

Massasoit Community College

Instructor:

Office:

Email:

Phone:

Office Hours:

Course: Topics in Math II

Course Number: MATH153-XX

Semester:

Classroom:

Day and Time:

Course Description: This course is provided for students who wish to know what mathematics is all about but who do not wish to be mathematicians. Possible topics are: number systems, mathematical systems, number theory, voting coalitions, geometry, mathematics of finance, topology, linear programming, game theory, and cryptography. A selection of three or more such topics are offered each semester. Prerequisite: D- or higher in MATH003 Preparation for College Math III or MATH012 Intermediate Algebra or a score of 72 or higher on mathematics placement testing results; or departmental approval.

Required Text and Materials:

1. Angel, Abbot, and Runde, *A Survey of Mathematics with Applications*, 10th edition, Pearson Education, plus MyMathLab Student Access Kit. ISBN: 9780134112237. Note: this textbook comes packaged with MyMathLab, which is a requirement for this course. Homework for this course will be assigned through MyMathLab. If you do not purchase your textbook through the bookstore, please make sure that it comes with a MyMathLab access code.
2. You will need a calculator for this course. A scientific calculator, such as the TI30X-IIS should be able to handle all of the calculations needed for the course. A graphing calculator, such as the TI-84 Plus should work as well. You may not use any other technologies such as a cell phone, iPod, tablet, laptop, etc. as a calculator on assessments.

Course Topics:

Chapter 4: Systems of Numeration

Chapter 5: Number Theory and the Real Number System

Chapter 8: Geometry

Chapter 14: Voting and Apportionment

Teaching Procedures: This course will be taught in a lecture/discussion format with ample opportunity for student questions. Generally, class will begin with a question and answer session on the most recent homework assignment. New material will then be presented in a lecture format and homework be assigned to reinforce the topics covered in class.

Instructional Objectives:

COURSE OUTCOMES	OUTCOMES ACTIVITIES
At the end of this course, students will be able to	
Demonstrate an understanding of additive, multiplicative, positional, and ciphered systems of numeration in order to gain an appreciation for numeration systems other than the Hindu-Arabic system.	<ol style="list-style-type: none"> 1. Convert back and forth between an additive system, such as the Egyptian or Roman numeration system, and the Hindu-Arabic system of numeration. (CT, QS, R) 2. Convert back and forth between a multiplicative system, such as the traditional Chinese numeration system, and the Hindu-Arabic system of numeration. (CT, QS, R) 3. Convert back and forth between a positional system, such as the Babylonian or Mayan numeration system, and the Hindu-Arabic system of numeration. (CT, QS, R) 4. Convert back and forth between a ciphered system, such as the classical Greek numeration system, and the Hindu-Arabic system of numeration. (CT, QS, R) 5. Add and subtract in some or all of the numeration systems mentioned above. (CT, QS, R)
Perform conversions within base ten and between base ten and other bases and perform computations in other bases in order to better understand the Hindu-Arabic system of numeration.	<ol style="list-style-type: none"> 1. Convert among standard form, expanded form, and written form. (CT, QS, R, W) 2. Multiply using some or all of the following methods: (CT, QS, R) <ol style="list-style-type: none"> a. Successive duplication, b. Mediation and duplication, c. Lattice method, d. Napier's rods. 3. Convert between base ten and other bases, 4. Add, subtract, multiply, and divide in bases other than ten.
Determine which properties of a mathematical system are satisfied in a given system in order to better understand these properties as they apply to the Hindu-Arabic numeration system	<ol style="list-style-type: none"> 1. Identify the set of elements and the binary operations of a given mathematical system. (R, W, CT, QS) 2. Perform calculations using a binary operation defined by a table. (CT, QS)

