# Workshop 2

PHY142: Honors Introductory E&M

09-18-2013

*"It is of great advantage to the student of any subject to read the original memoirs on that subject, for science is always most completely assimilated when it is in the nascent state..."*
- James Clerk Maxwell, A Treatise on Electricity and Magnetism (1873)

**Objective:** Review last week's homework. Finish problems from last week. Topics: charge distributions, more geometrically heavy forms of Coulomb's law, grad-div-curl. Help with this week's homework if there are any questions.

**Electrostatics Problems:**

**1** Two small charged spheres hang from cords of equal length $\ell$ and make small angles $\theta_1$ and $\theta_2$ with a vertical.

**a** If $Q_1 = Q$, $Q_2 = 2Q$, and $m_1 = m_2 = m$, determine the ratio $\frac{\theta_1}{\theta_2}$.

**b** If $Q_1 = Q$, $Q_2 = 2Q$, $m_1 = m$, and $m_2 = 2m$, determine the ratio $\frac{\theta_1}{\theta_2}$.

**c** Estimate the distance between the spheres for each case.

**2** Three charges $(+q, +q, -q)$ have equal magnitudes and are located at the vertices of an equilateral triangle. Find the magnitude of the total force on one of the positive charges due to the other two charges.

**Math Problems:**

**7** Find the curl of the vector function $\mathbf{v}_3 = -y\hat{\mathbf{i}} + x\hat{\mathbf{j}}$. Sketch the curl, what direction does the curl of $\mathbf{v}_3$ point? Intuitively speaking, what do you expect the divergence to be?

**8** Find the volume of a sphere of radius $R$ using integration.

**9** Find the formulas for $r, \theta, \phi$ in terms of $x, y, z$ – the inverse, in other words, of spherical polar coordinates.