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Analytical Methods (ACHA4000)

Question 3

$$\begin{aligned} \text{a) i) } & \int (x^5 - 2x)(5x^3 + 6x) dx \\ &= \int 5x^8 + 6x^6 - 10x^4 - 12x^2 dx \\ &= \int 5x^8 dx + \int 6x^6 dx - \int 10x^4 dx - \int 12x^2 dx \\ &= \frac{5x^9}{9} + \frac{6x^7}{7} - 2x^5 - 4x^3 + C \end{aligned}$$

$$\begin{aligned} \text{ii) } & (e^{5x} + 1)(e^{3x} + 2) dx \\ &= dx(e^{8x} + 2e^{5x} + e^{3x} + 2) \\ &= e^{8x} dx + 2e^{5x} dx + e^{3x} dx + 2dx \end{aligned}$$

$$\begin{aligned} \text{iii) } & \int_0^2 (3x^3 + 2x)^3 + 4x + 3 dx \\ &= \int_0^2 \left(\frac{9x^6 - 4x^2}{3x^3 - 2x} \right)^3 + 4x + 3 dx \\ &= \int_0^{\sqrt{\frac{2}{3}}} \left(\frac{9x^6 - 4x^2}{3x^3 - 2x} \right)^3 + 4x + 3 dx = \sqrt{6} + \frac{256}{45} \\ &= \sqrt{6} + \frac{256}{45} - \sqrt{6} + \frac{44254}{9} \\ &= \frac{24614}{5} = 4922.8 \end{aligned}$$