HOWELL TOWNSHIP PUBLIC SCHOOLS

MATHEMATICS CURRICULUM FRAMEWORK

ALGEBRA

BOARD APPROVED: August 23, 2017

Algebra Curricular Framework

Overview	NJSLS Standards	Unit Focus	Standards for Mathematical Practices
Unit 1			1. Make sense of problems and persevere in solving them.
Modeling with Linear Equations and Inequalities	N.Q.A.1, N.Q.A.2, N.Q.A.3, A.REI.B.3,A.REI.A.1, A.CED.A.4, A.SSE.A.1, A.CED.A.1, A.REI.D.11, S.ID.C.7, S.ID.C.8, S.ID.C.9, S.ID.B.6, A.REI.A.1, A.CED.A.2, A.REI.D.10	· Reason quantitatively and use units to solve problems · Solve [linear] equations and inequalities in one variable · Understand solving equations as a process of reasoning and explain the reasoning · Create equations that describe numbers or relationships · Interpret the structure of expressions · Represent and solve equations graphically · Summarize, represent, and interpret data on quantitative variables. Interpret linear models	2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with Mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Unit 2			
Modeling with Linear Functions, Linear Systems, & Exponential Functions	A.REI.C.6, A.CED.A.3, A.REI.C.5 A.REI.D.12, F.IF.A.1, F.IF.A.2 F.LE.A.1, F.LE.A.2, F.IF.A.3, F.IF.B.5, F.IF.B.6, F.IF.C.9, F.IF.C.7, F.IF.B.5, F.IF.B.6, F.IF.C.9, F.IF.C.7	· Solve linear systems of equations · Create equations that describe numbers or relationships · Interpret the structure of expressions · Represent and solve equations and inequalities graphically	

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		· Construct & compare linear & exponential models · Interpret expressions for functions in terms of the situation · Build a function that models a relationship between two quantities · Understand the concept of a function and use function notation · Interpret functions that arise in applications in terms of the context · Analyze functions using different representations	
Unit 3			
Quadratic Equations, Functions & Polynomials	A.APR.A.1, A.SSE.A.2 A.REI.B.4, A.CED.A.1 F.IF.B.4*, F.IF.B.5*, A.SSE.B.3 F.BF.A.1, F.IF.C.7*, F.IF.C.8* F.IF.C.9*, F.IF.B.6, F.LE.A.3 F.BF.B.3, A.REI.D.11 A.APR.B.3, N.RN.B.3	· Perform arithmetic operations on polynomials · Understand the relationship between zeros and factors · Interpret the structure of expressions · Solve equations and inequalities in one variable · Create equations that describe numbers or relationships · Interpret functions that arise in applications in terms of the context · Represent and solve equations and inequalities graphically · Build a function that models a relationship between two quantities	

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		· Construct & compare linear, quadratic, & exponential models · Build new functions from existing functions · Analyze functions using different representations Use properties of rational and irrational numbers	

Unit 1: **Modeling with Linear Equations and Inequalities**
Learning Goal:
Learning Goal 1. Solve multi-step problems, using units to guide the solution, interpreting units consistently in formulas and choosing an appropriate level of accuracy on measurement quantities. Develop descriptive models by defining appropriate quantities. Learning Goal 2. Solve linear equations and inequalities in one variable (including literal equations); justify each step in the process**.** Learning Goal 3: Interpret terms, factors, coefficients, and other parts of expressions in terms of a context. Learning Goal 4: Create linear equations and inequalities in one variable and use them in contextual situations to solve problems. Justify each step in the process and the solution. Learning Goal 5: Create linear equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Learning Goal 6: Represent data on a scatter plot, describe how the variables are related and use technology to fit a function to data. Learning Goal 7: Interpret the slope, intercept, and correlation coefficient of a data set of a linear model; distinguish between correlation and causation. Learning Goal 8: Explain why the solutions of the equation $f(x) = g(x)$ are the x-coordinates of the points where the graphs of the linear equations $y=f(x)$ and $y=g(x)$ intersect. ** function notation is not introduced here Learning Goal 9: Find approximate solutions of $f(x) = g(x)$, where $f(x)$ and $g(x)$ are linear functions, by making a table of values, using technology to graph and finding successive approximations.
Learning Target:
● Solve equations , inequalities, absolute value , and literal equations. ● Graph and solve compound inequalities
Prerequisite Skills:
● Solve real life problems involving operations with rational numbers. ● Find the absolute values of numbers and use absolute value to compare numbers in real-life situations. ● Use variables to represent quantities in real life problems.

