This course requires a performance assessment. It covers 5 competencies.

Introduction

Overview

Calculus I is the study of rates of change in relation to the slope of a curve. It covers the knowledge and skills necessary to use differential and integral calculus of one variable and appropriate technology to solve basic problems. Topics include:

- graphing functions and finding their domains and ranges;
- limits, continuity, differentiability, visual, analytical, and conceptual approaches to the definitions of the derivative and the integrals;
- the sum, power, chain, and substitution rules for derivatives, antiderivatives, and definite and indefinite integrals of polynomial, trigonometric, and exponential functions, position and velocity;
- L'Hopital's Rule; and
- the Fundamental Theorem of Calculus.

Candidates should have completed a course in pre-calculus before engaging in this course.

Getting Started

Welcome to Calculus I! In this course, you'll watch videos, then take diagnostics to make sure you got what you needed from the videos. If you don't score well, you can review what you missed in the interactive textbook and see other examples, extended solutions, and readings to help you learn what you need before you take the diagnostic again. You will repeat that cycle until you have improved enough, and then you will move on to the next set of videos and diagnostics.

You will complete 4 tasks to demonstrate your competence in calculus, each of which you will submit for evaluation in Taskstream. For details about this performance assessment, see the "Assessment" tab in this course. For directions on how to receive access to performance assessments, see the "Accessing Performance Assessments" page.

Watch the following welcome video for this course:

Note: To download this video, right-click the following link and choose "Save as...": download video.

Teaching Dispositions Statement

Please review the Statement of Teaching Dispositions.

Competencies and Objectives

This course provides guidance to help you demonstrate the following 5 competencies:

- **Competency 209.6.2: Limits**
  The graduate demonstrates a conceptual understanding of limits and finds limits of functions.
  - Use L'Hopital's Rule to calculate limits of an indeterminate form.
  - Define the concept of limit using the formal definition.
  - Find limits for a given polynomial function.
  - Find limits for a given trigonometric function.
  - Find limits for a given transcendental function.
  - Find limits for a given rational function.
  - Apply the squeeze theorem to determine the limit of a given function.
- **Competency 209.6.3: Continuity**
  The graduate demonstrates a conceptual understanding of and solves problems involving continuity and defines the relationship of continuity to differentiability and integrability.
  - Determine points of discontinuity for a given function on a given domain.
- **Competency 209.6.4: Differentiation**
  The graduate demonstrates a conceptual understanding of differentiation and applies differentiation techniques to solve problems and aid function graphing.
  - Apply standard differentiation rules to find the derivative of a given polynomial function.
  - Apply standard differentiation rules to find the derivatives of a given trigonometric function.
  - Approximate a given derivative numerically.
  - Use implicit differentiation to find the first derivative with respect to x of a given function defined in terms of x and y.
  - Use implicit differentiation to find the second derivative with respect to x of a given function defined in terms of x and y.
  - Apply standard differentiation rules to find the derivative of a given product of two functions.
  - Apply standard differentiation rules to find the derivative of a given quotient of two functions.
  - Define the concept of the derivative of a function using the formal definition.
  - Apply the definition of the derivative to determine the derivative of a given function.
- **Competency 209.6.5: Applied Differentiation**
  The graduate applies differentiation in various ways to solve problems.
  - Apply the first derivative test to find the turning points of a given function.
  - Apply the first derivative test to find intervals on which a given function is increasing.
  - Apply the first derivative test to find intervals on which a given function is decreasing.
  - Apply the second derivative test to identify concavity of a given function.
  - Apply the second derivative test to identify points of inflection for a given function.

    - Apply the results of the first and second derivative tests to graph a given function.
    - Find the velocity of a particle at a point in time, given its position function.
    - Find the acceleration of a particle at a point in time, given its position function
    - Find the relative maximum of a function on an interval.
    - Find the relative minimum of a function on an interval.
    - Apply Newton's method to approximate the zeros of a function.
- **Competency 209.6.6: Integration**
  The graduate applies integration techniques to solve problems.
    - Determine the antiderivative of a function using knowledge of derivatives.
    - Define the concept of the integral of a function using the formal definition.
    - Apply standard integration rules to find the integral of a given polynomial function.
    - Apply standard integration rules to find the integral of a given trigonometric function.
    - Apply standard integration rules to find the integral of a given exponential function.
    - Solve problems using properties of definite integrals, such as additivity, zero width, sum and difference, constant multiple, and order of integration.
    - Find the area between two curves using integration.
    - Approximate a given definite integral numerically.
    - Apply the Fundamental Theorem of Calculus.
    - Find the position of a particle at a point in time, given its velocity function and an initial condition.
    - Find the velocity of a particle at a point in time, given its acceleration function and an initial condition.
    - Identify a variety of applications of definite integrals, such as volumes of revolution, lengths of curves, surface areas of revolution, centers of mass, and areas of surface revolution.

