

## **Final Report**

### **SFC 2009 Conference: Mathematics Option Committee**

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## Recommendations for the Mathematics Option

- Edit description of the Mathematics option in the course catalogue to make it obvious that Ma 5 can be taken freshman year (with instructor approval)
- Add exam reviews or a T.A.-led section to Ma 5
- Notify entering freshman who have passed out of Ma 1/Ma 2 that they can and should take Ma 5
- Advertise Ma 6 as a pure math proof-based class prospective math majors can take freshman year
- Develop a website for Ma 98 explaining the logistics of undertaking an undergraduate reading course
- Inform faculty members of the student perspective on exams that are 5-6 hours or longer and exams that are weighed 60% or more (net worth)
- Construct an informative letter from the students to new faculty & postdocs explaining some of the unofficial policies of Caltech, including take-home open-resource exams
- Organize a seminar on mathematical topics presented at the undergraduate level.

The Math SFC Committee for 2009 met monthly during the academic year until the SFC Conference in April 2009. We produced a survey for math majors to take that was based on findings from the 2007 SFC as well as our student experiences. From the results of this survey as well as the advice of the faculty members of the committee, we discussed and formulated comments and suggestions about the mathematics option to share with both students and faculty. On April 6, 2009, we held a discussion of these recommendations with the SFC committee as well as other mathematics faculty and students on improving our major. In this report, we examine many aspects of the math option, and make proposals for adjustments in some areas.

### **Ma 5: Introduction to Abstract Algebra**

From the 2007 survey, we learned that on average, half of math majors take Ma 5 during their freshman year. This class is overwhelmingly considered the first introduction students have into rigorous pure mathematics. Students find that Ma 5 should be more feasible for math majors to take freshman year, but the reasons for this are widespread. One reason focuses on the need to decide whether the mathematics option is correct direction before sophomore year. Another reason is due to the fact that mathematics has a steep learning curve and it may be hard to have opportunities such as research without taking higher-level courses, many of which have Ma 5 as a prerequisite. However, many students enjoy the curriculum of Ma 5 and do not see the coursework as something that needs to be changed. Possibilities for making Ma 5 more available to freshman include changing the catalog to ensure that incoming students realize that it is an option for the first year, holding reviews for exams or sections to make the class more “freshman-friendly.” If however, incoming students are more interested in getting a taste of the math major, then another option is to advertise Ma 6 as a class to take during freshman year (as well as Ma 3 in the Spring term). Methods for advertising Ma 6 include adding it to the list of optional courses mailed to freshman the summer before they matriculate. Another option is to recommend classes to students who pass out of core mathematics courses.

## **Ma 98: Undergraduate Reading Course**

The students as well as the faculty on the SFC Math Committee believe that studying mathematics via a reading course is beneficial and almost necessary at a school with a small math department. Furthermore, many faculty members are willing to oversee reading courses for students, but we were not sure how many students have considered this option. From the survey, a majority of undergraduates would have liked to review material, undertake research during the school year, or learn material that is not readily available at Caltech or not available during a specific term. Our recommendation is for the mathematics department to construct a website for Ma 98 that includes a catalog description of the course, descriptions of what people have previously done with the course, the list of mathematics faculty arranged by subject, as well as a guide for undergraduates on how to go about approaching a professor for overseeing a reading course (similar to the guide given for SURF). One concern of professors who have overseen reading courses is that students may not take it as seriously as their other, more structured courses which can affect the utility of the course. Thus, the website should also convey the general time commitment and responsibility necessary for undertaking such an independent study.

## **Exam Weight & Length**

Another concern of students is focused on exams in math courses, specifically, the combined issue of their length and weight. A number of math majors expressed that they were unhappy that a large proportion of their grade was decided within  $n$ -hours divided between at most 2 exams. Faculty explained that a large portion of one's grade should be individual work and there are not many other ways to evaluate that except for such exams. Students were in general unhappy with exams that were continuous 6 hours or more as well as exams that were weighed 60% or more (net exam worth). Because exam weight and length is completely up to the professor teaching a course, the committee has no suggestion for the math department except to inform faculty members, especially postdocs & new faculty members, of student opinions. During the discussion at the SFC, both students and faculty brought up the need for some sort of guide for new faculty members explaining some of Caltech's unofficial policies

(e.g. take-home open-resource exams) as well as the student perspective. A recommendation for this is to include a page in the introductory package for new faculty members that is from the students (potentially ARC) and explains our perspectives on exams, the honor code, etc.

### **Undergraduate Seminar**

Finally, it is clear from the student survey that a vast majority of math majors would like there to be a pizza course or seminar on various topics in mathematics at the undergraduate level. Besides the interest in having such a seminar, this could potentially address other concerns of undergraduates including providing an environment for talking to professors and finding mathematical research opportunities. We recommend for such a lecture series to be organized under the umbrella of the Math Club, starting with volunteer lectures by Caltech faculty as well as graduate students. Ideally, seminars should be given bi-weekly with food provided to give an informal setting which would allow attendees to speak with the lecturer. Since the Math Club has limited funding, applying for Housner funding or MHF funding could provide for the lecture series. In order to ensure that a seminar continues to run, it would be ideal if there were a volunteering faculty member who could act as a co-organizer to the students in charge of the seminars. Such a faculty member could further assist in asking visiting faculty whether they would like to give an undergraduate seminar.

