Mathematics Discipline Assessment 2008–2009

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1 Introduction

The mathematics curriculum is designed to

- help students develop competence in mathematical techniques and methods,
- sharpen students' mathematical intuition and abstract reasoning as well as their reasoning from numerical data,
- encourage and stimulate the type of independent thinking required for research beyond the confines of the textbook,
- provide students with the basic knowledge and skills to make mathematical contributions to modern society.

The curriculum prepares students to enter graduate school, pursue careers in applied mathematics, or teach mathematics.

2 Staff Reduction

The math discipline will have its FTE faculty reduced from 7.0 to 6.0 beginning fall 2009. The math course offerings for 2009/10 were reduced by 20 credits in the following way:

- Math will no longer teach IS 1001 First Year Seminar (two section, for a reduction of 4 credits).
- Math 2101 Calculus III will not be offered in the spring, and Math 2111 Linear Algebra will not be offered in the fall (a reduction of 8 credits). Math 2101 is required for the Math and Physics majors and the Physics minor, and Math 2111 is required for the Math major and minor. This change will negatively impact student course planning. Also, Calculus III has been moved to the regular classroom Sci 3610 to allow for increased enrollment, so this change will affect pedagogy (typically, Calculus I—III are in the math computer lab Sci 3510).
- Math 4401 Numerical Methods will not be offered (a reduction of 4 credits). This class alternates each year with Math 4452 Mathematical Modeling, so it is likely that neither of these courses will be offered in the next few years. This will have a negative impact on student research opportunities, since these classes expose students to advanced mathematical techniques that are needed to conduct research in applied mathematics.
- Reduce the number of 42xx pure math electives offered each year from three to two (a reduction of 2 credits). This will reduce the options for our best students who are planning to pursue graduate studies in mathematics.
- The cross-listed courses Math/Mgmt 3501 (2cr) and Math/Mgmt 3502 (2cr) are not being offered (since they were offered in alternate years, this is a reduction of 2 credits).

This comes at a time when we are introducing the new Math 1012 Precalculus I (4cr) and Math 1013 Precalculus II (2cr) courses. There is an additional 6 credits compared to previous years for the three sections of Math 1013 which are being offered in 2009/10. The reduced FTE faculty will also make it more difficult to cover sabbatical and single semester leaves without canceling classes (for this reason, Math 3401 Operations Research is not offered in 2009/10).

3 Math 4901 Senior Seminar

Relates to the goal of the math curriculum:

- *encourage and stimulate the type of independent thinking required for research beyond the confines of the textbook.*

More detail on Math 4901, including the assessment tool used in the presentation, can be found in Appendix A.

3.1 Minutes from Faculty Discussion on May 7, 2009

Eight students presented senior seminars in spring 2009, and one student presented in fall 2008. One student did not submit a proposal by the deadline for presenting in the spring, and had never identified a faculty advisor. This student was awarded an F grade.

The participation of the students was deemed excellent as a whole. Participation and independent work are somewhat related. Most students met once a week or more with their advisor. All students who completed the senior seminar submitted proposals on time.

The presentations were deemed very good as a whole. Many of the students made an effort to convert their paper into something that would be understandable to their intended audience, rather than simply recycling their paper for the presentation. The presentations were professional, many were quite polished. One student used *Mathematica* actively during their presentation, another used physical models. Some students could improve their presentations by varying their voice, and moving around the room to help engage the audience.

The final papers were deemed excellent as a whole. Three papers dealt with original mathematical results developed by the students, which is a significant accomplishment for an undergraduate student. Two papers, to varying degrees, suffered from a lack of precision in language and mathematical notation. As a whole, students responded to suggestions from the faculty meeting and their final papers were significantly improved over the near final drafts.

