Math Department

Curriculum Guide

Chinquapin Preparatory School

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Course Descriptions and Standards

Mission Statement

To provide a high-quality college preparatory education to highly motivated students from Houston's under-resourced communities and schools.

Vision Statement

Through a rigorous curriculum and an emphasis on community service and earning what one receives, we aim to produce responsible, well-educated citizens who will become constructive leaders in their communities.

Overview

The Department of Mathematics is committed to fostering an inclusive environment where all students develop into confident problem-solvers. We provide a rigorous foundation in mathematical concepts, promote collaborative exploration, and integrate technology to enhance understanding. Our goal is to prepare students for college-level mathematics, empower them to solve complex problems in real-world scenarios, and equip them to communicate mathematical solutions effectively.

Key Pillars of the Mathematics Curriculum:

Collegiate Readiness

- Our rigorous curriculum provides a strong foundation in mathematical concepts, essential for success in college-level coursework.

Applications to Real World Scenarios

- Students will apply the solving and/or graphing techniques from class to conduct projects using real-world data.

Communicate Mathematical Ideas

- Students will use correct vocabulary and mathematical notation to present solutions and show work graphically, algebraically, and numerically,

Technology

- Students are confident using a variety of technological applications including graphing calculators, and online tools

End Goal:

Students will graduate as confident, collaborative problem-solvers with a deep understanding of mathematical principles, the ability to apply them to real-world challenges, the resilience to tackle complex problems, and the communication skills to effectively articulate their mathematical reasoning.

Our Faculty

This Curriculum Guide serves as a comprehensive framework outlining the course and classroom standards within the Chinquapin Preparatory School Leadership Department. While the document provides a structured foundation, it is important to note that our esteemed faculty members are specialists in their respective disciplines. We acknowledge that meaningful growth, confidence building, and lasting educational impact result from authentic challenge, academic risk-taking, and personal achievement.

Our dedicated teachers are granted the autonomy to shape the learning experience in their classrooms, as they possess the expertise to tailor activities to the unique needs and interests of their students. This creative freedom allows for the cultivation of dynamic, engaging, and innovative educational experiences that extend beyond the constraints of a rigid curriculum.

We believe in fostering an environment where our educators are empowered to inspire and challenge students through diverse teaching methods, real-world applications, and experiential learning. This approach not only enriches the academic experience but also instills a sense of curiosity, critical thinking, and lifelong learning.

As we celebrate the diversity of thought and teaching styles within our faculty, we affirm our commitment to maintaining high standards of excellence in education. We trust that our teachers, in their pursuit of educational excellence, will continue to guide our students toward achieving their full potential, fostering a love for learning that extends far beyond the classroom.

Chinquapin Preparatory School remains dedicated to the holistic development of each student, and we appreciate the unique contributions our faculty brings to this collective journey. This disclaimer serves as a testament to our belief in the power of a well-rounded education that goes beyond the confines of a standardized curriculum.

Program of Study

Our college preparatory curriculum is predicated on the belief that certain abilities are of major importance: to reason carefully and logically, to think creatively and sensitively, and to communicate precisely and articulately. The program seeks to encourage curiosity, openness, and the joy of discovery that leads to a lifelong enthusiasm for learning.

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- Pre-Algebra A

7th Grade
- Pre-Algebra B

8th Grade
- Algebra 1

9th Grade
- Geometry

10th Grade
- Algebra 2

11th Grade
- Precalculus

12th Grade
- AP Calculus
- AP Statistics

6th Grade – Pre-Algebra A

Course Description: Students start to prepare for Algebra by solidifying and expanding on understanding of fundamentals. Sixth-grade math builds upon elementary math skills and prepares students for middle school math. The focus is on developing a strong conceptual understanding of numbers and operations, along with problem-solving abilities. Students will explore various areas of mathematics, including rational numbers, algebra, geometry, statistics, and probability.

Key Topics Covered:

Number Sense and Operations with Rational Numbers:

- Understanding and applying negative numbers (integers)
- Adding, subtracting, multiplying, and dividing fractions and decimals
- Converting between fractions, decimals, and percents
- Understanding ratios and proportions

Algebraic Thinking:

- Representing problems with variables and expressions
- Evaluating expressions and simplifying equations

Geometry:

- Classifying and measuring angles, lines, and shapes
- Calculating area and volume of basic geometric figures
- Understanding the concepts of symmetry and congruence

Statistics, Data Analysis, and Probability:

- Collecting, organizing, and interpreting data
- Creating and analyzing graphs and charts
- Understanding basic concepts of probability

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Learning Standards:

- **Rational Numbers:**
  - **Classification:** classify whole numbers, integers, and rational numbers using a visual representation such as a Venn diagram to describe relationships between sets of numbers (TEKS 6.2a)
  - **Identification:** identify a number, its opposite, and its absolute value (TEKS 6.2B)
  - **Comparison:** locate, compare, and order integers and rational numbers using a number line (TEKS 6.2C) and order a set of rational numbers arising from mathematical and real-world contexts (TEKS 6.2D)

- **Number Sense:**
  - **Reciprocal Multiplication:** recognize that dividing by a rational number and multiplying by its reciprocal result in equivalent values (TEKS 6.3A)
  - **Fractional Multiplication:** determine, with and without computation, whether a quantity is increased or decreased when multiplied by a fraction, including values greater than or less than one (TEKS 6.3B)
  - **Concrete Integer Representation:** represent integer operations with concrete models and connect the actions with the models to standardized algorithms (TEKS 6.3C)

- **Operations:**
  - **Integers:** add, subtract, multiply, and divide integers fluently (TEKS 6.3D)
  - **Rational Numbers:** multiply and divide positive rational numbers fluently (TEKS 6.3E)
  - **Fraction Notation:** extend representations for division to include fraction notation such as a/b represents the same number as a ÷ b where b ≠ 0. (TEKS 6.2E)

