COLORADO STATE UNIVERSITY GLOBAL

MTH166: PRE-CALCULUS

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 pre-calculus topics with a personalized learning approach. The main topics of study include functions (polynomial, exponential, logarithmic, and trigonometric), analytic trigonometry, vectors, the complex plane, systems of equations, sequences and series, and analytic geometry. Assessments for this course will include discussions, mastery exercises, and critical thinking assignments. This course fulfills a general education mathematics requirement.

Course Overview:

Welcome to MTH166: Pre-calculus! In this course, you will learn about pre-calculus topics with a personalized learning approach. The main topics of study you will master include functions (polynomial, exponential, logarithmic, and trigonometric), analytic trigonometry, vectors, the complex plane, systems of equations, sequences and series, and analytic geometry. You will complete a variety of assessments, including discussions, mastery exercises, and critical thinking assignments. Your completion of this course fulfills a general education mathematics requirement.

Course Learning Outcomes:

1. Analyze polynomial functions algebraically and graphically.
2. Analyze exponential and logarithmic functions algebraically and graphically.
3. Analyze trigonometric functions algebraically and graphically.
4. Apply trigonometric identities and formulas in problem solving.
5. Demonstrate knowledge of vectors and the complex plane.
6. Utilize a variety of techniques to solve systems of equations.
7. Demonstrate knowledge of a variety of topics involving sequences and series.
8. Utilize analytic geometry techniques in problem solving.

COLORADO GTPATHWAYS COURSE

Colorado Guaranteed Transfer (GT) Pathways Course: The Colorado Commission on Higher Education has approved MTH166: Pre-Calculus for inclusion in the Guaranteed Transfer (GT) Pathways program in the **GT-MA1** category. For transferring students, successful completion with a minimum C– grade guarantees transfer and

application of credit in this GT Pathways category. For more information on the GT Pathways program, go to http://highered.colorado.gov/academics/transfers/gtpathways/curriculum.html

The table in **Appendix A** details the specific alignment of Course Learning Outcomes and Assessments to gtPathways Content and Criteria requirements.

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:
Abramson, J., Falduto, V., & Gross, R. (2014). *Precalculus*. Houston, TX: OpenStax. Retrieved from https://openstax.org/details/books/precalculus

Suggested:
Safier, F. (2013). *Schaum's outline of precalculus* (3rd 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.

- **Discussion Boards:** The original post must be completed by Thursday at 11:59 p.m. MT and Peer Responses posted by Sunday 11:59 p.m. MT. Late posts 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

- Chapters 3 & 4 in *Precalculus*

Opening Exercise (0 points):

Discussion (25 points)

Mastery Exercise (15 points): via Knewton-Alta

Module 2

Readings

- Chapter 5 in *Precalculus*

Opening Exercise (0 points):

Discussion (25 points)

Mastery Exercise (15 points): via Knewton-Alta

Critical Thinking (75 points)

Option #1: Exploring the Unit Circle

For this Critical Thinking Assignment, you will use the GeoGebra Graphing Calculator tool in Canvas to explore the unit circle. Let's explore how points on the unit circle relate to trigonometric functions and the ratios of the side lengths of the inscribed right triangle.

Part I: Complete the following steps:

1. If you are not already familiar with GeoGebra, refer to the GeoGebra tutorial.
2. To begin, expand the tool menu by clicking on "More". Then click on the "Circle with Center and Radius" tool under "Circles". Then, create the unit circle with appropriate center and radius.
3. Select a point on the circle that is not on one of the axes using the "Point" tool under "Points".
4. Create a right triangle with the origin, your selected point, and the point directly above or below yours on the x-axis. Use the "Polygon" tool under "Polygons".
5. Check that your triangle is a right triangle by using the "Angle" tool under "Measure".
6. Use the "Distance or Length" tool under "Measure" to find the side lengths of your triangle.
7. Save your GeoGebra work as a .pdf file for submission.

