DEGREE/PROGRAM CHANGE
FORM C
Form Number: C1091

Fields marked with * are required

Name of Initiator: Sarita Jo Cargas **Email:*** cargas@unm.edu **Date:*** 08-31-12

Phone Number:* 505 277-4211 Initiator's Title* Lecturer III: UC University Honors Program

Associated Forms exist?* Yes

Faculty Contact* Rosalie Otero Administrative Contact* Lee Clark

Department* U Honors Admin Email* laclark@unm.edu

Branch Admin Phone* 277 4211

Proposed effective term:

Semester Fall Year 2013

Course Information

Select Appropriate Program Undergraduate Degree Program

Name of New or Existing Program * University Honors - Mathematics Core Course

Select Category UG Core Course Degree Type

Select Action New

Exact Title and Requirements as they should appear in the catalog. If there is a change, upload current and proposed requirements.

See current catalog for format within the respective college (upload a doc/pdf file)

Math syllabus.pdf

☐ **Does this change affect other departmental program/branch campuses? If yes, indicate below.**

Reason(s) for Request * (enter text below or upload a doc/pdf file)

It is expected that this change will be implemented by all branch campuses who offer honors courses.

Upload a document that inlcudes justification for the program, impact on long-range planning, detailed budget analysis and faculty workload implications. *

Math_Asses[1].docx

Form C core course Math.docx

Mathematics in the World: Journey Through Genius
Sample Syllabus

Description
This is a course that examines great mathematical thinking throughout history, mainly using the text *Journey Through Genius*, by William Dunham. A central concept in this course is the role of proof in mathematical discourse and discovery. A rare combination of the historical, biographical, and mathematical, this course is an introduction to a neglected field of human creativity.

We will study many areas of mathematics such as algebra, geometry, analytic geometry, and some aspects of calculus. Students will solve problems and prove theorems each of these areas, both in problem sets and in small groups, in-class, for other students. They will also read about the history of mathematics from the time of the ancient Greeks up to the end of the nineteenth century, discussing the interplay of human culture, genius, and mathematical thinking. Finally, students read and discuss mathematically motivated fiction, giving another perspective to the themes and content above.

Students will come to realize how proofs in math differ from convincing arguments in other areas of scholarship, both epistemologically (especially in how mathematical arguments embrace generality), and rhetorically: The proof of a great theorem does more than claim validity; it can be more interesting and enlightening than the original question. Students will come to understand the aesthetics and historical situation of mathematical proof as nontrivial aspects of their understanding: this is intended as an intentional correction to the commonly held belief that math is ultra-rational and ahistorical. By studying math as, when, and through whom it developed, by working through the proofs and attempting their own, students will experience the living breathing body of the subject. The adjacent study of mathematically influenced works of fiction reinforces this paradigm; students will learn that the math has importance outside the memorization of formulas; mathematical ideas play key roles in works that are strictly speaking not mathematical, and relate to concepts in other fields.

How JTG Addresses Common Mathematics in the World Student Learning Outcomes
Course Goal 1
SLO 1: Take home problem sets as illustrated by the sample.
SLO 2: Group presentations on Chapters from JTG; instructor evaluation of class discussion participation
SLOs 3, 4: Take home problem sets, rewrites of problem sets, group presentations on Chapters and Fictional works, instructor evaluation of class discussion (combined because they all relate to the mechanics in these activities).
SLO 5B: group presentations on Chapters and Fictional works, instructor evaluation of class discussion.

Course Goal 2
SLO 1: Take home problem sets, in-class problems
SLO 2: group presentations on Chapters and Fictional works, instructor evaluation of class discussion.
SLO 3B: Take home problem sets, rewrites of problem sets, group presentations on Chapters and Fictional works, instructor evaluation of class discussion.

Texts
Journey Through Genius, by William Dunham, Wiley, 1994. Like masterpieces of art, music, and literature, great mathematical theorems are creative milestones, works of genius destined to last forever. Now William Dunham gives them the attention they deserve. Dunham places each theorem within its historical context and explores the very human and often turbulent life of the creator.

Fictional Works
Proof, by David Auburn, Faber & Faber, 2001
A Curious Incident of the Dog in the Night-time, by Mark Haddon, Vintage, 2004.
Uncle Petros and Goldbach's Conjecture, by Apostolos Doxiadis, Bloomsbury USA, 2001.
Wild Numbers, by Philibert Schogt, Plume, 2001.

Student Requirements
We will form six groups of students, two to three to a group, and each group will select two of our twelve chapter subjects. The groups will present to the rest of us some of what they have learned in their chapter, including a proof of the major theorem in each chapter and the mathematical background to make sense of it. We will have extended discussions on these presentations, and the other students will formulate questions to further discussion.

