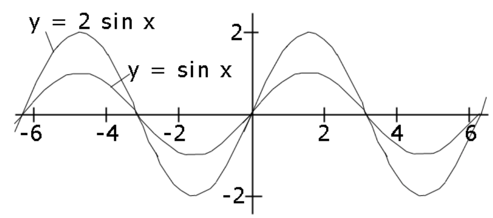
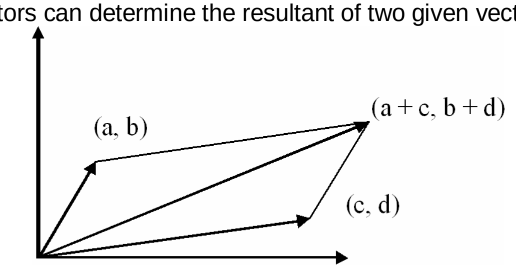
Math Precalculus Blueprint Assessed Quarter 1			
Strand Concept	***Performance Objectives***	***Mathematical Practices***	***Explanations, Examples, and Resources***
Strand 3: Concept 2: Functions and Relationships	**PO 11. Find approximate solutions for polynomial equations with or without graphing technology.** Connections SCHS-S5C2-06 Analyze the two-dimensional motion of objects by using vectors and their components.	11.MP.1. Make sense of problems and persevere in solving them.	Students need to understand that numerical solution methods (data in a table used to approximate an algebraic function) and graphical solution methods may produce approximate solutions, and algebraic solution methods produce precise solutions that can be represented graphically or numerically. Example: Use the trace function on your graphing calculator to approximate the solution of $x^4 - 3x^3 + 2x - 7 = 0$ to the nearest tenth.
Strand 3: Concept 2: Functions and Relationships	**PO 12. Use theorems of polynomial behavior (including but not limited to the Fundamental Theorem of Algebra, Remainder Theorem, the Rational Root Theorem, Descartes Rule of Signs, the Conjugate Root Theorem) to find the zeros of a polynomial function.**	11.MP.7. Look for and make use of structure.	Examples: • Use Descartes' Rule of Signs to determine how many positive and how many negative real zeros the polynomial can have. Then determine the possible number of real zeros. $P(x) = 2x^3 - x^2 - x + 5$ • List all possible rational zeros given by the Rational Root Theorem for the polynomial below. $F(x) = 12x^5 + 3x^4 + 6x^3 - 2x - 8$
Strand 3: Concept 2: Functions and Relationships	**PO 9. Find domain, range, intercepts, period, amplitude, and asymptotes of trigonometric functions.**	11.MP.2. Reason abstractly and quantitatively.	Example: Graph $f(x) = 2 \tan x - 1$. Describe its domain, range, intercepts, and asymptotes.

Math Precalculus Blueprint **Assessed Quarter 2**			
Strand Concept	***Performance Objectives***	***Mathematical Practices***	***Explanations, Examples, and Resources***
Strand 4: Concept 1: Geometric Properties	**PO 3. Apply the law of cosines and the law of sines to find missing sides and angles of triangles.**	11.MP.2. Reason abstractly and quantitatively. 11.MP.8. Look for and express regularity in repeated reasoning.	Example: Tara wants to fix the location of a mountain by taking measurements from two positions 3 miles apart. From the first position, the angle between the mountain and the second position is 78^{o}. From the second position, the angle between the mountain and the first position is 53^{o}. How can Tara determine the distance of the mountain from each position, and what is the distance from each position?
Strand 4: Concept 2: Transformati on of Shapes	**PO 3. Describe how changing the parameters of a trigonometric function affects the shape and position of its graph (*f(x) = A sin B(x-C)+D* or the other trigonometric functions).**	11.MP.2. Reason abstractly and quantitatively. 11.MP.6. Attend to precision. 11.MP.8. Look for and express regularity in repeated reasoning.	Students will draw and analyze graphs of translations of trigonometric functions, investigating period, amplitude, and phase shift**.** Example: • Explain the effect on the shape and position of the graph when it is changed from $y = \sin x$ to $y = 2 \sin x$. 

