

By providing my signature below I acknowledge that I abide by the University's academic honesty policy. This is my work, and I did not get any help from anyone else:

Name (sign): _____

Name (print): _____

Student Number: _____

Instructor's Name: _____

Class Time: _____

Problem Number	Points Possible	Points Made
1	20	
2	10	
3	15	
4	15	
5	10	
6	25	
7	15	
8	15	
9	10	
10	10	
11	10	
12	10	
Total:	165	

- If you need extra space use the last page. *Do not tear off the last page!*
- Please show your work. **An unjustified answer may receive little or no credit.**
- If you make use of a theorem to justify a conclusion then state the theorem used by name.
- Your work must be **neat**. If we can't read it (or cannot find it), we cannot grade it.
- The total number of possible points that is assigned for each problem is shown here. The number of points for each subproblem is shown within the exam.
- Please turn off your mobile phone.
- You are only allowed to use a TI-30 calculator. No other calculators are permitted.
- A calculator is not necessary, but numerical answers should be given in a form that can be directly entered into a calculator.
- Common identities:

$$\begin{aligned}\cos(\alpha + \beta) &= \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta), \\ \sin(\alpha + \beta) &= \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta).\end{aligned}$$

1. Determine all values of x that satisfy each equation below. Print your answer(s) in the box provided, and your answer(s) should be exact. (No decimal approximations.)

_____ (a) [5 pts] $2e^{5x-1} = 1$.

$x =$

_____ (b) [5 pts] $2x^2 = 3x + 1$.

$x =$

_____ (c) [5 pts] $\ln\left(\frac{x+1}{2}\right) = 8.$

$x =$

_____ (d) [5 pts] $\tan(1 - 4x) = \frac{1}{\sqrt{3}}$ where x is the smallest possible positive number.

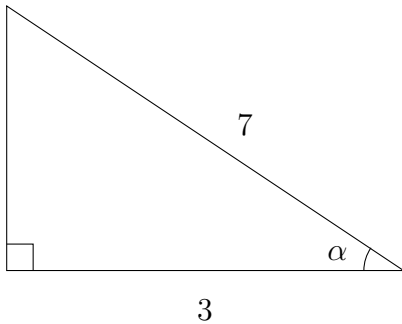
$x =$

2. [10 pts] Factor the polynomial

$$p(x) = x^3 + x^2 - 9x - 9.$$

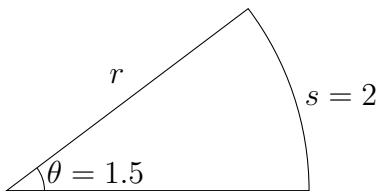
3. Determine the value of the missing quantity in each diagram below. Print your answer in the box provided. All angles should be in radians.

_____ (a) [5 pts] Determine the value of α in radians.



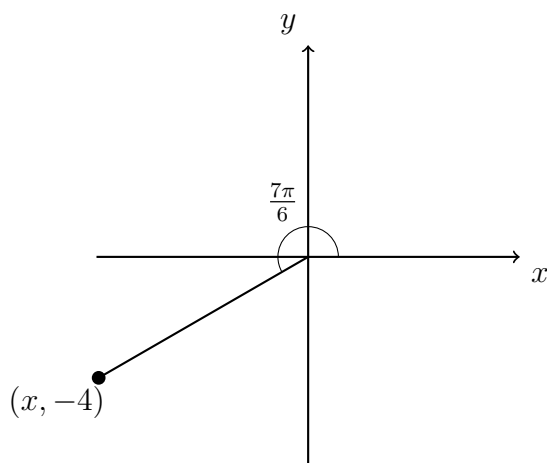
$\alpha =$

_____ (b) [5 pts] Determine the value of r in the sector where the angle shown is in radians.



$r =$

_____ (c) [5 pts] Determine the value of x in the plot below.



$x =$

4. For each scenario below circle the phrase that best describes the **kind** of function that will best approximate the phenomena described.

