EE106 – Engineering Mathematics I

Problem Set 9

Due by 5pm on Friday, 7 December 2018

1. Compute the indefinite integral

$$\int \arctan(x)\,\mathrm{d}x$$

using the following method:

   (a) First, apply the integration by parts technique to this integral with the choices $f(x) = \arctan x$ and $g'(x) = 1$.

   (b) The $\int f'(x)g(x)\,\mathrm{d}x$ integral you obtained in (a) still needs to be evaluated; you should be able to find an appropriate change of variables that will allow you to do so, and thus get the final result.

2. Use integration by parts (twice) to show that

$$\int_0^{\pi/2} x^2 \sin(2x)\,\mathrm{d}x \quad = \quad \frac{\pi^2}{8} - \frac{1}{2}.$$

3. Use the method of partial fractions to compute

$$\int \frac{x+1}{x^2 - 3x}\,\mathrm{d}x$$

4. Using whatever method you like, compute the two integrals below:

$$\text{(a)} \qquad \int_0^{1/2} \frac{1}{x(\ln(x))^2}\,\mathrm{d}x,$$

$$\text{(b)} \qquad \int \frac{x^2}{16 - x^2}\,\mathrm{d}x.$$

   (Hint for (a): be careful with the limits of integration, in particular the one at $x = 0$.)

   And by "whatever method", I mean just that. It's preferable if you compute them by hand using the methods we've learned in lectures, but looking them up in a book or on the Internet, or using a computer package (like Mathematica) is also okay. However, if you decide to look them up, *cite* your sources, and if you use a computer, include a copy of the code you wrote. Not doing so will result in a loss of marks.