NEW PROVIDENCE BOARD OF EDUCATION

Administrative Offices
356 Elkwood Avenue
New Providence, New Jersey 07974

ALGEBRA 1

Curriculum Guide

Grade 9

2008

Board Approved: August 28, 2008

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NEW JERSEY CORE CURRICULUM CONTENT STANDARDS

Mathematics

- 4.1 (Number and Numerical Operations) All students will develop number sense and will perform standard numerical operations and estimations on all types of numbers in a variety of ways.

- 4.2 (Geometry and Measurement) All students will develop spatial sense and the ability to use geometric properties, relationships, and measurement to model, describe and analyze phenomena.

- 4.3 (Patterns and Algebra) All students will represent and analyze relationships among variable quantities and solve problems involving patterns, functions, and algebraic concepts and processes.

- 4.4 (Data Analysis, Probability, and Discrete Mathematics) All students will develop an understanding of the concepts and techniques of data analysis, probability, and discrete mathematics, and will use them to model situations, solve problems, and analyze and draw appropriate inferences from data.

- 4.5 (Mathematical Processes) All students will use mathematical processes of problem-solving, communication, connections, reasoning, representations, and technology to solve problems and communicate mathematical ideas.

Technological Literacy

- 8.1 (Computer and Information Literacy) All students will use computer applications to gather and organize information and to solve problems.

- 8.2 (Technology Education) All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and their environment.

Career Education and Consumer, Family, and Life Skills

- 9.1 (Career and Technical Education) All students will develop career awareness and planning, employability skills, and foundational knowledge necessary for success in the workplace.

- 9.2 (Consumer, Family, and Life Skills) All students will demonstrate critical life skills in order to be functional members of society.

COURSE DESCRIPTION

This course is designed to develop skills and understanding necessary to communicate mathematically through the language of Algebra. Students will learn to simplify and evaluate expressions, solve different types of equations and inequalities, and graph several different mathematical functions. Strong emphasis is placed on connecting mathematics to real life situations, as well as developing critical thinking and problem-solving skills. Students will use technology as a component in problem-solving throughout the year.

Written by: Juliette Campasano

Department Head: Rochelle Phillips

ADOPTED TEXT(S)

Larson, Boswell, Kanold, and Stiff, Algebra 1, McDougal Littell, 2008.

ADDITIONAL RESOURCES

- Leveled Textbook
- Chapter Resource Books
- Best Practice Toolkit – teaching strategies and pre-AP resources
- Practice Workbook – leveled practice
- Notetaking Guide
- Chapter Transparency Book
- Worked-Out Solution Key
- Assessment Book– leveled assessments
- Benchmark Tests
- Remediation Book
- Power Presentations (CD-ROM) – animated algebra
- Activity Generator (CD-ROM) – for leveled activities
- @Home Tutor (CD-ROM and online)
- Test Generator (CD-ROM)
- Online support: multi-sensory learning at www.mcdougallittell.com ; companion website for the student at home at classzone.com

Unit 1: Linear Functions

Suggested Time Frame: 13-14 weeks

I. DESIRED RESULTS

Subject/Topic Areas: (if applicable)

1. Writing Linear Equations, Functions and Inequalities
2. Graphing Linear Equations, Functions, and Inequalities
3. Solving Linear Equations, Functions, and Inequalities
4. Solving Linear Systems of Equations, Functions and Inequalities

Critical Vocabulary (if applicable)

like terms	distributive property	identity
ratio	proportion	percent
cross product	scale	congruent figure
similar figures	corresponding parts	percent of change
percent of increase	percent of decrease	quadrants
ordered pair	coordinate plane	linear function
standard form of a linear equation		function notation
domain	range	discrete function
linear function	x-intercept	y –intercept
slope	rate of change	slope-intercept form
point-slope form	sequence	arithmetic sequence
scatterplot	correlation	line of best fit
linear regression	linear interpolation	inequalities
equivalent inequalities	compound inequality	

I. DESIRED RESULTS (CONT.)

Established Goals– NJCCCS *(Includes applicable content-area, technology, career, and interdisciplinary indicators)*

