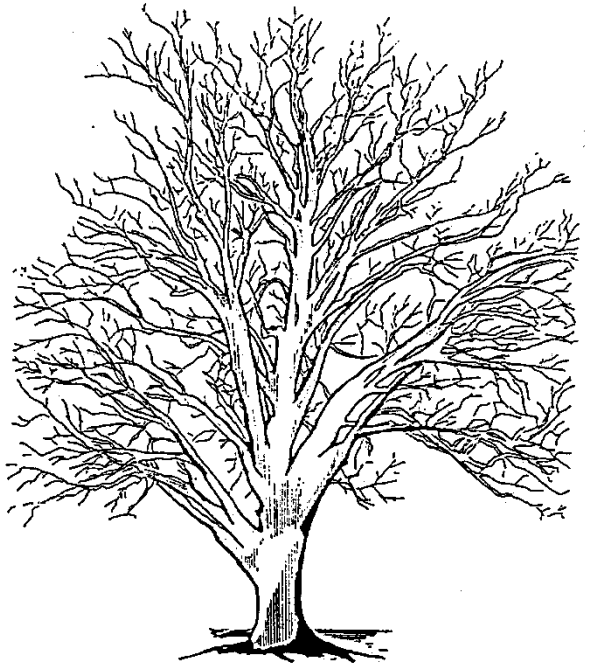
Monroe Township Schools



Curriculum Management System

Algebra II

Grade 11

August 2010

*** For adoption by all regular education programs as specified and for adoption or adaptation by all Special Education Programs in accordance with Board of Education Policy # 2220.**

Board Approved:

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Acknowledgments

The following individuals are acknowledged for their assistance in the preparation of this Curriculum Management System:

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Monroe Township Schools

Vision, Mission, and Goals

Vision Statement

The Monroe Township Board of Education commits itself to all children by preparing them to reach their full potential and to function in a global society through a preeminent education.

Mission Statement

The Monroe Public Schools in collaboration with the members of the community shall ensure that all children receive an exemplary education by well trained committed staff in a safe and orderly environment.

Goals

Raise achievement for all students paying particular attention to disparities between subgroups.

Systematically collect, analyze, and evaluate available data to inform all decisions.

Improve business efficiencies where possible to reduce overall operating costs.

Provide support programs for students across the continuum of academic achievement with an emphasis on those who are in the middle.

Provide early interventions for all students who are at risk of not reaching their full potential.

INTRODUCTION, PHILOSOPHY OF EDUCATION, AND EDUCATIONAL GOALS

Philosophy

Monroe Township Schools are committed to providing all students with a quality education resulting in life-long learners who can succeed in a global society. The mathematics program, grades K-12, is predicted on that belief and is guided by the following six principals as stated by the National Council of Teachers of Mathematics (NCTM) in the *Principles and Standards for School Mathematics, 2000.* First, mathematics education requires equity. All students will be given worthwhile opportunities and strong support to meet high mathematical expectations. Second, a coherent mathematics curriculum will effectively organize, integrate, and articulate important mathematical ideas across the grades. Third, effective mathematics teaching requires the following: a) knowing and understanding mathematics, students as learners, and pedagogical strategies, b) having a challenging and supportive classroom environment and c) continually reflecting on and refining instructional practice. Fourth, students must learn mathematics with understanding. A student's prior experiences and knowledge will actively build new knowledge. Fifth, assessment should support the learning of important mathematics and provide useful information to both teachers and students. Lastly, technology enhances mathematics learning, supports effective mathematics teaching, and influences what mathematics is taught.

As students begin their mathematics education in Monroe Township, classroom instruction will reflect the best thinking of the day. Children will engage in a wide variety of learning activities designed to develop their ability to reason and solve complex problems. Calculators, computers, manipulatives, technology, and the Internet will be used as tools to enhance learning and assist in problem solving. Group work, projects, literature, and interdisciplinary activities will make mathematics more meaningful and aid understanding. Classroom instruction will be designed to meet the learning needs of all children and will reflect a variety of learning styles.

In this changing world those who have a good understanding of mathematics will have many opportunities and doors open to them throughout their lives. Mathematics is not for the select few but rather is for everyone. Monroe township Schools are committed to providing all students with the opportunity and the support necessary to learn significant mathematics with depth and understanding. This curriculum guide is designed to be a resource for staff members and to provide guidance in the planning, delivery, and assessment of mathematics instruction.

Educational Goals

Algebra II is the third course of the college preparatory sequence. It is designed to provide a more in-depth analysis of the real world system and extend the process of algebra introduced in the Algebra 1 course. Topics included are; mathematical models, functions, permutations and combinations, linear functions, equations and inequalities, matrices, system of linear equations and inequalities, quadratic equations and functions, roots and powers, irrational and complex numbers, polynomials and polynomial functions, exponential functions, logarithmic functions, and conic sections.

A note about Common Core State Standards for Mathematics

The Common Core State Standards for Mathematics were adopted by the state of New Jersey in 2010. The standards referenced in this curriculum guide refer to these new standards and may be found in the Curriculum folder on the district servers. A complete copy of the new Common Core State Standards for Mathematics and the end of year algebra 1 test content standards may also be found at:

http://www.corestandards.org/the-standards
http://www.achieve.org/AlgebraITestOverview

Algebra II

Scope and Sequence

<table>
<tr><th colspan="2">Quarter I- Relationships</th></tr>
<tr><td>Big Idea: Relationships
I. Linear Functions and their Graphs
a. Represent, analyze, and interpret relations and functions.
b. Graph linear functions using various methods.
c. Write equations of lines.
d. Determine correlation and line of best fit.
e. Represent linear inequalities with two unknowns graphically.
f. Evaluate and graph piecewise functions.
g. Solve absolute value equations and represent absolute value functions graphically.</td><td>Big Idea: Relationships
II. Systems of Linear Equations and Inequalities.
a. Solve systems of equations with two unknowns by graphing and algebraic methods.
b. Build a function that models a relationship between two quantities.
c. Graph, build, and solve systems of inequalities with two unknowns.
d. Solve linear programming problems.
e. Solve systems of equations with three unknowns.</td></tr>
<tr><td>Big Idea: Relationships
III. Quadratic Functions and their Graphs
a. Graph quadratic functions in various forms (standard, vertex, and intercept).
b. Write quadratic expressions in equivalent forms to solve problems.
c. Solve quadratic equations by factoring.
d. Solve quadratic equations by finding the square roots (real number solutions).
e. Solve quadratic equations by completing the square and the quadratic formula (real number solutions).
f. Use the discriminant to determine the number of solutions for quadratic equations.
g. Graph and solve quadratic inequalities with two unknowns.
h. Build a quadratic function for given information.</td><td></td></tr>
<tr><th colspan="2">Quarter II- Modeling, Representation, and Relationships</th></tr>
<tr><td>Big Idea: Modeling and Representation
IV. The Complex Number System
a. Classify and describe numbers as rational or irrational, real or imaginary.
b. Perform arithmetic operations with complex numbers.
c. Determine the absolute value of complex numbers and represent graphically.
d. Represent complex numbers on the complex plane.
e. Solve quadratic equations involving complex numbers, by finding the square roots, the quadratic formula or completing the square.</td><td>Big Idea: Relationships
V. Polynomial Functions.
a. Simplify polynomial expressions using the properties of exponents.
b. Perform operations on polynomial functions (add, subtract, multiply).
c. Identify and evaluate polynomial functions using various methods (synthetic substitution, synthetic division, polynomial long division).
d. Graph polynomial functions using end behavior.
e. Solve polynomial equations by factoring.
f. Determine the zeros of polynomial functions by using the relationship between zeros and factors of polynomials.
g. Analyze the graphs of polynomial functions.</td></tr>
</table>

Big Idea: Modeling and Representation VI. Powers, Roots, and Radicals. a. Extend the properties of exponents to rational exponents. b. Simplify and perform operations on numerical expressions containing radicals and rational exponents. c. Determine the nth roots of functions. d. Perform operations on functions. e. Determine the inverse of functions. f. Graph functions with various roots. g. Solve equations that contain radicals and rational exponents.	

