

# LaSalle-Peru Township High School District 120



## Math Curriculum

Adopted by the Board of Education, June 24, 2015

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## Introduction

The purpose of the LaSalle-Peru Township High School District's Mathematics Curriculum is to provide a clear, organized framework on which to base instruction in the classroom. The curriculum includes specific outcomes and components for these outcomes which further clarify the skills necessary to achieve each outcome. Each outcome also describes the depth of knowledge and level of rigor required for students to demonstrate their conceptual understanding of the mathematical knowledge and skills outlined in the curriculum.

There are two critical components to the math curriculum:

- The *Standards for Mathematical Practice* describe processes and proficiencies that have been proven to be necessary for students to become true mathematicians. These standards are to be embedded **at every grade level and within each course** to establish habits of mind which will empower students to become mathematically literate.

The *Outcomes and Components* are **grade-level/course specific**. These have been carefully aligned to the Illinois Common Core State Standards and teachers are expected to align their instruction to the identified outcomes for each course. Outcomes express the essential learning that all students in the grade level/course must know or be able to do in the content area. They make connections among separate concepts or skills described in the components. Outcomes require high cognitive levels and direct assessment. Components state simple and complex concepts or skills that students must know or do in order to perform each outcome. All outcomes and components are to be included within the course of instruction for the year. Assessments will be written at the outcome level.

Each outcome has been assigned a code number consisting of symbols for content area, grade level or course, and outcome number. In the example shown below, M stands for Math (content area) – A1 stands for Algebra 1 (course) – 1 symbolizes that it is the first outcome in this course.

Example:

**Outcome M-A1-1:**

**Students will ...**

- M.A1.1.1 Solve one-step equations.
- M.A1.1.2 Solve two-step equations.
- M.A1.1.3 Solve multi-step equations.
- M.A1.1.4 Solve equations with variables on both sides.

Mathematics

Algebra 1

1<sup>st</sup> Outcome, 4<sup>th</sup> component

At the end of each component, the code number in parentheses indicates the Illinois Common Core State Standards to which it aligns and includes the category, domain, and standard number. The following is a link to the complete Illinois Common Core State Mathematics Standards –

[http://www.isbe.net/common\\_core/pls/level1/pdf/math-standards.pdf](http://www.isbe.net/common_core/pls/level1/pdf/math-standards.pdf).

There are many steps to the curriculum implementation process. The draft curriculum will be implemented during the 2014-15 school year. During that time, teachers will provide feedback to validate the draft curriculum. Based on teacher feedback, the SAC will then make revisions as deemed necessary and finalize the curriculum. During the 2015-16 school year, the SAC will select aligned resources and develop common outcome assessments. The following year, 2016-17, teachers will use the assessments and provide feedback to validate them. The SAC will make revisions and finalize the assessments. The curriculum and assessments will be fully implemented for several years before the curriculum development process begins again in 2019-20.

*We Are*



## **District Mission Statement**

The Mission of LaSalle-Peru Township High School is to educate all students to the highest standards in a safe and challenging environment while developing within each of them:

- The ability to think critically, solve problems, and communicate effectively.
- Pride and respect in themselves, school, and community.
- An inspiration to become life-long learners who meet the challenges of an ever-changing and diverse world.

## **Vision Statement**

Learn... Grow... Lead... Excellence is our Standard.

## **Beliefs**

We believe that...

- Every person should strive for excellence.
- Every person is unique and worthy of respect.
- LPHS is the core of the community.
- Students need a safe school.
- Today's learners must be educated to meet tomorrow's challenges.

## **Mathematics Subject Area Mission**

Students completing the LPHS Mathematics curriculum will develop college and/or career readiness through demonstration of the following:

- Thinking critically and logically using mathematical concepts
- Communicating using computational and conceptual skills
- Solving problems individually and cooperatively
- Persevering in solving real-world applications

## **Course Purposes**

### **Algebra 1**

Students will choose the appropriate method and solve linear and quadratic equations and linear inequalities. Students will graph, write, and compare linear, quadratic, and exponential functions and apply these concepts to real-world situations. In addition, students will summarize, represent, and interpret data.

### **Algebra 1 Honors**

Students will choose the appropriate method and justify the process of solving linear and quadratic equations and linear inequalities. Students will graph, write, compare, and analyze linear, quadratic, and exponential functions and apply these concepts to real-world situations. In addition, students will design studies and summarize, represent, and interpret the data.

### **Geometry**

Students will construct logical arguments based on geometric concepts. Students will classify geometric figures and apply their properties to solve problems. Students will utilize and communicate appropriate geometric concepts and terminology in everyday situations.

## **Geometry Honors**

Students will analyze problems to construct logical arguments based on geometric concepts. Students will examine geometric figures to find and apply their properties to solve problems. Students will apply the concepts of coordinate geometry to investigate geometric relationships. In addition, students will utilize and communicate appropriate geometric concepts and terminology in everyday situations.

## **Algebra 2**

Students will choose the appropriate method and solve polynomial, logarithmic, exponential, trigonometric, rational, and radical equations. Students will graph, write, and compare polynomial, logarithmic, exponential, trigonometric, and radical functions and apply these concepts in a variety of situations. In addition, students will apply probability rules to real-world situations.

## **Algebra 2 Honors**

Students will choose the appropriate method and justify the process of solving polynomial, logarithmic, exponential, trigonometric, rational, and radical equations. Students will graph, write, compare, and analyze polynomial, logarithmic, exponential, trigonometric, and radical functions and apply these concepts in a variety of situations. In addition, students will apply probability rules to formulate solutions to real-world situations.

## **Algebra 3**

Students will perform operations on and apply matrices in real-world situations. Students will represent sequences and series algebraically to solve problems. In addition, students will identify, graph, and write equations for conic sections and graph rational functions.

## **Trigonometry**

Students will solve and graph trigonometric equations. Students will prove and apply trigonometric identities. In addition, students will apply trigonometry to all triangles and complex numbers. Students will represent and model with vector quantities.



## **Probability and Statistics**

Students will design studies and experiments. Students will summarize, represent, interpret, and analyze data. Students will calculate probability of events and use probability distributions to solve problems.

## **Discrete Math**

Students will apply mathematics in practical situations including management science, voting and social choice, fairness and game theory, encryption and decryption, and money and resources.

## **Pre-Calculus Honors**

Students will represent and model with vector quantities; perform operations on and apply matrices in real-world situations; identify, graph, and write equations for conic sections; and graph rational functions. Students will represent sequences and series algebraically to solve problems. In addition, students will solve and graph trigonometric equations; prove and apply trigonometric identities; and apply trigonometry to all triangles and complex numbers. Students will use a variety of methods to calculate limits.

## **AP Statistics**

Students will summarize, represent, and interpret data. Students will make inferences and justify conclusions from sample surveys, experiments, and observational studies. In addition, students will apply the rules of probability to real-world situations.

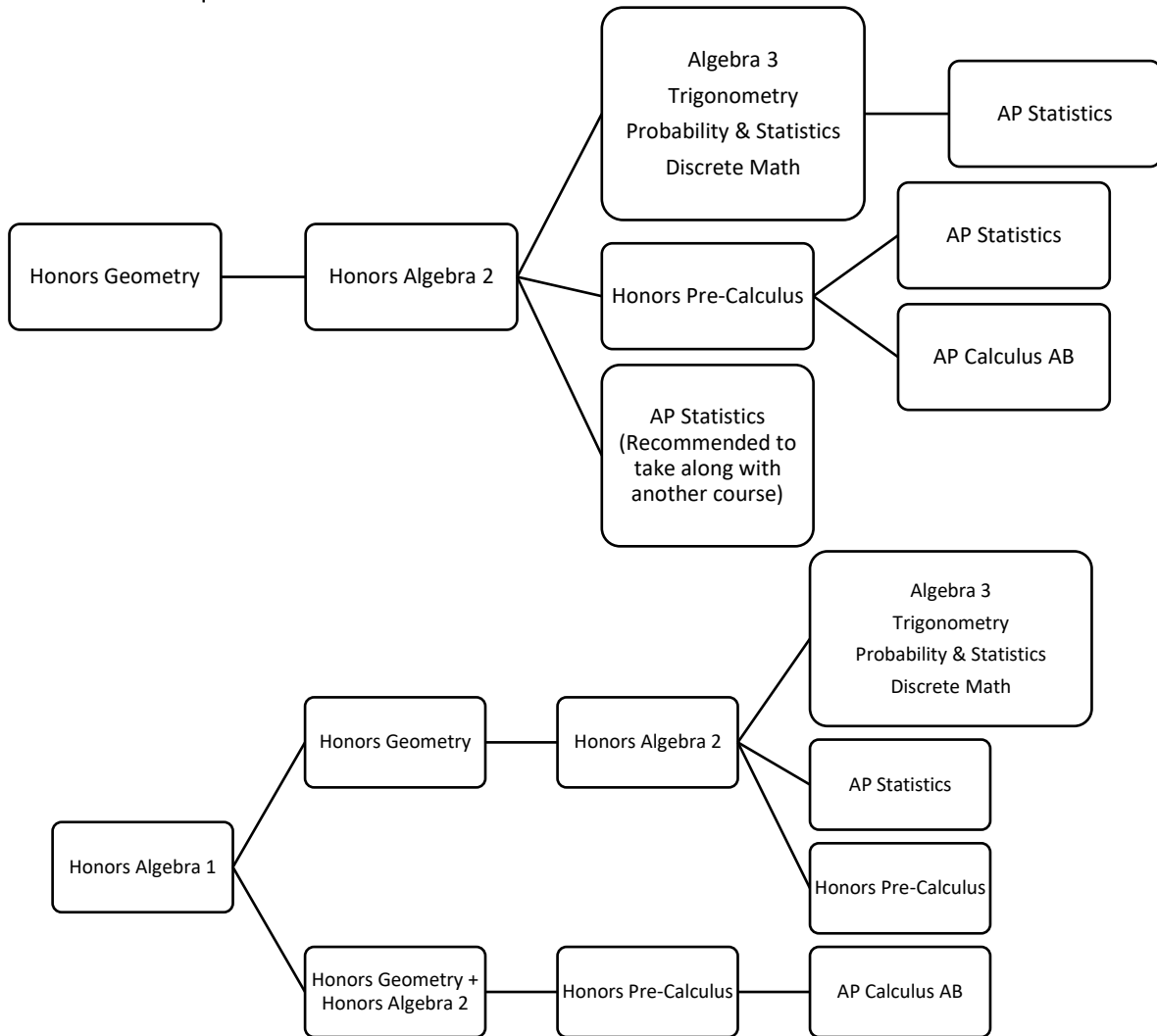
## **AP Calculus AB**

Students will evaluate functions and limits graphically, analytically, and numerically. Students will compute, analyze, evaluate, and apply derivatives and integrals.

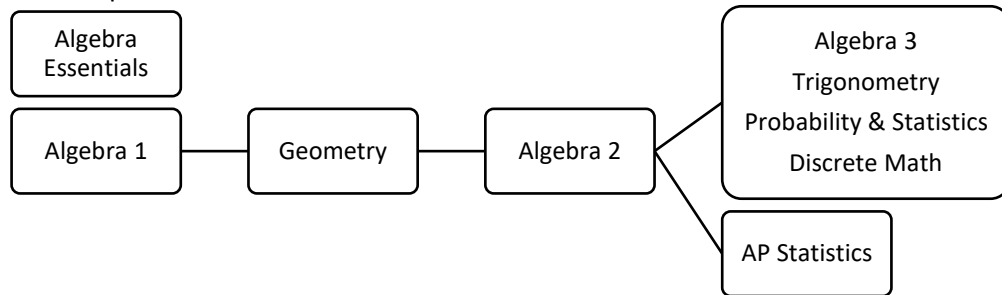
## **AP Computer Science A**

Students will design and implement solutions to real-world problems by writing, running, and debugging computer programs. Students will develop and select appropriate algorithms and data structures to solve problems. In addition, students will code fluently in an object-oriented paradigm using the programming language Java.

### Honors Course Sequences



### Regular Course Sequences



In addition, students will be able to take AP Computer Science A during their Junior or Senior year as an elective mathematics credit. It is highly recommended that college-bound students who choose to take AP Computer Science A do so along with another mathematics class.

# Curriculum at a Glance

## Algebra 1

### Course Purpose:

Students will choose the appropriate method and solve linear and quadratic equations and linear inequalities. Students will graph, write, and compare linear, quadratic, and exponential functions and apply these concepts to real-world situations. In addition, students will summarize, represent, and interpret data.

- M.A1.1** Students will solve linear and absolute value equations in one variable. Given a situation, they will also create linear equations to represent the information, solve the equation, and explain the reasonableness of the solution. (A-CED.1, A-CED.4, A-REI.1, A-REI.3, A-SSE.1, N-Q.1, N-Q.2, N-Q.3)
- M.A1.2** Students will solve and graph linear and compound inequalities in one variable. Given a situation, they will also create linear inequalities to represent the information, solve the inequality, and explain the reasonableness of the solution. (A-CED.1, A-REI.3, A-SSE.1, N-Q.1, N-Q.2, N-Q.3)
- M.A1.3** Students will use the domain and range to determine if a relation is a function and justify their reasoning. Using function notation, students will evaluate, interpret, and write functions using the independent and dependent variables in a given situation. (F-BF.1, F-IF.3, F-IF.1, F-IF.5, F-IF.2, F-LE.5, A-SSE.1)
- M.A1.4** Students will choose and apply an appropriate method to graph linear equations in two variables and interpret graphs of linear equations given a situation. (A-REI.10, A-REI.11, S-ID.7, A-SSE.1, F-IF.6)
- M.A1.5** Students will write linear equations in various forms (point-slope, slope-intercept, standard) using the given information. They will also write linear equations to represent data for a real-life situation. (A-CED.2)
- M.A1.6** Students will apply an appropriate method to solve a system of equations, write a system of equations to model a given situation, and determine appropriate solutions. They will also identify solutions of inequalities and systems of inequalities by graphing. (A-REI.5, A-REI.6, A-REI.12, A-CED.3, A-SSE.1)
- M.A1.7** Students will apply the most appropriate method to simplify expressions using the properties of exponents and extend those properties to rational exponents. (A-SSE.3c)

- M.A1.8** Students will classify polynomials by number of terms and degree, apply mathematical operations to simplify expressions involving polynomials, and factor polynomials completely. (A-SSE.2, A-APR.1)
- M.A1.9** Students will identify and apply key characteristics of the graph of a quadratic function to solve problems; choose and apply an appropriate method to solve a quadratic equation; and examine their solution(s) to determine validity and appropriateness within a given context. (F-IF.7a, A-REI.4a, A-SSE.3a, A-REI.10, A-REI.4b, A-SSE.3b, A-APR.3, F-IF.8a, N-Q.1, N-Q.2, N-Q.3)
- M.A1.10** Students will simplify radical expressions and solve radical equations. (N-RN.A.2)
- M.A1.11** Students will graph exponential functions and identify key features of the functions. Students will identify linear, quadratic, and exponential models in different forms and justify their reasoning. They will also write the appropriate function to represent given data. (F-IF.4, F-IF.9, F-LE.1, F-LE.2, F-LE.3, F-LE.5, F-BF.1a, F-BF.2)

## Algebra 1 Honors

### Course Purpose:

Students will choose the appropriate method and justify the process of solving linear and quadratic equations and linear inequalities. Students will graph, write, compare, and analyze linear, quadratic, and exponential functions and apply these concepts to real-world situations. In addition, students will design studies and summarize, represent, and interpret the data.

