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T³IC 2023

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International Conference

AP® Precalculus: The Nuts and Bolts of the Course Including the AP® Exam, Technology Use and Resources

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Agenda

- Content Overview – Jason
- Calculus Connections and Pathways – Stephanie
- Classroom and Technology – Vicki
- Exams – Craig

AP Precalculus: The Nuts and Bolts of the Course, Including the AP Exam, Technology Use, and Resources

September 30, 2023
Virtual T³IC

AP Precalculus Overview

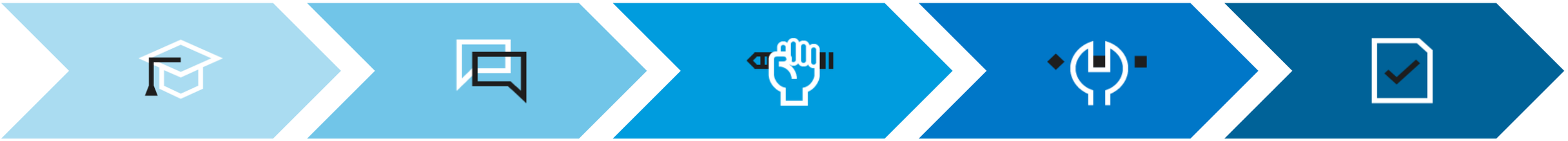
Jason VanBilliard

Course Research and Design

Higher Education Research
Syllabi analyses, major requirements, course transfer competencies, textbook analyses.

Advisory Board and Writing Team
Content development committees consisting of college faculty and experienced high school teachers.

Pacing and Confidence Study
Vetting framework content, skills complexity, and pacing.

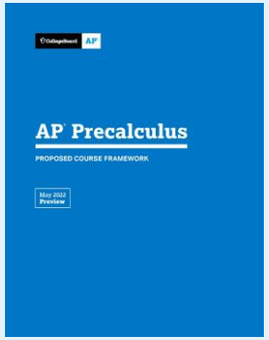


Faculty Input
Conversations with individual faculty, small-group academic conversations, content surveys.

AP Framework and Exam Structure
Building from best practices for AP course design (140-day framework, leveraging AP skill categories, utilizing AP question performance data, project design).

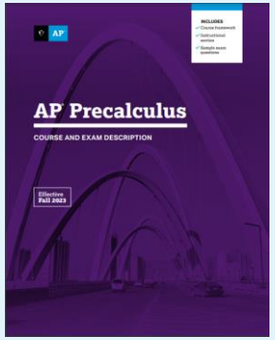
NOW AVAILABLE IN 2023-24

AP Precalculus



Spring 2022

AP course framework available.



Spring 2023

AP course and exam description available.

Spring 2023

AP Course Audit opens for teachers to begin submitting their syllabus.

Summer 2023

AP Summer Institutes offer AP Precalculus for teachers.

Fall 2023

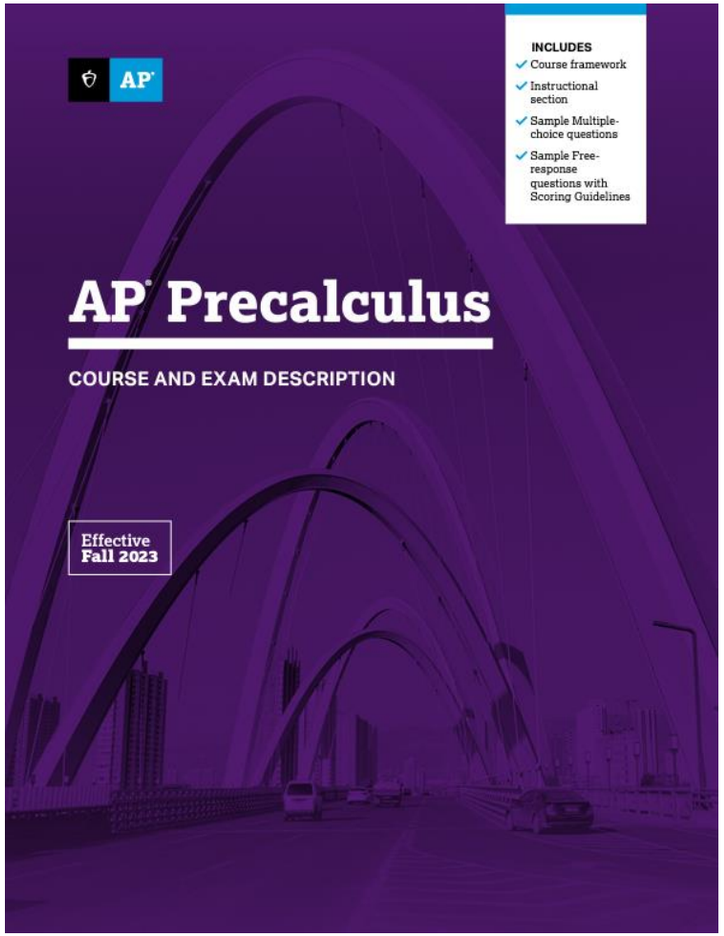
High schools can offer AP Precalculus in the 2023-24 academic year.