_____ (a) [5 pts] The height of a swinging pendulum as a function of time.

Linear
Function

Quadratic
Function

Exponential
Function

Logistic
Function

Trigonometric
Function

_____ (b) [5 pts] A plant produces a toxin at a constant rate. The amount of toxin as a function of time.

Linear
Function

Quadratic
Function

Exponential
Function

Logistic
Function

Trigonometric
Function

_____ (c) [5 pts] The balance in a savings account without any withdrawals as a function of time.

Linear
Function

Quadratic
Function

Exponential
Function

Logistic
Function

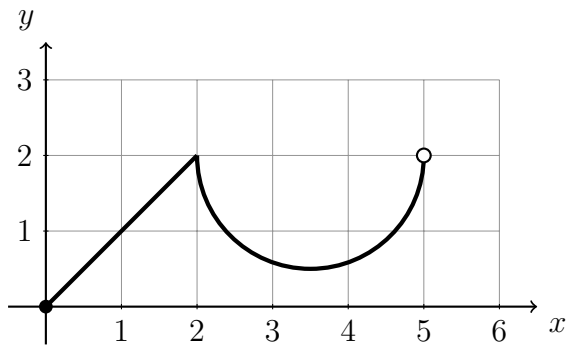
Trigonometric
Function

_____ 5. [10 pts] Determine the inverse of the function

$$h(x) = \ln(5x + 1).$$

If you decide that an inverse does not exist provide a full justification for your conclusion.

6. The following questions refer to the function whose graph is given in the figure below. (The arc is a semicircle.)



_____ (a) [5 pts] Determine the domain of the function.

_____ (b) [5 pts] Determine the range of the function.

_____ (c) [10 pts] Determine the equation for the function. (Use the notation for a piecewise defined function.)

_____ (d) [5 pts] Does an inverse for the function exist? Briefly justify your conclusion.

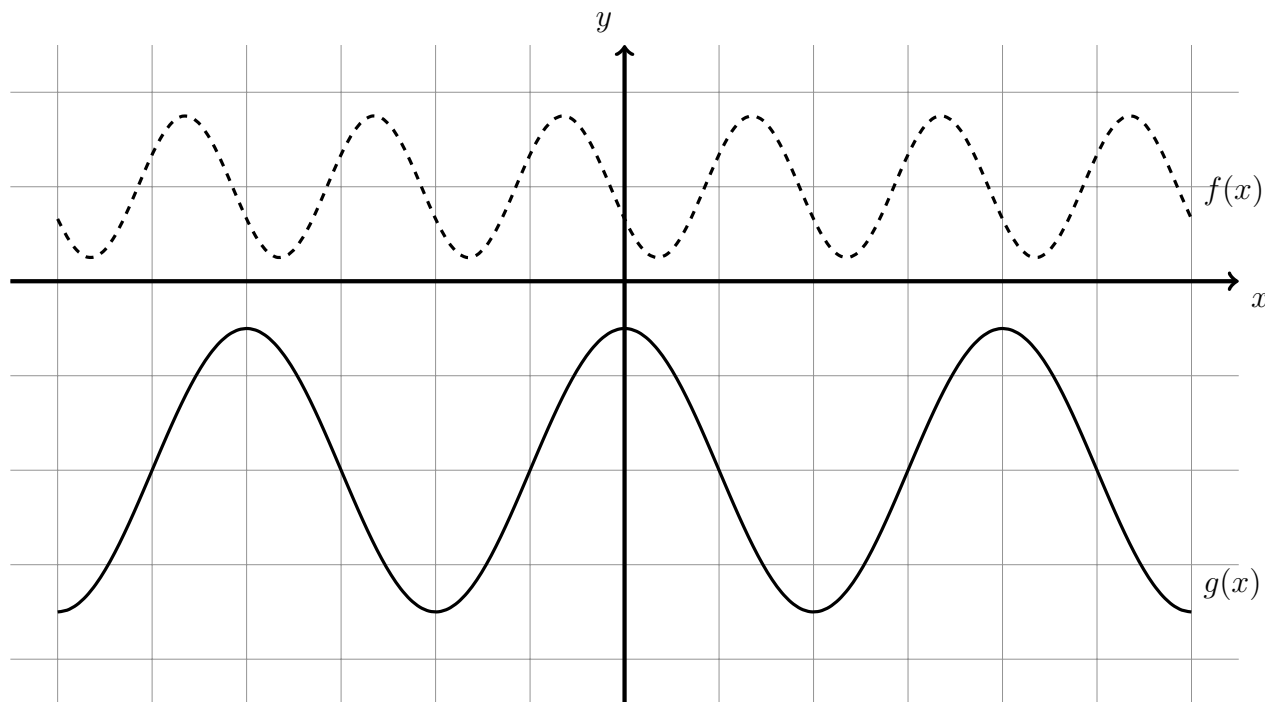
7. Two functions are shown in the figure below. The function whose graph is shown with the dashed line is

