**Subject**

**Algebra 1**

**Curriculum Guide**

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**LINDEN PUBLIC SCHOOLS**

**LINDEN, NEW JERSEY**

**DR. MARNIE HAZELTON**

**SUPERINTENDENT**

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**The Linden Board of Education adopted the Curriculum Guide on:**

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| **July 28, 2022** |  | **Education Report #22** |
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| **Rationale** | | |

**EDUCATION EQUITY:** The Linden Public School District guarantees each student equal educational opportunity regardless of age, race, color, creed, religion, gender, language, affectional or sexual orientation, ancestry, national origin, marital or economic status. For Information, contact District Educational Equity Officer Kevin Thurston at **(**908) 486-2800 x 8307**.**

**NONDISCRIMATION:** The Linden Public School District does not discriminate against handicapped persons in admission or access to or treatment or employment in its programs, activities, and vocational opportunities. For information contact District Public 504 Officer Annabell Louis at (908) 486-2800 x 8025.

**Linden Public Schools Vision**

The Linden Public School District is committed to developing respect for diversity, excellence in education, and a commitment to service, in order to promote global citizenship and ensure personal success for all students

**Linden Public Schools Mission**

The mission of the Linden Public School District is to promote distinction through the infinite resource that is Linden’s diversity, combined with our profound commitment to instructional excellence, so that each and every student achieves their maximum potential in an engaging, inspiring, and challenging learning environment.

**Math Department Vision**

To equip students with the understanding and application of mathematical skills and processes to foster a drive for advanced mathematics and higher-level thinking.

**Math Department Mission Statement**

To develop a community of learners who construct and communicate meaning from the mathematical world around them. Students will experience mathematics that encourage them to think critically, discover and apply concepts to solve problems strategically. Students will be encouraged to solve equations with accuracy, efficiency, and flexibility. Furthermore, students will have a multitude of opportunities to apply mathematical tools and practice standards to solve real-world and multi-step problems.

**Math Department Goals**

* Provide opportunities for student to develop computation skills, conceptual understanding, and problem-solving skills
* Require students to explain, justify or prove their thinking through mathematical reasoning, modeling, and speaking

Course Description

This is a one-year course designed to develop an understanding of the structure of the real number system. The students will be able to solve equations and inequalities that lead to the solution of a quadratic equation in one variable and use this knowledge for practical applications. Solving systems of linear equations will also be covered.

Course Instructional Materials

* LPS Adopted Textbooks and Programs
  + Pearson EnVision Algebra
  + Pearson Realize (Computer Based program supplementing Envision)
* Khan Academy
* Edmentum Exact Path

Standards and NJDOE Mandates Guiding Instruction

* 1. New Jersey Student Learning Standards

<https://www.state.nj.us/education/cccs/>

Diversity, Equity, and Inclusion

* Use students’ interests in conceptualized tasks
* Expose students to a diverse group of mathematicians
* Design assessments and assignments with a variety of response types
* Use systematic grading and participation methods
* Encourage students to embrace a growth mindset

**Algebra 1 Pacing Guide**

**Quarter 1**

September 6, 2022 –November 15, 2022

**Quarter 1 Topics**

* Foundations of Algebra
* Analyze and Apply Expressions and Equations
* Solve Linear Equations and Inequalities
* Rewrite Literal Equations
* Graph Linear Equations and Inequalities

**Quarter 1 Student Learning Objectives**

Students will be able to:

* identify different parts of an expression, including terms, factors and constants.
* explain the meaning of parts of an expression in context.
* solve linear equations with coefficients represented by letters in one variable.• use the properties of equality to justify steps in solving linear equations.
* solve linear inequalities in one variable.
* rearrange linear formulas and literal equations, isolating a specific variable.
* identify and describe relationships between quantities in word problems.
* create linear equations in one variable.
* create linear inequalities in one variable.
* use equations and inequalities to solve real world problems.
* explain each step in the solution process.
* select appropriate scales for constructing a graph.
* interpret the origin in graphs.
* graph equations on coordinate axes, including labels and scales.
* identify and describe the solutions in the graph of an equation.

**Quarter 2**

November 16, 2022 –January 31, 2023

**Quarter 2 Topics**

* Systems of Equations & Inequalities
* Function Notation (Equations & Graphing)
* Properties of Exponents
* Operations on Functions
* Composition on Functions
  + *All of the above – before winter break*
* Properties of Rational Exponents
* Polynomial Operations (no division)

**Quarter 2 Student Learning Objectives**

Students will be able to:

* create linear equations in two variables, including those from a context.
* select appropriate scales for constructing a graph.
* interpret the origin in graphs.
* graph equations on coordinate axes, including labels and scales.
* identify and describe the solutions in the graph of an equation.
* explain the relationship between the x-coordinate of a point of intersection and  
  the solution to the equation f(x) = g(x) for linear equations y = f(x) and y = g(x).
* find approximate solutions to the system by making a table of values, graphing,  
  and finding successive approximations.
* identify and define variables representing essential features for the model.
* model real world situations by creating a system of linear equations.
* solve systems of linear equations using the elimination or substitution method.• solve systems of linear equations by graphing.
* interpret the solution(s) in context.
* model real world situations by creating a system of linear inequalities given a context.
* interpret the solution(s) in context.
* use the definition of a function to determine whether a relationship is a function.• use function notation once a relation is determined to be a function.
* evaluate functions for given inputs in the domain.
* explain statements involving function notation in the context of the problem.
* identify and describe situations in which one quantity changes at a constant rate.
* use the properties of exponents to simplify or expand exponential expressions, recognizing these are equivalent forms.
* add and subtract polynomials.
* multiply polynomials.

**Quarter 3**

February 1, 2023 – April 5, 2023

**Quarter 3 Topics**

* Factoring using GCF
* Factoring Trinomials
* Solve by Factoring
* Graph Quadratics in Intercept Form
* Solve by Completing the Square
* Graph from Vertex Form
* Graph from Standard From
* Quadratic Formula

**Quarter 3 Student Learning Activities**

Students will be able to:

* 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.
* use the method of completing the square to transform a quadratic equation in x into an equation of the form (x - p)2 = q.
* derive the quadratic formula from (x - p)2 = q.
* solve a quadratic equation in one variable by inspection.
* solve quadratic equations in one variable by taking square roots.
* solve a quadratic equation in one variable by completing the square.
* solve a quadratic equation in one variable using the quadratic formula.
* solve a quadratic equation 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.
* create quadratic equations in one variable.
* use quadratic equations to solve real world problems.
* interpret maximum/minimum and intercepts of quadratic functions from graphs and tables in the context of the problem.
* sketch graphs of quadratic functions given a verbal description of the relationship between the quantities.
* identify intercepts and intervals where function is increasing/decreasing
* determine the practical domain of a function.
* factor a quadratic expression for the purpose of revealing the zeros of a function.
* complete the square for the purpose of revealing the maximum or minimum of a  
  function.
* identify and describe key features of the graphs of quadratic functions.
* given two quadratic functions, each represented in a different way, compare the  
  properties of the functions.

**Quarter 4**

April 17, 2023 – June 22, 2023

**Quarter 4 Topics**

* Families of Functions
* Scatterplots
* Sequences & Series
* Exponential Functions
* Probability & Statistics

**Quarter 4 Student Learning Objectives**

* distinguish linear models representing approximately linear data from linear.  
  equations representing “perfectly” linear relationships.
* create a scatter plot and sketch a line of best fit.
* fit a linear function to data using technology.
* solve problems using prediction equations.
* interpret the slope and the intercepts of the linear model in context.
* determine the correlation coefficient for the linear model using technology.
* determine the direction and strength of the linear association between two  
  variables.
* identify and describe situations in which one quantity changes at a constant rate.
* identify and describe situations in which a quantity grows or decays by a constant  
  percent.
* show that linear functions grow by equal differences over equal intervals.
* show that exponential functions grow by equal factors over equal intervals.
* create arithmetic and geometric sequences from verbal descriptions.
* create arithmetic sequences from linear functions.
* create geometric sequences from exponential functions.
* identify recursively defined sequences as functions.
* create linear and exponential functions given
  + a graph;
  + a description of a relationship;
  + a table of values.
* use the properties of exponents to simplify or expand exponential expressions, recognizing these are equivalent forms.
* given a verbal description of a relationship, sketch linear and exponential functions.
* identify intercepts and intervals where the function is positive/negative.
* interpret parameters in context.
* determine the domain of a function.
* compare key features of two linear functions represented in different ways.
* compare key features of two exponential functions represented in different ways.
* calculate the rate of change from a table of values or from a function presented  
  symbolically.
* estimate the rate of change from a graph.
* graph linear, square root, cube root, and piecewise-defined functions.
* graph more complicated cases of functions using technology.
* identify and describe key features of the graphs of square root, cube root, and  
  piecewise-defined functions .
* perform transformations on graphs of linear and quadratic functions.
* 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).
* identify the effect on the graph of combinations of transformations.
* given the graph, find the value of k.
* illustrate an explanation of the effects on linear and quadratic graphs using technology.
* represent two or more data sets with plots and use appropriate statistics to compare their center and spread.
* interpret differences in shape, center, and spread in context.
* explain possible effects of extreme data points (outliers) when summarizing data and  
  interpreting shape, center and spread.
* explain possible associations between categorical data in two-way tables.
* identify and describe trends in the data
* fit a function to data using technology.
* solve problems using functions fitted to data (prediction equations).
* interpret the intercepts of models in context.
* plot residuals of linear and non-linear functions.
* analyze residuals in order to informally evaluate the fit of linear and non-linear  
  functions.

