

ECE344 Preliminary Test

September 9, 2009

1. Write the expression for the force acting between two point-like charges q_1 and q_2 at a distance r in vacuum.
2. Calculate the potential energy of a charge $q_1 = 1.6 \times 10^{-19}$ Coulomb at a distance of 5×10^{-11} m from a fixed charge $q_2 = q_1$.
3. Given the function $\phi(x, y, z) = x^2 + y^2 + z^2$, calculate its gradient $\nabla\phi$ at the point $(x, y, z) = (1, 1, 0)$.
4. Calculate i^i , where i is the imaginary unit $i = \sqrt{-1}$ (you may know it as j instead!).
5. Write the expression for the general solution $y(x)$ of the linear differential equation:

$$D \frac{d^2 y}{dx^2} - \frac{y}{\tau} = 0.$$