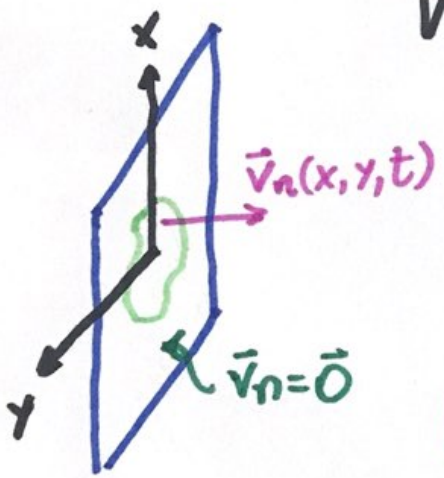
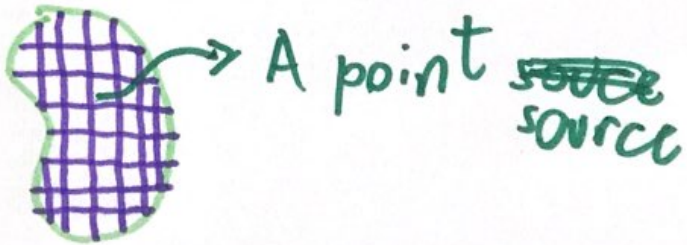
Diffraction Theory



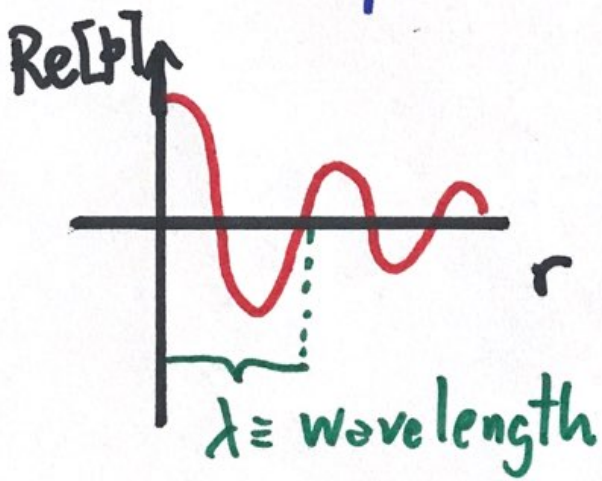
What is the sound pattern of a moving piston?

Hint: Decompose the piston into small vibrating ~~sources~~ sources.



Point source (spherical wave)

$$p = p_0 \frac{e^{ikr}}{r} \quad ; \quad k = \frac{2\pi}{\lambda}$$



Let's go to Mathematica ...

We saw

$$p = \sum (\text{spherical sources} \ldots)$$

Taking the continuous limit, we arrive at the Rayleigh integral

$$p(\vec{r}) = -\frac{i\omega\rho}{2\pi} \int_{2\Omega} v_n(x_0, y_0) \frac{e^{ik|\vec{r}-\vec{r}_0|}}{|\vec{r}-\vec{r}_0|} dx_0 dy_0$$

Project 1: Design a 128-array of sources with a Gaussian amplitude v_n. Plot the pressure in the xy-plane ($x>0$).