# 9TH GRADE ALGEBRA CURRICULUM MAP 2012-2013

*Jo, Joyce, Dorota*

| Units | Unit Essential Questions | Understanding Goals |
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| **Problem Solving** | What are the different approaches in solving problems using Mathematics? | **OA.1.** Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.<br>**A-SSE.3.** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.<br>◦ a. Factor a quadratic expression to reveal the zeros of the function it defines.<br>*1. Solve diamond problems* |
| **Variables and Proportions** | How are variables and equations used in real world context?<br>What is a variable?<br>Why would we want to write mathematical expressions or equations? | **A-APR.1.** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.<br>**A-REI.1.** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.<br>**A-REI.3.** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.<br>A. Solve 1-2 step single variable equations.<br>*B.* Solve multi-step single variable equations |
| **Graphs and Equations** | How are patterns seen in the real world and how can we express through them through graphs and equations?<br>How can we generalize a pattern?<br>What is the relationship between a rule, a table, and a graph? | **N-Q.1.** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.<br>**N-Q.2.** Define appropriate quantities for the purpose of descriptive modeling.<br>**S-ID.6.** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br>a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.<br>b. Informally assess the fit of a function by plotting and analyzing residuals.<br>c. Fit a linear function for a scatter plot that suggests a linear association.<br>**F.5.** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. |

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| **Multiple Representations** | How can analyze data?<br>What is the connection between different representations of data? | **A-CED.2.** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.<br>A. Explain the connection between different linear representations (table, graph, rule, pattern)<br>**S-ID.7.** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. |
| **Multiplication and Proportions** | How are algebraic expressions helpful to our understanding of the world around us and used to generalize patterns and make predictions? | **RP.2.** Recognize and represent proportional relationships between quantities.<br>• Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.<br>• Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.<br>• Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.*<br>**RP.3.** Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.<br>• Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.<br>• Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*<br>• Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.<br>**A-CED.4.** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* |
| **Linear Relationships** | How can slope represent rates of change in real life applications?<br>What is slope? What is rate? | **F-IF.1.** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).<br>**F.3.** Interpret the equation *y* = *mx* + *b* as defining a linear function, whose graph is a |

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| | | straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.* |
| **Systems of Equations** | How do we express and compare two or more similar situations through mathematics?<br>What is a solution?<br>How can we solve different forms of systems quickly and efficiently? | **A-REI.5.** Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.<br>**A-REI.6.** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. |
| **Quadratics** | How do quadratic expressions and equations model real life situations?<br>How to factor a quadratic expression completely? | **A-SSE.3.** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.<br>a. Factor a quadratic expression to reveal the zeros of the function it defines.<br>**A-REI.4.** Solve quadratic equations in one variable.<br>• Use the method of completing the square to transform any quadratic equation in $x$ into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.<br>• Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers $a$ and $b$.<br>**F-IF.4.** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*.<br>**F-IF.7.** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br>◦ a. Graph linear and quadratic functions and show intercepts, maxima, and minima.<br>**A-CED.2.** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.<br>B. Explain the connection between different quadratic representations (table, graph, rule, pattern)<br>**F-IF.8.** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. |

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| | | ◦ a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.<br>**A-REI.7.** Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$. |
| **Inequalities** | What are the applications of inequalities?<br>How do we write an inequality to represent a word problem?<br>How to solve linear inequalities and represent the solutions on a number line and/or graph?<br>How do we represent solutions of linear and nonlinear inequalities with two variables on a graph?<br>How do we graph a system of inequalities? | **A-CED.1.** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*<br>A. Write an inequality to represent a word problem<br>**A-REI.3.** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.<br>*C.* Solve a single variable inequality .<br>**A-CED.3**. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* |

*All units refer to CPM College Preparatory Mathematics Algebra Connections book [www.cpm.org](http://www.cpm.org)*

# 9TH GRADE ALGEBRA 2012-2013

*Jo, Joyce, Dorota*

| Essential Questions: | Enduring Understandings: |
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| 1. Why do we need to use algebra in our lives?<br>2. How are algebraic expressions and equations helpful to our understanding of the world around us?<br>3. What is the relationship between a pattern, a rule, a table and a graph?<br>4. What are the different approaches in solving algebraic problems?<br>5. How can we generalize a pattern? | *Students will understand that…*<br><br>1. Algebraic expressions are not just terms with letters; rather, those letters represent something.<br>2. All relationships can be written as algebraic expressions.<br>3. Data can be represented in multiple ways.<br>4. There is a relationship between patterns, tables, equations, and graphs.<br>5. Patterns can be generalized and used to make predictions. |

