Print and sign a brief statement stating this is your work and you used no other resource:

Name (sign): _____ Name (print): _____

Student Number: _____

Instructor's Name: _____ Class Time: _____

Problem Number	Points Possible	Points Made
??	30	
??	15	
??	10	
??	10	
??	10	
??	10	
??	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:

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

1. Determine the value of x for each question below that satisfies the given equations. In each case provide exact expressions and not numerical values from a calculator.

(a) $7^{x+2} = 4$.

(b) $\ln(1 - 5x) = 17$.

(c) $5 \cdot 8^x = 12 \cdot 3^{x+1}$.

(d) $2\ln(3x+1) = \ln(14x)$.

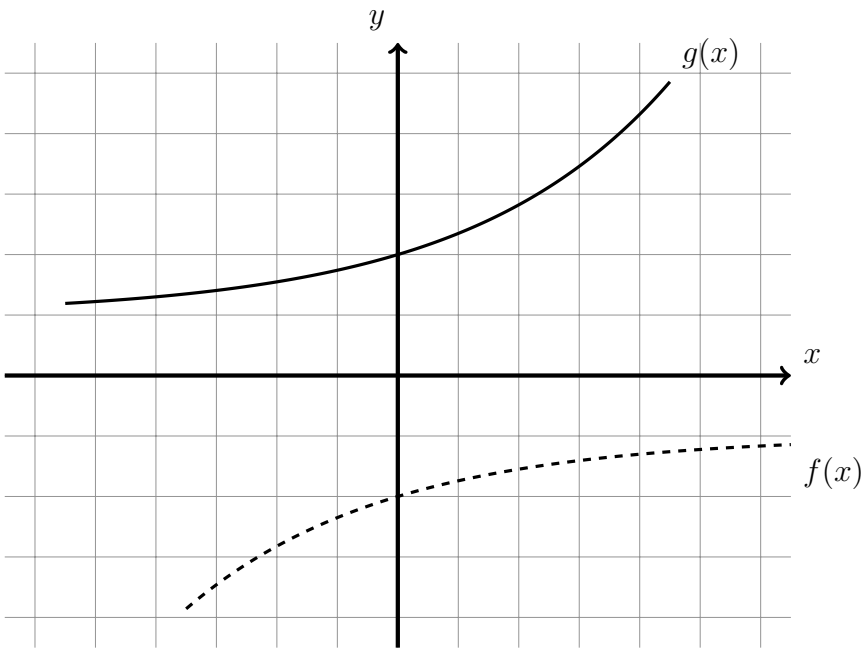
2. Two functions are shown in the figure below. The function whose graph is shown with the dashed line is

$$f(x) = Ae^{bx} + C,$$

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

$$g(x) = Ke^{lx} + M,$$

where K, l, and M are constants. Answer each question below about how the constants compare to one another.



(a) Is $C < M$ or is $C > M$? (Provide a brief justification of your answer.)

(b) Is $b < l$ or is $b > l$? (Provide a brief justification of your answer.)

(c) Is $A < K$ or is $A > K$? (Provide a brief justification of your answer.)

3. The number of bird species on an island is approximated by

$$P(x) = 7 + 4\log_{10}(x)$$

where x is the area in square kilometers of the island.

(a) What is the approximate number of species that an island of 100 square kilometers would have?

_____

(b) An island is estimated to have 20 different bird species. What is the approximate area of the island?

_____

4. Determine if the function

$$f(x) = e^{2x} - 1$$

is one-to-one. If it is not one-to-one determine a way to restrict the domain so that the function is one-to-one on the resulting restriction of the domain.

5. The number of elk on a preserve is approximated by a logistic function,

$$P(t) = \frac{A}{1 + 3e^{-2t}}$$

where t is the number years since the previous cull.

(a) The population is 150 at $t = 0$. How long will it take until the population is 300?

(b) If the preserve's managers wait a very long time without having a cull, how many elk will be expected to be on the preserve? Briefly explain your reasoning.

6. An Auburn student spends \$300 on a football ticket using a credit card, but he does not have any money to pay the bill. The credit card company charges 15% interest compounded monthly. (Hint: debt works the same as a bank account balance.)

(a) How much money will the student owe when he graduates in eight years?

(b) How long will it take before the credit card balance is \$1,000?

7. A child is given two functions,

$$\begin{aligned} f(x) &= \ln(x), \\ g(x) &= 3x - 1. \end{aligned}$$

You try to impress the child by creating a third function by taking the composition, $h(x) = f(g(x))$, of the functions.

(a) Determine the domain of $h(x)$.

(b) Determine the inverse of $h(x)$.

(c) Show that the inverse of $h(x)$ is equal to the composition $g^{-1}(f^{-1}(x))$.

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: _____