Alchesay H.S. 11th and 12th **Pre-Calculus Chapter 1 Relations and Functions**
Summary Deciding if a relation is a function and if so describing the domain and range. Finding composite functions. Identifying piece wise function.

Topic: **Relations and Functions**

Big Ideas: Finding the domain and range of a function. Find composite functions and describe discontinuity of piece-wise functions.
Essential Questions:

Anchor Chart

$f^{-1}(x)$ is a reflection of f(x) over y = x	Domain: Input x values
Domain and range swap for $f^{-1}(x)$	Range: Output y values

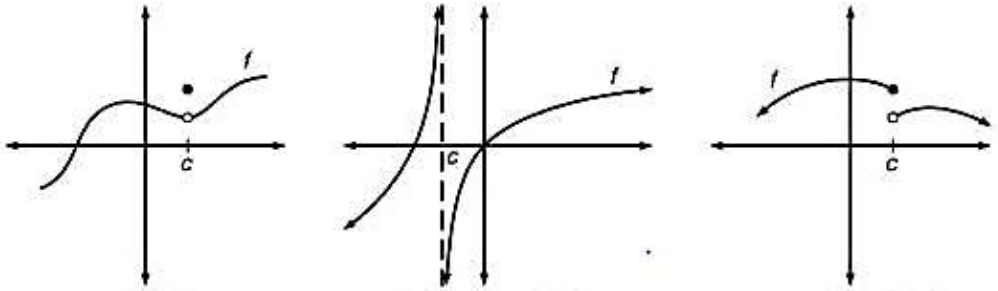
$$(g \circ f)(x) = g(f(x))$$

This is read "*g* composition *f*" and means to copy the *g* function down but where ever you see an *x*, substitute in the *f* function.

$f(x) = 2x^2 + 3 \quad g(x) = 4x^3 + 1$

$g \circ f = 4(2x^2 + 3)^3 + 1$

You could multiply this out but since it's to the 3rd power we won't



point discontinuity
$\lim_{x \to c} f(x) \neq f(c)$
or
$f(c)$ does not exist

infinite discontinuity
(also called *essential discontinuity*)
$\lim_{x \to c} f(x) = \infty$ or $-\infty$

jump discontinuity
$\lim_{x \to c^+} f(x) \neq \lim_{x \to c^-} f(x)$

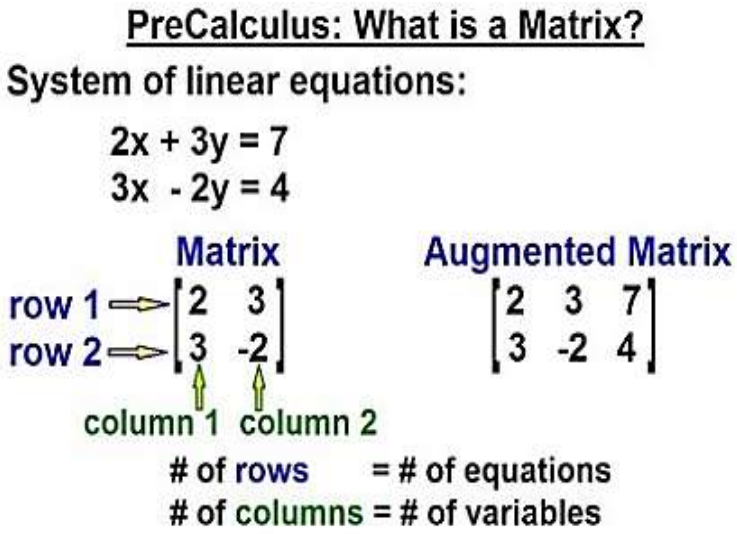
6 days Dates:			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will learn whether a relation is a function, the domain and range of a function, and evaluating functions. I will learn what a composite function is and the points of discontinuity of a piece-wise function.	Relation Domain Range Vertical line test Function Composite function Piece-wise function	**RFR.BF.2**Model relationships through composition and attend to the restrictions of the domain. **RFR.BF.3**Rewrite a function as a composition of functions. **RFR.AF.2** Sketch the graph of a function that models a relationship between two quantities, identifying key features.	
Priority Strategies: Use graphing calculators to graph functions and find their domain, range, and points of discontinuity.			
Writing: **QWS:** What part of a function does the domain represent? The range? **QWS:** What does the word discontinuity represent?			

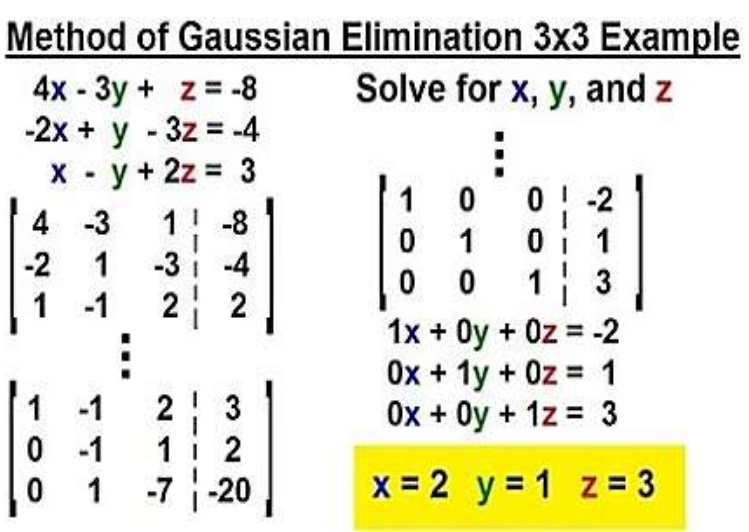
Alchesay H.S. 11th and 12th **Pre-Calculus Chapter 2 Systems/Matrices**
Summary Use matrices to represent and manipulate data, use matrix operations to solve problems, find the inverse and determinant of a matrix, and use matrices to solve a system

Topic **Using Matrices**

Big Ideas Use Matrices to represent data, manipulate data, and solve problems.
Essential Questions What is a Matrix? How is it useful?

Anchor Chart





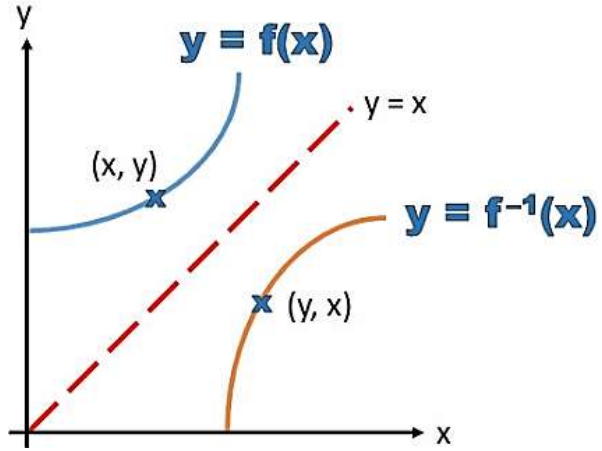
6 days Dates:			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will learn what a matrix is, how to perform operations with matrices, and how to solve a system using a matrix.	System Matrix Element Row and Column Add Matrix Subtract Matrix Multiply Matrix Scalar Inverse Determinant Zero Matrix Identity matrix	**RM.UM.1** Use matrices to represent and manipulate data. **RM.UM.2** Use matrix operations to solve problems. Add, subtract, and multiply matrices of appropriate dimensions. Multiply matrices by scalars to produce new matrices. **RM.UM.3** Find the inverse and determinant of a matrix. **RM.UM.4** Use matrices to solve systems of linear equations.	
Priority Strategies: Have students perform operations by hand and then allow use of the graphing calculator.			
Writing: **QWS:** How is a matrix a system? **QWS:** Can a 2x3 matrix be multiplied by a 3x3?			

