2023 Mathematics Curriculum

Grade 9: Algebra 1

Born on August 23, 2022 by the South Bergen Jointure Commission Board of Education
Revisions adopted on August 22, 2023 by the South Bergen Jointure Commission Board of Education
Aligned to the 2016 New Jersey Student Learning Standards for Mathematics (NJSLS-S)

SOUTH BERGEN JOINTURE COMMISSION

The mission of the South Bergen Jointure Commission is to unlock the potential of every student. As a leading educational provider, we will focus on the development of each student's social, emotional, and academic needs. By fostering an environment that is supportive and challenging, we will empower students to maximize their independence and potential in becoming fulfilled and productive members of their community.

NJSLS: ALGEBRA STANDARDS- OVERVIEW

Seeing Structure in Expressions

- Interpret the structure of expressions
- Write expressions in equivalent forms to solve problems

Arithmetic with Polynomials and Rational Functions

- Perform arithmetic operations on polynomials
- Understand the relationship between zeros and factors of polynomials
- Use polynomial identities to solve problems
- Rewrite rational expressions

Creating Equations

- Create equations that describe numbers or relationships

Reasoning with Equations and Inequalities

- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable
- Solve systems of equations
- Represent and solve equations and inequalities graphically

Standards for Mathematical Practices

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education.

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.

2016 New Jersey Student Learning Standards for Math (NJSLS-M)
Algebra

Seeing Structure in Expressions (A-SSE)

A. Interpret the structure of expressions

- A-SSE.1. Interpret expressions that represent a quantity in terms of its context.1
  - A-SSE.1a. Interpret parts of an expression, such as terms, factors, and coefficients.
  - A-SSE.1b. 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.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 $(x^2 – y^2)(x^2 +y^2)$.

B. Write expressions in equivalent forms to solve problems

- A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
  - A-SSE.3a. Factor a quadratic expression to reveal the zeros of the function it defines.
  - A-SSE.3b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
  - A-SSE.3c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as $(1.151/^{12)\,12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.
- A-SSE.4. Derive and/or explain the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.

Arithmetic with Polynomials and Rational Expressions (A-APR)

A. Perform arithmetic operations on polynomials

- A-APR.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.

B. Understand the relationship between zeros and factors of polynomials

- A-APR.2. Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).
- A-APR.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

C. Use polynomial identities to solve problems

- A-APR.4. Prove polynomial identities and use them to describe numerical relationships. For example, the difference of two squares; the sum and difference of two cubes; the polynomial identity (x2 + y2) 2 = (x2 – y2) 2 + (2xy) 2 can be used to generate Pythagorean triples.
- A-APR.5. Know and apply the Binomial Theorem for the expansion of (x + y) n in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

D. Rewrite rational expressions

- A-APR.6. Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.
- A-APR.7.Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Creating Equations (A-CED)

A. Create equations that describe numbers or relationships

- A -CED.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.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- A -CED.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.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.

Reasoning with Equations and Inequalities (A-REI)

A. Understand solving equations as a process of reasoning and explain the reasoning

- A-REI.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.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

B. Solve equations and inequalities in one variable

- A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- A-REI.4. Solve quadratic equations in one variable.
    - A-REI.4a. 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.4b. Solve quadratic equations by inspection (e.g., for x2 = 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 ± bi for real numbers a and b.

C. Solve systems of equations

- A-REI.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.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
- A-REI.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = –3x and the circle x2 + y2 = 3.
- A-REI.8. Represent a system of linear equations as a single matrix equation in a vector variable.
- A-REI.9. Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

D. Represent and solve equations and inequalities graphically

- A-REI.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.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.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.

General Curriculum: Textbook Series

McGraw Hill: Reveal Algebra I

Reveal Algebra 1, a high school core math program, provides a truly active classroom experience through a seamless approach to blended print and digital delivery. With purposefully integrated technology and plentiful opportunities for students to explore, collaborate, and reflect, Reveal Math increases both student engagement and students' confidence in their own math abilities.

Reveal Math 9-12 Program Overview Brochure

Intervention Curriculum: Textbook Series

SRA- McGraw Hill: Essentials for Algebra

Provide the essential knowledge that students need to tackle algebra with *Essentials for Algebra*. By using the highly-structured lessons in this year-long math intervention course, more of your students will master essential pre-algebra content and gain an understanding of introductory concepts found in traditional Algebra I classes.

