# Quiz #1 - CSU540 Computer Graphics - Spring 2005

# Professor Futrelle

Given on February 1st 2005

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## Linear Algebra and Geometric Transformations

Put your answers and all your calculations in your Blue Book. No calculator is needed or should be used. For example, a value such as $\sqrt{2}$ should be kept in that form and certainly not written down as 1.41421356237309504880, etc. In drawing diagrams based on such values, a reasonable approximation suffices.

For convenience in writing out your answers, vectors can be written in row format, as [x,y] or [x,y,z], and for homogeneous coordinates too, in contrast to the book's column format.

When you are asked to do a transformation step-by-step, write, draw and, comment on the results of each step.

1. Draw the vectors A = [8,0], B = [0,6] and the sum C = A + B. Using the coordinates of C, compute its length.

2. As in Problem 1, but draw and compute the difference, C - B.

3. Write out the normalized form of the vector [3,4] and show how you computed it.

4. Write out the general form of the rotation matrix R for $\theta = 3\pi/4$. You might want to plot the functions $\sin\theta$ and $\cos\theta$ from $\theta=0$ to $\theta=2\pi$ to be sure you're using the correct values.

5. Write out the rotation matrix R2 for $\theta=-\pi/2$. Apply R2 to the endpoints of the line segment from [3,3] to [5,5]. Does the result agree with what you'd expect intuitively? Explain.

6. Write out the 3x3 translation matrix Td for a translation by [tx,ty]. By multiplying out the components, show in general that the product of Td and Td produces a translation of twice the extent.

7. Write out the 3D transform for $+\pi$ rotation around the z axis Apply it to the point [7,9,14]. Explain why you expected the result you obtained.

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