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

1. What quadrant is your point in? How can you tell?
2. Which angle has terminal side which crosses the unit circle at your point? How did you determine this?
3. Discuss how to find the reference angle for an angle.
4. What is the reference angle for the angle you just found?
5. Use the reference angle to find all six trigonometric functions of your angle.
6. Could you have used other angles to evaluate the six trigonometric functions? Explain.
7. What missing sides does your right triangle have? Fill in any that are missing and discuss how you found them.
8. Describe at least one alternative method for finding the missing sides you just solved for. If no other method exists, explain why not.
9. Discuss how you can verify that you have drawn the unit circle by comparing side lengths of the triangle with trigonometric values of the angle at the origin.

10. Is there an equal right triangle to the one you created? If so, discuss how you identified it and give the coordinates of its vertices.

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:

1. Your paper should be 2-3 pages in length (not counting the title page and references page) and 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.
2. Include a title page, introduction, body, conclusion, and a reference page.
    a. 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.
    b. 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.
    c. 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.
3. 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.)
4. 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, the CSU-Global Writing Center has many helpful tools and tutorials (Citing & APA Resources, Writing Templates, Writing Tutorials, and others).

Option #2: Measuring the Height of a Tall Object

For this Critical Thinking Assignment, you will be using trigonometry concepts to measure the height of a tall object indirectly.

Part I: Complete the following steps:

1. Research methods for measuring the height of a tall object indirectly using trigonometry. Select one and make sure to include a citation for the source you obtained it from.
2. Locate a tall object that can be measured using the method you selected for Part I.
3. Make a sketch of the problem situation and mark all unknown and known values. (You can draw this by hand and submit a picture of your work with this submission.)
4. Write an equation relating the variables including the unknown height.
5. Solve the equation for the unknown height.

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

1. Summarize the methods you researched for measuring the height of a tall object.

2. Discuss why you selected your method.
3. What challenges did you face in carrying out the method you selected?
4. Were you surprised by the height you measured? How could you have checked that this figure was accurate?
5. What trigonometric concept did you utilize and how?
6. Could this height have been calculated indirectly without the use of trigonometry?
7. Think of another scenario where this trigonometric concept can be used to solve a real-world problem.
    a. What characteristics are shared by real-world scenarios that can be solved using trigonometry?
    b. Discuss the advantages of using trigonometry in the context of the scenario you created.

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:

1. Your paper should be 2-3 pages in length (not counting the title page and references page) and 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.
2. Include a title page, introduction, body, conclusion, and a reference page.
    a. 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.
    b. 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.
    c. 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.
3. 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.)
4. 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, the CSU-Global Writing Center has many helpful tools and tutorials (Citing & APA Resources, Writing Templates, Writing Tutorials, and others).

Module 3

Readings

- Chapters 6 & 7 in *Precalculus*

Opening Exercise (0 points)

Discussion (25 points)

Live Classroom (0 points)

Mastery Exercise (15 points): via Knewton-Alta

Critical Thinking (85 points)

Option #1: Ferris Wheel Height

For this Critical Thinking Assignment, you will be exploring a real-world example that can be modeled using a periodic function.

Begin by reading the following prompt:

A Ferris wheel is 25 meters in diameter and boarded from a platform that is 1 meter above the ground. The six o'clock position on the Ferris wheel is level with the loading platform. The wheel completes 1 full revolution in 10 minutes. The function $h(t)$ gives a person's height in meters above the ground t minutes after the wheel begins to turn.

Part I: Complete the following steps:

1. Find the amplitude, midline, and period of $h(t)$.
2. Find the domain and range of the function $h(t)$ and
3. Find a formula for the height function $h(t)$.
4. State the phase shift and vertical translation, if applicable.
5. How high off the ground is a person after 5 minutes?
6. Use the GeoGebra Graphing Calculator tool in Canvas to model this situation. (Refer to the GeoGebra tutorial as needed. Save your GeoGebra work as a .pdf file for submission.)

