Fake Quiz 1 **Calculus 3** **9/10/2010**

Each problem is worth 0 points. In the event of an actual quiz, you would have received warning.

1. Find an equation for the plane through the points (2, 3, –1), (1, 10, 1), and (0, 11, 0).

Vector from $(2,3,-1)$ to $(1,10,1)$ = $\langle -1, 7, 2\rangle$

Vector from $(2,3,-1)$ to $(0,11,0)$ = $\langle -2, 8, 1\rangle$

So their cross product will be perpendicular to both and normal to the plane:

$$\langle -1,7,2\rangle \times \langle -2,8,1\rangle = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -1 & 7 & 2 \\ -2 & 8 & 1 \end{vmatrix} = \langle 7-16, -(-1+\cancel{4}), -8+14\rangle$$
$$= \langle -9, -3, 6\rangle$$

So the plane has equation $\langle -9,-3,6\rangle \cdot (\langle x,y,z\rangle - \langle 2,3,-1\rangle) = 0$

or $-9(x-2) - 3(y-3) + 6(z+1) = 0$

2. Find three vectors that lie in the plane $-3(x-2) - 1(y-3) + 2(z+1) = 0$ and show that each is perpendicular to the plane's normal vector.

I can write that equation more simply as $-3x - y + 2z = -11$

Then trial and error finds $(1,10,1)$, $(0,11,0)$, and $(3,0,-1)$ to be points on this plane (i.e., satisfying that equation).

The vectors from $(2,3,-1)$ to those three points are

$\vec{v}_1 = \langle -1, 7, 2\rangle$

$\vec{v}_2 = \langle -2, 8, 1\rangle$

$\vec{v}_3 = \langle 1, -3, 0\rangle$

The normal vector to the plane was $\langle -3,-1,2\rangle$, and we see

$$\langle -3,-1,2\rangle \cdot \langle -1,7,2\rangle = 3 - 7 + 4 = 0$$
$$\langle -3,-1,2\rangle \cdot \langle -2,8,1\rangle = 6 - 8 + 2 = 0$$
$$\langle -3,-1,2\rangle \cdot \langle 1,-3,0\rangle = -3 + 3 + 0 = 0$$

So in all cases, since the dot products are zero, the vectors are perpendicular to the plane's normal vector.