

**Portales Municipal Schools**  
**CURRICULUM MAP**

<b>Subject:</b> Mathematics	<b>June 2010</b>	<b>Grade Level:</b>	Pre-Calculus
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<b>Essential Questions:</b> What is slope? What is a linear equation? What is slope-intercept form of a line? What is the meaning of parallel and perpendicular?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>1<sup>st</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p><b>FUNCTIONS AND GRAPHS</b></p> <p>A. Lines</p> <ol style="list-style-type: none"> <li>1. Find the slopes of lines.</li> <li>2. Write linear equations given points on lines and their slopes.</li> <li>3. Use slope-intercept forms of linear equations to sketch lines</li> <li>4. Use slope to identify parallel and perpendicular lines.</li> </ol>	<p>Students will explore linear functions of the form <math>f(x) = a x + b</math> and the properties of their graphs are explored interactively using an applet. (Another tutorial on <u>graphing linear functions</u> is included in this website)</p> <p>The exploration is carried out by changing the parameters a and b defining the linear function</p> <p><b>Assessment:</b> Peer evaluation and teacher created tests</p>	<p><a href="http://www.analyzemath.com/function/linear_functions.html">http://www.analyzemath.com/function/linear_functions.html</a></p>

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<b>Essential Questions:</b> What is a function? What is domain and range? What is the difference quotient? What are relative extrema? What are step functions? What are piecement functions? What are even and odd functions?				
Calendar	Strand/Standard/ Benchmark	Concepts/Skills (All Master)	Suggested Student Activities/Assessments	Resources/Materials
<b>1<sup>st</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p style="text-align: center;"><b>FUNCTIONS AND GRAPHS</b></p> <p style="text-align: center;">B. Functions and Their Graphs</p> <ol style="list-style-type: none"> <li>1. Determine whether a relation is a function.</li> <li>2. Use function notation and evaluate functions.</li> <li>3. Find the domains and ranges of functions.</li> <li>4. Use functions to model and solve real-life problems.</li> <li>5. Evaluate difference quotients.</li> <li>6. Determine intervals on which functions are increasing, decreasing, or constant.</li> <li>7. Determine relative extrema of function.</li> <li>8. Identify and graph step functions and other piecemeal functions.</li> <li>9. Identify even and odd functions</li> </ol>	<p>Students will explore and practice concepts concerning transformations of functions with an interactive activity that checks for understanding of the effects of various types of shifts, scaling and reflections on graphs. Students are assessed for responses and given immediate feedback.</p> <p><b>Assessment:</b> Feedback from web-site and teacher-created tests</p>	<p><a href="http://people.hofstra.edu/stefan_waner/calctopic1/scaledgraph.html">http://people.hofstra.edu/stefan_waner/calctopic1/scaledgraph.html</a></p> <p>Parent functions video <a href="http://www.onlinemathlearning.com/parent-functions.html">http://www.onlinemathlearning.com/parent-functions.html</a></p> <p>various videos on functions <a href="http://www.onlinemathlearning.com/recalculus.html">http://www.onlinemathlearning.com/recalculus.html</a></p>

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<b>Essential Questions:</b> What are the common functions? What are translations? What is a combination function?				
Calendar	Strand/Standard/ Benchmark	Concepts/Skills (All Master)	Suggested Student Activities/Assessments	Resources/Materials
<b>1<sup>st</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p><b>FUNCTIONS AND GRAPHS</b></p> <p>C. Transformations of Graphs</p> <ol style="list-style-type: none"> <li>1. Recognize graphs of commons functions.</li> <li>2. Use horizontal and vertical shifts and reflections to graph functions .</li> <li>3. Use non rigid transformations to graph functions.</li> </ol> <p>D. Combinations of Functions</p> <ol style="list-style-type: none"> <li>1. Add, subtract, multiply, and divide functions.</li> <li>2. Find combinations of one function with another function.</li> <li>3. Use combinations of functions to model and solve real-life problems.</li> </ol>	<p>Students will use and interactive tutorial to understand even and odd functions graphically and analytically. Which graphs are symmetric with respect to y axis? Which graphs are symmetric with respect to the origin of the system of axes (0 , 0)? Students will then verify analytically that all even functions satisfy the condition <b><math>f(x) = f(-x)</math></b> and all odd functions satisfy the condition <b><math>f(x) = - f(-x)</math></b>.</p> <p><b>Assessment:</b> Peer evaluation and teacher-created tests</p>	<p><a href="http://www.analyzemath.com/function/even_odd.html">http://www.analyzemath.com/function/even_odd.html</a></p>

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<b>Essential Questions:</b> How can the derivative be used to describe velocity and acceleration? What are the rules for differentiating trig functions?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>1<sup>st</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p style="text-align: center;"><b>FUNCTIONS AND GRAPHS</b></p> <p>E. Inverse Functions</p> <ol style="list-style-type: none"> <li>1. Find inverse functions informally and verify that two functions are inverse functions of each other.</li> <li>2. Use graphs of functions to decide whether functions have inverse functions.</li> <li>3. Determine if functions are one-to-one.</li> <li>4. Find inverse functions algebraically.</li> </ol>	<p>Students will explore the principles and properties of inverse functions. In part I the definition and properties of inverse functions are reviewed. In part II, a large window applet helps students explore the inverse of one to one functions graphically. The exploration is carried out by changing parameters included in the functions. There is also a tutorial on finding inverse functions.</p> <p><b>Assessment:</b> Peer review and teacher-created tests</p>	<p><a href="http://www.analyze-math.com/inversefunction/inversefunction.html">http://www.analyze-math.com/inversefunction/inversefunction.html</a></p>