One of the strengths of the math senior seminar is that every student can gain something from the process of completing a paper and presentation and stretching their mathematical abilities, whatever their abilities are. Overall, the faculty consider this a very successful year of senior seminar

Final Grade Distribution for Senior Seminar

	A	A-	B+	B	B-	C+	C-	D+	D	F	K
# of Students	3	3	1	1						1	

3.2 Presentation Assessment Data for 2008/2009

Eight students completed their senior seminar presentation in 2008/2009 (1 fall 2008, 7 spring 2009). Here we collect the numerical summary of the data from the assessment sheets which are distributed to the audience at the senior seminar presentation. This assessment is only on the student's presentation. The Assessment tool is in Appendix A.

1. *Presented a clear explanation of a mathematical topic*

	Student								
	1	2	3	4	5	6	7	8	All
# of Respondents	26	19	24	29	20	23	23	17	
Mean	4.73	4.47	4.08	4.66	4.58	3.61	4.30	4.65	4.38
St. Dev.	0.53	0.61	0.65	0.55	0.67	0.89	0.70	0.61	0.74

2. *Spoke clearly, correctly, competently, and confidently*

	Student								
	1	2	3	4	5	6	7	8	All
Mean	4.81	4.42	4.42	4.36	4.60	4.30	4.43	**5.00**	4.53
St. Dev.	0.40	0.61	0.78	0.77	0.50	0.70	0.66	0.00	0.65

3. *Used presentation tools effectively*

	Student								
	1	2	3	4	5	6	7	8	All
Mean	4.85	4.47	4.56	4.66	4.95	3.87	4.48	4.76	4.57
St. Dev.	0.37	0.61	0.71	0.61	0.22	0.97	0.66	0.44	0.68

4. *Displayed a depth of understanding in the area of research*

	Student								
	1	2	3	4	5	6	7	8	All
Mean	**5.00**	4.66	4.33	**5.00**	4.50	4.39	4.52	4.82	4.67
St. Dev.	0.00	0.47	0.81	0.00	0.61	0.72	0.66	0.39	0.89

4 Student Participation in the Putnam Competition

Relates to the goal of the math curriculum:

- *help students develop competence in mathematical techniques and methods,*
- *sharpen students' mathematical intuition and abstract reasoning as well as their reasoning from numerical data,*
- *encourage and stimulate the type of independent thinking required for research beyond the confines of the textbook.*

A description of the Putnam Competition can be found in the 2007/08 Math Discipline Assessment, or online at http://math.scu.edu/putnam/.

Students prepare to take this national exam by working in the Problem Solving directed study. In 2008/09, we had two students take the Putnam exam.

Student	**Points**	**Rank (out 3627 of students)**
1	12	876.5
2	2	1660.5

5 M/SR Requirement in Math 1001 Survey of Math

The course Math 1001 Survey of Math is the discipline's Math/Symbolic Reasoning (M/SR) general education course for non-science students. The M/SR general education requirement has the following goals: *To strengthen students' ability to formulate abstractions, construct proofs, and utilize symbols in formal systems.* In April 2009, the two instructors who regularly teach this course devised an assessment tool for the M/SR requirement. Since this is a new assessment tool, a sample is included in Appendix B.

5.1 Assessment for Spring 2009

Assessment of students' ability to utilize symbols in formal systems.

Students utilize symbols in formal systems when they examine rigid motion symmetries of objects and examine the group structure that results.

1. **Assessment from Assignment #8**:
   (a) Demonstrate each of the seven rigid motion symmetries of the square (if you include the stay put transformation, you get eight total rigid motion symmetries).
   (b) Construct a partial Cayley table for the rigid motion symmetries of the square, filling in the portion that shows:
   - all combinations of rotations,
   - combinations that lead to the identity element, and
   - at least one entry that deals with a combination of two reflections.

Assessment of students ability to utilize symbols in formal systems

	Good	Fair	Poor
Number of Students	15	4	7
Percentage of Students	58%	15%	27%

Assessment of students' ability to construct proofs.

Students do not construct formal proofs in this class, however, they do many activities that require a detailed explanation of a mathematical result.

1. **Assessment from Assignment #8**:
   (a) Draw an object that has only two lines of reflection symmetry, and one rotational symmetry (exclude the stay-put symmetry). Demonstrate the symmetries of your object.
   (b) Can you draw an object that has only two rotational symmetries and only one reflection symmetry (exclude the stay-put symmetry)? Explain your answer.

