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HEALTH & PHYSICAL EDUCATION

RAHWAY PUBLIC SCHOOLS

# CURRICULUM & INSTRUCTION

**Content Area:** Mathematics

**Course:** Algebra I & Algebra I Honors

**Grade Level:** 8-10

This curriculum is part of the Educational Program of Studies of the Rahway Public Schools.

## **ACKNOWLEDGMENTS**

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**Program Supervisor of 7-12 Math & Science and 9-12 Business & Technology Education**

The Board acknowledges the following who contributed to the preparation of this curriculum.

**Toni Robertelli, Mathematics Teacher**

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**Dr. Aleya Shoieb, Superintendent of Schools**

Subject/Course Title:  
**Algebra I & Algebra I Honors**  
**Grades 8-10**

Date of Board Adoption:  
**August 27, 2024**

# RAHWAY PUBLIC SCHOOLS CURRICULUM

Algebra I & Algebra I Honors: Grades 8-10

## *PACING GUIDE*

<b>Unit</b>	<b>Title</b>	<b>Pacing</b>
1	Equations and Inequalities	10 weeks
2	Linear Functions	10 weeks
3	Systems of Equations & Inequalities; Exponential & Square Root Functions	10 weeks
4	Polynomials Equations and Factoring; Quadratic Functions	10 weeks

## *ACCOMMODATIONS*

<p><b>504 Accommodations:</b></p> <ul style="list-style-type: none"> <li>● Provide scaffolded vocabulary and vocabulary lists.</li> <li>● Provide extra visual and verbal cues and prompts.</li> <li>● Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials.</li> <li>● Provide links to audio files and utilize video clips.</li> <li>● Provide graphic organizers and/or checklists.</li> <li>● Provide modified rubrics.</li> <li>● Provide a copy of teaching notes, especially any key terms, in advance.</li> <li>● Allow additional time to complete assignments and/or assessments.</li> <li>● Provide shorter writing assignments.</li> <li>● Provide sentence starters.</li> <li>● Utilize small group instruction.</li> <li>● Utilize Think-Pair-Share structure.</li> <li>● Check for understanding frequently.</li> <li>● Have student restate information.</li> <li>● Support auditory presentations with visuals.</li> <li>● Weekly home-school communication tools (notebook, daily log, phone calls or email messages).</li> <li>● Provide study sheets and teacher outlines prior to assessments.</li> <li>● Quiet corner or room to calm down and relax when anxious.</li> <li>● Reduction of distractions.</li> <li>● Permit answers to be dictated.</li> <li>● Hands-on activities.</li> <li>● Use of manipulatives.</li> <li>● Assign preferential seating.</li> <li>● No penalty for spelling errors or sloppy handwriting.</li> <li>● Follow a routine/schedule.</li> <li>● Provide student with rest breaks.</li> <li>● Use verbal and visual cues regarding directions and staying on task.</li> <li>● Assist in maintaining agenda book.</li> </ul>	<p><b>IEP Accommodations:</b></p> <ul style="list-style-type: none"> <li>● Provide scaffolded vocabulary and vocabulary lists.</li> <li>● Differentiate reading levels of texts (e.g., Newsela).</li> <li>● Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials.</li> <li>● Provide extra visual and verbal cues and prompts.</li> <li>● Provide links to audio files and utilize video clips.</li> <li>● Provide graphic organizers and/or checklists.</li> <li>● Provide modified rubrics.</li> <li>● Provide a copy of teaching notes, especially any key terms, in advance.</li> <li>● Provide students with additional information to supplement notes.</li> <li>● Modify questioning techniques and provide a reduced number of questions or items on tests.</li> <li>● Allow additional time to complete assignments and/or assessments.</li> <li>● Provide shorter writing assignments.</li> <li>● Provide sentence starters.</li> <li>● Utilize small group instruction.</li> <li>● Utilize Think-Pair-Share structure.</li> <li>● Check for understanding frequently.</li> <li>● Have student restate information.</li> <li>● Support auditory presentations with visuals.</li> <li>● Provide study sheets and teacher outlines prior to assessments.</li> <li>● Use of manipulatives.</li> <li>● Have students work with partners or in groups for reading, presentations, assignments, and analyses.</li> <li>● Assign appropriate roles in collaborative work.</li> <li>● Assign preferential seating.</li> <li>● Follow a routine/schedule.</li> </ul>
<p><b>Gifted and Talented Accommodations:</b></p> <ul style="list-style-type: none"> <li>● Differentiate reading levels of texts (e.g., Newsela).</li> <li>● Offer students additional texts with higher lexile levels.</li> <li>● Provide more challenging and/or more supplemental readings and/or activities to deepen understanding.</li> <li>● Allow for independent reading, research, and projects.</li> <li>● Accelerate or compact the curriculum.</li> <li>● Offer higher-level thinking questions for deeper analysis.</li> <li>● Offer more rigorous materials/tasks/prompts.</li> <li>● Increase number and complexity of sources.</li> <li>● Assign group research and presentations to teach the class.</li> <li>● Assign/allow for leadership roles during collaborative work and in other learning activities.</li> </ul>	<p><b>ML Accommodations:</b></p> <ul style="list-style-type: none"> <li>● Provide extended time.</li> <li>● Assign preferential seating.</li> <li>● Assign peer buddy who the student can work with.</li> <li>● Check for understanding frequently.</li> <li>● Provide language feedback often (such as grammar errors, tenses, subject-verb agreements, etc...).</li> <li>● Have student repeat directions.</li> <li>● Make vocabulary words available during classwork and exams.</li> <li>● Use study guides/checklists to organize information.</li> <li>● Repeat directions.</li> <li>● Increase one-on-one conferencing.</li> <li>● Allow student to listen to an audio version of the text.</li> <li>● Give directions in small, distinct steps.</li> <li>● Allow copying from paper/book.</li> <li>● Give student a copy of the class notes.</li> </ul>