Quarter III- Relationships	
Big Idea: Relationships VII. Exponential and Logarithmic Functions. a. Interpret, analyze, and graph exponential functions (with and without base e). b. Evaluate and graph logarithmic functions c. Utilize the properties of logarithms and exponents to solve equations. d. Recognize, express, and solve problems that can be modeled using exponential functions (with and without logarithms). e. Construct and compare linear, quadratic and exponential models	**Big Idea: Relationships** VIII. Rational Functions. a. Construct and use inverse and joint variation models. b. Represent simple and general rational functions graphically. c. Simplify, multiply and divide rational expressions. d. Perform operations on complex fractions (add, subtract). e. Rewrite rational functions. f. Solve rational equations.
Big Idea: Relationships IX. Conic Sections. a. Graph and write equations of parabolas, circles, ellipses, and hyperboles in standard form. b. Graph and write equations of translated conics. c. Determine the solution for a system of quadratic equations.	
Quarter IV- Modeling, Representation, and Data Analysis	
Big Idea: Modeling and Representation X. Matrices and Determinants. a. Represent and model quantities using matrices. b. Perform operations on matrices (add, subtract, and multiply). c. Find the determinant of a square matrix. d. Solve systems using matrices.	**Big Idea: Data Analysis** XI. Probability and Statistics. a. Summarize and interpret data using the fundamental counting principle, permutations, and combinations. b. Compute probabilities of compound events. c. Determine the probability of independent and conditional (dependent) events. d. Calculate expected values of collections of outcomes.
Big Idea: Modeling and Representation XII. Sequences and Series. a. Construct the rule for a given sequence of numbers (arithmetic and geometric sequences and series). b. Determine the sum of arithmetic and geometric sequences and series (finite and infinite). c. Use sequences and series to model real life quantities.	

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Linear Functions and their Graphs** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 1: The student will be able to analyze, describe, and graph linear functions in two variables.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
7 days total	1.1 Represent, analyze, and interpret relations and functions.(F-IF:1, F-IF:2) 1.2< Graph linear functions using various methods.(F-IF:4, F-IF:7a) 1.3< Write equations of lines.(A-CED:1) 1.4< Determine correlation and line of best fit.(F-IF:4, F-IF:6, S-ID:6a, S-ID:6b, S-ID:6c, S-ID:7) 1.5< Represent linear inequalities with two unknowns graphically.(A-REI:12) 1.6< Evaluate and graph piecewise functions. (F-IF:7b) 1.7< Solve absolute value equations and represent absolute value functions graphically. (F-IF:7b, F-IF:5)	**Essential Questions:** • How do you describe the relationship of a linear function given its graph? • How do the slope, the points on a line, and the intercepts relate to each other? • Using a linear relationship in science, which graphing method is most appropriate to model the situation? • What are the similarities and/ or differences between linear functions, piecewise functions, and absolute value functions? **Enduring Understandings:** • There are many different ways to manipulate a linear equation and to graph a relationship between two variables. This models many relationships in the real world. • Some relationships are linear in nature, but are better described in pieces based on the domain of a function.	**NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** **Learning Activities:** • Discovery activity where students will determine which graphs of relations are or are not functions (use the Algebra II Resource Book McDougal Littell, © 2001, Visual Approach Lesson Opener pg. 12 as a guide). • Hands on activities incorporating graphing calculator technology which can be done in a cooperative learning format (pair or small group is best): 1. Use the table feature of the graphing calculator to solve equations (see Algebra II McDougal Littell, © 2004, pg. 25 as a guide)

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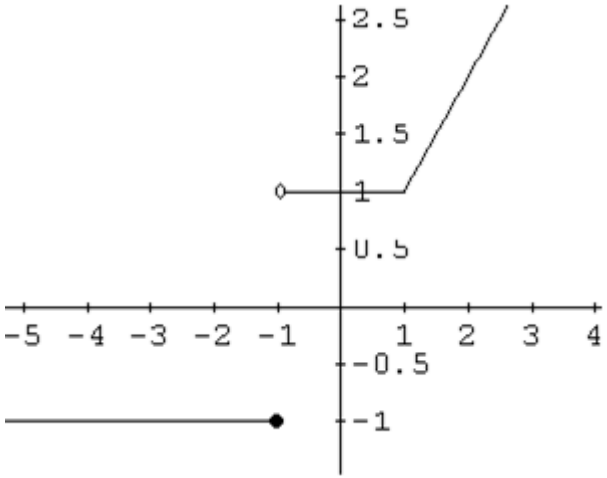
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		Sample Conceptual Understandings: • What is the solution set of $\lvert x-1\rvert = 2x+3$? Is it the same as the solution set of $x-1=2x+3$? Why or why not? Explain your reasoning. • **Consider the function below:**  	2. Analyzing graphs of lines. Students will work in pairs. One student will graph a linear function on the graphing calculator and the other will use the graph to determine the equation. Using the derived equation, students will both graph the line for the equation by hand, using a method of their choice, and analyze if this graphed line is the same as the line that was graphed on the graphing calculator. Compare and contrast results as applicable. Continue activity with the partners switching roles. 3. Use the linear regression feature on the graphing calculator to determine the best fitting line of a set of data (use Algebra II McDougal Littell, © 2004,pg. 107 as a guide). 4. Absolute value lab. Students will analyze absolute value equations using the graphing calculator. Equations will include various shifts and stretches of the original absolute value equations. Students will record their results, synthesize their outcomes, and make conjecture base on their data.

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Linear Functions and their Graphs** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 1: The student will be able to analyze, describe, and graph linear functions in two variables.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		Write the function that best represents this graph and explain your reasoning. • Describe the effects of a, h, and k on the following equations: $y = 2\|x-1\|+3$ $y = 2\|x+1\|-3$ $y = -2\|x-1\|+3$	**Assessment Models:** • Students will work in pairs to analyze what the solutions of absolute equations and absolute values inequalities look like on a number line. They will analyze several of each equations and inequalities. Students will describe the nature of the solutions in the given absolute value equations and predict if all absolute value equations will behave this way, using examples to justify. Students will describe how solutions for absolute value inequalities are similar and different to the absolute value equations, analyzing the effect of the inequality symbol on the outcome. • Students will collect data of the height and shoe size of all the students in the class and construct a line of best fit, using the linear regression feature of the graphing calculator. Students will analyze their results and determine if there is positive, negative or no correlation in the data and why.

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Systems of Linear Equations and Inequalities** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 2: The student will be able to analyze, describe and solve systems of linear equations and inequalities using algebraic and graphical methods.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
5 days total	2.1. Solve systems of equations with two unknowns by graphing and algebraic methods.(A-REI:5, A-REI:6)) 2.2. Build a function that models a relationship between two quantities. (A-CED:2, F-IF:4)) 2.3. Graph, build, and solve systems of inequalities with two unknowns. (A-CED:3, A-REI:12) 2.4. Solve linear programming problems.(A-REI:10, A-REI:12) 2.5. Solve systems of equations with three unknowns.(A-REI:8)	**Essential Questions:** • Which is the most efficient method to use when solving a system of equations algebraically? • How do you use the graph of a system of inequalities to determine the solution? How is this similar and different from using the graph of a system of equations? • Will every system of equations have a solution? • How can linear programming help a business run more efficiently? **Enduring Understandings:** • Many situations in real life involve determining the most efficient way to complete two or more activities or work with two or more items. There are various mathematical methods available which allow for the opportunity to choose which method is most efficient for a particular situation. • Maximizing profit and efficiencies and minimizing loss is a major factor of a business being successful; these reasons lead to the development of linear programming.	**NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** **Learning Activities:** • Exploration and Projects Book, McDougalLittell, © 2003, Investigating Ways that Lines Intersect, p.99. • Use the graphing calculator to graph systems of equations (see Algebra II McDougal Littell, © 2004, pg. 146 as a guide). • Students will graph various systems of equations on the graphing calculator, working in small groups. They will observe which graphs produce no solution, one solution, or infinitely many solutions and

