

## Homework 2

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1. Two charges of  $+2q$  and  $-5q$  are placed on a line. The distance between the two charges is  $d$ . (a) There is a point on the line where the strength of the electric field due to the two charges is zero. Describe where the point is, relative to the positions of the two charges. (b) Is there any point **not** on the line, where the strength of the electric field is zero?
2. An electric field has a value of  $350 \text{ N/C}$  at a particular point in space, directed along the  $x$  axis. What is the force this field exerts at this point on a particle of charge (a)  $5.00 \mu\text{C}$ ? (b)  $-8.25 \text{ mC}$ ? (c)  $-525 \text{ C}$ ? (d)  $5.34 \times 10^{-15} \text{ C}$ ?
3. In a hydrogen atom in its lowest energy state, the single electron and the single proton are separated by a tiny distance called the Bohr radius,  $5.29 \times 10^{-11} \text{ m}$ . The proton carries a charge  $e = 1.60 \times 10^{-19} \text{ C}$ . (a) What is the strength of the electric field generated by the proton at the Bohr-radius distance? (b) In what direction does the field point?
4. A solid conducting sphere with a radius of  $35.4 \text{ cm}$  contains a total charge of  $5.46 \text{ mC}$ , evenly distributed over its surface. (a) What is the direction of the electric field at its surface? (b) What is the strength of the electric field at its surface? Hint: use the shell theorem, which states that when calculating an electrostatic force or field outside a charged sphere, the sphere can be treated as though all of its charge resides at its center.