Randolph Township Schools
Randolph Middle School

Algebra 1 Honors

"Mathematics, even in its present and most abstract state, is not detached from life. It is just the ideal handling of the problems of life."

- *Cassius Jackson Keyser*

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July 2017

Date of Board Approval
September 2017

Randolph Township Schools
Department of Science, Technology, Engineering, & Mathematics
Algebra 1 Honors

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Randolph Township Schools

Mission Statement

We commit to inspiring and empowering all students in Randolph schools to reach their full potential as unique, responsible and educated members of a global society.

Randolph Township Schools
Affirmative Action Statement

Equality and Equity in Curriculum

The Randolph Township School district ensures that the district's curriculum and instruction are aligned to the state's standards. The curriculum provides equity in instruction, educational programs and provides all students the opportunity to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972

RANDOLPH TOWNSHIP BOARD OF EDUCATION
EDUCATIONAL GOALS
VALUES IN EDUCATION

The statements represent the beliefs and values regarding our educational system. Education is the key to self-actualization, which is realized through achievement and self-respect. We believe our entire system must not only represent these values, but also demonstrate them in all that we do as a school system.

We believe:

- The needs of the child come first
- Mutual respect and trust are the cornerstones of a learning community
- The learning community consists of students, educators, parents, administrators, educational support personnel, the community and Board of Education members
- A successful learning community communicates honestly and openly in a non-threatening environment
- Members of our learning community have different needs at different times. There is openness to the challenge of meeting those needs in professional and supportive ways
- Assessment of professionals (i.e., educators, administrators and educational support personnel) is a dynamic process that requires review and revision based on evolving research, practices and experiences
    - Development of desired capabilities comes in stages and is achieved through hard work, reflection and ongoing growth

Randolph Township Schools
Department of Science, Technology, Engineering, & Mathematics
Introduction

The Randolph Township School District is committed to excellence. We believe that all children are entitled to an education that will equip them to become productive citizens of the 21st century. We believe that an education grounded in the fundamental principles of science, technology, engineering, and math (STEM) will provide students with the skills and content necessary to become future leaders and lifelong learners.

A sound STEM education is grounded in the principles of inquiry, rigor, and relevance. Students will be actively engaged in learning as they use real-world STEM skills to construct knowledge. They will have ample opportunities to manipulate materials and solve problems in ways that are developmentally appropriate to their age. They will work in an environment that encourages them to take risks, think critically, build models, observe patterns, and recognize anomalies in those patterns. Students will be encouraged to ask questions, not just the "how" and the "what" of observed phenomena, but also the "why". They will develop the ability, confidence, and motivation to succeed academically and personally.

STEM literacy requires understandings and habits of mind that enable students to make sense of how our world works. Scientifically and technologically literate citizens deal sensibly with problems that involve mathematics, evidence, patterns, logical arguments, uncertainty, and problem-solving.

Algebra 1 Honors
Introduction

The Algebra I Honors course is designed to provide students with an in-depth level of instruction, an accelerated pace and a cooperative learning environment. While Algebra 1A teaches concepts primarily at the concrete level, this course differs in the intentional, sustained abstract nature of the application of concepts. The course guides students in the development of critical thinking skills and algebraic problem-solving skills, which provide the foundation for real world problem solving. Modeling and problem solving are at the heart of the curriculum. Mathematical modeling consists of recognizing and clarifying mathematical structures that are embedded in other contexts, formulating a problem in mathematical terms, using mathematical strategies to reach a solution and interpreting the solution in the context of the original problem. Students must be able to solve practical problems, representing and analyzing the situation using symbols, graphs, tables or diagrams. They must effectively distinguish relevant from irrelevant information, identify missing information, acquire needed information and decide whether an exact or approximate answer is called for, with attention paid to the appropriate level of precision. After solving a problem and interpreting the solution in terms of the context of the problem, they must check the reasonableness of the results and devise independent ways of verifying the results.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Curriculum Pacing Chart
Algebra 1 Honors

SUGGESTED TIME ALLOTMENT	UNIT NUMBER	CONTENT - UNIT OF STUDY
4 weeks	I	Linear Relationships
6 weeks	II	Linear Functions
4 weeks	III	Systems of Linear Equations
10 weeks	IV	Polynomials & Quadratic Functions
8 weeks	V	Exponential & Radical Functions
4 weeks	VI	Data Analysis

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT I: Linear Relationships

<table>
<tr><td rowspan="9">STANDARDS / GOALS:

<u>High School Mathematics</u>

HSN - Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

HSA - CED.A.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

HSA - CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.

HSA - REI.A.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

HSA - REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

<u>Mathematical Practices</u></td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Connecting strategies and foundational mathematical knowledge together help organize the steps necessary to solve problems.</td><td>• How do algebraic expressions apply to real-world situations?</td></tr>
<tr><td>Combining like terms, isolating the variable and using inverse operations are strategies to apply when solving equations.</td><td>• Is the solution to an equation related to a real world problem always a solution to the real world problem?</td></tr>
<tr><td>The relationships among the operations and their properties promote computational fluency.</td><td>• What is algebraic thinking and how does it help solve real world problems?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

The foundational mathematical principles and their relationship to algebraic expressions.

Relationships exist between variables and constants, and operations on algebraic expressions and equations.

Linear equations in one variable can be solved for the</td><td>Students will be able to:

Extend understanding and use of operations to real numbers and algebraic procedures.

Apply the distributive property to real numbers.

Translate verbal phrases and sentences into expressions and equations.

Write the steps necessary to solve multi-stop equations using algebraic operations.

