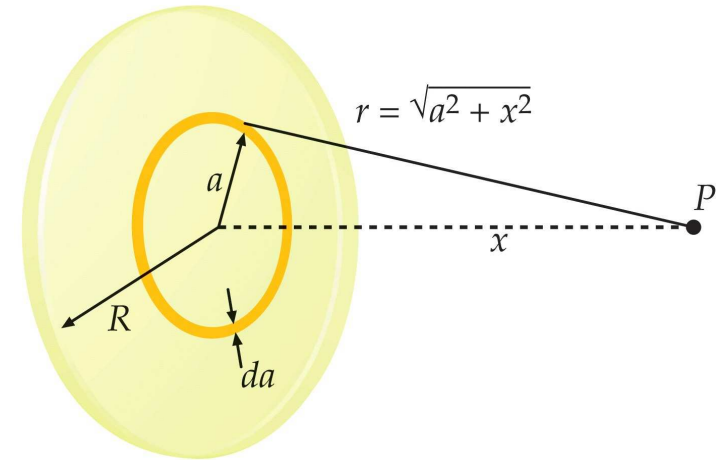


Electric Potential of Charged Disk



- Area of ring: $2\pi a da$
- Charge on ring: $dq = \sigma(2\pi a da)$
- Charge on disk: $Q = \sigma(\pi R^2)$



Find the electric potential at point P on the axis of the disk.

- $dV = k \frac{dq}{\sqrt{x^2 + a^2}} = 2\pi\sigma k \frac{a da}{\sqrt{x^2 + a^2}}$
- $V(x) = 2\pi\sigma k \int_0^R \frac{a da}{\sqrt{x^2 + a^2}} = 2\pi\sigma k \left[\sqrt{x^2 + a^2} \right]_0^R = 2\pi\sigma k \left[\sqrt{x^2 + R^2} - |x| \right]$

Electric potential at large distances from the disk ($|x| \gg R$):

$$V(x) = 2\pi\sigma k|x| \left[\sqrt{1 + \frac{R^2}{x^2}} - 1 \right] \simeq 2\pi\sigma k|x| \left[1 + \frac{R^2}{2x^2} - 1 \right] = \frac{k\sigma\pi R^2}{|x|} = \frac{kQ}{|x|}$$