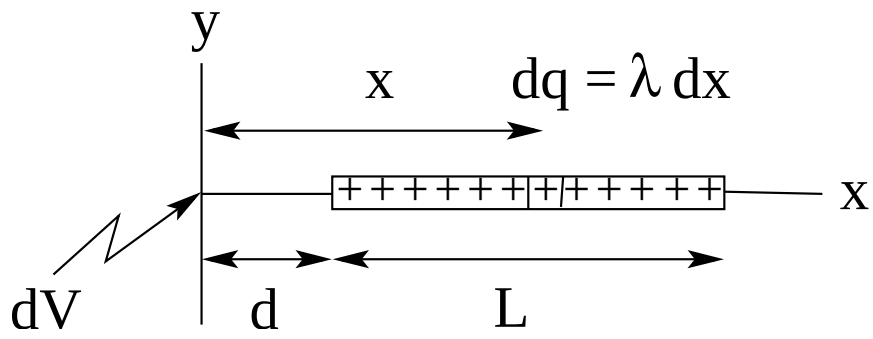
Electric Potential of Charged Rod

- Charge per unit length: $\lambda = Q/L$
- Charge on slice dx: $dq = \lambda dx$



- Electric potential generated by slice dx: $dV = \dfrac{kdq}{x} = \dfrac{k\lambda dx}{x}$
- Electric potential generated by charged rod:

$$V = k\lambda \int_d^{d+L} \frac{dx}{x} = k\lambda \left[\ln x\right]_d^{d+L} = k\lambda \left[\ln(d+L) - \ln d\right] = k\lambda \ln \frac{d+L}{d}$$

- Limiting case of very short rod $(L \ll d)$: $V = k\lambda \ln\left(1 + \dfrac{L}{d}\right) \simeq k\lambda \dfrac{L}{d} = \dfrac{kQ}{d}$