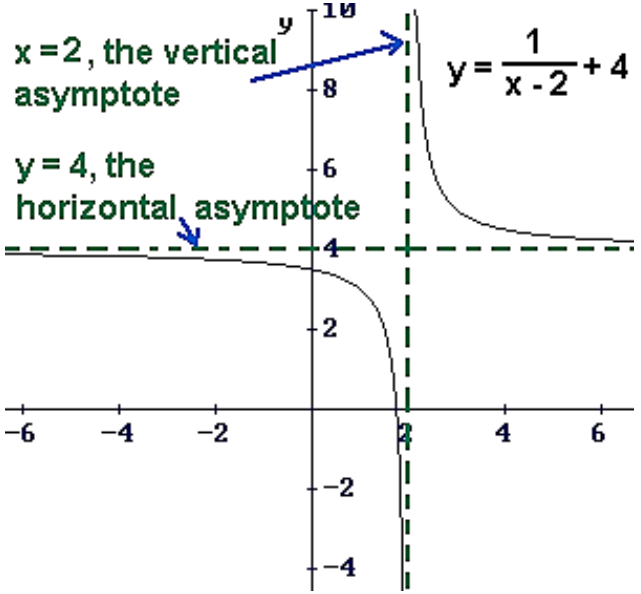
Alchesay H.S. 11th and 12th **Pre-Calculus Chapter 3 The Nature of Graphs**
Summary Examine the nature of graphs through graphing, find the inverse of a function and graph the inverse, determine whether a function is continuous, determine whether a function is increasing or decreasing, find extrema of a function and determine asymptotes

Topic **Relations and Functions**

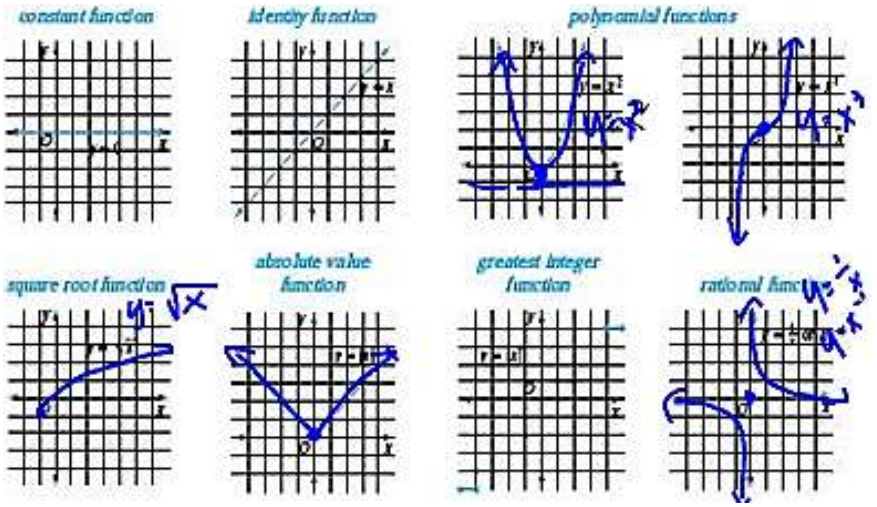
Big Ideas: Identify the nature of nonlinear graphs and examine critical components of the graphs
Essential Questions: What patterns can be found through examining behavior and critical points of various graphs?

Anchor Chart





Transformation Rules		
Function Notation	**Type of Transformation**	**Change to Coordinate Point**
f(x) + d	Vertical translation up d units	$(x, y) \rightarrow (x, y+d)$
f(x) - d	Vertical translation down d units	$(x, y) \rightarrow (x, y-d)$
f(x + c)	Horizontal translation left c units	$(x, y) \rightarrow (x-c, y)$
f(x - c)	Horizontal translation right c units	$(x, y) \rightarrow (x+c, y)$
-f(x)	Reflection over x-axis	$(x, y) \rightarrow (x, -y)$
f(-x)	Reflection over y-axis	$(x, y) \rightarrow (-x, y)$
af(x)	Vertical stretch for $\|a\| > 0$	$(x, y) \rightarrow (x, ay)$
af(x)	Vertical compression for $0 < \|a\| < 1$	$(x, y) \rightarrow (x, ay)$
f(bx)	Horizontal compression for $\|b\| > 0$	$(x, y) \rightarrow \left(\frac{x}{b}, y\right)$
f(bx)	Horizontal stretch for $0 < \|b\| < 1$	$(x, y) \rightarrow \left(\frac{x}{b}, y\right)$



3.2/3.3 Families of Graphs

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can graph non-linear functions, apply transformations, and examine key components	Parent Graph Transformations Radical Function Rational Functions	Perquisite Skill	
Priority Strategies: Have students sketch graphs by hand then use technology to apply the transformations			
Writing: **QWS:** Demonstrate how a graph can be transformed to move left or right and/or up or down?			

3.4 Inverse Functions and Relations

2 Days			
Standards	**Essential Vocabulary**		**Resources/ Notes**
I can determine and graph the inverses of relations and functions	Inverse Function Horizontal Line Test	**RFR.BF.4** Determine if a function has an inverse. If so, find the inverse. If not, define a restriction on the domain that meets the requirement for invertibility and find the inverse on the restricted domain.	
Priority Strategies: Stress the concept that the domain and range are inverted for the inverse and that if a function does not pass the horizontal line test its inverse will not be a function			
Writing: State whether the function f(x)=lxl has an inverse that is a function			

3.5 Continuity and End Behavior

2 days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will determine if a function is continuous, identify end behavior, and determine if a function is increasing or decreasing	Continuous Discontinuous Infinite Jump Point Everywhere	**RFR.AF.4** Use limits to describe long-range behavior, asymptotic behavior, and points of discontinuity.	
Priority Strategies: Examine various graphs and if the graphs are continuous, if they are not then identify the points of discontinuity			
Writing: How do you determine end behavior of function? Explain why the square root functions are undefined under certain intervals			

3.6 Critical Points and Extrema

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can find the extrema of a function	Critical Points Maximum Minimum Point of Inflection Relative Extrema Relative Maximum Relative Minimum	**RFR.AF.4** Use limits to describe long-range behavior, asymptotic behavior, and points of discontinuity.	
Priority Strategies: Graph various functions, describe critical points, and end behavior			
Writing: For the graph y=sinϴ describe the extrema of the function			

3.7 Graphs of Rational Functions

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
Graph rational functions and determine vertical, horizontal, and slant asymptotes	Rational Function Asymptote Vertical Asymptote Horizontal Asymptote Slant Asymptote	**RFR.AF.4** Use limits to describe long-range behavior, asymptotic behavior, and points of discontinuity.	
Priority Strategies: Show student show to algebraically find the asymptote of a rational function, follow up by using the graphing calculator to find asymptotes of a rational function			
Writing: Write an equation of a function with a vertical asymptote at -5			

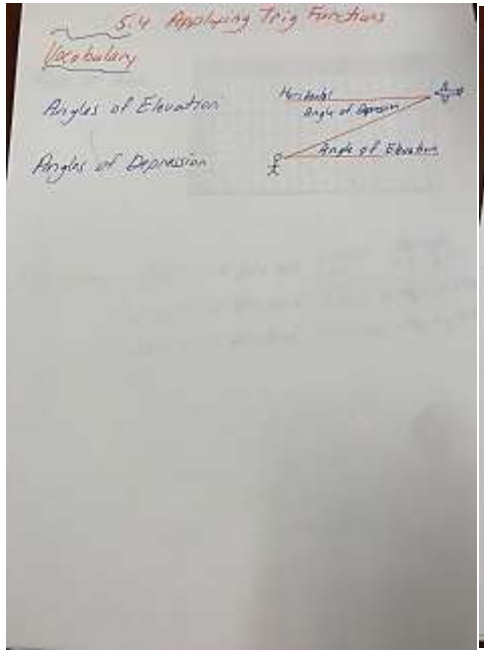
Common Struggles:
Tier II Extensions:

