MTH 111: Precalculus

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Course Description

Equations of first and second degree, systems of equations. Inequalities. Functions and graphs. Exponential, logarithmic, and trigonometric functions. Applications. Introduction to analytic geometry. Complex numbers. Designed for students who need to strengthen their background in mathematics below calculus. (Lec. 3) Pre: passing a placement test or C- or better in MTH 101. Not for credit for mathematics majors.

Required Materials

- Precalculus by J. Abramson, OpenStax
  Available as a downloadable pdf online at https://openstax.org/details/books/precalculus

Course Objectives

The primary goal of MTH 111 is to prepare you for calculus (MTH131 or MTH141). The calculus sequence is often an essential step toward degree and career objectives, so MTH 111 is also such a step. Thus MTH 111 is aimed at the student for whom it will be the first of an important series of courses rather than a last math course. The prerequisite requirement for MTH131 and MTH141 is earning a C- or better in MTH 111. This course completely fulfills the general education requirements for Mathematical, Statistical or Computational Strategies, (MSCS) A,B and C elements and for Knowledge Outcome: STEM Discipline (STEM) elements. However, this course is NOT a good choice simply to fulfill a general education requirement. It demands a very substantial amount of hard work for 3 credits.

In order to succeed in this course and future math courses, you will have to master the following 10 Precalculus Competency Areas (PCA).
1. **Inequalities:** Solve and graph simple linear inequalities, compound inequalities, absolute value inequalities quadratic inequalities and rational inequalities. Rubric Elements: A.1, A.2, B.2, STEM1, STEM2

2. **Graphs and Graphing:** Find the distance between and midpoint of two points. Calculate and graph x-intercepts and y-intercepts. Graph horizontal and vertical lines. Identify families of functions and shifted graphs for linear, quadratic, cubic, square root, cubic root and greatest integer functions. Transform the graphs of linear, quadratic, cubic, square root and step functions by identifying the horizontal and vertical shifts, stretches, shrinkages and reflections. Discern symmetry from a graph. Graph piecewise functions. Determine and notate increasing, decreasing and constant intervals. Rubric Elements: A.2, A.2, B.1, C.3, STEM1, STEM2, STEM3, STEM4

3. **Linear Equations and Lines:** Calculate and identify the slope of a line, slopes of parallel and perpendicular lines, and slopes of vertical and horizontal lines. Create the equation of a line given two points or given a point and a slope or the line parallel or perpendicular. Detect the slope of a line given the graph of the line. Rubric Elements: A.1, A.2, B.1, B.2, STEM1, STEM2, STEM3

4. **Functions:** Test whether a given relation is a function for sets, graphs and equations. Use function notation. Evaluate the value of a function. Explain piecewise functions. Perform basic operations with functions. Determine the domain and range of a function. Compute the difference quotient of a function. Compose two or more functions. Test whether a given function is even or odd algebraically. Explain how to determine one-to-one functions for sets, graphs and equations. Find the inverse of a given function. Verify inverse functions using composition. Find the inverse of a mathematical model. Rubric Elements: A.1, A.2, B.1, B.2 C.1, C.2, C.3, STEM1, STEM2, STEM5, STEM6, STEM7

5. **Polynomials:** Factor polynomials, expand/multiply polynomials. Convert from the standard quadratic form to the standard parabola form by completing the square. Find the vertex, axis of symmetry, and other properties of a parabola represented by given quadratic function. Perform basic operations on complex numbers. Solve quadratic equations with real and imaginary roots. Divide two polynomials by both the long division and synthetic division methods. Recognize and apply the Zero Factor Theorem. Interpret and apply the Remainder Theorem. Interpret and apply the Rational Roots Theorem. Interpret and apply Descarte's Rule of Signs. Graph higher order polynomials. Determine the end behavior of a polynomial function using the Leading Coefficient Test. Find all roots of a higher order polynomial. Determine the behavior of a polynomial function at the x-intercepts. Create the polynomial given its roots (both real and complex). Understand and apply the Complex Conjugate Theorem. Graph higher order polynomial functions. Rubric Elements: A.1, A.2, B.1, B.2, STEM1, STEM2, STEM5, STEM6

6. **Radicals and Exponents:** Perform basic operations on radical expressions. Explain the domain of exponential functions. Graph exponential functions and the associated family of functions. Simplify exponential expressions. Transform between radical, fractional and exponential forms. Rubric Elements: A.1, A.2, C.1, STEM1, STEM2, STEM5
7. **Rational Expressions**: Identify the domain of a rational expression. Evaluate rational expressions. Determine the vertical and horizontal asymptotes. Graph rational equations including asymptotes and 'holes'. Rubric Elements: A.1, A.2, B.1, B.2, STEM1, STEM2, STEM5, STEM6

8. **Trigonometric Functions**: Evaluate basic trigonometric functions. Convert angles to degrees or radians. Find the domain and the range of the trigonometric functions. Understand Sine and Cosine functions from unit circle. Memorize and recall the trigonometric values at important angles based on unit circle. Understand and identify the graphs of trigonometric functions. Calculate the values of all other trigonometric functions. Transform and graph Sine and Cosine functions including phase shifts, periodicity and amplitude. Determine the values and graph inverse trigonometric functions. Solve right triangles and use right triangle trigonometry to solve application problems involving angle of elevation and angle of depression. Memorize and recall the Pythagorean Identities, Odd and Even Identities, Sum and Difference Identities, Double-Angle Identities and Half-Angle Identities. Simplify trigonometric expressions and prove equivalent expressions using trigonometric identities. Rubric Elements: A.1, A.2, B.1, C.1, C.2, STEM1, STEM2, STEM5, STEM6, STEM7

