MAT 301
Homework # 7
Due: Friday, December 8th, 2017

Directions: Write careful solutions to each of the following problems on separate sheets of paper. (You may put more than one solution on the same sheet of paper, if you have enough room). Be sure to show all of your work. You are allowed to talk to your classmates about these problems. If you do receive help from a classmate, be sure to give them credit by noting their name on your solution. All solutions should be written in your own words, regardless of if you've received help. Partial credit is available. Each problem is worth five points.

1. Let $\vec{u} = \langle -1, 5 \rangle$ and $\vec{v} = \langle 2, -6 \rangle$ be vectors in $\mathbb{R}^2$. Find each of the following:

   (a) $3\vec{u} - 2\vec{v}$

   (b) $||\vec{v}||$

   (c) A unit vector parallel to $\vec{u}$.

   (d) The angle between $\vec{u}$ and $\vec{v}$

   (e) The projection of $\vec{u}$ onto $\vec{v}$

2. Let $\vec{u} = \langle -2, 1, 4 \rangle$ and $\vec{v} = \langle 1, 3, -5 \rangle$ be vectors in $\mathbb{R}^3$. Find each of the following:

   (a) $\vec{u} \cdot \vec{u}$

   (b) The vector component of $\vec{u}$ along $\vec{v}$.

   (c) The vector component of $\vec{u}$ orthogonal to $\vec{v}$.

   (d) $\vec{u} \times \vec{v}$

   (e) The area of the parallelogram spanned by $\vec{u}$ and $\vec{v}$.

3. Find the volume of the parallelpiped having $\vec{u} = \langle 3, -5, 1 \rangle$, $\vec{v} = \langle 0, 2, -2 \rangle$, and $\vec{w} = \langle 3, 1, 1 \rangle$ as adjacent edges.

4. Use property 4 from Theorem 12.2 (p.826) to prove property 7 from Theorem 12.2.

Theorem. *The distance between a point Q and a line in space is*

$$D = \frac{||\vec{PQ} \times \boldsymbol{u}||}{||\boldsymbol{u}||}$$

where $\boldsymbol{u}$ is a direction vector for the line and P is a point on the line.

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5. Use the theorem above to find the distance between the point $Q = (3, -1, 4)$ and the line given by

$$x = -2 + 3t, \qquad y = -2t, \qquad \text{and} \qquad z = 1 + 4t$$