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<b>Essential Questions: What is a quadratic function? What does the equation and the graph of a quadratic look like?</b>				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>1<sup>st</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p><b>POLYNOMIAL AND RATIONAL FUNCTIONS</b></p> <p>A. Quadratic Functions</p> <ol style="list-style-type: none"> <li>1. Analyze graphs of quadratic function.</li> <li>2. Write quadratic functions in standard form and use the results to sketch graphs of functions.</li> <li>3. Find minimum and maximum values of functions in real-life applications.</li> </ol> <p>B. Higher Degree Polynomials</p> <ol style="list-style-type: none"> <li>1. Use transformations to sketch graphs of polynomial functions.</li> <li>2. Use the Leading Coefficient Test to determine the end behavior of graphs of polynomial functions.</li> <li>3. Find and use zeros of polynomial functions as sketching aids.</li> </ol>	<p>Students will work interactively with quadratic functions in standard form <math>f(x) = a(x - h)^2 + k</math> and the properties of their graphs such as vertex and x and y intercepts are explored, interactively, using an applet. Students will also practice changing from standard form to general form.</p> <p><b>Assessment:</b> Teacher-created tests</p>	<p><a href="http://www.anlyzemath.com/quadratics/quadratics.htm">http://www.anlyzemath.com/quadratics/quadratics.htm</a></p>

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<b>Essential Questions: What are zeros of polynomial functions? What are the ways to find them? What are complex numbers?</b>				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>1<sup>st</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p><b>POLYNOMIAL AND RATIONAL FUNCTIONS</b></p> <p>C. Zeros/Roots of Polynomial Functions</p> <ol style="list-style-type: none"> <li>1. Use long division to divide polynomials by other polynomials.</li> <li>2. Use synthetic division.</li> <li>3. Use the Remainder and Factor Theorems.</li> <li>4. Use the Rational Zero Test to find possible rational zeros of polynomial functions.</li> </ol> <p>D. Complex Numbers</p> <ol style="list-style-type: none"> <li>1. Use the imaginary unit <math>i</math> to Write complex numbers</li> <li>2. Add, subtract, and multiply Complex numbers</li> <li>3. Use complex conjugates to Write the quotient of two Complex numbers in Standard form</li> <li>4. Plot complex numbers in the Complex plane</li> </ol>	<p>Students will use the interactive site to obtain a visual representation of what a complex number is and will investigate the properties and operations used with complex numbers and the graphical meaning obtained from them. Students Will then research and analyze possible uses for complex numbers in real-life situations and applications and write a Schaffer paragraph about what they learn.</p> <p><b>Assessment:</b> Peer review and teacher-created tests</p>	<p><a href="http://www.cut-the-knot.org/Curriculum/Algebra/ComplexNumbers.shtml">http://www.cut-the-knot.org/Curriculum/Algebra/ComplexNumbers.shtml</a></p>

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<b>Essential Questions:</b>				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>1<sup>st</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p><b>POLYNOMIAL AND RATIONAL FUNCTIONS</b></p> <p>E. Fundamental Theorem of Algebra</p> <ol style="list-style-type: none"> <li>1. Use the FTA to determine the number of zeros of a polynomial function.</li> <li>2. Find all zeros of polynomial functions, including complex zeros.</li> <li>3. Find conjugate pairs of complex zeros.</li> <li>4. Find zeros of polynomials by factoring.</li> </ol> <p>F. Rational Functions and Asymptotes</p> <ol style="list-style-type: none"> <li>1. Find the domains of rational functions.</li> <li>2. Find horizontal and vertical asymptotes of graphs of rational functions.</li> <li>3. Use rational functions to model and solve real-life problems.</li> </ol>	<p>Rational functions and the properties of their graphs such as domain, vertical and horizontal asymptotes, x and y intercepts are explored using an applet. The investigation of these functions is carried out by changing parameters included in the formula of the function. Each parameter can be changed continuously which allows a better understanding of the properties of the graphs of these functions.</p> <p><b>Assessment:</b> Peer review and teacher-created tests</p>	<p><a href="http://www.analyze-math.com/rational/rational1.html">http://www.analyze-math.com/rational/rational1.html</a></p>

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<b>Essential Questions:</b> What are rational functions? What are slant asymptotes and when do they occur?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>1<sup>st</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p><b>POLYNOMIAL AND RATIONAL FUNCTIONS</b></p> <p><b>G. GRAPHS OF RATIONAL FUNCTIONS</b></p> <ol style="list-style-type: none"> <li>1. Analyze and sketch graphs of rational functions.</li> <li>2. Sketch graphs of rational functions that have slant asymptotes.</li> <li>3. Use rational functions to model and solve real-life problems.</li> </ol>	<p>Students will use the information and techniques learned to be able to sketch the graph of a rational function on the interactive graph applet. The steps used in graphing a rational function based on all the information gathered are given. Students will use their knowledge to plot information on the graph and then will be given feedback as to the correctness of their responses and be given the opportunity to correct errors.</p> <p><b>Assessment:</b> Teacher-created test</p>	<p><a href="http://colalg.math.csusb.edu/camdemo/rationals/src/Graph.html">http://colalg.math.csusb.edu/camdemo/rationals/src/Graph.html</a></p>