Math Precalculus Blueprint Assessed Quarter 2			
Strand Concept	***Performance Objectives***	***Mathematical Practices***	***Explanations, Examples, and Resources***
Strand 4: Concept 3: Coordinate Geometry	**PO 4. Graph all six trigonometric functions identifying their key characteristics**.	11.MP.2. Reason abstractly and quantitatively. 11.MP.7. Look for and make use of structure.	Key characteristics of trigonometric functions include period, amplitude, and asymptotes. Example: • Draw the graph of *f*(*x*) = sin *x* and *f*(*x*) = cos *x*. What are the similarities and differences of the two graphs?
	PO 5. Evaluate all six trigonometric functions at angles between (0 degrees and 360 degrees, 0 and 2π radians) using the unit circle in the coordinate plane.	11.MP.2. Reason abstractly and quantitatively. 11.MP.7. Look for and make use of structure.	Examples: • Evaluate all six trigonometric functions of $\theta = \frac{\pi}{3}$. • Evaluate all six trigonometric functions of $\theta = 225^{o}$.
Strand 4: Concept 4: Measurement	**PO 1. Explain, use, and convert between degree and radian measures for angles.** <u>Connections</u> SCHS-S5C4-06 Solve problems involving such quantities as moles, mass, molecules, volume of a gas, and molarity using the mole concept and Avogadro's number.	11.MP.2. Reason abstractly and quantitatively. 11.MP.7. Look for and make use of structure.	Examples: • Convert $\frac{2\pi}{3}$ to degree measure. • Convert 135^{o} to radian measure and explain your steps, including explaining the conversion factor used.

Math Precalculus Blueprint
Assessed Quarter 3

Strand Concept	***Performance Objectives***	***Mathematical Practices***	***Explanations, Examples, and Resources***
Strand 3: Concept3 Algebraic Representations	**PO 10. Represent vectors as matrices.**	11.MP.1. Make sense of problems and persevere in solving them. 11.MP.2. Reason abstractly and quantitatively. 11.MP.6. Attend to precision.	A matrix is a two dimensional array with rows and columns; a vector is a one dimensional array that is either one row or one column of the matrix. Students will use matrices of vectors to represent and transform geometric objects in the coordinate plane. They will explain the relationship between the ordered pair representation of a vector and its graphical representation.
	PO 11. Add, subtract, and compute the dot product of two-dimensional vectors; multiply a two-dimensional vector by a scalar.	11.MP.1. Make sense of problems and persevere in solving them. 11.MP.2. Reason abstractly and quantitatively.	Addition of vectors can determine the resultant of two given vectors.  Example: • Find 3***u*** – 4***v*** given ***u*** = $\langle -2, -8 \rangle$ and ***v*** = $\langle 2, 8 \rangle$.
Strand 4: Concept 1: Geometric Properties	**PO 4. Use basic trigonometric identities including Pythagorean, reciprocal, half-angle and double-angle, and sum and difference formulas to solve equations and problems.**	11.MP.1. Make sense of problems and persevere in solving them. 11.MP.2. Reason abstractly and quantitatively. 11.MP.8. Look for and express regularity in repeated reasoning.	Students can derive and apply basic trigonometric identities (e.g. $\sin^2\theta + \cos^2\theta = 1$, $\tan^2\theta + 1 = \sec^2\theta$) and the Law of Sines and Law of Cosines. Example: Use an appropriate half angle formula to find the exact value of $\cos\frac{\pi}{12}$.