Solve multi-step equations using algebraic op-</td></tr>
</table>

MP1 Make sense of problems and persevere in solving them. **MP2** Reason abstractly and quantitatively. **MP3** Construct viable arguments and critique the reasoning of others. **MP4** Model with mathematics. **MP5** Use appropriate tools strategically. **MP6** Attend to precision. **MP7** Look for and make use of structure. **MP8** Look for and express regularity in repeated reasoning.	variable. Linear inequalities in one variable can be solved for and graphed. Compound Inequalities exist with two or more inequalities. Absolute value equations can be solved and graphed. Absolute value inequalities have a unique solution set that can be represented graphically. Literal equations can be solved for any variable. Problem solving requires a thoughtful, logical progression of mathematically sound processes.	erations. Solve linear equations that have variables on both sides. Identify special solutions of linear equations. Write linear inequalities from graphs and word phrases. Solve linear inequalities using inverse operations. Write and graph compound inequalities. Connect inequality graphs with proper inequalities equations. Solve compound inequalities. Solve absolute value equations. Identify special solutions of absolute value equations. Solve absolute value inequalities. Use absolute value inequalities to solve real-life problems. Rewrite literal equations and geometric formulas. Use a problem solving plan to solve problems using inductive and deductive reasoning

	Linear equations can be used to solve real-world problems. **VOCABULARY/KEY TERMS:** conjecture, rule, theorem, equation linear equation, solution, inverse operations, equivalent equations, inverse operations, mean, identity, absolute value, opposite, literal equation, inequality, solution set, graph of an inequality, equivalent inequalities, compound inequality, absolute value in equality.	Connect linear equations to real-world problems and situations in order to solve.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Maintaining Mathematical Proficiencies
- Quiz, Common Chapter and Benchmark Assessments
- Brain Scan/Exit Ticket

KEY LEARNING EVENTS AND INSTRUCTION:

- Problem Sets and Recitations
- Capstone Project

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT I: Linear Relationships

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
4 weeks	**Unit I: Linear Relationships** • Equations • Inequalities • Absolute Value • Compound Inequalities • Absolute Value Inequalities • Literal Equations	Big Ideas Math Algebra Textbook (Algebra I Honors Text) Algebra for College Students Textbook Holt McDougal Algebra 1 Concepts and Skills Textbook http://classzone.com http://illuminations.nctm.org Student resource worksheets http://www.kutasoftware.com Glencoe Algebra 1 Practice Masters and Study Guide Masters, Algebra with Pizzazz!, Kelly Wingate Algebra, Algebra Made Simple, Algebra Puzzlers Purple Math www.purplemath.com Graph generation tools: Winplot software http://math.exeter.edu/rparris/peanut/wp32z.exe, MathGV software www.mathgv.com/ Algebra teaching materials, Alexandria City, VA: http://www.acps.k12.va.us/curriculum/design/sample-algebra-course.pdf West Virginia Department of Education: http://wveis.k12.wv.us/Teach21/public/Uplans/U_menu.cfm?tsele1=2&tsele2=116 Common Core Curriculum Standards: http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf Interactive math practice www.mathgoodies.com, www.aaamath.com

		Appendix D

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT II: Linear Functions

<table>
<tr><td rowspan="8">STANDARDS / GOALS:

<u>High School Mathematics</u>

HSA - CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

HSA - REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

HSF - IF.A.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

HSF - IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

HSF - IF.A.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

HSF - IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Algebraic expressions and equations generalize relationships from specific cases.</td><td>• What is a function? Why is the domain and range important in defining a function?</td></tr>
<tr><td>Some mathematical statements have one or no solution, while others have an infinite number of solutions.</td><td>• What does it mean in a real world context for an equation to have one solution, no solution, or infinitely many solutions?</td></tr>
<tr><td>Functional relationships associate the value of one variable in relation to the value of another variable in a special manner.</td><td>• What us the best way to represent a function?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Functional relationships is any relationship where one y value correlates directly to only one x value.

Linear functions can be represented using tables, graphs, or equations.

Any relationship that is determined to be a function should</td><td>Students will be able to:

Determine whether relations are functions.

Identify domain and range of functions.

Identify the dependent and independent variables of functions.

Identify linear functions using graphs, tables, and functions.

Graph linear functions using discrete and continuous data.

Use function notation to evaluate and interpret</td></tr>
</table>

in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. **HSF - IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. **HSF - IF.C.7a** Graph linear and quadratic functions and show intercepts, maxima, and minima. **HSF - IF.C.7b** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. **HSF - IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **HSF - BF.A.1a** Determine an explicit expression, a recursive process, or steps for calculation from a context. **HSF - BF.B.3** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. **HSF - LE.A.1b** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **HSF - LE.A.2** Construct linear and exponential functions, including arithmetic	be written using function notation. Graphs of linear equations will result in straight lines. There are four major transformations for graphs of linear functions. Graphs of absolute value functions can be identified and represented using transformations. There are three written formats of linear equations. Parallel and perpendicular lines are identified by slope. Scatter plots represent comparisons between two pieces of	functions. Use function notation to solve and graph functions. Graph equations of horizontal and vertical lines. Graph equations in standard form using intercepts. Graph equations in slope-intercept form using slope and y-intercepts. Graph equations in point-slope form using slope and given point. Translate, reflect, stretch, shrink, and combine transformations of graphs of linear functions. Translate graphs of absolute value functions. Stretch, shrink, and reflect graphs of absolute value functions. Combine transformations of graphs of absolute value functions. Write linear equations in slope-intercept form, point-slope form, and standard form. Identify parallel and perpendicular lines using slopes. Write equations of parallel and perpendicular lines. Interpret scatter plots.

and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). **HSF - LE.B.5** Interpret the parameters in a linear or exponential function in terms of a context. **HSS - ID.B.6a** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. **HSS - ID.B.6b** Informally assess the fit of a function by plotting and analyzing residuals. **HSS - ID.B.6c** Fit a linear function for a scatter plot that suggests a linear association. **HSS - ID.C.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. **HSS - ID.C.8** Compute (using technology) and interpret the correlation coefficient of a linear fit. **HSS - ID.C.9** Distinguish between correlation and causation. **<u>Mathematical Practices</u>** **MP1** Make sense of problems and persevere in solving them. **MP2** Reason abstractly and quantitatively. **MP3** Construct viable arguments and cri-	data. A combination of two or more functions on one-graph results in a piecewise functions. Linear functions can be used to solve real-world problems. **VOCABULARY/KEY TERMS:** relation, function, domain, range, independent variable, dependent variable, linear functions, nonlinear functions, discrete domain, continuous domain, function notation, standard form, x-intercept, y-intercept, slope, rise, run, slope-intercept form, constant function, point-slope form, family of functions, parent function, transformation, translation, reflection, horizontal shrink, horizontal stretch, vertical shrink, vertical stretch, absolute value function, vertex, vertex form, linear model, parallel lines, perpendicular lines, scatter plots, correlation, line of fit, piecewise function, step function.	Identify correlations between data sets. Use lines of fit to model data. Evaluate, graph, and write piecewise functions and step functions. Connect piecewise functions to absolute value functions. Write absolute value functions. Connect linear functions to real-world problems and situations in order to solve.

tique the reasoning of others. **MP4** Model with mathematics. **MP5** Use appropriate tools strategically. **MP6** Attend to precision. **MP7** Look for and make use of structure. **MP8** Look for and express regularity in repeated reasoning.		