4.1.12. A.1 Extend understanding of the number system to all real numbers.
4.1.12. A.2 Compare and order rational and irrational numbers.
4.1.12. B.1 Extend understanding and use of operations to real numbers and algebraic procedures.
4.1.12. B.2 Develop, apply and explain methods for solving problems involving rational and negative exponents.
4.1.12. B.4 Understand and apply the laws of exponents to simplify expressions involving numbers raised to powers.
4.2.12. C.1 Use coordinate geometry to represent and verify properties of lines and line segments.
4.3.12. B.1 Understand relations and functions and select, convert flexibly among, and use various representations for them, including equations or inequalities, tables, and graphs.
4.3.12. B.2 Analyze and explain the general properties and behavior of functions or relations, using algebraic and graphing techniques.
4.3.12. B.3 Understand and perform transformations on commonly-used functions.
4.3.12. C.1 Use functions to model real-world phenomena and solve problems that involve varying quantities.
4.3.12. D.2. Select and use appropriate methods to solve equations and inequalities.
4.4.12. A.4 Estimate or determine lines of best fit (or curves of best fit if appropriate) with technology, and use them to interpolate within the range of the data.
4.5. E.1 Create and use representations to organize, record, and communicate mathematical ideas.
4.5. E.2 Select, apply, and translate among mathematical representations to solve problems.
4.5.F.3 Use graphing calculators and computer software to investigate properties of functions and their graphs.
4.5. F.4 Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).

Enduring Understandings: *Stated as full-sentence statements, the understandings specify what we want students to come to understand about the big ideas, or transferable concepts, principles, and theories.*	**Essential Questions:** *Essential questions reflect the most historically important issues, problems, and debates in a field of study. For example, "what is a proof? Is history inevitably biased? By examine such questions students are engaged in thinking like an expert. Essential questions are open-ended with no single, correct answer. They are meant to stimulate inquiry, debate and further questions, and can be reexamined over time. They are designed to be thought provoking to students, engaging them in sustained, focused inquiries, culminating in meaningful performances.*
Students should understand that: 1. Algebra is the language by which we communicate the patterns in mathematics. 2. Algebraic representation can be used to generalize patterns and relationships. 3. Mathematical models can be used to describe physical relationships. 4. Patterns and relationships can be represented graphically, numerically, symbolically, or verbally. 5. In mathematical relationships, the value for one quantity depends on the value of another quantity.	1. How can change be best represented mathematically? 2. How can patterns, relations, and functions be used as tools to best describe and help explain real-life situations? 3. How are patterns of change related to the behavior of functions? 4. How can we use mathematical models to describe physical relationships? 5. How can we use physical models to clarify mathematical relationships?

	6. What makes an algebraic algorithm both effective and efficient? 7. How can patterns, relations, and functions be used as tools to help explain real-life situations?

Students Will Know and Be Able To:

1. Recognize relationships as functions from graphs, tables, and descriptions.
2. Identify the domain and range of a given function.
3. Express a relationships using function notation.
4. Use properties of real numbers to solve equations with one variable.
5. Interpret slope as a rate of change.
6. Describe how changing the slope and/or y- intercept affect the graph of a line.
7. Write and graph direct variation equations.
8. Use direct variation equations to solve real-world problems.
9. Write and solve linear equations in slope-intercept form.
10. Write and solve linear equations in point-slope form.
11. Write and solve linear equations in standard form.
12. Use lines of best fit to model and interpret data and make predictions.
13. Write, solve and graph linear inequalities.
14. Use inequalities to interpret and represent real life situations.
15. Solve absolute value equations and inequalities.
16. Use graphing to solve systems of linear equations and inequalities.
17. Use substitution to solve systems of linear equations and inequalities.
18. Use elimination to solve systems of linear equations and inequalities.
19. Identify whether a linear system that has one, infinitely many, or no solution.

II. EVIDENCE OF STUDENT LEARNING

Authentic Performance Tasks *(Complex, authentic, challenges that mirror the issues and problems faced by adults. Ranging in length from short-term tasks to long-term, multi-staged projects, they yield one or more tangible products and performances.)*

1. Wireless phone companies charge monthly for the number of minutes that you use for incoming and outgoing calls. Some plans offer unlimited minutes for night and weekend plan, sharing of minutes, text messaging, downloadable ring tones, and Internet access.

Research, compare and analyze the cost of three different phone companies and their related charges for wireless service. Using your data collection and analysis, write a recommendation when each of the companies is the most cost effective. Analysis must include a graph showing monthly cost against minutes of usage for each company, and explain the significance of any intersections on the graph.

