MATH 280 – QUIZ #1 **Name:** KEY

Directions: Please show all work to receive maximum credit. This quiz is worth 14 points.

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

(2 points) a. $\vec{a}\cdot\vec{b}$ $= 12-4-4 = 4$

(2 points) b. $\text{proj}_{\vec{a}}\vec{b}$

$$\frac{\vec{a}\cdot\vec{b}}{|\vec{a}|^2}\langle 3,2,-4\rangle \qquad |\vec{a}| = \sqrt{9+4+16} = \sqrt{29}$$

$$\frac{4}{29}\langle 3,2,-4\rangle = \langle \tfrac{12}{29}, \tfrac{8}{29}, -\tfrac{16}{29}\rangle$$

(2 point) c. The area of the parallelogram determined by $\vec{a}$ and $\vec{b}$.

$$\vec{a}\times\vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 2 & -4 \\ 4 & -2 & 1 \end{vmatrix} = \hat{i}(2-8) - \hat{j}(3+16) + \hat{k}(-6-8)$$

$$= -6\hat{i} - 19\hat{j} - 14\hat{k}$$

$$|\vec{a}\times\vec{b}| = \sqrt{(-6)^2+(-19)^2+(-14)^2} = \sqrt{36+361+196} = \sqrt{593} \text{ sq units.}$$

(4 points) 2. Find the parametric form of the equation of a line that passes through the points $P(5,7,-3)$ and $Q(2,-4,9)$.

$\vec{PQ} = \langle -3, -11, 12 \rangle$

$x = 5 - 3t$

$y = 7 - 11t$

$z = -3 + 12t$

(4 points) 3. Find the equations of the plane that passes through the points $P(4,-2,3)$, $Q(1,-3,2)$, and $R(5,2,-3)$.

$\vec{PQ} = \langle -3, -1, -1 \rangle \quad \vec{PR} = \langle 1, 4, -6 \rangle$

$$\vec{PQ} \times \vec{PR} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -3 & -1 & -1 \\ 1 & 4 & -6 \end{vmatrix} = \hat{i}(6+4) - \hat{j}(18+1) + \hat{k}(-12+1)$$

$$= 10\hat{i} - 19\hat{j} - 11\hat{k}$$

$10(x-4) - 19(y+2) - 11(z-3) = 0$

$10x - 40 - 19y - 38 - 11z + 33 = 0$

$10x - 19y + 11z - 45 = 0$