Math2210 Quiz 2 (Sections 11.2, 11.3) Summer, 2008 Dylan Zwick

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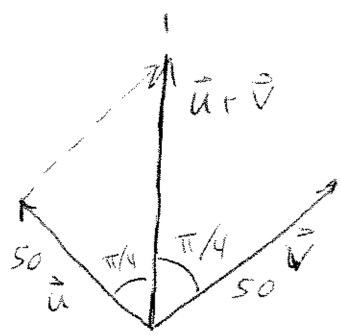
Instructions: Please show all of your work as partial credit will be given where appropriate, **and** there may be no credit given for problems where there is no work shown. All answers should be completely simplified, unless otherwise stated.

1. Force $\boldsymbol{u}$ has a magnitude of 50 pounds and a direction of N $\frac{\pi}{4}$ W. Force $\boldsymbol{v}$ has a magnitude of 50 pounds and a direction of N $\frac{\pi}{4}$ E. Find the magnitude and direction (geometrically) of the force $\boldsymbol{w}$ needed to counterbalance $\boldsymbol{u}$ and $\boldsymbol{v}$. (Just write answers in as simplified a form as you can without a calculator.)



$\vec{w} = -(\vec{u}+\vec{v})$

$|\vec{w}| = |\vec{u}+\vec{v}| = \sqrt{50^2+50^2} = 50\sqrt{2}$

$\vec{u}+\vec{v}$ points N

so, $\vec{w}$ points S.

magnitude of $\boldsymbol{w}$: $50\sqrt{2}$

direction of $\boldsymbol{w}$: S (South)

2. For $\boldsymbol{u}=\langle -1,3,2\rangle$ and $\boldsymbol{v}=4\boldsymbol{i}+5\boldsymbol{j}-2\boldsymbol{k}$.

(a) find $\boldsymbol{u}-3\boldsymbol{v}$.

$\langle -1,3,2\rangle - 3\langle 4,5,-2\rangle$

$= \langle -1-12, 3-15, 2+6\rangle$

$= \langle -13, -12, 8\rangle$

$\boldsymbol{u}-3\boldsymbol{v}$ = $\langle -13,-12,8\rangle$ or $-13\hat{i}-12\hat{j}+8\hat{k}$

(b) find $\hat{\boldsymbol{u}}$.

$$\hat{u} = \frac{\langle -1,3,2\rangle}{\sqrt{(-1)^2+3^2+2^2}} = \frac{\langle -1,3,2\rangle}{\sqrt{14}} = \left\langle -\frac{1}{\sqrt{14}}, \frac{3}{\sqrt{14}}, \frac{2}{\sqrt{14}} \right\rangle$$

$\hat{\boldsymbol{u}}$ = $\left\langle -\frac{1}{\sqrt{14}}, \frac{3}{\sqrt{14}}, \frac{2}{\sqrt{14}} \right\rangle$

3. Find the projection of <1, 5, -4> onto the vector <2, 0, -1>

$$\vec{u} = \langle 1, 5, -4 \rangle$$
$$\vec{v} = \langle 2, 0, -1 \rangle$$

$$\vec{u} \cdot \vec{v} = 2 \cdot 1 + 5 \cdot 0 + (-1) \cdot (-4) = 6$$
$$\vec{v} \cdot \vec{v} = 2 \cdot 2 + 0 \cdot 0 + (-1) \cdot (-1) = 5$$

So,

$$\text{proj}_{\vec{u}}(\vec{v}) = \left(\frac{\vec{u} \cdot \vec{v}}{\vec{v} \cdot \vec{v}} \right) \vec{v} = \frac{6}{5} \langle 2, 0, -1 \rangle$$

$$= \left\langle \frac{12}{5}, 0, -\frac{6}{5} \right\rangle$$

projection: $\left\langle \frac{12}{5}, 0, -\frac{6}{5} \right\rangle$

4. Circle all of the following statements that do not make sense.

(a) $\boldsymbol{u} \cdot (\boldsymbol{v} + \boldsymbol{w})$

(b) $|\boldsymbol{u}| \cdot (\boldsymbol{v} + \boldsymbol{w})$

(c) $(\boldsymbol{u} \cdot \boldsymbol{v})|\boldsymbol{w}|$ ← nevermind! It makes sense.

(d) $(\boldsymbol{u} + \boldsymbol{v})\boldsymbol{w}$

So, b) and d) do not make sense.