

First Name: _____ Last Name: _____

Student-No: _____ Section: _____

Short answer questions — you must show your work1. 6 marks Each part is worth 2 marks.

(a) For what values of x does the derivative of $\frac{e^x + x}{\cos(x)}$ exist? Explain your answer.

(b) Consider a function of the form $f(x) = Ae^{kx}$ where A and k are constants. If $f(0) = 4$ and $f(3) = 1$, find the constants A and k .

(c) Estimate $\sin\left(\frac{13\pi}{12}\right)$ using a linear approximation

Long answer question — you must show your work

2. 4 marks Determine whether the derivative of following function exists at $x = 0$

$$f(x) = \begin{cases} x^3 \sin\left(\frac{1}{x}\right) & \text{if } x < 0 \\ 6x^3 + 2xe^x & \text{if } x \geq 0 \end{cases}$$

You must justify your answer.