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Integrated Mathematics I

Glendale Unified School District

Basic Course Information

School(s) Offering This Course:

School Name	Course Learning Environment	Transcript Code(s)
Verdugo Academy (054386)	Classroom Based	Abbreviation: Course Code IntgMath IA: 3507D IntgMath IB: 3508D
Clark Magnet High School (051301)	Classroom Based	Abbreviation: Course Code IntgMath IA: 3507D IntgMath IB: 3508D
Allan F. Daily High School (051052)	Classroom Based	Abbreviation: Course Code IntgMath IA: 3507D IntgMath IB: 3508D
Crescenta Valley High School (051313)	Classroom Based	Abbreviation: Course Code IntgMath IA: 3507D IntgMath IB: 3508D
Glendale High School (051050)	Classroom Based	Abbreviation: Course Code IntgMath IA: 3507D IntgMath IB: 3508D
Herbert Hoover High School (051060)	Classroom Based	Abbreviation: Course Code IntgMath IA: 3507D IntgMath IB: 3508D

Title: Integrated Mathematics I

Length of course: Full Year

Subject area:	Mathematics ("c") / Mathematics I
UC honors designation?	No
Prerequisites:	None
Co-requisites:	None
Integrated (Academics / CTE)?	No
Grade levels:	9th, 10th, 11th, 12th

Course Description

Course overview:

The fundamental purpose of Integrated Mathematics I is to formalize and extend the mathematics that students learned in the middle grades. The Mathematical Practice Standards embedded throughout the course, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

Integrated Mathematics I is the first of a three course sequence including Integrated Mathematics I, Integrated Mathematics II, and Integrated Mathematics III. This course satisfies the California State Standards for Mathematics and is intended for all ninth graders. Integrated Mathematics I builds and strengthens students' conceptual knowledge of functions, linear functions, equations, inequalities, sequences, basic exponential functions, systems of linear equations, systems of linear inequalities, one variable descriptive statistics, correlation and residuals, analyzing categorical data, mathematical modeling, and both coordinate and transformational geometries.

The purpose of Integrated Mathematics I is to develop students' ability to think mathematically and develop their conceptual understanding of mathematics and procedural fluency in mathematics. Integrated Mathematics I will extend the mathematics students learned in earlier grades and begin 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 content:

Unit 1 Functions

The unit starts with function puzzles the students will solve in groups. Students will be introduced to function notation, which will then be utilized throughout the course. Students will distinguish the difference between the domain and range of functions, using graphs, equations and tables. They will explore functions with a restricted domain and determine the domain exclusions. They will be introduced to the idea of a composite function, although the concept is not formalized in this unit.

Students will investigate growth patterns, including some that are nonlinear, in an introduction to pattern growth and how the growth rate is related to the type of function. The general idea of multiple representation of a function is also introduced as students use graphs, tables, tile patterns, equations and situations to investigate functions.

Using structure and patterns, students will rewrite exponential expressions in equivalent forms by factoring out "ones" and use this same method to perform operations on numbers written in scientific notation.

Progression of Content:

In Unit 2, students will expand on their knowledge of linear functions from their previous math course. Students will explore slope in more depth, investigate connections between multiple representations of a line, and write equations of lines from a variety of representations.

In Unit 5, students will study arithmetic ("linear") and geometric ("exponential") sequences, which leads into deeper investigation of exponential functions in Unit 7.

In Unit 7, students will apply some of their skills with the laws of exponents when evaluating exponential functions; hence, the inclusion of a short section in this chapter.

Mathematical Practices used in Unit 1:

- Reason Abstractly and Quantitatively in their work with rewriting expressions with exponents including scientific notation and formalizing the laws of exponents and using them to deduce the meaning of and
- Modeling with Mathematics as they use algebra tiles to find the dimensions of a hot tub and then write equations to represent the area and perimeter, use beans to model the number of people infected with a disease and then enter the data into a table so they can find a pattern that predicts the number of infected people at a particular point in time, and determining how long it takes them to sign their name 2, 3, 5, 7 and 10 times and using proportions to predict how long a different number of signatures will take them.
- Attend to Precision as they study tile patterns and determine the next pattern in the sequence as well as the pattern before the first figure, look at functions and determine the excluded values in the domain,
- Look for and Make use of Structure as they compare and contrast functions in multiple representations to find 3 other students with the same function they have, determining the order in which, when given an input and a final output, students need to order four functions.
- Look for and Express Regularity in Repeated Reasoning when they are determining which relations represent functions.

