Math 241, Fall 1999, Final Exam

PRINT Your Name:_____

There are 22 problems on 11 pages. Problems 1 through 4 are each worth 6 points. Problems 5 through 22 are each worth 7 points. The exam is worth a total of 150 points. SHOW your work. CIRCLE your answer. **NO CALCULATORS!**

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1. **(There is no partial credit for this problem. Make sure your answer is correct.)** Find the equation of the plane through $(1,2,3)$, $(2,0,2)$, and $(-3,1,1)$.

$P=$ $Q=$

$$\overrightarrow{PQ}\times\overrightarrow{PR}=\begin{vmatrix}\vec{i}&\vec{j}&\vec{k}\\1&-2&-1\\-4&-1&-2\end{vmatrix}=\begin{vmatrix}-2&-1\\-1&-2\end{vmatrix}\vec{i}-\begin{vmatrix}1&-1\\-4&-2\end{vmatrix}\vec{j}+\begin{vmatrix}1&-2\\-4&-1\end{vmatrix}\vec{k}=+3\vec{i}+6\vec{j}-9\vec{k}$$

The plane through $(2,0,2)$ $\perp$ $+\vec{i}+2\vec{j}-3\vec{k}$ is $(x-2)+2y-3(z-2)=0$

$$\boxed{x+2y-3z+4=0}$$

Check at $(1,2,3)$: $1+4-9+4=0$ ✓

at $(2,0,2)$ $2+0-6+4=0$ ✓

at $(-3,1,1)$ $-3+2-3+4=0$ ✓

2. **(There is no partial credit for this problem. Make sure your answer is correct.)** Find the equations of the line through $(5,4,2)$ and $(3,4,7)$.

$P=$ $Q=$

$$\overrightarrow{PQ}=-2\vec{i}+0\vec{j}+5\vec{k}$$

The line through P and $\parallel$ to $\overrightarrow{PQ}$ is

$$\begin{cases}x=5-2t\\y=4\\z=2+5t\end{cases}$$

at time $t=0$ this line hits P

at time $t=1$ this line hits $x=3$, $y=4$, $z=7$ which is Q