



Santa Rosa City Schools Course Proposal: Integrated Math 2P Modeling in Our World (MOW)

Proposal Submitted By: Samuel Martinez and Lara Costanzo

Needs Statement: *Discuss how this course fits into your Site and/or the District's goals. Attach minutes of meetings where this course was approved at site or district leadership meetings.*

This course serves as an option for students to meet the graduation requirement of three years of math.

For students who intend to go on to post-high school learning that requires mathematics (some trade schools or military fields, two- or four-year colleges) Integrated Math 2P Modeling in Our World is recommended as a supportive transition to support their high school and beyond plans. The mathematics that students complete in MOW will strengthen their skill base to make additional study of mathematics more attainable.

Students' success in Math 2P Modeling in Our World encourages students to continue with Mathematics with Financial Applications P, Statistics for Social Justice P, or Statistical Reasoning in Sports P or equivalent, increasing their mathematics facility and expanding their career pathways.

Graduation Requirements: *Specify which requirement is met. (High School only)*

Math

UC A-G Requirements: *Specify which requirement is met. (High School only)*

C: Math

Explain the rationale for course addition or modification. How does this fit in with district/site goals. If this course is replacing a current course, which course is it replacing and why? Will this course require new sections? Be explicit.

This is an additional course option for a year of math beyond Integrated Math 1P.

Students who take Integrated Math 2P Modeling in Our World (MOW) should have taken Integrated Math 1P or equivalent, and have earned at least ten credits of math. The lessons in MOW were developed to highly

engage students to support their learning in mathematics. MOW can fulfill ten math credits as well as a year of math requirements beyond Integrated Math 1P. Students will choose between either Math 2P or MOW and thus it will not require additional sections.

This course provides rigorous, relevant, engaging, high-quality, and inclusive instruction that is responsive to the needs of individual students and that is informed by multiple measures of achievement that are economically and culturally inclusive. The mathematics pathways are well articulated from high school to and through postsecondary education and careers, that are personally and socially relevant, and that enable students to move across pathways as their interests and aspirations evolve. Individualized academic, career and other student supports that respect and promote student and family decision-making and that enable students to explore options, make strategic choices, and set and achieve informed goals are embedded into the course.

Learning Outcomes: *Explain the measurable learning outcomes.*

The purpose of the course, Modeling in Our World, is to engage students with focused attention to the Math 2 CA CCSS standards through the high-interest lens of career connections. Students will achieve competence with Math 2 standards and also see how math understanding applies to a variety of career areas. They will also learn valuable 21st century skills that transcend specific math content and support successful endeavors in their adult futures. Not only are these 21st skills critical to all areas of employment but they are also the foundation for the Standards for Mathematical Practice (SMPs) and a large focus of the new CA Math Framework.

Course Description: *To be used in the course catalog.*

Math in Our World is a modularly-designed mathematics course developed to follow a year of Math 1P. It contains career-connected thematic units where students use high school mathematics to analyze everyday life and work. The content and instructional strategies support attainment of the Math 2 Common Core high school content standards while developing the Standards for Mathematical Practice. The mathematics skills, problem-solving strategies and growth mindset developed in the course will support student success in the Graduation Pathway of their choice.

Detailed Course Design: *Course design should include the objectives, activities, assessments, and standards to be addressed in this course.*

This course includes 6 content units; each with a focus on a different area of employment opportunities while investigating rigorous math concepts. Through those contexts, students explore Math 2 standards and their application in real-world modeling experiences. An additional introductory unit (Unit 0: Mathematical Practices & SEL) builds classroom and learning norms that are necessary for rich mathematical learning and discussion. Detailed unit plans follow this overall content summary:

Core Math content included in the course:

Algebra	Geometry	Probability and Statistics
<ul style="list-style-type: none">• Absolute Value Functions	<ul style="list-style-type: none">• Parallel Lines and Angle	<ul style="list-style-type: none">• Sample Space

