Chino Valley Unified School District
High School Course Description

CONTACTS	
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A. COVER PAGE - COURSE ID	
1. Course Title:	Integrated Mathematics 3
2. Transcript Title/Abbreviation:	Int Math 3
3. Transcript Course Code/Number:	5118
4. Seeking Honors Distinction:	Yes
5. Subject Area/Category:	Meets the UC "c" Mathematics requirement
6. Grade level(s):	9-12
7. Unit Value:	5 credits per semester/10 total credits – math
8. Was this course previously approved by UC?	Yes
9. Is this course classified as a Career Technical Education course:	No
10. Is this course modeled after an UC-approved course?	Yes
11. Repeatable for credit?	Yes
12. Date of Board Approval:	June 11, 2015
13. Brief Course Description: Integrated Math 3 is the third course of a three course series which includes all of the common core state standards. It builds and strengthens students' conceptual knowledge of tools of geometry, similarity through transformations, symmetry, congruence through transformations, trigonometry, quadratic functions, polynomials and quadratics functions, and their inverses. Integrated Math 3 also includes linear relations and functions, systems of equations, polynomials and their functions, radical functions and relations, exponential and logarithmic functions, and a continued study of statistics.	
14. Prerequisites:	Integrated Mathematics 2
15. Context for Course: Daily class work is designed around structured tasks. The lessons involve opportunities for students to work individually and cooperatively, to make sense of problems and persevere in solving them, reason abstractly and quantitatively, construct viable arguments and critique the reasoning of others, model with mathematics, use appropriate tools strategically, attend to precision, look for and make use of structure, and look for and express regularity in repeated reasoning. Students will share their mathematical thinking, and develop their ability to think critically and problem solve. Students will daily use at least one of the eight standards of Mathematical Practice.	
15. Textbooks:	McGraw-Hill – Integrated Math 3
16. Supplemental Instructional Materials:	

B. COURSE CONTENT

Course Purpose:

The purpose of Integrated Math 3 is to develop students' ability to think mathematically and develop their conceptual understanding of and procedural fluency in mathematics. Integrated Math 3 will extend the mathematics students learned in earlier grades and continue the development of concepts in Number and Quantity, Algebra, Functions, Modeling, Geometry, and Statistics and Probability needed for higher level mathematics courses. Extensive use of models/real-world situations, manipulatives, graphs, and diagrams will help students see the connections between different topics which will promote students' view that mathematics is a set of related topics as opposed to a set of discrete topics. In addition, students will learn to solve problems graphically, numerically, algebraically, and verbally and make connections between these representations. Students in this course will learn to use mathematical models to understand real world events and situations, and use algebraic reasoning to manipulate these models for deeper learning.

Course Guide:

Unit 1: Equations and Inequalities

Learning objectives:

- Use expressions and formulas to model and solve real world applications
- Explore the properties of real numbers
- Use modeling to solve equations and inequalities
- Evaluate and solve absolute value equations and inequalities

Unit 2: Linear Relations and Functions

Learning objectives:

- Analyze relations and functions, including interpreting graphs and tables
- Explore linear relations and functions, including interpreting key features in graphs and tables
- Write and graph linear equations
- Calculate and interpret average rate of change
- Create and analyze linear equations
- Write, graph and interpret piece wise defined functions, step functions, and absolute value functions
- Identify parent functions and understand the transformations as well as how to graph them
- Graph and analyze absolute value inequalities and linear inequalities
- Solve systems of equations utilizing multiple methods
- Solve systems of inequalities by graphing and interpret the solutions

Unit 3: Polynomials and Polynomial Functions

Learning objectives:

- Use the laws of exponents to simplify monomial expressions
- Multiply and divide monomial expressions involving exponents
- Add, subtract, and multiply polynomials
- Determine which strategy to use when dividing polynomials
- Use polynomial long division to find the quotient of two polynomials
- Use synthetic division to find the quotient of two polynomials
- Determine the left and right behaviors of a polynomial functions
- Use the remainder theorem to find all zeros of a polynomial function
- Use the remainder theorem to determine the value of a function when X is given
- Graph a polynomial function
- Determine the minimum degree of a polynomial function given the graph of the function

