2024-2025

Rapid City
Central High School

AP Precalculus

RCAS Policies/Procedures:

Students will be required to follow all RCAS policies and procedures. To view the RCAS High School Student Handbook, click handbook.

Course Description:

AP Precalculus prepares a college-bound student for their first course in calculus. The course includes the study of advanced functions, including polynomial, exponential, logarithmic, trigonometric, and circular functions. Students will study the algebraic relationships between these functions, their graphs, and transformations of these functions. Students will also be introduced to the concepts of limits.

Textbook:

Precalculus with Trigonometry – Forester (2012)

Required Resources:

AP Classroom – www.apclassroom.collegeboard.org

"Limited Choice" Resources: (students will be asked to choose at least one title from this list)

Student Choice:

Will student be asked to choose additional reading material from the classroom or school library?

No

Essential Questions:

What does it look like to demonstrate procedural and symbolic fluency?

What does it look like to show multiple representations?

What does it look like for students to communicate and reason?

Essential Learning Intentions:

Unit 1 – Polynomial and Rational Functions

- 1.1 – Change in Tandem
- 1.1.A – Describe how the input and output values of a function vary together by comparing function values.
- 1.1.B – Construct a graph representing two quantities that vary with respect to each other in a contextual scenario.
- 1.2 – Rates of Change
- 1.2.A – Compare the rates of change at two points using average rates of change near the points.
- 1.2.B – Describe how two quantities vary together at different points and over different intervals of a function.
- 1.3 – Rates of Change in Linear and Quadratic Functions
- 1.3.A – Determine the average rates of change for sequences and functions, including linear, and other function types.
- 1.3.B – Determine the change in the average rates of change for linear, quadratic, and other function types.
- 1.4 – Polynomial Functions and Rates of Change
- 1.4.A – Identify key characteristics of polynomial functions related to rates of change.
- 1.5 – Polynomial Functions and Complex Zeros
- 1.5.A – Identify key characteristics of a polynomial function related to its zeros when suitable factorizations are available or with technology.
- 1.5.B – Determine if a polynomial function is even or odd.
- 1.6 – Polynomial Functions and End Behavior
- 1.6.A – Describe end behaviors of polynomial functions.
- 1.7 – Rational Functions and End Behavior
- 1.7.A – Describe end behaviors of rational functions.
- 1.8 – Rational Functions and Zeros
- 1.8.A – Determine the zeros of rational functions.
- 1.9 – Rational Functions and Vertical Asymptotes
- 1.9.A – Determine vertical asymptotes of graphs of rational functions.
- 1.10 – Rational Functions and Holes
- 1.10.A – Determine holes in graphs of rational functions.
- 1.11 – Equivalent Representations of Polynomial and Rational Expressions
- 1.11.A – Rewrite polynomial and rational expressions in equivalent forms.
- 1.11.B – Determine the quotient of two polynomial functions using long division.
- 1.12 – Transformations of Functions
- 1.12.A – Construct a function that is an additive and/or multiplicative transformation of another function.

- 1.13 – Function Model Selection and Assumption Articulation
- 1.13.A – Identify an appropriate function type to construct a function model for a given scenario.
- 1.13.B – Describe assumptions and restrictions related to building a function model.
- 1.14 – Function Model Construction and Application
- 1.14.A – Construct a linear, quadratic, cubic, quartic, polynomial of degree n, or related piecewise-defined function model.
- 1.14.B – Construct a rational function model based on a context.
- 1.14.C – Apply a function model to answer questions about a data set or contextual scenario.

Unit 2 – Exponential and Logarithmic Functions

- 2.1 – Change in Arithmetic and Geometric Sequences
- 2.1.A – Express arithmetic sequences found in mathematical and contextual scenarios as functions of the whole numbers.
- 2.1.B – Express geometric sequences found in mathematical and contextual scenarios as functions of the whole numbers.
- 2.2 – Change in Linear and Exponential Functions
- 2.2.A – Construct functions of the real numbers that are comparable to arithmetic and geometric sequences.
- 2.2.B – Describe similarities and differences between linear and exponential functions.
- 2.3 – Exponential Functions
- 2.3.A – Identify key characteristics of exponential functions.
- 2.4 – Exponential Function Manipulation
- 2.4.A – Rewrite exponential expressions in equivalent forms.
- 2.5 – Exponential Function Context and Data Modeling
- 2.5.A – Construct a model for situations involving proportional output values over equal-length input-value intervals.
- 2.5.B – Apply exponential models to answer questions about a data set or contextual scenario.
- 2.6 – Competing Function Model Validation
- 2.6.A – Construct linear, quadratic, and exponential models based on a data set.
- 2.6.B – Validate a model constructed from a data set.
- 2.7 – Composition of Functions
- 2.7.A – Evaluate the composition of two or more functions for given values.
- 2.7.B – Construct a representation of the composition of two or more functions.
- 2.7.C – Rewrite a given function as a composition of two or more functions.
- 2.8 – Inverse Functions

- 2.8.A – Determine the input-output pairs of the inverse of a function.
- 2.8.B – Determine the inverse of a function on an invertible domain.
- 2.9 – Logarithmic Expressions
- 2.9.A – Evaluate Logarithmic expressions.
- 2.10 – Inverses of Exponential Functions
- 2.10.A – Construct representations of the inverse of an exponential function with an initial value of 1.
- 2.11 – Logarithmic Functions
- 2.11.A – Identify key characteristics of logarithmic functions.
- 2.12 – Logarithmic Function Manipulation
- 2.12.A – Rewrite logarithmic expressions in equivalent forms.
- 2.13 – Exponential and Logarithmic Equations and Inequalities
- 2.13.A – Solve exponential and logarithmic equations and inequalities.
- 2.13.B – Construct the inverse function for exponential and logarithmic functions.
- 2.14 – Logarithmic Function Context and Data Modeling
- 2.14.A – Construct a logarithmic function model.
- 2.15 – Semi-log Plots
- 2.15.A – Determine if an exponential model is appropriate by examining a semi-log plot of a data set.
- 2.15.B – Construct the linearization of exponential data.

