MATH 213 – QUIZ 5 – 28 FEBRUARY 2012

Answer the following question in the space provided. Show all work as partial credit may be given. Answers without justification, even if they are correct, will earn no credit. This quiz is worth 5 points.

Find an equation of the plane passing through the points $(-1,1,-2)$, $(-1,3,-3)$ *and* $(-1,3,0)$. *Make sure your answer is in the form* $ax+by+cz=d$.

Find normal vector:

$P=(-1,1,-2)$ $Q=(-1,3,-3)$ $R=(-1,3,0)$

$\vec{n}=\vec{PQ}\times\vec{QR}$ will work

$$\vec{PQ}\times\vec{QR}=\begin{vmatrix}\vec{i} & \vec{j} & \vec{k}\\ 0 & 2 & -1\\ 0 & 0 & 3\end{vmatrix}=\begin{vmatrix}2 & -1\\ 0 & 3\end{vmatrix}\vec{i}-\begin{vmatrix}0 & -1\\ 0 & 3\end{vmatrix}\vec{j}+\begin{vmatrix}0 & 2\\ 0 & 0\end{vmatrix}\vec{k}$$

$=6\vec{i}$ (take $\vec{n}=\vec{i}$ for convenience)

Find a point on the plane: take $P=(-1,1,-2)$ (or any of the other points given)

Equation of plane:

$1(x+1)+0(y-1)+0(z+2)=0$

$x+1=0$

$\boxed{x=-1}$

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Find an equation of the plane passing through the points $(0, 2, -2)$, $(-1, 4, -3)$ *and* $(1, 0, 3)$. *Make sure your answer is in the form* $ax + by + cz = d$.

Find normal vector:

$P=(0,2,-2)$ $Q=(-1,4,-3)$ $R=(1,0,3)$

$\vec{n} = \vec{PQ} \times \vec{QR}$ will work

$$\vec{PQ} \times \vec{QR} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -1 & 2 & -1 \\ 2 & -4 & 6 \end{vmatrix} = \begin{vmatrix} 2 & -1 \\ -4 & 6 \end{vmatrix}\vec{i} - \begin{vmatrix} -1 & -1 \\ 2 & 6 \end{vmatrix}\vec{j} + \begin{vmatrix} -1 & 2 \\ 2 & -4 \end{vmatrix}\vec{k}$$

$= 8\vec{i} + 4\vec{j}$ (take $\vec{n} = 2\vec{i} + \vec{j}$ for convenience.)

Find point on plane: take $P=(0,2,-2)$
(could take any of the others for example)

Equation of plane:

$2(x-0) + 1(y-2) + 0(z+2) = 0$

$2x + y - 2 = 0$

$$\boxed{2x + y = 2}$$

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Answer the following question in the space provided. Show all work as partial credit may be given. Answers without justification, even if they are correct, will earn no credit. This quiz is worth 5 points.

Find an equation of the plane passing through the points $(-4,1,1)$, $(-1,2,4)$ *and* $(0,3,1)$. *Make sure your answer is in the form* $ax+by+cz=d$.

Find normal vector:

$P=(-4,1,1)$ $Q=(-1,2,4)$ $R=(0,3,1)$

$\vec{n} = \vec{PQ} \times \vec{QR}$ will work.

$$\vec{PQ} \times \vec{QR} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 3 & 1 & 3 \\ 1 & 1 & -3 \end{vmatrix} = \begin{vmatrix} 1 & 3 \\ 1 & -3 \end{vmatrix}\vec{i} - \begin{vmatrix} 3 & 3 \\ 1 & -3 \end{vmatrix}\vec{j} + \begin{vmatrix} 3 & 1 \\ 1 & 1 \end{vmatrix}\vec{k}$$

$= -6\vec{i} + 12\vec{j} + 2\vec{k}$ (take $\vec{n} = -3\vec{i} + 6\vec{j} + \vec{k}$ for convenience)

Find point on plane: take $P=(-4,1,1)$

(could take any of the other points instead.)

Equation of plane

$-3(x+4)+6(y-1)+1\cdot(z-1)=0$

$-3x+6y+z-12-6-1=0$

$$\boxed{-3x+6y+z=19}$$