PHYSICS 1030
Homework #3

(Due Sept. 20, 2016)

1. (Serway 3-23) Consider the two vectors $\mathbf{A} = 3\,\mathbf{i} - 2\,\mathbf{j}$ and $\mathbf{B} = -\mathbf{i} - 4\,\mathbf{j}$. Calculate (a) $\mathbf{A} + \mathbf{B}$, (b) $\mathbf{A} - \mathbf{B}$, (c) $|\mathbf{A} + \mathbf{B}|$, (d) $|\mathbf{A} - \mathbf{B}|$, and (e) the directions of $\mathbf{A} + \mathbf{B}$ and $\mathbf{A} - \mathbf{B}$.

2. Add vectors $\mathbf{A} = 2\angle 35°$ and $\mathbf{B} = 5\angle 145°$. Give your answer in polar form.

3. (Serway 3-32) Vector $\mathbf{A}$ has x and y components of -8.70 cm and 15.0 cm, respectively; vector $\mathbf{B}$ has x and y components of 13.2 cm and -6.60 cm, respectively. If $\mathbf{A} - \mathbf{B} + 3\mathbf{C} = \mathbf{0}$, what are the components of $\mathbf{C}$?

4. Show how to find vectors $\mathbf{A}$ and $\mathbf{B}$, given the vectors $\mathbf{C} = \mathbf{A} + \mathbf{B}$ and $\mathbf{D} = \mathbf{A} - \mathbf{B}$. (That is, find expressions for $\mathbf{A}$ and $\mathbf{B}$ in terms of $\mathbf{C}$ and $\mathbf{D}$.)

5. (Serway 4-7) The vector position of a particle varies in time according to the expression $\mathbf{r} = (3.00\,\mathbf{i} - 6.00\,t^2\,\mathbf{j})$, where $\mathbf{r}$ is in meters and t is in seconds. (a) Find an expression for the velocity of the particle as functions of time. (b) Determine the acceleration of the particle as a function of time. (c) Calculate the particle's position and velocity at $t = 1.00$ s.

6. (Serway 4-15) A projectile is fired in such a way that its horizontal range is equal to three times its maximum height. What is the angle of projection?

7. A canon in use during the American Revolution would have a typical maximum range of 250 meters. Given this maximum range, (*a*) what would be the muzzle velocity v_0? (*b*) At what angle θ above the horizontal would you aim the canon to hit a target 140 meters away? (Use the smallest angle possible.) (*c*) What is the maximum height reached by the projectile in this case? (*d*) What is another possible solution to part b?