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- Write simple equations to solve real-life problems.
- Solve linear equations using the distributive property and combining like terms.
- Write word sentences as inequalities.
- Graph the solution set of an inequality on a number line.
- Use addition, subtraction, multiplication, or division to solve multi-step inequalities.
- Use inequalities to represent and solve real-life problems.

Content Standards	Mathematical Practices	Enduring Understandings	Essential Questions
Math : N.Q.A.1, N.Q.A.2, N.Q.A.3, A.REI.B.3,A.REI.A.1, A.CED.A.4, A.SSE.A.1, A.CED.A.1, A.REI.D.11, S.ID.C.7, S.ID.C.8, S.ID.C.9, S.ID.B.6, A.REI.A.1, A.CED.A.2, A.REI.D.10 Technology Standards:8.1.8.A.1, 8.1.8.A.4 Career Readiness Practices:CRP2., CRP4., CRP7., CRP8.	MP.1 MP.2 MP.3 MP.4 MP.5 MP.6 MP.7	Students are able to: · use units to understand real world problems. · use units to guide the solution of multi-step real world problems (e.g. dimensional analysis). · choose and interpret units while using formulas to solve problems. · identify and define appropriate quantities for descriptive modeling. · choose a level of accuracy when reporting measurement quantities. · solve linear equations with coefficients represented by letters in one variable. · use the properties of equality to justify steps in solving linear equations. · solve linear inequalities in one variable. · rearrange linear formulas and literal equations, isolating a specific variable. Students are able to:	- How can you use equations to solve real-life problems - How can you solve an absolute value equations - How can use an inequality to describe a real- life statement - How can you solve a multi-step inequality - How can you solve an absolute value inequality

		· identify different parts of an expression, including terms, factors and constants. · explain the meaning of parts of an expression in context. · identify and describe relationships between quantities in word problems. · create linear equations in one variable. · create linear inequalities in one variable. · use equations and inequalities to solve real world problems. · explain each step in the solution process. · create linear equations in two variables, including those from a context. · select appropriate scales for constructing a graph. · interpret the origin in graphs. · graph equations on coordinate axes, including labels and scales. identify and describe the solutions in the graph of an equation. · distinguish linear models representing approximately linear data from linear. equations representing "perfectly" linear relationships. · create a scatter plot and sketch a line of best fit. · fit a linear function to data using technology.	

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		· solve problems using prediction equations. · interpret the slope and the intercepts of the linear model in context. · determine the correlation coefficient for the linear model using technology. · determine the direction and strength of the linear association between two variables. · explain the relationship between the x-coordinate of a point of intersection and the solution to the equation f(x) = g(x) for linear equations y = f(x) and y = g(x). · find approximate solutions to the system by making a table of values, graphing, and finding successive approximations.	

Assessments:
STAR Math – Fall
Chapter Assessments
Trimester Assessments

Unit 1 Resources: Big Ideas Learning www.bigideasmath.com N.Q.A.1 Runners' World N.Q.A.2 Giving Raises N.Q.A.3 Calories in a Sports Drink A.REI.B.3, A.REI.A.1 Reasoning with linear inequalities A.CED.A.4 Equations and Formulas		

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[A.SSE.A.1 Kitchen Floor Tiles](#) [A.CED.A.1 Planes and wheat](#) [A-CED.A.1 Paying the rent](#) [A.REI.A.1 Zero Product Property 1](#) [A.CED.A.2 Clea on an Escalator](#) [S.ID.B.6,S.ID.C.7-9 Coffee and Crime](#)		

Unit 2: **Modeling with Linear Functions, Linear Systems, & Exponential Functions**
Learning Goal: Learning Goal 1: Solve multistep contextual problems by identifying variables, writing equations, and solving systems of linear equations in two variables algebraically and graphically. Learning Goal 2: Graph linear inequalities and systems of linear inequalities in two variables and explain that the solution to the system. Learning Goal 3: Explain the definition of a function, including the relationship between the domain and range. Use function notation, evaluate functions and interpret statements in context. Learning Goal 4: Distinguish between and explain situations modeled with linear functions and with exponential functions. Learning Goal 5: Write linear and exponential functions given a graph, table of values, or written description; construct arithmetic and geometric sequences. Learning Goal 6: Write explicit expressions, recursive processes and steps for calculation from a context that describes a linear or exponential relationship between two quantities. Learning Goal 7: Use properties of exponents to produce equivalent forms of exponential expressions in one variable. Learning Goal 8: Sketch graphs of linear and exponential functions expressed symbolically or from a verbal description. Show key features and interpret parameters in context. Learning Goal 9: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Learning Goal 10: Calculate and interpret the average rate of change of a function presented symbolically or as a table; estimate the rate of change from a graph. Learning Goal 11: Graph linear, square root, cube root, and piecewise-defined functions (including step and absolute value functions) expressed symbolically. Graph by hand in simple cases and using technology in more complex cases, showing key features of the graph.
Learning Target: ● Identify functions ● Use function notation ● Graph linear functions ● Apply transformations to graphs of linear functions and absolute value functions ● Write equations in slope-intercept,standard and point-slope form