- Provide written and oral instructions.
- Differentiate reading levels of texts (e.g., Newsela).
- Shorten assignments.
- Read directions aloud to student.
- Give oral clues or prompts.
- Record or type assignments.
- Adapt worksheets/packets.
- Create alternate assignments.
- Have student enter written assignments in criterion, where they can use the planning maps to help get them started and receive feedback after it is submitted.
- Allow student to resubmit assignments.
- Use small group instruction.
- Simplify language.
- Provide scaffolded vocabulary and vocabulary lists.
- Demonstrate concepts possibly through the use of visuals.
- Use manipulatives.
- Emphasize critical information by highlighting it for the student.
- Use graphic organizers.
- Pre-teach or pre-view vocabulary.
- Provide student with a list of prompts or sentence starters that they can use when completing a written assignment.
- Provide audio versions of the textbooks.
- Highlight textbooks/study guides.
- Use supplementary materials.
- Give assistance in note taking
- Use adapted/modified textbooks.
- Allow use of computer/word processor.
- Allow student to answer orally, give extended time (time-and-a-half).
- Allow tests to be given in a separate location (with the ESL teacher).
- Allow additional time to complete assignments and/or assessments.
- Read question to student to clarify.
- Provide a definition or synonym for words on a test that do not impact the validity of the exam.
- Modify the format of assessments.
- Shorten test length or require only selected test items.
- Create alternative assessments.
- On an exam other than a spelling test, don't take points off for spelling errors.

## *UNIT 1 OVERVIEW*

**Content Area:** Mathematics

**Unit Title:** Equations and Inequalities

**Target Course/Grade Level:** Algebra I & Algebra I Honors/Grades 8-10

**Unit Summary:** Students will be presented with the foundational skills related to solving linear equations and linear inequalities and the connected skills of solving absolute value equations and inequalities and rewriting equations and formulas. Students will be familiar with the idea of equality from their prior learning and the notion that what is done on one side, must be done on the other side to keep the equation balanced. Students will be rewriting equations and formulas, which provides the students with insight into the structure of equations and the operations performed. As the unit progresses, the students start to focus on inequalities and begin to solve increasingly more complex inequalities, eventually leading to the solving of compound inequalities and absolute value inequalities.

**Approximate Length of Unit:** 10 weeks

## *LEARNING TARGETS*

### **NJ Student Learning Standards:**

- A.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.
- A.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.
- A.CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
- A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context.
  - a. Interpret parts of an expression, such as terms, factors, and coefficients.
- A.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.
- A.REI.B.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- N.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- N.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.
- N.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- S.ID.A.1** Represent data with plots on the real number line (dot plots, histograms, and box plots).
- S.ID.A.2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
- S.ID.A.3** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

### **Career Readiness, Life Literacies, and Key Skills:**

**9.4.12.CI.1** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

**9.4.12.CT.1** Identify problem-solving strategies used in the development of an innovative product or practice.

**9.4.12.CT.2** Explain the potential benefits of collaborating to enhance critical thinking and problem solving.

**9.4.12.IML.2** Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

**9.4.12.TL.1** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

### **Interdisciplinary Connections and Standards:**

#### **ELA**

**RL.CR.9–10.1** Cite a range of thorough textual evidence and make relevant connections to strongly support analysis of multiple aspects of what a literary text says explicitly and inferentially, as well as including determining where the text leaves matters uncertain.

**L.SS.9–10.1** Demonstrate command of the system and structure of the English language when writing or speaking.

**L.VL.9–10.3** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, including technical meanings, choosing flexibly from a range of strategies.

**W.AW.9–10.1** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient textual and non-textual evidence.

**W.IW.9–10.2** Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

**W.RW.9–10.7** Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

**SL.PE.9–10.1** Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

**SL.II.9–10.2** Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source.

**SL.PI.9–10.4** Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.

**SL.AS.9–10.6** Adapt speech to a variety of contexts and tasks, demonstrating command of formal English.

#### **Science**

**HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

### **Unit Understandings:**

*Students will understand that...*

- Reasoning quantitatively and using units to solve problems.
- Creating equations and inequalities that describe numbers or relationships.
- Solving equations is a process of reasoning and explaining the reasoning.
- Solving equations and inequalities in one variable.
- Interpreting the structure of expressions.
- Writing expressions in equivalent forms to solve problems.

### **Unit Essential Questions**

- How can real-world situations be represented as equations or inequalities?
- How can you solve an equation or inequality for the variable of interest?
- How can you test the reasonableness of a solution?

- How can you use a formula for one measurement to write a formula for another measurement?
- How can you use a coordinate plane to solve problems involving linear inequalities?