- M.A1H.1** Students will solve linear and absolute value equations in one variable. After creating a situation, they will also write a linear equation to represent the information, solve the equation, and justify the solution. (A-CED.1, A-CED.4, A-REI.1, A-REI.3 A-SSE.1, N-Q.1, N-Q.2, N-Q.3)
- M.A1H.2** Students will solve and graph linear, compound, and absolute value inequalities in one variable. After creating a situation, they will also write linear inequalities to represent the information, solve the inequality, and justify the solution. (A-CED.1, A-REI.3, A-SSE.1, N-Q.1, N-Q.2, N-Q.3)
- M.A1H.3** Students will use the domain and range to determine if a relation is a function and justify their reasoning. Using function notation, students will evaluate and interpret functions. They will also create a situation using independent and dependent variables and write a function in function notation, identifying the appropriate domain and range, to represent the situation. (F-BF.1, F-IF.3, F-IF.1, F-IF.5, F-IF.2, F-LE.5, A-SSE.1)
- M.A1H.4** Students will choose and apply an appropriate method to graph linear equations in two variables. Students will create a situation in two variables, write the equation, apply an appropriate method to graph the equation, and analyze the key features of the graph as they relate to the situation. (A-REI.10, A-REI.11, S-ID.7, A-SSE.1, F-IF.6)
- M.A1H.5** Students will write linear equations in various forms (point-slope, slope-intercept, standard) using the given information. Students will also find an example of real-time data and analyze the data to create a scatter plot, approximate the line of best fit, and write the equation of the line. (A-CED.2)
- M.A1H.6** Students will apply an appropriate method to solve a system of equations, write a system of equations to model a student-selected situation, and determine appropriate solutions. They will also identify solutions of inequalities and systems of inequalities by graphing. (A-REI.5, A-REI.6, A-REI.12, A-CED.3, A-SSE.1)
- M.A1H.7** Students will determine and apply the most appropriate method to simplify expressions using the properties of exponents and extend those properties to rational exponents. (A-SSE.3c)

- M.A1H.8** Students will classify polynomials by number of terms and degree, apply mathematical operations to simplify expressions involving polynomials, and factor polynomials completely. (A-SSE.2, A-APR.1)
- M.A1H.9** Students will identify and apply key characteristics of the graph of a quadratic function to solve problems; choose and apply an appropriate method to solve a quadratic equation; and examine their solution(s) to determine validity and appropriateness within a given context. Given a situation, students will also write a quadratic function and determine appropriate solutions for the situation. (F-IF.7a, A-REI.4a, A-SSE.3a, A-REI.10, A-REI.4b, A-SSE.3b, A-APR.3, F-IF.8a, N-Q.1, N-Q.2, N-Q.3)
- M.A1H.10** Students will simplify radical expressions and solve radical equations. (N-RN.A.2)
- M.A1H.11** Students will graph exponential functions and identify key features of the functions. Students will identify linear, quadratic, and exponential models in different forms and justify their reasoning. They will also write the appropriate function to represent given data. (F-IF.4, F-IF.9, F-LE.1, F-LE.2, F-LE.3, F-LE.5, F-BF.1a, F-BF.2)
- M.A1H.12** Students will state the name of the parent function (linear, quadratic, exponential, square root, cube root, absolute value) from an equation or graph and identify the transformation applied. (F-IF.7b, F-BF.3)

## Geometry

### Course Purpose:

Students will construct logical arguments based on geometric concepts. Students will classify geometric figures and apply their properties to solve problems. Students will utilize and communicate appropriate geometric concepts and terminology in everyday situations.

- M.G.1** Students will model points, lines, and planes and define other basic geometric terms. They will identify and explain basic relationships using points, lines, and planes. Students will accurately draw and correctly label basic geometric figures and will perform basic compass/straightedge constructions. (G-CO.1)
- M.G.2** Students will formulate logical arguments, using geometric rules and laws of logic, to prove statements. (G-CO.9, G-CO.10, G-CO.11)
- M.G.3** Students will apply properties of angles formed by lines cut by a transversal to solve problems and to prove lines parallel. Students will construct and apply theorems of parallel and perpendicular lines. (G-CO.1, G-CO.9, A-CED.2)
- M.G.4** Students will prove triangles congruent and use triangle congruence to prove theorems. (G-CO.6, G-CO.7, G-CO.8, G-CO.10, G-SRT.5)
- M.G.5** Students will apply properties of various centers of triangles and the mid-segments of triangles to solve problems, including real-world applications. (G-CO.10)
- M.G.6** Students will prove and/or apply theorems about right triangles, including the Pythagorean Theorem and the patterns of special right triangles. (G-CO.10, G-SRT.5)
- M.G.7** Students will classify polygons and apply the theorems about angles of a polygon to solve problems. They will apply properties of special quadrilaterals and use them to write proofs. (G-CO.11)
- M.G.8** Students will apply the definition of similar polygons and other proportionality theorems to solve problems. Students will prove triangles similar using the triangle similarity theorems. (G-SRT.2, G-SRT.5)
- M.G.9** Students will apply an appropriate method to solve for side(s) and/or angle(s) in right triangles and in applications that can be modeled with a right triangle. (G-SRT.6, G-SRT.7, G-SRT.8)

- M.G.10** Students will apply formulas to calculate areas of regular polygons and volumes of solids. Students will model real world objects as geometric solids and apply formulas to solve problems. (G-GMD.1, G-GMD.3, G-GMD.4, G-MG.1, G-MG.2)
- M.G.11** Students will apply theorems about lines, segments, arcs, and angles related to circles to solve problems and calculate sector areas and arc lengths. (G-C.1, G-C.2, G-C.3, G-C.5)
- M.G.12** Students will verify theorems using coordinate methods. (G-GPE.1, G-GPE.4, G-GPE.5, G-GPE.7)
- M.G.13** Students will identify transformations and classify them as isometries or not. They will also transform figures on a coordinate plane and describe transformation(s) used to map one shape to another. (G-CO.1, G-CO.2, G-CO.3, G-CO.4, G-CO.5, G-CO.6, G-SRT.1, G-SRT.3)



## Geometry Honors

### Course Purpose:

Students will analyze problems to construct logical arguments based on geometric concepts. Students will examine geometric figures to find and apply their properties to solve problems. Students will apply the concepts of coordinate geometry to investigate geometric relationships. In addition, students will utilize and communicate appropriate geometric concepts and terminology in everyday situations.

- M.GH.1** Students will model points, lines, and planes and define other basic geometric terms. They will identify and explain basic relationships using points, lines, and planes. Students will accurately draw and correctly label basic geometric figures, will perform basic compass/straightedge constructions, and will apply distance and midpoint formulas to investigate properties of basic geometric figures. (G-CO.1, G-CO.5, G-GPE.7)
- M.GH.2** Students will formulate logical arguments, using geometric rules and laws of logic, to prove statements. (G-CO.9, G-CO.10, G-CO.11)
- M.GH.3** Students will apply properties of angles formed by lines cut by a transversal to solve problems and to prove lines parallel. They will also write equations of lines and apply slope criteria for parallel and perpendicular lines to solve geometric problems. (G-CO.1, G-CO.9, A-CED.2, G-GPE.5)
- M.GH.4** Students will prove triangles congruent and use triangle congruence to prove theorems. They will also use coordinate geometry and transformations to prove triangles congruent. (G-CO.6, G-CO.7, G-CO.8, G-CO.10, G-SRT.5)
- M.GH.5** Students will apply theorems about right triangles, including the Pythagorean Theorem and the patterns of special right triangles. Students will use coordinate geometry to classify triangles and determine centers (circumcenter, incenter, orthocenter, and centroid). (G-CO.10, G-SRT.5, G-GPE.4)
- M.GH.6** Students will classify polygons and apply the theorems about angles of a polygon to solve problems. They will prove and apply properties of special quadrilaterals using traditional and coordinate methods. (G-CO.11, G-GPE.4, G-GPE.5)
- M.GH.7** Students will apply the definition of similar polygons and other proportionality theorems to solve problems. Students will prove triangles similar using triangle similarity theorems and transformations. (G-SRT.1, G-SRT.2, G-SRT.3, G-SRT.4, G-SRT.5)

- M.GH.8** Students will apply an appropriate method to solve for side(s) and/or angle(s) in right triangles and in applications that can be modeled with a right triangle. (G-SRT.6, G-SRT.7, G-SRT.8)
- M.GH.9** Students will apply formulas to calculate areas of plane figures. Students will apply formulas to solve real world problems and find geometric probability. (G-GMD.1, G-GMD.3, G-GMD.4, G-MG.1, G-MG.2)
- M.GH.10** Students will apply formulas to calculate lateral area, surface area, and volumes of solids. Students will model real world objects as geometric solids and apply formulas to solve problems. (G-GMD.1, G-GMD.3, G-GMD.4, G-MG.1, G-MG.2)
- M.GH.11** Students will apply theorems about lines, segments, arcs, and angles related to circles to solve problems and calculate sector areas and arc lengths. Students will use coordinate methods to write equations of circles and to graph circles. (G-C.1, G-C.2, G-C.3, G-C.5)

## Algebra 2

### Course Purpose:

Students will choose the appropriate method and solve polynomial, logarithmic, exponential, trigonometric, rational, and radical equations. Students will graph, write, and compare polynomial, logarithmic, exponential, trigonometric, and radical functions and apply these concepts in a variety of situations. In addition, students will apply probability rules to real-world situations.

- M.A2.1** Students will identify parent functions, domain, range and transformations given equations or graphs (Linear, Quadratic, Cubic, Square Root, Absolute Value). (F-BF. 3, F-BF.4, F-IF.4, F-IF.7)
- M.A2.2** Students will perform arithmetic operations on expressions containing complex numbers. They will also solve quadratic equations with real coefficients that have complex solutions. (N-CN.1, N-CN.2, N-CN.3, N-CN.7, A-REI.1, A-REI.4b, A-SSE.2)
- M.A2.3** Students will perform arithmetic operations and factor polynomial expressions. They will also solve and sketch a given polynomial equation using an appropriate method. When graphing, students will identify domain, range, local maxima, local minima, end behavior, and transformations. (A-APR.1, A-APR.2, A-APR.3, A-APR.4, A-APR.6, A-SSE.1a, A-SSE.2, A-REI.1, A-CED.1, F-IF.4)
- M.A2.4** Students will perform arithmetic operations with a rational expression. They will also solve rational equations including application situations. In addition, students will graph a rational expression identifying domain, range, vertical asymptotes, and transformations. (N-Q.2, F-IF.6, A-CED.1, A-APR.6, A-REI.1, A-REI.2, A-REI.11)
- M.A2.5** Students will simplify radical expressions. They will also solve and graph radical equations, identifying domain, range, and transformations. (F-IF.6, A-REI.1, A-REI.2, N-Q.2, N-RN.1, N-RN.2)
- M.A2.6** Students will write and solve an exponential or logarithmic equation including application situations. They will also graph exponential and logarithmic functions identifying domain, range, asymptotes, and transformations. (F-LE.1, F-LE.2, F-LE.3, F-LE.4, F-LE.5, F-IF.4, F-IF.6, N-Q.2, A-CED.1, A-REI.1)
- M.A2.7** Students will analyze and compare polynomial, exponential, logarithmic, rational, and radical functions in different forms. (F-LE.2, F-LE.3, F-LE.4, F-LE.5, F-IF.6, F-IF.9, F-BF.1a, F-BF.1b, F-BF.2, A-REI.11, N-Q.2)

- M.A2.8**      **Students will use rules of probability to compute probabilities of situations. They will also explain the process of statistical experiments and make inferences. (S-CP.1, S-CP.2, S-CP.3, S-CP.4, S-CP.5, S-CP.6, S-IC.1, S-IC.2, S-IC.3, S-IC.4, S-IC.5, S-IC.6)**
- M.A2.9**      **Students will summarize, represent, and interpret data in real-world situations, including distinguishing between correlation and causation. (S-ID.1, S-ID.2, S-ID.3, S-ID.4, S-ID.5, S-ID.6, S-ID.8, S-ID.9)**
- M.A2.10**     **Students will define trigonometric ratios and solve problems involving right triangles. They will also extend the domain of trigonometric functions using the unit circle and graphs of sine and cosine to solve problems with trigonometric functions. (A-REI.1, F-TF.1, F-TF.2, F-TF.5, F-TF.8)**

## Algebra 2 Honors

### Course Purpose:

Students will choose the appropriate method and justify the process of solving polynomial, logarithmic, exponential, trigonometric, rational, and radical equations. Students will graph, write, compare, and analyze polynomial, logarithmic, exponential, trigonometric, and radical functions and apply these concepts in a variety of situations. In addition, students will apply probability rules to formulate solutions to real-world situations.

- M.A2H.1** Students will identify parent functions and transformations given equations or graphs. In addition, they will create equations to model application situations and apply transformations. (Linear, Quadratic, Cubic, Square Root, Absolute Value) (F-BF. 3, F-BF.4, F-IF.4, F-IF.7)
- M.A2H.2** Students will perform arithmetic operations on expressions containing complex numbers. They will also solve quadratic equations with real coefficients that have complex solutions. In addition, students will create and use quadratic models in application situations. (N-CN.1, N-CN.2, N-CN.3, N-CN.7, A-REI.1, A-REI.4b, A-SSE.2)
- M.A2H.3** Students will perform arithmetic operations and factor polynomial expressions. They will also solve and sketch a given polynomial equation using an appropriate method. When graphing, students will identify domain, range, local maxima, local minima, end behavior, and transformations. (A-APR.1, A-APR.2, A-APR.3, A-APR.4, A-APR.6, A-SSE.1a, A-SSE.2, A-REI.1, A-CED.1, F-IF.4)
- M.A2H.4** Students will perform arithmetic operations with a rational expression. They will also solve rational equations including application situations. In addition, students will graph a rational expression identifying domain, range, vertical and horizontal asymptotes, and apply transformations. (N-Q.2, F-IF.6, A-CED.1, A-APR.6, A-REI.1, A-REI.2, A-REI.11)
- M.A2H.5** Students will simplify radical expressions and solve radical equations. They will also identify domain and range and apply transformations to graph radical equations. (F-IF.6, A-REI.1, A-REI.2, N-Q.2, N-RN.1, N-RN.2)
- M.A2H.6** Students will write and solve an exponential or logarithmic equation including application situations. They will also graph exponential and logarithmic functions identifying domain, range, and asymptotes and apply transformations. In addition, students will use technology to model exponential and logarithmic data. (F-LE.1, F-LE.2, F-LE.3, F-LE.4, F-LE.5, F-IF.4, F-IF.6, N-Q.2, A-CED.1, A-REI.1, A-REI.11)

- M.A2H.7** Students will analyze and compare polynomial, exponential, logarithmic, rational, and radical functions in different forms. Students will also construct functions given real-world data to make predictions. (F-LE.2, F-LE.3, F-LE.4, F-LE.5, F-IF.6, F-IF.9, F-BF.1a, F-BF.1b, F-BF.2, A-REI.11, N-Q.2)
- M.A2H.8** Students will use rules of probability to compute probabilities of situations. They will also explain the process of statistical experiments and make inferences. (S-CP.1, S-CP.2, S-CP.3, S-CP.4, S-CP.5, S-CP.6, S-IC.1, S-IC.2, S-IC.3, S-IC.4, S-IC.5, S-IC.6)
- M.A2H.9** Students will summarize, represent, and interpret data in real-world situations, including distinguishing between correlation and causation. (S-ID.1, S-ID.2, S-ID.3, S-ID.4, S-ID.5, S-ID.6, S-ID.8, S-ID.9)
- M.A2H.10** Students will define trigonometric ratios and solve problems involving right triangles. They will also extend the domain of trigonometric functions using the unit circle to solve problems. (A-REI.1, F-TF.1, F-TF.2, F-TF.5, F-TF.8)
- M.A2H.11** Students identify domain, range, period, amplitude, and asymptotes of trigonometric functions and graph the functions. Students will also apply transformations to a given function to create a new function. In addition, they will prove and apply trigonometric identities. (A-REI.1, F-TF.1, F-TF.2, F-TF.5, F-TF.8)

## Algebra 3

### Course Purpose:

Students will perform operations on and apply matrices in real-world situations. Students will represent sequences and series algebraically to solve problems. In addition, students will identify, graph, and write equations for conic sections and graph rational functions.

