SAMPLE SYLLABUS #2

AP® Precalculus

Curricular Requirements

CR1	The students and teacher have access to a college-level precalculus textbook, in print or electronic format.	*See page:* 2
CR2	The course is structured to incorporate the required content (Units 1, 2, and 3) outlined in each of the units described in the AP Precalculus Course and Exam Description.	*See page:* 2
CR3	The course provides opportunities for students to develop the skills related to Mathematical Practice 1: Procedural and Symbolic Fluency.	*See page:* 3
CR4	The course provides opportunities for students to develop the skills related to Mathematical Practice 2: Multiple Representations.	*See page:* 3
CR5	The course provides opportunities for students to develop the skills related to Mathematical Practice 3: Communication and Reasoning.	*See page:* 4
CR6	Students have access to graphing calculators and opportunities to use them to solve problems and to explore and interpret precalculus concepts.	*See page:* 4
CR7	The course provides opportunities for students to practice building function models in settings where students must choose, construct, and defend the selection of a function model.	*See page:* 5

Advanced Placement Precalculus Sample Syllabus #2

Textbook:

Textbook provided on the AP Course Audit form. CR1

Course Description:

AP Precalculus is a rigorous course to prepare students for college-level calculus.

Unit 1 Polynomial and Rational Functions (6–6.5 weeks) CR2

- 1.1 Change in Tandem
- 1.2 Rates of Change
- 1.3 Rates of Change in Linear and Quadratic Functions
- 1.4 Polynomial Functions and Rates of Change
- 1.5 Polynomial Functions and Complex Zeros
- 1.6 Polynomial Functions and End Behavior
- 1.7 Rational Functions and End Behavior
- 1.8 Rational Functions and Zeros
- 1.9 Rational Functions and Vertical Asymptotes
- 1.10 Rational Functions and Holes
- 1.11 Equivalent Representations of Polynomial and Rational Expressions
- 1.12 Transformations of Functions
- 1.13 Function Model Selection and Assumption Articulation
- 1.14 Function Model Construction and Application

Unit 2 Exponential and Logarithmic Functions (6–6.5 weeks)

- 2.1 Change in Arithmetic and Geometric Sequences
- 2.2 Change in Linear and Exponential Functions
- 2.3 Exponential Functions
- 2.4 Exponential Function Manipulation
- 2.5 Exponential Function Context and Data Modeling
- 2.6 Competing Function Model Validation
- 2.7 Composition of Functions
- 2.8 Inverse Functions
- 2.9 Logarithmic Expressions
- 2.10 Inverses of Exponential Functions
- 2.11 Logarithmic Functions
- 2.12 Logarithmic Function Manipulation
- 2.13 Exponential and Logarithmic Equations and Inequalities
- 2.14 Logarithmic Function Context and Data Modeling
- 2.15 Semi-Log Plots

CR2
The syllabus must include an outline of course content by unit topic or collection of topics using any organizational approach.

Unit 3 Trigonometric and Polar Functions (7–7.5 weeks)

- 3.1 Periodic Phenomena
- 3.2 Sine, Cosine, and Tangent
- 3.3 Sine and Cosine Function Values
- 3.4 Sine and Cosine Function Graphs
- 3.5 Sinusoidal Functions
- 3.6 Sinusoidal Function Transformations
- 3.7 Sinusoidal Function Context and Data Modeling
- 3.8 The Tangent Function
- 3.9 Inverse Trigonometric Functions
- 3.10 Trigonometric Equations and Inequalities
- 3.11 The Secant, Cosecant, and Cotangent Functions
- 3.12 Equivalent Representations of Trigonometric Functions
- 3.13 Trigonometry and Polar Coordinates
- 3.14 Polar Function Graphs
- 3.15 Rates of Change in Polar Functions

Unit 4 Functions Involving Parameters, Vectors, and Matrices (7–7.5 weeks)

- 4.1 Parametric Functions
- 4.2 Parametric Functions Modeling Planar Motion
- 4.3 Parametric Functions and Rates of Change
- 4.4 Parametrically Defined Circles and Lines
- 4.5 Implicitly Defined Functions
- 4.6 Conic Sections
- 4.7 Parametrization of Implicitly Defined Functions
- 4.8 Vectors
- 4.9 Vector-Valued Functions
- 4.10 Matrices
- 4.11 The Inverse and Determinant of a Matrix
- 4.12 Linear Transformations and Matrices
- 4.13 Matrices as Functions
- 4.14 Matrices Modeling Contexts

Evidence of Mathematical Practice 1: Procedural and Symbolic Fluency

While studying polynomial and rational functions in Unit 1, \olving polynomial and rational functions expressed analytically. Students will first work together to find the zeros of a collection of polynomial and rational functions through factorization by hand. Students will verify their solutions using the graphing calculator. **CR3**

Evidence of Mathematical Practice 2: Multiple Representations

While studying conic sections in Unit 4, students will complete a card-sorting activity in which the cards contain different representations of given conic sections. For each conic section, there will be one card with a verbal description of the figure, one card with a graph of the conic, one card containing a set of ordered pairs for the conic, one card with an implicitly defined analytic equation, and one card with the conic expressed parametrically. After students sort the cards, they will provide a rationale for why each set of five cards represents the same conic section. **CR4**

CR3
The syllabus must include a description or copy of at least one lesson, activity, or assignment in which students are algebraically manipulating functions expressed analytically, without technology.

