Glendale Unified School District

High School

April 16, 2019

Department: Mathematics

Course Title: Integrated Math IIIA – Accelerated (Summer Bridge B)

Course Code: 3515J/3516J

School(s)
Course Offered: Glendale High School

UC/CSU Approved
(Y/N, Subject):   No

Course Credits: 10, Full Year, elective credit Summer School only

Recommended
Prerequisite: Integrated Math II, teacher approval

Recommended
Textbook: *Core Connections Integrated III*
                         Judy Kysh, Evra Baldinger, Michael Kassarjian, Karen Wootton, et. al
                         CPM Educational Program
                         Second Edition, Version 5.0

Course Overview: Integrated Mathematics IIIA Accelerated is the summer bridge course for
                         students who have completed Integrated II and would like to accelerate
                         into Integrated IIIB/Precalculus Accelerated the following year. Integrated
                         IIIB/Precalculus is a year and a half course. Along with this course,
                         students will have completed all the standards in Integrated III and
                         Precalculus in one summer and one school year. This course will
                         strengthen and build on students' previous knowledge from Integrated
                         Mathematics I and II standards. This course will focus on polynomial
                         expressions and functions, quadratic functions and equations, rational
                         functions and equations, radical functions and equations.

Course content:

Unit 5: **Inverses and Logarithms**

STANDARDS
F-BF.3, F-BF-4, F-BF.4a, F-LE.4, F-LE.4.2, I-IF.7e

A.   Reversing is an important theme in the early part of this chapter. The first section introduces the concept of inverse relations. Students learn that reversing, or working backward to undo the action of a function, can create a new function. They explore multiple representations of functions and their inverses, and recognize that many functions have inverses that are not functions. In the second, students determine inverses of parent functions. They learn that the inverse of an exponential function is a logarithm. Reversing is emphasized once again as they learn how to convert exponential equations into logarithmic form, and vice versa. Students investigate the new family of logarithmic functions $f(x) = \log_b(x)$ for different values of b, test values on their calculators to determine the base the calculators work in, and learn to graph transformations of $f(x) = \log(x)$.

Progression of Content:
This chapter adds to students' lists of parent functions, which will continue to expand with the addition of polynomial functions in Unit 8 and trigonometric functions in Unit 9.

B.   Unit Assignment(s):
        Mathematics Practices used in Unit 5:
- Students will look for and make use of structure and construct viable arguments as they develop and justify strategies for undoing functions and as they investigate different bases for logarithms..
- Students will use appropriate tools strategically and look for and make use of structure when they graph inverses of functions and write their equations.
- Students will look for and make use of structure as they verify inverses using multiple representations, and attend to precision as they restrict the domain of a function to ensure that its inverse is also a function.
- Students will construct viable arguments and critique the reasoning of others and look for and make use of structure as they apply their knowledge of parent graphs and inverses to learn about logarithms.
- Students will look for and make use of structure and express regularity in repeated reasoning as they learn the definition of logarithm and calculate the values of logarithms.
- Students will construct viable arguments and critique the reasoning of others, use appropriate tools strategically, and look for and make use of structure as they investigate logarithms with different bases.

Sample Activities:

Guess My Number Game - Students are asked to guess the number the teacher is thinking of based on the order of operations applied to the number and what the mystery number has ultimately transformed into. Students may or may not write an equation, but you may want to encourage them to do so as it will help when they progress to working with functions and inverses. Making sure that the idea of reversing, or undoing, comes up in the discussion of the "Guess My Number" game. You undo each step, reversing the original Order of Operations.

Graph the Inverse Function - Students will be looking at strategies for creating graphs of inverse functions. The first two graphs have functions that they are capable of finding the equation of their inverse functions but the third function does not lend itself to be solved for the inverse function. Teams could make a mini-table of some coordinates from the graph and then use it to help make a mini-table for the inverse graph. Students will soon discover that the line $y = x$ is the line of symmetry.

Unit 7: **Logarithms and Triangles**

STANDARDS
F-LE.3, F-LE.4, F-LE.4.1, F-LE.4.3, A-SSE.2, F-BF.1, F-IF.7e, G-SRT.9+, G-SRT.10+, G-SRT.11+

A.   In this unit, students return to their work with logarithms to develop tools they can use when solving application problems involving exponential equations. In the first half of this unit, students investigate the family $y = \log(m^n)$ and discover the Power Property of Logarithms, which allows them to solve exponential equations by using logs to undo or rewrite the equation. Students generalize from number patterns to make conjectures about other properties of logarithms and then prove these properties. Furthermore, students develop and share strategies to write the equation of the exponential function with a given asymptote that passes through two given points. Then they use that equation to make predictions.