- Find the relative maxima and minima of a polynomial function
- Factor polynomial
- Solve polynomial equations by factoring
- Find all zeros of a polynomial function by factoring
- Determine the interval in which the value of a function is increasing, decreasing, constant, positive or negative
- Determine the symmetry of a polynomial functions
- Prove polynomial identities
- Use the factor theorem to determine whether a binomial is a factor of a larger polynomial
- Use the fundamental theorem of algebra to determine the number of zeros a function has
- Use the rational zero test to find all possible rational zeros of a polynomial function
- Find all zeros of a function using synthetic substitution
- Know and apply the Binomial Theorem for the expansion of a binomial to a power greater than one using Pascal's Triangle

Unit 4: Inverses and Radical Functions and Relations

Learning objectives:

- Add, subtract, and multiply functions
- Find composite functions
- Find the inverse of a function or relation
- Determine whether a function is one-to-one
- Verify two functions are inverses of each other
- Graph radical functions
- Find the range and domain of radical functions
- Graph radical inequalities
- Solve radical equations
- Determine if a solution to a radical equation is extraneous
- Simplify radicals using the properties of radicals
- Use a calculator to approximate the value of a radical
- Use the properties of radicals to simplify a radical expression
- Add, subtract, multiply, and divide radical expressions
- Use rational exponents to simplify expressions
- Rewrite a radical function using rational exponents
- Solve equations involving rational exponents
- Solve inequalities involving rational exponents

Unit 5: Logarithmic Functions and Relations

Learning objectives:

- Evaluate logarithmic expressions
- Graph logarithmic functions using various methods
- Find the range and domain of logarithmic functions
- Use the properties of logarithms to rewrite a single log as the sum or difference of logs
- Use the properties of logarithms to condense the sum or difference of logs to a single statement
- Solve logarithmic equations using the one to one property
- Solve logarithmic inequalities using the one to one property
- Use the base change formula to evaluate a log of any base
- Use the properties of logarithms to solve logarithmic equations

- Solve exponential and logarithmic functions graphically
- Evaluate natural logarithms
- Solve exponential equations involving the number **e**
- Use logarithms to solve exponential equations
- Use logarithms to solve word problems involving exponential functions
- Solve problems involving the compound interest formulas
- Choose the best model to fit data (exponential vs. quadratic etc.)
- Derive the formula for the sum of a finite geometric series and use the formula to solve real-world problems

Unit 6: Rational Functions and Relations

Learning objectives:

- Perform operations with rational expressions
- Simplify rational and complex expressions
- Apply properties of exponents to simply rational expressions and perform operations
- Understand that rational expressions form a system analogous to the rational numbers, closed under attrition, subtraction, multiplication, and division by a nonzero rational expression
- Graph and interpret rational functions, including determining asymptotes and domain and range
- Apply transformations of parent functions
- Analyze and solve rational equations and inequalities

Unit 7: Conic Sections

Learning objectives:

- Identify a conic section given an equation in standard form
- Graph a quadratic equation given a focus and directrix
- Given a graph, locate the focus and directrix of a quadratic equation
- Graph a circle given the general form of an equation
- Derive the equation of a circle given the endpoints of the diameter and/or radius
- Model real-world situations using the equation of a circle

Unit 8: Statistics and Probability

Learning objectives:

- Understand statistics as a process for making inferences about population parameters based on a random sample from that population
- Design statistical studies
- Recognize the purposes of and differences among sample surveys, experiments, and observational studies
- Explain how randomization relates to each
- 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
- Use data from a randomized experiment to compare two treatments
- Use simulations to decide if differences between parameters are significant
- Evaluate reports based on data
- Use probabilities to make fair decisions
- Analyze decisions and strategies using probability concepts

Unit 9: Introduction to Trigonometry and Trigonometric Functions

Learning objectives:

- Graph all six basic trigonometric functions

- Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline
- Utilize the unit circle to evaluate the six basic trigonometric functions
- Understand radian measure of an angle as the length of the arc on the unit circle subtended by the central angle
- Find co-terminal angles to evaluate periodic functions
- Simplify trigonometric functions using the reciprocal identities, quotient identities and Pythagorean identities
- Determine the quadrant in which the terminal of side of an angle resides
- Utilize reference angles to evaluate trigonometric functions

Unit 10: Modeling with Geometry

Learning Objectives:

- Apply geometric methods to solve design problems such as designing an object to satisfy physical constraints or minimize cost and working with typographic grid systems based on ratios
- Discover the formulas for surface area and volume of solids
- Identify the shapes of two dimensional cross sections of three dimensional objects and identify three dimensional objects generated by the rotation of two dimensional objects

Key Assignments:

Modeling Exponential Growth and Decay Functions with M&M's.

Instructional Methods and/or Strategies:

- Guided Inquiry/Problem Based Learning
- Direct Instruction
- Kagan Cooperative Learning Structures
- Discourse
- Use of Visual Representations and Concrete Models
- Guided Inquiry

A variety of instructional strategies will be used throughout Integrated Math 3. Instructional strategies will be utilized during whole group instruction, small group instruction, partner/pair work, and individual work. The key goal of instruction is to challenge students to think about and discuss mathematics while using the eight standards for Mathematical Practice.

The standards for Mathematical Practice emphasize the importance of making sense of problems and persevering in solving them (MP 1), reasoning abstractly and quantitatively (MP 2), and solving problems that are based upon everyday life, society, and the workplace (MP 4). Implicit instruction models such as guided inquiry provide students with the time and support to successfully engage in mathematical inquiry by collecting data and testing hypothesis.

During guided inquiry, the teacher provides the data and then questions students to help them arrive at a solution to the problem. The teacher utilizes this strategy throughout each unit to encourage students to explore and make sense of mathematical situations. Content especially suited to the use of this strategy involves functions with patterns and geometric relationships.

Problem Based Learning:

In problem based learning, the teacher poses a problem or question, assists when necessary, and monitors students' methods and solutions. During the use of this strategy students work either individually or in cooperative groups to solve challenging problems with real world applications Throughout problem-based learning teachers encourage students to think for themselves and show resourcefulness and creativity. When students engage in problem solving they must be allowed to make mistakes. The teacher creates a classroom environment that recognizes errors and uncertainties as inevitable accoutrements of problem solving. Through class discussion and feedback, student errors become the basis of furthering understanding and learning. Problem based learning will be utilized during the introduction of a concept as well as at the end of a unit of study.

Direct Instruction:

Direct instruction is highly structured and sequential strategy. It is effective for teaching information and basic skills during whole class instruction. In the first phase the teacher introduces, demonstrates, or explains the new concept or strategy, asks questions, and checks for understanding. The second phase is an intermediate step designed to result in the independent application of the new concept or described strategy. In the relatively brief third phase students work independently and receive opportunities for closure. This phase also often serves in part as an informal assessment of the extent to which students understand what they are learning and how they use their knowledge or skills in the larger scheme of mathematics.

Cooperative Learning:

The cooperative learning model involves students working either in partners or in mixed ability groups to complete specific tasks. It assists teachers in addressing the needs of the wide diversity of students that is found in many classrooms. The teacher presents the group with a problem or a task and sets up the student activities. While the students work together to complete the task, the teacher monitors progress and assists student groups when necessary. Specific Kagan Cooperative Learning structures that will be used in Integrated Math 3 are as follows:

- Mix-n-Match
- Line-Ups
- Inside-Outside
- Circle, Rally Coach
- Quiz-Quiz Trade
- Rally Robin
- Stand-Up Hand Up Pair-Up
- Talking Chips
- Timed Round Robin
- All Write Round Robin
- Round Table
- Mix Pair Rally Coach
- Fan-n-Pick

These structures will be utilized within each unit to introduce concepts, practice important skills, and review key content.

