Math 140 – Precalculus Mathematics
Course Syllabus

Course description: Preparatory for the calculus sequence: properties and graphs of algebraic, exponential, logarithmic, and trigonometric (with inverses); fundamental trigonometric identities; conic sections; polar and rectangular coordinate systems.

Credit hours: 4

Course Prerequisites and Corequisites: See general course prerequisites.

Course outline: Approximate time spent

- **Functions** 30%
  - Definition/notation
  - Domains/ranges of basic functions, their graphs, and topics appropriate to each type of function:
    - Linear functions: constant functions; slope; point-slope/slope-intercept form; solving linear equations/inequalities
    - Power functions: end behavior
    - Polynomials: intercepts, maximum/minimum number of turning points, and end behavior; solving polynomial equations/inequalities (factoring, Zero Product Principle, quadratic formula)
    - Rational functions: horizontal, vertical, and oblique asymptotes; polynomial long division and proper rational functions, end behavior
    - Exponential functions: properties of exponents (including, especially, rational exponents); asymptotes and end behavior; exponential growth/decay; natural exponential
    - Logarithmic functions: properties of logarithms; asymptotes and end behavior; natural logarithms; solving exponential/logarithmic equations
    - Piecewise-defined: common piece-wise defined functions (absolute value, stamp-price, etc.); graphing/interpreting piecewise-defined functions; 'skip' and 'jump' discontinuities
  - Transformations of the basic graphs: translations, reflections, and compressions/expansions
  - Combining functions: algebraically and by composition
  - Inverses of functions (including those that require branches, like the principal square root)
- **Trigonometry** 40%
  - Triangular/circular functions
    - Definitions in both contexts
    - Special triangles and values of the trigonometric functions at the standard multiples
    - Graphs, domains/ranges, asymptotes, and transformations of the circular functions
  - Trigonometric Identities
    - Basic: reciprocal, quotient and Pythagorean identities
    - Others: sum/difference identities, double- and half-angle identities
  - Inverse trigonometric functions
    - Domains/ranges, reference angles
  - Graphs
  - Solving trigonometric equations
  - Law of Sines and Cosines

Approximate time spent

- **Analytic Geometry** 30%
    - Cartesian coordinate system/distance formula
    - Conic sections: parabola, ellipse, hyperbola
    - Transformations (including rotations)
    - Polar coordinates
    - Systems of equations

Student Learning Outcomes (SLO): At the end of MTH 140, a student who has studied and learned the material should be able to:

1. Define "function".
2. Recognize basic functions (including transcendental functions) algebraically and graphically.
3. Identify determining factors of the graph of a function either algebraically or from the graph, including the domain and range, intercepts, asymptotes, and end behavior.
4. Generate composite functions and identify domains/ranges.
5. Define and recognize when a function is one-to-one and explain why this is necessary for a function to have an inverse.
6. Compute the inverse of a function and understand that the domain may need to be restricted in order to do so.
7. Define triangular/circular trigonometric functions.
8. Determine the domains/ranges/graphs of circular trigonometric functions and their transformations.
9. Identify special triangles and values of the trigonometric functions at the standard multiples.
10. Extend the definition of the trigonometric functions and the Pythagorean Theorem to obtain the reciprocal, quotient, and Pythagorean identities.
11. Understand the sum and difference formulas and use them to generate the double- and half-angle formulas.
12. Restrict the domain of the trigonometric functions so that the inverse trigonometric functions may be defined.
13. Solve trigonometric equations.
14. Use Law of Sines/Cosines to solve triangles.
15. Recognize that the distance formula is an application of the Pythagorean Theorem.
16. Define and analyze the conics: circles, ellipses, parabolas, and hyperbolas.
17. Convert the polar equation of a conic to a rectangular equation and vise versa.
18. Solve basic systems of equations.

There are no specific program learning outcomes for this major addressed in this course. It is a general education core curriculum course and/or a service course.