

### M233 Spring 2004 Homework 4

Due: 2 April 2004

1. Write the equations of the lines that are tangent and normal to the planar curve  $2x^3 + 2y^3 - 9xy = 0$  at  $(1, 2)$ .
2. Suppose that  $f(x, y) = \arctan(y/x)$  and  $\mathbf{u}$  is the unit vector in the direction of  $3\mathbf{i} + 4\mathbf{j}$ . Calculate  $D_{\mathbf{u}}f(-3, 3)$ .
3. Locate all local maxima, minima, and saddle points of  $f(x, y) = 2x^3 - 3x^2 + y^2 - 12x + 10$ .
4. Find the maximum and minimum values (if either exists) of  $x^2 + y^2 + z^2$  subject to the constraint  $3x + 2y + z = 6$ .
5. The plane  $x + y + z = 12$  intersects the paraboloid  $z = x^2 + y^2$  in an ellipse. Find the highest and lowest points on this ellipse.