HARFORD COUNTY PUBLIC SCHOOLS
ALGEBRA I GRADE 8 CURRICULUM

CLICK HERE for the Maryland College and Career Ready Standards for Algebra 1.

Unit 1: Systems of Equations

Primary Resource: *Course 3,* Carnegie Learning (2011).

Enduring Understandings

- Mathematical situations and structures can be translated and represented abstractly using variables, expressions, and equations.
- Rules of arithmetic and algebra can be used together with notions of equivalence to transform equations and inequalities so solutions can be found.

Essential Questions

- How can systems of equations model real-world situations to help solve problems?
- What are the advantages and disadvantages of solving a system of linear equations graphically versus algebraically?
- What does the number of solutions (one, none or infinitely many) of a system of linear equations represent in the given context?

Lesson Title	Lesson Overview	Standards
Unit Launch Linear Equation Review	To open the unit, students will refresh skills on solving linear equations with variables on one side and both sides, slope, and graphing lines.	
Parallel or Perpendicular – Slopes of Parallel and Perpendicular Lines	Students will investigate various equations and their graphs to develop the understanding of parallel and perpendicular relationships.	8.G.A.1c A.CED.A.3
Exploration Lesson Basketball Shots	Students will analyze a problem scenario that could be solved using a variety of strategies, including by solving a system of linear equations, in this 3-act lesson.	

Producing and Selling T-Shirts – Using a Graph to Solve a Linear System	Students will solve systems of linear equations that represent mathematical or real-world situations using graphs.	8.EE.C.8a 8.EE.C.8b 8.EE.C.8c A.REI.C.6
Saving Money – Graphs and Solutions of Linear Systems	Students will solve systems of linear equations that represent mathematical or real-world situations using graphs.	8.EE.C.8a 8.EE.C.8b 8.EE.C.8c A.REI.C.5 A.REI.C.6 A.REI.D.11
The County Fair – Using Substitution to Solve a Linear System, Part 1	Students will solve systems of linear equations that represent mathematical or real-world situations using substitution.	8.EE.C.7a 8.EE.C.7b 8.EE.C.8a 8.EE.C.8b 8.EE.C.8c A.REI.C.6
Tickets, Please – Using Substitution to Solve a Linear System, Part 2	Students will solve systems of linear equations that represent mathematical or real-world situations using substitution.	8.EE.C.7a 8.EE.C.7b 8.EE.C.8a 8.EE.C.8b 8.EE.C.8c A.REI.C.6
Systems of Equations – Using Linear Combinations to Solve a Linear System	Students will solve systems of linear equations that represent mathematical or real-world situations using elimination.	8.EE.C.7a 8.EE.C.7b 8.EE.C.8a 8.EE.C.8b 8.EE.C.8c A.REI.C.5 A.REI.C.6

What's for Lunch – Solving More Systems	Students will solve systems of linear equations that represent mathematical or real-world situations using elimination.	8.EE.C.7a 8.EE.C.7b 8.EE.C.8a 8.EE.C.8b 8.EE.C.8c A.REI.C.5 A.REI.C.6

Unit 2: Systems of Inequalities

Primary Resource: *Algebra,* Carnegie Learning (2012).

Enduring Understandings

- Mathematical situations and structures can be translated and represented abstractly using variables and inequalities.

Essential Questions

- How are the solutions to a linear inequality or system of linear inequalities represented on a coordinate plane?
- How can systems of inequalities model real-world situations to help solve problems?

Lesson Title	Lesson Overview	Standards
Exploration Lesson	Students will explore backyard farming and create combinations of tomatoes and green beans discussing cost and profit that lead to systems of linear inequalities.	8.EE.8a 8.EE.8b 8.EE.8c
Playoffs - Graphing Inequalities	Students will write and graph inequalities with two variables. Students will work through a real-world problem to recognize that inequality has multiple solutions. They will review vocabulary to determine whether a line is dashed or solid, and they will practice graphing inequalities. Students will graph a real-world situation and describe which points are solutions and which are not.	A.REI.D.12
Working the System – Systems of Linear Inequalities	Students will write and graph systems of linear inequalities by hand and with a graphing calculator or graphing utility. Students will write a system of inequalities modeling a given situation. Students will graph the two inequalities and identify where the shaded regions overlap which represents the solution set.	A.CED.A.3 A.REI.B.3 A.REI.D.12
Our Biggest Sale of the Season! – Systems with More than Two Linear Inequalities	Students will solve systems of linear inequalities in the coordinate plane. They will work with systems in which there are more than two inequalities.	A.CED.A.3 A.REI.D.12

Unit 3: Linear and Exponential Modeling

Primary Resource: *Algebra I*, 3rd Edition**,** UCSMP.

