Quiz 1, Calculus III

Fall 2012

8:20
8:25
5 min.

Name: Key

P Q

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

R

$\vec{PQ} = \langle -1, 2, 3 \rangle$

$\vec{PR} = \langle -2, -1, -4 \rangle$

$$\begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -1 & 2 & 3 \\ -2 & -1 & -4 \end{vmatrix}$$

$\vec{PQ} \times \vec{PR} = -8\vec{i} - 6\vec{j} + \vec{k} + 3\vec{i} - 4\vec{j} + 4\vec{k}$

$= \langle -5, -10, 5 \rangle$ ✓✓✓

$\Rightarrow 0 = -5(x-2) - 10(y-1) + 5(z-5)$ ✓

$$0 = -5x - 10y + 5z - 5$$

2. (3 points) For each of the following, state if the expression gives a vector, a scalar, or does not exist. Assume that $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$ are all nonzero vectors.

(i) $(\mathbf{u} \times \mathbf{v}) \times \mathbf{w}$ vector

(ii) $(\mathbf{u} \cdot \mathbf{v}) \cdot \mathbf{w}$ does not exist (scalar · vector makes no sense)

(iii) $(\mathbf{u} \cdot \mathbf{v})\mathbf{w}$ vector

(iv) $(\mathbf{u} \cdot \mathbf{v}) \times \mathbf{w}$ does not exist (scalar × vector makes no sense)

(v) $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}$ scalar

3. (3 points) Let $\mathbf{u} = \langle 1, 0, 2 \rangle$, $\mathbf{v} = \langle 3, 1, -2 \rangle$, and $\mathbf{w} = \langle 0, 4, 1 \rangle$. Calculate numbers (iv) and (v) from question 2, assuming they exist (Hint: one of them exists and the other does not).

(iv) does not exist

(v) is the triple scalar product

$$\begin{vmatrix} 1 & 0 & 2 \\ 3 & 1 & -2 \\ 0 & 4 & 1 \end{vmatrix}$$

$1 + 0 + 24 + 8 - 0 - 0 = \boxed{33}$