



Mathematics Benchmarks High School

GEOMETRY

Points, Lines and Planes

- Use basic geometric shapes to create & define other shapes
- Use reasoning skills to prove Geometric and Algebraic statements
- Identify and construct types of angles
- Measure angles
- Understand the relationship between bisected angles and segments
- Understand relationships of lines
- Find points of intersection
- Prove that angles are congruent, and prove that lines are parallel

Triangles

- Classify triangles by sides and angles
- Prove triangles congruent
- Use properties of right and isosceles triangles to find lengths and angle measures
- Identify different centers
- Understand properties of and use special segments to solve problems

Polygons

- Identify and name different types of polygons and parts thereof
- Find the measures of angles, interior and exterior, of polygons
- Use and identify specific types of quadrilaterals to solve problems in geometry and real life

Circles

- Identify and describe different parts of circles
- Use properties of tangents to solve purely geometric, as well as real life problems
- Identify types of angles relative to a circle
- Find angle and arc measures using properties of chords, secants and tangents

Right Triangles

- Identify parts of right triangles
- Find angle measures within right triangles
- Find side lengths of right triangles, given two sides
- Solve real life problems involving right triangles
- Use set ratios to find side lengths of special right triangles, given one side
- Use Trig ratios to solve problems, given one side and one angle, or two sides of a right triangle

Similarity

- Set up and use proportions to solve problems
- Identify similar polygons and use properties of similarities to solve problems
- Use proportions in similar triangles to solve real life problems

- Identify and create dilations

Measurement

- Find perimeters of polygons and areas of squares and rectangle (by counting square units)
- Find the areas of polygons
- Find circumference, arc length, area and sector values of circles
- Identify and describe the properties of different solids
- Use properties/formulas of solids to find surface area and volume
- Find surface area and volume to solve real life problems

Transformations

- Identify types of transformations, including rigid and non-rigid
- Use properties of reflections to solve problems and identify linear symmetry
- Use properties of rotations to solve problems and identify rotational symmetry
- Use vectors to create translations and solve problems
- Create patterns using compositions

ADVANCED ALGEBRA

Advanced Algebra

- Understand and use mathematical notation involving arithmetic and geometric sequences and series.
- Differentiate between permutations, combinations and the Counting Principle.
- Possess sufficient skills to be able to perform a simple probability one event at a time; convert probability to odds format and find the complement and intersection of two events.
- Expand binomials and recognize the properties of Pascal's triangle.
- Become familiar with functions and graphs.
- Derive linear and quadratic equations.
- Find slope, midpoint, and distance between points.
- Tell whether lines are parallel or perpendicular.
- Differentiate among the conics.
- Rewrite conic equations in standard form.
- Identify domain and range.
- Perform combinations and transformations of functions.
- Determine whether a graph is a function.
- Understand exponential
- And logarithmic functions.
- Solve exponential and logarithmic equations.

ALGEBRA I

Algebra I

- Discover, analyze, describe, extend, and create patterns and other real world phenomenon.
- Find formulas for any term in a sequence, and use these equations.
- Represent real-life problem situations using equations, tables and graphs.
- Use ratios, proportions, and percents to represent relationships between quantities and measures.
- Evaluate expressions using grouping symbols and order of operations.
- Simplify expressions by combining like terms.
- Simplify problems using operations of integers.
- Develop two different expressions to demonstrate the distributive property.
- Use the distributive property to solve real life problems, working with equations, tables, and graphs.
- Use the distributive property of multiplication of addition and subtraction.
- Use the distributive property of division over addition and subtraction.
- Solve linear equations of the form $Ax + B = Cx + D$.
- Interpret the meaning of negative values in a problem situation, applying the results using equations, tables, and graphs.
- Understand the basic differences between linear and quadratic equations by reading visually equations, tables and graphs.
- Graph linear equations using all four quadrants.
- Write a literal equation from a word problem to find the independent value when the dependent value is given.
- Combine multiple representations and algebraic equations.
- Write equations with two variables and define these variables in terms of the problem situation.
- Solve for a given variable in a formula (literal equation).
- Identify the x and y intercepts and slopes from linear equations.
- Identify the x and y intercepts and slopes from a graph of a linear equation.
- State the slope, y intercept, and equation of the line that would be drawn through given points on a graph, and construct a table of values for the given points.
- Construct linear equations on graphs using:
 - Intercepts and a point
 - A table of values
 - By plotting the slope and y-intercept

