

Name: _____

Directions: Show all work. No credit for answers without work.

1. [**2 points**] Find an equation of the sphere that passes through the point $(4, 3, -1)$ and has center $(3, 8, 1)$.

2. [**2 points**] Find the angle between $2\vec{i} - 3\vec{j} + 5\vec{k}$ and $4\vec{i} + 2\vec{j} + 1\vec{k}$ in radians and degrees.

3. [**2 points**] Which of the following expressions are meaningful, and which are meaningless? Circle the expressions that are meaningful. Here, \vec{a} , \vec{b} , and \vec{c} are all vectors in \mathbb{R}^3 .

(a) $(\vec{a} \cdot \vec{b}) \cdot \vec{c}$

(b) $(\vec{a} \cdot \vec{b})\vec{c}$

(c) $|\vec{a}|(\vec{b} \cdot \vec{c})$

(d) $\vec{a} \cdot (\vec{b} + \vec{c})$

(e) $\vec{a} \cdot \vec{b} + \vec{c}$

(f) $|\vec{a}| \cdot (\vec{b} + \vec{c})$

4. [**2 points**] Find a vector orthogonal to both $\langle 1, -2, 4 \rangle$ and $\langle 3, 1, -1 \rangle$.
5. [**2 points**] Find the area of the triangle PQR with vertices $P(2, 0, 4)$, $Q(1, -1, -2)$, and $R(3, 1, 5)$.