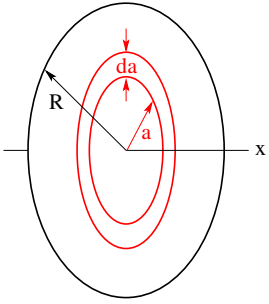
Electric Field of Charged Disk



- Charge per unit area: $\sigma = \dfrac{Q}{\pi R^2}$
- Area of ring: $dA = 2\pi a da$
- Charge on ring: $dq = 2\pi\sigma a da$

- $dE_x = \dfrac{kx dq}{(x^2+a^2)^{3/2}} = \dfrac{2\pi\sigma k x a da}{(x^2+a^2)^{3/2}}$
- $E_x = 2\pi\sigma k x \displaystyle\int_0^R \frac{a da}{(x^2+a^2)^{3/2}} = 2\pi\sigma k x \left[\frac{-1}{\sqrt{x^2+a^2}}\right]_0^R$
- $E_x = 2\pi\sigma k \left[1 - \dfrac{x}{\sqrt{x^2+R^2}}\right]$ for $x > 0$
- $x \ll R:\ E_x \simeq 2\pi\sigma k = \dfrac{\sigma}{2\epsilon_0}$
- Infinite sheet of charge produces uniform electric field perpendicular to plane.