Colorado State University GLOBAL CAMPUS

MTH201: CALCULUS I

Credit Hours: 4

Contact Hours: This is a 4-credit course, offered in accelerated format. This means that 16 weeks of material is covered in 8 weeks. The exact number of hours per week that you can expect to spend on each course will vary based upon the weekly coursework, as well as your study style and preferences. You should plan to spend 16-20 hours per week in each course reading material, interacting on the discussion boards, writing papers, completing projects, and doing research.

Faculty Information: Faculty contact information and office hours can be found on the faculty profile page.

Course Description and Outcomes

Course Description:

This online course covers beginning calculus topics with a personalized learning approach. The topics include limits, differentiation, applications of differentiation, and integration. Assessments for this course will include discussions, mastery exercises, and critical thinking assignments. This course fulfills a general education mathematics requirement.

Course Overview:

This course will introduce you to beginning single-variable calculus topics. In particular, the concepts to be covered in this course are limits, differentiation, applications of differentiation, integration, and logarithmic and exponential functions.

Each week, in your adaptive lecture will present the material with a variety of modalities that include videos and interactive activities. Check Your Understanding exercises at the end of each initial page will personalize the learning experience by allowing you to learn more about select topics.

Module 0 is available for you to review the prerequisite topics for this course. You can refer to Module 0 throughout this term if you ever need to review any Precalculus topics.

During weeks 3 and 6, you will be encouraged to attend an optional 1-hour **Live Classroom** synchronous session with your instructor. This will be an opportunity for you to ask questions and see select problems worked out.

The four **Critical Thinking Assignments** for this course will explore some of the ways the concepts you are learning can be applied to solve real-world problems.

Weekly **Collaboration Exercises** will provide opportunities for you to discuss and reflect on the material and respond to open-ended prompts in collaboration with a few of your classmates.

Your course assessments will include **mastery exercises** for each module, a **midterm exam**, and a **cumulative final exam**. **Opening exercises** at the beginning of each module and **check your understanding** questions at the end of each page will serve as non-graded self-assessments of the material.

Course Learning Outcomes:

1. Evaluate limits analytically and graphically.
2. Apply various differentiation rules to compute derivatives.
3. Solve application problems by differentiation.
4. Apply various integration rules to compute integrals.
5. Evaluate the derivative and integral of logarithmic and exponential functions.

Participation & Attendance

Prompt and consistent attendance in your online courses is essential for your success at CSU-Global Campus. Failure to verify your attendance within the first 7 days of this course may result in your withdrawal. If for some reason you would like to drop a course, please contact your advisor.

Online classes have deadlines, assignments, and participation requirements just like on-campus classes. Budget your time carefully and keep an open line of communication with your instructor. If you are having technical problems, problems with your assignments, or other problems that are impeding your progress, let your instructor know as soon as possible.

Course Materials

Required:

OpenStax. (2018). *Calculus, Volume 1*. Houston, TX: OpenStax. Retrieved from https://openstax.org/details/books/calculus-volume-1.

Recommended:

Ayres, F., & Mendelson, E. (2013). *Schaum's outline of calculus* (6th ed.). New York, NY: McGraw Hill.

NOTE: *All non-textbook required readings and materials necessary to complete assignments, discussions, and/or supplemental or required exercises are provided within the course itself. Please read through each course module carefully.*

Course Schedule

Due Dates

The Academic Week at CSU-Global begins on Monday and ends the following Sunday.

- **Collaboration Exercises:** The initial contribution must be completed by Thursday at 11:59 p.m. MT and additional contributions completed by Sunday 11:59 p.m. MT. Late contributions may not be awarded points.
- **Opening Exercises:** Take the Opening Exercise before reading each week's content to see which areas you will need to focus on. You may take these exercises as many times as you need. The Opening Exercises will not affect your final grade.
- **Mastery Exercises:** Students may access and retake Mastery Exercises up to 3 times through the last day of the assignment week. Late contributions may not be awarded points.
- **Exams:** Students take a midterm and final exam in this course. Exams are due Sunday at 11:59 p.m. MT of the week the exam is assigned.
- **Critical Thinking:** Assignments are due Sunday at 11:59 p.m. MT. Late contributions may not be awarded points.

- **Live Classroom:** Although participation is not required, Live Classroom sessions are held during weeks 3 and 6. There are two total sessions.

