Wednesday, February 5, 2014	**Physics250: UnTest 01**	Name _____

Instructions: You have a total of 55 minutes to complete this test.
Answer each question completely showing complete details.
For complete credit you must include correct SI units with numerical answers.

Time Start_____ Time finish _____pledged _____

Constants: $k=8.987\text{x}10^{9}\frac{Nm^2}{C^2}$: $\epsilon_0=8.854\text{x}10^{-12}\frac{C^2}{Nm^2}$

(1) A charge q=3μC is located at x=-3m and y=-5m.
(1:a) Find the **vector** electric field at the point p: x=3m,y=-11m.

(1:b) If a charge q_p=+5μC is placed at p, find the **vector** electric force on q_p.

(2) Consider two charges: 1:[-2μC;1m,1m] and 2:[+2μC;-1m,-1m].
(2:a) Find the **vector** electric field at the point given by p:[-5m,5m].

(2:b) Provide a sketch of the electric field map showing direction and relative strength. Note: one line here is completely insufficient.

(2:c) Find the **vector dipole moment** of the charge distribution with correct SI units.

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(3) A sphere of total charge Q and of radius a has a volume charge density given by $\rho = \frac{Q}{\pi a^3}\left(\frac{r}{a}\right)$ **Hint:** you will need to integrate $Q_{enc} = 4\pi \int \rho(r) r^2 dr$ with appropriate limits.

(3:a) Find the **vector** electric field **inside** the sphere (showing complete details with sketches).

(3:b) Find the **vector** electric field **outside** the sphere (again, showing complete details with sketches).

(4) An infinite plane is located in the x-y plane at z=0 and has a uniform surface charge density $+\sigma$. A second plane is located (parallel to the first) at z=+d and has a surface charge density $-\sigma$.

(4:a) Showing complete details, with sketches, find the **vector** electric field at z<0 and z>d.

(4:b) Again, showing complete details, **with sketches**, find the **vector** electric field in the region z>0 and z<d.

(4:c) Provide numerical answers **with correct SI units** for the case that the surface charge density is $\sigma = 3\mu C/m^2$.

4c:(a): $\vec{E}_{z<0 \text{ or } z>d}$ =_____ 4c:(b): $\vec{E}_{z>0 \text{ and } z<d}$ _____