

$$(iv) \begin{bmatrix} 2 & 5 \\ -6 & 0 \\ 1 & 12 \end{bmatrix} \begin{bmatrix} 8 & -1 & 7 \\ -5 & 2 & 5 \\ 3 & 0 & 2 \end{bmatrix}$$

Since the number of columns in the first matrix, 2, does not equal the number of rows in the second matrix, 3, the two matrices have incompatible dimensions.

$$vii) \begin{bmatrix} 8 & -1 & 7 \\ -5 & 2 & 5 \\ 3 & 0 & 2 \end{bmatrix} + \begin{bmatrix} -2 & 8 & 0.5 \\ 2 & 5 & 2 \\ 0 & -9 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 6 & 7 & 7.5 \\ -3 & 7 & 7 \\ 3 & -9 & 3 \end{bmatrix}$$

$$viii) \begin{bmatrix} 8 & -1 & 7 \\ -5 & 2 & 5 \\ 3 & 0 & 2 \end{bmatrix} \cdot \begin{bmatrix} -2 & 8 & 0.5 \\ 2 & 5 & 2 \\ 0 & -9 & 1 \end{bmatrix} + \begin{bmatrix} 8 & 14 \\ 0.25 & 21 \end{bmatrix}$$

$$\begin{bmatrix} 8 & 14 \\ 0.25 & 21 \end{bmatrix} + \begin{bmatrix} -16 & -8 & 3.5 \\ -10 & 10 & 10 \\ 0 & 0 & 2 \end{bmatrix}$$

Q1 matrices

i) AB

$$= \begin{bmatrix} 8 & -1 & 7 \\ -5 & 2 & 5 \\ 3 & 0 & 2 \end{bmatrix} \times \begin{bmatrix} -2 & 8 & 0.5 \\ 2 & 5 & 2 \\ 0 & -9 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} -18 & -4 & 9 \\ 14 & -7.5 & 6.5 \\ -6 & 6 & 3.5 \end{bmatrix}$$

ii) $\begin{bmatrix} -2 & 8 & 0.5 \\ 2 & 5 & 2 \\ 0 & -9 & 1 \end{bmatrix} \times \begin{bmatrix} 8 & -1 & 7 \\ -5 & 2 & 5 \\ 3 & 0 & 2 \end{bmatrix}$

$$\begin{bmatrix} 54.5, 16, 27 \\ -3, 8, 43 \\ 48, -18, -43 \end{bmatrix}$$

iii) $\begin{bmatrix} 8 & -1 & 7 \\ -5 & 2 & 5 \\ 3 & 0 & 2 \end{bmatrix} \times \begin{bmatrix} 2 & 5 \\ -6 & 0 \\ 1 & 2 \end{bmatrix}$

$$= \begin{bmatrix} 29, 124 \\ -17, 35 \\ 8, 39 \end{bmatrix}$$

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Q1) $\int (x^5 - 2x)(5x^3 + 6x) dx$

$$5x^8 + 6x^6 - 10x^4 - 12x^2$$

$$5 \int x^8 dx + 6 \int x^6 dx - 10 \int x^4 dx - 12 \int x^2 dx$$

$$= \frac{5x^9}{9} + 6 \int x^6 dx - 10 \int x^4 dx - 12 \int x^2 dx$$

$$= \frac{6x^7}{7} + \frac{5x^9}{9} - 10 \int x^4 dx - 12 \int x^2 dx$$

$$= 2x^5 + \frac{6x^7}{7} + \frac{5x^9}{9} - 12 \int x^2 dx$$

$$= \boxed{\frac{5x^9}{9} + \frac{6x^7}{7} - 2x^5 - 4x^3}$$

(ii) $\int (e^{5x} + 1)(e^{3x} + 2) dx$

$$u = e^{3x}$$

$$v' = (1 + e^{5x}) dx$$

$$u' = (3^x e^x \log(3)) dx$$

$$v = \frac{(e^{5x})}{\log(5)} + x$$

$$\int (2 + e^{3x})(1 + e^{5x}) dx = \int (2 + e^{3x}) \left(x + \frac{e^{5x}}{\log(5)} \right) dx - \int 3^x e^{3x} \log(3) \left(x + \frac{e^{5x}}{\log(5)} \right) dx$$

