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 | 29 | |
| 3 | 14 | |
| 4 | 10 | |
| 5 | 27 | |
| 6 | 20 | |
| 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: Was it a good idea for Blanka Vas to skip the World Championships?

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] $\ln(4x - 3) = 783$.

(b) [7 pts] $\log_{10}(x) + \log_{10}(x - 1) = 2$.

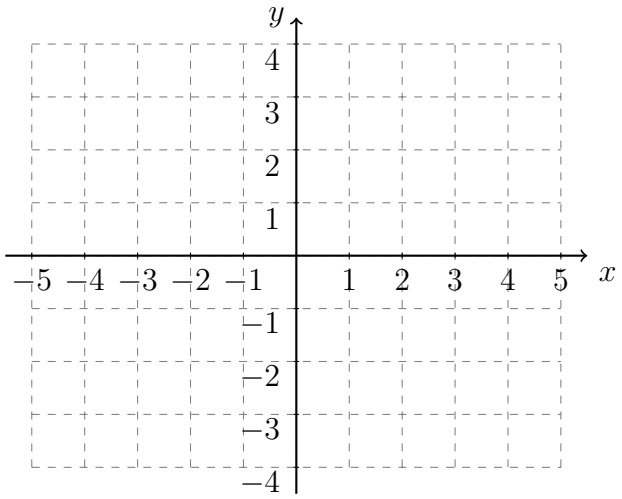
_____

(c) [7 pts] $6^{2x+1} = 3$.

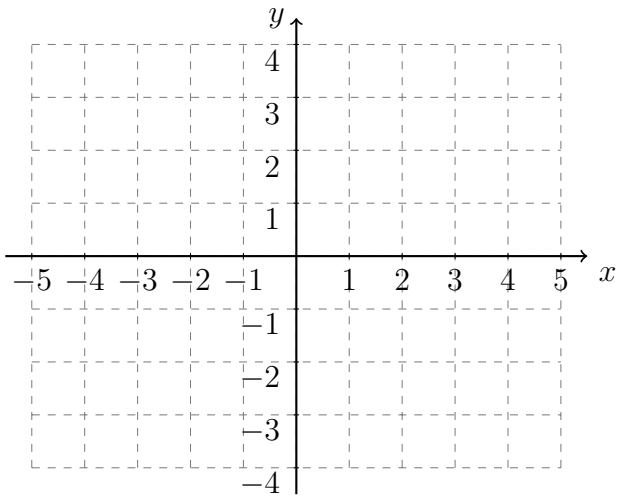
(d) [8 pts] $18 \cdot 7^{x-1} = 13 \cdot 4^{8x+1}$

3. Sketch functions that match the descriptions given below.

(a) [7 pts] Make a rough sketch of a function that has domain $[-4, 4]$, and the function is 1-1. Briefly explain why the function is 1-1 and do not simply state that it passes some particular test. State whether or not an inverse of your function exists.




(b) [7 pts] Make a rough sketch of a function that has domain $[-4, 4]$, and the function is not 1-1. Briefly explain why the function is not 1-1 and do not simply state that it passes some particular test. State whether or not an inverse of your function exists.



4. A function is used to approximate a system that exhibits **exponential growth**,

$$H(t) = Ce^{rt}.$$

The function should return a positive value.

(a) [5 pts] What are the possible values of $C$ and $r$? Express your answers as intervals, and the possible values could be any number in the stated interval.

(b) [5 pts] If it is known that $H(2) = 5$ and $H(3) = 8$ determine the values of $C$ and $r$.

5. Two bank accounts are examined, and both offer an annual interest rate that is compounded monthly.

   (a) [9 pts] The first bank account offers an annual interest rate of 1.2% compounded monthly. Determine how much money will be in the account after two years if $10,000 is deposited in the account.

   (b) [9 pts] The first bank account offers an annual interest rate of 1.2% compounded monthly. How long will it take for the amount of money in the account to double?

   (c) [9 pts] A bank officer says that if you deposit $15,000 into the second account, the account's balance after three years will be $15,800. What is the annual interest rate for the account?

6. The PR interval (abbreviated PR) for a mammal is the time between contractions of the left atrium and the left ventricle. Experiments[1] have shown that the body mass (BM) of a mammal and its PR are related by

$$\ln(\text{PR}) = 2.4 + 0.24 \ln(\text{BM}).$$

(a) [10 pts] Determine the formula that provides the PR as a function of BM for a mammal. (There should not be any logarithms in your final answer.)

(b) [10 pts] Determine the formula that provides the BM as a function of PR for a mammal. (There should not be any logarithms in your final answer.)

[1] Bassil G, Zarzoso M, Noujaim SF. Allometric scaling of electrical excitation and propagation in the mammalian heart. J Theor Biol. 2017 Apr 21;419:238-242. doi: 10.1016/j.jtbi.2016.09.024. Epub 2016 Sep 26

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: _____