Advanced Algebra 3/4 Course Syllabus

Franklin High School	**2019-2020**
Course Title: Advanced Algebra 3/4	**Grade Level(s):** 9th, 10th, 11th, 12th

Prerequisites:
Completion of Algebra ½

Course description:

During this course, students will learn about the following topics:

1. Equations and Inequalities
2. Parent Graphs
3. Inverses
4. Logarithms and Exponentials
5. Complex numbers and roots
6. Polynomials
7. Rational expressions
8. Trigonometric functions
9. Statistics

Unit 1: Equations and Inequalities

Priority Standards:

HSA.CED.A.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*.

HSA.CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Supporting Standards:

HSA.REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

HSA.CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods*.

HSA.CED.A.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*.

Unit 2: Parent Graphs

Priority Standards:

HSF.IF.B.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*.*

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

HSF.IF.C.7.B Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

HSF.BF.B.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.

HSF.IF.B.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.**

Supporting Standards:

HSF.IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

HSA.SSE.B.3.A Factor a quadratic expression to reveal the zeros of the function it defines.

HSA.SSE.B.3.B Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

HSG.GPE.A.2 Derive the equation of a parabola given a focus and directrix.

HSF.BF.A.1 Write a function that describes a relationship between two quantities.*

Unit 3: Inverses

Priority Standards:

HSF.BF.B.4 Find inverse functions.

HSF.BF.B.4.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) =2 x3 or f(x) = (x+1)/(x-1) for $x \neq 1$*.

Unit 4: Logarithms and Exponentials

Priority Standards:

HSF.LE.A.4 For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and $d$are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

HSF.IF.C.7.E Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Supporting Standards:

HSF.IF.B.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*.*

HSF.IF.C.8.B Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)12^t$, $y = (1.2)^t/10$, and classify them as representing exponential growth or decay.

HSF.BF.A.1.A Determine an explicit expression, a recursive process, or steps for calculation from a context**.**

HSF.BF.A.1.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 relate these functions to the model*.

HSA.SSE.A.1.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*.

Unit 5: Complex Numbers and Roots

Priority Standards:

HSN.CN.A.1 Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.

HSN.CN.A.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

HSN.CN.C.7 Solve quadratic equations with real coefficients that have complex solutions.

Unit 6: Polynomials

Priority Standards:

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

HSA.APR.B.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

HSF.IF.C.7.C Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

Supporting Standards:

HSA.APR.B.2 Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.

HSA.APR.C.4 Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples***.**

HSA.SSE.A.1 Interpret expressions that represent a quantity in terms of its context.*

HSA.SSE.A.1.A Interpret parts of an expression, such as terms, factors, and coefficients.

HSA.SSE.A.1.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*.

HSF.IF.B.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*.*

HSF.BF.B.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

Unit 7: Rational Expressions

Priority Standards:

HSA.APR.D.6 Rewrite simple rational expressions in different forms; write $^{a(x)}/_{b(x)}$ in the form $q(x) + {}^{r(x)}/_{b(x)}$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.

Supporting Standards:

HSA.SSE.A.2 Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*

HSA.SSE.B.3.A Factor a quadratic expression to reveal the zeros of the function it defines.

HSN.RN.B.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 that the product of a nonzero rational number and an irrational number is irrational

Unit 8: Trigonometric Functions

Priority Standards:

HSF.TF.A.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

HSF.TF.B.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.*

HSF.IF.C.7.E Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Supporting Standards:

HSF.TF.A.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

HSF.TF.C.8 Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.

HSF.IF.B.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*.*

Unit 9: Statistics

Priority Standards:

HSS.ID.A.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve

Supporting Standards:

HSS.IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

HSS.IC.A.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model*?

HSS.IC.B.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

HSS.IC.B.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

HSS.IC.B.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

HSS.IC.B.6 Evaluate reports based on data.

Schedule of topics/units covered:

1. Equations and Inequalities
2. Parent Graphs
3. Inverses
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Differentiation/accessibility strategies and supports (TAG, ELL, SpEd, other):

Leveled, standards-based assessments with clear benchmarks for C-, B- and A-level work. Students will have practice problems that are leveled as well and provide opportunities for extensions in each learning target area.

Class time is time for feedback, group work, investigations, and demonstrating understanding. During this time the habits of interaction that will be encouraged and modeled include:
-Time to think independently before working collaboratively
-Time to explain your reasoning
-Demonstrating how to listen to understand in groups
-Exploring multiple pathways to solve problems
-Time to explore and compare logic in our ideas and thinking
-Time to critique and debate mathematically

Assessment (pre/post)/evaluation/grading policy:

Grades will be based the student's demonstration of understanding of the standards.

Standard Grading Scale:
90-100% - A
80-89% - B
70-79% - C
60-69% - D
59- below - F

Grades will be determined as follows:
Grades are based on total points based on demonstrated understanding of the material on assignments, quizzes, projects and tests.

Behavioral expectations:

Students will follow the norms as outlined in class. These include phones are off and away, students respect each other and the classroom, and that they are attentive to their work and learning.

Our classroom routine is designed to provide opportunities for students to move and talk while accessing the

content. Each day will provide time to get feedback, discuss new concepts, and practice what has been learned.

Students are expected to be in class on time and participate in all activities. In general, a student who follows the Franklin STRONG acronym as posted in the room, will be demonstrating great behavior.

Students and teachers will refer to the Franklin High School Student Climate Guide when addressing issues that arise.

Safety issues and requirements:

Students and teachers will refer to the Franklin High School Student Climate Guide when dealing with safety issues.