

MATH 280 - QUIZ #1

Name: Key

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

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

(3 points) a. $\vec{a} \cdot \vec{b} = -2 \cdot 3 + 4 \cdot 2 + 3 \cdot (-3)$
 $= -6 + 8 - 9 = -7$

(2 point) b. $3\vec{a} - 4\vec{b} = 3\langle -2, 4, 3 \rangle - 4\langle 3, 2, -3 \rangle$
 $= \langle -6, 12, 9 \rangle + \langle -12, -8, 12 \rangle$
 $= \langle -18, 4, 21 \rangle$

(2 points) c. $\text{proj}_{\vec{a}} \vec{b} = \left(\frac{\vec{a} \cdot \vec{b}}{|\vec{a}|^2} \right) \left(\frac{\vec{a}}{|\vec{a}|} \right)$ $|\vec{a}| = \sqrt{4+16+9} = \sqrt{29}$
 $= \left(\frac{-7}{\sqrt{29}} \right) \frac{\langle 2, 4, 3 \rangle}{\sqrt{29}} = \frac{-7}{29} \langle -2, 4, 3 \rangle = \left\langle \frac{14}{29}, \frac{-28}{29}, \frac{-21}{29} \right\rangle$

(3 points) d. $\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -2 & 4 & 3 \\ 3 & 2 & -3 \end{vmatrix} = \hat{i}(-12-6) - \hat{j}(-6-9) + \hat{k}(-4-12)$
 $= -18\hat{i} + 3\hat{j} - 16\hat{k}$

(2 points) 2. Find the distance between $P(4, 2, -5)$ and $Q(3, -1, -4)$.

$$d = \sqrt{(3-4)^2 + (-1-2)^2 + (-4-(-5))^2}$$

$$d = \sqrt{(-1)^2 + (-3)^2 + (1)^2}$$

$$d = \sqrt{1+9+1} = \sqrt{11}$$

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

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

$$x^2 - 8x + 4^2 + 2y + z^2 + 6z = -1$$

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

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

Center: $(4, -1, -3)$

radius: 5