Department of Physics
Physics 374 Spring 2009
Due Wednesday, April 29, 2009

1.) Evaluate the following integral for $k > 0$ and for $k < 0$ using contour integration in the complex plane.

$$\frac{1}{2\pi}\int_{-\infty}^{\infty} dx e^{-ikx}\frac{C}{(x-x_0)^2+b^2} \tag{1}$$

2.) Evaluate the following integral using contour integration in the complex plane.

$$\int_{-\infty}^{\infty} d\omega e^{-i\omega t}\frac{\omega b^2}{[\omega + i/\tau](\omega^2+b^2)} \tag{2}$$

3.) An input signal has the Fourier representation

$$v(t) = \int_{-\infty}^{\infty} dt e^{-i\omega t} V(\omega), \tag{3}$$

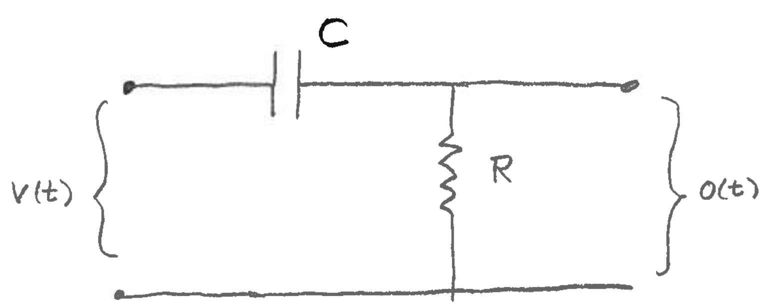
where

$$V(\omega) = \frac{C}{1+\omega^2/\omega_c^2}. \tag{4}$$

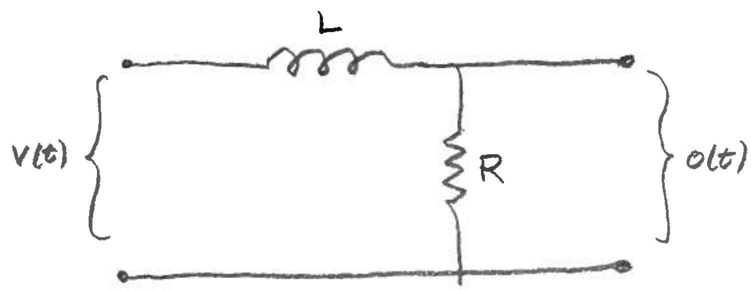
a.) The signal $v(t)$ is passed into a RC circuit as shown below to obtain the output signal $o(t)$. The signal $o(t)$ can also be expressed as a Fourier transform,

$$o(t) = \int_{-\infty}^{\infty} dt e^{-i\omega t} O(\omega). \tag{5}$$

Calculate the output signal $o(t)$ in the time domain by first getting the Fourier transform $O(\omega)$ and then doing the inverse Fourier transform using contour integration.



b.) The same signal is passed into a RL circuit as shown below. Calculate the output signal $o(t)$ in the time domain by first getting the Fourier transform $O(\omega)$ and then doing the inverse Fourier transform using contour integration.



c.) The same signal is passed into a RLC as below. Calculate the output signal $o(t)$ in the time domain by first getting the Fourier transform $O(\omega)$ and then doing the inverse Fourier transform using contour integration.