Name:_______________________________________

1. a) ________________
   b) ________________
   c) ________________
   d) ________________
   e) ________________
   f) ________________
   g) ________________
   h) ________________
   i) ________________
   j) ________________

Total:   ______________________ / 35

2. a) ________________
   b) ________________
   c) ________________

Total:   ______________________ / 20

3.   ______________________ / 15

4.   ______________________ / 20

5.   ______________________ / 15

6.   ______________________ / 20

7.   ______________________ / 15

8.   ______________________ / 10

TOTAL   ______________________ / 150
1. Give *brief* definitions for 7 of the following 11 names or terms. Clearly indicate (e.g. leave blank) those you are not defining. [5 points each, no bonus]

a) Rasterization: 

b) Refresh rate: 

c) View frustum: 

d) Resolution: 

e) Callback: 

f) LCD (say what it is, don’t just expand the acronym): 

g) Coherence: 

h) Interlaced: 

i) Double buffering: 

j) Vector display system: 

k) Locator:
2. Give short answers for each of the following. You may choose 2 of the 3. Clearly indicate (e.g. by leaving completely blank) the one you choose not to answer. [10 points each, no bonus]

a) Describe the three transformations used to create a canonical view volume.

b) Describe a process for polygon filling (polygon scan conversion).

c) Give a sequence of OpenGL commands to display a red triangle with vertices (0.0, 0.0, 0.0), (2.3, 5.1, 1.2), and (2.7, 1.0, 0.0). Assume your viewing matrix setup, window creation, etc. has already been done.
3. Give a list of the pixels filled in for a line from the point (2,3) to (5,8). (2,3) will be the first pixel, and (5,8) the last pixel. Show all work. [15 points]
4. Clip the line segment from (-1,4) to (2,-1) to the [0,1]x[0,1] rectangle. Use a
parametric technique to find line intersections. You can give the parameter values for
the starting and ending points of the clipped lines (instead of the actual coordinates) if
you want to. You do not need to follow any particular algorithm – just show that you can
find where the line should be clipped. [20 points]
5. For each of the following, give *both* the 3D transformation matrix *and* the OpenGL command to achieve the desired transformation. [15 points total]

a) Translation by 2 units in x, 3 in y, and 5 in z.

b) Rotation about the z axis by 45 degrees (rotating +x axis toward +y).
6. If your view plane normal is \[
\begin{bmatrix}
0 & \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}}
\end{bmatrix},
\] and the up direction is \[0 \quad 1 \quad 0\], give the necessary rotation matrix for the viewing transformation. [20 points]
7. Assume you are taking a picture. The image plane is 30 feet away, and encompasses an area 10 feet by 5 feet. Your “far” plane is 120 feet away. For both a parallel and a perspective view, give the scale matrix necessary to convert to the canonical view volume. [15 points total]

Parallel view scale matrix:

Perspective view scale matrix:
8. Consider a bookcase. Each shelf is made of a single 4’ board of wood, held in place by four brackets. Each bracket consists of a piece of metal and two screws. The bookcase also has a frame, composed of two more 4’ boards of wood (for the top and bottom), along with two 6’ boards (for the sides). There are four shelves. Draw a dag that represents how various parts are put together to form the bookcase. [10 points]