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: Grade 11/Algebra II	**Big Idea: Relationships** **Topic: Systems of Linear Equations and Inequalities** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 2: The student will be able to analyze, describe and solve systems of linear equations and inequalities using algebraic and graphical methods.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		Sample Conceptual Understandings: • You want to burn 380 calories during 40 minutes of exercise. Inline skating burns 8 calories per minute and swimming laps burns 12 calories per minute. Write a system of equations that models how long you should spend doing each activity to burn the desired number of calories. • You are making jewelry to sell at the Senior Class fundraiser. It takes you two hours to make a bracelet and 3 hours to make a necklace. You will sell the bracelets for $10 and the necklace for $20. You have no more than 30 hours available to make the jewelry and you want to sell at least 12 pieces of jewelry. How many necklaces and how many bracelets do you need to sell to maximize your profit?	record their results. Using this data, they will analyze which equations created particular solutions, paying careful attention to the slope. They will use their analysis to make a connection between the graphical interpretation and the algebraic interpretation. • Students will work in pairs to write and graph a system of linear inequalities showing the possible ages and heights for flight attendants based on the following information: To be a flight attendant, you must be at least 18 years old and at most 55 years old and you must be between 60 and 74 inches tall (inclusive). • Use the graphing calculator to graph systems of linear equations in three variables (see Algebra II McDougal Littell, © 2004, pg. 176 as a guide). **Assessment Models:** • Students will work in groups of 3 on the following application that links linear programming to U.S. History: The LST was a ship used during World War II that carried 3 ton trucks and 25 ton tanks. The upper deck of the ship could carry 27

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: Grade 11/Algebra II	Big Idea: Relationships	
		Topic: Systems of Linear Equations and Inequalities	
		Overarching Goals: (1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes. (2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems. (3) Investigate, research, and synthesize various information from a variety of media sources.	
		Goal 2: The student will be able to analyze, describe and solve systems of linear equations and inequalities using algebraic and graphical methods.	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Essential Questions, Enduring Understandings, Sample Conceptual Understandings	Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model
			trucks, but no tanks. The tank deck could carry 500 tons, but no more than 33 trucks. Based on this information, students will determine the following (each group member will be assigned one item to complete): 1. What is the maximum number of tanks that an LST could hold? 2. What is the maximum number of trucks that an LST could hold? 3. Suppose an LST was to be loaded with as many trucks and tanks as possible, and at least three times as many trucks and tanks. What is the maximum number of tanks and trucks that could be loaded? The groups will collaborate and analyze results and answer the final question as a team: 4. How did the development of linear program make a situation such as the one in this problem more efficient? Name three other industries that could also use linear programming to make their business more efficient. Explain your reasoning, connecting your results to what you learned from questions 1-3

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Quadratic Functions and their Graphs** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 3: The student will be able to analyze, model, solve, and graph quadratic functions and inequalities.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
10 days total	3.1 Graph quadratic functions in various forms (standard, vertex, and intercept). (F-IF:7a, A-REI:10) 3.2 Write quadratic expressions in equivalent forms to solve problems.(A-APR:1, A-SSE:2, A-SSE:3) 3.3 Solve quadratic equations by factoring (A-SSE: 3a, F-IF: 8a). 3.4 Solve quadratic equations by finding the square roots-real number solutions. (A-SSE: 3b, A-REI:4b) 3.5 Solve quadratic equations by completing the square and the quadratic formula- real number solutions. (A-SSE:3b, F-IF:8a, A-REI:4a) 3.6 Use the discriminant to determine the number of solutions for quadratic equations. (A-SSE:1a) 3.7 Graph and solve quadratic inequalities with two unknowns. (A-CED:3)	**Essential Questions:** • What are the key characteristics of quadratic functions and their graphs? • How are the key characteristics of quadratic functions similar and different to the key characteristics of linear functions? • How do changes in the parameters of a quadratic function effect the shape and position of its graph? • How do you identify a situation where a quadratic model would be most appropriate? **Enduring Understandings:** • Algebraic relationships provide a means to make sense of a variety of phenomena. • Quadratic models can be used to describe and quantify many real life relationships. • Physical models can be used to clarify mathematical relationships. • Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.	**NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** **Learning Activities:** • Students will do the following activity in a think-pair-share format: The height, *h* (in feet), of a falling object on Mars can be modeled by a quadratic equation, $h = -6t^2 + s$, where *t* is the time in seconds and *s* is the initial height in feet. If an object were dropped from a height of 237 feet, how long would it take to travel half the distance to the ground? • Graphing calculator activity: Use the graphing calculator to solve quadratic equations having real-number solutions (see Algebra II McDougal Littell, © 2004, pg. 271 as a guide).

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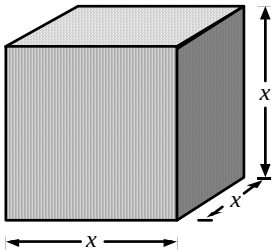
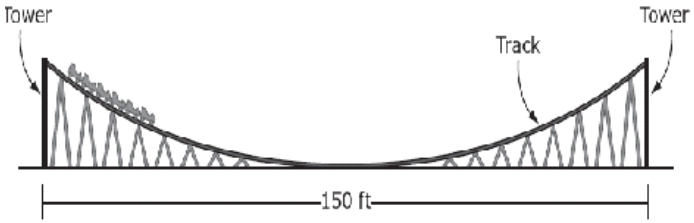
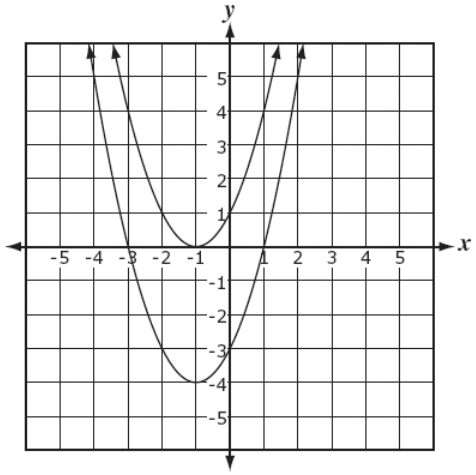
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
	3.8 Build a quadratic function for given information.(F-IF:4, A-CED:2)	**Sample Conceptual Understandings:** • The surface area of a cube is 380 square inches. How long is each edge?  	• Hands on discovery activity: Using Algebra Tiles to Complete the Square- pg. 281 in Algebra II McDougal Littell, © 2004, working in pairs. Each pair will complete the discovery chart which is listed in the activity, with each member responsible for one of the columns, looking for patterns in the chart. Analyze the results of the data and share conclusions as a class. • Graphing calculator activity: Finding Maximums and Minimums (see Algebra II McDougal Littell, © 2004, pg. 290 as a guide). Close activity with the traffic flow problem (#10 on pg. 290), using the graphing calculator to solve. This problem can be used as an assessment as well. • Discovery activity for the discriminant which will be done in small groups. Students will be given a table (which they will complete) for 10 specified quadratic functions. For each function, they will complete columns in the table with the following information (each student should be assigned a role): (1) identify *a, b, c* (2) compute $b^2 - 4ac$ (3) indicate whether $b^2 - 4ac$ is positive,

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Quadratic Functions and their Graphs** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 3: The student will be able to analyze, model, solve, and graph quadratic functions and inequalities.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		Sample Multiple Choice Question:  The above diagram is a visual model for the function $h(x) = \frac{1}{98}x^2$, in which $h(x)$ is the height of part of a rollercoaster track. Note that x is the horizontal distance in feet from the center of this section of the track. The towers that support this part of the track are the same height and are 150 feet apart. Which is the best estimate of the height of the towers? A. 57.4 feet B. 85.7 feet C. 121.2 feet D. 229.6 feet	negative, or zero (4) Graph the function on the graphing calculator and identify *how many* solutions the quadratic function has Students will examine the last two columns in the table (items 3 &4 above) and make a conjecture about what $b^2 - 4ac$ (the discriminant) tells us about the number of solutions to a quadratic equation. Students will summarize their results via writing. Close with a whole class discussion. **Assessment Models:** • You are throwing rocks into a lake from the top of a 46 foot high wall. The chart gives the horizontal distance, *x* (in feet), the rock has traveled from you and the height, *y* (in feet), of the rock above the lake. distance, x: 13, 23, 40, 54 height, y: 67.51, 76.88, 78.47, 66.23 Will this data model and parabolic curve? Why or why not? Model an equation that best fits the path of the rock from you to the lake below and sketch its graph using the graphing calcualtor. Explain your