### **Knowledge and Skills:**

*Students will know...*

- Writing and solving
  - One-step linear equations.
  - Multi-step linear equations.
  - Equations with variables on both sides.
  - Equations involving absolute value.
  - Literal equations for given variables.
  - Compound inequalities.
  - Multi-step inequalities.
  - Inequalities involving absolute value.
- Formulate inequalities and represent solutions of inequalities on number lines.
- Proportional reasoning and analyzing units when solving problems.
- Properties of equality for addition, subtraction, multiplication, and division.
- Vocabulary: one, two, and multi-step linear equations and inequalities, solution, equivalent equations, ratios, proportions, rate, accuracy, literal equation, inequality, solution of an inequality, equivalent inequalities, compound inequalities, and absolute value inequalities.

*Students will be able to...*

- Solve simple and multi-step equations and inequalities.
- Describe how to solve equations or inequalities.
- Analyze the measurements used to solve a problem and judge the level of accuracy appropriate for the solution.
- Apply properties of equality to produce equivalent equations for one-step and multi-step equations.
- Write linear equations that model real-life situations for one-step and multi-step equations.
- Utilize ratios and rates to solve real-life problems.
- Apply properties of equality using variable terms.
- Assess when an equation has zero, one, or infinitely many solutions.
- Evaluate the two linear equations related to a given absolute value equation.
- Compare and contrast solving inequalities with solving equations.
- Graph and interpret inequalities.
- Apply the Addition and Subtraction Properties of Inequality to produce equivalent inequalities.
- Apply the Multiplication and Division Properties of Inequality to produce equivalent inequalities.
- Produce multi-step inequalities to solve real-life problems.
- Solve and graph solutions of compound inequalities.
- Develop absolute value inequalities to solve real-life problems.
- Connect equation-solving techniques to solve real-life problems.
- Apply techniques for solving inequalities to solve real-life applications.



## EVIDENCE OF LEARNING

### Assessment:

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- End of Unit Common Assessment - See folder for assessment links.
- Formative: warm-up activities, exploratory activities, class discussions, student participation, homework, and exit tickets.
- Summative: quizzes, tests, projects, and benchmark assessments.
- Open-ended problems that involve written responses with justification of answers.
- Renaissance Star Math Diagnostic Assessment – Fall, Winter, Spring

### Learning Activities:

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Interactive Platforms: Desmos, Kahoot, Delta Math, Formative, Quizizz, Quizlet, Google Forms, Mathspace, PearDeck, Freckle, Geogebra, Gimkit, and Khan Academy.
- Group Work Suggestion: quiz trade, circuits, limit war, matching card games, jeopardy, relay review, and speed dating.
- **Sample Application Activities:**
  - Students will create their own multi-step equations and inequalities and explain in words each step taken to isolate the variable. The students must include which property of equality is used.
  - Students can write word problems and switch papers with a partner. The partner will write an equation for the partner’s word problem and solve the equation or inequality.
  - Students can research different literal equations that they will use in the real world. Then students can solve the literal equations for a different variable than what is given.

## RESOURCES

### Teacher Resources:

- **Textbook:** Larson, R. and Boswell, L. (2022). Algebra 1. Erie, PA: Big Ideas Learning, LLC.
- Useful Websites for Teachers to Utilize:
  - [www.illustrativemathematics.org](http://www.illustrativemathematics.org)
  - <http://www.ixl.com>
  - [www.kutasoftware.com](http://www.kutasoftware.com)
  - <https://www.khanacademy.org/>
  - <https://learnzillion.com/>
  - <https://www.teachingchannel.org/>
  - <http://illuminations.nctm.org>

### Equipment Needed:

- Projector, Computer/Laptop, Chromebooks, Document Camera, Graphing Calculator

## UNIT 2 OVERVIEW

**Content Area:** Mathematics

**Unit Title:** Linear Functions

**Target Course/Grade Level:** Algebra I & Algebra I Honors/Grades 8-10

**Unit Summary:** Students will extend their introductory understanding of “function machines” so that functions are seen as describing situations in which one quantity determines another. Function notation and characteristics of functions are also studied, often in the context of graphing linear functions. The unit begins with a focus on function notation, discrete and continuous functions, and evaluating functions. The students will be introduced to two forms of linear equations - standard and slope-intercept. Students will also create equations in two variables to represent relationships between quantities. Information may be given in the form of data, a context, or a graph and students are asked to write a linear function. Understanding that the information represents a linear function is incorporated in the learning. Writing linear equations in slope-intercept form and point-slope form will be discussed and then applied to real-life situations.

**Approximate Length of Unit:** 10 weeks

## LEARNING TARGETS

### **NJ Student Learning Standards:**

- A.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).
- A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context.
  - a. Interpret parts of an expression, such as terms, factors, and coefficients.
- A.CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- A.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.
- F.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  $y = f(x)$ .
- F.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.
- F.IF.A.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by  $f(0) = (1) = 1$ ,  $f(n + 1) = f(n) + f(n-1)$  for  $n \geq 1$ .
- F.IF.B.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing,

positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

**F.IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.

**F.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.

**F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

**F.LE.A.1** Distinguish between situations that can be modeled with linear functions and with exponential functions.

a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

**F.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).

**F.LE.B.5** Interpret the parameters in a linear or exponential function in terms of a context.

**F.BF.A.1** Write a function that describes a relationship between two quantities.

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

**F.BF.B.3** Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $kf(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

**S.ID.C.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

**S.ID.C.8** Compute (using technology) and interpret the correlation coefficient of a linear fit.

**S.ID.C.9** Distinguish between correlation and causation.

### **Career Readiness, Life Literacies, and Key Skills:**

**9.4.12.CI.1** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

**9.4.12.CT.1** Identify problem-solving strategies used in the development of an innovative product or practice.

**9.4.12.CT.2** Explain the potential benefits of collaborating to enhance critical thinking and problem solving.

**9.4.12.IML.2** Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

**9.4.12.TL.1** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

### **Interdisciplinary Connections and Standards:**

#### **ELA**

**RL.CR.9–10.1** Cite a range of thorough textual evidence and make relevant connections to strongly support analysis of multiple aspects of what a literary text says explicitly and inferentially, as well as including determining where the text leaves matters uncertain.