## 9th Grade Habits of Mind:

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| 1. Using Evidence | 2. Making Connections | 3. Asking "What if?" |

## 9th Grade Understanding Checks Emphasis:

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| 1. Content | 2. Process | 3. Conventions |

## 9th Grade Course Description:

9th Grade Algebra focuses on the fundamentals of Algebra. Through hands-on investigations of patterns, students will learn how to solve equations, graph linear functions, factor quadratic equations and graph inequalities. They will demonstrate their knowledge through homework, class activities, weekly understanding checks as well as exhibitions, presentations and roundtable discussions. Through performance based assessments students demonstrate what they have learned during the semester. Each of these assessments includes a written, visual and/or oral component.

# 10TH GRADE GEOMETRY CURRICULUM MAP 2012-2013

*Gayle, Tessa*

| Units | Unit Essential Questions | Understanding Goals |
|---|---|---|
| **Transformations** | What are the similarities and differences between rigid and non-rigid transformations? | **TRANS1 –** Dilate a figure on a coordinate plane<br>**TRANS2** – Translate a figure on a coordinate plane<br>**TRANS3 –** Rotate (90, 180, 270, 360)<br>**TRANS4 –** Reflect a figure around the x-axis, y-axis & y = x |
| **Angles & Measurement** | When can I use the Pythagorean Theorem?<br>Why is the Triangle Inequality Theorem true? | **A&M 1a** – Find the measure of a missing angle numerically<br>**A&M 1b –** Find the measure of a missing angle algebraically<br>*8.G.5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*<br><br>**A&M 2a** – Calculate the perimeter & area of a right triangle<br>**A&M 2b** – Calculate the perimeter & area of a right triangle<br>**A&M 2c** – Calculate the perimeter & area of a non-right triangle<br>**A&M 3a** – Find a missing side length using the Pythagorean Theorem<br>*G-SRT.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.*<br>*8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.*<br><br>**A&M 3b** – Find a missing side length using the Triangle Inequality Theorem |
| **Similarity** | What is mathematical similarity? | **SIM1** – Find a missing side or angle given a pair of similar shapes<br>**SIM2** – Prove (or disprove) that two shapes are similar |
| **Right Angle Trigonometry** | Why do the trig ratios always hold?<br>When can I use trig? | **TRIG1** – Find the missing side of a triangle using trig ratios<br>**TRIG2** – Find a missing angle using trig ratios<br>*G-SRT.6. Understand that by similarity, side ratios in right triangles are* |

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| | | *properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.*<br>*G-SRT.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.* |
| **Probability** | What is probability?<br>What is the difference between theoretical & experimental probability? | **PROB1** – Represent the probability of an event using listing<br>**PROB2** – Represent the probability of an event using an area model<br>*S-CP.6. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.*<br>**PROB3** – Represent the probability of an event using a tree diagram |
| **Congruence** | What's the difference between similarity & congruence? | **CONG 1** – Prove (or disprove) that two triangles are congruent<br>**CONG EXT 1** – Apply triangle congruence properties to prove characteristics of quadrilaterals<br>**CONG EXT 2** – Find the midpoint of a line segment on a coordinate plane |

*All units refer to CPM College Preparatory Mathematics Geometry Connections book [www.cpm.org](http://www.cpm.org)*

***Algebra Goals:***

*A-REI.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = –3x$ and the circle $x^2 + y^2 = 3$. (Quad 2a/b)*

