Honors Advanced Math **Name**_____
Practice Test: Vectors **April, 2013**

General instructions: *Write a complete, fully explained solution to each problem, except where directions say otherwise. The quality of your responses will be a factor in grading. Decimal answers are acceptable unless otherwise stated and should be given to two decimal places.*

Cross Product Formula:

$$\langle a,b,c\rangle \times \langle d,e,f\rangle = \langle bf - ce, cd - af, ae - bd\rangle$$

1. The equations of two lines are given below.

$$l_1 : (x,y,z) = (3,-4,0) + \langle 2,1,-2\rangle t$$
$$l_2 : (x,y,z) = (-2,1,-7) + \langle 3,-1,1\rangle s$$

a. Find the coordinates of the point where the two lines intersect.

b. Find the angle formed by the two lines. Give your answer as a decimal in degrees.

2. The equations of two lines are given below. (These are the same lines as problem 1).

$$l_1 : (x,y,z) = (3,-4,0) + \langle 2,1,-2 \rangle t$$

$$l_2 : (x,y,z) = (-2,1,-7) + \langle 3,-1,1 \rangle s$$

Find the distance between the plane formed by the two lines and the point $(9,19,16)$. Leave the answer in an exact form.

3. The goal of this problem is to demonstrate some of the properties of the cross product. Suppose **v** and **w** are vectors in 3 dimensions.

a. Show that $\mathbf{v} \times \mathbf{w}$ is perpendicular to both **v** and **w**.

b. You are trying to show that $|\mathbf{v} \times \mathbf{w}|$ is equal to the area of the parallelogram formed by **v** and **w**. Suppose you have already established that $|\mathbf{v} \times \mathbf{w}|^2 = |\mathbf{v}|^2 |\mathbf{w}|^2 - (\mathbf{v} \cdot \mathbf{w})^2$. Finish the proof.

4. Consider the triangle formed by the following three points: $A = (2,-4,1)$, $B = (5,0,-2)$, and $C = (1,2,-1)$.

a. Without using Hero's formula, find the area of ΔABC. Give your answer as a decimal.

b. The centroid of a triangle is a point two thirds of the way from one corner of the triangle to the midpoint of the opposite side. Find the coordinates of the centroid of ΔABC.

5. The goal of this problem is to find the distance between a line and a plane.

Line: $(x,y,z) = \langle 2,5,4 \rangle t + (1,5,-3)$

Plane: $3x + 2y - 4z = -4$

a. Show that the line and the plane are parallel. ***Hint:*** Prove that they do not intersect.

b. Find the distance between the line and the plane. You may give your answer as a decimal rounded to two places.