MATH 1300(A02) QUIZ 4 March 21, 2016 **B08**

NAME SOLUTIONS ID Number______________

INSTRUCTIONS: Answer the following questions in the spaces provided below.

[12] TOTAL

[4] **1.**
(a) State the *Cauchy-Schwarz Inequality* for two vectors **u** and **v**.

$$|\underline{u}\cdot\underline{v}| \le \|\underline{u}\|\|\underline{v}\|$$

(b) State the *parallelogram law* for vector norms.

$$\|\underline{u}+\underline{v}\|^2 + \|\underline{u}-\underline{v}\|^2 = 2(\|\underline{u}\|^2 + \|\underline{v}\|^2)$$

[4] **2.** Let $\mathbf{a} = \langle 1, -1, 1, -1\rangle$ and $\mathbf{u} = \langle -2, 1, 4, -3\rangle$.
Find the vector component of **u** orthogonal to **a**.

$$\underline{u} - \operatorname{proj}_{\underline{a}}(\underline{u}) = \underline{u} - \frac{\underline{u}\cdot\underline{a}}{\|\underline{a}\|^2}\underline{a}$$

$$= \langle -2,1,4,-3\rangle - \frac{\langle -2,1,4,-3\rangle\cdot\langle 1,-1,1,-1\rangle}{1^2+1^2+1^2+1^2}\langle 1,-1,1,-1\rangle$$

$$= \langle -2,1,4,-3\rangle - \frac{1}{4}(-2-1+4+3)\langle 1,-1,1,-1\rangle$$

$$= \langle -2,1,4,-3\rangle - \langle 1,-1,1,-1\rangle$$

$$= \langle -3,-2,3,-2\rangle$$

[4] **3.** Find a vector form of the equation of the plane containing the point $\mathbf{b} = \langle 3, -3, 0\rangle$ and the straight line through $\mathbf{a} = \langle 1, -3, 2\rangle$ in the direction of $\mathbf{u} = \langle -1, 0, -1\rangle$.

So the direction vector of the line is one direction vector of the plane, and the vector from $\underline{a}$ to $\underline{b}$ $= \langle 3,-3,0\rangle - \langle 1,-3,2\rangle = \underline{v}$
$= \langle 2,0,-2\rangle$ is another
(or calculate $\underline{a} - \underline{b} = \langle -2,0,2\rangle$.)

So an equation of the plane is

$$\underline{x} = \underline{a} + s\underline{u} + t\underline{v}$$

[or $\underline{x} = \underline{b} + s\underline{u} + t\underline{v}$ if you want.]

$$\langle x,y,z\rangle = \langle 1,-3,2\rangle + s\langle -1,0,-1\rangle + t\langle 2,0,-2\rangle$$