Discourse:

Throughout this course the teacher will facilitate classroom discussions to support student understanding. The standards for Mathematical Practice expect students to demonstrate competence in making sense of problems (MP 1), constructing viable arguments (MP 3), and modeling with mathematics (MP 4). Through discourse in the mathematics classroom, students will be expected to communicate their understanding of mathematical concepts, receive feedback, and progress to deeper understanding. The teacher will use facilitation techniques such as rephrasing student comments, allowing wait time, and asking students to revise peer statements. These discussions will support students

as they relate the everyday language of their world to mathematical language and symbols. Mathematical discourse will be an essential component of each unit of study and will provide detailed information to the instructor regarding student understanding and progress.

Visual Representations and Concrete Models Visual representations and models will be utilized to support student understanding of key content standards. The teacher will model effective use of diagrams, concept maps, graphic organizers, and flow charts to show relationships between concepts and develop deeper understanding. Learning that utilizes different modes of instruction is necessary to promote both student understanding and long-term memory. The Mathematical Practice standards suggest that students look for and make use of structure (MP 7), construct viable arguments (MP 3), model with mathematics (MP 4), and use appropriate tools strategically (MP 5).

In order to develop these mathematical habits, the teacher will emphasize meaningful relationships that connect concepts, utilize concept maps and graphic organizers to summarize lesson content and objectives, and facilitate student use of models and representations to demonstrate understanding. For example, teachers will use models to demonstrate the Pythagorean Theorem, utilize algebra tiles to demonstrate an algebraic expression, and use angles to demonstrate triangle congruencies.

<u>Supporting Mathematical Practice 1: Make sense of problems and persevere in solving them</u>
In Integrated Math 3, students will discuss, think, work in groups, and share, which provides a classroom environment for students to make sense of problems, develop strategies, persevere in implementing the strategy, and analyze the results.

As students work collaboratively through problems, they will plan and execute a solution strategy. Each group member has the responsibility to monitor and evaluate the progress of the group, and to make suggestions for changing course, if necessary. Teachers will circulate through the room monitoring students' work, assessing progress, and redirecting with guided questions.

To bring closure and provide summary for each problem, teachers will ask thought-provoking questions that require students to explain their thinking and process. Multiple groups will present their solutions with class discussion centered on alternate solution paths, connections to prior concepts, and generalizations.

<u>Supporting Mathematical Practice 2: Reason abstractly and quantitatively</u>
Throughout the course, scenarios will help students recognize and understand that quantitative relationships seen in the real-world are no different than quantitative relationships in mathematics. Some problems begin with real-world context to remind students that the quantitative relationships they already use can be formalized mathematically. Other problems will use real-world situations as an application of mathematical concepts.

<u>Supporting Mathematical Practice 3: Construct viable arguments and critique the reasoning of others</u>
In Integrated Math 3 classrooms, students are active participants in their learning; they are doing the work, presenting solutions, and critiquing each other. The teacher facilitates the discussion and highlights important connections, strategies, and conclusions.

Each lesson ends with the statement "Be prepared to share your solutions and methods." Students are expected to be able to communicate their reasoning and critique the explanation of others. As students explain problem-solving steps or the rationale for a solution, they will internalize the process and reasoning behind the mathematics.

Supporting Mathematical Practice 4: Model with mathematics
Activities throughout the course provide opportunities for students to create and use multiple representations (words, tables, graphs, and symbolic statements) to organize, record, and communicate mathematical ideas.

Manipulatives and various models are incorporated throughout to develop a conceptual understanding of mathematical concepts. These activities provide opportunities for students to develop strategies and reasoning that will serve as the foundation for learning more abstract mathematics. To foster the transfer of student understanding from concrete manipulatives to the abstract procedures, a variety of instructional prompts are used.

Supporting Mathematical Practice 5: Use appropriate tools strategically
In Integrated Math 3, activities throughout the course facilitate the appropriate use of tools including graphing calculators, rulers, protractors, compasses, and manipulatives. Tools are used in a variety of ways to build conceptual understanding, to explore concepts, and to verify solutions. Worked examples are provided as appropriate within lessons to demonstrate how to use various tools.