Enduring Understandings

- Mathematical rules (relations) can be used to assign members of one set to members of another set. A special rule (function) assigns members of one set to a unique member of another set.
- There are special numerical measures that describe the center and spread of numerical data sets.

Essential Questions

- What is exponential growth and how does it differ from linear growth?
- How can one describe the relationship between data that is displayed algebraically, graphically, numerically in tables, or by verbal descriptions?
- How can linear functions or exponential functions model real-world situations to help solve problems?

Lesson Title	Lesson Overview	Standards
Fitting a Line to Data	Students will make a scatter plot, find the line of best fit, and interpret the slope and intercept in the context of the problem as well as analyze the correlation coefficient.	8.SP.A.1 8.SP.A. 2 S.ID.C.7 S.ID.C.8 S.ID.C.9
Insert Lesson – Interpreting Data	Students will interpret the slope and the *y*-intercept of a linear model in the context of the data.	S.ID.B.6a S.ID.B.6b S.ID.C.7 S.ID.C.8 S.ID.C.9
Insert Lesson – Interpreting Linear Models, Plotting and Analyzing Residuals	Students will plot and analyze residuals. Consider using data from the previous lesson's activity, or the resources provided in Canvas.	S.ID.B.6a S.ID.B.6b S.ID.C.7 S.ID.C.8 S.ID.C.9

Exploration Lesson Exponential Growth	Students will explore a scenario that leads to exponential growth.	
Compound Interest	Students will develop and apply the Compound Interest Formula to solve real-world problems.	A.CED.A.1 F.LE.A.1a F.LE.A.1b F.LE.A.1c
Exponential Growth	Students will graph exponential growth relationships from mathematical or real-world situations and begin to write and apply exponential equations to represent those relationships.	A.SSE.A.1a A.SSE.A.1b F.IF.C.7a F.LE.B.5
Exponential Decay	Students will graph exponential decay relationships from mathematical or real-world situations and write and apply exponential equations to represent those relationships.	F.LE.A.1a F.LE.A.1b F.LE.A.1c F.LE.A.2 F.LE.B.5
Modeling Exponential Growth and Exponential Decay	Students will model data from mathematical or real-world contexts using exponential equations.	A.SSE.B.3c F.LE.A.1a F.LE.A.1b F.LE.A.1c F.LE.A.2 F.LE.A.3 S.ID.B.6a

Unit 4: Analyzing Functions

Primary Resources: Algebra, Carnegie Learning (2012); Algebra, 3rd Edition, UCSMP; Insert Lesson resources in Canvas.

Enduring Understandings

- Mathematical rules (relations) can be used to assign members of one set to members of another set. A special rule (function) assigns members of one set to a unique member of the other set.
- Objects in space can be transformed in an infinite number of ways, and those transformations can be described and analyzed mathematically.

Essential Questions

- How do functions and relations differ?
- How can functions be used to model relationships between quantities?
- What are the effects of a translation on a function in the coordinate plane?
- How can functions model real-word situations to help solve problems?

Lesson Title	Lesson Overview	Standards
To Be or Not to Be a Function? – Defining and Recognizing Functions	Students will determine whether a relation (represented as a mapping, set of ordered pairs, table, graph, equation, or context) is a function. This lesson defines relations and develops the understanding of functions.	8.F.A.1 8.F.A.2 8.F.A.3 8.F.B.5
The Language of Functions	Students will use the language of functions, including identifying the domain and range of a function. From the exploration lesson, students should have a general understanding of what makes a relation a function. Use this lesson to expand on that understanding.	F.IF.A.1 F.IF.A.2 F.IF.B.5
Function Notation	Students will apply function notation in mathematical and real-world contexts.	F.IF.A.1 F.IF.A.2
Insert Lesson – Function Notation in Context	Students will interpret statements that use function notation in terms of a context as well as relate the domain of a function to its graph and the relationship it describes.	F.IF.A.2 F.IF.B.5