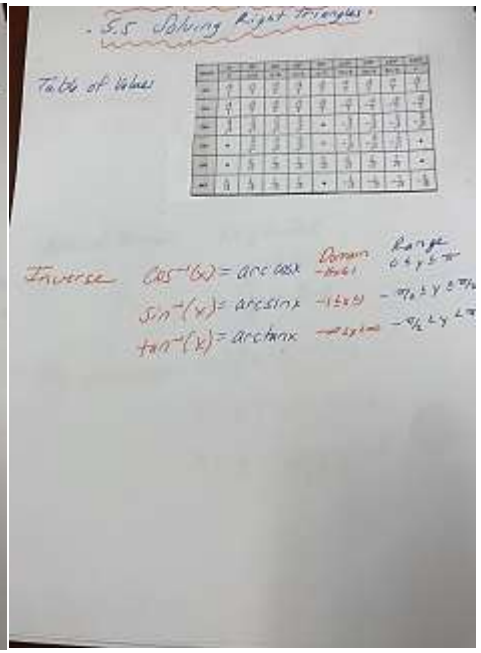
Alchesay H.S. 11th and 12th **Pre-Calculus Chapter 5 The Trigonometric functions**
Summary
Focus on the relationship of the six trigonometric functions and their graphs. Solve non right triangles using the law of sines and cosines.

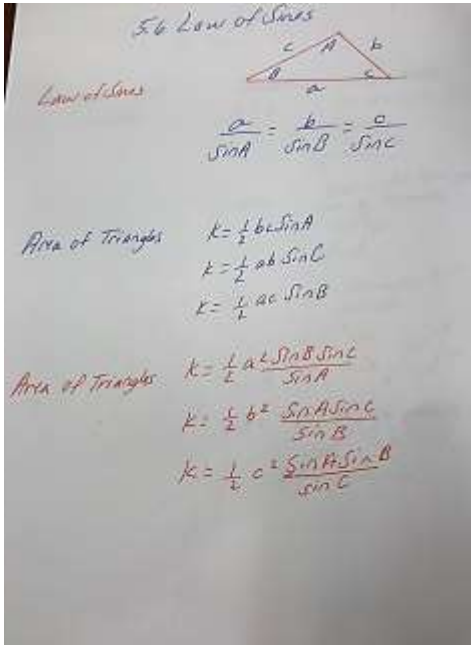
Topic **Trigonometric Functions**

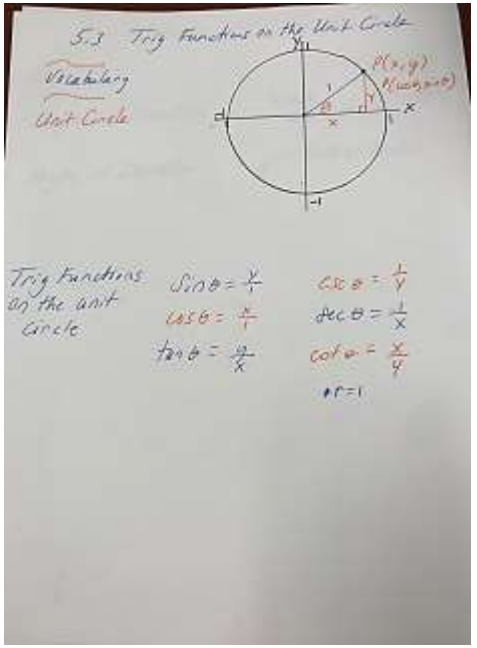
Big Ideas Focus on the relationship of the six trigonometric functions and their graphs
Essential Questions How are the six trigonometric graphs related and how are they useful?

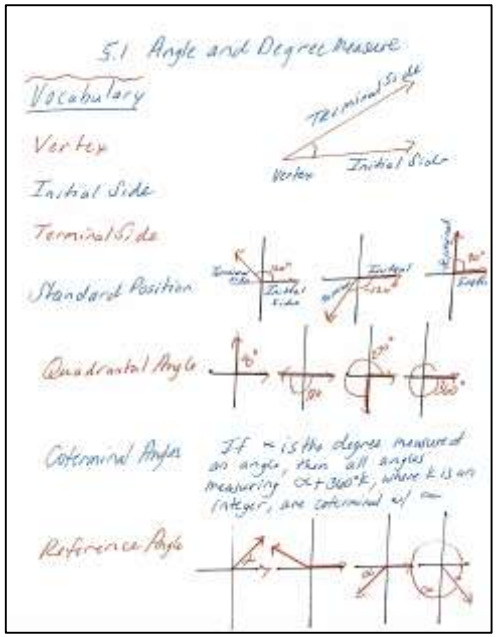
Anchor Chart

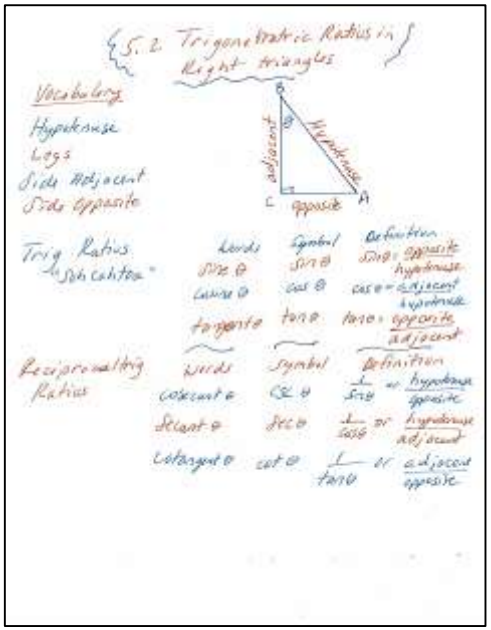


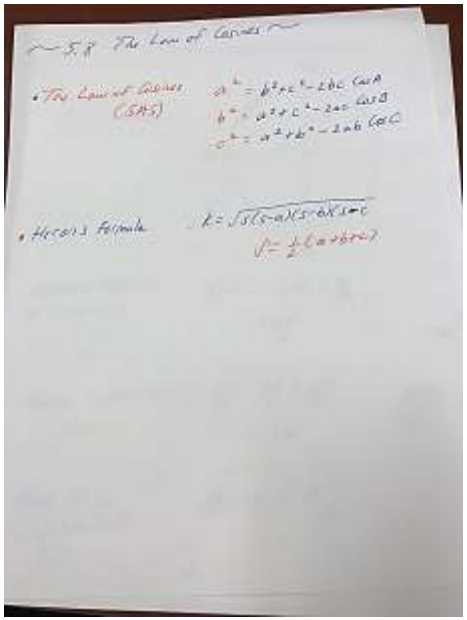


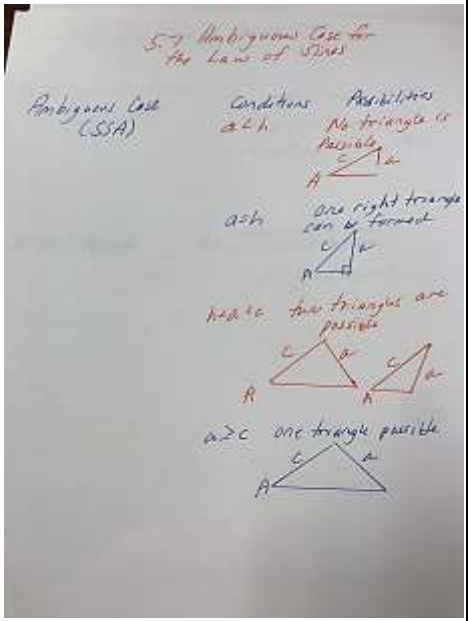












5.1 Angles and Degree Measure

2 days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will learn how to convert decimals degrees into minutes and seconds, vice versa. I will Find the number of degrees in a given number of rotations, and identify angels that are conterminal with a given angle.	Vertex Initial Side Terminal Side Standard Position Degree Minutes Seconds Quadrantal Angle Conterminal Angle	Pre-requisite for graphing trigonometric functions	https://www.mathopenref.com/reference-angle.html
Priority Strategies: Emphasize definitions of conterminal angle and rotations so that student understands that many angles pass thru a fixed position			
Writing: How many angles pass through an angle in standard position?			

