Expressions, Equations, and Inequalities

Content Area: **Math**
Course(s):
Time Period: **MP2**
Length: **45**
Status: **Published**

Unit Overview

Unit Summary	Unit Rationale
This unit is designed to enhance students' quantitative reasoning skills and their ability to model real-world situations with mathematical equations and inequalities. Students will learn to use units as a fundamental tool in problem-solving, choosing and interpreting them in formulas, and understanding how to scale and origin graphs and data displays. They will define appropriate quantities for modeling real-life situations and engage in activities that require identifying and justifying their choice of quantities in different contexts. The unit will cover creating and solving equations and inequalities in one variable, focusing on linear, quadratic, simple rational, and exponential functions. Students will also represent constraints using equations and inequalities, including systems, and interpret the solutions to determine viability within given contexts. Additionally, they will practice rearranging formulas to highlight particular quantities of interest. Through problem-solving, descriptive modeling projects, and hands-on activities, students will develop a comprehensive understanding of how to use mathematical units and create equations and inequalities to model and solve real-world problems, interpret viable solutions, and effectively rearrange f	The rationale behind this unit is to equip students with essential quantitative reasoning skills and the ability to model and solve real-world problems using mathematical equations and inequalities. By understanding and applying units as tools in problem-solving, students will develop a deeper comprehension of how to navigate and interpret various formulas and data displays. Defining appropriate quantities for descriptive modeling will enhance their ability to translate real-life scenarios into mathematical contexts. Focusing on the creation and resolution of equations and inequalities, especially those related to linear, quadratic, rational, and exponential functions, will provide students with versatile problem-solving strategies. Representing constraints and interpreting their solutions will help students make informed decisions based on viable options within given contexts. Furthermore, the practice of rearranging formulas to highlight specific quantities of interest will solidify their algebraic manipulation skills. Overall, this unit is designed to foster critical thinking, precision, and the ability to apply mathematical concepts to a wide range of practical situations, preparing students for advanced studies and real-world applications.

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.8.EE.C.7	Solve linear equations in one variable.
MATH.8.EE.C.7.a	Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
MATH.8.EE.C.7.b	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
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.7.EE.A.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
MATH.7.EE.A.2	Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.
MATH.7.EE.B.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
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.6.EE.A.2.b	Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.
MATH.6.EE.A.2.c	Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
MATH.6.EE.A.3	Apply the properties of operations to generate equivalent expressions.
MATH.6.EE.A.4	Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them).

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
• Understanding the structure of expressions and equations is essential for simplifying, solving, and modeling real-world problems. Recognizing and manipulating terms, variables, and coefficients allows for effective problem-solving. • Classifying expressions by their degree and number of terms and evaluating them correctly are fundamental skills for higher-level mathematics and practical applications. • Combining like terms and using the distributive property are key techniques for simplifying and solving more complex expressions and equations. • Factoring out the greatest common factor (GCF) is a critical skill for simplifying expressions and solving equations efficiently. • Solving two-step and multi-step equations, including those with variables on both sides, and understanding the process and reasoning behind each step are crucial for developing logical and systematic problem-solving skills. • Determining the number of solutions an equation or inequality has and interpreting these solutions in context helps in making informed decisions based on mathematical	• What are the different parts of an expression, and how do they contribute to its overall structure and meaning? • How can we classify expressions by their degree and the number of terms, and why is this classification useful? • What methods can we use to evaluate expressions by substituting values for variables accurately? • How do we identify and combine like terms to simplify expressions? • How does the distributive property help us expand and simplify expressions? • What is the greatest common factor, and how can we factor it out to simplify expressions? • What are the steps involved in solving two-step equations, and how do we ensure each step is correct? • How do we approach solving multi-step equations, including those that use the distributive property? • What strategies can we use to solve equations that have variables on both sides effectively?