**Unit 1 - Relationships between Quantities and Reasoning with Equations**

Content Area: **Mathematics**  
Course(s): **Algebra I**  
Time Period: **First Marking Period**  
Length: **8 Week**  
Status: **Published**

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| **Unit Overview** |
| After completing Math 7 Honors or Math 8, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. This unit builds on these earlier experiences by asking students to analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations. All of this work is grounded on understanding quantities and on relationships between them. |

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| **STAGE 1- DESIRED RESULTS** |
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| **Educational Standards** |
| The following goals, as outlined in the NJSLS, will provide a framework for preparation and instruction in mathematics. They make up the eight mathematical practice standards:  1. Make sense of problems and persevre 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. |

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| **New Jersey Student Learning Standards- Mathematics** |
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| **Introduction- Algebra** |
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| **Expressions** |
| |  |  | | --- | --- | |  | An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances. | |  | Reading an expression with comprehension involves analysis of its underlying structure. This may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning. For example, p + 0.05p can be interpreted as the addition of a 5% tax to a price p. Rewriting p + 0.05p as 1.05p shows that adding a tax is the same as multiplying the price by a constant factor. | |  | Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example, p + 0.05p is the sum of the simpler expressions p and 0.05p. Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure. | |  | A spreadsheet or a computer algebra system (CAS) can be used to experiment with algebraic expressions, perform complicated algebraic manipulations, and understand how algebraic manipulations behave. | |

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| **Equalities and Inequalities** |
| |  |  | | --- | --- | |  | An equation is a statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal. These values are the solutions to the equation. An identity, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form. | |  | The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system. | |  | An equation can often be solved by successively deducing from it one or more simpler equations. For example, one can add the same constant to both sides without changing the solutions, but squaring both sides might lead to extraneous solutions. Strategic competence in solving includes looking ahead for productive manipulations and anticipating the nature and number of solutions. | |  | Some equations have no solutions in a given number system, but have a solution in a larger system. For example, the solution of x + 1 = 0 is an integer, not a whole number; the solution of 2x + 1 = 0 is a rational number, not an integer; the solutions of x² – 2 = 0 are real numbers, not rational numbers; and the solutions of x² + 2 = 0 are complex numbers, not real numbers. | |  | The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid, 𝘈 = ((𝘣₁+𝘣₂)/2)𝘩, can be solved for 𝘩 using the same deductive process. | |  | Inequalities can be solved by reasoning about the properties of inequality. Many, but not all, of the properties of equality continue to hold for inequalities and can be useful in solving them. | |

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| **Connections to Functions and Modeling** |
| |  |  | | --- | --- | |  | Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling. | |

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| **Seeing Structure in Expressions** |
| |  |  | | --- | --- | | MA.A-SSE.A.2 | Use the structure of an expression to identify ways to rewrite it. For example, see 𝑥⁴ – 𝑦⁴ as (𝑥²)² – (𝑦²)², thus recognizing it as a difference of squares that can be factored as (𝑥² – 𝑦²)(𝑥² + 𝑦²). | | MA.A-SSE.B | Write expressions in equivalent forms to solve problems | | MA.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. | | MA.A-SSE.B.3a | Factor a quadratic expression to reveal the zeros of the function it defines. | | MA.A-SSE.B.3b | Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. | | MA.A-SSE.A | Interpret the structure of expressions | | MA.A-SSE.B.3c | Use the properties of exponents to transform expressions for exponential functions. | | MA.A-SSE.A.1 | Interpret expressions that represent a quantity in terms of its context. | | MA.A-SSE.A.1a | Interpret parts of an expression, such as terms, factors, and coefficients. | | MA.A-SSE.B.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. | | MA.A-SSE.A.1b | Interpret complicated expressions by viewing one or more of their parts as a single entity. | |

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| **Arithmetic with Polynomials and Rational Expressions** |
| |  |  | | --- | --- | | MA.A-APR.C.4 | Prove polynomial identities and use them to describe numerical relationships. | | MA.A-APR.A | Perform arithmetic operations on polynomials | | MA.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. | | MA.A-APR.B | Understand the relationship between zeros and factors of polynomials | | MA.A-APR.B.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). | | MA.A-APR.B.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. | | MA.A-APR.C.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. | | MA.A-APR.D | Rewrite rational expressions | | MA.A-APR.D.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. | | MA.A-APR.D.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. | | MA.A-APR.C | Use polynomial identities to solve problems | |

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| **Creating Equations** |
| |  |  | | --- | --- | | MA.A-CED.A | Create equations that describe numbers or relationships | | MA.A-CED.A.1 | Create equations and inequalities in one variable and use them to solve problems. | | MA.A-CED.A.2 | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. | | MA.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. | | MA.A-CED.A.4 | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. | |

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| **Reasoning with Equations and Inequalities** |
| |  |  | | --- | --- | | MA.A-REI.B | Solve equations and inequalities in one variable | | MA.A-REI.B.3 | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. | | MA.A-REI.B.4 | Solve quadratic equations in one variable. | | MA.A-REI.C | Solve systems of equations | | MA.A-REI.C.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. | | MA.A-REI.C.6 | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. | | MA.A-REI.C.7 | Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. | | MA.A-REI.C.8 | Represent a system of linear equations as a single matrix equation in a vector variable. | | MA.A-REI.C.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). | | MA.A-REI.D | Represent and solve equations and inequalities graphically | | MA.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. | | MA.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). | | MA.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. | | MA.A-REI.A | Understand solving equations as a process of reasoning and explain the reasoning | | MA.A-REI.D.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. | | MA.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. | | MA.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 equation𝑓(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. | | MA.A-REI.A.2 | Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. | |

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| **Career Ready Practices** |
| CRP2.   Apply appropriate academic and technical skills.    CRP4.   Communicate clearly and effectively and with reason.    CRP6.   Demonstrate creativity and innovation.    CRP8.   Utilize critical thinking to make sense of problems and persevere in solving them.    CRP11.   Use technology to enhance productivity.    CRP12.   Work productively in teams while using cultural global competence. |

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| **Essential Questions** |
| Why do we use variables?  Why are “the order of operations” and other properties of mathematics important?  When would we want to use the absolute value of numbers?  Why is advantageous to use and solve equations algebraically for real- world problems? |

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| **Enduring Understanding** |
| Solving linear equations and inequalities in an essential skill required to solve other types of equations. |

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| **Students will know...** |
| 1. Reason quantitatively and use units to solve probles.  2. Interpret the structure of expressions  3. Create equations that describe numbers or relationships  4. Understand solving equations as a process of reasoning and explain the reasoning  5. Solve equations and inequalities in one variable |

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| **Students will be able to...** |
| 1. Solve multi-step problems that can be represented algebraically with accurate and appropriately defined units, scales, and  models (such as graphs, tables, and data displays).  2. Interpret terms, factors, coefficients, and expressions (including complex linear and exponential expressions) in terms of  context  3. Solve linear equations and inequalities in one variable (including literal equations). Justify each step in the process and solution  4. Create linear equations and inequalities in one variable and use them to solve problems. Justify each step in the process and  the solution  5. Create linear equations in two or more variables to represent relationships between quantities; graph equations on  coordinate axes with labels and scales  6. Model and describe constraints with linear equations and inequalities and systems of equations and/or inequalities to  determine if solutions are viable or non-viable. |

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| **STAGE 2- EVIDENCE OF LEARNING** |
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| **Formative Assessment Suggestions** |
| |  |  | | --- | --- | | • 3- Minute Pause | **.** | | • A-B-C Summaries | **.** | | • Analogy Prompt | **.** | | • Choral Response | **.** | | • Debriefing | **.** | | • Exit Card / Ticket | **.** | | • Hand Signals | **.** | | • Idea Spinner | **.** | | • Index Card Summaries | **.** | | • Inside-Outside Circle Discussion (Fishbowl) | **.** | | • Journal Entry | **.** | | • Misconception Check | **.** | | • Observation | **.** | | • One Minute Essay | **.** | | • One Word Summary | **.** | | • Portfolio Check | **.** | | • Questions & Answers | **.** | | • Quiz | **.** | | • Self-Assessment | **.** | | • Student Conference | **.** | | • Think-Pair-Share | **.** | | • Web or Concept Map | **.** | |

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| **Authentic Assessments Suggestions** |
| Through the following authentic assessments, students will develop traits regarding thinking and reasoning, settings, mathematical tools and attitudes and dispositions:    1. Performance Assessments    2. Short Investigations    3. Open Ended Response Questions    4.  Portfolios    5.  Self-Assessments |

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| **Benchmark Assessments** |
| Edmentum Exact Path (BOY, MOY, EOY) |

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| **STAGE 3- LEARNING PLAN** |
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| **Instructional Map** |
| Start by directing students to understand written sequence of steps for solving linear equations which is the code for a narrative line of reasoning that would use words like “if”, “then”, “for all” and “there exists.” In the process of learning to solve equations, students should learn certain “if - then” moves: e.g. “if 𝑥 = 𝑦�� then 𝑥 + 𝑐 = 𝑦 + 𝑐 for any 𝑐.” The first requirement in this domain (REI) is that students understand that solving equations is a process of reasoning (A.REI.1).  Have students reason through problems with careful selection of units, and how to use units to understand problems and make sense of the answers they deduce. |

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| **Modifications/Differentiation of Instruction** |
| Differentiation Strategies for Special Education Students   * Remove unnecessary material, words, etc., that can distract from the content * Use of off-grade level materials * Provide appropriate scaffolding * Limit the number of steps required for completion * Time allowed * Level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials * Use technology, if available and appropriate * Varied homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language. * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Ability to work at their own pace * Present ideas using auditory, visual, kinesthetic, & tactile means * Provide graphic organizers and/or highlighted materials * Strategy and flexible groups based on formative assessment * Differentiated checklists and rubrics, if available and appropriate       Differentiation Strategies for Gifted and Talented Students   * Increase the level of complexity * Decrease scaffolding * Variety of finished products * Allow for greater independence * Learning stations, interest groups * Varied texts and supplementary materials * Use of technology * Flexibility in assignments * Varied questioning strategies * Encourage research * Strategy and flexible groups based on formative assessment or student choice * Acceleration within a unit of study * Exposure to more advanced or complex concepts, abstractions, and materials * Encourage students to move through content areas at their own pace * After mastery of a unit, provide students with more advanced learning activities, not more of the same activity * Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas       Differentiated Strategies for ELL Students   * Remove unnecessary materials, words, etc., that can distract from the content * Provide appropriate scaffolding * Limit the number of steps required for completion * Gradually increase the level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials, including visuals * Use technology, if available and appropriate * Differentiate homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language. * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Allow students to work at their own pace * Presenting ideas through auditory, visual, kinesthetic, & tactile means * Role play * Provide graphic organizers, highlighted materials * Strategy and flexible groups based on formative assessment       Differentiation Strategies for At Risk Students   * Remove unnecessary materials, words, etc., that can distract from the content * Provide appropriate scaffolding * Limit the number of steps required for completion * Gradually increase the level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials * Use technology, if available and appropriate * Differentiate homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Presenting ideas through auditory, visual, kinesthetic, & tactile means * Provide graphic organizers and/or highlighted materials * Strategy and flexible groups based on formative assessment       **504 Plans**  Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:   * walk, breathe, eat, or sleep * communicate, see, hear, or speak * read, concentrate, think, or learn * stand, bend, lift, or work       Examples of accommodations in 504 plans include:   * preferential seating * extended time on tests and assignments * reduced homework or classwork * verbal, visual, or technology aids * modified textbooks or audio-video materials * behavior management support * adjusted class schedules or grading * verbal testing * excused lateness, absence, or missed classwork * pre-approved nurse's office visits and accompaniment to visits * occupational or physical therapy |

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| **Modification Strategies** |
| |  |  | | --- | --- | | • Extended Time | **.** | | • Frequent Breaks | **.** | | • Highlighted Text | **.** | | • Interactive Notebook | **.** | | • Modified Test | **.** | | • Oral Directions | **.** | | • Peer Tutoring | **.** | | • Preferential Seating | **.** | | • Re-Direct | **.** | | • Repeated Drill / Practice | **.** | | • Shortened Assignments | **.** | | • Teacher Notes | **.** | | • Tutorials | **.** | | • Use of Additional Reference Material | **.** | | • Use of Audio Resources | **.** | |