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<b>Essential Questions:</b> What are exponential functions? What is base $e$ ? What is a logarithm? What are logarithmic functions?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>1<sup>st</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p><b>EXPONENTIAL AND LOGARITHMIC FUNCTIONS</b></p> <p>A. Exponential Functions and Their Graphs</p> <ol style="list-style-type: none"> <li>1. Recognize and evaluate exponential functions with base <math>a</math>.</li> <li>2. Graph exponential functions.</li> <li>3. Recognize, evaluate, and graph exponential functions with base <math>e</math>.</li> <li>4. Use exponential functions to model and solve real-life problems.</li> </ol> <p>B. Logarithmic Functions and Their Graphs</p> <ol style="list-style-type: none"> <li>1. Recognize and evaluate logarithmic functions with base <math>a</math>.</li> <li>2. Graph logarithmic functions.</li> <li>3. Recognize, evaluate, and graph natural logarithmic functions.</li> <li>4. Use logarithmic functions to model and solve real-life problems.</li> </ol>	<p>Exponential functions are explored by students, interactively, using an applet. The properties such as domain, range, horizontal asymptotes, <math>x</math> and <math>y</math> intercepts are also investigated. The conditions under which an exponential function increases or decreases are also investigated. Sliders in the applet control panel are used to change parameters included in the definition of the exponential function which in this tutorial has the form</p> $f(x)=a*B^{b(x+c)} + d$ <p>The values of the coefficients <math>a</math>, <math>b</math>, <math>c</math>, <math>d</math>, and the base <math>B</math> may be changed continuously (small increments). This makes this interactive tutorial very helpful and leads to a deep understanding of the behavior of the graph of the exponential functions.</p> <p><b>Assessment:</b> Teacher-created tests</p>	<p><a href="http://www.analyze-math.com/expfunction/expfunction.html">http://www.analyze-math.com/expfunction/expfunction.html</a></p>

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<b>Essential Questions:</b> What is the relationship between exponentials and logarithms?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>1<sup>st</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p><b>EXPONENTIAL AND LOGARITHMIC FUNCTIONS</b></p> <p>C. Properties of Logarithms</p> <ol style="list-style-type: none"> <li>1. Rewrite logarithms with different bases.</li> <li>2. Use properties of logarithms to evaluate or rewrite logarithmic expressions.</li> <li>3. Use properties of logarithms to expand or condense logarithmic expressions.</li> <li>4. Use logarithmic functions to model and solve real-life problems.</li> </ol> <p>D. Solving Exponential and Logarithmic Equations</p> <ol style="list-style-type: none"> <li>1. Solve simple exponential and logarithmic equations.</li> <li>2. Solve more complicated exponential and logarithmic equations.</li> <li>3. Use exponential and logarithmic equations to model and solve real-life problems.</li> </ol>	<p>An interactive applet is used by students to explore logarithmic functions and the properties of their graphs such domain, range, x and y intercepts and vertical asymptote. Parameters included in the definition of the logarithmic function may be changed, using sliders, to investigate its properties. The continuous (small increments) changes of these parameters help in gaining a deep understanding of logarithmic functions. The function to be explored has the form <math>f(x) = a \cdot \log_b [ b(x+c) ] + d</math> where a, b, c and d are coefficients and B is the base of the logarithm.</p> <p><b>Assessment:</b> Peer interaction and teacher-created tests</p>	<p><a href="http://www.analyzemath.com/logfunction/logfunction.html">http://www.analyzemath.com/logfunction/logfunction.html</a></p>

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<b>Essential Questions:</b> What is degree measure? What is radian measure? What is the unit circle?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>2<sup>nd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p><b>TRIGONOMETRIC FUNCTIONS</b></p> <p>A. Radian and Degree Measure</p> <ol style="list-style-type: none"> <li>1. Describe angles and use degree and radian measure.</li> <li>2. Convert between degree and radian measure.</li> <li>3. Use angles to model and solve real-life problems.</li> </ol> <p>B. Trigonometric Functions: The Unit Circle</p> <ol style="list-style-type: none"> <li>1. Identify a unit circle and describe its relationship to real numbers.</li> <li>2. Evaluate trigonometric functions using the unit circle.</li> <li>3. Use domain and period to evaluate sine and cosine functions.</li> <li>4. Use a calculator to evaluate trigonometric functions.</li> </ol>	<p>Using the unit circle, students will be able to explore and gain deep understanding of some of the properties, such as domain, range, asymptotes (if any) of the trigonometric functions. The relationships between the graphs (in rectangular coordinates) of <math>\sin(x)</math>, <math>\cos(x)</math> and <math>\tan(x)</math> and the coordinates of a point on a unit circle are explored using an applet which will let students analyze the relationship between the two forms of the graph.</p> <p><b>Assessment:</b> Peer interaction as the applet is viewed, teacher-created test</p>	<p><a href="http://www.anlyzemath.com/unitcircle/unitcircle.html">http://www.anlyzemath.com/unitcircle/unitcircle.html</a></p>

