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**Mathematics Curriculum:**

**Grade Eight**

**Algebra 1**

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**Born On & Board Approved: July 25, 2017**

**Re-Adopted: August 23, 2022**

**The following maps outline the New Jersey Student Learning Standards Standards for Mathematics for Algebra 1. Below is a list of assessment tools that are recommended for tracking student progress in these areas. In addition, resources that can be used in conjunction with instruction of these standards are provided but not limited to the list below.**

**Assessment:**

Formative Assessment Class-Work Review

Open-Ended Problems Project-Based Assessment

Self-Assessment Teacher Observation

End of Year Assessment Group & Cooperative Work

Benchmark Assessment Math Software (ex. Study Island)

Homework Review

Summative Assessment

**Resources:** \_

Math Journals Center Games Tangrams

Bar Models Ten Frame Geometric Shapes

Math Word Wall Protractors Geo-Board

Connecting Cubes Mini White Boards Textbooks

Number Line Manipulatives Rulers

Grid Paper Math Songs/Poems Three Dimensional Shapes

Computer Software Calculators Wiki-Sticks

Interactive White Board Fraction Tiles Pattern Blocks

Compass Measurement Tools

**Websites:**

http://www.aplusmath.com [www.wolframalpha.com](http://www.wolframalpha.com) [www.interactmath.com](http://www.interactmath.com)

<http://www.studyisland.com> [www.kutasoftware.com](http://www.kutasoftware.com) www.number2.com

<http://www.funbrain.com> [www.illuminations.nctm.org](http://www.illuminations.nctm.org) www.khanacademy.org

<http://www.songsforteaching.com> www.ixl.com www.betterlesson.com

[www.purplemath.com](http://www.purplemath.com) [www.tenmarks.com](http://www.tenmarks.com) www.buzzmath.com

**References:** [**http://www.state.nj.us/education/aps/cccs/math/**](http://www.state.nj.us/education/aps/cccs/math/)

NJ Technology Standards**:** <http://www.state.nj.us/education/cccs/2014/tech/8.pdf>

NJ Career Ready Practices: http://www.state.nj.us/education/aps/cccs/career/

| **Standards for Mathematical Practice** |
| --- |
| **MP. 1 - Make Sense of problems and persevere in solving them.** |
| **MP. 2 - Reason Abstractly and Quantitatively** |
| **Mp. 3 - Construct Viable Arguments and Critique the Reasoning of Others** |
| **MP. 4 - Model with Mathematics** |
| **MP. 5 - Use Appropriate Tools Strategically** |
| **MP. 6 - Attend to Precision** |
| **MP. 7 - Look for and make use of Structure** |
| **MP. 8 - Look for and Express Regularity in Repeated Reasoning** |

| **Curriculum Details**  **Mathematics - Eighth Grade - Algebra** | |
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| **Core Materials** | Holt-McDougal, Numbers World |
| **Interdisciplinary Connections** | **ELA:**  NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.  NJSLA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content  NJSLSA.L1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.  SL.9-10.4. Present information, findings and supporting evidence clearly, concisely and logically. The content, organization, development and style are appropriate to task, purpose and audience.  NJSLSA.L6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at all college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.  **Social Studies**  6.3.8.EconET.1: Using quantitative data, evaluate the opportunity cost of a proposed economic action, and take a position and support it (e.g. healthcare, education, transportation).  6.3.8.EconET.2: Assess the impact of government incentives and disincentives on the economy (e.g. patents, protection of private property, taxes) |
| **Career Ready Practices:** | CRP2. Apply appropriate academic and technical skills.  CRP4. Communicate clearly and effectively and with reason.  CRP6. Demonstrate creativity and innovation.  CRP7. Employ valid and reliable research strategies.  CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.  CRP12. Work productively in teams while using cultural global competence. |
| **Career Readiness, Life LIteracies, and Key Skills** | 9.1.8.CDM.1: Compare and contrast the use of credit cards and debit cards for specific purchases and the advantages and disadvantages of using each.  9.1.8.CP.1: Compare the prices for the same goods and services.  9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.  9.1.8.PB.3: Explain how to create a budget that aligns with financial goals.  9.1.8.PB.7: Brainstorm techniques that will help decrease expenses including comparison shopping, negotiating, and day-to-day expense management.  9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.  9.2.8.CAP.14: Evaluate sources of income and alternative resources to accurately compare employment options.  9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect.  9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.  9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.  9.4.8.TL.3: Select appropriate tools to organize and present information digitally. |
| **Computer Science and Design Thinking** | 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose. 8.1.8.DA.2: Explain the difference between how a computer stores data as bits and how the data is displayed.  8.1.8.DA.3: Identify the appropriate tool to access data based on its file format.  8.1.8.DA.4: Transform data to remove errors and improve the accuracy of the data for analysis.  8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g. physical prototype, graphical/technical sketch).  8.1.8.AP.2: Create clearly named variables that represent different data types and perform operations on their values. |

**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Number and Quantity- The Real Number System** | | | | | | |
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| **Essential Question(s):**  How do students use notation of mathematics to demonstrate the connections between integer exponents and rational exponents?  What is the difference between a rational exponent and an integer exponent?  How is the root of a number expressed as an exponent?  What real-world application would involve using rational exponents? | | | | | | |
| **Standards: N.RN**  A. Extend the properties of exponents to rational exponents. | | | | | | |
| **Standards for Mathematical Practice:**  MP 3, MP 6 | | | | | | |
| **Vocabulary:** rational numbers, root, power, exponent, radicals, based, radicand | | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | | |
| 1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define 51/3to be cube root of 5 because we want (51/3)3=(51/3) to hold, so (51/3) must equal 5.*  **(MP3, MP6)** | * Review properties of exponents to describe rational exponents. * Demonstrate equivalency between radicals and rational exponents. * Evaluate and simplify expressions containing exponents. | | Students may explain orally or in written format.  xa(xb)=x(a+b)  yn=y(y)(y)(y)…(y)  Explain why x3(x2)=x6  Explain why x3(x-2)=x -6  The aquarium has the shape of a cube. Each edge is 2.5 feet long.   1. Find the volume in cubic feet. 2. How many gallons of water will the aquarium hold?   Convert to liquid volume where one cubic foot holds 7.48 gallons.  a. v=s3  b. v= 15.625 ft3  =2.53 = 15.625 (7.48) gal  =15.625 ft3  = 116/875 gal | | | |
| 2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.  **(MP3, MP6)** | * Demonstrate equivalency between rational exponents and radicals. | | Screen Shot 2016-01-13 at 9 | | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
|  | | * Video clips * Choose excerpt(s) from book to focus on vocabulary development, comprehension * Translate vocabulary into native language * Read aloud * Word Wall * Build background knowledge * Picture Associations * Partner Work * For more, see <http://www.state.nj.us/education/modelcurriculum/ela/ellscaffolding/3u1.pdf> | | * Extended time * Modified assignments * Small group, alternate location * Modeling * Read aloud problems * Calculator * Build background knowledge * Oral/visual reminders * Peer assistance * Picture associations with vocabulary * Refer to each student’s IEP for more specific modifications | * RTI strategies including: teacher modeling, gradual release, think-Pair-Share, Think Aloud, Interactive notes * Tier II and Tier III intervention * More frequent STAR assessments * Morning tutoring * After school program * Parental contact |