Assessment of students ability to construct proofs

	Good	Fair	Poor
Number of Students	12	9	5
Percentage of Students	46%	35%	19%

6 Individual Course Assessments

Relates to the goal of the math curriculum*:*

- *help students develop competence in mathematical techniques and methods,*
- *sharpen students' mathematical intuition and abstract reasoning as well as their reasoning from numerical data,*
- *provide students with the basic knowledge and skills to make mathematical contributions to modern society.*

This section contains a selection of some of the assessments carried out by individual faculty members in the 2008–09 year.

6.1 Math 1101 Calculus I

The instructor uses proficiency tests in four areas: elementary functions, trigonometry, differentiation, and antidifferentiation. Students take these multiple choice tests until they achieve a high enough score to demonstrate their proficiency with the material. They receive no credit for the test until they demonstrate proficiency, at which point they receive full credit for the test.

N=11 students	Total Number of Attempts	Percentage of students who Demonstrate Proficiency
Elementary Functions	26	11/11 = 100%
Trigonometry	26	10/11 = 91%
Differentiation	51	10/11 = 91%
Antidifferentiation	40	8/11 = 73%

7 Student Research Presentations

Relates to the goal of the math curriculum:

- *encourage and stimulate the type of independent thinking required for research beyond the confines of the textbook.*

- At the 2009 *Joint AMS/MAA National Meeting in Washington DC,* Charles Rudeen, UMM 2009, presented his poster entitled, *Maximum Weight Connected Subgraph Problem,* (advisor: Peh Ng).
- At the 2009 *UMM Undergraduate Research Symposium:*
  - Charles Rudeen, UMM 2009, presented *Solving the Maximum Weight Connected Subgraph Problem on a Subclass of Graphs* (advisor: Peh Ng).
  - Samuel Potter, UMM 2009, presented *Impacts of Seasonality, Spatial Heterogeneity, and Disease on Competitive Grasslands* (advisor: Peh Ng).
  - David Nieves, UMM 2010, presented *Advanced Techniques for Summing Divergent Series* (advisor: Barry McQuarrie).
  - Jeremy Davis, UMM 2011, presented *Sierpinskii Fractals* (advisor: Byungik Khang).
  - Katherine Struss, UMM 2009, presented *A Chaotic Image Encryption* (advisor: Barry McQuarrie).
  - Tyler Sable, UMM 2010, presented *Computational Monodromy: Visualizing the Behavior of Polynomials* (advisor: David Roberts).

8 Math Content Knowledge from PRAXIS Exam

Relates to the goal of the math curriculum*:*

- *help students develop competence in mathematical techniques and methods,*
- *provide students with the basic knowledge and skills to make mathematical contributions to modern society.*

The mathematics students who have written the PRAXIS II math content exam for Secondary Education Licensure have consistently scored well above the cutoff for passing the test. Only 1 student out of 21 since 2002 has not passed the math subject test for teaching licensure

Student	Year	Points Above Cutoff (cutoff was 125)
1	2008	55
2	2008	45
3	2008	42

9 Placement Exam

The math discipline pursued using the online placement suite MapleTA during the registration period for Fall 2008. Unfortunately, due mainly to computer load issues, very few students were able to complete the online test. Some students completed the old paper based test, and others simply got no placement advice at all. For this reason, no data could be collected regarding the test from the registration for Fall 2008.

However, thanks to the efforts of Michael O'Reilly, the administration was convinced to try again since the long term benefits of using the MapleTA system are important for UMM in the future:

- More accurately diagnose students' math abilities and get them started in the correct math course which will aid in retention,
- The possibility for off-campus testing before students come to register.

The use of the MapleTA test went smoothly at the fist two registration sessions for Fall 2009, and we are now beginning to collect data on its effectiveness in placing students (which will be done in December 2009 and included in next year's Assessment report).

10 Curriculum Changes

For reasons documented in last year's Assessment Report, the following Curriculum changes were passed in Fall 2008 and become effective in Fall 2009.