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<b>Essential Questions:</b> What are the trigonometric functions? How does the unit circle relate to the graphs of sinusoids?				
Calendar	Strand/Standard/ Benchmark	Concepts/Skills (All Master)	Suggested Student Activities/Assessments	Resources/Materials
<b>2<sup>nd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum.	<p><b>TRIGONOMETRIC FUNCTIONS</b></p> <p>C. Right Triangle Trig</p> <ol style="list-style-type: none"> <li>1. Evaluate trig functions of Angles</li> <li>2. Use the fundamental trig Identities</li> <li>3. Use a calculator to evaluate Trig functions</li> <li>4. Use trig functions to model And solve real-life problems</li> </ol> <p>D. Trig Functions of Any Angle (Quadrants)</p> <ol style="list-style-type: none"> <li>1. Evaluate trig functions of Any angle in any quadrant</li> <li>2. Use reference angles to Evaluate trig functions</li> <li>3. Evaluate trig functions of real numbers</li> </ol>	<p>Students will be able to use the interactive unit circle applet to explore simultaneously the results of trig functions in each of the four quadrants. The included tutorial reviews the signs of the sine, cosine and tangent ratios in each of the four quadrants.</p> <p><b>Assessment:</b> Interactive mini-quiz included in site, teacher-created test</p>	<p><a href="http://www.intmath.com/Trigonometric-functions/5_Signs-of-trigonometric-functions.php">http://www.intmath.com/Trigonometric-functions/5_Signs-of-trigonometric-functions.php</a></p>

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<b>Essential Questions:</b> What are the characteristics of the various trigonometric graphs? What are inverse trig functions, how are they derived?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>2<sup>nd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p><b>TRIGONOMETRIC FUNCTIONS</b></p> <p>E. Graphs of Sine and Cosine Functions and Other Trig Functions</p> <ol style="list-style-type: none"> <li>1. Sketch graphs of basic sine And cosine functions</li> <li>2. Use amplitude and period To help sketch the graphs of Sine and cosine functions</li> <li>3. Sketch translations of sine And cosine functions</li> <li>4. Use sine and cosine functions To model real-life data</li> <li>5. Sketch the graphs of tangent, Cotangent, secant and Cosecant functions</li> </ol> <p>F. Inverse Trig Functions</p> <ol style="list-style-type: none"> <li>1. Evaluate inverse trig functions</li> <li>2. Evaluate compositions of Trig functions</li> </ol>	<p>In this lesson, students use uncooked spaghetti to transfer lengths from the unit circle to a function graph on large butcher paper. In the process, they discover the key features of sine and cosine graphs. The activity is presented for students working in degrees, but another version of the handouts is provided for students working in radians. This lesson is intended for students who have already explored unit circle trigonometry. In particular, students must understand the relationship between the coordinates of a point on the unit circle and the sine and cosine of its central angle in standard position.</p> <p><b>Assessment:</b> Assign a journal-writing task in which students explain the connection between the unit circle graph and the function graph, peer evaluation, teacher-created tests</p>	<p><a href="http://illuminations.nctm.org/LessonDetail.aspx?id=L785">http://illuminations.nctm.org/LessonDetail.aspx?id=L785</a></p>

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<b>Essential Questions:</b> What are the fundamental trig identities? What are the various techniques used in solving trig equations?				
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<b>2<sup>nd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p><b>ANALYTIC TRIGONOMETRY</b></p> <p><b>A. Using and Verifying Trig Identities</b></p> <ol style="list-style-type: none"> <li>1. Recognize and write the Fundamental trig identities</li> <li>2. Use the fundamental trig Identities to evaluate trig Functions, simplify trig Expressions, and rewrite Trig expressions</li> <li>3. Verify trig identities</li> </ol> <p><b>B. Solving Trig Equations</b></p> <ol style="list-style-type: none"> <li>1. Use standard algebraic Techniques to solve trig Equations</li> <li>2. Solve trig equations of Quadratic type</li> <li>3. Solve trig equations involving Multiple angles</li> <li>4. Use inverse trig functions to Solve trig equations</li> </ol>	<p>Students will use graphing to verify trigonometric identities, to demonstrate the ability to work with trigonometric identities and to be able to apply them when necessary. Students will create graphs to show that two trigonometric expressions are equivalent and then use their prior knowledge of simplifying expressions to prove that the expressions are equal. The students create pairs of equivalent trigonometric expressions, 'test' them by graphing and then prove using the fundamental identities. The students thereby obtain a visual understanding of the trigonometric equivalences.</p> <p><b>Assessment:</b> Peer review and evaluation</p>	<p><a href="http://www.saskschools.ca/curr_content/highmath/hsmath/strands/trigonometry/lesson_plans/c30/trigonometric_identities.htm">http://www.saskschools.ca/curr_content/highmath/hsmath/strands/trigonometry/lesson_plans/c30/trigonometric_identities.htm</a></p> <p>Graphing calculators</p>

