

Gr. 11, 12 Pre-Calculus Curriculum

Curriculum Standards	Student Learning Goals	Skills from FHS Rubric (Problem Solver)	Suggested Instructional Strategies	Suggested Assessment Techniques
<p>LS PC. N1 Plot complex numbers using both rectangular and polar coordinates, i.e., $a + bi = r(\cos \theta + i \sin \theta)$. Apply DeMoivre’s Theorem to multiply, take roots, and raise complex numbers to a power.</p>	<p>Demonstrate mastery of converting between rectangular and polar coordinates.</p> <p>Graph complex numbers</p> <p>Apply trigonometric form of complex number</p>	<p>Skill 3 Independently creates and carries out to completion a complex multi-step task</p> <p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p>	<ul style="list-style-type: none"> • Add, subtract, multiply and divide complex numbers in the “standard way” • Show graph as $x+iy$ • Introduce trig form $r(\cos\theta+ i\sin\theta)$ • Show how all complex numbers have n nth roots • Find roots using DeMoivre’s Theorem 	<ul style="list-style-type: none"> • Test • Quizzes • Student generated polar graphs • Showing DeMoivre’s Theorem
<p>LS PC. P1 Use mathematical induction to prove theorems and verify summation formulas, e.g., verify $\sum_{k=1}^n k^2 = \frac{n(n+1)(2n+1)}{6}$.</p>	<p>Use mathematical induction as a method of proof</p>	<p>Skill 3 Independently creates and carries out to completion a complex multi-step task</p>	<ul style="list-style-type: none"> • Demonstrate method and use simple theorems 	<ul style="list-style-type: none"> • Test • Quizzes • Student generated inductive proofs
<p>LS PC. P2 Relate the number of roots of a polynomial to its degree. Solve quadratic equations with complex coefficients</p>	<p>Demonstrate mastery of methods for finding roots/zeros of the function</p> <p>Demonstrate the connection between the expected number of roots=the degree of the polynomial</p> <p>Demonstrate the ability to solve polynomials with complex coefficients.</p>	<p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p> <p>Skill 8 Tests, analyzes, and adapts solutions</p>	<ul style="list-style-type: none"> • Teach different methods for finding roots, factoring, quadratic formula, synthetic and long division • Use the graphing calculator to show where on graph the roots are and then show the connection between the degree of the polynomial and how many times it crosses the x-axis. 	<ul style="list-style-type: none"> • Test • Quizzes • Graphing calculator activities
<p>LS PC. P3 Demonstrate an understanding of the trigonometric functions.</p>	<p>Demonstrate mastery of trigonometric functions</p>	<p>Skill 2 Identifies a variety of possible important information; gathers</p>	<ul style="list-style-type: none"> • SOHCAHTOA • Unit circle • Special right triangles 	<ul style="list-style-type: none"> • Test • Quizzes • Student generated unit

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Relate the functions to their geometric definitions.	Relate trigonometric functions to a right triangle Demonstrates an understanding of the reciprocal relationship between functions	sophisticated, apt. or valid information, organizes information in novel ways Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences		circles
LS PC. P4 Explain the identity $\sin^2 \theta + \cos^2 \theta = 1$. Relate the identity to the Pythagorean Theorem	Demonstrate mastery of the connection between the Pythagorean Identity and how x,y, and r of a triangle are related through the Pythagorean Theorem Demonstrates the ability to derive all three Pythagorean Identities	Skill 3 Independently creates and carries out to completion a complex multi-step task Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences	<ul style="list-style-type: none"> Teach students how to start with $x^2+y^2=r^2$ and to divide through by one variable to develop identities Show them how the result is directly related to the definitions of the trigonometric functions 	<ul style="list-style-type: none"> Test Quizzes
LS PC. P5 Demonstrate an understanding of the formulas for the sine and cosine of the sum or difference of two angles. Relate the formulas to DeMoivre's Theorem and use them to prove other trigonometric identities. Apply to the solution of problems	Demonstrate mastery and understanding of the connection between the sum and difference formulas and cofunction identities. Show an ability to use the identities interchangeably to solve proofs	Skill 3 Independently creates and carries out to completion a complex multi-step task Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences Skill 7 Selects, justifies, and evaluates a sophisticated solution	<ul style="list-style-type: none"> Practice analytical trigonometric proofs with students Show them different approaches to the same problem Help the students derive the cofunction identities by starting with the sum and difference formulas Play memory games to help remember the different identities and formulas 	<ul style="list-style-type: none"> Test Quizzes Student generated proofs
LS PC. P6 Understand, Predict, and interpret the effects of the parameters a,	Demonstrate mastery of amplitude and period changes in trigonometric graphs	Skill 2 Identifies a variety of possible important information; gathers	<ul style="list-style-type: none"> Compare amplitude and period changes to shrinking and stretching 	<ul style="list-style-type: none"> Test Quizzes Graphing quiz without

