Recitation Week 3

Sections 12.4, 12.5

1. Le.t $w = (x + y + z)^2$, $x = r - s$, $y = \cos(r + s)$, $z = \sin(r + s)$. Find $\partial w/\partial r$.

2. Find $\partial z/\partial x$ and $\partial z/\partial y$ at $(2, 3, 6)$ if the equation

$$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} - 1 = 0$$

   defines z as a differentiable function of x and y.

3. Suppose that the partial derivatives of a function $f(x, y, z)$ at points on the helix $x = \cos t$, $y = \sin t$ and $z = t$ are

$$f_x = \cos t, \quad f_y = \sin t, \quad f_z = t^2 + t - 2.$$

   At what points on the curve, if any, can f take on extreme values?

4. Consider $f(x, y) = x^2 - xy + y^2$. Sketch the curve $f(x, y) = 7$ together with ∇f and the tangent line at the point $(-1, 2)$. Then write an equation for the tangent line and an equation for the normal line at that point.

5. The derivative of $f(x, y)$ at $P_0(1, 2)$ in the direction of $\vec{i} + \vec{j}$ is $2\sqrt{2}$ and in the direction of $-2\vec{j}$ is -3. What is the derivative of f in the direction of $-\vec{i} - 2\vec{j}$? Give reasons for your answer.