Groton Public Schools
Curriculum Map

INTRODUCTION
Course Title: **Algebra I**
Curriculum Area and Grade: **Algebra I (9th Grade)**

Course Purpose:
This course utilizes both a standards-based and thematic approach to algebra. Based on a real-world application of algebra, students will develop an understanding of the symbolic language of mathematics. Algebra skills and concepts are developed and applied through a variety of problem-solving situations Students will learn to simplify expressions, solve equations and inequalities in one variable, describe patterns and functions, write and graph linear functions, solve systems of linear equations, and study trends in one- and two-variable data. This course is aligned to the Common Core State Standards and provides opportunities for students to prepare for the SAT.

Major Learning Goals and Understandings:
FHS Student Learning Expectation(s): SE1 Apply effective analysis, synthesis, and evaluative processes that enable productive problem solving. SE2 Communicate information clearly and effectively using a variety of tools/media in varied contexts and for a variety of purposes. SE3 Work independently and collaboratively to solve problems and accomplish goals. SE4 Use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. SE5 Demonstrate innovation, flexibility and adaptability in thinking patterns, work habits, and working/learning conditions. SE6 Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior. Course Specific Learning Expectations: 1. Students will be able to solve a variety of linear equations and inequalities in one variable. 2. Students will be able to write and graph linear functions and use linear functions to represent real world situations. 3. Students will be able to interpret data by calculating measures of center and spread and creating visual representations using graphs. 4. Students will be able to solve systems of linear equations by graphing and algebraic methods.

Units/Theme/Concept and # of Weeks Quarter = 9 weeks, Semester=18 weeks, Trimester= 12 weeks, Year=36 weeks --- usually spread over 40 weeks	
1. **Solving Equations (9 weeks)**	2. **Patterns and Functions (6 weeks)**

3. **Linear Functions (9 weeks)**	4. **Statistics (6 weeks)**
4. **Systems of Equations (6 weeks)**	

Mappers/Authors: A. Harvey
Date Approved:

Part 1 – Unit 1: Solving Equations			
Grade: 9	**Subject:** Math	**Course:** Algebra I	**Length of Unit:** 9 weeks

Common Core State Standards (Priority)

CCSS.MATH.CONTENT.HSA.SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
CCSS.MATH.CONTENT.HSA.REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
CCSS.MATH.CONTENT.8.EE.C.7.A	Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).
CCSS.MATH.CONTENT.8.EE.C.7.B	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
CCSS.MATH.CONTENT.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.

Supporting Standards

CCSS.MATH.CONTENT.HSA.SSE.A.1.A	Interpret parts of an expression, such as terms, factors, and coefficients.
CCSS.MATH.CONTENT.HSN.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
CCSS.MATH.CONTENT.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.
CCSS.MATH.CONTENT.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.

Part 2 – Standards	
Key (GLE) Content Knowledge and Concepts/Skills	**Bloom's Taxonomy Levels** Creating, Evaluating, Analyzing, Applying, Understanding and Remembering

The students will know:	The students will be able to:	During this unit of study, all levels will be used for multiple learning experiences.
1. Finding a solution to an equation always involves the process of undoing operations. 2. Equations may have one solution, no solution, or infinite solutions. 3. Inequalities have a solution set that can be represented with a graph. 4. Equations and inequalities can be used to model real-world situations. 5. Strategies for solving multi-step equations.	1. Solve one-step, two-step, and multi-step equations in one variable. 2. Solve and graph the solution to inequalities in one variable. 3. Model real-world situations using equations and inequalities.	

Big Idea and Essential Questions

- **Big Ideas**
  1. The solution to an equation is the value that satisfies the equation (makes it true).
  2. An equation in one variable can have one solution, no solution, or infinite solutions.
  3. Inverse operations are used to solve for a variable.
  4. The solution to an inequality is the set of values that make the inequality true.

- **Essential Questions**
  1. What are the characteristics of an equation?
  2. What does equality mean?
  3. How do we determine if a relationship is equivalent?
  4. To what extent can equations be used to model all relationships?
  5. How can we use linear equations and linear inequalities to solve real world problems?

