Math 304 (Spring 2015) - Homework 7

Problem 1.
Find the angle between the vectors $\vec{x} = (1, 1, 1)$ and $\vec{y} = (1, 0, 1)$. (You can express your answer in terms of $\arccos\theta$.)

Problem 2.
Let V be the subspace of $\mathbb{R}^3$ spanned by $v_1 = (1, 0, 1)$ and $v_2 = (1, 0, 0)$. Find a basis of $V^\perp$.

Problem 3.
Suppose W is a subspace of $\mathbb{R}^n$. Show that $W^\perp$ is also a subspace of $\mathbb{R}^n$.

Problem 4.
Let $v = (1, 2, -2, 0)$ and $w = (2, 0, 3, 1)$ in $\mathbb{R}^4$.

(a) Find the scalar projection of v onto w.

(b) Find the vector projection of v onto w.

Problem 5.

(a) Find the distance between the point $(2, 3, 4)$ and the plane

$$x + y + z = 3$$

(b) Recall that we use three equations to describe a line in $\mathbb{R}^3$. For example a line that passes through the point $(1, -1, 5)$ with the direction $\vec{v} = (2, 3, 4)$ is given by

$$x = 2t + 1, \quad y = 3t - 1, \quad z = 4t + 5.$$

Now given two lines

$$L_1 : x = t + 1,\ y = 3t + 1,\ z = 2t - 1,$$

and

$$L_2 : x = 2t - 2,\ y = 2t + 3,\ z = t + 1,$$

suppose a plane H is parallel to both L_1 and L_2. Moreover, H passes through the point $(0, 1, 0)$. Find the equation of the plane H.