$$f(x) = A \sin(b \cdot x + c) + D,$$

where A , b , c , and D are constants, and A is positive. The function whose graph is shown with the solid line is

$$g(x) = K \sin(l \cdot x + m) + N,$$

where K , l , m , and N are constants, and K is positive. Answer each question below about how the constants compare to one another.



- _____ (a) [5 pts] Is $A < K$ or is $A > K$? (Provide a brief justification of your answer.)

- _____ (b) [5 pts] Is $b < l$ or is $b > l$? (Provide a brief justification of your answer.)

- _____ (c) [5 pts] Is $D < N$ or is $D > N$? (Provide a brief justification of your answer.)

8. A dairy produces a constant 120 gallons of milk per day. At midnight on Monday there are 150 gallons. Just before midnight on the following Friday a truck with a capacity of 720 gallons arrives and fills up.

_____ (a) [5 pts] Determine a formula for the amount of milk at any time given the number of days since Monday at midnight and before the truck arrives.

_____ (b) [5 pts] Determine the amount of milk stored before the truck arrives on Friday evening.

_____ (c) [5 pts] How much milk will the dairy have when the truck leaves?

9. [10 pts] A plane is flying in straight, level flight at a constant speed. The plane's elevation is 1600m and will fly over a person. An initial observation by the person results in an angle of elevation of 5.2° . What will the angle of elevation be after the plane flies 5,000m toward the observer?

10. The University of Georgia opened its doors to the first class in 1801. At that time Josiah Higgleston III bestowed a gift of two squirrels to the University. At the start of classes in 1805 there were ten squirrels.

_____ (a) [5 pts] Assuming an exponential model for the squirrel population what should the population be at the start of the 2017 school year?

_____ (b) [5 pts] The area of the current campus is approximately 168,100,000 square meters. Using the same model as in the previous part determine the year that there is one squirrel per square meter.

11. A bicycle race will take place on a circular track that has a radius of 30 meters. The race will consist of forty laps. Also, each wheel on the bicycles has a radius of 0.35 meters.

_____ (a) [5 pts] How long is the race?

(b) [5 pts] What angle will a wheel rotate through during the race?

12. [10 pts] Two types of bacteria will be used to produce a medicinal compound. Bacteria A will be given x hours, and it produces 3g of the compound per hour. Bacteria B will be given y hours, and it produces 4g of the compound per hour. The total cost for the type A bacteria is x^2 dollars, and the total cost for the type B bacteria is $2y^2$ dollars. A total of 40g of product will be required. How many hours should be allocated to each bacteria to minimize the total cost?

Extra space for work. **Do not detach this page.** If you want us to consider the work on this page you should print your name, instructor and class meeting time below.

Name (print): _____ Instructor (print): _____ Time: _____