Calculus II Video Library (Integral Calculus)

Approximating Area Under a Curve

Sigma Notation / Summation Notation
Ex: Area of a Parallelogram on the Coordinate Plane
Ex: Area of a Trapezoid on the Coordinate Plane
Area Under a Graph
Ex: Approximate Distance Traveled From a Table Using Area
Ex 1: Find the Area Under a Curve Using a Geometric Formula (Rectangle)
Ex 2: Find the Area Under a Curve Using a Geometric Formula (Triangle)
Ex 3: Find the Area Under a Curve Using a Geometric Formula (Trapezoid)
Determining Area Under Graphs Using Geometric Formulas
Ex: Evaluate a Definite Integral Using Area from a Graph
Ex: Definite Integration Using Geometric Formula (Line Above and Below X-Axis)
Ex: Definite Integration of an Absolute Value Function Using Geometric Formula
Ex: Evaluate a Definite Integral Using a Geometric Formula (Semicircle)
Ex: Accumulation of Area Under a Function Using Geometric Formulas
Ex: Application of Area Under a Function Using Geometric Formulas - Distance
Ex 1: Reimann Sum Using a Quadratic Function (Right Endpoints and Above x-axis)
Ex 2: Reimann Sum Using an Exponential Function (Left Endpoints and Above x-axis)
Ex 3: Reimann Sum Using a Quadratic Function (Right Endpoints and Above/Below x-axis)
Ex: Approximate the Area Under a Curve Using Rectangles (Left Using Graph)
Ex: Approximate the Area Under a Curve Using Rectangles (Right Using Graph)
Ex: Approximate the Area Under a Curve Using Rectangles (Midpoint Using Graph)
Area Under a Graph Using Rectangles - Application
Approximating Area Under a Graph Using Rectangles

Improper Integrals

Improper Integral
Ex 1: Improper Integrals
Ex 2: Improper Integrals
Ex 3: Improper Integrals
Ex 4: Improper Integrals and Area
Ex: Area Using Improper Integrals
Ex 1: Improper Integral - Infinite Interval (-inf,+inf)
Ex 2: Improper Integral - Infinite Interval (-inf, constant)
Ex 3: Improper Integral - Infinite Interval (-inf,+inf)
Ex 1: Improper Integral - Discontinuous Integrand
Ex 2: Improper Integral - Discontinuous Integrand
Ex: Improper Integral Involving Rational Function to Find Area Under a Curve
Ex: Improper Integral Involving Function with Rational Exponent to Find Area Under Curve

Introduction to Differential Equations

Introduction to Differential Equations
Ex: Determine Which Functions Are Solutions to a Differential Equation
Ex: Determine Which Function is a Solution to a Second Order Differential Equation
Ex: Verify a Solution to a Differential Equation and Find a Particular Solution
Ex: Find a Constant Function Solution to a Differential Equation
Ex: Find Two Exponential Function Solutions to a Differential Equation
Slope Fields
Ex: Determine Which Differential Equation Would Produce a Given Direction Field
Ex: Determine Direction Field Given a Solution to a Differential Equation
Ex: Select a Direction Field Given a Differential Equation Using Points
Differential Equations and Exponential Functions
Ex: Solve a Basic Initial Value Problem (Linear)

Parametric Equations

Introduction to Parametric Equations
Graphing Parametric Equations in the TI84
Converting Parametric Equation to Rectangular Form
Ex 1: Write Parametric Equations as a Cartesian Equation
Ex 2: Write Parametric Equations as a Cartesian Equation
Ex 3: Write Parametric Equations as a Cartesian Equation
Ex 4: Write Parametric Equations as a Cartesian Equation
Ex: Parametric Equations Modeling a Path Around a Circle
Ex: Parametric Equations for an Ellipse in Cartesian Form
Ex: Find Parametric Equations For Ellipse Using Sine And Cosine From a Graph
Find the Parametric Equations for a Line Segment Given an Orientation
Determine Which Parametric Equations Given Would Give the Graph of the Entire Unit Circle
Determine Which Parametric Equations Would Give the Graph of an Entire Line
Ex 1: Find the Parametric Equations for a Lissajous Curve
Ex 2: Find the Parametric Equations for a Lissajous Curve
Ex 3: Find the Parametric Equations for a Lissajous Curve
Ex 4: Find the Parametric Equations for a Lissajous Curve
Ex: Point on a Spoke of a Rotating Wheel - Find the Radius
The Derivative of Parametric Equations
Ex 1: Derivatives of Parametric Equations and Applications
Ex 2: Derivatives of Parametric Equations and Applications (Trig)
Ex 1: Equation of a Tangent Line to a Curve Given by Parametric Equations
Ex 2: Equation of a Tangent Line to a Curve Given by Parametric Equations
Ex 3: Equation of a Tangent Line to a Curve Given by Parametric Equations
Determine the Points Where the Tangent Lines are Horizontal or Vertical Using Parametric Equations
Second Derivative of Parametric Equations: Part 1, Part 2
Ex: Determine the First and Second Derivative Given Parametric Equations
First and Second Derivative of Parametric Equations -

Ex 1: Approximate the Area Under a Curve with 4 Left Sided Rectangles
Ex 2: Approximate the Area Under a Curve with 4 Right Sided Rectangles
Ex 3: Approximate the Area Under a Curve with 8 Left Sided Rectangles
Ex 4: Approximate the Area Under a Curve with 8 Right Sided Rectangles

The Antiderivative

Introduction to Antiderivatives and Indefinite Integration (No Trig)
The Antiderivative
Ex 1: Determine Antiderivatives
Ex 2: Determine Antiderivatives
Ex 3: Determine Antiderivatives
Ex 4: Determine Antiderivatives
Ex 5: Determine Antiderivatives
Ex 1: Antiderivative Concept - Given Information about f(x), Describe F(x)
Ex 2: Antiderivative Concept - Given Information about f(x), Describe F(x)
Ex: Find the Particular Solution to a Basic Differential Equation
Basic Antidifferentiation of Trigonometric Functions

