Advanced Placement® (AP®) Calculus (APCALC) A Syllabus

Course Name

APCALC A

Advanced Placement® (AP®) Calculus – Semester A

Course Information

APCALC A is the first semester of this two-semester course.

In AP Calculus A and B, 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 A and B prepare students for the AP exam and further studies in science, engineering, and mathematics.

Prerequisite: Algebra II, Geometry, and Pre-Calculus with Trigonometry

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Course Delivery Method

Online

Contacting Your Instructor

You may contact your instructor through the Blackboard messaging system. Technical support is available 24/7 at www.k12.ttu.edu.

Course Objectives

After completing this course, you should be able to:

1. 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;
2. evaluate the soundness of proposed solutions;
3. apply mathematical reasoning to real-world models; and
4. understand the complex relationships behind real-world phenomena.

APCALC addresses the required Texas Essential Knowledge and Skills (TEKS). These can be found at the Texas Education Agency website.

Textbook and Materials

Textbook(s)

There is no required text to purchase for this course.

Materials

Required:

- TI-89, TI-84 Plus, TI-83, or TI-83 Plus calculator or equivalent

Optional:

- *Calculus: Single Variable*, 8th ed. James Stewart (Brooks/Cole, 2016). ISBN-10: 1305266633 / ISBN-13: 9781305266636.
  Acceptable alternate: 7th ed. (2012). ISBN-10: 0538497831.
  Acceptable alternate: 6th ed. (2008). ISBN-10: 0495011614.
- *Cracking the AP Calculus AB Exam*, 2020 Edition. Princeton Review. (Penguin Random House, 2019). ISBN-10: 0525568158 / ISBN-13: 9780525568155.
  Acceptable alternate: 2019 ed. ISBN-13:9781524757984.
  Acceptable alternate: 2018 ed. ISBN-13:9781524710019.

Technical Requirements

- Internet access – preferably high speed (for accessing Blackboard)
- Email
- Word processing software such as Microsoft Word
- Adobe Reader (download from Adobe.com)
- Audio and video capabilities (for watching/listening to course content)
- PDF app (free options available)

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Technical Skill Requirements

Be comfortable with the following:

- using a word processor
- Internet search engines and browsers
- creating PDFs (see **Requirements for Creating PDFs** in the Syllabus section of your course)

Coursework

The graded assignments within each unit are formative in nature. This means that they are designed to assist you in applying and demonstrating the unit concepts, as well as identifying areas in which you need additional review. You may use all the unit's learning activities to assist you as you complete the graded assignments.

Submitting Assignments

You will submit all assignments through the Blackboard Assignment Tool, rather than by mail or email.

All course work will be completed in the Apex system (quizzes, discussions, practice assignments, journals, etc.). When submitting a Practice Assignment, you will submit it through the **Apex system > Messages > New Message** tool and choose your instructor. This will be the place where you upload file attachments showing your work on the assignment. Your instructor will receive the assignment submission and grade it, then provide feedback that will be sent back to you through Apex messages.

Course Organization

This course consists of five units and a final exam. Each unit contains the following:

- Introduction and Instructions
- Learning Objectives and Curriculum Standards
- Learning Activities
- Assignments

Each unit includes several activities that present content knowledge. Each unit also includes multiple graded assignments to ensure that you learn the content that has been presented in the activities. Some of the assignments are automatically-graded quizzes, and some are written assignments or activities that your instructor will grade. Be sure you read all instructions carefully and ask your instructor for help if something is not clear.

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Course Outline

Please note that some assignments will be hidden from you when you start the course. As you move through the units and complete assignments, more will unlock for you.