ASSESSMENT EVIDENCE: Students will show their learning by:

- Maintaining Mathematical Proficiencies
- Quiz, Common Chapter and Benchmark Assessments
- Brain Scan/Exit Ticket

KEY LEARNING EVENTS AND INSTRUCTION:

- Problem Sets and Recitations
- Capstone Project

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT II: Linear Functions

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
6 weeks	**UNIT II: Linear Functions** • Linear Functions • Function Notation • Graphing Linear Equations in Slope-Intercept Form • Graphing Linear Equations in Point-Slope Form • Graphing Linear Equations in Standard Form • Graphing Absolute Value Functions • Write Linear Equations in Slope-Intercept Form • Write Linear Equations in Point-Slope Form • Write Linear Equations in Standard Form • Scatter Plots • Line of Fit • Piecewise Functions	Big Ideas Math Algebra Textbook (Algebra I Honors Text) Algebra for College Students Textbook Holt McDougal Algebra 1 Concepts and Skills Textbook http://classzone.com http://illuminations.nctm.org Student resource worksheets http://www.kutasoftware.com Glencoe Algebra 1 Practice Masters and Study Guide Masters, Algebra with Pizzazz!, Kelly Wingate Algebra, Algebra Made Simple, Algebra Puzzlers Purple Math www.purplemath.com Graph generation tools: Winplot software http://math.exeter.edu/rparris/peanut/wp32z.exe, MathGV software www.mathgv.com/ Algebra teaching materials, Alexandria City, VA: http://www.acps.k12.va.us/curriculum/design/sample-algebra-course.pdf West Virginia Department of Education: http://wveis.k12.wv.us/Teach21/public/Uplans/U_menu.cfm?tsele1=2&tsele2=116 Common Core Curriculum Standards: http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf Interactive math practice www.mathgoodies.com, www.aaamath.com Appendix D

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT III: Systems of Linear Equations

STANDARDS / GOALS:	**ENDURING UNDERSTANDINGS**	**ESSENTIAL QUESTIONS**
<u>High School Mathematics</u> **HSA - CED.A.3** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. **HSA - REI.C.5** Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. **HSA - REI.C.6** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. **HSA - REI.D.11** Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. **HSA - REI.D.12** Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear	The graph of a linear equation in two variables is a line, and you can write the equation of the line in slope-intercept form.	• What information can we infer from the relationship between two variables based on the slope and y-intercept of the graph or equation?
	Several representations of linear equations and systems are used to model and solve real-world problems.	• How can someone determine the best method for solving a system of linear equations?
	KNOWLEDGE	**SKILLS**
	Students will know: Systems of linear equations can be solved by graphing. Systems of linear equations can be solved by the substitution method. Systems of linear equations can be solved by the elimination method. Special types of systems of linear equations can have zero solutions or infinitely many solutions. Solutions of linear inequalities in two variables must be	**Students will be able to:** Check solutions of systems of linear equations. Solve systems of linear equations by graphing. Solve systems of linear equations by substitution. Solve systems of linear equations by elimination. Justify methods for solving systems of linear equations. Determine the number of solutions of linear systems.

inequalities in two variables as the intersection of the corresponding half-planes. **<u>Mathematical Practices</u>** **MP1** Make sense of problems and persevere in solving them. **MP2** Reason abstractly and quantitatively. **MP3** Construct viable arguments and critique the reasoning of others. **MP4** Model with mathematics. **MP5** Use appropriate tools strategically. **MP6** Attend to precision. **MP7** Look for and make use of structure. **MP8** Look for and express regularity in repeated reasoning.	graphed and shaded. Systems of linear equations and linear inequalities can be used to solve real-life problems. **VOCABULARY/KEY TERMS:** system of linear equations, solution of a system of linear equations, linear inequality in two variables, half-planes, system of linear inequalities, graph of system of linear inequalities.	Check solutions of linear inequalities. Graph linear inequalities in two variables. Check solutions of systems of linear inequalities. Graph and write systems of linear inequalities. Use systems of linear equations and linear inequalities to solve real-life problems. Connect systems of linear equations to real-world problems and situations in order to solve.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Maintaining Mathematical Proficiencies
- Quiz, Common Chapter and Benchmark Assessments
- Brain Scan/Exit Ticket

KEY LEARNING EVENTS AND INSTRUCTION:

- Problem Sets and Recitations
- Capstone Project

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT III: Systems of Linear Equations

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
4 weeks	**UNIT III: Systems of Linear Equations** • Solving Systems of Linear Equations by Graphing. • Solving Systems of Linear Equations by Substitution. • Solving Systems of Linear Equations by Elimination. • Solving Special Systems of Linear Equations. • Graphing Linear Inequalities in Two Variables. • Systems of Linear Inequalities.	Big Ideas Math Algebra Textbook (Algebra I Honors Text) Algebra for College Students Textbook Holt McDougal Algebra 1 Concepts and Skills Textbook http://classzone.com http://illuminations.nctm.org Student resource worksheets http://www.kutasoftware.com Glencoe Algebra 1 Practice Masters and Study Guide Masters, Algebra with Pizzazz!, Kelly Wingate Algebra, Algebra Made Simple, Algebra Puzzlers Purple Math www.purplemath.com Graph generation tools: Winplot software http://math.exeter.edu/rparris/peanut/wp32z.exe, MathGV software www.mathgv.com/ Algebra teaching materials, Alexandria City, VA: http://www.acps.k12.va.us/curriculum/design/sample-algebra-course.pdf West Virginia Department of Education: http://wveis.k12.wv.us/Teach21/public/Uplans/U_menu.cfm?tsele1=2&tsele2=116 Common Core Curriculum Standards: http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf Interactive math practice www.mathgoodies.com, www.aaamath.com Appendix D

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT IV: Polynomials & Quadratic Functions

<table>
<tr><td rowspan="8">STANDARDS / GOALS:

<u>High School Mathematics</u>

HSA - SSE.A.2 Use the structure of an expression to identify ways to rewrite it.

HSA - SSE.B.3a Factor a quadratic expression to reveal the zeros of the function it defines.

HSA - APR.A.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

HSA - APR.B.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

HSA - CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

HSA - REI.B.4b Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>A relationship exists between polynomial factors, roots, zeros, and x-intercepts.</td><td>• How can we use polynomials to help solve real-world problems?</td></tr>
<tr><td>Special patterns can be used to factor polynomials more efficiently.</td><td>• How does the recognition of patterns aid in problem solving?</td></tr>
<tr><td>Each coefficient in a quadratic polynomial function determines unique characteristics of the graph of the function.</td><td>• How do graphs of quadratic equations relate to the real world?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td>Students will know:

Polynomials can be added and subtracted.

