Cliffside Park Public Schools

COURSE OF STUDY UNIT PLANNING GUIDE FOR:

Algebra 1

Grade Level:
8th or 9th

Cliffside Park School District
Cliffside Park, NJ 07010
www.cliffsidepark.edu

Revised on August 2018

Course Overview:

Algebra 1 course looks into the structure of expressions. Student learn how to interpret expressions and write equivalent forms to solve problems. Arithmetic operations are extended to polynomials and rational functions. The understanding of significant values such as the zeros and factors of polynomials is used throughout the course. Students create equations and define functions that model relationships between numbers. Students are expected to explain their reasoning when they obtain a solution or solve an equation or an inequality. Students are introduced to various representations of problems such as graphic, tabular and algebraic.

Overview of Units:

1. Modeling with Linear Equations and Inequalities

2. Modeling with Linear Functions, Linear Systems, & Functions

3. Quadratic Equations, Functions, and Polynomials

4. Modeling with Statistics

Unit 3 Algebra 1		
NJSLS-M Content Standards	**NJSLS-M Standards for Mathematical Practice**	**Critical Knowledge & Skills**
NJSLS-Technology: 8.1.12.A.3 Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue. **Career Ready Practices:** CRP2. apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11. Use technology to enhance productivity	MP.3 Construct viable arguments & critique the reasoning of other MP4 Model with mathematics MP5. Use appropriate tools strategically MP.6 Attend to precision.	Students must learn to collaborate with others to perform specific tasks. Students must defend their answers with reason and communicate effectively. Students must be able to use technology effectively to find the correct answers and justify their claims.
• 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. • A.SSE.A.1. Interpret expressions that represent a quantity in terms of its context A.SSE.A.1a: Interpret parts of an expression, such as terms, factors, and coefficients. A.SSE.A.1b: Interpret complicated expressions by viewing one or more	MP.2 Reason abstractly and quantitatively. MP.7 Look for and make use of structure.	Concept(s): • Polynomials form a system analogous to the integers. • Polynomials are closed under the operations of addition, subtraction, and multiplication. Students are able to: • interpret parts of an expression • classify polynomials in terms of degree and number of terms • add and subtract polynomials. • multiply polynomials. • recognize numerical expressions as a difference of squares and rewrite the expression as the product of sums/differences.

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.* *[Algebra 1 limitation: exponential expressions with integer exponents]		• recognize polynomial expressions in one variable as a difference of squares and rewrite the expression as the product of sums/differences. Learning Goal 1: Identify, classify, add, and subtract, polynomials, relating these to arithmetic operations with integers. Factor to produce equivalent forms of quadratic expressions in one variable.
• 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.	MP.2 Reason abstractly and quantitatively. MP.7 Look for and make use of structure.	Concept(s): • Polynomials form a system analogous to the integers. • Polynomials are closed under the operations of addition, subtraction, and multiplication. Students are able to: • multiply polynomials. • recognize numerical expressions as a difference of squares and rewrite the expression as the product of sums/differences. • recognize polynomial expressions in one variable as a difference of squares and rewrite the expression as the product of sums/differences. Learning Goal 2: Multiply polynomials, relate this to arithmetic operations with integers.

• A.SSE.A.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* $(x^2 - y^2)(x^2 + y^2)$. A.SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. A.SSE.B.3a. Factor a quadratic expression to reveal the zeros of the function it defines. A.SSE.B.3b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it	MP.2 Reason abstractly and quantitatively. MP.7 Look for and make use of structure.	Concepts(s): • Polynomials are factored analogous to integers • GCFs(greatest common factors) are important in factoring polynomials. Students will be able to: • find GCF • factor using GCFs • factor out a common binomial factor • factor by grouping • model factorization of trinomials • Factor trinomials various ways, including using graphs • Factoring special products Learning Goal 3: Understand the similarities between prime numbers and factoring polynomials. Learning Goal 4: Factor polynomials by using the greatest common factor (GCF). Learning Goal 5: Model factorization of trinomials with algebra tiles. Learning Goal 6: Use various strategies and techniques to factor trinomials. Learning Goal 7: Use graphing calculator to factor polynomials. Learning Goal 8: Understand and memorize how to factor special products.