<ul style="list-style-type: none"> • Polynomial Operations • Quadratic Functions: <ul style="list-style-type: none"> • Graphing (with transformations) • Solving Equations • Comparing functions (Linear, Exponential, and Quadratic) 	<ul style="list-style-type: none"> • Pair relationships • Triangle Congruence • Rigid and Non-rigid Transformations • Similarity • Right Triangles and Trigonometric Ratios • Solids and Circles • Constructions 	<ul style="list-style-type: none"> • Independent/Dependent Events • Conditional Probability • Two-way tables
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Unit 0: Mathematical Practices & SEL

Overview:

Use these lessons to get to know your students and to set the culture of the course. The math is introductory to encourage students to build confidence, because the thinking processes are crucial. Instructional routines are introduced. Implementing them in this context will make them easier to use later in the course when the math is more challenging. This unit is about getting started with a positive mathematical mindset.

Essential Standards:

This unit focuses on building skills within the Standards for Mathematical Practice of the CA CCSS Math Standards, rather than the Content Standards.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

G.SRT.6

G.SRT.8

G.SRT.7

Essential Question:

What does our learning environment require to support all students with developing a growth mindset to allow for rigorous mathematics investigation and learning?

Objectives:

- Establish class norms of participation, engagement, respect for all individuals
- Assign mathematical competence to all individuals to support a positive math mindset
- Practice discourse strategies to support necessary mathematical discourse on content

[Link to Unit Plan:](#)

☰ Unit 0: Mathematical Practices & SEL MOW

Unit 0 Assignment(s)

- 1: Welcome!
 - 2: Growing Our Mindset
 - 3: Talking About Math Thinking and the Standards for Mathematical Practice
 - 4: Working as a Team & Convincing Others
 - 5: If at First You Don't Succeed...
 - 6: Squares to Stairs: Thinking About Patterns
 - 7: Revisiting Our Norms and Seeing How They Work in Two New Routines
 - 8: Our Favorite Tasks & What We Learned From Them
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Unit 1: Functions in Health and Fitness

Overview:

In this unit students will model mathematical relationships that represent real world applications of Health and Fitness. Students will gather data on calories burned, water needs, nutritional content, and more health and nutrition topics to develop formulas that will allow them to predict future events or make estimates that can support their personal health. Students will work to create representations of linear and piecewise-defined models as graphs, tables, and equations. Finally, students will investigate multiple mathematical models, including, linear, exponential, quadratic, square root, piecewise, and absolute value simultaneously, to optimize health outcomes.

Essential Standards:

F.BF.1
F.IF.4
F.IF.5
F.IF.6
F.IF.7a
F.IF.9
A.CED.1
A.CED.2
A.CED.4
A.SSE.1

Essential Question:

How do we create models that represent health and nutrition?
How do we use models to make predictions to optimize health outcomes?
How can we use simultaneous equations and inequalities to make health and nutrition based decisions?

Objectives:

What will students know ?	What will students understand ?	What will students do ?
Linear and piecewise functions can model real-world situations	How to translate between different representations of linear and piecewise functions	Construct tables, graphs, and equations of linear and piecewise functions that model real-world contexts
Other types of functions are sometimes more appropriate to model different situations	How to choose between linear, exponential, quadratic, square root, piecewise, and absolute value functions to model a situation	Use technology as well as an understanding of the characteristics of each function family to model a variety of real-life scenarios using a variety of function families
Systems of equations are sometimes necessary to model different situations	How to choose between linear, exponential, quadratic, square root, piecewise, and absolute value functions to use a system of equations to model a situation	Use technology as well as an understanding of the characteristics of each function family to model a variety of real-life scenarios using a system of equations

Link to Unit Plan:

☰ Unit 1: Health and Fitness MOW

Unit Assignment(s)

