

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 |
|----------------|-----------------|-------------|
| ??             | 0               |             |
| ??             | 25              |             |
| ??             | 18              |             |
| ??             | 10              |             |
| ??             | 18              |             |
| ??             | 10              |             |
| ??             | 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:

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

1. 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)

$$e^{5-3x} = 2.$$

\_\_\_\_\_

$$2 \log_4(x) + 1 = 4.$$

(b)

\_\_\_\_\_

(c)  $\frac{\ln(x+1)}{\ln(1-x)} = 2.$

\_\_\_\_\_

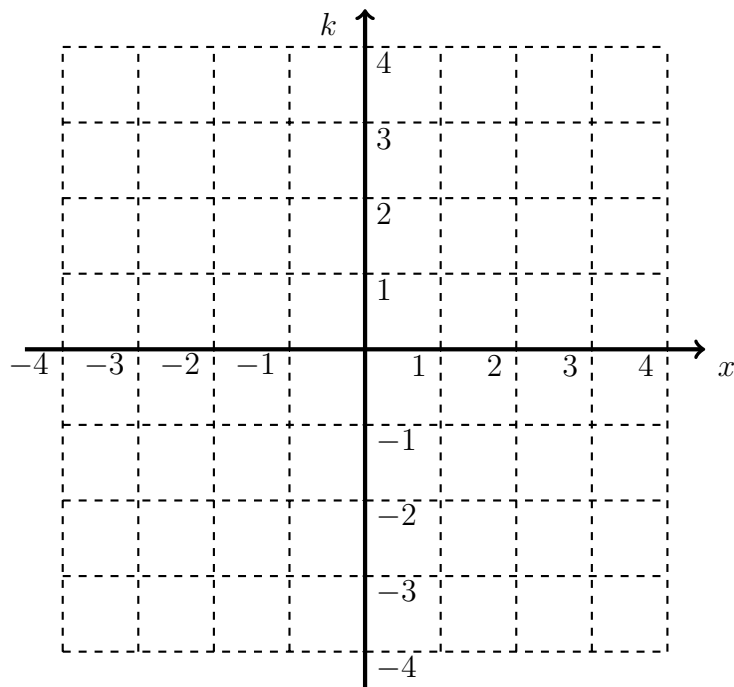
(d)  $2 \cdot 3^{1-2x} = 7 \cdot 6^{4+x}.$

\_\_\_\_\_

3. The questions below refer to the function

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

(a) Make a rough sketch of the function using the axes below:



(b) Determine the asymptotes of  $p(x)$ .

(c) Determine any  $x$ -intercepts and  $y$ -intercepts of  $p(x)$ .

4. 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) Show that the function is one-to-one.

(b) Determine the inverse of the function.

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

6. 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) What are the values of  $C$  and  $r$ ?
- (b) How long will it take for the population to reach 1,300 animals?
- (c) 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: \_\_\_\_\_