WEEKLY READING AND ASSIGNMENT DETAILS

MODULE 1

Readings

- Chapter 2, Sections 2.1-2.4 in *Calculus, Volume 1*
- Chapters 7 and 8 in *Schaum's Outline of Calculus*
- Estonanto, J. J. (2017). Effectiveness of MnemoPow (mnemonics power) device in teaching limit theorems of calculus. *Asia Pacific Journal of Multidisciplinary Research*, 5(4.2), 102-106. Retrieved from http://www.apjmr.com/wp-content/uploads/2017/12/APJMR-2017.5.4.2.13.pdf

Opening Exercise (0 points)

Collaboration Exercise (25 points)

Mastery Exercise (15 points)

MODULE 2

Readings

- Chapter 3, Sections 3.1 and 3.2 in *Calculus, Volume 1*
- Chapter 9 in *Schaum's Outline of Calculus*
- Carlson, M., Madison, P., & West, B. (2015). A study of students' readiness to learn calculus. *International Journal of Research in Undergraduate Mathematics Education, 1*(2), 209-233. Retrieved from https://link.springer.com/article/10.1007%2Fs40753-015-0013-y

Opening Exercise (0 points)

Collaboration Exercise (25 points)

Mastery Exercise (15 points)

Critical Thinking (75 points)

Option #1: Visualizing the Derivative

For this Critical Thinking Assignment, you will be using the GeoGebra tool in Canvas to explore what it means to take the derivative of a function at a point.

Part I: Complete the following steps:

1. If you are not already familiar with GeoGebra, refer to the following tutorial: https://www.geogebra.org/m/XUv5mXTm
2. Using the GeoGebra tool in Canvas, input any non-linear function (such as a polynomial of degree 2 or higher, an exponential function, or a trigonometric function).
3. Click on "More" at the bottom of the tool menu to visualize all tools.
4. Use the "Point" tool under "Basic Tools" to plot a point on the function you created.
5. Create a tangent line at the point using the "Tangent" tool under "Construct". First select the point, and then select the function graph it is on.
6. Use the "Slope" tool under "Measure" by clicking on the point you created.
7. Select the "Move" tool under "Basic Tools" and practice moving your point along the function graph you created.
8. Save your GeoGebra work as a .pdf file for submission.

Part II: Based on your work in Part I, discuss the following:

1. Discuss any challenges that you face in visualizing the slope of the tangent line as you move the point along the graph. If necessary, adjust your function so that you can clearly see the value of the slope at all points along the curve shown in the graphing area.
2. Discuss any observations you notice about how the slope of the tangent line changes as you move the point along the function graph.
3. Pick three specific points on the graph. Give the coordinates of the point and the slope of the tangent line at each point. Discuss how the slope of the tangent line relates to the derivative at each point.
4. At what point(s) does the tangent line become horizontal or vertical? What can you say about $f(x)$, and $f'(x)$ at those points?
5. Based on your answer above, discuss how this animation is a visual representation of the derivative of a function at a point.
6. Determine all points (if any) on your function graph for which the slope is 0.
7. Discuss how this can be determined using only your GeoGebra animation and how it relates to the derivative of the function.
8. Re-read section 3.1 in *Calculus, Volume* 1 to review the role of secant lines in relation to the derivative of a function. Research external resources that show ways to visually represent the limit definition of the derivative of a function at a point using secant lines. Make sure to include citations for the sources you used and to summarize your findings.

Requirements:

You must submit two files for this assignment. The first file should contain the computations, graphs, diagrams, etc., associated with the questions in Part I. This file may be formatted as a numbered list of answers. Unless stated in the problem, a narrative discussion is not required, but you must provide enough information to show how you arrived at the answer.

The second file should be a 2- to 3-page narrative paper, written in APA format, associated with the situation described in Part II. Specific requirements for the paper are provided below:

a. Your paper should be 2-3 pages in length (not counting the title page and references page) and should cite and integrate at least two credible outside sources. The CSU-Global Library is a great place to find resources. Your textbook is a credible resource.
b. Include a title page, introduction, body, conclusion, and a reference page.
    i. The introduction should describe or summarize the topic or problem. It might discuss the general applications of the topic or it might introduce the unique terminology associated with the topic.
    ii. The body of your paper should address the questions posed in the problem. Explain how you approached and answered the question or solved the problem, and, for each question, show all steps involved. Be sure this is in paragraph format, not numbered answers like a homework assignment.
    iii. The conclusion should summarize your thoughts about what you have determined from your analysis in completing the assignment. Nothing new should be introduced in the conclusion that was not previously discussed in the body paragraphs.
c. Include any tables of data or calculations, calculated values, and/or graphs referenced in the paper. (Note: The minimum required length excludes any tables, graphs, etc.)
d. Document formatting, citations, and style should conform to the CSU-Global Guide to Writing and APA. A short summary containing much that you need to know about paper

formatting, citations, and references is contained in the New Sample APA Paper. In addition, information in the CSU-Global Virtual Library under the Writing Center/APA Resources tab has many helpful areas (Writing Center, Writing Tips, Template & Examples/Papers & Essays, Figures and Tables, and others).

