This course supports the assessment for Calculus I. The course covers 3 competencies and represents 4 competency units.

Introduction

Overview
Calculus I explores the key concepts, methods, and applications of differential calculus of one variable. It is the first course in the calculus sequence intended for secondary mathematics teachers. A solid background in precalculus is highly recommended. Topics include a review of functions, limits, derivatives, and applications of differential calculus. Upon completion, students will be able to apply the concepts and methods of differential calculus and appropriate technology to solve practical problems and communicate results.

Competencies
This course provides guidance to help you demonstrate the following 3 competencies:

- **Competency 2004.1.1: Limits and Continuity**
  The graduate demonstrates a conceptual understanding of limits and continuity and solves problems involving limits and continuity.

- **Competency 2004.1.2: The Derivative**
  The graduate demonstrates a conceptual understanding of the derivative and finds the derivative of functions.

- **Competency 2004.1.3: Applications of Derivatives**
  The graduate applies concepts and techniques of differentiation to solve application problems.

Course Instructor Assistance
As you prepare to successfully demonstrate competency in this subject, remember that course instructors stand ready to help you reach your educational goals. As subject matter experts, mentors enjoy and take pride in helping students become reflective learners, problem solvers, and critical thinkers. Course instructors are excited to hear from you and eager to work with you. Successful students report that working with a course instructor is the key to their success. Course instructors are able to share tips on approaches, tools, and skills that can help you apply the content you're studying. They also provide guidance in assessment preparation strategies and troubleshoot areas of deficiency. Even if things don't work out on your first try, course instructors act as a support system to help you prepare for another attempt. You should expect to work with course instructors for the duration of your coursework, and you are encouraged to contact them as soon as you begin. Course instructors are fully committed to your success!

Preparing for Success

The information in this section is provided to detail the resources available for you to use as you complete this course.
Learning Resources
The learning resources listed in this section are required to complete the activities in this course. For many resources, WGU has provided automatic access through the course. However, you may need to manually enroll in or independently acquire other resources. Read the full instructions provided to ensure that you have access to all of your resources in a timely manner.

Note: The resources you are using to master the competencies for this assessment will also be valuable as you prepare for the Praxis II exam and any state-mandated mathematics content exams.

Automatically Enrolled Learning Resources

You can access the learning resources listed in this section by clicking on the links provided throughout the course. You may be prompted to log in to the WGU student portal to access the resources.

Pearson E-Text


Thinkwell

You will access the materials in the following Thinkwell course at the activity level within this course. This web-based resource includes multimedia video lectures, review notes, interactive animations, and sample exercises:

- Thinkwell Calculus, ONLINE, CRN 03U

Additional Preparations

Graphing Calculator

Acquire a graphing calculator and familiarize yourself with how to use it. Refer to the WGU Calculator and Scratch Paper Guidelines for calculators permitted on WGU exams. If you are in a secondary mathematics program, refer to the WGU Calculator Recommendations for Secondary Math and Science Programs document for calculator suggestions for your degree program.

Pacing Guide

The pacing guide suggests a weekly structure to pace your completion of learning activities. It is provided as a suggestion and does not represent a mandatory schedule. Follow the pacing guide carefully to complete the course in the suggested timeframe.

- Pacing Guide: Calculus 1

Note: This pacing guide does not replace the course. Please continue to refer to the course for a comprehensive list of the resources and activities.
Pretest and Review Material

Before you engage in this course, you may want to check your existing knowledge and understanding of this material.

Course Pretest

This course will prepare you to assess your knowledge of Calculus I material. If you have previous experience with this material, you may want to complete the course diagnostic to simulate an exam for further practice and verification of your understanding.

This topic addresses the following competencies:

- **Competency 2004.1.1: Limits and Continuity**  
  The graduate demonstrates a conceptual understanding of limits and continuity and solves problems involving limits and continuity.
- **Competency 2004.1.2: The Derivative**  
  The graduate demonstrates a conceptual understanding of the derivative and finds the derivative of functions.
- **Competency 2004.1.3: Applications of Derivatives**  
  The graduate applies concepts and techniques of differentiation to solve application problems.

