1. Consider two vectors $\vec{v} = -\vec{i} - \vec{j} + 3\vec{k}$ and $\vec{w} = 0\vec{i} + 2\vec{j} + \vec{k}$. Decompose $\vec{v}$ into two vectors $\vec{a}$ and $\vec{b}$ such that $\vec{v} = \vec{a} + \vec{b}$, with $\vec{a}$ parallel to $\vec{w}$ and $\vec{b}$ perpendicular to $\vec{w}$.

2. Find the distance between $(-2, 4, 1)$ and the plane $2x - y + 3z + 2 = 0$ (you may not simply plug in into a formula, you need to show a reasoning).

3. Show that
$$\underbrace{\left\| \frac{\vec{v}}{\|\vec{v}\|} \times \frac{\vec{w}}{\|\vec{w}\|} \right\|^2}_{\text{“first expression”}} + \underbrace{\left(\frac{\vec{v}}{\|\vec{v}\|} \cdot \frac{\vec{w}}{\|\vec{w}\|} \right)^2}_{\text{“second expression”}} = 1.$$
In your own words, explain why the first expression has $\| \quad \|$, but the second expression only has parentheses.