Unit	Topic	Approximate Time for Completion
Unit 1	Precalculus Review	One week
Lesson 1	Pre-Test over Precalculus	
Lesson 2	Post-Review on Assessment	
Unit 2	Bridge to Calculus	Four weeks
Lesson 1	Intro to Calculus	
Lesson 2	Functions	
Lesson 3	Graphical Symmetry	
Lesson 4	Patterns in Graphs: Parameters	
Lesson 5	Wrap-Up	
Unit 3	Limits and Continuity	Three weeks
Lesson 1	Limits and Continuity	
Lesson 2	Asymptotic and Unbounded Behavior	
Lesson 3	Continuous Functions	
Lesson 4	Wrap-Up	
Unit 4	Derivatives	Four weeks
Lesson 1	Derivatives at a Point	
Lesson 2	Computing Derivatives	
Lesson 3	Derivative as a Function	
Lesson 4	Higher-Order Derivatives	
Lesson 5	Chain Rule and Implicit Differentiation	
Lesson 6	Wrap-Up	
Unit 5	Rates of Change	Four weeks
Lesson 1	Extrema and Optimization	
Lesson 2	Tangent and Normal Lines	
Lesson 3	Rates of Change	

Unit	Topic	Approximate Time for Completion
Lesson 4	Related Rates	
Lesson 5	Rectilinear Motion	
Lesson 6	Semester Wrap-Up Semester Exam (APCALC A)	
Final Exam	Units 1-5	

Assignment Schedule

Each of the following must be completed to complete the course. Items with an asterisk (*) indicate that these are summative assessments for the course.

Unit	Weeks	Assignments
1	1-2	Pre-Test over Precalculus Post-Review on Assessment
2	3-6	2.1.3 Discuss: Introductions 2.2.3 Quiz: Asymptotes and Domain Restrictions 2.2.12 Quiz: Finding Function Combinations 2.3.3 Quiz: Symmetry of Equations 2.3.4 Practice: Writing Symmetrical Functions *2.5.2 Test (CS): Bridge to Calculus
3	7-9	3.1.1 Discuss: Coming to Terms With Infinity 3.1.4 Quiz: Limits Practice 3.2.3 Practice: Determining Graphs When Given Limits 3.2.6 Quiz: Limits 3.2.9 Discuss: Nonexistent Limits in Nature 3.3.3 Quiz: Domains of Continuity 3.3.4 Practice: Continuity Problems 3.3.7 Discuss: Unbounded Behavior and Continuity *3.4.2 Test (CS): Limits and Continuity
4	10-13	4.1.3 Quiz: Slope Estimates 4.1.8 Quiz: nDeriv Examples 4.1.11 Practice: Comparing Calculator Derivatives to Real Ones 4.2.1 Discuss: Shortcut Rules 4.2.7 Quiz: Product and Quotient Rule Practice 4.2.8 Practice: Determining Slope Lesson Overview: Derivative as a Function 4.3.7 Practice: More Exploration

Unit	Weeks	Assignments
		4.4.2 Quiz: Multiple Derivatives of Functions 4.4.5 Practice: Concavity 4.5.4 Practice: Finding the Slope of a Curve *4.6.2 Test (CS): Derivatives
5	14-17	5.1.4 Quiz: Finding Extrema 5.1.6 Discuss: Salsa Jars 5.1.9 Practice: Applied Optimizing 5.2.3 Quiz: Finding Tangent and Normal Lines 5.2.5 Discuss: Approximation 5.2.8 Practice: Tangent Line Approximation 5.3.4 Discuss: Derivatives in the Real World 5.4.3 Quiz: Practice Determining Rates 5.4.4 Practice: Related-Rates Problems 5.5.4 Quiz: Rectilinear Motion Problems 5.6.1 Practice: Applications of the Derivative
		5.6.3 Exam: Semester Final

Course Detailed Description

UNIT 1: PRECALCULUS REVIEW

UNIT 2: BRIDGE TO CALCULUS

LESSON 1: INTRO TO CALCULUS

2.1.1 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: 30 mins

2.1.2 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: 30 mins

2.1.3 Discuss: Introductions
Before exploring the details of calculus, discuss its definition with your classmates.
Duration: 30 mins; Scoring: 10 points

LESSON 2: FUNCTIONS

2.2.1 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: 30 mins

2.2.2 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: 30 mins

2.2.3 Quiz: Asymptotes and Domain Restrictions
Practice finding asymptotes and domain restrictions.
Duration: 45 mins; Scoring: 12 points

