Homework 1, due Tuesday, September 5th in class.

(1) Find the center and radius of the sphere $x^2 + y^2 + z^2 = x + y + z$.

(2) Find the largest sphere contained in the first octant (i.e. $x \geq 0$, $y \geq 0$, $z \geq 0$) with center $(5, 4, 3)$.

(3) Compute the sum of the vectors $(-1, -1)$ and $(2, 3)$, and illustrate this sum geometrically.

(4) Find the angle between the vectors $(0, 1, 1)$ and $(1, 0, 1)$.

(5) Find a unit vector that is orthogonal to both $\vec{i} + \vec{j}$ and $\vec{i} + \vec{k}$. (Here $\vec{i}$ is an older notation for the unit vector $(1, 0, 0)$, likewise $\vec{j} = (0, 1, 0)$ and $\vec{k} = (0, 0, 1)$.)

(6) For $\vec{a} = (1, 0, 0)$, $\vec{b} = (1, 1, 0)$, and $\vec{c} = (1, 1, 1)$, compute the following quantities if they have meaningful answers.

(a) $\vec{a} \times (\vec{b} \times \vec{c})$

(b) $(\vec{a} \cdot \vec{b}) \times (\vec{a} \cdot \vec{c})$

(c) $(\vec{a} \cdot \vec{b})\ \vec{c}$

(d) $(\vec{a} \times \vec{b}) \cdot (\vec{a} \times \vec{c})$

(e) $\vec{a} \cdot (\vec{b} \times \vec{c})$

(f) $\vec{a} \times (\vec{b} \cdot \vec{c})$

(7) Find an implicit equation for the plane that contains the point $(2, 0, -1)$ and which has normal vector $2\vec{j} + \vec{k}$.

(8) Find an implicit equation for the plane that contains the points $(1, 1, 0)$, $(1, 0, 1)$, and $(0, 1, 1)$.

(9) Compute the projection of the vector $(1, 1, 1)$ onto the direction of the vector $(2, 0, 0)$.