Polynomials can be multiplied.

There are two types of special products of polynomials.</td><td>Students will be able to:

Find the degree of polynomials.

Classify polynomials.

Add and subtract polynomials.

Multiply binomials.

Use the FOIL method.

Multiply binomials and trinomials.

Use the square of a binomial pattern.

Use the sum and difference pattern.</td></tr>
</table>

HSF - IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. **HSF - IF.B.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. **HSF - IF.C.7a** Graph linear and quadratic functions and show intercepts, maxima, and minima. **HSF - IF.C.8a** Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. **HSF - IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **HSF - LE.A.3** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. **HSF - BF.A.1a** Determine an explicit expression, a recursive process, or steps for calculation from a context. **HSF - BF.B.3** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value	Polynomial equations can be solved while in factored form. Polynomials in the form x^2+bx+c can be factored. Polynomials in the form ax^2+bx+c can be factored. There are two types of special products of polynomials and each can be factored. Polynomials must be factored completely. Graphs of polynomials have specific characteristics. Linear, exponential, and quadratic functions each have specific characteristics. Polynomial & quadratic functions can be used to solve real-world problems. **VOCABULARY/KEY TERMS:** monomial, degree of a monomial, polynomial, binomial, trinomial, degree of a polynomial, standard form, leading coefficient, closed,	Use the zero products property. Factor polynomials using the GCF. Factor x^2+bx+c. Factor ax^2+bx+c. Factor the difference of two squares. Factor perfect square trinomials. Factor polynomials by grouping. Factor polynomials completely. Justify methods for factoring polynomials completely. Identify characteristics of quadratic functions. Graph quadratic functions in standard form, vertex form, and intercept form. Choose functions to model data. Write functions to model data. Compare functions using average rate of change. Formulate a problems solving strategy using polynomial and quadratic functions in order to solve real-world problems.

of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. **<u>Mathematical Practices</u>** **MP1** Make sense of problems and persevere in solving them. **MP2** Reason abstractly and quantitatively. **MP3** Construct viable arguments and critique the reasoning of others. **MP4** Model with mathematics. **MP5** Use appropriate tools strategically. **MP6** Attend to precision. **MP7** Look for and make use of structure. **MP8** Look for and express regularity in repeated reasoning.	FOIL method, zero product property, factor by grouping, factor completely, quadratic functions, parabola, vertex, axis of symmetry, zero of a function, minimum value, maximum value, vertex form, intercept form, average rate of change.	

ASSESSMENT EVIDENCE: Students will show their learning by:

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KEY LEARNING EVENTS AND INSTRUCTION:

- Problem Sets and Recitations
- Capstone Project

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT IV: Polynomials & Quadratic Functions

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
10 weeks	**UNIT IV: Polynomials & Quadratic Functions** • Adding and Subtracting Polynomials. • Multiplying Polynomials. • Special Products of Polynomials. • Solving Polynomial Equations in Factored Form. • Factoring x^2+bx+c. • Factoring ax^2+bx+c. • Factoring Special Products. • Factoring Polynomials Completely. • Graphing $f(x) = ax^2$. • Graphing $f(x) = ax^2+c$. • Graphing $f(x) = ax^2+bx+c$. • Graphing $f(x) = a(x-h)^2+k$. • Using Intercept Form. • Comparing Linear, Exponential, and Quadratic Functions.	Big Ideas Math Algebra Textbook (Algebra I Honors Text) Algebra for College Students Textbook Holt McDougal Algebra 1 Concepts and Skills Textbook http://classzone.com http://illuminations.nctm.org Student resource worksheets http://www.kutasoftware.com Glencoe Algebra 1 Practice Masters and Study Guide Masters, Algebra with Pizzazz!, Kelly Wingate Algebra, Algebra Made Simple, Algebra Puzzlers Purple Math www.purplemath.com Graph generation tools: Winplot software http://math.exeter.edu/rparris/peanut/wp32z.exe, MathGV software www.mathgv.com/ Algebra teaching materials, Alexandria City, VA: http://www.acps.k12.va.us/curriculum/design/sample-algebra-course.pdf West Virginia Department of Education: http://wveis.k12.wv.us/Teach21/public/Uplans/U_menu.cfm?tsele1=2&tsele2=116 Common Core Curriculum Standards: http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf Interactive math practice www.mathgoodies.com, www.aaamath.com Appendix D

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT V: Exponential & Radical Functions

STANDARDS / GOALS:	**ENDURING UNDERSTANDINGS**	**ESSENTIAL QUESTIONS**
<u>High School Mathematics</u> **HSN - RN.A.1** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. **HSN - RN.A.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents. **HSN - RN.B.3** Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. **HSA - SSE.B.3b** Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. **HSA - SSE.B.3c** Use the properties of exponents to transform expressions for exponential functions. **HSA - CED.A.1** Create equations and inequalities in one variable and use them to solve problems. **HSA - CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations on	Non-linear functions are used in real-world applications.	• Why are most real-world function non-linear?
	The characteristics of power and radical functions and their representations are useful in solving real-world problems.	• How are expressions involving radicals and exponents related?
	KNOWLEDGE	**SKILLS**
	Students will know: Expressions with exponents can be simplified using exponent properties. Radical expressions are a form of exponents and can be simplified. Exponential functions are represented by curved graphs. Exponential growth and decay are common types of exponential functions. Exponential equations can be solved for missing variables.	**Students will be able to:** Use zero and negative exponents. Use the properties of exponents Find nth roots. Evaluate expressions with rational exponents. Identify and evaluate exponential functions. Graph exponential functions. Use and identify exponential growth and decay functions. Interpret and rewrite exponential growth and decay functions. Solve exponential equations with the same base.

coordinate axes with labels and scales. **HSA - CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. **HSF – IF.B.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. **HSF – IF.B.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. **HSF – IF.C.7a** Graph linear and quadratic functions and show intercepts, maxima, and minima. **HSF – IF.C.7b** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. **HSF – IF.C.7e** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **HSF – IF.C.8a** Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. **HSF – IF.C.8b** Use the properties of exponents to interpret expressions for exponential functions.	Radical expressions can be simplified using radical properties. Quadratic equations can be solved by graphing**.** Quadratic equations can be solved using square roots. Quadratic equations can be solved by completing the square. The quadratic formula can be used to solve quadratic equations.	Solve exponential equations with unlike bases. Solve exponential equations with graphing. Use properties of radicals to simplify expressions. Simplify expressions by rationalizing the denominator. Perform operations with radicals. Solve quadratic equations by graphing. Use graphs to find and approximate the zeros of functions. Solve quadratic equations using square roots. Approximate the solutions of quadratic equations. Complete the square for expressions of the form x^2+bx. Solve quadratic equations by completing the square. Find and use maximum and minimum values. Solve quadratic equations using the quadratic formula. Interpret the discriminant. Justify methods for solving polynomials.