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**L.VL.9–10.3** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, including technical meanings, choosing flexibly from a range of strategies.

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- W.IW.9–10.2** Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
- W.RW.9–10.7** Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
- SL.PE.9–10.1** Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
- SL.II.9–10.2** Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source.
- SL.PI.9–10.4** Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
- SL.AS.9–10.6** Adapt speech to a variety of contexts and tasks, demonstrating command of formal English.
- Science**
- HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

### Unit Understandings:

*Students will understand that...*

- Create equations that describe numbers or relationships.
- Interpret the structure of expressions.
- 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.
- Construct and compare linear and exponential models and solve problems.
- Build a function that models a relationship between two quantities
- Summarize, represent, and interpret data on two categorical and quantitative variables.

### Unit Essential Questions:

- What is a function?
- How can you determine whether a function is linear or nonlinear?
- How can you describe the graph of the equation  $Ax + By = C$ ?
- How can you describe the graph of the equation  $y = mx + b$ ?
- How does the graph of the linear function  $f(x) = x$  compare to the graphs of  $g(x) = f(x) + c$  and  $h(x) = f(cx)$ ?
- Given the graph of a linear function, how can you write an equation of the line?
- How can you write an equation of a line when you are given the slope and a point on the line?

### Knowledge and Skills:

*Students will know...*

- The concepts of functions.
- Describing the characteristics of a function.
- Identifying and graphing linear functions.
- Using function notation.
- Graphing and interpreting equations written in standard form.
- Finding the slope of a line.
- Using the slope-intercept form.
- Graphing transformations of linear functions.
- Graphing absolute value functions.

- Writing equations of lines in slope-intercept form.
- Writing equations of lines in point-slope form.
- Recognizing and writing equations of parallel and perpendicular lines.
- Using scatter plots and lines of fit to describe relationships between data.
- Analyzing lines of fit and finding lines of best fit.
- The concept of arithmetic sequences.
- Graphing and writing piecewise functions.
- Vocabulary: relation, function, independent variable, dependent variable, x-intercept, y-intercept, domain and range, slope, horizontal and vertical lines, parallel, perpendicular, slope-intercept form, standard form, point-slope form, transformations, scatter plots, best-fit lines, and arithmetic sequence.

*Students will be able to...*

- Identify the graph of a linear function.
- Graph linear functions written in different forms.
- Describe the characteristics of a function.
- Explain how a transformation affects the graph of a linear function.
- Discover the domain and range of a function.
- Approximate when a function is positive, negative, increasing, or decreasing.
- Sketch a graph of a function from a verbal description.
- Create real-life problems that correspond to discrete or continuous data.
- Evaluate functions using function notation.
- Solve real-life problems using linear equations in standard form.
- Predict the slope-intercept form of a linear equation.
- Explain how translation, reflections, stretches, and shrinks affect graphs of functions.
- Determine the slope given ordered pairs, a graph, or a context.
- Write the equation of a line in different forms.
- Interpret scatter plots and analyze lines of fit.
- Write a function that represents an arithmetic sequence to solve a real-life problem.
- Discover the slope and y-intercept of a line.
- Solve real-life problems using equations in slope-intercept form.
- Utilize a point and the slope, or two points on a line to write the equation of a line.
- Write equations of parallel and perpendicular lines.
- Predict correlations between sets of data.
- Graph, identify, and write arithmetic sequences.
- Evaluate piecewise functions.

## ***EVIDENCE OF LEARNING***

### **Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- End of Unit Common Assessment - See folder for assessment links.
- Formative: warm-up activities, exploratory activities, class discussions, student participation, homework, and exit tickets.
- Summative: quizzes, tests, projects, and benchmark assessments.
- Open-ended problems that involve written responses with justification of answers.

- Renaissance Star Math Diagnostic Assessment – Fall, Winter, Spring

### Learning Activities:

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Interactive Platforms: Desmos, Kahoot, Delta Math, Formative, Quizizz, Quizlet, Google Forms, Mathspace, PearDeck, Freckle, Geogebra, Gimkit, and Khan Academy.
- Group Work Suggestion: quiz trade, circuits, limit war, matching card games, jeopardy, relay review, and speed dating.
- **Sample Application Activities:**
  - As you ride home from a football game, the number of kilometers you are away from home depends on the number of minutes you have been riding. Suppose that you are 13 km from home when you have been riding for 10 minutes, and 8 km from home when you have been riding for 15 minutes. (Assume that the distance varies linearly with time.)
    - Make a graph with the vertical axis representing distance home and the horizontal axis representing time.
    - Label your graph.
    - Plot the data given as two points on your graph.
    - How long did it take (on average) to travel 1 km?
    - How far was the football game from your home? Explain your answer.
  - The Math Club needs to raise money for its annual neighborhood park beautification project. The club members decide to have a one-day car wash to raise money for this project. After estimating the cost of the activities, determine the total cost of sponges, rags, soap, buckets, and other materials, and investigate the average local charge for washing one car.
    - Write a general rule to determine how much money can be raised for any number of cars.
    - Realistically, can the car wash raise enough money to support this activity?
  - Students can create scenarios which can be represented using a table, linear function, and a graph. They will then form questions based on this information and ask their peers to answer the questions. Questions may be related to: graphing a linear function, domain and range of a function, determining whether a function is discrete or continuous, etc.