May 2024

First AP Precalculus Exam given.

Course Framework

Each Learning Objective/Essential Knowledge pair can potentially be taught and measured from the perspective of each of the eight skills.



1

Content

2

Skills

Precalculus Unit Structure (Content)

01 Polynomial and Rational Functions

02 Exponential and Logarithmic Functions

03 Trigonometric and Polar Functions

04 *Functions Involving Parameters, Vectors, and Matrices

Unit Overview

- **Units 1–3 topics will be tested on the AP Precalculus Exam.**
- **Unit 4 topics are included based on local discretion and local requirements.**

Unit 1	Polynomial and Rational Functions
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
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

Unit 3	Trigonometric and Polar Functions
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

Local discretion.

Unit 4	Functions Involving Parameters, Vectors, and Matrices
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

Unit 4 will <u>not</u> be tested on the AP Precalculus Exam.

Precalculus Skills and Mathematical Practices

PRACTICE 1	PRACTICE 2	PRACTICE 3
Procedural and Symbolic Fluency *Algebraically manipulate functions, equations, and expressions.*	**Multiple Representations** *Translate mathematical information between representations.*	**Communication and Reasoning** *Communicate with precise language, and provide rationales for conclusions.*
• **Skill 1.A: Solve equations and inequalities** represented analytically, with and without technology. • **Skill 1.B: Express** functions, equations, or expressions in analytically **equivalent forms** that are useful in a given mathematical or applied context. • **Skill 1.C: Construct new functions**, using transformations, compositions, inverses, or regressions, that may be useful in modeling contexts, criteria, or data, with and without technology.	• **Skill 2.A: Identify information from** graphical, numerical, analytical, and verbal **representations** to answer a question or construct a model, with and without technology. • **Skill 2.B: Construct equivalent** graphical, numerical, analytical, and verbal **representations** of functions that are useful in a given mathematical or applied context, with and without technology.	• **Skill 3.A: Describe** the **characteristics** of a function with varying levels of precision, depending on the function representation and available mathematical tools. • **Skill 3.B: Apply** numerical **results** in a given mathematical or applied context. • **Skill 3.C: Support conclusions** or choices with a logical rationale or appropriate data.