Sample Activities and Assignment:

Team Sort – Each student will be given a card that contains an algebraic expression. Each student will be asked to evaluate their expression using the directions on the card. They will then need to find students whose evaluation gives the same value. The students who believe they have matching cards will then explain their process to the rest of the team members and justify their work. This activity will determine study teams for the first unit.

Function Machines – Student study teams will be given 4 pieces of cardstock, each one containing a different function. Students will be given an initial input and a final output and will be asked to arrange their functions so that if they take the initial input, substitute it into the one function, take that output and substitute it into a different function, and continue the process until they have found the correct order to achieve the final output. This introduces the idea of a composite functions and the as well as leads to a discussion of domain and range, including excluded values. Students will be asked to use the mathematical vocabulary to justify their work.

Unit 2 Linear Functions

Beginning with tile patterns, students will develop a deeper understanding of linear functions. The tile patterns will introduce the students to the notion of a slope and a *y*- intercept and how they affect the position of a line on the coordinate axis as well as the steepness of the line. They will compare and see the connection to the slope of a line using triangles on a graph. Comparing similar triangles, they will see that the slope of a line is always constant. Simulating a tricycle race, students will compare rates of change of a line and determine how the rate as well as the riders starting point affects lines.

Association of discrete data will also be introduced in anticipation of further development in future chapters. Building on the notion of simplifying ones from unit 1, students will look at dimensional analysis and convert units, beginning with rates.

Progression of Content:

Units 3 and 4 will focus on algebraically solving problems using equations and systems of equations.

In Unit 5 students will study arithmetic (“linear”) and geometric (“exponential”) sequences, which leads into a deeper investigation of exponential functions in Unit 7. In Unit 7, students will complete the connections in a multiple representations web for exponential functions.

Mathematical Practices used in Unit 2:

- Make Sense of Problems and Persevere in Solving Them when students write linear equations relating the figure number of a geometric pattern and its number of tiles, and solve a challenging problem that describes the rate and starting point of several tricycle racers.
- Reason Abstractly and Quantitatively when they gain the abstract understanding of slope as they discover that the slope is the change in y divided by the change in x, compare the relative steepness of lines and build intuition about positive, negative, and zero slopes
- Construct Viable Arguments and Critique the Reasoning of Others as they interpret piecewise graphs and explain the motion the graph describes, and employ multiple methods to determine the y-intercept of a line given its slope and one point on it.

- Model with Mathematics in the graphing of lines, comparing slopes using tables, and create a line design by writing linear equations.
- Use Appropriate Tools Strategically in the process of using a motion detector to determine velocity of a person and make a piecewise graph to describe the motion.
- Attend to Precision as they calculate slopes of lines from graphs, tables and in situations, convert units using dimensional analysis, and solve for a y-intercept to write the equation of a line algebraically.
- Look for and Make Use of Structure as they continue to connect growth and starting value graphs of linear functions, later in the unit they will write equations of lines given to them in multiple representations, and practice calculating slopes and writing linear equations while solving a challenging team puzzle
- Look for and Express Regularity in Repeated Reasoning in using tables to identify connections between the growth of a pattern, the number of tiles in figure 0 and its linear equation.

Sample Activities and Assignments:

The Line Factory – Students will be given the role of an engineer at a Line Factory and it their job to fulfill orders of lines. The orders will be given in multiple representations and students will determine if the information will give them one specific line, in which case they must write the equation, an infinite number of lines, in which case they must give equations of two lines that fit the criteria and explain the conditions necessary to determine one specific line. They will also be given information that is not linear and students will explain how they know the data is not linear.

The Big Race – Students will be given a simulation involving a tricycle race. Each student will be given information regarding one or more of the participants of the race. The information will include starting points, rate of change and points of intersection. Using the given information, students will determine the slope, y-intercept and equation of each rider's distance. They will graph the line and using the graph, answer questions such as "Who won the race?" and "When and where did one racer pass another?" The puzzle cannot be solved without participation from all students in the group.

Down on the Farm – The activity requires students to analyze data regarding the growth of baby chickens given two data points. Students will analyze the data using a table and a graph and eventually leading to the students writing a linear equation that models the chickens' growth. Students will then determine the significance of the slope and the y- intercept and answer questions using both graphically and algebraically.

Unit 3 Transformations and Solving

In this unit, students will investigate the three basic rigid transformations of geometric shapes: rotations, translations and reflections. They will use these transformations to build new shapes, using new notation for corresponding parts. Further work will show that objects and their images are equidistant from the line of reflection and the line segment connecting a point with is reflected image is perpendicular to the line of reflection. They will identify which common shapes have symmetry and the type of symmetry it has.

