3.28

$$V(\vec{r}) \cong \frac{1}{4\pi\varepsilon_0}\left[\frac{1}{r}\int \lambda(\vec{r}\,')\,dl' + \frac{1}{r^2}\int r'\cos\alpha\,\lambda(\vec{r}\,')\,dl' + \frac{1}{r^3}\int (r')^2\left(\frac{3}{2}\cos\alpha - \frac{1}{2}\right)\lambda(\vec{r}\,')\,dl'\right]$$

Here $\lambda(\vec{r}\,') = \lambda_0$, $dl' = R\,d\phi$, and assuming the point is on the z-axis, $\alpha = \frac{\pi}{2}$ and $\therefore$ $\cos\alpha = 0$

$$\int \lambda(\vec{r}\,')\,dl' = \lambda\int dl' = 2\pi R\lambda$$

$$\int r'\cos\alpha\,\lambda(\vec{r}\,')\,dl' = 0$$

$$\int (r')^2\left(\frac{3}{2}\cos\alpha - \frac{1}{2}\right)\lambda(\vec{r}\,')\,dl' = -\frac{1}{2}\int (r')^2\lambda(r')\,dl'$$

$$-\frac{1}{2}\int (r')^2\lambda(r')\,dl' = -\frac{\lambda}{2}\int R^2\cdot R\,d\phi = -\pi\lambda R^3$$

$$V(z) = \frac{1}{4\pi\varepsilon_0}\left[\frac{1}{z}(2\pi R\lambda) + \frac{1}{z^3}(-\pi\lambda R^3)\right] = \frac{1}{4\pi\varepsilon_0}\left[2\pi\lambda\left(\frac{R}{z}\right) - \pi\lambda\left(\frac{R}{z}\right)^3\right]$$

$$= \frac{\pi\lambda R}{4\pi\varepsilon_0 z}\left[2 - \left(\frac{R}{z}\right)^2\right]$$