

6. (12 points) The electric field (in Newtons/Coulomb) outside of a charged sphere of charge q (in Coulombs) is given by the formula

$$E(r) = \frac{kq}{r^2}$$

where k is a positive constant and r is the distance measured in meters from the center of the sphere to the point from which one is measuring.

(a) Find a formula for the local linearization of $E(r)$ near $r = 2$ meters. [Your answer will contain k and q .]

(b) Use your result from part (a) to approximate $E(2.1)$. [Again, your answer will contain k and q .]

(c) Assuming $q > 0$, do you expect your estimate in part (b) to be an over- or underestimate of the actual value of $E(2.1)$? Use calculus to justify your answer. Explain.