- Solve CAPT-like problems by working in groups, taking practice tests, and reviewing released test questions.
- Graph points and find the slope, y-intercept and the equation of the line that best fits in each given problem situation (Line of Best Fit).
- Calculate the average for given data sets in 3 different ways, as the mean, median, and mode.
- Predict outcomes based on findings in an experiment, using line of best fit.
- Explore different problem situations involving 2 distinct algebraic equations.
- Solve systems of equations by graphing the equations, and substitution method. Predict outcomes based on findings in an experiment using line of best fit. (Stroop test).
- Explore different problem situations involving 2 distinct algebraic equations.
- Solve systems of equations by:
 - Graphing the equations
 - Substitution method
- Simplify expressions using Laws of Exponents:
 - Multiply powers
 - Dividing powers
 - Raising a power to a power
 - Raising a product to a power
 - Raising a quotient to a power
 - Definition of zero power.

HONORS ALGEBRA III

Honors Algebra III

- Students use the basic math operations with complex numbers.
- Students study, find, and graph linear and quadratic models.
- Students will solve and graph polynomial equations using algebraic theorems.
- Students will solve and graph inequalities in one variable.
- Students will solve applied problems using linear programming.
- Students will apply all the properties of functions.
- Students will apply the laws of exponents and logarithms.
- Students will solve growth and decay models using exponents and logarithms.
- Students identify, graph, and solve the conic sections.
- Students solve various problems using trigonometric equations and functions.
- Students apply trig graphs and equations to real world problems.
- Students solve triangles.
- Students make a poster and/or model of a practical application problem.
- Students solve and graph trigonometric equations.
- Students graph polar coordinates and polar equations with the graphing calculator.
- Students apply vectors and parametric equations to application problems.
- Students define, evaluate, and apply determinants.
- Students apply formulas to sequences and series.
- Students solve problems using permutations and combinations.
- Students use the binomial theorem and Pascal's tri-angle.
- Students find the probability of an event occurring.
- Students use the binomial probability theorem to find a given outcome of an experiment.

MATH EMPLOYMENT

Math Employment

- Learn the cost involved in owning or renting a house, apartment or condominium.
- Fill out a 1040 EZ tax form and understand federal and state income tax.
- Interpret bar and line graphs based on sales of a product.
- Compare in a table the savings on a \$432 purchase with different sales tax rates and different distances to stores.
- Make a personal budget and understand the importance of having one.
- Investigate the different forms of investments.
- Solve and graph linear equations.
- Determine the cost of owning a car.
- Estimate the distance of trips and cost of travel.

MATH AND SOCIETY

Math and Society

- Be able to compute basic mathematical operations.
- Determine when estimating or the use of a calculator is appropriate.
- Compute their gross salary, bonus, and salary deductions for their weekly pay.
- Determine their gross pay, net pay and overtime from their paycheck.
- Determine the cost of participating in different sports and hobbies.
- Find the sale price based on the discount rate, and compute sales tax based on general purchases.
- Determine the better buy by computing the unit price.
- Learn how to write a check and balance their checking account, and compute simple and compound interest.
- Learn how good credit is obtained and determine the cost of a loan.

TRIGONOMETRY

Trigonometry

- Identify the values of the domain and range from a set of points, graph or equation of a function or relation.
- Demonstrate knowledge of angles in standard position.
- Name co-terminal angles from a given angle through designated rotations in radian and degree measure.
- List the six trigonometric values from a point, a specific triangle or from special angles with rotation.
- Use a calculator to find decimal equivalents of trigonometric functions and angles given the decimal equivalent.
- Effectively use trigonometric ratios to solve right triangle and application problems in the real world.
- Graph sine and cosine graphs and recognize the graphs of the 4 remaining trigonometric functions.
- Apply the Law of Sines and/or Law of Cosines to appropriate problems.
- Find the area of a triangle both with or without right angles using various formulas.
- Identify, simplify, and manipulate the trigonometric identities, and apply the rules of the sums and differences of sines, cosines, and tangents.

INTRODUCTION TO CALCULUS

Introduction to Calculus

- Define and use function notation. Derive and apply the slope formula. Investigate rates of change: velocity, acceleration.
- The ability to find limits to the discrete and to the infinite.
- Applying instantaneous rates of change. Deriving the definition of the derivative. The application of the derivative to extreme situations.
- Utilizing the rectangle method for finding area. Applying the principle of the anti-derivative. Employing the fundamental theorem of calculus to solve real life and probability-based problems.
- Utilizing the formulas for the areas of conics and polygons. Using the methods of axis rotation to determine volume.

