

Hoboken Public Schools

Pre-AP Algebra I Curriculum



Updated SY 26-27

Pre-AP Algebra I

HOBOKEN PUBLIC SCHOOLS

Course Description

This Pre-AP Algebra 1 curriculum reflects the 2023 New Jersey Student Learning Standards for Mathematics and is designed for advanced students in Grades 7 or 8 who are ready to engage with Algebra 1 content and standards. The curriculum develops conceptual understanding, procedural fluency, mathematical reasoning, problem-solving, communication, collaboration, and creativity through meaningful mathematical experiences and situational problem solving. The Hoboken Public School District believes that mathematics empowers students to describe, analyze, and understand the world around them. Instruction is aligned to the New Jersey Student Learning Standards for Mathematics and incorporates the Mathematical Practices throughout all units of study.

As an accelerated and advanced mathematics course, Pre-AP Algebra 1 provides both advanced content and increased depth and complexity. Acceleration is not defined simply by moving through content at a faster pace. Students engage with Algebra 1 concepts through complex and non-routine problem solving, mathematical modeling, analysis of multiple strategies and representations, justification of reasoning, and application of mathematical concepts. Students investigate the “why” behind algebraic relationships and apply their learning through investigations, project-based learning, performance tasks, and open-ended problem-solving opportunities embedded throughout the curriculum.

Because students complete Algebra 1 prior to the traditional high school sequence, instruction intentionally connects prerequisite middle school mathematics knowledge and skills to Algebra 1 concepts. Teachers will use formative assessment and ongoing observation of student understanding to identify prerequisite skills requiring additional development and provide appropriate scaffolding and targeted instruction. Acceleration does not eliminate foundational learning; rather, students build upon and strengthen prerequisite knowledge while engaging with the increased depth, complexity, and expectations of Algebra 1.

Advanced Mathematical Discourse Expectations

Mathematical discourse will serve as a vehicle for developing advanced mathematical reasoning throughout all units of study. Students will formulate conjectures; justify and generalize algebraic relationships; compare the efficiency and accuracy of strategies; analyze and critique reasoning; revise claims based on evidence; construct examples and counterexamples; and make connections among contexts, tables, graphs, equations, and mathematical language. Classroom discussions will emphasize depth of thinking rather than speed of response and provide students with regular opportunities to explain, evaluate, defend, and build upon mathematical ideas.

Pacing Guide

Unit Titles	Timeframe	Resources
Unit 1: Linear Functions and Linear Equations	September - November	enVision 2024 Pre-AP Algebra 1 (College Board) Desmos Classroom
Unit 2: Systems of Linear Equations and Inequalities	November - December	enVision 2024 Pre-AP Algebra 1 (College Board) Desmos Classroom
Unit 3: Quadratic Functions	January - March	enVision 2024 Pre-AP Algebra 1 (College Board) Desmos Classroom
Unit 4: Exponent Properties and Exponential Functions	March - April	enVision 2024 Pre-AP Algebra 1 (College Board) Desmos Classroom
Unit 5: PLTW App Creator	April - June	



Climate Change standards are denoted with this symbol.

Course Resources and Materials

- Pre-AP Algebra 1 - College Board, 2026
- enVision Math 2024 (available in English & Spanish)
- Desmos Classroom
- NJ Student Learning Standards in Mathematics
- Achieve the Core - Focus Areas
- Khan Academy
- NJCTL.org
- Illustrative Mathematics
- Connected Mathematics 3 (CMP3)
- [LinkIt! Online Data Platform](#)
- IXL

Unit 1 – Linear Functions and Linear Equations

Timeframe: September - November

Overview

Linear relationships are among the most prevalent and useful relationships in mathematics and the real world. Any equality in two variables that exhibits a constant rate of change for these variables is linear. Real-world contexts that have a constant rate of change and data sets with a nearly constant rate of change can be effectively modeled by a linear function. Students explore all aspects of linear relationships in this unit: contextual problems that involve constant rate of change, lines in the coordinate plane, arithmetic sequences, and algebraic means of expressing a linear relationship between two quantities. Through this unit, students develop deep skills with linear functions and equations and an appreciation for the simplicity and power of linear functions as building blocks of all higher mathematics.

Essential Questions

- What does the slope of a graph tell us about the data it models?
- How can you identify functions and their components when they are represented in a variety of forms, such as graphs, tables, and ordered pairs?
- How can linear functions be used to model situations and solve problems?
- How do you know if an ordered pair is a solution to a two-variable linear equation or inequality?

Essential Learning Outcomes

- Students will understand that a linear relationship has a constant rate of change, which can be visualized as the slope of the associated graph.
- Students will understand that there are many ways to algebraically represent a linear function and each form reveals different aspects of the function.
- Students will understand that linear functions can be used to model contextual scenarios that involve a constant rate of change or data whose general trend is linear.
- Students will understand that a solution to a two-variable linear equation or inequality is an ordered pair that makes the equation or inequality true.

Standards Addressed

- 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.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.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.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.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.
- A.SSE.A.1.a - Interpret parts of an expression, such as terms, factors, and coefficients.
- F.BF.A.1.a - Determine an explicit expression, a recursive process, or steps for calculation from a context.
- 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 $f(0) = f(1) = 1$, $f(n + 1) = f(n) + f(n - 1)$ 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.b - Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- F.LE.A.1.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.
- 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.3 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. 🌱
- S.ID.B.6.a - Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.*
- S.ID.B.6.b - Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
- S.ID.B.6.c - Fit a linear function for a scatter plot that suggests a linear association.
- 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.

Standards for Mathematical Practice

- MP1. Make sense of problems and persevere in solving them.
- MP2. Reason abstractly and quantitatively.
- MP3. Construct viable arguments and critique the reasoning of others.
- MP4. Model with mathematics.
- MP5. Use appropriate tools strategically.
- MP6. Attend to precision.
- MP7. Look for and make use of structure.
- MP8. Look for and express regularity in repeated reasoning.

Pre-AP Algebra I - Grade 8 Scaffolding Standards

Unit 1 - Linear Functions and Linear Equations

These Grade 8 standards provide the most direct prerequisite/scaffolding foundation for the Algebra I standards in Unit 1. They may be reviewed, embedded in warm-ups, or used for targeted intervention as needed. These Grade 8 standards are not additional Algebra I standards. They identify prerequisite knowledge that may be explicitly activated, reviewed, or scaffolded when students need support accessing the Algebra I standards in this unit.

