California State University, San Marcos General Education Program
GENERAL EDUCATION NEW COURSE CERTIFICATION REQUEST
• AREA B4: Mathematics and Quantitative Reasoning
See GE Handbook for information on each section of this form

ABSTRACT

Course Abbreviation and Number: MATH 100 **Number of Units: 3** _____	**Course Title: Mathematical Ideas**	
College or Program: ☐CHABSS ☒CSM ☐CEHHS ☐COBA ☐Other_____	**Desired term of implementation:** ☒Fall ☐Spring ☐Summer Year2014	**Mode of Delivery:** ☒face to face ☐hybrid ☐ fully on-line
Course Proposer (please print): David Barsky	**Email: djbarsky@csusm.edu**	**Submission Date:**

1. Course Catalog Description: Basic mathematical concepts such as logic, number theory, number systems, algebra, geometry, functions, graphs, counting methods, probability, and statistics together with related cultural and historical perspectives. Applications of mathematics will be emphasized. *May not be taken for credit by students who have received credit for GEM 100. Enrollment restricted to students who have completed the Entry-Level Mathematics (ELM) requirement.*

2. GE Syllabus Checklist: The syllabi for all courses certified for GE credit must contain the following:

☒	Course description, course title and course number
☒	Student learning outcomes for General Education Area and student learning objectives specific to your course, linked to how students will meet these objectives through course activities/experiences
☒	Topics or subjects covered in the course
☒	Registration conditions
☒	Specifics relating to how assignments meet the writing requirement
☒	Tentative course schedule including readings
☒	Grading components including relative weight of assignments

SIGNATURES

David Barsky 4/23/14
Course Proposer Date

Andre Kundgen 4/23/14
Department Chair date

Please note that the department will be required to report assessment data to the GEC annually. _____ *DC Initial*

	Support	Do not support*
4/23/14 Library Faculty Date	☑	☐

	Support	Do not support*
N/A Impacted Discipline Chair Date	☐	☐

	Support	Do not Support*
Impacted Discipline Chair Date	☐	☐

	Approve	Do not Approve
GEC Chair Date	☐	☐

*** If the proposal is not supported, a memo describing the nature of the objection must be provided.**

Course Coordinator: Varies by year. Contact the Dept. Chair for a name. Phone Email:

Part A: B4 Quantitative Reasoning General Education Learning Outcomes (GELOs) related to course content. [Please type responses into the tables.]

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Math/Quant Reasoning GELOs this course will address:	Course content that addresses each GELO.	How will these GELOs be assessed?
B4.1: Explain and apply a variety of fundamental mathematical concepts, symbols, computations and principles.	Concepts: Prime Factorization; Infinite Number of Primes and the Prime Number Theorem; Fermat's Last Theorem; Rational and irrational numbers; Pythagorean Theorem; measures of central tendency Symbols: Usual algebraic symbols such as exponent notation and square roots used in (for example) solving quadratic equations and working with the Pythagorean theorem. Computations: Golden ratio as the limit of quotients of successive Fibonacci numbers; Modular arithmetic; RSA (public key) coding; proof of irrationality of $\sqrt{2}$; proof that there are only five Platonic solids; counting arguments Principles: Pigeonhole Principle; Euler Characteristic; Law of Large Numbers	Students will be given problems involving one or more of the concepts learned and will be expected to solve it using the relevant symbols and computations and principles. Students will be expected to state their solution in a clear and logical manner. Examples: • Students will be able to apply the Pythagorean Theorem in various contexts • Students will be able to make a graphical plot of statistical data and compute the mean, median and mode. • Students will be able to use error-detecting codes to determine the value of a missing digit.
B4.2: Determine which quantitative or symbolic reasoning methods are appropriate for solving a given problem and correctly implement those methods.	An example: Computing a probability.	Students will need to determine whether it is better to compute the probability directly, or to use the complementary probability strategy. In some problems they will need to determine whether the event is an intersection ("and") or union ("or") of simpler events. In calculations with equiprobable outcomes where the calculations are based on counting, they will need to distinguish between situations where order matters and where it doesn't.

Part B: General Education Learning Outcomes required of all GE courses related to course content:

GE Outcomes required of <u>all</u> Courses	Course content that addresses each GE outcome?	How will these GELOs be assessed?
Students will communicate effectively in writing to various audiences. (writing)	Homework and exam problems will require students to explain their reasoning. The syllabus asks students to give explanations "in complete sentences" in their homework assignments. Additionally, students complete three projects that will be graded for accuracy, completeness, organization and grammar.	Attainment of this GELO could be assessed by applying a writing rubric to sampled student homework and/or projects.
Students will think critically and analytically about an issue, idea or problem. (critical thinking)	Student projects lead students through an in-depth study of particular topics in the course. Examples: • Working through three different proofs of the Pythagorean Theorem and then researching a fourth proof (there are scores of such proofs) • Finding the shortest-length circuit through a collection of sites.	Attainment of this GELO could be assessed by using a rubric with a sample of the student projects.