Course Diagnostic

If you feel you already know this material, complete the following quiz. However, if this is new material for you, or if it has been a long time since you learned this material, skip this activity and move carefully through the entire course.

- **WGU Calculus I: Course Diagnostic**

*Note: If you score 70% or above on this quiz, you may feel comfortable moving through the remaining activities at a faster pace (such as skipping some of the recommended exercises, readings, or videos). Regardless, please read through the following activities, because there are important directions in completing work on the assessment for this course.*

Limits and Continuity

Informally, a limit is the value that a function approaches as the input approaches a specific value. This concept is essential in the study of calculus. It distinguishes calculus from algebra and allows you to solve problems that cannot be solved with algebra alone. Limits help to describe the behavior of a function and define other important concepts, such as continuity. A function is continuous if there are no interruptions in the graph of the function. In other words, the graph of the function can be sketched without lifting your pencil off the paper. In this subject, you will explore these concepts and learn how to use them to solve problems.

Limits and Continuity Preview

Before you engage in this topic, you may want to check your existing knowledge and understanding of this material.
Limits and Continuity Quiz Preview

If you feel you already know this material, complete the following quiz. However, if this is new material for you, or if it has been a long time since you learned this material, skip this activity and move carefully through the following activities.

- [WGU Calculus I: Quiz—Limits and Continuity](#)

**Note:** If you score 70% or above on this quiz, you may feel comfortable moving through the remaining activities at a faster pace (such as skipping some of the recommended exercises, readings, or videos). Regardless, please read through the following activities, because there are important directions in completing work on the assessment for this course.

**Limits**

The limit of a function allows you to explore the behavior of a function as the input of the function value approaches a specific value. This informal definition is the central theme of this topic. You will internalize an intuitive understanding of limits, explore various methods for estimating limits, and develop skills for using algebra techniques to calculate the value of limits.

This topic addresses the following competency:

- **Competency 2004.1.1: Limits and Continuity**
  The graduate demonstrates a conceptual understanding of limits and continuity and solves problems involving limits and continuity.

This topic highlights the following objective:

- Determine limits or that the limit does not exist through various methods (e.g., tables, graphs, or algebraic and numeric computations).

**Rates of Change, Tangent Lines, and Limits**

This topic requires foundational competency in geometry, algebra, and precalculus concepts. Of particular relevance are the concepts of a function, a tangent line, and a secant line. Functions are addressed in chapter 1 (“Functions”) in Thomas’ Calculus, and you may find a review of this material helpful. Section 2.1 briefly reviews key concepts of tangent lines and secant lines, but if you need further practice to refresh your understanding, return to your geometry course materials or contact your course instructor for further guidance.

As you complete the listed material below, focus on understanding the concept of a tangent to a curve, and how this connects to the idea of a limit. Practice determining limits both by analyzing graphs and by performing calculations. Commit the fundamental limit laws to memory:

- sum rule
- difference rule
- constant multiple rule
- product rule
• quotient rule
• power rule
• root rule

Read and complete the following:

• Read section 2.1 ("Rates of Change and Tangents to Curves"). Next, check your understanding of these concepts in WGU Calculus I: section 2.1. After submitting your results, click “Review Test,” and explore the resources provided for each question.
• Read section 2.2 ("Limit of a Function and Limit Laws"). Next, check your understanding of these concepts in WGU Calculus I: section 2.2. After submitting your results, click “Review Test,” and explore the resources provided for each question.

One-Sided Limits and Limits Involving Infinity

Having established a conceptual and practical understanding of limits, explore specific special cases. As you read, focus on the following key points:

• right- and left-hand limits
• cases in which no limit exists
• finding limits graphically
• limits of trigonometric functions
• limits as \( x \) approaches positive or negative \( \pm \infty \)
• limits at infinity
• infinite limits
• asymptotes
• dominant terms

Read and complete the following:

• Read section 2.4 ("One-Sided Limits"). Next, check your understanding of these concepts in WGU Calculus I: section 2.4. After submitting your results, click “Review Test,” and explore the resources provided for each question.
• Read section 2.5 ("Continuity").
• Read section 2.6 ("Limits Involving Infinity: Asymptotes of Graphs"). Next, check your understanding of these concepts in WGU Calculus I: section 2.6. After submitting your results, click “Review Test,” and explore the resources provided for each question.