They will develop a method to rewrite products of polynomials, beginning with computing areas and perimeters of shapes formed with algebra tiles and eventually using generic rectangles as area diagrams, writing the area as a product and a sum. This will lead to being able to multiply two algebraic expressions. They will verify the distributive property using area models and eventually move to multiplying algebraic expressions without an area model. Students will look at three methods for solving equations: rewriting, looking inside and undoing. They will develop new methods to solve complicated equations involving multiplication, fractions, and exponents.

Progression of Content:

In Unit 7, students will apply their knowledge of rigid transformations from the chapter. They will use rigid transformations to determine whether triangles are congruent, create flowcharts demonstrating congruence, and learn the conditions for triangle congruence. Also in Unit 7, students apply their knowledge of parallel and perpendicular slopes to their study of coordinate geometry.

The skills and conceptual understanding gained in solving equations in this chapter will be applied to solving absolute value and multi-variable equations in later chapters. In Unit 6, students will then learn multiple strategies for solving systems of equations. Later, skill with solving equations is extended to solving inequalities and systems of inequalities.

Mathematical Practices used in Unit 3:

- Make Sense of Problems and Persevere in Solving Them as they identify the dimensions of and compute areas and perimeters of shapes formed with algebra tiles and use the looking inside method to solve simple exponential equations.
- Reason Abstractly and Quantitatively as they discover that reflection symmetry can help them discover relationships within a polygon and as they move from multiplying algebraic expressions with an area diagram to multiplying without first creating an area model.
- Construct Viable Arguments and Critique the Reasoning of Others as they develop methods to describe the image of a shape after it is rotated or translated, write the area as a sum and area as a product to multiply polynomials and solve equations at least two different ways.
- Model with Mathematics as they translate and rotate shapes and when they use an area model to represent an expression as a sum and as a product.
- Use Appropriate Tools Strategically as they make new polygons, including the rhombus, square, parallelogram, isosceles triangle, isosceles trapezoid, right triangle, kite and dart,
- Attend to Precision as they translate and rotate shapes on the coordinate axes, recognize that perpendicular lines have slopes that are opposite reciprocals, and learn to solve linear equations that involve fractions by undoing the denominators with multiplication.
- Look for and Make Use of Structure as they use their spatial visualizations skills to investigate reflections, discover that objects and their images are equidistant from the line of reflection, write the area of a composite rectangle as a pair of equivalent expressions the sum of its partial areas and as a product of its dimensions.
- Look for and Express Regularity in Repeated Reasoning as they learn the different types of symmetry and describe the symmetry for common shapes.

Sample Activities and Assignments:

Rotations, Reflections and Translation on a Grid – Given several geometric shapes on a grid, students will be given conditions with which to rotate them. For each shape, they will determine if the rotation direction matters, if there are other rotations that give the same results and is there a rotation in which the rotated image will lie exactly on the original shape. Similarly, they will be asked to reflect objects and determine

relationships between the line of reflection and segments connecting a point with its image. Translations will also be investigated and through the problem, students will determine that the rigid transformations preserve shape and size.

Algebra Tiles – Students will be given a set of algebra tiles and initially will be given a model to build using their tiles. After building the figure, students will be asked to determine both the area and the perimeter of the figure. Students will then transition to polynomial expressions. They will be given an expression and will build it using their tiles. They will look at the perimeter of the figure and will also be asked to determine the area as a sum and the area as a product. Students will eventually move to generic rectangles to multiply polynomials.

Unit 4 Modeling Two-Variable Data

Throughout the first part of the unit, students will "eyeball" a line of best fit and use it to make predictions, interpret the slope and y-intercept in a statistical situation, and describe the form, direction, strength, and outliers of an association. They will also calculate residuals and create upper and lower bounds for predictions and use calculators to create the least squares regression line. Students will understand that a residual plot is a way to visualize how well a linear model goes through the data points.

The second half of the unit has the students creating residual plots and analyzing them to determine whether a model is an appropriate fit to the data. They will calculate correlation coefficients and interpret them in context. Students will use more mathematical terms to describe the form, direction, and strength of an association and discover that "association is not causation" because there might be a lurking variable.

Progression of Content:

In this unit, students describe the linear association between two numerical variables. In Unit 8, after students have studied exponential functions, students will fit an exponential function to data.

