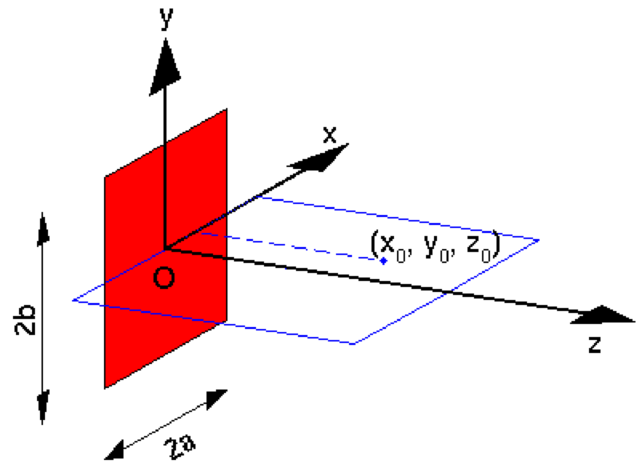
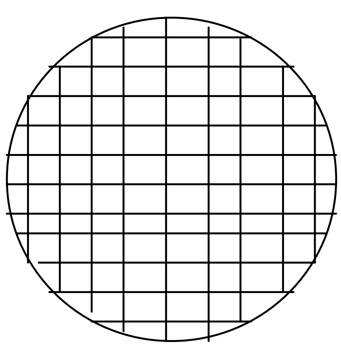
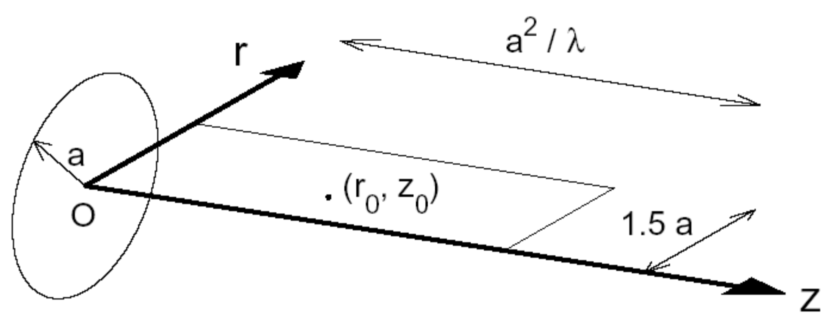
HW 10 – due Tuesday, November 25, 2003:

1. Calculate the nearfield pressure distribution for a *rectangular* piston, width = 2a and height = 2b, where a = 2.5λ and b = 1.5a. Apply the method outlined in class that evaluates the superposition of point sources (i.e., simple sources or Green's functions) using Cartesian coordinates in the plane y = 0 (see below) with x varying from 0 to 1.5a and z varying from 0 to a^2 / λ. The origin of the coordinate system is coincident with the center of the rectangular piston, and the element edges are located at x = a, x = -a, y = b, and y = -b. Evaluate the result when the radiating source is subdivided into 48 simple sources in the y-direction and 32 simple sources in the x-direction.



2. Calculate the nearfield pressure distribution for a *circular* piston with radius = 5λ. Apply the method outlined in class that evaluates the superposition of point sources (i.e., simple sources or Green's functions) on a rectangular grid (see below). Compute the result in cylindrical coordinates at all points (r, z) with r varying from 0 to 1.5a and z varying from 0 to a^2 / λ, where the origin of the coordinate system is coincident with the center of the circular piston and the edge of the circular piston is located at r = a. Evaluate the contribution of 96 simple sources in the y-direction and 96 simple sources in the x-direction.



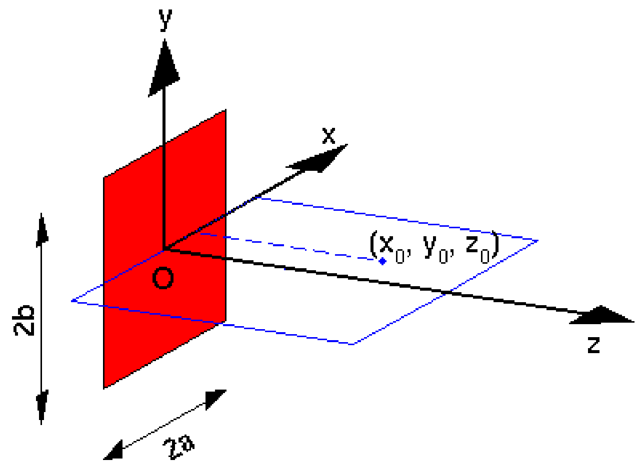


a) aperture subdivision

b) coordinate system definition

3. Calculate the nearfield pressure distribution for a *rectangular* piston, width = 2a and height = 2b, where a = 2.5λ and b = 1.5a. Apply the method outlined in class that evaluates the superposition of small rectangular sources (i.e., small **rectangular radiators**, which are evaluated far enough away to generate a sinc * sinc distribution) using Cartesian coordinates in the plane y = 0 (see below) with x varying from 0 to 1.5a and z varying from 0 to a^2 / λ. The origin of the coordinate system is coincident with the center of the rectangular piston, and the element edges are located at x = a, x = -a, y = b, and y = -b. Evaluate the result when the radiating source is subdivided into 24 rectangular radiators in the y-direction and 16 rectangular radiators in the x-direction.

In this problem, you *do not* need to adaptively subdivide the aperture into smaller subelements according to the 'official' rectangular radiator method, but you do need to include a sinc * sinc term when you numerically evaluate the 2D integral describing the pressure field generated by the rectangular piston.



<u>Hint for all problems:</u> Start with a smaller number of subdivisions (i.e., point sources or rectangular radiators) while you are first debugging and testing your code. You might also restrict your initial calculations to a line, say, along the central axis where the results are easily recognizable.