MATH 202
Quiz 3

Name :_____

February 13, 2008

Instructions: This quiz is worth five points. You get one point for taking this quiz.

1. (2 pts.)

   (a) Write the equation $z = -3x^2 - 3y^2$ in spherical and cylindrical coordinates.

$\begin{cases} z = z \\ x = r\cos\theta \\ y = r\sin\theta \end{cases}$

$z = -3r^2\cos^2\theta - 3r^2\sin^2\theta$

$= -3r^2(\cos^2\theta + \sin^2\theta) = -3r^2$

$\begin{cases} x = \rho\sin\varphi\cos\theta \\ y = \rho\sin\varphi\sin\theta \\ z = \rho\cos\varphi \end{cases}$

$\rho\cos\varphi = -3\rho^2\sin^2\varphi\cos^2\theta - 3\rho^2\sin^2\varphi\sin^2\theta$

$= -3\rho^2\sin^2\varphi$

$\rho = -\frac{1}{3}\frac{\cos\varphi}{\sin^2\varphi}$

in cylindrical coordinates: $z = -3r^2$

in spherical coordinates: $\rho = -\frac{1}{3}\frac{\cos\varphi}{\sin^2\varphi}$

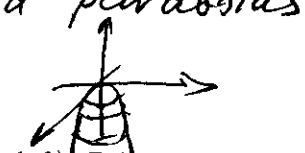
   (b) Describe the surface $z = -3x^2 - 3y^2$. (You may sketch it, but be sure to describe the cross-sections.)

$z = k$: $-3x^2 - 3y^2 = k$, $x^2 + y^2 = -\frac{3}{k}$ circles

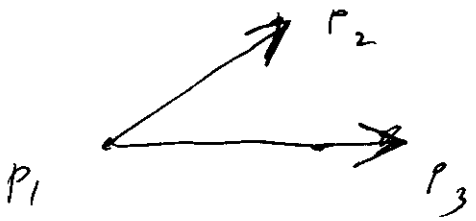
$x = k$: $z = -3y^2 - 3k^2$ downward parabolas

$y = k$: $z = -3x^2 - 3k^2$ downward parabolas

elliptic paraboloid



2. (2 pts.) Find the equation of the plane passing through the points $P_1(1,1,0)$, $P_2(2,-1,0)$, and $P_3(1,2,-1)$.



$\overrightarrow{P_1P_2} = \langle 1, -2, 0 \rangle$

$\overrightarrow{P_1P_3} = \langle 0, 1, -1 \rangle$

$\overrightarrow{P_1P_2} \times \overrightarrow{P_1P_3} = \begin{vmatrix} i & j & k \\ 1 & -2 & 0 \\ 0 & 1 & -1 \end{vmatrix}$

$= 2\vec{i} + \vec{j} + \vec{k}$

$2(x-1) + (y-1) + z = 0$

$\boxed{2x + y + z = 3}$