**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Number and Quantity- The Real Number System** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  How do students use the property of closure to determine why sums or products would be rational or irrational? | | | | | | |
| **Standards: N.RN**  B. Use properties of rational and irrational numbers. | | | | | | |
| **Standards for Mathematical Practice:**  MP 3, MP 6 | | | | | | |
| **Vocabulary:** Nonzero, sum, product, rational, irrational, quotient, difference | | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | | |
| 3. Explain why the sum or product of two rational numbers is rational; that 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.  **(MP3, MP6)** | * Define rational and irrational numbers. * Provide examples using the closure property and expanding to irrational numbers. | | Every difference is a sum and every quotient is a product.  Given that π is irrational explain why the number 2π must also be irrational  2(π)= 6.28 …which is irrational. | | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
| * Adjusting the pace of lessons. * Curriculum compacting * Inquiry-based instruction * Independent study * Higher order thinking skills * Interest-based content * Student driven lessons * Real-word problems and scenarios | | * Video clips * Choose excerpt(s) from book to focus on vocabulary development, comprehension * Translate vocabulary into native language * Read aloud * Word Wall * Build background knowledge * Picture Associations * Partner Work * For more, see <http://www.state.nj.us/education/modelcurriculum/ela/ellscaffolding/3u1.pdf> | | * Extended time * Modified assignments * Small group, alternate location * Modeling * Read aloud problems * Calculator * Build background knowledge * Oral/visual reminders * Peer assistance * Picture associations with vocabulary * Refer to each student’s IEP for more specific modifications | * RTI strategies including: teacher modeling, gradual release, think-Pair-Share, Think Aloud, Interactive notes * Tier II and Tier III intervention * More frequent STAR assessments * Morning tutoring * After school program * Parental contact |

**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Number and Quantities- Qualities** | | | | | |
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| **Essential Question(s):**  Why does one need to have units a problem?  In what ways can the choice of unites, quantities, and levels accuracy impact a solution?  How are units and conversions play a role in correctness and accuracy of solutions? | | | | | |
| **Standards: N.Q.**  A. Reason quantitatively and use units to solve problems. | | | | | |
| **Standards for Mathematical Practice:**  MP1, MP2, MP4, MP5 | | | | | |
| **Vocabulary:** margin of error, conversion, reasonable, precision, accuracy | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | |
| 1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.  **MP1, MP2, MP4, MP5** | * Review basic conversions. * Use manipulatives (yard stick, 12 in ruler, clocks) to visually show the conversion. * Being with common error accuracy and detail. * Model conversions and present application | | * An object is moving 12 feet per second and another object is move at 5 miles per hour. Compare the speeds in units.   24000 sec (1min/60 sec) (1hr/60min) (1 day/24hr) which is more than 8 miles per hour.   * Demonstrate graphical representations and data displays such as: lime graphs, circle graphs, histograms, multi-line graphs, scatterplots, and multi-bar graphs. | | |
| 2. Define appropriate quantities for the purpose of descriptive modeling.  **MP1, MP2, MP4, MP5** | * Allow students to examine appropriate models for number of situations. In small groups, students should create their own example displaying reasonable quantity. * Have students work with actual data and chose the most appropriate model. | | Examples:   * What type of measurements could be used to determine income and expense for one month? * Given data about auto accidents in New Jersey, students select an appropriate model to explain data. | | |
| 3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.  **MP1, MP2, MP4, MP5** | * Given everyday situations student will select the appropriate measurement tools. | | * Provide recipes. * How would you adjust the amount of each ingredient to produce various quantities?   Example: The original recipe serves 8. List the quantity of each ingredient to serve 2, then to serve 12. | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
| * Adjusting the pace of lessons. * Curriculum compacting * Inquiry-based instruction * Independent study * Higher order thinking skills * Interest-based content * Student driven lessons * Real-word problems and scenarios | | * Video clips * Choose excerpt(s) from book to focus on vocabulary development, comprehension * Translate vocabulary into native language * Read aloud * Word Wall * Build background knowledge * Picture Associations * Partner Work * For more, see <http://www.state.nj.us/education/modelcurriculum/ela/ellscaffolding/3u1.pdf> | | * Extended time * Modified assignments * Small group, alternate location * Modeling * Read aloud problems * Calculator * Build background knowledge * Oral/visual reminders * Peer assistance * Picture associations with vocabulary * Refer to each student’s IEP for more specific modifications | * RTI strategies including: teacher modeling, gradual release, think-Pair-Share, Think Aloud, Interactive notes * Tier II and Tier III intervention * More frequent STAR assessments * Morning tutoring * After school program * Parental contact |