Part 3 – Common Unit Assessments

1. Portable Music Performance Assessment
2. Cab Fares Performance Assessment
3. Unit Test

Part 4 – Common/Assured Learning Experiences

- Students will practice solving a variety of one-variable equations, including equations that contain the distributive property, variables on both sides, and equations with fractions.
- Students will practice modeling a variety of real-world situations by solving word problems.

Part 5 – Teacher Notes

- Students should practice researching and organizing information for the Portable Music Device Performance Task.
- Students should practice making decisions and assumptions while solving word problems for the Cab Fares Performance Task.

Part 1 – Unit 2: Patterns and Functions

Grade:	**Subject:**	**Course:**	**Length of Unit:**
9	Math	Algebra I	6 Weeks

Common Core State Standards

CCSS.MATH.CONTENT.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).
CCSS.MATH.CONTENT.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.
CCSS.MATH.CONTENT.HSF.BF.A.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.*
CCSS.MATH.CONTENT.HSF.LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.
CCSS.MATH.CONTENT.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).
CCSS.MATH.CONTENT.HSF.BF.A.1	Write a function that describes a relationship between two quantities.*

Supporting Standards

CCSS.MATH.CONTENT.HSF.BF.A.1.A	Determine an explicit expression, a recursive process, or steps for calculation from a context.
CCSS.MATH.CONTENT.HSF.LE.A.1.A	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
CCSS.MATH.CONTENT.HSF.LE.A.1.B	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
CCSS.MATH.CONTENT.HSF.LE.A.1.C	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
CCSS.MATH.CONTENT.HSF.LE.B.5	Interpret the parameters in a linear or exponential function in terms of a context.

Part 2 – Standards

Key (GLE) Content Knowledge and Concepts/Skills		**Bloom's Taxonomy Levels** Creating, Evaluating, Analyzing, Applying, Understanding and Remembering
The students will know: 1. A function is a relation in which each input has exactly one output. 2. Arithmetic sequences represent patterns of repeated addition, while geometric sequences represent patterns of repeated multiplication. 3. Real-world patterns can be represented using recursive or explicit rules.	The students will be able to: 1. Represent relations and functions using ordered pairs, tables, mapping diagrams, and graphs. 2. Identify the domain and range of a given relation or function. 3. Determine whether a relation is a function. 4. Write recursive and explicit rules for arithmetic and geometric sequences. 5. Model real-world data using arithmetic and geometric sequences.	During this unit of study, all levels will be used for multiple learning experiences.

Big Idea and Essential Questions

- **Big Ideas**
  1. A function is a type of relation in which each input has exactly one output.
  2. Arithmetic sequences are patterns formed by repeated addition or subtraction.
  3. Geometric sequences are patterns formed by repeated multiplication or division.
  4. Real-world situations can be modeled by arithmetic and geometric sequences and their models can be used to make predictions.

- **Essential Questions**

1. What does it mean to be a function?
2. What is a pattern?
3. When does something represent an identifiable pattern?
4. What are some similarities and differences between arithmetic and geometric sequences?
5. Do scale, duration, frequency, and variability enable us to identify and understand a pattern?

Part 3 – Common Unit Assessments

1. Functions and Patterns Independent Project

Part 4 – Common/Assured Learning Experiences

1. Students will create their own examples and non-examples of functions and explain how they know if a relation is a function.
2. Students will define patterns in everyday life as arithmetic or geometric sequences and model them using algebra.

Part 5 – Teacher Notes

- Students should practice collecting data and organizing it using tables prior to their Independent Project.
- Students should practice presenting their findings (such as group posters) prior to their Independent Project.