In Unit 10, students explore relationships between categorical (non-numerical) variables. Students interpret two-way frequency tables using relative frequencies and probabilities, and make conclusions about associations in two-way tables.

Students will continue their study of the variability of data in Unit 10 when they quantify the variability in single-variable data by using standard deviation.

Mathematical Practices used in Unit 4:

- Make Sense of Problems and Persevere in Solving Them as they collect data on forearm length vs height and analyze the data to determine the height of an early humanoid.
- Reason Abstractly and Quantitatively as they learn that extrapolation with a statistical model can lead to nonsensical results.
- Construct Viable Arguments and Critique the Reasoning of Others when they understand that the cause and effect cannot be determined from a study that reports an association.
- Model with Mathematics as they collect data to determine the viewing field of a football stadium looking through a pipe and when they interpret correlation coefficients in context
- Use Appropriate Tools Strategically as they learn to use the calculator to determine the least squares regression line.

- Attend to Precision as they construct a model of a young man viewing a football game through a tube, determine the upper and lower bounds for a prediction they make from linear best-fit model,
- Look for and Make Use of Structure as they observe the impact of an outlier on the least squares regression line.

Sample Activities and Assignments:

Football Game – Unable to afford tickets to a football game, a young man plans to watch it through the drainage pipe. Using PVC pipes as models, students will collect data to determine the width of the field of vision and model the data using a line of best fit. They will approximate the width of the field of view at the south end of the field as well as the north end of the field. They will make a scale drawing of the football field, shading the viewing area. Students will then determine the probability that a touchdown at each end of the field will be seen.

Ancient Humanoid – An ulna bone from an ancient humanoid has been discovered by anthropologists and they would like to determine the height of the humanoid. Students will collect data comparing the length of their forearm to their height. From the data, student will create a scatter plot, describe the association, form, direction, strength and outliers. They will indicate how they handled the outliers, will write an equation that models the data and interpret the slope and y-intercept in context. Students will graphically compute upper and lower bounds for the error as in informal introduction to margin of error. Using their data, they will determine the height range of the humanoid.

Unit 5 Sequences

The unit begins with lessons that ask students to describe the growth of a rabbit population and the decreasing rebound height of a bouncing ball. They will use tables, graphs and equations to represent the data. Students will learn to categorize sequences, the vocabulary associated with sequences, and learn how to write equations for both the nth term of a sequence as well as recursive equations.

Students will compare the growth of sequence and recognize growth by addition and growth by multiplication. They will also compare and contrast functions and sequences, and discrete vs continuous functions. They will recognize that all sequences are functions with domains limited to positive integers. Students will use equations of sequences to solve problems involving linear rates of change as well as percent increase and decrease.

Progression of Content:

The work with arithmetic sequences allows students to extend their thinking with linear functions from Unit 2. The work with geometric sequences prepares them for thinking about exponential functions in Unit 7.

Mathematical Practices used in Unit 5:

- Make Sense of Problems and Persevere in Solving Them as they look at situations that can be represented by sequences, write equations and answer questions involving the situation.
- Reason Abstractly and Quantitatively as they use the rebound ratio for a ball to determine a relationship between the drop height and the rebound height.

- Construct Viable Arguments and Critique the Reasoning of Others when they are introduced to examples of exponential decay, as they begin work with sequences and determine the properties of arithmetic and geometric sequences.
- Model with Mathematics as they write equations and graph data to represent the height of bouncing balls.
- Use Appropriate Tools Strategically to graph the data collected from bouncing balls, use the graphing calculator to graph functions and make predictions from the Attend to Precision as they learn to represent a discrete pattern and use geometric sequences to solve problems involving percent increase and decrease.
- Look for and Make Use of Structure when they write descriptions of both arithmetic and exponential growth based on the patterns in their tables, recognize patterns of arithmetic and exponential growth and use their descriptions to make predictions, learn the vocabulary and notation for arithmetic and geometric sequences and write equations of the nth term as well as write recursive equations.
- Look for and Express Regularity in Repeated Reasoning using the rebound ratio of a ball to determine its height after a particular number of bounces, converting between explicit and recursive equations for sequences, compare linear and exponential growth patterns in situations, tables and graphs.

Sample Activities and Assignments:

Multiplying Like Bunnies – George and Lenny have decided to raise rabbits. Students will advise them as to which the type of rabbits they should raise. The information given about rabbit reproduction rates is exponential and for each scenario, they will determine the rate of growth as well as the starting value. They will investigate ways to represent the data algebraically and lead to the development of geometric sequences, equations, and significance of the parameters in the equation.

