Maths for Actuarial Science Coursework 1

This is an assessed coursework, and will count towards your final grade. Solutions should be handed in to the **mathematics general office** (C123) by **noon on Thursday 13th November**. Late submissions will be penalised.

1. Solve the equation
$$\frac{2x+3}{x-5} < \left| \frac{4x+12}{x+1} \right|.$$

   [**8**]

2. Find an equation for the ellipse with focus at $(4,4)$, centre at $(4,6)$ and major axis of length 10.   [**6**]

3. Find all solutions of
$$2\cos 2\theta + 4\sin\theta\cos\theta = \sqrt{2}$$
   in the range $0 \le \theta \le 2\pi$.   [**10**]

4. (i) Differentiate the following expressions with respect to x, simplifying where possible:

        (a) $\ln(\sec x + \tan x)$ (b) $\sin^3 x \cos 3x + \cos^3 x \sin 3x$

   (ii) Find the first and second derivatives (with respect to x) of the function
$$x = 4t^2 - 5t + 6 \qquad y = t^3 - t^2 + t.$$

   [**8**]

5. Calculate
$$\int \frac{x^3}{(x^2-9)(x+1)}\, dx.$$

   [**8**]

6. Calculate

        (a) $\displaystyle\int e^x \sqrt{1 - e^{2x}}\, dx$ (b) $\displaystyle\int x^2 e^{-2x} dx.$

   [**10**]