## *RESOURCES*

### Teacher Resources:

- **Textbook:** Larson, R. and Boswell, L. (2022). Algebra 1. Erie, PA: Big Ideas Learning, LLC.
- Useful Websites for Teachers to Utilize:
  - [www.illustrativemathematics.org](http://www.illustrativemathematics.org)
  - <http://www.ixl.com>
  - [www.kutasoftware.com](http://www.kutasoftware.com)
  - <https://www.khanacademy.org/>
  - <https://learnzillion.com/>
  - <https://www.teachingchannel.org/>
  - <http://illuminations.nctm.org>

### Equipment Needed:

- Projector, Computer/Laptop, Chromebooks, Document Camera, Graphing Calculator

## UNIT 3 OVERVIEW

**Content Area:** Mathematics

**Unit Title:** Systems of Equations & Inequalities; Exponential & Square Root Functions

**Target Course/Grade Level:** Algebra I & Algebra I Honors/Grades 8-10

**Unit Summary:** Students will be able to write and solve systems of linear equations and inequalities. The big understanding for students is that a solution of a system must satisfy every equation or inequality in the system. Many of the applications in this unit require students to write a system to represent a context, which is an essential skill for modeling with mathematics. Students will also be able to understand exponential functions and sequences. Students will extend the properties of integer exponents, introduced in middle school, to rational exponents. This leads to an introduction of exponential functions and then making a connection between exponential functions and geometric sequences. Lastly, students will be able to graph radical functions and solve radical equations. Students will apply transformations to the square root and cube root parent functions, and interpret key features of the graphs. Radical equations are used to solve problems and inverse functions are introduced.

**Approximate Length of Unit:** 10 weeks

## LEARNING TARGETS

### NJ Student Learning Standards:

**N.RN.A.1** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

For example, we define  $5^{\frac{1}{3}}$  to be the cube root of 5 because we want  $(5^{\frac{1}{3}})^3 = 5^{(\frac{1}{3})^3}$  to hold, so  $(5^{\frac{1}{3}})^3$  must equal 5.

**N.RN.A.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents.

**A.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.

**A-REI.C.6** Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables.

**A.REI.D.11** Explain why the  $x$ -coordinates of the points where the graphs of the equations  $y=f(x)$  and  $y=g(x)$  intersect are the solutions of the equation  $f(x)=g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

**A.REI.D.12** Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

**F.BF.B.3** Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

**F.IF.A.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by  $f(0) = f(1)$ ,  $f(n + 1) = f(n) + f(n - 1)$  for  $n \geq 1$ .

**F.IF.B.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

**F.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.

**F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

e. Graph exponential and logarithmic functions, showing intercepts and end behavior.

**F.IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

**F.LE.A.1** Distinguish between situations that can be modeled with linear functions and with exponential function.

a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

**F.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).

**A.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.

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

**A.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.

**A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.

b. Interpret complicated expressions by viewing one or more of their parts as a single entity.

**A.SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

c. Use the properties of exponents to transform expressions for exponential functions. For example, the expression  $1.15^t$  can be rewritten as  $(1.15^{\frac{1}{12}})^{12t} \approx 1.012^{12t}$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

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

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

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



**S.ID.B.6** Represent data on two quantitative variables on a scatter plot and describe how the variables are related.  
c. Fit a linear function for a scatter plot that suggests a linear association.

**Career Readiness, Life Literacies, and Key Skills:**

**9.4.12.CI.1** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

**9.4.12.CT.1** Identify problem-solving strategies used in the development of an innovative product or practice.

**9.4.12.CT.2** Explain the potential benefits of collaborating to enhance critical thinking and problem solving.

**9.4.12.IML.2** Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

**9.4.12.TL.1** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

**Interdisciplinary Connections and Standards:**

**ELA**

**RL.CR.9–10.1** Cite a range of thorough textual evidence and make relevant connections to strongly support analysis of multiple aspects of what a literary text says explicitly and inferentially, as well as including determining where the text leaves matters uncertain.

**L.SS.9–10.1** Demonstrate command of the system and structure of the English language when writing or speaking.

**L.VL.9–10.3** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, including technical meanings, choosing flexibly from a range of strategies.

**W.AW.9–10.1** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient textual and non-textual evidence.

**W.IW.9–10.2** Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

**W.RW.9–10.7** Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

**SL.PE.9–10.1** Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

**SL.II.9–10.2** Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source.

**SL.PI.9–10.4** Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.

**SL.AS.9–10.6** Adapt speech to a variety of contexts and tasks, demonstrating command of formal English.

**Science**

**HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

**Unit Understandings:**

*Students will understand that...*

- Extend the properties of exponents to rational exponents.
- Understand solving equations as a process of reasoning and explain the reasoning.
- Solve systems of equations.
- Represent and solve equations and inequalities graphically.
- Create equations that describe numbers or relationships.
- Interpret the structure of expressions.
- Write expressions in equivalent forms to solve problems.
- Build new functions from existing functions.

