

**MAT1841 Continuous Mathematics for Computer Science****Assignment 3**

*The assignment is to be submitted via MOODLE via 11:55 pm AEDT Friday 14 October 2021.*

*See the instructions under the assessment tab on MOODLE. Be sure to press the “submit assignment” button to complete the submission. You must submit a single PDF document no larger than 100MB in size. It’s the student’s responsibility to ensure that the file is not corrupted.*

*Assignment 3 is worth 10% of the final mark. There are four questions.*

***The standard penalty of 10% of the total mark per day will apply for late work.***

***Show your working.*** You are required to clearly explain your steps in both English and mathematical expressions. Most of the marks will be allocated for clear working and explanations. A mathematical writing guide is available on Moodle.

1. Compute the first four non-zero terms in the Taylor series for the following functions centred about the specified point  $a$ . **[5 + 5 = 10 marks]**

a.  $f(x) = \ln(x^3 + 1), \quad a = 1$

b.  $f(x) = \tan^{-1}(e^x - 1), \quad a = 0$

2. Calculate the three cubic spline functions that pass through the four points

$x$	-1	1	2	3
$f(x)$	2	0	0	1

with the second derivatives set equal to zero at the two endpoints. Using a software package, graph the three polynomials over the over the full domain. **[16 + 2 = 18 marks]**

3. Use integration by parts to calculate the following integrals. **[4 + 4 = 8 marks]**

a.  $I = \int x^3 \ln(2x) dx$

b.  $I = \int e^{2x} \sin(x) dx$

4. Consider the area bounded by the two functions  $y = (x^3 - 5x^2 + 4x)/5$  and  $y = x^2 - 4x$  over the domain  $0 \leq x \leq 4$ . **[2 + 4 + 4 + 4 = 14 marks]**

- a. Sketch these two curves, noting the area bounded between them.
- b. Use the Fundamental Theorem of Calculus to calculate the area bounded between the two curves.
- c. Approximate the area between the curves using the Trapezoidal rule with  $n = 4$ .
- d. Approximate the area between the curves using the Trapezoidal rule with  $n = 8$ .