

Valparaiso University Course Syllabus

MATH 115: Trigonometry and Functions

- Description:** *Topics will include trigonometry in the plane, trigonometric functions, simple vector geometry, functional concepts and notation, and an introduction to polar coordinates. Self-paced course.*
- Credit Hours:** 1
- Frequency:** Offered every term
- Audience:** Completion of this course, or placement higher, is a prerequisite or corequisite for many quantitative courses across the University. This course may not be used to fulfill the General Education Requirement in the College of Arts and Sciences nor be counted toward a major or minor in mathematics.
- Prerequisites:** Grade of S in MATH 111, or placement higher than MATH 111 in the Math Placement process
- Format:** 1 class session (50 minutes) per week for 15 weeks, plus online work outside of class
- Textbook:** All required coursework will be completed in the ALEKS 360 platform, which includes access to tutorials, an e-textbook, and videos. The instructor will provide you with a course code to input into the ALEKS 360 platform, but you must also purchase an ALEKS access code. An ALEKS access code can be purchased through the University Bookstore, or through the ALEKS website after inputting the course code. (You can use a financial aid access code that will be provided from the instructor for the first two weeks if you are not able to purchase an ALEKS access code at the beginning of the term. However, you must purchase your own ALEKS access code within the first two weeks.)
- AARC:** The Access and Accommodations Resource Center (AARC) is the campus office that works with students to provide access and accommodations in cases of diagnosed mental or emotional health issues, attentional or learning disabilities, vision or hearing limitations, chronic diseases, or allergies. You can contact the office at aarc@valpo.edu or 219.464.5206. Students who need, or think they may need, accommodations due to a diagnosis, or who think they have a diagnosis, are invited to contact AARC to arrange a confidential discussion with the AARC office. Further, students who are registered with AARC are required to contact their professor(s) if they wish to exercise the accommodations outlined in their letter from the AARC.

Notice of Cancellation: Notifications of class cancellations will be made through Blackboard with as much advance notice as possible. It will be both posted on Blackboard and sent to your Valpo e-mail address. If you don't check your Valpo e-mail account regularly or have it set-up to be forwarded to your preferred e-mail account, you may not get the message. Please check Blackboard and your Valpo e-mail (or the e-mail address it forwards to) before coming to class.

Emergency Protocol: VU's Emergency Notification System (ENS) uses multiple forms of communication, including e-mail, building alarms, outdoor sirens, message boards, computer alerts, Twitter, and public address messaging. Please review the specific procedures for this class found in Blackboard. Remember: "Siren inside, GO outside; Siren outside, GO inside." To evacuate, gather your personal belongings quickly and proceed to the nearest exit. Do not use the elevator. To shelter in place, move away from the windows and stay low to the ground; lock or barricade the door if there is a threat of violence.

Student Learning Objectives:

- A. Students will demonstrate mastery of fundamental topics in the area of trigonometry and its applications, particularly those needed for success in Calculus and other disciplines which rely on trigonometric principles. (See attached example detailed syllabus from ALEKS 360.)
- B. Students will demonstrate the ability to use the language of functions and their notation at a level sufficient for success in Calculus.

Class: MATH 115 Fall 2021 - A

Class Code: HHAPW-ATTRV

Subject: College Algebra with Trigonometry

Instructor: Kolba

Class Dates: 08/25/2021 - 12/10/2021




Class Content: 160 topics / 128 accessible topics

Textbook: Miller: College Algebra & Trigonometry, 1st Ed. (McGraw-Hill)



 Accessible Topic - Topics accessible to visually impaired students using a screen reader.