Indefinite Integration

Ex: Basic Indefinite Integration (Polynomial, Exponential, Quotient)
Ex: Indefinite Integration with a Negative Exponent
Ex: Indefinite Integration Involving a Product
Ex: Indefinite Integration with a Variety of Terms
The Six Basic Trigonometric Integration Formulas
Indefinite Integration Using Basic Trig Integral Formulas: Part 1, Part 2
Integration Involving Inverse Trig Functions: Part 1, Part 2, Part 3

Definite Integral and The Fundamental Theorem of Calculus

Ex: Solve a Basic Initial Value Problem (Exponential and Trig)
Solving a differential equation by separation of variables
Ex: Find the Particular Solution to a Basic Differential Equation
Ex 1: Initial Value Problem Using Separation of Variables (Square Root)
Ex 2: Initial Value Problem Using Separation of Variables (Square Root)
Ex 1: Initial Value Problem Using Separation of Variables Involving Natural Logarithm
Ex 2: Initial Value Problem Using Separation of Variables Involving Natural Logarithm
Ex 1: Initial Value Problem Using Separation of Variables in the form y' = ky
Ex 2: Initial Value Problem Using Separation of Variables in the Form y'=ay+b
Ex: Initial Value Problem in the Form y' = kx Using Shortcut
Ex: Initial Value Problem Using Separation of Variables in the Form y' = e^(ay+bx)
Ex: Solve an IVP Using Separation of Variables in the Form y'=(ax+b)/(xy^2)
Ex: Solve an IVP Using Separation of Variables in the Form y'=axy+bx

Applications of Integration: Business

Ex: Write a Differential Equation to Model the Change in a Bank Account
Ex: Limited Growth Differential Equation
Ex: Solve a Differential Equation that Models the Change in a Bank Account Balance
Ex: Logistic Growth Differential Equation
Ex: Complementary and Substitute Goods - Demand Function
Ex: Future Value of One Time Investment
Ex: Present Value of One Time Investment Given Future Value
Ex 1: Future Value of Continuous Money Flow
Ex 2: Continuous Money Flow needed for a Given Future Value
Ex: Present Value of Continuous Money Flow

Concavity
Arc Length in Parametric Form
Ex 1: Determine the Arc Length of a Curve Given by Parametric Equations
Ex 2: Determine the Arc Length of a Curve Given by Parametric Equations
Find the Length of a Loop of a Curve Given by Parametric Equations
Area Under Parametric Curves
Surface Area of Revolution in Parametric Form
Ex 1: Surface Area of Revolution in Parametric Form
Ex 2: Surface Area of Revolution in Parametric Form

Polar Coordinates and Equations

Polar Coordinates
Ex: Convert Cartesian Coordinates to Polar Coordinates
Animation: Rectangular and Polar Coordinates
Converting Polar Equations to Rectangular Equations
Ex: Find the Rectangular and Polar Equation of a Circle From a Graph
Ex: Find the Polar Equation of a Circle With Center at the Origin
Ex: Find the Polar Equation for a Horizontal Line
Ex: Find the Polar Equation for a Line
Ex: Write a Polar Equations of a Line as a Cartesian (Rectangular) Equations
Ex: Find the Polar Equation for a Parabola
Ex: Find the Rectangular Equation of a Circle from a Polar Equation
Ex: Convert a Polar Equation to a Rectangular Equation

Graphing Polar Equations

Graph Polar Equations I
Graph Polar Equations II
Animation: Graph Polar Equations
Ex: Determine the Type of Conic Section Given a Polar Equation
Graph Conic Sections in Polar Form: Part 1, Part 2, Part 3
Conics in Polar Form and Graphing a Parabola in Polar

The Definition of The Definite Integral
The Definite Integral
Ex: Setting Up a Definite Integral To Determine Area Under a Function
Ex: Definite Integral as Area Given a Graph (Function)
Ex: Definite Integral as Area Given a Graph (Function + Constant)
Ex: Definite Integral as Area Given a Graph (Constant*Function)
Ex: Evaluate Definite Integral Using Area Above and Below the x-axis
The Fundamental Theorem of Calculus
Proof of the Fundamental Theorem of Calculus (Part 2)
Ex: Evaluate a Definite Integral on the TI-84
Ex: Graph and Evaluate a Definite Integral on the TI84

Ex: Evaluate a Basic Definite Integral of a Constant Function Using the FTC
Ex: Evaluate a Basic Definite Integral of a Basic Linear Function Using the FTC
Ex: Evaluate a Basic Definite Integral of a Basic Quadratic Function Using the FTC
Ex: Evaluate a Basic Definite Integral of Cosine Using the FTC
Ex: Fundamental Theorem of Calculus Concept Check
Ex: Property of Definite Integral Subtraction
Ex: Property of Definite Integral Addition
Ex: Evaluate a Definite Integral of a Basic Quotient - Area Under a Curve
Ex: Evaluate a Definite Integral of a Polynomial
Local Maximum and Local Minimum of a Definite Integral Function (Accumulation Function)
Ex 1: Area Under a Constant Function Using Definite Integration
Ex 2: Area Under a Linear Function Using Definite Integration
Ex 3: Area Under a Quadratic Function Using Definite Integration
Ex 4: Area Under a Rational Function Using Definite Integration
Ex 5: Area Under a Piece Wise Defined Function Using Definite Integration

