Tutorial 1: Device Independent Graphics

1. A user works in her/his co-ordinate system (called the world coordinate system) which is a square area with corner co-ordinates :

[(-20,-50) , (80,50)]

The picture (isn't terribly exciting) and consists of a triangle with vertices [-5,30], [50,30] and [-5,-10].

The user's area is mapped into a square viewport (part of a screen window), which uses device coordinates that are in pixel units. The corner device co-ordinates are:

[(409,613), (613,818)]

The whole screen has pixel addresses from [0..1023] for both x and y.

a. Sketch roughly what will appear on the screen (ignoring anything else the operating system may provide)

b. What pixel corresponds to the origin [0,0] in the user's co-ordinate system?

c. The mapping between user's and device co-ordinates is given by:

$$x' = Ax + B$$
$$y' = Cy + D$$

Find A, B, C, D

d. The user moves the window by 50 pixels in the positive y direction and 100 pixels in the positive x direction. Find the new values of A B C D and sketch what will appear in the window on the screen.

e. The user moves the window back where it was and then performs a "zoom in" operation by changing the world coordinate system, so that the picture is magnified to 4 times its original area (or twice in each direction). The origin remains at the same place. Recalculate the window co-ordinates and the above constants, A B C D.

f. Assuming that whatever falls outside the user window is clipped from view, sketch again what will appear on the screen.