Course Readiness and Chapter R: Review of Prerequisites (31 Topics)








Section R.2 (3 Topics)

- Product rule with positive exponents: Univariate 
- Power rules with positive exponents: Multivariate products 
- Simplifying a ratio of multivariate monomials: Advanced 









Section R.3 (2 Topics)

- Square root of a rational perfect square 
- Square root multiplication: Basic 












Section R.4 (7 Topics)

- Simplifying a sum or difference of two univariate polynomials 
- Multiplying a univariate polynomial by a monomial with a positive coefficient 
- Multiplying binomials with leading coefficients greater than 1 
- Multiplying binomials in two variables 
- Multiplying conjugate binomials: Univariate 
- Squaring a binomial: Univariate 
- Multiplying binomials with negative coefficients 

Section R.5 (8 Topics)




- Factoring a linear binomial 
- Factoring out a monomial from a polynomial: Univariate 
- Factoring a quadratic with leading coefficient 1 
- Factoring out a constant before factoring a quadratic 
- Factoring a quadratic with leading coefficient greater than 1: Problem type 1 
- Factoring a quadratic with a negative leading coefficient 
- Factoring a difference of squares in one variable: Basic 
- Factoring a difference of squares in one variable: Advanced 

Section R.6 (11 Topics)

- Restriction on a variable in a denominator: Linear 
- Simplifying a ratio of factored polynomials: Linear factors 
- Simplifying a ratio of polynomials using GCF factoring 
- Simplifying a ratio of polynomials by factoring a quadratic with leading coefficient 1 
- Multiplying rational expressions made up of linear expressions 
- Finding the LCD of rational expressions with linear denominators: Relatively prime 
- Finding the LCD of rational expressions with linear denominators: Common factors 
- Complex fraction without variables: Problem type 1 
- Simplifying a quotient of square roots 
- Simplifying a quotient involving a sum or difference with a square root 
- Rationalizing a denominator using conjugates: Integer numerator 

Chapter 1: Equations and Inequalities (9 Topics)

Section 1.3 (6 Topics)

- Using i to rewrite square roots of negative numbers 
- Simplifying a product and quotient involving square roots of negative numbers 
- Adding or subtracting complex numbers 

- Multiplying complex numbers [↗](#)
- Dividing complex numbers [↗](#)
- Simplifying a power of i [↗](#)

Section 1.4 (2 Topics)

- Pythagorean Theorem [↗](#)
- Completing the square [↗](#)

Chapter 1 Supplementary Topics (1 Topic)

- Evaluating a linear expression: Signed fraction multiplication with addition or subtraction [↗](#)

Chapter 2: Functions and Relations (25 Topics)

Section 2.1 (1 Topic)

- Distance between two points in the plane: Exact answers [↗](#)

Section 2.3 (4 Topics)

- Vertical line test [↗](#)
- Domain of a rational function: Excluded values [↗](#)
- Domain of a square root function: Advanced [↗](#)
- Domain and range from the graph of a piecewise function

Section 2.4 (6 Topics)

- Graphing a linear equation of the form $y = mx$ [↗](#)
- Graphing a line given its equation in slope-intercept form: Fractional slope [↗](#)
- Graphing a line given its equation in standard form [↗](#)
- Graphing a vertical or horizontal line [↗](#)
- Finding x- and y-intercepts of a line given the equation: Advanced [↗](#)
- Finding slope given two points on the line [↗](#)

Section 2.6 (4 Topics)

- Matching parent graphs with their equations
- Translating the graph of a parabola: Two steps
- Writing an equation for a function after a vertical translation [↗](#)
- Writing an equation for a function after a vertical and horizontal translation [↗](#)

Section 2.7 (7 Topics)

- Determining if graphs have symmetry with respect to the x-axis, y-axis, or origin
- Evaluating a piecewise-defined function [↗](#)
- Finding where a function is increasing, decreasing, or constant given the graph [↗](#)
- Finding where a function is increasing, decreasing, or constant given the graph: Interval notation [↗](#)
- Finding local maxima and minima of a function given the graph [↗](#)
- Graphing a piecewise-defined function: Problem type 2
- Even and odd functions: Problem type 1

Section 2.8 (3 Topics)

