Lecture 7: Viewing – Review Questions

- Explain the difference in OpenGL between the modelView matrix, set with glMatrixMode(GL_MODELVIEW), and the projection matrix, set with glMatrixMode(GL_PROJECTION). What transforms are represented by these matrices?
- Derive matrices to do the following:
    - Transform from a canonical view volume bounded by 3D points [1,1,1] and [-1,-1,-1] to a 2D viewing rectangle of size nx pixels by ny pixels, having its origin at the 2D point [-0.5, -0.5]
    - Transform from an aligned orthographic view volume defined by left, right, top, bottom, near, and far parameter values to the canonical view volume. The expression 'aligned orthographic view volume' means that the view volume is aligned with the xyz coordinate frame, and the camera is at the origin, pointing along the –z direction.
    - Transform from an arbitrary orthographic view volume to the aligned orthographic view volume. For this step, the orthographic view volume is aligned with some right handed coordinate frame uvw. The camera can be located anywhere, and it is pointing in the –w direction.
    - Transform from a perspective projection view frustrum to an orthographic view volume.
- Given these four transformation matrices, what is the sequence of operations that are required to transform arbitrary x,y,z points into pixel locations for orthographic projection? ..for perspective projection? (Don't forget to do perspective division .. to divide by the homogeneous coordinate.)
- Bonus: Suppose we do not clip geometry at the near and far clipping planes. Given a perspective projection with camera at the origin, pointing along the –z direction, describe how an infinite line parallel to the z axis and passing through point [1,0,0] will appear on the image plane.