Grade 8 NJSLs-M (2023)	Grade 8 Skill / Concept	Corresponding Algebra I Standard(s) in This Unit	Scaffolding Connection
8.EE.B.5	Graph proportional relationships and interpret unit rate as slope.	F.IF.B.6; F.LE.A.1.b; F.LE.B.5; S.ID.C.7	Builds the meaning of slope/rate of change before students interpret and model linear functions.
8.EE.B.6	Use similar triangles to explain constant slope and derive $y = mx$ and $y = mx + b$.	A.CED.A.2; A.REI.D.10; F.LE.A.2	Direct bridge from proportional relationships to equations of lines.
8.EE.C.7a-b	Analyze and solve linear equations in one variable, including equations with rational coefficients.	A.REI.A.1; A.CED.A.4; A.SSE.A.1.a	Supports equation solving, equivalent forms, and rearranging formulas.
8.F.A.1	Understand a function as assigning exactly one output to each input.	F.IF.A.1; F.IF.A.2	Provides the formal prerequisite concept for function notation, domain, and range.
8.F.A.2	Compare properties of functions represented algebraically, graphically, numerically, or verbally.	F.IF.B.4; F.IF.B.5; F.IF.B.6	Prepares students to interpret and compare multiple representations of functions.
8.F.A.3	Interpret $y = mx + b$ as a linear function and distinguish linear from nonlinear functions.	F.IF.A.1; F.LE.A.1.b; F.LE.A.2	Establishes the linear-function structure that Unit 1 develops in greater depth.
8.F.B.4	Construct a linear function from a context, two points, a table, or a graph; interpret rate of change and initial value.	F.BF.A.1.a; F.LE.A.2; F.LE.B.5	Direct prerequisite for constructing and modeling with linear functions.
8.F.B.5	Analyze qualitative features of relationships shown in graphs or verbal descriptions.	F.IF.B.4; F.IF.B.5	Supports interpretation of increasing/decreasing behavior and contextual graph features.
8.SP.A.1-3	Construct scatter plots, informally fit lines, and use linear-model equations to solve contextual problems.	S.ID.B.6.a-c; S.ID.C.7	Directly scaffolds linear modeling, lines of fit, slope, and intercept in data contexts.

Advanced Math Discourse

- Use these moments across the unit as recurring discourse routines. Students should formulate a precise claim, construct a mathematical justification, interrogate assumptions and competing reasoning, and revise, formalize, or generalize their conclusions.
- **Prove linearity:** Students determine whether relationships represented by tables, graphs, equations, sequences, or contexts are linear and justify the conclusion using constant rate of change, equal differences, and structural features rather than appearance alone.
- **Compare equivalent forms:** Students rewrite a linear equation among slope-intercept, point-slope, standard, explicit, and recursive forms, then argue which form most efficiently reveals slope, intercepts, a known point, constraints, or sequence structure.
- **Interrogate domain and parameters:** Students identify mathematically possible and contextually meaningful domains, interpret slope and intercept with units, and critique models whose algebra is correct but whose parameter meanings or domains are unreasonable.
- **Analyze model validity:** Given contextual data, students defend whether a linear model is appropriate, examine residual patterns or departures from constant rate, and state assumptions and limitations of predictions or extrapolations.
- **Teacher discourse moves:** Press for formal reasoning with “What warrants that step?”, “Under what conditions is the claim true?”, “Is this evidence or proof?”, “Can you construct a counterexample?”, “What is invariant under the transformation?”, “How do the representations encode the same relationship?”, “What assumptions support the model?”, and “What evidence would change your conclusion?”
- **Student evidence:** Capture at least one oral or written argument per discourse cycle containing a precise claim, connected symbolic and representational evidence, a logically sequenced justification, analysis of assumptions or an alternative approach, and a revised, generalized, or qualified conclusion.

Integrated Accommodations and Modifications

- **Special Education Students**
 - Ongoing Interventions, strategic Interventions and Intensive Interventions that are teacher and/or technologically driven within the curriculum and targeted to standards in need of support.
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
 - [Unique Learning System](#) enables educators in self-contained classes to deliver differentiated, standards-aligned content from one convenient, cloud-based platform enhanced by robust assessments, data tools, and evidence-based instructional support. Students from pre-K through transition have the advantage of consistent, high-quality instruction, a motivating interactive learning environment, engaging symbol support, and a path to independence.
- **English Language Learners**
 - Bilingual language glossary for mathematical literacy and vocabulary prior to and during each lesson.

- English Language Learner support embedded into each lesson for use during the instructional part of the lesson (rephrasing, models, photos, etc.)
- Targeted support strategies that focus on key areas of language development: listening, speaking, reading, and writing for students at different proficiency levels.
- Technology supported assignments aligned with standards in students native language.
- **Skills Fragile Students**
 - Teacher led reteach to build understanding which encompass guided reteaching activities for teachers to utilize when students need a better understanding of lesson topics.
 - Readiness assessment individualized study plan generated based on a students' score on the topic readiness assessment. Allows students to gain additional support in standards that should have been mastered in a previous grade.
 - Adaptive practice and homework utilizing recommended resources
 - Encourage students to make transformations - use a common task or item in a different way
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
- **504 Students**
 - Video tutorials for each lesson with units for students to access as needed.
 - Mathematical literacy and vocabulary activities that provide scaffolded support for students to build vocabulary
 - Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment.
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
- **Gifted & Talented Students**
 - Enrichment activities for teachers to utilize when learners are advanced within the given standard/topic.
 - Encourage students to explore concepts in depth and encourage independent studies or investigations.
 - Modeling or independent student led research

Assessments (Diagnostic, Formative, Summative, Benchmark, Alternative)

- Course Readiness Assessments
- Topic Readiness Assessments
- Independent problems during lessons
- Learning Checkpoints
- Entrance & Exit Tickets
- Self-Assessments
- Topic Assessments
- Performance Tasks
- Benchmark Assessments
- Mid-Course Assessments
- End of Course Assessments

- NJSLA Released Items

Integration of Computer Science and Design Thinking

- 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

Integration of 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.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

Integration of Financial Literacy Standards (NJSL 9.1)

- **9.1.8.CP.1: Compare prices for the same goods or services.**
- **9.1.8.CP.2: Analyze how spending habits affect one's ability to save.**

Integration of Career Awareness Standards (NJSL 9.2)

- 9.2.8.CAP.15: Present how the demand for certain skills, the job market, and credentials can determine an individual's earning power.