Continuity

Informally, continuity is an unbroken curve—a function that can be graphed without lifting your pencil. In this topic, focus on constructing a thorough conceptual and practical understanding of continuity. This in-depth understanding is important in calculating limits, and is foundational for later topics.

This topic addresses the following competencies:

• Competency 2004.1.1: Limits and Continuity
The graduate demonstrates a conceptual understanding of limits and continuity and solves problems involving limits and continuity.

This topic highlights the following objective:

- Determine where a function is continuous and not continuous through various methods (e.g., doing computations, inspecting graphs).

**Continuity and Discontinuity Lecture**

Watch the Lecture in section 2.1.8 (“Continuity and Discontinuity”) in *Thinkwell Calculus*, focusing on the following key points:

- continuity at a point
- continuity over a closed interval
- discontinuity
- continuous and discontinuous functions
- properties of continuous functions
- continuity of inverse functions
- limits of continuous functions
- intermediate value property
- continuous extension

**Self-Check: Continuity**

- Check your understanding of these concepts in *WGU Calculus I: section 2.5*. After submitting your results, click “Review Test,” and explore the resources provided for each question.
- If necessary, review section 2.5 (“Continuity”) in *Thomas’ Calculus*.

**Limits and Continuity Review**

You may wish to review the following material now in order to help you prepare for taking the Praxis II exam near the end of your program.

**Quiz: Limits and Continuity Review**

Complete the following quiz:

- [WGU Calculus I: Quiz—Limits and Continuity](#)

*Note: You will need to attempt this quiz multiple times under exam-like conditions for extra practice and verification of your understanding. Each time you attempt this quiz, you will be given a slightly different set of problems. After each attempt, be sure to review your answers and utilize the interactive features (“Help Me Solve This,” “View an Example,” “Video,” etc.) to help correct your errors. Before moving on to the next area in this course, you should reach at least 70% on 3 attempts in a row with this quiz. If you find you are unable to meet that standard, spend time identifying which questions you are struggling with, review the information on those topics from above and/or get in contact with your course instructor.*

**The Derivative**
Finding the slope of a line is an important skill in algebra. But what does it mean to find the slope of a curve? For a curve, the slope is constantly changing. Finding the slope of a curve at a given point or, more accurately, the slope of the tangent line at a given point is one way to describe differentiation. Isaac Newton is credited for providing the first general solution to this problem.

**Differentiation Preview**

Before you engage in this topic, you may want to check your existing knowledge and understanding of this material.

This topic addresses the following competency:

- **Competency 2004.1.2: The Derivative**
  - The graduate demonstrates a conceptual understanding of the derivative and finds the derivative of functions.

This topic highlights the following objectives:

- Identify the derivatives of basic algebraic, logarithmic, exponential, and trigonometric functions.
- Apply the sum, product, and quotient rules to find derivatives.
- Analyze the relationship among rates of change, tangent lines, secant lines, and derivatives at a point.
- Analyze the relationship between a function and its derivative (e.g., differentiability, higher order derivatives, relation of graphs).
- Apply the chain rule to find derivatives.
- Find the derivative of implicitly defined functions.

**Differentiation Quiz Preview**

If you feel you already know this material, complete the following quiz. However, if this is new material for you, or if it has been a long time since you learned this material, skip this activity and move carefully through the following activities.

- **WGU Calculus I: Quiz—Differentiation**

*Note: If you score 70% or above on this quiz, you may feel comfortable moving through the remaining activities at a faster pace (such as skipping some of the recommended exercises, readings, or videos). Regardless, please read through the following activities, because there are important directions in completing work on the assessment for this course.*

**Computations with the Derivative**

Calculating derivatives unlocks many applications, but it requires knowing key formulae, when to use them, and how to use them.