• 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.7a. Graph linear and quadratic functions and show intercepts, maxima, and minima. *[emphasize quadratic functions] • A.REI.D.10 Understanding that a graph of an equation in two variables is a set of all its solutions plotted in the coordinate plane., often forming a curve (which could be a line).	MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): No new concept(s) introduced Students are able to: • identify quadratic functions using tables of values • identify and describe key features of the graphs of quadratic functions. • find the domain and range from a graph. • identify zeros, axis of symmetry, vertex and understand its meaning in context of the problem asked • given two quadratic functions, each represented in a different way, compare the properties of the functions. • graph more complicated cases of quadratic functions using technology. Learning Goal 9: Graph quadratic functions by hand in simple cases and with technology in complex cases, showing intercepts, extreme values and symmetry of the graph. Compare properties of two quadratic functions, each represented in a different way.
• F.BF.A.3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them • F.IF.C.7. Graph functions expressed symb F.IF.C.7a. Graph linear and quadratic functions and show intercepts, maxima, and minima. *[emphasize quadratic functions] • F.IF.B.5. Relate the domain of a function t	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concept(s): Applying concepts of linear movement on parent functions to quadratic functions Students are able to: • use linear transformation understanding to transform quadratic functions • compare graphs of quadratic functions. • understand characteristics of transformed quadratic function Learning Goal 10: Transform quadratic functions by hand in simple cases and with technology in complex cases, compare properties of two quadratic functions and using this information to solve

For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function		application problems; as well as being able to explain changes.
• A.REI.D.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.B.4. Solve quadratic equations in one variable. A.REI.B.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.B.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. • A.SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the	MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concept(s): • Multiple methods for solving quadratic equations, including using graphing calculator. • explore roots, zeros and x-intercepts (technology) • understand the Zero Product Property • . Students are able to: • use the method of completing the square to transform a quadratic equation in *x* into an equation of the form $(x - p)^2 = q$. • understand the derivation of the quadratic formula from $(x - p)^2 = q$. • solve a quadratic equations in one variable by inspection. • solve quadratic equations in one variable by taking square roots. • solve a quadratic equations in one variable by completing the square. • solve a quadratic equations in one variable using the quadratic formula. • solve a quadratic equations in one variable by factoring. • strategically select, as appropriate to the initial form of the equation, a method for solving a quadratic equation in one variable. • write complex solutions of the quadratic formula in $a \pm bi$ form. • analyze the quadratic formula, recognizing the conditions leading to complex solutions (discriminant). Learning Goal 11: Solve quadratic equations by graphing

quantity represented by the expression. A.SSE.B.3a. Factor a quadratic expression to reveal the zeros of the function it defines. A.SSE.B.3b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. • 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. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. • A.CED.A.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear functions and quadratic functions, and simple rational and exponential functions. • F.BF.A.1 Write a function that describes a relationship between two quantities. a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of cooling body by adding s constant function to a decaying exponential, and relate these functions to the model.* c. (+) Compose functions functions. *For example T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a*		Learning Goal 12: Derive the quadratic formula by completing the square and recognize when there are no real solutions. Learning Goal 13: Solve quadratic equations in one variable using a variety of methods (including inspection, taking square roots, factoring, completing the square, and using the TI-84 calculator and the quadratic formula).

function of time,then T9H(t)) is the temperature at the location of the weather balloon as a function of time.		

Unit 3 Algebra 1 What This May Look Like	
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
Homework, *IXL practice,* do nows, warm-ups, exit tickets, surveys, projects, teacher made unit tests and quizzes	Benchmark Assessment (or Project) for indicated unit. Type of assessment to be unanimously determined by department.

Alternate Assessments:

Journaling
Problems worked out partially
Using manipulatives to gauge understanding and develop reasoning skills
Using questioning strategies in TE.
Creating scaffolding questions on test
Online tests
Questions tied to Real-World scenarios
Projects

Focus Mathematical Concepts

Districts should consider listing prerequisites skills. Concepts that include a focus on relationships and representation might be listed as grade level appropriate.