- M.A3.1** Students will identify basic graphs of a variety of functions and their key features utilizing interval notation, identify transformations from the equations, and apply transformations to the graphs. Students will compose functions and determine the inverse of a function. (F-IF.7, F-BF.1c, F-BF.3, F-BF.4)
- M.A3.2** Students will solve systems of equations and inequalities graphically and algebraically. Systems will include linear and nonlinear equations. (A-REI.7, A-REI.10, A-REI.11, A-REI.12)
- M.A3.3** Students will use matrices to represent data and systems of linear equations. Students will perform operations on matrices and apply properties of matrix operations. Students will use matrices to solve linear systems. (N-VM.6, N-VM.7, N-VM.8, N-VM.9, N-VM.10, A-REI.8, A-REI.9)
- M.A3.4** Students will identify conic sections from the equations and from the graphs. Given the equation of a conic section, students will produce a graph. In addition, students will derive the equation of a conic section from the given information. Students will solve systems of equations of conics. (G-GPE.1, G-GPE.2, G-GPE.3, A-REI.7)
- M.A3.5** Students will apply formulas and write expressions for sequences and series to solve problems. (F-IF.3, F-BF.1a, F-BF.2, A-SSE.4)

## Trigonometry

### Course Purpose:

Students will solve and graph trigonometric equations. Students will prove and apply trigonometric identities. In addition, students will apply trigonometry to all triangles and complex numbers. Students will represent and model with vector quantities.

- M.T.1**      **Students will identify and apply the basic trigonometric functions using the unit circle in both radian and degree measures. (F-TF.1, F-TF.2, F-TF.3, F-TF.4)**
- M.T.2**      **Students will graph trigonometric functions and use them to solve application problems. Also, students will solve equations using inverse functions. (F-TF.5, F-TF.6, F-TF.7)**
- M.T.3**      **Students will derive and apply trigonometric identities to solve equations. (F-TF.7, F-TF.8)**
- M.T.4**      **Students will apply addition, subtraction, double-angle, and half-angle formulas to solve problems. (F-TF.7, F-TF.9)**
- M.T.5**      **Students will solve problems involving right triangles. Students will apply trigonometry to general triangles. (G-SRT.8, G-SRT.9, G-SRT.10, G-SRT.11)**
- M.T.6**      **Students will use vectors to represent and model quantities. Students will perform operations on vectors. Students will use vectors to solve problems with velocity. In addition, students will represent complex numbers and their operations on the complex plane. (N-VM.1, N-VM.2, N-VM.3, N-VM.4, N-VM.5, N-CN.3, N-CN.4, N-CN.5, N-CN. 6)**



## Probability and Statistics

### Course Purpose:

Students will design studies and experiments. Students will summarize, represent, interpret, and analyze data. Students will calculate probability of events and use probability distributions to solve problems.

- M.PS.1**      **Students will design a survey/experiment and then collect, display, analyze, and interpret the data from the survey/experiment. (S-IC.1, S-IC.3, S-IC.4, S-IC.5, S-IC.6)**
- M.PS.2**      **Students will summarize, represent, and interpret data in a single variable. They will also use the mean and standard deviation to compare data sets. (S-ID.1, S-ID.2, S-ID.3)**
- M.PS.3**      **Students will summarize, represent, and interpret data in two variables focusing on linear and exponential models. They will also write the equation of the line of best fit for linear models and utilize the line of best fit to solve problems in context of the data. (S-ID.5, S-ID.6)**
- M.PS.4**      **Students will identify the sample space of an experiment and calculate the probabilities of individual, compound, independent, and dependent events. (S-CP.1, S-CP.2, S-CP.3, S-CP.4, S-CP.5, S-CP.6, S-CP.7, S-CP.8, S-CP.9)**
- M.PS.5**      **Students will develop probability distributions for random variables, calculate expected values, and use them to solve problems. (S-MD.1, S-MD.2, S-MD.3, S-MD.4, S-MD.5, S-MD.6, S-MD.7, S-ID.4)**

## **Discrete Math**

### **Course Purpose:**

Students will apply mathematics in practical situations including management science, voting and social choice, fairness and game theory, encryption and decryption, and money and resources.

**The Discrete Math curriculum is designed to give students in the class a choice in the content covered and sequence. In a semester, the class will cover to three topics. The topics are Management Science, The Digital Revolution, and Your Money and Resources. Additional curriculum can also be developed for two additional topics: Fairness and Game Theory and Voting and Social Choice.**

### **Management Science**

- M.D.1** Students will identify features of a graph and draw graphs from given information. They will also determine whether a graph has an Euler circuit or not and then identify an Euler circuit if one exists or eulerize the graph to find an Euler circuit if one does not exist. In addition, students will describe real-life situations in which paths, circuits, and Euler circuits are important.
- M.D.2** Students will identify a Hamiltonian circuit and spanning tree on a given graph. They will apply various methods to determine a minimum cost Hamiltonian circuit for the Traveling Salesman Problem. Students will also determine the minimum cost spanning tree for weighted graphs and application problems. They will determine the critical path and earliest completion time for an order-requirement digraph, including ones they create from real world situations.
- M.D.3** Students will schedule tasks given an order-requirement digraph using the list-processing algorithm or critical-path algorithm and then determine whether the amount of time required to complete the tasks is optimal. They will also schedule independent tasks using the list-processing algorithm or decreasing-time-list algorithm and determine the time required to complete the tasks. Students will determine the minimum number of bins of a given weight required to pack a given list of weights without exceeding the capacity of the bins. They will use vertex coloring to resolve conflicts in scheduling situations and determine the chromatic number for the graph.
- M.DM.4** Students will describe the differences between Preferential List and Majority Rules, including faults, failures, and manipulability. They will also calculate a winner using a given method (plurality voting, the Borda count, the Hare system, sequential pairwise voting).

### **The Digital Revolution**

- M.DM.5** Students will determine validity of numbers using the appropriate method and check digit. They will also interpret bar codes, Social Security Numbers, and ZIP codes. Given a system for coding from a specific state and an individual's information, students will determine the digits of an identification number.
- M.DM.6** Students will use various methods to code and decode messages and binary codes.

## **Your Money and Resources**

- M.DM.7** Students will calculate simple and compound interest when investing money and the value of items that have depreciated. They will also explain the relationships between interest rate, inflation rate, and real rate of growth.
- M.DM.8** Students will calculate simple and compound interest and payments on a loan. They will also explain the difference between APR and EAR for an add-on loan. In addition, students will calculate income based on annuities.
- M.DM.9** Students will calculate growth and decay for populations and non-renewable resources. Given a graph of a reproduction curve, estimate the equilibrium population size and the maximum sustainable yield.

## Pre-Calculus Honors

### Course Purpose:

Students will represent and model with vector quantities; perform operations on and apply matrices in real-world situations; identify, graph, and write equations for conic sections; and graph rational functions. Students will represent sequences and series algebraically to solve problems. In addition, students will solve and graph trigonometric equations; prove and apply trigonometric identities; and apply trigonometry to all triangles and complex numbers. Students will use a variety of methods to calculate limits.

- M.PCH.1** Students will identify basic graphs of a variety of functions, identify transformations from the equations, and apply transformations to the graphs. Students will compose functions and determine the inverse of a function. (F-IF.7, F-BF.1c, F-BF.3, F-BF.4)
- M.PCH.2** Students will identify and apply the basic trigonometric functions using the unit circle in both radian and degree measures. (F-TF.1, F-TF.2, F-TF.3, F-TF.4)
- M.PCH.3** Students will graph trigonometric functions and use them to solve application problems. Also, students will solve equations using inverse functions. (F-TF.5, F-TF.6, F-TF.7)
- M.PCH.4** Students will derive and apply trigonometric identities to solve equations. Students will apply addition, subtraction, double-angle, and half-angle formulas to solve problems. (F-TF.7, F-TF.8, F-TF.9)
- M.PCH.5** Students will solve problems involving right triangles. Students will apply trigonometry to general triangles. (G-SRT.8, G-SRT.9, G-SRT.10, G-SRT.11)
- M.PCH.6** Students will use vectors to represent and model quantities. Students will perform operations on vectors. In addition, students will use vectors to solve problems with velocity and other quantities. (N-VM.1, N-VM.2, N-VM.3, N-VM.4, N-VM.5)
- M.PCH.7** Students will represent complex numbers and their operations on the complex plane. (N-CN.3, N-CN.4, N-CN.5, N-CN. 6)
- M.PCH.8** Students will solve systems of equations and inequalities graphically and algebraically. Systems will include linear and nonlinear equations. (A-REI.7, A-REI.10, A-REI.11, A-REI.12)

- M.PCH.9** Students will use matrices to represent data and systems of linear equations. Students will perform operations on matrices and apply properties of matrix operations. Students will use matrices to solve linear systems. (N-VM.6, N-VM.7, N-VM.8, N-VM.9, N-VM-10, A-REI.8, A-REI.9)
- M.PCH.10** Students will apply formulas and write expressions for sequences and series to solve problems. They will also apply the binomial theorem, permutations, and combinations to solve problems and determine probabilities of events. (F-IF.3, F-BF.1a, F-BF.2, A-SSE.4)
- M.PCH.11** Students will identify conic sections from the equations and from the graphs. Given the equation of a conic section, students will produce a graph. In addition, students will derive the equation of a conic section from given information. Students will solve systems of equations of conics. (G-GPE.1, G-GPE.2, G-GPE.3, A-REI.7)
- M.PCH.12** Students will find limits and use limits to find slopes of graphs.

## Algebra 1

**M.A1.1**      **Students will solve linear and absolute value equations in one variable. Given a situation, they will also create linear equations to represent the information, solve the equation, and explain the reasonableness of the solution.**  
(A-CED.1, A-CED.4, A-REI.1, A-REI.3, A-SSE.1, N-Q.1, N-Q.2, N-Q.3)

- M.A1.1.1      Solve one-step equations.
- M.A1.1.2      Solve two-step equations.
- M.A1.1.3      Solve multi-step equations.
- M.A1.1.4      Solve equations with variables on both sides.
- M.A1.1.5      Solve absolute value equations.
- M.A1.1.6      Solve literal equations for a given variable.
- M.A1.1.7      Given a situation, create linear equations to represent the information, solve the equation, and explain the reasonableness of the solution.

**M.A1.2**      **Students will solve and graph linear and compound inequalities in one variable. Given a situation, they will also create linear inequalities to represent the information, solve the inequality, and explain the reasonableness of the solution.** (A-CED.1, A-REI.3, A-SSE.1, N-Q.1, N-Q.2, N-Q.3)

- M.A1.2.1      Solve and graph one-step inequalities.
- M.A1.2.2      Solve and graph two-step inequalities.
- M.A1.2.3      Solve and graph multi-step inequalities.
- M.A1.2.4      Solve and graph inequalities with variables on both sides.
- M.A1.2.5      Solve and graph compound inequalities.
- M.A1.2.6      Given a situation, create linear inequalities to represent the information, solve the inequality, and explain the reasonableness of the solution.

**M.A1.3 Students will use the domain and range to determine if a relation is a function and justify their reasoning. Using function notation, students will evaluate, interpret, and write functions using the independent and dependent variables in a given situation. (F-BF.1, F-IF.3, F-IF.1, F-IF.5, F-IF.2, F-LE.5, A-SSE.1)**

- M.A1.3.1 Identify domain and range of a relation or function.
- M.A1.3.2 Use an appropriate method to justify whether a relation is or is not a function.
- M.A1.3.3 Identify the independent and dependent variables of a given situation and use them to write a function in function notation.
- M.A1.3.4 Evaluate functions in function notation.
- M.A1.3.5 Interpret a function for a given situation and identify reasonable domain and range.

**M.A1.4 Students will choose and apply an appropriate method to graph linear equations in two variables and interpret graphs of linear equations given a situation. (A-REI.10, A-REI.11, S-ID.7, A-SSE.1, F-IF.6)**

- M.A1.4.1 Graph a linear equation by using a student generated table of values.
- M.A1.4.2 Find the x- and y-intercepts of a linear equation.
- M.A1.4.3 Graph a linear equation using the intercepts from standard form.
- M.A1.4.4 Find the rate of change of a given set of data.
- M.A1.4.5 Find the slope of a line given the graph, two points, or an equation.
- M.A1.4.6 Graph a linear equation using slope and y-intercept from slope-intercept form or standard form.
- M.A1.4.7 Graph a linear equation using the point and slope from point-slope form.
- M.A1.4.8 Choose and apply an appropriate method to graph linear equations in two variables.
- M.A1.4.9 Given a situation, interpret the graph of a linear equation.

**M.A1.5 Students will write linear equations in various forms (point-slope, slope-intercept, standard) using the given information. They will also write linear equations to represent data for a real-life situation. (A-CED.2)**

- M.A1.5.1 Given a linear equation in any format, rewrite the equation in slope-intercept or standard form.
- M.A1.5.2 Write linear equations in point-slope form.
- M.A1.5.3 Write linear equations in slope-intercept form.
- M.A1.5.4 Write linear equations in standard form.
- M.A1.5.5 Write equations of parallel and perpendicular lines.
- M.A1.5.6 Given a real-life situation, write a linear equation in the appropriate form.
- M.A1.5.7 Given data for a real-life situation, create a scatter plot, approximate the line of best fit, and write the equation of that line.

**M.A1.6**      **Students will apply an appropriate method to solve a system of equations, write a system of equations to model a given situation, and determine appropriate solutions. They will also identify solutions of inequalities and systems of inequalities by graphing. (A-REI.5, A-REI.6, A-REI.12, A-CED.3, A-SSE.1)**

- M.A1.6.1      Solve systems of equations by graphing.
- M.A1.6.2      Solve systems of equations using substitution.
- M.A1.6.3      Solve systems of equations using elimination.
- M.A1.6.4      Apply an appropriate method to solve a system of equations.
- M.A1.6.5      Write a system of equations to model a given situation and determine appropriate solutions.
- M.A1.6.6      Identify solutions of linear inequalities by graphing.
- M.A1.6.7      Identify solutions of a system of linear inequalities by graphing.

**M.A1.7**      **Students will apply the most appropriate method to simplify expressions using the properties of exponents and extend those properties to rational exponents. (A-SSE.3c)**

- M.A1.7.1      Simplify expressions with exponents of zero.
- M.A1.7.2      Simplify expressions with negative exponents.
- M.A1.7.3      Simplify expressions using the multiplication properties of exponents (product of powers, powers of powers, powers of products).
- M.A1.7.4      Simplify expressions using the division properties of exponents (quotient of powers, powers of quotients, negative powers of quotients).
- M.A1.7.5      Simplify expressions involving rational exponents.
- M.A1.7.6      Apply the most appropriate method to simplify any expression involving exponents.



**M.A1.8 Students will classify polynomials by number of terms and degree, apply mathematical operations to simplify expressions involving polynomials, and factor polynomials completely. (A-SSE.2, A-APR.1)**

- M.A1.8.1 Classify polynomials by number of terms and degree.
- M.A1.8.2 Add and subtract polynomials.
- M.A1.8.3 Multiply polynomials.
- M.A1.8.4 Determine the greatest common factor of monomials.
- M.A1.8.5 Factor the greatest common factor from a polynomial.
- M.A1.8.6 Factor polynomials by grouping.
- M.A1.8.7 Factor trinomials with a leading coefficient of one.
- M.A1.8.8 Factor trinomials with a leading coefficient other than one.
- M.A1.8.9 Factor polynomials with special patterns (difference of two squares, perfect square trinomials).
- M.A1.8.10 Determine and apply the most appropriate method to factor a polynomial completely.

**M.A1.9 Students will identify and apply key characteristics of the graph of a quadratic function to solve problems; choose and apply an appropriate method to solve a quadratic equation; and examine their solution(s) to determine validity and appropriateness within a given context. (F-IF.7a, A-REI.4a, A-SSE.3a, A-REI.10, A-REI.4b, A-SSE.3b, A-APR.3, F-IF.8a, N-Q.1, N-Q.2, N-Q.3)**

- M.A1.9.1 Identify key characteristics of quadratic functions to graph the functions and solve real-world applications.
- M.A1.9.2 Solve quadratic equations by graphing.
- M.A1.9.3 Solve quadratic equations by factoring.
- M.A1.9.4 Solve quadratic equations using square roots.
- M.A1.9.5 Solve quadratic equations by completing the square.
- M.A1.9.6 Solve quadratic equations using the quadratic formula.
- M.A1.9.7 Choose and apply an appropriate method to solve a quadratic equation.
- M.A1.9.8 Examine the solution(s) of a quadratic equation to determine validity and appropriateness within a given context.