Option #2: Creating Your Own Real-World Scenario Involving Derivatives of Exponential Functions

For this Critical Thinking Assignment, you will be creating your own real-world scenario and exploring the meaning of differentiation of exponential functions in that context.

Part I: Complete the following steps:

1. Select a real-world scenario that can be modeled by an exponential function and define the function *F(x)* based on your scenario. (Ex.: Suppose that *F(x)* computes the rabbit population on a game reserve that doubles every 6 months. Suppose there were 120 rabbits initially.)
2. Write a mathematical expression for $F(x)$.
3. Find the domain and range of $F(x)$.
4. Find $F(x)$ and $F'(x)$ at any point.
5. Find all x values for which $F'(x) = 0$.

Part II: Based on your work in Part I, discuss the following:

1. Discuss if your function $F(x)$ is differentiable and why. If it is not differentiable, select another function that is and discuss the change you made.
2. Discuss the domain and range of $F(x)$ and why they make sense in the context of your problem.
3. Discuss the physical meaning of $F(x)$ and $F'(x)$ at a point in the context of your problem.
4. Discuss what it means for $F'(x) = 0$ in the context of your problem.
5. Reflect on any adjustments you had to make to your original problem context and discuss what characteristics of a real-world context make it a valid choice for applying differentiation concepts to it.
6. Provide at least two other real-world situations where differentiation can be applied and respond to the following:
    a. What common characteristics do the real-world scenarios you chose share?
    b. What did you look for in the way that the real-world scenario can be modeled?
7. Discuss the criteria for selecting a real-world scenario that would change if you were seeking to model it with a logarithmic function instead. What key similarities and differences would you find?

Requirements:

You must submit two files for this assignment. The first file should contain the computations, graphs, diagrams, etc., associated with the questions in Part I. This file may be formatted as a numbered list of answers. Unless stated in the problem, a narrative discussion is not required, but you must provide enough information to show how you arrived at the answer.

The second file should be a 2- to 3-page narrative paper, written in APA format, associated with the situation described in Part II. Specific requirements for the paper are provided below:

a. Your paper should be 2-3 pages in length (not counting the title page and references page) and should cite and integrate at least two credible outside sources. The CSU-Global Library is a great place to find resources. Your textbook is a credible resource.
b. Include a title page, introduction, body, conclusion, and a reference page.

i. The introduction should describe or summarize the topic or problem. It might discuss the general applications of the topic or it might introduce the unique terminology associated with the topic.
ii. The body of your paper should address the questions posed in the problem. Explain how you approached and answered the question or solved the problem, and, for each question, show all steps involved. Be sure this is in paragraph format, not numbered answers like a homework assignment.
iii. The conclusion should summarize your thoughts about what you have determined from your analysis in completing the assignment. Nothing new should be introduced in the conclusion that was not previously discussed in the body paragraphs.

c. Include any tables of data or calculations, calculated values, and/or graphs referenced in the paper. (Note: The minimum required length excludes any tables, graphs, etc.)
d. Document formatting, citations, and style should conform to the CSU-Global Guide to Writing and APA. A short summary containing much that you need to know about paper formatting, citations, and references is contained in the New Sample APA Paper. In addition, information in the CSU-Global Virtual Library under the Writing Center/APA Resources tab has many helpful areas (Writing Center, Writing Tips, Template & Examples/Papers & Essays, Figures and Tables, and others).

MODULE 3

Readings

- Chapter 3, Sections 3.3 - 3.6 in *Calculus, Volume 1*
- Chapter 10 in *Schaum's Outline of Calculus*
- Sari, P., Hadiyan, A., & Antari, D. (2018). Exploring derivatives by means of GeoGebra. *International Journal on Emerging Mathematics Education*, 2(1), 65-78. Retrieved from http://journal.uad.ac.id/index.php/IJEME/article/view/8670/pdf_20

Opening Exercise (0 points)

Collaboration Exercise (25 points)

Mastery Exercise (15 points)

Critical Thinking (85 points)

Option #1: Graphing Position, Velocity, And Acceleration

For this Critical Thinking Assignment, you will be using GeoGebra to sketch graphs and solve real-world examples.

Begin by reading the following scenario:

After a diver jumps off a diving board, the edge of the board oscillates with position given by $s(t) = -5\cos(t)$ cm at t seconds after the jump.

Part I: Complete the following steps:

1. Using the GeoGebra tool in Canvas, sketch one period of the position function for $t \geq 0$.
2. Find the velocity function.
3. Using the GeoGebra tool in Canvas, sketch one period of the velocity function for $t \geq 0$.
4. Determine the times in the first period (or a single period) when the velocity is 0.