CR4
The syllabus must include a description or copy of at least one lesson, activity, or assignment in which students work with multiple representations. Each of the four representations (analytical, numerical, graphical, and verbal) must be in at least one of the provided lessons, activities, or assignments. It is not necessary that all four representations appear in a single lesson, activity, or assignment.

AND

There must be evidence of a connection between at least two different representations in at least one of the provided lessons, activities, or assignments.

Evidence of Mathematical Practice 3: Communication and Reasoning

The class is presented with sinusoidal functions that model the daily high temperatures and daily low temperatures for five different cities. A homework assignment asks students to decide in which city the cost to keep a house at a comfortable temperature would be greatest and least, and provide a rationale for their choice using appropriate sinusoidal-function-related mathematical language. **CR5**

Evidence of Calculator Usage

All students will be asked to purchase an approved graphing calculator. If a student cannot purchase one, they will be provided access to one by the school for the entirety of this course. **CR6**

Calculators will be used to do each of the following:

1. Identify minima/maxima of functions: **CR6**
   - While studying Unit 1, students will be finding extrema using the "calculate minimum" and "calculate maximum" graphing calculator feature. Students will be required to classify extrema as relative or absolute over the function's domain as well as on closed intervals within the domain. Students will practice this skill on a worksheet in class.
2. Identify numerical solutions to equations in one variable: **CR6**
   - While studying Unit 2, students will study exponential growth of two populations. On a homework assignment, students will find intersection points for the pairs of exponential functions, using the calculator's equation solver, and interpret the results in context.
3. Find regression equations to model data and analyze residual graphs: **CR6**
   - In a classroom activity during Unit 3, students will use the calculator to calculate a sinusoidal regression on monthly electricity usage in a town over a 12-month period of time. Students will use the calculator to produce the residual plot and determine the months for which the model underestimates the actual values and for which months the model overestimates the actual values. Using the absolute values of the residuals, students will determine the greatest difference between the predicted and actual value for the 12 data points.
4. Perform matrix operations: **CR6**
   - While studying Unit 4, students are given a worksheet containing two-by-two matrices. Students will find the determinant of each matrix by hand. If the determinant of the matrix is not zero, students will use the calculator to find the inverse of the matrix. Students will then multiply the original matrix by its inverse on the calculator then multiply the inverse by the original matrix to verify they are inverses.

CR5

The syllabus must include a description or copy of at least one lesson, activity, or assignment in which students use appropriate mathematical language while providing rationales for conclusions.

CR6

The syllabus includes a statement that each student has individual access to an approved graphing calculator.

AND

The syllabus must include a description or copy of lessons, activities, or assignments in which students use graphing calculators to do each of the following:

Identify minima/maxima of functions

Identify numerical solutions to equations in one variable

Find regression equations to model data and analyze residual graphs

It is not necessary that the requirements appear in a single lesson, activity, or assignment.

Evidence of Modeling

As a classroom activity, students are given a table with rows numbered 1–12. Each row of the table describes a characteristic of a function such as a zero, a vertical asymptote, a horizontal asymptote, an end behavior, or the x-value of a hole. Each student is assigned three of these characteristics using a dodecahedral die. Each student must write the formula for a function having those three characteristics. If such a function does not exist, the student must explain why and is given three new characteristics. This process is repeated until each student has a viable set of characteristics for which they will build a function. In the last step of this activity, in pairs, students will provide a rationale as to how their function displays the three characteristics. **CR7**

As a classroom activity, students are given six tables of values. Each table contains 15 ordered pairs of values. For each table, students calculate each of the following regressions: linear, quadratic, cubic, quartic, exponential, logarithmic, and sinusoidal. Students choose an appropriate model for each set of data and validate the decision using the residual plots. In some cases, more than one model may be appropriate. **CR7**

CR7

The syllabus must include a description or copy of at least one lesson, activity, or assignment in which students are given mathematical or contextual criteria such as zeros, end behavior, and covariation of quantities and are asked to select and build a model satisfying the criteria (without using regression) and provide a rationale for their selection.

AND

A description or copy of at least one lesson, activity, or assignment in which students are given bivariate data and are asked to select a model for the data and build the model using regression and then assess the suitability of their selection using residual plots.

In both cases, students should not be given direction toward a specific function model. The criteria and data sets can be supplied by the teacher or be self-selected.