# Math 2110: College Trigonometry

**Credit hours:** **3 credit hours**
**Prerequisites:** **Placement in ACCUPLACER Grid 6 or MATH 1200 with a grade of C or better**

## Course Description

Designed for students who plan to study calculus eventually, this course deals with trigonometry from an analytical approach. Topics include relations and functions in general, the trigonometric functions and their inverses, graphs, solutions of triangles, vectors, trigonometric identities and equations, and applied problems.

## Course Objectives

1. Provide a comprehensive course to ready students for the rigors of pre-calculus and calculus
2. Enhance understanding of Trigonometry necessary for success in pre-calculus and calculus
3. Reinforce algebraic concepts required for advanced mathematics

## Learning Outcomes

1. Find exact (for special angles) and approximate (calculator) values of trigonometric functions and their corresponding angles in both degree and radian measure
2. Graph the general trigonometric functions
3. Determine amplitudes, periods, phase shifts, and vertical translations of trigonometric functions
4. Use memorized fundamental trigonometric identities (e.g. Pythagorean, sum/difference, double angle, half angle formulas) to simplify trigonometric expressions and solve equations
5. Solve problems involving arc length, area of a sector of a circle, angular and linear velocity
6. Solve right triangle and oblique triangle problems using the Law of Sines and the Law of Cosines
7. Solve Sine, Cosine, and Tangent equations including those in quadratic form
8. Solve vector problems involving vector components, vector addition, force equilibrium, and navigation
9. Find exact and approximate values, the domain, and the range of inverse trigonometric functions
10. Graph inverse trigonometric functions

## Course Topics

I. RELATIONS AND FUNCTIONS
   A. Definitions and examples
   B. Domain and range
   C. Graphs and the vertical-line test
   D. Composition of functions and inverses of functions*

II. GEOMETRIC CONCEPTS
   A. Definition of angle
   B. Degree measure
   C. Description of various triangles
   D. Pythagorean Theorem
   E. Properties of 45-45-90 and 30-60-90-degree triangles (derivation)
   F. Derivation of the distance formula
   G. Definition of circle and parts of a circle
   H. Definition of $\pi$
   I. Radian measure

III. CIRCULAR FUNCTIONS

A. Definitions and the Unit Circle

IV. TRIGONOMETRIC FUNCTIONS

A. Definition of the basic functions
B. Solving for trigonometric functions of angles
    1. Exact values for angles
    2. Calculator values for any angle
C. Solving for the angle (general solution)
    1. Exact values for angles
    2. Calculator values for any angle

V. IDENTITIES

A. Derivation of the basic trigonometric identities
    1. Reciprocal identities
    2. Pythagorean identities
    3. Ratio identities
B. Using the basic identities to prove new identities (such as $\sin(-2) = -\sin(2)$)
C. Sine, cosine, and tangent of the sum or difference of two angles (no derivation)
    1. Numerical examples
    2. Use in proving other identities
D. Double-angle and half-angle formulas (no derivation)
    1. Numerical examples
    2. Use in proving other identities

VI. TRIGONOMETRIC EQUATIONS (USING IDENTITIES DESCRIBED IN V)

A. Solutions with restricted domains
B. General solutions

VII. SOLVING TRIANGLES

A. Right triangles
B. Oblique triangles
    1. Law of sines (derivation*)
    2. Law of cosines (derivation*)
C. Vectors
    1. Vector addition by using horizontal and vertical components
    2. Vector addition by using right or oblique triangles
D. Word problems

VIII. GRAPHS OF THE TRIGONOMETRIC FUNCTIONS

A. $y = a\sin(bx + c) + d, y = a\cos(bx + c) + d$
B. $y = \tan(x), y = \csc(x), y = \sec(x), y = \cot(x)$

IX. INVERSES OF TRIGONOMETRIC FUNCTIONS

A. Definitions and examples
B. Graphing inverses of $y = \sin(x), y = \cos(x), y = \tan(x)$
C. Notation for inverses of trigonometric functions
D. Restricting the domain for sine, cosine, and tangent so that their inverses will be functions
E. Evaluation the principal inverses of sine, cosine, and tangent

X. APPLICATIONS

A. Areas of sectors and segments of circles
B. Arc length
C. Angular and Linear Velocity

*Optional