

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	24	
3	14	
4	10	
5	21	
6	21	
7	10	
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:

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

1. [2 Bonus] Common Knowledge: Who will win the first Le Tour Femmes? (No credit for obvious answers like Lizzie Deignan.)

2. Determine all of the values of x for each question below that satisfy the given equation. If no values of x satisfy the equation provide a brief justification as to how you arrived at your conclusion.

_____ (a) [7 pts] $e^{8x-3} = 7$.

_____ (b) [7 pts] $\ln(\sqrt{x+1}) = 5$.

_____ (c) [10 pts] $4 \cdot 3^{2x-1} = 5 \cdot 6^{x+1}$

3. Determine the inverse of each of the following functions.

(a) [7 pts] Determine the inverse of $m(x) = \ln(2x - 8) - 3$

(b) [7 pts] Determine the inverse of $p(x) = \sqrt{7e^{x-3}}$

4. For each question below determine the possible values given the conditions stated.

(a) [5 pts] The function

$$A(t) = 3 \cdot e^{rt}$$

is used to model the decay of a radioactive material. What are the possible values of the constant r ? Express your answer as an interval, and the value of r could be any number in the interval.

(b) [5 pts] The function

$$P(t) = 3 \cdot b^t$$

is used to model the number of individuals in a growing population. What are the possible values of the constant b ? Express your answer as an interval, and the value of b could be a number in the interval.

5. The power output (Watts) of an individual from a particular species of bird depends on its mass (kg),

$$\text{Power} = 0.4 (\text{Mass})^{0.8}.$$

The surface area (m^2) of a bird also depends on its mass,

$$\text{Surface Area} = 1.4 (\text{Mass})^{0.67}.$$

- (a) [5 pts] If the mass of a bird is 0.3 kg, what is its power output and its surface area?

- (b) [8 pts] Determine the formula to obtain the mass of a bird given its power output.

- (c) [8 pts] Determine the formula to obtain the surface area of a bird given its power output.

6. A bank account will have an annual interest rate that is compounded monthly.
- (a) [5 pts] If the annual interest rate is 0.9% and the initial investment is \$250,000 what will the balance be after six years?
- (b) [8 pts] If the annual interest rate is 0.8% how long will it take for any initial investment to double?
- (c) [8 pts] What interest rate will ensure that any initial investment will double every twenty five years?

7. [10 pts] A graphics card will be used to run an algorithm for a calculation to verify the security of a potential crypto currency transaction. The calculation is made on a string with length n . The cost of the energy required to complete the calculation scales exponentially with n . The energy cost to check a string of length 2056 is 0.02\$, and the cost to check a string of length 8224 is 0.38\$. Your budget allows for a calculation that has an energy cost of 0.50\$. What is the highest possible value of n that can be used?

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: _____