Math 13 Fall 2009 Homework 1

Due Friday October 2, 2009 in class.

1) Show that the area of the parallelogram spanned by $\vec{a}$ and $\vec{b}$ is given by: 
$$\sqrt{||\vec{a}||^2 ||\vec{b}||^2 - (\vec{a} \cdot \vec{b})^2}$$

Show that the formula holds both for vectors in $\mathbb{R}^2$ and in $\mathbb{R}^3$, depending on how you approach the problem you might have to treat the two cases separately.

2) Show that any three vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ satisfy:

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

3.) Page 839, Number 64

Find the parametric equations for the line through the point $(0, 1, 2)$ that is perpendicular to the line $x = 1 + t$, $y = 1 - t$, $z = 2t$ and intersects this line.

4.) Page 821, Number 42

The vector $orth_a b = b - proj_a b$ is called the Orthogonal Projection of $b$ with respect to $a$. It is not hard to check that $orth_a b$ is orthogonal to $a$ (see problem 41 on page 821 in the text). For the vectors $a = \langle 1, 2 \rangle$ and $b = \langle -4, 1 \rangle$ find $orth_a b$ and illustrate (the relationship between these vectors) by drawing the vectors $a$, $b$, $proj_a b$ and $orth_a b$. 