SRA Essentials for Algebra offers a unique progression for introducing and expanding problem types. When a new skill or operation is introduced, it is presented in a highly structured, step-by-step manner. As students progress from one lesson to the next, the teacher provides less and less guidance. Work on new skills and problem types develops in small increments from lesson to lesson. Students are never overwhelmed and receive the practice needed to become skilled at solving complex problems independently.

Program Features:

- Concentrates on core concepts and procedures needed for algebra or to prepare for high school exit exams
- Carefully presents all the component skills and discriminations that students need to work complicated math problems
- Provides far more practice on each problem type than traditional programs offer
- Content starts with basic information and systematically adds details and extensions, enabling students to solve complex problems
- Uniform solution strategies allow struggling students to learn advanced mathematical content in the minimum amount of time
- Teaching techniques maximize the amount of time that students are engaged in application and practice

ALGEBRA I
REVEAL ALGEBRA I: PACING GUIDE

SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY
Module 1: Expressions **NJSLS** A.SSE.1b, A.SSE.2, A.SSE.1, N.RN.3, A.SSE.1a, N.Q.2, N.Q.3	**Module 2: Equations in One Variable** **NJSLS** A.CED.1, A.CED.3, A.REI.1, A.REI.3, A.CED.4	**Module 3: Relations and Functions** **NJSLS** N.Q.1, F.IF.1, F.IF.2, F.IF.4, F.IF.5, A.REI.10, F.IF.9	**Module 4: Linear and Nonlinear Functions** **NJSLS** A.REI.10, F.IF.7a, F.LE.5, F.IF.6, A.CED.2, F.LE.1a, F.BF.3, F.BF.1a, F.BF.2, F.LE.2, F.IF.4, F.IF.7b	**Module 5: Linear and Nonlinear Equations** **NJSLS** A.CED.2, S.ID.7, A.CED.3, S.ID.6a, S.ID.6c, S.ID.9, S.ID.6, S.ID.8, F.BF.4a **Module 6: Linear Inequalities** **NJSLS** A.CED.1, A.REI.3, A.CED.3, A.REI.12

FEBRUARY	MARCH	APRIL	MAY	JUNE
Module 7: Systems of Linear Equations and Inequalities **NJSLS** A.REI.6, A.REI.11, A.CED.3, A.REI.5, A.REI.12	**Module 8: Exponents and Roots** **NJSLS** A.SSE.2, A.SSE.3c, A.SSE.2, N.RN.1, N.RN.2, N.RN.3 **Module 9: Exponential Functions** **NJSLS** F.IF.7e, F.LE.1c, F.LE.5, F.BF.3, F.LE.2, F.LE.5, A.SSE.3c, F.IF.8b, F.BF.2, F.LE.2, F.IF.3	**Module 10: Polynomials** **NJSLS** A.SSE.1a, A.APR.1, A.SSE.2, A.REI.5	**Module 11: Quadratic Functions** **NJSLS** F.IF.4, F.IF.7a, F.BF.3, A.SSE.3a, A.REI.4b, F.IF.8a, A.SSE.3b, A.REI.4, A.CED.1, A.REI.4, A.CED.2, A.REI.7, F.LE.1, F.LE.3, F.LE.1a, F.BF.1b	**Module 12: Statistics** **NJSLS** N.Q.1, S.ID.1, S.ID.2, S.ID.3, S.ID.5

ALGEBRA I
REVEAL ALGEBRA I: PROGRAM OVERVIEW

Module 1: Expressions

- 1-1 Numerical Expressions — A.SSE.1b, A.SSE.2
- 1-2 Algebraic Expressions — A.SSE.1, A.SSE.2
- 1-3 Properties of Real Numbers — A.SSE.2
- 1-3 Operations with Rational Numbers — N.RN.3
- 1-4 Distributive Property — A.SSE.1a, A.SSE.2
- 1-5 Expressions Involving Absolute Value — A.SSE.2
- 1-6 Descriptive Modeling and Accuracy — N.Q.2, N.Q.3

Module 2: Equations in One Variable

- 2-1 Writing and Interpreting Equations — A.CED.1, A.CED.3
- 2-2 Solving One-Step Equations — A.CED.1, A.REI.1, A.REI.3
- 2-3 Solving Multi-Step Equations — A.CED.1, A.REI.3
- 2-4 Solving Equations with the Variables on Each Side — A.CED.1, A.REI.3
- 2-5 Solving Equations Involving Absolute Value — A.CED.1, A.REI.3
- 2-6 Solving Proportions — A.CED.1, A.REI.3
- 2-7 Using Formulas — A.REI.3, A.CED.4

