

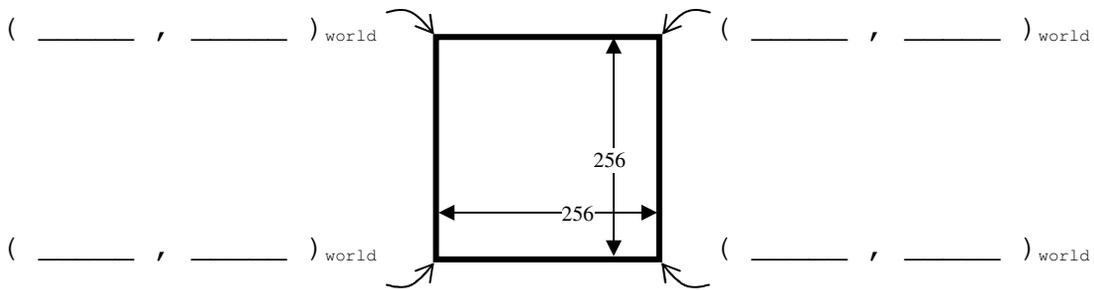
1. Assume these calls made in an OpenGL/GLUT program:

```
// How big should we make the "GLUT window" ?
glutInitWindowSize( 256, 256 );

// What part of the GLUT window do we want to use?
glViewport( 0, 0, 256, 256 );

// What portion of the world do we want to see?
gluOrtho2D( -100.0, +100.0, -100.0, +100.0 );
```

a. Label the *world coordinates* of the corners of this "GLUT window", established by the above world-to-viewport mapping:



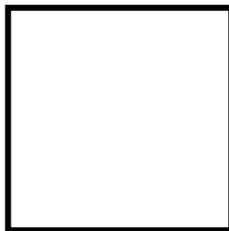
b. What are the *world coordinates* of the center of the window (x, y) ?

Answer: \_\_\_\_\_

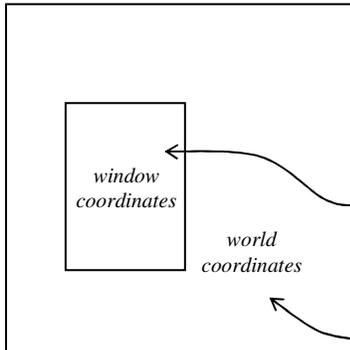
2. If the following call was made instead: `glViewport( 128, 128, 128, 128 );`

What would the *world coordinates* of the center of the window be (x, y) ?

Answer: \_\_\_\_\_ Show where the viewport is in this "GLUT window", and label its corners with their world coordinates:



Copy the program named "hw1" (no source code is given, only an executable program).



Although the program draws a huge red rectangle, only the viewport is colored in red.

With all mouse buttons up, if the mouse is moved around *inside* the inner rectangle (including the viewport border), the *window coordinates* of the cursor are output.

With any mouse button down, if the mouse is moved around *outside* of the inner rectangle (including the viewport border), the *world coordinates* of the cursor are output.

As discussed in class, the equations mapping *world* coordinates to *window* coordinates are:

$$1. x_{window} = VPL + (x_{world} - WORLDL) \left( \frac{VPW}{WORLD R - WORLDL} \right)$$

$$2. y_{window} = VPB + (y_{world} - WORLD B) \left( \frac{VPH}{WORLD T - WORLD B} \right)$$

Write the equations mapping *window* coordinates to *world* coordinates:

$$3. x_{world} =$$

$$4. y_{world} =$$

Run the program to determine these function parameters actually used in the source code:

```
gluOrtho2D( _____ , _____ , _____ , _____ )
gluOrtho2D( WORLDL, WORLD R, WORLD B, WORLD T )

glViewport( _____ , _____ , _____ , _____ )
glViewport( VPL , VPB , VPW , VPH )
```

**Show** below how you would use the appropriate equations from above to determine the *world coordinates* of the center of the viewport:

Answer : ( \_\_\_\_\_ , \_\_\_\_\_ )

What is the size of the GLUT window?  
How did you get your answer?

```
glutInitWindowSize( _____ , _____ )
glutInitWindowSize( WINDOWW, WINDOWH )
```