Based on your calling habits, which is the best plan for you and why?

2. Skiing is a popular sport, but avid skiers are constrained by the seasons, weather conditions, time of day, and more. Indoor ski slopes are gaining in popularity as they allow for the control of many of these constraints and could provide year-round fun. Still, the most interesting indoor ski slopes are probably yet to be designed. Try your hand at it!

You are going to explore various existing indoor ski slopes and then develop a plan for an indoor ski center of your own. You'll need a healthy background knowledge of coordinate planes, slopes, lines, and graphing linear equations (those equations that produce straight lines.) Your task is to graph the mathematical slope of various existing indoor ski slopes and design three unique ski slopes for varying abilities. Your ski slopes should be drawn carefully on graph paper and include the linear equations for the straight segments.

(adopted from http://www.ideportal.com/PBL/docs/ Ski%20_Indoors.doc, see related website for possible grading rubric)

Formal evidence of student learning may include:

Summative Performance Assessment/Transfer Task**:** *Assessment designed by teachers in which students are required to think critically, not just recall knowledge, and to prepare specific academic responses, products, or performances)*

Tests on recognizing and writing relationships as functions given a data table, graph or equation, solving linear equations, graphing linear equations and functions, writing linear equations, solving and graphing linear inequalities, and solving and graphing systems of equations and inequalities.

Quizzes on identifying relationships as functions, identifying independent and dependent variable given a real life situation, order of operations, properties of real numbers, simplifying and writing expressions, writing rules and graphing from linear data tables, finding slope, graphing inequalities, graphing the absolute value function.

Rubrics to assess above task.

Assessed Elements from Authentic Performance Assessments (Section III)

Other teacher-graded evaluations

Any of the above performance tasks (given within a smaller period of time)

Presentations of student research

II. LEARNING PLAN

Suggested Activities *(suggested learning activities that will allow students to successfully complete the assessment activities described in section II)*	**Strategies for Differentiation** *(Differentiating content, process, and/or product using variables of student readiness, interest, and learning style)* *Examples include:* *Readiness: small-group instruction, homework options, tiered assessments, compacting, multiple-entry points.* *Interest: Choices of books, homework options, explorations by interest and modes of expression (artistic, technological, written, oral, community service).* *Learning Style: Organizational options, working choice options, flexible environment, Multiple Intelligences options*
Explore a letter-shift code, and how it is used to decode messages. Examine the relationship between cryptography and functions. Use a "function machine" and have students write equations using function notation. Give students a series of graphs labeled as functions and non-functions. Have them work in pairs to use these graphs to determine what makes a graph a function. Identify the domain and range for those that are functions. Brainstorm non-numeric relationships that represent functions. http://illuminations.nctm.org/LessonDetail.aspx?id=L667 Use math lesson activities* available at http://enlvm.usu.edu to explore slope. 1. "Slippery Slope": introduces slope by comparing real world items with slope. Slope formula introduced. 2. "Writing Equations of Lines": interactive graphs to extend the meaning of slope and practice writing equations in point-slope form and slope-intercept form. Graph transformations of the direct variation equation. Have students write conclusion based on their observations. Use math activities* available at http://illuminations.nctm.org/ 1. Examine numeric, algebraic, and graphical representations of compositions of function in the context of successive discounts at a retail store ("Successive Discounts" lesson).	Interactive* lessons to review, define, recognize and write functions. http://enlvm.usu.edu/ma/nav/toc.jsp?sid=__shared&cid=emready@functions&bb=course Leveled textbook homework assignments. Use colored pencils to circle like terms in polynomials to help simplify expressions. Mini-lessons 1. Simplifying equations and expressions by combining like terms. 2. Using algebra tiles to model when solving single variable equations. 3. Using algebra tiles to model solving of systems of equations using elimination. Identify student coaches to provide individual help in solving equations with one variable, calculation of slope, writing equations from a graph, using graphing calculator, graphing inequalities, using the different methods to solve systems of equations and inequalities. Individual use of vocabulary explanations:* http://www.mathwords.com/ Individual use of related activities:* http://www.classzone.com/