Is There a Pattern Here? – Recognizing Patterns and Sequences	Students will be able to describe and continue patterns and write numeric sequences to represent patterns and situations.	F.LE.A.1a F.LE.A.1b F.LE.A.1c
The Password is Operations! – Arithmetic and Geometric Sequences	Students will be able to continue arithmetic and geometric sequences and determine the common difference or common ratio. Students will extend arithmetic and geometric sequences and determine the common difference or common ratio.	F.LE.A.1a F.LE.A.1b F.LE.A.1c
Formulas for Arithmetic Sequences	Students will write explicit formulas for arithmetic sequences using subscript notation as well as function notation. Given an explicit or recursive formula, written in subscript notation or function notation, they will determine unknown terms of an arithmetic sequence.	F.IF.A.3 F.BF.A.1a F.LE.A.2
Formulas for Geometric Sequences	Students will write explicit formulas for geometric sequences using subscript notation as well as function notation. Given an explicit or recursive formula, written in subscript notation or function notation, they will determine unknown terms of an arithmetic sequence.	F.IF.A.3 F.BF.A.1a F.LE.A.2
Non-Linear Functions	Students will graph a variety of functions as well as interpret key features of their graphs.	F.IF.B.4 F.IF.B.5
Comparing Linear and Exponential Functions	Students will compare linear and exponential functions while focusing on average rate of change.	F.LE.A.2
Translating Linear and Exponential Functions Vertically and Horizontally	Students will translate linear and exponential functions vertically and horizontally. Given a function and a translation to be performed, students will write the equation for the translated function.	F.BF.B.3

Unit 5: Introduction to Quadratic Functions

Primary Resource: *Algebra*, Carnegie Learning (2012).

Enduring Understandings

- Relationships can be described, and generalizations made for mathematical situations that have numbers of objects that repeat in predictable ways.
- Objects in space can be transformed in an infinite number of ways, and those transformations can be described and analyzed mathematically.

Essential Questions

- How can one determine the equation for a quadratic function displayed algebraically, graphically, numerically in a table, or by verbal descriptions?
- What are the effects of a dilation, translation, and/or reflection on a function in the coordinate plane?
- How can quadratic functions model real-world situations to help solve problems?

Lesson Title	Lesson Overview	Standards
Motivation / Exploration	Students will be introduced to quadratic functions through this 3-act lesson.	
Up and Down and Up – Exploring Quadratic Functions	Students will create quadratic equations to represent real-world situations and analyze the key features of the graphs of those equations.	A.CED.A.1 A.CED.A.2 F.IF.B.4
Just U and I – Comparing Linear and Quadratic Functions	Students will identify linear and quadratic functions from multiple representations. This lesson explores the first and second differences of linear and quadratic functions. Students will analyze tables and graphs of different functions to identify the function type.	A.CED.A.1 A.CED.A.2 A.SSE.A.1a A.SSE.A.1b F.IF.B.4 F.IF.B.6 F.LE.A.1a

Walking the Curve – Domain, Range, Zeros, and Intercepts	Students will identify the key features of a quadratic function in a real-world context. This lesson provides a real-world situation that models vertical motion.	A.SSE.A.1a A.SSE.A.1b A.CED.A.1 A.CED.A.2 F.IF.B.4 F.IF.B.5 F.IF.C.7a
Are you Afraid of Ghosts? – Factored Form of a Quadratic Function	Students will determine the *x*-intercepts from a quadratic function written in factored form and write the equation of a quadratic function in factored form, given the *x*-intercepts of its graph. This lesson provides opportunities for students to understand the significance of a quadratic function written in factored form. Students will compare the behaviors of the graph of the quadratic equation to the function written in factored form.	A.SSE.A.1a A.SSE.B.3a A.CED.A.1 A.CED.A.2 F.IF.B.4 F.IF.C.7a
Just Watch the Pumpkin Fly! – Investigating the Vertex of a Quadratic Function	Students will investigate the vertex and symmetry of the graph of a quadratic function in mathematical and real-world contexts. This lesson provides opportunities for students to understand the significance of the line of symmetry with respect to quadratic functions. Students will use the axis of symmetry to determine additional points on the parabola.	A.CED.A.4 A.SSE.A.1a F.IF.B.4 F.IF.C.7a
The Form is Key – Vertex Form of a Quadratic Function	Students will identify and compare the key characteristics of a quadratic function written in standard form, factored form, and vertex form. Students are then given two functions written in standard form and complete graphic organizers by writing the functions in factored form and vertex form, and then identifying the key features of each form.	A.SSE.A.1a F.IF.B.4 F.IF.C.7a
More Than Meets the Eye – Transformations of Quadratic Functions	Students will perform transformations of quadratic functions graphically and write equations of quadratic functions, given multiple transformation. This lesson presents a basic quadratic function and investigates transformations and dilations of that function.	F.BF.B.3 F.IF.C.7a

