Date Approved by DJUSD Board of Education: _____

Davis Joint Unified School District

Course descriptions are updated and reviewed with all new text adoptions.

Secondary Course Description

COVER PAGE

1. Course Title: Integrated Mathematics III	**2. Transcript Title / Abbreviation: Int. Math III**
3. Transcript Course Code / Number (Office Use Only):	**4. School: Davis Senior High School, Harper Junior High School, Holmes Junior High School, Emerson Junior High School, Da Vinci Junior and High School, Davis School for Independent Study, King High School**
5. District: Davis Joint Unified School District	**6. Length of Course: One Year – Fall/Spring**
7. School / District Web Site: http://www.djusd.net	**8. School Contact** Name: Stephanie Gregson Title/Position: Director, Curriculum & Instruction Phone: 530/757-5300 Ext.: 150 Fax: E-mail: sgregson@djusd.net

9. Subject Area:

☐ History/Social Science ☐ English ☒ Mathematics

☐ Science ☐ Language other than English ☐ Visual & Performing Arts

☐ DJUSD Graduation Elective ☐ College Prep Elective (will seek UC/CSU approval)

10. Grade Level(s): 9-12	**11. Seeking "Honors" Distinction?** ☐ Yes ☒ No

12. Credit Value:

☐ 0.5 (half year or semester equivalent) ☒ 1.0 (one year equivalent)

☐ 2.0 (two year equivalent) ☐ Other: _____

13. Was this course previously approved by UC? ☐ Yes ☒ No

If so, in what year? _____ **Under what course title?** _____

14. Pre-Requisites: Integrated Mathematics II

Co-Requisites: None

15. Preliminary Approval - Secondary Site Principal Signature (Must be signed before proceeding to Step 16):

_____

16. Date Course Proposal with Preliminary Approval (Step 15) sent to Associate Superintendent, Educational Services: _____

17. Review & Approval:

Date		**Signature**
_____	**Site Curriculum and Instruction Leadership Team**	**Signature/Title** _____
_____	**Secondary Department Articulation/Collaboration**	**Signature/Title** _____

Secondary Principals Signatures: _____ _____

Date: _____ _____ _____

BACKGROUND INFORMATION

In 2010 the California State Department of Education adopted the Common Core State Standards for Mathematics. The goal of the Common Core State Standards for Mathematics is
for students to be college and career ready upon graduation from high school and to assist students in becoming competitive in a global economy. Therefore, the Common Core State Standards for Mathematics provide not only for rigorous curriculum and instruction, but also conceptual understanding, procedural skill and fluency and the ability to apply mathematics. Students will develop the skills to be able to problem-solve creatively and not be satisfied by just arriving at an answer, thus meeting the challenges of the 21st century.

These new Standards for Mathematics have been developed to provide students with the knowledge, skills, and understanding in mathematics to be college and career ready when they complete high school. They are internationally benchmarked and assist students in their preparation for enrollment at a public or private university.

The Common Core State Standards for Mathematics include two types of standards:
1. Eight Standards for Mathematical Practice that are the same in each grade level and high school mathematics course.
2. Mathematical Content Standards that are organized into high school courses.
"Together these standards address both 'habits of mind' that students should develop to foster mathematical understanding and expertise and skills and knowledge – what students need to know and be able to do. The mathematical content standards were built on progressions of topics across a number of grade levels, informed both by research on children's cognitive development and by the logical structure of mathematics."

Adapted from California Common Core State Standards – Mathematics
Introduction, page 2

In August of 2014, Davis Joint Unified went through a process with all of the secondary math teachers to determine the pathways for implementation of the Common Core State Standards. Through this process it was unanimously decided to follow the Integrated Pathway to help our students become college and career ready along with having a cohesive TK-12 math program for all of our students.

The Integrated Pathway is made up of three courses (Mathematics I, II, and III). The integrated mathematics courses follow the structure began in the K-8 standards of presenting mathematics as a multifaceted, coherent subject, and is the way most other high performing countries present higher mathematics. Each course is comprised of standards selected from the six high school conceptual categories, which were written to encompass the scope of content and skills to be addressed throughout grades 9–12 rather than through any single course. By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. They have defined, evaluated, and compared functions, and used them to model relationships between quantities. Students have worked with radicals and applied the laws of exponents to situations involving integer exponents.

Context for Course: List the State/District Standards addressed in this course.
See attached Standards Sheet.

History of Course Development: See Background Information.