Prerequisite skills:

- Interpret linear models
- Interpret the structure of expressions
- Interpret expressions for functions in terms of the situation
- Understand the concept of a function and use function notation
- Interpret functions that arise in applications in terms of the context
- Analyze functions using different representations
- Solve linear systems of equations
- Represent and solve equations and inequalities graphically
- Build a function that models a relationship between two quantities

Common Misconceptions:

- Students may have difficulty recognizing the graph of the function that is the result of adding, subtracting, or multiplying functions.
- Students may confuse the effects of different transformations.

- Students may find it difficult to recognize equivalent expressions, especially when quadratic expressions are written as the product of two linear functions.
- Students may struggle to write quadratic expressions as a product of its factors due to weakness in number sense. In particular, students may have difficulty with expressions where a > 1 and/or where c < 0.
- Students often forget to balance the equation when completing the square.
- Students may make sign mistakes when squaring negative numbers.
- Students get confused by multiple negative signs when using the formula to find the axis of symmetry. Use $-\left(\frac{b}{2a}\right)$ *instead of* $\frac{-b}{2a}$.
- Students misunderstand the effects of *a* on the shape of the parabola. The greater the absolute value of *a,* the faster the graph rises or falls and the *narrower* it is.

District/School Tasks	District/School Primary and Supplementary Resources
District Benchmarks End of Year Projects	Holt McDougal Algebra 1 Common Core Edition 2012 and online website. Big Ideas Algebra 1 (Honors classes) www.IXL.com www.Khanacademy.com www.desmos.com www.illustrativemathematics.org www.GeoGebra.com Graphing Calculator

Interdisciplinary Standards

Interdisciplinary Connections

NJSLS for ELA and Science are introduced, developed, and practiced in the context of learning math content and engaging in mathematical practices.

ELA

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
RST.11-12.10 By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.
W.11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
W.11-12.2.D Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Science

NJSLS: 21st Century Life and Careers

9.1.12.B.6 Design and utilize a simulated budget to monitor progress of financial needs.
9.1.12.C.2 Compare and compute interest and compound interest and develop an amortization table using business tools.
9.1.12.C.3 Compute and assess the accumulating effect of interest paid over time when using a variety of sources of credit.

Career Ready Practices: Today's students need to develop thinking skills, content knowledge, and social and emotional competencies to navigate complex life and work environments.

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity

NJSLS Technology Standards

Students will participate in activities on Google Classroom and other online resources, Desmos. GeoGebra, IXL

8.1.12.A.3 Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
8.1.12.A.4 Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all the worksheets to convey the results.

Integrated Differentiation/Accommodations/Modifications for Math Algebra 1 Unit 3 *(Alternate Modes of Instruction and Support)*		
Modifications to Support Gifted and Talented Students	**Modifications to Support English Language Learners**	**Modifications to Support Our Learners (Students with IEPs/504s and At-Risk Learners)**
Integrate Higher Order Thinking Skills (HOTS) through questioning and extension projects specific to linear equations, inequalities and functions Provide menu of challenge activities for when the child finishes the lesson early (integrate technology when possible). College/Career Readiness skill enhancement - G & T students can research professions related to the Algebra. Have the student teach the lesson - peer tutoring (research-based strategy) Accelerate pace for students who are advanced in concepts. Use inquiry-based, discovery learning approaches that emphasize open-ended problems with multiple solutions or multiple paths to solutions. Allow students to design their own ways to find the answers to complex questions. Leveled Questions assignments for classwork and homework. Challenge Problems	**Concept/Idea Map** - teacher models note-taking on quadratic equations, functions and polynomials. **Contextualize language** for the following key vocabulary terms: ***monomial, degree of a monomial,polynomial, degree of a polynomial, standard form of a polynomial, leading coefficient, quadratic, cubic, binomial, trinomial, set, element, subset, closure, perfect-square trinomial, difference of two squares, prime factorization, greatest common factor, perfect square trinomials, difference of squares, quadratic function, parabola, vertex, minimum, maximum, zero of a function, axis of symmetry,quadratic equation, roots, zeros, x-intercepts, completing the square, discriminant*** **Visuals and illustrations** to be used for comprehension of polynomials, factoring, parabolas, vertex, maximum, minimum, zeros, roots, and x-intercepts terms. **Word/picture bank** available for students' reference in classroom, online and in their textbooks. **Wait Time Two** - extend basic "Wait Time" - after the 1st student responds to a question, the teacher waits an additional 5 - 7 seconds before calling on another student to ask a question about unit 3.	Review student individual educational plan and/or 504 plan for instructional, assessment, and environmental supports. Allow student to use calculator to solve scatter plots; lines of correlation; absolute value function transformations; systems of linear equations; and systems of linear inequalities. Teach students how to check the accuracy of the solution that was derived from use of the graphing calculator. Provide manipulatives to aid in solving systems of equations (algebra tiles). Utilize manipulatives and/or visuals within instructional presentation of modeling linear functions, linear systems and inequalities ans well as absolute value functions. to support visual learners. Teach students how to check the accuracy of the solution that was derived from use of the calculator or other method. Provide graph paper to aid in aligning system of equations or system of inequalities properly. Utilize graphic organizer or partially completed template for students to solve system problems. Provide study guides that are partially completed by teacher, allowing the student to fill in missing information