Math Precalculus Blueprint Assessed Quarter 4			
Strand Concept	***Performance Objectives***	***Mathematical Practices***	***Explanations, Examples, and Resources***
Strand 1: Concept 2: Numerical Operations	**PO 4. Define polar coordinates; relate polar coordinates to Cartesian coordinates.**	11.MP.1. Make sense of problems and persevere in solving them. 11.MP.8. Look for and express regularity in repeated reasoning.	Examples: • Represent complex numbers using polar coordinates, e.g., $a + bi = r(\cos\theta + \sin\theta)$. • Convert the polar coordinates $\left(2, \frac{\pi}{3}\right)$ to (x, y) form
Strand 1: Concept 2: Numerical Operations	**PO 5. Convert complex numbers to trigonometric form and then multiply the results.**	11.MP.2. Reason abstractly and quantitatively.	Examples: • Write $3 + 3i$ and $2 – 4i$ in trigonometric form. Solution: $z_1 = 3\sqrt{2}(\cos\theta_1 + i\sin\theta_1)$ and $z_2 = 2\sqrt{5}(\cos\theta_2 + i\sin\theta_2)$ • Now multiply the results. What do you notice about the product?
Strand 1: Concept 2: Numerical Operations	**PO 6. Apply DeMoivre's Theorem to calculate products, powers, and roots of complex numbers.**	11.MP.2. Reason abstractly and quantitatively. 11.MP.7. Look for and make use of structure.	Examples: • Simplify $(1 – i)^{23}$. • Find the sixth root of z = - 64. Note that, in polar form, $z = 64(\cos\pi + i\sin\pi)$.

Math Precalculus Blueprint Assessed Quarter 4			
Strand Concept	***Performance Objectives***	***Mathematical Practices***	***Explanations, Examples, and Resources***
Strand 3: Concept 2: Functions and Relationships	**PO 13. Relate logarithms and exponential functions as inverses, prove basic properties of a logarithm using properties of its inverse, and apply those properties to solve problems.**	11.MP.4. Model with mathematics. 11.MP.7. Look for and make use of structure.	Properties of Logarithms (These apply to all bases, including base *e*.): • $\log_a 1=0$ • $\log_a a=1$ • $\log_a a^x=x$ • $a^{\log_a x} = x$ • $a^x \bullet a^y = a^{x+y}$ and $\log_a (xy) = \log_a x + \log_a y$ • $\frac{a^x}{a^y} = a^{x-y}$ and $\log_a \left(\frac{x}{y}\right) = \log_a x - \log_a y$ Examples: • Find the inverse of $f(x) = 3(10)^{2x}$. • Use the properties of logarithms to evaluate $\ln\frac{1}{e^3}$.
Strand 3: Concept 2: Functions and Relationships	**PO 17. Develop an informal notion of limits.**	11.MP.1. Make sense of problems and persevere in solving them. 11.MP.2. Reason abstractly and quantitatively.	Students can estimate limits from graphs and tables of values to develop an informal notion of limits. They can also come to a conceptual understanding that a limit, if one exists, is the value that the dependent variable approaches as the independent variable approaches a given value. We write $\lim_{x\to a} f(x) = L$ and say "the limit of *f*(*x*), as *x* approaches *a*, equals *L"* if we can make the values of *f(x)* arbitrarily close to *L* (as close to *L* as we like) by taking *x* to be sufficiently close to *a*, but not equal to *a*. Students can best develop this understanding through exploration and investigation (e.g.; exploring how many rectangles of a given size can fit below a curve but above the horizontal axis on a coordinate grid).

Math Precalculus Blueprint Assessed Quarter 4			
Strand Concept	***Performance Objectives***	***Mathematical Practices***	***Explanations, Examples, and Resources***
Strand 4: Concept 3: Coordinate Geometry	**PO 6. Convert between rectangular and polar coordinates.**	11.MP.1. Make sense of problems and persevere in solving them. 11.MP.2. Reason abstractly and quantitatively. 11.MP.7. Look for and make use of structure.	Students will represent complex numbers using polar coordinates. $a + bi = r(\cos\theta + \sin\theta)$ Example: • Convert the rectangular coordinates $(\sqrt{6}, \sqrt{6})$ to polar coordinates with $r > 0$ and $0 < \theta < 2\pi$.
	PO 7. Graph equations given in polar coordinates.	11.MP.1. Make sense of problems and persevere in solving them. 11.MP.4. Model with mathematics.	Example: • Sketch graphs of the following equations: $r = 2\sin\theta$ $r = 3\cos 2\theta$

Mathematical Practices will be integrated in all precalculus assessments, instruction, and activities.