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<p>ω, b, and c on the graph of $y = a \sin(\omega(x - b)) + c$: similarly for the cosine and tangent. Use to model periodic processes.</p>	<p>Demonstrate mastery of phase and vertical shifts of trigonometric graphs</p> <p>Demonstrate ability to generate graph functions from real life modeled data</p>	<p>sophisticated, apt. or valid information, organizes information in novel ways</p> <p>Skill 3 Independently creates and carries out to completion a complex multi-step task</p> <p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p> <p>Skill 7 Selects, justifies, and evaluates a sophisticated solution</p>	<p>of the graph, standing still, move your arms away from your body and then bring them back to it</p> <ul style="list-style-type: none"> • To demonstrate phase and vertical shifts, move the axis of the graph for sin, cos, sec, and csc • For tangent and cotangent, teach the trick of setting the information inside the parenthesis equal to the original asymptotes of the graph to find the new asymptotes • Use real-life data to generate the equations of the graph, finding the period, amplitude, phase and vertical shifts • Use the graphing calculator to teach the Sin Regression capabilities 	<p>calculators</p> <ul style="list-style-type: none"> • Model real life applications
<p>LS PC. P7 Translate between geometric, algebraic, and parametric representations of curves. Apply to the solution of problems.</p>	<p>Understand the connection between equations and their graphical representation and the parametric form of an equation</p>	<p>Skill 3 Independently creates and carries out to completion a complex multi-step task</p> <p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p> <p>Skill 8 Tests, analyzes, and adapts solutions</p>	<ul style="list-style-type: none"> • Show circle as geometric shape and show circle as $x^2 + y^2 = r^2$ and as $x = \cos t$ and $y = \sin t$ 	<ul style="list-style-type: none"> • Test • Quizzes • Graphing calculator activities (physics)

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<p>LS PC. P8 Identify and discuss features of conic sections: axes, foci, asymptotes, and tangents. Convert between different algebraic representations of conic sections.</p>	<p>Connect the distance definition for conic sections to the distance formula</p> <p>Use algebraic representations to define center, loci, asymptotes, etc.</p>	<p>Skill 3 Independently creates and carries out to completion a complex multi-step task</p> <p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p>	<ul style="list-style-type: none"> • Derive algebraic form from distance definition • Use algebra to locate critical information and vice versa 	<ul style="list-style-type: none"> • Test • Quizzes • Graphing calculator activities
<p>LS PC. P9 Explain the significance of a horizontal tangent line. Apply these concepts to the solution of problems.</p>	<p>Demonstrate mastery of maximum and minimum values in finding vertices of quadratic and trigonometric functions.</p>	<p>Skill 2 Identifies a variety of possible important information; gathers sophisticated, apt. or valid information, organizes information in novel ways</p> <p>Skill 3 Independently creates and carries out to completion a complex multi-step task</p> <p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p>	<ul style="list-style-type: none"> • Quadratic functions are the first to have easily found max or min points at the vertex of a function • Other functions that can be treated as quadratic (usually even-powered functions) may have max or min points • Sine and Cosine functions have max or min points and occur periodically, and students will find them using their knowledge of amplitude, period, and phase shift • Exponential and logarithmic functions most usually have asymptotes • Odd powered functions may have “local” max or min points, and they can be found using the “trace” function on a calculator 	<ul style="list-style-type: none"> • Test • Quizzes • Student generated graphs when “x” values get large

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<p>LS PC. G1 Demonstrate an understanding of the laws of sines and cosines. Use the laws to solve for the unknown sides or angles in triangles. Determine the area of a triangle given the length of two adjacent sides and the measure of the included angle.</p>	<p>Demonstrate mastery of the Laws of Sines and Cosines. (AAS, ASA, SSA for sines, SSS and SAS for cosines)</p> <p>Understand the “ambiguous” case of SSA (it ain’t so ambiguous!)</p> <p>Demonstrate ability to use the Laws to solve real-world problems</p> <p>Demonstrate mastery of the three formula’s used to solve for the area of a triangle.</p>	<p>Skill 3 Independently creates and carries out to completion a complex multi-step task</p> <p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p>	<ul style="list-style-type: none"> • Teach students the two laws and how they relate to oblique triangles • Introduce real-world problems where these laws would need to be applied • Show examples of the different situations when to use Law of Sines versus Cosines • Introduce Heron’s Area Formula, along with $A=absinC$, and $A=1/2bh$ 	<ul style="list-style-type: none"> • Tests • Quizzes • Hands on application of Law of Sines and Law of Cosines
<p>LS PC. G2 Use the concept of vectors to solve problems. Describe addition of vectors, multiplication of a vector by a scalar, and the dot product of two vectors, both symbolically and geometrically. Use vector methods to obtain geometric results.</p>	<p>Demonstrate mastery in applying vector geometry to solve problems, using vector methods to obtain geometric results</p>	<p>Skill 2 Identifies a variety of possible important information; gathers sophisticated, apt. or valid information, organizes information in novel ways</p> <p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p>	<ul style="list-style-type: none"> • Make connection between word problems dealing with force and the using the Law of cosines to complete the problems 	<ul style="list-style-type: none"> • Tests • Quizzes • Student generated graphs of combinations of vectors
<p>LS PC. G3 Apply properties of angles, parallel lines, arcs, radii, chords, tangents, and secants to solve problems</p>	<p>Apply geometric knowledge to solve problems that arise in Trigonometry and solid geometry</p>	<p>Skill 3 Independently creates and carries out to completion a complex multi-step task</p> <p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p>	<ul style="list-style-type: none"> • Graphical representations from geometry connected to the algebraic formulas 	<ul style="list-style-type: none"> • Tests • Quizzes