HSF – IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **HSA - REI.A.1** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. **HSA - REI.B.4a** Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. **HSA - REI.B.4b** Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. **HSA - REI.C.7** Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. **HSA - REI.D.11** Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear,	Non-Linear systems of equations can be solved algebraically and graphically. Square root functions can be represented graphically. Cube root functions can be represented graphically. Radical equations can be solved for missing variables. Exponential functions and radicals can be used to solve real-life problems. **VOCABULARY/KEY TERMS:** power, base, exponent, scientific notation, nth root, radical, index of a radical, exponential functions, exponential growth, exponential growth function, exponential decay, exponential decay function, compound interest, exponential equation, radical expression, simplest form, rationalizing the denominator, conjugate, like radicals, quadratic equation, completing the square, quadratic formula, discriminant, systems of non-	Prove the quadratic formula. Solve systems of non-linear equations by graphing. Solve systems of non-linear equations algebraically. Approximate solutions of non-linear systems and equations. Graph square root functions. Compare square root functions with average rate of change. Graph cube root functions. Compare cube root functions with average rate of change. Solve radical equations. Identify extraneous solutions. Formulate a problems solving strategy using radicals and exponential functions in order to solve real-world problems.

polynomial, rational, absolute value, exponential, and logarithmic functions. **HSF - BF.A.1a** Determine an explicit expression, a recursive process, or steps for calculation from a context. **HSF - BF.B.3** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. **HSF - LE.A.1a** Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. **HSF - LE.A.1c** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. **HSF - LE.A.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). **<u>Mathematical Practices</u>** **MP1** Make sense of problems and persevere in solving them. **MP2** Reason abstractly and quantitatively. **MP3** Construct viable arguments and critique the reasoning of others.	linear equations, square root function, radical function, cube root function, radical equation.	

MP4 Model with mathematics. **MP5** Use appropriate tools strategically. **MP6** Attend to precision. **MP7** Look for and make use of structure. **MP8** Look for and express regularity in repeated reasoning.		

ASSESSMENT EVIDENCE: Students will show their learning by:

- Maintaining Mathematical Proficiencies
- Quiz, Common Chapter and Benchmark Assessments
- Brain Scan/Exit Ticket

KEY LEARNING EVENTS AND INSTRUCTION:

- Problem Sets and Recitations
- Capstone Project

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT V: Exponential & Radical Functions

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
8 weeks	**UNIT V: Exponential & Radical Functions** • Properties of Exponents • Simplifying Radical Expressions • Solving Radical Equations • Writing and Graphing Growth and Decay Functions • Solving Exponential Equations • Properties of Radicals • Solving Quadratics by Graphing • Solving Quadratics Using Square Roots • Solving by Completing the Square • Solving Quadratic Equations by Using the Quadratic Formula • Solving Non-Linear Systems of Equations • Graphing Square Root Functions • Graphing Cube Root Functions • Solving Radical Equations	Big Ideas Math Algebra Textbook (Algebra I Honors Text) Algebra for College Students Textbook Holt McDougal Algebra 1 Concepts and Skills Textbook http://classzone.com http://illuminations.nctm.org Student resource worksheets http://www.kutasoftware.com Glencoe Algebra 1 Practice Masters and Study Guide Masters, Algebra with Pizzazz!, Kelly Wingate Algebra, Algebra Made Simple, Algebra Puzzlers Purple Math www.purplemath.com Graph generation tools: Winplot software http://math.exeter.edu/rparris/peanut/wp32z.exe, MathGV software www.mathgv.com/ Algebra teaching materials, Alexandria City, VA: http://www.acps.k12.va.us/curriculum/design/sample-algebra-course.pdf West Virginia Department of Education: http://wveis.k12.wv.us/Teach21/public/Uplans/U_menu.cfm?tsele1=2&tsele2=116 Common Core Curriculum Standards: http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf Interactive math practice www.mathgoodies.com, www.aaamath.com Appendix D

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT VI: Data Analysis

<table>
<tr><td rowspan="3">STANDARDS / GOALS:

<u>High School Mathematics</u>

HSS - ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).

HSS - ID.A.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

HSS - ID.A.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

HSS - ID.B.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

<u>Mathematical Practices</u>

MP1 Make sense of problems and persevere in solving them.

MP2 Reason abstractly and quantitatively.

MP3 Construct viable arguments and critique the reasoning of others.</td><td>ENDURING UNDERSTANDINGS</td><td>ESSENTIAL QUESTIONS</td></tr>
<tr><td>Statisticians summarize, represent, and interpret categorical and quantitative data in multiple ways since one method can reveal or create a different view than another.</td><td>• How can data be analyzed and represented to reveal information enabling a better understanding of the phenomena from which the data was generated?</td></tr>
<tr><td>KNOWLEDGE</td><td>SKILLS</td></tr>
<tr><td></td><td>Students will know:

There are three measures of central tendency and variation.

Box and whisker plots can be used to show ranges in data sets.

The shapes of distribution identifies the most appropriate measurement tool for a data set.</td><td>Students will be able to:

Compare the mean, median, and mode of a data set.

Find the range and standard deviation of a data set.

Identify the effects of transformations on data.

Use box and whisker plots to represent and compare data sets.

Interpret box and whisker plots.

Describe the shape of data distribution.

Use the shapes of data distributions to choose appropriate measures.

Compare data distributions.</td></tr>
</table>

MP4 Model with mathematics. **MP5** Use appropriate tools strategically. **MP6** Attend to precision. **MP7** Look for and make use of structure. **MP8** Look for and express regularity in repeated reasoning.	Two-way tables should be used to represent bivariate data. Appropriate data displays can enhance data. Information in data displays can be used to solve real-life problems. **VOCABULARY/KEY TERMS:** central tendency, measure of center, mean, median, mode, outlier, measure of variation, range, standard deviation, data transformation, box and whisker plots, quartile, five number summary, interquartile range, histogram, frequency table, two-way table, joint frequency, marginal frequency, joint relative frequency, marginal relative frequency, conditional relative frequency, qualitative data, quantitative data, misleading graph.	Find and interpret marginal frequencies. Make two-way tables. Find relative and conditional relative frequencies. Use two-way tables to recognize associations in data. Classify data as quantitative or qualitative. Choose and create appropriate data displays. Analyze various components of misleading graphs. Formulate a problems solving strategy in order to solve real-world problems that involve data representations.