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<b>Essential Questions:</b> What are the various formulas for evaluating trig functions? Why are they necessary?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>2<sup>nd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<b>ANALYTIC TRIGONOMETRY</b>  C. Sum and Difference Formulas and Multiple-Angle Formulas 1. Use sum and difference Formulas to evaluate trig Functions, verify identities, and Solve trig equations 2. Use multiple-angle formulas to Rewrite and evaluate trig Functions 3. Use half-angle and power-Reducing formulas to rewrite And evaluate trig functions	Interactive tutorials are provided that allow students to work independently or in small groups to practice concepts concerning sum and difference formulas and multiple-angle formulas. They are guided through the proofs for these and then are provided practice problems to work on interactively that will provide immediate feedback as they are worked.  <b>Assessment:</b> Peer interaction and review, teacher-created tests	<a href="http://www.intmath.com/analytic-trigonometry/2-sum-difference-angles.php">http://www.intmath.com/analytic-trigonometry/2-sum-difference-angles.php</a>  <a href="http://www.intmath.com/analytic-trigonometry/3-double-angle-formulas.php">http://www.intmath.com/analytic-trigonometry/3-double-angle-formulas.php</a>  <a href="http://www.intmath.com/analytic-trigonometry/4-half-angle-formulas.php">http://www.intmath.com/analytic-trigonometry/4-half-angle-formulas.php</a>

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<b>Subject:</b> Mathematics	<b>June 2010</b>	<b>Grade Level:</b>	Pre-Calculus
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<b>Essential Questions:</b> What is the Law of Sines used for and when can it be applied? For what situations is the Law of Cosines necessary?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>2<sup>nd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p><b>TRIGONOMETRY</b></p> <p>A. Law of Sines</p> <ol style="list-style-type: none"> <li>1. Use Law of Sines to solve Oblique triangles</li> <li>2. Find area of oblique triangles</li> <li>3. Use Law of Sines to model And solve real-life problems</li> </ol> <p>B. Law of Cosines</p> <ol style="list-style-type: none"> <li>1. Use Law of Cosines to solve Oblique triangles</li> <li>2. Use Law of Cosines to model And solve real-life problems</li> <li>3. Use Heron’s Formula to find Areas of triangles</li> </ol>	<p>This activity is designed to expand the students' knowledge of trigonometry using the Law of Sines and Law of Cosines. This lesson comes in three parts.</p> <ul style="list-style-type: none"> <li>• Part One: The students will construct a Triangle Trigonometry Tool to help them visualize the trigonometry laws.</li> <li>• Part Two: Students will examine the use of these laws by working in pairs using the attached worksheets.</li> <li>• Part Three: Students will reconstruct triangles of their own, trade those constructions with other student groups, then find the solutions. Students will check their solutions using a protractor and centimeter ruler as their measuring tools</li> </ul> <p><b>Assessment:</b> The worksheets may be corrected with the class as a whole, or individually as students use their measuring tools to correct their calculations. For the group activity, students can check each other's work, or students may check their own.</p>	<p><a href="http://www.uen.org/Lessonplan/preview.cgi?LPid=19845">http://www.uen.org/Lessonplan/preview.cgi?LPid=19845</a></p>

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<b>Essential Questions:</b> What are complex numbers? What information do the different forms of complex numbers contain?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>2<sup>nd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<b>TRIGONOMETRY</b> C. Trig form of a Complex Number <ol style="list-style-type: none"> <li>1. Find absolute values of complex numbers</li> <li>2. Write trig forms of complex numbers</li> <li>3. Multiply and divide complex numbers written in trig form</li> <li>4. Use DeMoivres Theorem to find powers of complex numbers</li> <li>5. Find <math>n^{\text{th}}</math> roots of complex numbers</li> </ol>	Students will use the interactive site to obtain a visual representation of what a complex number is and will investigate the properties and operations used with complex numbers and the graphical meaning obtained from them. Students Will then research and analyze possible uses for complex numbers in real-life situations and applications and write a Schaffer paragraph about what they learn.  <b>Assessment:</b> Peer review and teacher-created tests	<a href="http://www.cut-the-knot.org/Curriculum/Algebra/ComplexNumbers.shtml">http://www.cut-the-knot.org/Curriculum/Algebra/ComplexNumbers.shtml</a>



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<b>Essential Questions:</b> What is a matrix? What are matrices used for?				
Calendar	Strand/Standard/ Benchmark	Concepts/Skills (All Master)	Suggested Student Activities/Assessments	Resources/Materials
<b>3<sup>rd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p><b>LINEAR SYSTEMS AND MATRICES</b></p> <p style="margin-left: 40px;">B. Matrices and Systems of Equations</p> <ol style="list-style-type: none"> <li>1. Write matrices and identify their orders.</li> <li>2. Perform elementary row operations on matrices.</li> <li>3. Use matrices, Gaussian elimination to solve systems of linear equations.</li> </ol> <p style="margin-left: 40px;">C. Operations with Matrices</p> <ol style="list-style-type: none"> <li>1. Decide whether two matrices are equal.</li> <li>2. Add and subtract matrices and multiply matrices by a scalar.</li> <li>3. Multiply two matrices.</li> <li>4. Use matrix operations to model and solve real-life problems.</li> </ol>	<p>This is an introductory lesson on multiplying matrices. Students should <u>not</u> have been introduced to a procedure for multiplying matrices prior to this lesson. Students will organize data using matrices and use matrix multiplication to generate new data. The lesson is set in the real-life context of running an ice cream production business. In this lesson, students will organize information about running an ice cream production business into matrices. They will then explore ways to combine the data in the matrices to create new matrices that contain relevant information about their business. Students will share strategies for multiplying and organizing their data and recognize the need to standardize the process of multiplying matrices.</p> <p><b>Assessment:</b> Peer interaction and review; write a Schaffer paragraph analyzing and evaluating the uses of the matrices created.</p>	<p style="text-align: center;"><a href="http://www.uen.org/Lessonplan/preview.cgi?LPid=19849">http://www.uen.org/Lessonplan/preview.cgi?LPid=19849</a></p> <p style="text-align: center;">Graphing calculators</p>

