

Mathematics Programmatic and Course Assessment

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Outline

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- Course Level Assessment
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 - Instrument
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Math Major Undergraduate Program Assessment

Learning Outcomes

1. Students will be able to solve mathematical problems using tools and concepts from calculus, linear algebra and differential equations.
2. Students will demonstrate proficiency in the comprehension and writing of mathematical proofs. They will be able to write well-organized, grammatically correct, and logically sound mathematical arguments.
3. Students will be able to communicate mathematical ideas through symbolic expressions and graphs and be able draw inferences from such presentations of data.
4. Students will have an appreciation of the beauty and/or power of mathematics.

Mathematics Major

Students will demonstrate mastery of the core concepts in algebra, analysis, and at least one other core area of mathematics.

Specialization in Applied and Computational Mathematics

Students will demonstrate the ability to apply mathematics to real world situations, using deterministic or probabilistic models, and will be able to employ a variety of techniques to solve these systems, including numerical methods.

Specialization in Statistics

Students will be able to analyze and interpret data using statistical tools.

Concentration in Mathematics for Economics

Students will demonstrate the ability to apply mathematical tools to economics problems and appropriately interpret the results.

Specialization in Mathematics for Education

Students will have had the opportunity to act as a mathematics instructor to one or more students and will be able to discuss principles of good educational practices as it relates to this teaching experience.

Math Major Assessment Instrument

- Exit survey / exam for graduating math majors
- Administered in a variety of ways (in-class, voluntary, party, etc.)
- Survey questions on...
 - Courses taken
 - Extracurricular mathematical activities
 - Post-graduation plans
 - Suggestions for improving the major
- Mathematical questions ...
 - 6 GRE type multiple choice problems
 - State your favorite theorem or problem in mathematics
 - Prove 2 of 3 given mathematical propositions



Assessment Results

- Students taking Introduction to Proof got significantly higher average scores on the assessment
- Students tended not to select the set property proof and/or did less well on this proof than the others
- Students did not perform well on the question regarding linear algebra and number of solutions to a system of equations with a parameter.
- Students did perform well on the differential equations and calculus type problems.



Programmatic Changes

- Based on 2 years of assessment results, we added Math 13-Introduction to Proof as a required course for all math majors.
- Our new assessment study seeks to study the course level performance in finer detail.



Course Level Assessment

Focus on key transition courses:

- Introduction to Proof (Math 13)
- Algebra (Math 120)
- Analysis (Math 140)
- Introduction Graduate Algebra (Math 206)
- Introduction Graduate Analysis (Math 205)

Goals:

- To assess the growth of the students' abstract mathematical skills as they progress through the major.
- To assess the effectiveness of various teaching strategies on student learning outcomes related abstract mathematics.