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

1. In your own words, discuss why this situation can be modeled with a periodic function and how the information provided relates to the amplitude, midline, and period of the function $h(t)$.
2. Discuss why the domain and range you found in Part I makes sense in the context of this problem.
3. Discuss how you found the height off the ground of the person after 5 minutes.
4. Discuss how your answers in Part I would be affected if:
    a. The diameter of the Ferris wheel increased.
    b. The time it takes for the Ferris wheel to complete 1 full revolution decreases.
5. Provide at least two other real-world situations that can be modeled using a periodic function 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?
    c. How can you verify that the real-world scenarios you chose can be modeled by a periodic function?

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:

1. Your paper should be 2-3 pages in length (not counting the title page and references page) and 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.

2. Include a title page, introduction, body, conclusion, and a reference page.
    a. 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.
    b. 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.
    c. 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.
3. 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.)
4. 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, the CSU-Global Writing Center has many helpful tools and tutorials (Citing & APA Resources, Writing Templates, Writing Tutorials, and others).

Option #2: Creating Your Own Real-World Scenario Involving Periodic Functions

For this Critical Thinking Assignment, you will create your own real-world scenario that can be modeled using a periodic function.

Part I: Complete the following steps:

1. Select a real-world scenario that can be modeled by a periodic function (ex. temperature over time or tidal patterns).
2. Write a mathematical expression for the function that can model your scenario.
3. Find the amplitude, midline, and period of your function.
4. Find the domain and range of your function.
5. State the phase shift and vertical translation, if applicable.

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

1. Discuss your rationale for your choice of real-world scenario.
2. Reflect on your thought process as you created the scenario. What challenges did you face?
3. Discuss what information you needed to include in order for the amplitude, midline, and period of your function to be computed.
4. Discuss why the domain and range you found in Part I makes sense in this context.
5. Discuss two possibilities for a change in the parameters of your scenario. How would your answers to Part I be affected by these changes?
6. Provide at least two other real-world situations that can be modeled using a periodic function 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?
    c. How can you verify that the real-world scenarios you chose can be modeled by a periodic function?

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:

1. Your paper should be 2-3 pages in length (not counting the title page and references page) and 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.
2. Include a title page, introduction, body, conclusion, and a reference page.
    a. 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.
    b. 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.
    c. 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.
3. 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.)
4. 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, the CSU-Global Writing Center has many helpful tools and tutorials (Citing & APA Resources, Writing Templates, Writing Tutorials, and others).

Module 4

Readings

- Chapter 8, Sections 8.1-8.5, in *Precalculus*

Opening Exercise (0 points)

Discussion (25 points)

Mastery Exercise (15 points): via Knewton-Alta

Midterm Exam (150 points)

Module 5

Readings

- Chapter 8, Sections 8.6-8.8, in *Precalculus*

Opening Exercise (0 points)

Discussion (25 points)

Mastery Exercise (15 points): via Knewton-Alta

Critical Thinking (85 points)

Option #1: Comparing Graphs of Parametric Equations

For this Critical Thinking Assignment, you will explore a real-world scenario that can be modeled using parametric equations.

Begin by reading the following:

For the following exercises, use this scenario: A dart is thrown upward with an initial velocity of 65 mm per second at an angle of elevation of 52°. Consider the horizontal and vertical positions of the dart at any time *t.* Neglect air resistance.

Part I: Complete the following steps:

1. Find parametric equations that model the problem situation.
2. Use the GeoGebra tool to graph the parametric equations. (Refer to this tutorial as needed.)
3. Find all possible values for *t* that represent the situation.
4. State the parametric equations.
5. State the domain and range for each parametric equation.
6. Plot the minimum and maximum heights of the dart.
7. Plot the minimum and maximum horizontal positions of the dart.
8. Find the time at which the dart reaches the maximum height.
9. Save your GeoGebra work as a .pdf file for submission.

