

Logarithms and Exponentials

Question Paper

Level	Pre U
Subject	Maths
Exam Board	Cambridge International Examinations
Topic	Logarithms and Exponentials
Booklet	Question Paper

Time Allowed: 60 minutes

Score: /50

Percentage: /100

Grade Boundaries:

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- 1 (i) Use integration by parts to show that $\int \ln x dx = x \ln x - x + c$. [2]
(ii) Find

(a) $\int (\ln x)^2 dx$, [4]

(b) $\int \frac{\ln(\ln x)}{x} dx$. [5]

- 2 (a) Express each of the following as a single logarithm.

(i) $\log_a 5 + \log_a 3$ [1]

(ii) $5 \log_b 2 - 3 \log_b 4$ [3]

(b) Express $(9a^4)^{-\frac{1}{2}}$ as an algebraic fraction in its simplest form. [2]

(c) Show that $\frac{3\sqrt{3}-1}{2\sqrt{3}-3} = \frac{15+7\sqrt{3}}{3}$. [3]

- 3 Diane is given an injection that combines two drugs, Antiflu and Coldcure. At time t hours after the injection, the concentration of Antiflu in Diane's bloodstream is $3e^{-0.02t}$ units and the concentration of Coldcure is $5e^{-0.07t}$ units. Each drug becomes ineffective when its concentration falls below 1 unit.

(i) Show that Coldcure becomes ineffective before Antiflu. [3]

(ii) Sketch, on the same diagram, the graphs of concentration against time for each drug. [3]

(iii) 20 hours after the first injection, Diane is given a second injection. Determine the concentration of Coldcure 10 hours later. [2]

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- 4 Solve the equation $2^{5x} = 15$, giving the value of x correct to 3 significant figures. [4]
- 5 Use logarithms to solve the equation $2^{2x-1} = 5$. [4]
- 6 (i) Show that $4 \ln x - \ln(3x - 2) - \ln x^2 = \ln\left(\frac{x^2}{3x - 2}\right)$, where $x > \frac{2}{3}$. [3]
- (ii) Hence solve the equation $4 \ln x - \ln(3x - 2) - \ln x^2 = 0$. [3]
- 7 Solve the equation $2^x = 4^{2x+1}$. [3]
- 8 Solve the inequality $\log_3(2x^2 - x) - \log_3(2x^2 - 3x + 1) > 1$. [5]