

General Education Course Inclusion Proposal

Quantitative Reasoning and Analysis

This proposal form is intended for departments proposing a course for inclusion in the Northern Michigan University General Education Program. Courses in a component satisfy both the Critical Thinking and the component learning outcomes. Departments should complete this form and submit it electronically through the General Education SHARE site.

Course Name and Number: MA 103 Finite Mathematics

Home Department: Mathematics & Computer Science

Department Chair Name and Contact Information (phone, email): J.D. Phillips 227 2020 jophilli@nmu.edu

Expected frequency of Offering of the course (e.g. every semester, every fall): every semester

Official Course Status: Has this course been approved by CUP and Senate? YES

Courses that have not yet been approved by CUP must be submitted to CUP prior to review by GEC. Note that GEC is able to review courses that are in the process of approval; however, inclusion in the General Education Program is dependent upon Senate and Academic Affairs approval of the course into the overall curriculum.

Overview of course (please attach a current syllabus as well): *Please limit the overview to two pages (not including the syllabus)*

A. Overview of the course content

Finite Mathematics, MA 103, covers the topics of linear equations, systems of linear equations, matrices, inequalities, linear programming, functions, the mathematics of finance, permutations, combinations and probability.

B. Explain why this course satisfies the Component specified and significantly addresses both learning outcomes

Critical Thinking Learning Outcomes:

- Evidence: Students are often presented with problems (particularly “word” problems) in which they must determine what pieces of the information given should be used to solve the situation.
- Integrate: In a majority of problems on exams, students are not told how to solve the given problem. They must choose from a variety of known methods to solve the given problem.
- Evaluate: The student needs to be able to recognize when they have arrived at a viable solution to a given problem and present the solution coherently. The student must evaluate whether their solution makes sense within the context of the problem by checking their results. For example, a negative number of objects being produced does not make sense in an optimization problem. In this example, the method chosen to produce a solution resulted in an answer that does not make sense in the context of the problem. The student must stop and evaluate the situation and come up with a satisfactory conclusion.

Quantitative Reasoning and Analysis Learning Outcomes:

- Calculation: 90% (or more) of exam and homework problems require a mathematical calculation. The students will demonstrate proficiency in the required mathematical calculations.
- Analysis / Application: At each stage in the process of problem-solving, the students will demonstrate their grasp of the mathematical concepts presented in order to analyze which concepts are required for a particular problem, and then applying those concepts to each step in a new problem to eventually obtain a correct solution.
- Interpretation: Students must be able to interpret information given in multiple formats, such as equations, graphs, diagrams, tables, and words; use that information to develop a process to solve a problem; interpret their results so that they can present those results in proper mathematical form, such as an equation, graph, diagram, table, or words.

C. Describe the target audience (level, student groups, etc.)

MA 103, Finite Mathematics, is designed primarily for first-year students entering into programs in business, economics, management, and/or the social sciences and life sciences.

D. Give information on other roles this course may serve (e.g. University Requirement, required for a major(s), etc.)

MA 103 Finite Mathematics builds on the algebraic skills of MA 100 (Intermediate Algebra) while emphasizing applications, modeling, and decision-making from business, social and natural sciences, medicine, and other areas. It is a prerequisite for MA 171 (Introduction to Probability and Statistics) which is a required course in multiple majors. MA 103 can be used as a Liberal Studies elective under Division III Natural Sciences/Mathematics. MA 103 will also satisfy the new mathematics competency requirement.

E. Provide any other information that may be relevant to the review of the course by GEC

At this time we do not have anything to add. However, if you have questions or would like us to clarify anything, please let us know.

PLAN FOR LEARNING OUTCOMES
CRITICAL THINKING

Attainment of the CRITICAL THINKING Learning Outcome is required for courses in this component. There are several dimensions to this learning outcome. Please complete the following Plan for Assessment with information regarding course assignments (type, frequency, importance) that will be used by the department to assess the attainment of students in each of the dimensions of the learning outcome. Type refers to the types of assignments used for assessment such as written work, presentations, etc. Frequency refers to the number of assignments included such as a single paper or multiple papers. Importance refers to the relative emphasis or weight of the assignment to the entire course. For each dimension, please specify the expected success rate for students completing the course that meet the proficiency level and explain your reasoning. Please refer to the Critical Thinking Rubric for more information on student performance/proficiency in this area. Note that courses are expected to meaningfully address all dimensions of the learning outcome.