- 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.
- Construct and compare linear and exponential models and solve problems.

### Unit Essential Questions:

- How can you solve a system of linear equations?
- How can you use substitution and elimination to solve a system of linear equations?
- How can you use a system of linear equations to solve an equation with variables on both sides?
- How can you graph a linear inequality in two variables?
- How can you graph a system of linear inequalities?
- How can you solve an exponential equation graphically?
- How can you use a geometric sequence to describe a pattern?
- What are some of the characteristics of the graph of a square root and cube root functions?
- How can you solve an equation that contains square roots?
- How are a function and its inverse related?

### Knowledge and Skills:

*Students will know...*

- Solving linear equations by multiple methods (graphing, substitution, or elimination).
- Solving linear equations with a different number of solutions.
- Graphing linear inequalities in two variables.
- Graphing and writing systems of linear inequalities.
- Writing equivalent expressions involving powers.
- Writing and evaluating the  $n$ th root of a number.
- Graphing and writing exponential functions.
- Writing and graph exponential growth and decay functions.
- Solving exponential equations.
- Identifying, extending, and graphing geometric sequences.
- Writing terms of recursively defined sequences and writing recursive rules for sequences.
- Graphing and describing square root functions.
- Graphing and describing cube root functions.
- Solving radical equations and identifying any extraneous solutions.
- Understanding the relationship between inverse functions.
- Vocabulary: system of linear equations, linear inequality in two variables, half-planes, system of linear inequalities, exponential function, exponential growth, exponential decay, exponential equation,  $n$ th roots, extraneous solutions, rational exponents, geometric sequences, square root function, radical function, cube root function, radical equation, inverse relation, and inverse function.

*Students will be able to...*

- Identify a system of linear equations.
- Describe different methods for solving systems of linear equations.
- Analyze systems of linear equations and decide what solution method is most efficient.
- Predict whether a system of linear equations has one solution, no solution, or infinitely many solutions.
- Approximate the solution of a linear system using a graph.
- Solve real-life system problems using substitution and elimination.
- Compare and contrast solving systems of linear equations using substitution and elimination.
- Solve an absolute value equation by graphing.
- Assess solutions of a linear inequality in two variables in a real-life situation.

- Discover whether an ordered pair is a solution to a system of linear inequalities.
- Identify and use properties of exponents.
- Describe exponential functions.
- Analyze data, a graph, or a context to determine whether it represents exponential growth or decay.
- Model using an exponential function or a geometric sequence.
- Simplify expressions using properties of exponents.
- Evaluate and solve expressions involving rational exponents.
- Model real-life problems using exponential functions.
- Write exponential growth functions and exponential decay functions to solve real-life situations.
- Differentiate whether a sequence is arithmetic, geometric, or neither.
- Translate between recursive rules and explicit rules.
- Identify domains and ranges of radical functions.
- Graph square root and cube root functions.
- Solve radical equations.
- Find inverses of relations and functions.
- Graph and describe transformations of square root and cube root functions.
- Investigate square root and cube root functions to solve real-life problems.
- Conclude whether the inverse of a function is also a function.

## ***EVIDENCE OF LEARNING***

### **Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- End of Unit Common Assessment - See folder for assessment links.
- Formative: warm-up activities, exploratory activities, class discussions, student participation, homework, and exit tickets.
- Summative: quizzes, tests, projects, and benchmark assessments.
- Open-ended problems that involve written responses with justification of answers.
- Renaissance Star Math Diagnostic Assessment – Fall, Winter, Spring

### **Learning Activities:**

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Interactive Platforms: Desmos, Kahoot, Delta Math, Formative, Quizizz, Quizlet, Google Forms, Mathspace, PearDeck, Freckle, Geogebra, Gimkit, and Khan Academy.
- Group Work Suggestion: quiz trade, circuits, limit war, matching card games, jeopardy, relay review, and speed dating.
- **Sample Application Activities:**
  - **Choice A:** The Cape May-Lewes Ferry has space for cars and buses. Using the internet, investigate how many of each can be transported on a single trip. Use variables to represent the unknowns (e.g.  $x$  for cars and  $y$  for buses) and develop the graph. Each additional minute, or part of a minute, for Plan B costs \$0.15. How many minutes need to be used for the plans to have the same cost? Show or explain your work.
  - **Choice B:** A landscaping contractor uses a combination of two brands of fertilizers, each containing a different amount of phosphates and nitrates. In a package, brand A has 4lb. of phosphates and 2 lb. of nitrates. Brand B contains 6 lb. of phosphates and 5lb. of

nitrate. On her current job, the lawn requires at least 24 lb. of phosphates and 16 lb. of nitrate. How much of each fertilizer does the contractor need? (*Students represent the given conditions as inequalities and use the intersection of their regions as the set of feasible answers.*) equality, using either paper-and-pencil or a graphing calculator. Recognizing that the solutions have to be whole numbers, students should identify the points whose coefficients are non-negative integers and in the first quadrant on or below the line.

- **Choice C:** Jim spent \$200 on gifts for his family. He spent the money on toys, clothes, and a \$15 DVD. He spent four times as much on clothes as he did on toys. Write a system of equations that can be used to determine how much money Jim spent on toys. Solve the system to determine how much Jim spent on toys and clothes.
- **Choice D:** Cell phone plan A charges a fixed cost of \$45.00 per month, which includes 200 minutes. Each additional minute, or part of a minute, for Plan A costs \$.30. Cell phone Plan B charges a fixed cost of \$65.00 per month, which includes 300 minutes.