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| **High Preparation Differentiation** |
| |  |  | | --- | --- | | • Alternative Assessments | **.** | | • Choice Boards | **.** | | • Games and Tournaments | **.** | | • Group Investigations | **.** | | • Guided Reading | **.** | | • Independent Research / Project | **.** | | • Interest Groups | **.** | | • Learning Contracts | **.** | | • Leveled Rubrics | **.** | | • Literature Circles | **.** | | • Menu Assignments | **.** | | • Multiple Intelligence Options | **.** | | • Multiple Texts | **.** | | • Personal Agendas | **.** | | • Project Based Learning (PBL) | **.** | | • Stations / Centers | **.** | | • Think-Tac-Toe | **.** | | • Tiered Activities / Assignments | **.** | | • Varying Graphic Organizers | **.** | |

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| **Low Preparation Differentiation** |
| |  |  | | --- | --- | | • Choice of Book / Activity | **.** | | • Cubing Activities | **.** | | • Exploration by Interest (using interest inventories) | **.** | | • Flexible Grouping | **.** | | • Goal Setting With Student | **.** | | • Homework Options | **.** | | • Jigsaw | **.** | | • Mini Workshops to Extend Skills | **.** | | • Mini Workshops to Re-teach | **.** | | • Open-ended Activities | **.** | | • Think-Pair-Share by Interest | **.** | | • Think-Pair-Share by Learning Style | **.** | | • Think-Pair-Share by Learning Style | **.** | | • Think-Pair-Share by Readiness | **.** | | • Use of Collaboration | **.** | | • Use of Reading Buddies | **.** | | • Varied Journal Prompts | **.** | | • Varied Product Choice | **.** | | • Varied Supplemental Materials | **.** | | • Work Alone / Together | **.** | |

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| **Vertical Integration- Discipline Mapping** |
| In Grade 8 students learned to solve linear equations in one variable. In Algebra 2, students will revisit these standards to extend their learning to functions beyond linear equations.  In Grade 8 students learned to solve linear equations in one variable. In Algebra 2, students extend their thinking with these standards to functions beyond linear equations and use the knowledge to apply to more complex equations. |

