Please PRINT your name _____

No calculators, cell phones, computers, notes, etc.

Circle your answer. Make your work correct, complete and coherent.

The quiz is worth 5 points. The solutions will be posted on my website later today.

Quiz 4, January 29, 2020

Find a vector perpendicular to the plane containing $P = (1, -1, 2)$, $Q = (2, 0, -1)$, and $R = (0, 2, 1)$.

ANSWER: The vector $\overrightarrow{PQ} \times \overrightarrow{PR}$ is perpendicular to the plane containing P, Q, and R. We compute

$$\overrightarrow{PQ} \times \overrightarrow{PR} = (\overrightarrow{i} + \overrightarrow{j} - 3\overrightarrow{k}) \times (-\overrightarrow{i} + 3\overrightarrow{j} - \overrightarrow{k})$$

$$= \begin{vmatrix} \overrightarrow{i} & \overrightarrow{j} & \overrightarrow{k} \\ 1 & 1 & -3 \\ -1 & 3 & -1 \end{vmatrix} = \begin{vmatrix} 1 & -3 \\ 3 & -1 \end{vmatrix} \overrightarrow{i} - \begin{vmatrix} 1 & -3 \\ -1 & -1 \end{vmatrix} \overrightarrow{j} + \begin{vmatrix} 1 & 1 \\ -1 & 3 \end{vmatrix} \overrightarrow{k} = \boxed{8\overrightarrow{i} + 4\overrightarrow{j} + 4\overrightarrow{k}}.$$

We check that $8\overrightarrow{i} + 4\overrightarrow{j} + 4\overrightarrow{k}$ is perpendicular to $(\overrightarrow{i} + \overrightarrow{j} - 3\overrightarrow{k})$. The dot product of these vectors is $8 + 4 - 12 = 0\checkmark$. We check that $8\overrightarrow{i} + 4\overrightarrow{j} + 4\overrightarrow{k}$ is perpendicular to $(-\overrightarrow{i} + 3\overrightarrow{j} - \overrightarrow{k})$. The dot product of these vectors is $-4 - 8 + 12 = 0.\checkmark$