SPECIAL NOTE

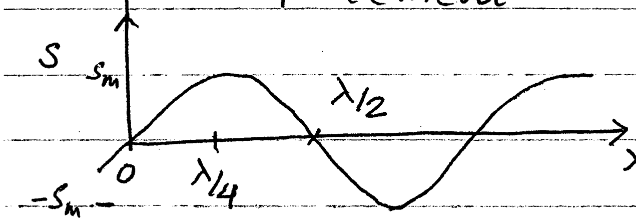
DETAILED INTERPRETATION OF DISPLACEMENT AND PRESSURE CURVES IN A SOUND WAVE

or

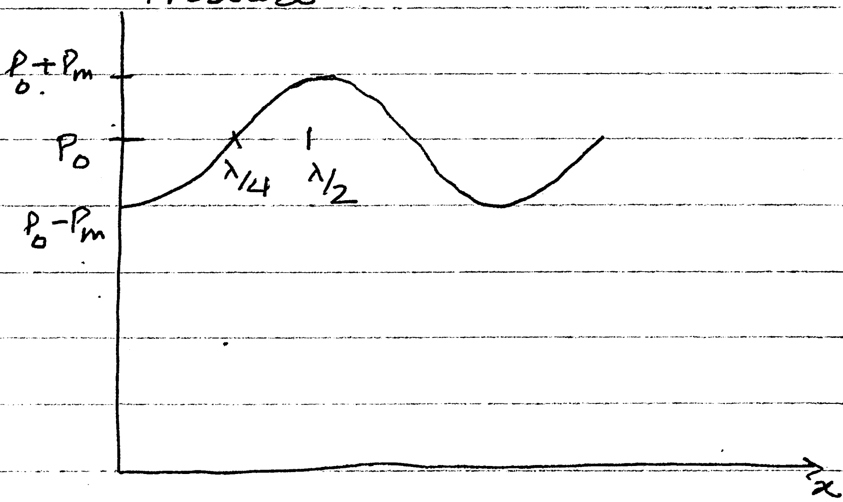
WHY IS PRESSURE VARIATION $\frac{\pi}{2}$ Out of PHASE WITH DISPLACEMENT AS A FUNCTION OF POSITION?

The curves are (at $t=0$).

Displacement



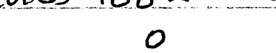
Pressure



$S = S_m \sin kx.$

$P = P_0 - P_m \cos kx.$

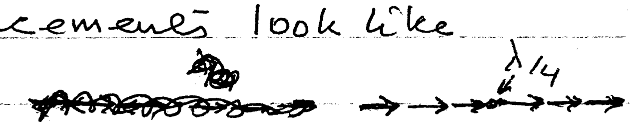
Near $x=0$, Displacements look like



ALL Displacements away from

That is displacements of particles increase rapidly as you go away from $x=0$. Consequently, gas is in expansion, that is why pressure is at a <u>MINIMUM</u>

Near $x = \frac{\lambda}{4}$, Displacements look like



That is, <u>all</u> the displacements are nearly equal so there is little change in volume and hence P is at its equilibrium value. Deviation from Em is <u>zero</u>

Near $x = \frac{\lambda}{2}$.

Displacements look like.

$\lambda/2$

$\longrightarrow \rightarrow \rightarrow \leftarrow \leftarrow \leftarrow$

Displacements are toward $\lambda/2$ and increase as you go away from $\frac{\lambda}{2}$ so here gas is in contraction and that is why pressure is at a <u>MAXIMUM</u>

CRUCIAL Pt. is that change of volume and hence change of pressure happens only if displacement everywhere is not the same.