2. Explore linear equations and lines of best fit. a. "Barbie Bungee" lesson examines linear functions. b. "Constant Dimensions" lesson allows students to discover that the ratio of length to width of a rectangle is constant. Use a graphing calculator* to compare several linear equations to identify parallel and/or perpendicular lines. Draw conclusions about slope of perpendicular and parallel lines based on the analysis of the equations. How is slope related? How is the y-intercept involved? Have students write equations that will construct a given polygon on the co-ordinate plane, They must define domain and range for each equation they write so that it constructs the necessary line segment to create the polygon. Have students write inequalities that will construct and shade in a given polygon on the co-ordinate plane. They must define domain and range for each inequality they write to construct and shade in the polygon. Explore solving inequalities using multiplication and division using "Walking the Line" (Attachment 1-1) Graph transformation of the absolute value function. Have students draw conclusions based on observations. How do these transformations compare to transformations of the direct variation (linear) function?	Enrichment Activity*: Explore can explore cryptology with lessons at http://illuminations.nctm.org/LessonDetail.aspx?id=U161

*technology implementation

Attachment 1-1

Name_____

Walking the Line Investigation Partner Activity

1. Draw a number line from -20 to 20 to use for reference as you perform each operation before entering the inequality symbol.

2. Enter the inequality symbol in the table after the each operation is performed and each player calculates his new position.

Operation	A's position	Inequality Symbol < or >	B's position
Start	2		4
Add 2			
Subtract 3			
Add –2			
Subtract –4			
Multiply by 2			
Subtract 7			
Multiply by –3			
Add 5			
Divide by –4			
Subtract 2			
Multiply by -1			

When does the inequality symbol sign change?

When does it *not* change?

What can be concluded about the relationship between the inequality symbol and the numerical operations (+, -, x, ÷)?

Does this conclusion hold true for all real numbers?

Check your findings by performing operations on real numbers and observing the changes in the inequality symbol.

Unit 2: Exponential Functions

Suggested Time Frame: 6-7 weeks

I. DESIRED RESULTS

Subject/Topic Areas: (if applicable)

1. Properties of exponents
2. Operations with negative and positive exponents
3. Scientific notation
4. Exponential functions – growth and decay
5. Geometric sequences

Critical Vocabulary (if applicable)

order of magnitude	power	exponent
base	reciprocal	cube root
scientific notation	exponential function	exponential growth
compound interest	exponential decay	geometric sequence
common ratio		

I. DESIRED RESULTS (CONT.)

Established Goals– NJCCCS *(Includes applicable content-area, technology, career, and interdisciplinary indicators)*

4.1.12.B.2 Develop, apply, and explain methods for solving problems involving rational and negative exponents.
4.1.12.B.4 Understand and apply the laws of exponents to simplify expressions involving numbers raised to powers.
4.3.12.A.1 Use models and algebraic formulas to represent and analyze sequences and series.
4.3.12.B.1 Understand relations and functions and select, convert flexibly among, and use various representations for them, including equations or inequalities, tables, and graphs.
4.3.12.B.2 Analyze and explain the general properties and behavior of functions or relations, using algebraic and graphing techniques.
4.3.12.C.1. Use functions to model real-world phenomena and solve problems that involve varying quantities.
4.5.E.1 Create and use representations to organize, record, and communicate mathematical ideas.
4.5.E.2 Select, apply, and translate among mathematical representations to solve problems.
4.5.F.3 Use graphing calculators and computer software to investigate properties of functions and their graphs.
4.5.F.4 Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).

Enduring Understandings: *Stated as full-sentence statements, the understandings specify what we want students to come to understand about the big ideas, or transferable concepts, principles, and theories.*	**Essential Questions:** *Essential questions reflect the most historically important issues, problems, and debates in a field of study. For example, "what is a proof? Is history inevitably biased? By examine such questions students are engaged in thinking like an expert. Essential questions are open-ended with no single, correct answer. They are meant to stimulate inquiry, debate and further questions, and can be reexamined over time. They are designed to be thought provoking to students, engaging them in sustained, focused inquiries, culminating in meaningful performances.*
Students should understand that: 1. Algebra is the language by which we communicate the patterns in mathematics. 2. Algebraic representation can be used to generalize patterns and relationships. 3. Mathematical models can be used to describe physical relationships. 4. Patterns and relationships can be represented graphically, numerically, symbolically, or verbally. 5. In mathematical relationships, the value for one quantity depends on the value of another quantity.	1. How can change be best represented mathematically? 2. How can patterns, relations, and functions be used as tools to best describe and help explain real-life situations? 3. How are patterns of change related to the behavior of functions? 4. How can we use mathematical models to describe physical relationships? 5. How can we use physical models to clarify mathematical relationships? 6. What makes an algebraic algorithm both effective and efficient? 7. How can patterns, relations, and functions be used as tools to help explain real-life situations?