The remainder of this unit focuses on completing a tool kit for calculating missing parts of non-right triangles. Students identify the types of information needed to determine all of the missing sides and angles of a triangle. Through this exercise, students also identify triangles for which they do not yet have the tools to determine missing parts. Students notice that they *do* have enough tools to calculate the measures and side lengths of right triangles. This leads to the question, "*What if the triangle is not a right triangle?*" Students then develop the Law of Sines and Law of Cosines so that they have a complete set of tools to determine the other missing parts of any triangle (when sufficient information is provided).

The unit concludes with students looking at different application problems using triangles and identifying which tools are most useful in each situation. In addition, students investigates the ambiguous case of triangles: SSA. This lesson is offered for accelerated classes or those that could benefit from a complete view of the relationships between the

sides and angles of a triangle. Working through the problems of this lesson before you decide to use the lesson with your students is highly recommended.

Progression of Content:
The work with logarithms in this unit prepares students for future work in a pre-calculus course. Working with Law of Sines and Cosines and reviewing the use of right triangle trigonometry and special right triangles prepares students for working with the trigonometric family of functions in Unit 9.

B.   Unit Assignment(s):
        Mathematics Practices used in Unit 7:
        • Students will look for and make use of structure and express regularity in repeated reasoning while they develop the Power Property of Logarithms, learn other properties of logs and how to rewrite equations with different bases.
        • Students will make sense of problems and reason abstractly and quantitatively as they write the equation of an exponential function given two points and an asymptote.
        • Students will make sense of problems and persevere in solving them, model with mathematics, and reason abstractly and quantitatively as they explore exponential functions with an asymptote other than $y = 0$ and apply logarithms to solve an exponential equation.
        • Students will make sense of problems and persevere in solving them as they figure out what information they need to solve for parts of triangles. They will need to attend to precision as they communicate what they know and do not know.
        • Students will look for and express regularity in repeated reasoning as they develop the ratios for the Law of Sines.
        • Students will make sense of problems and persevere in solving them using the Law of Cosines.
        • Students will attend to precision as they work with triangles involving the SSA relationship. They must also use appropriate tools strategically as they explore the ambiguous case of the Law of Sines.
        • Students will reason abstractly and quantitatively as they make sense of problems and persevere in solving them. They will attend to precision as they solve the problems and communicate within their teams, labeling diagrams, attending to units, and calculating their answers accurately.

Sample Activities:
"The Case of the Cooling Corpse" - a problem in which students model the falling temperature of a corpse to establish time of death and solve a murder mystery. In order to solve the mystery, students will need to decide which information is relevant to solving the problem (e.g., body temperature, times listed on sign-in sheets, etc.). Students will need to write and solve a system of exponential functions, with a horizontal asymptote representing the room temperature, the independent variable as time, and the dependent variable as the temperature of the body.

Solving Triangles - This activity consists of eight independent triangle problems (suggestion is to assign one problem to a group of 3-4 students) that will provide students with a chance to consolidate their understanding of the various tools and strategies they have developed so far to solve triangle problems. Some problems may be solved using the Law of Sines, Law of Cosines, or a combination of both. Students will present their assigned problem to the entire class and their process for solving the assigned problem.

Unit 8: **Polynomials**

STANDARDS
A-APR.1, A-APR.2, A-APR.4, A-APR.6, A-APR.3, F-IF.4, F-IF.7c, N-CN.8+, N-CN.9+, A-SSE.2, A-CED.2, F-BF.1

A.   In the first section, students will investigate the equation $\leftrightarrow$ graph connections for polynomial functions. They will recognize that equations in factored form are much easier to sketch, and they will understand the relationship between the factors and the x-intercepts of the graph. Then, in the second section, they will develop an understanding of imaginary and complex numbers and recognize that polynomial functions can have complex roots. In the third and last section, they will learn to divide polynomials by a known factor to find other factors. This will allow them to determine complex and irrational roots of some cubic and quartic functions.

