ACALANES UNION HIGH SCHOOL DISTRICT
COURSE OF STUDY: CURRICULAR AREA – Mathematics

COURSE TITLE:	Precalculus
GRADE LEVEL(S):	11-12
COURSE LENGTH:	Year
PREFERRED PREVIOUS COURSE OF STUDY:	Algebra 2 or Algebra 2 Advanced
CREDITS PER SEMESTER:	5
STANDARDS & BENCHMARKS:	California Common Core State Standards: Mathematics
GRADUATION REQUIREMENT:	Meets 1 year of the 3-year AUHSD graduation requirement in Mathematics
UC/CSU A-G DESIGNATION:	UC/CSU approved – "C" Mathematics
ADOPTED by AUHSD GOVERNING BOARD:	Adopted by Governing Board, August 5, 2026
INSTRUCTIONAL MATERIALS:	Textbook: *Glencoe Precalculus: Graphs and Algebraic Functions*. Common Core Content Area ed., McGraw-Hill Education, 2014. Supplemental Materials: Flipped Mastery Learning, flippedmath.com

COURSE DESCRIPTION:

Precalculus integrates concepts from algebra, geometry, trigonometry, and mathematical modeling to prepare students for advanced college-level mathematics courses. The course develops students' analytical thinking, problem-solving abilities, and mathematical reasoning through the exploration of functions and their applications. Major topics include polynomial, rational, exponential, logarithmic, and trigonometric functions; complex numbers; vectors; matrices; conic sections; parametric equations; and polar coordinates. Students learn to represent and analyze mathematical relationships using multiple approaches, including graphical, numerical, algebraic, and geometric methods. These skills provide a strong foundation for future math courses, including high school statistics and college-level math pathways. Throughout the course, students are expected to apply the California Standards for Mathematical Practice as they investigate, model, and solve real-world problems.

GRADING GUIDELINES:

- Formative Coursework: 10%
- Summative Assessments: 90%

COURSE CONTENT – SCOPE and SEQUENCE

Units and Standards	Core Objectives with Assignments and Assessments
Unit 1: Fundamentals, Polynomial Functions, and Rational Functions California Common Core State Standards — Mathematics	**Unit 1 Summary** Students explore polynomial and rational functions. They learn that a function is a relation in which each input from the domain maps to one unique element in the range, and they study how inputs and outputs change together and the average rate of change. Developing proficiency with functions provides

● *Algebra:* Arithmetic with Polynomials and Rational Expressions (A-APR); Creating Equations (A-CED); and Seeing Structure in Expressions (A-SSE) ● *Functions:* Interpreting Functions (F-IF) and Building Functions (F-BF) ● *Number and Quantity:* Complex Number System (N-CN) ● *Modeling* (M)	students with a powerful tool to solve real-world problems in science, business, and other fields. Through this unit, students build the core problem-solving skills needed for advanced mathematics. Key topics in the unit include the following: ● Operations with Complex Numbers ● Quadratic Functions and Equations ● *n*th Roots and Real Exponents ● Systems of Equations and Inequalities and Matrices ● Analyzing Graphs of Functions ● Continuity and End Behavior ● Extrema and Average Rate of Change ● Parent Functions and Transformations ● Function Operations and Composition of Functions ● Inverse Relations and Functions ● Power and Radical Functions ● Polynomial Functions ● The Remainder and Factor Theorem ● Zeros of Polynomial Functions ● Rational Functions ● Nonlinear Inequalities **<u>Unit 1 Representative Assignment: Graph and Switch Activity</u>** In this collaborative group assignment, students practice shifting and stretching the parent functions of polynomial and rational functions, thereby developing a conceptual bridge between abstract algebraic notation and visual geometry. Students gain insights into how specific constants and coefficients directly dictate the graph's vertical and horizontal position, orientation, and steepness. Working in pairs, students are each given a basic math graph and tasked with drawing a new version based on simple team directions, such as translating the function 2 units horizontally to the right and applying a vertical stretch by a factor of 3. Partners then trade papers and try to identify the exact algebraic equation that matches their classmate’s new drawing. Once the equations are

