

# Electric Potential of a Uniformly Charged Wire



- Consider a uniformly charged wire of infinite length.
- Charge per unit length on wire:  $\lambda$  (here assumed positive).

- Electric field at radius  $r$ :  $E = \frac{2k\lambda}{r}$ .

- Electric potential at radius  $r$ :

$$V = -2k\lambda \int_{r_0}^r \frac{1}{r} dr = -2k\lambda [\ln r - \ln r_0]$$

$$\Rightarrow V = 2k\lambda \ln \frac{r_0}{r}$$

- Here we have used a finite, nonzero reference radius  $r_0 \neq 0, \infty$ .
- The illustration from the textbook uses  $R_{ref}$  for the reference radius,  $R$  for the integration variable, and  $R_p$  for the radial position of the field point.