Integration of Civics (NJSL - Social Studies)

- 6.3.8.CivicsPR.4: Use evidence and quantitative data to propose or defend a public policy related to climate change.

Integration of Diversity, Equity, and Inclusion (N.J.S.A. 18A:35-4.36a): (See Appendix A)

- Amistad / African- American History: Students examine the **Amistad case (1839)** and model data related to the trans-Atlantic slave trade, interpreting rates of change to understand historical and economic patterns tied to abolition efforts.

Interdisciplinary Connections

- *Social Studies / Civics*: Students use primary-source data and historical context to analyze how economic inequality and freedom movements can be quantified through linear relationships.
- *NJSL ELA Companion Standards*
 - NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
 - NJSLSA.R4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
 - NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

- NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
- NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- *NJSLS Science*
 - HS-ETS1-4: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Unit 2 - Systems of Linear Equations and Inequalities

Timeframe: November - December

Overview

Across Unit 2, students are asked to solve systems of equations in support of two goals: to determine the solution to the system of equations and to become strategic and efficient in choosing a method to solve the system. Students use systems of linear equations and systems of linear inequalities to model physical phenomena, especially those with multiple constraints where an optimal solution to an objective function is desired. Through these contexts students build upon their prior knowledge of solving systems of equations and develop more sophisticated understandings about what the solution(s) to a system means in the context of the problem.

Essential Questions

- What does the solution to a system of linear equations represent?
- What do the solutions to a system of linear inequalities represent?
- How many solutions can systems have?
- What strategies might I use to find the solution or solutions to a system of linear equations or inequalities?
- How do I determine if an ordered pair is a solution or not to a system of linear equations or inequalities?
- How do you use systems of linear equations and inequalities to model situations and solve problems?

Essential Learning Outcomes

- Students will understand that a solution to a system of linear equations or inequalities is an ordered pair of numbers that satisfies all the equations or inequalities simultaneously.
- Students will understand that solving a system of linear equations or inequalities is a process of determining the value or values that make the equation or inequality true.
- Students will understand that systems of linear equations or inequalities can be used to model scenarios that include multiple constraints, such as resource limitations, goals, comparisons, and tolerances.

Standards Addressed

- 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.REI.C.5 - Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
- A.REI.C.6 - Solve systems of linear equations exactly and approximately (e.g., with graphs), 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.
- 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. 🌱

Standards for Mathematical Practice

- MP1. Make sense of problems and persevere in solving them.
- MP2. Reason abstractly and quantitatively.
- MP3. Construct viable arguments and critique the reasoning of others.
- MP4. Model with mathematics.
- MP5. Use appropriate tools strategically.
- MP6. Attend to precision.
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- MP8. Look for and express regularity in repeated reasoning.

Pre-AP Algebra I - Grade 8 Scaffolding Standards

Unit 2 - Systems of Linear Equations and Inequalities

Unit 2 has the strongest direct Grade 8 prerequisite connection: Grade 8 students analyze and solve pairs of simultaneous linear equations. These standards are the natural scaffolds for the Algebra I systems work. These Grade 8 standards are not additional Algebra I standards. They identify prerequisite knowledge that may be explicitly activated, reviewed, or scaffolded when students need support accessing the Algebra I standards in this unit.

Grade 8 NJSLS-M (2023)	Grade 8 Skill / Concept	Corresponding Algebra I Standard(s) in This Unit	Scaffolding Connection
8.EE.C.7b	Solve linear equations with rational coefficients, including distributing and collecting like terms.	A.REI.C.5; A.REI.C.6	Fluency with equivalent equations is essential for substitution and elimination.
8.EE.C.8a	Understand solutions to two linear equations as intersection points satisfying both equations.	A.REI.C.6; A.REI.D.11	Direct conceptual prerequisite for interpreting the solution of a system.
8.EE.C.8b	Solve systems of two linear equations by substitution, graphing/estimation, and simple inspection.	A.REI.C.5; A.REI.C.6	Direct prerequisite for Algebra I systems methods and increased procedural sophistication.
8.EE.C.8c	Solve real-world and mathematical problems leading to two linear equations in two variables.	A.CED.A.2; A.CED.A.3; A.REI.C.6	Prepares students to model contexts with systems and interpret solutions.
8.EE.B.6	Use slope and $y = mx + b$ to represent lines.	A.CED.A.2; A.REI.D.11	Supports graphing both equations accurately before analyzing intersections.
8.F.A.3 / 8.F.B.4	Interpret linear functions and construct them from contexts, points, tables, and graphs.	A.CED.A.2; A.REI.D.11	Supports writing the equations that form a system from multiple representations.

Advanced Math Discourse

- Use these moments across the unit as recurring discourse routines. Students should formulate a precise claim, construct a mathematical justification, interrogate assumptions and competing reasoning, and revise, formalize, or generalize their conclusions.
- **Prove solution-set preservation:** Students justify why replacing one equation by the sum of that equation and a multiple of another produces an equivalent system, distinguishing a valid elimination transformation from an unsupported procedural step.
- **Connect solution types across representations:** Students relate one, none, or infinitely many solutions to slopes and intercepts, algebraic elimination outcomes, tables, and graphical intersections, and explain why each representation encodes the same solution structure.
- **Evaluate strategic method choice:** Students compare substitution, elimination, graphing, and technology for carefully chosen systems, defending a method based on exactness, efficiency, numerical structure, and the purpose of the problem.
- **Critique optimization models:** For systems of inequalities, students translate constraints, justify boundaries and feasible regions, identify viable and nonviable points, and challenge hidden assumptions or omitted constraints before optimizing an objective.
- **Teacher discourse moves:** Press for formal reasoning with “What warrants that step?”, “Under what conditions is the claim true?”, “Is this evidence or proof?”, “Can you construct a counterexample?”, “What is invariant under the transformation?”, “How do the representations encode the same relationship?”, “What assumptions support the model?”, and “What evidence would change your conclusion?”
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 - Modeling or independent student led research

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- Benchmark Assessments
- Mid-Course Assessments
- End of Course Assessments

- NJSLA Released Items

Integration of Computer Science and Design Thinking

- 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

Integration of 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.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

Integration of Financial Literacy Standards (NJSL 9.1)

- 9.1.8.FP.3: Explain how self-regulation is important to managing money (e.g., delayed gratification, impulse buying, peer pressure, etc.).
- 9.1.8.FP.6: Compare and contrast advertising messages to understand what they are trying to accomplish.