Preparing for Success

Seek Help When You Need It

Your course instructor is an important resource for you to take advantage of as you progress through your study of the course. Your course instructor will be able to help guide your learning, answer questions, and provide valuable information. Be sure to consult your course instructor frequently.

Learning Resources

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

Pearson E-text

The following textbook is available to you as an e-text within this course. You will be directly linked to the specific readings required within the activities that follow.

- Thomas, G.B. (2014). *Thomas' calculus: Early transcendentals, single variable* (13th ed.). Boston: Pearson Education, Inc. ISBN: 978-0321884077

Note: These e-texts are available to you as part of your program tuition and fees, but you may purchase hard copies at your own expense through a retailer of your choice. If you choose to do so, please use the ISBN listed to ensure that you receive the correct edition.

Student Companion Websites

The *Thomas' Calculus* e-text has student companion websites that include additional interactive study materials:

- Diagnostic Homework and Tests
- Review Results
- Pearson Study Plan
- Tests

How to learn in this course

Typically, you will watch a Thinkwell video, but you won't explore any of the other material offered by Thinkwell. Instead, you will find and take the corresponding diagnostic and try to succeed without using any notes or readings. Whether you score low or high, you will review results after you're done (click the word "Review" for in-depth help). This is the most important step because the textbook provides many features useful for self-guided learning:

- "View an Example" to see the solution to a similar problem done step-by-step
- "Help Me Solve This" to go through the solution interactively
- "Textbook" for a direct link to the relevant section of the textbook
- "Animation" to view an interactive and/or animated illustration (sometimes available)
- "Video" to hear a lecturer working a problem or explaining an idea (sometimes available)

You should consider yourself competent when you are regularly scoring above 60% on all diagnostics. After you've done several diagnostics to train the system on what you need to study, another way to review material is to follow the Pearson Study Plan to work on learning objectives that you have missed, but that will work only after you have several diagnostics to train the system on what you need to learn. If you want additional practice with the problems that generated the diagnostics, you can work on the customized homework problems for each section of the book.

Most students use the textbook as a supplement to watching the Thinkwell videos, rather than as their primary resource. When you review results, you will be directed to the relevant readings and interactive materials (examples, illustrations, videos), which is another reason it is used as a supplement.

Calculator

Refer to the WGU Calculator and Whiteboard Guidelines document for calculators permitted on WGU exams. Acquire one of these if you don't already have one. You do not have an exam in this course, but you may have exams in other courses, so you should use it now while solving problems in this course.

Supplemental Activities

There might be times when you need more information or practice than what is provided in the course. In addition to consulting with your course instructor when you need help, you can access optional and supplemental activities by using the word "supplemental" in the Course Search box. These activities can be enriching, but they are not essential for becoming competent.

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.

The suggested schedule for completing the course:

Week 1: Course Self-evaluation; Limits; Continuity; Task 1
Week 2: Basic Differentiation
Week 3: Advanced Differentiation and the Chain Rule; Task 2
Week 4: L'Hopital's Rule; Task 3; Optimization and Curve Sketching|
Week 5: Antidifferentiation; Area and Definite Integrals
Week 6: The Fundamental Theorem of Calculus; Task 4

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.

Technology Check and Self-Evaluation

Be sure to complete the Technology Check and Self-Evaluation before beginning the section on limits and continuity.

Technology Check

Check the following reference links for the activities later in the course:

Watch Thinkwell videos (click "Course Home" in the upper left)

Do the corresponding diagnostic listed below (find it on a list)

Make sure to review results (use the tools shown under the “Question Help” drop-down menu)

Make sure you can read the textbook

Course Self-Evaluation

Take the diagnostic on WGU Calculus I course. If you score above 60%, you can probably skip directly to working on the tasks and fill in your gaps as needed instead of going through the course linearly. If you score below 30%, you may need to use Chapter 1 of the Calculus textbook and/or your pre-calculus textbook to fill in missing algebraic knowledge—however, do that "as needed" while you launch into the course, because it is not a good idea to take the time to review before starting.

Limits and Continuity

Do the following activities.