- 1: The Running Game
 - 2: Nutrition
 - 3: Drink Water
 - 4: Ivy Smith Grows Up
 - 5: You Are What You Eat
 - 6: Vitruvian Man
 - 7: Batters Can't Handle the Heat
 - 8: Scott's Push-Up
 - 9: Working Out with Equations
 - 10: Contextualizing Equations
 - 11: Systems of Equations and Inequalities
 - 12: Playing Catch-Up
 - 13: Gym Membership
 - 14: Reasoning About Systems of Equations
 - 15: Iron Man Workout
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Unit 2: Geometry through Environmental Science

Overview:

This unit focuses on forestry, including tree population estimation, using trigonometric ratios to determine tree height, calculating tree volume, estimating timber value, and understanding wildland firefighting techniques, burn area analysis, and production rate determinations for firefighting crews. Students explore circle geometry, volume, and scale factor ratios while learning about maximizing planting areas and estimating tree replanting needs after wildfires and timber sales.

Essential Standards:

A.SSE.1
G.SRT.8
G.C.5
G.GMD.3
G.C.1
G.C.3
G.GPE.1
G.GPE.4
G.GMD.5
G.GMD.6

Essential Questions:

How can you use information and formulas to deduce needed information?
How can trig ratios be used to calculate height?
How can circle properties be used to estimate area?
What properties are needed to verify shapes?
How can scale factor be used to estimate?
What properties can be identified in triangles?

Objectives:

What will students know ?	What will students understand ?	What will students do ?
trig ratios	How to use them	Estimate heights
Basic constructions	Points of concurrency	Construct inscribed and circumscribed circles
volume	How to use the formulas	Find volume of trees
Parts of circles	Arc length and sector area	Calculate the values
Equation of a circle	How to apply the Pythagorean theorem	Translate center and radius of a circle to and from the equation
Basic properties of shapes	How to use coordinates to prove a shape	Use coordinates to identify shapes on a map

Scale factor ratios	proportions	Use scale factor to calculate
Exterior angle theorem and angle side relationships in triangles	Relationships in triangles	Calculate various triangle angles and compare sides.

Link to Unit Plan:

☰ Unit 2: Environmental Science MOW

Unit Assignment(s):

- 1: Land Stewardship
- 2: Sampling Acreage
- 3: Height of Trees
- 4: Volume of Trees
- 5: Value of Timber
- 6: Wildfire!
- 7: Burn Area
- 8: Triangle Explorations
- 9: Production Rates
- 10: Restoring Habitat

Unit 3: Probability through Civic Readiness

Overview:

This lesson introduces students to the United States Census, guiding them through various statistical analyses. Students interpret distributions and evaluate independence. The lesson includes comparing and contrasting population distributions using probability and two-way tables. Students delve into the process of redistricting legislative districts, focusing on creating equal-population geographic areas. Using a fictional region called "Squaretopia," students engage in the creation of districts with different goals. They also learn about the irregular shapes of gerrymandered districts.

Essential Standards:

- S.CP.1
- S.CP.2
- S.CP.3
- S.CP.4
- S.CP.6
- S.CP.7
- S.CP.8

Essential Questions:

How do we assess independence in a two-way table?
 How do we calculate and interpret probabilities and conditional probabilities?
 How do we use the addition and multiplication rules to find probabilities?

Objectives:

What will students know ?	What will students understand ?	What will students do ?
Definition of Independent	How to evaluate independence	Determine independence from a two-way table
How to set up and use venn diagrams and two way tables to find probabilities	Venn diagram, two way tables and basic probability	Convert between two way tables and venn diagrams, and identify basic probabilities
Definition and notation for conditional probability	How to calculate conditional probability	find and interpret conditional probability from two-way tables
Addition and Multiplication Rules	When to use an AND or an OR	Calculate probabilities using addition and multiplication rules.

