**MATH3404, Assignment 1 (due at 15:00 on 25 August 2014)**
**Submission: At the tutorial or at the Assignment**
**Box on Level 4 of the Priestley Building 67.**

**Question 1.** *(3 Marks)*
*Find the local minimum of the function*

$$f(x_1, x_2, x_3) = x_1^2 - 2x_1x_2 + 2x_2^2 + x_3^2$$

*in* $\mathbb{R}^3$.

**Question 2.** *(3 Marks)*
*Find the critical points of the following constrained optimization problem*

$$f(x_1, x_2, x_3) = x_1^2 + x_2^2 + 2x_3^2 \quad \textit{subject to} \quad g(x_1, x_2, x_3) = x_1 + x_2 + x_3 = 4$$

*and check that they are non-degenerate. Determine the local minima and maxima.*

**Question 3.** *(4 Marks)*
*Find the local maxima and minima of the following problem by introducing two Lagrange multipliers:*

$$f(x_1, x_2, x_3) = 2x_1 + x_2 + x_3$$

*subject to* $x_1^2 + x_2^2 + x_3^2 = 2$ *and* $x_1^2 + (x_2 - 1)^2 + x_3^2 = 3$.