	written down, the pairs talk through their solutions, explaining their steps and correcting any graphing mistakes. This peer activity helps students practice talking and listening within a math context while building confidence in graphing skills.
Unit 2: Exponential and Logarithmic Functions California Common Core State Standards — Mathematics ● *Algebra:* Reasoning with Equations and Inequalities (A-REI) ● *Functions:* Interpreting Functions (F-IF); Building Functions (F-BF); and Linear, Quadratic, and Exponential Models (F-LE) ● *Modeling* (M)	**<u>Unit 2 Summary</u>** Students learn about exponential and logarithmic functions. They study how these functions are used across multiple fields. For example, students study how exponential functions model phenomena that grow or decay at a rate proportional to their current value, such as population growth, radioactive decay, and interest rates. They also study how logarithmic functions help scientists understand phenomena such as sound intensity and earthquake magnitude. Through this unit, students sharpen the essential graphing, communication, and quantitative reasoning skills used across various fields such as business, medicine, chemistry, and physics. Key topics in the unit include the following: ● Exponential Functions ● Logarithmic Functions ● Properties of Logarithms ● Exponential and Logarithmic Equations ● Modeling with Nonlinear Regression **<u>Unit 2 Representative Assignment: Linear vs. Exponential Function Builder</u>** Students practice explaining the difference between linear and exponential relationships by building their own number tables. Working in small groups,

	students randomly pick five input numbers between -8 and 8. They then work together to invent two different sets of matching output numbers: one that shows a steady linear pattern and one that shows an exponential growth pattern. Next, the teams present their number tables to the rest of the class, explaining how they know which table is linear and which is exponential based on whether the outputs grow by exhibiting a constant linear difference or a constant exponential ratio. This collaborative project helps students find and use patterns of reasoning and structure in the behavior of linear and exponential rate of change using numerical, algebraic, and graphical approaches.
Unit 3: Trigonometry and Analytic Trigonometry California Common Core State Standards — Mathematics ● *Algebra:* Creating Equations (A-CED) and Reasoning with Equations and Inequalities (A-REI) ● *Functions:* Interpreting Functions (F-IF); Building Functions (F-BF); and Trigonometric Functions (F-TF) ● *Geometry:* Similarity, Right Triangles, and Trigonometry (G-SRT) ● *Modeling* (M)	**<u>Unit 3 Summary</u>** Students explore trigonometric functions and learn how they connect to the angles and curves of a circle. Since a circle repeats its shape every rotation, these functions are effective for modeling periodic phenomena. Natural Patterns – Students use these functions to map repeating patterns in nature, such as the rising and falling of ocean or sound waves, the rhythm of blood pressure produced by a beating heart, and the changing angle between the North Pole and the sun over the course of a year. Mechanical, Social, and Business Patterns – Students use these functions to map repeating patterns in traffic flow, business cycles, and mechanical items such as clocks. In this unit, students develop skills to identify and graph repeating patterns in nature and society and then create trigonometric functions to model their behavior and predict outcomes. Key topics in this unit include the following: ● Right Triangle Trigonometry ● Degrees and Radians ● Trigonometric Functions on the Unit Circle ● Graphing Sine and Cosine

	● Graphing Other Trigonometric Functions ● Inverse Trigonometric Functions ● The Law of Sines and Cosines ● Trigonometric Identities ● Verifying Trigonometric Identities ● Solving Trigonometric Equations ● Sum and Difference Identities ● Multiple-Angle and Product-to-Sum Identities **Unit 3 Representative Assignment: Trigonometric Graph Matching and Correction Activity** Students use the structure of a function's periodicity to match trigonometric equations to their graphs. Working in pairs, students look at a set of cards where equations for sine and cosine functions are paired up with visual graphs. Some of the cards match perfectly, while others have been drawn with intentional errors, such as the wrong amplitude or an incorrect starting point. Partners collaborate to identify the key characteristics of the graph (e.g., amplitude, midline, and period) and match these values to the parameters of the trig equations. For every card that is incorrect, the student pairs must sketch a new, corrected graph by hand and write a brief explanation of what was wrong with the original card. This hands-on project provides students with the opportunity to practice speaking and listening within a math context while helping each other correct common graphing mistakes. This assignment requires students to read and write equations, translate between graphical characteristics and algebraic parameters, and verify that solutions are correct, approximate, or reasonable.
Unit 4: Polar Coordinates and Conic Sections	**Unit 4 Summary** Students learn about two core geometric topics: polar coordinates and conic sections. ● Polar Coordinates – Students express locations using radial distance

