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

My plane contains P and is $\perp$ $\overrightarrow{PQ}\times\overrightarrow{PR} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & -2 & 1 \\ 1 & 1 & -1 \end{vmatrix} = \vec{i}\begin{vmatrix} -2 & 1 \\ 1 & -1 \end{vmatrix} - \vec{j}\begin{vmatrix} 1 & 1 \\ 1 & -1 \end{vmatrix} + \vec{k}\begin{vmatrix} 1 \\ 1 \end{vmatrix}$

$= \vec{i} + 2\vec{j} + 3\vec{k}$

My plane is $(x-1)+2(y-2)+3(z-1)=0$

$x+2y+3z=8$

verify P is on this plane ✓
Q is on this plane ✓
R is on this plane ✓

5. Let $\vec{a} = 2\vec{i} + 3\vec{j} + \vec{k}$ and $\vec{b} = 2\vec{i} - \vec{j} + 4\vec{k}$. Find the angle between $\vec{a}$ and $\vec{b}$.

$\vec{a}\cdot\vec{b} = \|\vec{a}\|\,\|\vec{b}\|\cos\theta$

$4-3+4 = \sqrt{14}\,\sqrt{21}\,\cos\theta$

$\cos^{-1}\left(\frac{5}{\sqrt{14}\,\sqrt{21}}\right) = \theta$

6. **(There is no partial credit for this problem. Make sure your answer is correct.)** Find the equations of the line which contains $P=(1,2,3)$ and $(-4,2,0)=Q$

My line contains P and is $\parallel$ to $\overrightarrow{PQ} = -5\vec{i} - 3\vec{k}$

My line is

$x = 1-5t$
$y = 2$
$z = 3-3t$

verify P is on my line ✓
Q is on my line ✓