HARFORD COUNTY PUBLIC SCHOOLS
ALGEBRA 1 GRADE 8 CURRICULUM

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

Unit 1: Systems of Equations

Primary Resource: *Algebra 1,* 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	Students will have opportunities to refresh skills on solving equations with variables on one side and both sides, slope, and/or graphing.	
Basketball Shots	Students will attempt to solve a 3-act lesson, an opportunity to analyze a problem scenario that could be solved using a variety of strategies, including by solving a system of linear equations.	
Producing and Selling T-Shirts – Using a Graph to Solve a Linear System	Students will be presented with a real-world situation and use graphing as a strategy to solve a linear system. Students will compare and analyze cost and income equations graphically, and then interpret the point of intersection in terms of the problem situation.	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 use real-world situations to investigate linear systems of equations that either have different slopes and *y*-intercepts, that have the same slope, or that have slopes that are perpendicular.	8.EE.C.8a 8.EE.C.8b 8.EE.C.8c A.REI.C.5 A.REI.C.6 A.REI.D.11
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
The County Fair – Using Substitution to Solve a Linear System, Part 1	Students will be presented with a real-world situation to introduce the substitution method to solve a system of equations.	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 continue to practice solving linear systems algebraically using the substitution method within the context of a real-world situation as well as abstractly.	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 write linear systems of equations in standard form to represent problem situations and then use the linear combination method to solve the system for the unknown.	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 continue to solve linear systems using the linear combination method.	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 1,* 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 an inequality has multiple solutions. 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. Students 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*, 3rd Ed., University of Chicago School Mathematics.

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 a 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
Interpreting Data	Students will interpret the slope and the *y*-intercept of a linear model in the context of data. Students will distinguish between correlation and causation.	S.ID.B.6a S.ID.B.6b S.ID.C.7 S.ID.C.8 S.ID.C.9
Interpreting Linear Models, Plotting and Analyzing Residuals	Students will plot and analyze residuals.	S.ID.B.6a S.ID.B.6b S.ID.C.7 S.ID.C.8 S.ID.C.9

Exponential Growth	Students will explore a scenario that leads to exponential growth.	
Powers and Repeated Multiplication, Interest	Students will learn the terms principal and interest relative to real-world examples. Students will learn the concept of compound interest and how to compute interest over time.	A.CED.A.1 F.LE.A.1a F.LE.A.1b F.LE.A.1c
Powering and Population Growth	Students will solve problems involving exponential growth.	A.SSE.A.1a A.SSE.A.1b F.IF.C.7a F.LE.B.5
Growth Factor and Exponential Change	Students will solve problems involving exponential growth and decay and will make connections between different types of growth – linear, exponential, quadratic, etc. Students will graph exponential growth and decay models of real-world situations.	F.LE.A.1a F.LE.A.1b F.LE.A.1c F.LE.A.2 F.LE.B.5
Exponential Decay	Students will solve problems involving exponential growth and decay. Students will determine whether a situation is constant increase, constant decrease, exponential growth, exponential decay, or a nonconstant change. Students will find and compare linear, exponential, and quadratic regression of data.	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 Ed., 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 recognize if relations presented as mappings, sets of ordered pairs, tables, equations, and graphs are functions.	8.F.A.1 8.F.A.2 8.F.A.3 8.F.B.5
The Language of Functions	Students will understand the concept of a function and use function notation. Students will note the difference between stating domain and range from a graph as compared to stating them from a table.	F.IF.A.1 F.IF.A.2 F.IF.B.5
Function Notation	Students will evaluate expressions and make connections to evaluating functions.	F.IF.A.1 F.IF.A.2
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 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 generate next terms for different sequences, and then sort these sequences based on common characteristics. Students will explore the definitions of arithmetic and geometric sequences. 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, students 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, students will determine unknown terms of a geometric sequence.	F.IF.A.3 F.BF.A.1a .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 Growth	Students will compare linear and exponential functions represented as graphs, tables, real-world scenarios, or equations.	F.IF.C.7a F.IF.C.7e F.LE.A.3
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. Students will recognize a translation based on provided function notation; for example, they should interpret the notation $g(x) = f(x - 1) + 7$ to mean that the graph of $g(x)$ is the translation image of the graph of $f(x)$ one unit to the right and seven units up.	F.BF.B.3