ASSESSMENT EVIDENCE: Students will show their learning by:

- Maintaining Mathematical Proficiencies
- Quiz, Common Chapter and Benchmark Assessments
- Brain Scan/Exit Ticket

KEY LEARNING EVENTS AND INSTRUCTION:

- Problem Sets and Recitations
- Capstone Project

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors
UNIT VI: Data Analysis

SUGGESTED TIME ALLOTMENT	CONTENT-UNIT OF STUDY	SUPPLEMENTAL UNIT RESOURCES
4 weeks	**UNIT VI: Data Analysis** • Measures of Center and Variation • Box and Whisker Plots • Shapes of Distributions • Two-Way Tables • Choosing a Data Display	Big Ideas Math Algebra Textbook (Algebra I Honors Text) Algebra for College Students Textbook Holt McDougal Algebra 1 Concepts and Skills Textbook http://classzone.com http://illuminations.nctm.org Student resource worksheets http://www.kutasoftware.com Glencoe Algebra 1 Practice Masters and Study Guide Masters, Algebra with Pizzazz!, Kelly Wingate Algebra, Algebra Made Simple, Algebra Puzzlers Purple Math www.purplemath.com Graph generation tools: Winplot software http://math.exeter.edu/rparris/peanut/wp32z.exe, MathGV software www.mathgv.com/ Algebra teaching materials, Alexandria City, VA: http://www.acps.k12.va.us/curriculum/design/sample-algebra-

		course.pdf West Virginia Department of Education: http://wveis.k12.wv.us/Teach21/public/Uplans/U_menu.cfm?tsele1=2&tsele2=116 Common Core Curriculum Standards: http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf Interactive math practice www.mathgoodies.com, www.aaamath.com Appendix D

APPENDIX A

RESOURCES:

Textbook:

Big Ideas Math Algebra 1
Authors: Lawson, Boswell
ISBN: 9781608408382
Copyright: 2014 Houghton Mifflin Harcourt

Associated textbook resources:

Algebra 1
Authors: Burger, et al.
ISBN: 978-0-547-64712-8
Copyright 2012 Holt McDougal

Algebra 1 Common Core
Authors: Charles, et al.
ISBN-13: 978-0-13-318548-5
Copyright 2012 Person Education, Inc.

Algebra 1 Concepts and Skills
Authors: Larson, et al.
ISBN-13: 978-0-547-00833-2
Copyright 2010 Holt McDougal

Algebra 1
Authors: Larson, et al.
ISBN-13: 978-0-618-88834-4
Copyright 2007 McDougal Littell

Algebra for College Students
Authors: Lial, Hornsby, & McGinnis
ISBN: 978-0-321-96926-2
Copyright: 2016 Pearson Education, Inc.

Other Learning Resources:

Algebra Made Simple
Author: Theresa Kane McKell
ISBN 0-7682-0260-4
Copyright 1999 McGraw-Hill Children's Publishing

Kelley Wingate Algebra
Author: Dawn Talluto Jacobi
ISBN 0-88724-450-5
Copyright 1995 Kelley Wingate Publications, Inc.

Algebra with Pizzazz!
Authors: Steve Marcy and Janis Marcy
ISBN 0-88488-244-6
Copyright1983 Creative Publications, Inc.

Algebra Puzzlers
Authors: Theresa Kane McKell
ISBN 0-7682-0101-2
Copyright 1998 McGraw-Hill Children's Publishing

Write! Mathematics
Multiple Intelligences & Cooperative Learning Writing Activities
Author: Virginia DeBott
ISBN: 978-1-879097-38-4
Copyright 1998 Kagan Publishing

Technology:

- Presentation software such as Powerpoint
- TI-83+ Graphing calculators (TI-84 Plus preferred)
- IPad graphing technology
- Computer room access
- Desmos Graphing Resource

APPENDIX B

Opportunities exist for interdisciplinary units with courses such as Science, Technology, Social Studies and Reading/Language Arts.

Example: Integrated Capstone Project involving the UN Sustainable Development Goals

APPENDIX C

Students have successfully completed Pre-Algebra, Grade 7, and show capacity to learn Algebra at the abstract level.

RANDOLPH TOWNSHIP SCHOOL DISTRICT
Algebra 1 Honors

APPENDIX D

Sample Projects/Worksheets

Name _____ Date_____

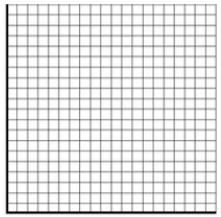
Problem Set A - Chapter 3

A Quadratic Function: The Diving Problem

You are jumping off the 10-foot diving board at the local pool. You bounce up at 6 feet per second and then drop toward the water. Your height h above the water, in terms of time t, follows the function shown.

$$h(t) = -16t^2 + 6t + 10$$

a. Graph this function, with t on the horizontal axis. Fill in a table of values where the increments of time are tenths of a second.



b. Explain what the ***domain*** and ***range*** might be and why.

c. Explain why this situation is quadratic instead of linear. Give a graphical explanation and a logical explanation.

d. Use the graph to determine the maximum height of your dive.

e. Use the graph to determine when you reach the maximum height of your dive.

f. Use the graph to determine how long it takes you to hit the water.

g. Use the ***quadratic formula*** to prove your answer in part (f).

Linear Functions: Taking a Taxi

You take a trip to downtown Boston to walk the Freedom Trail with your family. After you walk through the Bunker Hill Memorial, your family decides to take a taxi to a restaurant for dinner. After 1 mile, the meter on the taxi says $4.75. It will cost $8.25 to go 3 miles. The cost varies linearly with the distance that you traveled.

a. Write the particular linear function that models the cost of your trip as a function of the distance traveled. Use the notation $C(d)$.

