

School of the Future Math Department
 Comprehensive Curriculum Plan: **ALGEBRA II** (Holt “Algebra 2” textbook as reference guide)
 2016-2017

Instructor: Diane Thole

EU for the year: How do mathematical models represent algebraic principles?

Color Coding: Work Habits

Math Content

Math Skills

Math Strategy and Design Math Communication

<p><u>Time Frame:</u> <i>September 2016 - beginning October 2016</i></p>	<p><u>Unit Map</u> Unit 1: Review of Linear Functions & Applications of Regression Models</p> <p><i>EQ: How can regression models be used to display and analyze the data in our everyday lives?</i></p> <p><u>EU Content and Skills:</u></p> <ul style="list-style-type: none"> ⇒ Define the basic equation and attributes of a linear function and quadratic function ⇒ Defining what a scatterplot graph looks like (graphing calculator) ⇒ Types of correlation ⇒ Generating lines of best fit both by hand and by graphing calculator ⇒ Correlation coefficient ⇒ Predicting future data 	<p><u>Standards Covered (Common Core)</u></p> <p>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).</p> <p>A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p> <p>F.IF.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.</p> <p>A.REI.11 Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. I</p>
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<p><u>Formative and Summative Assessments:</u> PBAT #1 Scuba Diving Problem (diagnostic) PBAT #1 Scuba Diving Problem (diagnostic) -Daily HW checks -Question of the Day entrance/exit cards -Writing Prompts (TO BE PEER GRADED whenever possible) -Quizzes -Larger Quiz or Mini Test Summative Project: Create your own linear regression model using real-world data (option to extend to quadratic regressions) - REAL WORLD data (tie into current event data) Create your own linear regression model using real-world data (option to extend to quadratic regressions) - REAL WORLD data (tie into current event data)</p>		<p><u>Spiraled Skills:</u> -Equation of a line (point slope form, slope intercept form) -Reading a graph accurately (axes, labels, scaling) -Interpolating or extrapolating data -Selecting appropriate data to use</p>
<p>October 2016</p>	<p>Unit 2: Rational and Radical Functions</p> <p><i>EQ: How do rational functions extend from direct variation functions? How do we simplify radical expressions and solve radical equations?</i></p> <p><u>EU Content and Skills:</u> -Direct vs Inverse Variation -Operations with Rational Expressions - Graph and transform rational functions by changing parameters -Solving rational equations (work application word problems) -Simplifying radical expressions with rational exponents -Graph and transform radical functions by changing parameters -Solving radical equations (automobile application word problem)</p>	<p><u>Standards Covered (Common Core)</u> N.RN.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 $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5(1/3)^3$ to hold, so $(5^{1/3})^3$ must equal 5. N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents. F.IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p>
<p><u>Formative and Summative Assessments:</u> -Daily HW checks</p>		<p><u>Spiraled Skills:</u> -Simplifying radicals from Algebra I</p>

<p>-Question of the Day entrance/exit cards -Writing Prompts (TO BE PEER GRADED whenever possible) -Quizzes -Leveled classwork practice -Larger Tests</p>	<p>-FOIL and factoring in order to add/subtract/multiply/divide polynomials -Graphing and scaling (spiraled from unit 1) **GASP word problem chart</p>	
<p>November 2016</p>	<p>Unit 3: Polynomial Functions</p> <p><i>EQ: How do polynomial functions extend from quadratics? How can they be analyzed using different expressions?</i></p> <p><u>EU Content and Skills:</u></p> <ul style="list-style-type: none"> ● Defn. of Polynomial functions ● How to recognize polynomial functions ● Transforming polynomial functions ● Rational roots ● Synthetic Division ● Graphing polynomial functions ● Zeros of polynomial functions ● The meaning of i and complex numbers ● Fundamental Thm of Algebra <p>**Transforming parent functions (width, vertical, & horizontal) **enrichment</p>	<p><u>Standards Covered (Common Core)</u></p> <ul style="list-style-type: none"> - Use complex numbers in polynomial identities and equations - Interpret the structure of expressions - Understand the relationship between zeros and factors of polynomials - Rewrite rational expressions - Understand solving equations as a process of reasoning and explain the reasoning - Solve equations and inequalities in one variable - Analyze functions using different representations (graph polynomial functions, identify zeros when suitable factorizations are available and showing end behavior)
<p><u>Formative and Summative Assessments:</u></p> <p>-Daily HW checks -Question of the Day entrance/exit cards -Writing Prompts (TO BE PEER GRADED whenever possible) -Leveled classwork practice -Quizzes -Larger Quiz or Mini Test</p>	<p><u>Spiraled Skills:</u></p> <p>-Factoring -Solving for roots by factoring and quadratic formula -Graphing and scaling appropriately -Simplifying radicals now to include complex numbers -Long division (to lead into synthetic division)</p>	

