

In AP* Calculus AB, students learn to understand change geometrically and visually (by studying graphs of curves), analytically (by studying and working with mathematical formulas), numerically (by seeing patterns in sets of numbers), and verbally. Instead of simply getting the right answer, students learn to evaluate the soundness of proposed solutions and to apply mathematical reasoning to real-world models. Calculus helps scientists, engineers, and financial analysts understand the complex relationships behind real-world phenomena. The equivalent of an introductory college-level calculus course, AP Calculus AB prepares students for the AP exam and further studies in science, engineering, and mathematics.

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Length: Two semesters

UNIT 1: PRECALCULUS REVIEW

UNIT 2: BRIDGE TO CALCULUS

LESSON 1: INTRO TO CALCULUS

Study: What Is Calculus?

Explore calculus as the mathematical study of change, which can help us understand and model change in our world. See some specific examples of uses for calculus.

Duration: 0 hr 30 min

Practice: What Is Calculus?

Explore calculus as the mathematical study of change, which can help us understand and model change in our world. See some specific examples of uses for calculus. *Duration: 0 hr 30 min*

Discuss: Introductions

Before exploring the details of calculus, discuss its definition with your classmates. *Duration: 0 hr 30 min Scoring: 10 points*

LESSON 2: FUNCTIONS

Study: Functions

Explore the concepts of domain, range, zeros (roots) of a function, and asymptotes, including the idea that a function gives a unique value for a given domain value. *Duration: 0 hr 30 min*

Practice: Functions

Explore the concepts of domain, range, zeros (roots) of a function, and asymptotes, including the idea that a function gives a unique value for a given domain value. *Duration: 0 hr 30 min*

Quiz: Asymptotes and Domain Restrictions

Practice finding asymptotes and domain restrictions. *Duration: 0 hr 45 min Scoring: 12 points*

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Practice: How to Use Your Graphing Calculator

Use your graphing calculator to graph a function to an arbitrary viewing window. *Duration: 1 hr*

Practice: Finding Zeroes with Your Graphing Calculator

Use your graphing calculator to find the zeroes of a function. *Duration: 0 hr 45 min*

Practice: Graphing Functions and Finding Roots

Graph various functions and find roots for those functions. *Duration: 1 hr*

Study: Functions From Functions 1

Learn about adding, subtracting, multiplying, and dividing functions to create new functions. Notice what happens to their domains. *Duration: 0 hr 30 min*

Practice: Functions From Functions 1

Learn about adding, subtracting, multiplying, and dividing functions to create new functions. Notice what happens to their domains. *Duration: 0 hr 30 min*

Practice: Exploring Functions With Your Graphing Calculator

Use your graphing calculator to explore combinations of functions. *Duration: 0 hr 45 min*

Study: Functions From Functions 2

Explore functions created from composites and inverses of other functions. Notice what happens to their domains. *Duration: 0 hr 30 min*

Practice: Functions From Functions 2

Explore functions created from composites and inverses of other functions. Notice what happens to their domains. *Duration: 0 hr 30 min*

Quiz: Finding Function Combinations

Practice finding functions that are combinations of other functions. *Duration: 1 hr Scoring: 10 points*

Practice: Concepts in Functions

Answer questions and solve problems that relate the concepts covered in the study of functions. *Duration: 1 hr*

LESSON 3: GRAPHICAL SYMMETRY

Study: Symmetry

Explore what symmetry is present in the cases of odd, even, and inverse functions. Look at ways to identify the various symmetry cases graphically and algebraically.

Duration: 0 hr 30 min

Practice: Symmetry

Explore what symmetry is present in the cases of odd, even, and inverse functions. Look at ways to identify the various symmetry cases graphically and algebraically. *Duration: 0 hr 30 min*

Quiz: Symmetry of Equations

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After determining the type of symmetry for various equations that may be given graphically, algebraically, or as a table of values, answer questions about symmetry. *Duration: 1 hr Scoring: 11 points*

Practice: Writing Symmetrical Functions

Practice with functions by writing functions for situations and situations for functions. *Duration: 1 hr Scoring: 25 points*

LESSON 4: PATTERNS IN GRAPHS: PARAMETERS

Study: Families of Functions and Their Graphs

Explore how to use information about one graph to quickly draw the graphs of other, related functions. *Duration: 0 hr 30 min*

Practice: Families of Functions and Their Graphs

Explore how to use information about one graph to quickly draw the graphs of other, related functions. *Duration: 0 hr 30 min*

Practice: Exploring Shifting and Distorting Graphs

Use the TI-83 to explore shifting and distorting graphs. *Duration: 0 hr 45 min*

Practice: Pattern Recognition

Work on pattern recognition for the various forms, and sharpen your skills with parameters and how they relate to families of functions.

Duration: 1 hr

LESSON 5: BRIDGE TO CALCULUS WRAP-UP

Review: Bridge to Calculus

Review your studies of functions, graphical symmetry, and patterns in graphs. *Duration: 5 hr*

Test (CS): Bridge to Calculus

Take a 25-minute test, modeled after the AP Exam, covering the concepts of functions, graphical symmetry, and patterns in graphs. *Duration: 0 hr 25 min Scoring: 20 points*

Test (TS): Bridge to Calculus

Take a 35-minute test, modeled after the AP Exam, covering the concepts of functions, graphical symmetry, and patterns in graphs. *Duration: 0 hr 35 min Scoring: 30 points*

LESSON 6: DIAGNOSTIC

Diagnostic: Bridge to Calculus

Test your understanding of the key concepts covered in this unit. *Duration: 0 hr 45 min Scoring: 30 points*

UNIT 3: LIMITS AND CONTINUITY

LESSON 1: LIMITS AND CONTINUITY

Discuss: Coming to Terms With Infinity

Discuss Zeno's paradox of Achilles and the tortoise (and maybe some other paradoxes) in preparation for studying the infinite.

Duration: 0 hr 30 min Scoring: 10 points

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Study: Limits of Functions

Explore how to estimate limits from graphs or tables of data. *Duration: 0 hr 30 min*

Practice: Limits of Functions

Explore how to estimate limits from graphs or tables of data. *Duration: 0 hr 30 min*

Quiz: Limits Practice

Answer questions about whether (and where!) limits exist. *Duration: 1 hr Scoring: 9 points*

Study: Determining Limits Analytically

Examine the basic properties of limits and how to calculate limits using algebra; explore the limits of functions that include trig functions.

