Quiz 1

Name: ~KEY~

Throughout, let $\mathbf{u} = \langle 2, 3, 1 \rangle$, $\mathbf{v} = \langle -1, -1, -2 \rangle$, and $\mathbf{w} = \langle 0, 1, 1 \rangle$.

1. Find the position vector $\mathbf{a}$ (i.e. the vector $\mathbf{a}$ with initial point at the origin) with representation given by the directed line segment $\overrightarrow{AB}$ between the points $A(0, 3, 1)$ and $B(2, 3, -1)$.

$$\vec{a} = \langle 2-0, 3-3, -1-1 \rangle = \langle 2, 0, -2 \rangle.$$

2. Determine whether each of the following exists. If it *does* exist, compute it (writing vectors with respect to $\mathbf{i}$, $\mathbf{j}$, and $\mathbf{k}$); if not, state why.

(a) $\mathbf{u} + \mathbf{w}$

$$2\vec{i} + 4\vec{j} + 2\vec{k}$$

(b) $|\mathbf{v}| + \mathbf{w}$

Does not exist (Can't add scalar to vector)

(c) $(\mathbf{u} + \mathbf{w}) \cdot (\mathbf{u} + \mathbf{w})$

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(d) $\text{proj}_{\mathbf{u}}\, \mathbf{v}$

$$-\vec{i} - \frac{3}{2}\vec{j} - \frac{1}{2}\vec{k}$$

(e) The unit vector in the same direction as $(\mathbf{u} \cdot \mathbf{v})\, \mathbf{w}$.

$$= \frac{(\vec{u}\cdot\vec{v})\vec{w}}{|(\vec{u}\cdot\vec{v})\vec{w}|} = 0\vec{i} - \frac{1}{\sqrt{2}}\vec{j} - \frac{1}{\sqrt{2}}\vec{k}$$

(f) $\mathbf{v} + \langle -3, \frac{1}{2} \rangle$

Does not exist (vectors have diff dimensions)

(g) The angle between $\mathbf{v}$ and the z-axis. **Hint**: Any position vector in the direction of the z-axis may be used.

$=$ angle between $\vec{v}$ & $\vec{k} = \langle 0, 0, 1 \rangle$

$$= \arccos\left(-\sqrt{\frac{2}{3}}\right)$$

3. Draw a rectangular box with the origin and the point $P(1,2,3)$ as opposite vertices and with its faces parallel to the coordinate planes. Label all vertices of the box. **Note**: The arrowheads are pointing towards the *positive* values on each axis!