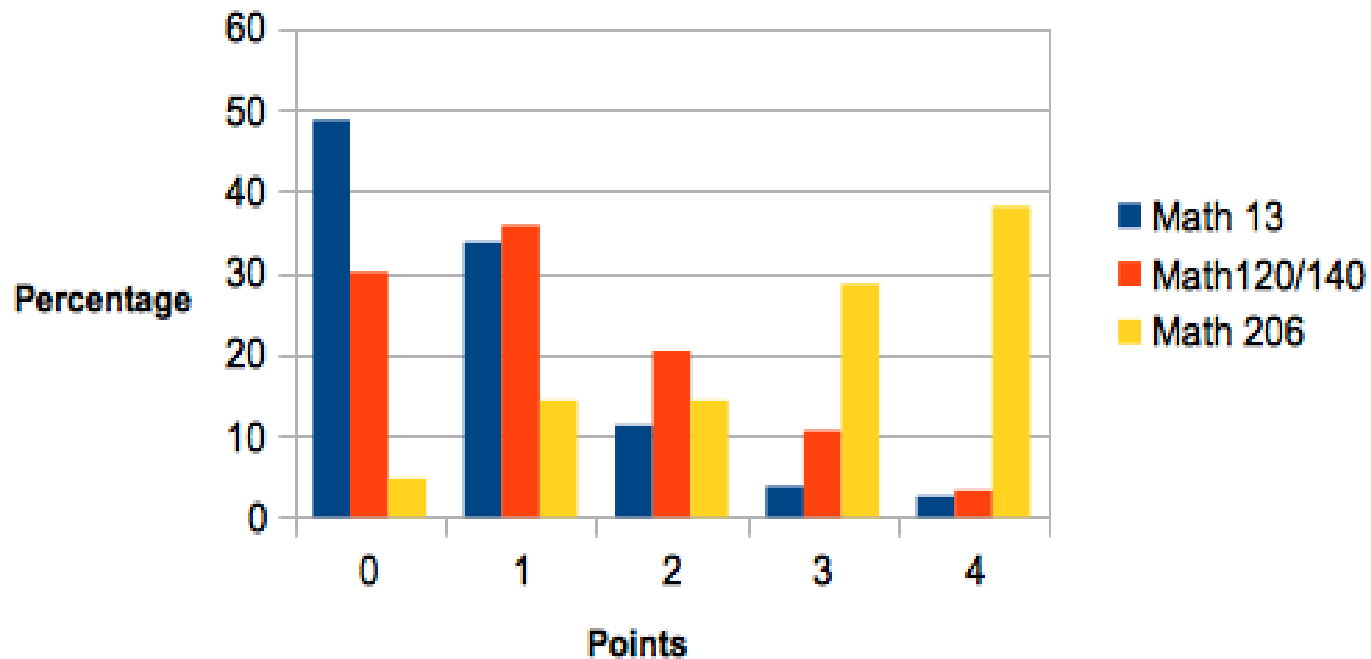
Assessment Instrument

- Four question quiz administered during 10 minutes of discussion section the first week of the course.
- Quiz questions are designed not to assume advanced mathematical content beyond basic calculus.
- Questions focused on:
 - Forming mathematical statements
 - Interpreting mathematical statements
 - Writing simple proofs
 - Using mathematical logic



Sample Question Results

1.) Define *function*.



2.) We say a set is *shifty* if and only if x being in S implies that $x-1$ or $x+1$ is also in S .

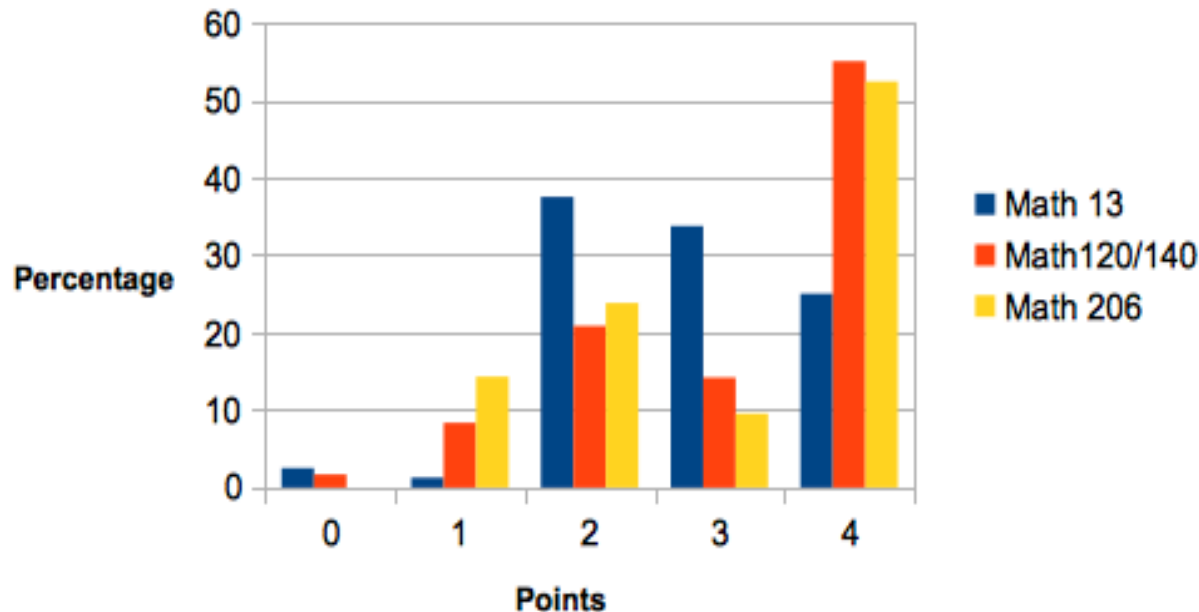
Determine whether each of the following sets is *shifty*.