Part 1 – Unit 3: Linear Functions

Grade:	**Subject:**	**Course:**	**Length of Unit:**
9	Math	Algebra I	9 Weeks

Common Core State Standards

CCSS.MATH.CONTENT.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.
CCSS.MATH.CONTENT.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.*
CCSS.MATH.CONTENT.HSF.IF.C.7.A	Graph linear ~~and quadratic~~ functions and show intercepts, ~~maxima, and minima.~~

CCSS.MATH.CONTENT.8.F.A.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
CCSS.MATH.CONTENT.8.F.A.3	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function A = s2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.
CCSS.MATH.CONTENT.8.F.B.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
CCSS.MATH.CONTENT.8.SP.A.3	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.
Supporting Standards	
CCSS.MATH.CONTENT.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).

Part 2 – Standards		
Key (GLE) Content Knowledge and Concepts/Skills		**Bloom's Taxonomy Levels** Creating, Evaluating, Analyzing, Applying, Understanding and Remembering
The students will know: 1. A linear function is a function in which there is a constant rate of change. 2. Linear functions can be written in slope-intercept form, standard form, or point-slope form based on the information provided. 3. The graph of a linear function forms a straight line. 4. Parallel lines have the same slope, while perpendicular lines have opposite reciprocal slopes.	The students will be able to: 1. Graph linear functions written in slope-intercept form, standard form, and point-slope form. 2. Write linear functions in slope-intercept form, standard form, or point-slope form given a graph. 3. Write the equation of a linear function given two points. 4. Write equations for parallel and perpendicular lines. 5. Model real-world situations using linear functions in slope-intercept form, standard	During this unit of study, all levels will be used for multiple learning experiences.

5. Linear functions can be used to model real-world situations.	form, or point-slope form based on the data given.	

Big Idea and Essential Questions

- **Big Ideas**
  1. A linear function is a function that has a constant rate of change; a linear function forms a straight line.
  2. Linear functions can be written in in multiple forms.
  3. Linear functions can be used to model real-world situations that have a constant rate of change.

- **Essential Questions**
  1. What does it mean to have a constant rate of change?
  2. What is a linear relationship?
  3. How can you represent a linear relationship?
  4. What is the significance of a linear function's slope and y-intercept?
  5. Are real life problems more easily solved when a model is available?

Part 3 – Common Unit Assessments

1. Green Bags Performance Task
2. Bottled Water Performance Task
3. Unit 3 Test

Part 4 – Common/Assured Learning Experiences

1. Students will practice graphing linear functions in all forms.
2. Students will practice transforming linear functions between forms.
3. Students will practice using different forms to model real-world situations by solving word problems.
4. Students will make predictions using linear models.

Part 5 – Teacher Notes

- Students should practice identifying relevant information from a word problem for the Green Bags Performance Task.
- Students should practice writing the equation of a line through two points for the Bottled Water Performance Task.

Part 1 – Unit 4: Statistics			
Grade: 9	**Subject:** Math	**Course:** Algebra I	**Length of Unit:** 6 Weeks

Common Core State Standards	
CCSS.MATH.CONTENT.HSS.ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
CCSS.MATH.CONTENT.HSS.ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
CCSS.MATH.CONTENT.HSS.ID.B.6.A	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.
CCSS.MATH.CONTENT.HSS.ID.B.6.C	Fit a linear function for a scatter plot that suggests a linear association.
CCSS.MATH.CONTENT.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.
CCSS.MATH.CONTENT.HSS.ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.
CCSS.MATH.CONTENT.HSS.ID.C.9	Distinguish between correlation and causation.
Supporting Standards	
CCSS.MATH.CONTENT.8.SP.A.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
CCSS.MATH.CONTENT.8.SP.A.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

Part 2 – Standards		
Key (GLE) Content Knowledge and Concepts/Skills		**Bloom's Taxonomy Levels** Creating, Evaluating, Analyzing, Applying, Understanding and Remembering
The students will know:	The students will be able to:	During this unit of study, all levels will be used for multiple learning experiences.

1. One-variable data can be modeled using dot plots, histograms, and box-and-whisker plots. 2. Scatter plots are a visual way to show the relationship between two quantitative variables. 3. Outliers can make it more difficult to make predictions based on a data set. 4. The difference between correlation and causation.	1. Construct dot plots, histograms, and box-and-whisker plots to represent a one-variable data set. 2. Calculate measures of center and determine which measure of central tendency (mean, median, or mode) is most appropriate for a data set. 3. Identify outliers in one-variable data sets using the 1.5xIQR rule. 4. Compare and contrast two data sets based on their measures of center and spread. 5. Construct scatter plots and lines of best fit by hand and using technology. 6. Determine the strength and direction of correlation between two variables.	