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<b>Essential Questions:</b> What is Cramer's Rule used for?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>3<sup>rd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<b>LINEAR SYSTEMS AND MATRICES</b>  D. Determinant of a Square, Matrix, and Cramer's Rule <ol style="list-style-type: none"> <li>1. Find the determinant of 2x2 matrices</li> <li>2. Use Cramer's Rule to solve systems of linear equations</li> </ol>	Cramer's rule is a theorem in linear algebra, which gives the solution of a system of linear equations in terms of determinants. The website provides video tutorials, worksheets and word problems. Students will analyze the connections between solving systems of equations, matrices and Cramer's Rule and explore real-life applications.  <b>Assessment:</b> teacher-created tests, peer evaluation	<a href="http://tulyn.com/12th-grade-math/cramers-rule">http://tulyn.com/12th-grade-math/cramers-rule</a>

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<b>Essential Questions:</b> What are factorials? What is summation notation? What is an arithmetic sequence?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>3<sup>rd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p><b>SEQUENCES, SERIES, AND PROBABILITY</b></p> <p>A. Sequences and Series</p> <ol style="list-style-type: none"> <li>1. Use sequence notation to write the terms of sequences.</li> <li>2. Use factorial notation.</li> <li>3. Use summation notation to write sums.</li> <li>4. Find sums of infinite series.</li> <li>5. Use sequences and series to model real-life problems.</li> </ol> <p>B. Arithmetic Sequences and Partial Sums</p> <ol style="list-style-type: none"> <li>1. Recognize, write, and find the <math>n</math>th terms of arithmetic sequences.</li> <li>2. Find <math>n</math>th partial sums of arithmetic sequences.</li> <li>3. Use arithmetic sequences to model and solve real-life problems.</li> </ol>	<p>This lesson is designed to introduce students to the arithmetic and geometric sequences. Students will have been introduced to sequences, understand the terminology used with sequences, understand how to vary a sequence by changing the starting number, multiplier, and add-on values used to produce the sequence, be able to determine the starting values that should be used to produce a desired sequence. Students will use the computers to learn about sequences and to create their own sequences. There are worksheets provided for additional practice.</p> <p><b>Assessment:</b> Peer interaction and evaluation, teacher-created tests</p>	<p><b>Videos on sequences and series</b>  <a href="http://www.onlinemathlearning.com/prec calculus.html">http://www.onlinemathlearning.com/prec calculus.html</a></p> <p><a href="http://www.shodor.org/interactivate/lessons/IntroArithmetic/">http://www.shodor.org/interactivate/lessons/IntroArithmetic/</a></p>

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<b>Essential Questions:</b> What is a geometric sequence? What is a binomial? What is binomial expansion?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>3<sup>rd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p><b>SEQUENCES, SERIES, AND PROBABILITY</b></p> <p>C. Geometric Sequences and Series</p> <ol style="list-style-type: none"> <li>1. Recognize, write, and find the <math>n</math>th terms of geometric sequences</li> <li>2. Find <math>n</math>th partial sums of geometric sequences.</li> <li>3. Find sums of infinite geometric series.</li> <li>4. Use geometric sequences to model and solve real-life problems.</li> </ol> <p>D. Binomial Theorem (Pascal's Triangle)</p> <ol style="list-style-type: none"> <li>1. Use the Binomial Theorem and Pascal's Triangle to calculate binomial coefficients.</li> <li>2. Use binomial coefficients to write binomial expansions.</li> </ol>	<p>This lesson is designed to show students that patterns exist in the Pascal's Triangle, and to reinforce student's ability to identify patterns. Upon completion of this lesson, students will have been introduced to Pascal's Triangle and its patterns and have practiced identifying and determining patterns in Pascal's Triangle The applet can be used to explore patterns in large or small groups, worksheets are provided for further expansion of concepts.</p> <p><b>Assessment:</b> Take up the individual or group worksheets to evaluate for completion Bring the class together and have different groups or individuals share their result for a particular number with the rest of the class. Allow students who did not get to finish that number to sketch the result so that they will not lack some of the information needed for full understanding Have the students write a short paragraph explaining the type of patterns that they saw including the similarities between the different pictures, and the type of shapes that recurred in the pictures</p>	<p><b>Videos on probability</b> <a href="http://www.onlinemathlearning.com/precalculus.html">http://www.onlinemathlearning.com/precalculus.html</a></p> <p><a href="http://www.shodor.org/interactivate/lessons/PatternsInPascal/">http://www.shodor.org/interactivate/lessons/PatternsInPascal/</a></p>