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Quadratic Functions and their Graphs** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 3: The student will be able to analyze, model, solve, and graph quadratic functions and inequalities.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		Sample Open Ended Question: The two quadratic functions graphed in the figure below are vertical translations of each other.  The equation for one of the functions is $y = x^2 + 2x - 3$. Write an equation that will describe the graph of the other function. Explain your reasoning.	reasoning with your knowledge of the various types of functions. • Quarter 1 benchmark assessment to be administered at the end of this unit. **Additional Resources:** Quarter I Benchmark Assessment

<table>
<tr><td rowspan="5">Suggested days of Instruction</td><td rowspan="4">Curriculum Management System
<u>Subject/Grade Level</u>:
Grade 11/Algebra II</td><td colspan="2">Big Idea: Modeling and Representation</td></tr>
<tr><td colspan="2">Topic: The Complex Number System</td></tr>
<tr><td colspan="2"><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td colspan="2"><u>Goal 4:</u> The student will be able to identify and perform operations on complex numbers, simplify powers of pure imaginary numbers, and identify, analyze, model, and solve quadratic functions involving imaginary solutions.</td></tr>
<tr><td>Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td>Essential Questions, Enduring Understandings, Sample Conceptual Understandings</td><td>Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Mode</td></tr>
<tr><td>3 days total</td><td>4.1. Classify and describe numbers as rational or irrational, real or imaginary.(N-CN:1, N-RN:3)
4.2. Perform arithmetic operations with complex numbers.(N-CN:2, N-CN:3, N-CN:5))
4.3. Determine the absolute value of complex numbers and represent graphically. (N-CN:4, N-CN:5)
4.4. Represent complex numbers on the complex plane.(N-CN:4, N-CN:6)
4.5. Solve quadratic equations involving complex numbers, by finding the square roots, the quadratic formula or completing the square.(N-CN:7, A-REI:4a, A-REI:4b)></td><td>Essential Questions:
• What makes a complex number complex?
• How do you represent the square root of a negative number?
• How do you create the graphical model of the absolute value of a complex number?

Enduring Understandings:
• When extending the real number system to include imaginary numbers, a new classification of numbers is created which allows the opportunity for analysis beyond traditional arithmetic operations.</td><td>NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses).
Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.
Learning Activities:
• Students will work in pairs adding, subtracting, and multiplying complex numbers. Do they have the same properties (commutative, associative, identity) as real numbers? Students will use the data from their computations to justify their conjectures. Students will then represent their calculations geometrically on the complex plane.
• Student practice identifying complex conjugates. Discovery activity where students will determine that the product of complex conjugates will always result in a real number. Balance of activity will involve</td></tr>
</table>

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: Grade 11/Algebra II	**Big Idea: Modeling and Representation** **Topic: The Complex Number System** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 4: The student will be able to identify and perform operations on complex numbers, simplify powers of pure imaginary numbers, and identify, analyze, model, and solve quadratic functions involving imaginary solutions.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Mode**
		Sample Multiple Choice Question (non-calculator item): Write $\frac{1-3i}{-2-4i}$ in the form $a+bi$. **A.** $\frac{1}{2}+\frac{1}{2}i$ **B.** $\frac{1}{20}-\frac{3}{20}i$ **C.** $-\frac{1}{2}+\frac{3}{4}i$ **D.** $-\frac{5}{6}-\frac{5}{6}i$	dividing complex numbers where students will need to identify and use the conjugate to write the complex number in standard form. • Graphing calculator activity: Students will practice in pairs writing quadratic equations that will result in imaginary solutions and verify using a graphing calculator, graphing the functions, observing the location of the parabola on the coordinate plane. How can we use the discriminant as a tool when we want to model a quadratic equation whose roots are not real? • Discovery activity for the absolute value of complex numbers. Students will plot various complex numbers on the complex plane. They will then construct triangles to determine the distance from the complex number to the origin (the absolute value). When constructing the triangle, they will discover that a right triangle is produced, with the absolute values as the hypotenuse, thus the similarity to the formula for the Pythagorean Theorem.

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Modeling and Representation** **Topic: The Complex Number System** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 4: The student will be able to identify and perform operations on complex numbers, simplify powers of pure imaginary numbers, and identify, analyze, model, and solve quadratic functions involving imaginary solutions.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Mode**
		Sample Extended Response Question: Let $f(x) = x^2 + x + c$ **Part A** For what values of c are the roots of $f(x)$ not real? Show or explain your work. **Part B** Using one of the values for c that you found in Part A, determine the roots of $f(x)$. Show or explain your work.	**Assessment Models:** • Evaluate $\sqrt{-4} \bullet \sqrt{-9}$ and $\sqrt{36}$. Does the product property for square roots, $\sqrt{a} \bullet \sqrt{b} = \sqrt{ab}$ hold in this case? Why or why not? Explain your response.>

<table>
<tr><td rowspan="5">Suggested days of Instruction</td><td rowspan="4">Curriculum Management System
<u>Subject/Grade Level</u>:
Grade 11/Algebra II</td><td colspan="2">Big Idea: Relationships</td></tr>
<tr><td colspan="2">Topic: Polynomial Functions</td></tr>
<tr><td colspan="2"><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td colspan="2"><u>Goal 5:</u> The student will be able to evaluate and graph polynomial equations by: factoring or dividing to find the zeros, using their knowledge of end behavior, the Fundamental Theorem of Algebra, and turning points.</td></tr>
<tr><td>Objectives / Cluster Concepts / Cumulative Progress</td><td>Essential Questions, Enduring Understandings, Sample Conceptual Understandings</td><td>Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model</td></tr>
<tr><td>8 days total</td><td>5.1. Simplify polynomial expressions using the properties of exponents. (A-SSE:1a, A-SSE:2, A-SSE:3c)
5.2. Perform operations on polynomial functions (add, subtract, multiply).(A-APR:1)
5.3. Identify and evaluate polynomial functions using various methods (synthetic substitution, synthetic division, polynomial long division).(A-APR:2, A-APR:4)
5.4. Graph polynomial functions using end behavior.(F-IF:4, F-IF:5, F-IF:7c)
5.5. Solve polynomial equations by factoring.(A-APR:3, A-APR:4)
5.6. Determine the zeros of polynomial functions by using the relationship</td><td>Essential Questions:
• What kinds of natural events can be modeled by a polynomial equation?
• Given a polynomial equation, what process is best used to find the graph?
• What do the degree of a polynomial, the leading coefficients, the end behavior and the zeros tell me about a polynomial function?

Enduring Understandings:
• Polynomial functions are best graphed using an algorithm of steps. As we follow these steps to get a graph, we can determine many important characteristics of the polynomial that tell us important information about what this function describes.
• Polynomial functions describe many natural events. The ability to find the zeros and the local minimum(s)/maximum(s) gives us the power to maximize profit or minimize waste.</td><td>NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses).
Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.
Learning Activities:
• Graphing calculator activity: How to set an appropriate viewing window on the graphing calculator (see <u>Algebra II</u> McDougal Littell, © 2004, pg. 337 as a guide). Have students work in a think-pair-share format using the exercises in the activity. Also introduce the various viewing choices in the ZOOM menu of the calculator and have students compare and contrast which method is most appropriate for graphing particular polynomial functions. Record results and summarize via a table to use as a reference.</td></tr>
</table>