- Sum, difference, and product of two functions [↗](#)
- Quotient of two functions: Basic [↗](#)
- Composition of two functions: Basic [↗](#)

Chapter 3: Polynomial and Rational Functions (6 Topics)

Section 3.2 (3 Topics)

- Finding zeros of a polynomial function written in factored form [↗](#)
- Finding zeros and their multiplicities given a polynomial function written in factored form [↗](#)
- Determining the end behavior of the graph of a polynomial function [↗](#)

Section 3.5 (3 Topics)

- Finding the asymptotes of a rational function: Constant over linear
- Finding the asymptotes of a rational function: Linear over linear
- Matching graphs with rational functions: Two vertical asymptotes

Chapter 4: Exponential and Logarithmic Functions (4 Topics)

Section 4.1(4 Topics)

- Horizontal line test
- Determining whether two functions are inverses of each other [↗](#)
- Inverse functions: Cubic, cube root [↗](#)
- Inverse functions: Rational [↗](#)

Chapter 5: Trigonometric Functions (28 Topics)

Section 5.1(5 Topics)

- Converting degrees-minutes-seconds to decimal degrees [↗](#)
- Converting a decimal degree to degrees-minutes-seconds [↗](#)
- Converting between degree and radian measure: Problem type 1 [↗](#)
- Coterminal angles [↗](#)
- Arc length and central angle measure [↗](#)

Section 5.2 (4 Topics)

- Using the Pythagorean Theorem to find a trigonometric ratio [↗](#)
- Finding trigonometric ratios given a right triangle [↗](#)
- Using a trigonometric ratio to find a side length in a right triangle [↗](#)
- Using cofunction identities [↗](#)

Section 5.3(4 Topics)

- Reference angles: Problem type 1 [↗](#)
- Determining the location of a terminal point given the signs of trigonometric values [↗](#)
- Finding values of trigonometric functions given information about an angle: Problem type 1 [↗](#)
- Finding values of trigonometric functions given information about an angle: Problem type 2 [↗](#)

Section 5.4(3 Topics)

- Trigonometric functions and special angles: Problem type 1 [↗](#)
- Evaluating expressions involving sine and cosine [↗](#)
- Even and odd properties of trigonometric functions [↗](#)

Section 5.5 (5 Topics)

- Sketching the graph of $y = a \sin(x)$ or $y = a \cos(x)$
- Sketching the graph of $y = a \sin(x + c)$ or $y = a \cos(x + c)$
- Sketching the graph of $y = a \sin(bx)$ or $y = a \cos(bx)$
- Amplitude, period, and phase shift of sine and cosine functions [↗](#)
- Writing the equation of a sine or cosine function given its graph: Problem type 1

Section 5.6 (2 Topics)

- Sketching the graph of a secant or cosecant function: Problem type 1
- Sketching the graph of a tangent or cotangent function: Problem type 1

Section 5.7(4 Topics)

- Values of inverse trigonometric functions [↗](#)
- Composition of a trigonometric function with its inverse trigonometric function: Problem type 1 [↗](#)
- Composition of a trigonometric function with the inverse of another trigonometric function: Problem type 1 [↗](#)
- Composition of trigonometric functions with variable expressions as inputs: Problem type 1 [↗](#)

Chapter 5 Supplementary Topics (1 Topic)

- Relationship between the sines and cosines of complementary angles [↗](#)

Chapter 6: Analytic Trigonometry (20 Topics)

Section 6.1(2 Topics)

- Simplifying trigonometric expressions [↗](#)
- Verifying a trigonometric identity

Section 6.2 (3 Topics)

- Evaluating a linear expression: Signed fraction multiplication with addition or subtraction [↗](#)
- Sum and difference identities: Problem type 1 [↗](#)
- Sum and difference identities: Problem type 3

Section 6.3 (4 Topics)

- Double-angle identities: Problem type 1 [↗](#)
- Double-angle identities: Problem type 2 [↗](#)
- Power-reducing identities [↗](#)
- Half-angle identities: Problem type 1 [↗](#)

