

## Mathematics Curriculum

### Strand: I – Patterns, Relationships and Functions

### Advanced Algebra

<b>Standard</b>	<b>1. Students recognize similarities and generalize patterns, use patterns to create models and make predictions, describe the nature of patterns and relationships, and construct representations of mathematical relationships.</b>
<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Study patterns in geometric and arithmetic sequences and be able to express these in explicit and recursive formulas.</li><li>• Use matrices to arrange information, see patterns and manipulate this information.</li><li>• Be able to graph data and use tables to recognize patterns relating to linear, quadratic and exponential functions.</li><li>• Study direct and inverse variations and the resulting graphs in the first and second degree. Also study the translations of these graphs.</li><li>• Solve problems using graphs such as the inequalities involved in linear programming.</li></ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"><li>• Explore and create geometric patterns similar to those found in fractals like the Sierpinski carpet or Koch snowflake. (See I, 2 H1)</li><li>• Group students by handing out note cards with three representations of the same pattern (numerical, geophysical, symbolic). (See I, 1, H2)</li></ul>
<b>Resources</b>	<ul style="list-style-type: none"><li>• Technology Support – TI-83 Plus calculator.</li></ul>

## Mathematics Curriculum

**Strand: I – Patterns, Relationships and Functions**

**Advanced Algebra**

<b>Standard</b>	2. Students describe the relationships among variables, predict what will happen to one variable as another variable is changed, analyze natural variation and sources of variability, and compare patterns of change.
<b>Benchmarks</b>	<ul style="list-style-type: none"> <li>• Study the Fundamental Theorem of Variation as related to direct variation and inverse variation.</li> <li>• Develop the concept of range and domain as it applies to functions. The functions can be grouped by whether they are direct, inverse, and their degree. Exponential functions are also studied.</li> <li>• Expand their understanding of function to include non-linear functions, composition of functions (including rotation) inverses of functions, and piecewise and recursively-defined functions.</li> <li>• Use matrices to solve systems of equations.</li> <li>• Analyze the ratios of sides of right triangles and relate this to trigonometric functions.</li> <li>• Increase the use of various functions to solve and model mathematical situations (e.g. using matrices to solve systems of equations).</li> </ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"> <li>• Use of the TI-83 Plus calculator to graph functions, compare tables, and solve problems involving matrices.</li> </ul>
<b>Resources</b>	<ul style="list-style-type: none"> <li>• Technology Support – TI-83 Plus calculator.</li> </ul>

## Mathematics Curriculum

**Strand: II – Geometry and Measurement**

**Advanced Algebra**

<b>Standard</b>	<b>1. Students develop spatial sense, use shape as an analytic and descriptive tool, identify characteristics and define shapes, identify properties and describe relationships among shapes.</b>
<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Use graphs to identify functions. Relate transformed functions to the parent graph.</li><li>• Use coordinate mapping in the study of transformation matrices.</li><li>• Compare graphs for points of intersection.</li><li>• Use algebra to solve for missing sides and angles or algebraically represent the missing sides and angles in real life problems involving shapes.</li></ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"><li>• Use graphing calculator to find appropriate function for data.</li></ul>
<b>Resources</b>	

## Mathematics Curriculum

**Strand: II – Geometry and Measurement**

**Advanced Algebra**

<b>Standard</b>	<b>2. Students identify locations of objects, identify location relative to other objects, and describe the effects of transformations on an object.</b>
<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Describe location of objects especially parabolas and important points relative to that description (vertex, y-intercept, maximum, minimum).</li><li>• Use symmetry and translation to describe parent functions and images. Use asymptotes to describe a function location on the coordinate system.</li><li>• Study how transformations especially translations, change the position of the graph and the equation representing that graph. Use matrices to help perform transformations.</li><li>• Use the locus of a point to describe a circle. Use the locus of a point to describe a parabola.</li></ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"><li>• Use the graphing calculator to show patterns for transformation matrices.</li><li>• Use the overhead and acetate sheets to illustrate translations of parent graphs.</li></ul>
<b>Resources</b>	

