

2013 11fEvaluate $\int_0^1 \frac{x^2}{x^3 + 1} dx$.**3**

$$\begin{aligned}
 \int_0^1 \frac{x^2}{x^3 + 1} dx &= \frac{1}{3} \int_0^1 \frac{3x^2}{x^3 + 1} dx \\
 &= \frac{1}{3} [\log_e(x^3 + 1)]_0^1 \\
 &= \frac{1}{3} [\log_e(1 + 1) - \log_e(0 + 1)] \\
 &= \frac{1}{3} [\log_e 2 - \log_e 1] \\
 &= \frac{1}{3} \log_e 2
 \end{aligned}$$

State Mean: 2.02

* These solutions have been provided by [projectmaths](#) and are not supplied or endorsed by BOSTES.

Board of Studies: Notes from the Marking Centre

Many candidates had difficulty with this question.

Common problems were:

- not recognising that the integral involved a log function
- treating the integral like a polynomial, trying to simplify by using index laws poorly
- not being able to calculate the constant multiplier
- multiplying by a fraction involving x
- not substituting the limits into the primitive or not doing it correctly, often resulting in $[f(a)] + [f(b)]$.
- a weak understanding of logarithms and brackets, with common errors after the substitution, as in:

$$\begin{aligned}
 &\frac{1}{3}[\ln 1^3 + 1] - \frac{1}{3}[\ln 0^3 + 1] \\
 &= \frac{1}{3}(0 + 1) - \frac{1}{3}(0) \\
 &= \frac{1}{3}
 \end{aligned}$$

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