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| **Additional Materials** |
| LPS Adopted Textbooks and Programs   * Pearson EnVision Algebra I * Pearson Realize (Computer Based program supplementing Envision)   Khan Academy  Edmentum Exact Path  **Unit 2 - Linear and Exponential Reasoning**  Content Area: **Mathematics** Course(s): **Algebra I** Time Period: **First Marking Period** Length: **8 Week** Status: **Published**   |  | | --- | | **Unit Overview** | | Students will learn function notation and develop the concepts of domain and range. They move beyond viewing functions as processes that take inputs and yield outputs and start viewing functions as objects in their own right. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. They work with functions given by graphs and tables, keeping in mind that, depending upon the context, these representations are likely to be approximate and incomplete. Their work includes functions that can be described or approximated by formulas as well as those that cannot. When functions describe relationships between quantities arising from a context, students reason with the units in which those quantities are measured. Students explore systems of equations and inequalities, and they find and interpret their solutions. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions. |  |  | | --- | | **STAGE 1- DESIRED RESULTS** | |  |  |  | | --- | | **Educational Standards** | | The following goals, as outlined in the NJSLS, will provide a framework for preparation and instruction in mathematics. They make up the eight mathematical practice standards:  1. Make sense of problems and persevre 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. |  |  | | --- | | **New Jersey Student Learning Standards- Mathematics** | |  |  |  | | --- | | **Introduction- Algebra** | |  |  |  | | --- | | **Expressions** | | |  |  | | --- | --- | |  | An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances. | |  | Reading an expression with comprehension involves analysis of its underlying structure. This may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning. For example, p + 0.05p can be interpreted as the addition of a 5% tax to a price p. Rewriting p + 0.05p as 1.05p shows that adding a tax is the same as multiplying the price by a constant factor. | |  | Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example, p + 0.05p is the sum of the simpler expressions p and 0.05p. Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure. | |  | A spreadsheet or a computer algebra system (CAS) can be used to experiment with algebraic expressions, perform complicated algebraic manipulations, and understand how algebraic manipulations behave. | |  |  | | --- | | **Equalities and Inequalities** | | |  |  | | --- | --- | |  | An equation is a statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal. These values are the solutions to the equation. An identity, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form. | |  | The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system. | |  | An equation can often be solved by successively deducing from it one or more simpler equations. For example, one can add the same constant to both sides without changing the solutions, but squaring both sides might lead to extraneous solutions. Strategic competence in solving includes looking ahead for productive manipulations and anticipating the nature and number of solutions. | |  | Some equations have no solutions in a given number system, but have a solution in a larger system. For example, the solution of x + 1 = 0 is an integer, not a whole number; the solution of 2x + 1 = 0 is a rational number, not an integer; the solutions of x² – 2 = 0 are real numbers, not rational numbers; and the solutions of x² + 2 = 0 are complex numbers, not real numbers. | |  | The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid, 𝘈 = ((𝘣₁+𝘣₂)/2)𝘩, can be solved for 𝘩 using the same deductive process. | |  | Inequalities can be solved by reasoning about the properties of inequality. Many, but not all, of the properties of equality continue to hold for inequalities and can be useful in solving them. | |  |  | | --- | | **Connections to Functions and Modeling** | | |  |  | | --- | --- | |  | Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling. | |  |  | | --- | | **Seeing Structure in Expressions** | | |  |  | | --- | --- | | MA.A-SSE.A.2 | Use the structure of an expression to identify ways to rewrite it. For example, see 𝑥⁴ – 𝑦⁴ as (𝑥²)² – (𝑦²)², thus recognizing it as a difference of squares that can be factored as (𝑥² – 𝑦²)(𝑥² + 𝑦²). | | MA.A-SSE.B | Write expressions in equivalent forms to solve problems | | MA.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. | | MA.A-SSE.B.3a | Factor a quadratic expression to reveal the zeros of the function it defines. | | MA.A-SSE.B.3b | Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. | | MA.A-SSE.A | Interpret the structure of expressions | | MA.A-SSE.B.3c | Use the properties of exponents to transform expressions for exponential functions. | | MA.A-SSE.A.1 | Interpret expressions that represent a quantity in terms of its context. | | MA.A-SSE.A.1a | Interpret parts of an expression, such as terms, factors, and coefficients. | | MA.A-SSE.B.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. | | MA.A-SSE.A.1b | Interpret complicated expressions by viewing one or more of their parts as a single entity. | |  |  | | --- | | **Arithmetic with Polynomials and Rational Expressions** | | |  |  | | --- | --- | | MA.A-APR.C.4 | Prove polynomial identities and use them to describe numerical relationships. | | MA.A-APR.A | Perform arithmetic operations on polynomials | | MA.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. | | MA.A-APR.B | Understand the relationship between zeros and factors of polynomials | | MA.A-APR.B.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). | | MA.A-APR.B.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. | | MA.A-APR.C.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. | | MA.A-APR.D | Rewrite rational expressions | | MA.A-APR.D.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. | | MA.A-APR.D.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. | | MA.A-APR.C | Use polynomial identities to solve problems | |  |  | | --- | | **Creating Equations** | | |  |  | | --- | --- | | MA.A-CED.A | Create equations that describe numbers or relationships | | MA.A-CED.A.1 | Create equations and inequalities in one variable and use them to solve problems. | | MA.A-CED.A.2 | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. | | MA.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. | | MA.A-CED.A.4 | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. | |  |  | | --- | | **Reasoning with Equations and Inequalities** | | |  |  | | --- | --- | | MA.A-REI.B | Solve equations and inequalities in one variable | | MA.A-REI.B.3 | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. | | MA.A-REI.B.4 | Solve quadratic equations in one variable. | | MA.A-REI.C | Solve systems of equations | | MA.A-REI.C.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. | | MA.A-REI.C.6 | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. | | MA.A-REI.C.7 | Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. | | MA.A-REI.C.8 | Represent a system of linear equations as a single matrix equation in a vector variable. | | MA.A-REI.C.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). | | MA.A-REI.D | Represent and solve equations and inequalities graphically | | MA.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. | | MA.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). | | MA.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. | | MA.A-REI.A | Understand solving equations as a process of reasoning and explain the reasoning | | MA.A-REI.D.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. | | MA.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. | | MA.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 equation𝑓(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. | | MA.A-REI.A.2 | Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. | |  |  | | --- | | **Career Ready Practices** | | CRP2.   Apply appropriate academic and technical skills.    CRP4.   Communicate clearly and effectively and with reason.    CRP6.   Demonstrate creativity and innovation.    CRP8.   Utilize critical thinking to make sense of problems and persevere in solving them.    CRP11.   Use technology to enhance productivity.    CRP12.   Work productively in teams while using cultural global competence. |  |  | | --- | | **Essential Questions** | | How does the slope affect direct variation?  What does the slope-intercept form of an equation tell us?  Why should we know different forms of linear equations?  How do we write the equations of parallel and perpendicular lines?  How do we use real-world data to write the equation of a line?  How might one determine the most efficient method for solving a system of equations?  Why would using a matrix to solve a system of equations be useful? |  |  | | --- | | **Enduring Understanding** | | Mathematical rules can be used to describe quantitative relationships. |  |  | | --- | | **Students will know...** | | 1. Solve systems of equations  2. Represent and solve equations and inequalities graphically  3. Understand the concept of a function and use function notation  4. Interpret functions that arise in applications in terms of a context  5. Analyze functions using different representations |  |  | | --- | | **Students will be able to...** | | 1. Solve systems of linear equations in two variables graphically and algebraically.  *2. Include solutions that have been found by replacing one equation by the sum of that equation and a multiple of the other.*  3. Find approximate solutions of linear equations by making a table of values, using technology to graph and successive *approximations*  4. Graph equations, inequalities, and systems of inequalities in two variables and explain that the solution to an equation is all *points along the curve, the solution to a system of linear functions is the point of intersection, and the solution to a syst em of inequalities is the intersection of the corresponding half-planes.*  5. Explain and interpret the definition of functions including domain and range and how they are related; correctly use function *notation in a context and evaluate functions for inputs and their corresponding outputs.*  *6. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers*  7. Graph functions by hand (in simple cases) and with technology (in complex cases) to describe linear relationships between two *quantities and identify, describe, and compare domain and other key features in one or multiple representations*  8. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or *by verbal descriptions).* |  |  | | --- | | **STAGE 2- EVIDENCE OF LEARNING** | |  |  |  | | --- | | **Formative Assessment Suggestions** | | |  |  | | --- | --- | | • 3- Minute Pause | **.** | | • A-B-C Summaries | **.** | | • Analogy Prompt | **.** | | • Choral Response | **.** | | • Debriefing | **.** | | • Exit Card / Ticket | **.** | | • Hand Signals | **.** | | • Idea Spinner | **.** | | • Index Card Summaries | **.** | | • Inside-Outside Circle Discussion (Fishbowl) | **.** | | • Journal Entry | **.** | | • Misconception Check | **.** | | • Observation | **.** | | • One Minute Essay | **.** | | • One Word Summary | **.** | | • Portfolio Check | **.** | | • Questions & Answers | **.** | | • Quiz | **.** | | • Self-Assessment | **.** | | • Student Conference | **.** | | • Think-Pair-Share | **.** | | • Web or Concept Map | **.** | |  |  | | --- | | **Authentic Assessments Suggestions** | | Through the following authentic assessments, students will develop traits regarding thinking and reasoning, settings, mathematical tools and attitudes and dispositions:    1. Performance Assessments    2. Short Investigations    3. Open Ended Response Questions    4.  Portfolios    5.  Self-Assessments |  |  | | --- | | **Benchmark Assessments** | | Edmentum Exact Path (BOY, MOY, EOY) |  |  | | --- | | **STAGE 3- LEARNING PLAN** | |  |  |  | | --- | | **Instructional Map** | | Use Analogy in the Context of the Math  Exponential Growth. When a quantity grows with time by a  multiplicative factor greater than 1, it is said the quantity  grows exponentially. Hence, if an initial population of  bacteria, 𝑃�0, doubles each day, then after  𝑡 days, the new population is given by 𝑃(𝑡) = 𝑃 2𝑡 0  This expression can be generalized to include different growth rates, as in (𝑡) = 𝑃 𝑟𝑡 . The following example  illustrates the type of problem that students can face after they have worked with basic exponential functions like these.  Example. On June 1, a fast growing species of algae is accidentally introduced into a lake in a city park. It starts to grow and cover the surface of the lake in such a way that the area covered by the algae doubles every day. If it continues to grow unabated, the lake will be totally covered and the fish in the lake will suffocate. At the rate it is growing, this will happen on June 30.  a. When will the lake be covered halfway? b. Write an equation that represents the percentage of the surface area of the lake that is covered in algae as a function of time (in days) that passes since the algae was introduced into the lake.  Facilitate a discussion that would direct students to generate recursive formula for the sequence 𝑃�(𝑛), which gives the population at a given time period 𝑛 in terms of the population 𝑛-1 for the following example:  Populations of bacteria can double every 6 hours under ideal conditions, at least until the nutrients in its supporting culture are depleted. This means a population of 500 such bacteria would grow to 1000, etc.  Use of Exit Slips to assess student understanding.  http://daretodifferentiate.wikispaces.com/Pre- Assessment EPR) strategies for whole group instruction. Strategies to check for understanding: Individual White Boards, Fist of Five, Exit Slip, etc. |  |  | | --- | | **Modifications/Differentiation of Instruction** | | Differentiation Strategies for Special Education Students   * Remove unnecessary material, words, etc., that can distract from the content * Use of off-grade level materials * Provide appropriate scaffolding * Limit the number of steps required for completion * Time allowed * Level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials * Use technology, if available and appropriate * Varied homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language. * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and 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content areas at their own pace * After mastery of a unit, provide students with more advanced learning activities, not more of the same activity * Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas       Differentiated Strategies for ELL Students   * Remove unnecessary materials, words, etc., that can distract from the content * Provide appropriate scaffolding * Limit the number of steps required for completion * Gradually increase the level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials, including visuals * Use technology, if available and appropriate * Differentiate homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language. * Use audio and visual supports, if available 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strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Presenting ideas through auditory, visual, kinesthetic, & tactile means * Provide graphic organizers and/or highlighted materials * Strategy and flexible groups based on formative assessment       **504 Plans**  Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:   * walk, breathe, eat, or sleep * communicate, see, hear, or speak * read, concentrate, think, or learn * stand, bend, lift, or work     Examples of accommodations in 504 plans include:   * preferential seating * extended time on tests and assignments * reduced homework or classwork * verbal, visual, or technology aids * modified textbooks or audio-video materials * behavior management support * adjusted class schedules or grading * verbal testing * excused lateness, absence, or missed classwork * pre-approved nurse's office visits and accompaniment to visits * occupational or physical therapy |  |  | | --- | | **Modification Strategies** | | |  |  | | --- | --- | | • Extended Time | **.** | | • Frequent Breaks | **.** | | • Highlighted Text | **.** | | • Interactive Notebook | **.** | | • Modified Test | **.** | | • Oral Directions | **.** | | • Peer Tutoring | **.** | | • Preferential Seating | **.** | | • Re-Direct | **.** | | • Repeated Drill / Practice | **.** | | • Shortened Assignments | **.** | | • Teacher Notes | **.** | | • Tutorials | **.** | | • Use of Additional Reference Material | **.** | | • Use of Audio Resources | **.** | |  |  | | --- | | **High Preparation Differentiation** | | |  |  | | --- | --- | | • Alternative Assessments | **.** | | • Choice Boards | **.** | | • Games and Tournaments | **.** | | • Group Investigations | **.** | | • Guided Reading | **.** | | • Independent Research / Project | **.** | | • Interest Groups | **.** | | • Learning Contracts | **.** | | • Leveled Rubrics | **.** | | • Literature Circles | **.** | | • Menu Assignments | **.** | | • Multiple Intelligence Options | **.** | | • Multiple Texts | **.** | | • Personal Agendas | **.** | | • Project Based Learning (PBL) | **.** | | • Stations / Centers | **.** | | • Think-Tac-Toe | **.** | | • Tiered Activities / Assignments | **.** | | • Varying Graphic Organizers | **.** | |  |  | | --- | | **Low Preparation Differentiation** | | |  |  | | --- | --- | | • Choice of Book / Activity | **.** | | • Cubing Activities | **.** | | • Exploration by Interest (using interest inventories) | **.** | | • Flexible Grouping | **.** | | • Goal Setting With Student | **.** | | • Homework Options | **.** | | • Jigsaw | **.** | | • Mini Workshops to Extend Skills | **.** | | • Mini Workshops to Re-teach | **.** | | • Open-ended Activities | **.** | | • Think-Pair-Share by Interest | **.** | | • Think-Pair-Share by Learning Style | **.** | | • Think-Pair-Share by Learning Style | **.** | | • Think-Pair-Share by Readiness | **.** | | • Use of Collaboration | **.** | | • Use of Reading Buddies | **.** | | • Varied Journal Prompts | **.** | | • Varied Product Choice | **.** | | • Varied Supplemental Materials | **.** | | • Work Alone / Together | **.