

Teaching Portfolio

Jay Daigle

The purpose of this document is to give an overview of my teaching history and experiences. It includes a discussion of my history of teaching experiences, a sample course syllabus, a sample homework assignment, and a collection of teaching evaluations and feedback I have received as an instructor over the past year. More material can be found on my website at <http://jaydaigle.net>.

Overview of Teaching Experience

At the California Institute of Technology I have acted as a teaching assistant, a head teaching assistant, and an instructor for a variety of freshman mathematics classes. As a teaching assistant my duties included leading discussion sessions, grading homework and exams, and holding weekly office hours. As head TA I also created grading policies and supervised several TAs for grading and teaching. As an instructor I was responsible for all aspects of the course—designing the syllabus and course policies, lecturing, and creating and grading assignments.

- Instructor for *Sequences and Series*, a supplemental core math class for students coming to Caltech with weak math backgrounds.

Note: The syllabus and a sample assignment are included below.

- Head TA for *Linear Algebra, Analytical Track*, a required core class.
- Head TA for *Multi-Variable Calculus, Practical Track*, a required core class.
- TA for *Freshman Mathematics*, which replaces the required core calculus class for students with weak or disadvantaged math backgrounds.
- TA for *Calculus of One Variable*, the required core calculus class.

This spring I am again the head TA for *Multi-Variable Calculus*, organizing nine teaching assistants and more than 170 students. I have also been hired by the Dean's office to provide math tutoring to struggling students. As part of my more generalized interest in teaching, I have also acted as a coach for the ballroom dance team for my five years at Caltech, and have taught a two-hour dance class each week.

At C2 Education I worked as a tutor in Math and English. I primarily worked to help struggling students prepare for standardized tests, but also spent a summer teaching one high schooler a full course in geometry, while helping another with English as a second language.

At Pomona College I was a tutor and a grader for classes in real analysis and vector calculus.

Sample Syllabus for Math 1d: Series, Winter 2014

Course overview

- Instructor: Jay Daigle
- Tuesday/Thursday, 9:00-10:00 AM in 151 Sloan
- Office Hours: Mondays 12-2 and 5-6 in Sloan 382
- Homework Due Date: Tuesday at noon, in the Math 1d dropbox
- Email: jdaigle@caltech.edu

Course Description

Math 1d is a seven-week course on sequences and series for students previously enrolled in Math 1a, section 1. This course focuses on material that was skipped over in Math 1a, primarily sequences, series, and a bit of work on complex numbers.

Course Policies

Math 1d is a pass-fail 5-unit course. Grades will be based on your performance on seven weekly homework sets. Homework will be posted by Wednesday afternoon and is due by noon the following Tuesday. There will be no midterm or final exam.

Each homework assignment will feature one problem marked (Redo). No collaboration will be allowed on this problem. It will be graded strictly, and graded for clear writing as well as for correct mathematical ideas. However, you may resubmit your answer to this problem as many times as you wish, and only your best attempt will affect your final grade.

The remainder of the homework set will be a collection of 4-6 problems, of which you must choose 2-3 to solve (depending on the assignment). While I encourage you to work all the problems out for yourself, please don't submit more than the requested number of problems. Some questions will be more computational and others more theoretical; feel free to focus on the side of the class that appeals more to you.

At the end of the term, your lowest homework score will be dropped and the remaining six will be averaged together for your final grade. Late homeworks will be excused only if accompanied by a note from the Deans or from the Student health center.

Other Resources

I will post additional materials from time to time on the course website, which can be found through the Caltech math website at <http://math.caltech.edu> or through my personal website at <http://jaydaigle.net>.

In previous years, this course was taught by Pádraic Bartlett; you can find his lecture notes and other comments at http://math.ucsb.edu/~padraic/notes_caltech.html.

Books you may find helpful:

- Mathematical Thinking: Problem Solving and Proofs, by John P. D'Angelo and Doug West.
- Calculus, by Michael Spivak.