Topic Pages

Supports for Instructional Planning

Skills Focus

Learning Objective

Topic

Essential Knowledge

TOPIC 1.1

Change in Tandem

Skills Focus: 2.B, 3.A

LEARNING OBJECTIVES	ESSENTIAL KNOWLEDGE
1.1.A Describe how the input and output values of a function vary together by comparing function values.	▪ **1.1.A.1** A *function* is a mathematical relation that maps a set of input values to a set of output values such that each input value is mapped to exactly one output value. The set of input values is called the *domain* of the function, and the set of output values is called the *range* of the function. The variable representing input values is called the *independent variable*, and the variable representing output values is called the *dependent variable*. ▪ **1.1.A.2** The input and output values of a function vary in tandem according to the *function rule*, which can be expressed graphically, numerically, analytically, or verbally. ▪ **1.1.A.3** A function is increasing over an interval of its domain if, as the input values increase, the output values always increase. That is, for all a and b in the interval, if $a<b$, then $f(a)<f(b)$. ▪ **1.1.A.4** A function is decreasing over an interval of its domain if, as the input values increase, the output values always decrease. That is, for all a and b in the interval, if $a<b$, then $f(a)>f(b)$.
1.1.B Construct a graph representing two quantities that vary with respect to each other in a contextual scenario.	▪ **1.1.B.1** The graph of a function displays a set of input-output pairs and shows how the values of the function's input and output values vary. ▪ **1.1.B.2** A verbal description of the way aspects of phenomena change together can be the basis for constructing a graph. ▪ **1.1.B.3** The graph of a function is *concave up* on intervals in which the rate of change is increasing. ▪ **1.1.B.4** The graph of a function is *concave down* on intervals in which the rate of change is decreasing. ▪ **1.1.B.5** The graph intersects the *x*-axis when the output value is zero. The corresponding input values are said to be *zeros of the function*.

Course Emphases

01 Functions

02 Modeling

03 Symbolic Manipulation

04 Covariation

AP Calculus Connections

Stephanie Ogden

AP Precalculus Fits Into All the Common Math Pathways

Most students will take AP Precalculus as seniors, but some will take it earlier in preparation for AP Calculus AB or BC.

<table>
<tr><th>Year 1</th><th>Year 2</th><th>Year 3</th><th>Year 4</th><th>Year 5+</th></tr>
<tr><td rowspan="5">Algebra 1</td><td rowspan="3">Geometry</td><td rowspan="3">Algebra 2</td><td>AP Precalculus*</td><td>AP Calculus AB*
AP Calculus BC*^
AP Statistics*</td></tr>
<tr><td>AP Statistics</td><td>AP Calculus AB
AP Calculus BC
AP Precalculus</td></tr>
<tr><td>AP Calculus AB</td><td>AP Calculus BC
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<tr><td>Algebra 2</td><td>Geometry</td><td>AP Precalculus*
AP Calculus AB
AP Statistics</td><td>AP Calculus AB*
AP Calculus BC*^
AP Statistics*</td></tr>
<tr><td>Geometry and
Algebra 2</td><td>AP Precalculus*
AP Statistics
AP Calculus AB</td><td>AP Calculus AB*
AP Calculus BC*^
AP Statistics</td><td>AP Calculus AB
AP Calculus BC
AP Statistics*</td></tr>
</table>

* Represents an anticipated sequence for most students on this pathway.
^ It is anticipated that a higher percentage of students may pursue AP Calculus BC having had AP Precalculus due to topic coverage not found in some precalculus courses.

Note: The **Pre-AP** course sequence is Pre-AP Algebra 1, Pre-AP Geometry with Statistics, Pre-AP Algebra 2.

Covariational Reasoning

Why is attrition so high from precalculus to calculus?

What do students need that many are currently missing?

- Quantitative and Covariational reasoning—considering how two quantities in a dynamic situation change together
  - A graph is not static but represents two quantities changing in tandem (see Topic 1.1)
- Understanding of key ideas:
  - Process view of a function (a mapping of inputs from the domain to outputs in the range)
  - Average rate of change on an interval of a function's domain (see Topic 1.3)
  - Proportional reasoning and modeling (see Topics 1.14, 2.1-2.3, 2.5, 2.11, and 2.14)
  - Central ideas of trigonometry and fluency reasoning in radians

Carlson, M.P., Madison, B., & West, R.D. (2015). A Study of Students' Readiness to Learn Calculus. Int. J. Res. Undergrad. Math. Ed (2015) 1:209-233. DOI 10.1007/s40753-015-0013-y

Preparation for STEM and STEM-Related Courses (in addition to Calculus)

- Well-developed proportional reasoning ability facilitates modeling in a wide range of STEM and STEM-related courses. For example:
  - Motion problems in Physics
  - Stoichiometry and reaction rates in Chemistry
  - Exponential and logistic models in Biology, Ecology, and life sciences
  - More generally, linear relationships between various powers or logarithms of one or both variables informs modeling in most quantitative sciences.
- Modeling with data sets, Statistics, and STEM courses that apply Statistics
  - Regressions
  - Analysis of residuals