	• Developing a conjecture for the number of spanning trees in a graph (based on examples with small graphs), and applying this to determine the number of spanning trees for a larger graph.	

Part C: GE Programmatic Goals: The GE program aligns with CSUSM specific and LEAP Goals. All B4 courses must meet at least one of the LEAP Goals.

GE Programmatic Goals	***Course addresses this LEAP Goal:***
LEAP 1: Knowledge of Human Cultures and the Physical and Natural World.	☐ *No* ☒ *Yes*
LEAP 2: Intellectual and Practical Skills	☐ *No* ☒ *Yes*
LEAP 3: Personal and Social Responsibility	☒ *No* ☐ *Yes*
LEAP 4: Integrative Learning	☒ *No* ☐ *Yes*
CSUSM Specific Programmatic Goals	**Course content that addresses the following CSUSM goals. Please explain, *if applicable.***
CSUSM 1: Exposure to and critical thinking about issues of diversity.	☒ *No* ☐ *Yes (please describe):*
CSUSM 2: Exposure to and critical thinking about the interrelatedness of peoples in local, national, and global contexts.	☒ *No* ☐ *Yes (please describe):*

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Part D: Course requirements to be met by the instructor.

Course Requirements:	How will this requirement be met by the instructor?
Course meets the All-University Writing requirement: A minimum of 2500 words of writing shall be required for 3+ unit courses.	The writing requirement will be met through students being required to include detailed explanations of their solutions in the homework.
All courses offered in area B4 must have a prerequisite of at least intermediate algebra and must use a level of mathematics beyond that of intermediate algebra. No remedial algebra courses (e.g., Math 10, 20, and 30) can be used to satisfy this requirement. Even if a course has intermediate algebra as a prerequisite, it will not satisfy the Quantitative Reasoning Requirement unless it also meets each of the following three conditions:	Some examples of material covered in MATH 100 that builds upon intermediate algebra: • The Fibonacci sequence is studied by recognizing that quotients of successive terms converge to a continued fraction that can be evaluated by solving a quadratic equation. • Students will set up and solve an appropriate linear equation for a repeating decimal in order to re-express it as a ratio of two integers. Students use the Pigeonhole Principle to prove that the decimal expansion of a rational number must be periodic if it fails to terminate. • Modular arithmetic calculations. Note that enrollment in MATH 100 is restricted to students who have completed the Entry-Level Mathematics (ELM) requirement. The ELM requirement is that students demonstrate proficiency at the level of intermediate algebra.
• It must focus on the use of mathematical language and formal reasoning in a variety of diverse disciplines, using a broad range of examples.	Examples of applications include: • Banking: Use of modular arithmetic for error detection in reading identification codes on checks • Cryptography: RSA (public key) coding • Art and Architecture: Golden ratio • Architecture: Art Gallery Theorem • Gambling: Probability calculations
• It must provide some historical perspective on the role which this approach has played in the development of human knowledge and of our understanding of the world.	One of the primary learning objectives of this course is that students gain an understanding of historical perspectives (learning why, where and how the mathematical concepts covered in this course emerged, what their significance is, and who developed/discovered them). These include: • The story of Ramanujan and Hardy which gives rise to "taxi cab numbers." • Leonardo of Pisa (aka Fibonacci) whose namesake sequence can be found occurring throughout nature in connection with growth processes • The 350+ year effort to find a proof of Fermat's Last Theorem (and statements of two open conjectures: Twin Primes and Goldbach's. • Pythagoreans and their reaction to the existence of irrational numbers. • Euler's solution of the Konigsberg Bridge Problem • The 4-Color Theorem and how its proof relies on a