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

1. Discuss why this situation can be modeled using parametric equations.
2. Discuss how you determined all possible values for *t* that represent the situation.
3. Discuss what the domain and range of the parametric equations mean in the context of this problem.
4. What do maximum and minimum values of the parametric equations represent in this context?
5. Discuss how your answers to Part I would be affected if:
    a. The initial velocity is increased.
    b. The angle of elevation is decreased.
6. Provide at least two other real-world situations that can be modeled using parametric functions 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?
    c. How can you verify that the real-world scenarios you chose can be modeled by parametric functions?

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:

1. Your paper should be 2-3 pages in length (not counting the title page and references page) and 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.
2. Include a title page, introduction, body, conclusion, and a reference page.

a. 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.
b. 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.
c. 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.

3. 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.)
4. 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, the CSU-Global Writing Center has many helpful tools and tutorials (Citing & APA Resources, Writing Templates, Writing Tutorials, and others).

Option #2: Graphs of Parametric Equations

For this Critical Thinking Assignment, use the parametric equations for integers a and b:
$x(t) = a\cos((a + b)t)$ $y(t) = a\cos((a - b)t)$

Part I: Complete the following steps:

1. Use the GeoGebra tool in Canvas to graph the parametric equations on the domain $[-\pi, 0]$ and include the orientation for the following cases:
    a. $a = 2$ and $b = 1$
    b. $a = 3$ and $b = 2$
    c. $a = 4$ and $b = 3$
    d. $a = 5$ and $b = 4$

(Refer to the GeoGebra tutorial as needed.)

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

1. Discuss the role of a and b in the parametric equations shown above.
2. Discuss why the domain is given as $[-\pi, 0]$. What would change if the domain were given as $[0, \pi]$ instead?
3. If a is 1 more than b, describe the effect the values of a and b have on the graph of the parametric equations.
4. Describe the graph if a = 100 and b = 99.
5. In general, discuss what happens if b is 1 more than a. How do you know?
6. Describe the graph from #4 above and graph it for one case.
7. If the parametric equations $x(t) = t^2$ and $y(t) = 6 - 3t$ have the graph of a horizontal parabola opening to the right, what would change the direction of the curve?
8. Based on the graph you created in Part I, answer the following:
    a. What real-world scenarios could this graph model?
    b. What do you look for in the way that the real-world scenario can be modeled?
    c. How can you verify that the real-world scenarios you chose can be modeled by these parametric functions?

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:

1. Your paper should be 2-3 pages in length (not counting the title page and references page) and 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.
2. Include a title page, introduction, body, conclusion, and a reference page.
    a. 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.
    b. 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.
    c. 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.
3. 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.)
4. 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, the CSU-Global Writing Center has many helpful tools and tutorials (Citing & APA Resources, Writing Templates, Writing Tutorials, and others).

Module 6

Readings

- Chapter 9, Sections 9.1-9.5, in *Precalculus*

Opening Exercise (0 points)

Discussion (25 points)

Live Classroom (0 points)

Mastery Exercise (15 points): via Knewton-Alta

Critical Thinking (85 points)

Option #1: Finding the Break-Even Point

For this Critical Thinking Assignment, you will investigate profits using systems of equations.

Part I: Complete the following steps:

1. Read Example 10 in Section 9.1 of *Precalculus*.
2. Use the GeoGebra tool in Canvas to graph the cost and revenue functions given in Example 10.
3. Identify the break-even point using the “Intersect” tool under “Points”.
4. Save your GeoGebra work as a .pdf file for submission.