Students Will Know and Be Able To:

1. Use the properties of positive exponents to simplify expressions.
2. Use the properties of zero and negative exponents to simplify expressions.
3. Read, write and perform operations with numbers in scientific notation.
4. Write and graph an exponential growth equation from a table of data.
5. Write and graph an exponential decay equation from a table of data.
6. Use exponential growth and decay equations to solve real-world problems.
7. Classify sequence as arithmetic or geometric.
8. Graph and write geometric sequences given a table of data.

II. EVIDENCE OF STUDENT LEARNING

Authentic Performance Tasks *(Complex, authentic, challenges that mirror the issues and problems faced by adults. Ranging in length from short-term tasks to long-term, multi-staged projects, they yield one or more tangible products and performances.)*

Scientists track populations of many species of animals and plants. Research how an animal/plant is placed on the endangered list. Identify a species on the endangered list and analyze its population decline. Write an exponential function to model the data.
If there are no interventions, use your model to predict when this species would become extinct? What is being done today to prevent its extinction?

Many animals/ plants are saved from extinction by human interventions. Identify a species that was once on the endangered list and analyze its recent population growth. Write an exponential function to model the data. What is being done to prevent it from becoming endangered again?

Formal evidence of student learning may include:
Summative Performance Assessment/Transfer Task**:** *Assessment designed by teachers in which students are required to think critically, not just recall knowledge, and to prepare specific academic responses, products, or performances)*

Tests on identifying and graphing exponential functions, using properties of exponents to solve real world problems.
Quizzes on simplifying variable expressions using rules of exponents, operations with numbers in scientific notation, writing and graphing exponential functions.
Essays
Rubrics
Assessed Elements from Authentic Performance Assessments (Section III)
Other teacher-graded evaluations

Strategies that will allow students to reflect upon and self-assess their learning, and enable teachers to informally assess student progress. They may include the following:

Pre-Assessments
Portfolios
Journals
Checklists
Closure Activities
Peer Review
Informal observations and dialogues
Think alouds
Examinations of student work
Other:

III. LEARNING PLAN

Suggested Activities *(suggested learning activities that will allow students to successfully complete the assessment activities described in section II)*	**Strategies for Differentiation** *(Differentiating content, process, and/or product using variables of student readiness, interest, and learning style)* *Examples include:* *Readiness: small-group instruction, homework options, tiered assessments, compacting, multiple-entry points.* *Interest: Choices of books, homework options, explorations by interest and modes of expression (artistic, technological, written, oral, community service).* *Learning Style: Organizational options, working choice options, flexible environment, Multiple Intelligences options*
Use math lesson activities* available at http://enlvm.usu.edu to explore sequences: "Patterns and Sequences": investigate arithmetic and geometric sequences. Use discovery activities and inductive reasoning to present the properties for multiplying and dividing exponents. Use math lesson activities* available at http://www.learner.org/channel/workshops/algebra/workshop8/w8_simms_skeeters.pdf to investigate growth of populations and use exponential function to represent growth. Using the TI-83*, graph transformations of the parent exponential quadratic function. Have students write conclusion based on their observations. Explore the difference between linear and exponential growth using a graphing calculator. Have students collect and model data for collectables that increase in value over time. Have students collect and model data for items that depreciate over time.	Leveled textbook homework assignments. For students having difficulty simplifying expressions with exponents using rules of exponents, write exponents in expanded form and apply properties of real numbers to simplify expressions. Individual use of related activities:* http://www.classzone.com/ Mini-lessons: 1. Writing and graphing exponential growth functions 2. Writing and graphing exponential decay functions. 3. Determining common ratios and writing geometric sequences. Identify student coaches to provide individual help in simplifying variable expressions with exponents, computations involving scientific notation, and writing exponential functions from data tables. Have available "How-to" sheets for: 1. "Rules" for operations with exponents. 2. Converting between standard notation and scientific notation.