Unit 6: Polynomials and Quadratics

Primary Resource: *Algebra,* Carnegie Learning (2012).

Enduring Understandings

- Relationships can be described, and generalizations made for mathematical situations that have numbers of objects that repeat in predictable ways.
- Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value.

Essential Questions

- How are the properties of algebraic expressions used to simplify polynomials?
- What do the factors of a quadratic equation reveal about its properties?
- When finding the roots of a quadratic equation, how does one decide between graphing, factoring, completing the square and quadratic formula?
- How can quadratic functions model real-world situations to help solve problems?

Lesson Title	Lesson Overview	Standards
Controlling the Population – Adding and Subtracting Polynomials	Students will add and subtract polynomial expressions by combining like terms. They will graph polynomial functions and make connections between the graph of the solution and the algebraic solution.	A.APR.A.1 A.CED.A.1 A.CED.A.2 A.SSE.A.1a F.BF.A.1b
They're Multiplying – Like Polynomials! – Multiplying Polynomials	Students will use the Distributive Property to multiply polynomials. This lesson introduces how to multiply two binomials using algebra tiles, multiplication tables, and the Distributive Property.	A.APR.A.1
What Factored into It? – Factoring Polynomials	Students will factor polynomial expressions using a greatest common factor (GCF) technique. They will factor quadratic trinomials into the product of linear factors as well as quadratic and higher power polynomials that require first factoring out the GCF.	A.APR.A.1 A.SSE.B.3a

Zeroing In – Solving Quadratics by Factoring	Students will solve quadratic equations by factoring to find the zeros. They will connect the zeros of the quadratic to the *x*-intercepts of the graph of the quadratic function. This lesson introduces the Zero Product Property as a strategy to calculate the roots of a quadratic equation.	A.REI.B.4b A.SSE.B.3a
What Makes You So Special? – Special Products	Students will factor polynomials involving special products. This lesson explores the difference of two squares, perfect square trinomials, the difference of two cubes, and the sum of two cubes. Students will continue to practice solving quadratic equations and functions.	A.SSE.A.2 A.SSE.B.3a
Could It Be Groovy to Be a Square? – Approximating and Rewriting Radicals	Students will evaluate square roots and simplify radicals involving square root. This lesson focuses on determining square roots, principal square roots, or positive square roots, negative square roots, and extracting the square root from both sides of the equation.	A.CED.A.1 A.REI.B.4b
Another Method – Completing the Square	Students will determine the roots of a quadratic equation by completing the square. This lesson uses the knowledge of perfect square trinomials to construct a process to solve any quadratic equation that is not factorable.	A.REI.B.4b A.SSE.B.3b F.IF.C.8a
Ladies and Gentlemen: Quadratic Formula	Students will solve quadratic equations using the Quadratic Formula. This lesson introduces the Quadratic Formula as a strategy to solve any quadratic equation. Questions focus students on solving quadratic equations using the Quadratic Formula. Students will analyze the discriminant to predict the number of real zeros of a quadratic function or the number of *x*-intercepts of the graph of a quadratic equation.	A.CED.A.1 A.CED.A.2 A.CED.A.3 A.CED.A.4 A.REI.B.4a A.REI.B.4b

Unit 7: Powers and Roots

Primary Resource: *Algebra*, 3rd Edition, UCSMP.