Ex: Integration Application - Present Value for Business
Ex: Future and Present Value of Continuous Money Flow
Ex: Present Value of Perpetual Money Flow
Ex: Determine the Present Value of a Continuous Income Stream on the TI84 (Linear)
Ex: Point of Equilibrium
Consumer and Producer Surplus
Ex: Consumer Surplus (Linear)
Ex: Producer Surplus (Linear)
Ex: Consumer Surplus
Ex: Producer Surplus

Applications of Integration: Volume of Revolution

Determine Volume Of Solids by Slices - Integration Application
Ex 1: Volume of a Solid with Known Cross Section Using Integration - Volume by Slices
Ex 2: Volume of a Solid with Known Cross Section Using Integration - Volume by Slices
Ex 3: Volume of a Solid with Known Cross Section Using Integration - Volume by Slices
Ex 4: Volume of a Solid with Known Cross Section Using Integration - Volume by Slices
Ex 5: Volume of a Solid with Known Cross Section Using Integration - Pyramid
Ex: Volume of a Solid With Slices Parallel to X-axis (Triangle)
Volume of Revolution - The Disk Method
Ex: Volume of Revolution - Disk Method (y=x^(1/3)
Ex: Volume of Revolution - Disk Method (Quadratic Function)
Ex: Volume of Revolution - Disk Method (Exponential Function base e)
Ex 1: Volume of Revolution Using the Disk Method (Rational Function about y = 1)
Ex 2: Volume of Revolution Using the Disk Method (Sine Squared Function)
Ex 3: Volume of Revolution Using the Disk Method (Exponential Function)
Volume of Revolution - The Washer Method about the x-axis
Volume of Revolution - The Washer Method about the y-

Form
Graphing an Ellipse in Polar Form
Graphing a Hyperbola in Polar Form
Ex: Find the Intercepts and Foci of a Ellipse Given a Polar Equation
Ex: Find the Intercepts and Foci of a Hyperbola Given a Polar Equation
Ex: Find the Intercepts and Focus of a Parabola Given a Polar Equation

Derivatives and Integrals with Polar Equations

Ex: Determine the Slope of a Tangent Line to a Polar Curve at a Given Angle
Ex: Determine Where a Polar Curve Has a Horizontal Tangent Line
Area using Polar Coordinates: Part 1, Part 2, Part 3
Ex: Find the Area Bounded by a Polar Curve Over a Given Interval (Spiral)
Ex: Find the Area of a Inner Loop of a Limacon (Area Bounded by Polar Curve)
Ex: Find the Area of Petal of a Rose (Area Bounded by Polar Curve)
Area between Polar Curves: Part 1, Part 2
Ex: Find the Area of a Region Bounded by a Polar Curve (r=Acos(n*theta))
Ex 1: Find the Area of a Region Bounded by Two Polar Curves
Ex 2: Find the Area of a Region Bounded by Two Polar Curves
The Slope of a Tangent Line to a Polar Curve
Horizontal and Vertical Tangent Lines to a Polar Curve
Arc Length of a Polar Curve
Ex 1: Arc Length of a Polar Curve
Ex 2: Arc Length of a Polar Curve
Ex: Find the Perimeter of a Region Bounded by Two Polar Curves
Surface Area of Revolution of a Polar Curve

Vectors in 2D

Introduction to Vectors
Vector Operations

Ex: Definite Integral Involving a Basic Linear Function
Ex: Definite Integral Involving a Basic Rational Function
Ex: Definite Integral Involving a Rational Function Requiring Simplifying
Ex: Definite Integration Application - Cars Passing Through an Intersection
Ex: Definite Integration Involving a Basic Trig Function (nonnegative)
Ex: Definite Integration Involving a Basic Trig Function (above and below x-axis)
Determining the value of a definite integral on the graphing calculator

The Second Fundamental Theorem of Calculus

The Second Fundamental Theorem of Calculus
Proof of the Fundamental Theorem of Calculus (Part 1)
Ex 1: The Second Fundamental Theorem of Calculus
Ex 2: The Second Fundamental Theorem of Calculus (Reverse Order)
Ex 3: The Second Fundamental Theorem of Calculus
Ex 4: The Second Fundamental Theorem of Calculus with Chain Rule
Ex 5: The Second Fundamental Theorem of Calculus with Chain Rule
Ex 6: Second Fundamental Theorem of Calculus with Chain Rule
Ex 7: Second Fundamental Theorem of Calculus with Chain Rule
Ex: Evaluate a Definite Integral and the Derivative of an Integral Using a Graph

Applications of Definite Integration

Ex: Interpret the Meaning of Area Under a Function
Ex 1: Application of Definite Integration (Accumulated Sales)
Ex 2: Application of Definite Integration (Distance)
Ex: Definite Integration Application - Velocity and Distance
Ex 1: Integration Application - Work Lifting an Object
Ex 2: Integration Application - Work Lifting an Object and Cable
Ex: Find the Work Lifting a Leaking Bucket of Sand Given

axis
Volume of Revolution - The Washer Method NOT about the x or y axis
Ex 1: Volume of Revolution Using Washer Method About y = 3
Ex 2: Volume of Revolution Using Washer Method About y = 3
Ex 1: Volume of Revolution Using Washer Method About Y-Axis
Ex 2: Volume of Revolution Using Washer Method About Y-Axis
Ex: Volume of Revolution Using Washer Method About x=5
Volume of Revolution - The Shell Method about the x-axis
Volume of Revolution - The Shell Method about the y-axis
Ex: Determine a Volume of Revolution Using the Shell (tube) Method (Quadratic About y-axis)