Duration: 0 hr 30 min

Practice: Determining Limits Analytically

Examine the basic properties of limits and how to calculate limits using algebra; explore the limits of functions that include trig functions. *Duration: 0 hr 30 min*

Practice: Limits in Trigonometric Functions

Practice determining limits, including limits of trigonometric functions. *Duration: 0 hr 45 min*

LESSON 2: ASYMPTOTIC AND UNBOUNDED BEHAVIOR

Study: Asymptotes as Limits

Examine asymptotes in terms of graphical behavior, and asymptotic behavior in terms of limits involving infinity. *Duration: 0 hr 30 min*

Practice: Asymptotes as Limits

Examine asymptotes in terms of graphical behavior, and asymptotic behavior in terms of limits involving infinity. *Duration: 0 hr 30 min*

Practice: Determining Graphs When Given Limits

Apply given information about limits, when determining graphs *Duration: 1 hr Scoring: 25 points*

Study: Comparing Relative Magnitudes of Functions

See how relative magnitudes of functions can help you determine limits quickly. *Duration: 0 hr 30 min*

Practice: Comparing Relative Magnitudes of Functions

See how relative magnitudes of functions can help you determine limits quickly. *Duration: 0 hr 30 min*

Quiz: Limits

Practice calculating limits as x goes to infinity. *Duration: 1 hr Scoring: 13 points*

Study: Limits That Do Not Exist

Learn about some nonexistent limits and the reasons for their nonexistence. *Duration: 0 hr 30 min*

Practice: Limits That Do Not Exist

Learn about some nonexistent limits and the reasons for their nonexistence. Duration: 0 hr 30 min

Discuss: Nonexistent Limits in Nature

Consider nonexistent limits in nature using a predator/prey model. Duration: 1 hr Scoring: 10 points

Practice: Overview of Limits

Apply your knowledge of limits as you determine limits that require algebraic manipulation. Duration: 1 hr

LESSON 3: CONTINUOUS FUNCTIONS

Study: Continuity

Explore the central idea of continuity (close values of the domain lead to close values of the range) and understand continuity in terms of limits. Duration: 0 hr 30 min

Practice: Continuity

Explore the central idea of continuity (close values of the domain lead to close values of the range) and understand continuity in terms of limits. Duration: 0 hr 30 min

Quiz: Domains of Continuity

Practice determining domains of continuity for functions, given either the graph or the algebraic expression (including asymptotes). Duration: 0 hr 30 min Scoring: 11 points

Practice: Continuity Problems

As you examine functions for discontinuities and examine their types, recognize the properties of functions that are important in describing functions. Duration: 1 hr 15 min Scoring: 25 points

Study: The Intermediate Value Theorem and the Extreme Value Theorem

Explore the existence of absolute extrema of a continuous function on a closed interval [a,b] and the possible nonexistence on an open interval (a,b) look at geometric understanding of graphs of continuous functions. Duration: 0 hr 30 min

Practice: The Intermediate Value Theorem and the Extreme Value Theorem

Explore the existence of absolute extrema of a continuous function on a closed interval [a,b] and the possible nonexistence on an open interval (a,b) look at geometric understanding of graphs of continuous functions. Duration: 0 hr 30 min

Discuss: Unbounded Behavior and Continuity

Brainstorm solutions to problems that show the relationship between unbounded behavior and continuity. Respond to your classmates ideas. Duration: 1 hr Scoring: 10 points

LESSON 4: LIMITS AND CONTINUITY WRAP-UP

Review: Limits and Continuity

Review your studies of limits and continuity. Duration: 5 hr

Test (CS): Limits and Continuity

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Take a 25-minute test, modeled after the AP Exam, covering the concepts of limits and asymptotes and continuity. *Duration: 0 hr 25 min Scoring: 20 points*

Test (TS): Limits and Continuity

Take a 35-minute test, modeled after the AP Exam, covering the concepts of limits and asymptotes and continuity. *Duration: 0 hr 35 min Scoring: 30 points*

LESSON 5: DIAGNOSTIC

Diagnostic: Limits and Continuity

Test your understanding of the key concepts covered in this unit. *Duration: 0 hr 45 min Scoring: 25 points*

UNIT 4: DERIVATIVES

LESSON 1: DERIVATIVES AT A POINT

Study: Rates of Change as Slopes and Limits

Examine approximate rate of change from graphs and tables of values, the tangent line to a curve at a point, and local linear approximation.

Duration: 0 hr 30 min

Practice: Rates of Change as Slopes and Limits

Examine approximate rate of change from graphs and tables of values, the tangent line to a curve at a point, and local linear approximation.

Duration: 0 hr 30 min

Quiz: Slope Estimates

Answer questions by estimating slope from graphs and tables of data. Find instantaneous rates of change by estimations.

Duration: 1 hr Scoring: 7 points

Study: The Derivative at a Point

Examine the derivative defined as the limit of the difference quotient. See examples, including points at which there are vertical tangents and points at which there are no tangents. *Duration: 0 hr 30 min*

Practice: The Derivative at a Point

Examine the derivative defined as the limit of the difference quotient. See examples, including points at which there are vertical tangents and points at which there are no tangents. *Duration: 0 hr 30 min*

Practice: Practice Finding Slopes

Practice finding slopes using easy examples of limits, some using real-world examples. *Duration: 1 hr*

Practice: Use of nDeriv or d (differentiate)

Use nDeriv or d (differentiate) on your calculator to compute the derivative at a point. *Duration: 1 hr*

Quiz: nDeriv Examples

On real-world examples, use nDeriv on points to find slopes. *Duration: 1 hr Scoring: 9 points*

Study: The Derivative as a Function

Explore the use of the derivative as a function to find the original function's slope at any x value.