reasoning. • Writing and solving equations and inequalities to model real-world problems connects abstract mathematical concepts to practical applications, enhancing understanding and relevance. • Rearranging formulas to isolate specific variables is a valuable skill for solving problems in various fields, including science, engineering, and economics. • Representing the solutions to inequalities graphically provides a visual understanding of the solutions and their implications within a given context. • Understanding and solving compound inequalities, and interpreting their solutions within real-world contexts, deepens comprehension of more complex scenarios and their constraints. • Creating and solving systems of inequalities allows for analyzing multiple constraints simultaneously, which is essential for optimization and decision-making in various real-life situations.	• How can we determine whether an equation has no solution, one solution, or infinitely many solutions? • How can we explain each step we take to solve a linear equation, and why is it important to justify our steps? • How do we write and solve equations to model real-world problems, and what considerations are important in this process? • How can we rearrange formulas to highlight a specific quantity by isolating the variable? • How do we use and rewrite formulas to solve real-world problems, ensuring that we use appropriate units and define unknown quantities clearly? • What approaches can we use to solve inequalities in one variable, and how do these solutions differ from those of equations? • How do we interpret the solutions to inequalities within the context of a problem? • How can we determine if solutions to an equation or inequality are true or false based on the number of solutions? • How can we represent the solutions to an inequality on a graph, and what does this graphical representation tell us? • What are the strategies for solving multi-step inequalities, and how do they compare to solving multi-step equations? • How do we solve compound inequalities, and what do their solutions represent in real-world contexts? • How do we create and solve systems of inequalities, and why are these systems important for analyzing complex scenarios? • How do we interpret the solution to a compound inequality within a real-world context, and what insights can we gain from it?

Instructional Focus

Learning Targets

- Identify and explain the key parts of an expression, including terms, variables, degree, like terms, and coefficients.
- Classify expressions by their degree and the number of terms.
- Evaluate expressions by substituting values for variables.
- Combine like terms to simplify expressions.
- Use the distributive property to expand expressions.
- Factor out the greatest common factor (GCF) from expressions.
- Solve two-step equations.
- Solve multi-step equations, including those that use the distributive property.
- Solve equations that have variables on both sides.
- Determine if an equation has no solution, one solution, or infinitely many solutions.
- Explain each step I take to solve a linear equation and why it works.
- Write and solve equations to model real-world problems.
- Rearrange formulas to highlight a specific quantity by isolating the variable.
- Use and rewrite formulas to solve real-world problems, using appropriate units and defining unknown quantities.
- Solve inequalities in one variable.
- Interpret the solutions to inequalities within the context of a problem.
- Identify if solutions to an equation or inequality are true or false based on the number of solutions.
- Represent the solutions to an inequality on a graph.
- Solve multi-step inequalities.
- Solve compound inequalities.

- Create and solve systems of inequalities.
- Interpret the solution to a compound inequality within a real-world context.

Prerequisite Skills

- Addition, subtraction, multiplication, and division of whole numbers, fractions, and decimals.
- Understanding and working with negative numbers.
- Recognizing and using variables in mathematical expressions.
- Understanding the concept of a variable as a placeholder for an unknown value.
- Applying the order of operations (PEMDAS) correctly to evaluate expressions.
- Understanding the importance of parentheses in determining the order of operations.
- Familiarity with the commutative, associative, and distributive properties.
- Using these properties to simplify and manipulate expressions.
- Identifying like terms in an algebraic expression.
- Combining like terms to simplify expressions.
- Solving simple one-step equations using addition, subtraction, multiplication, and division.
- Understanding the concept of maintaining balance in an equation.
- Understanding the concept of factoring as the reverse of expanding.
- Factoring out the greatest common factor (GCF) from simple expressions.

- Recognizing and interpreting inequality symbols (>, <, ≥, ≤).
- Solving basic one-step inequalities and understanding their graphical representation on a number line.
- Plotting points on a coordinate plane.
- Understanding the x-axis and y-axis and their significance.
- Translating simple word problems into mathematical expressions or equations.
- Identifying key information and variables in a word problem.

