2016 12 d (i) Differentiate $y = xe^{3x}$. **1**

(ii) Hence find the exact value of $\int_0^2 e^{3x}(3+9x)\,dx$. **2**

(i) $y = xe^{3x}$

Using the product rule,

Let $u = x$ $\quad \frac{du}{dx} = 1$

Let $v = e^{3x}$ $\quad \frac{dv}{dx} = 3e^{3x}$

$$\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$$

$$= x.3e^{3x} + e^{3x}.1$$

$$= e^{3x} + 3xe^{3x}$$

$$= e^{3x}(1 + 3x)$$

State Mean: **0.80**

(ii) $\int_0^2 (e^{3x}(3+9x)\,dx = 3\int_0^2 (e^{3x}(1+3x)\,dx$

$= 3\left[xe^{3x}\right]_0^2 dx$ (from part (i))

$= 3[2e^6 - 0]$

$= 6e^6$

State Mean: **1.26**

* These solutions have been provided by *projectmaths* and are not supplied or endorsed by BOSTES.

BOSTES: Notes from the Marking Centre

(i) Most candidates realised that they needed to use the product rule. Common problems were:

- using the product rule incorrectly
- differentiating e^{3x} incorrectly.

(ii) The candidates who had successfully answered (d) (i) were more able to recognise the connection and make the appropriate substitution. Common problems were:

- not rewriting the integral in terms of the expression from part (d)(i) and integrating incorrectly
- dividing, instead of multiplying, by 3
- substituting into the integral incorrectly.