5. Find the acceleration function.
6. Using the GeoGebra tool in Canvas, sketch one period of the acceleration function for $t \geq 0$.
7. Save your GeoGebra work as a .pdf file for submission.

Part II: Based on your work in Part I, discuss the following:

1. Discuss any observations you can make about the relationships between the graphs of the position, velocity, and acceleration functions. In particular, make sure to include the following:
    a. The connections between critical points on each graph.
    b. The similarities and differences among the characteristics of the three graphs (i.e. amplitude, midline, and period).
    c. How fast is the edge of the board moving after 2 seconds?
    d. Based on your graph, over what intervals is the edge of the diving board moving upward?
2. Discuss how your answers to Part I would be affected if:
    a. The sign of the coefficient of cos(t) were opposite.
    b. The coefficient of cos(t) were double.
3. Provide at least two other real-world situations that serve as applications to this concept and respond to the following:
    a. What common characteristics do the real-world scenarios you chose share?
    b. What did you look for in the way that the real-world scenario can be modeled?

Requirements:

You must submit two files for this assignment. The first file should contain the computations, graphs, diagrams, etc., associated with the questions in Part I. This file may be formatted as a numbered list of answers. Unless stated in the problem, a narrative discussion is not required, but you must provide enough information to show how you arrived at the answer.

The second file should be a 2- to 3-page narrative paper, written in APA format, associated with the situation described in Part II. Specific requirements for the paper are provided below:

a. Your paper should be 2-3 pages in length (not counting the title page and references page) and should cite and integrate at least two credible outside sources. The CSU-Global Library is a great place to find resources. Your textbook is a credible resource.
b. Include a title page, introduction, body, conclusion, and a reference page.
    i. The introduction should describe or summarize the topic or problem. It might discuss the general applications of the topic or it might introduce the unique terminology associated with the topic.
    ii. The body of your paper should address the questions posed in the problem. Explain how you approached and answered the question or solved the problem, and, for each question, show all steps involved. Be sure this is in paragraph format, not numbered answers like a homework assignment.
    iii. The conclusion should summarize your thoughts about what you have determined from your analysis in completing the assignment. Nothing new should be introduced in the conclusion that was not previously discussed in the body paragraphs.
c. Include any tables of data or calculations, calculated values, and/or graphs referenced in the paper. (Note: The minimum required length excludes any tables, graphs, etc.)
d. Document formatting, citations, and style should conform to the CSU-Global Guide to Writing and APA. A short summary containing much that you need to know about paper

formatting, citations, and references is contained in the New Sample APA Paper. In addition, information in the CSU-Global Virtual Library under the Writing Center/APA Resources tab has many helpful areas (Writing Center, Writing Tips, Template & Examples/Papers & Essays, Figures and Tables, and others).

Option #2: Creating Your Own Rates Of Change Problem

For this Critical Thinking Assignment, you will be creating your own rates of change problem and answering questions about it.

Part I: Complete the following steps:

1. Research real-world scenarios that involve motion along a line and create your own. (See Section 3.4 from *Calculus, Volume 1*.)
2. Draw a sketch to model the scenario you have created. (You can draw this by hand and include a picture of your work with this submission.)
3. Define the function $s(t)$ as the function giving the position of the object at time t with a mathematical expression.
4. Find $a(t)$, the acceleration of the object at time t.

Part II: Based on your work in Part I, discuss the following:

1. Discuss what information $s(t)$ gives in the context of your problem.
2. Discuss what $v(t)$ gives in the context of your problem.
3. Discuss the connections between $s(t)$, $v(t)$, and $a(t)$ and how they are reflected in the real-world context you selected.
4. Summarize the trajectory of the object within the real-world context you selected. Make sure to address the following:
    a. At what time(s) (if any) is the object at rest? What can you say about the velocity and position of the object during those times?
    b. At what time intervals is the object accelerating? What can you say about the velocity and position of the object during those times?
    c. At what time intervals is the object's position minimized or maximized? What can you say about the velocity and acceleration of the object during those times?
    d. At what time intervals is the object's velocity minimized or maximized? What can you say about the acceleration of the object during those times?
5. Provide at least two other real-world situations that involve rates of change and respond to the following:
    a. What common characteristics do the real-world scenarios you chose share?
    b. What did you look for in the way that the real-world scenario can be modeled?

Requirements:

You must submit two files for this assignment. The first file should contain the computations, graphs, diagrams, etc., associated with the questions in Part I. This file may be formatted as a numbered list of answers. Unless stated in the problem, a narrative discussion is not required, but you must provide enough information to show how you arrived at the answer.

