06	10a	Use Simpson's rule with three function values to find an approximation to the value of $\int_{0.5}^{1.5} (\log_e x)^3 \ dx$. Give your answer correct to three decimal places.	2

Simpson's Rule:

$$\int f(x)\ dx = \frac{h}{3}[\text{first} + \text{last} + 2 \times \text{odd} + 4 \times \text{even}]$$

x	0.5	1	1.5
$f(x)$	$(\log_e 0.5)^3$	$(\log_e 1)^3 = 0$	$(\log_e 1.5)^3$

$$\int_{0.5}^{1.5} (\log_e x)^3 \ dx = \frac{0.5}{3}[(\log_e 0.5)^3 + (\log_e 1.5)^3 + 4 \times 0]$$

$$= \frac{0.5}{3}[\log_e 0.5 + \log_e 1.5]$$

$$= -0.044394232 \ldots$$

$$= -0.044 \quad \text{(correct to 3 decimal places)}$$

* These solutions have been provided by *projectmaths* and are not supplied or endorsed by the Board of Studies

Board of Studies: Notes from the Marking Centre

This part was attempted by the majority of candidates and proved to be the part where most earned their marks. Most candidates seemed to know Simpson's rule well, and had no difficulty in applying it. Some replaced the $(\log_e x)^3$ function incorrectly with $(\log_{10} x)^3$, $3\log_e x$ or $\log_e x^3$. Correct evaluation of $\log_e 1$ was often hard to determine from the written responses. Candidates should be encouraged to show all values in a table before applying Simpson's rule. Often the $4(\log_e 1)^3$ term was left out of the calculations due to its zero value. Since Simpson's rule is often used for area calculation, most candidates converted their answer to a positive value, with some even taking the absolute value of any negative portions of their calculations. Finally, the calculation of $\frac{h}{3}$ or $\frac{b-a}{6}$ proved difficult for some candidates, but one interesting method employed involved the addition of the weightings eg $\frac{1.5-0.5}{1+4+1}$ for one application or $\frac{1.5-0.5}{1+4+2+4+1}$ for two applications.

Source: http://www.boardofstudies.nsw.edu.au/hsc_exams/