Chino Valley Unified School District
High School Course Description

CONTACTS	
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A. COVER PAGE - COURSE ID	
1. Course Title:	Integrated Mathematics 2 Honors
2. Transcript Title/Abbreviation:	Integrated Math 2 Honors
3. Transcript Course Code/Number:	5120
4. Seeking Honors Distinction:	Yes
5. Subject Area/Category:	(c) Mathematics
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?	No
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 25, 2015

13. Brief Course Description:

Integrated Math 2 Honor is the second course of a three course sequence including Integrated Math 1, Integrated Math 2, and Integrated Math 3. This course satisfies the California Common Core Standards for Integrated Math 2 Honors. For the Integrated Math 2 Honors course, students continue to develop algebra and geometry skills through engaging and real life applications. Students will build off of the standards they mastered in Integrated Math 1 building on geometry and algebra skills. Students will demonstrate abilities to reason logically and to understand and apply mathematical processes and concepts using algebraic operations, geometry topics with spatial sense, data analysis and probability. The honors series is designed to help students reach the AP Calculus courses.

14. Prerequisites:	Integrated Math I with an “A” or “B”
15. Textbooks:	Integrated Math 2

B. COURSE CONTENT

Course Purpose:

The purpose of Integrated Math 2 Honors is to develop students' ability to think mathematically and develop their conceptual understanding of mathematics and procedural fluency in mathematics. Integrated Math 2 Honors will extend the mathematics students learned in Integrated Math 1 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. Students will learn to solve problems graphically, numerically, algebraically, and verbally and 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: Quadratic Equations

Learning objectives:

- Add and subtract polynomial expressions
- Determine that performing operations on polynomials (addition/subtraction/multiplication) creates a system that is analogous to the integers, namely, the operations are closed
- Solve equations involving the product of polynomials or monomials
- Multiply polynomials
- Multiply polynomials using the distributive property
- Multiply polynomials using the special product rules (sum/difference of polynomials)
- Use the distributive property to factor binomials
- Factor simple trinomials
- Factor perfect square trinomials
- Factor by grouping (distributive property)
- Solve quadratic equations by factoring
- Determine the number and types of roots of a polynomial equation
- Find the zeros of a polynomial function
- Identify the zeros of a polynomial equation when in factored form
- Identify the zeros of a polynomial function when graphed
- Solve quadratic equations that have complex roots

Unit 2: Quadratic Functions and Equations

Learning objectives:

- Graph a quadratic function
- Show intercepts, maxima and minima of a quadratic function
- Find the range and domain of a quadratic function
- Use a quadratic function to find the average rate of change in the value of the function
- Solve quadratic equations by graphing
- Use the method of completing the square to transform a quadratic into the form $(x-p)^2=q$.
- Solve quadratic equations by using the quadratic formula
- Determine the number and nature of the roots of a quadratic equation using the discriminant
- Solve quadratic functions by factoring
- Write a quadratic function in vertex form

- Find the vertex of a quadratic function
- Find the x and y intercepts of a quadratic function
- Determine the maximum or minimum value of a quadratic function
- Write equations that model data
- Identify and graph the greatest integer function (step function)
- Find the range and domain of a greatest integer function
- Identify and graph piece-wise functions
- Find the range and domain of a piece-wise function
- Identify and graph absolute value functions
- Find the range and domain of an absolute value function

Unit 3: Quadratic Functions and Relations

Learning objectives:

- Solve quadratic functions by factoring
- Perform operation with complex numbers
- Derive the quadratic formula
- Solve quadratic equations by using the quadratic formula
- Determine the number and nature of the roots of a quadratic equation using the discriminant
- Determine how the values of a, h, and k affect the graph of a function in $y = a(x-h)^2 + k$ form
- Find the vertex of a quadratic function
- Graph quadratic functions using transformations of the parent function

Unit 4: Exponential and Logarithmic Function

Learning objectives:

- Graph exponential functions and relate the domain and range to the graph
- Explore the meaning and applications of exponential growth and decay models
- Create and solve exponential equations and inequalities
- Use properties of exponents to transform expressions into exponential functions
- Interpret exponential expressions
- Simplify radical expressions and operations with radical expressions
- Explore rational and irrational numbers
- Explore the properties and relationships of radical expressions

Unit 5: Geometric Proofs

Learning objectives:

- Use geometric postulates and theorems
- Write geometric proofs through reasoning
- Reason with algebraic proofs involving lines and angles
- Prove segment relationships
- Prove angle relationships

- Prove theorems about lines and angles
- Explore and prove relationships between angles and parallel lines
- Prove that lines are parallel
- Focus on reasoning while investigating proofs

Unit 6: Triangle Congruency and Relationships

Learning objectives:

- Learn and prove theorems about triangles
- Explore the relationships of congruent triangles
- Prove triangles are congruent
- Prove theorems involving parallelograms
- Make formal geometric constructions and prove using constructions
- Explore and prove congruence in right triangles
- Reason using the properties of isosceles and equilateral triangles
- Use coordinates to prove simple geometric theorems algebraically
- Focus on reasoning while investigating proofs.
- Use two dimensional and three dimensional modeling

Unit 7: Quadrilaterals

Learning objectives:

- Prove and learn theorems for polygons and quadrilaterals
- Use the theorems for polygons and quadrilaterals to solve problems
- Use coordinates to prove theorems about quadrilaterals
- Discover the properties for special parallelograms using coordinates and algebra
- Determine whether parallelograms are rectangles
- Apply the properties of special quadrilaterals in modeling situations

