Homework #4 (due on 02/15)

Boas Chapter 7 (Fourier transforms)
12.3; 12.11; 12.21; 13.20;

Boas Chapter 8 (Dirac δ-function)
11.15; 11.21;

Boas Chapter 11 (Special functions)
3.17; 5.5; 13.5; 13.17;

Extra-credit problem – Frequency spectrum of decaying oscillations

Many naturally-occurring oscillations start from some instantaneous perturbation, and then decay with time. Mathematically, they are described as

$$f(t)=\begin{cases} 0 & t<0 \\ Ae^{-\gamma t}\cos\omega_0 t & t\geq 0 \end{cases}$$

Find Fourier transform of this function F(ω) . Then consider a high-frequency case such that $\omega,\omega_0 >> 1,\gamma$. The resulting line-shape is called Lorentzian, and appears very often in, for example, optical and microwave spectroscopy.
Sketch the resulting F(ω). Based on this sketch, what is the physical meaning of parameters ω_0 and γ?