## Mathematics Curriculum

<b>Strand: II – Geometry and Measurement</b>	<b>Advanced Algebra</b>
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<b>Standard</b>	3. Students compare attributes of two objects, or of one object with a standard, and analyze situations to determine what measurements should be made and to what level of precision.
<b>Benchmarks</b>	<ul style="list-style-type: none"> <li>• Measure angles in degrees and radians and be able to change from one unit to the other. Use units that involve decibels, Richter scale, pH which involve logarithmic scales.</li> <li>• Solve real life problems involving percent of error. Use appropriate degree of accuracy in solution.</li> <li>• Study the Fundamental Theorem of Change that explains how changes in one measure may effect changes in other measures.</li> <li>• Understand and identify the trigonometric ratios as relating to the right triangle. Use the Law of Sines and Law of Cosines to find the length of sides and measure of angles.</li> <li>• Solve problems in real life with trigonometric functions.</li> </ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"> <li>• Use Cabri program to show the relation between degrees and radians.</li> </ul>
<b>Resources</b>	<ul style="list-style-type: none"> <li>• Cabri – geometry software for the computer.</li> <li>• Video – ESPN Sports Figures make math and physics a ball. #5 – The Trigonometry of Soccer.</li> </ul>



## Mathematics Curriculum

**Strand: III – Data Analysis and Statistics**

**Advanced Algebra**

<b>Standard</b>	1. Students collect and explore data, organize data into a useful form, and develop skill in representing and reading data displayed in different formats.
<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Collect data. Explore data.</li><li>• Organize data and represent it in graphs and tables. The line of best fit and the quadratic equation of best fit will be calculated and used to make predictions.</li></ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"><li>• Enter data on calculator, plot the data, determine the degree of polynomial, and find the equation for the polynomial. Graphs could also be exponential.</li></ul>
<b>Resources</b>	<ul style="list-style-type: none"><li>• TI – 83 Plus calculator.</li></ul>

## Mathematics Curriculum

**Strand: III – Data Analysis and Statistics**

**Advanced Algebra**

<b>Standard</b>	<b>2. Students examine data and describe characteristics of a distribution, relate data to the situation from which they arose, and use data to answer questions convincingly and persuasively.</b>
<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Read data from tables, charts and graphs.</li><li>• Describe the shape of the data as to linear, quadratic or an inverse variation. Use the correlation coefficient as found on the calculator to evaluate the accuracy of the line of best fit.</li><li>• Use the data and their characteristics to draw and support conclusions.</li></ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"><li>• Calculator activities.</li></ul>
<b>Resources</b>	<ul style="list-style-type: none"><li>• TI – 83 Plus calculator.</li></ul>

## Mathematics Curriculum

<b>Strand: IV – Number Sense and Numeration</b>	<b>Advanced Algebra</b>
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<b>Standard</b>	2. Students recognize that numbers are used in different ways such as counting, measuring, ordering and estimating, understand and produce multiple representations of a number, and translate among equivalent representations.
<b>Benchmarks</b>	<ul style="list-style-type: none"> <li>• Give decimal representations of rational and irrational numbers.</li> <li>• Develop an understanding of exponential and logarithmic expressions.</li> <li>• Determine when to use rational approximations and the exact values such as <math>\pi</math> and the irrationals.</li> <li>• Apply estimation to increasing complex situations. Use estimation to check the reasonableness of solutions.</li> <li>• Use rational and irrational numbers to solve problems.</li> </ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"> <li>• Do an experiment with licorice. A licorice stick is marked on a graph. The stick is then <math>\frac{1}{2}</math> eaten and marked again. Continue this process until you have a representation of an exponential graph.</li> <li>• Do an experiment with M&amp;M's. Count the original number and graph. Toss them on the table and eat the ones with M showing. Graph that number. Continue this process until you have an exponential graph.</li> </ul>
<b>Resources</b>	



## Mathematics Curriculum

**Strand: IV – Number Sense and Numeration**

**Advanced Algebra**

<b>Standard</b>	1. Students experience counting and measuring activities to develop intuitive sense about numbers, develop understanding about properties of numbers, understand the need for and existence of different sets of numbers, and investigate properties of special numbers.
<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Develop an understanding of irrational, real and complex numbers.</li><li>• Use the “<math>a + bi</math>” form of complex numbers.</li><li>• Understand <math>i</math> as special numbers. Learn their properties and conjugates.</li><li>• Apply understanding to solve problems. Understand why some solutions are non-real.</li></ul>
<b>Sample Activity/Assessment tasks</b>	
<b>Resources</b>	



## Mathematics Curriculum

**Strand: IV – Number Sense and Numeration**

**Advanced Algebra**

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<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Give decimal representations of rational and irrational numbers.</li><li>• Develop an understanding of exponential and logarithmic expressions.</li><li>• Determine when to use rational approximations and the exact values such as and the irrationals.</li><li>• Apply estimation to increasing complex situations. Use estimation to check the reasonableness of solutions.</li><li>• Use rational and irrational numbers to solve problems.</li></ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"><li>• Do an experiment with licorice. A licorice stick is marked on a graph. The stick is then <math>\frac{1}{2}</math> eaten and marked again. Continue this process until you have a representation of an exponential graph.</li><li>• Do an experiment with M&amp;M's. Count the original number and graph. Toss them on the table and eat the ones with M showing. Graph that number. Continue this process until you have an exponential graph.</li></ul>
<b>Resources</b>	



