Final Project
College Algebra

Upon successful completion of this course, the student will be able to:

1. Perform operations on algebraic expressions
2. Perform operations on functions expressed in standard function notation
3. Find solutions for algebraic equations and systems of linear equations
4. Graph two-variable equations and inequalities

BACKGROUND INFORMATION

This project will allow you to demonstrate your understanding of applying functions to two-variable equations and solving for solutions to these equations.

PROJECT INSTRUCTIONS

There are three parts to this project: Part A, Part B, and Part C. Complete all the sections within each part. Always show all of your work, and submit your work for all three parts for grading.

Part A

Let's consider the US national debt and the US population as a function of time. We will be using this throughout Part A of the project.

1. **Algebraic Equations**

   The current population of the United States is 317,000,000.
   The current national debt total is $17,000,000,000.

   a. Based on these figures, use algebraic equations to calculate the approximate amount of debt per citizen. Show all of your work.

2. **Linear Equations**

   Assume the population growth is a linear function that grows at a steady, unchanging rate of 0.9% per year, and that debt growth is a linear function that grows at a steady, unchanging rate of 13% per year.

   Using the population and debt figures from section 1:

   a. Find the linear equation for population in slope-intercept form.

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b. Find the linear equation for debt in slope-intercept form

3. Graphing Linear Equations, Algebraic Equations

Begin with figuring out the algebraic equation for each, and then graph the linear equation. There will be two graphs, one for the population and one for the debt. Please show your work for how you figured out each graph.

Using the population and debt information from section 1:

a. Graph the linear equation for population growth and debt in two separate graphs. Label the values of the x- and y-axes and title each graph. Show x from 0 (current year) to 30 (30 years from now).

b. Determine what the population and national debt will be 30 years from now. Calculate what the debt per citizen will be in 30 years. Show all your work.

4. Algebraic Equations, Graphing, and Linear Functions

Using calculations from sections 1 and 3:

a. Calculate the population, national debt, and debt per citizen in 10 and 20 years from now.

b. Complete the table below with your calculations:

Time (years)	Debt ($)	Population	Debt/Citizen
0	17,000,000,000	317,000,000	
10			
20			
30			

c. Using the figures from the table above, graph the function that shows the amount of debt per citizen as a function of time.

      i. Label the values of the x- and y-axes and title the graph.

      ii. Show x from 0 (current year) to 30 (30 years from now).

Iii. Identify the ordered pairs at x = 0, 10, 20 and 30 years either on the graph or below it. Is this a linear function? Why or why not?

5. **Functions**

Using the added information (below) regarding compound interest, calculate the national debt will be in 5, 10, and 20 years. Show equations for all three calculations. Please find the exact values, do not round.

The current national debt is $17,000,000,000. If the current compound interest rate on our national debt is 8% (compounded annually):

a. What will the national debt be in 5,10, and 20 years?

6. **Algebraic Equations**

Solve the following problem using an algebraic equation. Find the exact value and show all of your work.

The current national debt is $17,000,000,000. The interest rate is 8% and is compounded annually.

a. At what point does the compound interest on the national debt double the amount from the current year?

Part B

7. **Equations with two variables**

A company's profit is 15% lower in June than in May, due to unforeseen changes in weather. The total profit for both months together is $32,375.

a. Use an algebraic equation with two variables (x, y).
b. Solve for the profits for each month separately: May and June.
c. Show all of your work and provide justifications or explanations for each step.

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Part C

For this part, we will explore the various methods used to solve a quadratic equation.

The given quadratic equation: $y = x^2 + 2x - 3$

8. Graph the quadratic equation.

Be sure to label the x- and y-axes and title the graph. Show all of your work for how the x-intercepts and vertex are found..

    a. Graph the quadratic equation: $y = x^2 + 2x - 3$
    b. Label and include the ordered pair(s) for the x-intercepts on the graph.
    c. Provide the solution to the quadratic equation: $x^2 + 2x - 3 = 0$

9. Solve the quadratic equation by completing the square.

    a. Solve: $x^2 + 2x - 3 = 0$
    b. Show all of the necessary work.

10. Solve the quadratic equation by utilizing the quadratic formula.

    a. Solve by using the quadratic formula: $x^2 + 2x - 3 = 0$
    b. Show all the necessary work.

11. Analysis of square root method.

    a. Can the square root method be used to solve the quadratic equation?
$$x^2 + 2x - 3 = 0$$
    b. Why or why not?

PROJECT SUBMISSION

1. A title page is not required for project submissions. Because evaluators do not see student names when reviewing student work, it is important that students not include any personal identifiers in their project submissions.
2. *If your project requires a video*, you should post the video to a free video hosting site like www.youtube.com, www.photobucket.com, or another free web hosting site. The

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     following website maintains a list of video hosting sites: http://www.videohostings.com. In the written materials that you submit as part of the assignment, you should include the title of the video and a link for the evaluator to use to grade your submission. Please make sure that the privacy settings on your video are set to allow third parties to view it.

3. When you are ready, click on the **Upload Files** button in the Project tab of your course to submit your assignment. Your project should be graded within 7 days. Please contact your instructor if this is not the case.

4. Your assignment will not be returned to you, so keep a copy for your files.