Duration: 0 hr 30 min

Practice: The Derivative as a Function

Explore the use of the derivative as a function to find the original function's slope at any x value. *Duration: 0 hr 30 min*

Practice: Comparing Calculator Derivatives to Real Ones

Use the limit definition to find a function, then compare that to $y_2 = nDeriv(y_{1,x,x})$ (graphical analysis). Graph a function that you found using the limit and compare that to the calculator derivative graph $y_2 = nDeriv(y_{1,x,x})$ *Duration: 0 hr 45 min Scoring: 20 points*

LESSON 2: COMPUTING DERIVATIVES

Discuss: Shortcut Rules

Create a shortcut to the derivative, and make suggestions to your classmates. *Duration: 1 hr Scoring: 10 points*

Study: Computing Derivatives

See basic shortcuts for finding derivatives of power functions and of sine and cosine functions. *Duration: 0 hr 30 min*

Practice: Computing Derivatives

See basic shortcuts for finding derivatives of power functions and of sine and cosine functions. *Duration: 0 hr 30 min*

Practice: Practice on Derivatives

Practice the power rule and simple trig derivatives. Find slopes and simple applications. Come up with the original function and answer some questions based on the derivative. *Duration: 1 hr*

Study: Derivatives of Sums, Products, and Quotients of Functions

See how to take derivatives of functions defined as a combination of other functions. The rule for doing this will help determine derivatives for all sorts of functions. *Duration: 0 hr 30 min*

Practice: Derivatives of Sums, Products, and Quotients of Functions

See how to take derivatives of functions defined as a combination of other functions. The rule for doing this will help determine derivatives for all sorts of functions. *Duration: 0 hr 30 min*

Quiz: Product and Quotient Rule Practice

Answer questions using the product and quotient rules. *Duration: 1 hr Scoring: 10 points*

Practice: Determining Slope

Use the rules for finding derivatives to answer questions about curves. *Duration: 1 hr Scoring: 20 points*

LESSON 3: DERIVATIVE AS A FUNCTION

Discuss: Derivatives and Apex Sketchpad

Experiment with the Apex SketchPad while exploring derivatives. *Duration: 0 hr 30 min Scoring: 10 points*

Study: Relating the Graph of a Function and Its Derivative

Examine the corresponding characteristics of graphs of f and f". and the relationship between the increasing and decreasing behavior of f and the sign of f".

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Duration: 0 hr 30 min

Practice: Relating the Graph of a Function and Its Derivative

Examine the corresponding characteristics of graphs of f and f". and the relationship between the increasing and decreasing behavior of f and the sign of f". *Duration: 0 hr 30 min*

Brainbuilder: Derivatives and Graphs

Practice recognizing derivatives by looking at graphs. *Duration: 0 hr 45 min*

Study: The Relationship Between Continuity and Differentiability

Explore the relationship between differentiability and continuity. *Duration: 0 hr 30 min*

Practice: The Relationship Between Continuity and Differentiability

Explore the relationship between differentiability and continuity. *Duration: 0 hr 30 min*

Practice: More Exploration

Answer questions while exploring the relationship between differentiability and continuity. *Duration: 1 hr Scoring: 25 points*

Study: Theorems: Rolle and Mean Value

Explore Rolle's Theorem and the Mean Value Theorem and their geometric consequences. *Duration: 0 hr 30 min*

Practice: Theorems: Rolle and Mean Value

Explore Rolle's Theorem and the Mean Value Theorem and their geometric consequences. *Duration: 0 hr 30 min*

Practice: Mean Value Theorem

Answer free-response questions by finding x values that satisfy the Mean Value Theorem and looking at situations that call for the Mean Value Theorem.

Duration: 1 hr 30 min

LESSON 4: HIGHER-ORDER DERIVATIVES

Practice: Higher-Order Derivatives

Using Apex SketchPad explore patterns in Sin/cos/-sin/-cos/sin. Look for patterns in higher-order derivatives; learn notation for showing the second, third, etc. derivatives. *Duration: 1 hr*

Quiz: Multiple Derivatives of Functions

Practice finding some multiple derivatives of functions. *Duration: 1 hr Scoring: 10 points*

Study: The Second Derivative and Concavity

Explore the steps to find and use concavity. Examine the relationship between the concavity of f and the sign of f", and points of inflection as places where concavity changes. *Duration: 0 hr 30 min*

Practice: The Second Derivative and Concavity

Explore the steps to find and use concavity. Examine the relationship between the concavity of f and the sign of f", and points of inflection as places where concavity changes. *Duration: 0 hr 30 min*

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Practice: Concavity

Practice finding and using concavity. This activity is mostly graphical and numerical, with only a few analytical cases.

Duration: 1 hr Scoring: 25 points

Practice: Identifying Functions and Their Derivatives

Practice associating the features of a graph (a maximum or minimum point, an inflection point, an asymptote, uphill and downhill parts) with features on the graph of the derivative and the second derivative. *Duration: 0 hr 45 min*

LESSON 5: CHAIN RULE AND IMPLICIT DIFFERENTIATION

Study: The Chain Rule

See when and how to use the Chain Rule to find derivatives of composite functions. *Duration: 0 hr 30 min*

Practice: The Chain Rule

See when and how to use the Chain Rule to find derivatives of composite functions. *Duration: 0 hr 30 min*

Practice: Chain Rule Practice

Practice with the Chain Rule in a couple of applications to see the relationship to units. *Duration: 1 hr 30 min*

Practice: Finding the Slope of a Curve

Using algebra, find the slope of a curve at several places. *Duration: 1 hr Scoring: 20 points*

Study: Implicit Differentiation

Explore how to use a powerful tool, implicit differentiation, to find the slope of a curve that isn't a function. *Duration: 0 hr 30 min*

Practice: Implicit Differentiation

Explore how to use a powerful tool, implicit differentiation, to find the slope of a curve that isn't a function. *Duration: 0 hr 30 min*

Practice: Conic Sections

Answer questions using implicit differentiation. Practice using conic sections and new types of curves. *Duration: 1 hr 15 min*

LESSON 6: DERIVATIVES WRAP-UP

Review: Derivatives

Review your studies of derivatives, concavity, the Chain Rule, and implicit differentiation. *Duration: 5 hr*

Test (CS): Derivatives

Take a 25-minute test, modeled after the AP Exam, covering the concepts of derivatives, concavity, the Chain Rule, and implicit differentiation. *Duration: 0 hr 25 min Scoring: 20 points*

Test (TS): Derivatives

Take a 35-minute test, modeled after the AP Exam, covering the concepts of derivatives, concavity, the Chain Rule, and implicit differentiation. *Duration: 0 hr 35 min Scoring: 30 points*

LESSON 7: DIAGNOSTIC

Diagnostic: Derivatives

Test your understanding of the key concepts covered in this unit. *Duration: 0 hr 45 min Scoring: 45 points*

UNIT 5: RATES OF CHANGE

LESSON 1: EXTREMA AND OPTIMIZATION

Practice: Maximums

Complete an experiment and come up with an answer for the question "When can a continuous function have a maximum?"

