Math 126D - Spring 2009
Practice Problems for Midterm 2

1. Let $\mathbf{r}(t) = \langle\, t^3, t^2, t^3 - 2t\,\rangle$. Compute the curvature κ at the point $(-1, 1, 1)$.

2. Find the equation of the tangent plane of the function $F(x, y) = \dfrac{3y-2}{5x+7}$ at the point $(-1, 1)$.

3. Suppose a particle is moving in 3-dimensional space so that its position vector is

$$\mathbf{r}(t) = \left\langle t, t^2, \frac{1}{t} \right\rangle.$$

(a) Find the tangential component of the particle's acceleration vector at time $t = 1$.

(b) Find all values of t at which the particle's velocity vector is orthogonal to the particle's acceleration vector.

4. Let $f(x, y) = xe^y - \ln(x + y)$.

(a) Sketch the domain of f.

(b) Find $f_{xy}(x, y)$.

5. Find three positive numbers x, y and z whose sum is 100 and for which the product

$$xy^2z^3$$

is a maximum. (Remember to verify that your solution does give a maximum.)

6. While driving your car on a highway, you travel at a constant speed of 100 ± 2 km/hour for 50 ± 1 seconds. **Use differentials** to estimate the uncertainty in the distance you travelled in these 50 seconds.

7. Evaluate the following double integrals.

(a) $\iint_R xy\sin(x^2y)\,dA, \quad R = [0,1]\times[0,\pi/2]$

(b) $\iint_D y^2e^{xy}\,dA, \quad D = \{\ (x,y)\mid 0\le y\le 3,\ 0\le x\le y\ \}$