California Common Core State Standards — Mathematics ● *Number and Quantity:* The Complex Number System (N-CN) ● *Algebra:* Interpreting Functions (F-IF) ● *Geometry:* Expressing Geometric Properties with Equations (G-GPE)	and standard position angles. ● Conic Sections – Students utilize the structure of conic sections (circles, ellipses, parabolas, and hyperbolas) to model real-world phenomena in fields such as astronomy, engineering, architecture, and physics. This unit requires students to transition from rectangular coordinates to polar coordinates and examine the shapes of conic sections, which connects algebraic equations and visual geometry. Key topics in this unit include the following: ● Polar Coordinates ● Graphs of Polar Equations ● Polar and Rectangular Forms of Equations ● Polar Forms of Conic Sections ● Complex Numbers and De Moivre's Theorem ● Parabolas ● Ellipses and Circles ● Hyperbolas ● Introduction to Parametric Equations **Unit 4 Representative Assignment: Polar Function Behavior Analysis** Students analyze how geometric shapes behave in the polar coordinate system versus the rectangular coordinate system. Working in pairs, students use their calculators to graph an assigned polar function and split it into sections to find exactly where the radius is positive or negative, and whether it is increasing or decreasing. Partners compare their mathematical findings to check for accuracy, visually tracking how the curve winds around the origin. Next, each pair writes a joint summary describing how the radius changes in distance from the center as the angle rotates from the positive x-axis. Teams then present their summaries to the class, building crucial oral communication skills specific to the mathematics discipline. In this assignment, students read, write, and explain complex function behaviors using multiple approaches and

	generalize about the change in tandem between two variables (e.g., radius and angle of rotation).
Unit 5: Vectors, Sequences, and Series California Common Core State Standards — Mathematics ● *Algebra:* Creating Equations (A-CED) and Reasoning with Equations and Inequalities (A-REI) ● *Functions:* Interpreting Functions (F-IF) and Building Functions (F-BF) ● *Modeling* (M)	**<u>Unit 5 Summary</u>** In this unit, students learn about vectors. In mathematics and science, a vector is a tool used to describe any quantity that has a size and a direction. Students learn to express velocity, force, and displacement using vectors, and then apply vector operations to model real-world scenarios in fields such as navigation, computer graphics, and engineering. In this unit, students make connections between abstract algebra, geometry, and real-world physical applications. Students also learn the foundational principles of sequences and series, developing techniques to evaluate numeric patterns and summations. Key topics in this unit include the following: ● Introduction to Vectors ● Vectors in the Coordinate Plane ● Dot Products and Vector Projections ● Vectors in Three-Dimensional Space ● Dot and Cross Products of Vectors in Space ● Introduction to Sequences and Series **<u>Unit 5 Representative Assignment: Vectors and Flight Paths</u>** In this collaborative assignment, students apply theoretical concepts of vector mathematics and trigonometry to the real-world scenario of flight navigation. By mapping out a multi-city flight plan, students move beyond abstract textbook problems to see how vectors, bearings, and component forms are utilized in aviation, geography, and trip planning. Students will locate three cities on a map, measure the bearing angles (direction) between them, and use an online distance calculator to find the actual mileage (magnitudes) between the destinations. Next, students convert these real-world paths into mathematical vectors for the first two legs of the trip

	(using both magnitude/direction and component forms). Next, they use vector addition to calculate the resultant vector for a direct, one-way return flight home.