

**MATH 280 – QUIZ #1**

Name: KEY

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

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

(3 points) a.  $\vec{a} \cdot \vec{b} = 4 \cdot 2 + 2(-5) + (-1) \cdot 3$   
 $= 8 - 10 - 3 = -5$

(2 point) b.  $4\vec{a} - 2\vec{b} = 4\langle 4, 2, -1 \rangle - 2\langle 2, -5, 3 \rangle$   
 $= \langle 16, 8, -4 \rangle + \langle -4, 10, -6 \rangle$   
 $= \langle 12, 18, -10 \rangle$

(2 points) c.  $\text{proj}_{\vec{a}} \vec{b} = \left( \frac{\vec{a} \cdot \vec{b}}{|\vec{a}|} \right) \frac{\vec{a}}{|\vec{a}|}$   
 $= \frac{-5}{21} \langle 4, 2, -1 \rangle$   
 $= \left\langle -\frac{20}{21}, -\frac{10}{21}, \frac{5}{21} \right\rangle$

$|\vec{a}| = \sqrt{16 + 4 + 1} = \sqrt{21}$

(3 points) d.  $\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 4 & 2 & -1 \\ 2 & -5 & 3 \end{vmatrix} = \hat{i}(6-5) - \hat{j}(12+2) + \hat{k}(-20-4)$   
 $= \hat{i} - 14\hat{j} - 24\hat{k}$

(2 points) 2. Find the distance between  $P(5, -1, -2)$  and  $Q(7, 3, -5)$ .

$$\begin{aligned}
 d &= \sqrt{(7-5)^2 + (3-(-1))^2 + (-5-(-2))^2} \\
 &= \sqrt{(2)^2 + (4)^2 + (-3)^2} \\
 &= \sqrt{4+16+9} \\
 &= \sqrt{29}
 \end{aligned}$$

(2 points) 3. Find the center and radius of the following sphere:

$$x^2 + y^2 + z^2 - 8x + 2y + 6z + 1 = 0$$

$$x^2 - 8x + y^2 + 2y + z^2 + 6z = -1$$

$$x^2 - 8x + 16 + y^2 + 2y + 1 + z^2 + 6z + 9 = -1 + 16 + 1 + 9$$

$$(x-4)^2 + (y+1)^2 + (z+3)^2 = 25$$

center  $(4, -1, -3)$

radius: 5