

Name: Solution

UIN: \_\_\_\_\_

Show all your work! Credit will not be given without work.

Let  $a = \langle -2, 3, 4 \rangle$ ,  $b = \langle 3, 0, 1 \rangle$  and let  $\theta$  be the angle between  $a$  and  $b$ .

1) (4 points) Find  $a \times b$ .

2) (4 points) Find  $\cos \theta$ .

3) (2 points) Determine whether  $a$  and  $b$  are orthogonal or not.

$$1) \quad a \times b = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -2 & 3 & 4 \\ 3 & 0 & 1 \end{vmatrix}$$

$$= \begin{vmatrix} 3 & 4 \\ 0 & 1 \end{vmatrix} \vec{i} - \begin{vmatrix} -2 & 4 \\ 3 & 1 \end{vmatrix} \vec{j} + \begin{vmatrix} -2 & 3 \\ 3 & 0 \end{vmatrix} \vec{k}$$

$$= 3 \vec{i} + 14 \vec{j} - 9 \vec{k}$$

$$2) \quad \cos \theta = \frac{a \cdot b}{|a||b|} = \frac{-6 + 0 + 4}{\sqrt{4+9+16} \cdot \sqrt{9+1}} = \frac{-2}{\sqrt{290}}$$

$$3) \quad \cos \theta \neq 0 \quad \text{or} \quad a \cdot b \neq 0$$

Hence  $a$  and  $b$  are not orthogonal.