## *RESOURCES*

### Teacher Resources:

- **Textbook:** Larson, R. and Boswell, L. (2022). Algebra 1. Erie, PA: Big Ideas Learning, LLC.
- Useful Websites for Teachers to Utilize:
  - [www.illustrativemathematics.org](http://www.illustrativemathematics.org)
  - <http://www.ixl.com>
  - [www.kutasoftware.com](http://www.kutasoftware.com)
  - <https://www.khanacademy.org/>
  - <https://learnzillion.com/>
  - <https://www.teachingchannel.org/>
  - <http://illuminations.nctm.org>

### Equipment Needed:

- Projector, Computer/Laptop, Chromebooks, Document Camera, Graphing Calculator

## UNIT 4 OVERVIEW

**Content Area:** Mathematics

**Unit Title:** Polynomials Equations and Factoring; Quadratic Functions

**Target Course/Grade Level:** Algebra I & Algebra I Honors/Grades 8-10

**Unit Summary:** Students will perform basic operations with polynomials and factoring polynomials to solve equations and reveal the roots of polynomials. Students will be able to graph quadratic functions. Students will analyze different forms of quadratic functions to identify characteristics. Standard form and vertex form are developed by transforming the parent function  $f(x) = x^2$ . The intercept form is developed by identifying the x-intercepts of the graph. Students will be able to solve quadratic equations using a variety of methods: graphing, using square roots, completing the square, and using the Quadratic Formula. Students will consider which method is most efficient as they learn new methods. Students will also solve nonlinear systems of equations.

**Approximate Length of Unit:** 10 weeks

## LEARNING TARGETS

### NJ Student Learning Standards:

**F.BF.A.1** Write a function that describes a relationship between two quantities.

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

**F.BF.B.3** Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

**F.IF.B.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

**F.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.

**F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

- a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

**F.IF.C.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

**F.IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and

an algebraic expression for another, say which has the larger maximum.

**F.LE.A.3** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

**N.RN.A.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents.

**N.RN.A.3** Simplify radicals, including algebraic radicals (e.g.  $\sqrt[3]{54} = 3\sqrt[3]{2}$ , simplify  $\sqrt{32x^2}$ ).

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

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

**A.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.

**A.REI.B.4** Solve quadratic equations in one variable.

a. Use the method of completing the square to transform any quadratic equation in  $x$  into an equation of the form  $(x - p)^2 = q$  that has the same solutions. Derive the quadratic formula from this form.

b. Solve quadratic equations by inspection (e.g., for  $x^2=49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a+bi$  for real numbers  $a$  and  $b$ .

**A.REI.D.11** Explain why the  $x$ -coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where and/or are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

**A.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.

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

**A.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  $R$ .

**A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.

**A.SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

a. Factor a quadratic expression to reveal the zeros of the function it defines.

b. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

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

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

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

### **Career Readiness, Life Literacies, and Key Skills:**

**9.4.12.CI.1** Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

**9.4.12.CT.1** Identify problem-solving strategies used in the development of an innovative product or practice.

**9.4.12.CT.2** Explain the potential benefits of collaborating to enhance critical thinking and problem solving.

**9.4.12.IML.2** Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

**9.4.12.TL.1** Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

### **Interdisciplinary Connections and Standards:**

#### **ELA**

**RL.CR.9–10.1** Cite a range of thorough textual evidence and make relevant connections to strongly support analysis of multiple aspects of what a literary text says explicitly and inferentially, as well as including determining where the text leaves matters uncertain.

**L.SS.9–10.1** Demonstrate command of the system and structure of the English language when writing or speaking.

**L.VL.9–10.3** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, including technical meanings, choosing flexibly from a range of strategies.

**W.AW.9–10.1** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient textual and non-textual evidence.

**W.IW.9–10.2** Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

**W.RW.9–10.7** Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

**SL.PE.9–10.1** Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

**SL.II.9–10.2** Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source.

**SL.PI.9–10.4** Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.

**SL.AS.9–10.6** Adapt speech to a variety of contexts and tasks, demonstrating command of formal English.

#### **Science**

**HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

### **Unit Understandings:**

*Students will understand that...*

- Perform arithmetic operations on polynomials.
- Understand the relationship between zeros and factors of polynomials.
- Create equations that describe numbers or relationships.
- Understand solving equations as a process of reasoning and explain the reasoning.
- Solve quadratic equations and inequalities in one variable.
- Build a function that models a relationship between two quantities.
- Interpret functions that arise in applications in terms of the context.
- Analyze functions using different representations.
- Construct and compare polynomial models and solve problems.
- Extend the properties of exponents to rational exponents.

### **Unit Essential Questions:**

- How can you solve a polynomial equation?
- How can you recognize and factor special products?
- How can you factor a polynomial completely?
- How can you compare the growth rates of linear, exponential, and quadratic functions?
- How can you multiply and divide square roots?

- How can you use a graph to solve a quadratic equation in one variable?
- How can you derive a formula that can be used to write the solutions of any quadratic equation in standard form?