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: Grade 11/Algebra II	Big Idea: Modeling and Representation	
		Topic: The Complex Number System	
		Overarching Goals: (1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes. (2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems. (3) Investigate, research, and synthesize various information from a variety of media sources.	
		Goal 4: The student will be able to identify and perform operations on complex numbers, simplify powers of pure imaginary numbers, and identify, analyze, model, and solve quadratic functions involving imaginary solutions.	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Essential Questions, Enduring Understandings, Sample Conceptual Understandings	Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Mode
	between zeros and factors of polynomials.(A-APR:3, N-CN-9) 5.7. Analyze the graphs of polynomial functions.(N-CN:9, F-IF:7c, F-IF:9)	**Sample Conceptual Understandings:** • For 1987-1996 the sales S (in millions of dollars) of gym shoes and sneakers can be modeled by: $S = -.982t^5 + 24.6t^4 - 211t^3 + 661t^2 - 318t +$ Where *t* is the number of years since 1987. When were sneaker sales the highest? When were sneaker sales about $2000 billion? Explain • You are designing an in-ground lap swimming pool with a volume of 2000 cubic feet. The width of the pool should be 5 feet more than the depth. The length should be 35 feet more than the depth. What should the dimensions of the pool be? >	• Discovery Activity on End Behavior of Polynomial Functions: Students will work in pairs to complete a chart with the following information (each member will be assigned a role). For each polynomial determine the (1) degree, (2) sign of the leading coefficient, and (3) then graph each function on the graphing calculator and analyze what happens to the function as the x values get larger ($x \to \infty$) and what happens to the functions as the x values get smaller ($x \to -\infty$). Students will record all of their results in the chart, making a summary table of their data using the patterns they identify in the chart. Pairs will analyze their results and make a conjecture about the degree of the polynomial, the sign of the leading coefficient, and the end behavior of a polynomial function, using this information to sketch the end behavior of a polynomial. • Concept activity: Investigating the Number of Solutions to Polynomial Equations using the activity on pg. 366 in Algebra II McDougal Littell, © 2004.

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Modeling and Representation** **Topic: The Complex Number System** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 4: The student will be able to identify and perform operations on complex numbers, simplify powers of pure imaginary numbers, and identify, analyze, model, and solve quadratic functions involving imaginary solutions.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Mode**
			• Graphing calculator activity: Solving Polynomial Equations (see Algebra II McDougal Littell, © 2004, pg. 372 as a guide). Have students work in pairs.> **Assessment Models:** • The time, *t* (in seconds) it takes a camera battery to recharge after flashing *n* times can be modeled by $t = 0.000015n^3 - 0.0034n^2 + 0.25n + 5.3$ How can you utilize synthetic substitution to determine the recharge time after 100 flashes? What other method can you use to determine this information? Show how both methods will yield identical solutions to this polynomial function. • Suppose you are given a function $f(x) = 2x^3 - x^2 - 4x + 1$ and you graph the equation to find its real zeros. Your friend graphs the two equations $y = 2x^3$ and $y = x^2 + 4x - 1$ and finds the intersections of the two graphs. Explain how your results are related and show your work to justify your conclusions.

<table>
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<u>Subject/Grade Level</u>:
Grade Level 11/Algebra II</td><td colspan="2">Big Idea: Modeling and Representation</td></tr>
<tr><td colspan="2">Topic: Powers, Roots, and Radicals</td></tr>
<tr><td colspan="2"><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td colspan="2"><u>Goal 6:</u> The student will be able to evaluate, solve and graph power functions.</td></tr>
<tr><td>Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td>Essential Questions, Enduring Understandings, Sample Conceptual Understandings</td><td>Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model</td></tr>
<tr><td>8 days totals</td><td>6.1. Extend the properties of exponents to rational exponents.(N-RN:1, N-RN:2)
6.2. Simplify and perform operations on numerical expressions containing radicals and rational exponents.(A-SSE:3c)
6.3. Determine the nth roots of functions.(F-IF:8b)
6.4. Perform operations on functions.(F-BF:3, A-REI:11)
6.5. Determine the inverse of functions.(F-BF:4a, F-BF:4b, F-BF:4c)
6.6. Graph functions with various roots.(F-IF:5, F-IF:7b, F-LE:3)
6.7. Solve equations that contain radicals and rational exponents.(A-SSE:3c)</td><td>Essential Questions:
• How do you determine the domain of a power function?
• When is it useful to perform function operations? How do these operations affect the domain of the original functions?
• What does finding the inverse of a function mean graphically?
• Why is finding the inverse of a function useful?

Enduring Understandings:
• When performing operations on functions, it is essential to note any restrictions on the domain. These represent values that are undefined for the function.
• For every function, there must be a way to “undo” the operation. Finding this inverse gives us the ability to solve equations and draw conclusions about the domain and range</td><td>NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses).
Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.

Learning Activities:
• Concept activity: Exploring Inverse Functions using the activity on pg. 421 in <u>Algebra II</u> McDougal Littell, © 2004.
• Graphing calculator activity: Graphing Inverse Functions using the activity on pg. 430 of <u>Algebra II</u> McDougal Littell, © 2004 as a guide.
• Concept activity: Investigating graphs of radical functions, using the activity on pg. 431 of <u>Algebra II</u> McDougal Littell, © 2004 as a guide.</td></tr>
</table>

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade Level 11/Algebra II**	**Big Idea: Modeling and Representation** **Topic: Powers, Roots, and Radicals** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 6: The student will be able to evaluate, solve and graph power functions.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		Sample Conceptual Understandings: 1. A pinhole camera is made out of a light-tight box with a piece of film attached to one side and a pinhole on the opposite side. The optimum diameter, *d* (in millimeters) of the pinhole can be modeled by $d = 1.9\left[\left(5.5x10^{-4}\right)l\right]^{\frac{1}{2}}$ Where *l* is the length of the camera box (in millimeters) What is the optimum diameter for a pinhole camera if the camera box has a length of 10 cm? 2. You do an experiment on bacteria and find that the growth rate G of bacteria can be modeled by $G(t) = 8.2t^{.25}$ and the death rate D is modeled by $D(t) = 10.8t^{.25}$ where *t* is the time in hours. Find an expression for the number N of bacteria living at time T.	• Students will work in pairs using the model of a cube root function and their graphing calculators as an aid to solve: Biologists have discovered that the shoulder height, *h,* (in cm) of a male African elephant can be modeled by: $h = 62.5\sqrt[3]{t} + 75.8$ where *t,* is the age (in years) of the elephant. Students will use their graphing calculators to graph the model. They will analyze their graphs to estimate the age of an elephant whose shoulder height is 200 cm. **Assessment Models:** • Scientists have found that the body mass *m* (in kilograms) of a dinosaur that walked on two feet can be modeled by $m = (1.6X10^{-4})C^{\frac{273}{100}}$ where C is the circumference (in millimeters) of the dinosaur's femur. Scientists have estimated that the mass of a *Tyrannosaurus Rex* might have been 4500 kilograms. Determine the size of the femur that would have led them to this conclusion. Justify your reasoning.

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade Level 11/Algebra II**	**Big Idea: Modeling and Representation** **Topic: Powers, Roots, and Radicals** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 6: The student will be able to evaluate, solve and graph power functions.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		3. You are teaching an algebra II class how to solve: $x+2=\sqrt{5x+10}$. Describe the steps as you write them out. Explain your work.	• Two functions are graphed on the same axes. Explain how you can tell if the functions are inverses of one another. • For 1970 through 1995, the percent of MD degrees earned each year by women can be modeled by $p=(0.867t^2+39.2t+57.1)^{\frac{1}{2}}$ where *t* is the number of years since 1970. How can you determine in what year about 36% of the degrees were earned by women? Explain your solution, including how you derived your answer. • Midyear benchmark (Formative Assessment) should be administered at the end of this unit. **Additional Resources:** Formative Midyear Assessment

Suggested days of Instruction	**Curriculum Management System** **<u>Subject/Grade Level</u>:** **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Exponential and Logarithmic Functions** **<u>Overarching Goals:</u>** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **<u>Goal 7:</u> The student will be able to recognize the relationship between exponential and logarithmic functions and analyze what they represent in real life.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
9 days total	7.1. Interpret, analyze, and graph exponential functions (with and without base e).(A-SSE:1b, A-SSE:3c, F-IF:7e, F-IF:8b, F-LE:1c) 7.2. Evaluate and graph logarithmic functions. (F-IF:4, F-IF:7e, F-LE:3) 7.3. Utilize the properties of logarithms and exponents to solve equations.(F-IF:8b, F-BF:9, F-LE:4) 7.4. Recognize, express, and solve problems that can be modeled using exponential functions (with and without logarithms).(F-IF:8b, F-BF:9, F-LE:3, F-LE:4) 7.5. Construct and compare linear, quadratic, and exponential models.(A-CED:4, F-IF:9, F-LE:1a, F-LE:1b, F-LE:2, F-LE:5)>	**Essential Questions:** • When all other factors are the same, what affect does compounding interest on a given time period have on the total amount of interest earned? • Think of a situation in nature that is modeled by exponential growth or decay. Why is an exponential model the best way to describe this relationship? • What is the relationship between logarithmic and exponential equations? **Enduring Understandings:** • Exponential Models describe many real life situations, most notably, interest calculations. Given an equation, we can manipulate the variables using properties of exponents or logarithms to find the best investment situation. • Logarithmic and Exponential Functions are inverses of each other. This relationship is the key to solving equations involving either of these functions.	**NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** **Learning Activities:** • Concept Activity: Investigating the Natural Base e; use the activity on pg. 480 in <u>Algebra II</u> McDougal Littell, © 2004 as a guide. • Discovery Activity: What relationships exist between exponential growth and exponential decay when a piece of paper is folded repeatedly? Students will work in pairs. Use the activity on pg. 473 in <u>Algebra II</u> McDougal Littell, © 2004 as a guide. Use the Drawing Conclusions section as a recap and a closure.