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<p>LS PC. M1 Describe the relationship between degree and radian measure, and use radian measure in the solution of problems, in particular problems involving angular velocity and acceleration.</p>	<p>Understand where the radian is defined on a circle of radius r</p> <p>Demonstrate mastery of converting between degrees and radians</p> <p>Demonstrate mastery of using linear and angular velocity equations</p> <p>Learn the “secret of life” for circular motion $v = \omega r$, $s = \theta r$ and $a = \alpha r$</p> <p>Connections between real-life problems and angle measurement</p>	<p>Skill 2 Identifies a variety of possible important information; gathers sophisticated, apt. or valid information, organizes information in novel ways</p> <p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p> <p>Skill 8 Tests, analyzes, and adapts solutions</p>	<ul style="list-style-type: none"> • $2\pi=360$ degrees conversion factor • Teach one and two step problems with dimensional analysis so the students get used to using it when they hit the more complex problems • Link linear velocity with a point on the outer part of the circle and angular velocity with the angle changing (get out a bicycle wheel spin the wheel and then rotate your body with the wheel spinning to show the difference • Start using more and more Greek letters for variables to get the students familiar with the notation 	<ul style="list-style-type: none"> • Tests • Quizzes • Angle and distant measuring activities
<p>LS PC. M2 Use dimensional analysis for unit conversion and to confirm that expressions and equations make sense.</p>	<p>Demonstrate the ability to use dimensional analysis to verify units of the final answer</p>	<p>Skill 2 Identifies a variety of possible important information; gathers sophisticated, apt. or valid information, organizes information in novel ways</p> <p>Skill 3 Independently creates and carries out to completion a complex multi-step task</p>	<ul style="list-style-type: none"> • Students often want to use proportions to complete simple problems that are solved with dimensional analysis. • Use dimensional analysis to show the students how you can test solution by just canceling out the units, if you get the correct final units then 	<ul style="list-style-type: none"> • Tests • Quizzes

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		<p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p> <p>Skill 8 Tests, analyzes, and adapts solutions</p>	<p>you can compute the answer, otherwise you need to correct your unit mistake first, this saves a lot of time and erasing for the students.</p>	
<p>LS PC. D1 Design surveys and apply random sampling techniques to avoid bias in the data collection.</p>	<p>Demonstrate mastery at developing survey's based on the random sampling techniques.</p>	<p>Skill 1 Defines multiple or complex problems and brainstorms a variety of solutions</p> <p>Skill 2 Identifies a variety of possible important information; gathers sophisticated, apt. or valid information, organizes information in novel ways</p> <p>Skill 7 Selects, justifies, and evaluates a sophisticated solution</p>	<ul style="list-style-type: none"> • Help students identify something they are curious about • Help them create a survey using the random sampling techniques that they can give to students in the school or other classes 	<ul style="list-style-type: none"> • Tests • Quizzes
<p>LS PC. D2 Apply regression results and curve fitting to make predictions from data.</p>	<p>Demonstrate the ability to use the calculator and computer to create regression results and curve fitting</p>	<p>Skill 3 Independently creates and carries out to completion a complex multi-step task</p> <p>Skill 5 Recognizes and analyzes unlikely or subtle similarities and differences</p>	<ul style="list-style-type: none"> • Show the students how to create regression results and curve fitting on the computer and calculator • Use word problems with real-life data that either they generated for was obtained from another source to model linear, polynomials, exponential and trigonometric problems 	<ul style="list-style-type: none"> • Tests • Quizzes • Calculator activities

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<p>LS PC. D3 Apply uniform, normal, and binomial distributions in the solutions of problems.</p>	<p>Demonstrate mastery of the distribution curves and how to distinguish which method should be used</p>		<ul style="list-style-type: none"> • Use Pascal's triangle to expand $(1/2 + 1/2)^n$ to show how the triangle gives the binomial distribution on a true-false test. Extend with $(1/4 + 3/4)^n$ 	<ul style="list-style-type: none"> • Tests • Quizzes