### **Knowledge and Skills:**

*Students will know...*

- Adding, subtracting, multiplying, and dividing polynomials.
- Utilizing patterns to find products of polynomials.
- Solving polynomial equations in factored form.
- Factoring polynomial expressions using the Greatest Common Factor.
- Factoring trinomial expressions when  $a$  is one and when  $a$  is not 1.
- Recognizing and factoring special products (difference of two squares and perfect square trinomials).
- Factoring a polynomial by grouping.
- Recognizing when a polynomial is factored completely.
- Graphing and describing quadratic functions in any form (monomial, binomial or trinomial quadratics; vertex form; intercept form).
- Comparing the characteristics of linear, exponential, and quadratic functions.
- Utilize properties of radicals to write equivalent expressions.
- Utilize graphs to solve quadratic equations and find zeros of functions.
- Solving quadratic equations using square roots.
- Solving quadratic equations and finding maximum and minimum values of quadratic functions by completing the square.
- Utilizing the Quadratic Formula and its discriminant to solve and analyze quadratic equations.
- Solving nonlinear systems graphically and algebraically.
- Vocabulary: monomial, binomial, trinomial, leading coefficient, zeros of a function, vertex, axis of symmetry, maximum value, minimum value, the average rate of change, quadratic functions, quadratic formula, radical expression, rationalizing the denominator, like radicals, and system of nonlinear equations.

*Students will be able to...*

- Classify polynomials by degree and number of terms.
- Add, subtract, multiply, and divide polynomials.
- Solve polynomial equations.
- Factor polynomials and use factoring to solve real-life problems.
- Model real-life situations using sums and differences of polynomials.
- Multiply polynomials using the Distributive Property and the FOIL Method.
- Analyze the solution to polynomial equations by rewriting them in factored form.
- Factor polynomials using the Greatest Common Factor.
- Solve real-life problems by factoring utilizing special product patterns.
- Identify characteristics of quadratic functions.
- Describe how to graph quadratic functions in different forms.
- Find zeros of functions using intercept form.
- Choose an appropriate function to model data.
- Compare the graph of  $f(x) = ax^2$  to the graph of the parent quadratic function  $f(x) = x^2$ .
- Compare the graph of  $f(x) = ax^2 + c$  to the graph of the parent quadratic function.
- Discover the zeros of  $f(x) = ax^2 + c$ .
- Discover the maximum and minimum values of a quadratic function.
- Compare and contrast the graph of  $f(x) = a(x - h)^2$  to the graph of the parent quadratic function.
- Compare and contrast the graph of  $f(x) = a(x - h)^2 + k$  to the graph of the parent quadratic function.
- Illustrate graphs of quadratic and cubic functions.
- Assess functions using the average rates of change.



- Simplify expressions using properties of radicals.
- Describe different methods for solving quadratic equations.
- Solve quadratic equations.
- Solve nonlinear systems of equations graphically and algebraically.
- Perform mathematical operations with radicals.
- Utilize graphs and technology to approximate zeros of a function and discover the quadratic model for a set of data.
- Approximate solutions of quadratic equations.
- Evaluate the minimum and maximum values of quadratic functions by completing the square.
- Assess methods for solving a quadratic equation and choose the most efficient method.

## *EVIDENCE OF LEARNING*

### **Assessment:**

*What evidence will be collected and deemed acceptable to show that students truly “understand”?*

- End of Unit Common Assessment - See folder for assessment links.
- Formative: warm-up activities, exploratory activities, class discussions, student participation, homework, and exit tickets.
- Summative: quizzes, tests, projects, and benchmark assessments.
- Open-ended problems that involve written responses with justification of answers.
- Renaissance Star Math Diagnostic Assessment – Fall, Winter, Spring

### **Learning Activities:**

*What differentiated learning experiences and instruction will enable all students to achieve the desired results?*

- Interactive Platforms: Desmos, Kahoot, Delta Math, Formative, Quizizz, Quizlet, Google Forms, Mathspace, PearDeck, Freckle, Geogebra, Gimkit, and Khan Academy.
- Group Work Suggestion: quiz trade, circuits, limit war, matching card games, jeopardy, relay review, and speed dating.
- **Sample Application Activities:**
  - Students can write polynomials on index cards with the factored version on the back. Then students will trade index cards with another student next to them and solve the partner’s problems.
  - Students are given different three-dimensional shapes that have monomials as lengths of sides and will need to find the surface area and volume.
  - Form a group. The leader begins by choosing a quadratic function with integer coefficients and generating a sequence of five numbers. The leader then shows only the sequence to the other students in the group. The group then tries to find the quadratic function that generated the sequence.
  - Use a motion detector to investigate a falling object. Drop an object from 10 feet. Use the motion detector to find the object’s height above the ground over time. Use the time and height data to compute second differences in the height values. What are the second differences? Make a scatter plot of the data. Write an equation of the form  $y = -16x^2 + h$  where  $h$  is the initial height to fit the data.

## *RESOURCES*

### **Teacher Resources:**

- **Textbook:** Larson, R. and Boswell, L. (2022). Algebra 1. Erie, PA: Big Ideas Learning, LLC.
- Useful Websites for Teachers to Utilize:
  - [www.illustrativemathematics.org](http://www.illustrativemathematics.org)
  - <http://www.ixl.com>
  - [www.kutasoftware.com](http://www.kutasoftware.com)
  - <https://www.khanacademy.org/>
  - <https://learnzillion.com/>
  - <https://www.teachingchannel.org/>
  - <http://illuminations.nctm.org>

### **Equipment Needed:**

- Projector, Computer/Laptop, Chromebooks, Document Camera, Graphing Calculator