- **Proportionality:**
  - **Additive and Multiplicative Relationships:** compare two rules verbally, numerically, graphically, and symbolically in the form of $y = ax$ or $y = x + a$ in order to differentiate between additive and multiplicative relationships (TEKS 6.4A)

- ○ **Representation:** represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions (TEKS 6.5A)
- ○ **Measurement Conversion:** convert units within a measurement system, including the use of proportions and unit rates (TEKS 6.4H)

- **Ratios and Rates:**
  - ○ **Multiplicative Comparisons:** give examples of ratios as multiplicative comparisons of two quantities describing the same attribute (TEKS 6.4C)
  - ○ **Comparison by Division:** give examples of rates as the comparison by division of two quantities having different attributes, including rates as quotients (TEKS 6.4D)

- **Percents:**
  - ○ **Benchmark Percents:** represent benchmark fractions and percents such as 1%, 10%, 25%, 33 1/3%, and multiples of these values using 10 by 10 grids, strip diagrams, number lines, and numbers (TEKS 6.4 F)
  - ○ **Equivalent Forms:** generate equivalent forms of fractions, decimals, and percents using real-world problems, including problems that involve money (TEKS 6.4G)

- **Expressions:**
  - ○ **Generate Equivalent:** generate equivalent numerical expressions using order of operations, including whole number exponents, and prime factorization (TEKS 6.7A) and generate equivalent expressions using the properties of operations: inverse, identity, commutative, associative, and distributive properties. (TEKS 6.7 D)
  - ○ **Determine if Equivalent:** determine if two expressions are equivalent using concrete models, pictorial models, and algebraic representations (TEKS 6.7 C)
  - ○ **Distinguish between Expressions and Equations:** distinguish between expressions and equations verbally, numerically, and algebraically (TEKS 6.7 B)

- **Equations and Inequalities:**
  - ○ **Represent Constraints and Conditions:** write one-variable, one-step equations and inequalities to represent constraints or conditions within problems (TEKS 6.9 A)

- ○ **Solutions on Number Lines:** represent solutions for one-variable, one-step equations and inequalities on number lines (TEKS 6.9 B)

- ○ **Corresponding Real World Problems:** write corresponding real-world problems given one-variable, one-step equations or inequalities (TEKS 6.9 C)

- ○ **Model and Solve:** model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts (TEKS 6.10 A)

- ○ **Determine when True:** determine if the given value(s) make(s) one-variable, one-step equations or inequalities true. (TEKS 6.10 B)

- ● **Independent and Dependent:**

  - ○ **Identify:** identify independent and dependent quantities from tables and graphs (TEKS 6.6 A)

  - ○ **Write Equations:** write an equation that represents the relationship between independent and dependent quantities from a table (TEKS 6.6 B)

  - ○ **Represent Situations:** represent a given situation using verbal descriptions, tables, graphs, and equations in the form $y = kx$ or $y = x + b$ (TEKS 6.6 C)

- ● **Geometry:**

  - ○ **Properties of Triangles:** extend previous knowledge of triangles and their properties to include the sum of angles of a triangle, the relationship between the lengths of sides and measures of angles in a triangle, and determining when three lengths form a triangle (TEKS 6.8 A)

  - ○ **Model Area Formulas:** model area formulas for parallelograms, trapezoids, and triangles by decomposing and rearranging parts of these shapes (TEKS 6.8 B)

  - ○ **Write Area Equations:** write equations that represent problems related to the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers (TEKS 6.8 C)

- ○ **Determine Solutions:** determine solutions for problems involving the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers. (TEKS 6.8 D)

- ● **Stats:**
  - ○ **Graphic Representation:** represent numeric data graphically, including dot plots, stem-and-leaf plots, histograms, and box plots (TEKS 6.12 A)
  - ○ **Describe Data Distribution:** use the graphical representation of numeric data to describe the center, spread, and shape of the data distribution (TEKS 6.12 B)
  - ○ **Summarize Numerical Data:** summarize numeric data with numerical summaries, including the mean and median (measures of center) and the range and interquartile range (IQR) (measures of spread), and use these summaries to describe the center, spread, and shape of the data distribution (TEKS 6.12 C)
  - ○ **Summarize Categorical Data:** summarize categorical data with numerical and graphical summaries, including the mode, the percent of values in each category (relative frequency table), and the percent bar graph, and use these summaries to describe the data distribution. (TEKS 6.12 D)
  - ○ **Interpret Numerical Data:** interpret numeric data summarized in dot plots, stem-and-leaf plots, histograms, and box plots (TEKS 6.13 A)
  - ○ **Identify Statistical Situations:** distinguish between situations that yield data with and without variability (TEKS 6.13 B)

- ● **Personal Finance:**
  - ○ **Demonstrate Understanding of Credit Reports:** describe the information in a credit report and how long it is retained (TEKS 6.14 E), describe the value of credit reports to borrowers and to lenders (TEKS 6.14 F)
  - ○ **Explain Methods of Paying for College:** explain various methods to pay for college, including through savings, grants, scholarships, student loans, and work-study (TEKS 6.14 G)

- ○ **Compare Salaries of Varying Occupations:** compare the annual salary of several occupations requiring various levels of post-secondary education or vocational training and calculate the effects of the different annual salaries on lifetime income. (TEKS 6.14 H)

  - ○ **Explore Features of Local Financial Institutions:** compare the features and costs of a checking account and a debit card offered by different local financial institutions (TEKS 6.14 A)

  - ○ **Distinguish between Debit Cards and Credit Cards** (TEKS 6.14 B)

  - ○ **Balance a Check Register:** balance a check register that includes deposits, withdrawals, and transfers (TEKS 6.14 C)

Recommended Course Activities:

- ● **Hands-on activities and manipulatives:** Using physical objects to represent mathematical concepts can help students develop a deeper understanding.

- ● **Problem-solving tasks:** Challenge students to apply their knowledge to solve real-world problems.

- ● **Collaborative learning:** Encourage students to work together to solve problems and explain their thinking.

