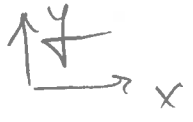
Answers Test 1 2011

1. a) $\vec{F}_{tot} = \frac{4\,qq}{4\pi\varepsilon_0 d^2}\cos\theta\,\vec{i}_x$



$\cos\theta = \frac{h}{d}$

b) $F_x = -\frac{1}{4\pi\varepsilon_0}\frac{2q^2}{d^2}\frac{h}{d}$

$F_y = \frac{1}{4\pi\varepsilon_0}\frac{q^2}{4(d^2-h^2)} - \frac{1}{4\pi\varepsilon_0}\frac{2q^2}{d^2}\frac{\sqrt{d^2-h^2}}{d}$

2. $d\vec{E} = \frac{dQ}{4\pi\varepsilon_0 r^2}\left[\cos\theta\,\vec{i}_x + \sin\theta\,\vec{i}_y\right]$

$r = \sqrt{a^2+(b-y)^2}$; $\cos\theta = \frac{a}{r}$; $\sin\theta = \frac{b-y}{r}$;

$dQ = \frac{Q}{H}dy$; $\vec{E} = \int_{y=H}^{y=2H} d\vec{E}$

3. a) $V(a,b) - V(0,0) = -\frac{2a^3}{3} - \frac{\beta b^4}{4}$

b) $E_x = -2c_1 x$; $E_y = -2c_2 y$

c) $V(2R) - V(0) = -\frac{c}{2R}$

4. a) $\Phi = 0$

b) $\Phi = c_3 a^3$

c) $\Phi = \frac{c_1 a^4}{2}$