Enduring Understandings

- Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value.
- Basic facts and algorithms for operations with rational numbers use notions of equivalence to transform calculations into simpler ones.

Essential Questions

- How are the properties of integer exponents used to simplify numerical and algebraic expressions?
- How is scientific notation used to describe very large or very small quantities and the relationship between quantities?
- What is the relationship between Pythagorean Theorem and the distance formula?
- How can the Pythagorean Theorem model real-world situations to help solve problems?

Lesson Title	Lesson Overview	Standards
Motivation / Exploration – Properties of Exponents	Students will explore the properties of integer exponents to generate equivalent numerical expressions.	
Products and Powers of Powers	Students will develop and apply the Product of Powers and Power of a Power properties.	8.EE.A.1 A.SSE.A.1a A.SSE.A.1b A.SSE.A.2
Quotient of Powers	Students will develop and apply the Quotient of Powers property.	8.EE.A.1 A.SSE.A.1a A.SSE.A.1b

Negative Exponents	Students will develop the meaning of powers with negative exponents by extending the properties of powers previously presented.	8.EE.A.1 A.SSE.A.1a A.SSE.A.1b A.SSE.A.2
Powers of a Product and Quotient	Students will develop and apply the Power of a Product and Power of a Quotient properties. Students will simplify products, quotients, and powers of powers. They will evaluate negative integer powers of real numbers. Students will rewrite powers of products and quotients. They will identify properties of powers to justify a simplification.	8.EE.A.1 A.SSE.A.1a A.SSE.A.1b A.SSE.A.2
Square Roots and Cube Roots	Students will evaluate square roots and cube roots. Students will define irrational numbers. They will evaluate small perfect cube roots or small perfect cubes. Students will discuss primary and positive roots as having the same meaning; these terms will be used in later units. They will address positive and negative square root possibilities.	8.EE.A.2 8.NS.A.2
Pythagorean Theorem	Students will apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in both two and three dimensions.	8.EE.A.2 8.G.B.6 8.G.B.7 8.NS.A.2
Multiplying and Dividing Square Roots	Students will simplify expressions involving products and quotients of square roots.	8.NS.A.2
Irrational and Rational Numbers	Students will apply operations with rational and irrational numbers based on their properties.	8.NS.A.1 8.NS.A.2 N.RN.B.3
Distance Formula	Students will Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	8.G.B.8

Unit 8: Synthesis of Modeling with Equations and Functions

Primary Resource: *Algebra I* Module 5, Topics A and B, EngageNY.

Enduring Understandings

- Students synthesize what they have learned during the year about functions to select the correct function type in a series of modeling problems.
- Skills and knowledge from the year's work will support the work including writing, rewriting, comparing, and graphing functions and interpretation of the parameters of an equation.

Essential Questions

- How can functions describe real-world situations and be used to model predictions?
- How can we use data to model situations and solve problems?

Lesson Title	Lesson Overview	Standards
Analyzing a Graph	From a graphic representation, students recognize the function type and interpret key features of the graph for functions addressed in previous modules (linear, exponential, quadratic, cubic, square root, cube root, absolute value, and other piecewise functions).	A.CED.A.2 F.IF.B.4 N.Q.A.2
Analyzing a Data Set	Students recognize linear, quadratic, and exponential functions when presented as a data set or sequence, and formulate a model based on the data.	A.CED.A.1 F.IF.B.4 F.IF.B.5 F.LE.A.1b F.LE.A.1c F.LE.A.2

Analyzing a Verbal Description	Students make sense of a contextual situation that can be modeled with linear, quadratic, and exponential functions when presented as a word problem. They analyze a verbal description and create a model using equations, graphs, or tables.	A.CED.A.2 F.BF.A.1a F.BF.A.1b F.IF.B.4 F.IF.B.5 F.LE.A.1b F.LE.A.1c F.LE.A.2 N.Q.A.2
Modeling a Context from a Graph	Students create a two-variable equation that models the graph from a context. Function types include linear, quadratic, exponential, square root, cube root, and absolute value. Students interpret the graph and function and answer questions related to the model, choosing an appropriate level of precision in reporting their results.	A.CED.A.1 A.CED.A.2 F.BF.A.1a F.BF.A.1b F.IF.B.4 F.IF.B.5 F.IF.B.6 N.Q.A.2 N.Q.A.3
Modeling from a Sequence	Students recognize when a table of values represents an arithmetic or geometric sequence. Patterns are present in tables of values. Students choose and define the parameter values for a function that represents a sequence.	A.CED.A.1 A.CED.A.2 F.BF.A.1a F.LE.A.2