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

6. Discuss the part of the graph that represents the profit.
7. Discuss how you found the break-even point on the graph.
8. If you are performing a break-even analysis for a business and their cost and revenue equations are dependent, explain what this means for the company's profit margins.
9. If you are solving a break-even analysis and get more than one break-even point, explain what this signifies for the company?
10. If you are solving a break-even analysis and there is no break-even point, explain what this means for the company.
11. How should they ensure there is a break-even point?
12. Solve the following problem: An investor earned triple the profits of what she earned last year. If she made $500,000.48 total for both years, how much did she earn in profits each year?
    a. Write an analysis of your solution to this problem similar to the one included at the end of Example 10.
    b. Describe the graph that could model this situation.
    c. Discuss how your answer would be affected if:
        i. The amount earned for both years was increased.
        ii. The investor only earned <u>double</u> the profits of what she earned last year.

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:

1. Your paper should be 2-3 pages in length (not counting the title page and references page) and 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.
2. Include a title page, introduction, body, conclusion, and a reference page.
    a. 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.
    b. 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.
    c. 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.
3. 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.)
4. 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, the CSU-Global Writing Center has many helpful tools and tutorials (Citing & APA Resources, Writing Templates, Writing Tutorials, and others).

Option #2: Creating Your Own Systems of Equations

For this Critical Thinking Assignment, you will create systems of linear equations of various characteristics and analyze their graphs using GeoGebra.

Part I: Complete the following steps:

1. Create a system of linear equations that is consistent.
2. Use the GeoGebra tool in Canvas to graph your system of linear equations.
3. Determine the number of solutions of your system.
4. Create a system of linear equations that is inconsistent.
5. Use the GeoGebra tool to graph your inconsistent system of linear equations.
6. Create a system of linear equations that is dependent.
7. Use the GeoGebra tool to graph your dependent system of linear equations.
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 how you can verify that the system you created is consistent.
2. Discuss what options there are for the number of intersection points of two lines and how they relate to the number of solutions to its system.
3. Discuss the characteristics that are shared by all graphs of inconsistent systems of linear equations.
4. How does the graph of the dependent system reflect the algebraic finding that the system is dependent?
5. How does being a dependent system affect the number of solutions the system has?
6. What type of real-world scenarios could the graph of a linear system model?
7. What do you look for in a real-world scenario that can be modeled by a linear system?
8. Set up, but do not solve, a word problem with real-world context that can be modeled using a linear system of equations. Then answer the following:
    a. What would it mean in the context of your problem if the linear system is dependent?
    b. What would it mean in the context of your problem if the linear system is inconsistent?

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:

1. Your paper should be 2-3 pages in length (not counting the title page and references page) and 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.
2. Include a title page, introduction, body, conclusion, and a reference page.
    a. 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.
    b. 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.

c. 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.

3. 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.)
4. 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, the CSU-Global Writing Center has many helpful tools and tutorials (Citing & APA Resources, Writing Templates, Writing Tutorials, and others).

Module 7

Readings

- Chapter 10 in *Precalculus*

Opening Exercise (0 points)

Discussion (25 points)

Mastery Exercise (15 points): via Knewton-Alta

Module 8

Readings

- Chapter 11, Sections 11.1-11.4, in *Precalculus*

Opening Exercise (0 points)

Discussion (25 points)

Mastery Exercise (15 points): via Knewton-Alta

Final Exam (200 points)

COURSE POLICIES

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

Course Grading

20% Discussion Participation
12% Mastery Exercises
33% Critical Thinking Assignments
15% Midterm
20% Final Exam

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 & APA 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

CSU-Global is committed to providing reasonable accommodations for all persons with disabilities. Any student with a documented disability requesting academic accommodations should contact the Disability Resource Coordinator at 720-279-0650 and/or email ada@CSUGlobal.edu for additional information to coordinate reasonable accommodations for students with documented disabilities.

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.

