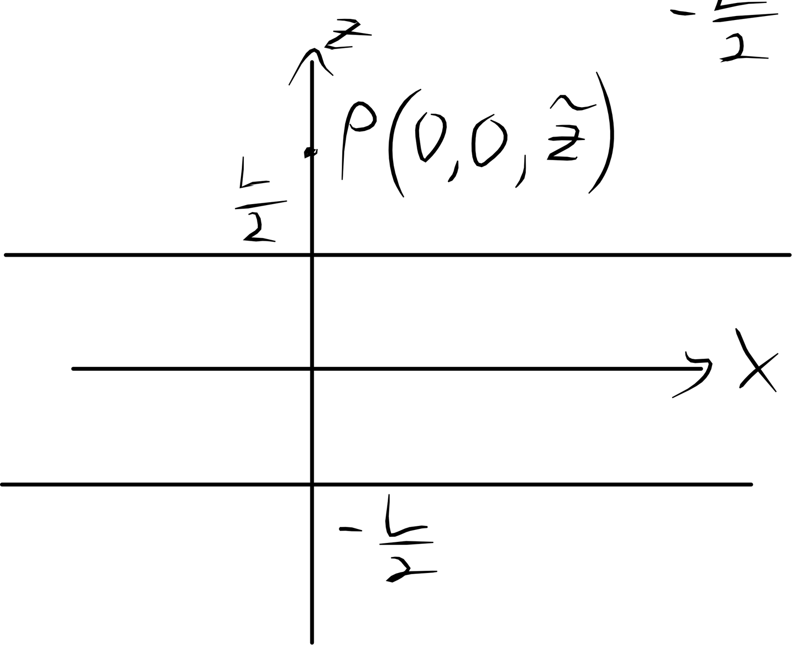
jedna warstwa $\qquad Q = \int d\sigma = \int \rho \, dz$

$$dE = sgn(z)\frac{d\sigma}{2\varepsilon_0}\hat{e}_z \qquad d\sigma = \rho\, dz$$

$$\rho = \rho_0 \cos^2\left(\frac{\pi}{L}z\right)$$

dla $|\tilde{z}| \geq \frac{L}{2}$

$$E_z = sgn(z)\frac{\rho_0 \hat{e}_z}{2\varepsilon_0}\int_{-\frac{L}{2}}^{\frac{L}{2}}\cos^2\left(\frac{\pi}{L}z\right)dz = sgn(z)\frac{\rho_0 \hat{e}_z}{2\varepsilon_0}\frac{L}{\pi}\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\cos^2(u)\,du =$$



$$\int_a^b \cos^2(x) = I = \cos x \sin x\Big|_a^b + \int_a^b \sin^2(x)\,dx =$$

	D	I
+	$\cos x$	$\cos x$
−	$-\sin x$	$\sin x$

$$= \cos x \sin x\Big|_a^b + \int_a^b 1\,dx - \int_a^b \cos^2(x)\,dx$$

$$\Rightarrow I = \left[\frac{1}{2}\cos x \sin x + \frac{1}{2}x\right]_a^b$$

$$= sgn(z)\frac{\rho_0 \hat{e}_z}{2\varepsilon_0}\frac{L}{\pi}\underbrace{\left(\frac{1}{2}\cos x \sin x + \frac{1}{2}x\right)\Big|_{-\frac{\pi}{2}}^{\frac{\pi}{2}}}_{\frac{\pi}{2}} = sgn(z)\frac{\rho_0 L}{4\varepsilon_0}\hat{e}_z$$

Dla $|\tilde{z}| < \frac{L}{2}$ Niech $\tilde{z} = La \quad a \in]-\frac{1}{2};\frac{1}{2}[$

$$E = \frac{\rho_0 \hat{e}_z}{2\varepsilon_0}\left(\int_{-\frac{L}{2}}^{La}\cos^2\left(\frac{\pi}{L}z\right)dz - \int_{La}^{\frac{L}{2}}\cos^2\left(\frac{\pi}{L}z\right)dz\right) =$$

$$= \frac{\rho_0 \hat{e}_z}{2\varepsilon_0}\frac{L}{\pi}\left(\int_{-\frac{\pi}{2}}^{a\pi}\cos^2(x)\,dx - \int_{a\pi}^{\frac{\pi}{2}}\cos^2(x)\,dx\right) =$$

$$= \frac{\rho_0 \hat{e}_z}{2\varepsilon_0}\frac{L}{\pi}\frac{1}{2}\left(\left[\sin x \cos x + x\right|_{-\frac{\pi}{2}}^{a\pi} - \left[\sin x \cos x + x\right]_{a\pi}^{\frac{\pi}{2}}\right) =$$

$$= \frac{\rho_0 \hat{e}_z}{4\varepsilon_0}\frac{L}{\pi}\left(\frac{1}{2}\sin(2a\pi) + a\pi + \cancel{\frac{\pi}{2}} + \frac{1}{2}\sin(2a\pi) + a\pi - \cancel{\frac{\pi}{2}}\right) =$$

$$= \frac{\rho_0 \hat{e}_z}{4\varepsilon_0}\frac{L}{\pi}\left(\sin(2a\pi) + 2a\pi\right) = \frac{\rho_0 \hat{e}_z}{4\varepsilon_0}\frac{L}{\pi}\left(\sin\left(\frac{2\pi\tilde{z}}{L}\right) + \frac{2\pi\tilde{z}}{L}\right)$$

Dla $\tilde{z} > 0$, bo symetria. Niech $\phi\left(\frac{L}{2}\right) = 0$

$\tilde{z} > \frac{L}{2}$

$$\phi = -\int_{\frac{L}{2}}^{\tilde{z}}\frac{\rho_0 L}{4\varepsilon_0}dz = -\frac{\rho_0 L}{4\varepsilon_0}\left(\tilde{z} - \frac{L}{2}\right)$$

$\tilde{z} < \frac{L}{2}$

$$\phi = -\int_{\frac{L}{2}}^{\tilde{z}}\frac{\rho_0 L}{4\pi\varepsilon_0}\left(\sin\left(\frac{2\pi z}{L}\right) + \frac{2\pi z}{L}\right)dz = \frac{\rho_0 L}{4\pi\varepsilon_0}\left(\frac{L}{2\pi}\cos\left(\frac{2\pi\tilde{z}}{L}\right) + \frac{L}{2\pi} - \frac{\pi}{L}\tilde{z}^2 + \frac{\pi L}{4}\right)$$

Między brzegami $\Delta\phi = 0$

Między brzegiem i środkiem $\left|\phi(0) - \phi\left(\frac{L}{2}\right)\right| = |\phi(0)| = \frac{\rho_0 L}{4\pi\varepsilon_0}\left(\frac{L}{2\pi} + \frac{L}{2\pi} + \frac{\pi L}{4}\right) =$

$$= \frac{\rho_0 L^2}{4\pi\varepsilon_0}\left(\frac{1}{\pi} + \frac{\pi}{4}\right)$$