DIMENSION	WHAT IS BEING ASSESSED	PLAN FOR ASSESSMENT
Evidence	Assesses quality of information that may be integrated into an argument	<ul style="list-style-type: none"> ❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, roughly 30% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring students to select from given information to arrive at a solution will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems
Integrate	Integrates insight and or reasoning with existing understanding to reach informed conclusions and/or understanding	<ul style="list-style-type: none"> ❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, at least 90% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring students to select from a variety of known methods to arrive at a solution will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems
Evaluate	Evaluates information, ideas, and activities according to established principles	<ul style="list-style-type: none"> ❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at

	and guidelines	<p>the end of the semester.</p> <ul style="list-style-type: none">❖ Overall Grading Weight: Between 80% & 100% for the exams, at least 90% of this grade involves problems that would address this learning objective❖ Assessment: Problems requiring students either to identify a solution from several possible answers produced during the solution process or to recognize and coherently express the final answer will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes.❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems
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**PLAN FOR LEARNING OUTCOMES
QUANTITATIVE REASONING AND ANALYSIS**

Attainment of the QUANTITATIVE REASONING AND ANALYSIS Learning Outcome is required for courses in this component. There are several dimensions to this learning outcome. Please complete the following Plan for Assessment with information regarding course assignments (type, frequency, importance) that will be used by the department to assess the attainment of students in each of the dimensions of the learning outcome. Type refers to the types of assignments used for assessment such as written work, presentations, etc. Frequency refers to the number of assignments included such as a single paper or multiple papers. Importance refers to the relative emphasis or weight of the assignment to the entire course. For each dimension, please specify the expected success rate for students completing the course that meet the proficiency level and explain your reasoning. Please refer to the Rubric for more information on student performance/proficiency in this learning outcome. Note that courses are expected to meaningfully address all dimensions of the learning outcome.

DIMENSION	WHAT IS BEING ASSESSED	PLAN FOR ASSESSMENT
Calculation	Ability to perform mathematical/numerical operations.	<ul style="list-style-type: none"> ❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, at least 90% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring mathematical calculation will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems
Analysis/Application	<p>Ability to manipulate quantitative data to produce new data.</p> <p>Ability to use data to make judgments and draw conclusions.</p>	<ul style="list-style-type: none"> ❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, at least 90% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring the determination of a proper mathematical process to solve a problem and then application of that process to arrive at a correct solution will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems.
Interpretation	Ability to explain information presented in	<ul style="list-style-type: none"> ❖ Task type: 3 or more in-class exams / quizzes and a comprehensive final exam

	<p>mathematical forms (e.g. equations, graphs, diagrams, tables, and words)</p>	<ul style="list-style-type: none"> ❖ Frequency: in-class exams / quizzes roughly equally spaced throughout the semester, with the comprehensive final exam at the end of the semester. ❖ Overall Grading Weight: Between 80% & 100% for the exams, at least 50% of this grade involves problems that would address this learning objective ❖ Assessment: Problems requiring students to use equations and /or inequalities to model situations and then present solutions in proper mathematical form will be embedded in the final exam and scored independently and tracked from semester to semester for assessment purposes. ❖ Expected Proficiency Rate: We expect 70% of students to earn 70% or higher on the assessment problems
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**MA 103 – Finite Mathematics
Winter 2015 Course Syllabus**

Days: M,W,Th,F

Class ID: MA 103 Section 02: CRN 10384 Time 9:00am – 9:50 am

Room/Testing Room: WS 2905

Credits: 4

Instructor: JoAnn Buhl

Office: Jamrich 2232

e-mail: jbuhl@nmu.edu

Office Hours: 10-11 am, M, W, Th, F . Other times are available by appointment. It is usually a good idea to drop me an e-mail or set up the appointment before or after class, just to confirm that I will be available.

Prerequisites: MA 100 (Passed with C- or better) or satisfactory score on the math placement exam.

Course Access: All course material and course instructions can be accessed through the EduCat website at NMU. <https://educat.nmu.edu/>

Text: *Finite Mathematics, 2nd Edition*, by Berresford & Rockett.

Course Description: This course is designed primarily for students in business, economics, management, and the social sciences and life sciences. MA 103 builds on the algebraic skills of MA 100 while emphasizing applications, modeling, and decision-making from business, social and natural sciences, medicine, and other areas. It is a prerequisite for MA 171 and can be used as a Liberal Studies elective under Division III Natural Sciences/Mathematics.

Course Content: This course is broken down into four distinct areas:

- algebraic equations and functions,
- formulas and the mathematics of finance,
- systems of equations and linear programming,
- probability and statistics

Attendance: You are expected to attend class each day and are responsible for the material covered on that day. Mathematics is like a sport. In order to improve, you must practice!