** | |  |  | | --- | | **Vertical Integration- Discipline Mapping** | | Previous Grades:  a) solve one‐ and two‐step linear equations;  b) solve practical problems in one variable  c) solve multistep linear equations in one variable (variable on one and two sides of equations);  d) ID properties of operations used to solve  Algebra 2:  a) abs value equation/inequ;  b) quad equation over complex;  c) equation containing rational algebraic expression;  d) equation containing radical exp |  |  | | --- | | **Additional Materials** | | LPS Adopted Textbooks and Programs   * Pearson EnVision Algebra I * Pearson Realize (Computer Based program supplementing Envision)   Khan Academy  Edmentum Exact Path |   **Unit 3 - Expressions and Equations**  Content Area: **Mathematics** Course(s): **Algebra I** Time Period: **Second Marking period**  Length: **8 Week** Status: **Published**   |  | | --- | | **Unit Overview** | | Unit 3 blends the conceptual understandings of quadratic expressions and equations with procedural fluency and problem solving. |  |  | | --- | | **STAGE 1- DESIRED RESULTS** | |  |  |  | | --- | | **Educational Standards** | | The following goals, as outlined in the NJSLS, will provide a framework for preparation and instruction in mathematics. They make up the eight mathematical practice standards:  1. Make sense of problems and persevre 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. |  |  | | --- | | **New Jersey Student Learning Standards- Mathematics** | |  |  |  | | --- | | **Introduction- Algebra** | |  |  |  | | --- | | **Expressions** | | |  |  | | --- | --- | |  | An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances. | |  | Reading an expression with comprehension involves analysis of its underlying structure. This may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning. For example, p + 0.05p can be interpreted as the addition of a 5% tax to a price p. Rewriting p + 0.05p as 1.05p shows that adding a tax is the same as multiplying the price by a constant factor. | |  | Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example, p + 0.05p is the sum of the simpler expressions p and 0.05p. Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure. | |  | A spreadsheet or a computer algebra system (CAS) can be used to experiment with algebraic expressions, perform complicated algebraic manipulations, and understand how algebraic manipulations behave. | |  |  | | --- | | **Equalities and Inequalities** | | |  |  | | --- | --- | |  | An equation is a statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal. These values are the solutions to the equation. An identity, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form. | |  | The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system. | |  | An equation can often be solved by successively deducing from it one or more simpler equations. For example, one can add the same constant to both sides without changing the solutions, but squaring both sides might lead to extraneous solutions. Strategic competence in solving includes looking ahead for productive manipulations and anticipating the nature and number of solutions. | |  | Some equations have no solutions in a given number system, but have a solution in a larger system. For example, the solution of x + 1 = 0 is an integer, not a whole number; the solution of 2x + 1 = 0 is a rational number, not an integer; the solutions of x² – 2 = 0 are real numbers, not rational numbers; and the solutions of x² + 2 = 0 are complex numbers, not real numbers. | |  | The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid, 𝘈 = ((𝘣₁+𝘣₂)/2)𝘩, can be solved for 𝘩 using the same deductive process. | |  | Inequalities can be solved by reasoning about the properties of inequality. Many, but not all, of the properties of equality continue to hold for inequalities and can be useful in solving them. | |  |  | | --- | | **Connections to Functions and Modeling** | | |  |  | | --- | --- | |  | Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling. | |  |  | | --- | | **Seeing Structure in Expressions** | | |  |  | | --- | --- | | MA.A-SSE.A.2 | Use the structure of an expression to identify ways to rewrite it. For example, see 𝑥⁴ – 𝑦⁴ as (𝑥²)² – (𝑦²)², thus recognizing it as a difference of squares that can be factored as (𝑥² – 𝑦²)(𝑥² + 𝑦²). | | MA.A-SSE.B | Write expressions in equivalent forms to solve problems | | MA.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. | | MA.A-SSE.B.3a | Factor a quadratic expression to reveal the zeros of the function it defines. | | MA.A-SSE.B.3b | Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. | | MA.A-SSE.A | Interpret the structure of expressions | | MA.A-SSE.B.3c | Use the properties of exponents to transform expressions for exponential functions. | | MA.A-SSE.A.1 | Interpret expressions that represent a quantity in terms of its context. | | MA.A-SSE.A.1a | Interpret parts of an expression, such as terms, factors, and coefficients. | | MA.A-SSE.B.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. | | MA.A-SSE.A.1b | Interpret complicated expressions by viewing one or more of their parts as a single entity. | |  |  | | --- | | **Arithmetic with Polynomials and Rational Expressions** | | |  |  | | --- | --- | | MA.A-APR.C.4 | Prove polynomial identities and use them to describe numerical relationships. | | MA.A-APR.A | Perform arithmetic operations on polynomials | | MA.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. | | MA.A-APR.B | Understand the relationship between zeros and factors of polynomials | | MA.A-APR.B.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). | | MA.A-APR.B.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. | | MA.A-APR.C.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. | | MA.A-APR.D | Rewrite rational expressions | | MA.A-APR.D.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. | | MA.A-APR.D.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. | | MA.A-APR.C | Use polynomial identities to solve problems | |  |  | | --- | | **Creating Equations** | | |  |  | | --- | --- | | MA.A-CED.A | Create equations that describe numbers or relationships | | MA.A-CED.A.1 | Create equations and inequalities in one variable and use them to solve problems. | | MA.A-CED.A.2 | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. | | MA.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. | | MA.A-CED.A.4 | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. | |  |  | | --- | | **Reasoning with Equations and Inequalities** | | |  |  | | --- | --- | | MA.A-REI.B | Solve equations and inequalities in one variable | | MA.A-REI.B.3 | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. | | MA.A-REI.B.4 | Solve quadratic equations in one variable. | | MA.A-REI.C | Solve systems of equations | | MA.A-REI.C.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. | | MA.A-REI.C.6 | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. | | MA.A-REI.C.7 | Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. | | MA.A-REI.C.8 | Represent a system of linear equations as a single matrix equation in a vector variable. | | MA.A-REI.C.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). | | MA.A-REI.D | Represent and solve equations and inequalities graphically | | MA.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. | | MA.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). | | MA.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. | | MA.A-REI.A | Understand solving equations as a process of reasoning and explain the reasoning | | MA.A-REI.D.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. | | MA.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. | | MA.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 equation𝑓(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. | | MA.A-REI.A.2 | Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. | |  |  | | --- | | **Career Ready Practices** | | CRP2.   Apply appropriate academic and technical skills.    CRP4.   Communicate clearly and effectively and with reason.    CRP6.   Demonstrate creativity and innovation.    CRP8.   Utilize critical thinking to make sense of problems and persevere in solving them.    CRP11.   Use technology to enhance productivity.    CRP12.   Work productively in teams while using cultural global competence. |  |  | | --- | | **Essential Questions** | | How do equations show a relationship between two quntities in real-life?  How can algebraic properties by used in problem solving?  How can solution to equation(s) or inequality(s) be represented in multiple ways?  What distinguishes equations from inequalities?  How do quadratic functions compare to linear functions? |  |  | | --- | | **Enduring Understanding** | | An expression can be manipulated to produce an equivalent yet different looking expression. Real numbers and their calculations can be represented in different manners. |  |  | | --- | | **Students will know...** | | 1. Interpret the structure of expressions  2. Write expressions in equivalent forms to solve problems  3. Perform arithmetic operations on polynomials  4. Create equations that describe numbers or relationships  5. Solve equations and inequalities in one variable  6. Solve systems of equations |  |  | | --- | | **Students will be able to...** | | 1. Interpret parts of expressions in terms of context including those that represent square and cube roots; use the structure of an expression to identify ways to rewrite it  2. Manipulate expressions using factoring, completing the square and properties of exponents to produce equivalent forms that highlight particular properties such as the zeros or the maximum or minimum value of the function  3. Perform addition, subtraction and multiplication with polynomials and relate it to arithmetic operations with integers.  4. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, simple rational and exponential functions and highlighting a quantity of interest in a formula*  5. Create linear and quadratic equations that represent a relationship between two or more variables. Graph equations on the *coordinate axes with labels and scale.*  *6. Derive the quadratic formula by completing the square and recognize when there are no real solutions*  *7. Solve quadratic equations in one variable using a variety of methods [including inspection (e.g. x2 = 81), factoring, completing the square, and the quadratic formula].*  8. 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.* |  |  | | --- | | **STAGE 2- EVIDENCE OF LEARNING** | |  |  |  | | --- | | **Formative Assessment Suggestions** | | |  |  | | --- | --- | | • 3- Minute Pause | **.** | | • A-B-C Summaries | **.** | | • Analogy Prompt | **.** | | • Choral Response | **.** | | • Debriefing | **.** | | • Exit Card / Ticket | **.** | | • Hand Signals | **.** | | • Idea Spinner | **.** | | • Index Card Summaries | **.** | | • Inside-Outside Circle Discussion (Fishbowl) | **.** | | • Journal Entry | **.** | | • Misconception Check | **.** | | • Observation | **.** | | • One Minute Essay | **.** | | • One Word Summary | **.** | | • Portfolio Check | **.** | | • Questions & Answers | **.** | | • Quiz | **.** | | • Self-Assessment | **.** | | • Student Conference | **.** | | • Think-Pair-Share | **.** | | • Web or Concept Map | **.** | |  |  | | --- | | **Authentic Assessments Suggestions** | | Through the following authentic assessments, students will develop traits regarding thinking and reasoning, settings, mathematical tools and attitudes and dispositions:    1. Performance Assessments    2. Short Investigations    3. Open Ended Response Questions    4.  Portfolios    5.  Self-Assessments |  |  | | --- | | **Benchmark Assessments** | | Edmentum Exact Path (BOY, MOY, EOY) |  |  | | --- | | **STAGE 3- LEARNING PLAN** | |  |  |  | | --- | | **Instructional Map** | |  |  |  | | --- | | **Modifications/Differentiation of Instruction** | | Differentiation Strategies for Special Education Students   * Remove unnecessary material, words, etc., that can distract from the content * Use of off-grade level materials * Provide appropriate scaffolding * Limit the number of steps required for completion * Time allowed * Level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials * Use technology, if available and appropriate * Varied homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language. * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Ability to work at their own pace * Present ideas using auditory, visual, kinesthetic, & tactile means * Provide graphic organizers and/or highlighted materials * Strategy and flexible groups based on formative assessment * Differentiated checklists and rubrics, if available and appropriate       Differentiation Strategies for Gifted and Talented Students   * Increase the level of complexity * Decrease scaffolding * Variety of finished products * Allow for greater independence * Learning stations, interest groups * Varied texts and supplementary materials * Use of technology * Flexibility in assignments * Varied questioning strategies * Encourage research * Strategy and flexible groups based on formative assessment or student choice * Acceleration within a unit of study * Exposure to more advanced or complex concepts, abstractions, and materials * Encourage students to move through content areas at their own pace * After mastery of a unit, provide students with more advanced learning activities, not more of the same activity * Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas       Differentiated Strategies for ELL Students   * Remove unnecessary materials, words, etc., that can distract from the content * Provide appropriate scaffolding * Limit the number of steps required for completion * Gradually increase the level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials, including visuals * Use technology, if available and appropriate * Differentiate homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language. * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Allow students to work at their own pace * Presenting ideas through auditory, visual, kinesthetic, & tactile means * Role play * Provide graphic organizers, highlighted materials * Strategy and flexible groups based on formative assessment       Differentiation Strategies for At Risk Students   * Remove unnecessary materials, words, etc., that can distract from the content * Provide appropriate scaffolding * Limit the number of steps required for completion * Gradually increase the level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials * Use technology, if available and appropriate * Differentiate homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Presenting ideas through auditory, visual, kinesthetic, & tactile means * Provide graphic organizers and/or highlighted materials * Strategy and flexible groups based on formative assessment       **504 Plans**  Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:   * walk, breathe, eat, or sleep * communicate, see, hear, or speak * read, concentrate, think, or learn * stand, bend, lift, or work       Examples of accommodations in 504 plans include:   * preferential seating * extended time on tests and assignments * reduced homework or classwork * verbal, visual, or technology aids * modified textbooks or audio-video materials * behavior management support * adjusted class schedules or grading * verbal testing * excused lateness, absence, or missed classwork * pre-approved nurse's office visits and accompaniment to visits * occupational or physical therapy |  |  | | --- | | **Modification Strategies** | | |  |  | | --- | --- | | • Extended Time | **.** | | • Frequent Breaks | **.** | | • Highlighted Text | **.** | | • Interactive Notebook | **.** | | • Modified Test | **.** | | • Oral Directions | **.** | | • Peer Tutoring | **.** | | • Preferential Seating | **.** | | • Re-Direct | **.** | | • Repeated Drill / Practice | **.** | | • Shortened Assignments | **.** | | • Teacher Notes | **.** | | • Tutorials | **.** | | • Use of Additional Reference Material | **.** | | • Use of Audio Resources | **.** | |  |  | | --- | | **High Preparation Differentiation** | | |  |  | | --- | --- | | • Alternative Assessments | **.** | | • Choice Boards | **.** | | • Games and Tournaments | **.** | | • Group Investigations | **.** | | • Guided Reading | **.** | | • Independent Research / Project | **.** | | • Interest Groups | **.** | | • Learning Contracts | **.** | | • Leveled Rubrics | **.** | | • Literature Circles | **.** | | • Menu Assignments | **.** | | • Multiple Intelligence Options | **.** | | • Multiple Texts | **.** | | • Personal Agendas | **.** | | • Project Based Learning (PBL) | **.** | | • Stations / Centers | **.** | | • Think-Tac-Toe | **.** | | • Tiered Activities / Assignments | **.** | | • Varying Graphic Organizers | **.** | |  |  | | --- | | **Low Preparation Differentiation** | | |  |  | | --- | --- | | • Choice of Book / Activity | **.** | | • Cubing Activities | **.** | | • Exploration by Interest (using interest inventories) | **.** | | • Flexible Grouping | **.** | | • Goal Setting With Student | **.** | | • Homework Options | **.** | | • Jigsaw | **.** | | • Mini Workshops to Extend Skills | **.** | | • Mini Workshops to Re-teach | **.** | | • Open-ended Activities | **.** | | • Think-Pair-Share by Interest | **.** | | • Think-Pair-Share by Learning Style | **.** | | • Think-Pair-Share by Learning Style | **.** | | • Think-Pair-Share by Readiness | **.** | | • Use of Collaboration | **.** | | • Use of Reading Buddies | **.** | | • Varied Journal Prompts | **.** | | • Varied Product Choice | **.** | | • Varied Supplemental Materials | **.** | | • Work Alone / Together | **.