Effective Fall 2005

Course Outline and Objectives

MA 1453 Precalculus with Graphing Calculators

TEXT: Precalculus, 3rd Edition, by Faires and DeFranza

NOTE: A graphing calculator is required for this course. The TI-86 should be recommended for students who must purchase a new calculator for the course. Students who already own a graphing calculator should be encouraged to use the one they have. The main objective of this course is to prepare students to take MA 1713 Calculus I. The course focuses on the specific pre-calculus concepts that are needed in Calculus I in the context and at the level of mathematical maturity normally encountered in calculus. Additionally, students will be taught the effective use of a graphing calculator. The terminology, level of exposition, and use of the calculator in the course should closely match what is commonly encountered in Calculus I. At least three graphing calculator projects that emphasize mathematical correctness and quality of presentation should be assigned and should reflect in the final grade. At least one of these should be a group project.

Chapter 1, Sections 1.2 - 1.8: After completing Chapter 1, a student should:

- know the properties of inequality and the definition and properties of absolute value.
- be able to find the solution set of linear and non-linear inequalities in one variable using analytical and graphical methods.
- know how to represent intervals graphically and using set and interval notation.
- know the distance and midpoint formulas for two points in the coordinate plane.
- know how to put the equation of a circle in standard form by completing the square, find the coordinates of the center and the radius, and graph the circle.
- know the difference in an equation and an identity.
- be able to determine the intercepts and symmetries of an equation in two variables and graph the equation without (or with a graphing calculator, as needed).
- be able to use the **graph**, **window**, **trace**, and **evaluate** operations on a graphing calculator, as needed.
- know the definitions of function, domain, range, value of a function, odd function and even function.
- be able to evaluate functions analytically and by using their graphs.
- be able to find the domain of algebraic functions.
- know the definitions of linear and quadratic functions and how to find their intercepts.
- be able to find the slope and y-intercept of a linear function, the critical number of a quadratic function, the extreme value of a quadratic function and to write linear and quadratic functions in standard form.
- be able to determine whether lines are parallel or perpendicular to a given line.
- be able to write the equations of lines in point-slope, slope-intercept and general form.s

Section	Suggested minimum course Assignment
1.2	p. 12: 1,2,5,7,9,12,16,19,27-35(odd),38,41,43,49,53,55,58,60,61
1.3	p. 19: 6,9,12,13,17,19,21,34,42,43,45,49,51,55,61,63
1.4	p. 25: 1-8,11,13,21,25,28,30,33,35,37,38-43
1.5	p. 32: 1bc,3bd,4,5,8,9,12
1.6	p. 46: 1acg,2h,3cde,4,5,7-15,17,20,21,23-31,37,41-51(odd), 52-55,57,61,68,69,71
1.7	p.58: 3,7,11,13,15,16,17bd,19,20,22,23-31(odd),35,37
1.8	p. 69: 3,7,11,13,20,21,23,28,29,31,33b,34,37,41

11 hours

Chapter 2, Sections 2.1 – 2.5 : After completing Chapter 2, a student should:

- know the properties of, the domain and range, and be able to sketch the graphs the absolute value function, the square root function, the cube root function, and the greatest integer function.
- be able to graph more complicated functions from simpler functions by understanding the algebra that produces horizontal or vertical shifts, dilations, or compressions in the graph.
- know the definitions o sum, difference, product, quotient and composition of two functions and the inverse of a function.
- be able to find the domain of various combinations of algebraic functions.
- know the properties of inverse functions and how to make the graph of of its inverse from the graph of a one-to-one function.
- understand the significance of the vertical and horizontal line tests as applied to a graph and whether or not the defining function is one-to-one.

Section	Suggested minimum course assignment
2.2	p. 86: 3,13,16,17ace,18a,19,22,25,27,30,33a-h
2.3	p. 95: 3,6,7,11,14,18,19,21,23,25
2.4	p. 104: 1,3,5,8,10,13,16,17,20,21a,22,28,29,33,37
2.5	p. 114: 1-10,13,17,19,23,25,28,30,32,33,37,39

4 hours

Chapter 3, Sections 3.1 – 3.6: After completing Chapter 3, a student should :

- be able to define polynomial, rational and irrational function.
- be able to find intercepts and the behavior of the function as $x \to \infty$ (or $-\infty$).
- be able to use a graphing calculator to graph the polynomial and to find critical numbers and relative extreme values.
- know the Intermediate Value Theorem, the Division Algorithm, the Factor Theorem, the Rational Zero Theorem, Descartes' Rule of Signs and the Fundamental Theorem of Algebra and how to apply them in solving polynomial equations and finding the zeros of polynomial functions.
- be able to find the domain, intercepts, vertical, horizontal and slant asymptotes of rational functions and sketch their graphs with the help of a graphing calculator.

- be able to find the domain and asymptotes, if they exist, and sketch the graph of irrational functions with the help of a graphing calculator.
- know how to perform complex arithmetic and determine complex roots of polynomial equations.

