Test 1 : Thursday 25th February
Differentiation Techniques

This assessment contributes 4% towards the final year mark.

40 minutes are allocated for this task.

No notes of ANY nature are permitted.

Calculators are NOT permitted for this task.

Full marks may not be awarded to correct answers unless sufficient justification is given.

Name :

Score :

(out of 40)

Do NOT turn over this page until you are instructed to do so.

Q1. **(11 marks)**

Find the derivatives of the following functions, leaving answers with positive indices and simplifying answers where possible.

(a) $y = e^{4x} + \dfrac{3}{x^2}$ (2 marks)

(b) $y = \sin(3x) - 4\cos(2x)$ (3 marks)

(c) $y = (1 + 5x)^4$

(2 marks)

(d) $y = x^2 e^{-2x}$ (leaving your answer in factorised form)

(4 marks)

Q2 **(8 marks)**

(a) Given that $f(x) = \dfrac{x^3 - 1}{x^3 + 1}$, find $f'(1)$ (4 marks)

(b) Given that $g(x) = \left(1 + \cos(3x)\right)^2$ find $g'\left(\dfrac{\pi}{6}\right)$ (4 marks)

Q5. **(7 marks)**

Consider the function $y = e^{2x} \sin 3x$.

Show that $\dfrac{d^2y}{dx^2}$ is of the form $e^{2x}\left[a \sin 3x + b \cos 3x\right]$ and find the values of a and b.

Q3. **(8 marks)**

Consider the graph of $y = \dfrac{x}{4 + x^2}$.

(a)   Find the values of x at which the gradient of the graph is equal to 0.   (4 marks)

(b)   Find the equation of the tangent to the curve at the point where x = 1.   (4 marks)

Q4. **(6 marks)**

Consider the function given by $y = \dfrac{ax^2 + b}{cx + d}$.

Find the values of a, b , c and d given that $\dfrac{dy}{dx} = \dfrac{6x^2 + 18x + 5}{(2x + 3)^2}$