March 8, 2007 Name _____

CS142 Exam 1

Spring 2007

1.	(max = 6)	5.	(max = 15)
2.	(max = 8)	6.	(max = 24)
3.	(max = 9)	7.	(max = 10)
4.	(max = 10)		
Total Score _____(max=82)			

Final grade: _____/ 100

1) (6 pts) What is the difference between perspective and orthographic projection? Draw a picture to illustrate the difference. Which one does your eye use?

2) (8 pts, total) **Vectors:**
   a) (6 pts) What is a vector? Give two examples.

   b) (2 pts) Dot Products: If A and B ***perpendicular*** are vectors, what is the value of A · B?

      Ans=_____

3) (9 pts total) **Colors**: 32 bit RGBA

   a) (3 pts) What color is 00000000000000001111111111111111 ? Ans=_____

   b) (3 pts) What color is 11111111111111111111111111111111 ? Ans=_____

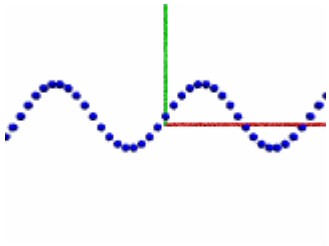
   c) (3 pts) If I had to write the binary number in part 3b in Hex (base 16), what would the Hex number be?
      Ans=_____

4) (10 pts, total) **Phong Model**:
   a) (3 pts) How would you qualitatively describe a surface that has a large specular component? Include an example of such a surface.

   b) (7 pts) What is the mathematical formula for the specular component? Define all your terms. Include a picture, labeling all the relevant items.

5) (15 pts) **Trig Functions**:

a) (7 pts) Suppose I want to draw a curve of spheres as shown. Assume that the curve oscillates in the y-direction between 5 and -5.



Complete the code:

```
#declare cnt = -50;
#while (cnt < 50)
     #declare myAngle = radians(cnt*20);
     sphere { <0,1,0,>, 0.5  // center and radius
               pigment { Blue }
               translate                  //complete this line
     }
     #declare cnt = cnt + 1;
#end
```

b) (8 pts, total) What is the value of the following trig functions:

i) (2 pts) sin (90°) = _____

ii) (2 pts) sin (270°) = _____

iii) (2 pts) cos (180°) = _____

iv) (2 pts) sin (π radians) = _____

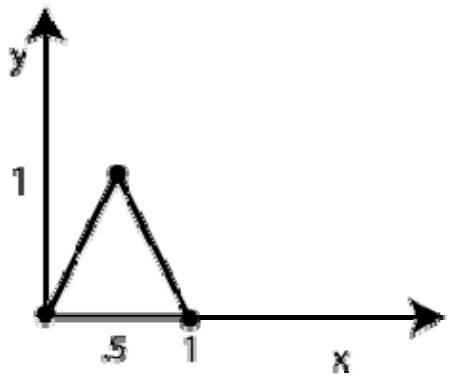
6) (24 pts total) **Matrices**:
   a) (12 pts total) What are the 2x2 matrices for the following 2D transformations?
      i) (4 pts) Scale by an amount 2 along x and 4 along y.

      ii) (4 pts) A rotation by 40 degrees about the origin.

      iii) (4 pts) A uniform scale of 10 about the point (3,9). (you must use homogeneous coordinates)

   b) (4 pts) What does the 2x2 matrix $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ do to an image? If you can't figure it out, try it on several points to see what happens.

c) (8 pts) Suppose you have the following triangle:



That happens to the triangle (i.e. draw the result on the above picture) after you apply the transformation $\begin{pmatrix} 2 & 0 \\ 1 & .5 \end{pmatrix}$?

7) (10 pts) **Ray Tracing**: Povray renders images through a technique called ray tracing. What is ray tracing and how does it work? Give as many details as you can remember.
(Please write in complete sentences). Include a picture (or pictures) to support your description.