**M.A1.10 Students will simplify radical expressions and solve radical equations. (N-RN.A.2)**

- M.A1.10.1 Simplify radical expressions (product and quotient properties of square roots).
- M.A1.10.2 Simplify radical expression using mathematical operations (addition, subtraction, multiplication).
- M.A1.10.3 Simplify radical expressions by rationalizing the denominator.
- M.A1.10.4 Solve radical equations.

**M.A1.11 Students will graph exponential functions and identify key features of the functions. Students will identify linear, quadratic, and exponential models in different forms and justify their reasoning. They will also write the appropriate function to represent given data. (F-IF.4, F-IF.9, F-LE.1, F-LE.2, F-LE.3, F-LE.5, F-BF.1a, F-BF.2)**

- M.A1.11.1 Graph exponential functions using a table of values and identify intercept and asymptotes.
- M.A1.11.2 Evaluate exponential functions for real world situations and interpret key features of the functions as they relate to the application.
- M.A1.11.3 Determine if the function is linear, quadratic, or exponential given equations, tables, or graphs.
- M.A1.11.4 Write arithmetic sequences and use them to find the  $n^{\text{th}}$  term.
- M.A1.11.5 Write geometric sequences and use them to find the  $n^{\text{th}}$  term.
- M.A1.11.6 Given a table of real world data, write the appropriate linear or exponential function to represent the data.

**If time allows, also introduce this unit:**

**M.A1.12 Students will state the name of the parent function (linear, quadratic, exponential, square root, cube root, absolute value) from an equation or graph and identify the transformation applied. (F-IF.7b, F-BF.3)**

- M.A1.12.1 Identify transformations from a point, graph, or picture (reflection, translation, stretch, compression).
- M.A1.12.2 Identify the transformations applied to a linear function and graph using transformations of the parent function.
- M.A1.12.3 Identify the transformations applied to a quadratic function and graph using transformations of the parent function.
- M.A1.12.4 Identify the transformations applied to an exponential function and graph using transformations of the parent function.
- M.A1.12.5 Identify the transformations applied to a square and cube root functions and graph using transformations of the parent function.
- M.A1.12.6 Identify the transformations applied to absolute value function and graph using transformations of the parent function.
- M.A1.12.7 State the name of the parent function from an equation or graph and identify the transformation applied.

## Algebra 1 Honors

**M.A1H.1** Students will solve linear and absolute value equations in one variable. After creating a situation, they will also write a linear equation to represent the information, solve the equation, and justify the solution. (A-CED.1, A-CED.4, A-REI.1, A-REI.3 A-SSE.1, N-Q.1, N-Q.2, N-Q.3)

- M.A1H.1.1 Solve one-step equations.
- M.A1H.1.2 Solve two-step equations.
- M.A1H.1.3 Solve multi-step equations.
- M.A1H.1.4 Solve equations with variables on both sides.
- M.A1H.1.5 Solve absolute value equations.
- M.A1H.1.6 Solve literal equations for a given variable.
- M.A1H.1.7 Given a situation, create linear equations to represent the information, solve the equation, and check the validity of the solution.
- M.A1H.1.8 Create a situation that can be solved using a linear equation in one variable, write and solve the equation, and justify the solution.

**M.A1H.2** Students will solve and graph linear, compound, and absolute value inequalities in one variable. After creating a situation, they will also write linear inequalities to represent the information, solve the inequality, and justify the solution. (A-CED.1, A-REI.3, A-SSE.1, N-Q.1, N-Q.2, N-Q.3)

- M.A1H.2.1 Solve and graph one-step inequalities.
- M.A1H.2.2 Solve and graph two-step inequalities.
- M.A1H.2.3 Solve and graph multi-step inequalities.
- M.A1H.2.4 Solve and graph inequalities with variables on both sides.
- M.A1H.2.5 Solve and graph compound inequalities.
- M.A1H.2.6 Solve absolute value inequalities.
- M.A1H.2.7 Given a situation, create linear inequalities to represent the information, solve the equation, and check the validity of the solution.
- M.A1H.2.8 Create a situation that can be solved using a linear inequality in one variable, write and solve the inequality, and justify the solution.

**M.A1H.3** Students will use the domain and range to determine if a relation is a function and justify their reasoning. Using function notation, students will evaluate and interpret functions. They will also create a situation using independent and dependent variables and write a function in function notation, identifying the appropriate domain and range, to represent the situation. (F-BF.1, F-IF.3, F-IF.1, F-IF.5, F-IF.2, F-LE.5, A-SSE.1)

- M.A1H.3.1 Identify domain and range of a relation or function.
- M.A1H.3.2 Use an appropriate method to justify whether a relation is or is not a function.
- M.A1H.3.3 Evaluate functions in function notation.
- M.A1H.3.4 Identify the independent and dependent variables of a given situation and use them to write a function in function notation.
- M.A1H.3.5 Interpret a function for a given situation and identify reasonable domain and range.
- M.A1H.3.6 Create a situation using independent and dependent variables and write a function in function notation, identifying the appropriate domain and range, to represent the situation.

**M.A1H.4** Students will choose and apply an appropriate method to graph linear equations in two variables. Students will create a situation in two variables, write the equation, apply an appropriate method to graph the equation, and analyze the key features of the graph as they relate to the situation. (A-REI.10, A-REI.11, S-ID.7, A-SSE.1, F-IF.6)

- M.A1H.4.1 Graph a linear equation using a student generated table of values.
- M.A1H.4.2 Find the x- and y-intercepts of a linear equation.
- M.A1H.4.3 Graph a linear equation using the intercepts in standard form.
- M.A1H.4.4 Find the rate of change of a given set of data.
- M.A1H.4.5 Find the slope of a line given the graph, two points, or an equation.
- M.A1H.4.6 Graph a linear equation using slope and y-intercept from slope-intercept or standard form.
- M.A1H.4.7 Graph a linear equation using the point and slope from point-slope form.
- M.A1H.4.8 Choose and apply an appropriate method to graph linear equations in two variables.
- M.A1H.4.9 Given a situation, interpret the graph of a linear equation.
- M.A1H.4.10 Create a situation to represent graphically and analyze the key features of the graph as they relate to the situation.

**M.A1H.5**      **Students will write linear equations in various forms (point-slope, slope-intercept, standard) using the given information. Students will also find an example of real-time data and analyze the data to create a scatter plot, approximate the line of best fit, and write the equation of the line. (A-CED.2)**

- M.A1H.5.1      Given a linear equation in any format, rewrite the equation in slope-intercept or standard form.
- M.A1H.5.2      Write linear equations in point-slope form.
- M.A1H.5.3      Write linear equations in slope-intercept form.
- M.A1H.5.4      Write linear equations in standard form.
- M.A1H.5.5      Write linear equations of parallel and perpendicular lines.
- M.A1H.5.6      Given a real life situation, write a linear equation in the appropriate form.
- M.A1H.5.7      Find an example of real-time data and analyze the data to create a scatter plot, approximate the line of best fit, and write the equation of that line.

**M.A1H.6**      **Students will apply an appropriate method to solve a system of equations, write a system of equations to model a student-selected situation, and determine appropriate solutions. They will also identify solutions of inequalities and systems of inequalities by graphing. (A-REI.5, A-REI.6, A-REI.12, A-CED.3, A-SSE.1)**

- M.A1H.6.1      Solve systems of equations by graphing.
- M.A1H.6.2      Solve systems of equations using substitution.
- M.A1H.6.3      Solve systems of equations using elimination.
- M.A1H.6.4      Apply an appropriate method to solve a system of equations.
- M.A1H.6.5      Write a system of equations to model a given situation and determine appropriate solutions.
- M.A1H.6.6      Create a situation that can be modeled with a system of equations and determine appropriate solutions.
- M.A1H.6.7      Identify solutions of linear inequalities by graphing.
- M.A1H.6.8      Identify solutions of a system of linear inequalities by graphing.

**M.A1H.7 Students will determine and apply the most appropriate method to simplify expressions using the properties of exponents and extend those properties to rational exponents. (A-SSE.3c)**

- M.A1H.7.1 Simplify expressions with exponents of zero.
- M.A1H.7.2 Simplify expressions with negative exponents.
- M.A1H.7.3 Simplify expressions using the multiplication properties of exponents (product of powers, powers of powers, powers of products).
- M.A1H.7.4 Simplify expressions using the division properties of exponents (quotient of powers, powers of quotients, negative powers of quotients).
- M.A1H.7.5 Simplify expressions involving rational exponents.
- M.A1H.7.6 Determine and apply the most appropriate method to simplify any expression involving exponents.

**M.A1H.8 Students will classify polynomials by number of terms and degree, apply mathematical operations to simplify expressions involving polynomials, and factor polynomials completely. (A-SSE.2, A-APR.1)**

- M.A1H.8.1 Classify polynomials by number of terms and degree.
- M.A1H.8.2 Add and subtract polynomials.
- M.A1H.8.3 Multiply polynomials.
- M.A1H.8.4 Factor by greatest common factor and grouping.
- M.A1H.8.5 Factor trinomials.
- M.A1H.8.6 Factor special cases. (difference of two squares, perfect square trinomials)
- M.A1H.8.7 Determine and apply the most appropriate method to factor a polynomial completely.

**M.A1H.9** Students will identify and apply key characteristics of the graph of a quadratic function to solve problems; choose and apply an appropriate method to solve a quadratic equation; and examine their solution(s) to determine validity and appropriateness within a given context. Given a situation, students will also write a quadratic function and determine appropriate solutions for the situation. (F-IF.7a, A-REI.4a, A-SSE.3a, A-REI.10, A-REI.4b, A-SSE.3b, A-APR.3, F-IF.8a, N-Q.1, N-Q.2, N-Q.3)

- M.A1H.9.1 Identify key characteristics of quadratic functions.
- M.A1H.9.2 Graph quadratic functions and solve real world application.
- M.A1H.9.3 Solve quadratic equations by graphing.
- M.A1H.9.4 Solve quadratic equations by factoring.
- M.A1H.9.5 Solve quadratic equations using square roots.
- M.A1H.9.6 Solve quadratic equations by completing the square.
- M.A1H.9.7 Solve quadratic equations using the quadratic formula.
- M.A1H.9.8 Choose and apply an appropriate method to solve a quadratic equation.
- M.A1H.9.9 Examine the solution(s) of a quadratic equation to determine validity and appropriateness within a given context.
- M.A1H.9.10 Given a situation, write a quadratic function to model the situation and determine appropriate solutions for the situation.

**M.A1H.10** Students will simplify radical expressions and solve radical equations. (N-RN.A.2)

- M.A1H.10.1 Simplify radical expressions (product and quotient properties of square roots).
- M.A1H.10.2 Simplify radical expression using mathematical operations (addition, subtraction, multiplication).
- M.A1H.10.3 Simplify radical expressions by rationalizing the denominator including using conjugates.
- M.A1H.10.4 Solve radical equations.

**M.A1H.11 Students will graph exponential functions and identify key features of the functions. Students will identify linear, quadratic, and exponential models in different forms and justify their reasoning. They will also write the appropriate function to represent given data. (F-IF.4, F-IF.9, F-LE.1, F-LE.2, F-LE.3, F-LE.5, F-BF.1a, F-BF.2)**

- M.A1H.11.1 Graph exponential functions using a table of values and identify intercept and asymptotes.
- M.A1H.11.2 Evaluate exponential functions for real world situations and interpret key features of the functions as they relate to the application.
- M.A1H.11.3 Determine if the function is linear, quadratic, or exponential given equations, tables, or graphs.
- M.A1H.11.4 Write arithmetic sequences and use them to find the  $n^{\text{th}}$  term.
- M.A1H.11.5 Write geometric sequences and use them to find the  $n^{\text{th}}$  term.
- M.A1H.11.6 Given a table of real world data, write the appropriate linear or exponential function to represent the data.

**M.A1H.12 Students will state the name of the parent function (linear, quadratic, exponential, square root, cube root, absolute value) from an equation or graph and identify the transformation applied. (F-IF.7b, F-BF.3)**

- M.A1H.12.1 Identify transformations from a point, graph, or picture (reflection, translation, stretch, compression).
- M.A1H.12.2 Identify the transformations applied to a linear function and graph using transformations of the parent function.
- M.A1H.12.3 Identify the transformations applied to a quadratic function and graph using transformations of the parent function.
- M.A1H.12.4 Identify the transformations applied to an exponential function and graph using transformations of the parent function.
- M.A1H.12.5 Identify the transformations applied to a square and cube root functions and graph using transformations of the parent function.
- M.A1H.12.6 Identify the transformations applied to absolute value function and graph using transformations of the parent function.
- M.A1H.12.7 State the name of the parent function from an equation or graph and identify the transformation applied.



## Geometry

**M.G.1 Students will model points, lines, and planes and define other basic geometric terms. They will identify and explain basic relationships using points, lines, and planes. Students will accurately draw and correctly label basic geometric figures and will perform basic compass/straightedge constructions. (G-CO.1)**

- M.G.1.1 Create representations of points, lines, and planes and identify real world examples of them.
- M.G.1.2 Define basic geometric terms.
- M.G.1.3 Draw and apply the conventional labeling methods for geometric figures.
- M.G.1.4 Apply the basic postulates to explain the relationships between points, lines, and planes.
- M.G.1.5 Use a compass and straightedge to do basic constructions (copying an angle, copying a segment, and bisecting an angle).

Vocabulary terms: undefined term, point, line, plane, collinear, coplanar, segment, endpoint, ray, opposite rays, postulate, coordinate, distance, length, congruent segments, construction, between, midpoint, bisect, segment bisector, angle, vertex, interior of an angle, exterior of an angle, measure, degree, acute angle, right angle, obtuse angle, straight angle, congruent angles, angle bisector, adjacent angles, linear pair, complementary angles, supplementary angles, vertical angles

**M.G.2 Students will formulate logical arguments, using geometric rules and laws of logic, to prove statements. (G-CO.9, G-CO.10, G-CO.11)**

- M.G.2.1 Identify and apply the Law of Detachment and the Law of Syllogism.
- M.G.2.2 Write the converse, inverse, and contrapositive of a given conditional and determine the truth value of each.
- M.G.2.3 Write a biconditional statement given a conditional and its converse and vice versa.
- M.G.2.4 Use counterexamples to prove statements false.
- M.G.2.5 Use definitions, properties, postulates, or theorems to justify statements.
- M.G.2.6 Use a variety of methods (two-column, flowchart, paragraph) to construct a series of logical steps that prove a statement.

Vocabulary terms: inductive reasoning, conjecture, counterexample, conditional statement, hypothesis, conclusion, truth value, negation, converse, inverse, contrapositive, logically equivalent statements, deductive reasoning, biconditional statement, definition, polygon, triangle, quadrilateral, proof, theorem, two-column proof, flowchart proof, paragraph proof

**M.G.3 Students will apply properties of angles formed by lines cut by a transversal to solve problems and to prove lines parallel. Students will construct and apply theorems of parallel and perpendicular lines. (G-CO.1, G-CO.9, A-CED.2)**

- M.G.3.1 Identify and name the different pairs of angles formed by two lines and a transversal (corresponding, alternate interior, alternate exterior, same-side interior).
- M.G.3.2 Apply the theorems involving angles formed when parallel lines are cut by a transversal.
- M.G.3.3 Use the converses of the angle theorems to prove lines parallel.
- M.G.3.4 Apply theorems involving perpendicular and parallel lines.
- M.G.3.5 Use a compass and straight edge to construct parallel lines, perpendicular bisector of a segment, perpendicular to a line through a point on the line, and perpendicular to a line through a point not on the line.

Vocabulary terms: parallel lines, perpendicular lines, skew lines, parallel planes, transversal, corresponding angles, alternate interior angles, alternate exterior angles, same-side interior angles, perpendicular bisector, distance from a point to a line

**M.G.4 Students will prove triangles congruent and use triangle congruence to prove theorems. (G-CO.6, G-CO.7, G-CO.8, G-CO.10, G-SRT.5)**

- M.G.4.1 Classify triangles by sides and by angles.
- M.G.4.2 Use the definition of congruent triangles to verify that triangles are congruent and state the correct congruence statement.
- M.G.4.3 Apply appropriate triangle congruence theorems to prove triangles congruent.
- M.G.4.4 Use congruent triangles to prove theorems including theorems about isosceles triangles.