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Exponential and Logarithmic Functions** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 7: The student will be able to recognize the relationship between exponential and logarithmic functions and analyze what they represent in real life.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		Sample Conceptual Understandings: • Describe the relationship between *a,b, h* and *k* given $y = ab^{x-h} + k$. How do *a,b, h* and *k* each alter the graph? **Sample Short Response Items:** 1. Solve: $5e^{6x} + 4 = 13$ for x. Show or explain your work. 2. A car has an original value of $20,000. The value decreases at a rate of 18% each year. **Part A**: Write a function where $f(x)$ represents the value of the car in dollars and x represents years. **Part B**: After how many years will the car be worth less than $\frac{1}{2}$ of the original value? Show or explain your work.	• Graphing Calculator actiivty using pg. 500 in Algebra II McDougal Littell, © 2004 as a guide. Students will have the opportunity to use the properties of logarithms when graphing logarithmic functions on the graphing calculator. • Graphing Calculator lab on exponential and logarithmic functions. Students will work in pairs to graph various functions on the graphing calculator, drawing conclusions from their graphs so they can have a visual exploration of the inverse relationship between exponential and logarithmic functions. **Assessment Models:** • Compare 8% interest compounded quarterly to 7.75% interest compounded continuously. If you have $2,500 to invest for a 10-year time period, which investment is better? Why?

<table>
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<u>Subject/Grade Level</u>:
Grade 11/Algebra II</td><td colspan="2">Big Idea: Relationships</td></tr>
<tr><td colspan="2">Topic: Exponential and Logarithmic Functions</td></tr>
<tr><td colspan="2"><u>Overarching Goals:</u>
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(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td colspan="2"><u>Goal 7:</u> The student will be able to recognize the relationship between exponential and logarithmic functions and analyze what they represent in real life.</td></tr>
<tr><td>Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's)
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<tr><td></td><td>Sample Multiple Choice Items:

1. Consider the equation: $8^x = 32$.
Solve for x.

A. $\frac{3}{5}$

B. $\frac{5}{3}$

C. 4

D. 5</td><td>• Prove that $uv = \log_b(b^x b^y)$ given that $x = \log_b u$ $y = \log_b v$ using properties of exponents and logarithms.

• Prove the change of base formula using properties of logarithms.</td></tr>
</table>

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Exponential and Logarithmic Functions** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 7: The student will be able to recognize the relationship between exponential and logarithmic functions and analyze what they represent in real life.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		2. The graph of the equation $y = 3^x$ is reflected over the y-axis. What is the equation of the image? A. $y = -3^x$ B. $y = -\left(\frac{1}{3}\right)^x$ C. $y = \left(\frac{1}{3}\right)^x$ D. $y = 3^x$	

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Rational Functions** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 8: The student will be able to simplify and perform operations with rational expressions, graph rational functions, solve rational equations, and use variation models and rational models in real life situations.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
9 days total	8.1. Construct and use inverse and joint variation models.(N-Q:2) 8.2. Represent simple and general rational functions graphically.(A-REI:11, F-IF:7d, F-IF:9) 8.3. Simplify, multiply and divide rational expressions.(A-APR:6, A-SSE:2) 8.4. Perform operations on complex fractions (add, subtract).(A-APR:7, A-SSE:1b, A-SSE:2) 8.5. Rewrite rational functions.(A-APR:6, A-SSE:1b) 8.6. Solve rational equations.(A-APR:7)	**Essential Questions:** • What types of relationships in the real world vary inversely? • What are the key characteristics of simple rational functions and their graphs? • What type of situations in the real world are best modeled using rational functions? **Enduring Understandings:** • There are many relationships in real life that vary inversely. • Manufacturers want to save money and control waste by finding ways to use the least amount of packing material for their products; constructing and analyzing the graphs of rational functions will assist this goal of controlling costs and wastes. **Sample Conceptual Understandings:** • The force *F* needed to loosen a bolt with a wrench varies inversely with the length *l* of the handle. Write an equation that models the relationship	**NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** **Learning Activities:** • Discovery Activity: What is the relationship between the distance you are standing from your partner and the apparent height of your partner? This activity explores inverse relationships and appeals to kinesthetic learners. Students will discover that the apparent height of an object varies inversely with the distance from the object. Use the activity on pg. 533 in Algebra II McDougal Littell, © 2004 as a guide.

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Rational Functions** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 8: The student will be able to simplify and perform operations with rational expressions, graph rational functions, solve rational equations, and use variation models and rational models in real life situations.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		between *F* and *l,* given that 250 pounds of force must be exerted to loosen a bolt when using a wrench with a handle 6 inches long. How much force must be exerted when using a wrench with a handle that is 24 inches long? • How can you write $x-\frac{y^2}{x}$ in an equivalent form with a monomial denominator? • A standard beverage can has a volume of 355 cubic cm. Find the dimensions of a can that has this volume and uses the least amount of material possible. Compare your result with the dimensions of an actual beverage can, which has a radius of 3.1 cm and a height of 11.8 cm.	• Graphing Calculator Activity- Investigating Graphs of Rational Functions. Graph the four functions (a-d) on pg. 540 in in Algebra II McDougal Littell, © 2004 on th graphing calcualtor. Use the graphs to describe how the sign of *a* and $\lvert a \rvert$ affects the graph of $y=\frac{a}{x}$. Students can work in a think-pair-share format. • Graphing calculator activity: Graphing Rational Functions, using the activity on pg. 546 in Algebra II McDougal Littell, © 2004 as a guide. Students will discover the importance of an adequate viewing window and why it is important to know how a graph should look before you graph it on the graphing calculator. • Graphing calculator discovery activity: Operations with Rational Expressions using the activity on pg. 561 in Algebra II McDougal Littell, © 2004 as a guide. Students will discover that the graph of a rational expression and its simplified form are equivalent except where a common factor has been divided out.

<table>
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Sample Conceptual Understandings</td><td>Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model</td></tr>
<tr><td></td><td></td><td></td><td>Assessment Models:
Write a model of a rational function whose graph is a hyperbola that has a vertical asymptote at x = 2 and a horizontal asymptote at y = 1. Sketch the graph of the function, labeling all of the key parts.
You and your friends order pizza and have it delivered to your house. The restaurant charges $8 per pizza plus a $2 delivery fee. Write a model that gives the average cost per pizza as a function of the number of pizzas ordered and graph the model. What happens to the average cost as the number of pizzas ordered increases?
You have 0.2 liter of an acid solution whose acid concentration is 16 moles per liter. You want to dilute the solution with water so that its acid concentration is only 12 moles per liter. How much water should you add to the solution? Construct an algebraic model to solve and explain why this problem is best solved by using a rational equation.</td></tr>
</table>