**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Seeing Structure in Expressions** | | | | | | |
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| **Essential Question(s):**  How does one tell the difference between a term, a factor, and a coefficient in an expression?  Why does one-use variables in formulas? | | | | | | |
| **Standards: A.SSE**  A. Interpret the structure of equations | | | | | | |
| **Standards for Mathematical Practice:** MP1, MP2, MP4, MP7 | | | | | | |
| **Vocabulary:** coefficient, variable, constant, factors, polynomials, trinomials, binomials, terms, expression, multiples, greatest common factor, quadratic expression, linear terms. | | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | | |
| [1.A](http://www.corestandards.org/Math/Content/HSA/SSE/A/1/a/). Interpret parts of an expression, such as terms, factors, and coefficients.  B. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P(1+r)n as the product of P and a factor not depending on P*.  **MP 1, MP2, MP4** | * Identify the parts of a given expression with increasing complexity. * Extend basic properties of arithmetic expressions to algebraic expressions. | | Students should be able to identify the parts of an expression.  Example:  3x+5x. Identify coefficient of each term  3(x-2)+ 5(x-2) Identify each term.  3f(x)+ 5f(x) Simplify and identify each factor.  x(x-2)+ 5(x-2) Simplify and identify each term of the quadratic expression. | | | |
| 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)  **MP2, MP7** | * Find the GCF of expressions of increasing complexity, including exponents. * Factor quadratic expressions. * Introduce types of factoring. | | Students should be extracting the greatest common factor (whether a constant, a variable, or a combination of each). If the remaining expression is quadratic, students should factor the expression further.  Example:  Factor 4x+16y+32= 4(x+4y+8)  Factor x3-2x2-35x= x(x2-x-35)  = x(x-7)(x+5) | | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
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**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Algebra- Seeing Structure in Expressions.** | | | | | | |
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| **Essential Question(s):**  How does the order of operations apply to varying degrees of expressions and equations?  Why would one need to use equivalent form of an expression?  What information can be given when one finds the zero of a function?  What are the advantages of knowing the properties of exponents? | | | | | | |
| **Standards: A-SSE**  B. Write expressions in equivalent forms to solve problems. | | | | | | |
| **Standards for Mathematical Practice:** MP1, MP2, MP4, MP7 | | | | | | |
| **Vocabulary:** maximum, minimum. Factoring, function, exponents | | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | | |
| 3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.  a. Factoring quadratic expressions to reveal the zeros of the function it defines.  b. Complete the square in a quadratic to expression to reveal the maximum or minimum value of the function is defines.  c. Use properties of exponents to transform expressions for exponential functions. *For example the expression 1.15tcan be written as (1.151/12)12t=1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*  **MP1, MP2, MP4, MP7** | * Review factoring techniques. * Solve quadratic expressions by factoring * Explain standard rom of quadratic formula * Model completing the square * Simplify expressions using the properties of exponents | | Screen Shot 2016-01-13 at 10 | | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
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**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Algebra- Arithmetic with Polynomials and Rational Expressions** | | | | | | |
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| **Essential Question(s):**  How can we perform operations with polynomials to solve problems?  What does it mean for a polynomial to be closed under an operation?  Why does one need to know that polynomials are closed under operations of addition, subtraction, and multiplication? | | | | | | |
| **Standards: A.APR**  A. Write expressions in equivalent forms to solve problems | | | | | | |
| **Standards for Mathematical Practice:** MP2, MP7 | | | | | | |
| **Vocabulary:** Polynomials, binomial, trinomial, monomial, degree of a polynomial, leading coefficient, constant, linear, quadratic, cubic. | | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | | |
| 1. Understand that polynomials form a system form a system analogous to the integers, namely, they are closed under the operation of addition, subtraction, and multiplication; add, subtract, and multiply polynomials  **MP2, MP7** | * Demonstrate ways to write equivalent forms of expressions * Add * Subtract * Multiply | | Screen Shot 2016-01-13 at 10 | | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
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**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Creating Equations** | | | | | | |
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| **Essential Question(s):**  In real-world context, why would want to use an inequality instead of an equation?  What is a situation that would require one to use an equation or inequality with one variable?  What are situations that would require one to use an equation or inequality with two or more variables?  How does one determine if a solution is a viable or nonviable option? | | | | | | |
| **Standards: A.CED**  Create equations that describe numbers or relationships. | | | | | | |
| **Standards for Mathematical Practice:** MP1, MP2, MP4, MP5, MP6, MP7 | | | | | | |
| **Vocabulary:** matrices coordinate plane, equation, inequality greater than, more than, at least, system of equations | | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | | |
| 1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions*.  **MP2, MP4, MP7** | * Provide models of linear and quadratic function. Use simple, rational and exponential functions in word problems. * Provide models of inequalities. | | Screen Shot 2016-01-13 at 10 | | | |
| 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.  **MP2, MP4, MP7** | * Review techniques for solving systems of equations. * Substitution * Multiplication * Addition/subtraction * Graphing * Matrices * Review graphing | | Students will solve a system of equations using substitution, multiplication, and addition/subtraction or graphing method. This can be extended to include matrices.  X+9y=42  6x-y=16 | | | |
| 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*.  **MP1, MP2, MP4, MP5, MP6** | * Solve equations/inequalities * Test reasonableness of solutions. | | Example:  A club is selling hats and jackets as a fundraiser. Their budget is $1500 and they want to order at least 250 items. They must buy at least as many hats as they buy jackets. Each hat costs $5 and each jacket costs $8.   * Write a system of inequalities to represent the situation. * Graph the inequalities. * If the club buys 150 hates and 100 jackets, will the conditions be satisfied? * What is the maximum number of jackets they can buy and still meet the conditions? | | | |
| 4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R*.  **MP2, MP6, MP7** | * Isolate the selected variable to solve an equation. | | Screen Shot 2016-01-13 at 10 | | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
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**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Reasoning with Equations and Inequalities** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  What strategies are most efficient in solving equations and inequalities?  What does a solution to an equation represent?  How does one justify the steps of solving an equation? | | | | | | |
| **Standards: N.REI**  A. Understand solving equations as a process of reasoning and explain the reasoning. | | | | | | |
| **Standards for Mathematical Practice:** MP2, MP6, MP7 | | | | | | |
| **Vocabulary:** equality, inequality, solution, variable, unknown | | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | | |
| 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.  **MP2, MP6, MP7** | * Review properties of equality and explain how they are used to solve simple equations. * Review order of operations and extend to solving multi-step equations. | | Properties of operations can be used to simplify expression on either side of the equation. Adding the same term to both sides of an equation or multiplying both sides by a non-zero constant produces an equivalent equation.  Example:   * Explain why the equation x/2+7/3=5 has the same solution as 3x+14=30. Does this mean that x/2+7/3 is equal to 3x+14? * Show that x=2 and x=-3 are solutions to the equation x2+x=6 | | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
| * Adjusting the pace of lessons. * Curriculum compacting * Inquiry-based instruction * Independent study * Higher order thinking skills * Interest-based content * Student driven lessons * Real-word problems and scenarios | | * Video clips * Choose excerpt(s) from book to focus on vocabulary development, comprehension * Translate vocabulary into native language * Read aloud * Word Wall * Build background knowledge * Picture Associations * Partner Work * For more, see <http://www.state.nj.us/education/modelcurriculum/ela/ellscaffolding/3u1.pdf> | | * Extended time * Modified assignments * Small group, alternate location * Modeling * Read aloud problems * Calculator * Build background knowledge * Oral/visual reminders * Peer assistance * Picture associations with vocabulary * Refer to each student’s IEP for more specific modifications | * RTI strategies including: teacher modeling, gradual release, think-Pair-Share, Think Aloud, Interactive notes * Tier II and Tier III intervention * More frequent STAR assessments * Morning tutoring * After school program * Parental contact |

