Unit 01: Linear & Quadratic Functions

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 1**
Length: **3-4 weeks**
Status: **Published**

Brief Summary of Unit

This unit reviews concepts previously studied in Geometry and Algebra II/Algebra II & Trig Honors. Coordinate Geometry is reviewed to stress the distance formula, slope formula, finding the equations of lines, and graphing lines. The class is then directed to solve quadratic equations by factoring, completing the square, and the quadratic formula. In addition, there is a review of complex numbers and rational expressions. There is also an introduction of how to utilize the graphing calculator as an algebraic tool to solve equations, graph functions and find relative extrema and intervals of increasing and decreasing. Lastly, students will be introduced to the three representations of a function and will be taught to recognize linear and quadratic relationships by a graph, table of values or its equation.

Revised Date: July 2025

Standards

This curriculum integrates algebra, geometry, statistics, and/or data analysis with diversity, equity, and inclusion by connecting mathematical concepts to cultural, historical, and social studies content. Students may explore statistical studies and data patterns tied to different cultures, analyze geometric designs rooted in global traditions, or use algebraic and quantitative reasoning to examine issues of equity and fairness. When relevant, units may incorporate elements such as the Amistad Commission mandate to highlight African and African-American history, the Asian American and Pacific Islander History Law to recognize contributions of AAPI communities, or New Jersey's Diversity and Inclusion Law to promote tolerance, belonging, and respect across gender, sexual orientation, race, ethnicity, disabilities, and religion. Instruction may also align with the Commission on Holocaust Education when appropriate, fostering awareness of human behavior, moral responsibility, and the importance of combating prejudice and discrimination. Units may also align to the English Language Development (ELD) standards for K–12, recognizing that multilingual learners develop content and language concurrently in English-medium classrooms; in particular, Standard 1 (Language for Social and Instructional Purposes) supports students in communicating effectively for both social and academic purposes. Across all domains of mathematics, students connect rigorous problem solving with real-world contexts that highlight the value of diversity in society.

L.SS.11–12.1	Demonstrate command of the system and structure of the English language when writing or speaking.
9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
9.2.12.CAP.5	Assess and modify a personal plan to support current interests and post-secondary plans.
9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).

L.VL.11–12.3	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, including technical meanings, choosing flexibly from a range of strategies.
9.2.12.CAP.13	Analyze how the economic, social, and political conditions of a time period can affect the labor market.
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.
A.REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
A.REI.B.4	Solve quadratic equations in one variable.
A.REI.B.4.a	Use the method of completing the square to transform any quadratic equation in □ into an equation of the form (□ – □)² = □ 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 □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 □ ± □□ for real numbers □ and □.
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.
F.IF.C.7.a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
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).
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.
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.
F.IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
A.SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
A.SSE.A.1.a	Interpret parts of an expression, such as terms, factors, and coefficients.
A.SSE.A.1.b	Interpret complicated expressions by viewing one or more of their parts as a single entity.

Essential Questions

- How can these functions and their graphs be used as mathematical models to solve real-world problems?
- What are the characteristics of linear and quadratic functions?
- What are the comparisons between an equation, graph, and table of information?
- Why does understanding imaginary numbers help in real world application problems?

Enduring Understandings

- Both the graph and the equation of a line can be determined by its y-intercept and slope.

- If a > 0, then the vertex of the parabola is a minimum. If a < 0, then the vertex of the parabola is a maximum. The x value of the vertex can be found by the formula -b/2a
- Three methods are available to solve a quadratic equation: factoring, quadratic formula, and completing the square. Students should know which method is appropriate for each type of problem.
- Answers involving complex numbers should be simplified into a + bi form and if the answer involves a fraction, the denominator should be rationalized.
- Graphing quadratic functions consists of finding the roots, y-intercept and vertex.
- Parallel lines have the same slope, while perpendicular lines will have slopes that are opposite reciprocals.
- Pythagorean Theorem can be applied in lieu of using the distance formula.
- The midpoint between two points is directly related to the mean of each the x and y coordinates.
- There are simple ways to recognize if a function is linear or quadratic by looking at its graph, a table of values or its equation.
- There may be extraneous roots when solving rational or radical equations.

Students Will Know

- How to solve a quadratic equation with real or imaginary solutions.
- How to utilize a graphing calculator to graph a function and solve an equation.
- The different formulas needed to find equation of a line including point-slope and slope-intercept.
- The formula (and their derivations) to find slope, distance and midpoint.
- The meaning of i in terms of complex numbers and how to simplify expressions involving i.
- The properties of parallel and perpendicular lines.
- When to apply the formula for the vertex of a parabola.

Students Will Be Skilled At

- Applying the real world meaning of a parabola's vertex point.
- Expressing imaginary numbers as solutions to quadratic equations.
- Factoring quadratic expressions to be simplified and solving quadratic equations in multiple ways.
- Implementing formulas within the coordinate plane.
- Using graphing calculators to graph and solve function equations.

Assessment

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform

problems, Albert/AP Classroom and/or Big Ideas Math unit assessments

- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Take tests and quizzes that will assess the essential questions, including pre-assessments.
- Teacher Observation

Learning Plan

The following list is meant to create a day-to-day plan. Teachers are encouraged to slow down or condense days as appropriate to the student population in the class. Assessment(s) should be given when appropriate.

- Review all coordinate geometry rules including but not limited to: writing linear equations; slope, midpoint, and distance formulas; parallel and perpendicular lines.
- Recall the concept of imaginary numbers, and the four operations of them. Also, some time should be spent simplifying the imaginary term with an exponent.
- Solve quadratic equations by factoring, quadratic formula, and completing the square.
- Solve radical equations, including square roots as well as higher index radicals. This should include multiple steps towards solution, and considering extraneous solutions.
- Model linear and quadratic equations and solve for real world answers, including consideration of imaginary solutions.
- Graph quadratic functions in multiple forms: vertex, standard, and intercept forms.

Graphing calculators are encouraged to be used as an extension of these topics.

Materials

Core instructional materials: Core Book List including PreCalculus Enhanced with Graphing Utilities, Sullivan, Savvas

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook

- Khan Academy
- Teacher created activiites
- Teacher created notes
- Whitebaord tables

Integrated Accommodation & Modifications

Possible accommodations/modification for CP PreCalc & Trig