APPENDIX A

Colorado General Transfer Pathways Alignment

Course Learning Outcomes	**GT Pathways Competencies & Content Criteria**	**Assessment Methods**
CLO1. Analyze polynomial functions algebraically and graphically.	**QL3: Perform Calculations** **a. Solve problems or equations at the appropriate course level.** **b. Use appropriate mathematical notation.**	**For QL3a.** Students solve problems or equations at the appropriate course level in all assignments of the course. For example, this is done in Module 1 when working with polynomial functions. This is assessed in **Module 1 Mastery Exercises** and culminates in the **Module 4 and Module 8 Final Exams.** **For QL3b.** Students use appropriate mathematical notation in all course assignments. For example, this is done in Module 1 when working with polynomial functions. This is assessed in **Module 1 Mastery Exercises** and culminates in the **Module 4 and Module 8 Final Exams.**
CLO2. Analyze exponential and logarithmic functions algebraically and graphically.	**QL1: Interpret Information** **a. Explain information presented in mathematical forms.** **QL3: Perform Calculations** **c. Solve a variety of different problem types that involve a multi-step solution and address the validity of the results.**	**For QL1a.** In all **Critical Thinking Assignments (Modules 2, 3, 5, and 6)**, students must explain information presented in mathematical forms. **For QL3c.** Students solve a variety of different problem types that involve a multi-step solution and address the validity of results in all **Critical Thinking Assignments (Modules 2, 3, 5, and 6)**.

	CCa: Demonstrate good problem-solving habits, including: 1. **Estimating solutions and recognizing unreasonable results.** 2. **Considering a variety of approaches to a given problem, and selecting one that is appropriate.** 3. **Interpreting solutions correctly.** **CCc: Communicate mathematical ideas in written and/or oral form using appropriate mathematical language, notation, and style.** **CCf: Utilize and integrate appropriate technology.**	**For CCa1.** Students estimate solutions and recognize unreasonable results in all weekly **Discussions** where they are asked to evaluate the solutions brought forth by their peers. **For CCa2.** Students consider a variety of approaches to a given problem, and select one that is appropriate in all weekly **Discussions** where they are asked to consider alternative ways to solve the given problem. **For CCa3.** Students are assessed in interpreting solutions correctly in various assignments of the course. For example, in the **Module 2 Critical Thinking Assignment,** students are asked to interpret and extend their solution. **For CCc.** Students communicate written mathematical ideas in the weekly **Discussions** as well as in the **Critical Thinking assignments (Modules 2, 3, 5, and 6).** **For CCf.** Students use

		GeoGebra, an online graphing tool, to address the prompts in **Critical Thinking Assignments (Modules 2, 3 and 5).**
CLO3. Analyze trigonometric functions algebraically and graphically.	**QL4: Apply and Analyze Information** **b. Formulate, organize, and articulate solutions to theoretical and application problems at the appropriate course level.**	**For QL4b.** Students perform this outcome in all assignments of the course. For example, in the **Module 3 Critical Thinking Assignment**, students respond to various prompts as part of both theoretical and application problems involving trigonometry. In doing this, they formulate, organize, and articulate their solutions to these prompts.
CLO4. Apply trigonometric identities and formulas in problem solving.	**CCd: Apply mathematical concepts, procedures, and techniques appropriate to the course.**	**For CCd.** Students apply mathematical concepts, procedures, and techniques in all assignments of the course. For example, this is evident in the application of trigonometric identities and formulas assessed in **Module 4 Mastery Exercises.** This also culminates in the **Module 4 Midterm Exam and Module 8 Final Exam.**
CLO5. Demonstrate knowledge of vectors and the complex plane.	**QL5: Communicate Using Mathematical Forms** **a. Express mathematical analysis symbolically, graphically, and in written language that clarifies/justifies/summarizes reasoning.**	**For QL5a.** Students express mathematical analysis symbolically, graphically, or in written language in all assignments of the course. For example, this outcome is present in Module 5 where students work with vectors and the complex plane. This involves the use of symbolic vector notation, graphical representations of functions on the complex plane, and written language. This is assessed in the **Module 5 Mastery Exercises**

