Math 251:1-2-3 **Workshop Problems #1** **February 9, 2010**

1. Find equations for two orthogonal planes both of which contain the line $\mathbf{v} = (1,0,3) + t(-1,2,1)$, one of which passes through the origin.

2.* Suppose that $\vec{v}$ is a vector in $\mathbb{R}^3$ which is not the zero vector.

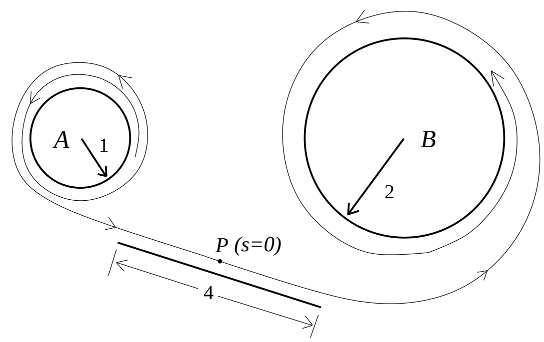
a) If $\vec{v} \cdot \vec{w} = \vec{v} \cdot \vec{q}$, must it be true that $\vec{w} = \vec{q}$?

b) If $\vec{v} \times \vec{w} = \vec{v} \times \vec{q}$, must it be true that $\vec{w} = \vec{q}$?

c) If $\vec{v} \cdot \vec{w} = \vec{v} \cdot \vec{q}$ and $\vec{v} \times \vec{w} = \vec{v} \times \vec{q}$, must it be true that $\vec{w} = \vec{q}$?

3. Is the point (1,2,3) on a tangent line of the twisted cubic $\mathbf{c}(t) = (t, t^2, t^3)$?

4. A point is moving along the curve below in the direction indicated. Its motion is parameterized by arc length, s, so that it is moving at unit speed. Arc length is measured from the point P (both backward and forward). The curve is intended to continue indefinitely both forward and backward in s, with its forward motion curling more and more tightly around the indicated circle, B, and, backward, curling more and more tightly around the other circle, A. Near P the curve is parallel to the indicated line segment. Sketch a graph of the curvature, κ, as a function of the arc length, s. What are $\lim_{s\to+\infty} \kappa(s)$ and $\lim_{s\to-\infty} \kappa(s)$? Explain your graph and the numbers you give.



One problem will be selected for a writeup to be handed in at the next recitation meeting. Please see Professor Greenfield's Math 251 webpage to learn which problem to hand in.

Your workshop writeup will be read either by the lecturer or the recitation instructor. Grading will be on a 10 point scale: 5 points for mathematical content and 5 points for exposition which should be in *complete English sentences.* Neatness counts! Further explanation of what is desired will be linked to the course webpage.

* This problem resembles problems in several textbooks.