	computer checking more cases than any mathematician could do by her/himself.
• It must demonstrate a variety of methods, such as the use of abstract symbols, of numeric techniques, of logical reasoning, of geometry, etc.	Examples of methods: • Abstract symbols and algebraic techniques are used to show that the limit of the ratios of successive terms in the Fibonacci sequence is the golden ratio. • The proofs that various numbers ($\sqrt{2}$, $\sqrt{3}$, $\sqrt{6}$, $\sqrt{2}+\sqrt{3}$, $\log_3 10$) are irrational and that there are infinitely many prime numbers both use the method of proof by contradiction. • Modular arithmetic is used to code and decode "messages" via RSA coding schemes. • Graph theoretic methods include determining whether a graph contains an Euler circuit and finding a minimal cost spanning tree. • Also see the response to B4.2 for an indication of the types of probability calculations included in MATH 100.
A **statistics component** may be included which must:	
• Develop the students' ability to comprehend the power and broad utility of the fundamental mathematical models presented, rather than merely teaching rote statistical skills; and	A short (at most three lectures) component on statistics in which students are introduced to measures of central tendency. Rather than teaching rote skills, this unit focuses on examining key assumptions (e.g., is the data really from a normal distribution, is the sample representative of the population, etc.)
• Must indicate applications to several areas.	Topical examples will be used to emphasize the importance of thinking critically about statistics that are reported in the media.
A **computer science component** may be included which must:	
• Teach a computer language that is suitable for use in diverse areas;	N/A for MATH 100
• Teach this language in such a way that the student is led to a fundamental understanding of the nature of problem solving by combining data structures with algorithms; and	N/A for MATH 100
• Provide fundamental skills in the use of computers for the application of university level quantitative methods to the solution of problems in many diverse areas.	N/A for MATH 100

Math 100
Mathematical Ideas
CSU San Marcos
Spring 201_

Instructor: _____

Contact: Email: _____@csusm.edu **Website:** http://cc.csusm.edu

Office Hours: _____; Room: _____

Textbook: Heart of Mathematics: An Invitation to Effective Thinking; 4th edition

Enrollment Restriction: Enrollment restricted to students who have completed the Entry-Level Mathematics (ELM) requirement.

Course Description: Basic mathematical concepts such as logic, number theory, number systems, algebra, geometry, functions, graphs, counting methods, probability and statistics together with related cultural and historical perspectives. Applications of mathematics will be emphasized.

Materials: You will need to have, and bring to class every day, paper and pencils/pens for note taking. You will also need a basic calculator for exams and in-class activities. It is your responsibility to have a calculator the day of the exam. You will not be allowed to use calculators on phones or any electronic device that has internet or text-messaging capabilities. You may not share calculators on the day of the exam.

Homework: Homework will be assigned daily. The assignments and due dates can be found in Cougar Courses. Homework should be written up neatly and stapled. Explanations should be given in complete sentences. Written explanations in homework satisfy the 2500 word writing requirement. Each homework will be worth 10 points. Your lowest two homework scores will be dropped. **Late homework will not be accepted for any reason whatsoever.**

Homework is very important. Math is not a spectator sport. *You can listen and read all you like, but you don't really learn much until you grab a pencil and do some problems.*

Projects: There will be three projects assigned over the course of the semester. The projects will focus on applications of the concepts you have learned in class, as well as making connections between concepts.

Projects will be graded for accuracy, completeness, organization and grammar. All work for your projects must be written neatly, stapled, with your name on the first page. All explanations must be given in complete sentences. Any sources that you consulted to complete the project must be cited on the first page. Such sources would include fellow students, any book other than our text, tutors in the math lab or websites. If no outside sources were consulted, "no outside sources" must be printed on the first page. Projects are worth 25 points each. **No late projects will be accepted.**

Exams: There will be three regular exams and a comprehensive final. Exam dates Are listed in the class schedule. **Absolutely no makeup exams will be given for any reason whatsoever.** Don't even ask. I will, however, replace your lowest exam score with the same score you receive on the final if it is

higher. *Please note the time of the final exam is listed in the course schedule. The final exam grade cannot be replaced.

Attendance: First, I expect you to attend class regularly. It is a rare student who does well in a class without being there. We will frequently have group activities during class time. You need to be in class in order to participate. If you finish the class with a "borderline" grade, your attendance will be the deciding factor when I assign your final grade.

Grading:

9 Homeworks @10 points each =	90 points	A	More than 733 points
3 Projects @25 points each =	75 points	B	652-733 points
3 Exams @150 points each =	450 points	C	571-651 points
Final Exam =	200 points	D	489-570 points
Total =	815 points	F	Less than 489 points

Accommodations: Students with disabilities who require reasonable accommodations must be approved for services by providing appropriate and recent documentation to the Office of Disabled Student Services (DSS). This office is located in Craven Hall 4300, and can be contacted by phone at (760) 750- 4905, or TTY (760) 750-4909. Students authorized by DSS to receive reasonable accommodations should meet with me after class or during my office hours in order to ensure confidentiality.

