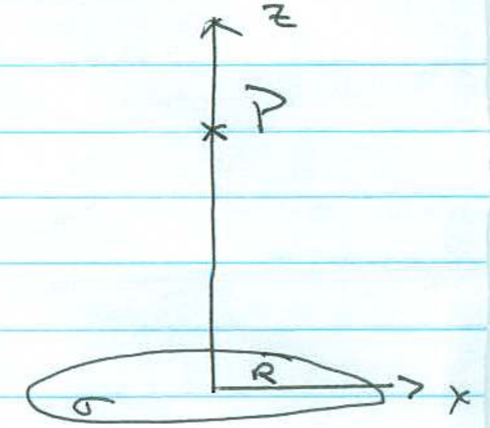
3-6 a) Find $\vec{E}$ along the axis of a disk of radius R:



$\vec{E}/|\vec{E}| = \hat{k}$ by symmetry.

Divide disk into thin rings.
Equation 3-20 gives the field for a ring:

$$dE_z = \frac{dq\ z}{4\pi\varepsilon_0 (r^2+z^2)^{3/2}} = \frac{(2\pi r \Delta r\, \sigma)\, z}{4\pi\varepsilon_0 (r^2+z^2)^{3/2}}$$

$$E_z = \int_{r=\emptyset}^{r=R} dE_z = \frac{2\pi\sigma z}{4\pi\varepsilon_0}\int_0^R \frac{r\,dr}{(r^2+z^2)^{3/2}} = \frac{\sigma z}{2\varepsilon_0}\left[\frac{1}{|z|} - \frac{1}{\sqrt{R^2+z^2}}\right]$$

b) For an infinite plane, $R \to \infty$

for $z > \emptyset$

$$E_z(\emptyset, \emptyset, z) = \frac{\sigma}{2\varepsilon_0}$$

for $z < \emptyset$

$$E_z = -\frac{\sigma}{2\varepsilon_0}$$