The University of Sydney
School of Mathematics and Statistics

Assignment 2

MATH1021: Single Variable Calculus — Semester 1, 2019

Web Page: http://sydney.edu.au/science/maths/u/UG/JM/MATH1021/

This **individual** assignment is due by **11:59pm Thursday 2 May 2019**, via Canvas. Late assignments will receive a mark of zero. A single PDF copy of your answers must be uploaded in the Learning Management System (Canvas) at https://canvas.sydney.edu.au/courses/15252/assignments. Please submit only one PDF document (scan or convert other formats). It should include your SID, your tutorial time, day, room and Tutor's name. Please note: Canvas does NOT send an email digital receipt. We strongly recommend downloading your submission to check it. What you see is exactly how the marker will see your assignment. Submissions can be overwritten until the due date. To ensure compliance with our anonymous marking obligations, please do not under any circumstances include your name in any area of your assignment; only your SID should be present. The School of Mathematics and Statistics encourages some collaboration between students when working on problems, but students must write up and submit their own version of the solutions. If you have technical difficulties with your submission, see the University of Sydney Canvas Guide, available from the Help section of Canvas.

This assignment is worth 2.5% of your final assessment for this course. Your answers should be well written, neat, thoughtful, mathematically concise, and a pleasure to read. Please cite any resources used and show all working. Present your arguments clearly using words of explanation and diagrams where relevant. After all, mathematics is about communicating your ideas. This is a worthwhile skill which takes time and effort to master. The marker will give you feedback and allocate an overall letter grade and mark to your assignment using the following criteria:

Mark	Grade	Criterion
5	A	Outstanding and scholarly work, answering all parts correctly, with clear accurate explanations and all relevant diagrams and working. There are at most only minor or trivial errors or omissions.
4	B	Very good work, making excellent progress, but with one or two substantial errors, misunderstandings or omissions throughout the assignment.
3	C	Good work, making good progress, but making more than two distinct substantial errors, misunderstandings or omissions throughout the assignment.
2	D	A reasonable attempt, but making more than three distinct substantial errors, misunderstandings or omissions throughout the assignment.
1	E	Some attempt, with limited progress made.
0	F	No credit awarded.

1. A 20 cm long wire is cut into two pieces, one of length x and the other of length $20 - x$. The piece of length x is bent in the shape of an equilateral triangle and the other is bent in the shape of a circle.

What should the value of x be so as to minimize the total area enclosed by the shapes?

[**Hint:** Draw two diagrams showing the dimensions of the triangle and circle and calculate the total area $A(x)$ as a function of x. Then find the global minimum of $A(x)$ in the interval $[0, 20]$.]

2. Given the function $f(x) = \dfrac{e^x}{x-1}$,

(a) Find the natural domain of f and its vertical and horizontal asymptotes, if any.

(b) Find the critical points and the intervals of increase or decrease of f.

(c) Find the points of inflection, if any, and the intervals of concavity.

(d) Sketch the graph of f, showing all the features found in Parts (a), (b) and (c).