Module 3: Relations and Functions

- 3-1 Representing Relations — N.Q.1, F.IF.1
- 3-2 Functions — F.IF.1, F.IF.2
- 3-3 Linearity and Continuity of Graphs — F.IF.4, F.IF.5
- 3-4 Intercepts of Graphs — A.REI.10, F.IF.4
- 3-5 Shapes of Graphs — F.IF.4
- 3-6 Sketching Graphs and Comparing Functions — F.IF.4, F.IF.9

Module 4: Linear and Nonlinear Functions

- 4-1 Graphing Linear Functions — A.REI.10, F.IF.7a, F.LE.5
- 4-2 Rate of Change and Slope — F.IF.6, F.LE.5
- 4-3 Slope-Intercept Form — A.CED.2, F.IF.7a, F.LE.5, F.LE.1a
- 4-4 Transformations of Linear Functions — F.IF.7a, F.BF.3
- 4-5 Arithmetic Sequences — F.BF.1a, F.BF.2, F.LE.2
- 4-6 Piecewise and Step Functions — F.IF.4, F.IF.7b
- 4-7 Absolute Value Functions — F.IF.7b, F.BF.3

Module 5: Linear and Nonlinear Equations

- 5-1 Writing Equations in Slope-Intercept Form — A.CED.2, S.ID.7
- 5-2 Writing Equations in Standard and Point-Slope Forms — A.CED.2, A.CED.3
- 5-3 Scatter Plots and Lines of Fit — S.ID.6a, S.ID.6c
- 5-4 Correlation and Causation — S.ID.9

- 5-5 Linear Regression S.ID.6, S.ID.8
- 5-6 Inverse of Linear Functions A.CED.2, F.BF.4a

Module 6: Linear Inequalities

- 6-1 Following One-Step Inequalities A.CED.1, A.REI.3
- 6-2 Solving Multi-Step Inequalities A.CED.1, A.REI.3
- 6-3 Solving Compound Inequalities A.CED.1, A.CED.3
- 6-4 Solving Absolute Value Inequalities A.CED.1, A.CED.3
- 6-5 Graphing Inequalities in Two Variables A.CED.3, A.REI.12

Module 7: Systems of Linear Equations and Inequalities

- 7-1 Graphing Systems of Equations A.REI.6, A.REI.11
- 7-2 Substitution A.CED.3, A.REI.6
- 7-3 Elimination Using Addition and Subtraction A.CED.3, A.REI.6
- 7-4 Elimination Using Multiplication A.REI.5, A.REI.6
- 7-5 System of Inequalities A.CED.3, A.REI.12

Module 8: Exponents and Roots

- 8-1 Multiplication Properties of Exponents A.SSE.2, A.SSE.3c
- 8-2 Division Properties of Exponents A.SSE.2, A.SSE.3c
- 8-3 Negative Exponents A.SSE.2
- 8-4 Rational Exponents N.RN.1, N.RN.2
- 8-5 Simplifying Radical Expressions N.RN.2
- 8-6 Operations with Radical Expressions N.RN.2, N.RN.3
- 8-7 Exponential Equations N.RN.2

Module 9: Exponential Functions

- 9-1 Multiplication Properties of Exponents F.IF.7e, F.LE.1c, F.LE.5
- 9-2 Transformations of Exponential Functions F.IF.7e, F.BF.3
- 9-3 Writing Exponential Functions F.LE.2, F.LE.5
- 9-4 Transforming Exponential Expressions A.SSE.3c, F.IF.8b
- 9-5 Geometric Sequences F.BF.2, F.LE.2
- 9-6 Recursive Formulas F.IF.3, F.BF.2

Module 10: Polynomials

- 10-1 Adding and Subtracting Polynomials A.SSE.1a, A.APR.1
- 10-2 Multiplying Polynomials by Monomials A.APR.1
- 10-3 Multiplying Polynomials A.APR.1
- 10-4 Special Products page A.APR.1
- 10-5 Using the Distributive Property A.SSE.2, A.REI.5
- 10-6 Factoring Quadratic Trinomials A.SSE.2
- 10-7 Factoring Special Products A.SSE.2

