

The Correlation of PLATO® instructional curricula to California Academic Content Standards (CACCS)

Mathematics

Grade 8–12

Calculus

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PLATO Learning Correlation to the California Academic Content Standards

INTRODUCTION

PLATO Learning, Inc. combines PLATO® computer-assisted instruction into a flexible, integrated learning system to enhance instructional effectiveness in education programs. This document identifies PLATO® instructional activities that correlate to the California Academic Content Standards, Mathematics, Grade 8–12, Calculus.

It is recommended that instructors review the correlation in order to fine-tune the activity to fit their educational environment. Modules may be added or removed; web sites and offline activities may also be incorporated to enhance the learning path.

The following PLATO® courseware was used in this alignment:

- PLATO® Algebra 1, Part 1 and 2
- PLATO® Algebra 2, Part 1 and 2
- PLATO® Geometry and Measurement 1 and 2
- PLATO® Trigonometry
- PLATO® Calculus 1 and 2
- PLATO® Quality Fundamentals

PLATO Learning, Inc. looks forward to supporting your initiatives in providing successful educational programs using PLATO® computer-based lessons.

1.0 Students demonstrate knowledge of both the formal definition and the graphical interpretation of limit of values of functions. This knowledge includes one-sided limits, infinite limits, and limits at infinity. Students know the definition of convergence and divergence of a function as the domain variable approaches either a number or infinity.

1.1 Students prove and use theorems evaluating the limits of sums, products, quotients, and composition of functions.

PLATO Calculus 1

- Limits 1
- Limits of Rational--Tutorial
- Limits of Rational--Exercise
- Limits at Infinity--Tutorial
- Limits at Infinity--Exercises
- Limits 2
- Use of Limit Theorems--Tutorial

1.2 Students use graphical calculators to verify and estimate limits.

PLATO Calculus 1

- Limits 1
- Introduction to Limits--Tutorial
- Introduction to Limits--Exercises

1.3 Students prove and use special limits, such as the limits of $(\sin(x))/x$ and $(1-\cos(x))/x$ as x tends to 0.

PLATO Calculus 1

- Limits 1
- Limits at Infinity--Tutorial
- Limits at Infinity--Exercises
- Limits 2
- Use of Limit Theorems--Tutorial

2.0 Students demonstrate knowledge of both the formal definition and the graphical interpretation of continuity of a function.

PLATO Calculus 1

- Limits 2
- Continuity--Tutorial
- Continuity--Exercises

4.0 Students demonstrate an understanding of the formal definition of the derivative of a function at a point and the notion of differentiability.

4.1 Students demonstrate an understanding of the derivative of a function as the slope of the tangent line to the graph of the function.

PLATO Calculus 1

- The Derivative
- Derivative: Approximate Rates and Definition--Tutorial
- Derivative: Approximate Rates and Definition--Exercises
- Derivative: Instantaneous Rates--Exercises
- Tangent Line Approximation and Differentials
- Tangent Line Approximation--Tutorial
- Tangent Line Approximation--Exercises

4.2 Students demonstrate an understanding of the interpretation of the derivative as an instantaneous rate of change. Students can use derivatives to solve a variety of problems from physics, chemistry, economics, and so forth that involve the rate of change of a function.

PLATO Calculus 1

- The Derivative
- Derivative: Approximate Rates and Definition--Tutorial
- Derivative: Approximate Rates and Definition--Exercises

- Derivative: Instantaneous Rates--Exercises
- Tangent Line Approximation and Differentials
- Tangent Line Approximation--Tutorial
- Tangent Line Approximation--Exercises

4.3 Students understand the relation between differentiability and continuity.

PLATO Calculus 1

- General Properties of Continuous Differentiable Functions
- Basic Theorems--Tutorial
- Basic Theorems--Exercises

4.4 Students derive derivative formulas and use them to find the derivatives of algebraic, trigonometric, inverse trigonometric, exponential, and logarithmic functions.

