

# Virginia Western Community College

## MTH 167

### Pre-Calculus with Trigonometry

#### Prerequisites

Competency in MTE 1-9 as demonstrated through placement or unit completion or equivalent.

#### Course Description

Presents topics in power, polynomial, rational, exponential, and logarithmic functions, systems of equations, trigonometry, trigonometric applications, including Law of Sines and Cosines, and an introduction to conics.

**Semester Credits: 5**

**Lecture Hours: 5**

#### Required Materials

##### **Textbook:**

Precalculus. Sullivan. 10th edition. Pearson. ISBN: 9780321979070.

##### **Other Required Materials:**

TI-89 Calculator

#### Course Outcomes

**Suggested class hour pacing is given.**

**At the completion of this course, the student should be able to:**

- Distinguish between relations and functions. (0.5)
- Evaluate functions both numerically and algebraically. (0.5)
- Determine the domain and range of functions in general, including root and rational functions. (1)
- Perform arithmetic operations on functions, including the composition of functions and the difference quotient. (3)
- Identify and graph linear, absolute value, quadratic, cubic, and square root functions and their transformations. (2)
- Determine and verify inverses of one-to-one functions. (1)
- Determine the general and standard forms of quadratic functions. (0.5)
- Use formula and completing the square methods to determine the standard form of a quadratic function. (1.5)
- Identify intercepts, vertex, and orientation of the parabola and use these to graph quadratic functions. (2)
- Identify zeros (real-valued roots) and complex roots, and determine end behavior of higher order polynomials and graph the polynomial, and graph. (2)
- Determine if a function demonstrates even or odd symmetry. (0.5)
- Use the Fundamental Theorem of Algebra, Rational Root test, and Linear Factorization Theorem to factor polynomials and determine the zeros over the complex numbers. (2)
- Identify intercepts, end behavior, and asymptotes of rational functions, and graph. (2)

- Solve polynomial and rational inequalities. (1)
- Interpret the algebraic and graphical meaning of equality of functions ( $f(x) = g(x)$ ) and inequality of functions ( $f(x) > g(x)$ ) (1)
- Decompose partial fractions of the form  $P(x)/Q(x)$  where  $Q(x)$  is a product of linear factors. (1)
- Identify and graph exponential and logarithmic functions and their transformations. (3)
- Use properties of logarithms to simplify and expand logarithmic expressions. (2)
- Convert between exponential and logarithmic forms and demonstrate an understanding of the relationship between the two forms. (2)
- Solve exponential and logarithmic equations using one-to-one and inverse properties. (3)
- Solve application problems involving exponential and logarithmic functions. (1.5)
- Solve three variable linear systems of equations using the Gaussian elimination method. (3.5)
- Identify angles in standard form in both degree and radian format and convert from one to the other. (0.25)
- Find the arc length. (0.25)
- Find the value of trigonometric functions of common angles without a calculator using the unit circle and right triangle trigonometry. (3)
- Use reference angles to evaluate trig functions. (0.25)
- Find the value of trigonometric functions of angles using a calculator. (0.25)
- Use fundamental trigonometric identities to simplify trigonometric expressions. (2)
- Graph the six trigonometric functions using the amplitude, period, phase and vertical shifts. (3)
- Use trig functions to model applications in the life and natural sciences. (1.5)
- Use the fundamental, quotient, Pythagorean, co-function, and even/odd identities to verify trigonometric identities. (2)
- Use the sum and difference, double angle, half-angle formulas to evaluate the exact values of trigonometric expressions. (2.5)
- Determine exact values of expressions, including composite expressions, involving inverse trigonometric functions. (3)
- Solve trigonometric equations over restricted and non-restricted domains. (2)
- Solve right triangles and applications involving right triangles. (2)
- Use the Law of Sines and Cosines to solve oblique triangles and applications. (3)
- Apply concepts of trigonometry to extended topics such as plotting polar coordinates, converting rectangular and polar coordinates from one to the other, identifying vector magnitude and direction, or performing operations with vectors such as addition, scalar multiplication, component form, and dot product. (3)
- Identify the conic sections of the form:  $Ax^2 + By^2 + Dx + Ey + F = 0$ . (1)
- Write the equations of circles, parabolas, ellipses, and hyperbolas in standard form centered both at the origin and not at the origin. (3)
- Identify essential characteristics unique to each conic. (1)
- Graph equations in conic sections, centered both at the origin and not at the origin. (1)
- Solve applications involving conic sections. (1)

## **Topical Description**

<u>Topics</u>	<u>Chapters/Sections</u>
Lines, Functions and Their Graphs	1, 2, 5 (1.3, 2.1-2.5, 5.1)
Rational Functions & Complex Numbers	4 (4.2-4.6 & A60)
Exponential and Logarithmic Functions Chapter	5 (5.2-5.6)
Trigonometric Functions Chapter	6 (6.1-6.5)
Additional Topics in Trigonometry	7 & 8 (7.1-7.3, 7.7, 8.1-8.3)
Analytic Geometry	10 (10.1-10.5)
Matrices and Determinants	11 (11.2-11.4)

## **Notes to Instructors**

The purpose of MTH 167 is to get the students ready for MTH 263 (no calculators allowed), and to prepare them for engineering and physics. For the engineering majors they are required to have a TI-89 Titanium, any other major can get by with a TI-83. Our job is to teach them how to use the TI-89 Titanium for calculations they need in physics and engineering.