Supporting Mathematical Practice 6: Attend to precision
Each lesson throughout the course provides opportunities for students to communicate precisely when writing their solutions, and then sharing their solutions with their peers. Teachers ensure that students label units of measure and explain their reasoning using appropriate definitions and mathematical language.

Supporting Mathematical Practice 7: Look for and make use of structure
Activities throughout the course provide opportunities for students to analyze numeric, geometric, and algebraic patterns. Accompanying questions help students notice relationships for themselves as opposed to memorization of facts.

Supporting Mathematical Practice 8: Look for and express regularity in repeated reasoning
During activities throughout the course, students are provided opportunities to make observations, notice patterns, and make generalizations. Students are required to communicate their generalizations verbally and symbolically. This understanding will lead to greater transfer and ability to solve non-routine problems. In addition, teachers will facilitate discussions that highlight important connections, efficient strategies, and conclusions.

Assessment Including Methods and/or Tools:

- Daily Student Observation
- Formal Daily Assessment
- Performance Tasks
- End of Unit Test
- Projects
- Quizzes
- Semester Final Exam

A combination of both informal, formal, informative and summative assessments will be used to evaluate student progress towards students' ability to think mathematically, developing students' conceptual understanding of mathematics, and developing students' procedural fluency in mathematics.

Daily Student Observation:

Daily student observations are in class observations of students working on mathematics tasks, either independently or in groups. Walking around the room, actively listening to students, asking questions, directing discourse, and helping where needed are all forms of informal assessment. The instantaneous feedback to students about where to go next, what question they may want to ask themselves to gain insight into a problem, or simply correcting computational errors, results in this practice being a form of formative assessment. Teachers may use notes or they may focus their observations using checklists based on specific skills and concepts. In addition to notes and checklists, teachers may also use student whiteboards, Thumbs Up/Thumbs Down, or Fist to Five, to informally determine student understanding of the concept being taught.

Formal Daily Assessment:
Formal Daily Assessments are both in classroom and out of classroom assessments that teachers use to check for understanding. These assessments are typically done at the end of a lesson to see how much the students have learned. Examples of formal daily assessments are homework, class work, and ticket out the door. These types of assessments are formative because teachers use these assessments to gauge student understanding of the concept, procedure, or skill. Based on student results teachers modify lessons to meet the needs of their students.

Performance Tasks:
Performance Tasks consist of problems or scenarios that demand students engage in thinking about a problem, encourage them to justify their thinking, and often require students to engage with other students. Administered to individual students or to groups, performance tasks are often complex problem solving activities that require students to apply prior knowledge in a given situation or to extend current knowledge in new directions.

Both closed tasks and open tasks are used in Performance Tasks. Closed tasks will ask students to provide one correct answer and usually there is only one correct way to reach that answer. In Integrated Math 3, closed tasks will be used to evaluate student procedural fluency in mathematics. Open tasks will come in two forms, open-middle tasks and open-ended tasks. Open-middle tasks require one correct answer; however, students may provide different paths to the answer. Open-middle tasks are effective in assessing how students solve problems and think about mathematics. They reveal student thinking throughout the problem solving process and they give students the opportunity to develop and use their own strategies and to solve problems in ways that are most comfortable to them. Open-ended tasks have many correct answers and many correct routes to getting those answers. They include tasks that require students to make conjectures, solve non-routine problems, and justify their answers. Open-ended tasks often pose questions based in real situations, thereby giving the students a chance to see how mathematics is used outside the classroom. They often require students to make many decisions about using mathematics and sometimes require students to make assumptions and add pertinent information. They provide teachers with the opportunity to see how their students make problem-solving decisions and how they use the mathematics they have learned. Open-ended tasks also give students the opportunity to be creative and use their own ideas for solving problems. In Integrated Math 3, open tasks will be used to assess students problem solving ability and conceptual understanding.

Performance Tasks will be given at the conclusion of units 3, 6, 9, and 12. The Performance Tasks will be evaluated according to unit goals and objectives and scored with a four-point rubric shown below.