	<ol style="list-style-type: none"> 3. Determine whether or not the following properties are satisfied in either a given finite or a given infinite mathematical system: (CT,R,W,QS) <ol style="list-style-type: none"> a. Closure property, b. Commutative property, c. Associative property, d. Identity property, e. Inverse property, f. Distributive property for a system with two binary operations. 4. Determine if a given mathematical system is a group or an abelian group. (CT,QS,R,W)
<p>Perform calculations, solve problems, and analyze properties of modulo systems in order to better understand finite mathematical systems.</p>	<ol style="list-style-type: none"> 1. Determine if two numbers are congruent modulo m. (CT,QS) 2. Add, subtract, and multiply modulo m. (CT,QS) 3. Solve linear equations in modulo systems. (CT,QS) 4. Determine whether or not a given modulo system is an abelian group. (CT,QS) 5. Solve applications problems involving modulo systems. (CT,QS,R,W)
<p>Demonstrate an understanding of some of the basic results in number theory in order to gain an appreciation of number and numeracy.</p>	<ol style="list-style-type: none"> 1. Apply the rules of divisibility. (QS,CT,R) 2. Find all the divisors of a given number. (CT,QS) 3. Determine if a given number is prime or composite. (CT,QS) 4. Write the prime factorization of a given composite number. (CT,QS) 5. Find the greatest common divisor of two numbers. (CT,QS) 6. Find the least common multiple of two numbers. (QS,CT) 7. Determine if a number is abundant, deficient, or perfect. (QS,CT) 8. Determine if two numbers are friendly numbers. (CT,QS)
<p>Demonstrate an understanding of sequences in order to gain an appreciation of number and numeracy.</p>	<ol style="list-style-type: none"> 1. Determine the next term of a given sequence. (CT,QS,R) 2. Determine if a given sequence is arithmetic, geometric, Fibonacci, or neither. (CT,QS,R,W) 3. For an arithmetic sequence whose first term and common difference are known, find <ol style="list-style-type: none"> a. The next several terms, b. The general term, c. The sum of the first n terms. (CT,QS,R) 4. For a geometric sequence whose first term and common ratio are known, find <ol style="list-style-type: none"> a. The next several terms,

	<ul style="list-style-type: none"> b. The general term, c. The sum of the first n terms. (CT, QS, R) <p>5. For a Fibonacci sequence whose first two terms are known,</p> <ul style="list-style-type: none"> a. Find the next several terms, b. Find the ratios of successive terms and compare this sequence of ratios with the 'golden ratio.' (CT, QS, R, W)
<p>Demonstrate an understanding of various voting methods and various apportionment methods in order to gain an appreciation of these methods as seen in real-life applications.</p>	<ol style="list-style-type: none"> 1. Solve election problems using the plurality method, the Borda count method, the plurality with elimination method, the pairwise comparison method, the sequential pairwise comparison method, and/or the approval voting method. (CT, QS, R, W) 2. Determine if a given voting method violates the majority criterion, the Condorcet criterion, the monotonicity criterion, and/or the independence of irrelevant alternatives method. (CT, QS, R, W) 3. Explain Arrow's Impossibility Theorem. (CT, W) 4. Solve apportionment problems using the Hamilton method, the Jefferson method, and the Webster method. (CT, QS, TS, R, W) 5. Explain the quota rule, the Alabama paradox, the population paradox, and the new states paradox. (CT, W) 6. Verify that a specified paradox occurs for a given apportionment scenario. (CT, QS, TS, R, W) 7. Explain the Balinski and Young Impossibility Theorem. (CT, W)
<p>Demonstrate an understanding of basic definitions and properties of Euclidean geometry and measurement formulas in order to solve related problems.</p>	<ol style="list-style-type: none"> 1. Correctly identify lines, rays, half-lines, and line segments. (CT, QS, R) 2. Correctly identify acute angles, right angles, obtuse angles, and straight angles. (CT, QS, R) 3. Correctly identify triangles as obtuse, right, or obtuse, and as scalene, isosceles, or equilateral. (CT, QS, R) 4. Correctly identify a given quadrilateral as a trapezoid, parallelogram, rhombus, rectangle, or square. (CT, QS, R) 5. Correctly identify a polygon by the number of its sides. (CT, QS) 6. Solve problems involving vertical angles, complementary angles, and supplementary angles. (CT, QS, R) 7. Solve problems involving parallel lines cut by a transversal. (CT, QS, R)

