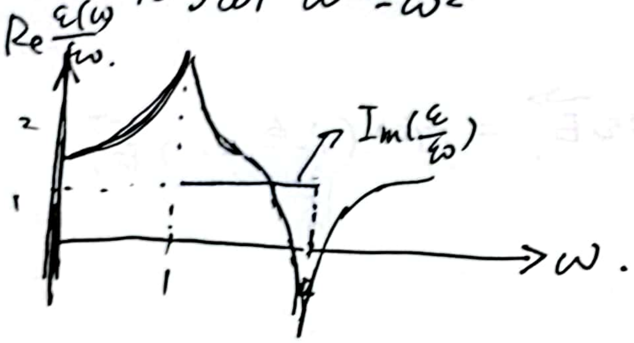
1.22.

(a). $\text{Re}\frac{\varepsilon(\omega)}{\varepsilon_0} = 1 + \frac{1}{\pi} P\int_{-\infty}^{\infty} \frac{\omega' \text{Im}\frac{\varepsilon(\omega')}{\varepsilon_0}}{\omega'^2-\omega^2} d\omega'$.

$= 1 + \frac{A}{\pi}\int_{\omega_1}^{\omega_2} \frac{1}{\omega'^2-\omega^2} d\omega'^2 = 1 + \frac{A}{\pi}\ln\left|\frac{\omega_2^2-\omega^2}{\omega_1^2-\omega^2}\right|$. $A = \frac{Ne^2 f_0}{\varepsilon_0 m}$



(b). $\text{Re}\frac{\varepsilon(\omega)}{\varepsilon_0} = 1 + \frac{1}{\pi} P\int_0^{\infty} \frac{\omega' \text{Im}\frac{\varepsilon(\omega')}{\varepsilon_0}}{\omega'^2-\omega^2} d\omega'$

$= 1 + \frac{1}{\pi} P\int_{-\infty}^{\infty} \frac{\omega'}{\omega'^2-\omega^2} \cdot \frac{A\Gamma'\omega'}{(\omega_0^2-\omega'^2)^2+\gamma^2\omega^2} d\omega'$.

$\omega_1 = \frac{\Gamma'}{2} \pm \sqrt{\frac{4\omega_0^2-\Gamma^2}{2}}$

$\omega_2 = -\frac{\Gamma'}{2} \pm \sqrt{\frac{4\omega_0^2-\Gamma^2}{2}}$.

$\rightarrow \text{Re}\frac{\varepsilon(\omega)}{\varepsilon_0} = 1 + A\frac{\omega_0^2-\omega^2}{(\omega_0^2-\omega^2)+\gamma^2\omega^2}$.