*A-REI.12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. (Ineq A)*

*A-SSE.2. Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$. (Rad)*

# 10TH GRADE GEOMETRY 2012-2013

*Gayle, Tessa*

| Essential Questions: | Enduring Understandings: |
|---|---|
| 1. What are the similarities and differences between rigid and non-rigid transformations?<br>2. When can I use the Pythagorean Theorem?<br>3. Why is the Triangle Inequality Theorem true?<br>4. What is mathematical similarity?<br>5. Why do the trig ratios always hold? When can I use trig?<br>6. What is probability? What is the difference between theoretical & experimental probability?<br>7. What's the difference between similarity & congruence? | *Students will understand that…*<br><br>1. Rigid transformations change the orientation of a shape, but maintain its size, while non-rigid transformations change the size of a shape.<br>2. Pythagorean Theorem can only used to find the missing side length of a right triangle, given two other side lengths.<br>3. A triangle can only be formed if the sum of any two sides of a triangle is longer than the third side.<br>4. Shapes are similar if their angles are congruent and their side lengths are proportional.<br>5. Trig ratios can be used to find a missing side length or angle in a right triangle.<br>6. Theoretical probability is the chance of an event happening and experimental probability is the event happening based on a test.<br>7. Similar shapes are proportional, while congruent shapes are both proportional and identical in size. |

## 10th Grade Habits of Mind:

| 1. Using Evidence | 2. Making Connections | 3. Asking "What if?" |
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## 10th Grade Understanding Checks Emphasis:

| 1. Content | 2. Process | 3. Conventions |
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## 10th Grade Geometry Course Description:

10th Grade Geometry focuses on the fundamentals of Geometry. Through hands-on investigations students will learn how to describe, classify and name shapes based on their attributes, understand angle relationships, utilize area formulas, and understand similarity and symmetry. Students will use their prior knowledge of algebra to solve equations for geometry problem solving. Students will also use their logical reasoning skills to articulate math concepts clearly. They will demonstrate their knowledge through homework, class activities, weekly understanding checks as well as exhibitions, presentations and roundtable discussions. Through performance based assessments students demonstrate what they have learned during the semester. Each of these assessments includes a written, visual and/or oral component.

# 11TH GRADE ALGEBRA II CURRICULUM MAP 2012-2013

*Ronit, Keriann, Geoffrey*

| Units | Unit Essential Questions | Understanding Goals |
|---|---|---|
| **Mathematical Modeling** | What function can I use? How can I find the pattern to find a reasonable function? What are the multiple representations to examine a situation? | **F-LE.1.** Distinguish between situations that can be modeled with linear functions and with exponential functions.<br>**F-LE.2.** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).<br>**F-LE.3.** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.<br>**F-LE.4.** For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where $a$, $c$, and $d$ are numbers and the base $b$ is 2, 10, or $e$; evaluate the logarithm using technology. |
| **Functions and Relations** | What is a function? How can I recognize functions from a variety of representations? | **F-IF.1.** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$. The graph of $f$ is the graph of the equation $y = f(x)$.<br>**F-IF .4.** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*<br>**F-IF .5.** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function. |
| **Sequences and Equivalence** | How can I describe a sequence? What are the connections between sequences and functions? | **F-BF.2.** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. |
| **Exponential Functions** | Where is exponential growth or decay? What are ways we can model and represent exponential growth and decay? | **F-IF.8b.** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. (b) Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay. |
| **Transformations of Parent Graphs** | How can I model data to be useful in making meaningful predictions and observations?<br>How are members of a family of functions and relations connected? | **F-BF.3.** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs.<br>Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. |

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| | How can I transform a function? How do we solve quadratic equations by completing the square? | **F-IF.8.** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. (a) Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. |
| **Solving and Intersections** | What are the meanings of solutions? How can I model and organize possibilities? | **A-REI.7.** Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$. |
| **Simplifying and Solving** | How can we solve complex equations or simplify complex expressions? How do we simplify expressions involving exponents and fractions? How do we solve and represent new types of equations and inequalities, such as those with square roots, rational expressions, and absolute values? | **ALS2a** - linear equations<br>**ALS2b** - higher order equations |
| **Inverses and Logarithms** | How can I undo functions? What are logarithms and how can we transform their graphs? | **F-BF.4.** Find inverse functions. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.* (+) Verify by composition that one function is the inverse of another. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. (+) Produce an invertible function from a non-invertible function by restricting the domain.<br>**F-BF.5.** (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. |
| **Trigonometric Functions** | How can we model a periodic relationship using a trigonometric function?<br>How does the unit circle connect to the graph of the sine/cosine curve?<br>How are the trigonometric functions related to each other? | **ALS2d** - trigonometric equations<br>**F-TF.1.** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.<br>**F-TF.2.** Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.<br>**F-TF.3.** (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosines, and tangent for $x$, $\pi + x$, and $2\pi - x$ in terms of their values for $x$, where $x$ is any real number.<br>**F-TF.5.** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.<br>**F-TF.8.** Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle. |