In addition to our detailed mathematical work, we will look at the lives and personalities of some fictional but true to life mathematicians as portrayed in three novels and one play. Each student will thus be involved in three class presentations - two on chapters from *Journey Through Genius* and one on a fictional work about mathematics. In addition, attendance is an absolute must. This is a seminar, so each of you needs to contribute to each class with active listening and probing questions.

We will also have two extended take-home exercises one due at the end of the eighth week and the other due at the end of the fifteenth week. These will be problems and proofs that are relevant to our work in *Journey Through Genius* and additional topics that come up in class discussions.

Sample Schedule

Below is the schedule for our course. Basically, we will follow the chapters in JTG. Generally, Thursdays are for group presentations on the chapters and main theorems from JTG. Tuesdays are more general discussions of the material and themes in the chapters. Some of the topics are given by the material in JTG. As the week approaches, we will finalize any additional details here on this schedule (hence, the blank spots).

•. Three people sign up for each chapter, so that each person signs up for two.
•. There are also dates reserved for discussing the fictional works.
•. Four people sign up for each fictional work.
•. The midterm and final due dates are indicated. They will be handed out approximately a week and a half before they are due.

Date	Topics	Text(s)	Other/Notes
1-17	Intro - Names, discussion of Mathematician's Lament.		
1-19	Geometric Algebra, Origins of Math		
1-24	Read ahead, sign up for chapters/books, Axiomatic Method		
1-26	Squaring things, how to read math, general discussion	JTG Ch1	
1-31	Great Theorem: Squaring the Lune	JTG Ch1	
2-2	Irrational numbers, Euclid	JTG Ch1-2	
2-7	The Elements	JTG Ch2	
2-9	The Pythagorean Theorem	JTG Ch2	
2-14	Number Theory	JTG Ch3	
2-16	Infinitude of Primes	JTG Ch3	
2-21	Archimedes, limits	JTG Ch4	
2-23	Determination of Circular Area, approximation of π	JTG Ch4	
2-28		Proof	
3-1	Up to group!	Non-Western Math	
3-6	Cardano et al, symbolic algebra	JTG Ch6	
3-8	Solution to the Cubic	JTG Ch6	
Spring Break			
3-20		Uncle Petros	
3-22	??? - TBD by class interest	???	Midterm Due
3-27	Newton and Calculus, binomial theorem	JTG Ch7	
3-29	A gem from Isaac Newton	JTG Ch7	
4-3	The Bernoullis	JTG Ch8	
4-5	Divergence of the Harmonic	JTG Ch8	

	Series		
4-10	Euler 1 - more infinity	JTG Ch9	
4-12	Extraordinary sums of Euler	JTG Ch9	
4-17	Euler 2 - Number Theory	JTG Ch10	
4-19	Euler disproves Fermat	JTG Ch10	
4-24	Cantor and Infinite Sets	JTG Ch11	
4-26	Non-Denumerability of the Continuum	JTG Ch11	
5-1		Curious Incident	
5-3	Wrap up		
5-4	Final Due 5PM		

Sample Problem Set

Instructions

> Sometimes students will turn in this sloppy ____ in Journey, the kind of thing they would never turn in for a paper.
>
> -Frank Kelly

Remember, the main reason for writing these things out is to practice your skills and philosophy of exposition, not simply display the correct answer. Be neat. Think like a designer, where justification is required and where it is unnecessary. How do you know what you know and is it reasonable to suppose your reader knows that too? Write with the aim of satisfying the curiosity of a fellow student, not proving to the teacher that you know the right answer. Your challenge is to walk the tightrope between pedantry and hurried arrogance.

If your handwriting is anywhere near messy, you would do better to type out what you can. Do NOT write on both sides of a page. It's encouraged to work together and use the internet, but cite your sources of inspiration and make sure what you hand in can honestly be called yours.

Hints

- State the problem you are trying to solve.
- Use at least a few words.
- If you are asked to find something, you want to substantiate your claim that you've found the right thing. You don't get points for being anal, just explain ideas that are not obvious.
- Read these instructions again when it matters.

Questions

1. Find the next two terms in the series:

$$\sqrt{1-x} = 1 - \tfrac{1}{2}x - \tfrac{1}{8}x^2 - \tfrac{1}{16}x^3 - \tfrac{5}{128}x^4 + \ldots$$

Bonus - Find a method for generating many, many more terms in this series quickly.

2. Show that

$$\tfrac{1}{a-1} + \tfrac{1}{a+1} > \tfrac{2}{a}$$

for a > 1. Don't look at Dunham. You can do this in a way that doesn't look totally random. Then add 1a to both sides to get the formula on page 204 in JTG.

