# MAT1841 Continuous Mathematics for Computer Science

# Assignment 2

*The assignment is to be submitted via MOODLE via **11:55 pm AEST Friday 16 September 2022**.*

*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 2 is worth 20% of the final mark. There are three 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 following derivatives, showing all work as required.

    a.  Using first principles, differentiate $f(x) = -x^{2/3}$. (Hint: use the 'difference of cubes.')

    b.  Calculate the second derivative of $g(x) = \sin(\ln(x^2 + 1))$. State the domain and range of $g(x), g'(x)$ and $g''(x)$.

    c.  Use the inverse method (i.e., the "derivative rule for inverse functions" in §3.3.2 in the notes) to differentiate $h(x) = \tan^{-1}(x^3)$.

    **[8 + 6 + 6  marks]**

2.  Consider the function $f(x) = (5 + x - x^2)/(2 - x + x^2)$ over the domain $x \in [0, 5]$.

    a.  Present a graph of the function.

    b.  Calculate the absolute maximum and minimum of $f(x)$.

    **[2 + 12  marks]**

3.  Consider a curve define parametrically as $x(t) = 3 - t^{-1}$ and $y(t) = 2t + t^{-1}$

    a.  Write the equation of the curve in non-parametric form (i.e. eliminate $t$ between the two equations.)

    b.  Find $dy/dx$ in terms of $t$ using parametric differentiation.

    c.  Find $d^2y/dx^2$ in terms of $t$ using parametric differentiation.

    d.  Find the equation of the tangent line to the curve when $t = 1$.

    **[4 + 5 + 4 + 3  marks]**