	Native Language Supports (peer, online assistive technology, translation device, bilingual dictionary) Teach the text backward - **frontload** the concepts and vocabulary needed for learning the material and activating prior knowledge unit 3 vocabulary, see above. Use a **word square** to teach target academic vocabulary for unit 3. Reading Strategies Worksheets Reteach Worksheets Leveled Practice Problems	during instruction in order to aid in obtaining information pertaining to modeling linear functions and solving linear systems. Utilize visual aids such as charts or graphs connected to linear functions or systems of equations or system of inequalities and provide explicit instruction in how to analyze or use the data or information. By utilizing individual student assessment results, the teacher will provide small group or remedial instruction to review essential questions/big ideas of linear functions or systems of equations or system of inequalities, to provide additional explanations, more examples, and to model procedures in finding the solutions to particular problems. Provide wait time to allow students to process orally presented information and questions relating to the Unit 3. Access to word/picture banks to develop an understanding and use content-specific vocabulary, such as those listed under **Contextualize language.** Allow for Student Choice: Students should be permitted to demonstrate understanding of content through illustrations, computer projects, oral response, creative presentations or demonstration, etc. Support comprehension of unknown vocabulary, by providing examples of Note-taking, highlighting, underlining, etc. Students should be allowed given copies of grade level material or text so they can highlight or underline pertinent information. Text to speech/Oral reading Provide students with flexible seating options while working independently, depending on need or preference. Math-specific vocabulary and literary terms should be pre-taught before teaching relevant concepts.

		Allow extra time to complete in class written assignments. Provide students with a sample problem or list of steps or procedures for multi-step solutions to problems. Allow student to reference these procedures when solving independently. Reduce the number of assigned problems within Unit 3. Provide models or templates to teach the structure of how to solve problems systematically. If necessary, provide additional set of materials or online access so that students can utilize resources at school and home. Provide study guide for students to review before Unit 3 quizzes and tests. Review essential questions/big ideas of linear functions or systems of equations or system of inequalities, to provide additional explanations, more examples, and to model procedures in finding the solutions to particular problems. Provide wait time to allow students to process orally presented information and questions relating to the Unit 3. Access to word/picture banks to develop an understanding and use content-specific vocabulary, such as those listed under **Contextualize language.** Allow for Student Choice: Students should be permitted to demonstrate understanding of content through illustrations, computer projects, oral response, creative presentations or demonstration, etc.

		Support comprehension of unknown vocabulary, by providing examples of Note-taking, highlighting, underlining, etc. Students should be allowed given copies of grade level material or text so they can highlight or underline pertinent information. Text to speech/Oral reading Provide students with flexible seating options while working independently, depending on need or preference. Math-specific vocabulary and literary terms should be pre-taught before teaching relevant concepts. Allow extra time to complete in class written assignments. Provide students with a sample problem or list of steps or procedures for multi-step solutions to problems. Allow student to reference these procedures when solving independently. Reduce the number of assigned problems within Unit 3. Provide models or templates to teach the structure of how to solve problems systematically. If necessary, provide additional set of materials or online access so that students can utilize resources at school and home. Provide study guide for students to review before Unit 3 quizzes and tests. Modify tests to address big ideas/essential questions of Unit 3. Reading Strategies Worksheets Reteach Worksheets

		Leveled Practice Problems

Edit History:

July 2017 Update CCSS to NJSLS-M

August 2018 Correlation with pacing guide; Include differentiated instruction blueprint for units.