Bonus - Generalize this rule for all real numbers a.

3. State Theorems D, E, F, G in Chapter 10. How would you use Theorem G to show that the next Fermat number, $2^{64}+1$, is not prime?
Using Theorem F, Euler only had to check up to **k=10** to find the first prime factor of 232 +1. Using Theorem G, what **k** corresponds to the smallest prime factor of $2^{64}+1$?

4. We talked a lot about the formula for the sum of the first **n** numbers:

$$1+2+3+\ldots+n=\frac{n(n+1)}{2}$$

Find a formula for the sum of the first **n** odd numbers, and prove it by mathematical induction. i.e. 1 = 1, 1+3 = 4, and 1+3+5=9. What is the formula for this sum as you continue adding more odd numbers?
Hint: write the last number as **2n-1** and use **n** in your formula.

Bonus - Prove it without using induction

5. In Chapter 10, Dunham regurgitates Euler's argument that

$$(a^2+1)(a^{4k}-a^{4k-2}+\ldots+a^4-a^2+1)=a^{4k+2}+1$$

but he doesn't show where this idea comes from or even why it's true. As a result most people skim over this, shrug their shoulders and go on, perhaps believing it but not knowing why.

How would you explain this so that a student could really see why this works?

6. Show that the set {0, ±3, ±6, ±9, ...} is denumerable (i.e. countable).

7. The Golden Ratio is a famous number we never managed to talk about :(. The greeks would have described it as follows:
Start with a line segment of length a, and divide it into two pieces so that one piece, x, and the remaining piece, a-x satisfy the following relation:

The ratio of the original side to the piece is the same as
the ratio of the piece to the remainder.

Equivalently, x satisfies the following equation:

$$\frac{a}{x}=\frac{x}{a-x}$$

Use this equation to solve for x, and simplify your answer. This is the Golden Section. Then, write out ax, and again, simplify. This is the Golden Ratio. Your expression for the Golden Ratio should be an actual number (no a).

Plan for Assessment
Department Name: Honors

Dept. Assessment Contact: Dr. Rosalie Otero

I. Course Number and Title: UHON 229: Mathematics in the World: [topic]

A. Course Goal 1: Interdisciplinary Communication through and about Mathematics

SLO 1: Students will use proper mathematical notation and terminology to communicate mathematical phrases, concepts, and methods found in areas of mathematics such as set theory, symbolic logic, consumer math and common number theory in written form.
(Addresses UNM/ HED Area II: Mathematics Other College-Level Competency 3; UNM /HED Area Area 1: Writing and Speaking Competencies 2, 4, 5)

SLO 2: Students will use proper mathematical terminology to communicate mathematical phrases, concepts, and methods found in areas of mathematics such as set theory, symbolic logic, consumer math and common number theory orally.
(Addresses UNM/ HED Area II: Mathematics Other College-Level Competency 3; UNM /HED Area Area 1: Writing and Speaking Competencies 2, 4, 5, 6)

SLO 3: Students will evaluate information by summarizing, analyzing, and interpreting texts and data.
(Addresses UNM/ HED Area II: Mathematics Other College-Level Competency 1; Addresses UNM/HED Area I: Writing and Speaking Competencies 1, 5.)

SLO 4: Students are able to express information with clarity, in a logical and organized structure.
(Addresses UNM/ HED Area II: Mathematics Other College-Level Competency 3; Addresses UNM/HED Area I: Writing and Speaking Competencies 2, 3, 4, 6)

AND Contextually relevant SLO's by topic, such as:
SLO 5A: Students will communicate effectively about how they use mathematical reasoning to solve scientific problems.
(Addresses UNM /HED Area II: Mathematics Other College-Level Math Competency 2; UNM /HED Area III: Physical and Natural Sciences Competencies 1, 3)
OR
SLO 5B: Students will analyze and compare mathematical thinking across a range of historical periods.
(Addresses UNM /HED Area II: Mathematics Other College-Level Math Competencies 2, 5; UNM /HED Areas V and VII: Humanities and Fine Arts Competencies 1, 2, 3)

OR
SLO 5C: Students will apply the knowledge base of the social and behavioral sciences to identify, describe, explain, and critically evaluate relevant issues, ethical dilemmas, and arguments.
(Addresses UNM /HED Area IV: Social and Behavioral Sciences Competency 4)

B. Course Goal 2: Problem-solving in Context

SLO 1: Students will solve a variety of mathematical applications using tools they have learned such as those described by George Polya.
(Addresses UNM /HED Area II: Mathematics Other College-Level Math Competencies 2 & 3)

