CS4204 Computer Graphics Fall 2007
Homework Assignment 2

Assignment 2 is due on Tuesday, 10/03/2007 3:30pm. You need to turn your homework in before midterm start. Please write clearly on paper.
Note: There are 10 points for each question.

Q1. Viewport transform is a 2D transformation that maps normalized device coordinate system on to window coordinate system. What is the 2D transformation matrix for the following OpenGL command?

```
glViewport( 20, 30, width/3, height*1.5 );
```

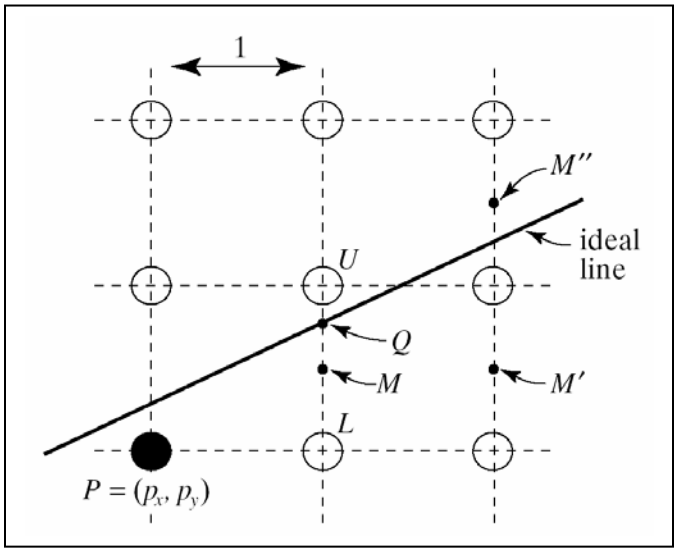
Q2. Please explain when windows reshape callback event happens. And display callback event?

Q3. What is the 2D transformation matrix for rotate 60 degree around point (-1, 2)?

Q4. For scan conversion for lines, we have Bresenham (midpoint) algorithm.

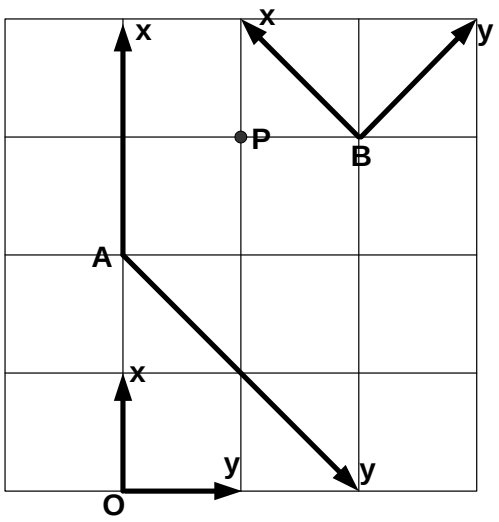
(a). What is implicit function *F(x,y)* of a line?

(b) Given the following figure. If our current choice is $P(p_x,p_y)$, how can we choose the next point $P'(p_{x+1}, p_y)$.



Q5. Let's represent 2D translation as TR(x,y), rotation as R(θ), scale as $S(s_x, s_y)$. Please write down the series of transformations produces the reflection of a two dimensional point about an arbitrary line y = 3x+5?

Consider the following three coordinate systems (O, A, B) for questions 6-10:



Notation: M_{ST} is a 3x3 homogeneous matrix that transforms points from coordinate system ***S*** to coordinate system ***T***.

Q6. What are the coordinates of P in coordinate system ***O***?

Q7. What are the coordinates of P in coordinate system ***A***?

Q8. What are the coordinates of P in coordinate system ***B***?

Q9. Express M_{OB} in terms of M_{AO} and M_{BA}.

Q10. Given a vector **a** and a plane with normal vector **n**, what is the angle between **a** and the projection of **a** on the plane?

Q11. What is the difference between orthographical projection and perspective projection?

Q12. Please draw the diagram for OpenGL transformation pipeline.