### **Status of Recommendations**

Currently, the recommendation to change the catalogue regarding Ma 5 has been undertaken by the math department. Furthermore, the undergraduate seminar is currently scheduled with 3 seminars for the Spring 2009 term, and the Math Club has applied for Housner funding. The website for Ma 98 and the process of informing faculty members of the student perspective regarding exams are being discussed with the math department and should be followed up on. Making Ma 5 more “freshman-friendly” and advertising Ma 6 to freshman are long-term recommendations that we hope the math department will undertake.

## Appendix: Survey Results

### Student Information

#### Please indicate your class year:

Sophomore	12	34.29%
Junior	9	25.71%
Senior	13	37.14%

#### (# of Math Majors

(Sophomore	21
(Junior	16
(Senior	23
(Total	60

#### % Survey-takers)

57.14%
56.25%
56.52%
56.67%

#### House most closely affiliated with:

Select one	3	8.57%
Avery	6	17.14%
Blacker	2	5.71%
Dabney	6	17.14%
Fleming	1	2.86%
Lloyd	2	5.71%
Page	5	14.29%
Ricketts	3	8.57%
Ruddock	7	20.00%
None		0.00%

**When ideally do you think Ma 5 should be taken by math majors?**

Freshman	21	60.00%
Sophomore	10	28.57%
Junior		0.00%
Senior		0.00%
No opinion/don't know	3	8.57%

**Do you think it should be easier for prospective math majors to take Ma 5 freshman year?**

Yes	18	51.43%
No	9	25.71%
I don't know	7	20.00%

**Do you think it should be easier for prospective math majors to take Ma 108 freshman year?**

Yes	11	31.43%
No	19	54.29%
I don't know	4	11.43%

**How do you feel about the length and weight of exams in core math classes (Ma 5, Ma 108, Ma 109)?  
(Feel free to reference only certain courses, certain terms, certain exams, etc.)**

Summary of Responses (for confidentiality):

Many students believe that exams are too heavily weighted in Ma 108 and Ma 109. Students were also unhappy with 5 and 6 hour exams, and in general believe homework should be weighted more.

Otherwise, students were mostly fine with exam length in weight.

**What do you think are appropriate exam lengths (include thoughts on infinite time exams, if applicable)?**

Summary of Responses (for confidentiality):

The general consensus is that 3-4 hour exams (w/ 3-5 problems) are optimal and infinite time exams are okay as long as they are not written to take infinite time. Specific course policies that students enjoy include breaks in longer exams, an extra hour after the exam time for writing up the exam, and having  $n+1$  problems with  $n$  required.

**In general, how much of one's grade should exams be worth?**

20% or less	2	5.71%
20% - 40%	15	42.86%
40% - 60%	11	31.43%
60% - 80%		0.00%
80% or more	1	2.86%
No opinion/I don't know	5	14.29%

**If offered, would you be interested in attending a pizza course/undergraduate seminar about mathematics & mathematics research taught at an undergraduate level?**

Yes	28	80.00%
No	5	14.29%
Don't care	1	2.86%

**Do you feel like there was any major redundancy between any of these courses: Ma 5, Ma 108, Ma 109?**

Yes, but I didn't mind	5	14.29%
Yes, and I did mind		0.00%
No	26	74.29%
Don't know	3	8.57%

**How would you rate the interactions with professors of core math classes (Ma 5, Ma 108, Ma 109)?**

1 - Terrible	1	2.86%
2	5	14.29%
3	11	31.43%
4	12	34.29%
5 - Excellent	1	2.86%
Don't know	4	11.43%

**How would you rate the interactions OUT of class with professors of core math classes?**

1 - Terrible	1	2.86%
2	8	22.86%
3	5	14.29%
4	5	14.29%
5 - Excellent	1	2.86%
Don't know	14	40.00%

**Are there enough research opportunities during the school year?**

Yes, would want to do research during the school year	7	20.00%
No, would want to do research during the school year	11	31.43%
Don't care, wouldn't want to do research during the school year	14	40.00%

**Any particular comments on faculty interaction? (Feel free to reference only certain courses, certain terms, certain professors, etc.)**

Summary of Responses (for confidentiality):

Students find professors approachable and nice, but do find it hard to look for SURF mentors and research opportunities. It is also suggested that there should be Student-Faculty events to encourage more interaction. One concern is that post-docs generally teach Ma 5, Ma 108, Ma 109, so approaching professors when students haven't taken classes with them becomes difficult.

**Have you ever been interested in doing a reading course (to learn material not offered in a normal course or review material)?**

Yes	18	51.43%
No	12	34.29%

**What is your biggest complaint/concern about the math major? (If there is anything you would like the SFC committee to take into consideration, please comment here.)**

Summary of Responses (for confidentiality):

The biggest complaint that has not been brought up by other questions in this survey is how slow one gets through the mathematics option due to the necessity of taking core during freshman and sophomore year, none of which is the type of coursework math majors are interested in doing. Other responses include:

- Classes are offered only 1 term per year
- Making sets due later in the day (to discourage all-nighters)
- Making mathematical research opportunities more feasible
- Allowing math majors to replace Ma 1 with Ma 108
- Making reading courses more viable during the school year
- Reducing overlap between 109b, 108, and 1