COURSE GOALS AND/OR MAJOR STUDENT OUTCOMES

Description of how this course supports district goal to increase student awareness and appreciation of diversity:

COURSE OBJECTIVES

It is in the Mathematics III course that students integrate and apply the mathematics they have learned from their earlier courses. This course includes standards from the conceptual categories of Number and Quantity, Algebra, Functions, Geometry, and Statistics and Probability. Some standards are repeated in multiple higher mathematics courses; therefore instructional notes, which appear in brackets, indicate what is appropriate for study in this particular course. Standards that were limited in Mathematics I and Mathematics II no longer have those restrictions in Mathematics III.

For the Mathematics III course, instructional time should focus on four critical areas: (1) apply methods from probability and statistics to draw inferences and conclusions from data; (2) expand understanding of functions to include polynomial, rational, and radical functions; (3) expand right triangle trigonometry to include general triangles; and (4) consolidate functions and geometry to create models and solve contextual problems.

COURSE OUTLINE

Integrated Mathematics III
Course Outline

Number and Quantity
The Complex Number System
☐ Use complex numbers in polynomial identities and equations.
Algebra
Seeing Structure in Expressions
☐ Interpret the structure of expressions.
☐ Write expressions in equivalent forms to solve problems.
Arithmetic with Polynomials and Rational Expressions
☐ Perform arithmetic operations on polynomials.
☐ Understand the relationship between zeros and factors of polynomials.
☐ Use polynomial identities to solve problems
☐ Rewrite rational expressions.
Creating Equations
☐ Create equations that describe numbers or relationships.
Reasoning with Equations and Inequalities
☐ Understand solving equations as a process of reasoning and explain the reasoning.
☐ Represent and solve equations and inequalities graphically.
Functions
Interpreting Functions
☐ Interpret functions that arise in applications in terms of the context
☐ Analyze functions using different representations.
Building Functions
☐ Build a function that models a relationship between two quantities.
☐ Build new functions from existing functions.
Linear, Quadratic, and Exponential Models
☐ Construct and compare linear, quadratic, and exponential models and solve problems.
Trigonometric Functions
☐ Extend the domain of trigonometric functions using the unit circle.
☐ Model periodic phenomena with trigonometric functions.
Geometry
Similarity, Right Triangles, and Trigonometry
☐ Apply trigonometry to general triangles.
Expressing Geometric Properties with Equations

☐ Translate between the geometric description and the equation for a conic section.

Geometric Measurement and Dimension

☐ Visualize relationships between two-dimensional and three-dimensional objects.

Modeling with Geometry

☐ Apply geometric concepts in modeling situations.

Statistics and Probability

Interpreting Categorical and Quantitative Data

☐ Summarize, represent, and interpret data on a single count or measurement variable.

Making Inferences and Justifying Conclusions

☐ Understand and evaluate random processes underlying statistical experiments.

☐ Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

Using Probability to Make Decisions

☐ Use probability to evaluate outcomes of decisions.

TEXTS AND SUPPLEMENTAL INSTRUCTIONAL MATERIALS

Integrated Math III: *Core Connections, Integrated III,* CPM (2014)

Previously Adopted? ☐ **Yes** [X] **No (If no, provide information directly below)**

Cost per book TBD	**Total Cost TBD**	**Budget Source: Instructional Materials Budget**

DIFFERENTIATED INSTRUCTIONAL METHODS AND/OR STRATEGIES

Strategies for Supporting School Goal of Improving Writing Skills:
Certain assignments have required written components, requiring original expression and articulating reasoning for problem solving.

ASSESSMENT METHODS AND/OR TOOLS

Pre and Post tests
Formative Assessments
Benchmark Assessments
Summative Assessments
Performance Tasks
Written work
Observation record of student performance
Completion of assignments and worksheets

ASSESSMENT CRITERIA

Students are presented with course criteria and necessary skills and concepts. This is followed by formative assessments, benchmark assessments and summative assessments with diverse types of performance tasks. Learning is successive, providing students opportunities for mastery over the course of the year.

HONORS COURSES ONLY

Sequence Participation

Describe what sequence this course would be a part of, and what role in the sequence this course plays.

This course is part of the continued sequence of Common Core Mathematics in the Integrated Pathway.

Post-Secondary Articulation

Indicate what post-secondary articulation this sequence offers: is this course part of a pathway that results in certification or college credit?

The sequence of courses is articulated with CSU and UC systems.