List of courses outside the major updates:

1. A list of non-math courses with Math prerequisite

- ~~Chem 1101. General Chemistry 1~~
- ~~Chem 1102. General Chemistry 2~~
- ~~Chem 1111. Honors General Chemistry 1~~ (no longer offered)
- Chem 3501. Physical Chemistry 1

- Econ 3201. Microeconomic Theory
- Econ 3202. Macroeconomic Theory
- Econ 3501. Introduction to Econometrics
- Econ 4111. Mathematical Economics 1
- Econ 4112. Mathematical Economics 2
- Geol 3401. Geophysics
- Geol 3501. Hydrology
- ~~Mgmt 3101. Financial Management~~ (Stat 1601--no math prereq)
- ~~Mgmt 3201. Marketing Principles and Strategy~~ (Stat 1601--no math prereq)
- ~~Mgmt 3301. Management Science~~ (Stat 1601) (no longer offered)
- Mgmt 3501. Applied Deterministic Modeling for Management Science
- Mgmt 3502. Applied Probabilistic Modeling for Management
- NSci 3201. ~~Honors:~~ Relativity and Cosmology
- Phys 1101. General Physics 1
- Phys 1102. General Physics 2
- Phys 2101. Modern Physics
- Phys 3101. Classical Mechanics
- Phys 3201. Mathematical Methods in Physics
- Phys 3301. Optics
- Phys 4101. Electromagnetism
- Phys 4201. Quantum Mechanics
- Stat 2601. Statistical Methods

2. A list of non-math courses without Math prerequisite but have math applications

- ~~CSci 1301. Problem Solving and Algorithm Development 1~~
- ~~CSci 1302. Problem Solving and Algorithm Development 2~~
- CSci 2101. Data Structures
- CSci 3401. Models of Computing Systems
- CSci 3501. Algorithms and Computability
- CSci 3601. Software Design and Development
- Phil 2101. Introduction to Symbolic Logic
- ~~Psy 3111. Sensation & Perception~~
- ~~Psy 3112. Cognition~~
- Psy 3601. Quantitative Methods in Psychology
- Stat 3601. Data Analysis
- Stat 3611. Multivariate Statistical Analysis
- Stat 4601. Biostatistics

Add a computing requirement to the math major:

Take one of the following:

- CSci 1301 Problem Solving and Algorithm Development, or
- CSci 1201 Introduction to Digital Media Computation, or

- CSci 1001 Introduction to the Computing World and CSci 1101 Dynamic Web Programming (two courses).

This requirement may be waived after consultation with the math faculty.

Rationale:

- Math majors should have exposure to computing.
- The particular courses in the requirement were agreed upon after consultation with CSci faculty.

Specific Course Changes

MATH 1011 **Pre-calculus** (4cr) is being deactivated.

MATH 1012 **PreCalculus I: Functions**
(4cr Prereq high school higher algebra, geometry; fall, spring every year)
Linear and quadratic functions, power functions with modeling; polynomial functions of higher degree with modeling; real zeros of polynomial functions; rational functions; solving equations in one variable; solving systems of equations; exponential and logarithmic functions, and the graphs of these functions.

MATH 1013 **PreCalculus II: Trigonometry (M/SR)**
(2cr prereq placement; fall, spring every year)
Angles and their measures; trigonometric functions; the circular functions of trigonometry; graphs of sine, cosine, tangent, cosecant, secant, and cotangent functions; algebra of trigonometric functions; inverse trigonometric functions; solving problems with trigonometry. analytic trigonometry; fundamental trig identities; proving trigonometric identities; sum and difference identities; multiple-angle identities; the Law of Sines; the Law of Cosines.

Rationale:

- Precalculus covers too much material too quickly for even the better students to get the most out of the course.
- Many students who earn a D in Precalculus could do much better if they had more time to work on the material. These students would also be better served by taking Survey of Calculus rather than Calculus I.
- We have roughly 125 student in Calculus I in a year, but only 15 in Survey of Calculus. It would be beneficial if we could balance that better.
- Students who need a Precalculus course to prepare for Survey of Calculus do not need to study trig since Survey of Calculus has no trig.
- Some students only need a trigonometry refresher to prepare for Calculus I.
- The new courses will include more applications than the previous precalculus course.