**The Derivative as a Function**

The derivative of the function \( f(x) \) with respect to the variable \( x \) is the function \( f' \) whose value at \( x \) is the limit of \([f(x + h) - f(x)]/h\) as \( h \) approaches 0.
As you complete the listed material below, pay attention to the following key points:

- differentiation
- notations
- graphing the derivative

Read and complete the following:

- Read section 3.1 (“Tangents and the Derivative at a Point”) in *Thomas’ Calculus.*
- Read section 3.2 (“The Derivative as a Function”) in *Thomas’ Calculus.* Next, check your understanding of these concepts in *WGU Calculus I: section 3.2.* After submitting your results, click “Review Test,” and explore the resources provided for each question.

**Derivatives to Memorize**

Just as you must memorize formulae in geometry or trigonometry, so too are there key concepts in Calculus that require memorization. Perhaps most important among these are the derivatives of the basic algebraic, logarithmic, exponential, and trigonometric functions. Commit these key derivatives to memory using a strategy that fits well for you. Challenge yourself to complete the quiz questions without calculating these derivatives, or perhaps make and use flashcards.

As you continue your studies in this course, note the explanations for each of these, and the specific restrictions and cases in which these general rules apply.

Select a method that works for you, but work to memorize each of the following derivatives:

- constant function
  - \( f(x) = n \)
  - \( f'(x) = 0 \)
- constant multiple function
  - \( f(x) = nx \)
  - \( f'(x) = n \)
- power function
  - \( f(x) = x^n \)
  - \( f'(x) = nx^{n-1} \)
- trigonometric functions

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- natural log function
f(x) = ln x  
\[ f'(x) = \frac{1}{x} \]

- exponential function
  - \( f(x) = a^x \)
  - \( f'(x) = a^x \ln a \)

- \( e \): Euler’s number
  - \( f(x) = e^x \)
  - \( f'(x) = e^x \)

- logarithmic function
  - \( f(x) = \log_a x \)
  - \( f'(x) = \frac{1}{x \ln a} \)

**Differentiation Rules: Polynomials, Exponentials, Products, and Quotients**

As you complete the material listed below, pay careful attention to each rule. You must become thoroughly familiar with these rules, using and applying each carefully when calculating derivatives. Practice applying these rules until they become second nature.

Additionally, higher-order derivatives are a straightforward topic, but one with significant relevance. Be certain to understand the concept, means of calculating, and notation for higher-order derivatives.

Read and complete the following:

- Read section 3.3 (“Differentiation Rules”) in *Thomas’ Calculus*. Next, check your understanding of these concepts in *WGU Calculus I: section 3.3*. After submitting your results, click “Review Test,” and explore the resources provided for each question.

**Foundational Applications of the Derivative: Rates of Change and Trigonometry**

Later in this course, you will explore many applications of differentiation, but it is crucial to build a foundational understanding of both how and why you will be calculating derivatives. As you complete the activities listed below, pay particular attention to the following key concepts:

- the rate of change at a point
- derivatives of trigonometric functions
- the application of differentiation rules in determining the derivatives of trigonometric functions
- determining the derivatives of trigonometric functions based on the relation of each trigonometric function to the others.

*Note*: You do not need to remember how each of the rules for trigonometric functions is derived. Focus on memorizing the rules and reviewing the examples. Quick recollection of these rules is essential when using them to solve more complex problems.

Read and complete the following:

- Read section 3.4 (“The Derivative as a Rate of Change”) in *Thomas’ Calculus*. 

Read section 3.5 (“Derivatives of Trigonometric Functions”) in Thomas’ Calculus. Next, check your understanding of these concepts in WGU Calculus I: section 3.5. After submitting your results, click “Review Test,” and explore the resources provided for each question.

**The Meaning of the Derivative**

The concept of a derivative is one of the most important applications of limits and can be explored from several different perspectives. In this topic, you will explore the concept of a derivative as the slope of the tangent line to a curve and as the instantaneous rate of change.

This topic addresses the following competencies:

- **Competency 2004.1.1: The Derivative**
  The graduate demonstrates a conceptual understanding of the derivative and finds the derivative of functions.

This topic highlights the following objectives:

- Analyze the relationship among rates of change, tangent lines, secant lines, and derivatives at a point.
- Analyze the relationship between a function and its derivative (e.g., differentiability, higher order derivatives, relation of graphs).