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<b>Essential Questions:</b> What is a permutation? What is a combination? What is probability?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>3<sup>rd</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p><b>SEQUENCES, SERIES, AND PROBABILITY</b></p> <p>E. Counting Principles (Permutations and Combinations)</p> <ol style="list-style-type: none"> <li>1. Solve simple counting problems.</li> <li>2. Use the Fundamental Counting Principle to solve more complicated counting problems.</li> <li>3. Use permutations and combinations to solve counting problems.</li> </ol> <p>F. Probability</p> <ol style="list-style-type: none"> <li>1. Find probabilities of events.</li> <li>2. Find probabilities of mutually exclusive events.</li> <li>3. Find probabilities of independent events.</li> <li>4. Find probabilities of complements of events.</li> </ol>	<p>This activity allows the student's to evaluate probabilities to see the results of a fire on a virtual forest by setting parameters such as forest density and wind speed. This is a realistic simulation of actual forest fires, with controls for wind speed and direction to add more realism. More sophisticated versions of this simple simulation have been used with much success to model fire behavior and plan forest planting strategies. The behavior of this activity is chaotic, since we cannot predict in advance whether a particular tree is burned or not, and since small changes in the set probability and the location of the initial burning can radically alter the final state of the forest. However, general patterns in the burning of the trees can be seen for particular probabilities.</p> <p><b>Assessment:</b> This activity can be used to demonstrate randomness, motivate the ideas of chaos, and demonstrate the basic concepts of probability through peer interaction and review.</p>	<p><a href="http://www.shodor.org/interactivate/activities/ABetterFire/">http://www.shodor.org/interactivate/activities/ABetterFire/</a></p>

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<b>Essential Questions:</b> What are the conic sections? What are the characteristics of the different conics?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>4th Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p style="text-align: center;"><b>ANALYTIC GEOMETRY</b></p> <p>A. Conic Sections: Parabolas</p> <ol style="list-style-type: none"> <li>1. Recognize a conic as the intersection of a plane and a double-napped cone.</li> <li>2. Write equations of parabolas in standard form.</li> <li>3. Use the reflective property of parabolas to solve real-life problems.</li> </ol> <p>B. Ellipses</p> <ol style="list-style-type: none"> <li>1. Write equations of ellipses in standard form.</li> <li>2. Use properties of ellipses to model and solve real-life problems.</li> </ol>	<p>This activity allows the students to experiment with changing constants and coefficients in a conic section. This activity would work well in groups of two to four for about twenty-five to thirty minutes if one uses the <a href="http://www.shodor.org/interactivate/exploration/questions">exploration questions</a> and five minutes per function type otherwise. This activity can be used to experiment on the graph of a conic section by changing the coefficients and constants and visualize some of the possible cross sections of an infinite cone.</p> <p><b>Assessment:</b> Peer evaluation and teacher-created tests</p>	<p><a href="http://www.shodor.org/interactivate/activities/ConicFlyer/">http://www.shodor.org/interactivate/activities/ConicFlyer/</a></p>

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<b>Essential Questions:</b> What are the conic sections? What are the characteristics of the different conics?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>4<sup>th</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p>C. Hyperbolas</p> <ol style="list-style-type: none"> <li>1. Write equations of hyperbolas in standard form and find asymptotes.</li> <li>2. Use properties of hyperbolas to solve real-life problems.</li> <li>3. Classify conics from their general equations</li> </ol>	<p>The activity that is presented here offers an opportunity to explore the properties of Parabolas, Ellipses and Hyperbolas through a geometric perspective within the browser window. This provides an animated view of the conic sections which is much better able to illustrate concepts of focus, directrix, etc. as applied to the conics. Students use the applet to create the conics desired and analyze and evaluate their properties.</p> <p><b>Assessment:</b> Peer review and interactive evaluation, teacher-created tests</p> <p style="text-align: center;">:</p>	<p><a href="http://mste.illinois.edu/dildine/sketches/parabola.htm">http://mste.illinois.edu/dildine/sketches/parabola.htm</a></p>

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<b>Essential Questions:</b> What are polar coordinates? What are the forms?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>4<sup>th</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p>C. Polar Coordinates</p> <ol style="list-style-type: none"> <li>1. Plot points and find multiple representations of points in the polar coordinate system.</li> <li>2. Convert points from rectangular to polar form and vice versa.</li> </ol>	<p>This is a tutorial on graphing polar equations by hand, or sketching, to help students gain deep understanding of these equations. Several examples with detailed solutions are presented. Points in polar coordinates are represented by <math>(R, t)</math> where <math>R</math> is the polar distance and <math>t</math> is the polar angle. The method of point-by-point is used here.</p> <p><b>Assessment:</b> Peer group interaction and review, and teacher-created tests</p>	<p><a href="http://www.anlyzemath.com/polarcoordinates/graphing_polar_equations.html">http://www.anlyzemath.com/polarcoordinates/graphing_polar_equations.html</a></p>

