THINKLAND.AI

Math(Grade 7-9)

Math006-Calculus

This is a one-on-one introductory calculus course designed to teach differential and integral calculus to students at a high-school level, loosely following the College Board AP Calculus AB and AP Calculus BC curriculum. The course is intended

Contents

Unit 1: Limits and Continuity

* Limits
* Continuity

Unit 2: Differentiation

* Limit Definition of Derivative
* Existence of the Derivative
* Differentiation Rules (Constant, Sum, Constant Multiple, Product, Quotient, Chain)
    - At this point we should have introduced the derivatives of power functions, trigonometric functions, exponential (base e) functions, and their sums, products, quotients, and compositions
* Kinematics Applications of Differentiation (Velocity, Acceleration)

* Differentiation of Inverse Functions
    - Now we introduce the derivatives of logarithmic functions (base e), inverse trigonometric functions, general exponential functions, general logarithmic functions, and their sums, products, quotients, and compositions
* Implicit Differentiation
* Related Rates

* Linear Approximations & Differentials
* L'Hopital's Rule
    - Introduce indeterminate forms (which come from evaluation of limits) and demonstrate when it is applicable to use L'Hopital's Rule (through proper identification of the indeterminate form)

Unit 3: Extrema and Curve Sketching

* Mean Value Theorem
    - Recognize necessary conditions to apply
* Extreme Value Theorem
    - Recognize necessary conditions to apply
* Local & Global Extrema
* Intervals of Increase and Decrease

* First Derivative Test
* Concavity and Points of Inflection
* Intervals of Concavity
* Second Derivative Test
* Optimization
* Curve Sketching

Unit 4: Integration

* Introduction to Area Under The Curve
* Approximating Area with Riemann Sums
* Riemann Sums and the Definite Integral
* The Fundamental Theorem of Calculus
* Finding Antiderivatives
* Kinematics Applications of Integration (Velocity, Acceleration)

Unit 5: Integration Techniques

* Integration by Substitution (u-Substitution)
* Integration by Long Division and Completing the Square
* Integration by Parts
* Integration by the Method of Partial Fractions
* Evaluating Improper Integrals
* Integration Strategy

Unit 6: Applications of Integration

* Average Value of a Function
* Area Between Curves
* Volumes with Cross - Sections
* Disc Method
* Washer Method
* Arc Length

Unit 7: Differential Equations

* Modeling Situations with Differential Equations
* Sketching and Interpreting Slope Fields
* Approximating Solutions using Euler's Method
* Separation of Variables and Initial Conditions
* Exponential Models with ODEs
* Logistic Models with ODEs

Unit 8: Parameterization

* Parametric Equations
* Differentiation of Parametric Equations

* Arc Length Using Parametric Equations
* Vector-Valued Functions
* Kinematics Applications of Parametric and Vector-Valued Functions
* Polar Coordinates
* Integration in Polar Coordinates
* Area Between Two Curves in Polar Coordinates

Unit 9: Sequences and Series
* Defining Series (Convergence & Divergence)
* Geometric Series
    - Recognize necessary conditions to apply
* *n*th Term Test
    -
* Integral Test
    -
* Harmonic Series & p-Series
    -
* Comparison Tests
    -
* Alternating Series & Alternating Series Test
    -
* Ratio Test
    -
* Absolute Versus Conditional Convergence
* AST Error Bounds
* Taylor Polynomials
* Lagrange Error Bounds
* Power Series (Taylor Series, Maclaurin Series)
* Radius and Interval of Convergence