SANTA ROSA CITY SCHOOLS
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Santa Rosa City Schools Course Proposal

Integrated Mathematics 1A/1B

Proposal Submitted By: Margie BradyLong and Amy Weise

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.

Integrated Math 1A and 1B is the first math course that some students will be enrolled in that covers the Integrated 1 course curriculum in a two year span. The course covers key algebra topics of linear and exponential functions. The course also focuses on geometric transformations and congruence. Successful completion of the majority of the course material will give the student credit for Integrated Math 1. The mathematics departments recommends all students pass Integrated Math 1 with a "C" or better before enrolling in Integrated Math 2
This is the first course in a three part series that replaces the traditional sequence of Algebra 1, Geometry and Algebra 2. The course is designed around the Common Core State Standards. The fundamental purpose of Integrated Math 1 is to formalize and extend the mathematics that students learned in the earlier grades. The critical areas, organized into units, deepen and extend understanding of linear relationships, in part by contrasting them with exponential phenomena, and in part by applying linear models to data that exhibit a linear trend. Mathematics 1 uses properties and theorems involving congruent figures to deepen and extend understanding of geometric knowledge from prior grades. The Mathematical Practice Standards apply throughout the course. Offering this course over two years promotes student success with this foundational material.

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

This course would count as one year of required Math, and prepare students for Math 2. First semester of each year is 5 units of elective credit and the second semester is 5 units of Math Credit for district graduation requirements.

UC a-g Requirements: Specify which requirement is met. (High School only)

C- Mathematics, Integrated Mathematics 1

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.

There is a strong commitment in Santa Rosa City Schools to graduate mathematically proficient students. Students come into our high schools with a variety of mathematical experiences. Not all students are equipped for the pace and rigor of a one year Math 1 course. This course is slowed down providing time for increased attention to bridging students' current skills with the skills necessary for success.

Integrated Math 1A and 1B cover the Integrated 1 course curriculum in a two year span. The course covers key algebra topics of linear and exponential functions. The course also focuses on geometric transformations and congruence. Successful completion of the majority of the course material will give the student credit for Integrated Math 1. The mathematics departments recommend all students pass Integrated Math 1 with a "C" or better before enrolling in Integrated Math 2.

Explain the measurable learning outcomes

This course is designed to meet the standards for Integrated Math 1 as enumerated in the 2013 CDE Curriculum Framework. This includes the following standards and the Mathematical Practices.

Number and Quantity

Quantities

- Reason quantitatively and use units to solve problems.

Algebra

Seeing Structure in Expressions

- Interpret the structure of 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.
- Solve equations and inequalities in one variable.
- Solve systems of equations.
- Represent and solve equations and inequalities graphically

Functions

Interpreting Functions

- Understand the concept of a function and use function notation.
- 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.
- Interpret expressions for functions in terms of the situation they model.

Geometry

Congruence

- Experiment with transformations in the plane.
- Understand congruence in terms of rigid motions.
- Make geometric constructions.

Expressing Geometric Properties with Equations

- Use coordinates to prove simple geometric theorems algebraically.

Statistics and Probability

Interpreting Categorical and Quantitative Data

- Summarize, represent, and interpret data on a single count or measurement variable.
- Summarize, represent, and interpret data on two categorical and quantitative variables.
- Interpret linear models.

Mathematical Practices

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.

Course Description (To be used in the course catalog)

The fundamental purpose of Mathematics 1 is to formalize and extend the mathematics that students learn in the middle grades. The critical areas, organized into units, deepen and extend the understanding of linear relationships, in part by contrasting them with exponential phenomena, and in part by applying linear models to data that exhibit a linear trend. Mathematics 1 uses properties and theorems involving congruent figures to deepen and extend understanding of geometric knowledge from prior grades. The Mathematical standards prescribe that

students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of the problem situations. This course is completed in two years for 10 units of Math 1 credit and 10 units of elective credit.

Detailed Course Design

(Course design should include the objectives, activities, assessments, and standards to be addressed in this course.)

Unit 1 Functions

In this unit students will investigate the meaning of a function including domain and range of the function, the definition of a function, and function notation. Students will be expected to explain why a relation is or is not a function. Students will see the connection between a function as an equation, a table of value and a graph. Students will look at key features of functions such as symmetry, intercepts, relative minimums and relative maximums. Key functions that will be investigated include square roots, cube roots, and absolute value. Students will look at the connection between direct and inverse variation in graphical form and in applications. Students will use functions to model real world applications such as going to a farmer's market and graphing the cost of buying produce; determining which company to hire for remodeling work; and analyzing the effects of a flu outbreak on high school attendance rates.