Link to Unit Plan:

☰ Unit 3: Civic Readiness MOW

Unit Assignment(s):

- 1: What is the Census?
- 2: Describing and Comparing Data Distributions to Understand American Life
- 3: Analyzing Relationships
- 4: Statistics Project
- 5: Creating Legislative Districts in Washington
- 6: "Squaretopia"
- 7: The Geometry of Gerrymandering
- 8: Student Project: Analyze a District

Unit 4: More Functions through Finances for Life

Overview:

In this unit, students develop understanding of quadratic functions by using them to model patterns and real-world contexts, and by examining their rates of change while comparing and contrasting them to linear and exponential functions. These topics encompass a comprehensive understanding of personal finance and economics which include:

- financial planning
- assessing the impact of career choices, wages, and basic living expenses
- comparing the consequences of lending versus saving
- consumer credit and loans including credit card debt, auto loans, and student loans
- analyzing various types of loans including those with compounding interest
- payday loans compared to alternative consumer credit options
- entrepreneurship and business economics
- learning how prices are determined in markets through supply and demand analysis
- break-even analysis for businesses and use quadratic functions to model revenue and profit scenarios

Essential Standards:

A.CED.1
 A.CED.2
 A.REI.7
 A.SSE.1
 A.SSE.3
 F.BF.1
 F.BF.3
 F.IF.4
 F.IF.5
 F.IF.6
 F.IF.7
 F.IF.8
 F.IF.9
 F.LE.3
 N.RN.1
 N.RN.2
 N.RN.3
 N.CN.1
 N.CN.2
 F.LE.6

Essential Questions:

How can quadratic functions be used to model and analyze financial growth?
 How do career choices and wages impact financial planning?
 How can linear and exponential growth be differentiated and applied to financial planning?
 How can functions be interpreted to understand the dynamics of financial growth?
 What are the different types of loans and how do they work?
 How is interest compounded and what are the repercussions of compounding interest?
 How can the real costs associated with credit card debt, auto loans, and student loans be calculated?
 What considerations should be taken into account when dealing with variable interest rates?
 How do payday loans compare to alternative consumer credit options in terms of affordability?
 How are prices determined in markets through supply and demand analysis?
 How can quadratic functions be used to model revenue and profit scenarios for businesses?
 What is break-even analysis and how does it relate to business economics?
 How do expenses, revenue, and profit dynamics affect decision-making in business operations?
 How can platforms like Desmos be used to further investigate expense, revenue, and profit dynamics for informed business decisions?

Objectives:

By the end of this math unit, students will be able to leverage their understanding of quadratic functions to effectively model patterns and real-world contexts, analyzing their rates of change and drawing comparisons to linear and exponential functions. Additionally, students will demonstrate a comprehensive comprehension of personal finance and economics.

What will students know ?	What will students understand ?	What will students do ?
Quadratic functions and their applications	How quadratics can model real-world situations.	Use quadratic functions to model patterns and real-world contexts.
Linear and exponential growth and their differences	The relationship between quadratic, linear, and exponential functions.	Analyze and compare rates of change between quadratic, linear, and exponential functions.
Personal finance and economics	Impacts of career choices, wages, and living expenses.	Establish a budget for daily living.
Simple and compound interest	Their implications for financial growth	Interpret functions to understand the dynamics of financial growth.
Various types of loans	Different types of interest rates	Calculate the cost associated with various types of loans.
Entrepreneurship and business economics	Costs related to starting a business.	Use quadratic functions to model revenue and profit scenarios.
Supply and demand analysis	How it determines prices and markets.	Model how prices are determined.
Break-even analysis modeling with quadratic functions	Its relevant to business economics.	Conduct break-even analysis
Use of online platforms to investigate and model	Modeling as a way of making informed decisions.	Utilize platforms like Desmos to investigate expense revenue and profit dynamics.