2.2.4 Practice: How to Use Your Graphing Calculator
Use your graphing calculator to graph a function to an arbitrary viewing window.
Duration: 1 hr

2.2.5 Practice: Finding Zeroes with Your Graphing Calculator
Use your graphing calculator to find the zeroes of a function.
Duration: 45 mins

2.2.6 Practice: Graphing Functions and Finding Roots
Graph various functions and find roots for those functions.
Duration: 1 hr

2.2.7 Study: Functions From Functions 1
Learn about adding, subtracting, multiplying, and dividing functions to create new functions. Notice what happens to their domains.
Duration: 30 mins

2.2.8 Practice: Functions From Functions 1
Learn about adding, subtracting, multiplying, and dividing functions to create new functions. Notice what happens to their domains.
Duration: 30 mins

2.2.9 Practice: Exploring Functions With Your Graphing Calculator
Use your graphing calculator to explore combinations of functions.
Duration: 45 mins

2.2.10 Study: Functions From Functions 2
Explore functions created from composites and inverses of other functions. Notice what happens to their domains.
Duration: 30 mins

2.2.11 Practice: Functions From Functions 2
Explore functions created from composites and inverses of other functions. Notice what happens to their domains.
Duration: 30 mins

2.2.12 Quiz: Finding Function Combinations
Practice finding functions that are combinations of other functions.
Duration: 1 hr; Scoring: 10 points

2.2.13 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

2.3.1 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: 30 mins

2.3.2 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: 30 mins

2.3.3 Quiz: Symmetry of Equations
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

2.3.4 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

2.4.1 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: 30 mins

2.4.2 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: 30 mins

2.4.3 Practice: Exploring Shifting and Distorting Graphs
Use your graphing calculator to explore shifting and distorting graphs.
Duration: 45 mins

2.4.4 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

2.5.1 Review: Bridge to Calculus
Review your studies of functions, graphical symmetry, and patterns in graphs.
Duration: 5 hrs

2.5.2 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: 25 mins; Scoring: 20 points

UNIT 3: LIMITS AND CONTINUITY

LESSON 1: LIMITS AND CONTINUITY

3.1.1 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: 30 mins; Scoring: 10 points

3.1.2 Study: Limits of Functions
Explore how to estimate limits from graphs or tables of data.
Duration: 30 mins

3.1.3 Practice: Limits of Functions
Explore how to estimate limits from graphs or tables of data.
Duration: 30 mins

3.1.4 Quiz: Limits Practice
Answer questions about whether (and where!) limits exist.
Duration: 1 hr; Scoring: 9 points

3.1.5 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: 30 mins

3.1.6 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: 30 mins

3.1.7 Practice: Limits in Trigonometric Functions
Practice determining limits, including limits of trigonometric functions.
Duration: 45 mins

LESSON 2: ASYMPTOTIC AND UNBOUNDED BEHAVIOR

3.2.1 Study: Asymptotes as Limits
Examine asymptotes in terms of graphical behavior, and asymptotic behavior in terms of limits involving infinity.
Duration: 30 mins

3.2.2 Practice: Asymptotes as Limits
Examine asymptotes in terms of graphical behavior, and asymptotic behavior in terms of limits involving infinity.
Duration: 30 mins

3.2.3 Practice: Determining Graphs When Given Limits
Apply given information about limits, when determining graphs
Duration: 1 hr; Scoring: 25 points

3.2.4 Study: Comparing Relative Magnitudes of Functions
See how relative magnitudes of functions can help you determine limits quickly.
Duration: 30 mins

3.2.5 Practice: Comparing Relative Magnitudes of Functions
See how relative magnitudes of functions can help you determine limits quickly.
Duration: 30 mins

3.2.6 Quiz: Limits
Practice calculating limits as x goes to infinity.
Duration: 1 hr; Scoring: 13 points

3.2.7 Study: Limits That Do Not Exist
Learn about some nonexistent limits and the reasons for their nonexistence.
Duration: 30 mins

3.2.8 Practice: Limits That Do Not Exist
Learn about some nonexistent limits and the reasons for their nonexistence.
Duration: 30 mins

