

$$V_{\text{semi-circle}} = \frac{\lambda}{4\epsilon_0}$$

$$V_{\text{line}} \Rightarrow dV = \frac{1}{4\pi\epsilon_0} \frac{dq}{L+R} = \frac{1}{4\pi\epsilon_0} \frac{\lambda dL}{L+R}$$

$$\int dV = \frac{\lambda}{4\pi\epsilon_0} \int_0^{2R} \frac{dL}{L+R}$$

$$V = \frac{\lambda}{4\pi\epsilon_0} \left[\ln(L+R) \right]_0^{2R} = \frac{\lambda}{4\pi\epsilon_0} \ln(3)$$

$$V_{\text{total}} = 2 \left(\frac{\lambda}{4\pi\epsilon_0} \ln(3) \right) + \frac{\lambda}{4\epsilon_0} = \boxed{\frac{\lambda}{4\epsilon_0} \left(1 + \frac{2\ln(3)}{\pi} \right)}$$

~~Ans.~~ Ans. in Book:

$$\frac{\lambda}{4\epsilon_0 R} \left(1 + \frac{2\ln(3)}{\pi} \right)$$