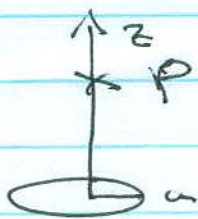


3-20 a) $V(\vec{x}) = \vec{C} \cdot \vec{x} = C_x x + C_y y + C_z z$
 $\vec{E} = -\nabla V = -(C_x \hat{i} + C_y \hat{j} + C_z \hat{k}) = -\vec{C}$

b) if $\vec{E} = E_0 \hat{k}$, $\vec{C} = -E_0 \hat{k} + \text{constant}$
 $V = -E_0 z$

3-21



Potential $V(r, \phi, z) = \int \frac{dq}{4\pi\epsilon_0 r'}$

$dq = \lambda d\phi \rho$
 $= \left(\frac{Q}{2\pi a}\right) (\rho d\phi)$

$V = \frac{Q/2\pi a}{4\pi\epsilon_0} \int \frac{\rho d\phi}{\sqrt{z^2 + \rho^2}} = \frac{Q}{2\pi a} \frac{\rho \cdot 2\pi}{4\pi\epsilon_0 \sqrt{z^2 + \rho^2}}$

but $\rho = a$
 $V = \frac{Q}{2\pi a} \cdot \frac{2\pi a}{4\pi\epsilon_0 \sqrt{z^2 + a^2}} = \frac{Q}{4\pi\epsilon_0 \sqrt{z^2 + a^2}}$

$\vec{E} = -\nabla V = -\frac{Q}{4\pi\epsilon_0} (z^2 + a^2)^{-3/2} \cdot \frac{\partial}{\partial z} (z^2 + a^2) \hat{k}$
 $= \frac{Qz}{4\pi\epsilon_0 (z^2 + a^2)^{3/2}} \hat{k}$

3-22