	Scientific notation multiplication practice and review lesson*: http://education.smarttech.com/ste/en-US/Ed+Resource/Lesson+Activities/Notebook+Activities/Browse+Notebook/Canada/Secondary/7-9/Math/Scientific+Notation.htm

*technology implementation

Unit 3: Quadratic Functions

Suggested Time Frame: 12-13 weeks

I. DESIRED RESULTS

Subject/Topic Areas: (if applicable)

1. Adding, subtracting, multiplying and simplifying polynomials
2. Factoring polynomials
3. Writing and solving polynomials to solve problems
4. Graphing quadratic equations
5. Solving quadratic equations
6. Comparing linear, exponential and quadratic models

Critical Vocabulary (if applicable)

monomial	degree	polynomial
coefficient	binomial	trinomial
roots	factor by grouping	factor completely
perfect square trinomial	quadratic function	parabola
parent quadratic function	vertex	axis of symmetry
minimum value	maximum value	intercept form
quadratic equation	x-intercept	vertex form
completing the square	quadratic formula	discriminant

I. DESIRED RESULTS (CONT.)

Established Goals– NJCCCS *(Includes applicable content-area, technology, career, and interdisciplinary indicators)*

4.3.12. B.2 Analyze and explain the general properties and behavior of functions or relations, using algebraic and graphing techniques.
4.3.12. B.3 Understand and perform transformations on commonly-used functions.
4.3.12. B.4 Understand and compare the properties of classes of functions, including exponential, polynomial, rational, and trigonometric functions.
4.3.12. C.1 Use functions to model real-world phenomena and solve problems that involve varying quantities.
4.3.12. D.1 Evaluate and simplify expressions.
4.3.12. D.2. Select and use appropriate methods to solve equations and inequalities.
4.5. E.1 Create and use representations to organize, record, and communicate mathematical ideas.
4.5. E.2 Select, apply, and translate among mathematical representations to solve problems.
4.5. F.3 Use graphing calculators and computer software to investigate properties of functions and their graphs.
4.5. F.4 Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).

Enduring Understandings:
Stated as full-sentence statements, the understandings specify what we want students to come to understand about the big ideas, or transferable concepts, principles, and theories.

Students should understand that:

1. Algebra is the language by which we communicate the patterns in mathematics.
2. Algebraic representation can be used to generalize patterns and relationships.
3. Mathematical models can be used to describe physical relationships.
4. Patterns and relationships can be represented graphically, numerically, symbolically, or verbally.
5. In mathematical relationships, the value for one quantity depends on the value of another quantity.

Essential Questions:
Essential questions reflect the most historically important issues, problems, and debates in a field of study. For example, "what is a proof? Is history inevitably biased? By examine such questions students are engaged in thinking like an expert. Essential questions are open-ended with no single, correct answer. They are meant to stimulate inquiry, debate and further questions, and can be reexamined over time. They are designed to be thought provoking to students, engaging them in sustained, focused inquiries, culminating in meaningful performances.

1. How can change be best represented mathematically?
2. How can patterns, relations, and functions be used as tools to best describe and help explain real-life situations?
3. How are patterns of change related to the behavior of functions?
4. How can we use mathematical models to describe physical relationships?
5. How can we use physical models to clarify mathematical relationships?
6. What makes an algebraic algorithm both effective and efficient?
7. How can patterns, relations, and functions be used as tools to help explain real-life situations?

Students Will Know and Be Able To:

1. Add, subtract and multiply polynomials.
2. Recognize the square of a binomial pattern.
3. Factor trinomials of the form x^2+by+c and ax^2+by+c
4. Solve for roots of a polynomial in factored form.
5. Recognize and factor perfect square trinomials.
6. Factor polynomials completely by grouping.
7. Write and solve polynomial equations.
8. Graph a quadratic function in standard form by creating a table of values.
9. Graph a quadratic function in standard form by finding the axis of symmetry and vertex.
10. Write quadratic equations in intercept form.
11. Graph quadratic equations in intercept form by finding the axis of symmetry.
12. Solve quadratic equations by graphing.
13. Write and solve quadratic equations by finding square roots.
14. Write and solve quadratic equations by completing the square.
15. Write and solve quadratic equations by using the quadratic formula.
16. Graph quadratic equations in vertex form.
17. Use the discriminant to determine the number of real number solutions to a quadratic equation.
18. Write quadratic equations from a given set of data.
19. Recognize and write a linear, quadratic or exponential equation using a table of data.