The changes to the precalculus courses lead to some minor changes in the prerequisites for Calculus I and Survey of Calculus.

MATH 2401 **- Differential Equations (M/SR)**
(4.0 cr; Prereq-1102 or #; fall, every year)
First-order and second-order differential equations with methods of solution and applications, Laplace transforms, systems of equations, series solutions, existence and uniqueness theorems, the qualitative theory of differential equations.

Rationale: Update content of course.

MATH 4452 **- Mathematical Modeling (M/SR)**
(4.0 cr; Prereq-#; fall, spring, offered when feasible)
~~Mathematical modeling using discrete and continuous models.~~ Mathematical topics include, but are not limited to, ~~curve fitting, statistical testing, regression analysis,~~ differential and difference equations, ~~and~~ discrete and continuous dynamical systems, predator-prey models, discrete and continuous optimization models, probabilistic models, stochastic and Poisson processes, and queuing models. Application are drawn from different areas in the sciences and social sciences. ~~. Topics drawn from population growth, interacting populations, biology, genetics, traffic flow, or finance.~~

Rationale: Update content of course.

MATH 4901 **- Senior Seminar (M/SR)**
(~~1.0~~ 2.0 cr; prereq-sr; full year course begins fall; fall every year)
This is a full-year course, required for all mathematics majors in their senior year. Students must attend year round and present one of the seminars.

Rationale: The amount of work students put into Math 4901 is representative of a 2cr course. To leave the number of credits in the math major unchanged, the number of elective credits required is reduced from 5cr to 4cr.

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11 Looking Ahead

An important task in the coming months will be to monitor the effectiveness of our new placement test and precalculus classes. Appendix C has the new placement rubric created for Advisors and a grid that will be used to assess the effectiveness of the placement exam.

Appendix A: Senior Seminar

The math senior seminar is a 1 credit course (beginning fall 2009 it will be 2 credits) and consists of a paper (typically 10-15 pages) and presentation (40 minutes long) created by the student, under the supervision of a faculty advisor. The student works on the senior seminar for two semesters. Students may approach the senior seminar from a variety of directions–they may build on previous work they have done as a Morris Academic Partner (MAP), through the Undergraduate Research Opportunity Program (UROP), or other research experience; they may reproduce or extend a mathematical concept from a primary paper in the literature; or they may use multiple references to obtain an understanding of a mathematical concept. In all cases, the student should strive for some degree of originality in their project.

The degree of independence in student work varies–some students work closely with their faculty advisor, and others work independently. In all cases students should periodically meet with their faculty advisors to receive feedback as they create their project proposal, paper and presentation.

The student submits a project proposal near the end of the first semester they are enrolled in the senior seminar. There is no standard template for what should go into a project proposal, it is used to ensure the student has made some progress on their paper in the first semester, and has an outline of what still needs to be completed.

Before the presentation, each student's near final version of their paper is read closely by a second reader from the math faculty, who provides constructive feedback on the paper before it is read by the rest of the math faculty. The entire math faculty meet with the student for a short (15 minute) meeting before the presentation. At this meeting, the faculty give their responses to the paper, and may offer suggestions to the student about the paper or the presentation.

Audience members at the presentation fill out an assessment tool (see Sec. 2.3). The results from the audience assessment can help faculty assess the quality of the presentation, but its primary use is to provide the student feedback on the presentation. The presentation should be at a level appropriate to the audience (math majors who may not be familiar with the specifics of the seminar topic). Both the paper and presentation should exhibit a significant mathematical component and be of a high professional quality.

After all the students have finished their presentations, the faculty meet to discuss the senior seminar process and assign grades (A-F) to the students. A student's grade is ultimately assigned by the faculty advisor for the student, and this meeting helps ensure consistency in the grading from one faculty member to the next. Students are made aware of the senior seminar time line and expectations of the course through communications and meetings with the senior seminar coordinator, their faculty advisor, and via the course webpage (http://www.morris.umn.edu/academic/math/policies-seniorsem08-09.html).

