Math 241 F1H, Prof. Hildebrand, Spring 2014
Written HW Assignment 2, DUE IN CLASS MONDAY, 2/3/2014

- Use this sheet as cover sheet and staple it to the assignment. Do the problems in order. Make sure that each problem is clearly labelled. Allow plenty of space for the problems.

- Write-up: Write legibly, use proper mathematical notation, show all work, and provide explanations where appropriate (especially in problems asking you to “show” or “prove” something). You will get points off if your writing is poorly legible, or if you don’t provide adequate explanation. (If you are unsure what is considered adequate, just ask!) Make sure to distinguish vectors from scalars through the arrow notation and indicate dot and cross products by clearly visible dot (•) and cross (×) symbols. E.g., write \( \vec{a} \) instead of \( a \) if you mean a vector, and write \( \vec{a} \times \vec{b} \) and \( \vec{a} \cdot \vec{c} \) to denote cross and dot products. Expressions like \( \vec{a} \vec{b} \), \( \vec{b} \vec{c} \), \( \vec{a}^2 \) do not make sense in a vector context; you will get points off if you use such nonsensical notations.

- Group work policy: For the regular written homework (such as this one), working with another student, or in a small group is fine and, indeed, encouraged, provide (i) you write up solutions yourself, using your own words, and (ii) you indicate the names of the student(s) you worked with on the cover sheet. NOTE: This applies only to regular (i.e., non-honors) homework; for Honors Homework assignments no collaboration or group work is allowed. (The first Honors HW will be given out later this week.)

- Open House: Sundays at 2 pm in 159 Altgeld (or an adjacent classroom if this room is taken). The Open House is intended as an informal office hour, and place to meet, for students in my classes. I’d be happy to look over your work (e.g., to see if the explanations are enough), provide hints if you get stuck on a problem, and answer questions on the course material. I am also free right after class; just get a hold of me after class. (On Tuesdays/Thursdays, there is another class right after ours, so we’ll have to move to an adjacent room or talk in the hallway. On Mondays/Wednesdays there is no class after ours (I believe), so we can stay in our classroom.)

Problems

The problems in this assignment all involve computations of distances of various kinds (point to line, point to plane, etc.). Distance in this context always means the shortest distance; for example, the distance between a given point and a plane is the shortest distance between this point and a point on the plane.

The purpose of the assignment is to develop the geometric intuition for doing such problems, so that you can apply the same ideas in other contexts. Figure 12 and Example 8 in 12.5 illustrate this geometric approach (using scalar projections and normal vectors). Do the problems below using a similar geometric approach. In each case, draw a picture of the situation, indicate the relevant points and vectors in that picture, and then use the picture to compute the distance.

The book gives formulas for such distances (such as (9) in 12.5). Do not use these formulas, since that would completely defeat the purpose of this assignment. You don’t need to know any of these distance formulas in exams, and memorizing them would be a waste of time. However, you do need to know the geometric ideas that are behind these formulas and you need to be able to apply such ideas to other situations; this assignment is intended to practice those geometric ideas and methods.

1. 12.4:45. (Distance between point and line.)
2. 12.5:71. (Distance between point and plane.)
3. 12.5:73. (Distance between two parallel planes.)
4. 12.5:78. (Distance between two skew lines.)

If you worked with another student or in a small group on this assignment, list the names of all students involved.