AP Precalculus Course Emphases and AP Calculus

01 Functions

02 Modeling

03 Symbolic Manipulation

04 Covariation

Functions and Modeling

- Practice 1: Procedural and Symbolic Fluency
  - Composition (and transformation) of functions, the chain rule and *u*-substitution.
  - Inverse functions and solving equations lead to differentiation and integration of general and particular inverse functions, solving differential equations, and specific models (exponential and logarithmic)
- Trigonometry and Polar Coordinates (Unit 3)--changing in tandem
  - Supports mastery of precalculus by revisiting function concepts from a new perspective
  - Native radian thinkers
- Parametric and Vector-Valued functions and motion in the plane (Unit 4 additional—planar motion)
  - Supports learning of physics, as well as Calculus BC

Practice 1

Procedural and Symbolic Fluency 1

Algebraically manipulate functions, equations, and expressions.

SKILLS

1.A **Solve equations and inequalities** represented analytically, with and without technology.

1.B **Express** functions, equations, or expressions in analytically **equivalent forms** that are useful in a given mathematical or applied context.

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

Functions and Modeling

Practice 2: Multiple Representations

- Interpreting, constructing, and using a variety of representations (graphical, numerical, analytical, and verbal) along with application of function types in diverse contexts enriches the study of precalculus.
- Precalculus practice with modeling supports learning and understanding of applied calculus (e.g., drawing and supporting conclusions based on model behaviors, including relationships among *f*, *f '*, and *f ”*).
- Precalculus practice with modeling supports learning and understanding of statistics (e.g., regressions and their analysis) and courses that use statistics.

Practice 2

Multiple Representations 2

Translate mathematical information between representations.

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

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

Symbolic Manipulation

Throughout this course, students develop and hone symbolic manipulation skills needed for future mathematics courses.

For example, consider the course's introduction of limit notation (at right).

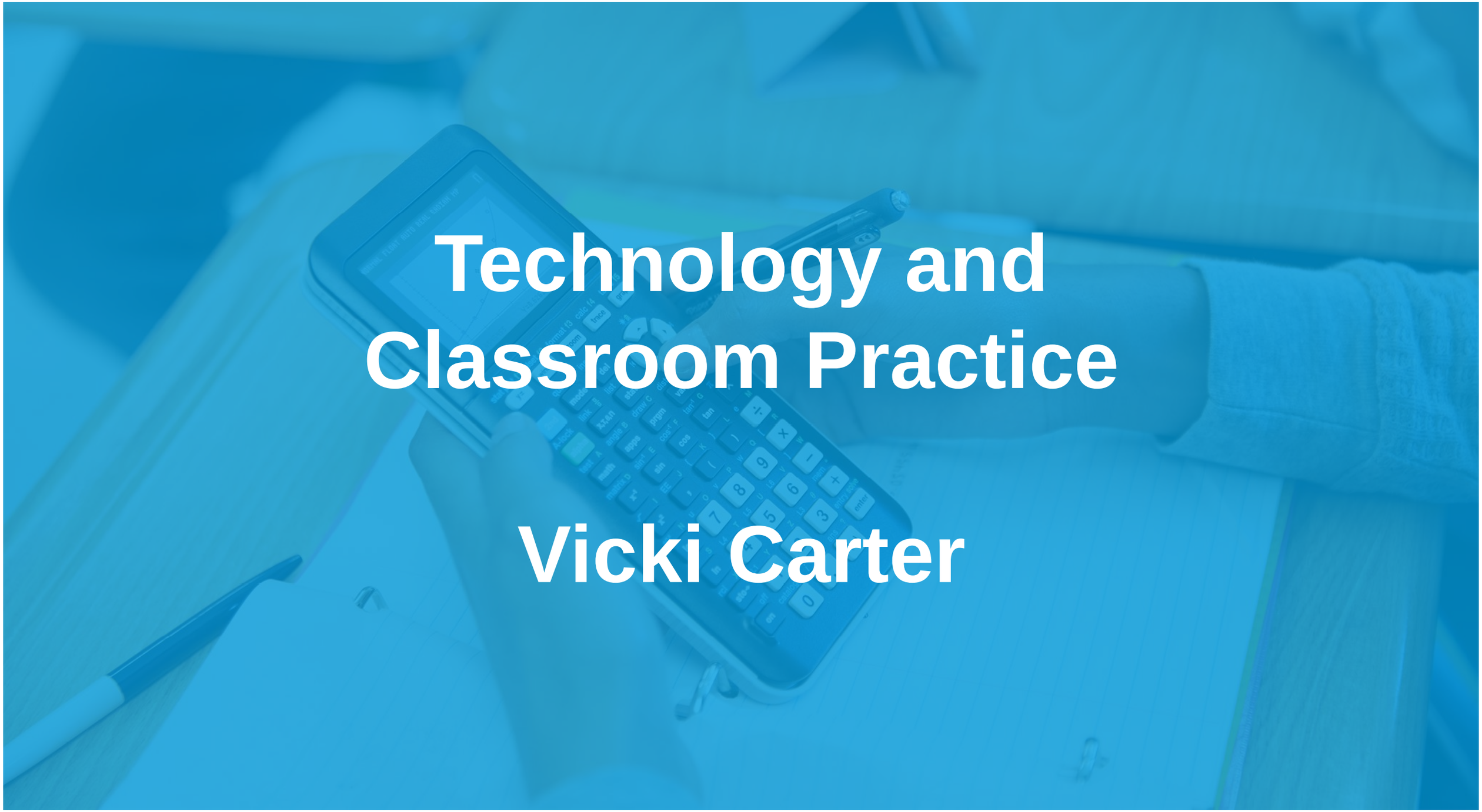
Development of the limit concept in Calculus will be natural with this preparation.

