Name:
Collaborator(s)¹:

Math 241 F1H, Prof. Hildebrand, Spring 2014
Written HW Assignment 1, DUE IN CLASS THURSDAY, 1/30/2014

- **Use this sheet as cover sheet and staple it to the assignment.** Allow plenty of space for the problems; you’ll need at least half a page for the first 3 problems, and one or two pages for Problem 4.

- **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 \( \vec{a} \bullet \vec{c} \) to denote cross and dots 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 and Wednesdays at 8 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.

**Problems**

1. **12.1:40.** (An interesting application of the distance formula.)

2. **12.2:51.** (Using vectors to prove a geometric property of triangles.)

3. **12.3:48.** (Switching \( \vec{a} \) and \( \vec{b} \) in formulas for scalar/vector projections.)

4. **True/False questions about dot and cross products.** These questions probe your understanding of basic properties of dot and cross products. You must explain your answer; an answer alone won’t earn credit. If the statement is TRUE, explain clearly why (e.g., by citing appropriate properties of dot or cross products). If the statement is FALSE, give a specific counterexample; that is find explicit vectors \( \vec{a}, \vec{b}, \vec{c} \), for which the equality is not true.

(a) (12.4:53(a)) Suppose \( \vec{a} \neq \vec{0} \). If \( \vec{a} \bullet \vec{b} = \vec{a} \bullet \vec{c} \), then \( \vec{b} = \vec{c} \).

(b) (12.4:53(b)) Suppose \( \vec{a} \neq \vec{0} \). If \( \vec{a} \times \vec{b} = \vec{a} \times \vec{c} \), then \( \vec{b} = \vec{c} \).

(c) For any vectors \( \vec{a}, \vec{b}, \vec{c} \) in \( \mathbb{R}^3 \), \( \vec{a} \bullet (\vec{b} \times \vec{c}) = \vec{c} \bullet (\vec{a} \times \vec{b}) \).

(d) For any vectors \( \vec{a}, \vec{b}, \vec{c} \) in \( \mathbb{R}^3 \), \( (\vec{a} \times \vec{b}) \bullet \vec{a} = 0 \).

(e) For any vectors \( \vec{a}, \vec{b}, \vec{c} \) in \( \mathbb{R}^3 \), \( (\vec{a} + \vec{b}) \times \vec{b} = \vec{a} \times \vec{b} \).

(f) The cross product of two unit vectors is always a unit vector.

¹If you worked with another student or in a small group on this assignment, list the names of all students involved.