PLATO Calculus 1

- The Derivative
- Derivative: Approximate Rates and Definition--Tutorial
- Derivative: Approximate Rates and Definition--Exercises
- Techniques of Differentiation
- Differentiation of Polynomials--Tutorial
- Differentiation of Polynomials--Exercises
- The Second Derivative--Tutorial
- The Second Derivative--Exercises

- Derivatives of Trigonometric Functions
- Differentiation of Trigonometric Functions--Tutorial
- Differentiation of Trigonometric Functions--Exercises

PLATO Calculus 2

- Introduction to Inverse Functions
- Derivatives of Inverse Functions
- Inverse Trigonometric Functions
- The Arcsine Function
- The Arctangent Function
- Other Logarithm and Exponential Functions
- Properties of Graphs...Logarithm Functions

5.0 Students know the chain rule and its proof and applications to the calculation of the derivative of a variety of composite functions.

PLATO Calculus 1

- Chain Rule and Related Rates
- Derivatives of Composite Functions--Tutorial
- Derivatives of Composite Functions--Exercises

- More on the Chain Rule--Tutorial
- More on the Chain Rule--Exercises
- Related Rates--Tutorial
- Related Rates--Exercises

6.0 Students find the derivatives of parametrically defined functions and use implicit differentiation in a wide variety of problems in physics, chemistry, economics, and so forth.

PLATO Calculus 1

- Chain Rule and Related Rates
- Implicit Differentiation--Tutorial
- Implicit Differentiation--Exercises

7.0 Students compute derivatives of higher orders.

PLATO Calculus 1

- Techniques of Differentiation
- The Second Derivative--Tutorial
- The Second Derivative—Exercises

8.0 Students know and can apply Rolle's theorem, the mean value theorem, and L'Hopital's rule.

PLATO Calculus 2

- L'Hopital's Rule
- L'Hopital's Rule
- Further Indeterminate Forms
- Improper Integrals
- Improper Integrals

9.0 Students use differentiation to sketch, by hand, graphs of functions. They can identify maxima, minima, inflection points, and intervals in which the function is increasing and decreasing.

PLATO Calculus 1

- Applications of the First Derivative
- The Behavior of a Function--Tutorial
- The Behavior of a Function--Exercises
- Finding Max and Min of Functions—
Tutorial
- Finding Max and Min of Functions—
Exercises

- Applications of the Second Derivative
- Concavity--Tutorial
- Concavity--Exercise
- Graphing Rational Functions--Tutorial
- Graphing Rational Functions--Exercises
- Narrative Max-Min Problems--Tutorial
- Narrative Max-Min Problems—
Exercises

11.0 Students use differentiation to solve optimization (maximum-minimum problems) in a variety of pure and applied contexts.

PLATO Calculus 1

- Applications of the Second Derivative
- Narrative Max-Min Problems--Tutorial
- Narrative Max-Min Problems--Exercises

12.0 Students use differentiation to solve related rate problems in a variety of pure and applied contexts.

PLATO Calculus 1

- The Derivative
- Derivative: Instantaneous Rates—
Tutorial
- Derivative: Instantaneous Rates—
Exercises

- Techniques of Differentiation
- Uses of the First Derivative--Tutorial
- Uses of the First Derivative--Exercises
- Chain Rule and Related Rates
- Related Rates--Tutorial
- Related Rates—Exercises

13.0 Students know the definition of the definite integral by using Riemann sums. They use this definition to approximate integrals.

PLATO Calculus 1

- The Definite Integral
- Introduction to the Definite Integral:
Definition--Tutorial
- Introduction to the Definite Integral:

- Definition--Exercises
- PLATO Calculus 2**
- Numerical Integration
- Riemann Sums and the Trapezoidal
Rule

14.0 Students apply the definition of the integral to model problems in physics, economics, and so forth, obtaining results in terms of integrals.

PLATO Calculus 1

- Physical Applications of the Definite Integral
- Work Done by Moving or Stretching—Tutorial
- Work Done by Moving or Stretching—Exercises
- Work Done by Lifting or Pumping—Tutorial

- Work Done by Lifting or Pumping—Exercises
- Force Due to Hydrostatic Pressure—Tutorial
- Force Due to Hydrostatic Pressure—Exercises
- Center of Mass--Tutorial
- Center of Mass—Exercises

15.0 Students demonstrate knowledge and proof of the fundamental theorem of calculus and use it to interpret integrals as anti-derivatives.

PLATO Calculus 1

- The Fundamental Theorem
- The Fundamental Theorem of Calculus--Tutorial
- The Fundamental Theorem of Calculus--

- Exercises
- Derivatives of Integrals with Functions as Limits--Tutorial
- Derivatives of Integrals with Functions as Limits—Exercises

16.0 Students use definite integrals in problems involving area, velocity, acceleration, volume of a solid, area of a surface of revolution, length of a curve, and work.