5.2 Trigonometric Ratios in Right Triangles

2 days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can find the values of trigonometric ratios for acute angles of a right triangle	Hypotenuse Legs Side Adjacent Trigonometric Ratios Sine Cosine Tangent Cosecant Secant Cotangent	Prerequisite for graphing six trig functions	
Priority Strategies: Use acronym SOHCAHTOA to help students remember the ratios for the six trig functions			
Writing: Give students a right triangle with two sides given. Ask students to explain how to find the values of the six trigonometric ratios.			

5.3 Trigonometric Functions on the Unit Circle

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can find the values of the six trigonometric functions using the unit circle	Unit Circle Circular functions Trigonometric Functions	**RFR.AF.5** Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions	
Priority Strategies: Use acronym SOHCAHTOA to help students remember the ratios for the six trig functions			
Writing: Explain why csc (180) is undefined			

5.4 Applying Trigonometric Functions

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will use trigonometry to find the measures of the side of right triangles	Angle of Elevation Angle of Depression	**RFR.ETT.1** Model real-world situations involving trigonometry.	
Priority Strategies: Have the students read the application problems twice, identify what is given, identify the question, build a model of the problem, and solve			
Writing: What is the difference between the inverse and the reciprocal of a trigonometric ratio?			

5.5 Solving Right Triangles

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can evaluate inverse trig functions, find missing angle measurements, and solve right triangles	Inverse Arcsine Arccosine Arctangent Solve a Triangle		
Priority Strategies: Make sure students understand the difference between arcsine and inverse of sin			
Writing: Have students explain the process of solving a right triangle when either two sides are given, or one side and an angle are given.			

5.6 The Law of Sines

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will solve triangles by using the Law of Sines and find the area of a triangle, if the measures of two side and the included angle or the measures of two angles and a side are given.	Law of Sines	**RFR.ETT.2** Apply the Law of Sines and Law of Cosines to solve problems. **RFR.ETT.3** Use trigonometry to find the area of triangles.	
Priority Strategies: Stress the concept that the domain and range are inverted for the inverse and that if a function does not pass the horizontal line test its inverse will not be a function			
Writing: Show that the law of sines is true for a 30° - 60° triangle			

5.7 The Ambiguous Case for the Law of Sines

2 days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can determine whether a triangle has zero, one, or two solutions. Solve triangles using the Law of Sines.	Ambiguous Case	**RFR.ETT.2** Apply the Law of Sines and Law of Cosines to solve problems.	
Priority Strategies: When looking for more than one solution, remind students sine is positive in the first and second quadrants, so reference angles in both quadrants apply			
Writing: Have students describe their approach to solving a given triangle			

5.8 Law of Cosines

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will solve triangles by using the Law of Cosines and find the area of triangles if the measures of the three sides are given.	Pythagorean theorem Law of Cosines Heron's formula	**RFR.ETT.2** Apply the Law of Sines and Law of Cosines to solve problems. **RFR.ETT.3** Use trigonometry to find the area of triangles.	
Priority Strategies: Have students make a poster of the Law of Cosines and Heron's formula			
Writing: Compare and contrast the 3 variations of the Law of Cosines			

Common Struggles:
Students may have trouble building a model and discerning between angle of elevation and depression
Tier II Extensions:

Alchesay H.S. 11th and 12th **Pre-Calculus Chapter 6 Graphs of Trigonometric Functions**

Chapter 6 Graphs of Trigonometric Functions

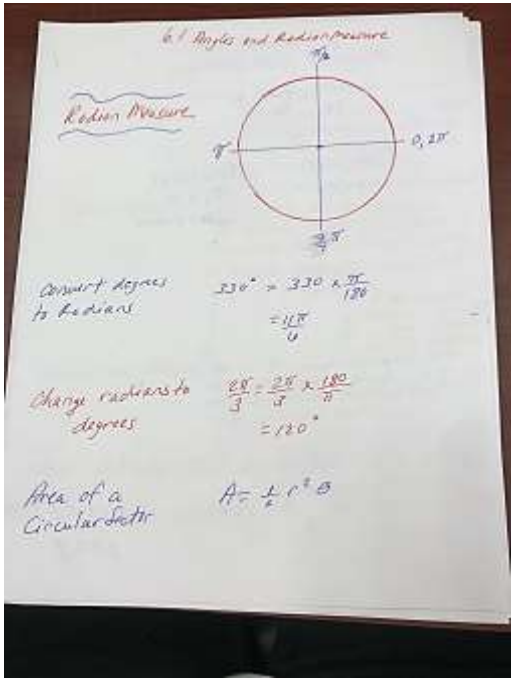
Summary

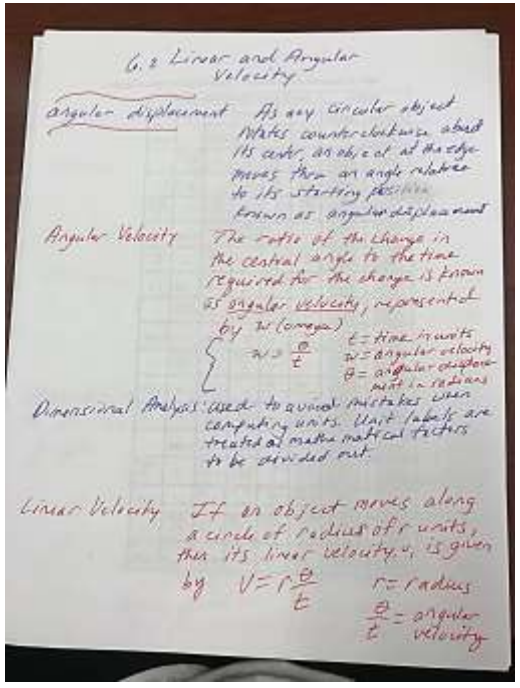
Review the graphs of trigonometric functions and their inverses using radian measure. Identify amplitude, period, phase shift, and vertical shift. Find linear and angular velocity and writing trigonometric equations to model real-life situations.

