Math 2153 – January 21, 2016 Full Name: _____

Quiz 1

1. *(1 point)* Decide if the following statement is true or false. **You do NOT need to justify your answer.**

(T) F If $\mathbf{u} = \langle u_1, u_2, u_3 \rangle$ is a nonzero vector then $\text{proj}_{\mathbf{u}}\, \mathbf{u} = \mathbf{u}$.

$\text{proj}_{\vec{u}} \vec{u} = \frac{\vec{u}\cdot\vec{u}}{|\vec{u}|} \cdot \frac{\vec{u}}{|\vec{u}|} = \frac{|\vec{u}|^2}{|\vec{u}|^2}\vec{u} = \vec{u}$ TRUE

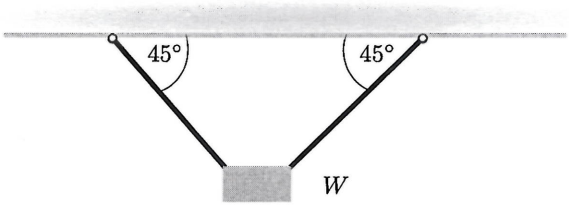
2. *(1 point)* Give a concrete example of a vector $\mathbf{u} = \langle u_1, u_2 \rangle$ satisfying $\mathbf{u} \cdot \mathbf{u} = 4$. **You do NOT need to simplify your answer.**

$\vec{u}\cdot\vec{u} = |\vec{u}|^2$ must equal 4 so $|\vec{u}| = 2$

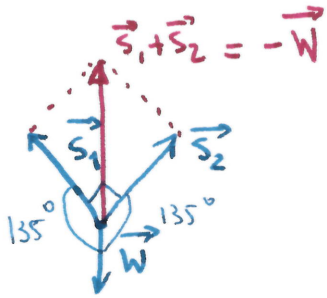
so $\vec{u} = \langle a, b \rangle$ satisfies $a^2 + b^2 = 4$, pick $a = 0$, $b = 2$

$\vec{u} = \langle 0, 2 \rangle$ is an example

3. *(3 points)* A weight is suspended from the ceiling by two strings as pictured below. If each string can support a maximum tension of 10 lbs., what is the maximum weight W that this configuration can support before at least one string breaks?



Weight vector $= \vec{W} = W\langle 0, -1 \rangle$ Need to find



$\vec{S}_1 + \vec{S}_2 = -W\langle 0, -1 \rangle$

$-\vec{S}_1 = 10 \langle \cos 45°, -\sin 45° \rangle = 10 \langle \frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2} \rangle$

$\Rightarrow \vec{S}_1 = \langle -\sqrt{2}\cdot 5, \sqrt{2}\,5 \rangle$

Similarly $= -\vec{S}_2 = 10 \langle -\cos 45°, -\sin 45° \rangle = -10 \langle \frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \rangle$

$\Rightarrow \vec{S}_2 = \langle \sqrt{2}\cdot 5, \sqrt{2}\cdot 5 \rangle$

So $W\langle 0, 1 \rangle = \vec{S}_1 + \vec{S}_2 = \langle 0, \sqrt{2}\cdot 10 \rangle \Rightarrow \boxed{W = \sqrt{2}\cdot 10}$