1. How is group velocity linked to phase velocity in a dispersive medium?
2. A pulse traveling through a medium has angular frequency $\omega = 2 \times 10^{15}$ rad/s and a wave number $k = 1 \times 10^{7}$ rad/m.
   a) Find the phase velocity
   b) If the dispersion relation is $\omega = a\sqrt{k}$, find group velocity and determine whether the medium is dispersive.
3. If $v_p = c/n$, derive group velocity in terms of n and $dn/d\lambda$ (refractive index "n" is a function of wavelength "λ").
4. In a medium, $v_p = a\,\lambda^{1/4}$, then express group velocity in terms of phase velocity?