- ● **Incorporation of technology:** Use educational apps, simulations, and graphing calculators to enhance learning.

- ● **Games and activities:** Make learning math fun with engaging games that reinforce key concepts.

Suggested Methods for Evaluating Student Outcomes:

- ● **Formative Assessments:** Regularly assess student progress through quizzes, homework assignments, and class participation.

- ● **Summative Assessments:** Use unit tests, projects, and presentations to evaluate students'

overall understanding of a particular topic.

- **Self-assessments:** Allow students to reflect on their learning and identify areas where they need improvement.
- **Observations:** Pay attention to student participation in class discussions and their ability to apply concepts to solve problems.

By incorporating these elements, you can create a well-rounded sixth-grade math program that fosters a love of learning and prepares students for success in future math courses.

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7th Grade - Pre-Algebra B

Course Description: Pre-algebra is a bridge course between arithmetic and formal algebra. It introduces students to the fundamental concepts and skills needed for success in algebra. The focus is on developing a strong foundation in working with expressions, equations, inequalities, and applying mathematical concepts to real-world problems.

Key Topics Covered:

- **Number Systems and Operations:**
  - Reviewing and solidifying operations with integers, fractions, and decimals.
  - Understanding and applying rational numbers (including negative numbers).
  - Calculating with exponents and roots.
  - Understanding percentages and their applications.
- **Expressions and Equations:**
  - Simplifying algebraic expressions using the order of operations and combining like terms.
  - Representing real-world situations with variables and expressions.
  - Solving one-step, two-step, and multi-step linear equations with rational number coefficients.
  - Understanding and solving inequalities.
- **Ratios, Proportions, and Percent:**
  - Writing and solving proportions to solve real-world problems.
  - Understanding and applying percents in various contexts (fractions, decimals, markup/markdown).
  - Recognizing proportional relationships in geometric figures.
- **Introduction to Functions and Relations:**
  - Understanding the concept of a function as a relationship between inputs and outputs.
  - Recognizing different ways to represent functions (tables, graphs, equations).
- **Geometry Concepts:**
  - Reviewing and classifying geometric shapes (lines, angles, triangles, quadrilaterals, circles).
  - Calculating the area and perimeter of basic shapes.
  - Applying the Pythagorean Theorem.
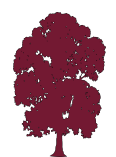
- **Introduction to Statistics and Probability:**
  - Collecting, organizing, and analyzing data using various methods (frequency tables, histograms, scatter plots).
  - Calculating measures of central tendency (mean, median, mode).
  - Understanding basic concepts of probability and chance.

Learning Standards:

- **Mathematical Process Standards (7.1):**
  - Apply mathematical processes to acquire and demonstrate understanding throughout all content areas.
- **Number and Operations (7.2):**
  - Perform operations on rational numbers (including fractions, decimals) while applying order of operations and simplifying expressions.
  - Understand and use absolute value of rational numbers.
  - Solve problems involving proportions and percents.
- **Expressions, Equations, and Relationships (7.10 & 7.11):**
  - Use variables to represent unknowns and write expressions to model real-world situations.
  - Apply mathematical properties (commutative, associative, distributive) to simplify expressions.
  - Reason about and solve one-variable equations and inequalities representing proportional relationships.
- **Measurement and Data (7.12):**
  - Use statistical measures (mean, median, mode, and range) to analyze data sets.
  - Represent data using various graphical representations (histograms, scatterplots) and interpret the results.
- **Personal Financial Literacy (7.13):**
  - Apply mathematical processes to solve problems involving personal finance concepts (budgets, simple interest).
- **Note:** While TEKS includes Geometry standards (7.9) in Grade 7, they primarily focus on

practical applications like volume and area of basic shapes, not necessarily formal proofs or complex geometric relationships typically found in pre-algebra courses.

- **Additional Resources:**
  - Texas Education Agency - Mathematics TEKS: https://tea.texas.gov/academics/curriculum-standards/teks-review/texas-essential-knowledge-and-skills

Recommended Course Activities:

- **Variable Activities:** Use manipulatives or real-life objects to represent variables and model how they change in expressions and equations.
- **Real-World Applications:** Present problems from various contexts (science, sports, finance) that require students to translate written problems into mathematical expressions and equations.
- **Technology Integration:** Utilize educational software, graphing calculators, and online simulations to visualize concepts and practice problem-solving.
- **Collaborative Learning:** Encourage group work on projects and activities to promote communication, critical thinking, and peer learning.
- **Games and Puzzles:** Make learning fun with engaging math games and puzzles that reinforce key concepts.

Suggested Methods for Evaluating Student Outcomes:

- **Formative Assessments:** Regularly check student understanding through quizzes, exit tickets, homework checks, and class participation.
- **Summative Assessments:** Use unit tests, projects, presentations, and performance tasks to evaluate students' mastery of specific topics.
- **Self-reflection:** Encourage students to reflect on their learning progress and identify areas for improvement.
- **Portfolios:** Create student portfolios that showcase their work, improvements, and self-assessments throughout the course.

8th Grade – Algebra 1

Course Description: Eighth-grade math builds upon the foundation set in pre-algebra and ventures deeper into algebraic concepts. The focus is on solidifying students' understanding of expressions, equations, and inequalities while introducing them to functions, proportional reasoning, and geometric applications of algebra. This course prepares students for the more advanced math they will encounter in high school.

Specifically, the topics covered in this Algebra 1 course include adding, subtracting, multiplying and dividing with powers and roots, scientific notation, solving linear equations and inequalities in one variable, rate, work and mixture word problems, simplifying and factoring polynomials, rational expressions, adding, subtracting, solving quadratic equations by factoring, completing the square, and using the quadratic formula, graphing linear equations, slope, solving systems of two linear equations in two variables graphically and algebraically, solving inequalities in one variable, and solving absolute value equations.