Duration: 1 hr

Study: Extrema and Number Line Tests

Explore absolute (global) and relative (local) extrema, critical points, and the first derivative test. *Duration: 0 hr 30 min*

Practice: Extrema and Number Line Tests

Explore absolute (global) and relative (local) extrema, critical points, and the first derivative test. *Duration: 0 hr 30 min*

Quiz: Finding Extrema

Practice curve analysis using a combination of the first and second derivative tests. *Duration: 0 hr 45 min Scoring: 8 points*

Practice: Work on Extrema

Work on extrema, answering free-response style questions similar to the kind posed on the AP Exam. *Duration: 1 hr*

Discuss: Salsa Jars

Discuss your answer to a question about the best number of salsa jars to produce per run by minimizing storage and production costs. Duration: 1 hr Scoring: 10 points

Study: Optimization

See how to identify variables in optimization situations, write functions representing specific situations, and solve various types of optimization problems. *Duration: 0 hr 30 min*

Practice: Optimization

See how to identify variables in optimization situations, write functions representing specific situations, and solve various types of optimization problems.

Duration: 0 hr 30 min

Practice: Applied Optimizing

Answer questions about applied optimization problems. *Duration: 2 hr Scoring: 30 points*

LESSON 2: TANGENT AND NORMAL LINES

Study: Tangent and Normal Lines

See how to find and use tangent and normal lines. *Duration: 0 hr 30 min*

Practice: Tangent and Normal Lines

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See how to find and use tangent and normal lines. *Duration: 0 hr 30 min*

Quiz: Finding Tangent and Normal Lines

Practice finding tangent and normal lines using calculus to find the slopes. *Duration: 0 hr 45 min Scoring: 4 points*

Practice: More Practice

Practice finding tangent and normal lines in slightly more difficult applications. *Duration: 1 hr*

Discuss: Approximation

Explain why theta is a good approximation for sin theta if theta is near zero. Discuss your explanation with your classmates.

Duration: 1 hr Scoring: 10 points

Study: Local Linearity and Tangent Line Approximation

Examine local linearity and tangent line approximation. *Duration: 0 hr 30 min*

Practice: Local Linearity and Tangent Line Approximation

Examine local linearity and tangent line approximation. *Duration: 0 hr 30 min*

Practice: Tangent Line Approximation

Answer questions by using the tangent line approximation. *Duration: 1 hr 30 min Scoring: 30 points*

LESSON 3: RATES OF CHANGE

Study: Rates of Change as Derivatives

See how to recognize derivatives in real world situations. Explore translating verbal descriptions into math and vice versa.

Duration: 0 hr 30 min

Practice: Rates of Change as Derivatives

See how to recognize derivatives in real world situations. Explore translating verbal descriptions into math and vice versa.

Duration: 0 hr 30 min

Practice: Finding Rates of Changes

Practice recognizing rates, as ways to start breaking down related-rates problems. *Duration: 1 hr*

Discuss: Derivatives in the Real World

Research real-world mentions of a derivatives. Discuss your findings with your classmates. *Duration: 1 hr Scoring: 10 points*

LESSON 4: RELATED RATES

Study: Related Rates

Explore modeling related rates of change, such as how the change in the volume of water in a tank is related to the change in the depth of water in the tank. *Duration: 0 hr 30 min*

Practice: Related Rates

Explore modeling related rates of change, such as how the change in the volume of water in a tank is related to

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the change in the depth of water in the tank. Duration: 0 hr 30 min

Quiz: Practice Determining Rates

Practice determining rates of change for related variables. *Duration: 1 hr Scoring: 4 points*

Practice: Related-Rates Problems

Solve complicated related-rates problems similar to those found on the AP Exam. *Duration: 1 hr 30 min Scoring: 30 points*

LESSON 5: RECTILINEAR MOTION

Practice: Velocity and Acceleration

Answer questions about velocity by first plotting position over time for a 20-minute car ride. *Duration: 1 hr*

Study: Rectilinear Motion

Explore interpretation of the derivative as a rate of change in motion problem. Examine velocity, speed, and acceleration. *Duration: 0 hr 30 min*

Practice: Rectilinear Motion

Explore interpretation of the derivative as a rate of change in motion problem. Examine velocity, speed, and acceleration.

Duration: 0 hr 30 min

Quiz: Rectilinear Motion Problems

Solve rectilinear motion problems, similar to the AP Exam questions. *Duration: 0 hr 45 min Scoring: 6 points*

Practice: More Rectilinear Motion Problems

Solve rectilinear motion problems, similar to the AP Exam free-response questions. *Duration: 1 hr*

LESSON 6: SEMESTER WRAP-UP

Practice: Applications of the Derivative

Answer free-response questions that tie together the concepts of basic calculus, limits and continuity, derivatives, and rates of change. Duration: 2 hr Scoring: 40 points

Review: Semester 1 Review

Review the concepts of basic calculus, limits and continuity, derivatives, and rates of change in preparation for the Semester Final. *Duration: 7 hr*

Exam: Semester Final

Take a 50-minute Semester Final, modeled after the AP Exam, covering the concepts of basic calculus, limits and continuity, derivatives, and rates of change. *Duration: 0 hr 50 min Scoring: 80 points*

Final Exam: Semester Final

Take a 70-minute Semester Final, modeled after the AP Exam, covering the concepts of basic calculus, limits and continuity, derivatives, and rates of change.

Duration: 1 hr 10 min Scoring: 120 points

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LESSON 7: DIAGNOSTIC

Diagnostic: Rates of Change

Test your understanding of the key concepts covered in this unit. *Duration: 0 hr 45 min Scoring: 25 points*

UNIT 6: THE INTEGRAL AND THE FUNDAMENTAL THEOREM OF CALCULUS

LESSON 1: AREA UNDER A CURVE

Discuss: Derivatives

Write about the derivative, and summarize and discuss what you've learned about derivatives. *Duration: 0 hr 30 min Scoring: 10 points*

Practice: Analyzing Velocity and Distance in a Car Ride

In this activity take a ride, record information, and then use your data to make discoveries about how math can be used to explore velocity and distance. Duration: 1 hr

Study: Area Under a Curve: Riemann Sums

Explore how to use rectangles to estimate the area under a curve. *Duration: 0 hr 30 min*

Practice: Area Under a Curve: Riemann Sums

Explore how to use rectangles to estimate the area under a curve. *Duration: 0 hr 30 min*

Quiz: Practice Using Riemann Sums

Practice estimating areas under curves by computing various Riemann sums using left-hand endpoints, right-hand endpoints, and midpoints.

