1.7 Solution: Choose the origin to be the center of the conductor with radius a_1 and the center of the other conductor is located on the x-axis at d. Assume the conductors are parallel to the z-axis, with linear charge density λ and -λ, respectively. The electric field along the x-axis is pointing in the positive x direction is approximately,

$$E(x) = \frac{\lambda}{2\pi\varepsilon_0}\left(\frac{1}{x} + \frac{1}{d-x}\right).$$

Then, the potential difference between the two conductors is

$$V = \int_{a_1}^{d-a_2} E(x)dx = \frac{\lambda}{2\pi\varepsilon_0}\int_{a_1}^{d-a_2}\left(\frac{1}{x} + \frac{1}{d-x}\right)dx = \frac{\lambda}{2\pi\varepsilon_0}\log\left(\frac{(d-a_1)(d-a_2)}{a_1a_2}\right).$$

Since $d \ll a_1, a_2$, and let $a^2 = a_1a_2$, we can write the potential difference as

$$V \simeq \frac{\lambda}{2\pi\varepsilon_0}\log\left(\frac{d^2}{a^2}\right) = \frac{\lambda}{\pi\varepsilon_0}\log\left(\frac{d}{a}\right).$$

Therefore, the capacitance is

$$C = \frac{\lambda}{V} = \pi\varepsilon_0\left[\log\left(\frac{d}{a}\right)\right]^{-1}.$$