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<b>Essential Questions:</b> What is a limit? What can a limit be used to describe?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>4<sup>th</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p><b>LIMITS AND INTRO TO CALCULUS</b></p> <p>A. Limits and Evaluating Limits</p> <ol style="list-style-type: none"> <li>1. Use the definition of a limit to estimate limits.</li> <li>2. Determine whether limits of functions exist.</li> <li>3. Use properties of limits and direct substitution to evaluate limits.</li> <li>4. Use the dividing out technique to find limits of functions.</li> <li>5. Use the rationalizing technique to find limits of functions.</li> <li>6. Approximate limits of functions graphically and numerically.</li> <li>7. Evaluate one-sided limits.</li> <li>8. Evaluate limits of difference quotients from calculus.</li> </ol>	<p>In this activity, students' will investigate, both graphically and numerically, the limit of a function at a point. They will examine how a function behaves as the input approaches a particular value. They will estimate limits from graphs and tables of values which will allow them to analyze and evaluate behavior of the functions examined.</p> <p><b>Assessment:</b> Teacher-created tests and peer evaluation</p>	<p><a href="http://education.ti.com/educationportal/activityexchange/activity_detail.do?cid=us&amp;activityid=5579">http://education.ti.com/educationportal/activityexchange/activity_detail.do?cid=us&amp;activityid=5579</a></p>

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<b>Essential Questions:</b> What can a limit describe?				
Calendar	Strand/Standard/ Benchmark	Concepts/Skills (All Master)	Suggested Student Activities/Assessments	Resources/Materials
<b>4<sup>th</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p><b>LIMITS AND INTRO TO CALCULUS</b></p> <p style="margin-left: 20px;">B. Tangent Line Problems</p> <ol style="list-style-type: none"> <li>1. Use a tangent line to approximate the slope of a graph at a point.</li> <li>2. Use the limit definition of slope to find exact slopes of graphs.</li> <li>3. Find derivatives of functions and use derivatives to find slopes of graphs.</li> </ol> <p style="margin-left: 20px;">C. Limits at Infinity and Limits of Sequences</p> <ol style="list-style-type: none"> <li>1. Evaluate limits of functions at infinity.</li> <li>2. Find limits of sequences.</li> </ol>	<p>Students will use the interactive applet to explore the relationship between the secant and tangent line and the role of the tangent line in finding slope of a function. They will achieve a visual understanding of the meaning of the tangent line and slope of a function which will allow them to analyze and evaluate behavior of functions.</p> <p><b>Assessment:</b> Peer interaction and review.</p>	<p><a href="http://higheredbcs.wiley.com/legacy/college/salas/0470073330/calc_applets/figure3_1_1/secanttangentexploration.htm">http://higheredbcs.wiley.com/legacy/college/salas/0470073330/calc_applets/figure3_1_1/secanttangentexploration.htm</a></p>

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<b>Essential Questions:</b> What can limits be used for?				
<b>Calendar</b>	<b>Strand/Standard/ Benchmark</b>	<b>Concepts/Skills (All Master)</b>	<b>Suggested Student Activities/Assessments</b>	<b>Resources/Materials</b>
<b>4<sup>th</sup> Nine Weeks</b>	There are no standards for Pre-Calculus in the NM_S&MB. This course will follow the College Board suggested curriculum	<p style="text-align: center;"><b>LIMITS AND INTRO TO CALCULUS</b></p> <p style="margin-left: 40px;">D. The Area Problem</p> <ol style="list-style-type: none"> <li>1. Find limits of summations.</li> <li>2. Use rectangles to approximate areas of plane regions.</li> <li>3. Use limits of summations to find areas of plane regions.</li> </ol>	<p>Area-under-a-curve tutorials will provide students with a very fast and concise understanding of how area is approximated through summation of rectangle areas. They will then be able to create graphs of functions and calculate area of increasing numbers of rectangles on a chosen interval.</p> <p><b>Assessment:</b> Peer evaluation and teacher-created tests</p>	<p><a href="http://www.screencast.com/users/kopsasd/folders/Jing/media/1148d629-03bd-462e-a23f-a6876499d017">http://www.screencast.com/users/kopsasd/folders/Jing/media/1148d629-03bd-462e-a23f-a6876499d017</a></p> <p><a href="http://www.screencast.com/users/kopsasd/folders/Jing/media/e5fbf243-ee5e-44b2-96a1-4784c3491908">http://www.screencast.com/users/kopsasd/folders/Jing/media/e5fbf243-ee5e-44b2-96a1-4784c3491908</a></p>

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for Pre-Calculus

[www.themathteacher.org](http://www.themathteacher.org) A website featuring activities, math humor, and a few other resources for math teachers.

<http://www.kutasoftware.com/freeia2.html> Free math worksheets

[www.edhelper.com](http://www.edhelper.com) Free printable worksheets for math

[www.blc.edu/fac/rbuelow/common/glossarya-m.htm](http://www.blc.edu/fac/rbuelow/common/glossarya-m.htm) Mathematical glossary for upper level courses (A-M)

[www.blc.edu/fac/rbuelow/common/glossaryn-z.htm](http://www.blc.edu/fac/rbuelow/common/glossaryn-z.htm) Mathematical glossary for upper level courses (N-Z)

<http://sites.google.com/site/danielkopsas/home/pre-calculus> Extensive Library of Pre-Calculus tutorials.

<http://www.ct4me.net/index.htm> Math resources include links to sites for basic skills mastery, problem solving and critical thinking, using data, homework assistance, games, simulations, virtual math manipulatives, project-based learning, field trips for math, standardized testing, and more.