SLO 2: Display an understanding and appreciation of the development of the mathematical techniques under consideration and the contexts of their use.
(Addresses UNM /HED Area II: Mathematics Other College-Level Math Competencies 4 & 5)

AND Contextually relevant SLO's by topic, such as:
SLO 3A: Students will construct mathematical models which reflect real world scenarios, and use them to empirically solve scientific problems.
(Addresses UNM /HED Area II: Mathematics Other College-Level Math Competencies 2; UNM /HED Area III: Physical and Natural Sciences Competencies 2, 5)
OR
SLO 3B: Students will solve problems within a specific historical context, analyze and interpret their methods within that context and in relation to others.
(Addresses UNM /HED Area II: Mathematics Other College-Level Math Competencies 2, 4; UNM /HED Areas V and VII: Humanities and Fine Arts Competencies 2, 4)
OR
SLO 3C: Describe and explain how problems using mathematical applications are dependent upon beliefs, assumptions and values which are influenced by by social structures, institutions, and processes within the contexts of complex and diverse communities.
(Addresses UNM /HED Area IV: Social and Behavioral Sciences Competencies 1, 2, 4)

1. <u>What</u>: For each SLO, identify one or more data collection points in the course. Preferably these are samples of student work already in the syllabus.

How JTG Assesses Common Mathematics in the World SLOs
Course Goal 1
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2. How: For this course, describe:
   a. Will the assessment include evidence from all sections of the course, or some subset of sections? Address the validity of any proposed sample of sections.
   YES

   b. Will the assessment include evidence from all students in the assessed sections or a sample? Address the validity of the proposed sample of students.
   YES

   c. Will all student learning outcomes for this course be measured every time? If not, how will the complete set of SLOs for the course be subset for measurement a chunk at a time?
   YES

3. When:
   a. Is assessment of student learning outcomes already underway in this course? If not, in what term (e.g., Fall 2007) will assessment of student learning outcomes commence in this course?
   WHEN THE COURSE IS FIRST OFFERED.

   b. With what frequency (e.g., every term, a different term each year, etc.) will assessment of student learning outcomes take place in this course?
   SLOs will be individually assessed on a 3-year cycle (WRITTEN ASPECTS OF COURSE GOAL 1, ORAL ASPECTS OF COURSE GOAL 1, COURSE GOAL 2).

   c. On what cycle will the complete set of SLOs for the course be assessed (e.g., all outcomes every term, a subset of outcomes each term with all outcomes every academic year,…)?

3 YEARS

4. Who:

a. Who will administer the measure or collect the student products?
THE TEACHER OF THE COURSE

b. Who will review/mark the products relative to the SLO statements and established qualitative criteria?
THE TEACHER OF THE COURSE

c. Where rubrics (or evaluative criteria) have been developed for assessing student learning for a given outcome, please enclose a copy of the rubric/qualitative criteria.

D. What process will be used to analyze/interpret the assessment data for this course?

1. Who will participate?
AN HONORS COLLEGE FACULTY COMMITTEE

2. How will recommendations be communicated?

a. In a memo to the faculty
b. Included in the annual report
c. At a semi-annual meeting of Honors faculty addressing assessment and pedagogy

3. When will interpretation and recommendations take place?
In the weeks immediately following the end of the term

E. How will results of assessment in this course be used for improvement?

Note: This process may be different for each course or the same for all courses in the dept.

1. Describe the process for consideration of the implications of assessment for change:

a. to assessment mechanisms themselves.
   i. As the number of offerings and section change, assessment mechanisms might need to be changed (evidence from students, sections and assessment scheduling).

b. to course design.
   i. Those assessing the course may suggest changes in course features:
      a. Length of class sessions.
      b. Frequency of class meetings
      c. The allotment of time to course topics

c. to pedagogy
   i. Those assessing the course may suggest changes in teaching methods:

a. Reading requirements
b. Discussion facilitation methods
c. Number and nature of writing assignments and oral presentations
d. The configuration of class activities (discussion, short lecture, small group discourse, writing prompts, etc.)

