CMSC 23700	**Introduction to Computer Graphics**	**Homework 3**
Winter 2010		**Due February 11**

For these questions, you may assume exact real arithmetic (*i.e.*, you do not need to worry about floating-point errors).

1. Let $\mathbf{M} = \begin{bmatrix} & \mathbf{N} & \\ 0 & 0 & 0 & 1 \end{bmatrix}$ be a 4×4 matrix. Show that $\mathbf{M}\langle x, y, z, 1\rangle^{\mathrm{T}}$ is the same as $\mathbf{M}\langle hx, hy, hz, h\rangle^{\mathrm{T}}$ after homogenization.

2. Suppose you have an application with a near plane of 10 meters, a far plane of 100 kilometers (10^5 meters), and a minimum feature size of 1 meter. How many bits of Z-buffer do you need to avoid Z-fighting? What if the near plane is at 1 meter?

3. Assume that we are approximating the circle defined by $x^2 + y^2 - r^2 = 0$ and $z = d$ (in eye space) by a hexagon. If the focal length is e, what is the maximum error in the radius of the approximation in projection-space coordinates.