Math 335-002 * Spring 2015
Homework #1
Due date: Thursday, January 29, 2015

Please show all work in detail to receive full credit

1. For $\vec{\mathbf{a}}$ = (1, -1, 1) and $\vec{\mathbf{b}}$ = (0, 2, 1), find the area of the triangle formed by these two vectors, and find the projection of $\vec{\mathbf{a}}$ onto the direction of $\vec{\mathbf{b}}$.

2. Problem 31, page 30: An airplane is located at position (3,4,5) km at noon and traveling with velocity 400**i** + 500**j** – **k** (in units of km/hr). The pilot spots an airport at position (23, 29, 0) km.

a. At what time is the plane directly over the airport?

b. How high above the airport will the plane be when it passes it?

Hint: write down the parametric equation of line describing the position of the airplane, $\vec{\mathbf{r}}(t)$; this will make the task much easier.

3. Find the equation of the plane that is perpendicular to, and cuts in half, the line connecting points P(3, 2,−4) and Q(0, 4,−1) (Hint: use the provided information to find the normal to this plane, $\vec{\mathbf{n}}$, and a point in this plane, $\vec{\mathbf{r}}_o$, and write down the equation of plane in the form $\vec{\mathbf{n}} \cdot \left(\vec{\mathbf{r}} - \vec{\mathbf{r}}_o \right) = 0$. Then, take the dot product to arrive at the final expression in the form $ax + by + cz = d$

4. Draw any two non-zero vectors $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ that satisfy the condition $|\vec{\mathbf{a}} - \vec{\mathbf{b}}|^2 = |\vec{\mathbf{a}}|^2 + |\vec{\mathbf{b}}|^2$ (hint: first, write the left-hand side of this expression as a dot product and expand to see what condition the two vectors have to satisfy).

5. Expand and/or simplify the following expressions (use the distributive property and other properties of the dot and cross vector products):

a) $|\vec{\mathbf{a}} \times \vec{\mathbf{b}}|^2 + (\vec{\mathbf{a}} \cdot \vec{\mathbf{b}})^2$
b) $(\vec{\mathbf{a}} + \vec{\mathbf{b}}) \times (\vec{\mathbf{a}} - \vec{\mathbf{b}})$
c) $(\vec{\mathbf{a}} + \vec{\mathbf{b}}) \cdot (\vec{\mathbf{a}} - \vec{\mathbf{b}})$