3.2.9 Discuss: Nonexistent Limits in Nature
Consider nonexistent limits in nature using a predator/prey model.
Duration: 1 hr; Scoring: 10 points

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

LESSON 3: CONTINUOUS FUNCTIONS

3.3.1 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: 30 mins

3.3.2 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: 30 mins

3.3.3 Quiz: Domains of Continuity
Practice determining domains of continuity for functions, given either the graph or the algebraic expression (including asymptotes).
Duration: 30 mins; Scoring: 11 points

3.3.4 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 mins; Scoring: 25 points

3.3.5 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: 30 mins

3.3.6 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: 30 mins

3.3.7 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

3.4.1 Review: Limits and Continuity
Review your studies of limits and continuity.
Duration: 5 hrs

3.4.2 Test (CS): Limits and Continuity
Take a 25-minute test, modeled after the AP Exam, covering the concepts of limits and asymptotes and continuity.
Duration: 25 mins; Scoring: 20 points

UNIT 4: DERIVATIVES

LESSON 1: DERIVATIVES AT A POINT

4.1.1 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: 30 mins

4.1.2 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: 30 mins

4.1.3 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

4.1.4 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: 30 mins

4.1.5 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: 30 mins

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

4.1.7 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

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

4.1.9 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: 30 mins

4.1.10 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: 30 mins

4.1.11 Practice: Comparing Calculator Derivatives to Real Ones
Use the limit definition to find a function, then compare that to y2 = nDeriv(y1,x,x) (graphical analysis). Graph a function that you found using the limit and compare that to the calculator derivative graph y2 = nDeriv(y1,x,x)

Duration: 45 mins; Scoring: 20 points

LESSON 2: COMPUTING DERIVATIVES

4.2.1 Discuss: Shortcut Rules
Create a shortcut to the derivative, and make suggestions to your classmates.
Duration: 1 hr; Scoring: 10 points

4.2.2 Study: Computing Derivatives
See basic shortcuts for finding derivatives of power functions and of sine and cosine functions.
Duration: 30 mins

4.2.3 Practice: Computing Derivatives
See basic shortcuts for finding derivatives of power functions and of sine and cosine functions.
Duration: 30 mins

4.2.4 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

4.2.5 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: 30 mins

4.2.6 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: 30 mins

4.2.7 Quiz: Product and Quotient Rule Practice
Answer questions using the product and quotient rules.
Duration: 1 hr; Scoring: 10 points

4.2.8 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

4.3.1 Discuss: Graphs of Derivatives
Explore derivatives and their graphs.
Duration: 30 mins; Scoring: 10 points

4.3.2 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''.
Duration: 30 mins

4.3.3 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: 30 mins

4.3.4 Practice: Derivatives and Graphs
Practice recognizing derivatives by looking at graphs.
Duration: 45 mins

4.3.5 Study: The Relationship Between Continuity and Differentiability
Explore the relationship between differentiability and continuity.
Duration: 30 mins

4.3.6 Practice: The Relationship Between Continuity and Differentiability
Explore the relationship between differentiability and continuity.
Duration: 30 mins

4.3.7 Practice: More Exploration
Answer questions while exploring the relationship between differentiability and continuity.
Duration: 1 hr; Scoring: 25 points

4.3.8 Study: Theorems: Rolle and Mean Value
Explore Rolle's Theorem and the Mean Value Theorem and their geometric consequences.
Duration: 30 mins

4.3.9 Practice: Theorems: Rolle and Mean Value
Explore Rolle's Theorem and the Mean Value Theorem and their geometric consequences.
Duration: 30 mins

4.3.10 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 mins

LESSON 4: HIGHER-ORDER DERIVATIVES

4.4.1 Practice: Higher-Order Derivatives
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

4.4.2 Quiz: Multiple Derivatives of Functions
Practice finding some multiple derivatives of functions.
Duration: 1 hr; Scoring: 10 points