Vocabulary terms: acute triangle, equiangular triangle, right triangle, obtuse triangle, equilateral triangle, isosceles triangle, scalene triangle, auxiliary line, corollary, interior, exterior, interior angle, exterior angle, remote interior angle, corresponding angles, corresponding sides, congruent polygons, included angle, included side, CPCTC, legs of an isosceles triangle, vertex angle, base, base angles

**M.G.5 Students will apply properties of various centers of triangles and the mid-segments of triangles to solve problems, including real-world applications. (G-CO.10)**

- M.G.5.1 Prove and apply theorems about perpendicular bisectors and angle bisectors.
- M.G.5.2 Apply the properties of perpendicular bisectors and angle bisectors of a triangle to solve problems.
- M.G.5.3 Apply properties of the medians and altitudes of a triangle to solve problems.
- M.G.5.4 Apply properties of the midsegments of a triangle to solve problems.

Vocabulary terms: Equidistant, locus, concurrent, point of concurrency, circumcenter of a triangle, circumscribed, incenter of a triangle, inscribed, median of a triangle, centroid of a triangle, altitude of a triangle, orthocenter of a triangle, midsegment of a triangle

**M.G.6 Students will prove and/or apply theorems about right triangles, including the Pythagorean Theorem and the patterns of special right triangles. (G-CO.10, G-SRT.5)**

- M.G.6.1 Apply theorems about inequalities in one triangle and in two triangles to determine relative angle measures and side lengths.
- M.G.6.2 Apply the Pythagorean Theorem and its converse to solve problems, including classifying triangles by angles.
- M.G.6.3 Develop and apply the patterns of special right triangles.

Vocabulary term: Pythagorean triple

**M.G.7 Students will classify polygons and apply the theorems about angles of a polygon to solve problems. They will apply properties of special quadrilaterals and use them to write proofs. (G-CO.11)**

- M.G.7.1 Use definitions to classify polygons and determine whether they are regular/irregular and convex/concave.
- M.G.7.2 Apply theorems to determine measures of interior and exterior angles.
- M.G.7.3 Prove properties of special quadrilaterals.
- M.G.7.4 Identify special quadrilaterals and use properties of these quadrilaterals to solve problems, including real world applications.

Vocabulary terms: side of a polygon, vertex of a polygon, diagonal, regular polygon, concave, convex, parallelogram, rectangle, rhombus, square, kite, trapezoid, base of a trapezoid, leg of a trapezoid, base angle of a trapezoid, isosceles trapezoid, midsegment of a trapezoid

**M.G.8 Students will apply the definition of similar polygons and other proportionality theorems to solve problems. Students will prove triangles similar using the triangle similarity theorems. (G-SRT.2, G-SRT.5)**

- M.G.8.1 Apply the definition of similar polygons to solve problems.
- M.G.8.2 Apply the triangle similarity theorems to prove two triangles are similar (AA~, SSS~, SAS~).
- M.G.8.3 Solve for segment lengths using the proportionality theorems.

Vocabulary terms: similar, similar polygons, similarity ratio, indirect measurement, scale drawing, scale

**M.G.9 Students will apply an appropriate method to solve for side(s) and/or angle(s) in right triangles and in applications that can be modeled with a right triangle. (G-SRT.6, G-SRT.7, G-SRT.8)**

- M.G.9.1 Apply the ratios for right triangle trigonometry.
- M.G.9.2 Apply the patterns for special right triangles to calculate the trigonometric ratios for special angles.
- M.G.9.3 Based on given information, select the appropriate method to use to solve a right triangle.
- M.G.9.4 Model a problem involving an angle of elevation or depression, and apply right triangle trigonometry to solve the problem.

Vocabulary terms: trigonometric ratio, sine, cosine, tangent, angle of elevation, angle of depression

**M.G.10 Students will apply formulas to calculate areas of regular polygons and volumes of solids. Students will model real world objects as geometric solids and apply formulas to solve problems. (G-GMD.1, G-GMD.3, G-GMD.4, G-MG.1, G-MG.2)**

- M.G.10.1 Use area formulas to calculate areas of plane figures including regular polygons.
- M.G.10.2 Use volume formulas to calculate volume of prisms, cylinders, pyramids, cones, and spheres.
- M.G.10.3 Model real world objects as geometric solids and apply formulas to solve problems.

Vocabulary terms: circle, center of a circle, center of a regular polygon, apothem, central angle of a regular polygon, composite figure, face, edge, vertex, prism, cylinder, pyramid, cone, cube, net, cross section, volume, sphere, center of a sphere, radius of a sphere, hemisphere, great circle

**M.G.11 Students will apply theorems about lines, segments, arcs, and angles related to circles to solve problems and calculate sector areas and arc lengths. (G-C.1, G-C.2, G-C.3, G-C.5)**

- M.G.11.1 Identify lines and segments related to circles.
- M.G.11.2 Use properties of tangents to solve problems.
- M.G.11.3 Use relationships between arcs, angles, and chords to solve problems.
- M.G.11.4 Apply formulas to find sector area and arc length.

Vocabulary terms: interior of a circle, exterior of a circle, chord, secant, tangent of a circle, point of tangency, congruent circles, concentric circles, tangent circles, common tangent, central angle, arc, minor arc, major arc, semicircle, adjacent arcs, congruent arcs, sector of a circle, segment of a circle, arc length, inscribed angle, intercepted arc, subtend, secant segment, external secant segment, tangent segment

**M.G.12 Students will verify theorems using coordinate methods. (G-GPE.1, G-GPE.4, G-GPE.5, G-GPE.7)**

- M.G.12.1 Apply coordinate methods (distance formula, midpoint formula, slope formula, and equations of lines) to investigate properties of quadrilaterals.
- M.G.12.2 Apply slope criteria for parallel and perpendicular lines to solve geometric problems.
- M.G.12.3 Given specific coordinates, use coordinate methods to verify geometric theorems.

**If time allows, also introduce this component:**

Prove geometric theorems using coordinate geometry.

Vocabulary terms: coordinate plane, leg, hypotenuse, rise, run, slope, point-slope form, slope-intercept form, coordinate proof

**M.G.13 Students will identify transformations and classify them as isometries or not. They will also transform figures on a coordinate plane and describe transformation(s) used to map one shape to another. (G-CO.1, G-CO.2, G-CO.3, G-CO.4, G-CO.5, G-CO.6, G-SRT.1, G-SRT.3)**

- M.G.13.1 Develop definitions of translations, reflections, rotations, and dilations.
- M.G.13.2 Identify transformations and classify them as isometries or not.
- M.G.13.3 Apply transformations to figures in a coordinate plane and identify the transformation(s) that carry one figure to another.
- M.G.13.4 Express transformations in correct notation.

**If time allows, also introduce this component:**

Determine congruence and similarity using transformations.

Vocabulary terms: transformation, preimage, image, reflection, rotation, translation, dilation, isometry, similarity transformation, dilation, scale factor

## Geometry Honors

**M.GH.1 Students will model points, lines, and planes and define other basic geometric terms. They will identify and explain basic relationships using points, lines, and planes. Students will accurately draw and correctly label basic geometric figures, will perform basic compass/straightedge constructions, and will apply distance and midpoint formulas to investigate properties of basic geometric figures. (G-CO.1, G-CO.5, G-GPE.7)**

- M.GH.1.1 Create representations of points, lines, and planes and identify real world examples of them.
- M.GH.1.2 Define basic geometric terms.
- M.GH.1.3 Draw and apply the conventional labeling methods for geometric figures.
- M.GH.1.4 Apply the basic postulates to explain the relationships between points, lines, and planes.
- M.GH.1.5 Use a compass and straightedge to do basic constructions (copying an angle, copying a segment, angle bisector, perpendicular bisector).
- M.GH.1.6 Apply distance and midpoint formulas to investigate properties of points, lines, and planes.
- M.GH.1.7 Develop definitions of translations, reflections, and rotations.

Vocabulary terms: undefined term, point, line, plane, collinear, coplanar, segment, endpoint, ray, opposite rays, postulate, coordinate, distance, length, congruent segments, construction, between, midpoint, bisect, segment bisector, perpendicular bisector, angle, vertex, interior of an angle, exterior of an angle, measure, degree, acute angle, right angle, obtuse angle, straight angle, congruent angles, angle bisector, adjacent angles, linear pair, complementary angles, supplementary angles, vertical angles, perimeter, area, base, height, diameter, radius, circumference, pi, coordinate plane, leg, hypotenuse, transformation, preimage, image, reflection, rotation, translation

**M.GH.2 Students will formulate logical arguments, using geometric rules and laws of logic, to prove statements. (G-CO.9, G-CO.10, G-CO.11)**

- M.GH.2.1 Use counterexamples to prove statements false.
- M.GH.2.2 Write the converse, inverse, contrapositive of a given conditional and determine the truth value of each.
- M.GH.2.3 Identify and apply the Law of Detachment and the Law of Syllogism.
- M.GH.2.4 Write a biconditional as a conditional and its converse and vice versa.
- M.GH.2.5 Use definitions, properties, postulates, and theorems to justify statements.
- M.GH.2.6 Use a variety of methods (two-column, flowchart, paragraph) to construct a series of logical steps that prove a statement.

Vocabulary terms: inductive reasoning, conjecture, counterexample, conditional statement, hypothesis, conclusion, truth value, negation, converse, inverse, contrapositive, logically equivalent statements, deductive reasoning, biconditional statement, definition, polygon, triangle, quadrilateral, proof, theorem, two-column proof, flowchart proof, paragraph proof

**M.GH.3 Students will apply properties of angles formed by lines cut by a transversal to solve problems and to prove lines parallel. They will also write equations of lines and apply slope criteria for parallel and perpendicular lines to solve geometric problems. (G-CO.1, G-CO.9, A-CED.2, G-GPE.5)**

- M.GH.3.1 Identify and name the different pairs of angles formed by two lines and a transversal.
- M.GH.3.2 Apply the theorems involving angles formed when parallel lines are cut by a transversal.
- M.GH.3.3 Use the converses of the angle theorems to prove lines parallel.
- M.GH.3.4 Apply theorems about parallel and perpendicular lines.
- M.GH.3.5 Use a compass and straight edge to construct parallel and perpendicular lines.
- M.GH.3.6 Apply slope formula and write equations of lines.
- M.GH.3.7 Apply slope criteria for parallel and perpendicular lines to solve geometric problems, including writing the equation of the perpendicular bisector of a segment.

Vocabulary terms: parallel lines, perpendicular lines, skew lines, parallel planes, transversal, corresponding angles, alternate interior angles, alternate exterior angles, same-side interior angles, perpendicular bisector, distance from a point to a line, rise, run, slope, point-slope form, slope-intercept form

**M.GH.4 Students will prove triangles congruent and use triangle congruence to prove theorems. They will also use coordinate geometry and transformations to prove triangles congruent. (G-CO.6, G-CO.7, G-CO.8, G-CO.10, G-SRT.5)**

- M.GH.4.1 Classify triangles by angles and by sides.
- M.GH.4.2 Apply coordinate methods to classify triangles.
- M.GH.4.3 Use the definition of congruent triangles to verify that triangles are congruent and write the correct congruence statement.
- M.GH.4.4 Apply appropriate triangle congruence theorems to prove triangles congruent.
- M.GH.4.5 Use congruent triangles to prove theorems.
- M.GH.4.6 Prove geometric theorems using coordinate geometry.
- M.GH.4.7 Classify transformations as isometries or not.
- M.GH.4.8 Apply transformations to figures in a coordinate plane and identify the transformation(s) that carry one figure to another.
- M.GH.4.9 Determine congruence using transformations.

Vocabulary terms: dilation, isometry, rigid transformation, acute triangle, equiangular triangle, right triangle, obtuse triangle, equilateral triangle, isosceles triangle, scalene triangle, auxiliary line, corollary, interior, exterior, interior angle, exterior angle, remote interior angle, corresponding angles, corresponding sides, congruent polygons, triangle rigidity, included angle, included side, CPCTC, legs of an isosceles triangle, vertex angle, base, base angles, coordinate proof



**M.GH.5**      **Students will apply theorems about right triangles, including the Pythagorean Theorem and the patterns of special right triangles. Students will use coordinate geometry to classify triangles and determine centers (circumcenter, incenter, orthocenter, and centroid). (G-CO.10, G-SRT.5, G-GPE.4)**

- M.GH.5.1      Apply properties of the angle bisector, perpendicular bisector, medians, and altitudes of a triangle to solve problems.
- M.GH.5.2      Use various centers of triangles to solve problems, including real world applications.
- M.GH.5.3      Use coordinate methods or linear equations to determine centers of triangles.
- M.GH.5.4      Apply properties of the midsegments of a triangle to solve problems.
- M.GH.5.5      Apply theorems about inequalities in one triangle and in two triangles to determine relative angle measures and side lengths.
- M.GH.5.6      Apply the Pythagorean Theorem and its converse to solve problems, including classifying triangles by angles.
- M.GH.5.7      Develop and apply the patterns of special right triangles.

Vocabulary terms: equidistant, focus, concurrent, point of concurrency, circumcenter of a triangle, circumscribed, incenter of a triangle, inscribed, median of a triangle, centroid of a triangle, altitude of a triangle, orthocenter of a triangle, midsegment of a triangle, indirect proof, Pythagorean triple

**M.GH.6**      **Students will classify polygons and apply the theorems about angles of a polygon to solve problems. They will prove and apply properties of special quadrilaterals using traditional and coordinate methods. (G-CO.11, G-GPE.4, G-GPE.5)**

- M.GH.6.1      Use definitions to classify polygons and determine whether they are regular/irregular and convex/concave.
- M.GH.6.2      Apply theorems to determine measures of interior and exterior angles.
- M.GH.6.3      Identify special quadrilaterals and use properties of these quadrilaterals to solve problems, including real world applications.
- M.GH.6.4      Use coordinate methods to verify geometric theorems.

Vocabulary terms: side of a polygon, vertex of a polygon, diagonal, regular polygon, concave, convex, parallelogram, rectangle, rhombus, square, kite, trapezoid, base of a trapezoid, leg of a trapezoid, base angle of a trapezoid, isosceles trapezoid, midsegment of a trapezoid

**M.GH.7 Students will apply the definition of similar polygons and other proportionality theorems to solve problems. Students will prove triangles similar using triangle similarity theorems and transformations. (G-SRT.1, G-SRT.2, G-SRT.3, G-SRT.4, G-SRT.5)**

- M.GH.7.1 Apply the definition of similar polygons to solve problems.
- M.GH.7.2 Apply triangle similarity theorems and transformations to prove two triangles are similar.
- M.GH.7.3 Solve for segment lengths using the proportionality theorems.
- M.GH.7.4 Use the distance formula along with triangle similarity theorems to demonstrate similarity.

Vocabulary terms: similar, similar polygons, similarity ratio, similarity transformation, dilation, scale factor, indirect measurement, scale drawing, scale

**M.GH.8 Students will apply an appropriate method to solve for side(s) and/or angle(s) in right triangles and in applications that can be modeled with a right triangle. (G-SRT.6, G-SRT.7, G-SRT.8)**

- M.GH.8.1 Apply the ratios for right triangle trigonometry.
- M.GH.8.2 Apply the patterns for special right triangles to calculate the trigonometric ratios for special angles.
- M.GH.8.3 Based on given information, select the appropriate method to use to solve a right triangle.
- M.GH.8.4 Model a problem involving an angle of elevation or depression and apply right triangle trigonometry to solve the problem.

Vocabulary terms: trigonometric ratio, sine, cosine, tangent, angle of elevation, angle of depression

**M.GH.9 Students will apply formulas to calculate areas of plane figures. Students will apply formulas to solve real world problems and find geometric probability. (G-GMD.1, G-GMD.3, G-GMD.4, G-MG.1, G-MG.2)**

- M.GH.9.1 Use area formulas to calculate areas of plane figures including regular polygons and composite figures.
- M.GH.9.2 Using coordinate methods, calculate the area of plane figures.
- M.GH.9.3 Apply formulas to solve real world applications.
- M.GH.9.4 Find geometric probability using area formulas.