**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Algebra- Reasoning with Equations and Inequalities** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  How can we determine which method is best to solve a problem?  How are solving inequalities the same as solving equations?  What does it mean to solve a literal equation? | | | | | |
| **Standards: A.REI**  B. Solve equations and inequalities in one variable. | | | | | |
| **Standards for Mathematical Practice:** MP1**,** MP2,MP3, MP5 MP6, MP7 | | | | | |
| **Vocabulary:** equality, inequality, literal, quadratic, number lines, real number, complex numbers, discriminate, root | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | |
| 3. Solve Linear equations and inequalities in one variable, including coefficients represented by letters.  **MP2, MP6, MP7** | * Compare linear equations to linear inequalities and their graphic representations. * Compare 3x+7=12 to ax+7=12 | | Screen Shot 2016-01-13 at 11 | | |
| 4. Solve quadratic equations in one variable.  a. Use the method of completing the square to transform any quadratic equation in x into an equation of form (x-p)2=q that has the same solutions. Derive the quadratic formula from this form.  b. Solve quadratic equations by inspection (e.g.. for x2=49), taking the square root, 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  **MP1, MP3, MP5, MP7** | * Discuss the difference between an expression and an equation. * Explain and define the zero product property * Use factoring techniques to solve quadratic equations. * Use completing the square to solve quadratic equations. * Derive the quadratic formula ax2+bx+c=0 * Determine the zeros of he function * Compare and contrast the usefulness of each method solving quadratic equations. | | Student should solve by factoring, completing the square, and by using the quadratic formula. The zero product property is used to explain why the factors are set to equal zero. Student should relate the value of the discriminate to the type of root to expect. A natural extension would be to relate the type of solution to the standard form of the quadratic equation to the behavior of the function y.   | Value of Discriminate | Nature of Roots | Nature of Graph | | --- | --- | --- | | b2-4ac = 0 | 1 real roots | Intersects x-axis once | | b2-4ac > 0 | 2 real roots | Intersects y-axis twice | | b2-4ac < 0 | 2 complex roots | Does not intersect x axis |  * Are the roots of 2x2+5=2x real or complex? How many roots does it have? Find all the solutions of the equation.   What are the roots of x2+6x+10=0? Solve the equation using the quadratic formula and completing the square. How are the two methods relate? | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
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**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Algebra- Reasoning with Equations and Inequalities** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  How can we apply mathematics to solve real world problem involving two entities?  Why does it makes sense that equations that have no solution would describe parallel lines? | | | | | | |
| **Standards: A.REI**  C. Solve systems of equations. | | | | | | |
| **Standards for Mathematical Practice:** MP1, MP2, MP3, MP4 | | | | | | |
| **Vocabulary:** systems of equations, substitution methods, elimination method, graphic method, intersecting lines, parallel lines, coinciding lines | | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | | |
| 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 solution.  **MP1, MP2, MP3, MP4** | * Review solving equations for a specified value and simplifying expressions * Review elimination method of solving systems of linear equations | | Stress the property of equality extends to adding equivalent expression to each side of an equation.  Example:  Given the sum of two numbers is 10 and their difference is 4, what are the numbers? Explain how your answer can be deducted from the fact that two numbers, x and y, satisfy the equations x+y=10 and x-y=4. | | | |
| 6. Solve systems of linear equations exactly and approximately (e.g. with graphs) focusing on pairs of linear equations in two variables.  **MP1, MP2, MP3, MP4** | * Review graphing equations. * Convert the solution of the system to its graphical representation. * Use substitution property of equality to solve systems of equations * Compare and contrast carious methods of solving systems of linear equations. | | The system solution can include but are not limited to graphical, elimination/linear combination, substitution, and modeling. Systems can be written algebraically or can be represented in context. Students may use graphing calculators, programs, and applets to model and find approximate solutions for systems of equations.  Examples:   * Jose has 4 times as many trading cards as Philip. After Jose gave away 50 cards to his litter brother and Philip gave 5 cards to his friend for his birthday, they each had an equal amount of cards. Write a system to describe the situation and solve the system.   Screen Shot 2016-01-13 at 11   * Solve the system of equations: x+y=11 and 3x-y=5. Use a second method to check your answer. * The opera theater contains 1,200 seats with three different prices. The seats cast $45 per seat, $50 per seat, and $60 per seat; the opera needs to gross $63,750 on seat sales. There are twice as many $60 seats as $45 seats. How many seats in each level need to be sold? | | | |
| 7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y=-3x and the circle x2+y2=3  **MP1, MP2, MP3, MP4** | * Review graphing linear and quadratic equations * Discuss the meaning of their points of intersection * Discuss algebraic method for solving linear-quadratic system. | | Example:  Find the points of intersection between the line y=-3x and the circle x2+y2=3 | | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
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**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Algebra- Reasoning with Equations and Inequalities** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  How can we use mathematics to visually represent the solution to problems?  Why does one need to set two equations equal to each other?  What is a real-world example where one needs to solve a system of linear inequalities? | | | | | |
| **Standards: A.REI**  C. Represent and solve equations and inequalities graphically. | | | | | |
| **Standards for Mathematical Practice:** mp1, mp2, mp4, mp3, mp5, mp6, mp7 | | | | | |
| **Vocabulary:** solutions, non-solutions, relations, functions, functional notation, half-plane, boundary | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | |
| 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)  **MP2. MP4, MP7** | * Use an equation to construct a table of values, graph the points, compare and discuss solutions, and non-solutions. | | Which of the following points is on the circle with equation  (x-1)2+(y+2)2=5?  a. (1,-2) b, (2,2) c. (3,-1) d. (3,4) | | |
| 11. Explain why the x-coordinate of the points where the graphs of the equations y=F(x) and y=g(x) intersect are the solutions of the equations f(x)=g(x); find the solution approximately, e.g., using technology to graph functions, make tables of values, or find successive approximations. Include case where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.  **mp1, mp3, mp5** | * Use technology to graph functions and examine tables. * Review functional notation * Relate the algebraic solution to the graph of the function. | | Students can use graphing calculators or programs to generate tables of values, graph, or solve a variety of functions. Students need to understand that numerical solution methods (data in a table used to approximate an algebraic function) and graphical solution methods may produce approximate solutions, and algebraic solution methods produce precise solutions that cab be represented graphically or numerically.  Example:   * Given the following equations determine the x value that results in an equal output for both functions.   F(x)= 3x-2  G(x)= (x+3)2-1 | | |
| 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.  **MP1, MP2, MP4, MP5, MP6** | * Compare the graphs of the solution of the following”   Y= 3x+3  Y ≤ 2x+3  Y <2x+3   * Graph systems of linear equalities and describe the meaning of the solution set. * What does it mean to be an element of the solution set? * What does it mean to not be an element of the solution set? * Use technology to help determine solutions | | Students may use graphing calculators, programs, or applets to model and find the solutions for inequalities or system of inequalities.  Examples:   * Graph the solutions: y=2x+3, y≤ 3x+3, y<2x+3 * A publishing company publishes a total of no more than 100 magazines every year. At least 30 of these are women’s magazines, but the company always publishes at least as many women’s magazines as men’s magazines find a system of inequalities that describes the possible number of men’s and women’s magazines that the company can produce each year consistent with these policies. Graph the solution set. * Graph the system of linear inequalities below and determine if (3,2) is a solution to the system.   Screen Shot 2016-01-13 at 1  (3,2) is not an element of the solution set (graphically or by substitution. | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
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**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Functions- Interpreting Functions** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  How do functions give us insight into the nature of relationships?  What is a function?  What are the characteristics of a function?  Why is a sequence an example of a function?  What is the purpose of function notation? | | | | | | |
| **Standards: F.IF**  A. Understand the concept of a function and use function notation. | | | | | | |
| **Standards for Mathematical Practice:**  MP2, MP5, MP6, MP7 | | | | | | |
| **Vocabulary:** Function, domain, range, input, output, function notation, mapping diagram, vertical line test, set, ordered pairs, recursive, sequence | | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | | |
| 1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and x is an element of its domain, the *f(x)* denotes the output of f corresponding to the input x. The graph of the equation y=f(x)  **MP2, MP6, MP7** | * Use real relationships to demonstrate functions and relations. * Have students come up with own examples * Translate to creating mapping diagram with numbers. * Graph ordered pairs, compare function vs. non-function to determine graphical appropriate vertical line test. | | The domain of a function given by an algebraic expression, unless otherwise specified is the largest possible domain.  Screen Shot 2016-01-13 at 1  Students give examples of non-functions.  Identify lists of ordered pairs that are function and non-function.  {(0,1), (0,2), (1,4)}  NOT  Screen Shot 2016-01-13 at 1  Use graphing software (ex. Geogebra) to display y=x+2 and f(x)= x+2 | | | |
| 2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.  **MP2, MP6, MP7** | * Analyze a graph to determine domain and input of function notation. | | The domain of a function given by an algebraic expression, unless otherwise specified is the largest possible domain.  Have students solve and demonstrate with a graphing calculator.  Examples  Demonstrate with graphing calculator   * If f(x)-x2+4x-12, find f(2). * Let f(x)=2(x+3)2. Find f(3), f(-1/2), f(a), and f(a-h)   Screen Shot 2016-01-13 at 1 | | | |
| 3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1*.  **MP5, MP6, MP7** | * Review various linear/non-linear sequences. * Determine patterns not in a function. * Review Fibonacci Sequence of rectangular numbers. | | Screen Shot 2016-01-13 at 1 | | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
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**Math Curriculum**

