Middle Atmosphere Dynamics, Homework 3

1. We showed in class that for damping of the form $q_t \propto -\alpha q$ with small α ($\alpha/k << U-c$), the general solution is $Ae^{imz} + Be^{-imz}$ with $m \approx m_0 + \frac{i\alpha/k\overline{q}_y}{2(U-c)^2 m_0}$, with m_0 being $m(\alpha = 0)$.

a) Show that $m = m_0 + \frac{i\alpha}{Cg_z}$. Discuss the meaning of this.

b) What is the general solution for :
1) an unbounded domain?
2) a Rigid lid at $z = z_t$?
What is F_z for each of these cases? Discuss and compare to the case of $\alpha = 0$.

2. Now assume damping is of the form $q_t \propto -\frac{1}{\rho}\frac{\partial}{\partial z}\left(\rho\alpha\frac{T'}{S}\right)$ and assume again that α is appropriately small. Show that again $m \approx m_0 + \frac{i\alpha D}{Cg_z}$, and find D (a function of the basic state and wave parameters). What is F_z for this form of damping, and unbounded domain. How does the solution compare to the damping of question 1 above?