TOPIC 1.6

Polynomial Functions and End Behavior

Skills Focus: 3.A

LEARNING OBJECTIVES	ESSENTIAL KNOWLEDGE
1.6.A Describe end behaviors of polynomial functions.	▪ **1.6.A.1** As input values of a nonconstant polynomial function increase without bound, the output values will either increase or decrease without bound. The corresponding mathematical notation is $\lim_{x\to\infty} p(x)=\infty$ or $\lim_{x\to\infty} p(x)=-\infty$. ▪ **1.6.A.2** As input values of a nonconstant polynomial function decrease without bound, the output values will either increase or decrease without bound. The corresponding mathematical notation is $\lim_{x\to-\infty} p(x)=\infty$ or $\lim_{x\to-\infty} p(x)=-\infty$. ▪ **1.6.A.3** The degree and sign of the leading term of a polynomial determines the end behavior of the polynomial function, because as the input values increase or decrease without bound, the values of the leading term dominate the values of all lower-degree terms.



Technology and Classroom Practice

Vicki Carter

Many investigations in Unit 1 help students make connections to important concepts

- Exploring graphs of polynomial functions and the roles of zeros with multiplicity
- Exploring asymptotes of graphs of rational functions
- Observing intervals on which the graph of the function increases or decreases
- Observing the concavity of the graph of a function

Explorations with TI technology

- Transformations of functions is important in all the Units of the course.
- The TI-84 has a built-in application called Transfrm.
- The TI-Nspire allows the use of sliders in the graphing application.

Using handheld technology

- Students should use the same calculator in class and at home that they will use on the exam.
- Teachers should have a means of demonstrating/projecting the calculator in the classroom.

Role of Handheld Technology

- Exploration
- Confirm equivalences, asymptotes
- Calculations such as rational exponents, logarithms, trig values
- Graphing to find zeros and intersection points
- Regressions and residual plots

Technology Needs (from the *CED*)

Technology should be used throughout the course as a tool to explore concepts.

Students should specifically practice using technology to do the following:

- Perform calculations (e.g., exponents, roots, trigonometric values, logarithms)
- Graph functions and analyze graphs
- Generate a table of values for a function
- Find real zeros of functions
- Find points of intersection of graphs of functions
- Find minima/maxima of functions
- Find numerical solutions to equations in one variable
- Find regressions equations to model data (linear, quadratic, cubic, quartic, exponential, logarithmic, and sinusoidal) and plot the corresponding residuals
- Perform matrix operations (e.g., multiplication, finding inverses)*

Important: Technology should not replace the development of symbolic manipulation skills.

