

MAT1841 Continuous Mathematics for Computer Science
(Semester 2, 2016)

Assignment 3

This is the third of three assignments worth 10% each. **It is to be submitted via the upload link in the Moodle assignment block by 5pm Monday 17 October (week 12).** Your assignment should be uploaded as a single .pdf or word file (scanned or photographed handwritten assignments with a filled in cover sheet are perfectly acceptable as long as they are placed in a single file). All assignments must have a signed and dated assignment cover sheet attached. A late penalty of 10% of the total possible mark per day will apply for late work. All late work must be uploaded via the same link and special consideration applications should be given directly to the unit coordinator (Daniel McInnes, Room 453, 9 Rainforest Walk).

Show all working. You are being marked on your ability to clearly explain your steps in both English and mathematical statements as appropriate. Writing an answer only will not attract full marks for that question (or part thereof).

Question 1 [10 marks] Find the first three non-zero terms in the Taylor series for the following functions around $x = 0$:

(a) $\tan^{-1}(e^x - 1)$

(b) $\sec(x) \tan(x)$

Question 2 [10 marks] Calculate the following:

(a) $I = \int e^{ax} \cos(bx) dx$ for $a \neq 0$ and $b \neq 0$.

(b) Find the area of the bounded region R lying between the curves $y = \frac{4}{x^2}$ and $y = 5 - x^2$.
(Hint: plot them first to get an idea of what the region looks like.)

Question 3 [10 marks]

(a) Find the tangent plane to the surface with equation

$$f(x, y) = z = \frac{2xy}{x^2 + y^2}$$

at $(x, y) = (0, 2)$.

(b) A partial differential equation (PDE) is an equation containing one or more partial derivatives. Show that the function

$$z = \frac{x + y}{x - y}$$

satisfies the PDE

$$x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = 0.$$