Got It: Evidence shows that the student essentially has the target concept or idea.

- Score of 4 Excellent: Full Accomplishment

Strategy and execution meet the content, process, and qualitative demands of the task. Communication is judged by effectiveness, not length. May have minor errors

- Score of 3 Proficient: Substantial Accomplishment

Could work to full accomplishment with minimal feedback. Errors are minor, so teacher is confident that understanding is adequate to accomplish objective.

Not Yet: Student shows evidence of major misunderstanding, incorrect concept or procedure, or failure to engage in task.

- Score of 2 Marginal: Partial Accomplishment

Part of the task is accomplished, but there is a lack of evidence of understanding or evidence of not understanding. Direct input or further teaching is required.

- Score of 1 Unsatisfactory: Little Accomplishment

The task is attempted and some mathematical effort is made. There may be fragments of accomplishment but little or no success.

End of Unit Test:

End of Unit Tests measure student learning of the content and skills in a unit. Such tests are linked to the specific learning goals of each unit, the California Common Core Mathematics Standards for Integrated Math 3, and pay attention to the standards for Mathematical Practice. To effectively assess such goals, such tests should include various types of assessment items, including multiple choice, selected response, short answer, and both closed tasks and open-middle tasks (see Performance Tasks).

Projects:

Projects are another form of formal assessment that will be used in Integrated Math 3. Projects are typically extended open-ended tasks. Like open-ended tasks, projects have many solutions with many routes to the solutions, but they require many more decisions from students and projects typically will require students to work for a week or more. Projects focus on situations outside of school that require students to use different types of mathematics, such as algebra, geometry, or probability in the same task. Also, they connect mathematics to other subjects, such as language arts, science, social studies, art, or music.

Projects allow students to see mathematics in action outside the classroom by giving students a chance to connect mathematics with real situations and other subject areas. They also allow teachers to assess how students think, how our students persevere, and how they connect ideas. If presentations are part of the project, teachers are also able to see how students communicate mathematics orally.

Projects will be evaluated according to unit goals and objectives and scored with a four-point rubric shown below and will be given after units 2, 10, and 14.

Got It: Evidence shows that the student essentially has the target concept or idea.

- Score of 4 Excellent: Full Accomplishment

Strategy and execution meet the content, process, and qualitative demands of the task. Communication is judged by effectiveness, not length. May have minor errors.

- Score of 3 Proficient: Substantial Accomplishment

Could work to full accomplishment with minimal feedback. Errors are minor, so teacher is confident that understanding is adequate to accomplish objective.

Not Yet: Student shows evidence of major misunderstanding, incorrect concept or procedure, or failure to engage in task.

- Score of 2 Marginal: Partial Accomplishment

Part of the task is accomplished, but there is a lack of evidence of understanding or evidence of not understanding. Direct input or further teaching is required.

- Score of 1 Unsatisfactory: Little Accomplishment

The task is attempted and some mathematical effort is made. There may be fragments of accomplishment but little or no success.

Quizzes:

In Integrated Math 3, quizzes are used as formative assessments as part of a unit of study. Quizzes are linked to specific subset of learning goals within a unit of study, the California Common Core Mathematics Standards for Integrated Math 3, and pays attention to the Standards for Mathematical Practice. To effectively assess such goals, quizzes should include various types of assessment items, including multiple choice, selected response, short answer, and both closed tasks and open-middle tasks (see Performance Tasks). A minimum of two quizzes will be given per unit.

Semester Final Exams:

Final exams are summative assessments designed to measure student learning of the content and skills learned in a semester. Such exams are linked to the specific learning goals of each unit taught in the semester, the California Common Core Mathematics Standards for Integrated Math 3, and the standards for Mathematical Practice. To effectively assess such goals, these tests will include various types of assessment items, including multiple choice, selected response, short answer, and both closed tasks and open-middle tasks (see Performance Tasks).

Semester final exams will be given twice a year, at the end of both fall and spring semesters.