$$V(z) = \frac{1}{4\pi\varepsilon_o}\int \frac{\rho(\vec{r}\,')d\tau'}{\Re}$$

$$\underset{\text{if z>0}}{=} \frac{1}{4\pi\varepsilon_0}\int_{z'=-d}^{z'=0} \frac{\lambda dz'}{(z-z')}$$

$$= \frac{\lambda}{4\pi\varepsilon_0}(-)\ln(z-z')\,\Big|_{-d}^{0}$$

$$= \frac{\lambda}{4\pi\varepsilon_0}\ln\left(\frac{z+d}{z}\right)$$