Unit 3 – Trigonometric and Polar Functions

- 3.1 – Periodic Phenomena
- 3.1.A – Construct graphs of periodic relationships based on verbal representations.
- 3.1.B – Describe key characteristics of a periodic function based on a verbal representation.
- 3.2 – Sine, Cosine, and Tangent
- 3.2.A – Determine the sine, cosine, and tangent of an angle using the unit circle.
- 3.3 – Sine and Cosine Function Values
- 3.3.A – Determine coordinates of points on a circle centered at the origin.
- 3.4 – Sine and Cosine Function Graphs
- 3.4.A – Construct representations of the sine and cosine functions using the unit circle.
- 3.5 – Sinusoidal Functions
- 3.5.A – Identify key characteristics of the sine and cosine functions.
- 3.6 – Sinusoidal Function Transformations
- 3.6.A – Identify the amplitude, vertical shift, period, and phase shift of a sinusoidal function.
- 3.7 – Sinusoidal Function Context and Data Modeling
- 3.7.A – Construct sinusoidal function models of periodic phenomena.
- 3.8 – The Tangent Function

- 3.8.A – Construct representations of the tangent function using the unit circle.
- 3.8.B – Describe key characteristics of the tangent function.
- 3.8.C – Describe additive and multiplicative transformations involving the tangent function.
- 3.9 – Inverse Trigonometric Functions
- 3.9.A – Construct analytical and graphical representations of the inverse of the sine, cosine, and tangent functions over a restricted domain.
- 3.10 – Trigonometric Equations and Inequalities
- 3.10.A – Solve equations and inequalities involving trigonometric functions.
- 3.11 – The Secant, Cosecant, and Cotangent Functions
- 3.11.A – Identify key characteristics of functions that involve quotients of the sine and cosine functions.
- 3.12 – Equivalent Representations of Trigonometric Functions
- 3.12.A – Rewrite trigonometric expressions in equivalent forms with the Pythagorean identity.
- 3.12.B – Rewrite trigonometric expression in equivalent forms with sine and cosine sum identities.
- 3.12.C – Solve equations using equivalent analytic representations of trigonometric functions.
- 3.13 – Trigonometric and Polar Coordinates
- 3.13.A – Determine the location of a point in the plane using both rectangular and polar coordinates.
- 3.14 – Polar Function Graphs
- 3.14.A – Construct graphs of polar functions.
- 3.15 – Rates of Change in Polar Functions
- 3.15.A – Describe characteristics of the graph of a polar function.

Unit 4 – Functions Involving Parameters, Vectors, and Matrices

- 4.1 – Parametric Functions
- 4.1.A – Construct a graph or table of values for a parametric function represented analytically.
- 4.2 – Parametric Functions Modeling Planar Motion
- 4.2.A – Identify key characteristics of a parametric planar motion function that are related to position.
- 4.3 – Parametric Functions and Rates of Change
- 4.3.A – Identify key characteristics of a parametric planar motion function that are related to direction and rate of change.
- 4.4 – Parametrically Defined Circles and Lines
- 4.4.A – Express motion around a circle or along a line segment parametrically.
- 4.5 – Implicitly Defined Functions
- 4.5.A – Construct a graph of an equation involving two variables.

- 4.5.B – Determine how the two quantities related in an implicitly defined function vary together.
- 4.6 – Conic Sections
- 4.6.A – Represent conic sections with horizontal or vertical symmetry analytically.
- 4.7 – Parametrization of Implicitly Defined Functions
- 4.7.A – Represent a curve in the plane parametrically.
- 4.7.B – Represent conic sections parametrically.
- 4.8 – Vectors
- 4.8.A – Identify characteristics of a vector.
- 4.8.B – Determine sums and products involving vectors.
- 4.8.C – Determine a unit vector for a given vector.
- 4.8.D – Determine angle measures between vectors and magnitudes of vectors involved in vector addition.
- 4.9 – Vector-Values Functions
- 4.9.A – Represent planar motion in terms of vector-valued functions.
- 4.10 – Matrices
- 4.10.A – Determine the product of two matrices.
- 4.11 – The Inverse and Determinant of a Matrix
- 4.11.A – Determine the inverse of a 2x2 matrix.
- 4.11.B – Apply the value of the determinant to invertibility and vectors.
- 4.12 – Linear Transformations and Matrices
- 4.12.A – Determine the output vectors of a linear transformation using a 2x2 matrix.
- 4.13 – Matrices as Functions
- 4.13.A – Determine the association between a linear transformation and a matrix.
- 4.13.B – Determine the composition of two linear transformations.
- 4.13.C – Determine the inverse of a linear transformation.
- 4.14 – Matrices Modeling Contexts
- 4.14.A – Construct a model of a scenario involving transitions between two states using matrices.
- 4.14.B – Apply matrix models to predict future and past states for n transition steps.