**Secant Lines, Tangent Lines, and the Rate of Change at a Point**

- Watch the Lecture in section 3.1.3 (“The Derivative”) in Thinkwell Calculus.
- Focus on sharpening your conceptual understanding of what the derivative really means, so that you can explain it clearly to others who are struggling to understand.

**Self-Check: Tangents and the Derivative at a Point**

- Check your understanding of these concepts in WGU Calculus I: section 3.1.
- After submitting your results, click “Review Test,” and explore the resources provided for each question.
- If necessary, review section 3.1 (“Tangents and the Derivative at a Point”) in Thomas’ Calculus.

**Self-Check: The Derivative as a Rate of Change**

- Check your understanding of these concepts in WGU Calculus I: section 3.4. After submitting your results, click “Review Test,” and explore the resources provided for each question.
- If necessary, review section 3.4 (“The Derivative as a Rate of Change”) in Thomas’ Calculus.

**The Chain Rule and Advanced Differentiation**

You have learned the basics of taking derivatives. You will now learn rules that are useful for functions involving logarithms, rules for composite functions, and rules for functions that are defined implicitly.
This topic addresses the following competencies:

- **Competency 2004.1.1: The Derivative**
  The graduate demonstrates a conceptual understanding of the derivative and finds the derivative of functions.

This topic highlights the following objectives:

- Apply the chain rule to find derivatives.
- Find the derivative of implicitly defined functions.

**The Chain Rule**

You have already studied the basic differentiation rules: the chain rule is another important addition to your toolkit for computing derivatives.

Read and complete the following:

- Read section 3.6 (“The Chain Rule”) in *Thomas’ Calculus*. Next, check your understanding of these concepts in *WGU Calculus I: section 3.6*. After submitting your results, click “Review Test,” and explore the resources provided for each question.

**Implicit Differentiation**

Differentiating implicitly defined functions—that is, those that do not take the form \( y = f(x) \)—poses a new challenge. When faced with an implicitly defined function, remember to check whether it is possible to solve for \( y \), yielding one or more functions in the form \( y = f(x) \) that can be easily differentiated. This is, however, not always possible. It is in such cases that you must turn to implicit differentiation.

Read and complete the following:

- Read section 3.7 (“Implicit Differentiation”) in *Thomas’ Calculus*. Next, check your understanding of these concepts in *WGU Calculus I: section 3.7*. After submitting your results, click “Review Test,” and explore the resources provided for each question.

**Derivatives of Logarithms**

Recall the logarithmic and exponential derivatives that you have memorized. In this section, you will see these explained. As you complete the listed material below, pay attention to the following key points:

- applications of the differentiation rules and implicit differentiation
- the significance of the number \( e \)

*Note:* within this course, you need not worry about differentiating inverse functions. The explanation of some logarithmic differentiation relies on the derivative rule for inverses—you may comfortably accept this theorem without seeking to understand it. If you are interested in further exploration of inverse differentiation, you may refer to pages 177–179 of *section 3.8*.
Read and complete the following:

- Read pages 179–185 of section 3.8 (“Derivatives of Inverse Functions and Logarithms”) in Thomas’ Calculus. Next, check your understanding of these concepts in WGU Calculus I: section 3.8. After submitting your results, click “Review Test,” and explore the resources provided for each question.

**Differentiation Review**

You may wish to review the following material now in order to help you prepare for taking the Praxis II exam near the end of your program.

**Quiz: Differentiation Review**

Complete the following quiz:

- [WGU Calculus I: Quiz—Differentiation](#)

**Note:** You will need to attempt this quiz multiple times under exam-like conditions for extra practice and verification of your understanding. Each time you attempt this quiz, you will be given a slightly different set of problems. After each attempt, be sure to review your answers and utilize the interactive features (“Help Me Solve This,” “View an Example,” “Video,” etc.) to help correct your errors. Before moving on to the next area in this course, you should reach at least 70% on 3 attempts in a row with this quiz. If you find you are unable to meet that standard, spend time identifying which questions you are struggling with, review the information on those topics from above and/or get in contact with your course instructor.