Common Misconceptions

- Students may think a variable always represents the same number in every context.
- Students might not follow the correct order of operations, leading to incorrect answers.
- Students might combine terms that are not alike, such as adding (3x) and (5) to get (8x).
- Students might incorrectly apply the distributive property, such as distributing incorrectly (e.g., (2(x + 3) = 2x + 3)).
- Students may not maintain the balance of an equation, leading to incorrect solutions.
- Students might confuse inequality symbols (e.g., > vs. <) or think they can treat them like equal signs.
- Students may not understand the difference between no solution, one solution, and infinitely many solutions.
- Students might not factor out the greatest common factor correctly or may leave terms behind.
- Students might graph inequalities incorrectly, such as shading the wrong side of the boundary line or using the wrong type of line (solid vs. dashed).
- Students might struggle to translate word problems correctly into algebraic expressions or equations.

Spiraling For Mastery

Current Unit Content/Skills	Spiral Focus	Activity
• Define Key Parts of an Expression	• Use knowledge of rational and irrational numbers to	• iXL problems • iXL Diagnostic

• Terms, Variables, Degree, Like Terms, Coefficients, etc.
• Classify Expressions
  ○ Degree
  ○ Number of Terms
• Evaluate Expressions
• Combine Like Terms
• Distributive Property
• Factor out GCF
• Solve Two-Step Equations
• Solve Multi-Step Equations
  ○ Including with the Distributive Property
• Solve Equations with Variables on Both Sides
• Determine the Number of Solutions of an Equation
  ○ No Solution, One Solution, Infinitely Many Solutions
• Explain Steps in Solving Linear Equations
  ○ Each step follows from the equality in the previous step
• Write and Solve Equations to Model Real World/Contextual Problems
• Rearrange Formulas and Equations
  ○ Highlight a quantity
	simplify algebraic expressions.
	• Apply arithmetic operations to combine like terms and simplify expressions.
	• Solve linear and quadratic equations that include rational and irrational numbers.
	• Use properties such as the addition, subtraction, multiplication, and division properties of equality and inequality in solving equations and inequalities.
	• Plot solutions of equations and inequalities on a number line, reinforcing the concept of rational and irrational numbers in the context of solutions.
	• Apply the concept of rational and irrational numbers in formulating and solving real-world problems expressed as equations and inequalities.
		Assessment
		• Delta Math

of interest by isolating the variable using the same reasoning used to solve equations ○ Include equations with variables as coefficients and formulas • Use and Re-write Formulas to Solve Real World/Contextual Problems ○ Using appropriate units and defining unknown quantities • Solve Inequalities in One Variable • Interpret Solutions to Inequalities within the Context • Identify Solutions as True or False Based on the Number of Solutions • Represent the Solutions to an Inequality Graphically • Solve Multi-Step Inequalities • Solve Compound Inequalities • Create and Solve a System of Inequalities • Interpret the Solution to a Compound Inequality within a Modeling Context		

Assessment

Formative Assessment	Summative Assessment
• Homework • Lesson Checks • MathXL • Quizzes • Exit Tickets • Lesson Reflections • Performance Tasks	• Topic Tests • Unit 2 Benchmark (Link-It)

Resources

Key Resources	Supplemental Resources
EnVision 6th Grade EnVision 7th Grade EnVision 8th Grade EnVision Algebra 1 Pacing Guide	iXL Delta Math ThatQuiz.org Desmos Khan Academy Teacher Made Worksheets

Career Readiness, Life Literacies, and Key Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Interdisciplinary Connections

HE.9-12.2.2.12.N.1	Compare and contrast the nutritional trends, eating habits, body image, and the impact of marketing foods on adolescents and young adults nationally and worldwide.

HE.9-12.2.2.12.LF.6	Implement a financial plan for participation in physical activity in the community for self and family members.
PFL.9.1.12.B.6	Design and utilize a simulated budget to monitor progress of financial plans.
PFL.9.1.12.D.1	Calculate short- and long-term returns on various investments (e.g., stocks, bonds, mutual funds, IRAs, deferred pension plans, and so on).