PROBABILITY AND STATISTICS

PROBABILITY AND STATISTICS

- Organize and display data pictorially and orally describe the result.
- Calculate mean, median and mode and employ to derive the variance and standard deviation.
- Understand and apply counting, binomial, and combinatorial concepts.
- Applying the standard and non-standard normal distribution to real life situations.
- Apply hypothesis testing, interval formation and correlation analysis to applicable scenarios.

ALGEBRA I, PART I

Algebra I, Part I

- STUDENTS WILL DISCOVER, ANALYZE, EXTEND, AND CREATE NUMBER PATTERNS.
- Students will find formulas for any term in a sequence, then use these equations to make predictions.
- Students can represent real-life problem situations using equations, tables and graphs.
- Students will evaluate ex-pressions using grouping symbols and order of operations.
- Students will simplify ex-pressions by combining like terms.
- Students will solve linear equations of the form $ax + b = cx + d$.
- Students will interpret the meaning of negative values in a problem situation, applying the results using equations, tables, and graphs.
- Students will graph linear equations using all 4 quadrants.
- Students will write equations with two variables and will define these variables in terms of the problem situation.
- Students will manipulate a linear equation to include evaluating, solving, graphing, finding intercepts and slope, and writing equations from a graph.

ALGEBRA I, PART 2

Algebra 1, Part 2

- Solve linear equations using 1 and 2 steps, distributive property, variables on both sides, factoring, combining like terms on 1 and both sides, and clearing fractions.
- Apply a given formula to appropriately solve a problem situation such as simple and compound interest, distance, perimeter, area, volume, motion problems, and Pythagorean theorem.
- Create valid linear equations for a variety of problem situations (including defining variables), ratio, proportion (conversion of measurements), percents, geometric situations, linear applications to real-life situations, and from graphs and tables.
- Graph linear equations from different types of data (using appropriate scales), such as tables, slope and y-intercepts, and x- and y-intercepts, equations and interpret the graph in terms of the problem situation.
- Identify from a graph: slope, x- and y-intercepts, and the equation of a line using $y = mx + b$.
- Transform linear equations from $y = mx + b$ to standard form and vice versa.
- Identify problem situations where a system of equations must be used and define variables, write valid equations. Solve by graphing, using transitive property ($y_1 = y_2$) and linear combination methods; identify breakpoint, and breakeven point, and interpret the graph in terms of the problem situation.
- Create a line of best fit by these steps:
 - Organizing & graphing data
 - Drawing an appropriate line
 - Writing its equation
 - And apply statistical measures of central tendency to interpret real-life situations (mean, median, mode and range).
- Understand and use the laws of exponents to simplify algebraic expressions and solve equations.
- Recognize and graph a quadratic function from a table of values and identify minimum and maximum point; determine whether it opens up or down, and identify x-intercepts by graphing, solving with quadratic formula and factoring.

ALGEBRA 3

Algebra 3

- Students can solve a variety of equations by using different methods.
- Students graph equations and inequalities on a line or in the x-y plane.
- Students apply properties of functions.
- Students solve triangles.
- Students can create equations, etc. to solve application problems.
- Students can write sequences and series.
- Students can find nth term formulas and find sums of series.
- Students can find the probability of different events.

AP CALCULUS

AP Calculus

- STUDENTS CAN EVALUATE POLYNOMIAL, RATIONAL, EXPONENTIAL AND TRIGONOMETRIC FUNCTIONS, AND DRAW A ROUGH SKETCH OF EACH.
- Students can find the roots of polynomial equations using algebra.
- Students can graph polynomial, rational, exponential, and trigonometric functions using a graphing calculator, and locate roots, if they exist.
- (Optional: not in AP syllabus)
- Students can use regression analysis on the graphing calculator to model table data and predict future behavior.
- Students can evaluate limits, and identify horizontal and vertical asymptotes, and points of discontinuity.
- Students can find a derivative of polynomial, rational, exponential, and transcendental functions using the definition of a derivative, rules for differentiation, and the graphing calculator.
- Students can estimate the values of a derivative from tables and graphs.
- Students can apply derivatives to solve related rates, optimization, and motion problems, and graph polynomial functions.
- Students can model the sum of an infinite series of areas with a definite integral.
- Students can calculate area and volume with a definite integral.
- Students can integrate polynomial, rational, exponential, logarithmic, and trigonometric functions using rules for integration and a graphing calculator.
- Students can integrate using integration by parts, by changing variables, and by partial fractions.
- Students can model applications using separable differential equations and solve their equations.