<p><i>December 2016 - mid January 2017</i></p>	<p>Unit 4: Building New Functions from Existing Functions EQ: <i>What are the key attributes of functions and how are these attributes graphically represented?</i></p> <p><u>EU Content and Skills</u></p> <ul style="list-style-type: none"> ⇒ Define the domain and range of a function ⇒ Implement the Vertical line test to graphs of functions ⇒ Determining the inverse of a function ⇒ Implement the Horizontal line test to graphs of functions ⇒ Determine whether functions are one-to-one ⇒ Expressing functions in function notation ⇒ Composing functions algebraically ⇒ Step functions, piecewise functions 	<p><u>Standards Covered (Common Core)</u></p> <p>F.IF.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.</p> <p>F.BF.1: Write a function that describes a relationship between two quantities</p> <p>F.1F.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, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.</p> <p>F.IF. 2: Use function notation, evaluate and compose functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p> <p>F.IF.5: Relate the domain of a function to its graph and where applicable, to the quantitative relationship it describes.</p>	<p><u>Skills/Content Tracked</u></p> <p>FS.1- Use the equation of a line to determine slope and y-intercept and graph</p> <p>FS. 2- Compare the graphs of systems of inequalities to systems of linear equations</p> <p>FC. 1 – Describe the solution set of a system of linear equations to the solution set of a system of inequalities</p> <p>FS.3 – Use a data table to determine first and second differences and graph parabolic graphs</p> <p>FS. 4 – Given equations or data tables of functions, identify values for domain and range</p> <p>FS. 5 - Sketch the vertical line test and horizontal line test on graphs of functions and analyze their meaning</p> <p>FS. 6- Use distributive property and algebraic order of operations to write the inverse of functions</p> <p>FC. 2- Describe what it means to express a function in $f(x)$ notation</p> <p>FS. 7- Use order of operations, distributive property, and FOIL to compose functions</p> <p>FS. 8 – Review adding and subtracting fractions when composing functions</p>
<p><u>Formative and Summative Assessments:</u></p> <ul style="list-style-type: none"> -Daily HW checks -Question of the Day entrance/exit cards -Writing Prompts (TO BE PEER GRADED whenever possible) -Leveled classwork practice -Quizzes 		<p><u>Spiraled Skills:</u></p> <ul style="list-style-type: none"> -Order of operations (to assist with composing functions) -Graphing and scaling -Inequalities and linear inequalities (open vs closed circles) -GASP word problem chart 	

<p>-Larger Quiz or Mini Test</p> <p>PROJECT (Summative) Create your own piecewise function word problem, data table, graph and analyze alterations to the scenario</p>	<p>-Solving equations for y or for x</p>		
<p><i>mid January - February 2017</i></p>	<p><u>Unit Map</u> Unit 5: Exponential and Logarithmic Functions</p> <p><i>EQ: How are exponential and logarithmic functions related to each other? How does altering an exponential or logarithmic function affect its real world representation?</i></p> <p><u>EU Content and Skills</u></p> <ul style="list-style-type: none"> ⇒ Simplifying algebraic expressions using properties of exponents ⇒ Developing growth and decay exponential functions using word problems and regression data ⇒ Solving exponential equations ⇒ Expressing exponential functions as logarithmic functions (and vice versa) ⇒ Simplify and expand logarithmic expressions ⇒ Identify attributes of exponential and logarithmic graphs 	<p><u>Standards Covered (Common Core)</u></p> <p>N. RN. 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.</p> <p>N. RN. 2: Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p> <p>F. LE. 1: Distinguish between situations that can be modeled with linear functions and with exponential functions.</p> <p>c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.</p> <p>F. LE. 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.</p> <p>F. LE. 5: Interpret the parameters in an exponential function in terms of a context</p>	<p><u>Skills/Content Tracked</u></p> <p>ELS. 1- Divide algebraic expressions using rules of exponents</p> <p>ELS. 2- Rewrite exponential expressions into common bases and solve equations</p> <p>ELC. 1 – Describe an exponential data set as having a common ratio</p> <p>ELC. 2 – Define what the base and power of an exponential equation is</p> <p>ELS. 3 – Convert exponential equations into logarithmic form</p> <p>ELS. 4 – Identify the base and power of a logarithmic equation</p> <p>ELC. 3 – Define common logarithm</p> <p>ELC. 4 – Define natural logarithm</p> <p>ELC. 5 – Describe the change of base formula for logarithms</p> <p>ELC. 6 – Define the zero rule for logarithms and exponential expressions</p> <p>ELC. 7 – Define the addition rules, subtraction rules, and power rules for logarithmic expressions</p> <p>ELS. 5 – Apply the rules of logarithms to expand or simplify logarithmic expressions</p> <p>ELC. 8- Define properties of exponential and logarithmic graphs</p> <p>ELS. 6 – Graph, transform, and analyze differences in exponential graphs and logarithmic graphs</p>