	CCb: Generate and interpret symbolic, graphical, numerical, and verbal (written or oral) representations of mathematical ideas.	and the **Module 8 Final Exam**. **For CCb.** Students interpret mathematical symbols, graphs and verbal information in all assignments of the course. For example, in Module 5, students express and interpret vectors using vector notation. This is assessed in the **Module 5 Mastery Exercises** as well as the **Module 8 Final Exam.**
CLO6. Utilize a variety of techniques to solve systems of equations.	**QL4: Apply and Analyze Information** **a. Make use of graphical objects to supplement a solution to a typical problem at the appropriate level.**	**For QL4a.** Students use graphical objects to supplement a solution to a typical problem at the appropriate level in the **Module 6 Critical Thinking Assignment** where they analyze graph of a system of equations.
CLO7. Demonstrate knowledge of a variety of topics involving sequences and series.	**QL2: Represent Information** **a. Convert information into and between various mathematical forms.** **CCe: Recognize and apply patterns or mathematical structure.**	**For QL2a.** Students convert information into and between various mathematical forms in several assignments of the course. For example, in Module 8, students convert between expressing a sequence as an explicit or recursive formula and as a list of terms. This is assessed in the **Module 8 Mastery Exercises** and the **Module 8 Final Exam**. **For CCe.** Students recognize and apply patterns or mathematical structure in various assignments of the course. One of the modules where this is done the most is in Module 8, where students recognize patterns in the relationship between terms of a sequence. This is assessed in the **Module 8 Mastery**

		Exercises and the **Module 8 Final Exam.**
CLO8. Utilize analytic geometry techniques in problem solving.	**QL4: Apply and Analyze Information** **c. Make judgments based on mathematical analysis appropriate to the course level.**	**For QL4c.** Throughout the course, students make judgements based on mathematical analysis appropriate to the course level. For example, in Module 7, students must analyze a geometric structure and determine the type it is and what its key parameters are. This is assessed in the **Module 7 Mastery Exercises** and the **Module 8 Final Exam**.

The general education requirement in mathematics is designed to help students:

• Develop an understanding of fundamental mathematical concepts and their applications.

• Develop their quantitative problem-solving skills.

• Develop a level of quantitative literacy that provides a foundation for success in their programs of study, careers, and citizenship.

Content Criteria for Designating a Mathematics Course as GT Pathways:

This course should provide students with the opportunity to / Students should be able to:

a) Demonstrate good problem-solving habits, including:

- Estimating solutions and recognizing unreasonable results.
- Considering a variety of approaches to a given problem, and selecting one that is appropriate.
- Interpreting solutions correctly.

b) Generate and interpret symbolic, graphical, numerical, and verbal (written or oral) representations of mathematical ideas.

c) Communicate mathematical ideas in written and/or oral form using appropriate mathematical language, notation, and style.

d) Apply mathematical concepts, procedures, and techniques appropriate to the course.

e) Recognize and apply patterns or mathematical structure.

f) Utilize and integrate appropriate technology.

Required Competencies and Student Learning Outcomes (SLOs) for Designating a Mathematics Course as GT Pathways:

All GT-MA1 courses shall include:

1. Interpret Information

a. Explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words).

2. Represent Information

a. Convert information into and between various mathematical forms (e.g., equations, graphs,

diagrams, tables, words).

3. Perform Calculations

a. Solve problems or equations at the appropriate course level.

b. Use appropriate mathematical notation.

c. Solve a variety of different problem types that involve a multi-step solution and address the validity of the results.

4. Apply and Analyze Information

a. Make use of graphical objects (such as graphs of equations in two or three variables, histograms, scatterplots of bivariate data, geometrical figures, etc.) to supplement a solution to a typical problem at the appropriate level.

b. Formulate, organize, and articulate solutions to theoretical and application problems at the appropriate course level.

c. Make judgments based on mathematical analysis appropriate to the course level.

5. Communicate Using Mathematical Forms

a. Express mathematical analysis symbolically, graphically, and in written language that clarifies/justifies/summarizes reasoning (may also include oral communication).