Please PRINT your name _____

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

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

Please take a picture of your quiz (for your records) just before you turn the quiz in. I will e-mail your grade and my comments to you. I will return your quiz when I next see you.

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

Math 241, Quiz 4, February 3, 2025

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

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

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

The vector

$$8\overrightarrow{i} + 4\overrightarrow{j} + 4\overrightarrow{k}$$

is perpendicular to the plane containing P, Q, and R. The vector

$$\boxed{\frac{1}{\sqrt{8^2 + 4^2 + 4^2}} (8\overrightarrow{i} + 4\overrightarrow{j} + 4\overrightarrow{k})}$$

is a unit vector perpendicular to the plane containing P, Q, and R.