Equations, Inequalities, and Introduction to Functions

Content Area: **Math**
Course(s):
Time Period: **MP1**
Length: **45**
Status: **Published**

Unit Overview

Unit Summary	Unit Rationale
Unit 1 focuses on extending students' understanding of writing and solving equations and inequalities to include equations and inequalities that require multiple steps to solve, as well as those that have variables on both sides of the equation or inequality. Students will extend their understanding of linear equations to linear functions. Students learn methods to write, graph, and transform linear functions. They also apply analytic methods to tabular and graphic data sets that have linear relationships.	A key aspect of this unit is for students to develop the ability to apply algebraic concepts to real world situations and use equations to model real world situations. The mathematical skills developed in this unit are applied and further developed in future math courses.

NJSLS

MATH.9-12.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.
MATH.9-12.N.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MATH.9-12.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.
MATH.9-12.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.
MATH.9-12.A.CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
MATH.9-12.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 $y = f(x)$.
MATH.9-12.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.
MATH.9-12.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.
MATH.9-12.A.REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
MATH.9-12.F.IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MATH.9-12.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.
MATH.9-12.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).
MATH.9-12.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).

Standards for Mathematical Practice

MATH.K-12.1	Make sense of problems and persevere in solving them
MATH.K-12.2	Reason abstractly and quantitatively
MATH.K-12.3	Construct viable arguments and critique the reasoning of others
MATH.K-12.4	Model with mathematics
MATH.K-12.5	Use appropriate tools strategically
MATH.K-12.6	Attend to precision
MATH.K-12.7	Look for and make use of structure
MATH.K-12.8	Look for and express regularity in repeated reasoning

Unit Focus

Enduring Understandings	Essential Questions
• Linear equations can be used to solve mathematical and real-world problems. You can solve linear equations by using the properties of equality. • The properties of equality are used to solve equations that have variables on each side. If an equation is true for all values of x, then it has infinitely many solutions; if it is not true for any value of x, then is has no solutions. • Literal equations are equations with two or more variables. They are solved by rewriting	• How do you create equations and use them to solve problems? . • How do you create equations with a variable on both sides and use them to solve problems? . • How is rewriting literal equations useful when solving problems? . • How are the solutions of an inequality different from the solutions of an equation? . • What are compound inequalities and how are their solutions represented? . • Why does the solution for an absolute value

the equation to highlight the variable of interest. • The solution to an inequality in one variable is solved by using the properties of inequalities. • Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly. • A compound inequality is a combination of two or more inequalities used to describe multiple constraints. • The solution to an absolute value equation either has two solutions, one positive and one negative, or if there is no value of x that makes the absolute value equation true, it has no solution. • The solution to an absolute value inequality is a compound inequality that uses or or and. • A relation is a function if each element of the domain is assigned to exactly one element of the range. • Linear functions can be represented in multiple ways, using words, tables, graphs, and rules. Function notation is a way to write the rule for a function f. The output of the function f(x), read "f of x", means that f is a function of the input variable of x. • A transformation of a function maps each point of its graph to a new location. Adding k to the function output causes a vertical translation, and adding k to the function input causes a horizontal translation.	equation or inequality typically result in a pair of equations or inequalities? • What is a function? Why is domain and range important in defining a function? . • How can you identify a linear function? . • How does modifying the input or the output of a linear function rule transform its graph? . • How are arithmetic sequences related to linear functions? . • How can you use a scatter plot to describe the relationship between two data sets? . • How can you evaluate the goodness of fit of a line of best fit for a paired data set?

Instructional Focus

Learning Targets
• Explain that each step in solving a linear equation follows from the equality in the previous step. • Create and solve linear equations with one variable using the properties of equality. • Use the properties of equality to solve linear equations with a variable on both sides.

- Identify whether linear equations have one solution, infinitely many solutions, or no solution.
- Rearrange formulas and equations to highlight a quantity of interest by isolating the variable using the same reasoning used to solve equations.
- Use formulas and equations to solve problems.
- Create and solve inequalities in one variable.
- Interpret solutions to inequalities within the context.
- Identify inequalities as true or false based on the number of solutions.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from a mathematical model might not align exactly with the problem situation.
- Create and solve a system of inequalities.
- Interpret the solution to a compound inequality within a modeling context.
- Solve absolute value equations and inequalities.
- Use absolute value equations and inequalities to solve problems.
- Understand that a relation is a function if each element of the domain is assigned to exactly one element in the range.
- Determine a reasonable domain and identify constraints on the domain based on the context of a real-world problem.
- Write and evaluate linear functions using function notation.
- Graph a linear function and relate the domain of a function to its graph.
- Interpret functions represented by graphs, tables, verbal descriptions, and function notation in terms of
  a context.
- Graph transformations of linear functions by identifying the effect of multiplying or adding specific values of k to the input or output of a function.
- Interpret the key features of the graph of a linear function and use them to write the function that the graph represents.
- Use mathematical modeling to represent a problem situation and to propose a solution.

Prerequisite Skills

- Graphing on a coordinate plane, converting meters to kilometers, graphing, converting seconds to hours
- Volume
- converting
- absolute value, parts of an expression re: negative and positive signs
- percentage growth
- surface area (circle and cylinder)
- solving equations and justifying steps
- solving for another variable with no numbers or coefficients and justifying your answer

- solving equations and inequalities
- solving inequalities
- writing and solving an equation
- writing, solving, comparing through mathematical explanation
- equations – solving for another variable
- graphing equations
- graphing inequalities
- writing inequalities

Common Misconceptions

- In solving systems graphically, students may mistake a system with infinite solutions for a system with no solutions.
- When solving by substitution, students may substitute into the same equation they used to isolate the variable.
- Students may attempt to solve a system of linear equations using a less efficient method.
- When students are graphing a system of inequalities, they might shade the wrong side of the line.
- When students are graphing a system of inequalities, they might confuse whether the boundary line should be solid or dashed.
- When students are graphing a system of inequalities, they might not know what to do if a point falls ON one of the lines in the system.
- When students are graphing a system of inequalities whose graph forms a set of parallel lines, they might assume that the system has no solutions.

Spiraling For Mastery

Current Unit Content/Skills	Spiral Focus	Activity
• Real Numbers • Equations • Literal Equations and Formulas	• Rational and Irrational Numbers (Grade 8) • Knowing and Applying Properties of Equality	• IXL • Math Diagnostic and Intervention System

• Inequalities • Understanding Linear Functions • Applications of Linear Functions	(Grade 8) • Solve Problems with Inequalities (Grade 7) • Use Functions to Model Relationships (Grade 8) • Solving Linear Equations (Algebra I)	Activities

Assessment

Formative Assessment	Summative Assessment
• Homework • Lesson Checks • MathXL • Quizzes • Exit Tickets • Lesson Reflections • Performance Tasks	• Topic Tests • Unit 1 Benchmark (Link-It)

Resources

Key Resources	Supplemental Resources
• Savvas EnVision Algebra I • Pacing Guide	• IXL • Delta Math • Desmos • Khan Academy

Career Readiness, Life Literacies, and Key Skills

WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.6	Model integrity, ethical leadership and effective management.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Interdisciplinary Connections

ELA.RI.AA.9–10.7	Describe and evaluate the argument and specific claims in an informational text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.
ELA.SL.PE.9–10.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
ELA.SL.PE.9–10.1.C	Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
ELA.SL.PE.9–10.1.D	Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.
ELA.SL.ES.9–10.3	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any false reasoning or distorted evidence.
9-12.HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
9-12.HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.