Sample Homework Assignment on Sequences of Functions

Instructions

The first problem is mandatory, and no collaboration is allowed. Be as clean as you can in your writeup; but remember you can resubmit as often as you like. You may consult the online notes, your own notes, and textbooks. Also please feel free to discuss the problem with me if you're having issues.

There are four optional problems; please choose and submit two. Collaboration is allowed and encouraged on these problems. You may consult Wikipedia, your own notes, the notes posted online, and textbooks, as well as your classmates and other Caltech students. Please be sure to write the solutions up in your own words.

All problems are worth equal amounts of points. The homework is due in the Math 1d dropbox outside the math office by noon on Tuesday, February 4.

Mandatory Redo Problem

Problem 1 (Redo). Let $f_n(x) = x/n^2$.

1. Show that $f_n(x)$ converges pointwise to 0.
2. Show that $f_n(x)$ converges uniformly to 0 on the interval $[-1, 1]$.
3. Show that $f_n(x)$ does *not* converge uniformly to 0 on \mathbb{R} .

Optional Problems

Problem 2. 1. Define the function f_n as follows:

$$f_n(x) = \begin{cases} 0, & x \leq 0, \\ x^n - x^{2n}, & 0 < x < 1, \\ 0, & 1 \leq x, \end{cases}$$

Show that the pointwise limit $\lim_{n \rightarrow \infty} f_n$ of these functions is the zero function $f(x) = 0$. Show that these functions do not converge uniformly to 0.

(Hint: using the derivative, find the maxima of f_n . What is this function equal to at its maximum? Why is this a problem if the functions are supposed to be converging uniformly to 0?)

2. Define $g_n : [1, 2] \rightarrow \mathbb{R}$ by $g_n(x) = \frac{nx^2+1}{nx+1}$. Show that these functions converge uniformly.

Problem 3. 1. Define $f_n : (-\pi/2, \pi/2) \rightarrow \mathbb{R}$ by $f_n(x) = \tan(x)/n$. Find the pointwise limit of the f_n . Prove they do not converge uniformly.

2. Define $g_n : [0, \pi]$ by $g_n(x) = \sin^n(x)$. Find the pointwise limit of the g_n . Without using an ϵ argument, prove they do not converge uniformly.

Problem 4. 1. In class, we stated the proposition that if (f_n) is a sequence of functions that converges to f , then (f_n) also converges to f pointwise. Prove this fact.

2. Using the definition of a complex derivative, prove that if $f, g : \mathbb{C} \rightarrow \mathbb{C}$ are functions of complex numbers, then $(f + g)' = f' + g'$.

Problem 5. We defined the “sup norm” $\|f\|_\infty$ of f to give us a sense of “distance” on functions. In particular, it has four properties that make it a good distance function (which you do *not* need to prove):

1. $\|f\|_\infty \geq 0$ for every f .
2. $\|f\|_\infty = 0$ if and only if $f = 0$.
3. $\|a \cdot f\|_\infty = |a|\|f\|_\infty$ for any $a \in \mathbb{C}$.
4. $\|f + g\|_\infty \leq \|f\|_\infty + \|g\|_\infty$ for any f, g .

The sup norm isn't the only way we could define distance, though. If f is a function integrable on some interval $[a, b]$, we define the “1-norm” by

$$\|f\|_1 = \int_a^b |f(t)| dt.$$

Prove that $\|f\|_1$ satisfies properties 1, 3, and 4 above. (As written, $\|f\|_1$ doesn't quite satisfy property 2. In a course on functional analysis we would make the necessary tweak to turn this norm into a sense of distance).

Evidence of Teaching Effectiveness

Jay Daigle

At the end of each term, Caltech asks its students to fill out Teaching Quality Feedback Reports. Students numerically score their professors and teaching assistants on several topics. For each class for which I have acted as an instructor or teaching assistant, the tables below give the score I was given on each of these questions, compared with the average score received by other Tas or instructors in my department, in my division, and at Caltech as a whole. The feedback form also gives a space for students to make any specific comments they wish; I have listed all of them below the score report.