Big Idea and Essential Questions

- **Big Ideas**
  1. There are multiple ways to represent a data set by showing its frequency (dot plots and histograms) and its spread (box-and-whisker plots).
  2. Although scatter plots and trend lines may reveal a pattern, the relationship of the variables may indicate a correlation, but not a causation.

- **Essential Questions**
  1. How do we make informed decisions based on current numerical information?
  2. What does it mean for two variables to have a relationship?
  3. How can we defined and describe a relationship between two variables?
  4. What are the advantages and disadvantages of analyzing data by hand versus by using technology?
  5. Should relationships between two variables always be represented with a function?
  6. What is the potential impact of making a decision from data that contains one or more outliers?

Part 3 – Common Unit Assessments

1. Scatter Plot Lab
2. Independent Research Project

Part 4 – Common/Assured Learning Experiences

1. Students will create graphs by hand and using technology to represent the data.
2. Students will compare and contrast data sets.

Part 5 – Teacher Notes

- Students should practice constructing data tables and scatter plots for the Scatter Plot Lab.
- Students should practice collecting data from a variety of sources for the Independent Research Project.
- Students should understand the difference between qualitative and quantitative data for the Independent Research Project.

Part 1 – Unit 5: Systems of Equations

Grade:	**Subject:**	**Course:**	**Length of Unit:**
9	Math	Algebra I	6 Weeks

Common Core State Standards

CCSS.MATH.CONTENT.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.
CCSS.MATH.CONTENT.8.EE.C.8.A	Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
CCSS.MATH.CONTENT.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. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.
CCSS.MATH.CONTENT.8.EE.C.8	Analyze and solve pairs of simultaneous linear equations.

Supporting Standards

CCSS.MATH.CONTENT.8.EE.C.8.B	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.
CCSS.MATH.CONTENT.8.EE.C.8.C	Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

Part 2 – Standards		
Key (GLE) Content Knowledge and Concepts/Skills		**Bloom's Taxonomy Levels** Creating, Evaluating, Analyzing, Applying, Understanding and Remembering
The students will know: 1. The solution to a system of equations is the ordered pair that satisfies both equations. 2. Solutions to systems of equations can be found algebraically or graphically. 3. A system of linear equations can have one solution, no solution, or infinite solutions. 4. Systems of equations can be used to model real-world problems.	The students will be able to: 1. Solve a system of equations by graphing, substitution, and elimination. 2. Verify that an ordered pair is a solution to the system of equations. 3. Determine the most efficient method to solving a system of equations based on the information given. 4. Identify the solution to a system of equations in the context of the real-world problem.	During this unit of study, all levels will be used for multiple learning experiences.

Big Idea and Essential Questions

- **Big Ideas**
  1. A system of linear equations is an algebraic way to compare two equations that model a situation and find the breakeven point or choose the most efficient or economical plan.
  2. There are multiple ways to solve a system of equations.

- **Essential Questions**
  1. What are three ways to solve a system of equations?
  2. What does the number of solutions (none, one, or infinite) of a system of linear equations represent?
  3. How do mathematical relationships help to make informed decisions?
  4. What are the advantages and disadvantages of solving a system of linear equations graphically versus algebraically??
  5. To what extent can models help us make good financial decisions?

Part 3 – Common Unit Assessments

1. Travel Performance Task
2. Unit 5 Test

Part 4 – Common/Assured Learning Experiences

1. Students will practice graphing systems of equations.
2. Students will practice solving systems of equations algebraically using the substitution method and elimination method.
3. Students will solve systems of equations that have rational solutions.
4. Students will solve real-world problems and interpret their solutions.

Part 5 – Teacher Notes

- Students should practice researching and organizing information for the Travel Project.