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- Utilize the graphing functions of Ti83
- Construct Scatter plots and lines of fit
- Solve systems of equations
- Graph systems of equations and inequalities
- Apply properties of exponents
- Identify and evaluate exponential function
- Solve exponential equations

Prerequisite Skills:
- Find slope and y-intercepts of linear equations.
- Write and graph equations of lines in slope intercept form and standard form, and point slope form.
- Write equations of lines, using a slope and a point, and using two points.
- Use input-output tables and graphs to identify and represent functions.
- Translate, reflect, and rotate figures in the coordinate plane.
- Use slope to identify parallel and perpendicular lines.
- Describe and interpret patterns in scatter plots.
- Find and use lines of fit to solve problems.
- Write linear functions using graphs and tables.
- Determine if a value is a solution of an equations.
- Solve linear equations with one solution, no solutions and infinitely many solutions.
- Solve systems of equations algebraically and graphically.
- Solve one and two step inequalities.
- Write and evaluate numerical expressions with whole number exponents.
- Use properties of exponents, evaluate square roots and cube roots.
- Use scientific notation and perform of operations with numbers in scientific notation.
- Use order of operations to evaluate expressions.

Content Standards	Mathematical Practices	Enduring Understandings	Essential Questions

Math Standards :
  A.REI.C.6, A.CED.A.3, A.REI.C.5
  A.REI.D.12, F.IF.A.1, F.IF.A.2
	MP1.
	MP2.
	MP3.
	MP4.
	MP5.
		Students are able to:
		· identify and define variables representing essential features for the model.
			- What is a function - How can you determine whether a function is linear or nonlinear

| F.LE.A.1, F.LE.A.2, F.IF.A.3, F.IF.B.5, F.IF.B.6, F.IF.C.9, F.IF.C.7, F.IF.B.5, F.IF.B.6, F.IF.C.9, F.IF.C.7

 Technology Standards:8.1.8.A.1, 8.1.8.A.4 Career Readiness Practices:CRP2., CRP4., CRP7., CRP8. | MP6.
 MP7.
 MP8. | · model real world situations by creating a system of linear equations.
 · solve systems of linear equations using the elimination or substitution method.
 · solve systems of linear equations by graphing.
 · interpret the solution(s) in context.
 · model real world situations by creating a system of linear inequalities given a context.
 · interpret the solution(s) in context.
 · use the definition of a function to determine whether a relationship is a function.
 · use function notation once a relation is determined to be a function.
 · evaluate functions for given inputs in the domain.
 · explain statements involving function notation in the context of the problem.
 · identify and describe situations in which one quantity changes at a constant rate.
 · identify and describe situations in which a quantity grows or decays by a constant percent.
 · show that linear functions grow by equal differences over equal intervals.
 · show that exponential functions grow by equal factors over equal intervals. | ● How can you describe the graph of y = mx + b
 ● How do the values affect the graph of the absolute value function
 ● Given the graph of a linear function, how can you write an equation of the line
 ● How can you write an equation of line when you are given the slope and a point on the line
 ● How can you recognize lines that are parallel or perpendicular
 ● How can you analytically find a line of best fit
 ● How can you solve a system of equations
 ● How can you graph a system of linear inequalities
 ● How can you write general rules involving properties of exponents
 ● What are some of the characteristics of the graph of an exponential function
 ● How can you solve an exponential equation graphically |

		· create arithmetic and geometric sequences from verbal descriptions.
		· create arithmetic sequences from linear functions.
		· create geometric sequences from exponential functions.
		· identify recursively defined sequences as functions.
		· create linear and exponential functions given
		        - a graph;
		        - a description of a relationship;
		        - a table of values.
		· given a context, write an explicit expressions, a recursive process or steps for calculation for linear and exponential relationships.
		· interpret parts of linear and exponential functions in context.
		· use the properties of exponents to simplify or expand exponential expressions, recognizing these are equivalent forms.
		· given a verbal description of a relationship, sketch linear and exponential functions.
		· identify intercepts and intervals where the function is positive/negative.
		· interpret parameters in context.
		· determine the *practical* domain of a function.
		· compare key features of two linear functions represented in different ways.	

