Math 180 **Hour Exam Two** **November 2007**

For every question, write out your computations in the exam booklet.

1. Find the derivative of the following functions, do simplify.

$$\text{(a) } \ln(x^2+x+1), \qquad \text{(b) } \cos(\sqrt{x}), \qquad \text{(c) } \arctan(x).$$

2. Find the derivatives $f'(x)$ and $f''(x)$ for the function $f(x) = e^{-x}\sin(x)$.

3. Use implicit differentiation to find the slope of the line tangent to the curve

$$xy^2 + 2x^2 - y = 0$$

at the point $(-1, 1)$.

4. Let $f(x) = x^4 - 6x^2 + 4$.
   (a) Find the critical points and the inflections points of f.
   (b) On what interval is f concave down?
   (c) Find the minimum value of f?

5. Find the limit: $\lim_{x\to 1} \dfrac{\ln(x)}{x^3-1}$.

6. A family of rectangles in the xy-plane has one side on the x-axis, the lower left corner at the origin $(0,0)$, and the upper right corner at a point (x,y) on the straight line

$$3x + 4y = 5.$$

   (a) Find the area of such a rectangle as a function of x alone.
   (b) Find the dimensions, x and y, of the particular rectangle with the largest area.