**Grade Eight-Algebra 1**

| **Content: Functions- Interpreting Functions** |
| --- |
| **Essential Question(s):**  How do different representations of functions allow for different interpretations of applications of a function?  What are key features of a graph?  Why does one want to find the key features of a graph?  Why does on need to worry about the domain and range of a function?  Why is it important to know the domain of a function?  Why would one want to know the average rate of change of a function?  Why is the rate of change found from a graph just an estimate? |
| **Standards: F.IF**  C. Analyze functions using different representations. |
| **Standards for Mathematical Practice:**  MP2, MP4, MP6 |
| **Vocabulary:** interval, increasing, decreasing, maxima/minimum, end behavior/periodicity, interprets |

| **Grade Specific Standards** | **Instructional Procedures** | **Explanations and Examples** |
| --- | --- | --- |
| 4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*.\*  **MP2, MP4, MP6** | * Review graphing linear and non linear functions * Determine domain and range * Sketch graphs to show key features * Determine domain and range of a given graph | Screen Shot 2016-01-13 at 1 |
| 5.Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*\*  **MP2, MP4, MP6** | * Discuss the appropriate units of domain and range given real life situations. | Students will explain the existing relationship between domain and range.  For example, if the function h(n) give the number of person-hours it takes to assemble n engines, then the positive integer would be an appropriate domain and range of the function.  Match reasonable domain and range for student generate problems. |
| 6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.\*  **MP2, MP4, MP6** | * Use slope formula to show how x and y values describe the growth/decay of the function. * Compare tables that show consistent rate of change (linear) and others that do not. | Screen Shot 2016-01-13 at 1 |

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| --- | --- | --- | --- |
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**Math Curriculum**