The second file should be a 2- to 3-page narrative paper, written in APA format, associated with the situation described in Part II. Specific requirements for the paper are provided below:

a. Your paper should be 2-3 pages in length (not counting the title page and references page) and should cite and integrate at least two credible outside sources. The CSU-Global Library is a great place to find resources. Your textbook is a credible resource.
b. Include a title page, introduction, body, conclusion, and a reference page.
    i. The introduction should describe or summarize the topic or problem. It might discuss the general applications of the topic or it might introduce the unique terminology associated with the topic.
    ii. The body of your paper should address the questions posed in the problem. Explain how you approached and answered the question or solved the problem, and, for each question, show all steps involved. Be sure this is in paragraph format, not numbered answers like a homework assignment.
    iii. The conclusion should summarize your thoughts about what you have determined from your analysis in completing the assignment. Nothing new should be introduced in the conclusion that was not previously discussed in the body paragraphs.
c. Include any tables of data or calculations, calculated values, and/or graphs referenced in the paper. (Note: The minimum required length excludes any tables, graphs, etc.)
d. Document formatting, citations, and style should conform to the CSU-Global Guide to Writing and APA. A short summary containing much that you need to know about paper formatting, citations, and references is contained in the New Sample APA Paper. In addition, information in the CSU-Global Virtual Library under the Writing Center/APA Resources tab has many helpful areas (Writing Center, Writing Tips, Template & Examples/Papers & Essays, Figures and Tables, and others).

MODULE 4

Readings

- Chapter 3, Sections 3.7 – 3.9 in *Calculus, Volume 1*
- Chapters 11, 17, & 18 in *Schaum's Outline of Calculus*
- Siyepu, S. (2015). Analysis of errors in derivatives of trigonometric functions. *International Journal of STEM Education,* 2(1), 1-16. Retrieved from https://stemeducationjournal.springeropen.com/articles/10.1186/s40594-015-0029-5

Opening Exercise (0 points)

Collaboration Exercise (25 points)

Mastery Exercise (15 points)

Midterm Exam (150 points)

MODULE 5

Readings

- Chapter 4, Sections 4.1-4.4 in *Calculus, Volume 1*
- Chapters 20 & 21 in *Schaum's Outline of Calculus*
- Trokhimchuk, Y. (2014). Mean-Value theorem. *Ukrainian Mathematical Journal*, 65(9), 1418-1425.

Opening Exercise (0 points)

Collaboration Exercise (25 points)

Mastery Exercise (15 points)

Critical Thinking (85 points)

Option #1: Creating a Related Rates Animation

For this Critical Thinking Assignment, you will be creating an animation that models a related rates problem using GeoGebra.

Part I: Complete the following steps:

1. Learn how to create animations in GeoGebra here: https://wiki.geogebra.org/en/Animation
2. Select a related rates problem from all even-numbered exercises 6 – 40 of Section 4.1 in *Calculus, Volume 1.*
3. Before solving the problem, model the way that the variables are changing by creating a GeoGebra animation.
4. Save your GeoGebra work as a .pdf file for submission.
5. Solve the related rates problem you selected.

Part II: Based on your work in Part I, discuss the following:

1. Discuss why you chose the related rates problem and what challenges you faced in trying to solve it.
2. Discuss the domain and range of the function. Do these values make sense in this context?
3. How exact is your model in showing how the variables from the problem are changing in relation to each other?
4. What are the limitations in trying to visually check your answer using the animation? Would there have been a way to determine the answer only by using your animation?
5. Discuss any challenges you faced when creating the animation.
6. Discuss any new information about the problem that you discovered by creating an animation to solve it.
7. Provide at least two other real-world situations that involve related rates and respond to the following:
    a. What common characteristics do the real-world scenarios you chose share?
    b. What did you look for in the way that the real-world scenario can be modeled?

Requirements:

You must submit two files for this assignment. The first file should contain the computations, graphs, diagrams, etc., associated with the questions in Part I. This file may be formatted as a numbered list of answers. Unless stated in the problem, a narrative discussion is not required, but you must provide enough information to show how you arrived at the answer.

The second file should be a 2- to 3-page narrative paper, written in APA format, associated with the situation described in Part II. Specific requirements for the paper are provided below:

a. Your paper should be 2-3 pages in length (not counting the title page and references page) and should cite and integrate at least two credible outside sources. The CSU-Global Library is a great place to find resources. Your textbook is a credible resource.
b. Include a title page, introduction, body, conclusion, and a reference page.
    i. The introduction should describe or summarize the topic or problem. It might discuss the general applications of the topic or it might introduce the unique terminology associated with the topic.
    ii. The body of your paper should address the questions posed in the problem. Explain how you approached and answered the question or solved the problem,

and, for each question, show all steps involved. Be sure this is in paragraph format, not numbered answers like a homework assignment.

iii. The conclusion should summarize your thoughts about what you have determined from your analysis in completing the assignment. Nothing new should be introduced in the conclusion that was not previously discussed in the body paragraphs.

c. Include any tables of data or calculations, calculated values, and/or graphs referenced in the paper. (Note: The minimum required length excludes any tables, graphs, etc.)

d. Document formatting, citations, and style should conform to the CSU-Global Guide to Writing and APA. A short summary containing much that you need to know about paper formatting, citations, and references is contained in the New Sample APA Paper. In addition, information in the CSU-Global Virtual Library under the Writing Center/APA Resources tab has many helpful areas (Writing Center, Writing Tips, Template & Examples/Papers & Essays, Figures and Tables, and others).