Bouncing Ball – Each study team will be given a bouncy ball and will determine the rebound ratio of the ball by dropping it from different heights and analyzing the rebound height. They will graph the data and determine the significance of the slope and the y-intercept. They will then look at the rebound height of the ball as it continues to bounce. After graphing and writing an equation, they will determine the significance of the starting value and the multiplier.

Unit 6 Systems of Equations

Students will begin the unit by solving multivariable equations for one variable. They will write mathematical equations in preparation for solving situational word problems. They will learn three algebraic methods for solving systems of equation: equal values method, substitution, and elimination. They will learn what it means for a system to have no solution or infinite solutions. Students will define variables and write equations to solve word problems.

Students will find ways to know which method is most efficient in solving a system and make important connections among solving equations, multiple representations, and systems of equations. Students will review the connections between a table, graph, and the equations of a system of equations, as well as how to write equations to solve simple system. The difference between intercepts and intersections will be examined in this unit.

Progression of Content:

While the focus of this unit is limited to systems of linear equations, students will later study systems of nonlinear equations (such as two exponential equations) in Unit 8. This work will also connect with solving systems of inequalities in Unit 9.

Students will continue to write and solve equations (and inequalities) from word problems in the remaining units of this book. Specifically, students will write equations in context in Units 8 and will write inequalities from context in Unit 9.

Mathematical Practices used in Unit 6:

- Make Sense of Problems and Persevere in Solving Them as they use multiple representations to solve a word problem.
- Reason Abstractly and Quantitatively as they learn the relationship between distance, rate and time, and when they choose the best strategy for solving a system.
- Construct Viable Arguments and Critique the Reasoning of Others when they learn three methods for solving a system and as they discover that different methods to setting up an elimination problem yield the same end result,
- Model with Mathematics as they use multiple representations to solve a system of equations. Attend to Precision as they solve both single and multi-variable equations.
- Look for and Make Use of Structure as they read problems to determine if the solution involves finding intercepts or intersections.
- Look for and Express Regularity in Repeated Reasoning as they solve multi-variable equations for one of the variables.

Sample Activities and Assignments:

The Hills are Alive – Students will be given information about an Alpine Music Club. The club members are yodelers and play the xylophone. They need to ride a gondola to the top of the hill and are charged for each person as well as each instrument. Students will write a system of equations of equations using the constraints given. They will graph the data in an x-y plane and make a table. Using the data in the table and the graph, students will determine the cost to transport the people and instruments up the hill. An introduction to solving systems algebraically will develop with this problem.

Phone Plans – Given information on three phone plans, students will write equations to represent the cost of each plan. They will graph the data on a single axes, make tables and solve the system algebraically. Students will then use their data to determine the conditions under which each plan should be purchased as well as determine the conditions under which the plans have the same costs.

Unit 7 Congruence and Coordinate Geometry

The unit begins with a review of similar triangles, rigid transformations, determining missing side lengths of similar polygons, identifying congruent polygons, using the Pythagorean Theorem and the Triangle Angle Sum Theorem. They will develop strategies to justify that two triangles are congruent. Students will learn how to use flowcharts to justify conclusions and in the process, they will learn some of the notation used in geometry.

The unit then has students studying polygons drawn on coordinate grids. Using algebraic tools, they will justify statements about shapes on coordinate grids. Students will also learn how to find the midpoint of a segment on a coordinate grid.

Progression of Content:

In Chapter 11, students are introduced to geometric constructions using a compass and a straight edge. The work with flowcharts in this chapter is a stepping stone to formal proofs in future courses.

Mathematical Practices used in Unit 7:

- Reason Abstractly and Quantitatively as they use their algebra skills to discover the properties of quadrilaterals and use the properties to verify and justify the identity of quadrilaterals.
- Construct Viable Arguments and Critique the Reasoning of Others as they determine if two triangles are congruent by comparing all three corresponding angle measurements and all three corresponding sides and then develop the conditions for determining triangle congruence.
- Use Appropriate Tools Strategically when using flowcharts to organize arguments for complex diagrams of triangle congruence
- Attend to Precision as they practice applying triangle congruence theorems, show that the triangle congruence conditions are true using rigid transformations, and develop methods for determining the midpoint of a segment on a coordinate
  grid
- Look for and Make Use of Structure as they determine the least amount of information necessary to determine the congruence of two triangles.

Sample Activities and Assignments:

Conditions for Triangle Congruence – In pairs, students will use a dynamic graphing tool and transformations on the computer to determine the minimum information needed to determine the congruence of two triangles. Students will manipulate different parts of the triangle and through trial and error and logical thinking, they will develop the congruence relationships.

