

## Physics 422 - Spring 2016 - Assignment #1, Due January 22<sup>nd</sup>

This first assignment is intended to be a review of basic math. Most of the math that you will encounter in subsequent assignments will be of similar complexity.

1. Find the roots of the following polynomials:

(a)  $(x - 2)(x + 3) = 0$

(b)  $x^3 - 7x + 6 = 0$

(c)  $x^2 - 2x + 2 = 0$

2. Solve for  $x$ :

(a) 
$$\begin{vmatrix} 1-x & 1 \\ 4 & -2-x \end{vmatrix} = 0$$

(b) 
$$\begin{vmatrix} 0 & 1-x & 0 \\ 1-x & 0 & 1 \\ 4 & 0 & -2-x \end{vmatrix} = 0$$

(c) 
$$\begin{vmatrix} 1+2i-x & 1 \\ 3 & 1-2i-x \end{vmatrix} = 0$$

**3.** Two forms of solutions to the simple harmonic oscillator problem can be written

$$x(t) = A \cos \omega t + B \sin \omega t \quad (1)$$

$$x(t) = \operatorname{Re} [r e^{i(\omega t - \varphi)}] \quad (2)$$

(a) Find expressions for the real numbers  $A$  and  $B$  in terms of the real numbers  $r$  and  $\varphi$ .

(b) Find expressions for the real numbers  $r$  and  $\varphi$  in terms of the real numbers  $A$  and  $B$ .

**4.** A spring attached to a mass,  $m$ , has a length  $L$  when it is lying at rest on a horizontal surface. When in static equilibrium and suspended vertically near the surface of the earth, where the acceleration of gravity is  $g$ , the spring stretches by an additional length  $\Delta L$ .

(a) Calculate the frequency with which the spring will oscillate in this configuration.

(b) What would the oscillation frequency be if the same mass and spring were located on the surface of the moon, where  $g' = g/6$ ?