- When algebraic expressions and equations are accessible with precalculus-level algebraic manipulation, students are expected to find zeros, solve equations, and calculate values without the help of technology.
- Most of the AP Exam will need to be completed without the use of technology. However, selected questions will require students to use a graphing calculator to complete the tasks delineated above.

Mathematical Practice 1

1.A **Solve equations and inequalities** represented analytically, with and without technology.

1.B **Express** functions, equations, or expressions in analytically **equivalent forms** that are useful in a given mathematical or applied context.

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

Using Technology

Mathematical Practice 2

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

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

Using Technology

Mathematical Practice 3

3.A **Describe** the **characteristics** of a function with varying levels of precision, depending on the function representation and available mathematical tools.

3.B **Apply** numerical **results** in a given mathematical or applied context.

3.C **Support conclusions** or choices with a logical rationale or appropriate data.

Using Technology

Resources

- TI-84 premade activities – 84 Activity Central
- TI-Nspire premade activities – TI MathNspired
- Mixed Six activities
- Circuits

AP Exam Design

Craig Wright

AP Precalculus Exam Structure

2024 AP Exam Date: Monday May 13 (PM)

2024 AP Exam Late Testing Date: Thursday May 23 (AM)

Assesses student understanding of mathematical practices and learning objectives from Units 1-3.
Unit 4 will not be assessed on the AP Precalculus Exam.

Section	Question Type	Number of Questions	Exam Weighting	Timing
I	**Multiple-Choice**			
	Part A: No calculator is permitted	28	43.75%	80 minutes
	Part B: Graphing calculator required	12	18.75%	40 minutes
II	**Free-Response**			
	Part A: Graphing calculator required	2	18.75%	30 minutes
	Part B: No calculator is permitted	2	18.75%	30 minutes

Mathematical Practices and Skills

Practice/Skill	Exam Weighting
Practice 1: Procedural and Symbolic Fluency	
1.A: Solve equations and inequalities	14–17%
1.B: Express equivalent forms	9–13%
1.C: Construct new functions	15–19%
Practice 2: Multiple Representations	
2.A: Identify information from representations	14–17%
2.B: Construct equivalent representations	6–9%
Practice 3: Communication and Reasoning	
3.A: Describe characteristics	10–14%
3.B: Apply results	9–13%
3.C: Support conclusions	13%

AP Precalculus Exam: Multiple-Choice

- Includes different function **representations** (graphical, numerical, analytical, verbal)
- Includes questions in a real-world context
- Includes questions involving modeling (determining a function expression)
- Function **types** are weighted as follows.
  - General Functions (non-analytical): 15-23%
  - Polynomial and Rational Functions: 20-25%
  - Exponential and Logarithmic Functions: 22-28%
  - Trigonometric and Polar Functions: 30-35%
- Angle measures for trigonometric functions are assumed to be in **radians**.

AP Precalculus Exam: Multiple-Choice

- **Part A**: Includes algebraic manipulation. For example, students are expected to find zeros, solve equations, and calculate values without the help of technology.
  - Factoring polynomials: factoring out common factor, rules for quadratics
  - Rules for exponents and logarithms
  - Transformations of functions
  - Values of trigonometric functions (for example, Topic 3.3)
  - Pythagorean identities; sum, difference, and double-angle identities for sine and cosine
- **Part B**: Only some questions require the use of the graphing calculator.
  - **Radian** mode
  - Vicki's Technology Needs slide (*AP Precalculus CED*, page 7)
  - Graphing calculators with the required capabilities for AP Precalculus https://apcentral.collegeboard.org/courses/ap-precalculus/exam/graphing-calculators

AP Precalculus Exam: Free-Response

- There are 4 **six-point** free-response questions, each weighted equally and scored on an analytic scale.
- Each free-response question has 3 parts: (A), (B), (C).
- The *AP Precalculus CED* provides an example of each question type. The *CED* is available on AP Central and in AP Classroom.
- Scoring guidelines are available in the *CED* and in AP Classroom.
- A walk-through video for teachers is available for each *CED* free-response question in AP Classroom. These videos provide great information!

