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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 $\underset{P}{(1,1,1)}$, $\underset{Q}{(2,2,3)}$, and $\overset{R}{(3,5,6)}$.

$$\vec{PQ} \times \vec{PR} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & 1 & 2 \\ 2 & 4 & 5 \end{vmatrix} = -3\vec{i} - \vec{j} + 2\vec{k}$$

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

$$-3x - y + 2z = -2$$

$$3x + y - 2z = 2$$

check $3+1-2=2$ ✓ P works

$6+2-6=2$ ✓ Q works

$9+5-12=2$ ✓ R works

5. Let $\vec{a} = 2\vec{i} + 3\vec{j}$ and $\vec{b} = 8\vec{i} - 2\vec{j} + 3\vec{k}$. Compute $\vec{a} \times \vec{b}$.

$$\begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 2 & 3 & 0 \\ 8 & -2 & +3 \end{vmatrix} = 9\vec{i} - 6\vec{j} - 28\vec{k}$$

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

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

$$\cos\theta = \frac{\vec{a} \cdot \vec{b}}{\|\vec{a}\| \, \|\vec{b}\|} = \frac{6-4}{\sqrt{9+4}\,\sqrt{4+4+9}}$$

$$\theta = \cos^{-1}\left(\frac{2}{\sqrt{13}\,\sqrt{17}}\right)$$