

Quiz #1

1.) $\vec{a} = \langle 3, 5, -2 \rangle$ $\vec{b} = \langle 2, -4, 1 \rangle$

a.) $3\vec{a} - 4\vec{b}$

$= 3\langle 3, 5, -2 \rangle - 4\langle 2, -4, 1 \rangle$

$= \langle 9, 15, -6 \rangle + \langle -8, 16, -4 \rangle = \langle 1, 31, -10 \rangle$

b.) $\vec{a} \cdot \vec{b} = \langle 3, 5, -2 \rangle \cdot \langle 2, -4, 1 \rangle$

$= 6 - 20 - 2 = -16$

c.) $\text{proj}_{\vec{a}} \vec{b} = \frac{\vec{a} \cdot \vec{b}}{|\vec{a}|^2} \vec{a} = \frac{-16}{38} \langle 3, 5, -2 \rangle = -\frac{8}{19} \langle 3, 5, -2 \rangle = \langle -\frac{24}{19}, \frac{40}{19}, \frac{16}{19} \rangle$

$|\vec{a}| = \sqrt{9 + 25 + 4} = \sqrt{38}$

d.) $\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 5 & -2 \\ 2 & -4 & 1 \end{vmatrix} = \hat{i}(5 - 8) - \hat{j}(3 - (-4)) + \hat{k}(-12 - 10)$
 $= -3\hat{i} - 7\hat{j} - 22\hat{k}$

2.) $P(2, 3, -1)$ $Q(5, 4, -6)$

$d = \sqrt{(5-2)^2 + (4-3)^2 + (-6-(-1))^2} = \sqrt{3^2 + 1^2 + (-5)^2}$
 $= \sqrt{9 + 1 + 25} = \sqrt{35}$

3.) $P(5, -4, 2)$ $Q(3, 1, -4)$ $\vec{PQ} = \langle -2, 5, -6 \rangle$

$x = 5 - 2t$

$y = -4 + 5t$

$z = 2 - 6t$

4.) $P(4, 1, 3)$ $Q(5, 2, -4)$ $R(3, -1, 2)$ $\vec{PQ} = \langle 1, 1, -7 \rangle$ $\vec{PR} = \langle -1, -2, -1 \rangle$

$\vec{PQ} \times \vec{PR} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 1 & -7 \\ -1 & -2 & -1 \end{vmatrix} = \hat{i}(-1 - 14) - \hat{j}(-1 - 7) + \hat{k}(-2 - (-1))$
 $= -15\hat{i} + 8\hat{j} - \hat{k}$

$-15(x-4) + 8(y-1) - 1(z-3) = 0$ $-15x + 80y - z + 55 = 0$

$15x + 60 + 80y - 8 - z + 3 = 0$