Integration of Career Awareness Standards (NJSL 9.2)

- 9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.

Integration of Civics (NJSL - Social Studies)

- 6.3.8.CivicsPR.4: Use evidence and quantitative data to propose or defend a public policy related to climate change.

Integration of Diversity, Equity, and Inclusion (N.J.S.A. 18A:35-4.36a): (See Appendix A)

- Persons with Disabilities: Students apply systems of equations to model cost constraints when designing an accessible community space (e.g., ramp slope vs. stair construction). They find optimal solutions that balance cost, safety, and inclusion.

Interdisciplinary Connections

- *Engineering / Civic Planning*: Students connect mathematical modeling to Universal Design principles and ADA compliance, exploring STEM applications for social equity.
- *NJSLS ELA Companion Standards*
 - NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
 - NJSLSA.R4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
 - NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

- NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
- NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- *NJSLS Science*
 - HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
 - HS-ETS1-4: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
 - HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Unit 3 – Quadratic Functions

Timeframe: January - March

Overview

In this unit, students develop a strong foundation in the important concept of quadratic functions. Students should understand that quadratic functions have a linear rate of change and are often formed by multiplying two linear expressions, and therefore are not linear. Quadratic functions are useful for modeling phenomena that have a linear rate of change and symmetry around a unique minimum or maximum. This foundational understanding of quadratics helps students build their conceptual knowledge of nonlinear functions and prepares them for further study of polynomial and rational functions in Algebra 2.

Essential Questions

- How can a quadratic function be built from a linear function?
- How can we use tables, graphs, and equations to help us understand how quadratic and exponential functions grow?
- How can we rewrite quadratic functions as a product of linear factors?
- How can we use sketches and equations of quadratic functions to model situations and make predictions?
- What do the solutions of a quadratic function represent?
- How can I determine if the solutions to a quadratic equation will be real or complex?
- How can I derive the Quadratic Formula and use it to solve quadratic equations?

Essential Learning Outcomes

- Students will understand that quadratic functions have a linear rate of change.
- Students will understand that quadratic functions can be expressed as a product of linear factors.

- Students will understand that quadratic functions can be used to model scenarios that involve a linear rate of change and symmetry around a unique minimum or maximum.
- Students will understand that every quadratic equation, $ax^2 + bx + c = 0$, where a is not zero, has at most two real solutions. These solutions can be determined using the quadratic formula.

Standards Addressed

- 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.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.REI.B.4.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.
- A.REI.B.4.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 $a \pm bi$ for real numbers a and b .
- A.SSE.A.2 - Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*
- A.SSE.B.3.a - Factor a quadratic expression to reveal the zeros of the function it defines.
- A.SSE.B.3.b - Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
- 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.C.7.a - Graph linear and quadratic functions and show intercepts, maxima, and minima.
- F.IF.C.8.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.

Standards for Mathematical Practice

- MP1. Make sense of problems and persevere in solving them.
- MP2. Reason abstractly and quantitatively.
- MP3. Construct viable arguments and critique the reasoning of others.
- MP4. Model with mathematics.
- MP5. Use appropriate tools strategically.
- MP6. Attend to precision.
- MP7. Look for and make use of structure.
- MP8. Look for and express regularity in repeated reasoning.

Pre-AP Algebra I - Grade 8 Scaffolding Standards

Unit 3 - Quadratic Functions

Grade 8 does not contain a quadratic-functions cluster. The standards below are therefore prerequisite scaffolds rather than direct Grade 8 versions of the Algebra I standards. These Grade 8 standards are not additional Algebra I standards. They identify prerequisite knowledge that may be explicitly activated, reviewed, or scaffolded when students need support accessing the Algebra I standards in this unit.

Grade 8 NJSLS-M (2023)	Grade 8 Skill / Concept	Corresponding Algebra I Standard(s) in This Unit	Scaffolding Connection
8.F.A.3	Distinguish linear functions from nonlinear functions.	F.IF.C.7.a; F.IF.B.4	Creates the conceptual opening for quadratics as a new nonlinear function family.
8.F.B.5	Describe qualitative functional relationships by analyzing and sketching graphs.	F.IF.B.4; F.IF.C.7.a	Supports interpreting shape, increasing/decreasing behavior, and key graph features.
8.EE.A.1	Apply properties of integer exponents to generate equivalent numerical expressions.	A.APR.A.1; A.SSE.A.2	Supports polynomial structure and manipulation of terms containing powers.
8.EE.A.2a	Use square roots to represent solutions to equations of the form $x^2 = p$ and evaluate perfect-square roots.	A.REI.B.4.a-b	Direct prerequisite for solving quadratic equations by taking square roots.
8.EE.A.2b	Simplify numerical square roots involving nonperfect squares.	A.REI.B.4.b	Supports exact radical forms that arise when solving quadratic equations.
8.NS.A.1-2	Understand irrational numbers and approximate irrational values with rational numbers.	A.REI.B.4.b	Supports interpreting irrational quadratic solutions and estimating their values.
8.EE.C.7b	Solve linear equations with rational coefficients using distributive property and like terms.	A.CED.A.1; A.SSE.A.2	Maintains algebraic manipulation skills needed before factoring and solving quadratics.

