Question 3 **(12 marks)**

(a) Differentiate $(2x^3 + 1)^5$. (2 marks)

(b) Given $g'(x) = e^{2x}\sin(3x)$, determine a simplified value for the rate of change of $g'(x)$ when $x = \frac{\pi}{2}$. (3 marks)

(c) Determine the following:

(i) $\int 3\cos(2x)\,dx$. (2 marks)

(ii) $\int_0^1 \frac{3x+1}{3x^2+2x+1}\,dx.$ (3 marks)

(d) If $f'(x) = e^{-2x}$, find the expression for $y = f(x)$, given $f(0) = -2$. (2 marks)