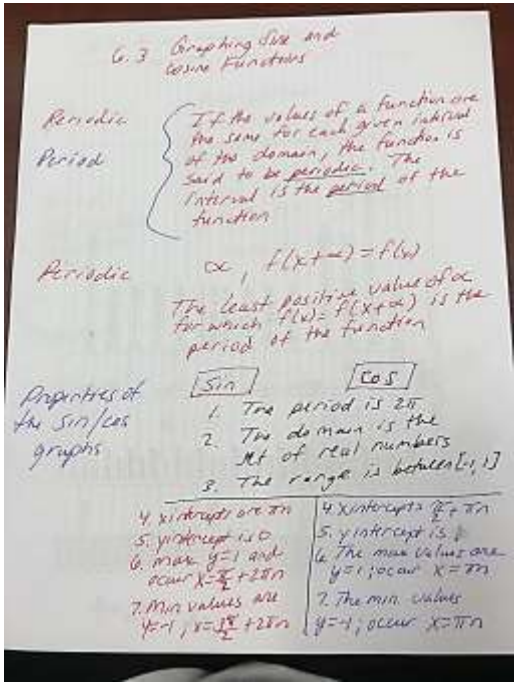
Big Ideas Review the six trig graphs, convert to radian measure, identify key features of the graphs and apply transformations

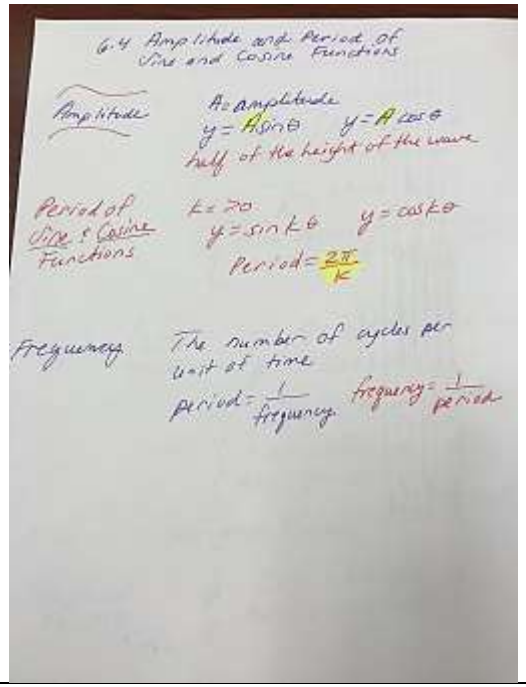
Essential Questions Why do we use Radians?

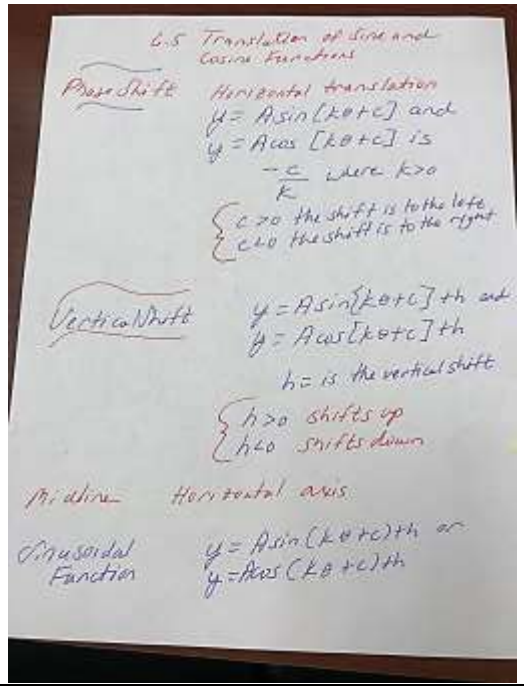
Anchor Chart











6.1 Angles and Radian Measures

2 days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will change radian measure to degree measure and vice versa. Find are length given the measure of the central angle. Find the area of a sector .	Degree Radian Circular Arc Central Angle	**RFR.AF.5** Sketch the graph of all six trigonometric functions, identifying key features.	
Priority Strategies: Use a table of values, created by students, to graph the six trigonometric functions in radians. Make sure students understand how to convert between radians and degrees.			
Writing: Answer and explain your solution to the following question: Earth rotates on its axis once every 24 hours. How long does it take Earth to rotate through an angle of 300 degrees? (20 hrs.) How long does it take Earth to rotate through an angle of 2pi/3 Radian? (8 hrs.)			

6.2 Linear and Angular Velocity

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will find Linear and Angular Velocity	Angular Displacement Angular Velocity Dimensional Analysis Linear Velocity	**RFR.AF.3** Interpret key features of graphs and tables for a function that models a relationship between two quantities in terms of the quantities.	
Priority Strategies: Linear velocity it directly proportional to the radius			
Writing: Students write a paragraph explaining the similarities and differences between angular velocity and linear velocity. Use one or more examples to illustrate these ideas.			

6.3 Graphing Sine and Cosine Functions

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can use the graphs of the sine and cosine functions	Periodic Period	**RFR.AF.5** Sketch the graph of all six trigonometric functions, identifying key features.	
Priority Strategies: Have students use their tables of values to graph sine and cosine			
Writing: When does the graph of sine cross the x-axis? When does the graph of cosine cross the y-axis?			

6.4 Amplitude and Period of Sine and Cosine Functions

2 days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will find the amplitude and period for sine and cosine functions. Write equations of sine and cosine functions given the amplitude and period.	Amplitude	**RFR.AF.5** Sketch the graph of all six trigonometric functions, identifying key features.	
Priority Strategies: Have students graph the sine cosine functions, have them measure the height of the wave to determine the amplitude.			
Writing: How are the sine cosine graphs different? The same?			

6.5 Translation of Sine and Cosine Functions

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will find the phase shift and the vertical translation for sine and cosine functions. Write the equations of sine and cosine functions given the amplitude, period, phase shift, and vertical translation Graph compound functions.	Phase Shift Vertical Shift Midline Compound Functions	**RFR.AF.5** Sketch the graph of all six trigonometric functions, identifying key features.	
Priority Strategies: Graph functions by hand using rules for translations, then graph using the graphing calculator. When finding the equation for a graph have students use the rules for translations and then check themselves with a graphing calculator			
Writing: How do you alter an equation to get a vertical or horizontal shift?			

6.6 Modeling Real-World Data with Sinusoidal Functions

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can model real-world data using sine and cosine functions. Use sinusoidal functions to solve problems.	Sinusoidal Functions	**RFR.ETT.1** Model real-world situations involving trigonometry.	
Priority Strategies: Create a model from the application problem, solve the problem, check the efficacy of the problem.			
Writing: If a point on an oscilloscope rides the sine curve y=sinx what path would the point on its reciprocal function y=cscx travel?			

6.8 Trigonometric Inverses and Their Graphs

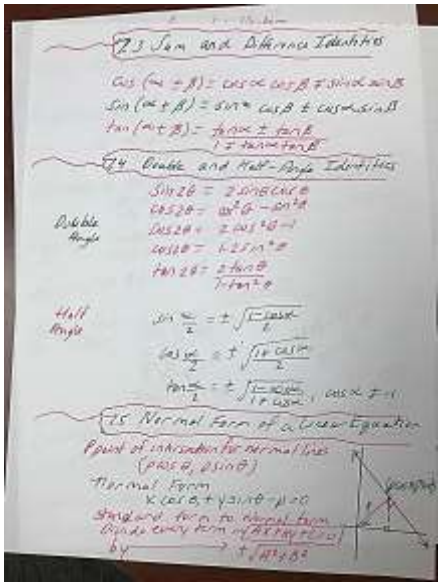
2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can graph inverse trigonometric functions. Find principal values of inverse trigonometric functions.	Principal Values	**RFR.AF.5** Sketch the graph of all six trigonometric functions, identifying key features.	
Priority Strategies: The graph of a function and its inverse are symmetric or reflect over the line y=x. Sin x is defined in quadrants I and IV, Cos x is defined in quadrants I and II, and Tan x is defined in quadrants I and IV			
Writing: Why do we restrict the domain on the inverse sine and cosine functions?			