4.4.3 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: 30 mins

4.4.4 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: 30 mins

4.4.5 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

4.4.6 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: 45 mins

LESSON 5: CHAIN RULE AND IMPLICIT DIFFERENTIATION

4.5.1 Study: The Chain Rule
See when and how to use the Chain Rule to find derivatives of composite functions.
Duration: 30 mins

4.5.2 Practice: The Chain Rule
See when and how to use the Chain Rule to find derivatives of composite functions.
Duration: 30 mins

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

4.5.4 Practice: Finding the Slope of a Curve
Using algebra, find the slope of a curve at several places.
Duration: 1 hr; Scoring: 20 points

4.5.5 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: 30 mins

4.5.6 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: 30 mins

4.5.7 Practice: Conic Sections
Answer questions using implicit differentiation. Practice using conic sections and new types of curves.
Duration: 1 hr 15 mins

LESSON 6: DERIVATIVES WRAP-UP

4.6.1 Review: Derivatives
Review your studies of derivatives, concavity, the Chain Rule, and implicit differentiation.
Duration: 5 hrs

4.6.2 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: 25 mins; Scoring: 20 points

UNIT 5: RATES OF CHANGE

LESSON 1: EXTREMA AND OPTIMIZATION

5.1.1 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

5.1.2 Study: Extrema and Number Line Tests
Explore absolute (global) and relative (local) extrema, critical points, and the first derivative test.
Duration: 30 mins

5.1.3 Practice: Extrema and Number Line Tests
Explore absolute (global) and relative (local) extrema, critical points, and the first derivative test.
Duration: 30 mins

5.1.4 Quiz: Finding Extrema
Practice curve analysis using a combination of the first and second derivative tests.
Duration: 45 mins; Scoring: 8 points

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

5.1.6 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

5.1.7 Study: Optimization
See how to identify variables in optimization situations, write functions representing specific situations, and solve various types of optimization problems.
Duration: 30 mins

5.1.8 Practice: Optimization
See how to identify variables in optimization situations, write functions representing specific situations, and solve various types of optimization problems.
Duration: 30 mins

5.1.9 Practice: Applied Optimizing
Answer questions about applied optimization problems.
Duration: 2 hrs; Scoring: 30 points

LESSON 2: TANGENT AND NORMAL LINES

5.2.1 Study: Tangent and Normal Lines
See how to find and use tangent and normal lines.
Duration: 30 mins

5.2.2 Practice: Tangent and Normal Lines
See how to find and use tangent and normal lines.
Duration: 30 mins

5.2.3 Quiz: Finding Tangent and Normal Lines
Practice finding tangent and normal lines using calculus to find the slopes.
Duration: 45 mins; Scoring: 4 points

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

5.2.5 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

5.2.6 Study: Local Linearity and Tangent Line Approximation
Examine local linearity and tangent line approximation.
Duration: 30 mins

5.2.7 Practice: Local Linearity and Tangent Line Approximation
Examine local linearity and tangent line approximation.
Duration: 30 mins

5.2.8 Practice: Tangent Line Approximation
Answer questions by using the tangent line approximation.
Duration: 1 hr 30 mins; Scoring: 30 points

LESSON 3: RATES OF CHANGE

5.3.1 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: 30 mins

5.3.2 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: 30 mins

5.3.3 Practice: Finding Rates of Changes
Practice recognizing rates, as ways to start breaking down related-rates problems.
Duration: 1 hr

5.3.4 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

5.4.1 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: 30 mins

5.4.2 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 the change in the depth of water in the tank.
Duration: 30 mins

5.4.3 Quiz: Practice Determining Rates
Practice determining rates of change for related variables.
Duration: 1 hr; Scoring: 4 points

5.4.4 Practice: Related-Rates Problems
Solve complicated related-rates problems similar to those found on the AP Exam.
Duration: 1 hr 30 mins; Scoring: 30 points

LESSON 5: RECTILINEAR MOTION

5.5.1 Practice: Velocity and Acceleration
Answer questions about velocity by first plotting position over time for a 20-minute car ride.
Duration: 1 hr

