# My Teaching Statement- Jesús Antonio De Loera.

I have been teaching for more than 30 years, I have taught and mentored students in four countries and from some of the top institutions in the world: UC Davis, Cornell, U. Minnesota, ETH (Switzerland), U. Magdeburg and TU Munich (Germany), and UNAM (Mexico). I have a wide range of experience teaching all kinds of courses for students of different levels (from freshmen calculus to Ph.D. courses). My student evaluations have been consistently in the very good to excellent range and I have been honored with several teaching awards (see my CV). Over the years I made a few observations that guide my approach to teaching a course :

(1) **The teacher student relationship is fragile and requires a human connection. Learning requires special inner desire and motivation from the student and dedication and patience from the teacher.** I try to connect to my students showing that I excited to speak to them, and excited of about the topics I present. One cannot learn or get to know something that is foreign or scary. There is a value in putting students at ease, to feel the classroom teacher is receptive to their frustrations and questions. We must teach the students we have, not those we wish we had!

(2) **Many students arrive to class scared or bored by their prior mathematical experience. Students come to us with barriers of connection.** I strongly believe any person that puts the effort can enjoy any Mathematics course. But we need to work on attracting students and establishing communication. Unfortunately our courses start full of fear, frustration, and low expectations. We need students to feel comfortable and proceed at their own pace, resist comparison, have faith, fail more often and recover, look for beauty, and exercise their imaginations. All students can reach this inner state and they should have equitable access to friendly, high-quality, challenging, effective mathematics instruction and support services. We need to keep them engaged. But how? The next principles offer some guidelines.

(3) **Mathematics is a fun and beautiful subject let us teach it that way!**: In my lectures I always try to convey that doing Mathematics is a fun activity, full of imagination, and ingenuity. I often bring geometric models or lovely examples to show the essential principles and puzzles to show the playful side of mathematics. It is only through my own love for the subject that I can convince others to enjoy it.

(4) **Mathematics is extremely useful too, let us teach it that way!** Mathematics is central to science and new technologies. In class I employ a broad range of examples and applications to motivate and illustrate the material; promote awareness of connections to other subjects (both in and out of the mathematical sciences) and strengthen the students ability to apply the course material to these subjects. I seek to introduce contemporary topics

(e.g., Data sciences, compressed sensing, cryptography) from the mathematical sciences and their applications, and enhance student perceptions of the relevance of mathematics in their lives. Explain why they are enrolled in the course!

(5) **Mathematics learning/teaching requires flexibility and variety of approaches:** Every course should present key ideas and concepts from a variety of perspectives. Learning theory says not everyone learns a topic the same way, nor everyone attracted to the same topics and ideas. The good news are Mathematics is ample enough for everyone to find something to love. Instruction should use appropriate combination of traditional (e.g., lectures) and new methods techniques (e.g., group activities). A multifaceted approach to instruction is important for teaching students to be flexible in the ways they process information. The use of these diverse instructional approaches should be a strategic part of the curriculum. There is no unique way to Mathematics!!

(6) **Mathematics is NOT an spectator sport!** I engage my audience in all lectures in a conversation, not a monologue. As a rule, all my courses rely much less on lecturing and much more on alternatives such as discussions, projects, lab exercises, and group problem-solving and frequent quizzes. I used the Socratic method trying to extract answers through questions that force reflection. Not only this is more engaging, but the science of learning says students need to be active participants in order to be effective learners. Just like one cannot teach swimming outside the pool, there has to be a minimum of hands-on activity to learn mathematics. I give students a variety of ways to engage via homeworks, tests, and projects.

(7) **Mathematics is logical, structured and highly organized. The meaning of "prepare your math class" should be at least as deep.** Good teaching of Mathematics should be thoughtfully constructed to approach content. Planning of lessons and curriculum should be centered in the goals of the course. One should plan a course and its lectures in four steps:

(1) Identify the purposes or objectives of each chapter, section, and tell students what the goals are (e.g., at the end of this chapter you should know how to use and interpret the KKT theorem),

(2) selecting the best means for the attainment or achievement of these objectives (e.g., homework exams should be directly connected to objectives, with incremental difficulty.

(3) organizing these educational or teaching-learning experiences (e.g., what writing exercises, projects, discussions, demonstrations, lecture topics best serve the goals?)

(4) frequently evaluate the outcomes of what have students attained or achieved. Frequent small tests, when highly coupled with the goals, are the most effective promoting learning.

(5) Finally, the structure of the class should help students make connections between the course content and other areas of Mathematics, society and their daily lives.

(8) **Constantly ask what works best in learning? Think beyond the lecture, explore other tools to learn and communicate.** What is the best way to learn a mathematical topic? Lecturing is great (when well-done) but it is by far not the only way to convey knowledge and clearly does not work well for everyone. I often explore new teaching techniques and curriculum, e.g., I experimented with the "flipped classroom model" in Linear Algebra and the use of videos. Most recently I experimented with adaptive learning software and laboratories. Of course I also tried ZOOM and enjoyed the options. My preferred tool in small advanced courses is to ask students to "write to learn". This means students are asked to keep a daily Math journal, where they write reports about what is going on in class, carefully explain their proofs, or delicate arguments, answer challenge quizzes, etc.

(9) **Technology is not the main tool, but it is a very useful tool and it is irresponsible to ignore it given the fast changes on the way people will interact with mathematics in the future.** Computers are indispensable to teach algorithmic thinking, simulation, and modeling. These are skills in high demand. But technology can also strengthen students' traditional problem-solving skills by encouraging them to utilize multiple strategies (graphical, numerical, algebraic). Wise use of technology can promote students' exploration of and experimentation with mathematical ideas. For example, students can be encouraged to ask "what if?" questions, try conjectures, to verify or refute them. Visualization of structures and patterns inspires students. Finally, data sets available on the Internet provide opportunities to address real-life problems, enriching the value of the course.

(10) **Yes, instructors must assign grades to students. But testing can be more meaningful relevant and less demoralizing.** The assessment of student learning in mathematics should be a fundamental tool for the improvement of instruction and student learning. Tests should be daily almost invisible opportunities to sharpen the skills to be learned and for students to show they understand the key ideas and skills. Making the exams relevant and related to the key content (what do I want them to learn for sure? what are the key essential ideas and skill they need?) is crucial. Thus I prefer frequent small exams to force the learning/revising of concepts regularly, rather than cramming. I also give plenty of opportunities to recover and reach mastery by dropping the lowest grades. This lowers penalties for concepts they learned only later. I rely on the entire statistics to finalize the grades with more complete information.

My last most important observation on teaching: We are excluding too many people from mathematics! This is particularly true for women and minorities into Mathematics. The fact that we have not been able to attract and retain a diverse student body in the mathematical sciences is a dreadful failure. The status quo is unsustainable. We need to do better!