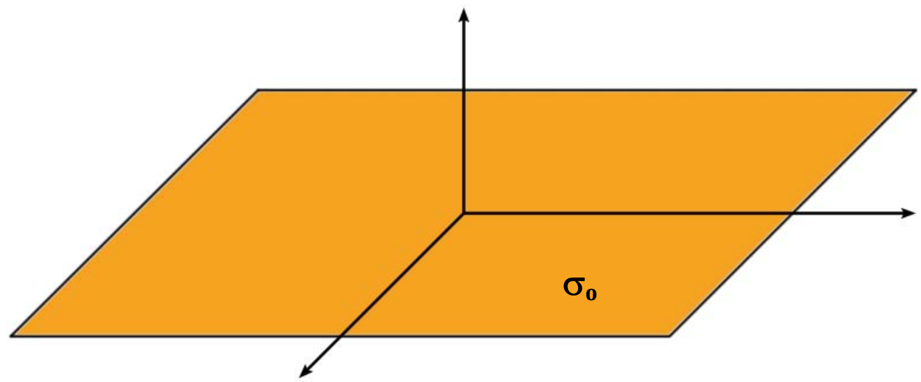
Representing the density function of an infinite sheet of charge using a delta function



Show that $\rho(x,y,z) = \sigma_o \delta(z)$ correctly models the charge distribution of an infinite sheet of charge.

If this charge density is correct, the following MUST be true:

$$\int_S \sigma(\mathbf{r})dA = \int_V \rho(\mathbf{r})dV$$

(total charge = total charge)

which comes from: $\sigma = \frac{dq}{dA}$, $\rho = \frac{dq}{dV}$

$\sigma dA = dq$, $\rho dV = dq$

➔ $\sigma dA = \rho dV$

$\therefore$

$$\int_S \sigma_o dxdy = \int_V \sigma_o \delta(z)dxdydz$$

$$= \int_S \sigma_o \left[\int_{-\infty}^{\infty} \delta(z)dz \right] dxdy$$

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$$\int_S \sigma_o dxdy = \int_S \sigma_o dxdy \quad \checkmark$$