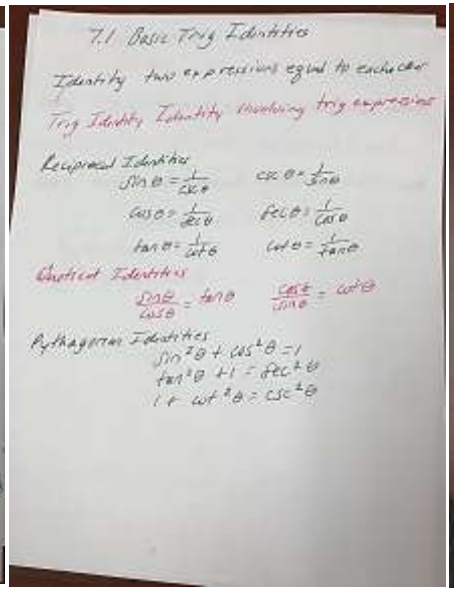
Common Struggles:
Tier II Extensions:

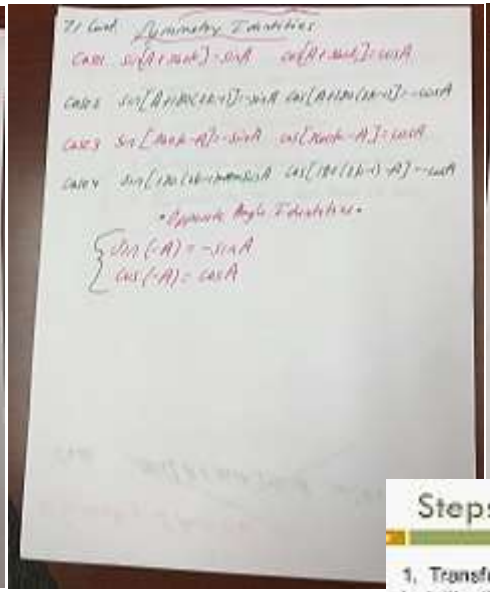
Alchesay High School Pre-Calculus **Chapter 7 Trigonometric Identities and Equations**
Summary Review basic trigonometric identities. Verify trigonometric identities, use sum and difference identities, and use double- angle and half- angle identities. Solve trigonometric equations, find the normal form of a linear equation, and then determine the distance to a line.

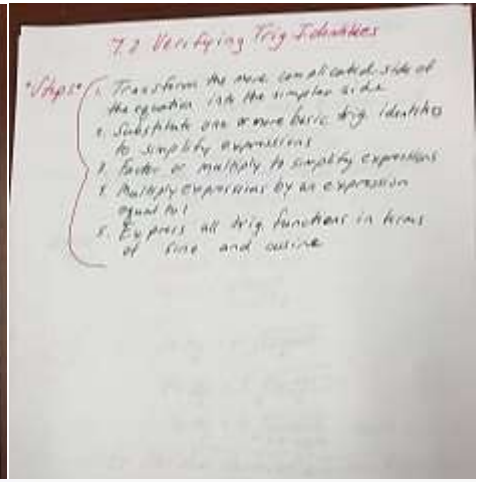
Big Ideas Verify trigonometric identities
Essential Questions

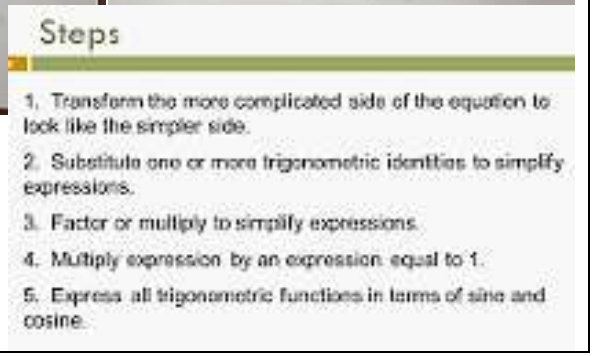
Anchor Chart











7.1 Basic Trigonometric Identities

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will identify and use reciprocal identities, quotient identities, Pythagorean identities , symmetry identities, and opposite angle identities	Identity Trigonometric Identity Reciprocal Identities Quotient Identity Pythagorean Identities	**RT.RTS.1** Use the structure of a trigonometric expression to identify ways to rewrite it.	
Priority Strategies: Have students become familiar with the identities, know which identity to use for each problem, correctly evaluate values for the identities. Have students make a formula sheet to prep work for verifying identities.			
Writing: Is the inverse of sinϴ the same as cscϴ?			

7.2 Verifying Trigonometric Identities

Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will use the basic trigonometric identities to verify other identities		**RT.RTS.1** Use the structure of a trigonometric expression to identify ways to rewrite it. **RT.RTS.2** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	
Priority Strategies: Steps to Verifying Identities • Transform the more complicated side of the equation into the simpler side • Substitute one or more basic trigonometric identities to simplify expressions • Factor or multiply to simplify expressions • Multiply expressions by an expression equal to 1 • Express all trigonometric functions in terms of sine and cosine			
Writing: Have students write examples of trigonometric identities and describe how each can be used to find the value of one trigonometric function from the value of another.			

7.3 Sum and Difference Identities

Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will use the sum and difference identities for the sine, cosine, and tangent functions	Difference Identity for cosine Sum Identity for cosine Difference Identity for sine Sum Identity for sine Difference Identity for Tangent Sum Identity for Tangent	**RT.RTS.1** Use the structure of a trigonometric expression to identify ways to rewrite it. **RT.RTS.2** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	
Priority Strategies: Correctly identify the needed formula, properly substitute, and simplify			
Writing: Why do we use sum and difference formulas to find values as opposed to using a calculator?			

7.4 Double-Angle and Half-Angle Identities

Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will use the double-angle and half-angle for the sine, cosine, and tangent functions.	Double-angle Identities Half-angle Identities	**RTS.1** Use the structure of a trigonometric expression to identify ways to rewrite it. **RT.RTS.2** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	
Priority Strategies: Correctly identify the needed formula, properly substitute, and simplify			
Writing: Write a paragraph about the conditions under which you would use each of the three identities for cos 2Θ			

7.5 Solving Trigonometric Equations

Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can solve Trigonometric equations and inequalities		**RT.RTS.3** Solve trigonometric equations.	
Priority Strategies: Factor the expression, set each factor equal to 0, and solve for each factor. If the expression cannot be easily factored, then the expression may be written in terms of only one trigonometric function. Also student may use a "factor by grouping" strategy.			
Writing: Explain the difference between a trigonometric identity and a trigonometric equation that is not an identity?			

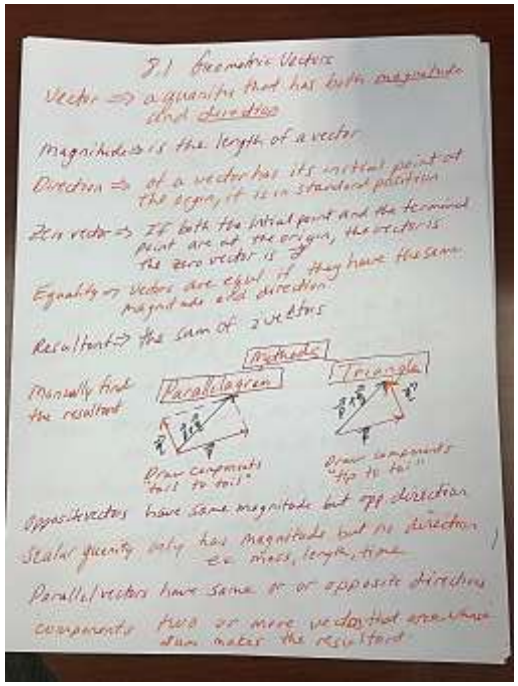
Common Struggles:
Tier II Extensions:

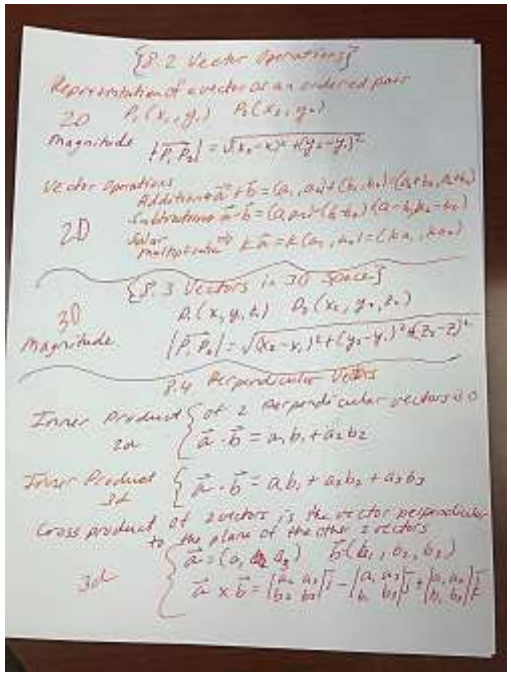
Alchesay H.S. 11th and 12th **Pre-Calculus Topic 8 Vectors and Parametric Equations**
Summary Introduction to vector notation, vector addition, subtraction, multiplication, cross products, and parametric equations.

