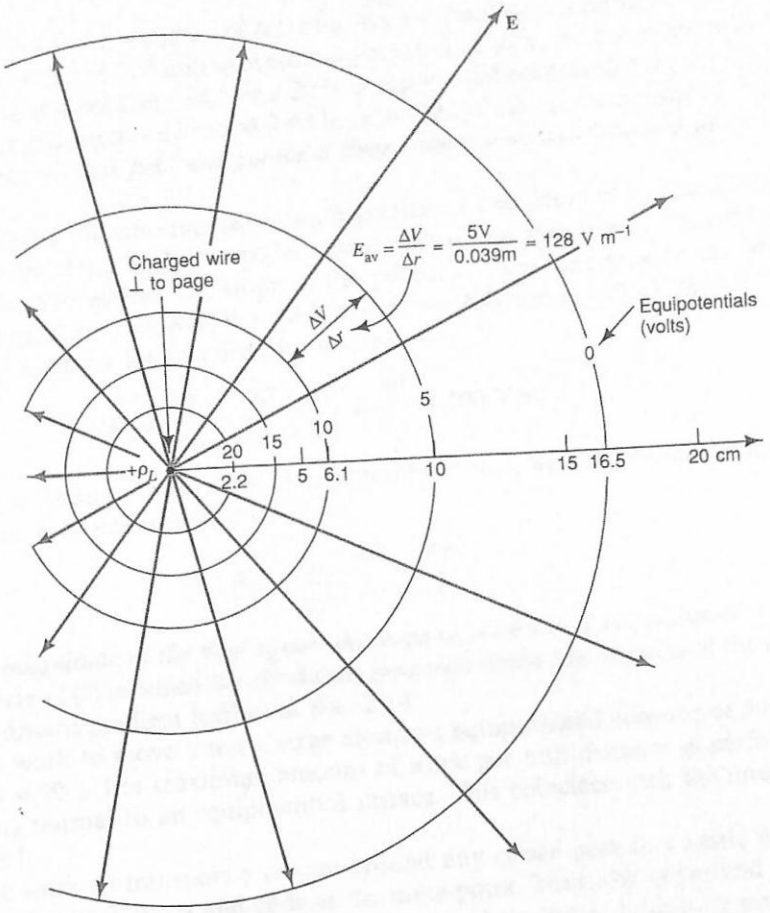

FIGURE 2-18
Electric field around long charged wire perpendicular to page. Field lines are radial. Equipotential surfaces are cylinders concentric with wire and seen as circles in this cross-section.

and by integration the potential difference between two radial distances r_1 and r_2 $(r_2 > r_1)$ is

$$\Delta V = V_1 - V_2 = \frac{\rho_L}{2\pi\epsilon_0}\int_{r_1}^{r_2}\frac{dr}{r} = \frac{\rho_L}{2\pi\epsilon_0}\ln\frac{r_2}{r_1} \quad \text{(V)} \tag{2}$$

For convenience let us set

$$\frac{\rho_L}{2\pi\epsilon_0} = 10 \text{ V} \tag{3}$$

which means that the charge per unit length

$$\rho_L = 20\pi\epsilon_0 = 20\pi 8.85 \times 10^{-12} = 556 \text{ pC m}^{-1}$$