Ex: Determine a Volume of Revolution Using the Shell (tubes) Method (y-axis) - Calculator
Volume of Revolution - The Shell Method NOT about x or y axis
Ex: Volume of Revolution Using the Shell Method (Basic Quadratic about y axis)
Ex: Volume of Revolution Using the Shell Method (Quadratic about y axis)
Ex: Volume of Revolution Using the Shell Method (Sine about y axis)
Ex: Volume of Revolution Using the Shell Method (Exponential about y axis)
Ex: Volume of Revolution Using Shell Method with Horizontal Axis (Not X-Axis)
Ex: Volume of Revolution Using Shell Method with Vertical Axis (Not Y-Axis)
Volume of Revolution - Comparing the Washer and Shell Method

Applications of Integration: Arc Length, Surface Area, Work, Force, Center of Mass

Arc Length – Part 1
Arc Length – Part 2

Unit Vector
Ex: Find the Sum of Two Vectors From a Graph (2 Dimensions)
Ex: 2D Vector Scalar Multiplication
Ex: Find the Unit Vector Given the Graph of a Vector in 2D
Ex: Find the Difference of Two Vectors in Component Form
Ex: Find the Sum of Two Vectors Given in Linear Combination Form
Ex: Find the Difference of Two Vector Given in Linear Combination Form
Ex: Find the Difference of Scalar Multiples of Vectors in 2D
Ex: Dot Product of Vectors - 2D
Ex: Dot Product of Vectors From a Graph - 2D
Ex: Find a Component of a Vector So Two Vectors are Orthogonal (Dot Product)
Ex 1: Find a Vector in Component Form Given an Angle and the Magnitude (30)
Ex 2: Find a Vector in Component Form Given an Angle and the Magnitude (45)
Ex 3: Find a Vector in Component Form Given an Angle and the Magnitude (60)
Ex 4: Find a Vector in Component Form Given an Angle and the Magnitude (90)
Ex 5: Find a Vector in Component Form Given an Angle and the Magnitude (180)
Ex: Find the Difference of Scalar Multiples of Vectors in 2D
Ex: Find the Magnitude of The Difference of Two Vectors and The Difference of Two Magnitudes
Find the Component Form of a Vector from the Graph of a Vector
Ex: Find the Direction and Magnitude of a Vector in Component Form
Find the Component Form of a Vector Given Magnitude and Direction
Ex: Write a Vector as a Combination of Two Vectors
Ex: Find the Net Force of Three Vectors and the Opposite Force
Ex: Find the Coordinates of a Rotated Point Using Vectors

Applications of Vectors

Mass
Ex: Find the Work Lifting a Leaking Bucket of Sand and Rope Given Mass
Ex: Find the Work Required to Stretch a Spring (Integration App)
Ex: Find the Force Required to Stretch a Spring (Integration App)
Ex: Definite Integral of Marginal Cost to find Total Cost
Properties of The Definite Integral
Properties of Definite Integrals and Average Value
The Mean Value Theorem for Integrals
Ex: Properties of Definite Integrals - Order of Integration
Ex: Properties of Definite Integrals - The Difference of Two Definite Integrals
Ex: Properties of Definite Integrals - Difference and Sum of Definite Integrals
Ex: Properties of Definite Integrals - Determine Limits of Integration
Ex: Properties of Definite Integrals - Zero Interval
Ex: Integration Application - Average Value of an Investment Account
Ex: Integration Application - Average Value of Temperature Function
Ex 1: Average Value of a Function
Ex 2: Average Value of a Trig Function
Ex: Integration Application - Average Value to Determine Average Coffee Temperature
Point of Equilibrium
Consumer and Producer Surplus
Present and Future Value: Part 1, Part 2

Area Bounded by Two Functions

Determining Area Between Two Curves - Integration Application
Area Between to Graphs
Ex 1: Find Area Between a Linear and Quadratic Function (respect to x)
Ex 2: Find Area Between a Linear and Exponential Function (respect to x)
Ex 3: Find Area Between Two Exponential Functions (respect to x)
Ex 4: Find Area Between Two Quadratic Functions (respect

Ex: Find the Arc Length of a Linear Function
Ex: Find the Arc Length of a Radical Function (Rational Exponent)
Ex: Find the Arc Length of a Quadratic Function
Surface Area of Revolution – Part 1
Surface Area of Revolution – Part 2
Ex: Surface Area of Revolution - Linear Function
Ex: Surface Area of Revolution - Sine Function
Ex: Find the Surface Area of Revolution of a Cubic Function About the x-axis
Ex: Find the Surface Area of Revolution of a Square Root Function About the x-axis
Ex: Determine the Work Required to Pump Water Out of a Circular Cylinder
Ex: Find the Surface Area of Revolution of a Quadratic Function About y-axis (Respect to x)
Ex: Find the Surface Area of Revolution of a Cube Root Function About y-axis (Respect to y)
Ex: Determine the Work Required to Pump Water Out of Trough (Isosceles Triangle)
Ex: Determine the Work Required to Pump Water Out of Trough (Quadratic Cross Section)
Ex: Find the Work Lifting a Leaking Bucket of Sand Given Mass
Ex: Find the Work Lifting a Leaking Bucket of Sand and Rope Given Mass
Ex: Determine the Center of Mass of Three Point Masses on the Coordinate Plane
Ex: Find the Centroid of a Region Consisting of Three Rectangles
Ex: Find the Centroid of a Triangular Region on the Coordinate Plane
Ex: Find the Centroid of a Bounded Region Involving Two Quadratic Functions
Ex: Find the Centroid of a Bounded Region Involving the Sine Function Using the TI84
Ex: Find the Hydrostatic Force on a Horizontal Plate (No Calculus)
Ex: Find the Hydrostatic Force on a Vertical Plate in the Shape of an Isosceles Triangle
Ex: Find the Hydrostatic Force on a Dam in the Shape of a Degree 4 Polynomial