AP Precalculus Exam: Free-Response

Part A: Graphing Calculator

FRQ 1: Function Concepts

Unit Focus: 1, 2

Skills: 1.A, 1.C, 2.A, 3.A, 3.C

FRQ 2: Modeling a Non-Periodic Context

Unit Focus: 1, 2

Skills: 1.B, 1.C, 3.B, 3.C

Part B: No Calculator

FRQ 3: Modeling a Periodic Context

Unit Focus: 3

Skills: 1.C, 2.A, 2.B, 3.A

FRQ 4: Symbolic Manipulations

Unit Focus: 2, 3

Skills: 1.A, 1.B

The following instructions will be provided to students for their AP Exam. Teachers are encouraged to **share and discuss these with students** so that students understand the requirements for the AP Exam.

General Instructions

- Show all of your work. Your work will be scored on the correctness and completeness of your responses, including your supporting work and answers. Answers without supporting work may not receive credit in cases where supporting work is requested.
- During Part A, work only on questions 1 and 2. You are expected to use your graphing calculator for tasks such as producing graphs and tables, evaluating functions, solving equations, and performing computations.
- **For Part A, your calculator must be in radian mode.** Avoid rounding intermediate computations on the way to the final result. Unless otherwise specified, any decimal approximations reported in your work should be accurate to three places after the decimal point.
- For Part A, it may be helpful to use your graphing calculator to store information such as computed values for constants, functions you are working with, solutions to equations, and any intermediate values. Computations with the graphing calculator that use the stored information help to maintain as much precision as possible and ensure the desired accuracy in final answers.
- During Part B, questions 3 and 4, no calculator is allowed. Carefully read the instructions provided with the questions. You may continue to work on questions 1 and 2 without the use of a calculator.
- Unless otherwise specified, the domain of a function f is assumed to be the set of all real numbers x for which $f(x)$ is a real number.

Task Verbs

The following task verbs are commonly used in the free-response questions:

- **Construct/write a function/expression/equation/model:** Develop an analytical representation, with and without technology, that is consistent with a scenario, data set, or other criteria.
- **Describe:** Develop a verbal representation that is consistent with a scenario, data set, function representation, or other criteria.
- **Determine/Find/Identify:** Apply appropriate methods or processes for answering a question.
- **Estimate/Compare:** Use a function representation to find approximate values and/or compare results.
- **Explain/Give a reason/Provide a rationale/Justify:** Use information from the scenario or function representation to provide reasons or rationales for solutions or conclusions.
- **Express/Indicate:** Provide information or a result in a desired form or include units as part of the answer to a question.
- **Interpret:** Describe the connection between a mathematical expression or solution and its meaning within the realistic context of a problem, often including consideration of units.
- **Plot and label, sketch and label:** Develop a graphical representation that is consistent with a scenario, data set, or other criteria.
- **Rewrite:** Apply appropriate methods to determine/find equivalent analytical representations of an expression.
- **Solve:** Apply appropriate methods to determine/find solutions to an equation or inequality.

Task Verbs represent the types of actions that students will be asked to take in each part of the free-response questions on the AP Precalculus Exam.

These task verbs are also seen in the language of the **learning objectives** in the course framework and the **mathematical practices (skills)**. The more students practice these throughout the school year, the more comfortable they will be with them on the AP Exam.

