Computer Graphics Comprehensive Exam Spring 2005

1. Consider a triangle defined by the clockwise enumeration of the vertices $(6, 10, -2)^\mathsf{T}$, $(3, -1, 17)^\mathsf{T}$, $(-9, 8, 0)^\mathsf{T}$.

   (a) What is the plane equation of the plane containing this triangle?

   (b) Compute the barycentric coordinates of the point $(-3, 12, 33)^\mathsf{T}$.

2. Consider a sphere of radius 10 centered at the origin. Find the points of intersection of the sphere (if they exist) with the infinite ray $\mathbf{p}(t) = \mathbf{p}_0 + \mathbf{d}t$ where $\mathbf{p}_0 = (-10, -9, -9)^\mathsf{T}$ and $\mathbf{d} = (0.5, 0.6, 0.5)^\mathsf{T}$

3. Write a fragment program that does Phong shading to a parametrically defined sphere. Add the environment illumination term to the Phong shading.

4. Devise a method for testing whether one planar polygon is fully on one side of another planar polygon.

5. Describe Gouraud shading.