Grading Scheme

30% Active participation throughout the process
10% Project proposal with mathematical foundation and research plans
30% Final written paper
30% 40-min presentation

The above grading scheme is meant to give an understanding of the relative importance of the various components of the senior seminar. Final grades are typically arrived at in a holistic manner.

Mathematics Discipline: Assessment of Senior Seminar Presentation

Presenter's Name:_____Presentation Title:_____Date: _____

I am a (check one): ___student ___faculty member ___other _____

	Excellent	Very Good	Good	Fair	Poor
Presented a clear explanation of a mathematical topic	5	4	3	2	1
Spoke clearly, correctly, competently, and confidently	5	4	3	2	1
Used presentation tools effectively	5	4	3	2	1
Displayed a depth of understanding in the area of research	5	4	3	2	1

Please take a moment to provide an honest and thoughtful assessment of the presentation.

What were the main strengths of the presentation?

What suggestions do you have for improvement?

Further comments:

Appendix B: Sample Gen Ed Assessment Tool

Assessment of students' ability to formulate abstractions

Students formulate abstractions by constructing a variety of types of graphs that represent underlying physical systems.

1. **Assessment from Assignment #2**:

   Question: Give an example of a job that is made up of at least 8 tasks, and for which at least 2 of the tasks depend on other tasks. Determine your best estimate of the time necessary to complete each task. Finally, construct an order requirement digraph for the job.

Table 1: Assessment of students ability to formulate abstractions

	Good (A-B)	Fair (C)	Poor (D-F)
Number of Students			
Percentage of Students			

2. **(optional) Feedback**:

   Based on student ability on this question:
   - Were any changes made to the assignment?
   - If necessary, were any changes made to the course to better assist students in understanding this particular concept?

3. **(optional) Reassessment from Test #2**:

   Question: The following table represents children who fight in day care. An X in a column means the two children do not get along.

	A	B	C	D	E	F
A		X	X	X	X	
B	X			X		
C	X					
D	X	X			X	
E	X			X		
F						

   Construct a graph that conveys this information. Then, use your graph to determine play groups of 2 children per group where children who fight are separated.

Table 2: Reassessment of students ability to formulate abstractions

	Good (A-B)	Fair (C)	Poor (D-F)
Number of Students			
Percentage of Students			

Assessment of students' ability to utilize symbols in formal systems.

Students utilize symbols in formal systems when they examine rigid motion symmetries of objects.

2. **Assessment from Assignment #8**:

   Question: Demonstrate each of the seven rigid motion symmetries of the square (if you include the stay put transformation, you get eight total rigid motion symmetries).

   Table 3: Assessment of students ability to utilize symbols in formal systems

	Good (A-B)	Fair (C)	Poor (D-F)
Number of Students			
Percentage of Students			

3. **(optional) Feedback**:

   Based on student ability on this question:

   - Were any changes made to the assignment?
   - If necessary, were any changes made to the course to better assist students in understanding this particular concept?

4. **(optional) Reassessment from Test #8**:

   Question: Find all the rigid motion symmetries of the following strip pattern (assume the pattern extends to infinity in both horizontal directions). You don't have to demonstrate the symmetries, just list them.

   Table 4: Reassessment of students ability to utilize symbols in formal systems

	Good (A-B)	Fair (C)	Poor (D-F)
Number of Students			
Percentage of Students			

Assessment of students' ability to construct proofs.

Students do not construct formal proofs in this class, however, they do many activities that require a detailed explanation of a mathematical result.

2. **Assessment from Assignment #8**:
   Question: Draw an object that has only two lines of reflection symmetry, and one rotational symmetry (exclude the stay-put symmetry). Demonstrate the symmetries of your object.
   Can you draw an object that has only two rotational symmetries and only one reflection symmetry (exclude the stay-put symmetry)? Explain your answer.

