Quiz 4

Name:

Problem 1(5 points): The following equation

$$x^2 + y^2 + z^2 - 6x + 4y - 2z + 10 = 0$$

generates a sphere in 3D. Find the center and radius of that sphere.

Solution:

$$x^2 - 6x + 9 + y^2 + 4y + 4 + z^2 - 2z + 1 = -10 + 9 + 4 + 1$$
$$(x-3)^2 + (y+2)^2 + (z-1)^2 = 4$$

So the center is at $(3, -2, 1)$ and $r = 2$

Problem 2 (5 points): Let $\mathbf{u} = \mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ and $\mathbf{v} = -4\mathbf{i} + 2\mathbf{j} - \mathbf{k}$. Compute

$$\text{proj}_{\mathbf{u}}\mathbf{v}.$$

Solution:

$$\begin{aligned}
\text{proj}_{\mathbf{u}}\mathbf{v} &= \frac{uv}{|u|^2}u \\
&= \frac{1(-4) + (-2)(2) + 3(-1)}{(\sqrt{1^2 + (-2)^2 + 3^2})^2}\langle 1, -2, 3\rangle \\
&= \frac{-11}{14}\langle 1, -2, 3\rangle \\
&= \left\langle \frac{-11}{14}, \frac{11}{7}, \frac{-33}{14} \right\rangle
\end{aligned}$$