**Applications of Derivatives**

You have learned important techniques for finding the derivative of a function. You will apply these techniques in order to explore important applications of derivatives. You will learn how to use derivatives to determine important features of a graph, calculate limits that cannot be determined algebraically, and solve problems that require you to maximize or minimize a function.

**Applied Differentiation Preview**

Before you engage in this topic, you may want to check your existing knowledge and understanding of this material.

**Applied Differentiation Quiz Preview**

If you feel you already know this material, complete the following quiz. However, if this is new material for you, or if it has been a long time since you learned this material, skip this activity and move carefully through the following activities.

- [WGU Calculus I: Quiz—Applied Differentiation](#)

**Note:** If you score 70% or above on this quiz, you may feel comfortable moving through the remaining activities at a faster pace (such as skipping some of the recommended exercises,
readings, or videos). Regardless, please read through the following activities, because there are important directions in completing work on the assessment for this course.

**Rates of Change**

The concept of *rate of change* is central to understanding differentiation, and it underlies all the applications of differentiation across fields.

This topic addresses the following competency:

- **Competency 2004.1.3: Applications of Derivatives**
  
  The graduate applies concepts and techniques of differentiation to solve application problems.

This topic highlights the following objectives:

- Solve problems about position, velocity, and acceleration.
- Solve problems involving related rates.

**Related Rates**

Sometimes it is useful to understand the rate at which one variable is changing based on the rate at which another variable is changing. Problems like these are *related rates*, the topic you will now learn about.

Read and complete the following:

- Watch the videos within section 7.4 ("Related Rates") in *Thinkwell Calculus*.
- Read section 3.10 ("Related Rates") in *Thomas’ Calculus*. Next, check your understanding of these concepts in *WGU Calculus I: section 3.10*. After submitting your results, click “Review Test,” and explore the resources provided for each question.

**Extreme Values, Position, Velocity, and Acceleration**

Everyday application of differentiation is made possible, in many cases, by key theorems and their corollaries:

- the extreme value theorem
- the first derivative theorem for local extreme values
- Rolle’s theorem
- the mean value theorem

As you complete the listed activities, focus on these theorems and the possibilities they open for applications within science and industry. In addition, focus on the following key concepts:

- absolute and relative minima and maxima
- critical points
- position, velocity, and acceleration
Read and complete the following:

- Watch both videos within section 7.1 ("Position and Velocity") in Thinkwell Calculus.
- Read section 4.1 ("Extreme Values of Functions") in Thomas' Calculus. Next, check your understanding of these concepts in WGU Calculus I: section 4.1. After submitting your results, click “Review Test,” and explore the resources provided for each question.
- If necessary, review section 3.4 ("The Derivative as a Rate of Change") of Thomas’ Calculus.
- Read section 4.2 ("The Mean Value Theorem") in Thomas’ Calculus. Next, check your understanding of these concepts in WGU Calculus: section 4.2. After submitting your results, click “Review Test,” and explore the resources provided for each question.
- If necessary, review these crucial theorems in section 8.1.2 ("Three Big Theorems") in Thinkwell Calculus.

**Optimization and Curve Sketching**

In this topic you begin your study of important applications of derivatives by learning how to use the first and second derivatives of a function to analyze the behavior of the function. You will use differentiation to determine the minimum and maximum values (extrema), increasing and decreasing regions, and concavity of a function. You will also integrate these techniques with problem solving skills for the purpose of finding the optimum value—the maximum or minimum value—for real-world applications.

This topic addresses the following competency:

- **Competency 2004.1.3: Applications of Derivatives**
  The graduate applies concepts and techniques of differentiation to solve application problems.

This topic highlights the following objectives:

- Analyze the behavior of a function using limits and derivatives.
- Solve applied optimization problems.

**The First Derivative Test**

The first derivative test is crucial in curve sketching, as it allows you to quickly identify local maxima and minima, as well as critical points which are not local extrema. Internalize this process, as it is required for thorough curve sketching and other applications. You will also need to recognize instances in which the first derivative test must be applied.