*All units refer to CPM College Preparatory Mathematics Algebra Connections book [www.cpm.org](http://www.cpm.org)*

# 11TH GRADE ALGEBRA II 2012-2013

*Ronit, Keriann, Geoffrey*

| Essential Questions: | Enduring Understandings: |
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| 1. What are the different families of functions, and how do they behave?<br>2. How do things grow, and how can we model that growth mathematically?<br>3. How can we use algebra to efficiently and accurately represent mathematical phenomena?<br>4. What role does "doing & undoing" play in algebra & functions?<br>5. How does understanding multiple representations of functions help us make predictions and better understand situations? | *Students will understand that…*<br><br>1. Changing parameters affects different families of functions in similar ways.<br>2. Mathematics can be a tool used to model a wide variety of phenomena.<br>3. "Doing & Undoing" is our most important tool for algebraic simplification. |

## 11th Grade Habits of Mind:

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|---|---|---|
| 1. Using Evidence | 2. Making Connections | 3. Asking "What if?" |

## 11th Grade Understanding Checks Emphasis:

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|---|---|---|
| 1. Content | 2. Process | 3. Conventions |

## 11th Grade Course Description:

11th Grade Math focuses on the study of functions and their behavior. Functions are the subset of math that deals with modeling different phenomena. In 11th grade we look particularly at non-linear phenomena: population growth, half-life, maximizing the volume of a box, trajectories, rebound heights, interest rates, etc. We also explore ways to model not only continuous phenomena but discrete as well. These phenomena are modeled using different families of functions: quadratic, cubic, exponential, logarithmic. Within those families, we find that by changing certain parameters we can get closer to an accurate mathematical representation of the phenomena we seek to model. Students develop a feel for the great flexibility of algebra as a language to succinctly and accurately model an immense variety of situations.

# 12TH GRADE PRE-CALCULUS CURRICULUM MAP 2012-2013

*Ronit, Geoffrey*

| Units | Essential Questions | Understanding Goals |
|---|---|---|
| **Polynomial Functions** | How can we model polynomial functions? How can I find other solutions? How can I graph it? What is an imaginary number? | **N-CN.1-3.** Know there is a complex number *i* such that $i^2 = -1$. Use the relation $i^2 = -1$ to manipulate complex numbers.<br>**N-CN.7.** Solve quadratic equations with real coefficients that have complex solutions.<br>**N-CN.9.** Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.<br>**A-APR.2.** Know and apply the Remainder Theorem<br>**A-APR.3**. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.<br>**A-APR.6.** Rewrite simple rational expressions in different forms using division<br>**F-IF.7.** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (c.) Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. |
| **Probability** | How can you use probability to predict outcomes? How can you use probability to make policy decisions and analyze the world around you? Is that a fair situation/game? Why or why not? | **S-MD.1.** Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.<br>**S-MD.2.** Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.<br>**S-MD.3.** Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.<br>**S-MD.5.** Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. (a) Find the expected payoff for a game of chance.<br>**S-MD.6.** Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). |
| **Series** | Is there another way to solve this? How can I represent it? How can I generalize this? How can I justify this generalization? | **F-BF2.** Write arithmetic and geometric sequences recursively and with an explicit formula<br>**SR1.** Understand series and summation notation<br>**A-SSE.4.** Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. |
| **Finding the Area Under the Curve: Rocket Launch** | What if it is in pieces? How can I find a sum faster? How can I estimate area? How can area be negative? Why use trapezoids to find area? | **F-IF.7b.** Graph functions and show key features of piecewise-defined functions, including step functions and absolute value functions<br>**AUC1.** Find area under the curve using rectangles and trapezoids<br>**AUC2.** Understand applications to finding the area under the curve |

All units refer to CPM College Preparatory Mathematics Algebra 2 Connections book www.cpm.org

# 12TH GRADE PRE-CALCULUS CURRICULUM MAP 2012-2013

*Ronit, Geoffrey*

| Units | Essential Questions | Understanding Goals |
|---|---|---|
| **Statistics** | How can you use statistics to advocate for social justice? What do these statistics tell you about the situation, is there bias? How does statistics help you seek significance in the study of mathematics? How can you use statistics to provide evidence and reinforce your argument? | **S-ID.1.** Represent data with plots on the real number line (dot plots, histograms, and box plots).<br>**S-ID.2.** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.<br>**S-ID.3.** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).<br>**S-ID.4.** Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.<br>**S-IC.1.** Understand statistics as a process for making inferences about population parameters based on a random sample from that population.<br>**S-IC.2.** Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.<br>**S-IC.3.** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.<br>S-**IC.4.** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.<br>**S-IC.5.** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.<br>**S-IC.6.** Evaluate reports based on data |

