Assignment 1
Photometry & Cameras
(Due date: 1/27/2005)

1. Problem 1.4 in Forsyth & Ponce
2. Problem 2.4 in Forsyth & Ponce
3. Consider an affine camera and a line in 3 space. Consider three points (A, B, and C) on that line, and the image of those three points (a, b, and c). Now consider the distance between a and b and the distance between a and c. Show that the ratio of the distance is independent of the direction of the line.
4. Consider a square light source with constant radiance \( L \) located along the x-axis at (2,0,0) and with size 4 in the y and z directions (i.e., the vertices of the square are at (2,-2,-2), (2,-2,2), (2,2,2) and (2,2,-2). Now, consider a surface patch located at the origin (0,0,0) with normal vector of (1,0,0). What is the irradiance \( E \) at the origin.
5. Assume that the sky has constant radiance \( L \) over the entire upper hemisphere (it is a perfectly cloudy day).
   A. Show that a constant radiance hemispherical source would contribute irradiance \( E = \pi L \) to a point on the ground.
   B. Suppose at some point on the terrain the ground plane is tilted by an angle \( \theta \) with the respect to the horizon. These means an angular wedge of the hemispherical sky will not be visible at that point because parts of the sky are below the local horizon of the surface. What is the irradiance \( E \) at this point?