Spring 2014 **Math 601** Name: _____

Quiz 1

Question 1. (12 pts)

(a) (6 pts) Find equations of the line L that passes through the point $A(1, 0, 4, 3)$ and is perpendicular to the plane $x_1 + x_2 + x_3 + x_4 = 1$.

Solution: The direction of the line is

$$(1, 1, 1, 1)$$

the equations of the line are

$$\begin{cases} x_1 = t + 1 \\ x_2 = t \\ x_3 = t + 4 \\ x_4 = t + 3 \end{cases}$$

(b) (6 pts) Find a *unit* vector that is orthogonal to both vectors $v = (1, 0, 2)$ and $u = (0, 1, 3)$.

Solution: We need a normal vector of the hyperplane.

$$n = \begin{vmatrix} i & j & k \\ 1 & 0 & 2 \\ 0 & 1 & 3 \end{vmatrix} = (-2, -3, 1)$$

Now scale it to a unit vector

$$v = (\frac{-2}{\sqrt{14}}, \frac{-3}{\sqrt{14}}, \frac{1}{\sqrt{14}})$$

Question 2. (8 pts)

Find an equation of the plane H that passes through the points $A(1,0,1)$, $B(0,2,0)$ and $C(1,2,2)$.

Solution: Consider

$$\overrightarrow{AB} = (-1,2,-1)$$

$$\overrightarrow{AC} = (0,2,1)$$

then a norm vector of H is

$$n = \begin{vmatrix} i & j & k \\ -1 & 2 & -1 \\ 0 & 2 & 1 \end{vmatrix} = (4,1,-2)$$

So the equation of H takes the form

$$4x + y - 2z = k$$

plug in, say, $A(1,0,1)$ and we get

$$k = 2$$

So the plane H is

$$4x + y - 2z = 2$$