University of Georgia   Math 1113
Department of Mathematics   **Test 2**   Spring 2021

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	0	
2	15	
3	15	
4	12	
5	13	
6	15	
7	15	
8	15	
Total:	100	

- 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:

$$\cos(\alpha + \beta) = \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta),$$
$$\sin(\alpha + \beta) = \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta).$$

1. [2 Bonus] Common Knowledge: Who will win this year's Paris-Roubaix Femmes?

2. Determine all of the values of x for each question below that satisfy the given equation.

   (a) [5 pts] $\ln(3x + 1) = 98$.

   (b) [5 pts] $3^{x-1} = 4$.

   (c) [5 pts] $\dfrac{1}{e^x + 1} = \dfrac{1}{7}$

3. Determine all of the values of x for each question below that satisfy the given equation.

(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] $e^{2x} - 2e^x - 8 = 0.$

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

    (a) [6 pts] A function, $h(t)$, is an exponential function where $h(0) = 4$ and $h(2) = 6.5$.

    (b) [6 pts] The function, $k(x)$, is the inverse of the function $l(x) = \frac{x}{1+x}$.

out of a possible 12 points

5. Answer each of the following, unrelated questions below relating to the topic of one-to-one functions.

_____ (a) [6 pts] The graph of a function that is not 1-1 is shown below. Determine a restriction on the domain so that the resulting function is one-to-one on the restricted domain, and the range of the function restricted to the domain is $[-3, 5]$. (In other words find a part of the domain where the function is one-to-one when you only examine the function on the part you choose.)
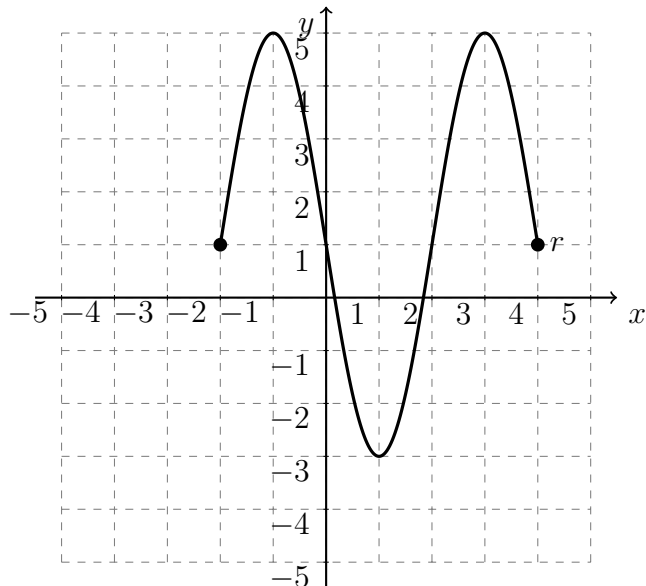
_____ (b) [7 pts] Show that the function $c(x) = \frac{1}{1+x}$ is one-to-one.

6. [15 pts] A firm is planning to invest some money into a fund that has an interest rate of 1.1% compounded monthly. If they initially invest $250,000.00 how much money will be in the account after three years?

7. [15 pts] A vial of radiactive material is found and immediately moved to a laboratory. Thirty days after the vial was found there is 20 grams of material. Fifty days after the vial was found there is 15 grams of material. How much material was in the vial when it was first found?

8. [15 pts] The number of fish in a pond is approximated by a logistic equation,

$$N(t) = \frac{500}{1 + ae^{-bt}}.$$

Initially there was 600 fish, and after a year there was 520 fish. Determine the values of a and b. Also, determine the approximate number of fish that will be in the pond after a very long time.

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: ⎯⎯⎯⎯⎯⎯