# Homework I First-Half

## Due in class July 11 2017

0. Read The Following Sections:

Chapter 10. Vectors and the Geometry of Space: Section 10.1 Three-Dimensional Coordinate Systems, 10.2 Vectors, 10.3 The Dot Product

1. Show that the equation represents a sphere, and find its center and radius:
$$x^2 + y^2 + z^2 - 2x - 4y + 8z = 15$$

2. Sketch the surface in the $xyz$-coordinate space $\mathbb{R}^3$ represented by
$$x + y = 1$$

3. compute $2\vec{u} - 3\vec{v}$ where $\vec{u} =< 3, -2, 5 >$ and $\vec{v} =< -1, 4, 3 >$

4. Find a unit vector that has the opposite direction as $\vec{v} =< 2, 2, -1 >$

5. $\vec{v} =< -6, 12, -2 >$. Find $\lambda, \mu, \eta$ such that $\vec{v} = \lambda\vec{a} + \mu\vec{b} + \eta\vec{c}$, where $\vec{a} =< 1, 1, -1 >$, $\vec{b} =< 1, -1, 1 >$, $\vec{c} =< -1, 1, 1 >$

6. Prove the following two vectors are orthogonal:
$$\vec{u} =< -5, 3, 6 >, \vec{v} =< 6, -8, 9 >$$

7. Find an unit vector that makes an angle of $\frac{\pi}{3}$ with $\vec{v} =< 1, \sqrt{3}, -2\sqrt{3} >$ and perpendicular to $\vec{k} =< 0, 0, 1 >$.

8. Find the scalar projection and vector projection of $\vec{v} =< 1, 2, 3 >$ onto $\vec{u} =< 3, 6, -2 >$

9. Show that if $\vec{u} + \vec{v}$ and $\vec{u} - \vec{v}$ are orthogonal, then $|\vec{u}| = |\vec{v}|$