** | |  |  | | --- | | **Vertical Integration- Discipline Mapping** | | Previous Grades:  ID domain, range, indep/dep variable  Algebra 2:  investigate/analyze functions (alg/graph) a) domain/range;  b) zeros;  c) x‐ and y‐intercepts;  d) intervals inc/dec;  e) asymptotes;  f) end behavior; |  |  | | --- | | **Additional Materials** | | LPS Adopted Textbooks and Programs   * Pearson EnVision Algebra I * Pearson Realize (Computer Based program supplementing Envision)   Khan Academy  Edmentum Exact Path |   **Unit 4 - Quadratic Functions and Modeling**  Content Area: **Mathematics** Course(s): **Algebra I** Time Period: **Second Marking period** Length: **8 Week**  Status: **Published**   |  | | --- | | **Unit Overview** | | Unit 4 involves quadratic and exponential functions, extending the concepts of integer exponents to concepts of rational exponents. The understandings will be applied to other types of equations in future courses. |  |  | | --- | | **STAGE 1- DESIRED RESULTS** | |  |  |  | | --- | | **Educational Standards** | | The following goals, as outlined in the NJSLS, will provide a framework for preparation and instruction in mathematics. They make up the eight mathematical practice standards:  1. Make sense of problems and persevre 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. |  |  | | --- | | **New Jersey Student Learning Standards- Mathematics** | |  |  |  | | --- | | **Introduction- Algebra** | |  |  |  | | --- | | **Expressions** | | |  |  | | --- | --- | |  | An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances. | |  | Reading an expression with comprehension involves analysis of its underlying structure. This may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning. For example, p + 0.05p can be interpreted as the addition of a 5% tax to a price p. Rewriting p + 0.05p as 1.05p shows that adding a tax is the same as multiplying the price by a constant factor. | |  | Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example, p + 0.05p is the sum of the simpler expressions p and 0.05p. Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure. | |  | A spreadsheet or a computer algebra system (CAS) can be used to experiment with algebraic expressions, perform complicated algebraic manipulations, and understand how algebraic manipulations behave. | |  |  | | --- | | **Equalities and Inequalities** | | |  |  | | --- | --- | |  | An equation is a statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal. These values are the solutions to the equation. An identity, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form. | |  | The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system. | |  | An equation can often be solved by successively deducing from it one or more simpler equations. For example, one can add the same constant to both sides without changing the solutions, but squaring both sides might lead to extraneous solutions. Strategic competence in solving includes looking ahead for productive manipulations and anticipating the nature and number of solutions. | |  | Some equations have no solutions in a given number system, but have a solution in a larger system. For example, the solution of x + 1 = 0 is an integer, not a whole number; the solution of 2x + 1 = 0 is a rational number, not an integer; the solutions of x² – 2 = 0 are real numbers, not rational numbers; and the solutions of x² + 2 = 0 are complex numbers, not real numbers. | |  | The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid, 𝘈 = ((𝘣₁+𝘣₂)/2)𝘩, can be solved for 𝘩 using the same deductive process. | |  | Inequalities can be solved by reasoning about the properties of inequality. Many, but not all, of the properties of equality continue to hold for inequalities and can be useful in solving them. | |  |  | | --- | | **Connections to Functions and Modeling** | | |  |  | | --- | --- | |  | Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling. | |  |  | | --- | | **Seeing Structure in Expressions** | | |  |  | | --- | --- | | MA.A-SSE.A.2 | Use the structure of an expression to identify ways to rewrite it. For example, see 𝑥⁴ – 𝑦⁴ as (𝑥²)² – (𝑦²)², thus recognizing it as a difference of squares that can be factored as (𝑥² – 𝑦²)(𝑥² + 𝑦²). | | MA.A-SSE.B | Write expressions in equivalent forms to solve problems | | MA.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. | | MA.A-SSE.B.3a | Factor a quadratic expression to reveal the zeros of the function it defines. | | MA.A-SSE.B.3b | Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. | | MA.A-SSE.A | Interpret the structure of expressions | | MA.A-SSE.B.3c | Use the properties of exponents to transform expressions for exponential functions. | | MA.A-SSE.A.1 | Interpret expressions that represent a quantity in terms of its context. | | MA.A-SSE.A.1a | Interpret parts of an expression, such as terms, factors, and coefficients. | | MA.A-SSE.B.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. | | MA.A-SSE.A.1b | Interpret complicated expressions by viewing one or more of their parts as a single entity. | |  |  | | --- | | **Arithmetic with Polynomials and Rational Expressions** | | |  |  | | --- | --- | | MA.A-APR.C.4 | Prove polynomial identities and use them to describe numerical relationships. | | MA.A-APR.A | Perform arithmetic operations on polynomials | | MA.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. | | MA.A-APR.B | Understand the relationship between zeros and factors of polynomials | | MA.A-APR.B.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). | | MA.A-APR.B.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. | | MA.A-APR.C.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. | | MA.A-APR.D | Rewrite rational expressions | | MA.A-APR.D.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. | | MA.A-APR.D.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. | | MA.A-APR.C | Use polynomial identities to solve problems | |  |  | | --- | | **Creating Equations** | | |  |  | | --- | --- | | MA.A-CED.A | Create equations that describe numbers or relationships | | MA.A-CED.A.1 | Create equations and inequalities in one variable and use them to solve problems. | | MA.A-CED.A.2 | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. | | MA.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. | | MA.A-CED.A.4 | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. | |  |  | | --- | | **Reasoning with Equations and Inequalities** | | |  |  | | --- | --- | | MA.A-REI.B | Solve equations and inequalities in one variable | | MA.A-REI.B.3 | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. | | MA.A-REI.B.4 | Solve quadratic equations in one variable. | | MA.A-REI.C | Solve systems of equations | | MA.A-REI.C.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. | | MA.A-REI.C.6 | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. | | MA.A-REI.C.7 | Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. | | MA.A-REI.C.8 | Represent a system of linear equations as a single matrix equation in a vector variable. | | MA.A-REI.C.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). | | MA.A-REI.D | Represent and solve equations and inequalities graphically | | MA.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. | | MA.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). | | MA.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. | | MA.A-REI.A | Understand solving equations as a process of reasoning and explain the reasoning | | MA.A-REI.D.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. | | MA.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. | | MA.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 equation𝑓(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. | | MA.A-REI.A.2 | Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. | |  |  | | --- | | **Career Ready Practices** | | CRP2.   Apply appropriate academic and technical skills.    CRP4.   Communicate clearly and effectively and with reason.    CRP6.   Demonstrate creativity and innovation.    CRP8.   Utilize critical thinking to make sense of problems and persevere in solving them.    CRP11.   Use technology to enhance productivity.    CRP12.   Work productively in teams while using cultural global competence. |  |  | | --- | | **Essential Questions** | | How can we determine which way the parabola wil be facing before you graph it?  How can we find the vertex when the equation is given? A graph?  How does the quadratic equation transform on a coordinate plane?  How can we recognize solutions on a parabola?  What do solutions of quadratics represent?  How do quadratics compare to linear functions?  How can we apply quadratics to real life situations? |  |  | | --- | | **Enduring Understanding** | | Functions give us the power to organize, compare, and make sense of relationships around us. |  |  | | --- | | **Students will know...** | | 1. Extend the properties of exponents to rational exponents  2. Use properties of rational and irrational numbers  3. Interpret functions that arise in applications in terms of a context  4. Analyze functions using different representations  5. Build a function that models a relationship between two quantities  6. Build new functions from existing functions.  7. Construct and compare linear, quadratic and exponential models and solve problems  8. Interpret expressions for functions in terms of the situation they model |  |  | | --- | | **Students will be able to...** | | 1. Use properties of integer exponents to explain and convert between expressions involving radicals and rational exponents, using correct notation. *For example, we define 51/3 to be the cube root of 5 because we want (51/3)3 = 5(1/3)3 to hold, so (51/3)3 must equal 5*  2. Use the properties of rational and irrational numbers to explain why the sum or product of two rational numbers is rational, *the sum of a rational number and an irrational number is irrational, and the product of a nonzero rational number and an irrational number is irrational*  3. Sketch the graph of a function that models a relationship between two quantities (expressed symbolically or from a verbal *description) showing key features ( including intercepts, minimums/maximums, domain, and rate of change) by hand in simple cases and using technology in more complicated cases and relate the domain of the function to its graph.*  4. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum*  5. Calculate (over a specified period if presented symbolically or as a table) or estimate (if presented graphically) and interpret the average rate of change of a function  6. Write functions in different but equivalent forms by manipulating quadratic expressions using methods such as factoring and completing the square, or exponential expressions using the properties of exponents, to reveal and explain properties of the function  7. Write a function that describes a linear or quadratic relationship between two quantities given in context using an explicit expression, a recursive process, or steps for calculation (include contexts that require a combination of various function types). *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*  *8. Identify the effects of translations [ f(x) + k, k f(x), f(kx), and f(x + k)] on a function and find the value of k given the graphs.* |  |  | | --- | | **STAGE 2- EVIDENCE OF LEARNING** | |  |  |  | | --- | | **Formative Assessment Suggestions** | | |  |  | | --- | --- | | • 3- Minute Pause | **.** | | • A-B-C Summaries | **.** | | • Analogy Prompt | **.** | | • Choral Response | **.** | | • Debriefing | **.** | | • Exit Card / Ticket | **.** | | • Hand Signals | **.** | | • Idea Spinner | **.** | | • Index Card Summaries | **.** | | • Inside-Outside Circle Discussion (Fishbowl) | **.** | | • Journal Entry | **.** | | • Misconception Check | **.** | | • Observation | **.** | | • One Minute Essay | **.** | | • One Word Summary | **.** | | • Portfolio Check | **.** | | • Questions & Answers | **.** | | • Quiz | **.** | | • Self-Assessment | **.** | | • Student Conference | **.** | | • Think-Pair-Share | **.** | | • Web or Concept Map | **.** | |  |  | | --- | | **Authentic Assessments Suggestions** | | Through the following authentic assessments, students will develop traits regarding thinking and reasoning, settings, mathematical tools and attitudes and dispositions:    1. Performance Assessments  2. Short Investigations  3. Open Ended Response Questions  4.  Portfolios  5.  Self-Assessments |  |  | | --- | | **Benchmark Assessments** | | Edmentum Exact Path (BOY, MOY, EOY) |  |  | | --- | | **STAGE 3- LEARNING PLAN** | |  |  |  | | --- | | **Instructional Map** | |  |  |  | | --- | | **Modifications/Differentiation of Instruction** | | Differentiation Strategies for Special Education Students   * Remove unnecessary material, words, etc., that can distract from the content * Use of off-grade level materials * Provide appropriate scaffolding * Limit the number of steps required for completion * Time allowed * Level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials * Use technology, if available and appropriate * Varied homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language. * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Ability to work at their own pace * Present ideas using auditory, visual, kinesthetic, & tactile means * Provide graphic organizers and/or highlighted materials * Strategy and flexible groups based on formative assessment * Differentiated checklists and rubrics, if available and appropriate       Differentiation Strategies for Gifted and Talented Students   * Increase the level of complexity * Decrease scaffolding * Variety of finished products * Allow for greater independence * Learning stations, interest groups * Varied texts and supplementary materials * Use of technology * Flexibility in assignments * Varied questioning strategies * Encourage research * Strategy and flexible groups based on formative assessment or student choice * Acceleration within a unit of study * Exposure to more advanced or complex concepts, abstractions, and materials * Encourage students to move through content areas at their own pace * After mastery of a unit, provide students with more advanced learning activities, not more of the same activity * Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas       Differentiated Strategies for ELL Students   * Remove unnecessary materials, words, etc., that can distract from the content * Provide appropriate scaffolding * Limit the number of steps required for completion * Gradually increase the level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials, including visuals * Use technology, if available and appropriate * Differentiate homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language. * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Allow students to work at their own pace * Presenting ideas through auditory, visual, kinesthetic, & tactile means * Role play * Provide graphic organizers, highlighted materials * Strategy and flexible groups based on formative assessments   Differentiation Strategies for At Risk Students   * Remove unnecessary materials, words, etc., that can distract from the content * Provide appropriate scaffolding * Limit the number of steps required for completion * Gradually increase the level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials * Use technology, if available and appropriate * Differentiate homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Presenting ideas through auditory, visual, kinesthetic, & tactile means * Provide graphic organizers and/or highlighted materials * Strategy and flexible groups based on formative assessment     **504 Plans**  Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:   * walk, breathe, eat, or sleep * communicate, see, hear, or speak * read, concentrate, think, or learn * stand, bend, lift, or work     Examples of accommodations in 504 plans include:   * preferential seating * extended time on tests and assignments * reduced homework or classwork * verbal, visual, or technology aids * modified textbooks or audio-video materials * behavior management support * adjusted class schedules or grading * verbal testing * excused lateness, absence, or missed classwork * pre-approved nurse's office visits and accompaniment to visits * occupational or physical therapy |  |  | | --- | | **Modification Strategies** | | |  |  | | --- | --- | | • Extended Time | **.** | | • Frequent Breaks | **.** | | • Highlighted Text | **.** | | • Interactive Notebook | **.** | | • Modified Test | **.** | | • Oral Directions | **.** | | • Peer Tutoring | **.** | | • Preferential Seating | **.** | | • Re-Direct | **.** | | • Repeated Drill / Practice | **.** | | • Shortened Assignments | **.** | | • Teacher Notes | **.** | | • Tutorials | **.** | | • Use of Additional Reference Material | **.** | | • Use of Audio Resources | **.** | |  |  | | --- | | **High Preparation Differentiation** | | |  |  | | --- | --- | | • Alternative Assessments | **.** | | • Choice Boards | **.** | | • Games and Tournaments | **.** | | • Group Investigations | **.** | | • Guided Reading | **.** | | • Independent Research / Project | **.** | | • Interest Groups | **.** | | • Learning Contracts | **.** | | • Leveled Rubrics | **.** | | • Literature Circles | **.** | | • Menu Assignments | **.** | | • Multiple Intelligence Options | **.** | | • Multiple Texts | **.** | | • Personal Agendas | **.** | | • Project Based Learning (PBL) | **.** | | • Stations / Centers | **.** | | • Think-Tac-Toe | **.** | | • Tiered Activities / Assignments | **.** | | • Varying Graphic Organizers | **.** | |  |  | | --- | | **Low Preparation Differentiation** | | |  |  | | --- | --- | | • Choice of Book / Activity | **.** | | • Cubing Activities | **.** | | • Exploration by Interest (using interest inventories) | **.** | | • Flexible Grouping | **.** | | • Goal Setting With Student | **.** | | • Homework Options | **.** | | • Jigsaw | **.** | | • Mini Workshops to Extend Skills | **.** | | • Mini Workshops to Re-teach | **.** | | • Open-ended Activities | **.** | | • Think-Pair-Share by Interest | **.** | | • Think-Pair-Share by Learning Style | **.** | | • Think-Pair-Share by Learning Style | **.** | | • Think-Pair-Share by Readiness | **.** | | • Use of Collaboration | **.** | | • Use of Reading Buddies | **.** | | • Varied Journal Prompts | **.** | | • Varied Product Choice | **.** | | • Varied Supplemental Materials | **.** | | • Work Alone / Together | **.