Students are asked to create new functions from old ones. They add or multiply by a constant to transform linear and exponential functions.

Exemplar Student Activities

1. Students will create graphs that are or are not functions. Students will see an arrangement of different graphed functions, will be able to classify functions, and will be able to explain their process in making their determination. their own graphs.

2. Students can explore various applications where consistency is valued, such as the strike zone in baseball, or the items dispensed from a vending machine, to create their own real world application.

Unit 2 Linear Relationships

Students will focus on the starting value and growth of linear functions. They will use multiple representations including: tables, graphs, equations, and the situation. Students will develop a deeper understanding of slope, in particular through exploring the idea of slope as a rate of change. Students will discover multiple methods for finding the equation of a line and apply

linear models to real life applications.

Exemplar Student Activities

1. Students will match linear functions with their associated graph, table and situation. Students will describe what strategies they used to determine the matches.

2. Given a function representing the labor costs (in dollars) for Company A to remodel their dream home, students will compare these costs with a table representing the labor costs (in dollars) for Company B to do the same remodeling work. Students will produce a rationale for why they would hire Company A or Company B, based on their information gathered from the function and the table. Students will share this information with the class.

Unit 3 Solving Equations

Rules of exponents are developed through patterns. Students will discover the rules for exponents including negative and fractional exponents. Students will extend some of these ideas to area models to learn how to multiply binomial expressions.

Students will work with multivariable expressions and use these expressions to solve for a particular variable in terms of others (for example students will start with the formula to convert the temperature in Celsius to Fahrenheit F = (9/5)C + 32 and then create a formula that converts Fahrenheit to Celsius).

Students will be able to solve complex mathematical equations including those that contain an absolute value or a square root. Students will solve equations with fractions by using Greatest Common Factors to rewrite. Students also use equivalent bases to solve simple exponential equations.

Students strengthen their ability to use three methods for solving equations and expand their solving skills to include other types of equations, including equations with square roots, absolute values, variables in exponents, and complex fractions.

Looking inside (parentheses, square roots, absolute values, exponents, etc.).
Undoing (using inverse operations).
And Rewriting (distributing, simplifying, Fraction Busting, etc.).

Students will understand the difference between intercepts and intersections.
They will use the graphs of y = $f(x)$ and y = $g(x)$ to estimate the solution of elaborate single variable equations, $f(x) = g(x)$.

Exemplar Student Activities

1. Students will make a poster for an exponential law. This will demonstrate exploring a

pattern and finding structure to create a generalization. The students will include various examples of using the law.

2. Students can create two nonlinear graphs that meet the parameters of given intercepts and intersections.

Unit 4 Transformations

Students will work with a variety of transformation models using rigid transformations of Reflections, Rotations and Translations. They will use the transformation of 90 degrees to develop a relationship between perpendicular lines.

Students will look at symmetry as a transformation of a figure onto itself.

Exemplar Student Activities

1. Students develop a simple figure and perform a variety of transformations on that figure. For each new drawing, they describe the transformation. After performing each transformation in isolation, they duplicate the design a number of times and create a larger design. Students describe what transformations occurred with each duplication (such as the design was duplicated 6 times, each rotating 60 degrees about the origin).

2. Students create a tessellation. The tessellation includes a rotation or reflection that is not composed entirely of regular polygons. Students get in groups with their completed tessellations and analyze the intersections of the figures for each project. Groups report out their findings to the class as a whole.

Unit 5 Systems of Equations

Students will learn how to solve word problems by using a system of equations. They will solve the system of equations with the same multiple representations they used for solving linear equations: table, graph, and by manipulating the equations. Students will develop multiple ways to solve different forms of systems (substitution, linear combination), and will learn how to recognize when one method may be more efficient than another. Students will explore and be able to identify systems which have one solution, no solutions and infinite solutions. Many of the problems will be applied to real world applications.

Exemplar Student Activities

1. Road Trip Fuel Efficiency
Students examine and calculate the fuel cost of a road trip to a destination of their choice using the fuel efficiency of a particular vehicle and a given cost of gasoline. Additionally, they compare the cost of the same trip using a different vehicle.

2. Develop Systems of Equations on Long Term Cost Difference
Students formulate a linear equation and create a graphic representation to model a solution by analyzing and comparing the long term cost difference between buying a used car for a randomly assigned cash value or applying that cash amount as a down payment on a new car. Students combine this into a system of equations, analyze the system, and summarize it.

3. Long Terms Costs
Students factor monthly payments, maintenance, registration, and insurance into the long term costs associated with each vehicle over a period of 1, 3, and 5 years. After that, they build a system of equations to represent these costs as a function of cost over time. Then, they create a visual display including a representation of the solution to each system graphically and algebraically.

