

## Problem Set #1

Due Wednesday, September 26, 2007

1. Consider two complex numbers  $z = 3 + 2i$  and  $w = 5 - i$  and evaluate the following quantities:

(a)  $z + w$ , (b)  $w - z$ , (c)  $wz$ , (d)  $z/w$ , (e)  $z^*w + w^*z$ , (f)  $z^2$ , (g)  $|z|^2$ , (h)  $|z|w$ .

2. The complex impedance of elements in series in an AC circuit is just the sum of the impedances of the individual elements. For a resistor  $R$ , a capacitor  $C$ , and an inductor  $L$ , the individual impedances are:  $Z_R = R$ ,  $Z_C = 1/i\omega C$ , and  $Z_L = i\omega L$  where  $\omega$  is the AC frequency.

Evaluate the series impedance,  $Z = Z_R + Z_C + Z_L$  to find the real and imaginary parts of the impedance,  $\text{Re } Z$  and  $\text{Im } Z$ , and show that  $\text{Im } Z$  (called the "reactance") vanishes when  $\omega^2 = 1/LC$  ("resonance").