

Homework 1

Due in class on Thursday September 1st, 2011

- 1) Review of electromagnetic spectrum (50%)
 - a) Show a graph of the visible spectrum and other electromagnetic radiation (online resources are OK).
 - b) Pick your favorite three colors (e.g. red, green, and blue) and give their wavelength, frequency, angular frequency, wave number, and photon energy.
 - c) Look up the spectral sensitivity of the eye. Plot it on the same graph as the spectrum of sun light. Comment on how this affects our vision and perception of colors.
- 2) Review of complex numbers (50%)
 - a) Let $z=1+2i$ be a complex number. Find its modulus and argument. Represent in the complex plane the following numbers: z , its complex conjugate z^* , its negative $-z$, its inverse $1/z$, its square z^2 , its modulus $|z|$.
 - b) Let $z_1 = a_1 e^{i\varphi_1}$ and $z_2 = a_2 e^{i\varphi_2}$. Find the modulus and argument of $z=z_1+z_2$.
 - c) Prove the following properties of complex numbers.

$$|z| = |z|^*$$

$$|z|^2 = zz^*$$

$$|z_1 z_2| = |z_1| |z_2|$$

$$\left| \left(\frac{1}{z} \right) \right| = \frac{1}{|z|}$$

$$\left| \left(\frac{1}{z} \right) \right|^* = \frac{1}{z^*}$$

$$(z^*)^* = z$$

$$(z_1 + z_2)^* = z_1^* + z_2^*$$

$$(z_1 z_2)^* = z_1^* z_2^*$$

$$\operatorname{Re}(z) \leq |z|$$

$$|z_1 + z_2| \leq |z_1| + |z_2|$$