Advanced Math Discourse

- Use these moments across the unit as recurring discourse routines. Students should formulate a precise claim, construct a mathematical justification, interrogate assumptions and competing reasoning, and revise, formalize, or generalize their conclusions.
- **Connect quadratic forms:** Students translate among standard, factored, and vertex forms, identify which features each reveals, and justify transformations by equivalence rather than treating the forms as unrelated formulas.
- **Compare solution methods:** Students select among factoring, square roots, completing the square, graphing, and the quadratic formula, then defend the choice based on expression structure, exactness, efficiency, and the information sought.
- **Derive and interpret the discriminant:** Students connect the discriminant to the number and type of solutions and to graph intersections with the x-axis, explaining why its sign predicts two, one, or no real zeros.
- **Analyze a quadratic model:** Students interpret zeros, vertex, axis of symmetry, domain, range, and intervals of change in context; test whether predictions are viable; and identify assumptions that limit extrapolation.
- **Teacher discourse moves:** Press for formal reasoning with “What warrants that step?”, “Under what conditions is the claim true?”, “Is this evidence or proof?”, “Can you construct a counterexample?”, “What is invariant under the transformation?”, “How do the representations encode the same relationship?”, “What assumptions support the model?”, and “What evidence would change your conclusion?”
- **Student evidence:** Capture at least one oral or written argument per discourse cycle containing a precise claim, connected symbolic and representational evidence, a logically sequenced justification, analysis of assumptions or an alternative approach, and a revised, generalized, or qualified conclusion.

Integrated Accommodations and Modifications

- **Special Education Students**
 - Ongoing Interventions, strategic Interventions and Intensive Interventions that are teacher and/or technologically driven within the curriculum and targeted to standards in need of support.
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
 - [Unique Learning System](#) enables educators in self-contained classes to deliver differentiated, standards-aligned content from one convenient, cloud-based platform enhanced by robust assessments, data tools, and evidence-based instructional support. Students from pre-K through transition have the advantage of consistent, high-quality instruction, a motivating interactive learning environment, engaging symbol support, and a path to independence.
- **English Language Learners**
 - Bilingual language glossary for mathematical literacy and vocabulary prior to and during each lesson.
 - English Language Learner support embedded into each lesson for use during the instructional part of the lesson (rephrasing, models, photos, etc.)

- Targeted support strategies that focus on key areas of language development: listening, speaking, reading, and writing for students at different proficiency levels.
- Technology supported assignments aligned with standards in students native language.
- **Skills Fragile Students**
 - Teacher led reteach to build understanding which encompass guided reteaching activities for teachers to utilize when students need a better understanding of lesson topics.
 - Readiness assessment individualized study plan generated based on a students' score on the topic readiness assessment. Allows students to gain additional support in standards that should have been mastered in a previous grade.
 - Adaptive practice and homework utilizing recommended resources
 - Encourage students to make transformations - use a common task or item in a different way
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
- **504 Students**
 - Video tutorials for each lesson with units for students to access as needed.
 - Mathematical literacy and vocabulary activities that provide scaffolded support for students to build vocabulary
 - Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment.
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
- **Gifted & Talented Students**
 - Enrichment activities for teachers to utilize when learners are advanced within the given standard/topic.
 - Encourage students to explore concepts in depth and encourage independent studies or investigations.
 - Modeling or independent student led research

Assessments (Diagnostic, Formative, Summative, Benchmark, Alternative)

- Course Readiness Assessments
- Topic Readiness Assessments
- Independent problems during lessons
- Learning Checkpoints
- Entrance & Exit Tickets
- Self-Assessments
- Topic Assessments
- Performance Tasks
- Benchmark Assessments
- Mid-Course Assessments
- End of Course Assessments
- NJSLA Released Items

Integration of Computer Science and Design Thinking

- 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

Integration of 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.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

Integration of Financial Literacy Standards (NJSLS 9.1)

- 9.1.8.FP.1: Describe the impact of personal values on various financial scenarios.
- 9.1.8.FP.2: Evaluate the role of emotions, attitudes, and behavior (rational and irrational) in making financial decisions.

Integration of Career Awareness Standards (NJSLS 9.2)

- 9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.

Integration of Diversity, Equity, and Inclusion (N.J.S.A. 18A:35-4.36a): (See Appendix A)

- Holocaust: Students analyze parabolic data representing population decline and post-war recovery (1940-1960). They reflect on prejudice and discrimination through a "Universe of Obligation" graphic and complete a Graffiti Board reflection from Facing History's Teaching Holocaust and Human Behavior.

Interdisciplinary Connections

- *ELA / Social Studies*: Students connect quantitative data to historical texts and reflective writing on identity, choices, and bias. (Aligned to NJ Holocaust Curriculum Unit 1: *Prejudice and Discrimination*.)
- *NJSLS ELA Companion Standards*
 - NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
 - NJSLSA.R4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
 - NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
 - NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
 - NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- *NJSLS Science*

- HS-ETS1-4: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Unit 4 – Exponent Properties and Exponential Functions

Timeframe: March - April

Overview

Students explore exponent rules as an extension of geometric sequences and the properties of multiplication and division for real numbers. Students should make sense of exponent rules and not simply memorize them without understanding how they arise. The unit culminates in students investigating how exponential functions can model physical phenomena that exhibit a constant multiplicative growth. Exponential functions are framed as multiplicative analogues of linear functions. Thus, a tight connection should be drawn between these two classes of functions and their shared properties.

Essential Questions

- How can I apply the properties of multiplication and division to solve problems involving exponents?
- How does the growth rate of an exponential function differ from that of a linear function?
- How do you use exponential functions to model situations and solve problems involving growth or decay?
- How do graphs and tables help us estimate the solution to an equation that involves exponential expressions?

Essential Learning Outcomes

- Students will understand that properties of exponents are derived from the properties of multiplication and division.
- Students will understand that an exponential function has constant multiplicative growth or decay.
- Students will understand that exponential functions can be used to model contextual scenarios that involve constant multiplicative growth or decay.
- Students will understand that graphs and tables can be used to estimate the solution to an equation that involves exponential expressions.

Standards Addressed

- A.SSE.A.1.b - Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P .*
- A.SSE.B.3.c - Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*
- F.BF.A.1.a - Determine an explicit expression, a recursive process, or steps for calculation from a context.

- 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 $f(0) = f(1) = 1$, $f(n + 1) = f(n) + f(n - 1)$ 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.e - Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
- F.LE.A.1.a - Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
- F.LE.A.1.b - Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- F.LE.A.1.c - Recognize situations in which a quantity grows or decays by a constant percent 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.
- 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.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., simplify).

Standards for Mathematical Practice

- MP1. Make sense of problems and persevere in solving them.
- MP2. Reason abstractly and quantitatively.
- MP3. Construct viable arguments and critique the reasoning of others.
- MP4. Model with mathematics.
- MP5. Use appropriate tools strategically.
- MP6. Attend to precision.
- MP7. Look for and make use of structure.
- MP8. Look for and express regularity in repeated reasoning.