Link to Unit Plan:

☰ Unit 4: Finances for Life MOW

Unit Assignment(s):

- 1: Introduction to Basics
- 2: Researching Careers
- 3: Saving versus Spending
- 4: Linear & Exponential Growth
- 5: Simple versus Compound Interest
- 6: Representing Linear and Exponential Growth
- 7: Reasoning About Exponential Graphs
- 8: Introduction to Consumer Credit

- 9: Credit Cards
 - 10: Auto Loans
 - 11: Student Loans
 - 12: Payday Loans
 - 13: Entrepreneurship
 - 14: Where does the Price of Pizza Come From?
 - 15: Break-Even Analysis
 - 16: Using System of Equations with Supply and Demand Functions
 - 17: Quadratic Functions
 - 18: Quadratic Functions in Business
 - 19: Represent Quadratic Functions Graphically
 - 20: Graphs of Expense and Revenue Functions
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Unit 5: Quadratics in the Digital World

Overview:

In this unit, students explore a wide range of applications involving linear, quadratic, and exponential models as they relate to our digital world. The activities cover predictive modeling of smartphone charging times, forecasting app download milestones, and applying Moore's Law the advancement of technology. Students will use conditional probability models to estimate the security of passwords, and investigate the strength of different password requirements. In the second part of this unit students will learn the basics of computer programming to build models that represent real world motion. The unit ends with students building quadratic representations for Rocket Height utilizing their new programming skills.

Essential Standards:

- A.CED.1
- A.CED.2
- A.SSE.1
- A.SSE.2
- A.REI.4
- F.BF.1
- F.IF.8
- F.IF.9
- F.LE.3
- S.CP.5
- S.CP.9
- S.MD.7
- N.RN.1
- N.RN.2
- N.RN.3
- N.CN.1
- N.CN.2
- F.LE.6
- G.GPE.2

Essential Question:

How do linear, exponential, and quadratic functions model real-world situations (in the context of today's digital world) and how can computer programming aid in modeling changing situations?

Objectives:

What will students know ?	What will students understand ?	What will students do ?
Conditional probability	Conditional probability allows us to make claims about what is likely to happen based on a set of conditions	Compute and represent conditional probability (with two-way tables and probability notation)
Linear, quadratic, and exponential models describe real-world situations	How to use technology to help model real-world scenarios with linear, quadratic, and exponential functions	Represent linear, exponential, and quadratic functions using graphs, tables, and equations to model a real-life context
Computer programming aids with modeling	How computer programming can help model changing situations	Basic computer programming to model a variety of real-world situations

Link to Unit Plan:

☰ Unit 5: Digital World MOW

Unit Assignment(s):

- 1: Phone Charge Times
- 2: App Downloads
- 3: iPhone Sales
- 4: Cell Phone Plans
- 5: Processing Speeds
- 6: Strong Password
- 7: Social Media Presence
- 8: Becoming a YouTube Star
- 9: Evaluation Blocks and Arithmetic Expressions
- 10: Strings and Images
- 11: Contracts, Domain, and Range
- 12: Writing Contracts
- 13: Defining Variables and Substitution
- 14: Fast Functions
- 15: Composite Functions
- 16: The Design Recipe
- 17: Solving Word Problems with the Design Recipe
- 18: Rocket Height

Unit 6: Geometric Shapes in The Arts

Overview:

Students will create and deconstruct Origami to explore triangle relationships. Students will use a MARS task to discover the Pythagorean Theorem. Students will use similarity to enlarge a cartoon character. Students will explore trig ratios for similar right triangles. Students will discover triangle properties and then formalize them into proofs. Students will do application problems to practice with all their tools, including using clinometers to solve for heights of campus structures. Students will explore monuments around the world and apply their trig ratios to solve for heights. Tangrams will be used to explore properties of shapes. Constructions will be used to explore properties of circles. Students will make a flip book (on post-its) to share one of their learnings from the chapter.

Essential Standards:

G.SRT.1
G.SRT.2
G.SRT.3
G.SRT.4
G.SRT.5
G.SRT.6
G.SRT.7
G.SRT.8
G.GPE.6
G.CO.9
G.CO.10
G.CO.11
G.C.1
G.C.2
G.C.3
G.C.4

Essential Question:

How do we construct circumscribed and inscribed circles?
How can we find a midpoint or distance between two points?
How do parallel lines inform angle relationships?
How are we able to use trig properties to find lengths we can not measure?
How can we determine the characteristics of a shape?