PLATO Calculus 1

- Geometrical Application of the Definite Integral
- Area Between Curves--Tutorial
- Area Between Curves--Exercises
- Volumes of Solids of Revolution by the Method of Disks--Tutorial
- Volumes of Solids of Revolution by the Method of Disks--Exercises
- Volumes of Solids of Revolution by the Method of Shells--Tutorial
- Volumes of Solids of Revolution by the Method of Shells--Exercises
- Physical Applications of the Definite Integral
- Work Done by Moving or Stretching—

- Tutorial
- Work Done by Moving or Stretching—Exercises
- Work Done by Lifting or Pumping—Tutorial
- Work Done by Lifting or Pumping—Exercises
- Force Due to Hydrostatic Pressure—Tutorial
- Force Due to Hydrostatic Pressure—Exercises
- Center of Mass--Tutorial
- Center of Mass--Exercises

PALTO Calculus 2

- Lengths of Curves
- Lengths of Graphs and Functions

17.0 Students compute, by hand, the integrals of a wide variety of functions by using techniques of integration, such as substitution, integration by parts, and trigonometric substitution. They can also combine these techniques when appropriate.

PLATO Calculus 1

- The Indefinite Integral
- Integration by Substitution--Tutorial
- Integration by Substitution--Exercises

PLATO Calculus 2

- Integration by Substitution and by Parts
- Integration by Substitution

- Integration by Parts
- Techniques of Integration Involving Trigonometric Functions
- Integration by Trigonometric Substitution

18.0 Students know the definitions and properties of inverse trigonometric functions and the expression of these functions as indefinite integrals.

PLATO Calculus 2

- Inverse Trigonometric Functions
- The Arcsine Function
- The Arctangent Function

19.0 Students compute, by hand, the integrals of rational functions by combining the techniques in standard 17.0 with the algebraic techniques of partial fractions and completing the square.

PLATO Algebra 2, Part 2

- Coordinates and Curves (Alg 2.2)
- Distance and Circles (Alg 2.2)
- Parabola and Its Vertex (Alg 2.2)

PLATO Calculus 2

- Partial Fractions
- Partial Fractions
- Integration by Partial Fractions

20.0 Students compute the integrals of trigonometric functions by using the techniques noted above.

PLATO Calculus 2

- Techniques of Integration Involving Trigonometric Functions
- Trigonometric Integrals

21.0 Students understand the algorithms involved in Simpson's rule and Newton's method. They use calculators or computers or both to approximate integrals numerically.

PLATO Calculus 1

- Geometrical Application of the Definite Integral
- Area Between Curves--Tutorial
- Area Between Curves—Exercises

23.0 Students demonstrate an understanding of the definitions of convergence and divergence of sequences and series of real numbers. By using the comparison test, ratio test, and alternate series test, they can determine whether a series converges.

PLATO Calculus 2

- Introduction to Sequences
- Sequences
- Further Properties of Convergent Sequences
- Introduction to Series
- Introduction to Series
- Preliminary Results on Infinite Series
- Tests for Convergence of Nonnegative Series
- The Integral Test and the Comparison

Tests

- The Ratio Test and the Root Test
- Additional Topics on Convergence/ Divergence of Series
- The Alternating Series Test
- Absolute and Conditional Convergence
- Power Series
- The Radius...Power Series

24.0 Students understand and can compute the radius (interval) of convergence of power series.

PLATO Calculus 2

- Introduction to Sequences
- Sequences
- Further Properties of Convergent Sequences
- Introduction to Series
- Introduction to Series
- Preliminary Results on Infinite Series

- Additional Topics on Convergence/ Divergence of Series
- Absolute and Conditional Convergence
- Power Series
- The Radius...Power Series
- Differentiation and Integration of Power Series

25.0 Students differentiate and integrate the terms of a power series in order to form new series from known ones.

PLATO Calculus 2

- Power Series
- The Radius...Power Series
- Differentiation and Integration of Power Series

26.0 Students calculate Taylor polynomials and Taylor series of basic functions, including the remainder term.

PLATO Calculus 2

- Introduction to Sequences
- Polynomial Approximation and Taylor's Theorem
- Power Series
- Taylor Series