Modeling a Context from Data	Students write equations to model data from tables, which can be represented with linear, quadratic, or exponential functions. They recognize when a set of data can be modeled with a linear, exponential, or quadratic function and create the equation that models the data. Students interpret the function in terms of the context in which it is presented, make predictions based on the model, and use an appropriate level of precision for reporting results and solutions.	A.CED.A.1 A.CED.A.2 F.BF.A.1a F.BF.A.1b F.IF.B.4 F.IF.B.5 F.IF.B.6 F.LE.A.2 N.Q.A.2 N.Q.A.3
Modeling a Context from Data	Students use linear, quadratic, and exponential functions to model data from tables, and choose the regression most appropriate to a given context. They use the correlation coefficient to determine the accuracy of a regression model and then interpret the function in context. They then make predictions based on their model and use an appropriate level of precision for reporting results and solutions.	A.CED.A.1 A.CED.A.2 F.BF.A.1a F.BF.A.1b F.LE.A.2 N.Q.A.2 N.Q.A.3
Modeling a Context from a Verbal Description	Students model functions described verbally in a given context using graphs, tables, or algebraic representations.	A.CED.A.1 A.CED.A.2 F.BF.A.1a F.BF.A.1b F.LE.A.2 N.Q.A.2 N.Q.A.3

Modeling a Context from a Verbal Description	Students interpret the function and its graph and use them to answer questions related to the model, including calculating the rate of change over an interval, and always using an appropriate level of precision when reporting results. Students use graphs to interpret the function represented by the equation in terms of the context, and answer questions about the model using the appropriate level of precision in reporting results.	A.CED.A.1 A.CED.A.2 F.BF.A.1a F.BF.A.1b F.IF.B.4 F.IF.B.5 F.IF.B.6 F.LE.A.2 N.Q.A.2 N.Q.A.3

Unit 9: Interpreting Categorical and Quantitative Data

Primary Resource: *Algebra,* Carnegie Learning (2012).

Enduring Understandings

- Some questions can be answered by collecting and analyzing data and the question to be answered determines the data that needs to be collected and how best to collect it.
- Data can be represented visually using tables, charts, and graphs. The type of data determines the best choice of visual representation.
- There are special numerical measures that describe the center and spread of numerical data sets.

Essential Questions

- What questions should I be asking to best analyze this set of data and how I can best communicate the results of these questions?
- What are the measures of central tendency and the measures of spread for this data set and how can I display them in an effective and coherent manner?
- How can real-world data be represented and summarized to help solve problems?

Lesson Title	Lesson Overview	Standards
Motivation / Exploration – Summarize, Represent and Interpret Data on a Single Count	Students will construct dot plots, histograms, and box-and-whisker plots to summarize and interpret data sets.	
Could You Participate in Our Survey? – Interpreting Frequency Distributions	Students will be introduced to categorical data and will explore frequency distributions of data sets. Questions ask students to organize data from a table into a two-way frequency table. Students learn and interpret the meanings of frequency distribution and joint frequency. Students then represent data as a bar graph or a double bar graph.	S.ID.B.5

It's so Hot Outside! – Relative Frequency Distributions	Students will extend their understanding of two-way frequency tables to include relative frequency marginal distributions. Questions ask students to determine the relative frequency distribution of a given data set. Students then must represent their data graphically.	S.ID.B.5
She Blinded Me with Science – Relative Frequency Conditional Distribution	Students will complete relative frequency conditional distributions for given two-way tables and use a relative frequency conditional distribution to answer questions.	S.ID.B.5
Oh! Switch the Station! – Drawing Conclusions from Data	Students will organize data from a data table, represent the data graphically, draw conclusions, and make decisions based upon the data.	S.ID.B.5