Homework Set #3
(due: Wednesday, January 29, 2003)

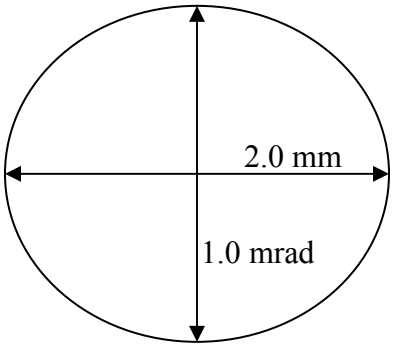
1. Consider a F0D0 lattice of period length L = 4 m.

   a) What is the focal length F of the quadrupoles (thin lenses) if the phase advance per cell $\mu = 120°$? How about if $\mu = 30°$?
   b) Draw the envelope function $\beta(s)$ for s ranging one period.

2. A thin quadrupole with focal length F is a distance L from a wire scanner that measures the rms beam size σ.

   a) If β and α at the beginning of the quadrupole are $\beta = \beta_0$ and $\alpha = \alpha_0$, and the emittance is ε, how does the spot size vary with F?
   b) How can α_0, β_0 and ε be determined from a "quadrupole scan" which is a measurement of $\sigma(F)$? You can treat F and L as known quantities.

3. A beam with the phase space ellipse shown below is injected in the middle of the drift space in a F0D0 lattice that has 60° phase advance per half cell and 2.0 m long drift spaces. The dimensions indicated in the figure are full widths.



   a) What are β, α, γ and ε of the injected beam?
   b) Assume there are some weak nonlinearities in the F0D0 lattice. What are β, α, and γ (at the beginning of one of the cells) and ε after traversing many cells of the lattice?