Table 5: Assessment of students ability to construct proofs

	Good (A-B)	Fair (C)	Poor (D-F)
Number of Students			
Percentage of Students			

3. **(optional) Feedback**:
   Based on student ability on this question:
   - Were any changes made to the assignment?
   - If necessary, were any changes made to the course to better assist students in understanding this particular concept?

4. **(optional) Reassessment from Test #8**:
   Question: Draw a diagram that shows how to construct the Golden rectangle (rectangle with length of 1 and width of $(1+\sqrt{5})/2$) from the square with length of sides 1.

Table 6: Reassessment of students ability to construct proofs

	Good (A-B)	Fair (C)	Poor (D-F)
Number of Students			
Percentage of Students			

Appendix C

Math Placement Information for UMM Advisors

- If a student needs Calculus I make sure they have trigonometry. Some students may be able to take Survey of Calculus for their major. The main difference between Calculus I and Survey of Calculus is Calculus I requires trig and Survey of Calculus does not.
- A student may take Precalculus I and Precalculus II concurrently.
- A student may take Precalculus II:Trig and Calculus I concurrently, although that would be 7cr of math and it is generally not recommended.
- If a student's ACT math score is 0, it means they did not take the ACT test. If a student has an SAT math score, use the following to determine a corresponding ACT math score:
    - SAT Math between 0-460 is the same as ACT math between 0-19
    - SAT Math between 461-640 is the same as ACT math between 20-28
    - SAT Math between 641-800 is the same as ACT math between 29-36

Necessary Scores					
Advanced Algebra	**Elementary Functions**	**Trigonometry**	**ACTMath**	**Prerequisite Satisfied**	**Recommended Math Course(s)**
0-7	0-4	0-6	0-28	Grades K-8 Math	Basic Algebra
0-7	5-8	0-6	0-19	Grades K-8 Math	Basic Algebra
8-14	0-8	0-6	0-28	Basic Algebra	Precalculus I: Functions Precalculus II: Trig
0-14	0-4	0-6	29-36	Basic Algebra	Precalculus I: Functions Precalculus II: Trig
0-14	5-8	0-6	20-28	Basic Algebra	Precalculus I: Functions Precalculus II: Trig
0-14	0-4	7-13	0-36	Basic Algebra, Precalculus II	Precalculus I: Functions
0-14	5-8	7-13	0-19	Basic Algebra, Precalculus II	Precalculus I: Functions
0-14	5-8	0-6	29-36	Basic Algebra, Precalculus I	Precalculus II: Trig or Survey of Calculus
0-14	9-13	0-6	0-36	Basic Algebra, Precalculus I	Precalculus II: Trig or Survey of Calculus
0-14	5-8	7-13	20-36	Precalculus I, Precalculus II	Calculus I or Survey of Calculus
0-14	9-13	7-13	0-36	Precalculus I, Precalculus II	Calculus I or Survey of Calculus

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This is a sample of the template that will be used to assess the placement exam's effectiveness.

Placement advice during summer 2009 and resulting course grades after Fall 2009. Student should be successful along the diagonal (highlighted).

		Recommended Math Course(s)					
	2009	Basic Algebra	Precalculus I Precalculus II	Precalculus I	Precalculus II or Survey of Calculus	Survey of Calculus or Calculus I	No Placement Advice Given
Course Taken	Basic Algebra	24 2.50 20/24, 83% 4/24, 17%					n= A,B,C: (%) D,F,W,I: (%)
	Precalculus I Functions	12 1.78 4/12, 33% 8/12, 67%	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)			n= A,B,C: (%) D,F,W,I: (%)
	Precalculus II Trig	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)		n= A,B,C: (%) D,F,W,I: (%)
	Survey of Calculus	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)
	Calculus I	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)	n= A,B,C: (%) D,F,W,I: (%)

Notes:

- An effective placement diagnostic will show diminishing student success below the shaded cells in each column.
- Very few students should be above the shaded cells (that would indicate they are taking a course below their abilities).

Cell Legend:

students Avg. GPA
A,B,C grades, %
D,F,W,I grades, %