Duration: 1 hr Scoring: 6 points

Practice: Finding a Better Approximation of Area Under a Curve

Explore how to find a better approximation of area under a curve. *Duration: 0 hr 45 min Scoring: 20 points*

Study: Numerical Approximations to Area

Examine an alternative to Riemann sums. *Duration: 0 hr 30 min*

Practice: Numerical Approximations to Area

Examine an alternative to Riemann sums. *Duration: 0 hr 30 min*

Quiz: An Alternative to Riemann Sums

Apply the trapezoid rule and see that in some cases the approximation is very good, and in other cases it contains a lot of error.

Duration: 1 hr Scoring: 7 points

Practice: Using Approximations to Area Under a Curve

Practice using approximations to area under a curve. *Duration: 1 hr*

LESSON 2: DEFINITE INTEGRALS

Practice: What If You Take More Intervals?

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Discover what happens if you take more intervals. *Duration: 1 hr*

Study: The Definite Integral

Look at how to determine the exact area under the curve. Evaluate some definite integrals by applying simple rules of geometry, and approximate some definite integrals numerically. *Duration: 0 hr 30 min*

Practice: The Definite Integral

Look at how to determine the exact area under the curve. Evaluate some definite integrals by applying simple rules of geometry, and approximate some definite integrals numerically. *Duration: 0 hr 30 min*

Quiz: Practice With the Definite Integral

Practice with the definition of the definite integral and its relationship to area under curves. *Duration: 0 hr 45 min Scoring: 7 points*

Study: Properties of the Definite Integral

Definite integrals work like the areas in precalculus; they have similar algebraic properties when you combine them. This Tutorial examines the important properties of the definite integral. *Duration: 0 hr 30 min*

Practice: Properties of the Definite Integral

Definite integrals work like the areas in precalculus; they have similar algebraic properties when you combine them. This Tutorial examines the important properties of the definite integral. *Duration: 0 hr 30 min*

Quiz: Practice With Properties of the Definite Integral

Practice combining and working with properties of definite integrals. Use the notion of definite integral as "signed area."

Duration: 0 hr 45 min Scoring: 9 points

Practice: Finding the Value of a Definite Integral

Approximate definite integrals numerically. *Duration: 1 hr*

Quiz: Practice Using fnInt()or nInt()

Use your graphing calculator to approximate definite integrals. *Duration: 0 hr 30 min Scoring: 5 points*

Study: The Definite Integral as Accumulated Change

The definite integral is more than just the area under the curve. In this Tutorial you'll look at the definite integral as an "accumulator."

Duration: 0 hr 30 min

Practice: The Definite Integral as Accumulated Change

The definite integral is more than just the area under the curve. In this Tutorial you'll look at the definite integral as an "accumulator."

Duration: 0 hr 30 min

Practice: Practice With the Definite Integral as Accumulated Change

Exercise your understanding about the definite integral as an accumulator of change and about the idea of average value of a function. *Duration: 1 hr Scoring: 25 points*

LESSON 3: ANTIDERIVATIVES

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Discuss: Going Between Position, Velocity, and Acceleration

Given an equation for velocity, attempt to come up with an equation for position. And given an equation for acceleration attempt to come up with an equation for velocity. *Duration: 0 hr 30 min Scoring: 10 points*

Study: The Antiderivative

Study how, given a derivative, to find the "original" function. *Duration: 0 hr 30 min*

Practice: The Antiderivative

Study how, given a derivative, to find the "original" function. *Duration: 0 hr 30 min*

Quiz: Practice Finding Antiderivatives

Practice finding antiderivatives. Duration: 1 hr Scoring: 11 points

Study: Antiderivatives of Composite Functions

Examine how to find antiderivatives of composite functions. *Duration: 0 hr 30 min*

Practice: Antiderivatives of Composite Functions

Examine how to find antiderivatives of composite functions. *Duration: 0 hr 30 min*

Quiz: Practice Finding Antiderivatives of Composite Functions

Practice finding antiderivatives of composite functions. *Duration: 1 hr Scoring: 11 points*

Practice: Practice Finding Antiderivatives of Composite Functions

Apply your knowledge about finding antiderivatives of composite functions. *Duration: 1 hr*

LESSON 4: THE FUNDAMENTAL THEOREMS OF CALCULUS

Practice: Exploring the Relationship Between the Derivative and the Antiderivative

In this activity, use your calculator to explore the relationship between the derivative and the antiderivative (or area function). See how the derivative and the antiderivative are related. *Duration: 0 hr 30 min Scoring: 20 points*

Study: The Fundamental Theorems of Calculus

Notice how the Fundamental Theorems of Calculus tie together into one neat package. Examine the shortcut for evaluating definite integrals exactly.

Duration: 0 hr 30 min

Practice: The Fundamental Theorems of Calculus

Notice how the Fundamental Theorems of Calculus tie together into one neat package. Examine the shortcut for evaluating definite integrals exactly.

Duration: 0 hr 30 min

Quiz: Practice Using the Fundamental Theorems

Develop a basic understanding of what the theorems mean and how to use them. *Duration: 0 hr 45 min Scoring: 10 points*

Study: Definite Integrals of Composite Functions

Apply the use of substitution to find antiderivatives to definite integrals and study about changing the limits of

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integration. Duration: 0 hr 30 min

Practice: Definite Integrals of Composite Functions

Apply the use of substitution to find antiderivatives to definite integrals and study about changing the limits of integration.