Pre-AP Algebra I - Grade 8 Scaffolding Standards

Unit 4 - Exponent Properties and Exponential Functions

This unit extends Grade 8 exponent, radical, and function work into Algebra I exponential expressions, sequences, and exponential models. These Grade 8 standards are not additional Algebra I standards. They identify prerequisite knowledge that may be explicitly activated, reviewed, or scaffolded when students need support accessing the Algebra I standards in this unit.

Grade 8 NJSL-S-M (2023)	Grade 8 Skill / Concept	Corresponding Algebra I Standard(s) in This Unit	Scaffolding Connection
8.EE.A.1	Apply properties of integer exponents to generate equivalent numerical expressions.	A.SSE.B.3.c; N.RN.A.2	Most direct prerequisite for transforming exponential expressions.
8.EE.A.2a-b	Use square/cube roots and simplify numerical square roots.	N.RN.A.2; N.RN.A.3	Supports the connection among exponents, radicals, and equivalent forms.
8.EE.A.3	Use powers of 10 to estimate and compare very large or very small quantities.	N.Q.A.1; A.SSE.B.3.c	Builds magnitude reasoning with powers before more general exponential models.
8.EE.A.4	Perform operations with scientific notation and interpret technology-generated notation.	N.Q.A.1; A.SSE.B.3.c	Reinforces exponent operations in applied contexts.
8.NS.A.1-3	Reason about rational and irrational numbers and their sums/products.	N.RN.A.2; N.RN.A.3	Supports work with radicals and the real number system.
8.F.A.1-2	Define functions and compare function properties across representations.	F.IF.A.2; F.IF.B.4-6	Provides the function framework used when students analyze exponential models.
8.F.A.3	Interpret linear functions and distinguish linear from nonlinear functions.	F.LE.A.1.a-c	Supports comparison of constant additive change with constant multiplicative change.
8.F.B.5	Analyze qualitative features of functional relationships from graphs and descriptions.	F.IF.B.4; F.IF.B.5	Supports interpreting exponential growth/decay graphs before formal parameter analysis.

Advanced Math Discourse

- Use these moments across the unit as recurring discourse routines. Students should formulate a precise claim, construct a mathematical justification, interrogate assumptions and competing reasoning, and revise, formalize, or generalize their conclusions.
- **Derive exponent laws:** Students derive product, quotient, power, zero, negative, and rational-exponent properties from repeated multiplication and inverse relationships, and critique rules stated without domain restrictions.
- **Prove linear-exponential distinctions:** Students compare equal differences with equal factors across tables, graphs, equations, and sequences, and prove why linear and exponential functions display fundamentally different long-term growth.
- **Interpret parameters and equivalent rates:** Students analyze initial value and growth or decay factor, rewrite annual rates as equivalent periodic rates, and explain what is preserved—and what assumptions are introduced—by the transformation.
- **Evaluate exponential models:** Students compare competing growth or decay models, estimate intersections using tables and graphs, justify the precision of approximate solutions, and identify where the model's assumptions become untenable.
- **Teacher discourse moves:** Press for formal reasoning with “What warrants that step?”, “Under what conditions is the claim true?”, “Is this evidence or proof?”, “Can you construct a counterexample?”, “What is invariant under the transformation?”, “How do the representations encode the same relationship?”, “What assumptions support the model?”, and “What evidence would change your conclusion?”
- **Student evidence:** Capture at least one oral or written argument per discourse cycle containing a precise claim, connected symbolic and representational evidence, a logically sequenced justification, analysis of assumptions or an alternative approach, and a revised, generalized, or qualified conclusion.

Integrated Accommodations and Modifications

- **Special Education Students**
 - Ongoing Interventions, strategic Interventions and Intensive Interventions that are teacher and/or technologically driven within the curriculum and targeted to standards in need of support.
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
 - [Unique Learning System](#) enables educators in self-contained classes to deliver differentiated, standards-aligned content from one convenient, cloud-based platform enhanced by robust assessments, data tools, and evidence-based instructional support. Students from pre-K through transition have the advantage of consistent, high-quality instruction, a motivating interactive learning environment, engaging symbol support, and a path to independence.
- **English Language Learners**
 - Bilingual language glossary for mathematical literacy and vocabulary prior to and during each lesson.
 - English Language Learner support embedded into each lesson for use during the instructional part of the lesson (rephrasing, models, photos, etc.)

- Targeted support strategies that focus on key areas of language development: listening, speaking, reading, and writing for students at different proficiency levels.
- Technology supported assignments aligned with standards in students native language.
- **Skills Fragile Students**
 - Teacher led reteach to build understanding which encompass guided reteaching activities for teachers to utilize when students need a better understanding of lesson topics.
 - Readiness assessment individualized study plan generated based on a students' score on the topic readiness assessment. Allows students to gain additional support in standards that should have been mastered in a previous grade.
 - Adaptive practice and homework utilizing recommended resources
 - Encourage students to make transformations - use a common task or item in a different way
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
- **504 Students**
 - Video tutorials for each lesson with units for students to access as needed.
 - Mathematical literacy and vocabulary activities that provide scaffolded support for students to build vocabulary
 - Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment.
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge.
 - Extended time for revisions or opportunity to identify and develop areas of personal interest
- **Gifted & Talented Students**
 - Enrichment activities for teachers to utilize when learners are advanced within the given standard/topic.
 - Encourage students to explore concepts in depth and encourage independent studies or investigations.
 - Modeling or independent student led research

Assessments (Diagnostic, Formative, Summative, Benchmark, Alternative)

- Course Readiness Assessments
- Topic Readiness Assessments
- Independent problems during lessons
- Learning Checkpoints
- Entrance & Exit Tickets
- Self-Assessments
- Topic Assessments
- Performance Tasks
- Benchmark Assessments
- Mid-Course Assessments
- End of Course Assessments
- NJSLA Released Items

Integration of Computer Science and Design Thinking

- 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

Integration of 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.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

Integration of Financial Literacy Standards (NJSL 9.1)

- 9.1.8.FP.7: Identify the techniques and effects of deceptive advertising.

Integration of Career Awareness Standards (NJSL 9.2)

- 9.2.8.CAP.10: Evaluate how careers have evolved regionally, nationally, and globally.