Suggested days of Instruction	Curriculum Management System **Subject/Grade Level:** **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Conic Sections** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 9: The student will be able to classify, graph and write equations of conic sections, and solve systems of quadratic equations.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
4 days total	9.1. Graph and write equations of parabolas, circles, ellipses, and hyperboles in standard form.(A,SSE:2, A-SSE:3a, A-SSE:3b, A-CED:2, A-REI:7, F-IF:4, F-IF:9) 9.2. Graph and write equations of translated conics. .(A,SSE:2, A-SSE:3a, A-SSE:3b, A-CED:2,A:REI:7, F-IF:4, F-IF:9) 9.3. Determine the solution for a system of quadratic equations. (A-REI:5)	**Essential Questions:** • What are the key characteristic of parabolas, circles, ellipses, and hyperboles? • How do you classify a conic section given its equation? • How do the parameters of a conic section affect its shape and position? • How many points of intersection are possible when solving a quadratic system? **Enduring Understandings:** • Conic sections can be used to describe and model many real-life phenomena. • Quadratic equations can result in the graphs of various types of conic sections. • Many of the methods used to solve systems of linear equations applicable for solving quadratic systems.	**NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** **Learning Activities:** • Graphing calculator activity: Graphing circles using the activity on pg. 608 in Algebra II McDougal Littell, © 2004 as a guide. Students will work in pairs and discover that circles can be graphed on a graphing calculator by writing them as two separate function equations. • Classifying a conic from its equation. Students will review various equations in small groups and determine how to classify the conic as a circle, ellipse, parabola, or hyperbola given the equation. They will use the concept summary on pg. 626 in Algebra

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Relationships** **Topic: Conic Sections** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 9: The student will be able to classify, graph and write equations of conic sections, and solve systems of quadratic equations.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		Sample Conceptual Understandings: • Sunfire is a glass parabola used to collect solar energy. The sun's rays are reflected from the mirrors toward the two boilers located at the focus of the parabola. When heated, the boilers produce steam that powers an alternator to produce electricity. Write an equation that models Sunfire's cross section and determine how deep the dish is. • Given the equation $(x-2)^2+(y+8)^2=18$, how do you determine the positioning of the graph relative to the origin? • Suppose an earthquake can be felt up to 80 miles from its epicenter. You are located at a point 60 miles west and 45 miles south of the epicenter. Do you feel the earthquake? If so, how can you determine how many miles south you would have to travel to be out of the range of the earthquake. • Sketch an example to illustrate the different numbers of points of intersection that a circle and an ellipse can have if both are centered at the origin.	II McDougal Littell, © 2004 as a guide. They will use various algebraic techniques (ie. completing the square) to aid in their classification, then they will sketch the graph of the applicable conics. Each groups will have the chance to present how they derived their equations and produced its graph. • Concept activity: Investigating points of intersection using the activity on pg. 632 in Algebra II McDougal Littell, © 2004 as a guide. **Assessment Models:** • In a standard equation for an ellipse, explain how you can determine which axis is the major axis and which axis is the minor axis. • How do you determine the asymptotes and vertices of a hyperbola modeled by $\frac{y^2}{a^2}-\frac{x^2}{b^2}=1$? • Quarter 3 benchmark will be administered at the end of this unit.

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<tr><td></td><td></td><td></td><td>Additional Resources: Quarter 3 benchmark assessment.</td></tr>
</table>

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Modeling and Representation** **Topic: Matrices and Determinants** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 10: The student will be able to perform operations on matrices, evaluate determinants, and solve linear systems using Cramer's rule and inverse matrices.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
6 days total	10.1. Represent and model quantities using matrices. (N-VM:6, N-VM:7) 10.2. Perform operations on matrices (add, subtract, and multiply). (N-VM:7, N-VM:8, N-VM:9, N-VM:10) 10.3. Find the determinant of a square matrix.(N-VM:9,N-VM:10, N-VM:12) 10.4. Solve systems using matrices.(N-VM:7, N-VM:8, N-VM:10)	**Essential Questions:** • What are the characteristics of matrices that can be multiplied and what are the characteristics of those that cannot be multiplied? • Does an inverse exist for every matrix? • How can you use inverse matrices to solve a system of equations? • What type of situations in the real world would be best modeled using matrices? **Enduring Understandings:** • Matrices can be used to model a variety of real world situations. • Matrices provide a method for solving linear equations and are a very efficient way for solving systems of three equations in three variables, particularly when graphing calculator technology is used. **Sample Conceptual Understandings:** • You are planning a birthday party for your younger brother at a skating rink. The cost of admission is	**NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** **Learning Activities:** • Graphing calculator activity: Using Matrix Operations, see activity on pg. 207 in Algebra II McDougal Littell, © 2004 as a guide. Students will discover the efficiency of using the graphing calculator to perform matrix operations. Students may work in pairs to complete the activity. Highlight which mathematical properties hold (ie. commutative, associative, distributive, identity, scalar). • Discovery Activity: Investigating Identity and Inverse Matrices. Use pg. 222 as a guide, students will work with a partner. Partners should share the calculations, then each pair should write their response to the

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Modeling and Representation** **Topic: Matrices and Determinants** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 10: The student will be able to perform operations on matrices, evaluate determinants, and solve linear systems using Cramer's rule and inverse matrices.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		\$3.50 per adult and \$2.25 per child, and there is a limit of 20 people. You have \$50 to spend. Use an inverse matrix to determine how many adults and how many children you can invite. • Your mother received an inheritance of \$20,000. She wants to put some of the money into a savings account that earns 2% interest annually and invest the rest in certificates of deposit (CDs) and bonds. A broker tells her that CDs pay 5% interest annually and bonds pay 6% interest annually. She wants to earn \$1000 interest per year and she wants to put twice as much money in CDs as in bonds. How can we use matrices to model this situation and determine how much money your mother should put in each type of investment?	"drawing conclusions" questions, then compare with other pairs of students. Students will discover that multiplying a square matrix by its inverse will result in the identity matrix and multiplying by the identity matrix will result in the original matrix. • Concept Activity: Investigating Matrix Equations. Students will practice writing matrix equations as linear systems, and writing linear systems as matrix equations. Solve both ways (use graphing calculator when solving the matrix). Compare/ contrast results, explaining which was the most efficient methods in particular situations and why. **Assessment Models:** • Two softball teams submit equipment lists for the season: Women's Team: 12 bats, 45 balls, 15 uniforms Men's Team: 15 bats, 38 balls, 17 uniforms Each bat costs \$21, each ball costs \$4, and each uniform costs \$30. How can you use matrices to determine the total costs of equipment for each team?

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: Grade 11/Algebra II	**Big Idea: Modeling and Representation** **Topic: Matrices and Determinants** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 10: The student will be able to perform operations on matrices, evaluate determinants, and solve linear systems using Cramer's rule and inverse matrices.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
			• Cryptogram problems. Use the examples 44-48 on pg. 228 207 in Algebra II McDougal Littell, © 2004 where students can encode/ decode messages with their classmates.

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: **Grade 11/Algebra II**	**Big Idea: Data Analysis** **Topic: Probability and Statistics** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 11: The student will be able to use the fundamental concepts and techniques of counting principles and probability to model situations, analyze data, and solve problems and make informed decisions.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
7 days total	11.1. Summarize and interpret data using the fundamental counting principle, permutations, and combinations.(S-IC:6, S-CP:9) 11.2. Compute probabilities of compound events.(S-IC:5, S-IC:6) 11.3. Determine the probability of independent and conditional (dependent) events.(S-CP:2, S-CP:3, S-CP:5, S-IC:5, S-IC:6) 11.4. Calculate expected values of collections of outcomes.(S-MD:1, S-MD:2, A-APR:5S-MD:7)	**Essential Questions:** • How do you analyze whether a situation should be modeled using the fundamental counting principle, permutations, or combinations? • How do you determine the probability that a series of events will occur? • How can you use theoretical and experimental probability to analyze data, make predictions, and/or draw conclusions? **Enduring Understandings:** • Grouping by attributes (classification) can be used to answer mathematical questions. • The Counting Principles and Probability play roles in our daily lives, allowing us to quantify the likelihood that something will happen and enabling us to make predictions and informed decisions. **Sample Conceptual Understandings:** • A school shirt is available either long-sleeved or short sleeved, in sizes small, medium, large, or	**NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** **Learning Activities:** • Students will work in pairs to compare the theoretical and experimental probability of the sum of rolling two standard dice. The will roll each die 50 times and record the results in a table and answer the following questions: 1. Which sum was rolled most often? Which sum was rolled least often? 2. Which sum is most likely to occur? Which sum is least likely to occur? Explain how you determined why a particular sum was most or least likely to occur?