II. EVIDENCE OF STUDENT LEARNING

Authentic Performance Tasks *(Complex, authentic, challenges that mirror the issues and problems faced by adults. Ranging in length from short-term tasks to long-term, multi-staged projects, they yield one or more tangible products and performances.)*

The Garden club is sponsoring a public garden in a rectangular space with a total area of 4800 sq. meters. An outer border of flowers 3 meters wide with an area of 870 sq. meters will surround an inside lawn area. The club wishes to install a sprinkler system that will water the grass and gardens while wasting as little water as possible on the surrounding parking lot.

Design the plan for the sprinkler installation, specifying the number of sprinklers, the distance you want each sprinkler to spray, and the amount of rotation for each sprinkler. You may choose from sprinklers that will spray 1, 3, and 5 meters. Each sprinkler may rotate in a complete circle or be restricted to rotate back and forth with in a specific range of not less than 45 degrees. Draw the garden to scale with the sprinklers you want to install. Shade in the coverage area for each sprinkler, being sure to indicate where 2 or more sprinklers overlap, thus watering the same area.

The best solution will be one that waters the lawn and garden with as few sprinklers as possible, as little overlap as possible, and a minimal amount of wasted water.

(adopted from http://www.ideportal.com/PBL/docs/wastenotthewater.pdf, see related website for possible grading rubric)

Formal evidence of student learning may include:

Summative Performance Assessment/Transfer Task**:** *Assessment designed by teachers in which students are required to think critically, not just recall knowledge, and to prepare specific academic responses, products, or performances)*

Tests on solving polynomial equations, and writing and solving polynomials to solve real-world problems; and solving quadratic equations, and writing and solving quadratic equations to solve real-world problems.

Quizzes on adding, subtracting and multiplying polynomial, factoring polynomials, graphing quadratic equations, calculating axis of symmetry and minimum/maximum values of a parabola, solving quadratic equations by factoring, interpreting the discriminant and using the quadratic formula.

Essays

Rubrics

Assessed Elements from Authentic Performance Assessments (Section III)

Other teacher-graded evaluations

III. LEARNING PLAN

Suggested Activities *(suggested learning activities that will allow students to successfully complete the assessment activities described in section II)*	**Strategies for Differentiation** *(Differentiating content, process, and/or product using variables of student readiness, interest, and learning style)* *Examples include:* *Readiness: small-group instruction, homework options, tiered assessments, compacting, multiple-entry points.* *Interest: Choices of books, homework options, explorations by interest and modes of expression (artistic, technological, written, oral, community service).* *Learning Style: Organizational options, working choice options, flexible environment, Multiple Intelligences options*
Use area models to write expressions in factored form. Examine patterns of "change" in quadratic data tables. Compare "change" to that of linear relationships. Conduct projectile motion experiments and find a quadratic function to model the data. Algebraically derive the quadratic formula from the standard form. Use math lessons* available at http://illuminations.nctm.org/ 1. "Egg Launch Contest" examines representations of quadratic functions. Use algebra tiles to model completing the square to solve quadratics. Using a graphing calculator*, graph transformations of the parent quadratic function. Have students write conclusion based on their observations. Compare different methods for solving quadratic equations. Discuss when it is most appropriate to use each method. Students can collect data from outside resources or experiments, and then make scatterplots using the data. Determine what type of model – linear, exponential or quadratic – best fits each scatterplot. Model the data using the graphing calculator. Write an equation to represent the graph.	Leveled textbook homework assignments. Individual use of related activities:* http://www.classzone.com/ Use colored pencils when using the "foil" method to multiply binomials to help students keep track of the distribution process. Mini-lessons: 1. Model multiplication of polynomials using algebra tiles. 2. Model factoring of polynomials using algebra tiles. 3. Complete the square to solve quadratic functions. Identify student coaches to provide individual help in factoring quadratics, operations with polynomials, using graphing calculator* to graph and trace quadratic equations. Have available "How-to" sheets for: 1. Classifying/naming polynomials. 2. Using the quadratic equation to solve for the roots of a quadratic function. 3. Interpreting the discriminant. Enrichment Activities: 1. Investigate the relationship between Pascal's Triangle and binomial coefficients. 2. Define "parabola" in words. Use Geometer's Sketchpad to draw a parabola based on your definition.

*technology implementation