Integration of Diversity, Equity, and Inclusion (N.J.S.A. 18A:35-4.36a): (See Appendix A)

- AAPI: Students explore the exponential rise of global internet connectivity through the contributions of **AAPI innovators**, such as **Ajay Bhatt** (co-inventor of the USB) and **Jerry Yang** (co-founder of Yahoo!). They model how exponential growth in digital communication technologies connects cultures and economies worldwide.

Interdisciplinary Connections

- *Computer Science / Global Studies / Technology History*: Students connect exponential functions in mathematics to real technological and societal change driven by AAPI innovators, linking mathematical reasoning to cultural and historical context.
- *NJSL ELA Companion Standards*
 - NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
 - NJSLSA.R4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
 - NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
 - NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
 - NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- *NJSL Science Standards*
 - HS-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
 - HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including

- cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- HS-PS4-1: Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

Unit 5 - Computer Science For Innovators and Makers

Timeframe: May - June

Overview

This unit introduces students to computer science through the design and development of physical computing solutions. Students explore how computing devices interact with the world through inputs, outputs, sensors, and programmed behaviors. Through hands-on design challenges, students apply computational thinking, programming, and the engineering design process to develop solutions to authentic problems. Students learn how hardware and software work together and consider how innovative computing technologies can be used to improve everyday life and address real-world needs.

Resources

- www.pltw.org

Essential Questions

- How can computer science be used to solve real-world problems?
- How do hardware and software work together to create a functioning computing system?
- How can inputs, outputs, and sensors allow a computing device to interact with its environment?
- How do programmers use algorithms and code to control the behavior of a device?
- How can data collected by a device be used to make decisions?
- How can computational thinking help break a complex problem into manageable parts?
- How do programmers test, debug, and improve computational solutions?
- How does the engineering design process support the development of computing solutions?
- How do constraints and criteria influence the design of a solution?
- How do teams collaborate to design, build, program, and improve a solution?
- How can computing innovations improve people's lives?
- What factors should be considered when evaluating the effectiveness of a computing solution?

Essential Learning Outcomes

- Students will apply computational thinking to analyze and solve authentic problems.
- Students will explain how hardware and software interact within a computing system.
- Students will use inputs, outputs, and sensors to create physical computing solutions.
- Students will develop algorithms to control the behavior of a computing device.
- Students will write, test, debug, and revise programs.

- Students will use variables, conditional statements, and other programming structures to develop computational solutions.
- Students will collect and use data from inputs and sensors to influence program behavior.
- Students will decompose complex problems into smaller, manageable components.
- Students will apply the engineering design process to design and develop computing solutions.
- Students will evaluate solutions based on established criteria and constraints.
- Students will collaborate effectively to plan, develop, test, and improve a solution.
- Students will communicate and justify design and programming decisions.

Advanced Math Discourse

- Use these moments across the unit as recurring discourse routines. Students should formulate a precise claim, construct a mathematical justification, interrogate assumptions and competing reasoning, and revise, formalize, or generalize their conclusions.
- **Formalize computational logic:** Students express conditional and nested-conditional logic using Boolean statements, tables, flowcharts, or piecewise rules, then prove that all intended cases are covered without contradiction or omission.
- **Analyze algorithms for correctness:** Students trace variable states through an algorithm, construct boundary and counterexample test cases, distinguish syntax errors from logical errors, and justify why a revision resolves the defect.
- **Interrogate data and models:** Students examine how an app collects, represents, transforms, and reports numeric data; challenge assumptions, units, precision, privacy, and bias; and determine whether outputs support the intended claim or decision.
- **Defend design tradeoffs:** Teams quantify competing priorities such as usability, accessibility, speed, accuracy, privacy, and equity, then present an evidence-based design decision and revise it after peer critique.
- **Teacher discourse moves:** Press for formal reasoning with “What warrants that step?”, “Under what conditions is the claim true?”, “Is this evidence or proof?”, “Can you construct a counterexample?”, “What is invariant under the transformation?”, “How do the representations encode the same relationship?”, “What assumptions support the model?”, and “What evidence would change your conclusion?”
- **Student evidence:** Capture at least one oral or written argument per discourse cycle containing a precise claim, connected symbolic and representational evidence, a logically sequenced justification, analysis of assumptions or an alternative approach, and a revised, generalized, or qualified conclusion.

Integrated Accommodations and Modifications

- **Special Education Students**
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge of mathematical concepts.
 - Provide extended time for revisions or opportunity to identify and develop areas of personal interest.
 - [Unique Learning System](#) enables educators in self-contained classes to deliver differentiated, standards-aligned content from one convenient, cloud-based platform enhanced by robust assessments, data tools, and evidence-based instructional support. Students from pre-K through transition

have the advantage of consistent, high-quality instruction, a motivating interactive learning environment, engaging symbol support, and a path to independence.

- **English Language Learners**
 - Invite students to explore different points of view on a particular mathematical standard and compare.
 - Provided translated materials and audio versions of text when applicable.
- **Skills Fragile Students**
 - Encourage students to make transformations - use a common task or item in a different way
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge of mathematical concepts.
 - Provide extended time for revisions or opportunity to identify and develop areas of personal interest.
- **504 Students**
 - Encourage creative expression and thinking by allowing students to choose how to approach a problem or assignment.
 - Provide graphic organizers for additional support or encourage students to create digital multimedia to showcase knowledge of mathematical concepts.
 - Provide extended time for revisions or opportunity to identify and develop areas of personal interest
- **Gifted & Talented Students**
 - Encourage students to explore concepts in depth and encourage independent studies or investigations.
 - Modeling or independent student led research

Assessments (Formative, Summative, Benchmark, Alternative)

- Formal Assessments by Way of Tests and Quizzes
- Multimedia Presentation
- Accountable Talk
- Vocabulary Quizzes
- Topic Quizzes
- Class Participation
- Class or small group discussions
- Topic blogging
- Journaling
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NJSLS Standard 8.1 Computer Science

- 8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.
- 8.1.8.CS.2: Design a system that combines hardware and software components to process data.
- 8.1.8.CS.3: Justify design decisions and explain potential system trade-offs.
- 8.1.8.CS.4: Systematically apply troubleshooting strategies to identify and resolve hardware and software problems in computing systems.
- 8.1.8.NI.1: Model how information is broken down into smaller pieces, transmitted as addressed packets through multiple devices over networks and the Internet, and reassembled at the destination.

