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	25	
3	18	
4	10	
5	18	
6	10	
7	19	
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: Will Emma Norsgaard Bjerg be able to build on her success from 2023 in the 2024 cycling season?

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) [6 pts] $e^{5-3x} = 2$.

(b) [6 pts] $2\log_4(x) + 1 = 4$.

_____

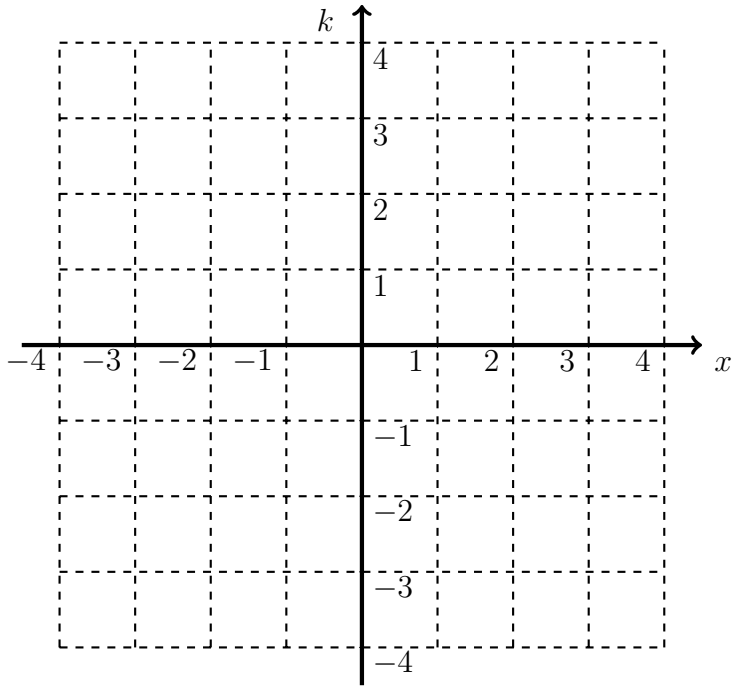
(c) [6 pts] $\dfrac{\ln(x+1)}{\ln(1-x)} = 2.$

(d) [7 pts] $2 \cdot 3^{1-2x} = 7 \cdot 6^{4+x}.$

3. The questions below refer to the function

$$p(x) = \frac{1}{4}\left(\frac{1}{3}\right)^x - 1$$

(a) [6 pts] Make a rough sketch of the function using the aces below:



(b) [6 pts] Determine the asymptotes of $p(x)$.

(c) [6 pts] Determine any x-intercepts and y-intercepts of $p(x)$.

4. [10 pts] The function Am is defined by

$$Am(t) \;=\; A + B\log(x+10).$$

The graph of the function goes through the points $(0, 5)$ and $(10, 7)$. Determine the values of A and B.

5. The function $h(x)$ is defined by

$$h(x) \;=\; e^{2x} + 1.$$

(a) [6 pts] Show that the function is one-to-one.

(b) [6 pts] Determine the inverse of the function.

(c) [6 pts] Verify your answer in the previous question is the inverse using function composition.

6. [10 pts] A bank offers an account that has a 3.5% annual interest rate, compounded monthly. How long will it take for an initial balance to double in value?

7. The number of animals in a park follows a logistic model,

$$P(t) = \frac{C}{1 + 20e^{-rt}}.$$

The initial population is 1,000 animals, and three years later the population is estimated to be 1,200 animals.

(a) [7 pts] What are the values of C and r?

(b) [7 pts] How long will it take for the population to reach 1,300 animals?

(c) [5 pts] What will the population be 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: _____