

Welcome to
the math
major at SJSU

Tim Hsu

Math careers

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Getting
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Updated Fall 2012

You've heard about teaching math. . .

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- A **bachelor's degree** in math, plus additional training (single-subject credential) qualifies you to teach high school math.
- A **master's degree** (2 extra years) in math qualifies you to teach at a community college (or work as a lecturer at a 4-year college or university).
- A **doctoral degree** (5–7 extra years) qualifies you to be a professor at a 4-year college or university.

... but there are many other careers in math

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Recent SJSU grads have gotten jobs in many different non-teaching careers.

- Bachelor's graduates
 - Investment advising (WaMu/Chase)
 - Programming (Sun Microsystems/Oracle)
 - Financial analysis (Applied Underwriters/Berkshire Hathaway)
 - Energy trading (PG & E)
- Master's graduates
 - Anti-satellite technology (Lockheed-Martin)
 - Aviation analysis (ATAC Corp.)
 - Sports broadcasting technology (Sportvision)

And Ph.D.'s are in demand in the fields of cryptography and operations research (optimization).

Hot fields in the mathematical sciences

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- **Statistics**
 - Any company that deals with data needs statisticians
 - **Actuaries** use statistics to help determine pricing for insurance companies, etc.
- **Mathematical biology**
 - **Bioinformaticians** apply statistics and discrete mathematics to molecular biology
 - **Epidemiologists** apply mathematical models and statistics to study disease spread and treatment effectiveness
- **Data mining:** Automated mathematical analysis of big data sets helps businesses find customers, political parties find donors, banks find good loan customers, etc.

Types of bachelor's degrees in math

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There are two main “flavors” of bachelor's degrees in math at SJSU:

- B.A. Mathematics (today's discussion)
 - Sub-flavor: Preparation for Secondary Teaching
- B.S. Applied Math. Three choices of concentration:
 - Concentration in Applied and Computational Math
 - Concentration in Economics and Actuarial Science
 - Concentration in Statistics

Requirements, on paper

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For the B.A. in Math, you need to take:

- Calculus I, II, III, plus Discrete Math (Math 42)
- 4 required courses (Math 108, 128A, 129A, 131A)
- 2 courses, each selected from among 4 choices (Math 112, 113, 115, 138; Math 128B, 129B, 131B, 175)
- 5 elective Math courses
- One year of physics (e.g., Physics 50 and 51; Physics 50 and 52)
- One programming class (CS 46A, or upper-level math class)
- GEs, writing requirement (WST), other university stuff

Requirements, in sequence

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So why does it take so long? Several reasons, but mainly, math degree has 3 stages that can't be skipped, and shouldn't be shortened:

- **Calculus sequence:** 3 semesters, can't be shortened except by summer classes.
- **Understanding what math is:** 2 semesters; very difficult to do faster.
- **Theory classes:** 3 semesters; terrible idea to do them faster.

Assuming you start from calculus! If starting from precalc, add one semester or summer classes.

The calculus sequence

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Like what you've seen before: Here are problems, solve them using learned procedures.

3 semesters:

- Calculus I–III (Math 30, 31, 32). Math based in calculus is often called *continuous* math.
- Discrete Math (Math 42). Example: How many ways are there to get a full house as a 5-card poker hand?

Understanding what math is really about

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Math past calculus is *not* cookbook-y: Instead of learning procedures, you learn ideas, creativity, and cleverness.

Recommended:

- **Math 129A: Linear algebra.** Starts with problem of solving many linear equations; introduces *higher algebra* and *discrete mathematics* (plus some theory).
- **Math 133A: Differential equations.** Solving equations involving derivatives; introduces *continuous applied mathematics*.
- **Math 161A: Statistics.** Randomness, error, data collection and interpretation; introduces *statistics*.
- **Math 108: Theory and proofs.** What is a mathematical fact, and how can we be sure of it? Introduces *definitions*, *theorems*, and *proofs*.

A good time to choose or change flavors

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Taking Math 129A, Math 133A, Math 161A, and Math 108 is a good way to see if you prefer theoretical math, applied math, or statistics. Changing types of degree is much easier at this point in your career than later.

