Exercise 1 *Suppose that* $\vec{\mathbf{u}} = \langle 0, -1, 3\rangle$ *and* $\vec{\mathbf{v}} = \langle -1, 2, 0\rangle$. *Find a vector* $\vec{\mathbf{w}}$ *with a positive* y*-component of magnitude* 7 *that is parallel to* $\vec{\mathbf{u}} + 2\vec{\mathbf{v}}$.

$$\vec{\mathbf{w}} = \left\langle \boxed{\frac{-14}{\sqrt{22}}}, \boxed{\frac{21}{\sqrt{22}}}, \boxed{\frac{21}{\sqrt{22}}} \right\rangle$$

Hint: *To begin, let's find a vector in the same direction as* $\vec{\mathbf{u}} + 2\vec{\mathbf{v}}$. *Using the rules of addition and scalar multiplication, we find:*

$$\vec{\mathbf{u}} + 2\vec{\mathbf{v}} = \left\langle \boxed{-2}, \boxed{3}, \boxed{3} \right\rangle$$

How should we proceed?

Multiple Choice:

(a) *Multiply this result by* 7; *that is,* $\vec{\mathbf{w}} = \langle -14, 21, 21\rangle$.

(b) *Find the magnitude of* $\langle -2, 3, 3\rangle$ *and scale it appropriately if necessary.* ✓

We compute:

$$\left|\vec{\mathbf{u}} + 2\vec{\mathbf{v}}\right| = \sqrt{\left(\boxed{-2}\right)^2 + \left(\boxed{3}\right)^2 + \left(\boxed{3}\right)^2} = \sqrt{\boxed{22}}$$

(type the components in the order of $\vec{\mathbf{u}} + 2\vec{\mathbf{v}}$*)*

A unit vector in the direction of $\vec{\mathbf{w}}$ *is thus* $\dfrac{\vec{\mathbf{u}} + 2\vec{\mathbf{v}}}{\left|\vec{\mathbf{u}} + 2\vec{\mathbf{v}}\right|}$, *so:*

$$\hat{\mathbf{w}} = \left\langle \boxed{\frac{-2}{\sqrt{22}}}, \boxed{\frac{3}{\sqrt{22}}}, \boxed{\frac{3}{\sqrt{22}}} \right\rangle$$

and $\vec{\mathbf{w}} = \boxed{7}\,\hat{\mathbf{w}}$.