		· compare key features of two exponential functions represented in different ways. · calculate the rate of change from a table of values or from a function presented symbolically. · estimate the rate of change from a graph. · graph linear, square root, cube root, and piecewise-defined functions. · graph more complicated cases of functions using technology. identify and describe key features of the graphs of square root, cube root, and piecewise-defined functions .	

Unit 2 Resources:
Big Ideas Learning www.bigideasmath.com
A.REI.C.6 Cash Box
A.CED.A.3 Dimes and Quarters
A.REI.C.5 Solving Two Equations in Two Unknowns
A.REI.D.12 Fishing Adventures 3
F.IF.A.1 The Parking Lot
F.IF.A.2 Yam in the Oven
F.LE.A.1 Finding Linear and Exponential Models
F.LE.A.2 Interesting Interest Rates

F.BF.A.1a Skeleton Tower
A.SSE.A.1 Mixing Candies
F.IF.B.4 Warming and Cooling
F.IF.B.4, F.IF.B.5 Average Cost

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Assessments:
STAR Math – Fall
Chapter Assessments
Trimester Assessments

Unit 3 : **Quadratic Equations, Functions & Polynomials**

Learning Goal:

 Learning Goal 1: Add, subtract, and multiply polynomials, relating these to arithmetic operations with integers. Factor to produce equivalent forms of quadratic expressions in one variable.

Learning Goal 2: Derive the quadratic formula by completing the square and recognize when there are no real solutions.

Learning Goal 3: Solve quadratic equations in one variable using a variety of methods (including inspection, taking square roots, factoring, completing the square, and the quadratic formula) and write complex solutions in $a \pm bi$ form.

Learning Goal 4: Create quadratic equations in one variable and use them to solve problems.

Learning Goal 5: Interpret key features of quadratic functions from graphs and tables.   Given a verbal description of the relationship, sketch the graph of a quadratic function, showing key features and relating the domain of the function to its graph.

Learning Goal 6: Use factoring and completing the square to produce equivalent forms of quadratic expressions in one variable that highlight particular properties such as the zeros or the maximum or minimum value of the function.

Learning Goal 7: Given a context, write an explicit expression, a recursive process or steps for calculation for quadratic relationships.

Learning Goal 8: Graph quadratic functions by hand in simple cases and with technology in complex cases, showing intercepts, extreme values and symmetry of the graph. Compare properties of two quadratic functions, each represented in a different way.

Learning Goal 9: Calculate and interpret the average rate of change of a quadratic function presented symbolically or as a table. Estimate and compare the rates of change from graphs of quadratic and exponential functions.

Learning Goal 10: Identify the effects of transformations and combinations of transformations $[f(x) + k, k\,f(x), f(kx),$ and $f(x + k)]$ on a function; find the value of k given the graph.

Learning Goal 11: Find approximate solutions of f(x) = g(x), where f(x) is a linear function and g(x) is a quadratic function by making a table of values, using technology to graph and finding successive approximations.

Learning Goal 13: Explain and justify conclusions about sums and products of rational and irrational numbers.

Learning Target:

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• Add, subtract, multiply polynomials
• Factor trinomials
• Factor polynomials
• Graph quadratic functions
• Compare linear,exponential and quadratic equations
• Apply properties of radicals
• Solve quadratic equations
• Solve nonlinear system of equations
• Graph square root and cube root functions
• Solve radical equations
• Find inverses of functions

Prerequisite Skills:
- Find the GCF of two whole numbers that are at most 100.
- Factor out the GCF in algebraic and numerical expressions.
- Use the distributive property both ways.
- Read, write, and evaluate algebraic expressions.
- Add, subtract, factor and expand linear expressions with rational coefficients.
- Write, graph, and compare equations.
- Write and evaluate expressions with whole number exponents.
- Understand the definition of a function.
- Compare functions represented in tables, words, and graphs.
- Describe dilations, translations, rotations, and reflections using coordinates.
- Evaluate square roots and cube roots, including those resulting from solving equations.
- Solve linear equations with one solution, no solution, and infinitely many solutions.
- Solve equations with a squared variable and a cubed variable.
- Solve systems of linear equations.
- Solve equations by graphing.
- Describe a sequence of transformations to get from a figure to a congruent figure/similar figure.
- Write functions given a table or graph, and interpret the rate of change and initial value.