Homework: Will be assigned on a daily basis. Your knowledge of the homework will be evaluated on the weekly quizzes and the tests. For the most part, only odd problems will be assigned for homework so that you may check your answers. There will be time at the beginning of each class period to ask any questions you may have. The best way to learn mathematics is by doing it yourself, and that requires steady, consistent effort. **For each hour of class time, you should expect**

an equal amount of time spent on the homework problems. Your hard work will pay off on the quizzes and tests.

Quizzes: There will be a quiz every Friday. Quizzes are valuable to give YOU some feedback as to the types of questions that will be asked on the tests so that you can evaluate whether you need to spend more time on a particular topic BEFORE the test rolls around!

Tests and the Final: There will be four tests, one for each category of mathematics that we cover. The Final will be comprehensive, and ask questions from the material covered on each of the four tests.

Final Date: MA 103 Section 02 Wednesday, April 29, 8:00-9:50 am WS 2905

Calculator: This course will use a graphing calculator. I will be using a TI-84 plus graphing calculator for my examples in class, so most students may want to purchase a TI-84 plus/silver graphing calculator: However, the Casio FX-9750 GII – WE graphing calculator is a good one too, and does everything the TI one does for about \$50 less. Just be aware that if you get the Casio calculator, you may have to figure things out by yourself (but Google can usually help!) The TI-89 graphing calculator is overkill unless you are planning to go on into upper level calculus classes, but it works too (again, you will have to figure it out by yourself!). There really isn't a good enough cell phone calculator app yet, so NO cell phone calculators. **You are EXPECTED to use the calculator on all homework, quizzes, and tests.**

Computers: I find that computers can be a distraction in class, and will NOT BE ALLOWED DURING CLASS TIME unless specifically requested. Same goes for cell phones! Besides, taking notes has been proven to help you remember the material – something to do with hand-to-brain nerve connections - So take notes!!

Course Access and correspondence: You will want to check your computers regularly OUTSIDE OF CLASS ☺, since course instructions can be accessed through the NMU EduCat website: <https://educat.nmu.edu/> . Also, any e-mail correspondence for the course will be via your NMU e-mail, so be sure to check it regularly.

Grades: Your grade will be based on the percentage you achieve of the following scores:

		<u>Grading Scale:</u>	
Test 1	: 100 pts	90% and up	A's
Test 2	: 100 pts	80% - 89%	B's
Test 3	: 100 pts	70% - 79%	C's
Test 4	: 100 pts		
Final	: 100 pts	60% - 69%	D's
Quizzes (10 pts each)	: <u>100 pts</u>	Below 60 %	F
TOTAL POINTS:	600 pts		

Tests may only be made up with a documented, validated excuse. If you know **AHEAD** of time that you have a test or quiz conflict, let me know and I will be happy to make alternate arrangements.

Extra Help: Be sure to take advantage of the following FREE Tutoring Centers!

Math Tutor Lab.	West Science 3810.
	M – TH 9 - 4 and F 9 – 3
All Campus Tutoring.	Learning Resource Center 111H.
	S – W 2 – 10:00 p.m.

Foundation of Natural Sciences/Mathematics Requirement: This course satisfies the Foundation of Natural Sciences/Mathematics requirement. Students who complete this course should be able to demonstrate a basic understanding of mathematical logic; use mathematics to solve scientific or mathematical problems in college classes; express relationships in the symbolic language of mathematics; and appreciate the role of mathematics in analyzing natural phenomena.

ADA Statement: If you have a need for disability-related accommodations or services, please inform the Coordinator of Disability Services in the Dean of Students Office at 2001 C. B. Hedgcock Building (227-1700). Reasonable and effective accommodations and services will be provided to students if requests are made in a timely manner, with appropriate documentation, in accordance with federal, state, and University guidelines.

Student Learning Outcomes

Upon successful completion of this course the student will be able to:

- Understand and apply the basic rules of algebra to solve algebraic equations.
- Understand and apply problem-solving methods to analyze a problem and obtain an answer.
- Understand and apply the concepts and properties of a function to model real-world situations, and use both algebraic and graphical methods to solve scenarios involving these functions. In particular, the student will understand how to use linear, polynomial, exponential, and logarithmic functions.
- Understand the financial mathematics behind interest, amortization, annuities, and sinking funds.
- Solve systems of equations using matrices.
- Understand the mathematics used to work with matrices.
- Model and solve linear programming applications.
- Understand basic probability and statistics concepts.

Student achievement of these learning outcomes will be measured through:

Performance on homework, quizzes, and exams.