

Abbott Lawrence Academy 2017-2018 Curriculum Map:

Year at a Glance

Subject: Advanced Honors Algebra II Grade: 9

Unit Title	Time Allocation (# weeks based on 38 weeks in school year)	Essential Questions (for unit)	Core Text/Supplemental Learnings (include major references)	Performance Tasks (How will you know that students have mastered the taught concepts)
1. Fitting Functions to Tables	4 weeks (8wks)	<ul style="list-style-type: none"> · How can you tell whether there is a linear function that fits a given table? · How can you use differences to decide what type of function fits a given table? · What polynomial functions agrees with a given table? · How do you find a line that fits a set of data? · What is the definition of the line of best fit? · What is the line of best fit for the data in a table? · What is a recursive definition of a function? When is this type of definition useful? · What is the recursive definition of the factorial function? · What is the monthly payment on a loan for a certain amount of time given the interest rate? 	<ul style="list-style-type: none"> • CME Project: Algebra II Common Core • Engage New York: Algebra II • Kuta Mathematical Software • Edmodo: Virtual Classroom • Desmos Graphing Calculator 	<p>SWBAT answer the following types of questions:</p> <ul style="list-style-type: none"> · What polynomial functions agree with the table? · What is the line of best fit for the data in the table? · What is the monthly payment of a loan of \$10000 for 36 months with an interest rate of 5%? <p>Students will have to complete 'Mathematical Reflections' for the various investigations that have students think and write about how to:</p> <ul style="list-style-type: none"> · Find closed-form and recursive function definitions that fit tables and how to use difference tables to decide whether a linear or quadratic function fits a given table · Represent linear functions with some data sets, calculate the balance point for a data set and find the line of best fit · Evaluate recursive functions, including the factorial functions · Calculate the balance of a loan and solve for an unknown variable in a monthly payment situation <p>Students are responsible for a unit project that relies on using the learned skills to express the relationship of a loan based on the closed-form and/or recursive functions</p> <p>Assessments: Tests, quizzes, homework, classwork</p>
2. Functions and Polynomials	5 weeks	<ul style="list-style-type: none"> · What is a function? · How do you compose two functions to make a new function? · What function undoes a given function? · How can you find a polynomial that agrees with a table? · How can you find two different functions that agree with the same table? · What number comes next in a sequence? 	<ul style="list-style-type: none"> • CME Project: Algebra II Common Core • Engage New York: Algebra II • Kuta Mathematical Software • Edmodo: Virtual Classroom • Desmos Graphing Calculator 	<p>SWBAT answer the following types of questions:</p> <ul style="list-style-type: none"> · What function undoes $x \rightarrow 3x+7$? · What number comes next in the sequence 1, 4, 9...? · What is the greatest polynomial that can fit a table with four inputs? · Does $x^2 + 4$ factor over Z? <p>Students will have to complete 'Mathematical Reflections' for the various investigations that have students think and write about how to:</p> <ul style="list-style-type: none"> · Demonstrate whether a table, graph, or closed-form rule is a function, compose functions, find

