



**Pre-AP
Trigonometry
&
Pre-Calculus**

Students enrolled in *CareerTech* Trigonometry/Pre-Calculus will receive rigorous and relevant curriculum that will enable them to be successful in upper level mathematics. It is an advanced course that can also prepare students for physics as well as the ACT Exam. A committee of Mathematics instructors produced this list of necessary objectives that all *CareerTech* students should master upon completion of the course. *CareerTech* math courses demonstrate the Content and Process Standards of the National Council of Teachers of Mathematics (NCTM) and the Process Standards of Oklahoma Priority Academic Student Skills (PASS). Students are expected to problem solve, do reasoning and proofs, demonstrate mathematical communication, connect and link mathematical ideas to real-world and other disciplines, and use mathematical representations for modeling, interpreting, and communicating. Technology will be integrated into the course in order to prepare students for real-world situations.

Course Description

This course is designed to be in preparation for Calculus or AP Calculus. A graphing calculator is recommended.

The first part of the course includes a study of six basic functions of trigonometry, solutions of right and oblique triangles, identities, and complex numbers. The calculator is used as an aide to computations. The second half of the course gives a review study of straight lines, conic sections, simplification of equations, algebraic curves, transcendental curves, a completed study of straight lines, simplification of equations, polar coordinates, and an introduction to limits and derivatives. Prerequisites for this course are: Algebra I, Geometry, Algebra II

Requirements for College Admission Status (Title 70 O.S. § 11-103.6)

These courses are to be taught by a highly qualified teacher with an Oklahoma Advanced Mathematics teaching certification. The students should be in the eleventh or twelfth grade or if a sophomore, they should be in a Focused Field of Career Study program. The course will have at a minimum, but may exceed, a duration of 120 hours within a school year.



**Pre-AP
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Syllabus**

Objective	NCTM Standard	Oklahoma PASS Process Standard
I. Quadratic Formula		
A. Review knowledge of irrational numbers	Number & Operations Algebra	1.1, 2.1, 2.2, 2.3, 5.3
B. Review knowledge of imaginary numbers	Number & Operations Algebra	1.1, 2.1, 2.2, 2.3, 5.3
C. Extend and apply the definitions of remainder, factor, and rational root theories	Number & Operations Algebra	1.1, 2.1, 2.2, 2.3, 5.3
D. Absolute values: Quadratic Equations	Number & Operations Algebra	1.1, 2.1, 2.2, 2.3, 5.3
E. Absolute values: Inequalities	Number & Operations Algebra	1.1, 2.1, 2.2, 2.3, 5.3
F. Apply polynomial inequalities	Number & Operations Algebra	1.1, 2.1, 2.2, 2.3, 5.3
G. Be able to work with rational inequalities	Number & Operations Algebra	1.1, 2.1, 2.2, 2.3, 5.3
H. Extend and apply the definitions of domain, range, and graphical analysis of	Number & Operations Algebra Geometry	1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 3.4, 4.3, 4.4, 5.1, 5.2, 5.3

rational functions		
II. Periodic Functions and Right Triangle Problems		
A. Find and graph the function that corresponds to a graph	Number & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 5.3
B. Given an angle of any measure, draw a picture of the angle	Number & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 5.3
C. Extend the definitions of sine and cosine for any angle	Number & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.2, 3.4, 5.3
D. Using a calculator, find values of the six trigonometric functions for any angle	Number & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 5.3
E. Given two sides of a right triangle or a side and an acute angle-find measures of the other sides and angles	Number & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 5.3
III. Functions and Mathematical Models		
A. Be able to work with functions that are defined algebraically, graphically, numerically, or verbally	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 5.3
B. Make connections among the algebraic equation for a function, its name, and its graph	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 4.1, 5.3
C. Transform a given pre-image functions so that the result is a graph of the image function that has been dilated by given factors and translated by given amounts	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 5.3
D. Given two	Numbers & Operations	1.1, 2.1, 2.2, 2.3, 3.3,

functions—graph and evaluate the composition of one function with the other	Algebra Measurement	3.4, 5.3
E. Given a function—find its inverse relation and tell whether or not the inverse relation is a function	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
F. Given a function—transform it by reflection and by applying absolute value to the function or its argument	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
G. Piecewise functions	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
H. Difference Quotient	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
VI. Applications of Trigonometric and Circular Functions		
A. Know the meanings of amplitude, period, phase displacement, and cycle of a sinusoidal graph	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 5.3
B. Given any one of these sets of information about a sinusoid, find the other two: the equation; the graph; the amplitude, period or frequency, phase displacement, and sinusoidal axis	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
C. Plot the graphs of the tangent, cotangent, secant, and cosecant functions—showing their behavior when the function value is	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3