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(ii)

$$\int_1^2 3x e^{2x} dx = 3 \int_1^2 x e^{2x} dx$$

$$u = x \quad u' = e^{2x}$$

$$u' = 1 \quad u = \frac{e^{2x}}{2}$$

$$3 \int_1^2 x e^{2x} dx = \frac{3x e^{2x}}{2} - \int \frac{e^{2x}}{2} dx$$

let ~~u~~ $u = e^{2x}$ $\therefore dx = \frac{1}{2} du$
 $\frac{du}{dx} = 2$

$$\frac{1}{4} \int e^u du = \frac{1}{4} [e^u] = \frac{e^u}{4} = \frac{e^{2x}}{4}$$

$$= \left[\frac{3x e^{2x}}{2} - \frac{e^{2x}}{4} \right]_1^2$$

$$= \frac{3x e^{2x}}{2} - \frac{3e^{2x}}{4}$$

$$\left(\frac{3(2)e^{2(2)}}{2} - \frac{3e^{2(2)}}{4} \right) - \left(\frac{3(1)e^{2(1)}}{2} - \frac{3e^{2(1)}}{4} \right)$$

$$= \left(\frac{6e^4}{2} - \frac{3e^4}{4} \right) - \left(\frac{3e^2}{2} - \frac{3e^2}{4} \right)$$

$$= \left(3e^4 - \frac{3e^4}{4} \right) - \left(\frac{3e^2}{2} - \frac{3e^2}{4} \right)$$

$$= 117.304045$$

$$= 117.304 \text{ (3.d.p.)}$$

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(ii)

$$\int_1^2 3x e^{2x} dx = 3 \int_1^2 x e^{2x} dx$$

$$u = x \quad u' = e^{2x}$$

$$u' = 1 \quad u = \frac{e^{2x}}{2}$$

$$3 \int_1^2 x e^{2x} dx = \frac{3x e^{2x}}{2} - \int \frac{e^{2x}}{2} dx$$

let ~~u~~ $u = e^{2x}$ $\therefore dx = \frac{1}{2} du$
 $\frac{du}{dx} = 2$

$$\frac{1}{4} \int e^u du = \frac{1}{4} [e^u] = \frac{e^u}{4} = \frac{e^{2x}}{4}$$

$$= \left[\frac{3x e^{2x}}{2} - \frac{e^{2x}}{4} \right]_1^2$$

$$= \frac{3x e^{2x}}{2} - \frac{3e^{2x}}{4}$$

$$\left(\frac{3(2)e^{2(2)}}{2} - \frac{3e^{2(2)}}{4} \right) - \left(\frac{3(1)e^{2(1)}}{2} - \frac{3e^{2(1)}}{4} \right)$$

$$= \left(\frac{6e^4}{2} - \frac{3e^4}{4} \right) - \left(\frac{3e^2}{2} - \frac{3e^2}{4} \right)$$

$$= \left(3e^4 - \frac{3e^4}{4} \right) - \left(\frac{3e^2}{2} - \frac{3e^2}{4} \right)$$

$$= 117.304045$$

$$= 117.304 \text{ (3.d.p.)}$$

Question 3 B

B

i) $\int 4x \cos(3x) dx = 4 \int x \cos(3x) dx$

$$u = x \quad v' = \cos(3x)$$

$$u' = 1 \quad v = \frac{\sin(3x)}{3}$$

$$\int u v' = uv - \int u' v$$

$$\int x \cos(3x) = \frac{x \sin(3x)}{3} - \int \frac{\sin(3x)}{3} dx$$

let $u = 3x$

$$\frac{du}{dx} = 3 \Rightarrow dx = \frac{1}{3} du$$

$$= \frac{1}{9} \int \sin(u) du$$

$$= \frac{1}{9} \cos(u) = -\frac{\cos(3x)}{9}$$

$$\int x \cos(3x) = \frac{x \sin(3x)}{3} - \frac{\cos(3x)}{9}$$

$$= \frac{x \sin(3x)}{3} + \frac{\cos(3x)}{9}$$

bring 4
back

$$4 \int x \cos(3x) dx$$

$$= \frac{4x \sin(3x)}{3} + \frac{4 \cos(3x)}{9} + C$$

Q3 a)

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① iv)

$$\int_2^4 (2x+3)(x+5) dx$$

$$\int_2^4 2x^2 + 13x + 15 dx$$

$$\left[\frac{2}{3}x^3 + \frac{13}{2}x^2 + 15x \right]_2^4$$

$$= \frac{620}{3} - \frac{184}{3}$$

$$= \boxed{\frac{436}{3}}$$

ii)

$$(3x^3 + 2x)^3 (3x^3 + 2x) (3x^3 + 2x)$$

$$(9x^6 + 6x^4 + 6x^4 + 4x^2) (3x^3 + 2x)$$

$$(9x^6 + 12x^4 + 4x^2) (3x^3 + 2x)$$

$$27x^9 + 18x^7 + 36x^5 + 24x^5 + 12x^3 + 8x^3$$

$$= \int 27x^9 + 54x^7 + 36x^5 + 8x^3 dx$$

$$\left[\frac{27}{10}x^{10} + \frac{54}{8}x^8 + \frac{36}{6}x^6 + \frac{8}{4}x^4 \right]_0^2$$

$$\left[\frac{27}{10}x^{10} + \frac{27}{4}x^8 + 6x^6 + 2x^4 \right]_0^2$$

$$\frac{24544}{5} - 0$$

$$= \frac{24544}{5} = 4908.8$$