Homework and Quiz 5

Due Wednesday, July 1, 2009

Ungraded homework

Remember, the midterm will be on Monday, July 6, 2009. Make sure you are well-prepared to perform all the tasks on the review sheet.

Graded Quiz

(a) Suppose P_1 and P_2 are both planes through the origin, with normal vectors n_1 and n_2, respectively. Find a point besides the origin which is contained in both P_1 and P_2. *Hint:* find the point in terms of n_1 and n_2.

(b) Let $v = (1, 2, 3)$ and $w = (4, 5, 6)$. Can you write $(7, 8, 9)$ as

$$\alpha \cdot v + \beta \cdot w,$$

and if you can, do so. Can you do it in more than one way?

(c) Let u, v, w be vectors in $\mathbb{R}^3$, and $t \in \mathbb{R}$. Find the first and second derivative of the vector-valued function

$$f(t) = u \times (v + tw).$$

(d) Consider the vector-valued functions

$$\begin{aligned} f(t) &= (t, t^2, t^3) \text{ and} \\ g(t) &= (t, t, t). \end{aligned}$$

The graphs of these functions intersect at $(1, 1, 1)$; find the cosine of the angle at which they intersect.

(e) Consider three planes P_1, P_2, P_3 which pairwise intersect. Name the three lines of intersection as follows:

$$L_{1,2} = P_1 \cap P_2, \quad L_{2,3} = P_2 \cap P_3, \quad L_{1,3} = P_1 \cap P_3.$$

Can you choose the three planes so that $L_{1,2}$ and $L_{2,3}$ are skew? Can you choose the three planes so that $L_{1,2}$, $L_{2,3}$, and $L_{1,3}$ all intersect in a common point?