# Equations, Inequalities, and Polynomials

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

## Unit Overview

| | **Unit Rationale** |
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| Unit 1 focuses on reviewing and reinforcing students' understanding of equations and inequalities. Students will apply their previous understandings of expressions to perform operations with polynomials. Students identify the parts and factors of polynomials. Students understand how to factor trinomials using the greatest common factor, binomial factors, and special patterns. Students learn methods to add, subtract, and multiply polynomials. Students will be able to model and solve real world problems using equations, inequalities, and polynomials. | 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

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| 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. |
| N.Q.A.1 | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. |
| N.Q.A.2 | Define appropriate quantities for the purpose of descriptive modeling. |
| A.CED.A.1 | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. |
| A.CED.A.3 | Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. |
| A.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. |

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| A.REI.B.3 | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. |
| A.REI.D.10 | Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). |
| A.SSE.A.1 | Interpret expressions that represent a quantity in terms of its context. |
| A.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. |
| A.SSE.A.2 | Use the structure of an expression to identify ways to rewrite it. |

## Standards for Mathematical Practice

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| 1 | Make sense of problems and persevere in solving them |
| 2 | Reason abstractly and quantitatively |
| 3 | Construct viable arguments and critique the reasoning of others |
| 4 | Model with mathematics |
| 5 | Use appropriate tools strategically |
| 6 | Attend to precision |
| 7 | Look for and make use of structure |
| 8 | Look for and express regularity in repeated reasoning |

## Unit Focus

| Enduring Understandings | Essential Questions |
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| • Linear equations can be used to solve mathematical and real-world problems. You can solve linear equations by using the properties of equality.<br>• 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.<br>• Literal equations are equations with two or more variables. They are solved by rewriting the equation to highlight the variable of interest.<br>• The solution to an inequality in one variable is solved by using the properties of inequalities.<br>• Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.<br>• A compound inequality is a combination of two or more inequalities used to describe | • How do you create equations and use them to solve problems? .<br>• How do you create equations with a variable on both sides and use them to solve problems? .<br>• How is rewriting literal equations useful when solving problems? .<br>• How are the solutions of an inequality different from the solutions of an equation? .<br>• What are compound inequalities, and how are their solutions represented? .<br>• Why does the solution for an absolute value equation or inequality typically result in a pair of equations or inequalities?<br>• How does adding or subtracting polynomials compare to adding or subtracting integers?<br>• How does multiplying polynomials compare to multiplying integers?<br>• What patterns are there in the product of the square of a binomial and the product of a sum and a difference? |

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| multiple constraints.<br>• 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.<br>• The solution to an absolute value inequality is a compound inequality that uses or or and.<br>• A relation is a function if each element of the domain is assigned to exactly one element of the range.<br>• A polynomial is a monomial or the sum or difference of two or more monomials (terms). Polynomials can be added or subtracted by combining like terms. Polynomials are closed under addition or subtraction, similar to integers.<br>• Polynomials can be multiplied by applying the Distributive Property or by using a table. They form a system similar to integers. Therefore, polynomials are closed under multiplication.<br>• The product of the square of a binomial in the form $(a + b)^2$ is always the square of the first term, plus twice the product of the first and last terms, plus the square of the last term.<br>• The product of a sum and a difference of two binomials in the form $(a + b)(a - b)$ is always the difference of two squares,<br>• The greatest common factor of the terms of a polynomial is the greatest common factor of the coefficients and the variables or variables, using the number of instances of the variable that are common to each term.<br>• When a trinomial is in the form $x^2 + bx + c$, the factors are found by identifying a pair of integers factors of c that have a sum of b and then using the factors to write binomials that have a product equal to the trinomial.<br>• Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.<br>• A quadratic trinomial in the form $ax^2 + bx + c$ when $a \neq 1$ can either be factored by grouping or by substitution.<br>• When a trinomial has the pattern $a^2 + 2ab + b^2$, then it can be factored as $(a + b)^2$ or $(a - b)^2$ respectively. If a binomial has the pattern | • How is factoring a polynomial similar to factoring integers?<br>• How does recognizing patterns in the signs of the terms help you factor polynomials?<br>• How is factoring a quadratic trinomial when $a \neq 1$ similar to factoring a quadratic trinomial when $a=1$?<br>• What special patterns are helpful when factoring a perfect-square trinomial and the difference of two squares? |

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| $a^2 - b^2$, then it can be factored as (a + b)(a - b). | |

## 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.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Identify the parts of a polynomial.
- Classify polynomials by number of terms and by degree.
- Write a polynomial in standard form.
- Add or subtract two polynomials.
- Use the Distributive Property with polynomials, recognizing that polynomials are closed under multiplication.
- Multiply polynomials using a table and an area model.
- Determine the square of a binomial.
- Find the product of a sum and difference of two squares.
- Solve real-world problems involving the square of a binomial.
- Find the greatest common factor of the terms of a polynomial.
- Use the structure of a polynomial to rewrite it in factored form.
- Factor polynomials that represent real-world problems.
- Factor a trinomial in the form x2+bx+x by finding two binomial factors whose product is equal to the trinomial.
- Identify and use patterns in the signs of the coefficients of the terms of a trinomial expression.
- 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 their mathematical models might not align exactly with the problem situation.

- Identify the common factor of the coefficients in the terms of a trinomial expression when a does not equal 1.
- Write a quadratic trinomial as a product of two binomial factors.
- Identify and factor a trinomial that is a perfect square or a binomial that is a difference of two squares.
- Factor special cases of polynomials within the context of real-world problems.

**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 |
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| • Real Numbers<br>• Equations<br>• Literal Equations and Formulas<br>• Inequalities<br>• Addition, Subtraction, and Multiplication<br>• Products<br>• Factors of Polynomials<br>• Quadratic Functions<br>• Modeling with Quadratic Functions<br>• Solving Quadratic Equations<br>• Solving Linear-Quadratic Systems of Equations | • Rational and Irrational Numbers (Grade 8)<br>• Knowing and Applying Properties of Equality (Grade 8)<br>• Solve Problems with Inequalities (Grade 7)<br>• Use Functions to Model Relationships (Grade 8)<br>• Solving Linear Equations (Algebra I)<br>• Factoring (Grade 8)<br>• Operations and Properties (Grade 8)<br>• Polynomials (Grade 8)<br>• Multiplying Exponents (Grade 8) | • IXL<br>• Math Diagnostic and Intervention System Activities |

## Assessment

| Formative Assessment | Summative Assessment |
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| • Homework<br>• Lesson Checks<br>• MathXL<br>• Quizzes | • Topic Tests<br>• Unit 1 Benchmark (Link-It) |

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| • Exit Tickets<br>• Lesson Reflections<br>• Performance Tasks | |

## Resources

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

## Career Readiness, Life Literacies, and Key Skills

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| 9.4.12.CT.2 | Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a). |
| 9.4.12.IML.1 | Compare search browsers and recognize features that allow for filtering of information. |
| 9.4.12.IML.7 | Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4). |

## Interdisciplinary Connections

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