Algebra (80-minutes)
Ohio’s New Learning Standards Pacing Guide

**Wrap Around:**
NQ Q #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.
NQ Q #2: Define appropriate quantities for the purpose of descriptive modeling.
NQ Q #3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

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<thead>
<tr>
<th>1st Nine Weeks</th>
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<tr>
<td><strong>UNIT 1 ~ REVIEW &amp; POWERS</strong></td>
<td><strong>UNIT 4 ~ LINEAR FUNCTIONS</strong></td>
<td><strong>UNIT 6 ~ QUADRATIC FUNCTIONS</strong></td>
<td><strong>UNIT 8 ~ LINEAR SYSTEMS</strong></td>
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<tr>
<td>EE #1: Know and apply the properties of integer exponents to generate equivalent numerical expressions.</td>
<td>A.CE #2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</td>
<td>A.CE #2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</td>
<td>A.REI #5: Verify 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.</td>
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<td>EE #2: Use square root and cube root symbols to represent solutions to equations of the form ( x^2 = p ) and ( x^3 = p ), where ( p ) is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that ( \sqrt{2} ) is irrational.</td>
<td>A.REI #10: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).</td>
<td>A.SSE #3: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.</td>
<td>A.REI #6: Solve systems of linear equations algebraically and graphically.</td>
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<td>EE #3: Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.</td>
<td>A.REI #12: Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.</td>
<td>a. Factor a quadratic expression to reveal the zeros of the function it defines.</td>
<td>a. Limit to pairs of linear equations in two variables.</td>
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<td>EE #4: Perform operations with numbers expressed in scientific notation, including problems where</td>
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<td>b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.</td>
<td>A.CE. #3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.</td>
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**Process Standards:**
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.
1st Nine Weeks | 2nd Nine Weeks | 3rd Nine Weeks | 4th Nine Weeks
---|---|---|---
both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology.

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<th><strong>UNIT 2 ~ EXPRESSIONS</strong> (Hypatia)</th>
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<td><strong>MP #3:</strong> Reason abstractly and quantitatively.</td>
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<tr>
<td><strong>A.SSE #1:</strong> Interpret expressions that represent a quantity in terms of its context.</td>
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  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.  
| **A.SSE #2:** Use the structure of an expression to identify ways to rewrite it.  
| **A.SSE #3:** Choose and produce an equivalent form of an expression to reveal and explain properties of the one variable. |
  a. Use the method of completing the square to transform any quadratic equation into an equation of the form 
\((x-p)^2 = q\) that has the same solutions.  
  b. Solve quadratic equations as appropriate to the initial form of the equation by inspection (taking square roots, completing the square, applying the quadratic formula or utilizing the Zero-Product Property after factoring).  
| **A.REI #5:** Verify that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.  
| **A.REI #6:** Solve systems of linear equations algebraically and graphically.  
  a. Limit to pairs of linear equations in two variables.  
| **A.REI #7:** Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. |

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<th><strong>UNIT 10 ~ PATTERNS</strong></th>
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<td><strong>F.LE #2:</strong> 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).</td>
</tr>
<tr>
<td><strong>F.BF #2:</strong> Write arithmetic and geometric sequences both recursively and with an explicit formula, use them</td>
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### Standards:

**A.APR #1:** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

- Focus on polynomial expressions that simplify to forms that are linear or quadratic.

**A.REI #3:** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

**A.REI #1:** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation is true.

**F.IF #7:** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

- Graph linear functions and indicate intercepts.

**F.IF #9:** Compare properties of two functions each represented in a different way.

- Focus on linear, quadratic and exponential functions.

**F.BF #1:** Write a function that describes a relationship between two quantities.

- Determine an explicit expression, a recursive process or steps for calculation from context.

**F.BF #3:** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

- Focus on transformations of graphs of quadratic functions, except for $f(kx)$.

**F.IF #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.

**F.IF #7:** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

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**Self-Paced, Independent Study**

(many items will be deleted after 2018-2019 school year)

*See final two pages for topics and standards.*
has a solution. Construct a viable argument to justify a solution method.

**A.CE #1:** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

**A.CE #3:** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.

**A.CE #4:** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

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**REAL NUMBER SYSTEM (Article)**

*Teach eighth grade standards for the 2018-2019 school year. This unit may be deleted afterwards.*

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**UNIT 7 ~ STATISTICS**

**SP.ID #1:** Represent data with plots on the real number line (dot plots, histograms, and box plots).

**SP.ID #2:** In the context of real-world applications by using the GAISE model, 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.

**SP.ID #3:** In the context of real-world applications by using the GAISE model, interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

**SP.ID #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 associations and trends in the data.

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<td>the graph, by hand in simple cases and using technology for more complicated cases.</td>
<td>e. Graph simple exponential functions, indicating intercepts and end behavior.</td>
<td>SP.ID #6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.</td>
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<td>F.IF #8: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</td>
<td>b. Use the properties of exponents to interpret expressions for exponential functions.</td>
<td>c. Fit a linear function for a scatter plot that suggests a linear association.</td>
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<td>F.LE #1: Distinguish between situations that can be modeled with linear functions and with exponential functions.</td>
<td>c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.</td>
<td>SP.ID #7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.</td>
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<td>F.LE #3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.</td>
<td>F.LE #5: Interpret the parameters in a</td>
<td>SP.ID #8: Compute (using technology) and interpret the correlation coefficient of a linear fit.</td>
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a. Determine an explicit expression, a recursive process or steps for calculation from context. | |
Self-Paced, Independent Study

VOLUME

G #9: Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

PYTHAGOREAN THEOREM

NS #2: Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π2).

EE #2: Use square root and cube root symbols to represent solutions to equations of the form x² = p and x³ = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.

G #6: Explain a proof of the Pythagorean Theorem and its converse.

G #7: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

G #8: Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

TRANSFORMATIONS

G #1: Verify experimentally the properties of rotations, reflections, and translations:
   a. Lines are taken to lines, and line segments to line segments of the same length.
   b. Angles are taken to angles of the same measure.
   c. Parallel lines are taken to parallel lines.

G #2: Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

G #3: Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

CONGRUENCE OF TRIANGLES

G #1: Verify experimentally the properties of rotations, reflections, and translations:
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Similarity

G #4: Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

Line & Angle Relationships

EE #6: Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation \( y = mx \) for a line through the origin and the equation \( y = mx + b \) for a line intercepting the vertical axis at \( b \).

F #3: Interpret the equation \( y = mx + b \) as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

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a. Lines are taken to lines, and line segments to line segments of the same length.
b. Angles are taken to angles of the same measure.
c. Parallel lines are taken to parallel lines.

G #5: Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.