Vocabulary terms: circle, center of a circle, center of a regular polygon, apothem, central angle of a regular polygon, composite figure, geometric probability, face, edge, vertex

**M.GH.10 Students will apply formulas to calculate lateral area, surface area, and volumes of solids. Students will model real world objects as geometric solids and apply formulas to solve problems. (G-GMD.1, G-GMD.3, G-GMD.4, G-MG.1, G-MG.2)**

- M.GH.10.1 Use appropriate formulas to calculate lateral area, surface area, and volume of prisms and cylinders (bases are not limited to rectangles).
- M.GH.10.2 Use appropriate formulas to calculate lateral area, surface area, and volume of pyramids and cones (bases are not limited to rectangles).
- M.GH.10.3 Use appropriate formulas to calculate surface area and volume of spheres.
- M.GH.10.4 Model real world objects as geometric solids and apply formulas to solve real world applications.
- M.GH.10.5 Generate a solid by revolving a shape in the coordinate plane around a line, and then calculate the volume of the solid.

Vocabulary terms: circle, center of a circle, center of a regular polygon, apothem, central angle of a regular polygon, composite figure, face, edge, vertex, prism, cylinder, pyramid, cone, cube, net, cross section, volume, sphere, center of a sphere, radius of a sphere, hemisphere, great circle

**M.GH.11 Students will apply theorems about lines, segments, arcs, and angles related to circles to solve problems and calculate sector areas and arc lengths. Students will use coordinate methods to write equations of circles and to graph circles. (G-C.1, G-C.2, G-C.3, G-C.5)**

- M.GH.11.1 Identify lines and segments related to circles.
- M.GH.11.2 Use properties of tangents to solve problems.
- M.GH.11.3 Use relationships between arcs, angles, and chords to solve problems.
- M.GH.11.4 Apply formulas to find sector area and arc length.
- M.GH.11.5 Use coordinate methods to write equations of circles and to graph circles.

Vocabulary terms: interior of a circle, exterior of a circle, chord, secant, tangent of a circle, point of tangency, congruent circles, concentric circles, tangent circles, common tangent, central angle, arc, minor arc, major arc, semicircle, adjacent arcs, congruent arcs, sector of a circle, segment of a circle, arc length, inscribed angle, intercepted arc, subtend, secant segment, external secant segment, tangent segment

## Algebra 2

**M.A2.1 Students will identify parent functions, domain, range and transformations given equations or graphs. (Linear, Quadratic, Cubic, Square Root, Absolute Value. (F-BF. 3, F-BF.4, F-IF.4, F-IF.7)**

- M.A2.1.1 State the name of parent function from an equation or graph which does not contain transformations.
- M.A2.1.2 Graph a function using a table or a graphing utility and identify domain and range.
- M.A2.1.3 Apply transformations to a point and a graph given a graph.
- M.A2.1.4 State the name of parent function from an equation or graph which contains transformations.
- M.A2.1.5 Identify transformations applied to the parent function given an equation.
- M.A2.1.6 Write the inverse of relations and functions.
- M.A2.1.7 Graph the inverse of relations and functions and identify the domain and range.

**M.A2.2 Students will perform arithmetic operations on expressions containing complex numbers. They will also solve quadratic equations with real coefficients that have complex solutions. (N-CN.1, N-CN.2, N-CN.3, N-CN.7, A-REI.1, A-REI.4b, A-SSE.2)**

- M.A2.2.1 Simplify radicals including those with negative numbers.
- M.A2.2.2 Add, subtract, and multiply with complex numbers.
- M.A2.2.3 Rationalize a fraction with complex numbers by using the conjugate.
- M.A2.2.4 Classify roots of quadratic equations using the discriminant.
- M.A2.2.5 Solve quadratic equations by using factoring, square root method, completing the square, and quadratic formula including those with real and complex solutions.
- M.A2.2.6 Solve an equation from a given application situation involving quadratic equations.

**M.A2.3 Students will perform arithmetic operations and factor polynomial expressions. They will also solve and sketch a given polynomial equation using an appropriate method. When graphing, students will identify domain, range, local maxima, local minima, end behavior, and transformations. (A-APR.1, A-APR.2, A-APR.3, A-APR.4, A-APR.6, A-SSE.1a, A-SSE.2, A-REI.1, A-CED.1, F-IF.4)**

- M.A2.3.1 Classify polynomials by degree and number of terms.
- M.A2.3.2 Add, subtract, or multiply polynomial expressions.
- M.A2.3.3 Divide polynomial expressions by long division and synthetic division when appropriate.
- M.A2.3.4 Factor polynomial expressions using factor by grouping and sum or difference of cubes.
- M.A2.3.5 Apply the Remainder Theorem and Factor Theorem.
- M.A2.3.6 Find roots of polynomial equations using the Fundamental Theorem of Algebra, Rational Root Theorem, and Conjugate Root Theorem (conjugate monomials).
- M.A2.3.7 Write polynomial equations when given a root or roots using the Fundamental Theorem of Algebra and Conjugate Root Theorem.
- M.A2.3.8 Construct a rough sketch of a polynomial function using end behavior and roots.
- M.A2.3.9 Given a graph of a polynomial function, identify the domain and range and approximate the local maxima and minima.
- M.A2.3.10 Identify transformations applied to the polynomial parent function given an equation.

**M.A2.4 Students will perform arithmetic operations with a rational expression. They will also solve rational equations including application situations. In addition, students will graph a rational expression identifying domain, range, vertical asymptotes, and transformations. (N-Q.2, F-IF.6, A-CED.1, A-APR.6, A-REI.1, A-REI.2, A-REI.11)**

- M.A2.4.1 Simplify rational expressions and identify excluded values.
- M.A2.4.2 Perform multiplication and division with rational expressions.
- M.A2.4.3 Perform addition and subtraction with rational expressions.
- M.A2.4.4 Solve rational equations including those that contain extraneous solutions.
- M.A2.4.5 Write and solve rational equations given an application situation.
- M.A2.4.6 Identify transformations applied to the rational parent function given an equation.
- M.A2.4.7 Graph a rational function limited to a constant divided by a linear expression using transformations.
- M.A2.4.8 Identify the domain and range of a rational function.

**M.A2.5 Students will simplify radical expressions. They will also solve and graph radical equations, identifying domain, range, and transformations. (F-IF.6, A-REI.1, A-REI.2, N-Q.2, N-RN.1, N-RN.2)**

- M.A2.5.1 Rewrite radical expressions using rational exponents.
- M.A2.5.2 Simplify and evaluate expressions containing rational exponents.
- M.A2.5.3 Perform arithmetic operations with radical expressions using rational exponents.
- M.A2.5.4 Solve a radical equation which contains extraneous solutions.
- M.A2.5.5 Identify transformations applied to the radical parent function given an equation.
- M.A2.5.6 Graph a radical function using transformations.
- M.A2.5.7 Identify the domain and range of a radical function.

**M.A2.6 Students will write and solve an exponential or logarithmic equation including application situations. They will also graph exponential and logarithmic functions identifying domain, range, asymptotes, and transformations. (F-LE.1, F-LE.2, F-LE.3, F-LE.4, F-LE.5, F-IF.4, F-IF.6, N-Q.2, A-CED.1, A-REI.1)**

- M.A2.6.1 Write equivalent forms for exponential and logarithmic functions utilizing the inverse relationship.
- M.A2.6.2 Evaluate exponential and logarithmic expressions.
- M.A2.6.3 Use the properties of logarithms to simplify expressions including the change of base formula.
- M.A2.6.4 Solve exponential and logarithmic equations including base  $e$  and natural logarithms.
- M.A2.6.5 Write exponential equations to model growth and decay situations then evaluate them for given values.
- M.A2.6.6 Solve exponential and logarithmic equations including application situations using inverse relationships.
- M.A2.6.7 Identify the domain, range, and asymptotes of an exponential or logarithmic function and graph the function (inverses to graph logarithmic).
- M.A2.6.8 Identify transformations applied to the exponential and logarithmic parent function given an equation.

**M.A2.7 Students will analyze and compare polynomial, exponential, logarithmic, rational, and radical functions in different forms. (F-LE.2, F-LE.3, F-LE.4, F-LE.5, F-IF.6, F-IF.9, F-BF.1a, F-BF.1b, F-BF.2, A-REI.11, N-Q.2)**

- M.A2.7.1 Determine the type of function (polynomial, exponential, logarithmic, rational, or radical) from graphs, tables, or equations.
- M.A2.7.2 Determine using graphs and tables that a quantity of one type of function eventually exceeds a quantity as compared to another type of function.
- M.A2.7.3 Compare quantities using graphs and tables of various functions.
- M.A2.7.4 Given real-world data, identify the function that best models the situation.

**M.A2.8 Students will use rules of probability to compute probabilities of situations. They will also explain the process of statistical experiments and make inferences. (S-CP.1, S-CP.2, S-CP.3, S-CP.4, S-CP.5, S-CP.6, S-IC.1, S-IC.2, S-IC.3, S-IC.4, S-IC.5, S-IC.6)**

- M.A2.8.1 Determine the theoretical or experimental probability.
- M.A2.8.2 Determine whether events are independent or dependent.
- M.A2.8.3 Compute the probability of independent and dependent events.
- M.A2.8.4 Interpret two-way frequency tables of data to approximate conditional probability.
- M.A2.8.5 Determine if a given situation requires permutations or combinations and state the number of possible outcomes.
- M.A2.8.6 Apply the Addition Rule to probabilities of compound events.



**M.A2.9 Students will summarize, represent, and interpret data in real-world situations, including distinguishing between correlation and causation. (S-ID.1, S-ID.2, S-ID.3, S-ID.4, S-ID.5, S-ID.6, S-ID.8, S-ID.9)**

- M.A2.9.1 Compare and contrast surveys, experiments, and observational studies.
- M.A2.9.2 Use random samples to make inferences about a population.
- M.A2.9.3 Represent data with histograms and box-and-whisker plots.
- M.A2.9.4 Use statistics appropriate to the shape of the data distribution to compare center (mean, median) and spread (interquartile range, standard deviation) of two or more data sets.
- M.A2.9.3 Determine and describe the effect of outliers on data.
- M.A2.9.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and estimate population percentages.
- M.A2.9.5 Represent data on two quantitative variables on a scatter plot and describe how the variables are related.
- M.A2.9.6 Compute and interpret the correlation coefficient of a linear fit using graphing calculators.
- M.A2.9.7 Distinguish between correlation and causation.

**M.A2.10 Students will define trigonometric ratios and solve problems involving right triangles. They will also extend the domain of trigonometric functions using the unit circle and graphs of sine and cosine to solve problems with trigonometric functions. (A-REI.1, F-TF.1, F-TF.2, F-TF.5, F-TF.8)**

- M.A2.10.1 Use right triangles including special right triangles to determine exact values of sine, cosine, tangent, secant, cosecant, and cotangent.
- M.A2.10.2 Draw angles in standard position and determine the values of the trigonometric functions for an angle in standard position.
- M.A2.10.3 Convert angle measures between degrees and radians.
- M.A2.10.4 Find the values of trigonometric functions on the unit circle utilizing reference angles.
- M.A2.10.5 Identify the domain, range, period, and amplitude of sine and cosine functions.
- M.A2.10.6 Use the transformations (domain, range, period, and amplitude) to create a sketch of sine and cosine functions.
- M.A2.10.7 Evaluate inverse trigonometric functions.
- M.A2.10.8 Solve one-step trigonometric equations using inverse trigonometric functions.

**If time allows, also introduce this component:**

Prove the fundamental trigonometric identities and use them to rewrite expressions.

## Algebra 2 Honors

**M.A2H.1 Students will identify parent functions and transformations given equations or graphs. In addition, they will create equations to model application situations and apply transformations. (Linear, Quadratic, Cubic, Square Root, Absolute Value) (F-BF. 3, F-BF.4, F-IF.4, F-IF.7)**

- M.A2H.1.1 State the name of parent function from an equation or graph which does not contain transformations.
- M.A2H.1.2 Graph a function using a table or a graphing utility and identify domain and range.
- M.A2H.1.3 Apply transformations to a point and a graph given a graph.
- M.A2H.1.4 State the name of parent function from an equation or graph which contains transformations.
- M.A2H.1.5 Identify transformations applied to the parent function given an equation.
- M.A2H.1.6 Write the inverse of relations and functions.
- M.A2H.1.7 Graph the inverse of relations and functions and identify the domain and range.
- M.A2H.1.8 Create an equation to model application situations and apply transformations.

**M.A2H.2 Students will perform arithmetic operations on expressions containing complex numbers. They will also solve quadratic equations with real coefficients that have complex solutions. In addition, students will create and use quadratic models in application situations. (N-CN.1, N-CN.2, N-CN.3, N-CN.7, A-REI.1, A-REI.4b, A-SSE.2)**

- M.A2H.2.1 Simplify radicals including those with negative numbers.
- M.A2H.2.2 Add, subtract, and multiply with complex numbers.
- M.A2H.2.3 Rationalize a fraction with complex numbers by using the conjugate.
- M.A2H.2.4 Classify roots of quadratic equations using the discriminant.
- M.A2H.2.5 Solve quadratic equations by using factoring, square root method, completing the square, and quadratic formula including those with real and complex solutions..
- M.A2H.2.6 Solve application situations involving quadratic equations.
- M.A2H.2.7 Write quadratic functions using information about the roots.
- M.A2H.2.8 Write a quadratic function given data and use the function to analyze and predict unknown values.

**M.A2H.3 Students will perform arithmetic operations and factor polynomial expressions. They will also solve and sketch a given polynomial equation using an appropriate method. When graphing, students will identify domain, range, local maxima, local minima, end behavior, and transformations. (A-APR.1, A-APR.2, A-APR.3, A-APR.4, A-APR.6, A-SSE.1a, A-SSE.2, A-REI.1, A-CED.1, F-IF.4)**

- M.A2H.3.1 Classify polynomials by degree and number of terms.
- M.A2H.3.2 Add, subtract, or multiply polynomial expressions.
- M.A2H.3.3 Divide polynomial expressions by long division and synthetic division when appropriate.
- M.A2H.3.4 Factor polynomial expressions using factor by grouping and sum or difference of cubes.
- M.A2H.3.5 Apply the Remainder Theorem and Factor Theorem.
- M.A2H.3.6 Find roots of polynomial equations using the Fundamental Theorem of Algebra, Rational Root Theorem, and Conjugate Root Theorem (conjugate monomials).
- M.A2H.3.7 Write polynomial equations when given a root or roots using the Fundamental Theorem of Algebra and Conjugate Root Theorem.
- M.A2H.3.8 Construct a rough sketch of a polynomial function using end behavior and roots.
- M.A2H.3.9 Given a graph of a polynomial function, identify the domain and range and approximate the local maxima and minima.
- M.A2H.3.10 Apply transformations to a given function to create a new function.
- M.A2H.3.11 Use technology to generate polynomial models for a given set of data.

**M.A2H.4 Students will perform arithmetic operations with a rational expression. They will also solve rational equations including application situations. In addition, students will graph a rational expression identifying domain, range, vertical and horizontal asymptotes, and apply transformations. (N-Q.2, F-IF.6, A-CED.1, A-APR.6, A-REI.1, A-REI.2, A-REI.11)**

- M.A2H.4.1 Simplify rational expressions and identify excluded values.
- M.A2H.4.2 Perform multiplication and division with rational expressions.
- M.A2H.4.3 Perform addition and subtraction with rational expressions.
- M.A2H.4.4 Solve rational equations including those that contain extraneous solutions.
- M.A2H.4.5 Write and solve rational equations given an application situation.
- M.A2H.4.6 Identify transformations applied to the rational parent function given an equation.
- M.A2H.4.7 Graph a rational function limited to a constant divided by a linear expression using transformations.
- M.A2H.4.8 Identify the domain and range of a rational function.

**M.A2H.5 Students will simplify radical expressions and solve radical equations. They will also identify domain and range and apply transformations to graph radical equations. (F-IF.6, A-REI.1, A-REI.2, N-Q.2, N-RN.1, N-RN.2)**

- M.A2H.5.1 Rewrite radical expressions using rational exponents.
- M.A2H.5.2 Simplify and evaluate expressions containing rational exponents.
- M.A2H.5.3 Perform arithmetic operations with radical expressions using rational exponents.
- M.A2H.5.4 Solve a radical equation including those that contain extraneous solutions.
- M.A2H.5.5 Identify transformations applied to the radical parent function given an equation.
- M.A2H.5.6 Apply transformations to a given function to create a new function.
- M.A2H.5.7 Graph a radical functions (square root and cube root) and identify the domain and range of the radical function.