Read and complete the following:

- Watch the videos within section 8.2.3 ("Regions Where a Function Increases or Decreases") and section 8.2.4 ("The First Derivative Test") in Thinkwell Calculus.
- Read section 4.3 ("Monotonic Functions and the First Derivative Test") in Thomas’ Calculus. Next, check your understanding of these concepts in WGU Calculus I: section 4.3. After submitting your results, click “Review Test,” and explore the resources
Concavity and the Second Derivative

The second derivative provides additional tools vital in curve sketching. Internalize these tools, as you did with the first derivative test—you will need to recognize instances that call for curve-sketching, then apply the relevant procedures for graphing the function. As you complete the listed activities, focus on the following key concepts:

- concave up
- concave down
- the second derivative test for concavity
- points of inflection (inflection points)
- the second derivative test for local extrema
- the procedure for graphing \( y = f(x) \)

Watch the videos within section 8.3.1 (“Concavity and Inflection Points”) and section 8.3.2 (“Using the Second Derivative to Examine Concavity”) in Thinkwell Calculus.

Read section 4.4 (“Concavity and Curve Sketching”) in Thomas’ Calculus. Next, check your understanding of these concepts in WGU Calculus I: section 4.4. After submitting your results, click “Review Test,” and explore the resources provided for each question.

Review the following sections relevant to curve sketching and higher-order derivatives in Thomas’ Calculus:

- section 2.6 (“Limits Involving Infinity: Asymptotes of Graphs”)
- pages 143—144, Second- and Higher-Order Derivatives, from section 3.3 (“Differentiation Rules”)

Optimization

Optimization problems have broad relevance across social, political, engineering, physics, economics, and business fields. Each optimization problem is a unique challenge, but what they share in common is a goal of a maximum or minimum solution. Draw on your knowledge of curve-sketching and the tests to identify extrema in real-world optimization activities.

Read and complete the following:

- Watch all the videos within section 7.3 (“Optimization”) in Thinkwell Calculus.
- Read section 4.5 (“Indeterminate Forms and L’Hôpital’s Rule”) and section 4.6 (“Applied Optimization”) in Thomas’ Calculus. Next, check your understanding of these concepts in WGU Calculus I: section 4.6. After submitting your results, click “Review Test,” and explore the resources provided for each question.

L’Hôpital’s Rule

In this topic you will study techniques for using derivatives to solve limit problems that cannot be
solved using algebra alone.

This topic addresses the following competency:

- **Competency 2004.1.3: Applications of Derivatives**
  The graduate applies concepts and techniques of differentiation to solve application problems.

This topic highlights the following objectives:

- Apply L'Hôpital's rule to find limits.

**Indeterminate Forms and L'Hôpital's Rule**

L'Hôpital's rule provides a valuable addition to your toolkit, but you must be cautious to apply it only to appropriate indeterminate forms. As you complete the listed activities, focus on committing to memory the criteria for using L'Hôpital's rule, as well as the process for using it.

- Watch all the videos within section 14.1 (“Indeterminate Quotients”) in *Thinkwell Calculus*.

**Self-Check: Indeterminate Forms and L'Hôpital's Rule**

- Check your understanding of these concepts in *WGU Calculus I: section 4.5*. After submitting your results, click “Review Test,” and explore the resources provided for each question.

- If necessary, review section 4.5 (“Indeterminate Forms and L'Hôpital's Rule”) in *Thomas’ Calculus*.

**Applied Differentiation Review**

You may wish to review the following material now in order to help you prepare for taking the Praxis II exam near the end of your program.

**Quiz: Applied Differentiation Review**

Complete the following quiz:

- [WGU Calculus I: Quiz—Applied Differentiation](#)

**Note:** You will need to attempt this quiz multiple times under exam-like conditions for extra practice and verification of your understanding. Each time you attempt this quiz, you will be given a slightly different set of problems. After each attempt, be sure to review your answers and utilize the interactive features (“Help Me Solve This,” “View an Example,” “Video,” etc.) to help correct your errors. Before moving on to the next area in this course, you should reach at least 70% on 3 attempts in a row with this quiz. If you find you are unable to meet that standard, spend time identifying which questions you are struggling with, review the information on those topics from above and/or get in contact with your course instructor.

**Final Steps**
Congratulations on completing the activities in this course! You are now prepared to complete the associated assessment. If you have not already been directed to complete it, schedule and complete the assessment now.