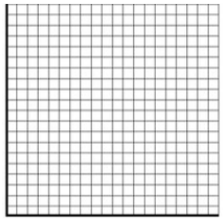
b. Write the function using improper fractions.

c. How much would it cost you to travel 10 miles in a taxi?

d. How far can you travel if you only have $10 to spend?

e. Calculate the cost-intercept. What does this number represent?

f. Plot the graph of this linear function. What is a suitable domain for this problem? A suitable range?



g. What is the slope of the line?

h. What does the slope of the line represent?

i. Write your own linear function word problem, and prove that it works graphically and algebraically.

Name _____ Date_____

Problem Set B - Chapter 3

Composition of Functions

Function Composition, $f(g(x))$ or $(f \circ g)(x)$, is applying the results of one function to the results of another. To perform a composition, you must combine the functions so that the output of one function becomes the input of another.

Example: If $f(x) = -x - 3$ and $g(x) = 2x + 7$, find $f(g(x))$ and $g(f(x))$.

$f(g(x)) = -(2x + 7) - 3$ $\qquad$ $g(f(x)) = 2(-x - 3) + 7$

$f(g(x)) = -2x - 7 - 3$ $\qquad$ $g(f(x)) = -2x - 6 + 7$

$f(g(x)) = -2x - 10$ $\qquad$ $g(f(x)) = -2x + 1$

Perform the indicated operation if $g(x) = 3x + 1$, $h(x) = -4x - 5$, and $p(x) = x^2$.

1. $h(g(x))$

2. $g(p(-5))$

3. $h(g(p(x)))$

4. $h(x) - g(x)$

Challenge: *x*- and *y*-intercepts

Find the *x*- and *y*-intercepts for the given equation. Assume that *a*, *b*, and *c* are all nonzero real numbers.

1. $ax + by = c$

2. $x + by + c = 5c - 2$

3. $ax + 2by - c = -2$

4. $\frac{2}{a}x + \frac{b}{3}y = 6c$

Challenge: Slope and Slope-Intercept Form

Find the slope of the line through the given points. Assume that *a* and *b* are nonzero real numbers. **Choose three out of four**

1. (a, b) and $(-2, 1)$

2. $(2a, 3b)$ and $(-2a, b)$

3. (a, b) and (b, a)

4. $(5a, b)$ and $(-5b, -a)$

Two lines are *parallel* if they both have the same slope. Two lines are *perpendicular* if the product of their slopes is -1, unless the slopes are 0 and undefined. Find the value of *x* so that the line through the pair of points is *parallel* to a line with the slope given. Then find the value of *x* so that the line through the pair of points is *perpendicular* to a line with the slope given. **Choose three out of four**

5. $m = \frac{1}{2}$; $(-3, x)$ and $(1, 4)$

6. $m = 0$; $(x, -3)$ and $(5, x)$

7. $m = -3$; $(3, -2x)$ and $(-4, 5)$

8. $m = \frac{5}{4}$; $(-1, 4)$ and $(x, -2)$

Factoring Maze

Instructions:

Start out the maze by factoring every polynomial. Write the binomial factors under the polynomial for easy reference. After you've finished factoring, find the path from the start to the end by moving one space up, down, left, or right when the adjacent square shares a factor with the current square. Ex: You may move from (x+2)(x-6) to (x+2)(3x+4) because they share a factor, but you would not move from (x-5)(2x-3) to (x-4)(x+5). You finish the maze when you reach the exit.

START

$x^2 + 6x - 16$	$x^2 - 8x + 12$	$5x^2 + 21x + 4$	$x^2 + 10x + 16$	$4x^2 - 4x - 3$	$x^2 - x - 20$
$2x^2 - 11x + 12$	$2x^2 - 9x - 18$	$4x^2 - 8x + 3$	$x^2 + 2x - 63$	$6x^2 - 19x + 10$	$9x^2 + 14x - 8$
$x^2 + 4x + 3$	$2x^2 + 23x + 30$	$x^2 - 4x - 60$	$6x^2 + 5x + 1$	$x^2 + 2x - 3$	$6x^2 + 13x + 6$
$5x^2 + 3x - 8$	$10x^2 + 31x + 24$	$16x^2 - 26x + 3$	$x^2 - 5x + 6$	$3x^2 - 13x + 12$	$9x^2 - 9x - 4$
$x^2 - 1$	$x^2 + 6x + 9$	$x^2 - x - 12$	$4x^2 - 11x - 3$	$x^2 - 2x - 15$	$6x^2 + x - 12$
$x^2 - 5x - 6$	$x^2 - 2x - 24$	$2x^2 + 9x + 4$	$8x^2 + 6x + 1$	$2x^2 + x - 6$	$2x^2 - 11x - 21$

END

Name: _____ Date: _____ Per: _____

Systems of Equations
21 Points

Directions: *The following real world problem relates to your classwork on linear equations and solving systems of linear equations. In your group, you will have 20 minutes to read through, discuss each question, and determine which strategies to use. After discussing with your group, you will have the rest of the hour today and tomorrow to complete the performance task. The rubric for grading is provided on the back.*

You are working as a representative for a cell phone company. Part of your job requires you to visually display the available cell phone plans. This way you can easily point out the advantages of each plan to the customers.

Part A:
There are three cell phone plans. All plans include unlimited calling, free nights and weekends, and free long distance. Write an equation for each cell phone plan.

Plan A costs $40 a month and $0.10 per text message. _____

Plan B costs $100 a month and has unlimited text messaging. _____

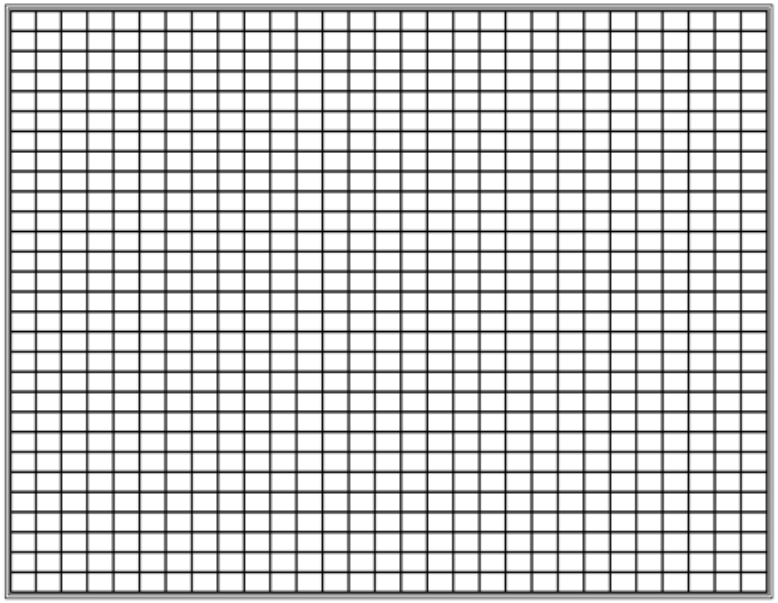
Plan C costs $50 a month and $0.05 per text message. _____

Part B:
On the paper provided, graph the three cell phone plans. Each cell phone plan should be clearly labeled with an equation. The graph should be labeled and neat.