Unit 6 Sequences

Students will investigate exponential growth and decay. They will discover the key components of an exponential equation in the form y = ax^b. Students will use multiple representations to explore relationships including patterns with manipulatives, tables, graphs, and by manipulating the equations. Through these experiences, students will see the connection between arithmetic sequences and linear functions as well as between a geometric sequence and exponential functions. Students will work with sequences and create the equations with explicit definitions. They will compare and contrast the sequences and apply them to real world applications.

Exemplar Student Activities

1. Students will be able to continue both exponential and linear visual patterns of growth with tiles. They will be able to create equations to model the patterns as well as utilize the equations to calculate the value of specific terms.

2. Students will match various linear and exponential tile patterns, sequences, tables, and graphs, and justify their reasoning.

Unit 7 Modeling Two Variable Data

Students will create scatter plots from data and draw lines of best fit first by best guess and then by linear regressions. They will find the line of best fit, interpret the slope and y-intercept in context, find residuals, and create residual plots. They will determine how strong a line fits a set of data looking at both the correlation coefficient and the residual plots. Students will describe a scatter plot in form, direction and strength. They will learn that association does not mean causation. They will look at both outliers and influential points.

Students extend what they learned about statistical association between two variables to utilize probability to determine association between categorical variables.

Students will review the differences between graphical representations of single-variable data, and expand their knowledge to two-variable data. They will use a scatter plot or two histograms to compare two-variable data. They will compare the center, shape, spread, and outliers of two distributions. Students will use standard deviation as a method of reporting the variability, or spread, in a distribution. Students will decide whether median and IQR or mean and standard deviation is most appropriate considering the shape and outliers of a distribution.

Exemplar Student Activities

1. Students determine whether there is a correlation between data given two variables.
   - a person's age and the number of vehicles owned
   - the temperature and the number of coats sold

2. Students will analyze a table that shows the age and systolic blood pressure for a group of people who recently donated blood. They will draw a scatter plot to show how age (x) and blood pressure (y) are related. Label appropriately and completely. They will also draw a trendline for the data. Students will identify a type of correlation. They will calculate an equation that represents the trend line. They will write their equation in slope intercept form. They will determine if this represents interpolation or extrapolation. They will determine whether the correlation they see in the data set is an example of causation. They will identify data ordered pairs that would exemplify outliers or influential observations.

3. Students will use the quadrant count ratio (QCR) to assess the strength of a data trend. The groups will display a finished scatter plot, divided into four parts using the means of each variable. Students will discuss what each part of the scatter plot means in context. Ex: Cars with fewer than average oil changes but above average repair costs.

4. Given dotplots which record temperatures for various locations, students are asked to choose where they would recommend someone move based on temperature. Their answer should incorporate values for center and spread

Unit 8 Inequalities and Systems Inequalities

Students will develop an understanding of one variable inequalities both solving algebraically and graphically on a number line. Students will extend their work with mathematical sentences by learning how to write inequalities that describe situations.

Students will be graphing systems of linear inequalities to determine the solution for the system. Students will also graph nonlinear systems of inequalities which will include exponential and absolute value functions.

Students will apply their solving skills to solve absolute value inequalities.

Exemplar Student Activities

1. Students will use graphing calculators or Desmos to help them graph systems of linear inequalities. Students will also manually graph and shade the system of linear inequalities, and be able to provide two ordered pairs that are solutions and two that are not solutions to the system.

3. Students will write instructions for a drawing of a five sided star utilizing inequalities with boundaries for other students to be able to make the same drawing.

Unit 9 Congruent Triangles

Students developed methods for rigidly transforming two-dimensional shapes using reflections, rotations, and translations earlier in the course. They will study congruent shapes, shapes that can be rigidly transformed from one to the other. In particular they will look at congruent triangles and discover methods to determine what conditions are necessary to show that triangles are congruent. Students will use conjectures to prove triangle congruence.

1. Students make a portfolio which includes the following basic constructions: copying a segment, copying an angle, bisecting a segment, bisecting an angle, constructing perpendicular lines including the perpendicular bisector of a line. The portfolio also contains the concepts about a line parallel to a given line through a point not on the line, an equilateral triangle, a square, and a regular hexagon each inscribed in a circle.

2. Students will create a triangle on one of the geoboards using different colored rubber bands for each side of the triangle. On a second geoboard, students will work together to create a reflected triangle. Students will use the same colored rubber bands for corresponding

sides. Students will then hold the geoboards against each other to verify that the two triangles are congruent. Students will measure each of the three angles and sides of each triangle. Pairs will translate and rotate either the image or preimage in the plane. Students will identify that translations, rotations, and reflections (or a combination of these transformations) maintain congruence of the triangles, so the side and angle measures remain the same. Students will note the definition of congruent triangles and corresponding sides and angles, emphasizing that the location in the plane and the orientation does not determine the corresponding sides and angles.