Unit 8: Similar Polygons and Proportions

Learning objectives:

- Understand similarity in terms of similarity transformations
- Prove theorems involving similarity
- Use proportions to make predictions in real-world situations
- Explain why two polygons are similar using the definition of similarity
- Identify similar triangles using AA, SAS, SSS similarity postulates and theorems
- Use proportional parts with parallel lines and triangles
- Use criteria for similarity to prove relationships in geometric figures
- Recognize and use proportional relationships of corresponding angle bisectors, altitudes, and medians of similar triangles
- Prove and use the Triangle Angle Bisector Theorem
- Explore similarity through dilations and scale models

Unit 9: Special Right Triangles and Trigonometry

Learning objectives:

- Define trigonometric ratios and solve problems involving right triangles
- Solve problems involving relationships between parts of a right triangle and the altitude to its hypotenuse

- Prove and use the Pythagorean Theorem and its converse
- Apply the properties for special right triangles to solve problems
- Explain and use the relationship between the sine and cosine of complementary angles

Unit 10: Properties of Circles

Learning objectives:

- Prove that all circles are similar regardless of the length of their radii
- Identify and describe parts of a circle such as radius, chords, minor arcs, major arcs, and semicircles
- Find arc lengths
- Identify and describe central and inscribed angles and explain their relationship
- Describe the relationship between the opposite angles of an inscribed quadrilateral in a circle
- Prove that when a quadrilateral is inscribed in a circle, the opposite angles are supplementary
- Describe a tangent line and its properties
- Construct a tangent line from a point outside a circle only a compass and a straight edge
- Derive the equation of a circle with center "C" and radius "r" using the Pythagorean Theorem
- Find the center of a circle and the length of its radius when the equation of circle is given
- Describe the relationship between a central angle and the length of arc it intercepts
- Describe the area and circumference of a circle
- Find the area of a sector
- Describe the relationship between a central angle and the area of a sector between the two radii and the intercepted arc

Unit 11: Two and Three and Dimensional Figures (Area and Volume)

Learning objectives:

- Describe the volume of a cylinder, pyramid, and a cone
- Apply Cavalieri's principle for volumes of solids
- Apply the formulas to compute the volume of different solids like cylinders, pyramids, and cones, and spheres
- Calculate the scale factor K when the length, perimeter, area, or volume of 2 solids are given or vise-versa
- Find out how the scale factor K is affected when the length, area, or volume of a solid is changed

Unit 12: Probability and Statistics

Learning objectives:

- Describe events as subsets of a sample space using categories or characteristics of the outcomes or as unions, intersections, or complements of other events
- Differentiate between independent and dependent probabilities
- Define the conditional probability of event A given B when two events are independent
- Construct and interpret 2 way frequency tables and approximate conditional probability of two events
- Recognize and explain the concepts of independent events and conditional probability in everyday life
- Find conditional probability of dependent event A when event B has already occurred and interpret the answer as a model
- Apply the Addition Rule and interpret the answer as a model
- Find the probability of simple events
- Use probabilities to make decisions

Unit 13: Linear and Non-linear functions

Learning objectives:

- Solve absolute value equations and inequalities and use them to solve problems
- Relate the domain of a function to its graph
- Calculate and interpret the average rate of change of a function
- Graph piecewise functions
- Graph a system of inequalities and interpret solutions in the context of modeling

Instructional Methods and/or Strategies:

A variety of instructional strategies will be used throughout Integrated Math 2 Honors. 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 Standards for Mathematical Practice.

- Instructional Methods/Strategies
- Guided Inquiry/Problem Based Learning
- Direct Instruction
- Cooperative Learning Structures, such as Kagan
- Discourse
- Use of Visual Representations and Concrete Models
- Guided Inquiry

The standards for Mathematical Practice emphasize the importance of making sense of problems and persevering in solving them, reasoning abstractly and quantitatively, and solving problems that are based upon everyday life, society, and the workplace. 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 could be used in Integrated Math 2 Honors 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, 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 AngLegs to demonstrate triangle

congruencies.

Supporting Mathematical Practice 1: Make sense of problems and persevere in solving them
In Integrated Math 2 Honors, 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 around alternate solution paths, connections to prior concepts, and generalizations.

Supporting Mathematical Practice 2: Reason abstractly and quantitatively
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.

Supporting Mathematical Practice 3: Construct viable arguments and critique the reasoning of others
In Integrated Math 2 Honors 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 2 Honors, 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:
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.

Assessment Methods and/or Tools:

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

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, classwork, 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 1, closed tasks will be used to evaluate student procedural fluency in mathematics. Open tasks will come in two forms, open-middled tasks and open-ended tasks. Open-middled tasks require one correct answer; however, students may provide different paths to the answer. Open-middled 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 2 Honors, 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.

- 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.

- Score of zero: Not Yet

Student shows evidence of major misunderstanding, incorrect concept or procedure, or failure to engage in task.

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 (see course outline), the California Common Core Mathematics Standards for Integrated Math 2, 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-middled tasks (see Performance Tasks above). End of Unit Tests will be given at the end of each unit.

Projects:
Projects are another form of formal assessment that will be used in Integrated Math 2. 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 2 Honors, 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 2 Honors, 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-middled tasks (see Performance Tasks above). A minimum of two quizzes will be given per unit.

Semester Final Exams:
Semester 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 2 Honors, 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-middled tasks (see Performance Tasks above). Semester Final exams will be given twice a year, at the end of both Fall and Spring semesters.