Unit 5: Introduction to Quadratic Functions

Primary Resource: *Algebra 1,* 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 a 3-act lesson.	
Up and Down and Up – Exploring Quadratic Functions	Students will model quadratic functions and explore graphical behavior of real-world situations. Students will determine absolute maximum or absolute minimum.	A.CED.A.1 A.CED.A.2 .IF.B.4
Just U and I – Comparing Linear and Quadratic Functions	Students will explore the first and second differences of linear and quadratic functions and 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 domain, range, zeros, and intervals of increase and decrease of a vertical motion situation. Students will contrast the domain and range of a problem situation versus the domain and range of a function.	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 understand the significance of a quadratic function written in factored form. Students will compare the behaviors of the graph of a quadratic equation to the function written in factored form. Students will write a quadratic function in factored form based on *x*-intercepts of its graph.	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 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 a 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.	A.SSE.A.1a F.IF.B.4 F.IF.C.7a
More Than Meets the Eye – Transformations of Quadratic Functions	Students will investigate transformations and dilations of a basic quadratic function.	F.BF.B.3 F.IF.C.7a

Unit 6: Polynomials and Quadratics

Primary Resource: *Algebra 1,* 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 be introduced to polynomials and will use a sorting activity to classify monomials, binomials, and trinomials. Students will model the sum of two functions using function notation, a graph, a table, and finally, using algebra.	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 multiply two binomials using algebra tiles, multiplication tables, and the Distributive Property.	A.APR.A.1
What Factored into It? – Factoring Polynomials	Students will write quadratic expressions as products of factors. Students will use GCF and multiplication tables to factor polynomials.	A.APR.A.1 A.SSE.B.3a

Zeroing In – Solving Quadratics by Factoring	Students will use the Zero Product Property as a strategy to calculate the roots of a quadratic equation. Students will connect the solutions to a quadratic equation using factoring to the *x*-intercepts of the graph of its equation.	A.REI.B.4b A.SSE.B.3a
What Makes You So Special? – Special Products	Students will explore the difference of two squares, perfect square trinomials, the difference of two cubes, and the sum of two cubes. Students will solve quadratic equations.	A.SSE.A.2 A.SSE.B.3a
Could It Be Groovy to Be a Square? – Approximating and Rewriting Radicals	Students will determine square roots, principal square roots or positive square roots, negative square roots, and extract the square root from both sides of an equation. Students will rewrite radicals.	A.CED.A.1 A.REI.B.4b
Another Method – Completing the Square	Students will solve quadratic equations by the process of completing the square.	A.REI.B.4b A.SSE.B.3b F.IF.C.8a
Ladies and Gentlemen: Quadratic Formula	Students will use the Quadratic Formula as a strategy to solve any quadratic equation. Students will connect the number of real zeros of a quadratic function to the number of *x*-intercepts of the graph of the 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 Ed., University of Chicago School Mathematics.

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 develop an understanding of the properties of integer exponents to generate equivalent numerical expressions.	
Products and Powers of Powers	Students will simplify products, quotients, and powers of powers. Students will identify properties of powers that justify simplification.	8.EE.A.1 A.SSE.A.1a A.SSE.A.1b A.SSE.A.2
Quotient of Powers, Zero Power	Students will simplify products, quotients, and powers of powers. Students will identify properties of powers that justify simplification.	8.EE.A.1 A.SSE.A.1a A.SSE.A.1b
Negative Exponents	Students will simplify products, quotients, and powers of powers. Students will evaluate negative integer powers of real numbers and identify properties of powers that justify simplification.	8.EE.A.1 A.SSE.A.1a A.SSE.A.1b A.SSE.A.2