- 8.1.8.NI.2: Model the role of protocols in transmitting data across networks and the Internet and how they enable secure and errorless communication.
- 8.1.8.NI.3: Explain how network security depends on a combination of hardware, software, and practices that control access to data and systems.
- 8.1.8.NI.4: Explain how new security measures have been created in response to key malware events.
- 8.1.8.IC.1: Compare the trade-offs associated with computing technologies that affect individual's everyday activities and career options.
- 8.1.8.IC.2: Describe issues of bias and accessibility in the design of existing technologies.
- 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
- 8.1.8.DA.2: Explain the difference between how the computer stores data as bits and how the data is displayed.
- 8.1.8.DA.3: Identify the appropriate tool to access data based on its file format.
- 8.1.8.DA.4: Transform data to remove errors and improve the accuracy of the data for analysis
- 8.1.8.DA.5: Test, analyze, and refine computational models.
- 8.1.8.DA.6: Analyze climate change computational models and propose refinements.
- 8.1.8.AP.1: Design and illustrate algorithms that solve complex problems using flowcharts and/or pseudocode.
- 8.1.8.AP.2: Create clearly named variables that represent different data types and perform operations on their values.
- 8.1.8.AP.3: Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.
- 8.1.8.AP.4: Decompose problems and sub-problems into parts to facilitate the design, implementation, and review of programs.
- 8.1.8.AP.5: Create procedures with parameters to organize code and make it easier to reuse.
- 8.1.8.AP.6: Refine a solution that meets users' needs by incorporating feedback from team members and users.
- 8.1.8.AP.7: Design programs, incorporating existing code, media, and libraries, and give attribution.
- 8.1.8.AP.8: Systematically test and refine programs using a range of test cases and users
- 8.1.8.AP.9: Document programs in order to make them easier to follow, test, and debug.
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NJSLS Standard 8.2 Design Thinking

- 8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

- 8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team.
- 8.2.8.ED.5: Explain the need for optimization in a design process.
- 8.2.8.ITH.1: Explain how the development and use of technology influences economic, political, social, and cultural issues.
- 8.2.8.ITH.2: Compare how technologies have influenced society over time.
- 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies.
- 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.

Integration of NJSL Standard 9 Career Readiness, Life Literacies & Key Skills

- 9.4.8.CI.2: Repurpose an existing resource in an innovative way
- 9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas
- 9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries.
- 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective
- 9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option
- 9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
- 9.4.8.DC.3: Describe tradeoffs between allowing information to be public (e.g., within online games) versus keeping information private and secure.
- 9.4.8.DC.4: Explain how information shared digitally is public and can be searched, copied, and potentially seen by public audiences.
- 9.4.8.DC.5: Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure.
- 9.4.8.DC.6: Analyze online information to distinguish whether it is helpful or harmful to reputation
- 9.4.8.DC.7: Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys.
- 9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).
- 9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping
- 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.

- 9.4.8.IML.5: Analyze and interpret local or public data sets to summarize and effectively communicate the data
- 9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
- 9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.8.TL.4: Synthesize and publish information about a local or global issue or event.
- 9.4.8.TL.5: Compare the process and effectiveness of synchronous collaboration and asynchronous collaboration.
- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem

Integration of Financial Literacy Standards (NJSL 9.1)

- 9.1.8.CR.2: Compare various ways to give back through strengths, passions, goals, and other personal factors

Integration of Career Awareness Standards (NJSL 9.2)

- 9.2.8.CAP.4: Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement

Integration of Civics (NJSL - Social Studies)

- 6.3.8.CivicsPR.4: Use evidence and quantitative data to propose or defend a public policy related to climate change.

Integration of Diversity, Equity, and Inclusion (N.J.S.A. 18A:35-4.36a): (See Appendix A)

- LGBTQ+: Students explore the impact of diverse voices in technology and design apps that promote equity or mental-health support for LGBTQ+ youth. They analyze data on representation in STEM and reflect on how inclusive innovation drives progress.

Interdisciplinary Connections

- *Computer Science / Health / Sociology*: Students apply coding and data skills to design solutions that encourage belonging and awareness of diversity in digital spaces.
- *NJSL Science Standards*
 - NGSS.P1 - Science and Engineering Practices Asking questions (for science) and defining problems (for engineering)
 - NGSS.P2 - Science and Engineering Practices Developing and using models
 - NGSS.P4 - Science and Engineering Practices Analyzing and interpreting data
 - NGSS.P5 - Science and Engineering Practices Using mathematics and computational thinking
 - NGSS.P6 - Science and Engineering Practices Constructing explanations (for science) and designing solutions (for engineering)
 - NGSS.P8 - Science and Engineering Practices Obtaining, evaluating, and communicating information
 - NGSS.MS-ETS1-1 - Engineering Design Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking

into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

- NGSS.MS-ETS1-3 - Engineering Design Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- *NJSLS ELA Companion Standards*
 - NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
 - NJSLSA.R4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
 - RST.6-8.10. By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
 - NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
 - WHST.6-8.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
 - WHST.6-8.10. Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

DEI Integration Chart

Unit	Description	Example
1	Amistad / African- American History	Students examine the Amistad case (1839) and model data related to the trans-Atlantic slave trade, interpreting rates of change to understand historical and economic patterns tied to abolition efforts.
2	Persons with Disabilities	Students apply systems of equations to model cost constraints when designing an accessible community space (e.g., ramp slope vs. stair construction). They find optimal solutions that balance cost, safety, and inclusion.
3	Holocaust Education	Students analyze parabolic data representing population decline and post-war recovery (1940-1960). They reflect on prejudice and discrimination through a “Universe of Obligation” graphic and complete a Graffiti Board reflection from Facing History’s Teaching Holocaust and Human Behavior.
4	AAPI (Asian American and Pacific Islander Heritage)	Students explore the exponential rise of global internet connectivity through the contributions of AAPI innovators, such as Ajay Bhatt (co-inventor of the USB) and Jerry Yang (co-founder of Yahoo!). They model how exponential growth in digital communication technologies connects cultures and economies worldwide.
5	LGBTQ+	Students explore the impact of diverse voices in technology and design apps that promote equity or mental-health support for LGBTQ+ youth. They analyze data on representation in STEM and reflect on how inclusive innovation drives progress.