**Algebra**

| **Content: Functions- \*Interpreting Functions** | | | | |
| --- | --- | --- | --- | --- |
| **Essential Question(s):**  How do different representations of functions allow for different interpretations or applications of a function?  Why is it important to know characteristics of graphs and equations?  What characteristics does one know by looking at an equation?  What characteristics does one know about an equation by looking at the graph? | | | | |
| **Standards: F.IF**  C. Analyze functions using different representations | | | | |
| **Standards for Mathematical Practice:** MP1, MP3, MP5, MP6, MP8 | | | | |
| **Vocabulary:** intercepts, maxima, translation, asymptote, piecewise, polynomials, zeros, roots, growth, decay | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | **Explanations and Examples** | | |
| 7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.\*  a. Graph linear and quadratic functions and show intercepts, maxima, and minima.  b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.  c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.  d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.  e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.  **MP1, MP5, MP6** | * Use software to demonstrate different types of functions. * Use graphs to introduce terminology (intercepts, maxima and minima) * Use parabola to identify when a quadratic can be factored into a binomial. * Use technology to identify the key characteristics of the function. | Key characteristics include: maxima, minima, intercepts, symmetry, end behavior, and asymptotes. Students may use technology to graph functions.  Examples:   * Describe key characteristics of the graph of   Macintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 1.24.54 PM.png   * Sketch the graph and identify the key characteristics of the function described below.   Macintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 1.24.45 PM.png   * Graph the function f(x)=2x by creating a table of values. Identify the key characteristics of the graph. * Graph f(x)=2 tan(x-1). Describe its domain, range, intercepts, and asymptotes. * Draw the graph of f(x)=sin(x) and f(x)=cos(x). What are the similarities between the two graphs? | | |
| 8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.  a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.  b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)ᵗ, y = (0.97)ᵗ, y = (1.01)12ᵗ, y = (1.2)ᵗ/10, and classify them as representing exponential growth or decay.  **MP1, MP3, MP5, MP6, MP8** | * Show graphs of growth and decay and use computer-assisted software to match equations. * Determine which equations result in growth or decay. * Given an equation describe the attributes of a graph. | Example  Macintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 1.25.03 PM.png | | |
| 9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum*.  **MP1, MP3, MP5, MP6, MP8** | * Discuss translations and transformations. * Discuss properties of functions. | Example   * Examine the functions below. Which function has the larger maximum? How do you know?   f(x) = -2x2 – 8x + 20  f(x) = -x2 + 3x -11 | | |
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**Math Curriculum**

**Algebra**

| **Content: Functions- \*Building Functions** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  How can we model relationships using mathematics?  For what type of real world application would one want to find an explicit expression?  For what type of real world application would one want to find a recursive expression? | | | | | |
| **Standards: F.BF**  A. Build a function that models a relationship between two quantities. | | | | | |
| **Standards for Mathematical Practice: MP2, MP4** | | | | | |
| **Vocabulary:** relationship. Recursive, geometric, exponential, model | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | |
| 1. Write a function that describes a relationship between two quantities  a. Determine an explicit expression, a recursive process, or steps for calculation from a context.  b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and related these functions to the model.* | * Given a table of values students will determine function rules and relationships. * Given open-ended questions students will determine function rules and relationships. | | * Students will analyze a given problem to determine the function expressed by identifying patters in the function’s relate of change. * Students will specify intervals of increase, decrease, constancy, and relate the function’s description in words. * Students will use computer-assisted technology to model various functions. | | |
| 2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.  **MP2, MP4** | * Students will write arithmetic and geometric sequences recursively. * Students will use sequences to model real like situations. | | * An explicit rule for the *n*th term of a sequence gives an as an expression in the term’s position *n*; a recursive rule gives the first term of a sequence, and a recursive equation related an to the preceding term(s). Both methods of presenting a sequence describe an as a function of *n*.   Examples   * Generate the 5th-11th germs of a sequence if A1 = 2 and A(n+1)=(An)2-1 * Use the formula An=A1+d(n-1) where d is the common difference to generate a sequence whose first three terms are: -7, -4, and -1 * There are 2,500 fish in a pond. Each year the population decreases by 25 percent, but 1,000 are added to the pond at the end of the year. Find the population in 5 years. Also, find the long-term population. * Given the formula An=2n-1, find the 17th term of the of the sequence. What is the 9th term of the sequence 3, 5, 7, 9,…? * Given a(1)=a(n+1)+3, write the explicit formula. | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
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**Math Curriculum**

**Algebra**

| **Content: Functions- \*Building Functions** | | | | | |
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| **Essential Question(s):**  How does the relationship between a parent function and translation of it help us to understand how to build functions?  What are the transformations that can be performed on a parent graph of a linear or exponential function? | | | | | |
| **Standards: F.BF**  B. Build new functions from existing functions. | | | | | |
| **Standards for Mathematical Practice:**  MP3, MP5, MP7 | | | | | |
| **Vocabulary:** parent function, vertical and horizontal translation, inverse function | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | |
| 3. Identify the effect on the graph of replacing f(x) by:  f(x) + k  kf(x)  f(kx)  and f(x + k)  for specific values of k (both positive and negative); find the value of k given the graphs.  Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.  **MP3, MP5, MP7** | * Determine the effect a constant has in various positions of the parent function. | | Students will apply transformations to functions and recognize functions as even and odd. Students may use computer-assisted software.  Examples:   * Is f(x)=x3-3x2+2x+1 even, odd, or neither? Explain your answer orally or in a written format. * Compare the shape and position of the graphs f(x)=x2 and g(x)=2x2, and explain the differences in terms of the algebraic expressions for functions.   Macintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 11.21.49 AM.png   * Describe effect of varying the parameters a, h, and k have on the shape and position of the graph f(x)=a(x-h)2+k * Compare the shape and position of the graphs f(x)=ex to g(x)=ex-6+5, and explain the differences, orally or in written format, in terms of the algebraic expressions for the functions.   Macintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 11.21.56 AM.png   * Compare the shape and position of the graphs y=sinx to y=2sinx   Macintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 11.22.02 AM.png | | |
| 4. Find inverse functions.  a. Solve an equation of the form f(x)=c for a simple function f that has an inverse and write an expression for the inverse. *For example,* f(x)=2x3 or f(x)=(x+!)/(x-1) for x≠1..  **MP3, MP5, MP7** | * Explain the results of switching an x and y value in an ordered pair. * Graph sets of coordinates and their inverses to determine the relationship between a function and its inverse. * Determine an inverse algebraically and graphically. | | Students may use computer-assisted software to model functions.  Examples:   * For the function h(x)=(x-2)3, defined on the domain of all real numbers, find the inverse function if it exists or explain why it doesn’t exist. * Graph h(x) and h-1(x) and explain how they relate to each other graphically. * Find a domain for f(x)=3x2+12x-8 on which it has an inverse. Explain why it is necessary to restrict the domain of the function. | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
| * Adjusting the pace of lessons. * Curriculum compacting * Inquiry-based instruction * Independent study * Higher order thinking skills * Interest-based content * Student driven lessons   Real-word problems and scenarios | | * Video clips * Choose excerpt(s) from book to focus on vocabulary development, comprehension * Translate vocabulary into native language * Read aloud * Word Wall * Build background knowledge * Picture Associations * Partner Work * For more, see <http://www.state.nj.us/education/modelcurriculum/ela/ellscaffolding/3u1.pdf> | | * Extended time * Modified assignments * Small group, alternate location * Modeling * Read aloud problems * Calculator * Build background knowledge * Oral/visual reminders * Peer assistance * Picture associations with vocabulary * Build background knowledge of the number system * Refer to each student’s IEP for more specific modifications | * RTI strategies including: teacher modeling, gradual release, think-Pair-Share, Think Aloud, Interactive notes * Tier II and Tier III intervention * More frequent STAR assessments * Morning tutoring * After school program * Parental contact |