Applications of Vectors
Determining the Angle Between Two Vectors
Proof of the formula for the Angle Between Two Vectors
Vector Projection
Proof of the Vector Projection Formula
Ex: Vector Projection in Two Dimensions
Ex: Find the Angle of Intersection of Two Curves Using Vectors
Ex: Direction and Speed of a Plane in the Wind Using Vectors
Ex: Vector App: Find an Airplane Direction In The Wind To Fly Due North
Vector App: Find the Direction of a Ball Thrown From a Car
Ex: Vector App - Find the Resultant Vector of a 5 Direction Walk
Ex: Vector App - Find the Resultant Vector of a 2 Direction Walk
Vector Applications: Force and Work

Vectors in Space

Plotting Points in 3D
The Equations of the Coordinate Planes in R3
Graphing a Plane Using Intercepts
Ex: Determine the Distance Between a Point and a Coordinate Plane in R3
Ex: Equation of a Sphere Given the Center and Radius
The Equation of a Sphere
Ex: Find the Difference of Scalar Multiples of Two Vectors in 3D (Linear Combination Form)
Vectors in Space
Parallel Vectors
Ex: Dot Product of Vectors - 3D
Ex: Find the Component of a Vector so Two Vectors are Orthogonal (3D)
Ex: Find the Angle Between Two Vectors in Three Dimensions
Ex: Vector Projection in Three Dimensions
Ex: Find the Component Form of a Vector in Space Given the Initial and Terminal Point
Ex: Find a Unit Vector in the Direction of a Given Vector in 3D

to x)
Ex 1: Area Bounded by Two Functions
Ex 2: Area Bounded by Two Functions (2 Regions)
Ex 3: Area Bounded by Two Trig Functions
Ex: Determine a Function Given The Area Between Two Functions

Integration by Substitution

Indefinite Integration Using Substitution
Integration by Substitution: Part 1, Part 2
Definite Integration Using Substitution
Ex 1: Indefinite Integration Using Substitution
Ex 2: Indefinite Integration Using Substitution
Ex 3: Indefinite Integration Using Substitution
Ex 4: Integration Using Substitution
Ex 5: Indefinite Integration Using Substitution
Ex 6: Indefinite Integration Using Substitution
Ex 7: Indefinite Integration Using Substitution
Ex 8: Indefinite Integration Using Substitution Involving Trig Functions
Ex 9: Indefinite Integration Using Substitution Involving Trig Functions
Ex: Evaluate a Indefinite Integral Using Substitution (Form e^u)
Ex: Evaluate a Indefinite Integral Using Substitution (Form ae^u with Decimals)
Indefinite Integration Using Substitution (Tough) Int(x^n*sqrt(x^(n-1)+c)
Ex 1: Definite Integration Using Substitution - Change Limits of Integration?
Ex 2: Definite Integration Using Substitution – Change Limits of Integration?
Ex: Evaluate a Definite Integral Using Substitution (Form e^u)
Ex: Evaluate a Definite Integral Using Substitution (Form ae^u with Decimals)
Ex: Evaluate a Definite Integral Using Substitution (Form 1/u)
Ex 1: Definite Integration Using Substitution
Ex 2: Definite Integration Using Substitution
Ex: Indefinite Integral Using Substitution Involving a Square Root
Ex: Find the Hydrostatic Force on a Semicircle Window Submerged in Water

Integration Involving Powers of Trigonometric Functions

Trig Integrals Involving Powers of Sine and Cosine: Part 1, Part 2
Trig Integrals Involving Powers of Secant and Tangent: Part 1, Part2
Ex: Integral Using Substitution with an Odd Power of Cosine
Ex: Integral Using Substitution with an Odd Power of Sine
Ex: Integral Using Substitution with an Odd Power of Tangent
Ex: Integral Using Substitution with an Even Power of Secant
Wallis's Formula to Integrate Powers of Sine and Cosine on [0, pi/2]

Integration Using Partial Fractions

Partial Fraction Decomposition: Part 1, Part 2
Ex: Partial Fraction Decomposition - Degree 2 / Degree 3
Integration Using Partial Fraction Decomposition: Part 1, Part 2
Ex 1: Integration Using Partial Fraction Decomposition
Ex 2: Integration Using Partial Fraction Decomposition and Long Division
Ex: Indefinite Integral Requiring Partial Fraction Decomposition

Integration Using Trigonometric Substitution

Integration Involving Trigonometric Substitution: Part 1, Part 2, Part 3, Part 4
Ex 1: Integration Using Trigonometric Substitution
Ex 2: Integration Using Trigonometric Substitution
Ex 3: Integration Using Trigonometric Substitution
Ex 4: Integration Using Trigonometric Substitution
Ex 5: Integration Using Trigonometric Substitution
Ex 6: Integration Using Trigonometric Substitution
Ex: Integration Using Trigonometric Substitution and Completing the Square
Ex: Find the Magnitude of a Vector in 3D
Ex: Find the Sum of Scalar Multiples of Two Vectors in 3D (Component Form
Ex: Find the Difference of Scalar Multiples of Two Vectors in 3D (Linear Combination Form)
Vector Cross Products
Ex: Find the Cross Product of Two Vectors
Ex: Find Two Unit Vectors Orthogonal to Two Given Vectors
Ex 1: Properties of Cross Products - Cross Product of a Sum and Difference
Ex 2: Properties of Cross Products - Cross Product of a Sum and Difference
Ex: Find the Area of a Triangle Using Vectors - 3D
Ex: Find the Distance Between Two Points In Space
An Application of Cross Products: Torque
The Triple Scalar Product: Volume of a Parallelepiped
Parametric Equations of Lines in 3D