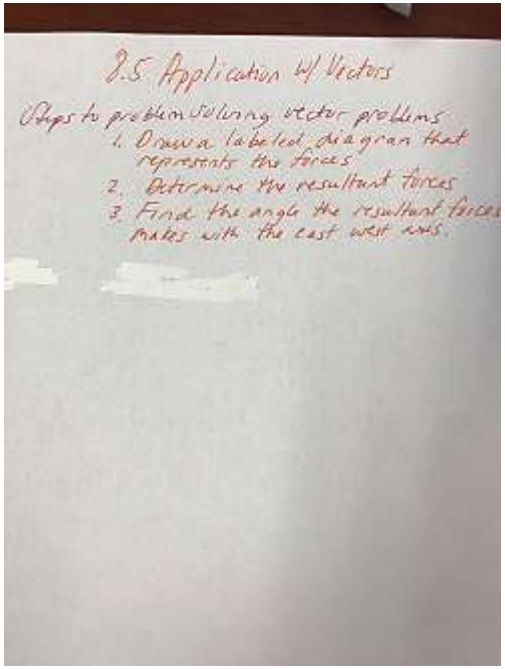
Topic **Relations and Functions**

Big Ideas Introduction to vectors and parametric equations
Essential Questions Why are vectors useful?

Anchor Chart







8.1 Geometric Vector

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can find equal, opposite, and parallel vectors	Vector Magnitude Standard Position Direction Zero Vector Resultant Opposites Scalar Quantity Scalars Parallel Components	**RV.EV.1** Recognize vector quantities as having both magnitude and direction. **RV.EV.2** Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes.	
Priority Strategies: Use the Parallelogram Method and Triangle Method for finding the resultant of 2 vectors.			
Writing: Describe a real-world situation involving, at least 2, vectors and represent with a diagram			

8.2 Algebraic Vectors

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will find ordered pairs that represent vectors. Add, subtract, multiply, and find the magnitude of vectors algebraically		**RV.EV.3** Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. **RV.EV.4** Solve problems involving velocity and other quantities that can be represented by vectors. **RV.EV.5** Add and subtract vectors, and multiply a vector by a scalar.	
Priority Strategies: Demonstrate how to perform simple operations with vectors and find the magnitude of a vector using the distance formula			
Writing: What is the magnitude of a vector? Why is the distance formula used to find the magnitude of a vector?			

8.3 Vectors in Three-Dimensional Space

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can add and subtract vectors in 3-d space. Find the magnitude of vectors in 3-d space.	Ordered Triple	**RV.EV.4** Solve problems involving velocity and other quantities that can be represented by vectors. **RV.EV.5** Add and subtract vectors, and multiply a vector by a scalar.	
Priority Strategies: Graph vectors in 3 space, find the resultant vector through graphing, find the resultant vector algebraically, and find the magnitude by using the distance formula.			
Writing: Describe the information you need to find the components of a three –dimensional vector from its given magnitude .			

8.4 Perpendicular Vectors

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will find the inner and cross product of 2 vectors	Dot Product Cross Product	**RV.EV.4** Solve problems involving velocity and other quantities that can be represented by vectors.	
Priority Strategies: Find and use the magnitude of a vector to solve application problems.			
Writing: Show that the cross product of 3-d vector with itself is the zero vector			

8.5 Application Vector

Week # _____ Dates:			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will solve application problems using vectors and right triangle trigonometry	Magnitude	**RV.EV.4** Solve problems involving velocity and other quantities that can be represented by vectors.	
Priority Strategies: Stress that magnitude represents velocity, weight, and gravity			
Writing: Explain what it means for forces to be in equilibrium			

8.6 Vectors and Parametric Equations

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will write vector and parametric equations of a line. Graph parametric equations.	Vector Equations Parametric Equations Direction Vector Parameter	**RV.MP.3** Graph parametric equations and identify orientation.	
Priority Strategies: Remind students an advantage of **parametric equations** is that the parameter can be used to represent something useful and therefore provide us with additional information about the graph. Often a plane curve is used to trace the motion of an object over a certain interval of time.			
Writing: Explain how to find the parametric equations for the line through the point at (3,6) , parallel to the vector v=i+2j			

8.7 Modeling Motion Using Parametric Equations

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can model the motion of a projectile using parametric equations. Solve problems related to the motion of a projectile, its trajectory, and range.		**RV.MP.1** Model real-world contexts with parametric equations. **RV.MP.4** Analyze and interpret the graphs of parametric equations.	
Priority Strategies: Students will find the initial and horizontal velocity in real world problems, remind students that he horizontal and vertical components of a vector, v, are perpendicular to each other, so these results come from right triangle trigonometry.			
Writing: Describes situations in which a projectile travel vertically. At what angel with the horizontal must the projectile be launched?			

8.8 Transformation Matrices in 3-D Space (optional)

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can transform 3-d figures using matrix operations to describe the transformation.		**RM.UM.2** Use matrix operations to solve problems. Add, subtract, and multiply matrices of appropriate dimensions. Multiply matrices by scalars to produce new matrices.	
Priority Strategies: Basic movement in 3-d space can be described using vectors and transformation matrices, by using the coordinates of a 3-d object and transformation operations students will be able to describe the movement.			
Writing: Have students make up the coordinates of the vertices of a parallelepiped or a rectangular prism, and the plot these vertices to make sure that they are accurate.			

Common Struggles:
When working with 3x3 matrices there are many operations involved allowing for computational errors to occur. The majority of the work for a 3x3 matrix will be done using the graphing calculator.
Tier II Extensions:

Alchesay H.S. 11th and 12th **Pre-Calculus Topic 9 Polar Coordinates and Complex Numbers**
Summary Introduce polar coordinates and continues the concepts of complex numbers from previous chapters. Students will graph polar equations, polar and rectangular coordinates, and polar forms of linear equations

Topic **Relations and Functions**

Big Ideas Graph polar equations and convert between polar and rectangular coordinates
Essential Questions What are polar coordinates?

Anchor Chart

9.1 Polar Coordinates

2 days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can graph points in polar coordinates. Graph simple polar equations. Determine the distance between two points with polar coordinates.	Polar Coordinate System Polar Coordinates Pole Polar Axis Polar Equation Polar Graph	**RT.EPE.1** Graph polar equations.	
Priority Strategies: Use graph paper to graph the polar coordinates.			
Writing: Explain why a point in the polar plane cannot be named by a unique ordered pair (r, Θ)			

9.2 Graphs of Polar Equations

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can graph polar equations	Limacon	**RT.EPE.1** Graph polar equations. **RT.EPE.2** Analyze and interpret the graphs of polar equations.	
Priority Strategies: Make a table of input values and output values, use graph paper to graph the coordinates			
Writing: Write a polar equation whose graph is a rose.			