	<p>⇒ Define the irrational number, e</p> <p>⇒ Solve natural logarithm ($\ln x$) word problems</p> <p>⇒ Transforming exponential and logarithmic graphs</p>	<p>F.BF. 4: Find inverse functions.</p> <p>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.*</p> <p>e. Graph exponential and logarithmic functions showing intercepts and end behavior.</p> <p>S. ID. 6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.</p> <p>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.</p> <p>S. ID. 8: Compute, using technology, and interpret the correlation coefficient of data models.</p> <p>F. LE. 4: For exponential models, express as a logarithm the solution to $a \cdot b^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.</p>	<p>ELS. 7 – Translate word problems into exponential growth and decay models and solve for time or another unknown variable</p> <p>ELC. 8 – Describe types of regression models and meaning of a correlation coefficient</p> <p>ELS. 8 – Determine which regression model best represents a data table</p> <p>ELS. 9 – Create an exponential or natural logarithmic regression equation from a data set</p>
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<p><u>Formative and Summative Assessments:</u></p> <ul style="list-style-type: none"> -Daily HW checks -Question of the Day entrance/exit cards -Writing Prompts (TO BE PEER GRADED whenever possible) -Leveled classwork practice -Quizzes -Larger Quiz or Mini Test <p>PROJECT (Summative) Use exponential regressions and logarithms to predict data (mini exhibition and unit project) - REAL WORLD data (tie into current event data)</p> <p>PBAT #2 (diagnostic before the start of the unit)</p>	<p><u>Spiraled Skills:</u></p> <ul style="list-style-type: none"> -Solving equations -Simplifying exponential expressions -Graphing and scaling appropriately (using Excel and the graphing calculator) -Laws of Exponents -Composing functions and inverse function relationships
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Bacteria decay and growth scenario	
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<p><i>March/April/May 2017</i></p>	<p><u>Unit Map</u> Unit 6: The Unit Circle & Trigonometric Graphs & Unit 7: Proving Trigonometric Identities & Solving Trigonometric Equations</p> <p><i>EQ: How does the unit circle influence trigonometric graphs and identities?</i></p> <p><u>EU Content and Skills</u></p> <ul style="list-style-type: none"> ⇒ Define an angle of rotation, co-terminal and reference angle ⇒ Develop the unit circle using sine and cosine ratios ⇒ Create the basic sine and cosine functions from the unit circle ⇒ Define radian measure and convert degrees to radians and vice versa ⇒ Define reciprocal trigonometric functions ⇒ Derive the fundamental trigonometric identities ⇒ Derive sum and difference identities of sine (A+B) or (A-B) and cosine (A+B) or (A-B) ⇒ Derive double angle formulas for sine and cosine ⇒ Develop the graphs of sine and cosine from the unit circle 	<p><u>Standards Covered (Common Core)</u></p> <p>F.TF. 1: Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.</p> <p>F.TF. 2: Explain how the unit circle in the coordinate plane enables the extension of the trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.</p> <p>F.TF. 5: Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and period.</p> <p>F.TF. 8: Prove the Pythagorean Identity and use it to find sin, cos, tan of an angle, or given sin, cos, or tan of an angle, determine the quadrant of the angle.</p> <p>F. TF. 9: Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.</p>	<p><u>Skills/Content Tracked</u></p> <p>UC. 1 – Define positive and negative angles of rotation</p> <p>UC. 2 – Define a co-terminal angle</p> <p>UC. 3 – Define a reference angle</p> <p>US. 1 – Sketch angles of rotation, co-terminal, and reference angles on a four quadrant graph</p> <p>US. 2 – Express the sine, cosine, and tangent of special angles in proper radical form</p> <p>US. 3 – Use special angles, reference angles and the unit circle to determine the sine, cosine, and tangent of angle measures</p> <p>UC. 4 – Define radian measure</p> <p>US. 4 – Convert radian to degree measure and vice versa</p> <p>US. 5 – Use reciprocal trigonometric functions to simplify trigonometric identities</p> <p>UC. 5 – Define amplitude, frequency, period, y – intercept and phase shift of a periodic function (sine or cosine graph)</p> <p>US. 6 – Transform various sine and cosine graphs given changes to frequency, amplitude, and phase shift</p> <p>US. 7 – Using right triangles side lengths and trigonometric ratios, determine the sum and difference of sine and cosine of two angles</p> <p>US. 8 – Determine the sum and difference of the sine and cosine of non-special angles</p> <p>US. 9 – Using right triangle side lengths, determine values of $\sin 2A$ and $\cos 2A$</p>
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	<p>⇒ Solve trigonometric equations</p> <p>⇒ Prove trigonometric identities</p>		<p>US. 10 – Simplify trigonometric expressions using fundamental trig identities, sum and difference identities, and double angle identities</p> <p>US. 11 – Prove trigonometric identities by substituting fundamental, double, and half-angle identities</p> <p>US. 12 – Factor binomial quadratic expressions</p> <p>US. 13 – Solve for the roots of a quadratic equation using the quadratic formula</p> <p>US. 14 – Solve for the angle measurements of a quadratic or linear trigonometric equation</p>
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Formative and Summative Assessments:

- Daily HW checks
- Question of the Day entrance/exit cards
- Writing Prompts (TO BE PEER GRADED whenever possible)
- Leveled classwork practice
- Quizzes
- Larger Quiz or Mini Test

PROJECT (Summative) - after Unit 6

Snakes on a Plane Graphing Activity (students create their own drawings using transformations and translations of sine and cosine graphs)

PBAT #3 (Summative) - after Unit 7

Comparing and transforming various functions

Spiraled Skills:

- Graphing and scaling using desmos.com
- Pythagorean Theorem, simplifying radicals
- Review of SOHCAHTOA
- Solving equations to assist in solving trig equations
- Special right triangle relationships
- Supplementary/complementary angles

<p>June 2017 <i>*enrichment mini unit</i></p>	<p><u>Unit Map</u> Unit 8: Sequences and Series EQ: <i>How can patterns of numbers be used to determine arithmetic and geometric sequences?</i></p> <p><u>EU Content and Skills</u></p> <ul style="list-style-type: none"> ⇒ Determine the <i>n</i>th term of a sequence ⇒ Write rules for sequences ⇒ Evaluate the sum of a series expressed in sigma notation ⇒ Find indicated terms and sums of arithmetic and geometric series ⇒ Find sums of infinite geometric series ⇒ Use mathematical induction to prove statements ⇒ Approximate area under a curve by using rectangles 	<p><u>Standards Covered (Common Core)</u></p> <p>F. BF. 1: Write a function that describes a relationship between two quantities.</p> <ul style="list-style-type: none"> a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. <p>F. BF. 2: Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.</p> <p>F. IF. 3: Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. (ex, the Fibonacci sequence can be defined recursively)</p>	<p><u>Skills/Content Tracked</u></p> <p>SEC. 1 – Define sequence, term of the sequence, infinite and finite sequence</p> <p>SES. 1 – Differentiate between a recursive and explicit formula</p> <p>SES. 2 – Write an explicit rule for a possible sequence</p> <p>SEC. 2 – Define a series and summation notation</p> <p>SES. 3 – Expand and evaluate series using summation notation</p> <p>SES. 4 – Determine the <i>n</i>th term of a given arithmetic sequence</p> <p>SES. 5 – Implement the graphing calculator to find the sum of arithmetic series</p> <p>SES. 6 – Determine the <i>n</i>th term of a given geometric sequence</p> <p>SES. 7 – Implement the graphing calculator to find the sum of geometric series</p> <p>SEC. 3 – Define a convergent series</p> <p>SEC. 4 – Define a divergent series</p> <p>SEC. 5 – Define a limit</p> <p>SES. 8 – Determine whether series are divergent or convergent</p> <p>SES. 9 – Use the process of mathematical induction to prove the sum of numbers in a series</p> <p>SES. 10- Use counterexamples to disprove mathematical statements</p> <p>SES. 11 – Determine the area under a curve using series</p>
<p><u>Formative and Summative Assessments:</u> -Daily HW checks -Question of the Day entrance/exit cards</p>		<p><u>Spiraled Skills:</u> -Summation techniques</p>	

<p>-Writing Prompts (TO BE PEER GRADED whenever possible)</p> <p>-Leveled classwork practice</p> <p>-Quizzes</p> <p>-Larger Quiz or Mini Test</p> <p><u>Sample Mini Project Problems</u></p> <p>1) Box office movie earnings data problem (comparing geometric sequences and series, pg. 908 of Holt's "Algebra 2" book)</p> <p>2) Tetrahedral kite size problem (an investigation into arithmetic sequences and series, pg. 888 of Holt's "Algebra 2" book)</p>	<p>-Discovering patterns algebraically through tables and constructing an equation</p>
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