		<ul style="list-style-type: none"> How are the zeros of a polynomial relate to its factors? How can you tell if two polynomials are equivalent without using the form-implies-function principle? What is the greatest polynomial that can fit a table? How do you factor nonmonic quadratics? How do you factor difference and sums of cubes? 		<p>the inverse of a function if it exists, and graph piecewise-defined functions</p> <ul style="list-style-type: none"> Use linear combinations of polynomials to determine new polynomials and find polynomials that agree with a given table Divide polynomials by linear polynomials and how to use the Remainder Theorem and the Factor Theorem. Factor polynomials by scaling, by finding roots, by using the sums and differences of squares and cubes, by grouping, and by identifying quadratic-like or cubic-like polynomials <p>Students are responsible for a unit project that relies on using the learned skills to read through a mathematical proof and make it their own to understand the reasons behind the steps.</p> <p>Assessments: 1 Unit Test At least 3 Unit Mini Quizzes 1 Unit Project</p> <ul style="list-style-type: none"> How to guide
<p>3. Complex Numbers</p>	<p>4 weeks</p>	<ul style="list-style-type: none"> What are complex numbers? How can you use complex numbers to solve any quadratic equation? How do you represent a complex number graphically? What is the graphical effect of adding two complex numbers? How are the magnitude and argument of the product of two complex numbers related to the magnitude and argument of the original numbers? 	<ul style="list-style-type: none"> CME Project: Algebra II Common Core Engage New York: Algebra II Kuta Mathematical Software Edmodo: Virtual Classroom Desmos Graphing Calculator 	<p>SWBAT answer the following types of questions:</p> <ul style="list-style-type: none"> What are two numbers have a sum of 20 and a product of 100? What is the graphical effect of multiplying a complex number by i? If $-2+i$ is a root of the polynomial $x^3+7x^2+17x+15$, what is another root? How can you graph the solutions to the equation $x^{10}-1=0$ on the complex plane without doing many calculations? <p>Students will have to complete 'Mathematical Reflections' for the various investigations that have students think and write about how to:</p> <ul style="list-style-type: none"> Calculate with complex numbers and use complex numbers as tools to solve equations Graph complex numbers as points and vectors on the complex plane Calculate magnitude and direction of the complex numbers Find relationships between magnitudes and arguments of factors and production as well as graph solutions to equations in the form $x^n-1=0$ <p>Students are responsible for a unit project that relies on using the learned skills to demonstrate the relationship between cyclotomic polynomials and integers.</p> <p>Assessments: Tests, quizzes, homework, classwork</p>

<p>4. Linear Algebra</p>	<p>6 weeks</p>	<ul style="list-style-type: none"> · Why is it possible to solve systems of linear equations in matrix form? · What is the process of Gaussian Elimination? · What is a dot product? How can you represent matrix multiplication using dot product? · What are some special cases in which $AB = BA$ is true for matrices A and B? · Is it true that a matrix associated with a reflection must be its own inverse? If so, what are some relationships that must hold for the entries a, b, c, and d in a 2×2 reflection matrix $R = ?$ · What is an absorbing state, and what does such a state look like in a transition matrix? 	<ul style="list-style-type: none"> • CME Project: Algebra II Common Core • Engage New York: Algebra II • Kuta Mathematical Software • Edmodo: Virtual Classroom • Desmos Graphing Calculator 	<p>SWBAT answer the following types of questions:</p> <ul style="list-style-type: none"> · Find x, y, and z such that $4x - y + 4z = 1$ $2x - y + 8z = 11$ $2x - 2y + 4z = 0$ · How can you solve this system of equations using matrix inverses? What is the solution? $x + 4y - z = -3$ $2x - 2y + z = 0$ $3x + y - 3z = -9$ · A transition matrix for a fixed population of 150 is . Does this matrix have a steady state? If so, what is it? If not, why not? <p>Students will have to complete 'Mathematical Reflections' for the various investigations that have students think and write about how to:</p> <ul style="list-style-type: none"> · Solve a system of three equations in three unknowns and use matrices and Gaussian Elimination to solve systems · Compute sums, differences, dot products, products, and inverses of matrices · Use matrix multiplication to describe geometric transformations and model situations that change over time · Use experimental data to compare the effect of two treatments <p>Students are responsible for a unit project that relies on using the learned skills to use special cases of the covered material to develop only the properties of determinant, trace, and transpose that will be part of <i>Pre-Calculus Common Core</i> using matrices and algebraic calculations.</p> <p>Assessments: Tests, quizzes, homework, classwork</p>
<p>5. Exponential and Logarithmic Functions</p>	<p>5 weeks</p>	<ul style="list-style-type: none"> · What is the Fundamental Law of Exponents? What are some of its corollaries? · How do you extend the laws of exponents to define zero, negative, and rational exponents? · For $f(x) = b^x$, why is it true that $f(m) \cdot f(n) = f(m+n)$? · Why must an exponential function have an inverse function? · What are some reason to use logarithms? · What is a logarithmic scale and when do you use it? 	<ul style="list-style-type: none"> • CME Project: Algebra II Common Core • Engage New York: Algebra II • Kuta Mathematical Software • Edmodo: Virtual Classroom • Desmos Graphing Calculator 	<p>SWBAT answer the following types of questions:</p> <ul style="list-style-type: none"> · What are the simplified forms of the expressions 4^0, 7^{-2}, and $5^{27/3}$? · If you invest \$1000 in an account at 6% interest, compounded annually, how much will you have after 30 years? · If you invest \$1000 in an account at 6% interest, compounded annually, how many years will it take until your money grows to \$10000? <p>Students will have to complete 'Mathematical Reflections' for the various investigations that have students think and write about how to:</p> <ul style="list-style-type: none"> · Develop the laws of exponents by extending from positive integers to include zero, negative, and rational numbers · Use sequences to explore exponents