Content Standards	Mathematical Practices	Enduring Understandings	Essential Questions
Math: A.APR.A.1, A.SSE.A.2	MP1. MP2.	Students are able to:	

A.REI.B.4, A.CED.A.1 F.IF.B.4*, F.IF.B.5*, A.SSE.B.3, F.BF.A.1, F.IF.C.7*,F.IF.C.8*, F.IF.C.9*, F.IF.B.6, F.LE.A.3, F.BF.B.3, A.REI.D.11 A.APR.B.3, N.RN.B.3 Technology Standards:8.1.8.A.1, 8.1.8.A.4 Career Readiness Practices:CRP2., CRP4., CRP7., CRP8.	MP3. MP4. MP5. MP6. MP7. MP8.	· add and subtract polynomials. · multiply polynomials. · recognize numerical expressions as a difference of squares and rewrite the expression as the product of sums/differences. · recognize polynomial expressions in one variable as a difference of squares and rewrite the expression as the product of sums/differences. · use the method of completing the square to transform a quadratic equation in x into an equation of the form $(x - p)^2 = q$. · derive the quadratic formula from $(x - p)^2 = q$. · solve a quadratic equations in one variable by inspection. · solve quadratic equations in one variable by taking square roots. · solve a quadratic equations in one variable by completing the square. · solve a quadratic equations in one variable using the quadratic formula. · solve a quadratic equations in one variable by factoring. · strategically select, as appropriate to the initial form of the equation, a method for solving a quadratic equation in one variable. · write complex solutions of the quadratic formula in $a \pm bi$ form. · analyze the quadratic formula, recognizing the conditions	● How can you add,subtract,multiply polynomials ● How can you solve a polynomial equation ● How can you recognize and factor special products ● How can you factor a polynomial completely ● What are some of the characteristics of the graph of a quadratic function ● How can you find the vertex ● How can you compare the growth rates of linear, exponential and quadratic functions ● How can you graph and solve a quadratic equation ● How can you complete the square ● How can you solve a system of two equations ● What are some of the characteristics of the graph of a square root functions and a cube root functions ● How can you solve an equation that contains square roots ● How are a function and its inverse related

		leading to complex solutions (discriminant). · create quadratic equations in one variable. use quadratic equations to solve real world problems. · interpret maximum/minimum and intercepts of quadratic functions from graphs and tables in the context of the problem. · sketch graphs of quadratic functions given a verbal description of the relationship between the quantities. · identify intercepts and intervals where function is increasing/decreasing · determine the practical domain of a function. · given a context, write explicit expressions, a recursive process or steps for calculation for quadratic relationships. · graph quadratic functions expressed symbolically. · graph more complicated cases of quadratic functions using technology. · identify and describe key features of the graphs of quadratic functions. · given two quadratic functions, each represented in a different way, compare the properties of the functions. · calculate the rate of change of a quadratic function from a table	

		of values or from a function presented symbolically.
		· estimate the rate of change from a graph of a quadratic function.
		· analyze graphs and tables to compare rates of change of exponential and quadratic functions.
		· perform transformations on graphs of linear and quadratic functions.
		· 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).
		· identify the effect on the graph of combinations of transformations.
		· given the graph, find the value of k.
		· illustrate an explanation of the effects on linear and quadratic graphs using technology.
		· recognize even and odd functions from their graphs and from algebraic expressions for them.
		· approximate the solution(x) to a system of equations comprised of a linear and a quadratic function by using technology to graph the functions, by making a table of values and/or by finding successive approximations.	

		· find the zeros of a polynomial (quadratic and cubic). · test domain intervals to determine where f(x) is greater than or less than zero. · use zeros of a function to sketch a graph. · explain and justify conclusions regarding sums and products of two rational numbers.. · explain and justify conclusions regarding the sum of a rational and irrational number. · explain and justify conclusions regarding the product of a nonzero rational and irrational number.	

Unit 3 Resources:
Big Ideas Learning www.bigideasmath.com
A.APR.A.1 Powers of 11
A.SSE.A.2 Equivalent Expressions
A.REI.B.4 Visualizing Completing the Square
A.REI.B.4 Braking Distance
A.REI.B.4 Two Squares are Equal
F.IF.B.4 Words – Tables - Graphs
F.IF.B.5 The restaurant
A.SSE.B.3 Profit of a company
A.SSE.B.3 Rewriting a Quadratic Expression
F.IF.C.7a Graphs of Quadratic Functions
F.IF.C.8a Springboard Dive
F.IF.C.8a Which Function?
F.IF.B.9 Throwing Baseballs
F.IF.B.6 Mathemafish Population

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F.LE.A.3 Population and Food Supply
F.BF.B.3 Identifying Even and Odd Functions
F.BF.B.3 Transforming the graph of a function
A.REI.D.11 Introduction to Polynomials – College Fund
A.APR.B.3 Graphing from Factors 1
N.RN.B.3 Operations with Rational and Irrational Numbers

Assessments:
STAR Math – Fall
Chapter Assessments
Trimester Assessments