**M.A2H.6 Students will write and solve an exponential or logarithmic equation including application situations. They will also graph exponential and logarithmic functions identifying domain, range, and asymptotes and apply transformations. In addition, students will use technology to model exponential and logarithmic data. (F-LE.1, F-LE.2, F-LE.3, F-LE.4, F-LE.5, F-IF.4, F-IF.6, N-Q.2, A-CED.1, A-REI.1, A-REI.11)**

- M.A2H.6.1 Write equivalent forms for exponential and logarithmic functions utilizing the inverse relationship.
- M.A2H.6.2 Evaluate exponential and logarithmic expressions.
- M.A2H.6.3 Use the properties of logarithms to simplify expressions including the change of base formula.
- M.A2H.6.4 Solve exponential and logarithmic equations including base e and natural logarithms.
- M.A2H.6.5 Write exponential equations to model growth and decay situations then evaluate them for given values.
- M.A2H.6.6 Solve exponential and logarithmic equations including application situations using inverse relationships.
- M.A2H.6.7 Identify the domain, range, and asymptotes of an exponential or logarithmic function and graph the function (inverses to graph logarithmic).
- M.A2H.6.8 Identify transformations applied to the exponential and logarithmic parent functions given an equation.
- M.A2H.6.9 Apply transformations to a given function to create a new function.
- M.A2H.6.10 Use technology to generate an exponential and logarithmic models for a given set of data. Then use the model to analyze and predict unknown values.

**M.A2H.7**     **Students will analyze and compare polynomial, exponential, logarithmic, rational, and radical functions in different forms. Students will also construct functions given real-world data to make predictions. (F-LE.2, F-LE.3, F-LE.4, F-LE.5, F-IF.6, F-IF.9, F-BF.1a, F-BF.1b, F-BF.2, A-REI.11, N-Q.2)**

- M.A2H.7.1     Determine the type of function (polynomial, exponential, logarithmic, rational, and radical) from graphs, tables, or equations.
- M.A2H.7.2     Given real-world data, identify the function that best models the situation.
- M.A2H.7.3     Determine using graphs and tables that a quantity of one type of function eventually exceeds a quantity as compared to another type of function.
- M.A2H.7.4     Compare quantities using graphs and tables of various functions.
- M.A2H.7.5     Construct functions given real-world data to make predictions.

**M.A2H.8**     **Students will use rules of probability to compute probabilities of situations. They will also explain the process of statistical experiments and make inferences. (S-CP.1, S-CP.2, S-CP.3, S-CP.4, S-CP.5, S-CP.6, S-IC.1, S-IC.2, S-IC.3, S-IC.4, S-IC.5, S-IC.6)**

- M.A2H.8.1     Determine the theoretical or experimental probability.
- M.A2H.8.2     Determine whether events are independent or dependent.
- M.A2H.8.3     Compute the probability of independent and dependent events.
- M.A2H.8.4     Construct and interpret two-way frequency tables of data to approximate conditional probability.
- M.A2H.8.5     Determine if a given situation requires permutations or combinations and state the number of possible outcomes.
- M.A2H.8.6     Apply the Addition Rule to probabilities of compound events.
- M.A2H.8.7     Compare and contrast surveys, experiments, and observational studies.
- M.A2H.8.7     Use random samples to make inferences about a population.

**M.A2H.9 Students will summarize, represent, and interpret data in real-world situations, including distinguishing between correlation and causation. (S-ID.1, S-ID.2, S-ID.3, S-ID.4, S-ID.5, S-ID.6, S-ID.8, S-ID.9)**

- M.A2H.9.1 Compare and contrast surveys, experiments, and observational studies.
- M.A2H.9.2 Use random samples to make inferences about a population.
- M.A2H.9.3 Represent data with histograms and box-and-whisker plots.
- M.A2H.9.4 Use statistics appropriate to the shape of the data distribution to compare center (mean, median) and spread (interquartile range, standard deviation) of two or more data sets.
- M.A2H.9.3 Determine and describe the effect of outliers on data.
- M.A2H.9.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and estimate population percentages.
- M.A2H.9.5 Represent data on two quantitative variables on a scatter plot and describe how the variables are related.
- M.A2H.9.6 Compute and interpret the correlation coefficient of a linear fit using graphing calculators.
- M.A2H.9.7 Distinguish between correlation and causation.

**M.A2H.10 Students will define trigonometric ratios and solve problems involving right triangles. They will also extend the domain of trigonometric functions using the unit circle to solve problems. (A-REI.1, F-TF.1, F-TF.2, F-TF.5, F-TF.8)**

- M.A2H.10.1 Use right triangles including special right triangles to determine exact values of sine, cosine, tangent, cosecant, and cotangent.
- M.A2H.10.2 Draw angles in standard position and determine the values of the trigonometric functions for an angle in standard position.
- M.A2H.10.3 Convert angle measures between degrees and radian.
- M.A2H.10.4 Find the values of trigonometric functions on the unit circle utilizing reference angles.
- M.A2H.10.5 Evaluate inverse trigonometric functions.
- M.A2H.10.6 Solve multi-step trigonometric equations using inverse trigonometric functions.

**M.A2H.11** Students identify domain, range, period, amplitude, and asymptotes of trigonometric functions and graph the functions. Students will also apply transformations to a given function to create a new function. In addition, they will prove and apply trigonometric identities. (A-REI.1, F-TF.1, F-TF.2, F-TF.5, F-TF.8)

- M.A2H.11.1 Identify the domain, range, period, and amplitude of the 6 trigonometric functions.
- M.A2H.11.2 Use the transformations (domain, range, period, amplitude, and asymptotes) to create a sketch of the 6 trigonometric functions.
- M.A2H.11.3 Apply transformations to a given function to create a new function.
- M.A2H.11.4 Prove the fundamental trigonometric identities and use them to rewrite expressions.

## Algebra 3

**M.A3.1 Students will identify basic graphs of a variety of functions and their key features utilizing interval notation, identify transformations from the equations, and apply transformations to the graphs. Students will compose functions and determine the inverse of a function. (F-IF.7, F-BF.1c, F-BF.3, F-BF.4)**

M.A3.1.1 Identify basic graphs of polynomial, rational, radical, logarithmic, and exponential functions.

M.A3.1.2 Identify key features of graphs utilizing interval notation.

M.A3.1.3 Analyze equations to determine transformations and apply the transformations to the graph.

M.A3.1.4 Apply arithmetic operations to functions and compose functions.

M.A3.1.5 Find the inverse of a function and verify that two functions are inverses.

M.A3.1.6 For invertible functions, find an inverse by restricting the domain.

**M.A3.2 Students will solve systems of equations and inequalities graphically and algebraically. Systems will include linear and nonlinear equations. (A-REI.7, A-REI.10, A-REI.11, A-REI.12)**

M.A3.2.1 Apply graphing, substitution, and elimination methods to solve systems of equations.

M.A3.2.2 Solve multivariable systems of equations.

M.A3.2.3 Solve systems of linear and nonlinear inequalities.

M.A3.2.4 Apply systems of inequalities to solve linear programming problems.

**M.A3.3 Students will use matrices to represent data and systems of linear equations. Students will perform operations on matrices and apply properties of matrix operations. Students will use matrices to solve linear systems. (N-VM.6, N-VM.7, N-VM.8, N-VM.9, N-VM.10, A-REI.8, A-REI.9)**

M.A3.3.1 Represent data and systems of equations as matrices.

M.A3.3.2 Identify and explain basic properties of matrix operations.

M.A3.3.3 Add and subtract matrices, apply scalar multiplication, and multiply matrices.

M.A3.3.4 Evaluate determinants of square matrices.

M.A3.3.5 Find the inverse of a matrix and use it to solve a matrix equation.

M.A3.3.6 Use row reduction and Cramer's rule to solve matrix equations.



**M.A3.4**      **Students will identify conic sections from the equations and from the graphs. Given the equation of a conic section, students will produce a graph. In addition, students will derive the equation of a conic section from the given information. Students will solve systems of equations of conics. (G-GPE.1, G-GPE.2, G-GPE.3, A-REI.7)**

- M.A3.4.1      Identify the vertex, focus, and directrix of a parabola from an equation and use them to graph the parabola.
- M.A3.4.2      Use key information about a parabola to write an equation.
- M.A3.4.3      Identify the center and radius of a circle from an equation and use them to graph the circle.
- M.A3.4.4      Use key information about a circle to write an equation.
- M.A3.4.5      Identify the vertices, foci, and center of an ellipse from an equation and use them to graph the ellipse.
- M.A3.4.6      Use key information about an ellipse to write an equation.
- M.A3.4.7      Identify the vertices, foci, asymptotes, and center of a hyperbola from an equation and use them to graph the hyperbola.
- M.A3.4.8      Use key information about a hyperbola to write an equation.
- M.A3.4.9      Solve systems of equations of conics.

**M.A3.5**      **Students will apply formulas and write expressions for sequences and series to solve problems. (FIF.3, F-BF.1a, F-BF.2, A-SSE.4)**

- M.A3.5.1      Identify and write rules for arithmetic and geometric sequences.
- M.A3.5.2      Find a formula for the  $n$ th term of a sequence.
- M.A3.5.3      Evaluate the sum of a series expressed in sigma notation.
- M.A3.5.4      Find partial sums of arithmetic and geometric series.
- M.A3.5.5      Find the sum of infinite geometric series or explain why it can't be found.
- M.A3.5.6      Use sequences to model situations.

## Trigonometry

- M.T.1**      **Students will identify and apply the basic trigonometric functions using the unit circle in both radian and degree measures. (F-TF.1, F-TF.2, F-TF.3, F-TF.4)**
- M.T.1.1      Convert between radian and degree measures of an angle.
  - M.T.1.2      Identify and calculate coterminal angles.
  - M.T.1.3      Use special right triangles to determine values of sine, cosine, and tangent.
  - M.T.1.4      Use the unit circle to extend trigonometric functions to all angles including the use of reference angles.
- M.T.2**      **Students will graph trigonometric functions and use them to solve application problems. Also, students will solve equations using inverse functions. (F-TF.5, F-TF.6, F-TF.7)**
- M.T.2.1      Graph sine and cosine functions utilizing amplitude, period, and translations.
  - M.T.2.2      Graph tangent, cotangent, secant, and cosecant functions.
  - M.T.2.3      Use domain and range of trigonometric functions to construct inverse trigonometric functions.
  - M.T.2.4      Use inverse functions to solve trigonometric equations, including the use of technology.
  - M.T.2.5      Use trigonometric functions and graphs to solve application problems involving periodic behavior.
- M.T.3**      **Students will derive and apply trigonometric identities to solve equations. (F-TF.7, F-TF.8)**
- M.T.3.1      Use trigonometric identities to simplify expressions.
  - M.T.3.2      Derive and verify trigonometric identities.
  - M.T.3.3      Utilize identities to solve multi-step trigonometric equations.
- M.T.4**      **Students will apply addition, subtraction, double-angle, and half-angle formulas to solve problems. (F-TF.7, F-TF.9)**
- M.T.4.1      Derive and apply addition and subtraction formulas.
  - M.T.4.2      Derive and apply double-angle and half-angle formulas.
  - M.T.4.3      Use addition, subtraction, double-angle, and half-angle formulas to solve problems.

**M.T.5        Students will solve problems involving right triangles. Students will apply trigonometry to general triangles. (G-SRT.8, G-SRT.9, G-SRT.10, G-SRT.11)**

- M.T.5.1        Use trigonometric ratios and the Pythagorean Theorem to solve right triangles including application problems.
- M.T.5.2        Derive the formula for area of a triangle and use it to solve problems.
- M.T.5.3        Prove and apply the Law of Sines and the Law of Cosines to find unknown measurements in non-right triangles.

**M.T.6        Students will use vectors to represent and model quantities. Students will perform operations on vectors. Students will use vectors to solve problems involving velocity and other quantities. In addition, students will represent complex numbers and their operations on the complex plane. (N-VM.1, N-VM.2, N-VM.3, N-VM.4, N-VM.5, N-CN.3, N-CN.4, N-CN.5, N-CN. 6)**

- M.T.6.1        Recognize vector quantities as having both magnitude and direction, use appropriate symbols, and represent vectors graphically.
- M.T.6.2        Perform operations (addition, subtraction, and scalar multiplication) on vectors and represent the operation graphically.
- M.T.6.4        Compute magnitude and direction with the sum of vectors and with a scalar multiple of a vector.
- M.T.6.3        Calculate the dot product of vectors and apply to a variety of problems.
- M.T.6.4        Solve problems involving velocity and other quantities that can be represented by vectors.
- M.T.6.5        Convert between rectangular and polar form of complex numbers and represent them on the complex plane.
- M.T.6.6        Perform operations (addition, subtraction, multiplication and division) on complex numbers and represent them in the complex plane.
- M.T.6.7        Find powers and roots of complex numbers and represent them in the complex plane.

## Probability and Statistics

**M.PS.1**      **Students will design a survey/experiment and then collect, display, analyze, and interpret the data from the survey/experiment. (S-IC.1, S-IC.3, S-IC.4, S-IC.5, S-IC.6)**

- M.PS.1.1      Distinguish between a population and sample.
- M.PS.1.2      Identify and explain the purposes of and differences among sample surveys, experiments, and observational studies.
- M.PS.1.3      Distinguish between the different sampling methods and how randomization relates to each.
- M.PS.1.4      Differentiate between qualitative and quantitative data.
- M.PS.1.5      Design a statistical study/experiment and collect, display, analyze, and interpret the data.

**M.PS.2**      **Students will summarize, represent, and interpret data in a single variable. They will also use the mean and standard deviation to compare data sets. (S-ID.1, S-ID.2, S-ID.3)**

- M.PS.2.1      Represent data with bar graphs, circle graphs, and stem-and-leaf plots.
- M.PS.2.2      Represent categorical data with frequency distributions and quantitative data with histograms and describe the shape of the distributions.
- M.PS.2.3      Calculate and compare centers of data using mean, median, and mode of two or more different data sets.
- M.PS.2.4      Calculate and compare spreads using interquartile range and standard deviation of two or more different data sets.
- M.PS.2.5      Determine outliers and interpret how they affect shape, center, and spread.
- M.PS.2.6      Construct box plots for data sets.

**M.PS.3 Students will summarize, represent, and interpret data in two variables focusing on linear and exponential models. They will also write the equation of the line of best fit for linear models and utilize the line of best fit to solve problems in context of the data. (S-ID.5, S-ID.6)**

- M.PS.3.1 Represent data using a scatter plot and describe how the variables are related.
- M.PS.3.2 Fit a function to the data represented on a scatter plot, focusing on linear and exponential models, and write the equation of the line of best fit for linear models.
- M.PS.3.3 Interpret the rate of change (slope) and constant term (intercept) of a linear model in context of the data.
- M.PS.3.4 Using technology, compute and interpret the correlation coefficient of a linear fit.
- M.PS.3.5 Use the line of best fit to solve problems in context of the data.
- M.PS.3.6 Assess the fit of the function by plotting and analyzing residuals.
- M.PS.3.7 Distinguish between correlation and causation.

**M.PS.4 Students will identify the sample space of an experiment and calculate the probabilities of individual, compound, independent, and dependent events. (S-CP.1, S-CP.2, S-CP.3, S-CP.4, S-CP.5, S-CP.6, S-CP.7, S-CP.8, S-CP.9)**

- M.PS.4.1 Identify sample space of an experiment, including compound events.
- M.PS.4.2 Describe the unions, intersections, and/or complements of a sample space.
- M.PS.4.3 Use permutations and combinations to count the possible number of outcomes of an experiment.
- M.PS.4.4 Calculate the probability of individual events.
- M.PS.4.5 Describe the differences between independent and dependent events.
- M.PS.4.6 Calculate the probability of independent and dependent events.
- M.PS.4.7 Recognize and explain the concepts of conditional probability and independence in everyday language and situations.
- M.PS.4.8 Apply the Addition Rule and interpret the solution in terms of the model.