Equations of Planes and Lines in Space

Ex: Determine the Equation of a Plane Given a Point and Normal Vector
The Equation of a Plane in 3D Using Vectors
Graphing a Plane in 3D
Ex: Determine the Point of Intersection of a Plane and a Line.
Find an Equation of a Plane Containing a Line and Orthogonal to a Given Plane
Find an Equation of a Plane Containing a Given Point and the Intersection of Two Planes
Determine the Linear Equation of the Intersection to Two Planes
Determining the Angle Between Two Planes
Determining the Distance Between a Plane and a Point
Determining the Distance Between a Line and a Point
Ex: Find the Distance Between Two Parallel Planes
Ex: Find the Equation of the Plane Containing a Given Line and a Point Using Vectors
Ex: Find the Equation of a Plane Given Three Points in the Plane Using Vectors
Ex: Find the Equation of a Plane Given an Orthogonal Line (Parametric) and a Point

Ex: Indefinite Integral Using Substitution Involving a Rational Function I
Ex: Indefinite Integral Using Substitution Involving a Rational Function II
Definite Integration Using Substitution - Int(e^(1/x^n)/x^(n+1))
Ex: Indefinite Integral Using Substitution with Exponential and Sine
Ex: Definite Integration Using Substitution Involving Sine
Ex: Definite Integration Using Substitution Involving Exponential and Trig Functions
Ex: Indefinite Integral Involving Arcsine with Substitution
Indefinite integral: (sin(x))^2- Power Reducing Substitution
Indefinite Integral: (cos(2x))^2 - Power Reducing Substitution
Ex 1: Trigonometric Integration - Power Reducing Formula and U-Substitution
Ex 2: Trigonometric Integration - Power Reducing Formula and U-Substitution
Ex: Evaluate a Indefinite Integral Integration Tables and Substitution (cot^2(a^x))
Ex: Evaluate a Indefinite Integral Integration Tables and Substitution (sin^2(x^n))
Ex: Evaluate a Indefinite Integral Using Integration Tables
Integration Application: Area Using Parametric Equations – Ellipse
Integration Application: Area Using Parametric Equations - Cycloid

Integration by Parts

Integration by Parts: Basics
Ex: Integration by Parts - Basic Example
Integration by Parts
Integration by Parts: More Examples
Ex 1: Integration by Parts
Ex 2: Integration by Parts
Ex 3: Integration by Parts
Ex 4: Integration by Parts
Ex 5: Integration by Parts (Trig)
Ex 6: Integration by Parts Twice
Ex: Integration by Parts Involving a Radical and Natural Log
Ex: Integration by Parts Involving a Trig and Linear Function

Ex 1: Definite Integration Using Trigonometric Substitution
Ex 2: Definite Integration Using Trigonometric Substitution
Ex: Indefinite Integral in the form x^n*sqrt(a^2+x^2) Using Trigonometric Substitition
Ex: Indefinite Integral in the form x^n*sqrt(a^2+x^2) Using U-Substitition
Ex: Indefinite Integral in the form x^n*sqrt(a^2 - x^2) Using Trigonometric Substitition
Ex: Indefinite Integral in the form x^n*sqrt(a^2 - x^2) Using U-Substitition
Ex: Indefinite Integration in the Form sqrt(a^2-x^(2n))/x^(n+1) Using Trigonometric Substiution
Wallis's Formula to Integrate Powers of Sine and Cosine on [0, pi/2]

Infinite Series

Introduction to Sequences
Arithmetic Sequences
Geometric Sequences
Ex: Find the Formula for a Geometric Sequence Given Terms
Sequences on the TI84 Graphing Calculator
Limits of a Sequence
Ex: Limit of a Sequence Using L'Hopital's Rule (Divergent
Ex: Limit of a Sequence (cos(n)/2^n)
Ex: Limit of a Sequence Using L'Hopital's Rule Twice (Convergent)
Ex: Limit of a Sequence Using L'Hopital's Rule (Convergent)
Ex: Limit of a Sequence (Num Degree Greater)
Ex 1: Limit of a Sequence (Linear/Linear)
Ex 2: Limit of a Sequence (Quadratic/Quadratic)
Ex: Limit of a Sequence (Num Degree Less)
The Squeeze Theorem
Arithmetic Series
Geometric Series
Introduction to Infinite Series
Infinite Series: The Nth Term Divergent Test

Ex: Find the Equation of Plane Containing a Line and Orthogonal to a Given Plane
Ex: Find the Equation of a Plane Given a Point in the Plane and a Parallel Plane
Ex: Find the Parametric Equations of a Line in Space Given Two Points on the Line
Ex: Find the Point Where a Line in 3D Intersects the xz-plane
Ex 1: Find the Parametric Equations of the Line of Intersection of Two Planes Using Vectors
Ex 2: Find the Parametric Equations of the Line of Intersection of Two Planes Using Vectors
Ex: Find the Parametric Equations of a Line Perpendicular to a Plane Through a Point
Ex: Find Parametric Equations of a Line in Space Parallel to a Vector Containing a Given Point

Quadric Surfaces, Cylindrical Coordinates and Spherical Coordinates

Cylindrical Surfaces
Introduction to Quadric Surfaces
The Ellipsoid
The Hyperboloid of One Sheet
The Hyperboloid of Two Sheets
The Elliptical Cone
The Elliptical Paraboloid
The Hyperbolic Paraboloid
Surfaces of Revolution
Cylindrical Coordinates
Converting Between Cylindrical and Rectangular Equations
Spherical Coordinates
Converting Between Spherical and Rectangular Equations
Ex 1: Convert Cartesian Coordinates to Spherical Coordinates
Ex 2: Convert Cartesian Coordinates to Spherical Coordinates
Ex 1: Convert Spherical Coordinates to Cartesian Coordinates
Ex 2: Convert Spherical Coordinates to Cartesian Coordinates