undefined		
D. Given an angle measure in degrees, convert it to radians and be able to convert from radians to degrees	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
E. Given an angle measured in radians- find the trigonometric function values	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
F. Be knowledgeable about the circular functions and their relationship to trigonometric functions	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
G. Given the equation a circular or trigonometric function and a value of y, find specified values of x or 0—Graphically, Numerically, or Algebraically	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
H. Given a verbal description of a periodic phenomenon, write an equation using sine or cosine functions and use the equation as a mathematical model to make predictions and interpretations about the real world	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 3.4, 4.3, 4.4, 5.1, 5.2, 5.3
V. Trigonometric Function Properties, Identities, and Parametric Functions		
A. Investigate the sum of the squares of the cosine and sine of the same argument	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
B. Derive algebraically	Numbers & Operations	1.1, 2.1, 2.2, 2.3, 3.3,

three kinds of properties expressing relationships among trigonometric functions	Algebra Measurement	3.4, 5.3
C. Given a trigonometric expression—transform it to an equivalent form that is perhaps simpler or more useful	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
D. Find algebraically or numerically the solutions for equations involving circular or trigonometric sines, cosines, and tangents of one argument	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
E. Given equations of a parametric function—plot the graph and make conclusions about the geometrical figure that results	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
F. Plot graphs of inverse trigonometric functions and relations	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
G. Find exact values of functions of inverse trigonometric functions	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
VI. Properties of Combined Sinusoids		
A. Investigate graphs formed by sums of sines and cosines	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
B. Derive a composite argument property expressing $\cos(A-B)$ in terms of cosines and sines of A and B, and use it to express a linear combination of cosine and sine as a	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3

single cosine with a phase displacement		
C. For trigonometric functions f -derive and learn properties for: $f(-x)$ in terms of $f(x)$, $f(90^\circ - x)$ in terms of $f(x)$ or $f(-x)$ in terms of functions of x , $f(A+B)$ and $f(A-B)$ in terms of functions of A and B	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
D. Given two sinusoids-form a new graph by adding or multiplying ordinates (y -coordinates)	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
E. Given a graph formed by adding or multiplying two sinusoids-find the equations of the two sinusoids	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
F. Transform a sum of two sinusoids to a product and then the reverse	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
G. Prove that a product of sinusoids with equal periods is also a sinusoid	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
H. Derive properties for $\cos 2A$, $\sin 2A$, and $\tan 2A$ in terms of functions of A	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
I. Derive properties for $\cos \frac{1}{2} A$, $\sin \frac{1}{2} A$, and $\tan \frac{1}{2} A$ in terms of functions of A	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
VII. Triangle Trigonometry		
A. Given two sides	Numbers & Operations	1.1, 2.1, 2.2, 2.3, 3.3,

and the included angle of a triangle-find the remaining side by direct measurement	Algebra Measurement	3.4, 5.1, 5.2, 5.3
B. Given two sides and the included angle of a triangle-derive and use the law of cosines to find the remaining side	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
C. Given three sides of a triangle-find an angle	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
D. Given the measures of two sides and the included angle-find the area of the triangle	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
E. Given the measure of an angle, the length of the side opposite this angle, and one other piece of information about the triangle-find the other side and angle measures	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
F. Given two sides of a triangle and a non-included angle-calculate the value of the third side	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
G. Given two vectors-add them to find the resultant	Numbers & Operations Algebra Measurement	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
H. Given a real-world problem-identify a triangle and use the appropriate technique to calculate unknown side lengths and angle measures	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 3.4, 4.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3
VIII. Properties of Elementary Functions		
A. Review exponents;	Numbers & Operations	1.1, 2.1, 2.2, 2.3, 3.3,

laws of exponents	Algebra	3.4, 5.3
B. Review radicals: laws of radicals	Numbers & Operations Algebra	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
C. Discover patterns in linear, quadratic, power, and exponential function graphs	Numbers & Operations Algebra	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
D. Given the graph of a function, know whether the function is exponential, power, quadratic, or linear and find the particular equation algebraically	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
E. Given a set of regularly spaced x- values and the corresponding y- values, identify which type of function they fit (linear, quadratic, power, or exponential)	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
F. Find other function values without finding the particular equation. Learn the definition and properties of logarithms, and use logarithms to find algebraic solutions of exponential and logarithmic equations.	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
G. Show that logarithmic functions have the multiply-add property, and find particular equations by algebra	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
H. Fit a logistic function to data for restrained growth	Numbers & Operations Algebra Measurement Data Analysis &	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3