**M.PS.5      Students will develop probability distributions for random variables, calculate expected values, and use them to solve problems. (S-MD.1, S-MD.2, S-MD.3, S-MD.4, S-MD.5, S-MD.6, S-MD.7, S-ID.4)**

- M.PS.5.1      Distinguish between discrete and continuous random variables.
- M.PS.5.2      Construct probability distributions (including binomial and geometric) and find the expected value and standard deviation of the distributions.
- M.PS.5.3      Use expected value of distributions to solve problems.
- M.PS.5.4      Construct normal probability distributions and use empirical rule to estimate probabilities.
- M.PS.5.5      Calculate z-scores for data and find probabilities for normally distributed populations.
- M.PS.5.6      Use calculators, spreadsheets, and/or tables to estimate areas under the normal curve.

## Discrete Math

The Discrete Math curriculum is designed to give students in the class a choice in the content covered and sequence. In a semester, the class will cover to three topics. The topics are Management Science, The Digital Revolution, and Your Money and Resources. Additional curriculum can also be developed for two additional topics: Fairness and Game Theory and Voting and Social Choice.

### Management Science

**M.D.1** Students will identify features of a graph and draw graphs from given information. They will also determine whether a graph has an Euler circuit or not and then identify an Euler circuit if one exists or eulerize the graph to find an Euler circuit if one does not exist. In addition, students will describe real-life situations in which paths, circuits, and Euler circuits are important.

- M.D.1.1 Identify the parts of a graph including the number of edges and vertices.
- M.D.1.2 Identify a path or circuit on a given graph.
- M.D.1.3 Determine the valence of the vertices of a graph.
- M.D.1.4 Determine whether a graph is connected or not and explain your reasoning.
- M.D.1.5 Draw a graph from given information (valences, edges, connectedness, etc.).
- M.D.1.6 Determine whether a graph has an Euler circuit or not and explain your reasoning.
- M.D.1.7 Identify an Euler circuit, if one exists, of a given graph.
- M.D.1.8 Eulerize a graph to find an Euler circuit using the best eulerization.
- M.D.1.9 Apply the “edge walker” technique to find the best eulerization of a rectangular network.
- M.D.1.10 Describe real-life situations in which paths, circuits, and Euler circuits are important, including situations in which graphs would be connected or not or when eulerization is required.

**M.D.2**            **Students will identify a Hamiltonian circuit and spanning tree on a given graph. They will apply various methods to determine a minimum cost Hamiltonian circuit for the Traveling Salesman Problem. Students will also determine the minimum cost spanning tree for weighted graphs and application problems. They will determine the critical path and earliest completion time for an order-requirement digraph, including ones they create from real world situations.**

- M.D.2.1            Identify a Hamiltonian circuit on a graph.
- M.D.2.2            Create a weighted graph for a given application.
- M.D.2.3            Use the brute force method to determine the minimum-cost Hamiltonian circuit for weighted graphs and application problems.
- M.D.2.4            Apply the fundamental principle of counting to determine how many choices are possible for a given situation.
- M.D.2.5            Determine a tour for the traveling salesman problem using a greedy algorithm (nearest-neighbor or sorted edges).
- M.D.2.6            Determine whether a graph represents a tree or not.
- M.D.2.7            Apply Kruskal's algorithm to determine the minimum cost spanning tree for weighted graphs and application problems.
- M.D.2.8            Determine the critical path of an order-requirement digraph and the earliest completion time for the job (digraph).
- M.D.2.9            Given information for a real-life project, create an order-requirement digraph and then determine the critical path and earliest completion time for the digraph.
- M.D.2.10           Describe real-life situations in which Hamiltonian circuits, spanning trees, and order-requirement digraphs are important.



**M.D.3**            **Students will schedule tasks given an order-requirement digraph using the list-processing algorithm or critical-path algorithm and then determine whether the amount of time required to complete the tasks is optimal. They will also schedule independent tasks using the list-processing algorithm or decreasing-time-list algorithm and determine the time required to complete the tasks. Students will determine the minimum number of bins of a given weight required to pack a given list of weights without exceeding the capacity of the bins. They will use vertex coloring to resolve conflicts in scheduling situations and determine the chromatic number for the graph.**

- M.D.3.1            Given the number of processors and order-requirement digraph, schedule tasks using the list-processing algorithm and determine the amount of time required to complete the tasks
- M.D.3.2            Determine if a created schedule is optimal and explain why or why not.
- M.D.3.3            Use the critical-path scheduling algorithm to schedule tasks and determine the amount of time required to complete the tasks.
- M.D.3.4            Schedule independent tasks using the list-processing algorithm and the decreasing-time-list algorithm and determine the amount of time required to complete the tasks.
- M.D.3.5            Determine the minimum number of bins (of a given weight capacity) required to pack a given list of weights without exceeding the capacity of the bins using the next fit, first fit, worst fit, next fit decreasing, first fit decreasing, and worst fit decreasing algorithms.
- M.D.3.6            Use vertex coloring to resolve conflicts in scheduling situations and identify the chromatic number for the graph.
- M.D.3.7            Describe real-life situations in which scheduling, bin packing, and conflict resolution would be important.

**The Digital Revolution**

**M.DM.5**            **Students will determine validity of numbers using the appropriate method and check digit. They will also interpret bar codes, Social Security Numbers, and ZIP codes. Given a system for coding from a specific state and an individual's information, students will determine the digits of an identification number.**

- M.DM.5.1            Determine if a number (ISBN, bank accounts/checks, credit cards, etc.) is valid using the appropriate method and the check digit.
- M.DM.5.2            Interpret bar codes to identify the UPC number or ZIP code + 4.
- M.DM.5.3            Determine personal data given Social Security Number or driver's license number.
- M.DM.5.4            Given a system for coding from a specific state and an individual's information, determine the digits of an identification number.

**M.DM.6 Students will use various methods to code and decode messages and binary codes.**

- M.DM.6.1 Use the diagram method to decode received messages.
- M.DM.6.2 Find the distance between pairs of words.
- M.DM.6.3 Encode and decode using parity-check sums.
- M.DM.6.4 Given an encoding formula, convert a sequence to binary code.
- M.DM.6.5 Encode and decode using Delta and Huffman coding schemes.
- M.DM.6.6 Using modular arithmetic, Caesar cipher, and Vigenere cipher, encrypt and decrypt messages.
- M.DM.6.7 Use the RSA public key encryption scheme to code and decode messages.

**Your Money and Resources**

**M.DM.7 Students will calculate simple and compound interest when investing money and the value of items that have depreciated. They will also explain the relationships between interest rate, inflation rate, and real rate of growth.**

- M.DM.7.1 Calculate simple and compound interest using arithmetic and geometric growth.
- M.DM.7.2 Determine the limit of compounding interest.
- M.DM.7.3 Calculate the value of an item that has depreciated.
- M.DM.7.4 Explain the relationship between interest rate, inflation rate, and rate of real growth.

**M.DM.8 Students will calculate simple and compound interest and payments on a loan. They will also explain the difference between APR and EAR for an add-on loan. In addition, students will calculate income based on annuities.**

- M.DM.8.1 Calculate simple and compound interest on a loan.
- M.DM.8.2 Calculate the monthly or weekly payment of a conventional loan.
- M.DM.8.3 Explain the difference between APR and EAR for an add-on loan.
- M.DM.8.4 Calculate income based on annuities.

**M.DM.9 Students will calculate growth and decay for populations and non-renewable resources. Given a graph of a reproduction curve, estimate the equilibrium population size and the maximum sustainable yield.**

- M.DM.9.1 Calculate biological growth using exponential growth formulas.
- M.DM.9.2 Determine the length of time a non-renewable resource will be available using exponential decay.
- M.DM.9.3 Given a graph of a reproduction curve, estimate the equilibrium population size and the maximum sustainable yield.

## Pre-Calculus Honors

**M.PCH.1 Students will identify basic graphs of a variety of functions, identify transformations from the equations, and apply transformations to the graphs. Students will compose functions and determine the inverse of a function. (F-IF.7, F-BF.1c, F-BF.3, F-BF.4)**

- M.PCH.1.1 Identify basic graphs of polynomial, rational, radical, logarithmic, and exponential functions.
- M.PCH.1.2 Analyze equations to determine transformations and apply the transformations to the graph.
- M.PCH.1.3 Apply transformations to a given function to create a new function.
- M.PCH.1.4 Apply arithmetic operations to functions and compose functions.
- M.PCH.1.5 Find the inverse of a function and verify that two functions are inverses.
- M.PCH.1.6 For invertible functions, find an inverse by restricting the domain.

**M.PCH.2 Students will identify and apply the basic trigonometric functions using the unit circle in both radian and degree measures. (F-TF.1, F-TF.2, F-TF.3, F-TF.4)**

- M.PCH.2.1 Convert between radian and degree measures of an angle.
- M.PCH.2.2 Use special right triangles to determine values of sine, cosine, and tangent.
- M.PCH.2.3 Use the unit circle to extend trigonometric functions to all angles including the use of reference angles.

**M.PCH.3 Students will graph trigonometric functions and use them to solve application problems. Also, students will solve equations using inverse functions. (F-TF.5, F-TF.6, F-TF.7)**

- M.PCH.3.1 Graph sine and cosine functions utilizing amplitude, period, and translations.
- M.PCH.3.2 Graph tangent, cotangent, secant, and cosecant functions.
- M.PCH.3.3 Use domain and range of trigonometric functions to construct inverse trigonometric functions.
- M.PCH.3.4 Use inverse functions to solve trigonometric equations, including the use of technology.
- M.PCH.3.5 Use trigonometric functions and graphs to solve application problems involving periodic behavior.

**M.PCH.4 Students will derive and apply trigonometric identities to solve equations. Students will apply addition, subtraction, double-angle, and half-angle formulas to solve problems. (F-TF.7, F-TF.8, F-TF.9)**

- M.PCH.4.1 Use trigonometric identities to simplify expressions.
- M.PCH.4.2 Derive and verify trigonometric identities.
- M.PCH.4.3 Utilize identities to solve multi-step trigonometric equations.
- M.PCH.4.4 Use addition and subtraction formulas to solve problems.
- M.PCH.4.5 Derive and apply double-angle and half-angle formulas to solve problems.

**M.PCH.5 Students will solve problems involving right triangles. Students will apply trigonometry to general triangles. (G-SRT.8, G-SRT.9, G-SRT.10, G-SRT.11)**

- M.PCH.5.1 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles including application problems.
- M.PCH.5.2 Derive the formula for area of a triangle and use it to solve problems.
- M.PCH.5.3 Prove and apply the Law of Sines and the Law of Cosines to find unknown measurements in non-right triangles.

**M.PCH.6 Students will use vectors to represent and model quantities. Students will perform operations on vectors. In addition, students will use vectors to solve problems with velocity and other quantities. (N-VM.1, N-VM.2, N-VM.3, N-VM.4, N-VM.5)**

- M.PCH.6.1 Identify vector quantities as having both magnitude and direction, use appropriate symbols, and represent vectors graphically.
- M.PCH.6.2 Perform operations (addition, subtraction, and scalar multiplication) on vectors.
- M.PCH.6.3 Represent the operation (addition, subtraction, and scalar multiplication) on vectors graphically.
- M.PCH.6.4 Compute magnitude and direction with the sum of vectors and with a scalar multiple of a vector.
- M.PCH.6.5 Solve problems involving velocity and other quantities that can be represented by vectors.
- M.PCH.6.6 Calculate the dot product of vectors and apply to a variety of problems.

**M.PCH.7 Students will represent complex numbers and their operations on the complex plane. (N-CN.3, N-CN.4, N-CN.5, N-CN. 6)**

- M.PCH.7.1 Convert between rectangular and trigonometric forms of complex numbers.
- M.PCH.7.2 Represent complex numbers on the complex plane in rectangular and trigonometric form.
- M.PCH.7.3 Perform operations (addition, subtraction, multiplication, division) on complex numbers.
- M.PCH.7.4 Find powers and roots of complex numbers and represent them in the complex plane.
- M.PCH.7.5 Plot points and polar equations on the polar coordinate system.

**M.PCH.8 Students will solve systems of equations and inequalities graphically and algebraically. Systems will include linear and nonlinear equations. (A-REI.7, A-REI.10, A-REI.11, A-REI.12)**

- M.PCH.8.1 Apply graphing, substitution, and elimination methods to solve systems of equations.
- M.PCH.8.2 Solve multivariable systems of equations.
- M.PCH.8.3 Solve systems of linear and nonlinear inequalities.
- M.PCH.8.4 Apply systems of inequalities to solve linear programming problems.

**M.PCH.9 Students will use matrices to represent data and systems of linear equations. Students will perform operations on matrices and apply properties of matrix operations. Students will use matrices to solve linear systems. (N-VM.6, N-VM.7, N-VM.8, N-VM.9, N-VM-10, A-REI.8, A-REI.9)**

- M.PCH.9.1 Represent data and systems of equations as matrices.
- M.PCH.9.2 Identify and explain basic properties of matrix operations.
- M.PCH.9.3 Add and subtract matrices, apply scalar multiplication, and multiply matrices.
- M.PCH.9.4 Evaluate determinants of square matrices.
- M.PCH.9.5 Find the inverse of a matrix and use it to solve a matrix equation.
- M.PCH.9.6 Use row reduction and Cramer's rule to solve matrix equations.

**M.PCH.10 Students will apply formulas and write expressions for sequences and series to solve problems. They will also apply the binomial theorem, permutations, and combinations to solve problems and determine probabilities of events. (F-IF.3, F-BF.1a, F-BF.2, A-SSE.4)**

- M.PCH.10.1 Identify and write rules for arithmetic and geometric sequences.
- M.PCH.10.2 Find a formula for the  $n$ th term of a sequence.
- M.PCH.10.3 Evaluate the sum of a series expressed in sigma notation.
- M.PCH.10.4 Find the sums of arithmetic and geometric series.
- M.PCH.10.5 Find the sum of infinite geometric series or explain why it can't be found.
- M.PCH.10.6 Use sequences to model situations.
- M.PCH.10.7 Apply sequences and series to mathematical induction.
- M.PCH.10.8 Apply the binomial theorem to expand a power of a binomial.
- M.PCH.10.9 Use permutations and combinations to solve counting problems.
- M.PCH.10.10 Determine probabilities of events.

**M.PCH.11 Students will identify conic sections from the equations and from the graphs. Given the equation of a conic section, students will produce a graph. In addition, students will derive the equation of a conic section from given information. Students will solve systems of equations of conics. (G-GPE.1, G-GPE.2, G-GPE.3, A-REI.7)**

- M.PCH.11.1 Identify the vertex, focus, and directrix of a parabola from an equation and apply them to graph the parabola.
- M.PCH.11.2 Use key information about a parabola to write an equation.
- M.PCH.11.3 Identify the center and radius of a circle from an equation and apply them to graph the circle.
- M.PCH.11.4 Use key information about a circle to write an equation.
- M.PCH.11.5 Identify the vertices, foci, and center of an ellipse from an equation and apply them to graph the ellipse.
- M.PCH.11.6 Use key information about an ellipse to write an equation.
- M.PCH.11.7 Identify the vertices, foci, asymptotes, and center of a hyperbola from an equation and apply them to graph the hyperbola.
- M.PCH.11.8 Use key information about a hyperbola to write an equation.
- M.PCH.11.9 Solve systems of equations of conics.

**M.PCH.12 Students will determine limits and use limits to find slopes of graphs.**

- M.PCH.12.1 Estimate limits and use properties and operations to evaluate limits.
- M.PCH.12.2 Find limits by direct substitution and by algebraic techniques.
- M.PCH.12.3 Approximate slopes of tangent lines, use the limit definition to calculate slope of a tangent line, and use the derivatives to find slopes of graphs.
- M.PCH.12.4 Evaluate limits at infinity.

## **AP Statistics**

The AP Statistics curriculum follows the topics outlined in the course description as set forth by the AP College Board.

## **AP Calculus**

The AP Calculus curriculum follows the topics outlined in the course description as set forth by the AP College Board.



## **AP Computer Science A**

The AP Computer Sciences curriculum follows the topics outlined in the course description as set forth by the AP College Board.