Progression of Content:
Students will build on their understanding of function families in Unit 9, where they study trigonometric functions and transform the graphs of sine and cosine functions. Students will use their algebra skills when they study rational expressions in Unit 11. Students will also use their algebra skills when they prove formulas for sums of series in Unit 10 and solve trigonometric identities in Unit 12.

B.   Unit Assignment(s):
Mathematics Practices used in Unit 8:
- Students will make sense of problems and persevere in solving them and construct viable arguments and critique the reasoning of others as they discuss factored form and describe the graphs of polynomials and their understanding of the stretch. Students will also look for and make use of structure as they draw graphs of polynomials.
- Students will look for and make use of structure as they continue their polynomial investigation. Students will also construct viable arguments and critique the reasoning of others as they consolidate their results on polynomials.
- Students will make sense of problems and persevere in solving them and construct viable arguments and critique the reasoning of others as they develop their understanding of a stretch factor. Student will also model with mathematics as

they develop an equation for the roller coaster problem first introduced in the first lesson of Unit 8.

- Students will look for and make use of structure as they use polynomial division to determine factors of polynomials. Students will also construct viable arguments and critique the reasoning of others as they develop their understanding of polynomial division.
- Students will look for and make use of structure as they use complex roots to write equations of quadratic functions and express regularity in repeated reasoning as they identify polynomial identities to help them factor. Students will also look for and express regularity in repeated reasoning as they identify patterns in the sums and products of complex roots.
- Students will make sense of problems and persevere in solving them and construct viable arguments and critique the reasoning of others when they determine all roots of a polynomial with a degree greater than two and when they determine all roots of a polynomial with a degree greater than two.

Sample Activities:

Polynomial Function Investigation - Students are instructed to look for, label, and describe the x-intercepts and "bounces" (double roots, although students will probably not use this term), the y-intercept, the number of turns, and the behavior of graphs for very large and very small x-values. They should share and discuss all of their graphs and their observations within their teams. The discussion should lead to conjectures and the creation of several new equations to try. Students are coming up with methods for determining the x- and y-intercepts, predictions about the numbers of crossings of the x-axis, and ideas for determining a reasonable window or maximum and minimum approximations.

Game of Polydoku - By treating division as a puzzle and using the organizational device of an area model, students can use logical reasoning to reverse the multiplication process and figure out a missing factor. Once they have worked through the process several times, they should be able to set up and solve their own division problems. This method is as efficient as (if not more efficient than) polynomial "long division" and you can use it to develop synthetic division if that is part of your curriculum. This game introduces polynomial division by challenging students to reverse the process of polynomial multiplication.

Unit 11: **Rational Expressions and Three-Variable Systems**

STANDARDS
A-APR.7+

A. In this chapter, students will focus on operations with rational expressions. Students did a function investigation in Unit 1 that previewed the investigation of rational expressions. Students learn a powerful method of simplifying rational expressions that uses properties of the number 1 and the properties of exponents. In a previous course,

students learned to solve a system of two linear equations in two variables, and they reviewed this topic in Chapter 3 of this text.

Progression of Content:

The remaining chapter requires students to use their algebra skills to solve trigonometric identities. In future courses, students may use matrices to solve systems of equations.

B.   Unit Assignment(s):

Mathematics Practices used in Unit 11:

- Students will look for and make use of structure as well as look for and express regularity in repeated reasoning as they use the number 1 to understand rational expressions.
- Students will also look for and make use of structure as well as look for and express regularity in repeated reasoning as they connect multiplication and division of fractions to that of rational expressions.
- Students will look for and make use of structure as they make connections between adding and subtracting fractions and adding and subtracting rational expressions, and as they locate points in three-dimensional space. They will construct viable arguments and critique the reasoning of others as they justify their strategies.
- Students will continue to look for and make use of structure as well as look for and express regularity in repeated reasoning as they work with rational expressions. They will construct viable arguments and critique the reasoning of others as they investigate the closure of rational expressions under operations.
- Students will reason abstractly and quantitatively and look for and express regularity in repeated reasoning as they write the equation of a quadratic function by solving a system of three equations with three unknowns.

Sample Activity:

Giant One - Students are encouraged to rewrite rational expressions to create fractions that will reduce to one. The new expressions will be reduced to its simplest form. This strategy to rewrite will allow students to simplify rational expression after doing basic operations on the original expressions.