# OpenGL 3D transformations

CS116A

Chris Pollett

Oct 27, 2004.

# Outline

- Affine Transformations
- Basic OpenGL Transformations
- OpenGL Matrix Operations
- OpenGL Matrix Stack

# Affine Transformations

- An affine transformations is a transformation which maps coordinates according to linear functions:

  $x' = ax+by+cz+d$

  $y' = ex+fy+gz+h$

  $z' = mx+ny+pz+q$
- Translations, rotations, scaling, reflection, and shear are all affine transformations.
- Such mapping preserve lines and map finite points to finite points

# OpenGL Geometric Transformations

- To translate one can use a command of form:

  glTranslate*(tx, ty, tz);

  For example, glTranslatef(25.0,-10.0, 0.0);

- Similarly, to rotate the command is of the form: glRotate*(theta, vx, vy, vz); and to scale is of the form glScale*(sx,sy,sz);

# OpenGL Matrix Operations

- Recall that in our initialization of our programs we have been setting the projection mode using glMatrixMode
- The same routine is used to set up matrices for geometric transformations. Matrix in this this case called a model view matrix.

  glMatrixMode(GL_MODELVIEW);

  says our matrices will be for acting on the model

# More OpenGL matrix operations

- Other matrix modes are texture and color mode.
- Once in model view can load the identity matrix with glLoadIdentity();

# Setting some other matrix

```
glMatrixMode(GL_MODELVIEW);
GLfloat elts1[16], elts2[16];
for(int k = 0; k < 16; k++)
{
    elts1[k] = (GLfloat)(k);
    elts2[k] = (GLfloat)(-k);
}
glLoadMatrixf(elts1);
glMultMatrixf(elts2);
```

# OpenGL Matrix Stack

- Each of the four matrix modes (modelview, projection, texture, color) comes with a stack
- The modelview stack depth can have a size of at least 32. Can determine exact value with:

  glGetIntegerv(GL_MAX_MODELVIEW_STACK_DEPTH, stackSize);

  Similar, flags work for other stacks.
- The current stack depth can be determined with

  glGetIntegerv(GL_MODELVIEW_STACK_DEPTH, numMats);
- The commands for popping from /pushing onto the stack are glPopMatrix(), glPushMatrix().