**Math Curriculum**

**Algebra**

| **Content: Functions- \*Linear, Quadratic, and Exponential Models** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  How do functions appear in daily living?  What situations have one quantity change at a constant rate per unit interval relative to another?  What situations have one quantity growing or decaying by a constant percent rate per unit interval relative to another? | | | | | |
| **Standards: F.L.E**  A.. Build new functions from existing functions. | | | | | |
| **Standards for Mathematical Practice:** MP1, MP2, Mp3, Mp4, MP5, MP7 | | | | | |
| **Vocabulary:** linear, quadratic or exponential functions | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | |
| 1. Distinguish between situations that can be modeled with linear functions and exponential functions.  a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.  b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.  c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.  **Mp3, Mp4** | * Define linear functions and exponential functions.   Graph y=x  Graph y=2x   * Compare linear functions and exponential functions. * Calculate simple interest and compound interest. | | Students may use computer-assisted technology to model and compare linear and exponential examples.  Examples:   * A cell phone company has three plans. Graph the equation for each plan, and analyze the change as the number of minutes used increase. When is it beneficial to enroll in Plan 1? Plan 2? Plan 3?  1. $59.95/month for 700 minutes and $0.25 for each additional minute. 2. $39.95/month for 400 minutes and $0.15 for each additional minute. 3. $89.95/month for 1,400 minutes and $0.05 for each additional minute.  * A computer store sells about 200 computers at the price of $1,000 per computer. For each $50 increases in price, about ten fewer computers are sold. How much should the computer store charge per computer in order to maximize their profit?   Students will investigate functions and graphs modeling different situations involving simple and compound interest.  Students will compare interest rates with different periods of compounding (monthly, daily) and compare them with the corresponding annual percentage rate.   * A couple wants to buy a house in 5 years. They need to save a down payment if $8,000. They deposit $1,000 in a bank account earing 3.25% interest, compounded quarterly. How much will they need to save each month in order to meet their goal? * Sketch and analyze the graphs of the following two situations. What information can you conclude about the types of growth each type of interest has? * Lee borrows $9,000 from his mother to buy a car. His mom charges him 5% interest a year, but she does not compound the interest. * Lee borrows $9,000 from a bank to buy a car. The bank charges 5% interest compounded annually. * Calculate the future value of a given amount of money, with and without technology. * Calculate the present value of a certain amount of money for a given length of time in the future, with and without technology. | | |
| 2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).  **MP1, MP2, MP4** | * Given a graph of a function, identify the characteristics given. * Write an algebraic sequence to describe a real-life situation. | | Examples:   * Determine an exponential function of the form *f*(x)=abx using data points from the table. Graph the function and identify the key characteristic.  | X | f(x) | | --- | --- | | 0 | 1 | | 1 | 3 | | 3 | 27 |  * Sara’s starting salary is $32,500. Each year she receives a $700 raise. Write a sequence in explicit form to describe the situation. | | |
| 3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.  **MP1, MP4, MP5, MP7** | * Compare and contrast exponential, linear, and polynomial functions. | | Example:  Contrast the growth of the f(x)=x3 and f(x)=3x | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
| * Adjusting the pace of lessons. * Curriculum compacting * Inquiry-based instruction * Independent study * Higher order thinking skills * Interest-based content * Student driven lessons   Real-word problems and scenarios | | * Video clips * Choose excerpt(s) from book to focus on vocabulary development, comprehension * Translate vocabulary into native language * Read aloud * Word Wall * Build background knowledge * Picture Associations * Partner Work * For more, see <http://www.state.nj.us/education/modelcurriculum/ela/ellscaffolding/3u1.pdf> | | * Extended time * Modified assignments * Small group, alternate location * Modeling * Read aloud problems * Calculator * Build background knowledge * Oral/visual reminders * Peer assistance * Picture associations with vocabulary * Build background knowledge of the number system * Refer to each student’s IEP for more specific modifications | * RTI strategies including: teacher modeling, gradual release, think-Pair-Share, Think Aloud, Interactive notes * Tier II and Tier III intervention * More frequent STAR assessments * Morning tutoring * After school program * Parental contact |

**Math Curriculum**

**Algebra**

| **Content: Functions- \*Linear, Quadratic, and Exponential Models** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  How do functions appear in daily living?  Why are parameters are important in a function? | | | | | |
| **Standards: F.L.E**  B. Interpret expressions for functions in terms of the situation they model. | | | | | |
| **Standards for Mathematical Practice:** MP2, MP4, MP6 | | | | | |
| **Vocabulary:** linear, quadratic or exponential functions | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | |
| 5. Interprets the parameters in a linear or exponential function in terms of a context.  **MP2, MP4, MP6** | * Model and interpret parameters in linear, quadratic or exponential functions. | | Students will use computer-assisted technology to model and interpret parameters in linear, quadratic, or exponential functions.  Example:   * A function in the form f(n)= P(1+r)n is used to model the amount of money in a savings account that earns 5% interest, compounded annually, where *n* is the number of years since the initial deposit. What is the value of *r*? Explain the meaning of the constant *P* in terms of the savings account? | | |
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**Math Curriculum**

