

2.2 Laws of Logarithms

Question Paper

Course	CIEAS Maths
Section	2. Logs & Exponentials
Topic	2.2 Laws of Logarithms
Difficulty	Hard

Time allowed: 60
Score: /45
Percentage: /100

Question 1a

(a) Evaluate

$$\log_2 8^2 + 3\log_2 16 - 2\log_2 2^5.$$

[2 marks]

Question 1b

(b) Evaluate

$$3\ln 2 + 2\ln 5 - \frac{1}{2}\ln 10\,000,$$

giving your answer in the form $\ln p$.

[3 marks]

Question 2a

(a) Solve the equation

$$4^{3x+2} = 16^{x+6}.$$

[2 marks]

Question 2b

(b) Solve the equation

$$4^{2x+3} - 8 = 92$$

giving your answer to 3 significant figures.

[3 marks]

Question 3a

Solve the following equations, giving your answers in exact form.

(a) $4e^{3x-2} = 12$

[2 marks]

Question 3b

(b) $3e^{2x} + 8 = 14e^x$

[3 marks]

Question 4a

(a) Simplify

$$2\ln 3^4 + \ln 3^3 - \ln 9,$$

giving your answer in the form $a\ln b$, where a and b are integers to be found.

[2 marks]

Question 4b

(b) Write

$$2\log_a x + 3\log_a(x + 1) - \log_a 4(x + 2)$$

as a single logarithm.

[2 marks]

Question 5

- (i) On the same axes, sketch the graphs of $y = e^x$ and $y = \ln x$.
On each graph, label any points where the graph intersects the coordinate axes.
Write down the equations of any asymptotes for each graph.
- (ii) Write down the line of reflection between the graphs $y = e^x$ and $y = \ln x$.

[5 marks]

Question 6

Solve the equation

$$5^{2x} - 8 \times 5^x + 12 = 0,$$

giving your answers in the form $\log_a b$.

[3 marks]

Question 7

Solve the equation

$$6 \times 3^{x-1} = 6^{2x},$$

giving your answer in the form $\frac{\ln a}{\ln b}$, where a and b are integers to be found.

[5 marks]

Question 8

A ship sets sail from a harbour.

After some time, the ship's position is $(4 \ln 3)$ km east of the harbour and $(3 \ln 3)$ km north of the harbour.

Find the direct distance between the ship and the harbour at this time giving your answer in the form $(p \ln 3)$ km.

[4 marks]

Question 9

By writing 5 as $5 \ln e$, show that

$$5 \ln 2 + 5$$

can be written as $5 \ln 2e$.

[3 marks]

Question 10

Solve the equation

$$\log_3(x + 4) = 4 + 2 \log_3 x$$

giving your answers correct to 3 significant figures.

[3 marks]

Question 11

Solve the equation

$$2 \log_x(x + 2) = 3$$

giving your answer correct to 3 significant figures.

[3 marks]