2. Who participates in this discussion/decision making.
THE TEACHER OF THE COURSE AND THE HONORS FACULTY

3. How will recommendations be communicated?
IN WRITING AND IN PERSON

4. When will this discussion/decision making take place?
Subsequent to the meeting(s) interpreting assessment data

Required attachment for adding core course as required by the instructions, "Criteria for adding core curriculum courses"

a. Statement of the core area course will fit in, rationale: how will course benefit UNM students, why does it belong in the core curriculum:

This new core course in the Mathematics area will benefit honors students by helping them remain and complete the Honors College curriculum. Currently too many students are forced to drop the program due to scheduling difficulties and problems fulfilling all their university graduation requirements including those for their major, minor, honors, and university core requirements. Allowing them to count a number of specific honors core courses towards their honors requirements will alleviate one of the more common problems for honors students. The honors version of the core course will also enhance the university core curriculum because it will introduce intense foci on interdisciplinarity and primary source materials.

b. Impact statement on effect course may have on other departments/courses currently in core:

"This new core course will minimally affect the number of students who take a pre-existing university core course. Honors students only make up approximately ten percent of the university population. Furthermore, Honors students are likely to take many of their core courses in the disciplines because those courses are prerequisites for courses in the students' majors.

c. Current and predicted enrollments for the next 3 yrs.

We predict these courses will fill at the Honors class maximum size of 17 students per course.

d. Budget/Faculty Load Statement: budget impact statement, resources (faculty/facilities) that the department has for teaching the course, memo from Dean or College Curriculum Committee regarding financial support for 5-10 yrs.

Budget impact statement:
See below.

Resources (faculty/facilities) that the department has for teaching the course:
The current honors full-time and adjunct faculty are prepared to teach these courses. The projected budget for the new Honors College projects hiring 3-6 new faculty over the next several years and they also will be a resource to teach the new core courses.

Memo from Dean or College Curriculum Committee regarding financial support for 5-10 yrs: See below.

For "Budget Impact Statement"

APPENDIX E

UNM OFFICE of the PROVOST/EVP for ACADEMIC AFFAIRS

APPENDIX E
Cost Estimation and Sources of Funding

COST ESTIMATION

Faculty		
Dean	$	160,000
Associate Dean - SAC and course buy-out		40,000
T/TT Faculty(1)		75,000
T/TT Faculty		75,000
T/TT Faculty		75,000
Honor Fellows (6) - 4 course buyouts/year @ $7000/course (2)		168,000
Lecturer (1)		45,000
Part Time Instructors - 12 courses/year @ $3,800/ course		45,600
	$	683,600
Staff		
Accountant I	$	40,000
Admin I for Deans Office		27,000
Development Associate		54,000
Admin I for Scholarship Office		27,000
CAELD, NISF Program Specialist		45,000
Academic Advisors (4)		144,000
	$	337,000
Benefits		
Fringe Benefits (29%)	$	289,134
Total Salary and Beneftis	**$**	**1,309,734**
Other		
Recruitment Budget	$	25,000
Supply and Equipment Budget		50,000
	$	75,000
Total	**$**	**1,384,734**

Tuition & Funding Formula Assumptions

Assumptions:
- 90 new students to the University that graduated within the top 25% of their class.
- Each student averages 26 credit hours per year to graduate in 5
- 85% retention rate
- Half of a student's credit hours are lower division/half upper

Instruction/Instructional Support Expenditure calculation used by the State Funding Formula.

Gross Tuition & Formula Revenue

Freshman Year 90 students * 26 ch * $151.48 = $354,463
Sophmore Year 77 students * 26 ch * $151.48 = $303,263
Junior Year 65 students * 26 ch * $242.96 = $410,602
Senior Year 55 students * 26 ch * $334.44 = $478,249
5th Year Senior 45 students * 26 ch * 334.44 = $391,295

Total Gross Tuition & Formula Revenue = $ 1,937,872

Notes: (1) Market Salaries for tenure stream faculty vary widely depending on discipline; $75000 is an estimated average that would include humanities, physical and social sciences
(2) Course buy-out costs will depend on current college policies. For example, A&S is moving to a policy that charges 1/8 of annual salary for one course buy-out.

UNM UNIVERSITY COLLEGE

Office of the Dean

MEMO
TO: Faculty Senate Curriculum Committees
FROM: Kate Krause, Interim Dean, University College
RE: Support for Core Courses in Honors
Date: July 10, 2012

Last spring the Faculty Senate approved the creation of an Honors College. One component of the proposal was the establishment of courses in Honors that satisfy Core Curriculum requirements by delivering content that addresses the learning outcomes established for each disciplinary area. The Honors faculty have developed this course to allow Honors students to satisfy a core requirement in [the social and behavioral sciences]. The long-term plan for the Honors College is to develop courses in each of five (?) core areas.

These courses will be taught by current tenure stream Honors faculty, new hires in Honors, adjunct faculty with special expertise in the area and Honors Fellows whose tenure homes are in a specific discipline. The budget established for the Honors College is sufficient to compensate these faculty members and, in the case of Honors Fellows, to compensate their home departments.

University College is committed to supporting this course now and as the Honors College grows.

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