Key Topics Covered:

- **Chapter 1-2: Algebra Basics and Working with Integers (review from 7th grade)**
- **Chapter 3: Order of Operations**
- **Chapter 4: Combining Like Terms**
- **Chapter 5: Distributing and Freeing x from a Fraction**
- **Chapter 6: x's on both sides of the Equation**
- **Chapter 7: Rational Expressions**
- **Chapter 8: Solving Rational Equations**
- **Chapter 9: Powers and Exponents**
- **Chapter 10: Radical Expressions**
- **Chapter 11: Quadratic Equations**
- **Chapter 12: Functions and Equations**
- **Chapter 13: Operations on Polynomials and Rational Expressions**
- **Chapter 14: Graphing Linear Functions**
- **Chapter 15: Rate of Change and Slope**
- **Chapter 16: Systems of Equations**
- **Chapter 17: Inequalities and Absolute Value Equations**

Learning Standards:

- **Seeing Structure in Expressions**
  - Interpret the structure of expressions
  - Write expressions in equivalent forms to solve problems

- **Arithmetic with Polynomials and Rational Functions**
  - Perform arithmetic operations on polynomials
  - Understand the relationship between zeros and factors of polynomials
  - Use polynomial identities to solve problems
  - Rewrite rational functions

- **Creating Equations**
  - Create equations that describe numbers or relationships

- **Reasoning with Equations and Inequalities**
  - Understand solving equations as a process of reasoning and explain the reasoning
  - Solve equations and inequalities in one variable
  - Solve systems of equations
  - Represent and solve equations and inequalities graphically

- **Mathematical Practices**
  - Make sense of problems and persevere in solving them.
  - Reason abstractly and quantitatively.
  - Construct viable arguments and critique the reasoning of others.
  - Model with mathematics.
  - Use appropriate tools strategically.
  - Attend to precision.
  - Look for and make use of structure.
  - Look for and express regularity in repeated reasoning.

- **Mathematical Process Standards**
  - Students use mathematical processes to acquire and demonstrate mathematical understanding

- **Linear Functions, Equations and Inequalities**
  - Students apply the mathematical process standards when using properties of linear functions to write and represent in multiple ways, with and without technology, linear equations, inequalities, and systems of equations.
  - Students apply the mathematical process standards when using graphs of linear functions, key features, and related transformations to represent in multiple ways and solve, with and without technology, equations, inequalities, and systems of equations.
  - The student applies the mathematical process standards to solve, with and without technology, linear equations and evaluate the reasonableness of their solutions

Recommended Course Activities:

- **Problem-solving:** Regular practice with word problems that require applying various concepts to reach solutions.
- **Discussions and debates:** Encouraging students to explain their reasoning and learn from different approaches to solving problems.
- **Real-World Function Applications:** Present problems from science, finance, or social studies that require students to analyze and interpret functions.
- **Technology Integration:** Utilize online graphing capabilities to visualize functions, and explore concepts of slope
- **Collaborative Learning:** Encourage group discussions and activities to promote problem-solving strategies, communication, and peer learning.

Suggested Methods for Evaluating Student Outcomes:

- **Homework assignments and quizzes:** Regularly assign problems that assess students' ability to apply Algebra techniques and justify their reasoning

- **Warm Ups:** Evaluate students' retention from the previous day by starting class with review problems

- **Error Analysis:** Present students with incorrectly solved equations and have them find the mistakes and correct them

- **Summative Assessments:** Utilize comprehensive exams to assess students' understanding of algebra concepts and their ability to apply them to solve problems correctly.

9th Grade – Geometry

Course Description: Get ready to unlock the secrets of shapes and space in 9th grade geometry! This course is your passport to a world where precise definitions meet creative problem-solving. Through a blend of hands-on activities, clear explanations, and interactive projects, you'll embark on a geometric adventure that will build your critical thinking skills and equip you with powerful tools. We'll explore the fundamental building blocks of geometry, like points, lines, and angles, and delve into the world of measurement, calculating perimeters and areas to understand the true "size" of geometric shapes. But geometry is more than just measurement – it's about using logic and reasoning to solve problems. We'll develop your deductive reasoning skills, empowering you to prove theorems and connect seemingly disparate geometric concepts. Visualization will be a key part of your journey, as you learn to see shapes not just on a page but also in the real world. Whether you're designing a building, navigating with a map, or simply appreciating the beauty of a snowflake's intricate form, geometry will provide you with a new lens to understand the world around you.

Key Topics Covered:

- **Foundations:** Points, lines, planes, angles (acute, obtuse, right, straight), measurement (perimeter, area)
- **Reasoning and Proof:** Inductive and deductive reasoning, postulates, theorems, and geometric constructions
- **Congruence and Similarity:** Conditions for congruent triangles, similarity transformations, applying ratios in similar figures
- **Circles:** Properties of circles, arc measures, inscribed angles
- **Polygons:** Classifying polygons, interior and exterior angles
- **Right Triangles:** The Pythagorean Theorem and its applications
- **Volume and Surface Area:** Formulas for volumes and surface areas of common 3D shapes (prisms, pyramids, cylinders, cones, spheres)
- **Coordinate Geometry:** The relationship between geometric figures and the coordinate plane

Learning Standards:

- **Bridging Algebra and Geometry with Coordinates: This concept focuses on using the language of algebra (coordinate systems) to understand and verify geometric ideas.:**
    - Coordinate Techniques: Utilize distance, slope, and midpoint formulas within 1D & 2D coordinate systems to find segment ratios (including midpoint) and verify geometric relationships (congruence, parallelism, perpendicularity).
    - Students will be able to determine the equation of a line with a specific relationship (parallel or perpendicular) to a given line, passing through a specific point.

- **Students will leverage their problem-solving skills to understand and differentiate between rigid transformations (translations, reflections, and rotations) and non-rigid transformations (dilations that maintain similarity, and reductions or enlargements that do not).**
    - Transformations in the Coordinate Plane: Students will describe and perform various transformations (rigid and non-rigid) of figures using coordinate notation.
    - Image Analysis and Symmetry: Students will be able to determine the transformed image of a figure under different compositions (rigid, non-rigid, or mixed) and identify reflectional and rotational symmetry within plane figures.

