Answers Exam 1 2016

1. $$\vec{F} = \left[-\frac{1}{4\pi\varepsilon_0}\frac{q_1 q_3 x}{(x^2+y^2)^{3/2}} - \frac{1}{4\pi\varepsilon_0}\frac{q_2 q_3 (a-x)}{\left((a-x)^2+(y-b)^2\right)^{3/2}}\right]\vec{i}_x$$
$$+\left[-\frac{1}{4\pi\varepsilon_0}\frac{q_1 q_3 y}{(x^2+y^2)^{3/2}} + \frac{1}{4\pi\varepsilon_0}\frac{q_2 q_3 (y-b)}{\left((a-x)^2+(y-b)^2\right)^{3/2}}\right]\vec{i}_y$$

2. $$\vec{E} = \left[\frac{1}{2\pi^2\varepsilon_0}\frac{Q_1}{R^2} + \int_{\frac{\pi}{2}}^{\pi}\frac{1}{4\pi\varepsilon_0}\frac{\lambda_0\theta}{\pi R}\cos\left(\theta-\frac{\pi}{2}\right)d\theta\right]\vec{i}_x +$$
$$+\left[-\frac{Q_1}{2\pi^2\varepsilon_0 R^2} + \int_{\frac{\pi}{2}}^{\pi}\frac{1}{4\pi\varepsilon_0}\frac{\lambda_0\theta}{\pi R}\sin\left(\theta-\frac{\pi}{2}\right)d\theta\right]\vec{i}_y$$

3. $$V(0,-2b) - V(0,2b) =$$
$$= \frac{1}{4\pi\varepsilon_0}\left(-\frac{Q_2}{\sqrt{a^2+9b^2}} + \frac{Q_2}{\sqrt{a^2+b^2}}\right)$$

4. a) $\Phi = \alpha a^4$

   b) $\Phi = \frac{\alpha a^4}{3}$