Duration: 0 hr 30 min

Practice: Practice Using Substitution and the Fundamental Theorems

Practice using the method of substitution for evaluating definite integrals. *Duration: 1 hr*

Quiz: Terms and Concepts

Examine the subtleties of terms and concepts related to the Fundamental Theorems and integration. *Duration: 0 hr 30 min Scoring: 10 points*

Study: Analyzing Functions Defined as Definite Integrals

Look at some functions given as definite integrals, and explore how to do calculus with them. *Duration: 0 hr 30 min*

Practice: Analyzing Functions Defined as Definite Integrals

Look at some functions given as definite integrals, and explore how to do calculus with them. *Duration: 0 hr 30 min*

Practice: Practice Analyzing Functions Defined by Definite Integrals

Find derivatives at points, and apply multiple applications on functions given as definite integrals. *Duration: 1 hr Scoring: 30 points*

LESSON 5: THE INTEGRAL AND THE FUNDAMENTAL THEOREM OF CALCULUS WRAP-UP

Review: The Integral and the Fundamental Theorem of Calculus

Review your studies of the area under a curve, definite integrals, antiderivatives, and the fundamental theorems of calculus.

Duration: 5 hr

Test (CS): The Integral and the Fundamental Theorem of Calculus

Take a 25-minute test covering the area under a curve, definite integrals, antiderivatives, and the fundamental theorems of calculus.

Duration: 0 hr 25 min Scoring: 20 points

Test (TS): The Integral and the Fundamental Theorem of Calculus

Take a 35-minute test covering the area under a curve, definite integrals, antiderivatives, and the fundamental theorems of calculus. *Duration: 0 hr 35 min Scoring: 30 points*

LESSON 6: DIAGNOSTIC

Diagnostic: The Integral and the Fundamental Theorem of Calculus

Test your understanding of the key concepts covered. *Duration: 0 hr 45 min Scoring: 34 points*

UNIT 7: APPLICATIONS OF THE INTEGRAL

LESSON 1: AREA

Study: Area Between Curves

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See how to use the definite integral to determine the area of just about any shape that can be defined with equations in terms of x and y. Duration: 0 hr 30 min

Practice: Area Between Curves

See how to use the definite integral to determine the area of just about any shape that can be defined with equations in terms of x and y. Duration: 0 hr 30 min

Quiz: Practice Finding Area Between Curves

Practice finding area between curves. Duration: 0 hr 45 min Scoring: 8 points

Study: More About Areas

See what else you can do with finding areas. Find areas in cases where there is no formula for the function, and analyze functions in cases where you're given an integral but not the original formula for the function. Duration: 0 hr 30 min

Practice: More About Areas

See what else you can do with finding areas. Find areas in cases where there is no formula for the function, and analyze functions in cases where you're given an integral but not the original formula for the function. Duration: 0 hr 30 min

Quiz: Practice Finding Domains for Given Areas

Work with the idea of the average value of a function. Some of the techniques will be the same as in the previous activity, where you found areas between curves. Duration: 1 hr Scoring: 10 points

Practice: More Practice with Areas

Practice applying definite integrals. Work with qualitative questions (not heavy on numbers and calculation). Duration: 1 hr 15 min Scoring: 25 points

LESSON 2: VOLUME

Discuss: Making a Solid

In this activity, construct a three-dimensional solid out of cardboard. Duration: 1 hr Scoring: 10 points

Study: Volumes of Revolution

Examine three-dimensional shapes formed by rotating a curve and how to use the integral to find their volumes. Duration: 0 hr 30 min

Practice: Volumes of Revolution

Examine three-dimensional shapes formed by rotating a curve and how to use the integral to find their volumes. Duration: 0 hr 30 min

Practice: Practice Working With Volumes of Revolution

Find the volume of solids formed by rotating given regions around a certain line. Duration: 1 hr

Study: Other Cross Sections

Investigate cross sections of solids. Duration: 0 hr 30 min

Practice: Other Cross Sections

Investigate cross sections of solids.

Duration: 0 hr 30 min

Practice: Practice With Many Kinds of Volumes

Practice computing the volumes of solids whose cross sections are not circular or annular (washer-shaped). *Duration: 1 hr 30 min Scoring: 25 points*

LESSON 3: OTHER APPLICATIONS OF THE DEFINITE INTEGRAL

Practice: Rectilinear Motion

Apply your knowledge of position, distance, velocity, speed, and acceleration in preparation for applying the definite integral to rectilinear motion (motion in a straight line). *Duration: 0 hr 30 min*

Study: Rectilinear Motion Revisited

Use integrals to find net and total distances. Look at the distinction between speed and velocity, and see how these relate to the distinction between net and total distance. *Duration: 0 hr 30 min*

Practice: Rectilinear Motion Revisited

Use integrals to find net and total distances. Look at the distinction between speed and velocity, and see how these relate to the distinction between net and total distance. *Duration: 0 hr 30 min*

Practice: Practice Finding Distances, Velocities, and Other Aspects of Rectilinear Motion

Answer questions about the relationships between distance, velocity, and other aspects of rectilinear motion. *Duration: 1 hr*

Study: Other Applications of the Definite Integral

Learn how these applications work in situations such as calculating arc length, work (force over a distance), and fluid pressure. Study about the connections between these applications. *Duration: 0 hr 30 min*

Practice: Other Applications of the Definite Integral

Learn how these applications work in situations such as calculating arc length, work (force over a distance), and fluid pressure. Study about the connections between these applications. *Duration: 0 hr 30 min*

Quiz: Practice Using Definite Integrals

Practice applying the definite integral. Underlying all these applications is the principle of accumulation. *Duration: 1 hr 15 min Scoring: 9 points*

Practice: Practice Using Definite Integrals

Practice applying the definite integral to situations involving accumulation of quantities. *Duration: 1 hr 30 min Scoring: 30 points*

Quiz: Important Concepts From This Unit

Review the meanings of some of the important terms and concepts in a series of qualitative (no math calculations) questions.

