SAMPLE SYLLABUS #1

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:* 2, 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:* 2, 4, 5
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 #1

Textbook provided on the AP Course Audit form. CR1

The course framework for AP Precalculus includes two essential components: Mathematical Practices and Course Content. The practices are skills that students should develop and apply repeatedly with different elements of content over the course of the year. The course content is organized into four units that comprise the core pieces of knowledge and conceptual understandings of precalculus, and the units provide a suggested scope and sequence for the course, to which this syllabus is aligned. This course provides ample opportunities for students to use calculus to solve real-world problems and for students to leverage technology in their work. Students will be provided with a graphing calculator to use at school and at home. CR6

Course Content at a Glance CR2

Unit Number and Title	Instructional Weeks
1: Polynomial and Rational Functions	Weeks 1–7
2: Exponential and Logarithmic Functions	Weeks 8–16
3: Trigonometric and Polar Functions	Weeks 17–23
4: Functions Involving Parameters, Vectors, and Matrices	Weeks 24–30

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

Unit Overviews

Unit 1: Polynomial and Rational Functions (Weeks 1–7)

Topics

- 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

Highlighted Instructional Strategies

1.8 Rational Functions and Zeros

- In a classroom activity, students will use graphs to estimate the x-intercepts of polynomial functions. Then, they will algebraically confirm the zeros of the function by solving the polynomial equation without using a calculator. CR3

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.

1.10 Rational Functions and Holes and 1.11 Equivalent Representations of Polynomial and Rational Expressions

- In a group project assignment, students will rewrite rational functions in a form that allows them to determine the function's vertical asymptotes and holes without technology. In class the next day, they will work in partners to determine when it is helpful to rewrite a rational function in an equivalent form and when is it not, and which forms of rational functions are most helpful to determine certain essential characteristics of the function (such as end behavior, discontinuities, etc.). **CR3**

Unit 2: Exponential and Logarithmic Functions (Weeks 8–16)

Topics

- 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

Highlighted Instructional Strategies

2.5 Exponential Function Context and Data Modeling

- In a performance task, students will work individually to model population growth in cities throughout the American Southwest using equivalent exponential analytical, numerical, graphical, and verbal representations. Then, they will draw connections between the representations and draw conclusions about the population patterns in the different cities using the models. **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.

2.10 Inverses of Exponential Functions

- In a classroom activity, students are presented with a logarithmic and exponential function that are inverses. Using the calculator, they identify the intercepts, extrema, and points of intersection of the two functions, using appropriate built-in calculator features, to discover the inverse relationship between the exponential and logarithmic functions. CR6

2.14 Logarithmic Function Context and Data Modeling

- In a homework assignment, students will decide and craft explanations using appropriate mathematical language as to why a logarithmic function does or does not model a data set. Then, students will trade their justifications with a partner and evaluate the rationale in class the next day, before getting feedback from the teacher. CR5

Unit 3: Trigonometric and Polar Functions (Weeks 17–23)

Topics

- 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

Highlighted Instructional Strategies

3.7 Sinusoidal Function Context and Data Modeling

- In a classroom activity, students become personal managers for the day and use a graphing calculator to model data about the popularity of an NBA star's Instagram account using both a quadratic and an exponential regression. Then, they determine the most accurate model for the data set using analysis of residual graphs produced by the calculator. CR6

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:

1. Identify minima/maxima of functions
2. Identify numerical solutions to equations in one variable
3. 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.

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.

Unit Review

- In an exploratory launch of a lesson, students use a graphing calculator to model data sets using linear, quadratic, cubic, quartic, exponential, logarithmic, and sinusoidal regressions. Then, they analyze residual graphs and select the most accurate model for each data set. CR7
- In a homework assignment, teachers provide students with the characteristics of a function such as the number and type of zeros, the end behavior, and the locations of extrema. Students build a function model from those criteria, without using regressions, including a justification for their model. The next day in class, they compare their models and justifications with their classmates' models and justifications, and the class picks the most accurate function model. CR7

Unit 4: Functions Involving Parameters, Vectors, and Matrices (Weeks 24–30)

Topics

- 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

Highlighted Instructional Strategies

4.10 Matrices

- In a classroom assignment, students use a graphing calculator to compute products, inverses, and determinants of matrices. CR6

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.