(x*cos(4x))
Ex: Integration by Parts - Definite Integral Involving a Quadratic and Natural Log Function
Ex: Definite Integral Using Integration by Parts in the Form x^n*ln(x)
Ex: Definite Integral Using Integration by Parts in the Form x^(n)*ln(bx)
Ex: Evaluate a Indefinite Integral Using Integration by Parts - Int(ln(ax+b),x)
Ex: Integration by Parts Twice Application
Ex: Integration by Parts Twice and Solving

Integration Involving Inverse Trig Function and Integration Tables

Ex: Integration Tables - Basic Integration Involving sqrt(a^2-u^2)
Ex: Integration Tables - Basic Integration Involving a^2+u^2
Ex: Integration Tables - Basic Integration Involving a^2-u^2
Ex: Integration Tables - Integration Involving e^(ax)*sin(bx)
Ex: Integration Table - Integration Involving 1/u and a^2+u^2
Ex: Integration Tables - Integration Requiring U-Substitution sqrt(a^2-u^2)
Ex: Integration Tables - Integration Requiring U-substitution Involving sqrt(u^2+a^2)
Ex: Integration Tables - Integration Involving Requiring U-substitution Involving (tan(u))^n
Ex: Indefinite Integration Using U-Substitution Involving an Inverse Trig Function
Ex: Definite Integration Involving Inverse Tangent - 1/sqrt(a^2-u^2)
Ex: Definite Integration Involving Inverse Tangent - 1/(a^2+u^2)
Ex: Definite Integration Involving Inverse Tangent with U-Substitution - 1/(a^2+u^2)
Ex: Indefinite Integration Involving Arctangent Requiring U-sub and Completing the Square
Ex: Indefinite Integration Involving Arctangent Requiring Completing the Square

Infinite Geometric Series
Sequences and Series on the TI84
Graph Partial Sums of an Infinite Series on the TI84
Telescoping Series
Ex 1: Telescoping Series (Convergent)
Ex 2: Telescoping Series (Divergent)
Ex 3: Telescoping Series with Partial Fractions
The Harmonic Series
The Integral Test
Infinite Series: The Integral Test
Ex: Infinite Series - Integral Test (Rational Function and Convergent)
Ex: Infinite Series - Integral Test (Rational Function and Divergent)
Ex: Infinite Series - Integral Test (Radical and Divergent)
Ex: Infinite Series - Integral Test (Exponential and Convergent)
Ex: Infinite Series - Integral Test (Convergent Involving Arctangent)
Ex: Infinite Series - Integral Test Requiring Integration by Parts (Convergent)
The p-series Test
Infinite Series: The p-Series Test
Ex 1: Infinite Series - P Series Test (Convergent) and Find a Partial Sum
Ex 2: Infinite Series - P Series Test (Divergent) and Find Partial Sum
The Direct Comparison Test
Infinite Series: The Direct Comparison Test
Ex: Infinite Series - Direct Comparison Test (Convergent)
Ex: Infinite Series - Direct Comparison Test (Divergent)
Ex: Infinite Series - Direct Comparison Test (Inconclusive)
The Limit Comparison Test
Ex: Infinite Series - Limit Comparison Test (Convergent)
Ex: Infinite Series - Limit Comparison Test (Geometric, Divergent)
Ex: Infinite Series - Limit Comparison Test (Radical, Convergent)
Ex: Infinite Series - Limit Comparison Test (Divergent)
Ex: Infinite Series - Limit Comparison Test (Radical, Divergent)
Infinite Series: The Limit Comparison Test (Divergent)
Infinite Series: The Limit Comparison and Direct

Ex 1: Convert Cartesian Coordinates to Cylindrical Coordinates
Ex 2: Convert Cartesian Coordinates to Cylindrical Coordinates
Ex: Convert Cylindrical Coordinates to Cartesian Coordinates

Vector Valued Functions

Introduction to Vector Valued Functions
The Domain of a Vector Valued Function
Ex: Determine the Domain of a Vector Valued Function
Ex: Find the Point of Intersection of a Line Given by a Vector Function and a Coordinate Plane
Ex 1: Vector Valued Function - Curve of Intersection
Ex 2: Vector Valued Function - Curve of Intersection
Determining a Vector Valued Function from a Rectangular Equation
Determine a Vector Valued Function from the Intersection of Two Surfaces
Limits of Vector Valued Functions
The Derivative of a Vector Valued Function
Ex: Find a Tangent Vector of a Space Curve Given by a Vector Valued Function
Ex: Find the Velocity and Acceleration Vector Given the Position Vector Valued Function
Ex: Find the Velocity and Position Vector Functions Given the Acceleration Vector Function
Ex: Find Parametric Equations of a Tangent Line to a Space Curve
Ex: Find a Unit Tangent Vector to a Space Curve Given by a Vector Valued Function
Determining Where a Space Curve is Smooth from a Vector Valued Function
Indefinite Integration of Vector Valued Functions
Indefinite Integration of Vector Valued Functions with Initial Conditions
Definite Integration of Vector Valued Functions
Ex: Integrate a Vector Valued Function
Properties of the Derivatives of Vector Valued Functions
The Derivative of the Cross Product of Two Vector Valued Functions
Determining Velocity, Speed, and Acceleration Using a

Numerical Integration

Ex 1: Numerical Integration - The Midpoint Rule
Ex 2: Numerical Integration - The Midpoint Rule (Fractions)
Trapezoidal Rule of Numerical Integration
Ex: Numerical Integration - The Trapezoid Rule
Trapezoid Rule Error - Numerical Integration Approximation
Trapezoid Rule - Determine n for a Given Accuracy
Simpson's Rule of Numerical Integration
Ex: Simpson's Rule Using a Table of Values
Ex 1: Numerical Integration - Simpson's Rule
Ex 2: Estimate a Definite Integral Using Simpson's Rule (fractional subintervals)
Simpson's Rule Error - Numerical Integration Approximation
Simpson's Rule - Determine n for a Given Accuracy