Duration: 1 hr 30 min Scoring: 8 points

LESSON 4: APPLICATIONS OF THE INTEGRAL WRAP-UP

Review: Applications of the Integral

Review concepts of area, volume, and other applications of the definite integral. *Duration: 5 hr*

Test (CS): Applications of the Integral

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Take a 25-minute test covering various applications of the definite integral, including finding areas of regions and volume for solids and use the definite integral to solve problems of accumulation of change. *Duration: 0 hr 25 min Scoring: 20 points*

Test (TS): Applications of the Integral

Take a 35-minute test covering various applications of the definite integral, including finding areas of regions and volume for solids and use the definite integral to solve problems of accumulation of change. *Duration: 0 hr 35 min Scoring: 30 points*

LESSON 5: DIAGNOSTIC

Diagnostic: Applications of the Integral

Test your understanding of the key concepts covered. *Duration: 0 hr 45 min Scoring: 20 points*

UNIT 8: INVERSE AND TRANSCENDENTAL FUNCTIONS

LESSON 1: INVERSE FUNCTIONS

Study: Inverse Functions and Their Derivatives

Re-visit derivatives. Just as you may want to know how fast y changes with respect to x, you may want to know how fast x changes with respect to y. Duration: 0 hr 30 min

Practice: Inverse Functions and Their Derivatives

Re-visit derivatives. Just as you may want to know how fast y changes with respect to x, you may want to know how fast x changes with respect to y. Duration: 0 hr 30 min

Quiz: Derivatives of Inverse Functions

Practice finding derivatives of inverse functions. *Duration: 0 hr 45 min Scoring: 10 points*

Study: Inverse Trigonometric Functions

Use implicit differentiation to find the derivatives of $\arctan(x)$ and $\arccos(y)$. Duration: 0 hr 30 min

Practice: Inverse Trigonometric Functions

Use implicit differentiation to find the derivatives of $\arctan(x)$ and $\arccos(y)$. Duration: 0 hr 30 min

Quiz: Use Inverse Trig Functions and Identify Their Domain Restrictions

Use inverse trigonometric functions, identify their domain restrictions, and find their derivatives. *Duration: 1 hr 30 min Scoring: 16 points*

Practice: Determine and Use Derivatives of Inverse Trig Functions

Determine and use derivatives of inverse trig functions. *Duration: 1 hr*

LESSON 2: REVIEW OF LOGARITHMIC AND EXPONENTIAL FUNCTIONS

Discuss: What Makes Logarithms So Scary?

Discuss what makes logarithms so scary. *Duration: 0 hr 30 min Scoring: 10 points*

Practice: Derivatives of Exponential Functions

In this activity, find the derivatives of some specific exponential functions by numerical exploration with your

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calculator. Duration: 1 hr

Study: Review of Exponential and Logarithmic Functions

Review some precalculus. It is important to understand the properties of these functions before working with derivatives and integrals that involve them.

Duration: 0 hr 30 min

Practice: Review of Exponential and Logarithmic Functions

Review some precalculus. It is important to understand the properties of these functions before working with derivatives and integrals that involve them.

Duration: 0 hr 30 min

Quiz: Exponential and Logarithmic Functions

Practice with exponential and logarithmic functions. *Duration: 0 hr 45 min Scoring: 16 points*

LESSON 3: COMPUTATION OF DERIVATIVES FOR SOME TRANSCENDENTAL FUNCTIONS

Practice: What Is the Area Under 1/x?

In this activity, use your calculator as a tool to find the exact area under the curve y = 1/x. Duration: 0 hr 45 min

Study: Derivatives of Logarithmic and Exponential Functions

Learn how to take the derivatives of logs and exponentials, and learn a new technique for taking messy derivatives.

Duration: 0 hr 30 min

Practice: Derivatives of Logarithmic and Exponential Functions

Learn how to take the derivatives of logs and exponentials, and learn a new technique for taking messy derivatives. *Duration: 0 hr 30 min*

Quiz: Derivatives of Logarithmic and Exponential Functions

Determine derivatives of logarithmic and exponential functions. *Duration: 0 hr 45 min Scoring: 15 points*

Practice: Determine Derivatives of Logarithmic and Exponential Functions

Practice determining derivatives of logarithmic and exponential functions. Duration: 1 hr

Study: Analysis of Curves Involving Transcendental Functions

Revisit some applications of derivatives. *Duration: 0 hr 30 min*

Practice: Analysis of Curves Involving Transcendental Functions

Revisit some applications of derivatives. *Duration: 0 hr 30 min*

Quiz: Practicing Curve Analysis

Work on problems involving related rates, rectilinear motion, optimization, and curve analysis. Use multiple functions to describe the relationships in the problems. *Duration: 1 hr Scoring: 8 points*

Duration: 1 nr Scoring: 8 points

Practice: Analysis of Curves

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Practice applying differentiation to problems involving transcendental functions. Duration: 1 hr Scoring: 25 points

LESSON 4: INTEGRALS OF SOME TRANSCENDENTAL FUNCTIONS

Study: Integrating Transcendental Functions

Review the antiderivative rules for transcendental functions, and start using them to work with integrals. Duration: 0 hr 30 min

Practice: Integrating Transcendental Functions

Review the antiderivative rules for transcendental functions, and start using them to work with integrals. Duration: 0 hr 30 min

Quiz: Antiderivatives of Transcendental Functions

Practice finding antiderivatives involving transcendental functions. Duration: 0 hr 45 min Scoring: 11 points

Practice: More Definite and Indefinite Integrals

Practice finding antiderivatives and definite integrals for the many types of functions covered in this course. Duration: 1 hr

Study: Applications of Integrals Using Transcendental Functions

Examine why the applications for the definite integral are valid. Duration: 0 hr 30 min

Practice: Applications of Integrals Using Transcendental Functions

Examine why the applications for the definite integral are valid. Duration: 0 hr 30 min

Practice: More Applications of Integrals

Find and use integrals for situations that include transcendental functions. Duration: 1 hr Scoring: 25 points

LESSON 5: INVERSE AND TRANSCENDENTAL FUNCTIONS WRAP-UP

Review: Inverse and Transcendental Functions

Review concepts of logarithmic, exponential, inverse and transcendental functions, and computation of some transcendental functions. Duration: 5 hr

Test (CS): Inverse and Transcendental Functions

Take a 25-minute test covering inverse and transcendental functions, including inverse trigonometric, exponential, and logarithmic functions, their derivatives and antiderivatives, and applications involving transcendental functions.

Duration: 0 hr 25 min Scoring: 20 points

Test (TS): Inverse and Transcendental Functions

Take a 35-minute test covering inverse and transcendental functions, including inverse trigonometric, exponential, and logarithmic functions, their derivatives and antiderivatives, and applications involving transcendental functions.

Duration: 0 hr 35 min Scoring: 30 points

LESSON 6: DIAGNOSTIC

Diagnostic: Inverse and Transcendental Functions

Test your understanding of the key concepts covered. Duration: 0 hr 45 min Scoring: 31 points

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UNIT 9: SEPARABLE DIFFERENTIAL EQUATIONS AND SLOPE FIELDS

LESSON 1: SEPARABLE DIFFERENTIAL EQUATIONS

Study: Differential Equations and Slope Fields

See how to graph a differential equation by visualizing a whole family of functions at once, using a slope field. Duration: 0 hr 30 min

Practice: Differential Equations and Slope Fields

See how to graph a differential equation by visualizing a whole family of functions at once, using a slope field. Duration: 0 hr 30 min

Quiz: Important Concepts From This Unit

Answer questions about differential equations, using a slope field, and prepare for a more in-depth treatment of differential equations.

