Topic 1

Question 1 [9 marks]

Determine the second derivative of each of the following.

(a) $f(x) = \left(-2x^5 - 3x^2\right) e^{-4x}$. [3]

$f'(x) = -4e^{-4x} \cdot \left(-2x^5 - 3x^2\right) + e^{-4x} \cdot \left(-10x^4 - 6x\right)$

$f''(x) = -4e^{-4x}\left(-10x^4 - 6x\right) + 16e^{-4x} \cdot \left(-2x^5 - 3x^2\right) + e^{-4x}\left(-40x^3 - 6\right) + -4e^{-4x}\left(-10x^4 - 6x\right)$

$= -8e^{-4x}\left(-10x^4 - 6x\right) + 16e^{-4x} \cdot \left(-2x^5 - 3x^2\right) + e^{-4}\left(-4x^3 - 6\right)$

$= 80e^{-4x}x^4 - 58e^{-4x}x - 32e^{-4x}x^5 - 48e^{-4x} \cdot x^2 - 4e^{-4x}x^3 - 6e^{-4x}$

(b) $g(x) = \left(-2x^5 - 3x^2\right) \sin(3x)$. [3]

(c) $h(x) = \sin(x)e^{-4x}$. [3]