- **Students will utilize problem-solving skills and deductive reasoning to analyze and understand geometric relationships.**
    - Formalizing Geometric Knowledge: Students will differentiate key geometric concepts like undefined terms, definitions, postulates, and theorems. They will also learn to identify and evaluate the converse, inverse, and contrapositive of conditional statements.
    - Logical Reasoning and Geometric Discovery: Students will develop their deductive reasoning skills by using counterexamples to disprove conjectures and by comparing geometric relationships in different geometries (e.g., Euclidean vs. spherical).

- **Students will utilize geometric constructions (tools like compass and straightedge) to explore and validate their conjectures about geometric figures.**
  - Exploring and Constructing Geometry: Students will use various tools (not just compass and straightedge) to discover patterns and make conjectures about geometric relationships (angles, triangles, quadrilaterals, polygons, circles). They will then solidify these conjectures by constructing congruent segments, angles, and key geometric elements.
  - Verifying with Triangles: Students will explore and apply the Triangle Inequality Theorem using constructions and problem-solving to solidify their understanding of geometric relationships within triangles.
- **Students will utilize deductive reasoning and process skills to prove and apply geometric theorems. They will learn various methods (coordinate, transformational, axiomatic) and formats (two-column, paragraph, flowchart) to effectively communicate their proofs.**
  - Theorems and Triangle Congruence: Students will prove and apply theorems related to angles (intersections, parallel lines) and perpendicular bisectors. They will also master proving triangle congruence using various criteria (SSS, SAS, etc.).
  - Relationships in Polygons and Problem-Solving: Students will delve into theorems about triangles (Pythagorean Theorem, angle sums) and quadrilaterals (parallelograms, rectangles, squares). They will apply these relationships to solve geometric problems.
- **Students will leverage their process skills to apply concepts of similarity in solving geometric problems.**
  - Understanding Similarity: Students will explore the concept of similarity using dilations to identify similar figures, their corresponding congruent angles, and the ratios between their corresponding sides.
  - Problem-Solving with Similar Triangles: Students will apply the Angle-Angle similarity criterion to verify similar triangles and leverage the proportional relationships between their sides to solve geometric problems.

- **Students will utilize their problem-solving skills to understand and apply key relationships within right triangles.**
    - Right Triangle Trigonometry: Students will explore trigonometric ratios (sine, cosine, tangent) to determine side lengths and angle measures in right triangles, applying these concepts to solve problems.
    - Special Right Triangles and the Pythagorean Theorem: Students will delve into the properties of special right triangles (30-60-90 and 45-45-90) and the Pythagorean Theorem, including Pythagorean triples, to solve geometric problems.
- **Students will develop their process skills to identify the characteristics (like number of sides, angles) and dimensional changes (area, volume) in both two-dimensional (flat) and three-dimensional (solid) geometric figures.**
    - 3D Shapes and Cross-Sections: Students will analyze three-dimensional figures (prisms, pyramids, cylinders, cones, spheres) by identifying their two-dimensional cross-sections and recognizing how rotations of 2D shapes can generate 3D objects.
    - Dimensional Changes and Measurement: Students will explore how changes in linear dimensions of a shape affect its measurements (perimeter, area, surface area, volume). They will distinguish between proportional and non-proportional changes in these measurements.
- **Students will utilize their process skills to apply appropriate formulas in determining measurements (perimeter, area, surface area, volume) of two-dimensional and three-dimensional geometric figures.**
    - Area and Surface Area Formulas: Students will apply formulas to solve problems involving the area of regular polygons and composite two-dimensional figures (including triangles, parallelograms, etc.). They will also extend this knowledge to calculate the surface area of various three-dimensional figures (prisms, pyramids, cones, etc.) using appropriate units.

- ○ Volume Formulas and Problem-Solving: Students will utilize formulas to determine the volume of various three-dimensional figures (prisms, pyramids, cones, etc.) and composite figures, applying these concepts to solve geometric problems with proper units of measurement.
- **Students will develop a strong understanding of geometric relationships within circles. This includes applying theorems and equations to solve problems involving circles (e.g., finding arc lengths, central and inscribed angles).**
  - ○ Circle Relationships and Problem-Solving: Students will apply theorems about circles (involving radii, chords, tangents, etc.) and solve problems related to arc lengths, central and inscribed angles, and proportional relationships between arc measures and circle circumferences.
  - ○ Sector Area and Circle Equations: Students will explore the proportional relationship between the area of a sector and the whole circle, and delve into writing equations for circles with different center points and radii.
- **Students will develop their problem-solving skills to understand how probability is used in real-world situations. They will explore concepts like independence and dependence of events to analyze and make predictions about the likelihood of various outcomes.**
  - ○ Probability Techniques and Applications: Students will learn strategies using permutations and combinations, and probability based on area, to solve real-world problems.
  - ○ Analyzing Event Dependence and Probability: Students will distinguish between independent and dependent events, and apply concepts of conditional probability to calculate the likelihood of combined events in various contexts.

Recommended Course Activities:
- Hands-on activities with manipulatives (models, geometric shapes) to visualize concepts
- Interactive proofs using dynamic geometry software

- Real-world problem-solving applications of geometric principles (e.g., architecture, engineering, design)
- Group projects on geometric topics and presentations
- Collaborative learning exercises to develop communication and teamwork skills

Suggested Methods for Evaluating Student Outcomes:

- **Formative Assessments:** Class participation, quizzes, homework assignments, exit tickets
- **Summative Assessments:** Unit exams, projects, presentations, performance-based tasks requiring geometric problem-solving
- **Self-Assessment:** Reflective journals, peer evaluations

This course will equip you with a solid foundation in geometry, preparing you for more advanced math courses and applications in various fields.

