

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 101 Quantitative Literacy

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

The overall purpose of the course is both to instill an overall appreciation of mathematics as a discipline and to expose students to the subtlety and variety of its many facets: applications, ideas, methods, and solutions.

Quantitative Literacy intends to teach students how to:

- Use critical-thinking skills needed to understand the major issues students will face in life, both on personal level and as citizens in a modern democracy.
- Perform simple mathematical computations associated with a quantitative model and make conclusions based on the results;
- Recognize, use, and appreciate mathematical thinking for solving problems that are part of everyday life;
- Understand the various sources of uncertainty and error in empirical data;
- Communicate logical arguments and their conclusions.

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

Critical Thinking Learning Outcomes: Demonstrates critical thinking.

- **Evidence:** Students are given problems or situations in which they must determine what pieces of the information given should be used to find the solution. For example, students will examine personal finance records to develop a monthly budget.

- Integrate: Students must integrate lecture material and apply appropriate problem solving methods when doing homework. For example, when determining unit price, sales price discounts and original price students are given formulas and examples in class. On the homework they must determine the appropriate methods and apply that to their problems. They must choose from a variety of known methods to solve the given problem.
- Evaluate: Student need to be able to recognize when they have arrived at a solution to a given problem and present the solution coherently. For example, after reading a loan document students will be able to compare loan products and make wiser decisions about borrowing.

Quantitative Reasoning and Analysis Learning Outcomes:

- Calculation: Approximately 80% of exam and homework problems require a mathematical calculation.
- Analysis / Application: Projects will require students to apply the concepts to some real life project. For example, after students learn the basic concepts of graph theory they could do a project on planning a quickest route for delivering Christmas presents around town.
- Interpretation: Students will be required to explain, in writing, their thought process, the methods chosen and their conclusions when doing projects. For example, students will use what they learn about basic statistics to create a randomly chosen sample to make inferences about a population and will prepare a written and oral report on their findings.

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

MA 101 is a 100-level quantitative literacy course intended for students in any major who possess solid arithmetic and rudimentary algebra skills. Quantitative literacy is a "habit of mind" competency and a comfort working with numerical data- skills needed by all graduates.

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

MA101 will 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: Homework, exams, final exam, projects ❖ Frequency: Daily homework, 5 exams, 1 final exam, 5 projects ❖ Overall Grading Weight: HW 10%, Exams 25%, Final 10%, Project 50% ❖ Assessment: Homework, exams and the final exam will have some problems where students need to read and decide what information is important in order to proceed. About 20% of the problems on these assessments will require this skill. For example, "word problems" require this skill. Projects will give students an opportunity to demonstrate their ability to select the most helpful information. About 30% of each project will assess this skill. Proficiency of the student learning outcomes that include the ability to assess quality of evidence will be tracked from semester to semester with the final exam. ❖ Expected Proficiency Rate: 70% average on all tasks
Integrate	Integrates insight and or reasoning with existing understanding to reach informed conclusions and/or understanding	<ul style="list-style-type: none"> ❖ Task type: Homework, exams, final exam, projects ❖ Frequency: Daily homework, 5 exams, 1 final exam, 5 projects ❖ Overall Grading Weight: HW 10%, Exams 25%, Final 10%, Project 50% ❖ Assessment: Homework, exams and the final exam problems will have students use what they have learned to synthesize ideas and information. Projects will require a written report. Students will be expected to explain their thinking. For example, a project might be to find and explain examples of the Fibonacci pattern in nature. Some projects will also have an oral component. Proficiency of the student learning outcomes that include the ability to integrate insight and/ or reasoning will be tracked from semester to semester with the final exam. ❖ Expected Proficiency Rate: 70% average on all tasks
Evaluate	Evaluates information, ideas, and activities according to	<ul style="list-style-type: none"> ❖ Task type: Homework, exams, final exam, projects ❖ Frequency: Daily homework, 5 exams, 1 final exam, 5 projects ❖ Overall Grading Weight: HW 10%, Exams 25%, Final 10%, Project

	<p>established principles and guidelines</p>	<p>50%</p> <ul style="list-style-type: none"> ❖ Assessment: Homework, exams and the final exam questions will be expect students to draw conclusions and show proper evidence for these conclusions. Projects will also assess the students' ability to evaluate information and reflect on informed evaluations. For example, when analyzing a monthly budget of a non-profit organization students will need to provide evidence how well the non-profit in on budget for the year. Proficiency of the student learning outcomes that include the ability to evaluate information will be tracked from semester to semester with the final exam. ❖ Expected Proficiency Rate: 70% average on all tasks
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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: Homework, exams, final exam, projects ❖ Frequency: Daily homework, 5 exams, 1 final exam, 5 projects ❖ Overall Grading Weight: HW 10%, Exams 25%, Final 10%, Project 50% ❖ Assessment: Homework, exams and the final exam will focus on performing calculation skills. Homework will provide daily practice on developing calculation skills. Exams will assess if the students can perform calculations without the aid of textbook and notes. The final exam will assess if the students have retained the ability to perform calculations until the end of the semester. Some computation will be required on all projects. About 80% of each homework set, each exam and the final exam will assess calculation skills. About 10% of each project will assess calculation skills. Proficiency of the computational type of student learning outcomes will be tracked from semester to semester with the final exam. ❖ Expected Proficiency Rate: 70% average on all tasks
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: Homework, exams, final exam, projects ❖ Frequency: Daily homework, 5 exams, 1 final exam, 5 projects ❖ Overall Grading Weight: HW 10%, Exams 25%, Final 10%, Project 50% ❖ Assessment: Homework, exams and final exam will have some problems that require students to manipulate and use quantitative data to draw conclusions. On average, about 20% of the problems on homework, exams and final exam will assess analysis and application skills. Projects will focus on application of the computational skills. For example, a student develops, implements and analyzes a survey about the freshman class at Northern. About 60% of each project

