Quiz #2 (CSE4190.410)

October 1, 2010 (Wednesday)

Name: _____ Dept: _____ ID No: _____

1. (5 points) Write down an algebraic expression for testing whether a given direction vector $\mathbf{d} = (d_1, d_2, d_3)$ is parallel to the plane determined by three non-colinear points $\mathbf{p}_i = (x_i, y_i, z_i)$, $i = 1, 2, 3$.

$$\begin{vmatrix} d_1 & d_2 & d_3 & 0 \\ x_1 & y_1 & z_1 & 1 \\ x_2 & y_2 & z_2 & 1 \\ x_3 & y_3 & z_3 & 1 \end{vmatrix} = 0$$

2. (5 points) Consider three parallel planes:

$$\begin{aligned}\Pi_0 &: \quad 3x - 4y + 5z = 0,\\ \Pi_1 &: \quad 3x - 4y + 5z + 1 = 0,\\ \Pi_2 &: \quad 3x - 4y + 5z + 2 = 0.\end{aligned}$$

What is the transformation from R^3 to R^1 that sends Π_0 to 0, Π_1 to 1, and Π_2 to 3?

$$\begin{bmatrix} A & 0 \\ B & 1 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix} \Rightarrow A = B + 1$$

$$\begin{bmatrix} A & 0 \\ B & 1 \end{bmatrix}\begin{bmatrix} 2 \\ 1 \end{bmatrix} = \begin{bmatrix} 3 \\ 1 \end{bmatrix} \Rightarrow 2A = 6B + 3$$

$$\therefore B = -\frac{1}{4}, \quad A = \frac{3}{4}$$

$$\begin{bmatrix} 3 & 0 \\ -1 & 4 \end{bmatrix}\begin{bmatrix} -3 & 4 & -5 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} -9 & 12 & -15 & 0 \\ 3 & -4 & 5 & 4 \end{bmatrix}$$