Homework 0

Due: Friday, September 4

1. Calculate the magnitude of the vector $\vec{A} =< 3, 5, 1 >$
2. The position of an electron is given by $\vec{r}_e = 4\hat{x} - 2\hat{z}$ and the position of a proton is given by $\vec{r}_p = 2\hat{y} + 3\hat{z}$. Find the vector which describes the position of the electron *relative to* the position of the proton.
3. Let $\vec{A} =< 9, 5, 8 >$ and $\vec{B} =< -3, -5, 4 >$. What is $\vec{A} \cdot \vec{B}$? What is the angle between these two vectors?
4. What is the unit vector describing the direction of the vector $< -3, 7, 1 >$? What is the angle of this vector with respect to the positive x-axis?
5. Let vector $\vec{B} = 3\hat{x} - 9\hat{y} + 7\hat{z}$ and $\vec{v} = 8\hat{x} + 4\hat{y} + 6\hat{z}$. Find the vector $\vec{F} = \vec{B} \times \vec{v}$
6. Are the vectors $\vec{A} =< 4, 5, -7 >$ and $\vec{B} =< 6, -2, 2 >$ orthogonal?
7. A metal bar of length L has its mass distributed evenly with a constant mass per unit length $\lambda = \lambda_0$. What is the mass of the bar?
8. A second metal bar of length L has its mass distributed as a function of distance from the edge of the bar: $\lambda(x) = \lambda_0 \left(\frac{x}{L}\right)^3$. What is the mass of this bar?
9. A metal wire of length L is bent into a circle such that the linear mass density (mass per unit length) is given as a function of the angle ϕ (see Figure 1) as $\lambda(\phi) = \lambda_0 \phi$. What is the mass of the bar?

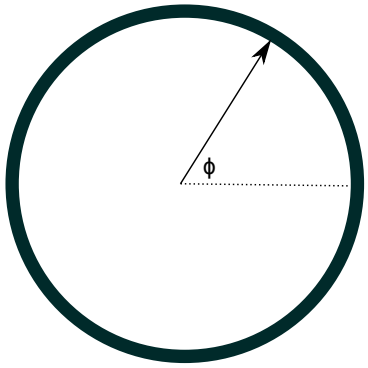

Figure 1: Diagram for problem 9.

10. A solid disk of radius R has mass per unit area distributed as $\sigma(r) = \sigma_0 \left(\frac{r}{R}\right)^2$. What is the mass of the disk?
11. A solid sphere of radius R has mass per unit volume distributed as $\rho(r) = \rho_0 \left(\frac{r}{R}\right)$. What is the mass of the sphere?