1. For any *unit* vectors $\vec{a}$ and $\vec{b}$, find the dot product of $(\vec{a} + \sqrt{3}\ \vec{b})$ and $(\vec{a} - \sqrt{3}\ \vec{b})$. Show all your work. *[2 points]*

2. For each of the following, answer **True** or **False**. Provide a brief justification for your answer. *[2 points each].*

   (a) If $\vec{p}$ is perpendicular to $\vec{q}$ and $\vec{r}$, then $\vec{p}$ is perpendicular to $5\ \vec{q} - \frac{1}{2}\ \vec{r}$.

   (b) Suppose that $\|\vec{u}\| = 3$ and $\|\vec{v}\| = 2$. The minimum possible value of $\|\vec{u} - \vec{v}\| + \vec{u} \cdot \vec{v}$ is achieved when $\vec{u}$ is perpendicular to $\vec{v}$.

3. Find unit vectors $\vec{a}$ and $\vec{b}$ that are perpendicular to $(2, -1, 0)$ and to each other. Show all your work. *[3 points]*

4. Fill in the blank below. Provide a brief justification for your answer. *[1 point]*

   All possible linear combinations of $\vec{a} = (1, 1, 1)$, $\vec{b} = (1, 2, -1)$ and $\vec{c} = (0, 1, -2)$ fill

   _____.
   (your answer should be one of the following: a line, a plane, or three-dimensional space)