Academic Integrity: The short story: DON'T CHEAT! The long story: All written work must be original work. Students are responsible for honest completion of their work including examinations. There will be no tolerance for infractions. If you believe there has been an infraction by someone in the class, please bring it to the instructor's attention. The instructor reserves the right to discipline any student for academic dishonesty, in accordance with the general rules and regulations of the university. Disciplinary action may include the lowering of grades and/or the assignment of a failing grade for an exam, assignment, or the class as a whole. Incidents of Academic Dishonesty will be reported to the Dean of Students. Sanctions at the University level may include suspension or expulsion from the University

Expectations:

Mathematics can be a very demanding subject. You should expect to spend 3-4 hours studying and completing homework assignments for each hour spent in class. You will get a lot more out of class if you read the material we are going to be covering beforehand. I realize that reading a math book isn't always the easiest thing to do, but give it a try!

It is vital that you keep up, as every topic we cover builds on previous topics. If you feel yourself falling behind, seek help IMMEDIATELY! I am available during office hours. In addition, the Math Lab in Kellogg 1109 has excellent tutors. I highly recommend them. Study groups are also a good idea. You'll be surprised how simply talking through a problem helps with understanding. However, all work submitted must be written up in your own words.

Course Learning Outcomes:

Probability: Use the definition of probability for equally likely outcomes to compute the chance of a given event; Construct a list of outcomes; Apply the multiplication principle; Use the complementary probability strategy; Demonstrate that unlikely events are likely over long time periods; Distinguish between cases where order matters and where it does not.

Statistics: Collection and analysis of data; Applications of normal distributions; Be able to compare data with the use of z-scores.

Number Theory: Apply the pigeonhole principle; Discover and describe sequential pattern and growth rates; Prove the infinitude of the prime numbers; Prove that the square root of a prime number is not rational; Demonstrate that any particular repeating or terminating decimal is rational; Explain why any rational number has either a repeating or terminating decimal representation; Construct a rational/irrational number between any two given numbers.

Graph Theory: Be able to represent a given situation with a graph; Determine whether a graph contains an Euler circuit; Determine a minimal cost spanning tree in a graph.

Historical Perspective: Know why, where and when the aforementioned mathematical concepts emerged, what their significance is and who developed/discovered them.

General Education Learning Outcomes: Successful completion of this course satisfies the General Education requirement in Mathematics/Quantitative Reasoning (B4). Students who successfully complete this course will be able to

- Explain and apply a variety of fundamental mathematical concepts, symbols, computations and principles; and
- Determine which quantitative or symbolic reasoning methods are appropriate for solving a given problem and correctly implement those methods.

Schedule:

Class Session:	*Section in Text:*	*Topics:*
1	2.1	1) Counting
2	2.1 2.2	1) The Pigeonhole Principle 1) Patterns in Nature 2) Fibonacci Numbers
3	2.2 2.3	1) The Golden Ratio 1) The Division Algorithm
4	2.3	1) Prime Factorization 2) Infinitely Many Primes 3) Fermat's Last Theorem
5	2.4	1) Modular Arithmetic 2) Check Digits
6	2.5	1) Public Key Codes 2) RSA Coding
7	2.6	1) Irrational Numbers
8	2.7	1) Real Numbers
9	Review	
10	Exam 1	
11	4.1	1) Pythagorean Theorem

12	4.2	1) The Art Gallery Problem
13	4.3	1) The Golden Rectangle 2) The Golden Mean (revisited) 3) Constructing a Golden Rectangle
14	6.1	1) The Konigsberg Bridge 2) Graphs 3) Euler Circuits
15	6.2	1) Plane Graphs 2) Euler's Characteristic Theorem 3) Platonic Solids
16	6.3	1) Complete Graphs 2) Bipartite Graphs 3) 4-Color Theorem
17	6.4	1) Networks 2) Hamiltonian Circuit
18	Review	
19	Exam 2	
20	8.1 8.2	1) The Monty Hall Problem 2) The Birthday Problem 1) Experimental Probability 2) The Law of Large Numbers
21	8.2 8.3	1) Computing Probabilities 1) The Infinite Monkeys Problem 2) Approximating π
22	8.4 8.5	1) "and" vs. "or" 1) Probability in Our World
23	9.1	1) Summarizing Data 2) Graphical Representations of Data
24	9.2	1) Mean, Median and Mode 2) 5-Number Summary 3) Standard Deviation
25	9.3	) Normal Distributions 2) Comparing Normal Distributions 3) z-scores
26	Review	
27	Exam 3	
28	Review	
29	Review	
30 (Finals Week)	Final Exam	