Limits

Watch Thinkwell videos 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, 2.2.1, 2.2.2, 2.2.4

The corresponding sections in the textbook are 2.1, 2.2, 2.3, 2.4 and 2.6, for optional reading.

Continuity

Watch Thinkwell video 2.1.8. The corresponding section in the textbook is 2.5, for optional reading.

Limits and Continuity Self-evaluation

Take the Competence in Limits and Continuity diagnostic. If you don’t score above 60%, review results and retake the diagnostic. If you haven't reached 60% in several cycles, contact your course instructor.

Performance Assessment, Task 1

Complete and submit Task 1 in Taskstream. Be sure to check your submission against the scoring rubric before submitting your task for evaluation. If you do not pass, work with your course instructor.

Differentiation

Do the following activities.

Basic Differentiation

Watch Thinkwell videos 3.1.1 through 3.1.4, 3.2.1 through 3.2.4, 4.1.1, 4.1.3, 7.1.1, 7.1.2, and 7.2.3.

The corresponding sections in the textbook are 3.1, 3.2, 3.3, and 3.4, for optional reading.

Basic Differentiation Self-evaluation

Take the Competence in Basic Differentiation diagnostic. If you don't score above 60%, review results and retake the diagnostic. If you haven't reached 60% in several cycles, contact your course instructor.

Advanced Differentiation and the Chain Rule

Watch Thinkwell videos 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 5.1.3, 5.2.2, 5.3.2, 5.3.3, 6.1.1, 6.1.2

The corresponding sections in the textbook are 3.5, 3.6, 3.7, and 3.8 through Example 6, for optional reading.

Advanced Differentiation Self-evaluation

Take the Competence in Advanced Differentiation diagnostic. If you score above 60%, move on to Optimization and Curve Sketching; otherwise, review results and retake the diagnostic. If you haven't reached 60% in several cycles, contact your course instructor.

Performance Assessment, Task 2

Complete and submit Task 2 in Taskstream. Be sure to check your submission against the scoring rubric before submitting your task for evaluation. If you do not pass, work with your course instructor.

Applied Differentiation

Do the following activities.

L'Hopital's Rule

Watch Thinkwell videos 14.1.1 through 14.1.4 and review 2.2.2.

The corresponding section in the textbook is 4.5, for optional reading.

L'Hopital's Rule Self-evaluation

Take the L'Hopital's Rule diagnostic. If you don't score above 60%, review results and retake the diagnostic. If you haven't reached 60% in several cycles, contact your course instructor.

Performance Assessment, Task 3

Complete and submit Task 3 in Taskstream. Be sure to check your submission against the scoring rubric before submitting your task for evaluation. If you do not pass, work with your course instructor.

Optimization and Curve Sketching

Watch Thinkwell videos 8.1.2, 8.2.1, 8.2.2, 8.2.3, 8.2.4, 8.3.1, and 8.3.2.

The corresponding sections in the textbook are 4.1 through 4.4, for optional reading.

Optimization and Curve Sketching Self-evaluation

Take the Competence in Optimization and Curve Sketching diagnostic. If you score above 60%, move on to L'Hopital's Rule; otherwise, review results and retake the diagnostic. If you haven't reached 60% in several cycles, contact your course instructor.

Integration

Do the following activities.

Antidifferentiation

Watch Thinkwell videos 9.1.1, 9.1.2, and 9.1.3.

The corresponding section in the textbook is 4.8, for optional reading.

Area and Definite Integrals

Watch Thinkwell videos 9.4.1 and 9.4.2.

The corresponding section in the textbook is the end of 5.2 (on Riemann Sums) and 5.3, for optional reading.

Fundamental Theorem of Calculus

Watch Thinkwell videos 9.4.3, 9.4.4, 9.4.5, and particularly 10.1.1. Read section 5.4 in the textbook and focus on "Theorem 4 (Continued)-The Fundamental Theorem of Calculus, Part 2," example 4 and example 5.

Area Between Curves

Watch Thinkwell video 10.2.1.

The corresponding section in the textbook is part of 5.6 (start after example 2 and go through example 6), for optional reading.

Integration Self-evaluation

Take the Integration diagnostic. If you don't score above 60%, review results and retake the diagnostic. If you haven't reached 60% in several cycles, contact your course instructor.

Performance Assessment, Task 4

Read about how to apply Part 1 of the Fundamental Theorem of Calculus to a function.

Complete and submit Task 4 in Taskstream. Be sure to check your submission against the scoring rubric before submitting your task for evaluation. If you do not pass, work with your course instructor.