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 during the exam:

Name (sign): ____________________ Name (print): ____________________

Student Number: ____________________

Instructor's Name: ____________________ Class Time: ________________

Problem Number	Points Possible	Points Made
1	15	
2	15	
3	12	
4	13	
5	15	
6	15	
Total:	85	

- If you need extra space use 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 I can't read it (or can't find it), I can't 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.
- 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. Let $\Lambda, \Omega \in \mathbb{R}$ be unknown positive real numbers. Solve the following equations for the independent variable x.

   (a) [5 pts] $\log_{10}(3x + \Omega) = \Lambda.$

   (b) [5 pts] $\Lambda^{x-1} = \Omega.$

   (c) [5 pts] $\dfrac{1}{\Lambda^x + 1} = \dfrac{1}{\Omega}$

2. Solve for x in the following equations:

(a) [5 pts] $7 \cdot 2^x = 8 \cdot 3^x$

(b) [5 pts] $\log\left(x^2+1\right) - \log(x+1) = 2.$

(c) [5 pts] $e^{x^2+1} = e^{2x}.$

3. For each description below, determine the formula for the function that matches the description.

_______ (a) [6 pts] A function $W(t)$ that models **exponential growth** where $W(0) = 4$ and $W(2) = 6$.

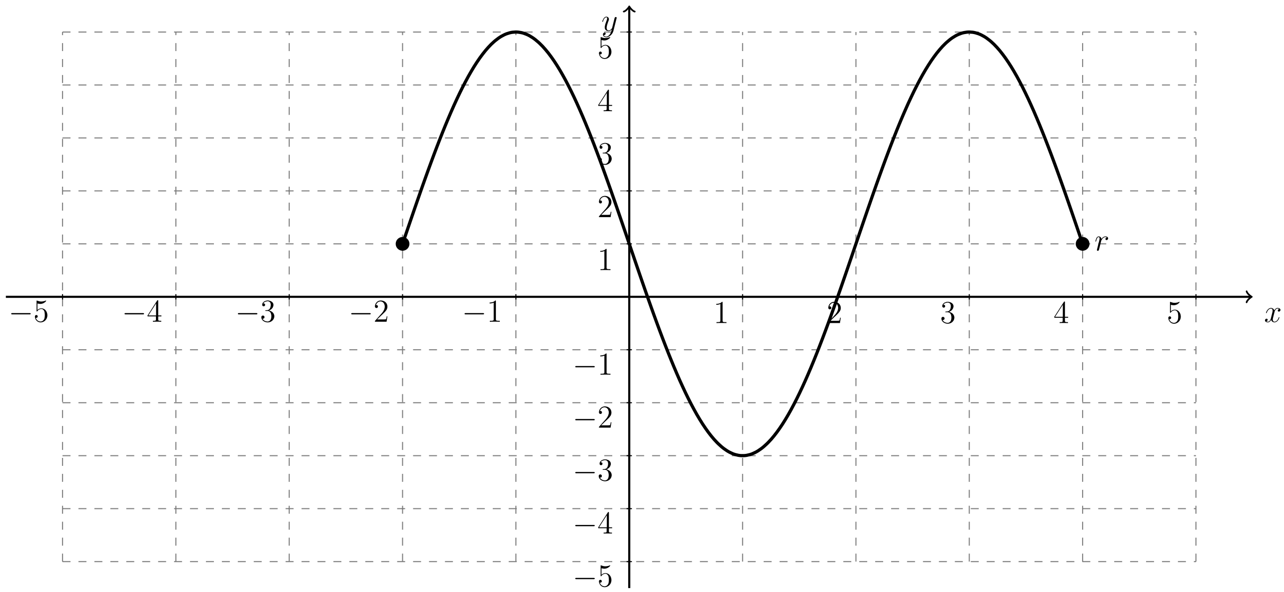
_______ (b) [6 pts] The function $G(x)$ that is the **functional inverse** of the function

$$F(x) = \log_{\alpha}(x).$$

where $\alpha \in \mathbb{R}$ is an unknown positive real number.

4. Answer each of the following questions relating to **injective** functions.

   (a) [6 pts] The graph of a function $f : \mathbb{R} \to \mathbb{R}$ is shown below.



1. Is this function injective? In at least one sentence, justify why or why not.
   Hint: you may appeal to a "line test", but you should mention/show a specific line.

2. What is the domain and range of this function, in interval notation?

3. Determine some new, smaller, restricted domain on which f is injective. In at least one sentence, justify why f is injective on this new domain.
   Hint: you may appeal to a line test again! Your new domain should be some interval contained in the interval you wrote above.

(b) [7 pts] Show **using the definition of injectivity** that the following function is injective

$$\begin{aligned} f : \mathbb{R} &\to \mathbb{R} \\ x &\mapsto \frac{1}{1+x} \end{aligned}$$

 Points earned: ____
out of a possible 7 points

5. [15 pts] A firm is planning to invest some money into a fund that has an interest rate of 1.1% compounded **once every month**. If they initially invest $250,000.00 how much money will be in the account after three years?

6. [15 pts] Suppose there is a petri dish filled with bacteria. Suppose the weight of the dish is given by some function $W(t)$ that models **exponential decay**. At time $t = 30$ days, it is weighed and found to be $W(30) = 200$ grams. At time $t = 50$ days, it is $W(50) = 150$ grams. How much did it weigh at $t = 0$ days?

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: ______________

 Points earned: ____
out of a possible 0 points