

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: _____

- 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:

Problem Number	Points Possible	Points Made
1	0	
2	30	
3	20	
4	10	
5	10	
6	15	
7	15	
Total:	100	

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

1. [2 Bonus] Common Knowledge: Who won the first Paris-Roubaix Femmes? (extra extra points: what kind of bike did she win on and where is it now?)

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) [10 pts] $\ln(x) - \ln(x + 1) = 101$.

(b) [10 pts] $e^{2x} - 7e^x = 8$.

(c) [10 pts] $8 \cdot 5^{9x+1} = 7 \cdot 2^x$

3. For each question below determine the exact numerical value of the expression without using any logarithmic or exponential functions. The values of the parameters are given below:

$$p = \ln(3.8) \quad q = \log(7.2)$$

$$r = \ln(9.4) \quad s = \log(1.5)$$

$$t = e^{-8.1} \quad u = 10^{2.2}$$

$$v = e^{5.3} \quad w = 10^{-6.3}$$

_____ (a) [10 pts] $\frac{e^{2p-r}}{10^q}$

_____ (b) [10 pts] $\ln(t^2) \cdot \log\left(\frac{u}{w}\right)$

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

- _____ (a) [5 pts] Do the graphs of the functions $y = 2^x + 1$ and $y = 3 \cdot 5^x$ intersect for a negative or a positive value of x ? Provide a written justification for your answer based on the shape, growth (or decay), and overall trends of the graphs of the two functions.

- _____ (b) [5 pts] The graphs of the functions $y = b^x$ and $4 \cdot (2.9)^x$ intersect for a positive value of x . What are the possible range of values of b ? Provide a written justification for your answer based on the shape, growth (or decay), and overall trends of the graphs of the two functions.

5. [10 pts] Show that the function 5^{1-3x} is a 1-1 function.

6. [15 pts] Money will be invested into a fund that has an annual interest rate of 1.2% compounded monthly. How long will it take for the principle to triple?

7. [15 pts] A pendulum swings back and forth, and the its height above the ground oscillates with some amplitude. The amplitude decays exponentially. Initially the amplitude is 2.3 cm, and after two hours the amplitude is 1.9 cm. How long will it take until the amplitude is less than 0.01 cm?

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: _____