Answers Test 1 2010

1. $|Q| = \dfrac{q(L^2+H^2)^{3/2}}{L^3}$

Q - negative

$L = H$

2. a) $E_x = \int_{-b}^{a} \frac{1}{4\pi\varepsilon_0} \frac{Q}{a+b} \frac{L}{(L^2+y^2)^{3/2}} dy$

$$E_y = -\int_{-b}^{a} \frac{1}{4\pi\varepsilon_0} \frac{Q}{a+b} \frac{y}{(L^2+y^2)^{3/2}} dy$$

b) $$E_x = \frac{1}{4\pi\varepsilon_0} \int_{-b}^{a} \frac{\lambda_0\left(1+\frac{y}{a}\right) L}{(L^2+y^2)^{3/2}} dy$$

$$E_y = -\frac{1}{4\pi\varepsilon_0} \int_{-b}^{a} \frac{\lambda_0\left(1+\frac{y}{a}\right) y}{(L^2+y^2)^{3/2}} dy$$

c) $$\lambda_0 = \frac{Q}{a+b+\frac{a^2-b^2}{2a}}$$

3. $$V(\vec{r}_2) - V(\vec{r}_1) = -\left[\frac{\alpha x_2^2}{2} - \frac{\alpha x_1^2}{2} + \frac{\beta y_2^2}{2} - \frac{\beta y_1^2}{2}\right]$$

$$V(x_2,y_2) - V(x_1,y_1) = \frac{Q}{4\pi\varepsilon_0}\left[\frac{1}{\sqrt{(x_2-a)^2+(y_2-b)^2}} - \frac{1}{\sqrt{(x_1-a)^2+(y_1-b)^2}}\right] =$$

4. a) $\Omega = \frac{A_1}{R_1^2} = \frac{A_2}{R_2^2}$; $A_2 = \Omega R_2^2$

b) $\Phi_1 = a_3 L^2$, $\Phi_2 = a_1 L^2$, $\Phi_3 = -a_1 L^2$; $\Phi_4 = -a_3 L^2$; $\Phi_5 = -a_2 L^2$

$\Phi_{top} = a_2 L^2$