Math 402 - ARC Quiz 2
Lui Name Key

No notes or calculators. Show all work. Note: boldface variables, such as **v**, represent vectors.

1. (2 points) Find the dot product of the vectors

$$\mathbf{u} = \langle 2, -1, 4 \rangle \qquad \mathbf{v} = \langle -5, 2, -1 \rangle$$

$$\vec{u} \cdot \vec{v} = 2(-5) + (-1)(2) + (4)(-1)$$
$$= -10 - 2 - 4$$
$$= \boxed{-16}$$

2. (4 points) Find a vector that is orthogonal to the given vectors.

$$\mathbf{u} = \langle 2, -1, 0 \rangle \qquad \mathbf{v} = \langle -3, 2, -1 \rangle$$

The cross product yields a vector that is orthogonal to both $\vec{u}$ & $\vec{v}$

$$\vec{u} \times \vec{v} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -1 & 0 \\ -3 & 2 & -1 \end{vmatrix} = \begin{vmatrix} -1 & 0 \\ 2 & -1 \end{vmatrix} \hat{i} - \begin{vmatrix} 2 & 0 \\ -3 & -1 \end{vmatrix} \hat{j} + \begin{vmatrix} 2 & -1 \\ -3 & 2 \end{vmatrix} \hat{k}$$

$$= (1-0)\hat{i} - (-2-0)\hat{j} + (4-(3))\hat{k}$$

$$\boxed{\begin{aligned} &= 1\hat{i} + 2\hat{j} + 1 \cdot \hat{k} \\ &= \langle 1, 2, 1 \rangle \end{aligned}}$$

3. (3 points) Find the equation of the line though the point $(3, 1, -6)$ and in the direction of the vector $\langle 3, -2, 6 \rangle$

A vector-valued equation of a line is
$\vec{r}(t) = \vec{r}_0 + t\vec{v}$ where $\vec{v}$ is some direction

$$\boxed{\vec{r}(t) = \langle 3, 1, -6 \rangle + t\langle 3, -2, 6 \rangle}$$