## Mathematics Curriculum

**Strand: IV – Number Sense and Numeration**

**Advanced Algebra**

<b>Standard</b>	<b>3. Students investigate relationships such as equality, inequality, inverses, factors and multiples, and represent and compare very large and very small numbers.</b>
<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Compare and order real numbers and compare rational approximations to exact values.</li><li>• Use ratios and rates for comparisons especially in the trigonometric unit.</li><li>• Use factors to simplify expressions.</li><li>• Study the rational exponents and their relationship to radicals.</li><li>• Use irrational exponential and logarithmic forms of numbers to solve real life problems.</li></ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"><li>• Graph <math>xx</math> on your calculator for <math>x</math> values <math>-5</math> to <math>5</math>. Set the window so a trace will have terminating decimals for <math>x</math>-values such as <math>-4.7</math>, <math>-4.6</math> etc. (Zoom decimal will do this on some calculators.) You should see a continuous part for <math>x &gt; 0</math> and a discrete part for <math>x &lt; 0</math>. Explain.</li></ul>
<b>Resources</b>	

## Mathematics Curriculum

### Strand: V – Numerical and Algebraic Operations and Analytical Thinking      Advanced Algebra

<b>Standard</b>	1. Students understand and use various types of operations to solve problems.
<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Use geometric area to represent binomial multiplication.</li><li>• Compute with 2 or 3 digit real numbers and two digit complex numbers with paper and pencil. Perform operations on 2x2 matrices and exponential expressions with the same base. Use a calculator on real numbers, matrices and exponential expressions of a more complex form.</li><li>• Describe the properties of operations such as closure, associative, commutative, distributive, inverse and identity. Understand that in matrices not all of the properties apply.</li><li>• Recognize how to use these properties of operations to help solve and represent solutions to real problems.</li></ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"><li>• Use the graphing calculator to see symbolic models for algebraic expressions.</li></ul>
<b>Resources</b>	

## Mathematics Curriculum

### Strand: V – Numerical and Algebraic Operations and Analytical Thinking      Advanced Algebra

<b>Standard</b>	2. Students analyze problems to determine an appropriate process for solution, and use algebraic notations to model or represent problems.
<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Read a problem, identify the variables, and correctly represent the relationship between them algebraically.</li><li>• Move between different representations such as tables, graphs, diagrams and matrices.</li><li>• Solve linear equations, non-linear equations, inequalities and systems of equations. Simple linear equations and systems should be solved with pencil and paper but in more complicated equations and systems the correct technology should be used.</li><li>• Analyze a problem, model the problem with a function and evaluate whether the solution (including the units used) is a reasonable solution.</li><li>• Examine problems that have real-life applications.</li></ul>
<b>Sample Activity/Assessment tasks</b>	<ul style="list-style-type: none"><li>• Discuss the advantages of using different representations.</li><li>• Use matrices to represent a system of linear equations.</li><li>• Use table making, graphing/tracing, zooming, and equation solving capabilities of technology to assist in solving algebraic problems.</li></ul>
<b>Resources</b>	

## Mathematics Curriculum

**Strand: VI – Probability and Discrete Mathematics**

**Advanced Algebra**

<b>Standard</b>	1. Students develop an understanding of the notion of certainty and of probability as a measure of the degree of likelihood that can be assigned to a given event based on the knowledge available, and make critical judgments about claims that are made in probabilistic situations.
<b>Benchmarks</b>	<i>These benchmarks taught in Functions, Statistics and Trigonometry.</i>
<b>Sample Activity/Assessment tasks</b>	
<b>Resources</b>	

## Mathematics Curriculum

**Strand: VI – Probability and Discrete Mathematics**

**Advanced Algebra**

<b>Standard</b>	2. Students investigate practical situations such as scheduling, routing, sequencing, networking, organizing and classifying, and analyze ideas like recurrence relations, induction, iteration, and algorithm design.
<b>Benchmarks</b>	<ul style="list-style-type: none"><li>• Use sets to describe number sets. These are related to each other in Venn diagrams.</li></ul>
<b>Sample Activity/Assessment tasks</b>	
<b>Resources</b>	