	Probability	
IX. Matrix Transformations and Fractal Figures		
A. Explore what happens to the perimeter and area of a square when the same set of transformations are performed repeatedly	Numbers & Operations Algebra Measurement Geometry Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
B. Given two matrices-find the sum and product	Numbers & Operations Algebra Geometry	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
C. Given a square matrix-find its multiplicative inverse	Numbers & Operations Algebra Geometry	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
D. Solve a system of linear equations algebraically, graphically, and using matrices	Numbers & Operations Algebra Measurement Geometry Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
X. Analytic Geometry of Conic Sections and Quadric Surfaces		
A. Given a quadratic equation with two variables, plot its graph and formulate conclusions	Numbers & Operations Algebra Measurement Geometry Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
B. Given a Cartesian or parametric equation of a conic section, sketch or plot the graph and find the equation	Numbers & Operations Algebra Measurement Geometry Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
C. Given the equation of a conic section, sketch the surface generated by rotating it about one of its axes	Numbers & Operations Algebra Measurement Geometry Data Analysis &	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3

and find the area or volume of a figure inscribed either in the plane region bounded by the graph or in the solid region bounded by the surface	Probability	
D. Given the equation of a conic section-find the foci, the directrix, and the eccentricity. Be able to do the reverse	Numbers & Operations Algebra Measurement Geometry Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
E. Given a situation from the real world in which conic sections appear-create a mathematical model and use it to make predictions and interpretations	Numbers & Operations Algebra Measurement Geometry Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
XI. Polar Coordinates, Complex Numbers, and Moving Objects		
A. Given an equation in polar coordinates, plot the graph on polar coordinate paper	Numbers & Operations Algebra Geometry	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
B. Given a polar equation-plot the graph	Numbers & Operations Algebra Geometry	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
C. Given the polar equation of a conic section-transform it to Cartesian coordinates	Numbers & Operations Algebra Geometry	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
XII. Sequences and Series		
A. Given a few terms in a sequence or series of numbers-find more terms	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
B. Given a series-find the sum of a specified	Numbers & Operations Algebra	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3

number of terms	Measurement Data Analysis & Probability	
C. Use sigma notation to write partial sums	Numbers & Operations Algebra Measurement Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
XIII. Polynomial and Rational Functions Limits and Derivatives		
A. Review rational equations	Numbers & Operations Algebra	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
B. Discover some properties of cubic functions and their graphs	Numbers & Operations Algebra	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.3
C. Given a polynomial function: Use a graph to interpret the degrees & the reverse Find the zeros from the equation or graph	Numbers & Operations Algebra Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
D. Given a set of points-find the equation of a polynomial function that fits the data exactly or fits the best for a given degree	Numbers & Operations Algebra Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
E. Find and identify discontinuities in the graphs of rational functions	Numbers & Operations Algebra Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3
F. Given an equation of a polynomial function-find the instantaneous rate of change at a given point and interpret the answer graphically	Numbers & Operations Algebra Data Analysis & Probability	1.1, 2.1, 2.2, 2.3, 3.3, 3.4, 5.1, 5.2, 5.3

References and Resources

Referenced Standards

Principles and Standards for School Mathematics (4th ed.). (2005). National Council of Teachers of Mathematics, Reston, VA

Oklahoma Priority Academic Student Skills (2003). Oklahoma State Department of Education-PASS-www.sde.state.ok.us

Suggested Text and Supplemental Materials

Larson, Ron, Hostetler, Bob, Edwards, Bruce. (2006). *PreCalculus with Limits: A Graphing Approach* (4th ed). Boston: McDougal Littell.

Larson, Ron, Hostetler, Bob, Edwards, Bruce. (2006). *Study and Solutions Guide*. Boston: McDougal Littell.

Larson, Ron, Hostetler, Bob. (2006). *Trigonometry* (7th ed). Boston: McDougal Littell.

Demana, Franklin, Waits, Bert K., Foley, Gregory D., & Kennedy, Daniel (2007). *Precalculus: Graphical, Numerical, Algebraic* (7th ed.). Boston: Addison-Wesley.

Gordon, Sheldon P., Gordon, Florence S., Tucker, Alan C., & Siegel, Martha J. (2004). *Functioning in the Real world: A Precalculus Experience* (2nd ed.). Boston: Addison-Wesley.

Bittinger, Marvin L., Beecher, Judith A., Ellenbogen, David J., & Penna, Judith A. (2006). *Precalculus: Graphs and Models Graphing Calculator Manual Package* (3rd ed.). Boston: Addison-Wesley.

Lial, Margaret L., Hornsby, Lial, & Schneider, David I. (2005). *Trigonometry* (8th ed.). Boston: Addison-Wesley.

Dugopolski, Mark (2007). *Trigonometry* (2nd ed.). Boston: Addison-Wesley.