10th Grade – Algebra 2

Course Description: Building on Algebra I, Algebra II dives deeper into functions, exploring quadratic functions, exponential functions, and systems of equations. Students will study logarithmic, square root, cubic, cube root, absolute value, rational functions, and their related equations. Students will connect functions to their inverses and associated equations and solutions in both mathematical and real-world situations. In addition, students will extend their knowledge of data analysis and numeric and algebraic methods.

Key Topics Covered:

- **Functions:** Linear, quadratic, polynomial, rational, radical, exponential, and logarithmic functions. Students will explore properties, graphing techniques, transformations, and applications of each function type.

- **Equations and Inequalities:** Solving linear and quadratic equations, systems of equations (including matrices), and working with inequalities in various forms.

- **Polynomials and Factoring:** Operations on polynomials, factoring techniques (including factoring by grouping and sum-product patterns), and applications of factoring.

- **Complex Numbers:** Introduction to imaginary unit (i), basic operations with complex numbers, and applications in solving quadratic equations.

- **Sequences and Series:** Arithmetic and geometric sequences, their formulas, and applications in modeling growth and decay patterns.

- **Probability and Statistics:** Basic concepts of probability, statistics vocabulary (mean, median, mode), and applications in data analysis.

Learning Standards:

- **Through problem-solving and communication, students develop and showcase their mathematical knowledge:**
  - In this course, you'll develop problem-solving skills by applying math to real-world situations and using appropriate tools and communication methods to solve problems and explain your reasoning.

- **Using mathematical tools, students will identify the special qualities of functions and the connection between a function and its inverse.**
  - This course will focus on graphing various functions (radical, rational, exponential, logarithmic, absolute value) and analyze their properties (domain, intercepts, etc.). We will then explore inverses of functions, how to find them, and the relationship between a function and its inverse, including limitations due to domain and range restrictions.
- **Using mathematical tools, students will create systems of equations and inequalities, solve them using multiple methods, and analyze whether the solutions are reasonable.**
  - In this course, we will delve into systems of linear and quadratic equations, alongside linear inequalities. We'll explore formulation techniques for various system types, tackle solution strategies using multiple methods, and develop the skill to evaluate the reasonableness of solutions.
- **Students will use quadratic functions and equations as tools to model situations, solve problems, and make predictions in various contexts.**
  - In this unit, we'll explore the power of quadratic functions and square root equations. We'll learn to write them in various forms, understand how to transform them, and solve them to model real-world problems and make predictions.
  - We'll also delve into how these functions are affected by transformations and how to identify extraneous solutions in square root equations.
- **Students will explore how exponential and logarithmic functions can be used to model and solve real-world problems.**
  - We'll explore how to model real-world phenomena using these functions, analyze the impact of transformations on their graphs, and develop techniques to solve exponential and logarithmic equations.
  - Additionally, we will examine the validity of solutions within the context of the modeled scenario.

- **Get ready to explore a wider range of functions! This course will equip you with cubic, cube root, absolute value, and rational functions to model real-world scenarios, solve problems, and even make predictions based on the models.**
  - We will investigate the visual impact of transformations on these functions through comprehensive graph analysis. You will hone your problem-solving abilities by tackling equations and inequalities involving these functions, emphasizing practical applications in real-world scenarios.
  - Finally, we will delve into the realm of rational functions, equipping you with the skills to model situations, solve equations, and analyze their key characteristics.
- **Students will learn to simplify expressions and solve equations using various mathematical operations.**
  - Operations & Expressions: Master addition, subtraction, multiplication, and division of polynomials, complex numbers, and rational expressions.
  - Factoring & Equations: Learn to factor polynomials (including linear, quadratic, sum/difference of cubes, and grouping) and solve equations involving rational exponents.
- **Students will use data analysis skills to find patterns, choose fitting models, express those models as functions, and use them to make predictions.**
  - Data Analysis & Modeling: Analyze data to identify trends and select fitting models (linear, quadratic, exponential) using technology. Write the corresponding functions to represent the data.
  - Prediction & Decision Making: Leverage your models to make predictions and informed decisions based on the data and analysis.

Recommended Course Activities:
- **Problem-solving:** Regular practice with word problems that require applying various concepts to reach solutions.
- **Group projects:** Collaborative projects where students can explain concepts to each other and reinforce their understanding.

- **Technology integration:** Utilizing graphing calculators or online tools to visualize functions and explore mathematical relationships.
- **Real-world applications:** Connecting algebraic concepts to real-life scenarios through modeling activities in science, economics, or other disciplines.
- **Discussions and debates:** Encouraging students to explain their reasoning and learn from different approaches to solving problems.

Suggested Methods for Evaluating Student Outcomes:

- **Formative Assessments:** Regular quizzes, homework checks, and exit tickets to monitor student progress and identify areas needing improvement.
- **Summative Assessments:** Midterm exams, unit tests, and projects to evaluate students' overall understanding of key concepts and their ability to apply them in various contexts.
- **Performance-based assessments:** Open-ended problems, presentations, or projects that demonstrate students' problem-solving skills and critical thinking abilities.
- **Self-assessments:** Encouraging students to reflect on their learning process, identify their strengths and weaknesses, and set goals for improvement.

11th Grade – AP Precalculus/Precalculus

Both classes cover the same basic content, but the AP section moves at a quicker pace and incorporates more specific review for AP style questions.

Course Description:

We will follow the course description set out by the College Board, which is an exploration of functions that is designed to better prepare students for college-level calculus and provide grounding for other mathematics and science courses. In this course, students study a broad spectrum of function types that are foundational for careers in mathematics, physics, biology, health science, business, social science, and data science.

Throughout this course, students develop and hone symbolic manipulation skills, including solving equations and manipulating expressions, for the many function types throughout the course. Students also learn that functions and their compositions, inverses, and transformations are understood through graphical, numerical, analytical, and verbal representations, which reveal different attributes of the functions and are useful for solving problems in mathematical and applied contexts. In turn, the skills learned in this course are widely applicable to situations that involve quantitative reasoning.