Option #2: Creating Your Own Related Rates Problem

For this Critical Thinking Assignment, you will be creating your own related rates problem.

Part I: Complete the following steps:

1. Select a context for your problem. (Ex. A problem involving two cars moving in different directions.)
2. Write your related rates problem.
3. Solve your related rates problem.

Part II: Based on your work in Part I, discuss the following:

1. What considerations did you have when selecting a context?
2. List the restrictions (if any) for the context that a related rates problem can have.
3. How can you check that you have provided all necessary information required to solve your problem?
4. What variables are related? How are those variables related?
5. What challenges do you foresee a student having when attempting to solve your problem?
6. Did you catch any errors in how you set up the problem while attempting to solve it?
7. Discuss any insight you gained about related rates problems from creating your own.
8. Change one aspect of your problem statement to increase its difficulty level. Then discuss how this change made the problem more challenging.
9. Would it be possible to have a related rates problem with two unknown rates?
10. Provide at least two other real-world situations that involve related rates and respond to the following:
    a. What common characteristics do the real-world scenarios you chose share?
    b. What did you look for in the way that the real-world scenario can be modeled?

Requirements:

You must submit two files for this assignment. The first file should contain the computations, graphs, diagrams, etc., associated with the questions in Part I. This file may be formatted as a numbered list of answers. Unless stated in the problem, a narrative discussion is not required, but you must provide enough information to show how you arrived at the answer.

The second file should be a 2- to 3-page narrative paper, written in APA format, associated with the situation described in Part II. Specific requirements for the paper are provided below:

a. Your paper should be 2-3 pages in length (not counting the title page and references page) and should cite and integrate at least two credible outside sources. The CSU-Global Library is a great place to find resources. Your textbook is a credible resource.
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    ii. The body of your paper should address the questions posed in the problem. Explain how you approached and answered the question or solved the problem, and, for each question, show all steps involved. Be sure this is in paragraph format, not numbered answers like a homework assignment.
    iii. The conclusion should summarize your thoughts about what you have determined from your analysis in completing the assignment. Nothing new should be introduced in the conclusion that was not previously discussed in the body paragraphs.
c. Include any tables of data or calculations, calculated values, and/or graphs referenced in the paper. (Note: The minimum required length excludes any tables, graphs, etc.)
d. Document formatting, citations, and style should conform to the CSU-Global Guide to Writing and APA. A short summary containing much that you need to know about paper formatting, citations, and references is contained in the New Sample APA Paper. In addition, information in the CSU-Global Virtual Library under the Writing Center/APA Resources tab has many helpful areas (Writing Center, Writing Tips, Template & Examples/Papers & Essays, Figures and Tables, and others).

MODULE 6

Readings

- Chapter 4, Sections 4.5, 4.7, and 4.8 in *Calculus, Volume 1*
- Chapters 14 & 27 in *Schaum's Outline of Calculus*
- Sevimli, E. (2016). Do calculus students demand technology integration into learning environment? Case of instructional differences. *International Journal of Educational Technology in Higher Education*, 13(1), 1-18. Retrieved from http://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-016-0038-6

Opening Exercise (0 points)

Collaboration Exercise (25 points)

Mastery Exercise (15 points)

Critical Thinking (85 points)

Option #1: Minimizing Travel Time

For this Critical Thinking assignment, you will explore applied optimization problems that minimize travel time.

Part I: Complete the following steps:

1. Read Example 4.34 in Section 4.7 of *Calculus, Volume 1.*

2. Consider the following scenario:

A lifeguard is at point A of a circular pool with diameter 40 m. He must reach someone who is drowning on the exact opposite side of the pool, at position C. The lifeguard swims with a speed v = 3 m/s from point A to point B, and then runs around the pool from point B to point C at speed w = 9 m/s. You will find an image representation in your Module 6 area in your course.

a. Find a function that measures the total amount of time it takes to reach the drowning person as a function of the swim angle, ϑ expressed in radians.
b. Find at what angle ϑ, in radians, the lifeguard should swim to reach the drowning person in the least amount of time.
c. What is the domain of the function you created in part (a)?