** | |  |  | | --- | | **Vertical Integration- Discipline Mapping** | | Previous Grades:  a) verify the Pythagorean Theorem;  b) apply the Pythagorean Theorem    Geometry:  The student will solve real‐world problems involving right triangles by using the Pythagorean Theorem and its converse, properties of special right triangles, and right triangle trigonometry. |  |  | | --- | |  | | **Additional Materials** | | LPS Adopted Textbooks and Programs   * Pearson EnVision Algebra I * Pearson Realize (Computer Based program supplementing Envision)   Khan Academy  Edmentum Exact Path  **Unit 5 - Descriptive Statistics**  Content Area: **Mathematics** Course(s): **Algebra I** Time Period: **Fourth Marking Period** Length: **8 Week** Status: **Published**   |  | | --- | | **Unit Overview** | | Unit 5 will builds on previous work with linear, quadratic and exponential equations and their graphical models |  |  | | --- | | **STAGE 1- DESIRED RESULTS** | |  |  |  | | --- | | **Educational Standards** | | The following goals, as outlined in the NJSLS, will provide a framework for preparation and instruction in mathematics. They make up the eight mathematical practice standards:  1. Make sense of problems and persevre 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. |  |  | | --- | | **New Jersey Student Learning Standards- Mathematics** | |  |  |  | | --- | | **Introduction- Algebra** | |  |  |  | | --- | | **Expressions** | | |  |  | | --- | --- | |  | An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances. | |  | Reading an expression with comprehension involves analysis of its underlying structure. This may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning. For example, p + 0.05p can be interpreted as the addition of a 5% tax to a price p. Rewriting p + 0.05p as 1.05p shows that adding a tax is the same as multiplying the price by a constant factor. | |  | Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example, p + 0.05p is the sum of the simpler expressions p and 0.05p. Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure. | |  | A spreadsheet or a computer algebra system (CAS) can be used to experiment with algebraic expressions, perform complicated algebraic manipulations, and understand how algebraic manipulations behave. | |  |  | | --- | | **Equalities and Inequalities** | | |  |  | | --- | --- | |  | An equation is a statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal. These values are the solutions to the equation. An identity, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form. | |  | The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system. | |  | An equation can often be solved by successively deducing from it one or more simpler equations. For example, one can add the same constant to both sides without changing the solutions, but squaring both sides might lead to extraneous solutions. Strategic competence in solving includes looking ahead for productive manipulations and anticipating the nature and number of solutions. | |  | Some equations have no solutions in a given number system, but have a solution in a larger system. For example, the solution of x + 1 = 0 is an integer, not a whole number; the solution of 2x + 1 = 0 is a rational number, not an integer; the solutions of x² – 2 = 0 are real numbers, not rational numbers; and the solutions of x² + 2 = 0 are complex numbers, not real numbers. | |  | The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid, 𝘈 = ((𝘣₁+𝘣₂)/2)𝘩, can be solved for 𝘩 using the same deductive process. | |  | Inequalities can be solved by reasoning about the properties of inequality. Many, but not all, of the properties of equality continue to hold for inequalities and can be useful in solving them. | |  |  | | --- | | **Connections to Functions and Modeling** | | |  |  | | --- | --- | |  | Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling. | |  |  | | --- | | **Seeing Structure in Expressions** | | |  |  | | --- | --- | | MA.A-SSE.A.2 | Use the structure of an expression to identify ways to rewrite it. For example, see 𝑥⁴ – 𝑦⁴ as (𝑥²)² – (𝑦²)², thus recognizing it as a difference of squares that can be factored as (𝑥² – 𝑦²)(𝑥² + 𝑦²). | | MA.A-SSE.B | Write expressions in equivalent forms to solve problems | | MA.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. | | MA.A-SSE.B.3a | Factor a quadratic expression to reveal the zeros of the function it defines. | | MA.A-SSE.B.3b | Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. | | MA.A-SSE.A | Interpret the structure of expressions | | MA.A-SSE.B.3c | Use the properties of exponents to transform expressions for exponential functions. | | MA.A-SSE.A.1 | Interpret expressions that represent a quantity in terms of its context. | | MA.A-SSE.A.1a | Interpret parts of an expression, such as terms, factors, and coefficients. | | MA.A-SSE.B.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. | | MA.A-SSE.A.1b | Interpret complicated expressions by viewing one or more of their parts as a single entity. | |  |  | | --- | | **Arithmetic with Polynomials and Rational Expressions** | | |  |  | | --- | --- | | MA.A-APR.C.4 | Prove polynomial identities and use them to describe numerical relationships. | | MA.A-APR.A | Perform arithmetic operations on polynomials | | MA.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. | | MA.A-APR.B | Understand the relationship between zeros and factors of polynomials | | MA.A-APR.B.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). | | MA.A-APR.B.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. | | MA.A-APR.C.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. | | MA.A-APR.D | Rewrite rational expressions | | MA.A-APR.D.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. | | MA.A-APR.D.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. | | MA.A-APR.C | Use polynomial identities to solve problems | |  |  | | --- | | **Creating Equations** | | |  |  | | --- | --- | | MA.A-CED.A | Create equations that describe numbers or relationships | | MA.A-CED.A.1 | Create equations and inequalities in one variable and use them to solve problems. | | MA.A-CED.A.2 | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. | | MA.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. | | MA.A-CED.A.4 | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. | |  |  | | --- | | **Reasoning with Equations and Inequalities** | | |  |  | | --- | --- | | MA.A-REI.B | Solve equations and inequalities in one variable | | MA.A-REI.B.3 | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. | | MA.A-REI.B.4 | Solve quadratic equations in one variable. | | MA.A-REI.C | Solve systems of equations | | MA.A-REI.C.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. | | MA.A-REI.C.6 | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. | | MA.A-REI.C.7 | Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. | | MA.A-REI.C.8 | Represent a system of linear equations as a single matrix equation in a vector variable. | | MA.A-REI.C.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). | | MA.A-REI.D | Represent and solve equations and inequalities graphically | | MA.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. | | MA.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). | | MA.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. | | MA.A-REI.A | Understand solving equations as a process of reasoning and explain the reasoning | | MA.A-REI.D.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. | | MA.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. | | MA.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 equation𝑓(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. | | MA.A-REI.A.2 | Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. | |  |  | | --- | | **Career Ready Practices** | | CRP2.   Apply appropriate academic and technical skills.    CRP4.   Communicate clearly and effectively and with reason.    CRP6.   Demonstrate creativity and innovation.    CRP8.   Utilize critical thinking to make sense of problems and persevere in solving them.    CRP11.   Use technology to enhance productivity.  CRP12.   Work productively in teams while using cultural global competence. |  |  | | --- | | **Essential Questions** | | In what different ways can data be represented on a real number line, and how can statistics appropriate to the shape of the data distribution serve to compare two or more data sets?  How do relative frequencies, two-way frequency tables,and residual analysis help us summarize and better understand categorical data?  What information can a slope and intercept of a linear model provide regarding the context of a situation? |  |  | | --- | | **Enduring Understanding** | | Statistical analysis and data models allow us to accurately interpret the information given to us by functions, equations and systems. |  |  | | --- | | **Students will know...** | | 1. Summarize, represent, and interpret data on a single count or measurement variable  2. Summarize, represent, and interpret data on two categorical and quantitative variables  3. Interpret linear models  4. Build a function that models a relationship between two quantities  5. Construct and compare linear, quadratic, and exponential models and solve problems |  |  | | --- | | **Students will be able to...** | | 1. Write linear and exponential functions (e.g. growth/decay and arithmetic and geometric sequences) from graphs, tables, or a description of the relationship, recursively and with an explicit formula, and describe how quantities increase linearly and exponentially over equal intervals.  2. Represent data on the real number line (i.e. dot plots, histograms, and box plots) and use statistics to compare and interpret differences in shape, center, and spread in the context of the data (account for effects of outliers).  3. Summarize and interpret categorical data for two categories in two-way frequency tables; recognize associations and trends in the data.  4. Represent and describe data for two variables on a scatter plot, fit a function to the data, analyze residuals (in order to informally assess fit), and use the function to solve problems.  *5. Uses a given function or choose a function suggested by the context. Emphasize linear and exponential models.*  *6. Interpret the slope, intercept and correlation coefficient (compute using technology) of a linear model.*  *7. Distinguish between correlation and causation in a data context.* |  |  | | --- | | **STAGE 2- EVIDENCE OF LEARNING** | |  |  |  | | --- | | **Formative Assessment Suggestions** | | |  |  | | --- | --- | | • 3- Minute Pause | **.** | | • A-B-C Summaries | **.** | | • Analogy Prompt | **.** | | • Choral Response | **.** | | • Debriefing | **.** | | • Exit Card / Ticket | **.** | | • Hand Signals | **.** | | • Idea Spinner | **.** | | • Index Card Summaries | **.** | | • Inside-Outside Circle Discussion (Fishbowl) | **.** | | • Journal Entry | **.** | | • Misconception Check | **.** | | • Observation | **.** | | • One Minute Essay | **.** | | • One Word Summary | **.** | | • Portfolio Check | **.** | | • Questions & Answers | **.** | | • Quiz | **.** | | • Self-Assessment | **.** | | • Student Conference | **.** | | • Think-Pair-Share | **.** | | • Web or Concept Map | **.** | |  |  | | --- | | **Authentic Assessments Suggestions** | | Through the following authentic assessments, students will develop traits regarding thinking and reasoning, settings, mathematical tools and attitudes and dispositions:    1. Performance Assessments    2. Short Investigations    3. Open Ended Response Questions    4.  Portfolios    5.  Self-Assessments |  |  | | --- | | **Benchmark Assessments** | | Edmentum Exact Path (BOY, MOY, EOY) |  |  | | --- | | **STAGE 3- LEARNING PLAN** | |  |  |  | | --- | | **Instructional Map** | |  |  |  | | --- | | **Modifications/Differentiation of Instruction** | | Differentiation Strategies for Special Education Students   * Remove unnecessary material, words, etc., that can distract from the content * Use of off-grade level materials * Provide appropriate scaffolding * Limit the number of steps required for completion * Time allowed * Level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials * Use technology, if available and appropriate * Varied homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language. * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Ability to work at their own pace * Present ideas using auditory, visual, kinesthetic, & tactile means * Provide graphic organizers and/or highlighted materials * Strategy and flexible groups based on formative assessment * Differentiated checklists and rubrics, if available and appropriate   Differentiation Strategies for Gifted and Talented Students   * Increase the level of complexity * Decrease scaffolding * Variety of finished products * Allow for greater independence * Learning stations, interest groups * Varied texts and supplementary materials * Use of technology * Flexibility in assignments * Varied questioning strategies * Encourage research * Strategy and flexible groups based on formative assessment or student choice * Acceleration within a unit of study * Exposure to more advanced or complex concepts, abstractions, and materials * Encourage students to move through content areas at their own pace * After mastery of a unit, provide students with more advanced learning activities, not more of the same activity * Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas     Differentiated Strategies for ELL Students   * Remove unnecessary materials, words, etc., that can distract from the content * Provide appropriate scaffolding * Limit the number of steps required for completion * Gradually increase the level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials, including visuals * Use technology, if available and appropriate * Differentiate homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language. * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Allow students to work at their own pace * Presenting ideas through auditory, visual, kinesthetic, & tactile means * Role play * Provide graphic organizers, highlighted materials * Strategy and flexible groups based on formative assessment     Differentiation Strategies for At Risk Students   * Remove unnecessary materials, words, etc., that can distract from the content * Provide appropriate scaffolding * Limit the number of steps required for completion * Gradually increase the level of independence required * Tiered centers, assignments, lessons, or products * Provide appropriate leveled reading materials * Deliver the content in “chunks” * Varied texts and supplementary materials * Use technology, if available and appropriate * Differentiate homework and products * Varied questioning strategies * Provide background knowledge * Define key vocabulary, multiple-meaning words, and figurative language * Use audio and visual supports, if available and appropriate * Provide multiple learning opportunities to reinforce key concepts and vocabulary * Meet with small groups to reteach idea/skill * Provide cross-content application of concepts * Presenting ideas through auditory, visual, kinesthetic, & tactile means * Provide graphic organizers and/or highlighted materials * Strategy and flexible groups based on formative assessment     **504 Plans**  Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:   * walk, breathe, eat, or sleep * communicate, see, hear, or speak * read, concentrate, think, or learn * stand, bend, lift, or work     Examples of accommodations in 504 plans include:   * preferential seating * extended time on tests and assignments * reduced homework or classwork * verbal, visual, or technology aids * modified textbooks or audio-video materials * behavior management support * adjusted class schedules or grading * verbal testing * excused lateness, absence, or missed classwork * pre-approved nurse's office visits and accompaniment to visits * occupational or physical therapy |  |  | | --- | | **Modification Strategies** | | |  |  | | --- | --- | | • Extended Time | **.** | | • Frequent Breaks | **.** | | • Highlighted Text | **.** | | • Interactive Notebook | **.** | | • Modified Test | **.** | | • Oral Directions | **.** | | • Peer Tutoring | **.** | | • Preferential Seating | **.** | | • Re-Direct | **.** | | • Repeated Drill / Practice | **.** | | • Shortened Assignments | **.** | | • Teacher Notes | **.** | | • Tutorials | **.** | | • Use of Additional Reference Material | **.** | | • Use of Audio Resources | **.** | |  |  | | --- | | **High Preparation Differentiation** | | |  |  | | --- | --- | | • Alternative Assessments | **.** | | • Choice Boards | **.** | | • Games and Tournaments | **.** | | • Group Investigations | **.** | | • Guided Reading | **.** | | • Independent Research / Project | **.** | | • Interest Groups | **.** | | • Learning Contracts | **.** | | • Leveled Rubrics | **.** | | • Literature Circles | **.** | | • Menu Assignments | **.** | | • Multiple Intelligence Options | **.** | | • Multiple Texts | **.** | | • Personal Agendas | **.** | | • Project Based Learning (PBL) | **.** | | • Stations / Centers | **.** | | • Think-Tac-Toe | **.** | | • Tiered Activities / Assignments | **.** | | • Varying Graphic Organizers | **.** | |  |  | | --- | | **Low Preparation Differentiation** | | |  |  | | --- | --- | | • Choice of Book / Activity | **.** | | • Cubing Activities | **.** | | • Exploration by Interest (using interest inventories) | **.** | | • Flexible Grouping | **.** | | • Goal Setting With Student | **.** | | • Homework Options | **.** | | • Jigsaw | **.** | | • Mini Workshops to Extend Skills | **.** | | • Mini Workshops to Re-teach | **.** | | • Open-ended Activities | **.** | | • Think-Pair-Share by Interest | **.** | | • Think-Pair-Share by Learning Style | **.** | | • Think-Pair-Share by Learning Style | **.** | | • Think-Pair-Share by Readiness | **.** | | • Use of Collaboration | **.** | | • Use of Reading Buddies | **.** | | • Varied Journal Prompts | **.** | | • Varied Product Choice | **.** | | • Varied Supplemental Materials | **.** | | • Work Alone / Together | **.** | |  |  | | --- | | **Vertical Integration- Discipline Mapping** | | In Grade 8 Students will be able to do...   * Investigate patterns of association in bivariate data.   In High School Math Students will be able to do...  Statistics and Probability  Interpreting Categorical and Quantitative Data   * Summarize, represent, and interpret data on a single count or measurement variable * Summarize, represent, and interpret data on two categorical and quantitative variables * Interpret linear models    Making Inferences and Justifying Conclusions   * Understand and evaluate random processes underlying statistical experiments * Make inferences and justify conclusions from sample surveys, experiments and observational studies   Conditional Probability and the Rules of Probability   * Understand independence and conditional probability and use them to interpret data * Use the rules of probability to compute probabilities of compound events in a uniform probability model   Using Probability to Make Decisions   * Calculate expected values and use them to solve problems * Use probability to evaluate outcomes of decisions |  |  |  |  | | --- | --- | --- | | |  | | --- | | **Additional Materials** | | LPS Adopted Textbooks and Programs   * Pearson EnVision Algebra I * Pearson Realize (Computer Based program supplementing Envision)   Khan Academy  Edmentum Exact Path | | |  | | |

