Math 143 Set 12

1. Do the following operations on the vectors $\mathbf{u} = \langle 3, 1, 2\rangle$, $\mathbf{v} = \langle 2, 0, -1\rangle$, and $\mathbf{w} = \langle 1, 1, 1\rangle$:

a. Find the cross products $\mathbf{u} \times \mathbf{v}$ and $\mathbf{v} \times \mathbf{u}$.

b. $|\mathbf{u} \times (2\mathbf{v} - \mathbf{w})|$.

c. Find two unit vectors in a direction orthogonal to both $\mathbf{u}$ and $\mathbf{v}$.

2. Find the cross product of $\langle t, t^2, t^3\rangle$ and $\langle 1, 2t, 3t^2\rangle$ and show that it is orthogonal to both vectors.

3. Find all vectors $\mathbf{u}$ and $\mathbf{v}$ such that

$$|\mathbf{u} \times \mathbf{v}| = \mathbf{u} \cdot \mathbf{v}.$$

4. Let $\mathbf{u}, \mathbf{v}, \mathbf{w}$ be vectors. Which of these operations make sense?

a. $(\mathbf{u} \cdot \mathbf{v}) \cdot \mathbf{w}$

b. $(\mathbf{u} \cdot \mathbf{v})\mathbf{w}$

c. $(\mathbf{u} \cdot \mathbf{v})|\mathbf{w}|$

d. $(\mathbf{u} \cdot \mathbf{v}) + \mathbf{w}$

e. $(\mathbf{u} + \mathbf{v}) \cdot \mathbf{w}$

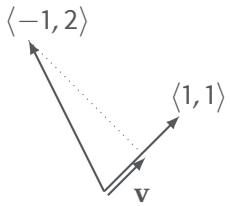
f. $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}$

g. $(\mathbf{u} \times \mathbf{v}) \times \mathbf{w}$

h. $(\mathbf{u} \cdot \mathbf{v}) \times \mathbf{w}$

5. Show, for any vectors $\mathbf{u}, \mathbf{v}$ in $\mathbb{R}^3$, $(\mathbf{v} \times \mathbf{u}) \cdot \mathbf{u} = 0$.

6. Find the vector $\mathbf{v}$ depicted here:



7. The vector $\mathbf{v}$ below is a unit vector and the vector $\mathbf{w}$ is in the direction of $\langle -1, 3\rangle$. What is $\mathbf{w}$?