Unit 10 Exponential Functions

Students will investigate several exponential functions in the form of y = b^x. They will discover how the value of the base will alter the shape of the graph. Students will make connections between the function, a table of values, and the graph. Students will be using technologies (graphing calculators or software) in their investigation. Students will develop an understanding of asymptotes during the investigation. Students will apply exponential functions to find equations for compound interest, half life, and other real world applications. Students will find exponential functions given two points. Students will also investigate the idea of a step function. Students will solve systems of exponential functions by graphing and algebra.

Exemplar Student Activities

1. Students will explore the difference between simple interest and compound interest. Tying back into early material, students will be able to explain the dramatic difference between linear and exponential growth of their investments.

2. Students will review key components of exponential growth and decay through the formulas: y = a(1 + r)t (exponential growth) and y = a(1 - r)t (exponential decay). Given a real-world scenario students will be able to identify and explain that the value of a represents the initial or starting value and is indicated graphically as the y-intercept and that the r represents the growth or decay factor, which applies a vertical stretch or shrink to the graph.

3. Students will calculate exponential growth through compound interest. Students will calculate how much interest $20,000 in a bank savings account that pays 3% interest compounded annually will earn after 1, 3, 5, and 10 years of compounding. After completing this calculation, students will explain the (1+r) portion of the formula.
4. Students will calculate depreciation through the example of a car purchased for $20,000 that depreciates at a rate of 3% per year. Using the formula model, students determine how many years it will take for the car to be worth less than $500.

Unit 11 Coordinate Geometry

Students will work with coordinate geometry to graph quadrilaterals. Students will use the connections of parallel and perpendicular lines to see the connection with the systems of equations and the figure that is formed. They will explore the properties of quadrilaterals. Students will work with midpoints and explore relationships formed by triangle midsegments.

Exemplar Student Activities

1. Students will explore various measures and angles, including relationships between parallel lines and transversals as they relate to construction. This will include students using manipulatives to experience the strength provided by inserting support to stabilize a parallelogram.

2. Students will explore various properties of shapes and use coordinate geometry to verify the properties they have identified. An example of this is the demonstration that the diagonals of a kite are perpendicular, or the diagonals of a rectangle are congruent.

Unit 12 Geometric Constructions

Students continue working with two dimensional shapes as they investigate constructions. This section provides a context for a wealth of review opportunities, including reflections, congruence, parallel line theorems, etc. Creating and justifying the constructions requires students to connect back to concepts from earlier courses. Students use patty (tracing) paper as well as a compass and straightedge. Rather than following step-by-step instructions, the text asks students to reason through creating different constructions and to use their knowledge from previous sections to justify that a specific shape (such as a rhombus) has been constructed.

Exemplar Student Activities

1. Students will construct various shapes, and use their construction tools and protractors to verify various properties.

Daily Assignments: Students are expected to complete daily skill practice, as well as occasional formative and summative performance tasks.

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.)	Textbooks $100/student - one of the two that follow. $15,000 for the district. Teachers Edition and ancillary supplies $500/teacher $7,500	$100 per class for manipulatives and consumables
Services (training, equipment maintenance, contracts, etc.)		
Capital Outlay (remodeling, technology, etc.)		
Total Projected Costs	$22,500	$1,500

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
Textbook	Houghton Mifflin Harcourt	California Integrated Mathematics 1	05444 41567	Timothy D. Kanold, Edward B. Burger, Juli K. Dixon, Matthew R. Larson, Steven J. Leinwand	2015	
Textbook	Houghton Mifflin Harcourt	Big Ideas: Integrated Math 1	16803 31124	Larson and Boswell	2016	

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)	

Appendix of Additional Documents

* Required additional documents include meeting minutes where the course was discussed and approved

District Principal Review and Approvals:

Principal's Signatures	Site	Approved / Not Approved
	Elsie Allen HS	Approved
	MHS	Approved
	PHS	Approved
	MCHS	Approved
	SRHS	Approved
	RHS	Approved

District Department Chair Review and Approvals:

Department Chair Signatures	Site	Approved / Not Approved
Margie Bradylong	MCHS	Approved
Ted Seche	MHS	Approved
Jon Giacomini	EAHS	Approved
Eric J. Bohn	SRHS	Approved
Julie Petrick	RHS	Approved
Wendy Valle	PHS	Approved