Physics 201 Sample Exam One

January 24, 2018

Name_____

1. Three equal charges of 0.35 mC sit at corners of a right triangle. One at the origin, one along the x-axis at 1.0m and one along the y-axis at y=2.2m. Find the electric field vector at x=1.0m, y=2.2m, the fourth corner of the rectangle.

2. Use Gauss' law to find the electric field inside and outside a pair of charged spheres. The inner solid sphere has charge Q_1 on it (evenly distributed throughout its volume) and a radius of a and the outer thin spherical shell, at radius b where $b > a$ has a charge $-Q_1$ on it (total charge is zero). There are three regions of interest: $r < a$, $a < r < b$ and $r > b$. Find the electric field in each region (as a function of r).

3. The Voltage (V, also known as the electrostatic potential, or just the potential) has been measured along the x-axis at several points: at x=0, V=2, x=1, V=1 and at x=2 V=0. If the values of V are in volts, and x in meters, find the electric field vector (x-component) in this region.

4. A 0.21 mC charge sits at the origin and a 0.54 mC charge at x=1.23 m has zero net force on it. A third, unknown, charge sits at 4.56 m. Find the unknown charge.

5. The voltage (electrostatic potential) has been measured along the x-axis to be: $V(x) = 1.0V + 0.12V/mx$. Find the electric field as a function of x (x-component only) and find the force on a 0.019 mC charge at x=0.312 m. Include direction.

6. A pair of point charges have negative potential energy. There are no other nearby charges. Which of the following statements (if any) are true (any number could be true):

(a) they have opposite charges

(b) they are attracted toward one another

(c) work is required to move the charges further away from one another

(d) the magnitude of the force on one charge equals the magnitude of the force on the other charge

(e) the direction of the force on one charge is opposite to the direction of the force on the other charge

(f) the force vector on one charge points toward the other charge

(g) the acceleration of one charge only equals the acceleration of the other charge if the masses of each charge are equal.

7. (Figure given) Set up the integral to find the voltage at a point P located on the x-axis at position x due to a uniformly charged finite rod, length L, total charge Q, which is oriented along the y-axis from y=0 to y=L.