

MATH 280 – QUIZ #1

Name: KEY

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

1. Given $\vec{a} = \langle -5, 4, 3 \rangle$ and $\vec{b} = \langle 4, 6, -2 \rangle$. Determine the following:

(2 points) a. $\vec{a} \cdot \vec{b}$ $-20 + 24 - 6 = -2$

(2 point) b. $5\vec{a} - 3\vec{b}$ $5\langle -5, 4, 3 \rangle - 3\langle 4, 6, -2 \rangle$
 $= \langle -25, 20, 15 \rangle + \langle -12, -18, 6 \rangle$
 $= \langle -37, 2, 21 \rangle$

(2 points) c. $\text{proj}_{\vec{a}} \vec{b}$ $\left(\frac{\vec{a} \cdot \vec{b}}{|\vec{a}|^2} \right) \frac{\vec{a}}{|\vec{a}|}$ $|\vec{a}| = \sqrt{25+16+9} = \sqrt{50} = 5\sqrt{2}$
 $-\frac{2}{50} \langle -5, 4, 3 \rangle = -\frac{1}{25} \langle -5, 4, 3 \rangle$
 $= \langle \frac{1}{5}, -\frac{4}{25}, -\frac{3}{25} \rangle$

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

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -5 & 4 & 3 \\ 4 & 6 & -2 \end{vmatrix} = \hat{i}(-8-18) - \hat{j}(10-12) + \hat{k}(-30-16)$$

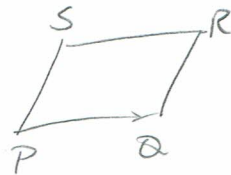
$$= -26\hat{i} + 2\hat{j} - 46\hat{k}$$

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

$$\begin{aligned}
 d &= \sqrt{(-2-3)^2 + (3-1)^2 + (4-(-2))^2} \\
 &= \sqrt{(-5)^2 + (2)^2 + (6)^2} \\
 &= \sqrt{25+4+36} \\
 &= \sqrt{65}
 \end{aligned}$$

(3 points) 3. Given the parallelogram with points $P(1,0,0)$, $Q(2,2,-1)$, $R(3,6,2)$, $S(2,4,3)$. Determine the area of the parallelogram.

$$\begin{aligned}
 \vec{PQ} &= \langle 1, 2, -1 \rangle \\
 \vec{PS} &= \langle 1, 4, 3 \rangle
 \end{aligned}$$



$$\begin{aligned}
 \vec{PQ} \times \vec{PS} &= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & -1 \\ 1 & 4 & 3 \end{vmatrix} = \hat{i}(6-(-4)) - \hat{j}(3-(-1)) + \hat{k}(4-2) \\
 &= 10\hat{i} - 4\hat{j} + 2\hat{k}
 \end{aligned}$$

$$|\vec{PQ} \times \vec{PS}| = \sqrt{100 + 16 + 4} = \sqrt{120} = \sqrt{4 \cdot 30} = 2\sqrt{30}$$

$\sqrt{120}$ square units or $2\sqrt{30}$ square units.