Objectives:

What will students know ?	What will students understand ?	What will students do ?
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Properties of Dilations	How to verify properties	Solve for missing parts in dilations
Pythagorean Theorem	How to prove using similarity	Use Pythagorean Theorem to verify right triangles
Trig Ratios	That these are ratios of sides of right triangles	Solve right triangles
How to solve triangles	When to use which tool for solving	Solving right triangle application problems
Properties of Triangles	Angle-side relationships, exterior angle theorem, triangle angle sum	Apply the theorems to applications
Coordinate Geometry	Distance formula, midpoint of a segment, midsegment of a shape, parallel and perpendicular lines	Identify shapes from coordinates
Parts of circles	Relationships between angles, arcs, chords	Solve for measures of segments, arcs, and angles
The six basic constructions	Inscribed and circumscribed circles	Construct the incenter, circumcenter, and shapes given pieces

Link to Unit Plan:

☰ Unit 6: The Arts MOW

Unit Assignment(s):

1. Origami Shapes
2. Discovering the Pythagorean Theorem
3. Enlarging Cartoon Character
4. Explore Trig Ratios
5. Discover Triangle Properties
6. Proving Triangle Properties
7. Monument Heights
8. Clinometer
9. Tangrams
10. Constructions
11. Flipbook Project

Budget: *Budget figures must be included even if they are an estimate.*

Projected Costs	Start-up	Ongoing
Personnel (Not to include classroom instructor unless a new section is needed)		
Instructional Material Supplies per student (textbooks, software, etc.)		
Services (training, equipment maintenance, contracts, etc.)		
Capital Outlay (remodeling, technology, etc.)		
Total Projected Costs	0	

Instructional Materials: *Must include estimates for new materials even if none have been selected. Place in the chart above.*

Type	Publisher	Title	ISBN	Author	Copyright	# Have/Need
Open Source Curriculum/Text	Open Up Resources	Math 2		Hendrickson et al.	2021	N/A

Funding Source(s) for Costs and Instructional Materials:

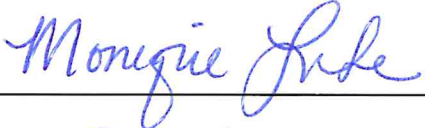
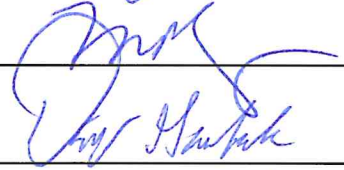
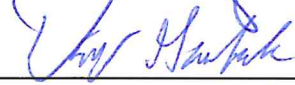



Grants (indicate specific grant and grant timeline)	
Categorical Funds (include related programs)	
Career Technical Education (must be for an approved CTE course)	
Department Funds	

Other (be specific)	
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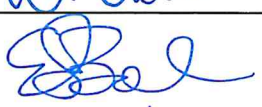
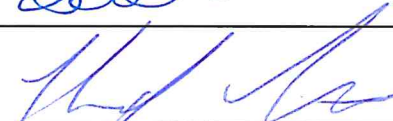
Appendix of Additional Documents:

<u>* Required additional documents include meeting minutes where the course was discussed and approved</u>
<ul style="list-style-type: none"> ■ 2023-24 Math Department Chair Meeting Minutes 3-6-24.pdf ■ 2023-24 Math Department Chair Meetings 11-14-23.pdf

District Principal Review and Approvals:

Principal's Signatures	Site	Approved / Not Approved
	MCHS	Approve
	SRWS	Approve
	RHS	Approve
	EMHS	Approve
	PHS	Approve
	MHS	APPROVE

District Department Chair Review and Approvals:

Department Chair Signatures	Site	Approved / Not Approved
	MCHS	Approve
W. Dalle	PHS	Approve
	SRHS	Approve
	RHS	Approve

Brendan Johnson	EAHS	Approve
Petina Huffman 8.	MHS	APPROVE