

Question 1 (11 marks)

(a) Using first principles, find $f'(x)$ if $f(x) = x^2 - 3$.

(3 marks)

(b) Determine $\frac{dy}{dx}$ for the following two functions. You do not need to simplify your answers.

(i) $y = 3x^4 + (7 + \sin x)^2$

$\frac{dy}{dx} = 12x^3 + 2(7 + \sin x) \cdot \cos x$

(3 marks)

(ii) $y = \frac{\ln(x^5 + 1)}{e^x}$

$\frac{dy}{dx} = \frac{5x^4 \cdot e^x - \ln(x^5 + 1) \cdot e^x}{e^{2x}}$																				

(3 marks)

(c) Determine $\int \left(\frac{1}{x-3} + 4 \right) dx$, where $x > 3$.

(2 marks)