Duration: 1 hr Scoring: 9 points

Study: Separable Differential Equations Used in Modeling

Study how to recognize a differential equation and how to solve some really simple differential equations used in modeling "real life" situations.

Duration: 0 hr 30 min

Practice: Separable Differential Equations Used in Modeling

Study how to recognize a differential equation and how to solve some really simple differential equations used in modeling "real life" situations.

Duration: 1 hr 45 min

Quiz: Setting up and Solving Separable Differential Equations

Look at some of the steps involved in setting up and solving these equations. Duration: 1 hr Scoring: 11 points

Practice: Applications of Differential Equations

Practice modeling situations as differential equations, and solve those equations. Duration: 1 hr 45 min Scoring: 30 points

LESSON 2: EXPONENTIAL GROWTH AND DECAY AND RELATED APPLICATIONS

Study: Exponential Growth and Decay

Look closely at dy/dt = ky, one of the most important differential equations used in modeling where the rate of change depends upon the amount. Duration: 0 hr 30 min

Practice: Exponential Growth and Decay

Look closely at dy/dt = ky, one of the most important differential equations used in modeling where the rate of change depends upon the amount. Duration: 0 hr 30 min

Quiz: Solving Growth and Decay Problems

Practice recognizing and solving differential equations that lead to exponential growth and decay. Duration: 1 hr Scoring: 10 points

Study: More Applications of Differential Equations

Look at Newton's law of cooling, mixing problems, falling bodies with air resistance, and logistic growth curves. Duration: 0 hr 30 min

Practice: More Applications of Differential Equations

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Look at Newton's law of cooling, mixing problems, falling bodies with air resistance, and logistic growth curves. *Duration: 0 hr 30 min*

Practice: More Applications of Exponential and Logarithmic Differential Equations

Practice using applications of exponential and logarithmic differential equations. *Duration: 1 hr 15 min Scoring: 30 points*

LESSON 3: SEPARABLE DIFFERENTIAL EQUATIONS AND SLOPE FIELDS WRAP-UP

Review: Separable Differential Equations

Review the concepts of separable differential equations and exponential growth and decay. *Duration: 5 hr*

Test (CS): Separable Differential Equations and Slope Fields

Take a 25-minute test covering real-world problems with differential equations, differential equations leading to exponential growth and decay and solve separable differential equations. *Duration: 0 hr 25 min Scoring: 20 points*

Test (TS): Separable Differential Equations and Slope Fields

Take a 35-minute test covering real-world problems with differential equations, differential equations leading to exponential growth and decay and solve separable differential equations. *Duration: 0 hr 35 min Scoring: 30 points*

LESSON 4: DIAGNOSTIC

Diagnostic: Separable Differential Equations and Slope Fields

Test your understanding of the key concepts covered. *Duration: 0 hr 45 min Scoring: 21 points*

UNIT 10: AP EXAM REVIEW AND FINAL EXAM

LESSON 1: CALCULUS AS A COHESIVE WHOLE

Study: Strategies for Taking the AP Exam

What to do between now and the Exam, and how to handle yourself during the Exam. Study how AP Exam scores are calculated, and explore some additional strategies for answering Free-response questions. *Duration: 0 hr 30 min*

Practice: Strategies for Taking the AP Exam

What to do between now and the Exam, and how to handle yourself during the Exam. Study how AP Exam scores are calculated, and explore some additional strategies for answering Free-response questions. *Duration: 0 hr 30 min*

Practice: Calculus as a Cohesive Whole

Using the Fundamental Theorems of Calculus as a focus, complete a "Concept Map" and take notice of what's helped you see calculus as a cohesive whole. *Duration: 0 hr 30 min*

Discuss: Calculus as a Cohesive Whole

Write a short question in which the solution requires the test taker to tie concepts from different parts of the Calculus AB course. Also answer a question that has been provided. *Duration: 0 hr 30 min Scoring: 10 points*

Practice: Goals for the AP Exam

Review the nine goals stated by the College Board for AP Calculus, using the goals as a framework for reviewing the course and reviewing for the Final Exam and for the AP Exam.

LESSON 2: REVIEW OF TOPICS

Quiz: AP-Style Multiple-Choice Questions, Part 1

Following an outline of the course, answer questions that review and combine concepts tested on the AP Exam. *Duration: 2 hr Scoring: 18 points*

Quiz: AP-Style Multiple-Choice Questions, Part 2

Following an outline of the course, answer questions that review and combine concepts tested on the AP Exam. *Duration: 2 hr Scoring: 22 points*

Practice: AP-Style Free-Response Questions

Answer AP-style Free-Response Questions. *Duration: 6 hr Scoring: 30 points*

LESSON 3: PRACTICE FINAL EXAMS

Practice: Full Final Practice Exam

Time yourself as you practice for the Final Exam and the AP Exam by taking this ungraded test. *Duration: 3 hr 20 min*

Study: AP Free-Response Questions

Learn general strategies for answering AP free-response questions by learning to score the practice test that you did in the previous activity. *Duration: 0 hr 30 min*

Practice: AP Free-Response Questions

Learn general strategies for answering AP free-response questions by learning to score the practice test that you did in the previous activity. *Duration: 0 hr 30 min*

Practice: Scoring Your Practice Exam

Review calculus problem-solving techniques and review AP Exam-taking strategies by applying the AP scoring techniques.

Duration: 2 hr Scoring: 30 points

Practice: Self-Scored Practice Exam

Grade yourself on how well you did the scoring work, as well as how you did on the practice exam. *Duration: 4 hr*

Discuss: Should You Take the AP Exam?

With your teacher and with other students in your class, discuss the pros and cons of taking the AP Exam. *Duration: 0 hr 30 min Scoring: 10 points*

LESSON 4: FINAL EXAM

Exam: Final Exam

Take a simulation of an AP Exam. Duration: 1 hr 40 min Scoring: 45 points

Final Exam: Final Exam

Take a simulation of an AP Exam. Duration: 1 hr 30 min Scoring: 55 points