Homework 14

Due 11/7/11

1. This problem is designed to give you some practice with sines, cosines and complex sinusoids. A *general* real sinusoid can be expressed as

$$f(x) = A\sin(kx + \phi). \tag{1}$$

   (a) Show that $f(x)$ can also be written as

$$f(x) = B\cos(kx) + C\sin(kx) \tag{2}$$

   and express B and C in terms of A and ϕ. *Hint: You will have to use the trig. identity for the sine of a sum of angles. This and its cosine version are an identities you will use often in physics.*

   A general complex sinusoid can be written as

$$g(x) = Ae^{ikx} \tag{3}$$

   where you know how to expand e^{ikx} and $A = a + ib$ is allowed to be a complex number.

   (b) By using the expanded form of A (above), write down the real and imaginary parts of $g(x)$ separately. You should notice that the real part (and the imaginary part) has the general form of a real sinusoid, given by Eq. (2).

   (c) Show that the imaginary part is just the real part phase shifted by $-\pi/2$ ($-90°$). You expect the latter to be true because it is true of $e^{ikx} = \cos(kx) + i\sin(kx)$.

2. Problem 6.10