Section 6.5 (11 Topics)

- Finding solutions in an interval for a basic equation involving sine or cosine [↗](#)
- Finding solutions in an interval for a basic tangent, cotangent, secant, or cosecant equation [↗](#)
- Solving a basic trigonometric equation involving sine or cosine [↗](#)
- Solving a basic trigonometric equation involving tangent, cotangent, secant, or cosecant [↗](#)
- Finding solutions in an interval for a trigonometric equation in factored form [↗](#)
- Finding solutions in an interval for a trigonometric equation with a squared function: Problem type 1 [↗](#)
- Finding solutions in an interval for a trigonometric equation using Pythagorean identities: Problem type 1 [↗](#)
- Finding solutions in an interval for an equation with sine and cosine using double-angle identities [↗](#)
- Solving a trigonometric equation modeling a real-world situation
- Solving a trigonometric equation involving an angle multiplied by a constant [↗](#)
- Finding solutions in an interval for a trigonometric equation with an angle multiplied by a constant [↗](#)

Chapter 7: Applications of Trigonometric Functions (11 Topics)

Section 7.1 (5 Topics)

- Using a trigonometric ratio to find a side length in a right triangle [↗](#)
- Using a trigonometric ratio to find an angle measure in a right triangle [↗](#)
- Using trigonometry to find angles of elevation or depression in a word problem [↗](#)
- Solving a right triangle [↗](#)
- Using trigonometry to find a length in a word problem with two right triangles [↗](#)

Section 7.2 (3 Topics)

- Solving a triangle with the law of sines: Problem type 1 [↗](#)
- Solving a triangle with the law of sines: Problem type 2
- Solving a word problem using the law of sines [↗](#)

Section 7.3 (3 Topics)

- Solving a triangle with the law of cosines [↗](#)
- Solving a word problem using the law of cosines [↗](#)
- Using trigonometry to find the area of a right triangle [↗](#)

Chapter 8: Trigonometry Applied to Polar Coordinate Systems and Vectors (28 Topics)

Section 8.1 (7 Topics)

- Plotting points in polar coordinates
- Multiple representations of polar coordinates
- Converting rectangular coordinates to polar coordinates: Special angles [↗](#)
- Converting polar coordinates to rectangular coordinates [↗](#)
- Converting an equation written in rectangular form to one written in polar form [↗](#)
- Converting an equation written in polar form to one written in rectangular form: Problem type 1 [↗](#)
- Converting an equation written in polar form to one written in rectangular form: Problem type 2 [↗](#)

Section 8.2 (5 Topics)

- Graphing a polar equation: Basic
- Graphing a polar equation: Circle
- Graphing a polar equation: Limacon
- Graphing a polar equation: Rose
- Graphing a polar equation: Lemniscate

Section 8.3 (6 Topics)

- Plotting complex numbers [↗](#)
- Writing a complex number in standard form given its trigonometric form
- Writing a complex number in trigonometric form: Special angles
- Multiplying and dividing complex numbers in trigonometric form [↗](#)
- De Moivre's Theorem: Answers in trigonometric form [↗](#)
- De Moivre's Theorem: Answers in standard form [↗](#)

Section 8.4 (10 Topics)

- Writing a vector in $ai+bj$ form given its initial and terminal points [↗](#)
- Writing a vector in component form given its initial and terminal points [↗](#)
- Magnitude of a vector given in $ai+bj$ form [↗](#)
- Vector addition and scalar multiplication: $ai+bj$ form [↗](#)
- Linear combination of vectors: $ai+bj$ form [↗](#)
- Vector addition and scalar multiplication: Component form [↗](#)
- Linear combination of vectors: Component form [↗](#)
- Multiplication of a vector by a scalar: Geometric approach
- Vector addition: Geometric approach
- Vector subtraction: Geometric approach