	<ol style="list-style-type: none"> 8. Solve problems involving the sum of the angles in a polygon. (CT, QS, R) 9. Solve problems involving similar triangles and congruent triangles. (CT, QS, R) 10. Solve problems involving right triangles and the Pythagorean Theorem. (CT, QS, R) 11. Use measurement formulas to find <ol style="list-style-type: none"> a. Perimeter of polygons, b. Area of triangles and quadrilaterals, c. Circumference and area of circles, d. Volume of rectangular solids, pyramids, cylinders, cones, and spheres, e. Surface area of three-dimensional objects. (CT, QS, R)
<p>Use simple and compound interest formulas in order to solve applications problems involving interest rates.</p>	<ol style="list-style-type: none"> 1. Calculate simple interest and maturity value. (CT, QS, TS, R) 2. Calculate compound interest and maturity value. (CT, QS, TS, R) 3. Calculate present value. (CT, QS, TS, R) 4. Understand and compute effective annual yield. (QS, CT, TS, R) 5. Find the value of an annuity. (QS, CT, TS, R)
<p>Use formulas involved in installment buying in order to make informed decisions in real-life situations involving buying on credit.</p>	<ol style="list-style-type: none"> 1. Determine the amount financed, the installment price, and the finance charge for a fixed loan. (CT, QS, TS, R, W) 2. Determine the APR. (CT, QS, TS, R, W) 3. Compute unearned interest and the payoff amount for a loan paid off early. (CT, QS, TS, R, W) 4. Find the interest, the balance due, and the minimum monthly payment for credit card loans. (CT, QS, TS, R, W) 5. Calculate interest on credit cards using the unpaid balance method, the previous balance method and/or the average daily balance method. (QS, CT, TS, R, W)
<p>Examine the cost of home ownership in order to make decisions as an educated consumer.</p>	<ol style="list-style-type: none"> 1. Compare and contrast fixed-rate mortgages and variable-rate mortgages. (CT, R, W) 2. Given information on income and monthly payments due, determine the maximum mortgage amount a given home buyer is qualified to borrow. (CT, QS, TS, R) 3. Compute interest costs for a fixed-rate mortgage. (CT, QS, R) 4. Compute the down payment. (CT, QS, TS, R) 5. Prepare a partial loan amortization schedule for a fixed-rate mortgage. (CT, QS, TS, R, W)

<p>OPTIONAL: Demonstrate an understanding of investing in stocks, bonds, and mutual funds in order to make decisions as an educated consumer.</p>	<p>6. Compute closing costs. (CT,QS,TS,R)</p> <ol style="list-style-type: none"> 1. Compare and contrast stocks, bonds, and mutual funds as investments. (CT,R,W) 2. Get information from stock tables. (CT,R) 3. Calculate the basic cost for a given number of shares of a specific stock using stock tables. (CT,QS,R) 4. Calculate broker fees. (CT,QS,R) 5. For a given investment scenario, find the total purchase price, the total dividend amount, the capital gain or loss, the total return, and the percentage return. (CT,QS,TS,R,W) 6. Find the total return earned by a given bond investment. (CT,QS,TS,R) 7. Find the effective rate of return for a given mutual fund scenario. (CT,QS,TS,R)
<p>Demonstrate an understanding of the basic definitions and properties of network theory, topology, hyperbolic geometry, elliptic geometry, and fractals in order to develop an appreciation for the nature of non-Euclidean geometry.</p>	<ol style="list-style-type: none"> 1. In a given network determine which vertices are even and which are odd. (CT,QS) 2. Determine if a given network is traversable or not. (CT,QS) 3. Find a path that traces a traversable network. (CT,QS,W) 4. Solve related network problems. (CT,QS,R,W) 5. Identify the genus of an object. (CT,QS) 6. Determine if two objects are topologically equivalent. (CT,QS) 7. For hyperbolic and elliptic geometry <ol style="list-style-type: none"> a. Identify at least one mathematician responsible for its development. (W) b. Identify the surface required for this type of geometry. (CT,W) c. Explain how Euclid's parallel postulate is changed. (CT,W) d. Explain why the sum of the measures of the angles in a triangle is not 180°. (CT,W) 8. Describe what a fractal is. (CT,W) 9. Use iteration techniques to demonstrate the construction of a fractal. (CT,QS,R,W)
<p>Use linear programming methods in order to solve maximum and minimum problems.</p>	<ol style="list-style-type: none"> 1. Solve a linear programming problem by <ol style="list-style-type: none"> a. Writing the appropriate inequalities subject to the given restrictions or constraints and the objective equation. (CT,QS,R) b. Graphing the inequalities to find the region of feasible solutions. (CT,QS,TS) c. Determine the corner points of the feasible region. (CT,QS)