**Interdisciplinary Connections/Standards**

With interdisciplinary instruction, the subject areas are woven together and explored through an overarching theme or concept. We use math to help us solve everyday problems in the kitchen, in the garden, and for many of us at our jobs.

Brain research has shown that information in our brains is organized in schematic structures. These structures are made up of interconnected bits of information and serve as a framework for the knowledge we acquire. When a learner’s knowledge is connected, it is much more likely that they will apply the prior knowledge to a wide variety of new situations. They will acquire new information in a way that is more accessible and will be better able to relate it to previously acquired knowledge.

Students learn about patterns in math, science, social studies, and even literature. Because of this, they are much more likely to “see” these patterns when they encounter new situations. Since patterns are not only studied in math they are able to make the connection and gain the understanding that patterns can be found in many areas of their lives. Interdisciplinary instruction allows students to understand the interconnectedness of the disciplines and makes learning more meaningful and relevant as fascinating connections are made across the subject areas.

**Science**

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

HS-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

**Language Arts**

RL.8.1. Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.

RL.9-10.1. Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.

RI.8.1. Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.

**Social Studies**

6.2.8.EconEM.3.a: Analyze the impact of expanding land and sea trade routes as well as a uniform system of exchange in the Mediterranean World and Asia.

6.2.12.GeoGE.1.a: Compare and contrast the economic policies of China and Japan, and determine the impact these policies had on growth, the desire for colonies, and the relative positions of China and Japan within the emerging global economy.

6.2.12.CivicsDP.3.b: Use data and evidence to compare and contrast the struggles for women’s suffrage and workers’ rights in Europe and North America and evaluate the degree to which each movement achieved its goals.