9. **Logarithms**: Evaluate logarithms. Apply logarithmic rules to simplify an expression. Solve logarithmic equations. Solve exponential equations. Understand and apply the properties of exponential functions and logarithmic functions. Apply mathematical methods and properties of exponential and logarithmic functions to solve real world application problems of compound interest calculation and radioactive decay. Rubric Elements: A.1, A.2, B.1, B.2, C.1, C.2, C.3, STEM1, STEM2, STEM3, STEM5, STEM6, STEM7

10. **Problem Solving**: For all PCA's, justify solutions and the problem solving process. Verify, interpret and communicate solutions with respect to the original problem. C.2, C.3, STEM7

**Course Structure**

**Assessments**

There will be three exams and a final. The dates of the exams will be:
- Exam 1: Wednesday, May 29
- Exam 2: Wednesday, June 6
- Exam 3: Wednesday, June 13
- Final Exam: Wednesday, June 20

**Classwork/Quizzes**

There will be times in class in which I will give either a classwork assignment in which you can work with other students or a quiz in which you will have to work alone.

**Homework**

Homework is extremely important in this course especially because of the pace of the course. There will be WeBWorK assignments due every Friday at 11:59PM with the last one due on June
The URL for the homework is https://webwork.math.uri.edu/webwork2/mth111_summer2019_ss1/. Make sure you are working on your homework throughout the week and not just on Friday night as working on all of the homework for the week can be overwhelming. Your username will be your URI ID number and your password will be the first 8 letters of your last name. Ignore spaces and characters other than letters. Use your entire last name if it contains 8 or less letters.

Grading Policy

Your grade in the course will be determined by a total of 900 points. The final grade will then be calculated by \([(\text{your total number of points})/900)\times100\]. This is the percentage that will be used to determine grades based on the normal grading scale. The points are distributed in the following way:

- **450 points** Exams (150 points each).
- **50 points** Classwork/Quizzes
- **200 points** WeBWorK Homework
- **200 points** Final Exam

Course Policies

Attendance Policy

With this being a summer course attendance is crucial as each class is equivalent to more than a week of a normal semester class. If you have a valid excuse please let me know as soon as possible as to why you are missing class. If you miss class you will miss not only a lot of the material, but also classwork assignments.

Policies on Missed and Late Assignments/Exams

No late assignments will be accepted unless documentation is provided as to why the assignment was missed and I am notified within 24 hours of the missed assignment. Exam makeups will only be given for valid, documented excuses and I am notified within 24 hours of the exam being given.

Academic Integrity and Honesty

According to the University's Student Manual:

Students are expected to be honest in all academic work. A student's name on any written work, quiz or exam shall be regarded as assurance that the work is the result of the student's own independent thought and study. Work should be stated in the student's own words, properly attributed to its source. Students have an obligation to know how to quote, paraphrase, summarize, cite and reference the work of others with integrity. The following are examples of academic dishonesty:

- Using material, directly or paraphrasing, from published sources (print or electronic) without appropriate citation
- Claiming disproportionate credit for work not done independently
- Unauthorized possession or access to exams
- Unauthorized communication during exams
- Unauthorized use of another's work or preparing work for another student
- Taking an exam for another student
• Altering or attempting to alter grades
• The use of notes or electronic devices to gain an unauthorized advantage during exams
• Fabricating or falsifying facts, data or references
• Facilitating or aiding another’s academic dishonesty
• Submitting the same paper for more than one course without prior approval from the instructors

Accommodations for Disabilities
Any student with a documented disability should contact me as soon as possible so I may work out reasonable accommodations with you to support your success in this course. Students should also contact Disability Services for Students: Office of Student Life, 330 Memorial Union, 874-2098. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Schedule
The schedule is tentative and is subject to change. Any changes will be announced in class.

Week 01, 05/19 - 05/23:
• Monday 05/20: Syllabus, 1.1-1.4
• Wednesday 05/22: 1.5-1.7
• Friday 05/24: WeBWorK 1.1-1.5 Due at 11:59PM

Week 02, 05/26 - 05/30:
• Monday 05/27: 2.1,2.1,3.1-3.3
• Wednesday 05/29: 3.4,3.5, Exam 1
• Friday 05/31: WeBWorK 1.6,1.7,2.1,2.2,3.1,3.2 Due at 11:59PM

Week 03, 06/02 - 06/06:
• Monday 06/03: 3.6,3.7, Polynomial and Rational Inequalities, 5.1
• Wednesday 06/05: 5.2,5.3, Exam 2
• Friday 06/07: WeBWorK 3.3-3.7 Due at 11:59PM

Week 04, 06/09 - 06/13:
• Monday 06/10: 5.4,7.1-7.3
• Wednesday 06/12: 6.1-6.3 Exam 3
• Friday 06/14: WeBWorK 5.1-5.4,7.1-7.3 Due at 11:59PM.

Week 05, 06/16 - 06/20:
• Monday 06/17: 4.1-4.6
• Wednesday 06/19: Review, Final Exam
• Friday 06/21: WeBWorK 6.1-6.3,4.1-4.6 Due at 11:59PM.

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