**Name: SOLUTIONS**

**Quiz #6 - October 23, 2008**

1. Let $f(x, y) = 3x + 12y - x^3 - y^3$. Find all critical points and classify each as a local maximum, local minimum or saddle point using the second derivative test.

**Solution:** $f_x = 3 - 3x^2, f_y = 12 - 3y^2$ so the critical points are $(1, 2), (-1, 2), (-1, -2), (1, -2)$.
Notice that $f_{xx} = -6x, f_{yy} = -6y$ and $f_{xy} = 0$. Thus $D(x, y) = 36xy$. We get:

$D(1, 2) = 72, f_{xx}(1, 2) < 0$ so local max.

$D(-1, -2) = 72, f_{xx}(1, 2) > 0$ so local min.

$D(1, -2) = D(-1, 2) = -72$ so saddles.

2. Let $z = x^2 y$. Find the total differential $dz$.

$$dz = 2xy dx + x^2 dy.$$