**Algebra**

| **Content: Statistics and Probability- \*Interpreting Categorical and Quantitative Data** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  What is the effect of measures of central tendency in interpreting data?  Why does one want to use graphical displays of data? | | | | | |
| **Standards: S.ID**  A. Summarize, represent, and interpret data on a single count of measurement variable. | | | | | |
| **Standards for Mathematical Practice:** MP1, MP2, MP4, MP5, MP6 | | | | | |
| **Vocabulary:** media, mean, mode, stem and leaf plot, box and whisker plot, histogram, scatter plot, standard deviation, inter-quartile range, outlier, range | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | |
| 1. Represent data with plots on the real number line (dot plots, histograms, and box plots)  **MP1, MP2, MP4, MP5, MP6** | * Review properties of the number line (x-axis) | | Students will illustrate different kinds of graphs: dot plots, histogram, box and whisker. | | |
| 2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.  **MP1, MP2, MP4, MP5, MP6** | * Explain measures of central tendency. * Explain/model standard deviation. * Compare/contrast sets of data by choosing appropriate statistics. | | Students will use computer-assisted technology for calculations, summaries, and comparisons of data sets.  Examples:   * The two data sets below depict the housing prices sold in the Kind River area and Toby Ranch areas of Pinal County, Arizona. Based on the prices below, which price range can be expected for a home purchased in Toby Ranch? In the King River area? In Pinal County? * King River area {1.2 million, 242000, 265500, 140000, 281000, 265000, 211000} * Toby Ranch homes {5 million, 154000, 250000, 250000, 200000, 160000, 190000} * Given a set of test scores: 99, 96, 94, 93, 90, 88, 96, 77, 70, 68, find the mean, median, and standard deviation. Explain how the values vary about the mean and median. What information does this give the teacher? | | |
| 3. Interpret differences in shape, center, and spread in the context of the data sets, account for possible effects of extreme data points (outliers).  **MP1, MP2, MP4, MP5, MP6** | * Compare/contrast multiple sets of data account for outliers. | | Students may use spreadsheets, graphing calculators, and statistical software to statistically identify outliers and analyze data sets with and without outliers as appropriate. | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
| **Gifted and Talented** | | **English Language Learners** | | **Students with Disabilities** | **Students at Risk of School Failure** |
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**Math Curriculum**

**Algebra**

| **Content: Statistics and Probability- \*Interpreting Categorical and Quantitative Data** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  What is the effect of measures on central tendency in interpreting data?  What type of data would be used in a two-way frequency table?  How does one determine whether to show data in a table of a graphical display? | | | | | |
| **Standards: S.ID**  B. Summarize, represent, and interpret data on two categorical and quantitative variables. | | | | | |
| **Standards for Mathematical Practice:** MP1, MP2, MP4, MP5, MP6, MP7 | | | | | |
| **Vocabulary:** joint, marginal and conditional relative frequencies, trends, residual, regression, function, scatter plot | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | |
| 5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible association and trends in the data.  **MP1, MP5, MP7** | * Analyze a two-way table to determine joint, marginal, and conditional relative frequencies | | Students may use spreadsheets, graphing calculators, and statistical software to create frequency tables and determine associations or trends in the data.  Examples:  **Two-way Frequency Table**  A two-way frequency table is shown below displaying the relationship between age and baldness. We took a table of 100 male subjects, and determined who is or is not bald. We also recorded the game of the male subjects by categories.  Macintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 9.50.51 AM.png  The *total* row and *total* column entries in the table above report the marginal frequencies, while entries in the body of the table are joint frequencies.  **Two-way Relative Frequency Table**  The relative frequencies in the body of the table are called conditional relative frequencies.  Macintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 9.51.02 AM.png | | |
| 6. Represent data on two quantitative variables on a scatter pot, and describe how the variables are related.  a. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.  b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.  c. Fit a linear function for a scatter plot that suggests a linear association.  **MP1, MP2, MP4, MP5, MP6** | * Given a function create a scatter plot and describe the relationship between the variables. * Determine how the variables are related to each other in given sets * Fit functions to data   Calculate regressions and calculate residuals. | | The residual in a regression model is the difference between the observed and the predicted *y* for some *x* (*y* is the dependent variable and *x* is the independent variable).  Macintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 10.03.05 AM.pngMacintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 10.03.09 AM.png  So if we have a model , and a data point the residual  Macintosh HD:Users:clomio:Desktop:Screen Shot 2016-01-13 at 10.03.13 AM.png  is for this point is  Example:   * Measure the wrist and neck size of each person in your class and make scatter plot. Find the least squares regression line. Calculate and interpret the correlation coefficient for this linear regression model. Graph the residuals and evaluate the fir of the linear equations. | | |
| **Differentiation/Accommodations/Modifications** | | | | | |
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| --- | --- | --- | --- | --- | --- |
| **Essential Question(s):**  How can we use mathematical models to make predictions and informed decisions based on past data and trends?  Why would one want to see if two variables are correlated to one another? | | | | | |
| **Standards: S.ID**  C. Interpret linear models | | | | | |
| **Standards for Mathematical Practice:** mp1, mp2, mp4, mp5, mp6 | | | | | |
| **Vocabulary:** slope, intercept, rate of change, correlation coefficient, correlation, causation | | | | | |
| **Grade Specific Standards** | **Instructional Procedures** | | **Explanations and Examples** | | |
| 7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.  **mp1, mp2, mp4, mp5, mp6** | * Explain rate of change for a given linear equation. * Determine x and y intercepts. | | Students will use computer-assisted technology to create representations of data sets and create linear models.  Example:   * Lisa lights a candle and records its height in inches every hour. The results recorded as (time, height) are (0,20), (1, 18.3), (2, 16.6), (3, 14.9), (4, 13.2), (5, 11.5), (7, 8.1), (9, 4.7), and (10, 3). Express the candle’s height (*h*) has a function of time (*t*) and state the meaning of the slope and the intercept in terms of the burning candle.   Solution:   * h = 1.7t + 20   Slope: The candle’s height decreases by 1.7 inches for each hour it is  burning.  Intercept: Before the candle begins to burn, its height is 20 inches. | | |
| 8. Compute (using technology) and interpret the correlation coefficient of a linear fit.  **mp1, mp2, mp4, mp5, mp6** | * Given the set of data, describe how the variables are related * Fit functions to data, * Preform regressions, * Calculate residuals and correlation coefficients | | Students will use computer-assisted software to represent data, describe how the variables are related, fit functions to data, preform regressions, and calculate residuals and correlation coefficients.  Example:  Collect height, shoe-size, and wrist circumference data for each student.  Determine the best way to display the data.   * Is there a correlation between any two of the three indicators? * Is there a correlation between all three indicators? * What patters and trends are apparent in the data? * What inferences can be made from the data? | | |
| 9. Distinguish between correlation and causation.  **mp1, mp2, mp4, mp5, mp6** | * Define correlation and causation. * Provide logical examples to illustrate the difference between correlation and causation. | | Some data leads observers to believe that there is a cause and effect relationship when a strong relationship is observed. Students should be careful not to assume that correlation implies causation. The determination that one thing causes another requires a controlled randomized experiment.  Example:  Diane did a study for a health class about the effects of a student’s end-of-year math test scores on height. Based on a graph of her data, she found that there was a direct relationship between students’ math scores and height. She concluded that “doing well on your end-of-the-course math test makes you tall”. Is this conclusion justified? Explain any flaws in Diane’s reasoning. | | |
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