Key Topics Covered:

- **Unit 1: Polynomial and Rational Functions**
    - Rates of Change in algebraic, graphical, and numerical functions
    - Zeros and complex zeros of polynomial functions
    - End behavior of polynomial functions
    - Zeros and DNE x-values for rational functions
    - End behavior for rational functions
    - Vertical and horizontal asymptotes
    - Transformations of functions
    - Modeling with polynomial functions
- **Unit 2: Exponential and Logarithmic Functions**
    - Arithmetic sequences and the connection to linear functions
    - Geometric sequences and the connection to exponential functions
    - Exponential function manipulation
    - Modeling with exponential functions
    - Composition of functions
    - Inverse Functions
    - Logarithmic functions
    - Logarithmic function manipulation
    - Modeling with logarithmic functions
- **Unit 3: Trigonometry and Polar coordinates**
    - Periodic phenomena
    - Unit circle
    - Sin and cosine unit circle values
    - Sin and cosine graphs
    - Sinusoidal functions and transformations of sin and cosine
    - Modeling with sinusoidal functions
    - The tangent function
    - Inverse trig functions

- - ○ Secant, cosecant and cotangent
    - ○ Trig equation and inequalities
    - ○ Polar Coordinates
- **Unit 4: Parametric Functions, Vectors and Matrices (optional, not on AP exam)**
    - ○ Parametric functions
    - ○ Conic sections
    - ○ Vectors
    - ○ Vector-valued functions
    - ○ Matrices
    - ○ The inverse and determinant of a matrix

Learning Standards:

- **Procedural and Symbolic Fluency**

    - ○ Solve equations and inequalities represented analytically, with and without technology

    - ○ Express functions, equations, or expressions in analytically equivalent forms that are useful in a given mathematical or applied context.

    - ○ Construct new functions, using transformations, compositions, inverses, or regressions, that may be useful in modeling contexts, criteria, or data, with and without technology.

- **Multiple Representations**

    - ○ Identify information from graphical, numerical, analytical, and verbal representations to answer a question or construct a model, with and without technology.

    - ○ Construct equivalent graphical, numerical, analytical, and verbal representations of functions that are useful in a given mathematical or applied context, with and without technology

- **Communication and Reasoning**

    - ○ Describe the characteristics of a function with varying levels of precision, depending on the function representation and available mathematical tools.

    - ○ Apply numerical results in a given mathematical or applied context.

    - ○ Support conclusions or choices with a logical rationale or appropriate data.

Recommended Course Activities:

- **Problem-solving:** Regular practice with word problems that require applying various concepts to reach solutions.
- **Group projects:** Collaborative projects where students can explain concepts to each other and reinforce their understanding.
- **Technology integration:** Utilizing graphing calculators or online tools to visualize functions and explore mathematical relationships.
- **Real-world applications:** Connecting calculus concepts to real-life scenarios through modeling activities in science, economics, or other disciplines.
- **Discussions and debates:** Encouraging students to explain their reasoning and learn from different approaches to solving problems.
- **Memorization competitions:** Building some friendly motivation in practice the important facts to memorize, especially the unit circle and trig identities.

Suggested Methods for Evaluating Student Outcomes:

- Homework assignments and quizzes: Regularly assign problems that assess students' ability to apply precalculus techniques and justify their reasoning
- Projects: Evaluate students' projects based on their use of functions and their ability to connect precalculus to the real world, especially with exponential and logarithmic functions
- Practice AP exams: Take partial and full length practice exams to gain exposure to the AP format of questions and identify gaps in knowledge
- Midterm and final exams: Utilize comprehensive exams to assess students' understanding of major precalculus concepts and their ability to apply them to solve problems.

12th Grade Option 1: AP Calculus AB

As per the college board, AP Calculus AB focuses on students' understanding of calculus concepts and provide experience with methods and applications. Through the use of big ideas of calculus (e.g., modeling change, approximation and limits, and analysis of functions), the course becomes a cohesive whole, rather than a collection of unrelated topics. AP Calculus AB requires students to use definitions and theorems to build arguments and justify conclusions.

The courses feature a multi representational approach to calculus, with concepts, results, and problems expressed graphically, numerically, analytically, and verbally. Exploring connections among these representations builds understanding of how calculus applies limits to develop important ideas, definitions, formulas, and theorems. A sustained emphasis on clear communication of methods, reasoning, justifications, and conclusions is essential. Teachers and students should regularly use technology to reinforce relationships among functions, to confirm written work, to implement experimentation, and to assist in interpreting results.

Prerequisite Knowledge: In order to take calculus, students should

- Have a strong foundation in reasoning with algebraic symbols and algebraic structures.
- Have basic knowledge of linear, polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric, and piecewise-defined functions.
- Properties of functions, the composition of functions, the algebra of functions, and the graphs of functions.
- Understand the language of functions (domain and range, odd and even, periodic, symmetry, zeros, intercepts, and descriptors such as increasing and decreasing).
- Know how the sine and cosine functions are defined from the unit circle and know the values of the trigonometric functions at the numbers $0, \pi/6, \pi/4, \pi/3, \pi/2$ and their multiples.

Key Topics Covered:

- **Unit 1: Limits and Continuity**

- **Unit 2: Differentiation: Definition and Basic Derivative Rules**

- **Unit 3: Differentiation: Composite, Implicit, and Inverse Functions**

- **Unit 4: Contextual Applications of Differentiation**

- **Unit 5: Analytical Applications of Differentiation**

- **Unit 6: Integration and Accumulation of Change**

- **Unit 7: Differential Equations**

- **Unit 8: Applications of Integration**

Learning Standards:

- **Implementing mathematical processes:**

  - Identify the question to be answered or problem to be solved

  - Identify key and relevant information to answer a question or solve a problem

  - Identify an appropriate mathematical rule or procedure based on the classification of a given expression

  - Identify an appropriate mathematical rule or procedure based on the relationship between concepts or processes

  - Apply appropriate mathematical rules or procedures, with and without technology

  - Explain how an approximated value relates to the actual value.