# 12TH GRADE PRE-CALCULUS 2012-2013

*Ronit, Geoffrey*

| Essential Questions: | Enduring Understandings: |
|---|---|
| 1. How can I model this situation?<br>2. How can I find the other solutions?<br>3. How can I graph it?<br>4. What is an imaginary number?<br>5. How can you use probability to predict outcomes?<br>6. How can you use probability to make policy decisions and analyze the world around you?<br>7. Is that a fair situation/game? Why or why not?<br>8. Is there another way to solve this?<br>9. How can I represent it?<br>10. How can I generalize this? How can I justify this generalization? | *Students will understand that…*<br><br>1. There is a relationship between patterns, tables, equations, and graphs. There are many types of functions that they have studied throughout their four years.<br>2. They can make connections with multiple representations and problem solving methods.<br>3. Data can be represented in multiple ways. |

## 12th Grade Habits of Mind:

| | | |
|---|---|---|
| 1. Using Evidence | 2. Making Connections | 3. Asking "What if?" |

## 12th Grade Understanding Checks Emphasis:

| | | |
|---|---|---|
| 1. Content | 2. Process | 3. Providing Evidence |

## 12th Grade Course Description:

In this course, students use the College Preparatory Mathematics program www.cpm.org This is an advanced, challenging course where students explore mathematical ideas such as Polynomial Functions, Probability, Series & Sequences and Area Under the Curve. Students will learn a variety of approaches to problem solve and use math in real life contexts. Students will demonstrate their understanding through classwork, homework, understanding checks, and projects. The Senior Graduation Oral Defense exit portfolio consists of an individual presentation to a committee of teachers, students, and guests. Students must defend their understanding to the committee and provide evidence to defend their thinking and understanding of the material.

# CALCULUS CURRICULUM MAP 2012-2013

| Units | Unit Essential Questions | Understanding Goals |
|---|---|---|
| **Pre-Calculus** | What skills do we already have that will help us in Calculus?<br><br>How can we describe a function's rate of change? | **AEE.** Manipulate algebraic equations and expressions<br>**FIF.** Interpret and compose functions<br>**GMD.** Evaluate geometric measurement and dimension |
| **Instantaneous Rates** | How can we analyze a function's local behavior? | **L.1.** Predict function behavior with limit<br>**L.2.** Formally define continuity |
| **Slope Functions and Curve Analysis** | How can we generalize the rate of change of a function at all instants? | **D.1.** Use Power Rule to find derivative of any polynomial function<br>**D.2.** Use derivative to find the tangent line at a particular point<br>**D.3.** Understand the relationship between derivatives, velocity and acceleration<br>**D.4.** Apply derivatives to curve sketching |
| **Fundamental Theorem of Calculus** | What is the FTC and how does it connect to limits, slopes and areas? | **I.1.** Estimate the area under a curve using Riemann Sum<br>**I.2.** Understand definite/indefinite integral and integration rules<br>**I.3.** Apply FTC to find area under a curve<br>**I.4.** Apply FTC to find area between the curves |
| **Optimization and Derivative Tools** | How can we use the derivative to solve a variety of problems? | **D.5.** Differentiate trig functions, products, quotients and composites<br>**D.6.** Apply calculus to optimization problems |
| **Completing the Derivative Toolkit** | What other derivative tools can we use? | **D.7.** Differentiate functions implicitly<br>**D.8.** Apply Mean Value Theorem to derivatives and integrals |
| **Related Rates and Integration Tools** | How do we use calculus to solve problems involving related rates? | **D.9.** Solve separable differential equations<br>**I.5.** Integrate functions using u-substitution |
| **Volumes of Revolutions** | How do use cross-sections of familiar shapes to find a volume of a solid? | **I.6.** Use a disc method to find the volume of a solid<br>**I.7.** Use a washer method to find the volume of a solid |

*All units refer to CPM College Preparatory Mathematics College Prep Calculus book www.cpm.org*