AP COMPUTER SCIENCE

AP Computer Science

- STUDENTS CAN DESCRIBE SIMPLE ALGORITHMS FOR SOLVING PROBLEMS AND CAN USE PROGRAMMING SOFTWARE TO IMPLEMENT THEIR SOLUTIONS.
- Students can design one or more solutions to a problem using the top-down design method and iterative enhancement.
- Students can improve a solution's design by making it modular, writing functions, and streamlining code to improve efficiency.
- Students can choose the proper data types for the problem they are solving from the built-in types, and create their own data types using enumerated types and structs.
- Students can construct correct programming expressions for mathematical computations.
- Students can read, interpret and write multi-level control statements and loop structures.
- Students can create, open and close files, and read from and write to files.
- Students can read, interpret, and write functions with value, reference, and constant reference parameters.
- Students can read, interpret and modify classes, and use appropriate classes including string, vector and matrix classes to solve problems.
- Students can discuss the design decisions made in the solution of a large programming problem written by The College Board, and compare features of the design to problems that they have solved.
- Students can list the steps in the process of designing a solution to a large programming problem.
- Students can describe algorithms for standard searching and sorting techniques, including those that use recursion.

HONORS ALGEBRA 3

Honors Algebra 3

- STUDENTS GRAPH QUADRATIC FUNCTIONS.
- Students graph linear functions.
- Students find linear and quadratic functions given certain information.
- Students study, find, and graph linear and quadratic models.
- Students student and use the basic math operations with complex numbers.
- Students will solve and graph polynomial equations in one variable.
- Students will graph polynomial equations in two variables.
- Students will use quadratic and cubic equation to solve application problems.
- Students will use the graphing calculator to find the roots of a polynomial equation.
- Students will apply algebraic theorems to write and solve polynomial equations.
- Students will solve and graph inequalities in one variable.
- Students will graph one or more 2-variable polynomials.
- Students will solve applied problems using linear programming.
- Students learn how to identify a function, determine the domain, range, and zeros of a function, and to graph a function.
- Students will perform operations on functions such as addition, subtraction, multiplication, division, and composition.
- Students will learn how to reflect and translate graphs of a function.
- Students will learn how to identify periodic functions, and graph these functions and stretch and shrink these graphs horizontally and vertically.
- Students will learn how to identify one-to-one functions by their graphs or rule.
- Students will apply the laws of exponents and logarithms.
- Students will solve exponential and logarithmic equations.
- Students will solve growth and decay models using exponents and logarithms.
- Students graph the conic sections.
- Students solve a system of two conic sections.
- Students identify the conic sections and their properties.
- Students find values of the six trigonometric functions.
- Students graph trigonometric functions.
- Students apply trigonometric functions to real world problems.
- Students solve trigonometric equations using inverse functions.
- Students measure angles using degrees and radians.
- Students solve trigonometric equations.
- Students graph trigonometric equations.
- Students apply trig graphs to real world problems.

- Students solve triangles.
- Students find the area of a triangle.
- Students make a poster and/or model of a practical application problem.
- Students graph polar coordinates and polar equations with the graphing calculator.
- Students perform basic operations on vectors.
- Students use vector and parametric equations to describe motion in a plane.
- Students apply vectors and parametric equations to application problems.
- Students define, evaluate, and apply determinants.
- Students find nth term formulas for sequences.
- Students find the sum of series.
- Students find limits of in-finite sequences.
- Students write series in sigma notation.
- Students solve counting problems.
- Students solve problems using permutations and combinations.
- Students use the binomial theorem and Pascal's tri-angle.
- Students find the probability of an event occurring.
- Students use the binomial probability theorem to find a given outcome of an experiment.

INTRODUCTION TO PROGRAMMING AND APPLICATIONS

Introduction to Programming and Applications

- Students can use programming
- Software to edit, compile, link and run a program.
- Students can describe simple algorithms for solving everyday problems such as changing a flat tire or finding a lost object.
- Students can create programs that accept input from the keyboard and produce output on the monitor.
- Students can choose the appropriate data types for the problems they are solving from the built-in types available.
- Students can construct correct programming expressions for mathematical computations.
- Students can read, interpret and write multi-level control statements and loops.
- Students can read, interpret and write functions with and without parameters, and functions that do and do not return values.
- Students can incorporate simple classes into programs they write.
- Students can create spreadsheets and use database software to solve problems.

INTERMEDIATE ALGEBRA

Intermediate Algebra

- Recognize, compute and order the real number system.
- Perform operations with algebraic polynomials.
- Compute solutions to linear equations and inequalities and apply them to real life situations
- Demonstrate understanding of all types of factoring and its use in solving quadratic equations.
- Perform all operations in simplifying algebraic rational expressions.
- Interpret, chart, graph and write the equation of a line.
- Complete all operations with radicals.
- Find perimeter, area and volume of geometric figures.
- Solve quadratic equations.