$$S_1 = \{1, 2, 4, 5\}$$

$$S_3 = \{-3, -2, 0, 4, 5\}$$

$$S_2 = \mathbb{Z}^+$$

$$S_4 = \{2^n : n \in \mathbb{Z}\}$$

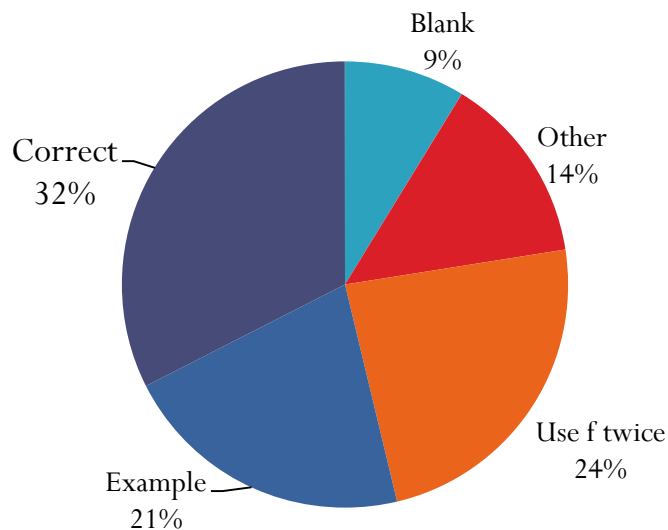


3.) **Def.:** If a function $f(x)$ satisfies $f(-x) = f(x)$ for every number x in its domain, then f is called an *even function*.

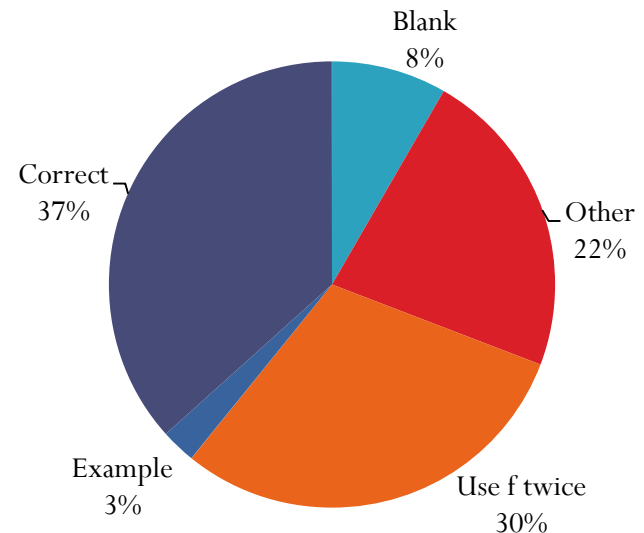
Def.: If a function $f(x)$ satisfies $f(-x) = -f(x)$ for every number x in its domain, then f is called an *odd function*.

Prove that the product of an even function and an odd function is an odd function.

Question 3: Math 13



Question 3: Math 120A/140A



4.) Write the negation (i.e. logical opposite) of each of the following statements without using the word “not”.

a.) UCI and UCLA have the same mascot.

b.) All UCI students are at least 5 feet tall.

c.) There is a unique bell tower at UCI.

	1	2	3	4a	4b	4c	Average Total
Math 13	0.77	2.77	1.15	1.7	0.6	0.35	7.35
Math120	1.20	2.91	1.56	1.54	1.16	0.66	9.06
Math140	1.26	3.26	1.30	1.54	0.95	0.56	8.90
Math206	2.80	3	2.80	1.80	1.19	0.85	12.47
TOTAL	4	4	3	2	2	2	17

- Work in progress...
 - Repetition of skills survey
 - Skills survey results correlated by instructor/teaching method
 - Focus group surveys regarding Math 13 instruction

Thank you!

Questions?



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