Proving Triangle Congruence – After students have determined the conditions necessary for triangle congruence, they will prove the congruence theorems using rigid transformations. They will organize their movement and reasons in a flowchart, leading to statements that prove triangle congruence.

The Shape Factory – Working in a shape factory requires employees to determine exact shapes, with their titles, given specific information. They will analyze intersections of lines or given vertices to determine the quadrilateral requested. Students create a diagram of each shape and justify it type using coordinate geometry and algebra.

Unit 8 Exponential Functions

Students will investigate the family of exponential functions. They will recognize exponential growth patterns in situations, tables, graphs, and equations and will make connections between the representations. Students will deepen their understanding of exponential functions by examining the multiplier and the y-intercept in different representations. The will generalize the roles of *a* and *b* in the equation. They will extend their knowledge of exponents and their properties and with the algebra skills they already possess, they will learn

to solve exponential equations. They will write exponential equations that fit data and apply exponential functions to real life situations involving growth and decay. Students will also be introduced to step functions in unit 8.

Progression of Content:

In Units 9 and 10, students will broaden their understanding of multiple representations of functions to include inequalities, systems of inequalities, transforming functions with vertical shifts, and arithmetic operations with functions.

In this unit (and Unit 4 previously), students describe the association between two numerical variables. In Unit 10, students explore relationships between two categorical (non-numerical) variables. Then students compare two single-variable numerical distributions and learn about standard deviation as an additional way to quantify variability in single-variable data.

Mathematical Practices used in Unit 8:

- Make Sense of Problems and Persevere in Solving Them when they use what they know about linear and exponential functions to investigate simple and compound interest, write and graphically solve a system of exponential functions in the context of investigating car prices.
- Reason Abstractly and Quantitatively as they solidify connections between the table, equation, graph, and situational representations of an exponential functions.
- Construct Viable Arguments and Critique the Reasoning of Others in their representation of exponential decay in multiple ways and further investigate the effect of an exponent that is 0 or negative.
- Model with Mathematics as they fit a nonlinear model to data that shows a curved trend and in their work with step functions.
- Attend to Precision as the write equations of exponential functions displayed in all types of multiple representations.
- Look for and Make Use of Structure in their investigation of the family of exponential functions, and as they write equations for exponential functions presented as graphs.
- Look for and Express Regularity in Repeated Reasoning when generalizing the parameters of an exponential functions, and also when writing the equation of an exponential given two points.

Sample Activities and Assignments:

Investigating Exponential Functions – Using a graphing calculator, students will investigate functions of the form. They will discover how changing the parameter affects the shape and location of the graph. They will look at the significance of both parameters and learn how to graph an exponential function without making a table first.

Fast Cars – Students will look at the value of three different cars over time. Using an initial cost and a rate of depreciation/appreciation, they will write equations modeling the value of each car and graph all three equations on the same set of axes. Students will then analyze the data and determine the time at which the cars have the same value, and after considering all the data, determine which car a person should purchase and justify their reasoning.

Unit 9 Inequalities

By using what they know about solving equations, students will develop ways to solve inequalities and represent the solutions both algebraically and graphically. They will begin by studying one-variable inequalities and represent the solutions on a number line and also study one variable absolute value equations and inequalities.

Students will then develop methods to solve two-variable inequalities and how to represent the solution of two-variable inequalities on an *xy*-coordinate graph. They will apply what they know about systems to equations to determine the solutions to a system of inequalities.

Progression of Content:

Students will continue their investigation of statistics in Unit 10 as well as transform functions by adding or multiplying by a constant. In Unit 11, students will work with two-dimensional shapes as they investigate constructions. Unit 11 provides a wealth of review opportunities, including reflections, congruence, parallel line theorems, etc. Students will also have the opportunity to review concepts from the entire course.

Mathematical Practices used in Unit 9:

- Make Sense of Problems and Persevere in Solving Them as they use the math they learned in the unit to solve application problems.
- Construct Viable Arguments and Critique the Reasoning of Others as they use inequalities to solve word problems.
- Model with Mathematics as they use the constraints from a problem to graph a viable region and determine the solutions using the graph.
- Use Appropriate Tools Strategically as they develop their ability to graph two-variable inequalities and as they learn to graph constraints using systems of inequalities.
- Attend to Precision as they solve one-variable absolute value equations and inequalities.
- Look for and Make Use of Structure as they solve inequalities and represent the solutions graphically and apply their understanding to solve problems.

