Quiz 1

Advanced Computer Graphics II

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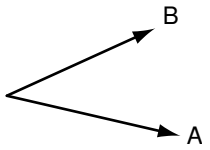
1. (**20 points**) Suppose $\vec{A}$ and $\vec{B}$ are both non-zero vectors. Let $\vec{A} = \{a_x, a_y, a_z\}$ and $\vec{B} = \{b_x, b_y, b_z\}$. Further, let θ be the angle between them ($0 \leq \theta \leq \pi$). Write an expression for each of the following in terms of a_x, a_y, a_z, b_x, b_y, and b_z:

   (Note: To simplify the expressions, intermediate variables are allowed.)

   a.) $\sin\theta$ b.) $\vec{A} \cdot \vec{B}$

   c.) $\cos\theta$ d.) $\vec{A} \times \vec{B}$

2. (**10 points**) Let $\vec{C} = \vec{A} \times \vec{B}$. In the following diagram, is $\vec{C}$ pointing into or out of the page (assuming a right-hand coordinate system)?



3. (**10 points**) Write the matrix corresponding to the following system of equations:

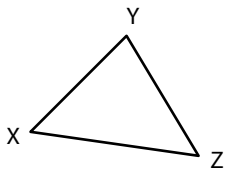
$$\begin{array}{rcrcrcr} 7x & - & 10y & & & = & -2 \\ 4x & & & + & 2z & = & 2 \\ & & 9y & + & 2z & = & 13 \end{array}$$

4. (**30 points**) Let $\vec{X}$ and $\vec{Y}$ be unit vectors, with ϕ the acute angle between them ($0 \leq \phi < \frac{\pi}{2}$). Which of the following are always true?

   a.) $\vec{X} \cdot \vec{Y} = \cos\phi$ b.) $\vec{X} \cdot \vec{Y} < 0$ c.) $\|\vec{X} \times \vec{Y}\| < 1$

   d.) $\|\vec{X} \times \vec{Y}\| < \cos\phi$ e.) $\vec{X} \cdot \vec{Y} > 0$ f.) $\vec{X} \cdot \vec{Y} \leq 1$

5. (**10 points**) Suppose X, Y, and Z are the vertices of a triangle (as in the digram below). Let $\vec{e_1} = Y - X$ and $\vec{e_2} = Y - Z$. Give an expression for X using only $\vec{e_1}$, $\vec{e_2}$, and Z.



6. (**20 points**) Let $\vec{A} = \{2, -2, 3\}$ and $\vec{B} = \{-3, 12, 4\}$. Compute the following:

   a.) $\vec{A} \cdot \vec{B}$ c.) $\|\vec{A} + \vec{B}\|$

   b.) $\vec{A} \times \vec{B}$ d.) $\|\vec{B}\|$