Extra Practice for Section IV: Chapter 1

1. Suppose that $\vec{v} = \langle -3, 7 \rangle$ and $\vec{w} = \langle 2, 10 \rangle$.

a. Express $\vec{v}$ and $\vec{w}$ using unit vectors.

b. Find $\|\vec{v}\|$ and $\|\vec{w}\|$.

c. Find $2\vec{v} - 5\vec{w}$.

Click here to see the solution to **1.**

2. Suppose that $\vec{m} = 7\vec{i} - 4\vec{j}$ and $\vec{n} = -5\vec{i} - 2\vec{j}$.

a. Express $\vec{m}$ and $\vec{n}$ using "pointy vector brackets" (i.e., $\langle a, b \rangle$).

b. Find $\|\vec{m}\|$ and $\|\vec{n}\|$.

c. Find $3\vec{m} - \vec{n}$.

Click here to see the solution to **2.**

3. a. Suppose that $\|\vec{p}\| = 34$ and that $\vec{p}$ makes an angle of 150° with the positive x-axis. Find the components of $\vec{p}$ in order to express $\vec{p}$ using both "pointy vector brackets" and unit vectors.

b. Suppose that the tail (or initial point) of $\vec{q}$ is $(2, -3)$ and the tip (or terminal point) is $(-4, 7)$. Find the components of $\vec{q}$ in order to express $\vec{q}$ using both "pointy vector brackets" and unit vectors.

Click here to see the solution to **3.**

Solution to **1.**

1. Suppose that $\vec{v} = \langle -3, 7 \rangle$ and $\vec{w} = \langle 2, 10 \rangle$.

a. Express $\vec{v}$ and $\vec{w}$ using unit vectors.

$$\vec{v} = \langle -3, 7 \rangle = -3\vec{i} + 7\vec{j} \quad \text{and} \quad \vec{w} = \langle 2, 10 \rangle = 2\vec{i} + 10\vec{j}$$

b. Find $\|\vec{v}\|$ and $\|\vec{w}\|$.

$$\|\vec{v}\| = \sqrt{(-3)^2 + (7)^2} = \sqrt{9 + 49} = \sqrt{58} \quad \text{and} \quad \|\vec{w}\| = \sqrt{(2)^2 + (10)^2} = \sqrt{104} = 2\sqrt{26}$$

c. Find $2\vec{v} - 5\vec{w}$.

$$\begin{aligned} 2\vec{v} - 5\vec{w} &= 2 \cdot \langle -3, 7 \rangle - 5 \cdot \langle 2, 10 \rangle \\ &= \langle -6, 14 \rangle - \langle 10, 50 \rangle \\ &= \langle -6 - 10, 14 - 50 \rangle \\ &= \langle -16, -36 \rangle \end{aligned}$$

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Solution to **2.**

2. Suppose that $\vec{m} = 7\vec{i} - 4\vec{j}$ and $\vec{n} = -5\vec{i} - 2\vec{j}$.

a. Express $\vec{m}$ and $\vec{n}$ using "pointy vector brackets" (i.e., $\langle a, b \rangle$).

$$\vec{m} = 7\vec{i} - 4\vec{j} = \langle 7, -4 \rangle \quad \text{and} \quad \vec{n} = -5\vec{i} - 2\vec{j} = \langle -5, -2 \rangle$$

b. Find $\|\vec{m}\|$ and $\|\vec{n}\|$.

$$\|\vec{m}\| = \sqrt{(7)^2 + (-4)^2} = \sqrt{49 + 16} = \sqrt{65} \quad \text{and} \quad \|\vec{n}\| = \sqrt{(-5)^2 + (-2)^2} = \sqrt{25 + 4} = \sqrt{29}$$

c. Find $3\vec{m} - \vec{n}$.

$$\begin{aligned} 3\vec{m} - \vec{n} &= 3\left(7\vec{i} - 4\vec{j}\right) - \left(-5\vec{i} - 2\vec{j}\right) \\ &= 21\vec{i} - 12\vec{j} + 5\vec{i} + 2\vec{j} \\ &= 26\vec{i} - 10\vec{j} \end{aligned}$$

(Note that we could have used "pointy vector brackets" here but we've chosen to use unit vectors since that's how the vectors are defined in the question. Unless directed to use a specific notation, it's best to mimic the notation used in the question.)

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Solution to **3.**

3. **a.** Suppose that $\|\vec{p}\| = 34$ and that $\vec{p}$ makes an angle of 150° with the positive x-axis. Find the components of $\vec{p}$ in order to express $\vec{p}$ using both "pointy vector brackets" and unit vectors.

$$\begin{aligned}\vec{p} &= \left\langle \|\vec{p}\|\cos(150^\circ), \|\vec{p}\|\sin(150^\circ) \right\rangle \\ &= \left\langle 34\cdot\left(-\frac{\sqrt{3}}{2}\right), 34\cdot\left(\frac{1}{2}\right) \right\rangle \\ &= \left\langle -17\sqrt{3}, 17 \right\rangle \\ &= -17\sqrt{3}\,\vec{i} + 17\vec{j}\end{aligned}$$

b. Suppose that the tail (or initial point) of $\vec{q}$ is $(2, -3)$ and the tip (or terminal point) is $(-4, 7)$. Find the components of $\vec{q}$ in order to express $\vec{q}$ using both "pointy vector brackets" and unit vectors.

$$\begin{aligned}\vec{q} &= \left\langle -4 - 2, 7 - (-3) \right\rangle \\ &= \left\langle -6, 10 \right\rangle \\ &= -6\vec{i} + 10\vec{j}\end{aligned}$$

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