Exercise 1 *Suppose that* $\vec{\mathbf{u}} = \langle -1, 2, 2\rangle$ *and* $\vec{\mathbf{v}} = \langle -2, 0, 1\rangle$. *Find a vector* $\vec{\mathbf{w}}$ *of magnitude* 4 *that is parallel to* $2\vec{\mathbf{u}} - 3\vec{\mathbf{v}}$.

$$\vec{\mathbf{w}} = \left\langle \boxed{\frac{16}{\sqrt{33}}}, \boxed{\frac{16}{\sqrt{33}}}, \boxed{\frac{4}{\sqrt{33}}} \right\rangle$$

Hint: *To begin, let's find a vector in the same direction as* $2\vec{\mathbf{u}} - 3\vec{\mathbf{v}}$. *Using the rules of addition and scalar multiplication, we find:*

$$2\vec{\mathbf{u}} - 3\vec{\mathbf{v}} = \left\langle \boxed{4}, \boxed{4}, \boxed{1} \right\rangle$$

How should we proceed?

Multiple Choice:

(a) *Multiply this result by* 4*; that is,* $\vec{\mathbf{w}} = \langle 16, 16, 4\rangle$.

(b) *Find the magnitude of* $\langle 4, 4, 1\rangle$ *and scale it appropriately if necessary.* ✓

We compute:

$$|2\vec{\mathbf{u}} - 3\vec{\mathbf{v}}| = \sqrt{\left(\boxed{4}\right)^2 + \left(\boxed{4}\right)^2 + \left(\boxed{1}\right)^2} = \sqrt{\boxed{33}}$$

(type the components in the order of $2\vec{\mathbf{u}} - 3\vec{\mathbf{v}}$*)*

A unit vector in the direction of $\vec{\mathbf{w}}$ *is thus* $\dfrac{2\vec{\mathbf{u}} - 3\vec{\mathbf{v}}}{\left|2\vec{\mathbf{u}} - 3\vec{\mathbf{v}}\right|}$, *so:*

$$\hat{\mathbf{w}} = \left\langle \boxed{\frac{4}{\sqrt{33}}}, \boxed{\frac{4}{\sqrt{33}}}, \boxed{\frac{1}{\sqrt{33}}} \right\rangle$$

and $\vec{\mathbf{w}} = \boxed{4}\hat{\mathbf{w}}$.