Part C:
A customer would like to know which cell phone plan will be the cheapest choice. Show your math work below. Then, in 4 – 5 Sentences, explain which phone plan would be the cheapest choice for the customer and why.

Part D:
A customer explains that she typically sends an average of 400 text messages per month. Which cell phone plan would be the best choice for the customer? Show your math work below. Then, in 4 – 5 sentences, explain which cell phone plan would be the best choice for the customer.

Part B: Title: _____



Name: _____ Date: _____

Which Cereals are "Kids" Cereals?

Your doctor has advised you to pay closer attention to the nutritional value of the food that you eat. The first thing you must do is get rid of all the "kids" cereals in your house. You look in your pantry and realize that you need to determine which of your cereals are kids' cereals and which are adults' cereals. How would you determine which is which?

PROBLEM: What criteria would you use to identify "Kids" cereals?

HYPOTHESIS: Of the three different statistics listed on the "Data Sheet," which do you think helps determine if a cereal is a "Kids" cereal, or an "Adult" cereal? Explain why.

Procedure:

1. Students will be divided into groups of 3.
2. One student in each group will be responsible for a separate part of the project.
   - One student will organize data collected for the percent of sugar in each cereal.
   - One student will organize data collected for the calories in each cereal.
   - One student will organize data collected for the sodium in each cereal.
3. Each student should create a Stem-and-Leaf plot to organize the data they are responsible for.
   - See instructions below.
4. Find the mean, median, mode, and range of their data.
5. Create (2) Box-and-Whisker plots to analyze your data.
   - One Box-and-Whisker plot should be created using data from kids cereal (K) only and one Box-and-Whisker plot should be created using the adult cereal (A) only.

*This part of the project is due in class on Wednesday (1/21).

*Conclusions will be discussed between groups and as a class next week.

Stem-and-Leaf:

- This plot should include data from all the cereals listed on the "Cereal Data" handout.
- Each student is responsible for creating a Plot for only their responsible data (i.e. % sugar, calories, sodium)
- The plot should be color coded. The "leaf" representing data from a "kids" cereal should be a different color than the "leaf" representing data from an "adult" cereal.

Box-and-Whisker:

- One box-and-whisker plot should be created using data only from the kids cereals (K).
- One box-and-whisker plot should be created using data only from the adults cereals (A).
- The plots should be created "side by side" so that they can easily be compared and analyzed.
- Be sure to use titles and label so that I can clearly identify the plot representing data from the kids cereal and the adults cereal.

These plots should be "presentation" quality and will be given a quiz grade.

Name: _____ Date: _____

Cereal Investigation Conclusion Questions (30 points) Period: _____

CALORIC CONTENT

1. What is the mean calorie content of the cereals on the list? Is the mean a good representation of the calorie content of all the cereals? Why?

2. Are there any outliers?

3. Would the mode be a good indicator of caloric content? Why?

4. What inferences can you make of the parallel box plots representing the caloric content of the adult and kids' cereals? How do they compare?

5. Is caloric content an indicator of a kids' cereal? Explain?

SODIUM

6. How many cereals have 280 mg of sodium? Is this the mode?

7. How many cereals have more than 280 mg of sodium? Less than 28 mg?

8. Life cereal claims to be low in sodium. Should they make this claim? Explain.

9. What inferences can you make of the parallel box plots representing the sodium content of the adult and kids' cereals? How do they compare?

10. Is sodium content an indicator of kids' cereal? Why or why not?

SUGAR

11. What is the median value of the sugar content in the list of cereals?

12. What inferences can you make of the parallel box plots representing the sugar content of the adult and kids' cereals? How do they compare?

13. Is a high sugar content an indicator of a "kids'" cereal? Why or why not?

CONCLUSIONS

14. Which of the criteria (sugar, calories, sodium) was most effective in identifying kids' cereals? Why?

15. Which plot was the most useful in representing the data (stem-and-leaf or box-and-whisker)?

Name: _____ Period: _____ Date: _____

Graphing Quadratic Functions

Investigating $y = a(x - h)^2 + k$
Vertex (h, k)

Part I

Complete the table of values.

x	–4	–3	–2	–1	0	1	2	3	4
x^2									

Use the table of values to draw the graph of $y = x^2$. Be sure to label the vertex, axis of symmetry, concavity and minimum/maximum values.

Part II

Group A $y = ax^2$

1. Sketch and label the following graphs using the graphing calculator.

   a) $y = 2x^2$ b) $y = -3x^2$ c) $y = \frac{1}{2}x^2$ d) $y = 6x^2$ e) $y = -\frac{1}{2}x^2$

2. What are the similarities among the graphs?
3. What are the differences?
4. How do the graphs differ from the graph in Part I?
5. Generalize your findings.

Group B $y = (x - h)^2$

1. Sketch and label the following graphs using the graphing calculator.

   a) $y = (x - 2)^2$ b) $y = (x + 5)^2$ c) $y = (x + 1)^2$ d) $y = (x - 4)^2$

2. What are the similarities among the graphs?
3. What are the differences?
4. How do the graphs differ from the graph in Part I?
5. Generalize your findings.

Name: _____ Period: _____ Date: _____

Group C $y = x^2 + k$

1. Sketch and label the following graphs using the graphing calculator.

   a) $y = x^2 - 2$ b) $y = x^2 + 4$ c) $y = x^2 + 2$ d) $y = x^2 - 5$

2. What are the similarities among the graphs?
3. What are the differences?
4. How do the graphs differ from the graph in Part I?
5. Generalize your findings.

Part III

Form groups of three students consisting of one member from each of the groups from Part II. Each member will explain/describe what changes took place and what generalizations were made.

Part IV

As a class, discuss the affects changing the values a, h and k will have on the function:

$$y = a(x - h)^2 + k$$

a) $y = 2(x - 2)^2 + 3$ b) $y = -(x + 5)^2 - 2$ c) $y = -3(x + 1)^2 + 1$ d) $y = \frac{1}{2}(x - 4)^2 + 2$