Sample Activities and Assignments:

Human Number Line – Ten to twelve students will be given large cards with integer values written on them. They will be asked to arrange themselves in numerical order and then will be given oral statements and will then hold their cards up if their integer makes the statement true. From the human number line, number lines will be graphed on paper, students will write the statements using mathematical symbols and will write the write the symbols as a sentence.

Graphing a Linear, Two Variable Inequality – Graphed on a large poster in the front of the room will be the line Students will be given several ordered pairs, colored sticky dots and the inequality If their points makes the inequality true, they will place a dot on the point on the graph. After the students have finished, there will be a class discussion followed by a student write-up regarding the solutions to the inequality, how many there are, how we represent them on a sheet of paper, how to determine which side of the boundary the solution lie and what happens to the boundary if the > is changed to a ≥.

Search and Rescue – A hot air balloon has gone down and the students are part of a search team to find the missing balloon. They will be given the flight plan, information from a person on the ground and information from a nearby plane. Using the information, students will write equations of the inequalities, graph the

inequalities and using the intersection, determine the region in which the hot air balloon went down so they can send a search team to rescue the passengers.

Unit 10 Functions and Data

The unit begins by looking at two-way tables to calculate probabilities and determine association of categorical data. They will review the differences between graphical representations of single-variable data and then compare the center, shape, spread, and outliers of two distributions. Using statistics, students will make decisions and predictions from the natural variability in data. They will learn standard deviations as a new way to describe spread.

Students will then transform and combine linear and exponential functions.

Progression of Content:

In Unit 11, students will work with two-dimensional shapes as they investigate constructions. Unit 11 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 will also have the opportunity to review concepts from the entire course.

Mathematical Practices used in Unit 10:

- Construct Viable Arguments and Critique the Reasoning of Others as they use the mean and five-number summary to describe data, interpret differences in spread in the context of the data sets accounting for possible effects of outliers.
- Model with Mathematics as they use Venn Diagrams to organize mutually exclusive events, create boxplots and histograms to represent data,
- Look for and Make Use of Structure as they transform linear and exponential functions.
- Look for and Express Regularity in Repeated Reasoning as they compare center, shape, spread and outliers of two collections of numerical data, and prove patterns of linear and exponential growth.

Sample Activities and Assignments:

Two Way Tables and Probability – Students will be given several two way tables and will learn how to read the tables, make predictions and determine probability using the tables. They will make Venn Diagrams and do a silent debate on the topic of using Venn Diagrams to represent categorical data.

Forty Holes of Golf – Students will simulate a golf "closest to the hole" competition using marked "hole" and tossing pennies to simulate hitting a golf ball. Each team will simulate 40 strokes of golf. Analyzing the data students will determine if they should represent their data using a dot plot, boxplot, circle graph, scatterplot, histogram or bar graph. Students will determine center, spread, shape and outliers. Using their data, they will determine which team was the most consistent and therefore the winners of the golf game.

Building a Slide – As engineers for a city, students are required to create plans for a pool slide. Given conditions for the slope the ladder, the horizontal distance from the edge of the pool, and an exponential equation representing the shape of the slide, students will transform the given equation to meet the

conditions set by the city. They are also given information on some slides created that did not meet the given criteria. They will take the data given to them and determine the equation of the slide that failed to meet the given criteria.

Unit 11 Constructions and Closure

Students will be introduced to the study of geometric constructions. They will begin with constructing congruent angles and line segments and move toward construction familiar geometric shapes, such as a rhombus or regular hexagon, using appropriate tools.

The final section of the unit gives the students an opportunity to apply the mathematics they have learned during the year through some challenging and culminating problems.

Progression of Content:

The culminating activities in this unit are a precursor to work students will do in Integrated Mathematics II, including further work with functions, geometry, statistics and probability, equations, expressions and inequalities, and trigonometry.

Mathematical Practices used in Unit 11:

- Make Sense of Problems and Persevere in Solving Them as they use their newly acquired construction skills to construct challenging geometric relationships.
- Reason Abstractly and Quantitatively as students solve equations and systems graphically.
- Construct Viable Arguments and Critique the Reasoning of Others as they learn how to construct perpendicular bisectors, angle bisectors, a line parallel to a given line through a given point and many others. Students will also use statistics to make predictions
- Model with Mathematics as they use statistics to solve problems.
- Use Appropriate Tools Strategically as they construct basic geometric shapes.
- Attend to Precision as they construct congruent figures as well as basic geometric shapes.
- Look for and Make Use of Structure as they solve word problems involving work and mixtures.
- Look for and Express Regularity in Repeated Reasoning in their constructions processes.