M3 Mathematics III

Number and Quantity

The Complex Number System — N-CN

Use complex numbers in polynomial identities and equations. [Polynomials with real coefficients; apply N.CN.9 to higher degree polynomials.]

8. (+) Extend polynomial identities to the complex numbers.
9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Algebra

Seeing Structure in Expressions — A-SSE

Interpret the structure of expressions. [Polynomial and rational]

1. Interpret expressions that represent a quantity in terms of its context. ★
   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. ★
2. Use the structure of an expression to identify ways to rewrite it.

Write expressions in equivalent forms to solve problems.

4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.* ★

Arithmetic with Polynomials and Rational Expressions — A-APR

Perform arithmetic operations on polynomials. [Beyond quadratic]

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.

Understand the relationship between zeros and factors of polynomials.

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 $p(x)$.
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.

Use polynomial identities to solve problems.

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.*
5. (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.[1]

Note: ★ Indicates a modeling standard linking mathematics to everyday life, work, and decision-making.(+) Indicates additional mathematics to prepare students for advanced courses.

1. The Binomial Theorem may be proven by mathematical induction or by a combinatorial argument.

Rewrite rational expressions. [Linear and quadratic denominators]

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.

7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Creating Equations — A-CED

Create equations that describe numbers or relationships. [Equations using all available types of expressions, including simple root functions]

1. Create equations and inequalities in one variable **including ones with absolute value** and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* **CA** ★

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

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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* ★

4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. ★

Reasoning with Equations and Inequalities — A-REI

Understand solving equations as a process of reasoning and explain the reasoning. [Simple radical and rational]

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

Represent and solve equations and inequalities graphically. [Combine polynomial, rational, radical, absolute value, and exponential functions.]

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. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★

Functions

Interpreting Functions — F-IF

Interpret functions that arise in applications in terms of the context. [Include rational, square root and cube root; emphasize selection of appropriate models.]

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.* ★

5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. ★
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. ★

Analyze functions using different representations. [Include rational and radical; focus on using key features to guide selection of appropriate type of model function.]

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★
   b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. ★
   c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. ★
   e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. ★
8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Building Functions F-BF

Build a function that models a relationship between two quantities. [Include all types of functions studied.]

1. Write a function that describes a relationship between two quantities. ★
   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.* ★

Build new functions from existing functions. [Include simple, radical, rational, and exponential functions; emphasize common effect of each transformation across function types.]

3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.*
4. Find inverse functions.
   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, $f(x) = (x + 1)/(x - 1)$ for $x \neq 1$.*

Linear, Quadratic, and Exponential Models F-LE

Construct and compare linear, quadratic, and exponential models and solve problems.

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. ★ [Logarithms as solutions for exponentials]

4.1. Prove simple laws of logarithms. CA ★

4.2 Use the definition of logarithms to translate between logarithms in any base. CA ★

4.3 Understand and use the properties of logarithms to simplify logarithmic numeric expressions and to identify their approximate values. CA ★

Trigonometric Functions F-TF

Extend the domain of trigonometric functions using the unit circle.

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

2.1 Graph all 6 basic trigonometric functions. CA

Model periodic phenomena with trigonometric functions.

5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★

Geometry

Similarity, Right Triangles, and Trigonometry G-SRT

Apply trigonometry to general triangles.

9. (+) Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.
11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Expressing Geometric Properties with Equations G-GPE

Translate between the geometric description and the equation for a conic section.

3.1 Given a quadratic equation of the form $ax^2 + by^2 + cx + dy + e = 0$, use the method for completing the square to put the equation into standard form; identify whether the graph of the equation is a circle, ellipse, parabola, or hyperbola and graph the equation. [In Mathematics III, this standard addresses only circles and parabolas.] **CA**

Geometric Measurement and Dimension G-GMD

Visualize relationships between two-dimensional and three-dimensional objects.

4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Modeling with Geometry G-MG

Apply geometric concepts in modeling situations.

1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★

2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★
3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★

Statistics and Probability

Interpreting Categorical and Quantitative Data — S-ID

Summarize, represent, and interpret data on a single count or measurement variable.

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. ★

Making Inferences and Justifying Conclusions — S-IC

Understand and evaluate random processes underlying statistical experiments.

1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. ★
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?* ★

Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. ★
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. ★
5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. ★
6. Evaluate reports based on data. ★

Using Probability to Make Decisions — S-MD

Use probability to evaluate outcomes of decisions. [Include more complex situations.]

6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). ★
7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). ★