

MATH 280 – QUIZ #1

Name: KEY

Directions: Please show all work to receive maximum credit. This quiz is worth 16 points.

1. Given  $\vec{a} = \langle 4, 3, -2 \rangle$  and  $\vec{b} = \langle 5, -1, 3 \rangle$ . Determine the following:

(3 points) a.  $\vec{a} \cdot \vec{b} = 20 - 3 - 6 = 11$

(2 points) b.  $5\vec{a} + 3\vec{b} = 5\langle 4, 3, -2 \rangle + 3\langle 5, -1, 3 \rangle$   
 $= \langle 20, 15, -10 \rangle + \langle 15, -3, 9 \rangle$   
 $= \langle 35, 12, -1 \rangle$

(1 point) c. The unit vector in the direction of  $\vec{a}$

$$|\vec{a}| = \sqrt{16 + 9 + 4} = \sqrt{29} \quad \hat{a} = \left\langle \frac{4}{\sqrt{29}}, \frac{3}{\sqrt{29}}, -\frac{2}{\sqrt{29}} \right\rangle$$

(3 points) d.  $\text{proj}_{\vec{a}} \vec{b} = \left( \frac{\vec{a} \cdot \vec{b}}{|\vec{a}|} \right) \frac{\vec{a}}{|\vec{a}|}$   
 $= \frac{11}{(\sqrt{29})^2} \langle 4, 3, -2 \rangle = \left\langle \frac{44}{29}, \frac{33}{29}, -\frac{22}{29} \right\rangle$

(3 points) e.  $\vec{a} \times \vec{b}$

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 4 & 3 & -2 \\ 5 & -1 & 3 \end{vmatrix} = \hat{i}(9 - 2) - \hat{j}(12 + 10) + \hat{k}(-4 - 15)$$

$$= 7\hat{i} - 22\hat{j} - 19\hat{k}$$

(4 points) 2. Given the parallelogram with points  $P(1,1)$ ,  $Q(3,5)$ ,  $R(6,8)$ ,  $S(4,4)$ . Determine the area of the parallelogram.

$$\vec{PQ} = \langle 2, 4 \rangle$$

$$\vec{PS} = \langle 3, 3 \rangle$$

$$\vec{PQ} \times \vec{PS} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 4 & 0 \\ 3 & 3 & 0 \end{vmatrix}$$

$$= \hat{i}(0-0) - \hat{j}(0-0) + \hat{k}(6-12) \\ = -6\hat{k}$$

$$|\vec{PQ} \times \vec{PS}| = 6$$