Section	Suggested minimum course assignment
3.2	p. 134: 1,3,4,5,7,11,13,15,23,2 6,33,34,35,39,41,43,47
3.3.	p. 144 5,9,15,17,21,25,29,33,35,38,39
3.4.	p. 157: 1-7,9,12,13,16,17,20,23,27,31,34,35,37,39,43
3.5.	p. 163: 1,3,9,11,13,19,25,31
3.6	p. 172: 2,5,8,13,16,18,19,21,23,25,26,28,37,41,43,47,48,51,55:

8 hours

Chapter 4, Sections 4.1 – 4.9: After completing Chapter 3, a student should:

- be able to define radian measure.
- be able to convert between degree and radian measure.
- know the definition of sine of t and cosine of t, where t is a real number and that they are bounded, periodic functions.
- know that sine is an odd function and cosine is even.
- know the sine and cosine of the special angles (in radians) and the quadrantal angles.
- be able to use reference angles to find the sine and cosine.
- be able to determine the amplitude, period and phase shift of sine and cosine functions and sketch their graphs.
- know the definitions of the tangent, cotangent, secant and cosecant functions in terms of sine and cosine, be able to determine their values for the special and quadrantal angles, know their periods,aand be able to sketch their graphs.
- know the Pythagorean identities and the sum, difference and double angle identities for sine and cosine.
- know the half-angle identities and their derivation for sine and cosine, i.e., $\sin^2 x = \frac{1}{2} - \frac{1}{2}\cos(2x)$.
- be able to state and apply the trigonometric identities that commonly arise in calculus and use them to solve problems.
- be able to solve applications using right-triangle trigonometry.
- be able to restrict the domain of trigonometric functions to produce trigonometric functions that are invertible.
- be able to define the inverse trigonometric functions and give their domains, ranges, and sketch their graphs.
- be able to work problems that involve inverse trigonometric functions.
- know the Law of Sines and the Law of Cosines and understand the ambiguous case of the Law of Sines.
- be able to apply the Law of Sines and Law of Cosines to applications involving oblique triangles.
- know how to add sine and cosine functions with the same argument to produce

a single sine (or cosine) function.
- know and be able to apply Heron's formula and to find the area of a triangle, given two sides and an included angle.

Section	Suggested minimum course assignment
4.2	p. 187: 1-9, 11-17(odd),18,21,24,25,29,31,33,34,35,38,40
4.3	p. 200: 1,2,3,5,6ab,7-53(odd)
4.4	p. 210: 1-8,13,16,19,23-35(odd),36,37,40
4.5	p. 219: 1-9, 9-17(odd), 21,23,29,31,35,39,41
4.6	p. 231: 1-53(odd)
4.7	p. 237: 1-17(odd)
4.8	p. 246: 1-43(odd)
4.9	p. 260: 1,5,9,13,15,17,19,22,23,25

12 days

Chapter 5, Sections 5.1 – 5.4: After completing Chapter 5, a student should:
- know the definition of e, how to approximate e, the definition of the natural exponential function, its properties, and how to work problems involving compound interest, and exponential growth or decay.
- know the definition of logarithm and natural logarithm and the properties of logarithmic functions.
- be able to graph exponential and logarithmic functions and know the change of base formulas for both exponential and logarithmic functions.
- be able to solve exponential and logarithmic equations in exact form and to approximate solutions using a calculator.

Section	Suggested minimum course assignment
5.2	p. 282: 1,3,5,7,11,15,17,19,21,24,25,30,32a,38
5.3	p. 292: 1,5,9,13,17,21,25,29,32,33,37,39,53,57,61,65
5.4	p. 298: 1,5,7,9,13,17,19,22:

3 days

Other Pertinent Information for Instructors

1. The fall and spring semesters normally contain 45 class hours on a MWF schedule; however, in the 2003-2004 academic year they contained 42 hours, only. The summer terms typically contain 42 hours. Sections 6.1 through 6.4 should be viewed as optional.
   The Course Outline suggests 38 hours of lecture. Three or four scheduled one-hour tests should be administered each semester in addition to a comprehensive final examination.

2. Instructors are expected to teach their students how to use their calculators wisely and well.

3. Instructors are expected to use a graphing calculator for the purpose of enhancement and clarification of material in the course and for speed and accuracy in calculation. They should teach students to give exact answers, when possible, and to resort to calculator approximations at the appropriate stage in their calculations.

4. Instructors should be aware of the symbolic manipulation capabilities of certain calculators (e.g. TI-89) and should exercise care in the construction of exams so that students using such calculators do not have an unfair advantage.

5. Calculators should be used on all scheduled tests and on the final examination.

6. If time allows, students should be introduced to coordinate transformations involving translations and rotations in the context of conic sections.

7. Instructors should take advantage of computer graded homework assignments that are available on the ILRN website of Brooks/Cole Publishing.

8. Instructors should assign at least three calculator projects during the course of the semester. The project reports should be graded for correctness, grammar, spelling and clarity of exposition. Graphs contained in the report should be neat, axes should be labeled and tick marks should be labeled with appropriate units.