

22. $\mathbf{a} + \mathbf{b} = \langle 8 + 5, 1 + (-2), -4 + 1 \rangle = \langle 13, -1, -3 \rangle$

$$4\mathbf{a} + 2\mathbf{b} = 4\langle 8, 1, -4 \rangle + 2\langle 5, -2, 1 \rangle = \langle 32, 4, -16 \rangle + \langle 10, -4, 2 \rangle = \langle 42, 0, -14 \rangle$$

$$|\mathbf{a}| = \sqrt{8^2 + 1^2 + (-4)^2} = \sqrt{81} = 9$$

$$|\mathbf{a} - \mathbf{b}| = |\langle 8 - 5, 1 - (-2), -4 - 1 \rangle| = |\langle 3, 3, -5 \rangle| = \sqrt{3^2 + 3^2 + (-5)^2} = \sqrt{43}$$

23. The vector $\langle 6, -2 \rangle$ has length $|\langle 6, -2 \rangle| = \sqrt{6^2 + (-2)^2} = \sqrt{40} = 2\sqrt{10}$, so by Equation 4 the unit vector with the same direction is $\frac{1}{2\sqrt{10}} \langle 6, -2 \rangle = \left\langle \frac{3}{\sqrt{10}}, -\frac{1}{\sqrt{10}} \right\rangle$.

24. The vector $-5\mathbf{i} + 3\mathbf{j} - \mathbf{k}$ has length $|-5\mathbf{i} + 3\mathbf{j} - \mathbf{k}| = \sqrt{(-5)^2 + 3^2 + (-1)^2} = \sqrt{35}$, so by Equation 4 the unit vector with the same direction is $\frac{1}{\sqrt{35}}(-5\mathbf{i} + 3\mathbf{j} - \mathbf{k}) = -\frac{5}{\sqrt{35}}\mathbf{i} + \frac{3}{\sqrt{35}}\mathbf{j} - \frac{1}{\sqrt{35}}\mathbf{k}$.

25. The vector $8\mathbf{i} - \mathbf{j} + 4\mathbf{k}$ has length $|8\mathbf{i} - \mathbf{j} + 4\mathbf{k}| = \sqrt{8^2 + (-1)^2 + 4^2} = \sqrt{81} = 9$, so by Equation 4 the unit vector with the same direction is $\frac{1}{9}(8\mathbf{i} - \mathbf{j} + 4\mathbf{k}) = \frac{8}{9}\mathbf{i} - \frac{1}{9}\mathbf{j} + \frac{4}{9}\mathbf{k}$.

26. $|\langle 6, 2, -3 \rangle| = \sqrt{6^2 + 2^2 + (-3)^2} = \sqrt{49} = 7$, so a unit vector in the direction of $\langle 6, 2, -3 \rangle$ is $\mathbf{u} = \frac{1}{7} \langle 6, 2, -3 \rangle$.

A vector in the same direction but with length 4 is $4\mathbf{u} = 4 \cdot \frac{1}{7} \langle 6, 2, -3 \rangle = \left\langle \frac{24}{7}, \frac{8}{7}, -\frac{12}{7} \right\rangle$.