

To receive full credit, you must show all work.

Question 1 [5 points] Given the points $P = (2, 1, 0)$ and $Q = (-1, 2, 4)$, find a *unit* vector that points in the opposite direction as \overrightarrow{PQ} .

Question 2 [5 points] For which value(s) of t are the vectors $(t - 2)\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ and $t\mathbf{i} + (t - 5)\mathbf{j} - 5\mathbf{k}$ orthogonal?

Question 3 [5 points] Find the equation of the plane containing the point $(3, 2, 1)$ and the line $\mathbf{l}(t) = (0, 1, -1) + t(-2, 1, 2)$.

Question 4 [5 points] Do the two lines $\mathbf{l}_1(t) = (\frac{8}{3}, \frac{1}{3}, 2) + t(1, 2, 3)$ and $\mathbf{l}_2(t) = (4, -2, -\frac{2}{3}) + t(-1, 1, 1)$ intersect? If so, where?