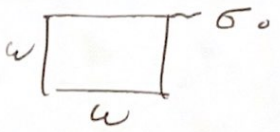
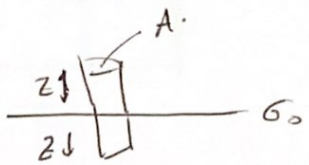
2.2.1



$$\oint E \cdot d\vec{a} = \frac{q_{in}}{\varepsilon_0} = \frac{A\sigma_0}{\varepsilon_0}$$



$$2EA = A\frac{\sigma_0}{\varepsilon_0}$$

$$E = \begin{cases} \frac{\sigma_0}{2\varepsilon_0} & z > 0 \\ -\frac{\sigma_0}{2\varepsilon_0} & z < 0 \end{cases}$$

2.2.2

Exact answer $E(z) = \frac{\sigma_0}{\pi\varepsilon_0} \tan^{-1}\left[\frac{w^2}{4z}\frac{1}{\sqrt{z^2 + w^2/2}}\right]$ $\frac{z}{w} \ll 1$

$$E(z) = \frac{\sigma_0}{\pi\varepsilon_0} \tan^{-1}\left[\frac{w^2}{4z}\frac{1}{\sqrt{w^2\left(z^2/w^2 + \frac{1}{2}\right)}}\right]$$

$$E(z) = \frac{\sigma_0}{\pi\varepsilon_0} \tan^{-1}\left[\left(\frac{w}{z}\right)\frac{1}{4\sqrt{\frac{z^2}{w^2} + \frac{1}{2}}}\right] \approx \frac{\sigma_0}{\pi\varepsilon_0} \tan^{-1}\left[\frac{w}{z}\frac{\sqrt{2}}{4}\right]$$

$\frac{w}{z} \gg 1 \Rightarrow \frac{\pi}{2}$

$$E(z) = \frac{\sigma_0}{\pi\varepsilon_0}\frac{\pi}{2}$$

$$\boxed{E(z) = \frac{\sigma_0}{2\varepsilon_0}}$$