				<ul style="list-style-type: none"> Graph exponential functions and write rules for exponential functions given a table of inputs and outputs or two points on the graph of the function Evaluate logarithms of any base, to use logarithms in solving exponential equations and to graph logarithmic functions <p>Students are responsible for a unit project that relies on using the learned skills to explore the functional equation that exponential functions satisfy: $f(x + y) = f(x) \cdot f(y)$ to build an understanding of how any function that satisfies this equation must behave.</p> <p>Assessments: Tests, quizzes, homework, classwork</p>
<p>6. Graphs and Transformations</p>	<p>4 weeks</p>	<ul style="list-style-type: none"> What are the basic graphs and their equations (parent functions)? What are the effects on both the graphs and their equations when the graphs are translated, stretched, shrunk, or reflected? Why do dilations commute under function composition? How do you compute the inverse of an affine translation? How do you use the computed inverse of affine transformation to graph the original equation? How do describe the effect of an affine transformation on an axis and the effect of changes in the axes on the graph of the equation? How you identify the fixed points of an affine transformation and the set of affine transformations that fix a particular point? 	<ul style="list-style-type: none"> CME Project: Algebra II Common Core Engage New York: Algebra II Kuta Mathematical Software Edmodo: Virtual Classroom Desmos Graphing Calculator 	<p>SWBAT answer the following types of questions:</p> <ul style="list-style-type: none"> How are the graphs of $y = x^2$ and $y = (x - 3)^2$ related? What does the graph of $(x + 1)^2 + (y - 3)^2 = 36$ look like? What does the graph of $-2y = x^3 - x$ look like? How do you transform an equation of the form $y = ax^3 + bx^2 + cx + d$ into one of the equations $y = x^3$, $y = x^3 + x$, or $y = x^3 - x$ by composing dilations and translations? How do you use the replacing-the-axes method to sketch the graph of $y = x^3 + 3x^2 - x + 4$? How do you use the replacing-the-axes method to explain the relationship between the graphs of $y = x^2$ and $y = (x - 3)^2$? What is the fixed point for $A_{(5,3)}$? <p>Students will have to complete 'Mathematical Reflections' for the various investigations that have students think and write about how to:</p> <ul style="list-style-type: none"> Relate the effects on a basic graph and on the equation of the graph of a translation, a scaling, or a reflection of the graph Write any composition of translations and dilations as an affine transformation and find the inverse of a dilatation, a translation, or an affine transformation Transform an equation into one the basic graphs, describe the effect of an affine transformation on an axis, and identify the fixed appoint on an affine transformation <p>Students are responsible for a unit project that relies on using the learned skills to identify the properties that define a group through it resembles abstract algebra. Students will receive practice with function composition, finding inverses for functions, and understanding mathematical definitions and notations.</p>