- **Connecting Representations:**

  - Identify common underlying structures in problems involving different contextual situations

  - Identify mathematical information from graphical, numerical, analytical, and/or verbal representations.

- ○ Identify a re-expression of mathematical information presented in a given representation.
- ○ Identify how mathematical characteristics or properties of functions are related in different representations.
- ○ Describe the relationships among different representations of functions and their derivatives.

- **Justification:**
  - ○ Apply technology to develop claims and conjectures
  - ○ Identify an appropriate mathematical definition, theorem, or test to apply.
  - ○ Confirm whether hypotheses or conditions of a selected definition, theorem, or test have been satisfied.
  - ○ Apply an appropriate mathematical definition, theorem, or test.
  - ○ Provide reasons or rationales for solutions and conclusions.
  - ○ Explain the meaning of mathematical solutions in context.
  - ○ Confirm that solutions are accurate and appropriate.

- **Communication and Notation:**
  - ○ Use precise mathematical language
  - ○ Use appropriate units of measure.
  - ○ Use appropriate mathematical symbols and notation
  - ○ Use appropriate graphing techniques.
  - ○ Apply appropriate rounding procedures.

Recommended Course Activities:

- **Problem Solving:** Students design and conduct surveys or experiments to collect real-world data.
- **Group Projects:** Students work in groups to solve problems, fostering teamwork and communication skills.

- **Technology Integration:** Students utilize graphing calculators to perform calculations, create graphs, and justify conclusions
- **Class discussions and debates:** Encourage critical thinking and discussions around calculus concepts and real-world applications.

Recommended Course Activities:

- **Problem-solving:** Regular practice with word problems that require applying various concepts to reach solutions.
- **Group Projects:** Collaborative projects where students can explain concepts to each other and reinforce their understanding.
- **Technology integration:** Utilizing graphing calculators or online tools to visualize functions and explore mathematical relationships.
- **Real-world applications:** Connecting calculus concepts to real-life scenarios through modeling activities in science, economics, or other disciplines.
- **Discussions and debates:** Encouraging students to explain their reasoning and learn from different approaches to solving problems.

Suggested Methods for Evaluating Student Outcomes:

- **Homework assignments and quizzes:** Regularly assign problems that assess students' ability to apply calculus techniques and justify their reasoning
- **Projects:** Evaluate students' projects based on their use of calculus processes and their ability to connect calculus to the real world
- **Practice AP exams:** Take partial and full length practice exams to gain exposure to the AP format of questions and identify gaps in knowledge
- **Summative assessments:** Utilize comprehensive exams to assess students' understanding of major calculus concepts and their ability to apply them to solve problems.

12th Grade Option 2: AP Statistics

Course Description

The AP Statistics course introduces students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. There are four themes evident in the content, skills, and assessment in the AP Statistics course: exploring data, sampling and experimentation, probability and simulation, and statistical inference. Students use technology, investigations, problem solving, and writing as they build conceptual understanding.

Key Topics Covered:

- **Unit 1: Exploring One-Variable Data**

- **Unit 2: Exploring Two-Variable Data**

- **Unit 3: Collecting Data**

- **Unit 4: Probability, Random Variables, and Probability Distributions**

- **Unit 5: Sampling Distributions**

- **Unit 6: Inference for Categorical Data: Proportions**

- **Unit 7: Inference for Quantitative Data: Means**

- **Unit 8: Inference for Categorical Data: Chi-Square**

- **Unit 9: Inference for Quantitative Data: Slope**

Learning Standards:

- **Selecting Statistical Methods:**

  - Identify the question to be answered or problem to be solved (not assessed).

  - Identify key and relevant information to answer a question or solve a problem.

  - Describe an appropriate method for gathering and representing data.

- Identify an appropriate inference method for confidence intervals.

- Identify an appropriate inference method for significance tests.

- Identify null and alternative hypotheses.

- **Data Analysis:**

  - Describe data presented numerically or graphically.

  - Construct numerical or graphical representations of distributions.

  - Calculate summary statistics, relative positions of points within a distribution, correlation, and predicted response.

  - Compare distributions or relative positions of points within a distribution.

- **Using Probability and Simulation :**

  - Determine relative frequencies, proportions, or probabilities using simulation or calculations.

  - Determine parameters for probability distributions.

  - Describe probability distributions.

  - Construct a confidence interval, provided conditions for inference are met.

  - Calculate a test statistic and find a p-value, provided conditions for inference are met.

- **Statistical Argumentation:**

  - Make an appropriate claim or draw an appropriate conclusion.

  - Interpret statistical calculations and findings to assign meaning or assess a claim.

  - Verify that inference procedures apply in a given situation.

  - Justify a claim based on a confidence interval.

  - Justify a claim using a decision based on significance tests.

Recommended Course Activities:

- **Hands-on investigations:** Students design and conduct surveys or experiments to collect real-world data.

- **Data analysis projects:** Students explore datasets, analyze data using statistical software, and present their findings.

- **Collaborative projects:** Students work in groups to solve statistical problems, fostering teamwork and communication skills.

- **Technology Integration:** Students utilize graphing calculators and statistical software to perform calculations, create graphs, and analyze data.

- **Class discussions and debates:** Encourage critical thinking and discussions around statistical concepts and real-world applications.

Suggested Methods for Evaluating Student Outcomes:

- **Homework assignments and quizzes:** Regularly assign problems that assess students' ability to apply statistical methods and interpret data.

- **Projects and presentations:** Evaluate students' projects based on data collection methods, analysis, interpretation, and communication of findings.

- **Midterm and final exams:** Utilize comprehensive exams to assess students' understanding of major statistical concepts and their ability to apply them to solve problems.