9.3 Polar and Rectangular Coordinates

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can convert between polar and rectangular coordinates		**RT.EPE.1** Graph polar equations.	
Priority Strategies: Use $x=r\cos\Theta$ and $y=r\sin\Theta$ to convert from polar coordinates to rectangular coordinates. The equations to can be manipulated to convert rectangular coordinates to polar coordinates			
Writing: Explain why you have to consider what quadrant a point lies in when converting from rectangular coordinates to polar coordinates? Answer: the quadrant that the point lies in determines whether Θ is given by Arctan(y/x) + pi			

Common Struggles:
Tier II Extensions:

Alchesay H.S. 11th and 12th **Pre-Calculus Topic 10 Conics**
Summary Students use equations to identify important characteristics of each conic section. Then use these characteristics to graph parabolas, circle, ellipses, and hyperbolas.

Big Ideas Finding Identify key features of circle, hyperbolas, ellipses, and parabolas and graph them
Essential Questions

Anchor Chart

10.1 Conics

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will find the distance and midpoint between two points on a coordinate plane .	Analytic Geometry	Pre-requisite for conics	
Priority Strategies: Use the distance and midpoint formulas			
Writing: Describe how can you show that a midpoint of a segment is equidistant from its endpoints given the coordinates of each point. Answer: Use the distance formula to show that the measure of the distance from the midpoint to either endpoint is the same.			

10.2 Circles

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will use and determine the standard and general forms of the equation of a circle. Graph circles	Concentric Circle Radius Conic Section	**RFR.IC.1** Model real-world situations which involve conic sections. **RFR.IC.2** Identify key features of conic sections (foci, directrix, radii, axes, asymptotes, center) graphically and algebraically. **RFR.IC.3** Sketch a graph of a conic section using its key features. **RFR.IC.4** Use the key features of a conic section to write its equation. **RFR.IC.5** Given a quadratic equation of the form $ax^2 + by^2 + cx + dy + e = 0$, determine if the equation is a circle, ellipse, parabola, or hyperbola.	
Priority Strategies: Write the standard form of an equation of a circle and graph it. Use properties of circles to solve real-world problems.			
Writing: Explain how to convert the general form of the equation of a circle to the standard from of the equation of a circle. Answer:			

10.3 Ellipses

2 days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will use and determine the standard and general forms of the equation of an ellipse. Graph ellipses	Ellipse Foci Center Major Axis Minor Axis Vertices	**RFR.IC.1** Model real-world situations which involve conic sections. **RFR.IC.2** Identify key features of conic sections (foci, directrix, radii, axes, asymptotes, center) graphically and algebraically. **RFR.IC.3** Sketch a graph of a conic section using its key features. **RFR.IC.4** Use the key features of a conic section to write its equation. **RFR.IC.5** Given a quadratic equation of the form $ax^2+ by^2 + cx + dy + e = 0$, determine if the equation is a circle, ellipse, parabola, or hyperbola.	
Priority Strategies: Write the standard form of an equation of an ellipse and graph it. Use properties of ellipses to solve real-world problems.			
Writing: Explain how to determine whether the foci of an ellipse lie on the horizontal or vertical axis of the ellipse.			

10.4 Hyperbolas

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can use and determine the standard and general forms of the equation of a hyperbola. Graph hyperbola	Hyperbola Foci Center Vertex Asymptotes Transverse Axis Conjugate Axis	**RFR.IC.1** Model real-world situations which involve conic sections. **RFR.IC.2** Identify key features of conic sections (foci, directrix, radii, axes, asymptotes, center) graphically and algebraically. **RFR.IC.3** Sketch a graph of a conic section using its key features. **RFR.IC.4** Use the key features of a conic section to write its equation. **RFR.IC.5** Given a quadratic equation of the form $ax^2+ by^2 + cx + dy + e = 0$, determine if the equation is a circle, ellipse, parabola, or hyperbola.	
Priority Strategies: Write the standard form of an equation of a hyperbola and graph it. Use properties of hyperbolas to solve real-world problems.			
Writing: Compare and contrast the standard forms of the equations of hyperbolas and ellipses.			

10.5 Parabolas

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can use and determine the standard and general forms of the equation of a hyperbola. Graph hyperbola	Focus Directix Axis of Symmetry Vertex	**RFR.IC.1** Model real-world situations which involve conic sections. **RFR.IC.2** Identify key features of conic sections (foci, directrix, radii, axes, asymptotes, center) graphically and algebraically. **RFR.IC.3** Sketch a graph of a conic section using its key features. **RFR.IC.4** Use the key features of a conic section to write its equation. **RFR.IC.5** Given a quadratic equation of the form $ax^2 + by^2 + cx + dy + e = 0$, determine if the equation is a circle, ellipse, parabola, or hyperbola.	
Priority Strategies: Write the standard form of an equation of a hyperbola and graph it. Use properties of hyperbolas to solve real-world problems.			
Writing: Explain a way in which you might distinguish the equation of a parabola from the equation of a hyperbola.			

Common Struggles:
Tier II Extensions:

Alchesay H.S. 11th and 12th **Pre-Calculus Topic 12 Sequences and Series**
Summary Deciding if a relation is a function and if so describing the domain and range. Finding composite functions. Identifying piece wise function.

Chapter 12 Sequences and Series
Summary: Review arithmetic and geometric sequences. Students explore such topics as limits, sums, convergence of series, and divergence of series, and sigma notation.

Big Ideas: Explore series and sequence relationships and patterns
Essential Questions: Where can sequence and series be found in real life?

Anchor Chart

12.1 Arithmetic Sequences and Series

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can find the nth term and arithmetic means of an arithmetic sequence. Find the sum of n terms of an arithmetic series.	Sequence Terms Arithmetic Sequence Terms	**RFR.ISS.1** Model real-world situations involving sequences or series using recursive and/or explicit definitions.	
Priority Strategies: Use the common difference to find the nth term of a sequence			
Writing: Describe the common difference for an arithmetic sequence in which the terms are decreasing			

12.2 Geometric Sequences and Series

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will find the nth term and geometric means of a geometric sequence	Geometric Sequence Common Ratio	**RFR.ISS.4** Find the sums of finite or infinite series, if they exist.	
Priority Strategies: Use the common ratio to find the nth term of a sequence			
Writing: Compare and contrast arithmetic and geometric sequences			

12.3 Infinite Sequences and Series

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will find the limit of the terms of an infinite sequence. Find the sum of an infinite geometric series.	Infinite Sequence Limit	**RFR.ISS.4** Find the sums of finite or infinite series, if they exist.	
Priority Strategies: First find the limit intuitively using values, then find limits using theorems for limits			
Writing: Give an example of an infinite geometric series having not sum. Answer: 2+4+6+8….			

12.4 Convergent and Divergent Series

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I will determine whether a series is convergent or divergent	Converge Diverge	**RFR.ISS.2** Use covariational reasoning to describe sequences and series.	
Priority Strategies: If a series has a limit it is convergent if a series has no limit it is divergent. A summary of series for reference and a comparison test will be used as well.			
Writing: Ask students to describe the different tests for determining whether a series is convergent or divergent.			

12.5 Sigma Notation and the nth Term

2 Days			
Learning Goals and Success Criteria	**Essential Vocabulary**	**Standards**	**Resources/ Notes**
I can use sigma notation	Sigma Notation Index of Summation Factorial	**RFR.ISS.3** Represent finite or infinite series using sigma notation.	
Priority Strategies: Have students write each expression in expanded form and then find the sum. Then have them express a series using sigma notation.			
Writing: Have students write a paragraph explaining how to express a series that has a general formula for the nth term using sigma notation.			

Common Struggles:
Tier II Extensions: