1. Given that $4 \ln 2 - 3\ln 4 = -\ln k$, find the value of k.

(Total 5 marks)

2. Write $\ln (x^2 - 1) - 2 \ln(x + 1) + \ln(x^2 + x)$ as a single logarithm, in its simplest form.

(Total 5 marks)

3. Solve the equation $\log_3(x + 17) - 2 = \log_3 2x$.

(Total 5 marks)

4. Solve the equation $2^{2x+2} - 10 \times 2^x + 4 = 0$, $x \in \mathbb{R}$.

(Total 6 marks)

5. Solve the equation $4^{x-1} = 2^x + 8$.

(Total 5 marks)

6. Let $g(x) = \log_5 \left| 2\log_3 x \right|$. Find the product of the zeros of g.

(Total 5 marks)

7. Solve the equations

$$\ln \frac{x}{y} = 1$$
$$\ln x^3 + \ln y^2 = 5.$$

(Total 5 marks)

8. (a) Find the solution of the equation

$$\ln 2^{4x-1} = \ln 8^{x+5} + \log_2 16^{1-2x},$$

expressing your answer in terms of ln 2.

(4)

(b) Using this value of x, find the value of a for which $\log_a x = 2$, giving your answer to three decimal places.

(2)

(Total 6 marks)

9. Solve the following system of equations.

$$\log_{x+1} y = 2$$
$$\log_{y+1} x = \frac{1}{4}$$

(Total 6 marks)