Suggested days of Instruction	Curriculum Management System Subject/Grade Level: Grade 11/Algebra II	Big Idea: Data Analysis	
		Topic: Probability and Statistics	
		Overarching Goals: (1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes. (2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems. (3) Investigate, research, and synthesize various information from a variety of media sources.	
		Goal 11: The student will be able to use the fundamental concepts and techniques of counting principles and probability to model situations, analyze data, and solve problems and make informed decisions.	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Essential Questions, Enduring Understandings, Sample Conceptual Understandings	Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model
		extra large, and in two colors, purple or gold. How many different choices for a school shirt are there? • Health officials who have studied a particular virus say that 50% of all Americans have had the virus. If a random sample of 144 people is taken, what is the probability that fewer than 60 have had the virus? • A basketball player has an average success rate of 60% on free throws. What is the probability that she will make 10 out of 12 free throws in the next game?	3. Compare and contrast the results in items 1 and 2, explaining you reasoning. • Graphing calculator activity where students will use the calculator to generate random numbers, using the activity on pg. 723 in in Algebra II McDougal Littell, © 2004 as a guide. Students will work in small groups to collect the data, discovering that as the number of trials increases, the experimental probability becomes closer to the theoretical probability. • Students will work in groups with a standard deck of cards. They will collect data in a table to show that the probability of drawing a card that is a heart from the whole deck is the same as drawing the ace of hearts from the set consisting of aces of hearts, diamonds, clubs, and spades. They will use both experimental and theoretical probabilities, and analyze the results of the data. Each group member will have different roles during the activity, and they will collaborate the the conclusion of the activity for data review and analysis.

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Sample Conceptual Understandings</td><td>Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model</td></tr>
<tr><td></td><td></td><td>Assessment Models:
How do you calculate the probability of randomly guessing at least 7 correct answers on a 10 questions true or false quiz to get a passing grade?
A basketball player is shooting two free throws. Let event A be making the first free throw and let event B be making the second free throw. Explain how to determine if events A and B are independent or dependent events.</td></tr>
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<table>
<tr><td rowspan="4">Suggested days of Instruction</td><td rowspan="4">Curriculum Management System
<u>Subject/Grade Level</u>:
Grade 11/Algebra II</td><td colspan="2">Big Idea: Modeling and Representation</td></tr>
<tr><td colspan="2">Topic: Sequences and Series</td></tr>
<tr><td colspan="2"><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
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<tr><td>9 days total.</td><td>12.1. Construct the rule for a given sequence of numbers (arithmetic and geometric sequences and series.(F-IF:3,F-BF:2, F-LE:2)
12.2. Determine the sum of arithmetic and geometric sequences and series (finite and infinite).(F-IF:3)
12.3. Use sequences and series to model real life quantities.(F-IF:3, F-BF:2, F-LE:2)></td><td>Essential Questions:
• What makes sequence arithmetic? What makes a sequence geometric?
• How do you create a recursive definition of a sequence given the explicit definition of a sequence?
• How do you determine if a geometric series has a finite sum?
Enduring Understandings:
• Sequences and series are useful in modeling sets of values in order to identify patterns which are relevant in many real world applications, such as situations that arise in personal finance (i.e. compound interest, home mortgage interest).
• Students will be able to analyze data numerically, algebraically, and graphically, with and without the assistance of the graphing calculator.
Sample Conceptual Understandings:
• A deposit of $2500 is made in an account that</td><td>NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses).
Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.
Learning Activities:
• Graphing Calculator Activity: Working with sequences and sums. Have students work in small groups with various sequences (arithmetic, geometric). Each student will be responsible for keystrokes for particular problems where they will first use the calculator to generate the terms of given sequences. Then, they will compare their results with another group to analyze consistency of results.
Once results are confirmed and verified with the whole class, the groups will calculate the sum of their given sequences, comparing and contrasting results with the</td></tr>
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Suggested days of Instruction	Curriculum Management System Subject/Grade Level: Grade 11/Algebra II	**Big Idea: Modeling and Representation** **Topic: Sequences and Series** **Overarching Goals:** **(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.** **(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.** **(3) Investigate, research, and synthesize various information from a variety of media sources.** **Goal 12: The student will be able to derive the formula to model the nth term of a sequence or series, determine the nth partial sum of a finite series and analyze the infinite sum of a geometric series.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions, Enduring Understandings, Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		earns 2% interest compounded quarterly. The balance in the account after *n* quarters is given by: $a_n = 2500\left(1+\frac{0.02}{4}\right)^n,\ n = 1,2,3.....$ a) Compute the first five terms of this sequence b) How do you determine the balance in this account after 10 years? • Write a quadratic model for the sequence 3, 5, 8, 12, 17, 23, … • The result of repeatedly squaring a number between -1 and 1 appears to approach zero; the result of repeatedly squaring a number less than -1 or greater than 1 appears to continue to increase; determine empirically how many steps are needed to produce 4-digit accuracy in square roots by iterating the operations divide and average. >	sum formulas for arithmetic and geometric sequences, analyzing which is the most efficient way in particular situations. **Steps for finding the terms of the sequence using TI 83 or 84:** 1. 2^{nd} STAT (LIST), goto OPS 2. In OPS, choose #5, seq and enter the sequence. You must enter 4 items: the sequence, the variable (will be x), the starting input and the last input. All items must be separated by a comma. **Steps for finding the sum of a sequence using TI83 or 84:** 1. 2^{nd} STAT (LIST), goto MATH 2. In MATH, choose #5, sum. An open parenthesis will appear, requiring you to enter the sequence you are taking the sum of. 3. 2^{nd} STAT (LIST), goto OPS 4. In OPS, choose #5, seq and enter the sequence. You must enter 4 items: the sequence, the variable (will be x), the starting input and the last input. All items must be separated by a comma. • Hands on discovery activity: Investigating an Infinite Geometric Series, use pg. 674 in

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			Algebra II McDougal Littell, © 2004 as a guide. Students will discover that the sum of a geometric series in which each term is smaller than the previous term has a finite sum. • Final exam preparation should be incorporated in warm ups to recap big ideas from earlier in the year. **Assessment Models:** • The first row of a concert hall has 25 seats, and each row after the first one has one more seat that the row before it. There are a total of 32 rows of seats. Construct a rule that will model the number of seats in the nth row. If 35 students want to sit in the same row, how close to the front can they sit? • Write a brief paragraph explaining why the terms of a geometric sequence decrease in magnitude when $-1 < r < 1$. This is an appropriate closure question to use at the conclusion of the hands on discovery activity: Investigating an Infinite Geometric Series (listed above in the learning activities) to assess student learning of

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			geometric series. • Final exam will be administered at the conclusion of this topic. **Additional Resources:** Algebra II Final Exam

Algebra II

COURSE BENCHMARKS

1. The student will be able to demonstrate number sense for real numbers and algebraic expressions in a variety of situations.

2. The student will be able to evaluate and analyze functions using various methods including mental math, paper and pencil, concrete objects, and graphing utilities or other appropriate technology.

3. The student will be able to explain the relationship between the solution(s) to systems of equations/inequalities in two unknowns and their corresponding graphs.

4. The student will be able to add, subtract, and multiply matrices, be able to organize data into matrices, find and use inverse matrices, and be able to solve matrix equations.

5. The student will be able to identify arithmetic and geometric sequences and series as well as recursion and special sequences.

6. The student will be able to apply probability theory to draw conclusions, generate convincing arguments, make predictions and decisions by collecting, organizing and interpreting numerical and non-numerical data sets. Students will also be able to analyze decisions including the use of concrete objects in a variety of situation.

7. The student will be able to perform fundamental operations with polynomials and then apply this knowledge to find the zeros of polynomial functions and rational functions.

8. The student will be able to graph and find the zeros of quadratic functions.

9. The student will be able to solve problems involving direct, inverse, and joint variation. Students will also be able to find the composition of two functions and be able to solve higher order polynomial equations.

10. The student will be able to extend the meaning of exponents to include rational numbers, to define logarithmic functions and to learn how they are related to exponential functions.

11. The student will be able to analyze and graph conic sections.