				Assessments: Tests, quizzes, homework, classwork
7. Sequences and Series	5 weeks	<ul style="list-style-type: none"> · How do you make a sum table for a function and write a closed-form rule for the sum column where appropriate? · How do you describe and use Gauss's method to find the sum of a sequence with a constant difference between successive terms? · How do you use Euclid's method to find the sum of a sequence with a constant ratio between successive terms? · How do you expand Σ notation or convert an expanded sum back to Σ notation? · How do you find closed-form expressions for indefinite sums and use them to evaluate definite sums? · Can you develop a list of Σ identities and recognize situations in which you can apply them? How? · Can you find closed-form expression for the series associated with a function? How? · How you find a closed-form representation for an arithmetic or geometric sequence and its associated series? · How do you determine whether a geometric sequence has a limit, and if it does, how do you find the limit? · How can you convert a repeating decimal into an exact fraction? · How do you generate Pascal's Triangle and evaluate the nth row, kth column entry as · How you notice and explain patterns in Pascal's Triangle? · How do you use the Binomial Theorem for expanding expression of the form n^n? 	<ul style="list-style-type: none"> • CME Project: Algebra II Common Core • Engage New York: Algebra II • Kuta Mathematical Software • Edmodo: Virtual Classroom • Desmos Graphing Calculator 	<p>SWBAT answer the following types of questions:</p> <ul style="list-style-type: none"> · Describe Gauss's method for summing all integers from 1 to n. · Find a formula for in terms of n. · Evaluate · What is ? · What is a recursive rule for the series associated with $f(n) = 3n + 6$ having initial term $f(0)$? · What is a closed form for the following recursive rule? · What is an arithmetic sequence? · What is a geometric sequence? · How do you write the repeating decimal 0.121212121212... as a fraction? · What is the sum of the entries in row 10 of Pascal's Triangle? · What is the expanded form of $(2d + 7)^9$? · What is the coefficient of $x^7 y^3$ in the expansion of $(x + y)^{10}$? <p>Students will have to complete 'Mathematical Reflections' for the various investigations that have students think and write about how to:</p> <ul style="list-style-type: none"> · Make a sum table for a function, write closed-form rules for the sum column, and use Σ notation · Use Gauss's method to find the sum of a sequence with constant differences and Euclid's method to find the sum of a sequence with constant ratios · Find closed-form definitions for indefinite sums and to use the definitions to evaluate definite sums, develop and use Σ identities, and find closed-form expression for the series associated with a function · Find closed-form for arithmetic and geometric sequences and their associated series · Generate Pascal's Triangle, to find and explain patterns in Pascal's Triangle, and to use the Binomial Theorem to expand expressions <p>Students are responsible for a unit project that relies on using the learned skills to use the line of best fit to derive the actual formula that their calculators use to find the line of best fit for a data set.</p> <p>Assessments: Tests, quizzes, homework, classwork</p>
8. Introductio n to	5 weeks	<ul style="list-style-type: none"> · How do you use right triangle trigonometry to find the coordinates of a person walking 	<ul style="list-style-type: none"> • CME Project: Algebra II Common Core • Engage New York: Algebra II 	<p>SWBAT answer the following types of questions:</p> <ul style="list-style-type: none"> · How can you extend the definitions of sine, cosine, and tangent to any angle, not just acute angles?

<p>Trigonometry</p>		<p>on the unit circle, given an angle through which an observer has turned?</p> <ul style="list-style-type: none"> · How do you evaluate the sine, cosine, and tangent function for any angle? · How do you solve equations involving trigonometric functions? · How do you sketch graphs of sine, cosine, and tangent and uses the graphs of trigonometric functions to solve problems? · How do you prove and use trigonometric identities? · How do you solve a triangle with the given information--to find all of its side lengths and angle measures? What information do you need to find all of a triangle's side lengths and angle measures? What information do you need to find the area of a triangle? · How do you state and use the Law of Sines, Law of Cosines, Heron's Formula? 	<ul style="list-style-type: none"> • Kuta Mathematical Software • Edmodo: Virtual Classroom • Desmos Graphing Calculator 	<ul style="list-style-type: none"> · If an angle is in Quadrant IV, what can you say about the sign of its sine, cosine, and tangent? · What is the relationship between the equation of the unit circle and the Pythagorean Identity? · What do the graphs of the sine and cosine functions look like? · Why does the tangent function have a period of 180°? · What is a simple rule for finding the value of $\cos(90^\circ + \theta)$? · A triangle has sides of length 5, 8, and 10. What is the measure of its largest angle? <p>Students will have to complete 'Mathematical Reflections' for the various investigations that have students think and write about how to:</p> <ul style="list-style-type: none"> · Review right angle trigonometry · Explore the relationships between points on a circle with radius 1 center at the origin and angles with vertex at the origin · Find the sine, cosine, and tangent of angles of any measure and to solve equations using trigonometric equations · Use the graphs of trigonometric functions to solve problems and to prove and use trigonometric identities · Solve a triangle · Prove and use the Law of Sines, Law of Cosines, and Heron's Formula <p>Students are responsible for a unit project that relies on using the learned skills to prove Brahmagupta's Formula reading the mathematics, figure it out, and write up results making their own proof.</p> <p>Assessments: Tests, quizzes, homework, classwork</p>
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