Comparison Tests
Infinite Series: The Limit Comparison and Ratio Tests - Part 1
Infinite Series: The Limit Comparison and Ratio Tests - Part 2
The Root Test
Infinite Series: The Root Test I
Infinite Series: The Root Test II
The Ratio Test
Ex 1: Infinite Series - The Root Test (Convergent)
Ex 2: Infinite Series - The Root Test (Divergent)
Ex 3: Infinite Series - The Root Test (Divergent)
Ex 4: Infinite Series - The Root Test (Convergent)
Ex 5: Infinite Series - The Root Test (Divergent)
Infinite Series: The Ratio Test I
Infinite Series: The Ratio Test II
Ex 1: Infinite Series - The Ratio Test (Convergent)
Ex 2: Infinite Series - The Ratio Test (Divergent)
Ex 3: Infinite Series - The Ratio Test (Convergent)
Ex 4: Infinite Series - The Ratio Test (Convergent)
The Alternating Series Test
Ex: Find a Partial Sum of a Alternating Series (Method #1)
Ex: Find a Partial Sum of a Alternating Series (Method #2)
Conditionally and Absolutely Convergent Series
Ex 1: Determine if a Series Is Conditionally Convergent, Absolutely Convergent, or Divergent
Ex 2: Determine if a Series Is Conditionally Convergent, Absolutely Convergent, or Divergent
Ex 3: Determine if a Series Is Conditionally Convergent, Absolutely Convergent, or Divergent
Ex 4: Determine if a Series Is Conditionally Convergent, Absolutely Convergent, or Divergent
Infinite Series: The Alternating Series Test
Ex: Apply Alternating Series to Infinite Series - Divergent
Ex: Determine if an Infinite Alternating Series Converges or Diverges (Convergent)
Ex: Determine if an Infinite Alternating Series Converges or Diverges (Divergent)
Ex 1: Determine if an Series and an Alternating Series Converge or Diverge
Ex 2: Determine if an Series and an Alternating Series Converge or Diverge
Ex: Find the Error When Using a Partial Sum to Estimate

Vector Valued Function
Determining the Unit Tangent Vector
Determining the Unit Normal Vector
Proving the Unit Normal Vector Formula
Determining a Tangent Line of a Curve Defined by a Vector Valued Function
Determining the Tangential and Normal Components of Acceleration
Determining Arc Length of a Curve Defined by a Vector Valued Function
Ex: Determine Arc Length of a Spiral Given by Parametric Equations
Ex: Determine Arc Length of a Helix Given by a Vector Valued Function
Determining Curvature of a Curve Defined by a Vector Valued Function
Ex 1: Find the Curvature of a Space Curve Given by a Vector Function (Cross Product)
Ex 2A: Find the Curvature of a Space Curve Given by a Vector Function (Cross Product)
Ex 2B: Find the Curvature of a Space Curve Given by a Vector Function (No Cross Product)
Find the Angle of Intersection of Two Space Curves Given As Vector Functions
Determining the Binormal Vector

Proofs

Proof of the Fundamental Theorem of Calculus (Part 1)
Proof of the Fundamental Theorem of Calculus (Part 2)
Proof of the formula for the Angle Between Two Vectors
Vector Projection
Proof of the Vector Projection Formula

	an Infinite Sum (Alternating Series) Ex: Number of Terms Needed in Partial Sum to Estimate an Infinite Sum with a Given Error Taylor Polynomials Taylor's Theorem with Remainder Power Series Power Series: Part 1, Part 2 Representing a Function as a Geometric Power Series: Part 1, Part 2 Ex 1: Interval of Convergence for Power Series (Centered at 0) Ex 2: Interval of Convergence for Power Series (Centered at 0) Ex 3: Interval of Convergence for Power Series (Centered at 0) Ex 4: Interval of Convergence for Power Series (Centered at 0) Ex 5: Interval of Convergence for Power Series (Not Centered at 0) Ex 6: Interval of Convergence for Power Series (Not Centered at 0) Taylor and Maclaurin Series Using Power Series Tables – Part 1, Part 2 Ex 1: Maclaurin Series and Polynomial of cos(2x) / Find Approximation Error Ex: Find the Taylor Series of x^3 Ex: Find the Taylor Series of e^x Ex: Find a Degree One and Degree Two Maclaurin Polynomial Determine the Maclaurin Series and Polynomial for Function in the Form a*cos(bx^2) Determine the Maclaurin Series and Polynomial for Function in the Form ax^2*e^(bx) Determine the Maclaurin Series and Polynomial for Function in the Form ax^2*sin(bx) Ex: Determine a Taylor Polynomial for a Square Root Function Ex: Find a Maclaurin Polynomial and Error of an Approximation - ln(cos(x)) Ex: Find a Maclaurin Polynomial and the Interval for a Given Error - cos(x)	

	Ex: Find a Maclaurin Polynomial and the Interval for a Given Error - ln(1+x) Ex: Use a Maclaurin Polynomial for sin(bx^n) to Approximate an Integral Ex 1: Find a Power Series to Represent a Rational Function Ex 2: Find a Power Series to Represent a Rational Function Ex 3: Find a Power Series to Represent a Power Series Ex: Find a Power Series to Represent a Power Series Using a Product Ex: Find a Power Series to Represent a arctan(x) Using Integration Ex: Find a Power Series to Represent a Rational Function Using Differentiation Differentiating and Integrating Using Power Series Ex: Determine a Simplified Power Series for a Function Involving e^(ax) Ex 1: Determine the Sum of a Power Series Ex 2: Determine the Sum of a Power Series Estimate a Definite Integral using a Power Series (Rational Function)	