	<p>d. Use the objective equation to determine which of these points gives a maximum or minimum value. (CT, QS, TS)</p> <p>2. Solve related applications problems. (CT, QS, TS, R, W)</p>
Demonstrate an understanding of the basic definitions and rules of game theory in order to gain an appreciation of the applications of game theory in business, economics, and the sciences.	<p>1. Construct the game matrix for a given two-person game. (CT, R, W)</p> <p>2. Determine whether or not a game matrix represents a strictly determined game. (CT, QS)</p> <p>3. Given the matrix for a strictly determined game, identify the saddle point, find the optimal pure strategy for each player, and the value of the game. (CT, QS, R, W)</p> <p>4. Given the matrix for a game that is not strictly determined, find the optimal mixed strategy and the value of the game for the row player. (CT, QS, R, W)</p> <p>5. Solve related application problems. (R, QS, CT, W)</p>
Strengthen Core Competencies** in order to increase success in this and other courses and in the workplace.	Referenced above

**Indicate the Core Competencies that apply to the outcomes activities and assessment tools: Critical Thinking (CT); Technology Skills (TS); Oral Communications (OC); Quantitative Skills (QS); Reading (R); Writing (W).

Basis for Student Grading: Grades for this course will be assigned as follows:

Grade	Average
A	93%-100%
A-	90%-92%
B+	87%-89%
B	83%-86%
B-	80%-82%
C+	77%-79%

Grade	Average
C	73%-76%
C-	70%-72%
D+	67%-69%
D	63%-66%
D-	60%-62%
F	0-59%

The grade you earn is the grade you will receive in this course. Grades are not negotiable. You will not be allowed to make up work, substitute alternative assignments, or submit extra assignments in order to improve your grade during the semester or after the semester ends.

Grades of incomplete are given only in situations when extenuating circumstances prevent a student from taking the final exam or fulfilling a specific requirement in the course. The grade of "I" cannot be used to give students additional time to complete course assignments in order to raise their grade.

Basis for Evaluating Student Performance: The grade for this course will be weighted based on the following categories:

- *Homework (10%):* Homework will be assigned in MyStatLab at the end of each section. It is due by the next class period, and loses 10% of its available credit each day that it is late.
- *Exams (60%):* There will be four in-class exams given throughout the semester, approximately every 3 weeks. Exams must be taken during the regular class time and no make-up exams will be given. The lowest exam grade will be dropped. Your exam average will account for 60% of your final grade.
- *Final Exam (30%):* The course will culminate in a cumulative final exam. It will be worth 30% of your final grade.

There is no extra credit available for this course.

Tentative Test Schedule/Assignment(s) Schedule:

Assignment:	Tentative Date:
Test 1	
Test 2	
Test 3	
Test 4	
Final Exam	

Attendance: Attendance for this course is mandatory. After the third absence, students will lose two points per absence thereafter from their final average. I will take attendance at the beginning of every class, and students not present at that time will be marked absent for the class, even if they show up late. If you must miss a regular class, you are still responsible for the material that was presented in class. The average student needs to attend all class meetings in order to be successful in this course.

Accommodations Statement: Massasoit’s Disability Services office provides accommodations to students who qualify for services based on a documented disability. Students interested in accessing classroom or testing accommodations must contact Disability Services directly. In an effort to avoid any lapse in services, new and returning students are encouraged to contact Disability Services at the beginning of each semester to receive an Accommodation Letter for the current semester. Students on all campuses can contact Disability Services at 508-588-9100 X 2132 or by e-mail at DisabilityServices@massasoit.edu for further information or questions.

Title IX Statement: Massasoit Community College is committed to providing a safe learning and work environment for all. If you believe you have experienced discrimination, sexual harassment, sexual assault, domestic/dating violence, stalking, or retaliation, we encourage you to report it to *Yolanda Dennis, Chief Diversity Officer and Title IX Coordinator, Office of Diversity and Inclusion, at 508-588-9100, x1309 or ODI@massasoit.edu*. While you may talk to a faculty member, understand that as a “responsible employee” of the College, the faculty member must report what you share to the College’s

Title IX Coordinator. On and off campus resources and interim measures are available to assist you. Information about both of these policies can be found at www.massasoit.edu/title-ix and www.massasoit.edu/eoo. We are here to support you.

Academic Integrity: Academic dishonesty will not be tolerated. Please see the following URL for more information on the college's policies on academic integrity:

<http://www.massasoit.edu/academics/policies/academic-honesty/index>