Part II: Based on your work in Part I, discuss the following:

1. How do you know that the function you created in Part I has a maximum and minimum value?
2. Discuss how your answers to Part I would be affected if the diameter of the pool increased.
3. For what running speed would it be faster to swim the entire time? What angle would correspond to this scenario?
4. For what angle, θ, would it take the longest to reach the drowning person?
5. Suppose the pool was rectangular. Respond to the following:
    a. Does it still make sense to parameterize using θ ? Why or why not?
        i. If not, what parameter would you use?
        ii. If so, how does the parameterization change?
    b. Set up, but do not solve, this problem with a rectangular pool.
6. Answer the following questions that reference Example 4.34:
    a. How do we know that the function $T(x)$ has a maximum and minimum?
    b. What restrictions are there on what the domain of T can be in this scenario?
    c. Elaborate, in your own words, on why we must evaluate $T(0)$ and $T(6)$.

Requirements:

You must submit two files for this assignment. The first file should contain the computations, graphs, diagrams, etc., associated with the questions in Part I. This file may be formatted as a numbered list of answers. Unless stated in the problem, a narrative discussion is not required, but you must provide enough information to show how you arrived at the answer.

The second file should be a 2- to 3-page narrative paper, written in APA format, associated with the situation described in Part II. Specific requirements for the paper are provided below:

a. Your paper should be 2-3 pages in length (not counting the title page and references page) and should cite and integrate at least two credible outside sources. The CSU-Global Library is a great place to find resources. Your textbook is a credible resource.
b. Include a title page, introduction, body, conclusion, and a reference page.
    i. The introduction should describe or summarize the topic or problem. It might discuss the general applications of the topic or it might introduce the unique terminology associated with the topic.
    ii. The body of your paper should address the questions posed in the problem. Explain how you approached and answered the question or solved the problem, and, for each question, show all steps involved. Be sure this is in paragraph format, not numbered answers like a homework assignment.

iii. The conclusion should summarize your thoughts about what you have determined from your analysis in completing the assignment. Nothing new should be introduced in the conclusion that was not previously discussed in the body paragraphs.

c. Include any tables of data or calculations, calculated values, and/or graphs referenced in the paper. (Note: The minimum required length excludes any tables, graphs, etc.)
d. Document formatting, citations, and style should conform to the CSU-Global Guide to Writing and APA. A short summary containing much that you need to know about paper formatting, citations, and references is contained in the New Sample APA Paper. In addition, information in the CSU-Global Virtual Library under the Writing Center/APA Resources tab has many helpful areas (Writing Center, Writing Tips, Template & Examples/Papers & Essays, Figures and Tables, and others).

Option #2: Maximizing Length

For this Critical Thinking Assignment, you will explore applied optimization problems that maximize length.

Part I: Complete the following steps:

1. Read Example 4.34 in Section 4.7 of *Calculus, Volume 1.*
2. Read the following question prompt:

You are moving into a new apartment and notice there is a corner where the hallway narrows from 8 ft to 6 ft. You will find an image representation in your Module 6 area in your course.

a. Determine which quantity must be maximized.
b. Write the formula for the quantity that would need to be maximized in order to solve this problem.
c. Write any equations relating the independent variables from your formula and write the quantity to be maximized as a function of one variable.
d. Determine the domain under consideration for this problem.
e. Determine whether the function has a maximum value on the domain.
f. What is the length of the longest item that can be carried horizontally around the corner?

Part II: Based on your work in Part I, discuss the following:

1. Discuss why constraints were placed on the domain of the function in this case.
2. Elaborate in your own words how you determined whether the function has a maximum value and make sure to mention any theorems used.
3. Discuss how your answers to Part I would be affected if:
    a. The widths of the hallways increased.
    b. The angle of the corner, shown in the diagram as a right angle, were decreased.
4. Set up, but do not solve, an alternative problem with a different context that would be solved using the same process outlined above.
    a. Discuss your thought process as you came up with an alternative problem.
    b. What restrictions are there for what real-world problems can be solved in this manner?
5. Answer the following questions that reference Example 4.34:
    a. How do we know that the function $T(x)$ has a maximum and minimum?
    b. What restrictions are there on what the domain of T can be in this scenario?
    c. Elaborate, in your own words, on why we must evaluate $T(0)$ and $T(6)$.

Requirements:

You must submit two files for this assignment. The first file should contain the computations, graphs, diagrams, etc., associated with the questions in Part I. This file may be formatted as a numbered list of

answers. Unless stated in the problem, a narrative discussion is not required, but you must provide enough information to show how you arrived at the answer.

