Math 121a: Combinatorial Analysis student at Caltech, Winter 2020

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<sup>1</sup>Anonymous student comments from Teaching Quality Feedback Reports