5.5.2 Study: Rectilinear Motion
Explore interpretation of the derivative as a rate of change in motion problem. Examine velocity, speed, and acceleration.
Duration: 30 mins

5.5.3 Practice: Rectilinear Motion
Explore interpretation of the derivative as a rate of change in motion problem. Examine velocity, speed, and acceleration.
Duration: 30 mins

5.5.4 Quiz: Rectilinear Motion Problems
Solve rectilinear motion problems, similar to the AP Exam questions.
Duration: 45 mins; Scoring: 6 points

5.5.5 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

5.6.1 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 hrs; Scoring: 40 points

5.6.2 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 hrs

5.6.3 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: 50 mins; Scoring: 80 points

Course Credit

The course grade will be calculated as follows:

- 50% coursework average;
- 50% summative assessment average, including the final exam;
- A passing course grade is 70 or higher.

Students must attempt all assignments in the course. The final exam will not be available until all assignments have been accepted and graded by the teacher.

Students who score below 70% on the final exam will be eligible for one re-exam opportunity.

Summative Assessments

Summative assessments are those that allow you to demonstrate mastery of the course objectives. For summative assessments, you will NOT be allowed to use the learning materials. These are opportunities for you to show what you have learned by that point in the course. The summative assessments for this course are as follows:

- Unit Tests **(20% of Course Grade)**
- Final Exam **(30% of Course Grade)**

Course Completion

- Students may not complete the course in less than 30 days.
- All courses expire six months after the enrollment date.

Academic Integrity

It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and high standard of integrity. The attempt of students to present as their own any work not honestly performed is regarded by the faculty and administration as a most serious offense and renders the offenders liable to serious consequences, possibly suspension.

"Scholastic dishonesty" includes, but is not limited to, cheating, plagiarism, collusion, falsifying academic records, misrepresenting facts, and any act designed to give unfair academic advantage to the student (such as, but not limited to, submission of essentially the same written assignment for two courses without the prior permission of the instructor) or the attempt to commit such an act.

Student Expectations

You will be expected to log into the Blackboard course regularly to be aware of possible announcements/reminders and to pace your progress in the course.

Students are expected to maintain an online environment conducive to learning, which includes "netiquette" (Internet etiquette). Please review the basic rules for Online Discussion Netiquette. Ensure that your email messages, discussion board postings, and other electronic communications are thoughtful and respectful. Diverse opinions are welcome in this course, and you are expected to demonstrate an open mind and courtesy when responding to the thoughts and ideas of others.

The following are prohibited:

- making offensive remarks in email or the discussion board;
- using inappropriate language or discussing inappropriate topics online;
- spamming;
- hacking;
- using TTU or Blackboard email or discussion boards for commercial purposes;
- using all caps (considered shouting in online communications); and
- cyber-bullying or online harassment of any type.

Inappropriate behavior shall result in consequences ranging from a request to correct the problem, to removal from the course or even the university, depending on the severity of the behavior. Disciplinary actions will be taken according to the TTU K-12 Student Handbook.

Communication

- You can expect a reply from your instructor within 2 business days.
- Use the Blackboard Course Messages tool for sending messages to your instructor.
- Apex Messages will be used for submitting assignments that your instructor must grade.

Technical Difficulties

Getting Help

For student assistance with Blackboard, visit TTU K-12 Support.

Computer Problems

A working computer is necessary for online coursework. Computer problems will not be accepted as a valid reason for failure to complete course activities within the allotted time frame. Identify a second computer, before the course begins, that you can use if you experience computer problems.

Server Problems

When the Blackboard server needs to be taken down for maintenance, the Blackboard administrator will post an announcement in your course informing you of the time and date. If the server experiences unforeseen problems, your course instructor will notify you.

Lost or Corrupted Files

You must keep/save a copy of every project/assignment on an external disk or personal computer. In the event of any kind of technology failure (e.g., Blackboard server crash or virus infection, students' own computer problems, loss of files in cyberspace, etc.) or any disputes, the instructor may request or require you to resubmit the files. In some instances, the instructor may need to open another attempt within Blackboard, so communication with your instructor is critical in these circumstances.