		<p>will assess analysis and application skills. Proficiency of the analysis and application type of student learning outcomes will be tracked from semester to semester with the projects.</p> <ul style="list-style-type: none"> ❖ Expected Proficiency Rate: 70% average on all tasks
<p>Interpretation</p>	<p>Ability to explain information presented in mathematical forms (e.g. equations, graphs, diagrams, tables, and words)</p>	<ul style="list-style-type: none"> ❖ Task type: Project ❖ Frequency: 5 projects ❖ Overall Grading Weight: Project 50% ❖ Assessment: Students will be required to explain, in writing, their thought process, the methods chosen and their conclusions when doing projects. For example, some of the projects will require an oral presentation. About 30% of each project will assess the student’s interpretation skills. Proficiency of the interpret type of student learning outcomes will be tracked from semester to semester with the projects. ❖ Expected Proficiency Rate: 70% average on all tasks

Quantitative Literacy
MA 101, Section 1, Fall 2016
MWRF 9:00 – 9:50 WS 2901

Text (suggestions):

Using and Understanding Mathematics: A Quantitative Reasoning Approach, 6/E,
Bennett and Briggs

Pathways to Math Literacy, Sobecki and Mercer

Quantitative Literacy Thinking Between the Lines, Crauder, Evans, Johnson and Noell

Thinking Mathematically, 6th Edition, Blitzer

Course Description:

The overall purpose of the course is both to instill an overall appreciation of mathematics as a discipline and to expose students to the subtlety and variety of its many facets: applications, ideas, methods, and solutions.

Quantitative Literacy courses are intended to teach students how to:

- Use critical-thinking skills needed to understand the major issues students will face in life, both on personal level and as citizens in a modern democracy.
- Perform simple mathematical computations associated with a quantitative model and make conclusions based on the results;
- Recognize, use, and appreciate mathematical thinking for solving problems that are part of everyday life;
- Understand the various sources of uncertainty and error in empirical data;
- Communicate logical arguments and their conclusions.

Prerequisite: OC 080 or placement into MA 090 or higher

Course Requirements: Organization of work into a portfolio, daily homework assignments, five projects (some group and some individual), five in-class exams and a final exam.

Grade scale: 91 – 100% = A, 81 – 89% = B, 71 – 79% = C, 61 – 69% = D, < 60% = F

Your grade as the following weighted categories:

Portfolio	5%
Homework	10%
Projects (one per unit)	50%
Exam (one per unit)	25%
Final Exam	10%

Course Outline & Learning Outcomes: Timeframe: 2 – 3 weeks per unit.

Units	Topics	Student Learning Outcomes
	Mathematics of Consumption and Finance	
	Taxes and discounts	Determine unit price, sales price, discount, original price
	Personal finance	Use mil rate to calculate property tax
	Borrowing/ saving	Create, balance and analyze monthly budget
		Compare simple interest to compound interest
		Calculate future values of investments
		Find and interpret annual percentage rate
		Analyze the cost of buying on credit
	Mathematics of Art and Nature	
	Fibonacci sequence	Recognize and analyze the Fibonacci pattern in real life examples
	Golden ratio	Recognize and analyze the golden ratio in art and architecture
	Geometric Transformations	Recognize and analyze reflection, rotation and translational symmetry in art
	Mathematics of Likelihood and Description: Statistics and Probability	
	Measures of central tendency	Use mean, median, and mode to describe the average value of a data set
	Graphical representation of data	Interpret graphical representations of data (area and stacked area graphs, box-and-whisker plots, histograms)
	Censuses, surveys, and clinical studies	Apply concepts of sample size and bias to determine whether a sample is representative of a population
		Use a randomly chosen sample to describe a population
	Measuring uncertainty and basic probability	Find and interpret theoretical and experimental probability
		Find and interpret expected values
		Find and interpret probability of events
	Mathematics of Logic	
	Sets and set diagrams	Determine union and intersection of sets
		Apply concepts of sets to real life problems

Statements and negations

Analyze statements and negations (all, some, many)

Fallacies in logic

Use set diagrams to detect fallacies

Recognize fallacies in advertisements

Mathematics of Management Science: Graph Theory

Euler paths and circuits

Define and recognize graphs, vertex, edge, paths, circuits

Apply concepts of paths and circuits (parade routes, traveling salesmen, mail carrier, snow plow efficiency)

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.