Module 11: Quadratic Functions

• 11-1 Graphing Quadratic Functions	F.IF.4, F.IF.7a
• 11-2 Transformations of Quadratic Functions	F.IF.7a, F.BF.3
• 11-3 Solving Quadratic Equations by Graphing	F.IF.4, F.IF.7a
• 11-4 Solving Quadratic Equations by Factoring	A.SSE.3a, A.REI.4b, F.IF.8a
• 11-5 Solving Quadratic Equations by Completing the Square	A.SSE.3b, A.REI.4, F.IF.8a
• 11-6 Solving Quadratic Equations by Using the Quadratic Formula	A.CED.1, A.REI.4
• 11-7 Solving Systems of Linear and Quadratic Equations	A.CED.2, A.REI.7
• 11-8 Modeling and Curve Fitting	F.LE.1, F.LE.3, F.LE.1a
• 11-9 Combining Functions	F.BF.1b

Module 12: Statistics

• 12-1 Measures of Center	NJSLS
• 12-2 Representing Data	N.Q.1, S.ID.1
• 12-3 Using Data	NJSLS
• 12-4 Measures of Spread	N.Q.1, S.ID.1
• 12-5 Distributions of Data	S.ID.3
• 12-6 Comparing Sets of Data	S.ID.2, S.ID.3
• 12-7 Summarizing Categorical Data	S.ID.5

ALGEBRA I
ESSENTIALS FOR ALGEBRA: PACING GUIDE

SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY
• **Short Division** • **Decimal Rounding** **NJSLS** Grades 1-5 • Operations and Algebraic Thinking • Number and Operations in Base Ten	• **Decimal Operations** • **Fraction Operations** **NJSLS** Grades 1-5 • Operations and Algebraic Thinking • Number and Operations in Base Ten Grades 3-5 • Number and Operation- Fractions	• **Decimal, Percent Equivalences** • **Abbreviations** **NJSLS** Grades 1-5 • Operations and Algebraic Thinking • Number and Operations in Base Ten Grades 3-5 • Number and Operation- Fractions	• **Problem Solving: Add/Subtract Fraction Simplification** **NJSLS** Grades 1-5 • Operations and Algebraic Thinking • Number and Operations in Base Ten Grades 3-5 • Number and Operation- Fractions	• **Problem Solving: Rate Equations** • **Algebra** **NJSLS** Grades 6-8 • The Number System • Expressions and Equations • Ratios and Proportional Relationships • Statistics and Probability High School- Algebra • Seeing Structure in Expressions • Arithmetic with Polynomials and Rational Functions • Creating Equations • Reading with Equations and Inequalities

FEBRUARY	MARCH	APRIL	MAY	JUNE
• **Problem Solving: Algebra Translation** • **Coordinate System** **NJSLS** Grades 6-8 • The Number System • Expressions and Equations • Ratios and Proportional Relationships • Statistics and Probability High School- Algebra • Seeing Structure in Expressions • Arithmetic with Polynomials and Rational Functions • Creating Equations • Reading with Equations and Inequalities	• **Signed-Number Operations** • **Straight-Line Equations** **NJSLS** Grades 6-8 • The Number System • Expressions and Equations • Ratios and Proportional Relationships • Statistics and Probability High School- Algebra • Seeing Structure in Expressions • Arithmetic with Polynomials and Rational Functions • Creating Equations • Reading with Equations and Inequalities	• **Exponents** • **Probability** **NJSLS** Grades 6-8 • The Number System • Expressions and Equations • Ratios and Proportional Relationships • Statistics and Probability High School- Algebra • Seeing Structure in Expressions • Arithmetic with Polynomials and Rational Functions • Creating Equations • Reading with Equations and Inequalities	• **Scientific Notation** • **Proportion Box and Whiskers** **NJSLS** Grades 6-8 • The Number System • Expressions and Equations • Ratios and Proportional Relationships • Statistics and Probability High School- Algebra • Seeing Structure in Expressions • Arithmetic with Polynomials and Rational Functions • Creating Equations • Reading with Equations and Inequalities	**End of Year Review** Review the mathematical concepts covered throughout the course, as well as any other functional math skills that require additional practice.

ALGEBRA I
ESSENTIALS FOR ALGEBRA: PROGRAM OVERVIEW

Objectives Taught in Essentials for Algebra

Algebra I

- Short Division
- Decimal Rounding
- Decimal Operations
- Fraction Operations
- Decimal, Percent Equivalences
- Abbreviations
- Problem Solving: Add/Subtract
- Fraction Simplification
- Problem Solving: Rate Equations
- Algebra
- Problem Solving: Algebra Translation
- Coordinate System
- Signed-Number Operations
- Straight-Line Equations
- Exponents
- Probability
- Scientific Notation
- Proportion Box and Whiskers