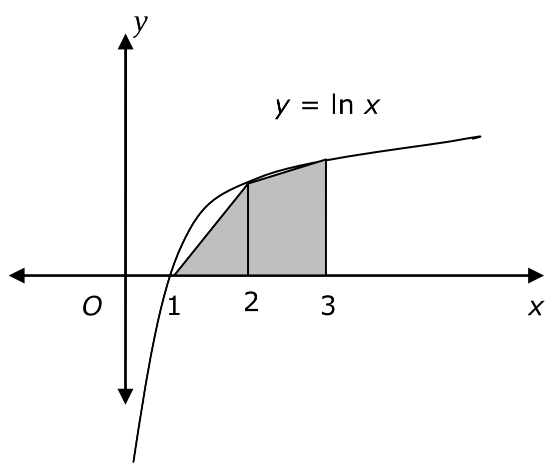
10	**3b**	(i)	Sketch the curve y = ln *x*.	**1**
		(ii)	Use the trapezoidal rule with three function values to find an approximation to $\int_1^3 \ln x \, dx$.	**2**
		(iii)	State whether the approximation found in (ii) is greater than or less than the exact value of $\int_1^3 \ln x \, dx$. Justify your answer.	**1**

(i)



(ii)

x	1	2	3
y	0	ln 2	ln 3

Trapezoidal rule:

$$\int_1^3 \ln x \ \mathrm{dx} \approx \frac{1}{2}[0 + \ln 3 + 2 \ln 2]$$

$$\approx \frac{1}{2}[\ln 3 + \ln 4]$$

$$\approx \frac{1}{2}\ln 12$$

State Mean:
0.55/1
1.28/2
0.12/1

(iii) The shaded region on the diagram in (i) is the area using the trapezoidal rule. It is less than the area under the curve.

* 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

(i) Although most candidates sketched a curve, many failed to address very important features of the log function, namely the domain, range, concavity and the asymptote.

(ii) Candidates answered this part by writing $\frac{1}{2}(\ln 1 + 2\ln 2 + \ln 3)$, or $\frac{1}{2}(\ln 1 + \ln 2) + \frac{1}{2}(\ln 2 + \ln 3)$, or used a table of function values and weightings. Some candidates could not determine the value of h required in the Trapezoidal Rule and many candidates applied Simpson's Rule and so did not obtain many, if any, marks.

(iii) Very few candidates were successful in this part. In better responses, candidates discussed the use of the Trapezoidal Rule for finding an area. They then said that the approximation was less than the value of the integral because the trapeziums formed under the concave-down log curve with straight lines from function value to function value generated a smaller area. The best attempts came with a justification in words and with two trapeziums indicated on their diagram.

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