The second file should be a 2- to 3-page narrative paper, written in APA format, associated with the situation described in Part II. Specific requirements for the paper are provided below:

a. Your paper should be 2-3 pages in length (not counting the title page and references page) and should cite and integrate at least two credible outside sources. The CSU-Global Library is a great place to find resources. Your textbook is a credible resource.
b. Include a title page, introduction, body, conclusion, and a reference page.
    i. The introduction should describe or summarize the topic or problem. It might discuss the general applications of the topic or it might introduce the unique terminology associated with the topic.
    ii. The body of your paper should address the questions posed in the problem. Explain how you approached and answered the question or solved the problem, and, for each question, show all steps involved. Be sure this is in paragraph format, not numbered answers like a homework assignment.
    iii. The conclusion should summarize your thoughts about what you have determined from your analysis in completing the assignment. Nothing new should be introduced in the conclusion that was not previously discussed in the body paragraphs.
c. Include any tables of data or calculations, calculated values, and/or graphs referenced in the paper. (Note: The minimum required length excludes any tables, graphs, etc.)
d. Document formatting, citations, and style should conform to the CSU-Global Guide to Writing and APA. A short summary containing much that you need to know about paper formatting, citations, and references is contained in the New Sample APA Paper. In addition, information in the CSU-Global Virtual Library under the Writing Center/APA Resources tab has many helpful areas (Writing Center, Writing Tips, Template & Examples/Papers & Essays, Figures and Tables, and others).

MODULE 7

Readings

- Chapter 4, Section 4.10 in *Calculus, Volume 1*
- Chapter 5, Sections 5.1-5.3 in *Calculus, Volume 1*
- Chapters 22, 23, & 24 in *Schaum's Outline of Calculus*
- Edrian E. G. (2015). A modular approach utilizing decision tree in teaching integration techniques in calculus. *Asia Pacific Journal of Multidisciplinary Research*, 3(3), 52-58. Retrieved from http://www.apjmr.com/wp-content/uploads/2015/07/APJMR-2015-3-3-009-A-Modular-Approach-Utilizing-Decision-Tree-in-Teaching.pdf

Opening Exercise (0 points)

Collaboration Exercise (25 points)

Mastery Exercise (15 points)

MODULE 8

Readings

- Chapter 5, Sections 5.5-5.7 in *Calculus, Volume 1*

- Chapters 31 & 32 in *Schaum's Outline of Calculus*
- Kissane, B. (2016). Integrating technologies into mathematics: comparing the cases of square roots and integrals. *Australian Senior Mathematics Journal*, 30(1), 4-17.

Opening Exercise (0 points)

Collaboration Exercise (25 points)

Mastery Exercise (15 points)

Final Exam (200 points)

COURSE POLICIES

Course Grading

20% Collaboration Exercises
0% Opening Exercises
12% Mastery Exercises
33% Critical Thinking Assignments
15% Midterm Exam
20% Final Exam

Grading Scale	
A	95.0 – 100
A-	90.0 – 94.9
B+	86.7 – 89.9
B	83.3 – 86.6
B-	80.0 – 83.2
C+	75.0 – 79.9
C	70.0 – 74.9
D	60.0 – 69.9
F	59.9 or below

IN-CLASSROOM POLICIES

For information on late work and incomplete grade policies, please refer to our **In-Classroom Student Policies and Guidelines** or the Academic Catalog for comprehensive documentation of CSU-Global institutional policies.

Academic Integrity
Students must assume responsibility for maintaining honesty in all work submitted for credit and in any other work designated by the instructor of the course. Academic dishonesty includes cheating, fabrication, facilitating academic dishonesty, plagiarism, reusing /repurposing your own work (see *CSU-Global Guide to Writing and APA Requirements* for percentage of repurposed work that can be used in an assignment), unauthorized possession of academic materials, and unauthorized collaboration. The CSU-Global Library provides information on how students can avoid plagiarism by understanding what it is and how to use the Library and Internet resources.

Citing Sources with APA Style
All students are expected to follow the *CSU-Global Guide to Writing & APA* when citing in APA (based on the most recent APA style manual) for all assignments. A link to this guide should also be provided within most assignment descriptions in your course.

Disability Services Statement
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Netiquette
Respect the diversity of opinions among the instructor and classmates and engage with them in a courteous, respectful, and professional manner. All posts and classroom communication must be conducted in accordance with the student code of conduct. Think before you push the Send button. Did you say just what you meant? How will the person on the other end read the words?

Maintain an environment free of harassment, stalking, threats, abuse, insults, or humiliation toward the instructor and classmates. This includes, but is not limited to, demeaning written or oral comments of an ethnic, religious, age, disability, sexist (or sexual orientation), or racist nature; and the unwanted sexual advances or intimidations by email, or on discussion boards and other postings within or connected to the online classroom. If you have concerns about something that has been said, please let your instructor know.