Winter 2014 Math 1d: Series (Instructor)

Total Responses: 3

Total Enrolled: 17

Course Section: Ma 001D

	Score	Dept.	Div.	Caltech
The quality of the course content	3.33 ± 0.94	3.87	3.96	4.08
The instructor's overall teaching	5.00 ± 0.00	3.70	3.84	4.01

	Score	Dept.	Div.	Caltech
Set out and met clear objectives announced for the course	5.00 ± 0.00	4.00	4.09	4.11
Displayed thorough knowledge of course material	4.50 ± 0.50	4.31	4.35	4.44
Explained concepts clearly	5.00 ± 0.00	3.63	3.81	3.95
Distinguished between more important and less important topics	5.00 ± 0.00	3.52	3.72	3.80
Presented material at an appropriate pace	5.00 ± 0.00	3.77	3.89	3.94

	Score	Dept.	Div.	Caltech
Emphasized conceptual understanding and/or critical thinking	4.00 ± 0.00	3.83	3.98	4.09
Related course topics to one another	4.50 ± 0.50	4.02	4.04	4.13

	Score	Dept.	Div.	Caltech
Demonstrated concern about whether students were learning	5.00 ± 0.00	3.80	3.96	4.11
Inspired and motivated student interest in the course content	4.50 ± 0.50	3.64	3.86	4.03
Was available for consultation outside of class	5.00 ± 0.00	3.96	4.04	4.19

	Score	Dept.	Div.	Caltech
Selected course content that was valuable and worth learning	4.50 ± 0.50	3.95	4.05	4.12
Organized course topics in a coherent fashion	5.00 ± 0.00	3.93	4.02	4.03
Chose assignments that solidified understanding	5.00 ± 0.00	3.87	3.96	4.02
Explained clearly how students would be evaluated	5.00 ± 0.00	4.03	4.10	4.13
Designed and used fair grading procedures	5.00 ± 0.00	4.00	4.14	4.13

	Score	Dept.	Div.	Caltech
Provided helpful comments on assignments, papers, exams	4.33 ± 0.47	4.28	4.40	4.33
Answered questions clearly and concisely	5.00 ± 0.00	4.47	4.43	4.36
Was well prepared for section, office hours or lab	4.33 ± 0.47	4.53	4.54	4.45
Presented material clearly in section or lab	4.67 ± 0.47	4.51	4.44	4.43
Overall teaching effectiveness	4.67 ± 0.47	4.48	4.44	4.38

Comments

Jay did a great job teaching and TAing the course, he gave homeworks that reviewed the week's material but were not too difficult.

It sucks just because lecture is at 9 AM but it's really not that bad a course.

Fall 2013 Math 1a Section 1: Freshman Mathematics

Total Responses: 8

Total Enrolled: 17

	Score	Dept.	Div.	Caltech
Provided helpful comments on assignments, papers, exams	4.40 ± 0.80	3.76	4.05	4.18
Answered questions clearly and concisely	4.20 ± 0.98	3.82	4.08	4.18
Was well prepared for section, office hours or lab	4.25 ± 0.83	3.95	4.21	4.26
Presented material clearly in section or lab	4.25 ± 0.83	3.85	4.11	4.21
Overall teaching effectiveness	4.50 ± 0.50	3.79	4.09	4.18

Comments

A++ would recommend!!! Jay is pretty much the best TA in the history of ever! He's very good at teaching us math and also good at connecting with us and getting to know us as people. He's always very nice and gives us hints to help point us in the right direction instead of just telling us how to do it. He teaches us so that we can do it by ourselves the next time. He also stays at office hours until all of us have all of our questions answered, which is about 3/4 times longer than he should have to be at office hours. He also gives constructive comments on our homework.

He was always enthusiastic about the course material. I found his office hours to be extremely helpful in developing my problem-solving skills, as he was usually able to help us determine approaches to solving homework problems without giving away the solutions.

He was a good TA, always helped everyone when we were stuck on a homework problem.