Theory classes

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The hardest classes in the bachelor's degree involve proofs. Each of these classes is like two regular math classes or more. For example:

- **Math 129B: Linear algebra II.** Linear algebra, but you prove everything.
- **Math 128A: Abstract algebra I.** Proving not just the algebra behind high school math, but the algebra underlying symmetry, geometry, etc.
- **Math 131A: Analysis I.** Proving calculus.

Can replace 129B with harder “B” classes: 128B, 131B, 175.

Finish your GE classes slowly

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The worst advice commonly given: To “get all of your GEs done first.” The problem with that is:

- You have nothing but math classes left to take. GE classes are valuable later on as sanity maintenance.
- You end up taking lots of math classes each semester. Often leads to failing one or more and delaying graduation.

Don't take too many math classes

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DO NOT TAKE MORE THAN 2–3 MATH CLASSES EACH SEMESTER

Taking more usually leads to failing grades, or at least lowering your GPA. Make sure your grades are as good as possible — a good GPA helps to get a better job.

Allow lots of time for upper-division classes

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For hard upper-division classes (e.g., proof classes), you will need to put in 10, 12, or more hours of work outside of class to do your best.

Think ahead: Where will you find this time?

- Unplug your video games, quit your scrapbooking hobby, stop wasting time on the internet.
- **Quit your job(s)!** Or cut down your hours, or at least get a job with professional value (i.e., not making lattes).
- Do you really need to see your friends and family members so much?
- Do you really need to shower and sleep?

(Just kidding about the last two — but not the first two.)

Stay out of trouble

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Warning: If approved, the math dept will soon have the following probation and disqualification policy. (This is in addition to the University and College probation/DQ policies.)

- If you take **12 units without completing any required or support courses for the major**, you go on probation. If you keep doing this, you will eventually be disqualified from the major.
- If you get a **D+ or lower** in any required class, you go on probation for the rest of your time at SJSU. If you get enough low grades, you will be disqualified from the major.

So stay away from both categories — by planning ahead, taking fewer classes, and spending more time on each one.

Find community

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You don't have to do it alone: Get to know other math majors and math profs.

- Join the math club!
- Leave Mon and Wed 3–4pm vacant on your schedule, and come to math colloquium and other events at those times. (**Colloquium** is: Free food and current developments/research in mathematics.)
- Go to your professors' office hours — make sure the prof knows your name.

A sample plan for graduating in 4 years

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For sample purposes only!

- Assumes starting from calculus I
- Basic version of math major
- Writing classes, GE classes, etc., not included
- Computer course not included
- “Math elective” includes geometry course (Math 112, 113, 115, 138)

Semesters 1–3: The calculus sequence

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- **Semester 1:**
Math 30 (Calculus I)
Math 42 (Discrete math)
- **Semester 2:**
Math 31 (Calculus II)
Physics 50 (Mechanics)
- **Semester 3:**
Math 32 (Calculus III)
Physics 51 (Electricity & magnetism)

Semesters 4–5: Understanding what math is

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- **Semester 4:**
 - Math 129A (Linear algebra I)
 - Math 133A (Differential equations)
 - Math elective
- **Semester 5:**
 - Math 161A (Statistics)
 - Math 108 (Introduction to proof)

Semesters 6–8: Theory classes

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- **Semester 6:**
Math 129B (Linear algebra II)
Math elective
- **Semester 7:**
Math 128A (Abstract algebra)
Math elective
- **Semester 8:**
Math 131A (Introduction to analysis)
Math elective

Note: Most upper-division courses, including Math 129B, 128A, and 131A, do not run every semester, so plan ahead as much as possible, and make sure you put in enough time to pass them — failing one can make for big delays.

Where can you get support?

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Wondering what classes to take? Stumped by proofs or by numerical linear algebra?

- Talk to your fellow majors that you meet in classes.
- Join the math club — there is often someone around who can help with any class you'll take.
- Go to professors' office hours and bug us — that's why we make the big money, heh.
- Talk to your advisor! (You're required to meet with your advisor once per semester, but you can always ask us questions anytime. . . .)

Welcome and enjoy your time here!