Powers of a Product and Quotient	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 and identify properties of powers that justify simplification.	8.EE.A.1 A.SSE.A.1a A.SSE.A.1b A.SSE.A.2
Areas of Squares, Powers of Square, Radical	Students will define irrational numbers. Students will evaluate small perfect cube roots or small perfect cubes. Students will discuss primary and positive roots as having the same meaning and will address positive and negative square root possibilities.	8.EE.A.2 8.NS.A.2
Pythagorean Theorem	Students will see visual proof of the Pythagorean theorem and will apply it to determine unknown side lengths in right triangles in two and three dimensions in real-world and mathematical problems.	8.EE.A.2 8.G.B.6 8.G.B.7 8.NS.A.2
Multiplying and Dividing Square Roots	Students will multiply and divide radicals.	8.NS.A.2
Irrational and Rational Numbers	Students will learn 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 the product of a nonzero rational number and an irrational is irrational.	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: Mathematical Modeling

Primary Resource: *Algebra 1,* 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.

Essential Questions

- What questions should I be asking to best analyze a set of data and how can I best communicate the results of these questions?
- How can a function model real-world situations to help solve problems?

Lesson Title	Lesson Overview	Standards
Fitting a Line to Data	Students will review using data and a scatterplot to create a line of best fit and generate an equation for that line.	8.SP.A.1 8.SP.A.2 S.ID.C.7 S.ID.C.8 S.ID.C.9
People, Tea, and Carbon Dioxide – Modeling Using Exponential Functions	Students will model problem situations with exponential functions. Students will use a graphing calculator to determine the regression equation and then use the function to make predictions about situations.	F.IF.B.4 F.IF.B.5 F.IF.C.7e F.BF.A.1a F.LE.A.1a F.LE.A.1c F.LE.A.2

Stop! What is Your Reaction? – Modeling Stopping Distances and Reaction Times	Students will choose the best regression equations, linear, exponential, or quadratic, to model problem situations. Students will analyze the correlation coefficients of each regression equation to determine the equations of the curves that best fit the data.	F.IF.B.4 F.IF.B.5 F.IF.C.7e F.BF.A.1a F.LE.A.1a F.LE.A.1c F.LE.A.2
Modeling Data Helps Us Make Predictions – Using Quadratic Functions to Model Data	Students will choose the best regression equations, linear, exponential, or quadratic, to model problem situations. Students will analyze the correlation coefficients of each regression equation to determine the equations of the curves that best fit the data.	F.IF.B.4 F.IF.B.5 F.IF.C.7e F.BF.A.1a F.LE.A.1a F.LE.A.1c F.LE.A.2
BAC is BAD News – Choosing a Function to Model BAC	Students will choose the best regression equations, linear, exponential, or quadratic, to model problem situations. Students will analyze the correlation coefficients of each regression equation to determine the equations of the curves that best fit the data. Students will analyze results and then write a report about their conclusions.	F.IF.B.4 F.IF.B.5 F.IF.C.7e F.BF.A.1a F.LE.A.1a F.LE.A.1c F.LE.A.2
Cell Phone Batteries, Gas Prices and Family Homes – Modeling with Piecewise Functions	Students will model problem situations using linear and non-linear piecewise functions. Students will list the advantages and disadvantages of using piecewise functions instead of a single function to model data.	F.IF.B.4 F.IF.B.5 F.IF.C.7e F.BF.A.1a F.LE.A.1a F.LE.A.1c F.LE.A.2

Unit 9: Interpreting Categorical and Quantitative Data

Primary Resource: *Algebra 1,* 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
Summarize, Represent and Interpret Data on a Single Count	Students will summarize a set of data using measures of central tendency: mean, median, and mode.	
Whose Scores are Better? – Calculating and Interpreting Standard Deviation	Students will use a calculator to find standard deviation of a data set and interpret the value in context.	S.ID.A.1 S.ID.A.2 S.ID.A.3
Could You Participate in Our Survey? – Interpreting Frequency Distributions	Students will explore frequency distributions of data sets. Students will organize data from a table into a two-way frequency table. Students will interpret the meanings of frequency distribution and joint frequency. Students will represent data as a bar graph or a double bar graph.	8.SP.A.1 8.SP.A.4 S.ID.B.5
It's so Hot Outside! – Relative Frequency Distributions	Students will explore relative frequency marginal distributions. Students will determine the relative frequency distribution of a given data set. Students will represent data graphically.	8.SP.A.1 8.SP.A.4 S.ID.B.5