INFORMAL GEOMETRY

Informal Geometry

- Identify & understand the basic elements of Geometry - points, lines, segments, rays & planes.
- Identify intersecting & parallel lines, and angle relationships for intersecting & parallel lines.
- Identify and classify triangles, find interior & exterior angle measures of a triangle, and use the triangle Inequality Property.
- Understand & solve problems with ratio & proportion, scale drawings, & similar triangles.
- Know, identify and use properties of congruent triangles; recognize & interpret Venn Diagrams.
- Know the Pythagorean theorem & apply it when solving triangle. Problems; solve.
- Problems using special right triangles; know & use coordinate plane and distance formula.
- Know and use properties of quadrilaterals.
- Understand the definition of area and perimeter & apply them in polygon problems.
- Understand circumference & area of a circle & apply the formulas in problems; use angle relationships of circles.
- Know & use formulas to find surface area & volume of solid figures. Identify & use trigonometric ratios and apply them to solve right problems.

HONORS ALGEBRA 2

Honors Algebra 2

- Understand the positive and negative numbers of properties and order them on the number line
- Evaluate expressions with a calculator using order of operations
- Generate algebraic expressions to model real-life situations
- Solve linear equations and inequalities
- Solve a literal equation for a specific variable and evaluate it for specified values of other variables
- Produce a table from a linear equation and graph the ordered pairs
- Determine the equation of a line from its graph or produce a graph from a linear equation
- Determine the equation of a line from various forms of given information
- Manipulate an equation of a line in standard or slope-intercept forms
- Use linear equations to model real-life situations
- Input a linear equation into a graphing calculator, manipulate the viewing window, and use the table function
- Represent patterns algebraically that are found on graphs
- Graph and solve a linear system in two variable
- Solve a linear system in two variables algebraically
- Develop a system of linear equations to model real-life situations, solve the system, and interpret the results
- Input and solve a system of linear equations into a graphing calculator and use the trace function
- Identify, apply, and analyze steps toward solving a system of equations
- Solve a quadratic equation by finding square roots or by using the quadratic formula
- Manipulate a formula containing squared factors & evaluate
- Graphically represent a quadratic equation manually and using a graphing calculator
- Develop a quadratic model to represent real-life situations
- Interpret algebraically and/or graphically a real-life quadratic model
- Identify imaginary and complex numbers algebraically & graphically
- Find the roots of a quadratic equation graphically, and interpret the roots in a real-life problem situation.
- Find simple probability of an event
- Recognize and apply the counting principle, permutations, or combinations as applicable to a problem
- Find the probability of two events either mutually exclusive, independent, or dependent

- Use graphing calculator to find permutations and combinations
- Synthesize information to predict outcomes using the counting principle, permutations, and combinations
- The student will be able to interpret various graphical representations of data (line, circle, bar, stem and leaf, scatter, histogram)
- Approximate the best-fitting line for a set of data and produce a linear equation
- Calculate measure of central tendency from sets of data and interpret their significance
- Run a linear regression on a graphing calculator given a set of data and interpret the results
- Evaluate different representations of the same data.
- Write a paragraph that correctly describes and interprets given data
- To discriminate between a relation and a function using a graph or set of ordered pairs and determines the domain & range.
- To perform function operations
- Identify, classify, and evaluate recursive functions.
- Graph both a function and its inverse in the Cartesian plane
- Describe both the behaviors and properties of functions.
- Use the properties of exponents to evaluate & simplify exponential expressions
- Use real-life applications of compound interest & growth & decay formulas
- Evaluate the n th roots of real numbers using radical & rational exponents notation
- To use a scientific calculator appropriately to compute rational, exponential, & logarithmic expressions
- Identify exponential, logarithmic, & square root functions from their graphs.
- Use formulas for compound interest, exponential growth, & exponential decay in order to make predictions
- Manipulate polynomial expressions in solving real-life problems
- Recognize the significance of varying degrees and coefficients of polynomial functions
- To use a graphing calculator to graph a polynomial function & interpret the results
- Find the linear factors of a polynomial by factoring or synthetic division
- Solve problems with polynomial equations by applying relationships between synthetic division polynomial factoring and rational root theorems.
- Distinguish between arithmetic & geometric sequences
- Find arithmetic, geometric, and infinite geometric series
- Manipulate the formulas to solve for unknown values
- Use arithmetic and geometric sequences to solve real-life world problems