Sample Activities and Assignments:

Constructing Parallel Lines, a Square and Three Triangles – After learning the basics of constructions, students will be given hints that lead them to the construction of more difficult shapes. They will justify each step and persevere in their work as they construct given shapes.

The Burning Candle – As a surprise for a friend's birthday, someone wants to carry in a cake with a special burning candle, of which there is only one. Not knowing how long the candles will burn, each study team will collect data of different candles by determining the initial mass of a candle, burning the candle for a period of time and finding the final mass of the candle. Students will record raw data, make a scatter plot, find equation of LSRL, give a verbal description of the form, direction, and strength of the data, give a residual plot, indicate outliers, etc. After a complete analysis of the data, students will make predictions as to how long the special candle will burn.

Cinco de Mayo Parade – Using exponential equations as well as linear equations, students will solve problems associated with organizing a parade, including traffic flow, hotel rooms, food and shuttles. There is not one correct answer, which allows students the opportunity to justify their solutions, using the mathematics they have learned in the course, to keeping the parade organized.

Assignments and Student Engagement

Through the use of technology (including graphing calculators, Desmos, and etools embedded throughout the curriculum), whole class/pair/group discussions, and independent practice, students will deepen their understanding of the mathematical content standards covered in this course. Furthermore, each unit will have multiple investigative activities that will require students to synthesize the information from the current unit as well as previous units and will require them to use their problem solving skills. For each unit, students will be assigned daily classwork and daily homework. Group activities will be incorporated into classwork assignments. Students will often engage with fellow students in the investigative and modeling process. Teachers will encourage all students to participate and explore. Opting out of learning will not be an option. While students are encouraged to construct their own viable arguments, they will be encouraged to appraise those of others during discussion sessions.

Assessments

The instructional methods and strategies listed below support the delivery of this Integrated Mathematics I course with emphasis on group work and investigative activities, the Standards of Mathematical Practice (SMP) will be applied throughout the curriculum. Student's mathematical skills and understanding will be assessed through a range of strategies, such as:

Individual Tests that will allow the teacher to determine a student's ability to solve mathematical problems, level of skill mastery, and conceptual understanding of topics or ideas.

Team Tests that will be used primarily as a formative assessment and an opportunity to assess the SMPs, which include problems designed to inspire in-depth conversations and collaboration around essential mathematics.

Participation Quizzes that will allow the teacher to assess (and therefore support) the quality of the teams' cooperation, independent of mathematical content. In a Participation Quiz, the **quality of the teamwork** on any given task is documented and assessed directly by the teacher, rather than the mathematical content.

Student Presentations that will allow students to exchange insights, use the language of mathematics, and deepen their understanding at the same time that they allow teachers to assess mathematical communication, justification, and making connections.

Class Observations that will allow the teacher to assess (with varying degrees of formality) the quality of the discussion of mathematics in the interactions created as teams work together. Daily Assignments will vary daily giving students' opportunities to practice what they've learned in class. This instructional approach allows students to look for and express regularity in repeated reasoning by practicing mathematical strategies learned in the classroom.

Independent Practice (Homework) that will allow students the opportunity to enhance their learning and extend their practice. Nightly homework may be an extension of an investigation, more practice with similar scenarios, or practice with basic symbolic skills. Students will use appropriate tools strategically and attend to precision while extending their learning.

Math Portfolios that will give students a chance to "show off" their learning, taking pride in their own perseverance, growth over time, and appropriate use of math tools, techniques and proficiency. Simultaneously, the teacher will be able to assess understanding and make instructional decisions accordingly, without the pressure of a test.

Investigative Activities that will encourage students to ask questions about a complicated situation and apply mathematics in pursuit of a solution. In the process students will make assumptions and approximations, understanding that revisions might be needed at a later time. Abstract and quantitative reasoning is applied in considering quantities and their relationships during problem solving.

Course Materials

Textbooks

Title	Author	Publisher	Edition	Website	Primary
Core Connections - Integrated I	Leslie Dietiker, Ph.D, Evra Baldinger, Michael Kassarjian	CPM Educational Program	2nd edition/2014	www.cpm.org	Yes
California Integrated Mathematics 1	Timothy D. Kanold, Edward B. Burger, Juli K. Dixon, Matthew R. Larson, Steven J. Leinwand	Houghton Mifflin Harcourt	1st edition/2015	[empty]	No