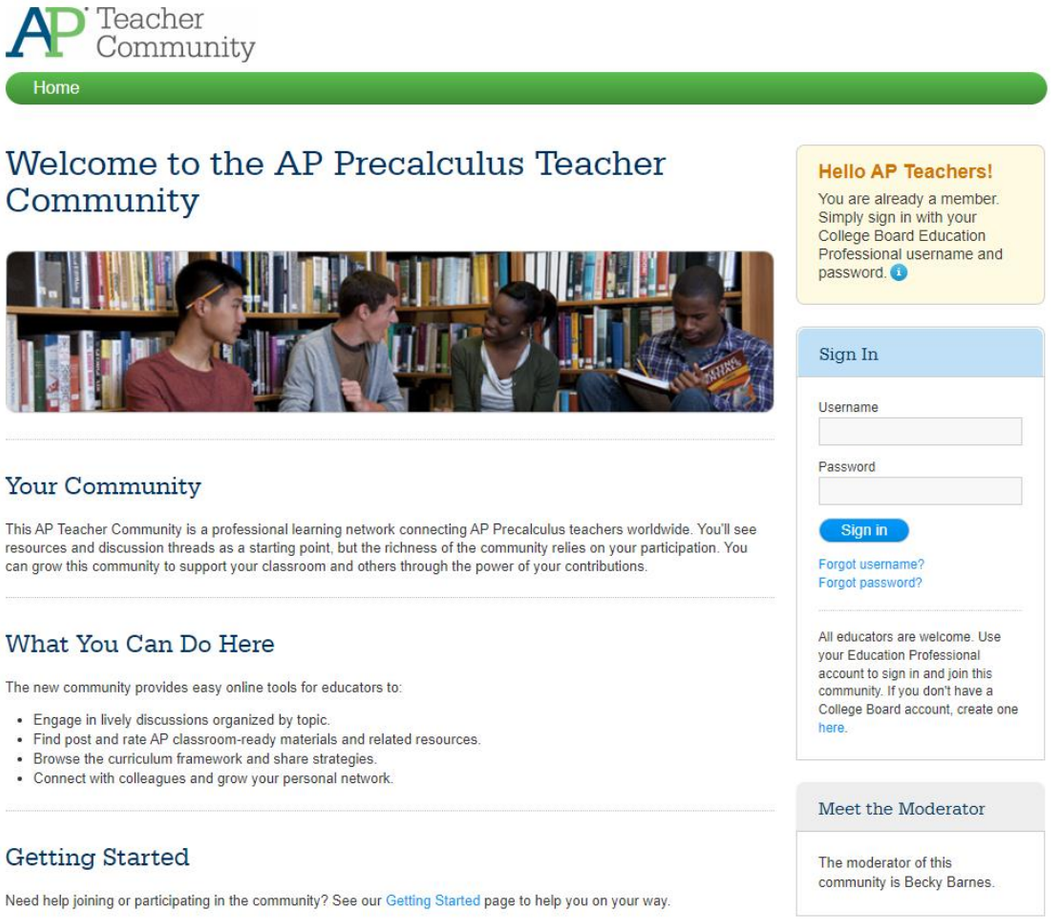
Teachers are encouraged to **use these task verbs in their instruction** starting from day 1 of the course so that students receive multiple opportunities to demonstrate the appropriate methods and reasoning that they'll be expected to show on the AP Exam.

2024 AP Precalculus Reading

- Apply to be a reader:
  https://apcentral.collegeboard.org/professional-development/become-an-ap-reader
- All AP Precalculus Course Audit-authorized high school teachers who are actively teaching are welcome to apply regardless of years of teaching experience.
- College faculty must be active faculty who teach Precalculus, College Algebra with Trigonometry, Calculus, or a mathematics course for which one of these courses is a prerequisite.
- Current AP Calculus or AP Statistics readers who are interested in **switching** to AP Precalculus, please contact APReader@ets.org. A reader can only be in the Reader pool for one subject.
- *Reading Dates*: June 11-17, 2024
  - In-person readers: Kansas City, MO Convention Center (same session as Calculus)
  - Distributed readers: Online from home

Join the AP Precalculus Teacher Community

https://apcommunity.collegeboard.org/web/apprecalculus/home



AP Classroom

- AP Daily Videos for all Topics in Units 1, 2, 3, and 4
- Exploration of FRQs from CED (1 video for each FRQ)
- Content Deep-Dive Videos for AP Precalculus Teachers
  - Covariational Reasoning
  - Modeling
  - Semi-Log Plots
  - Polar Functions
  - Parametric Equations and Vector-Valued Functions
  - Vectors
  - Matrices as Functions
- **Progress Checks (MCQs and FRQs) for Units 1, 2, and 3** (Unit 4: late 2023)
- **Topic Questions (MCQs) for Units 1, 2, and 3** (Unit 4: late 2023)
- **Practice Exams**
  - **Practice Exam 1: MCQs available now** (also available on AP Central)
  - **Practice Exam 1: FRQs (available January 2024)**
  - **Practice Exams 2 and 3 (available February 2024)**
- ***CED* MCQs and FRQs**

Thank You!

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