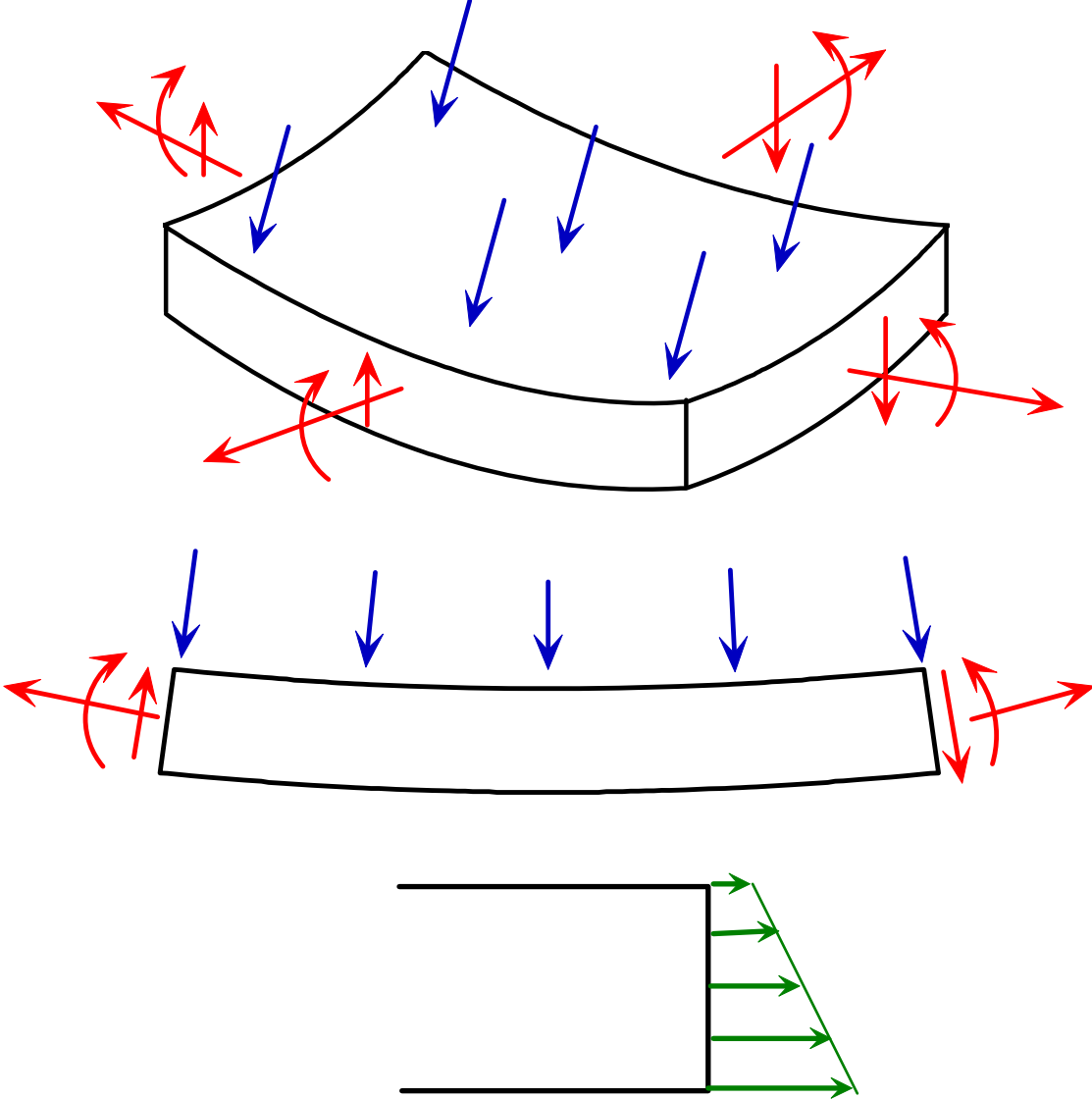


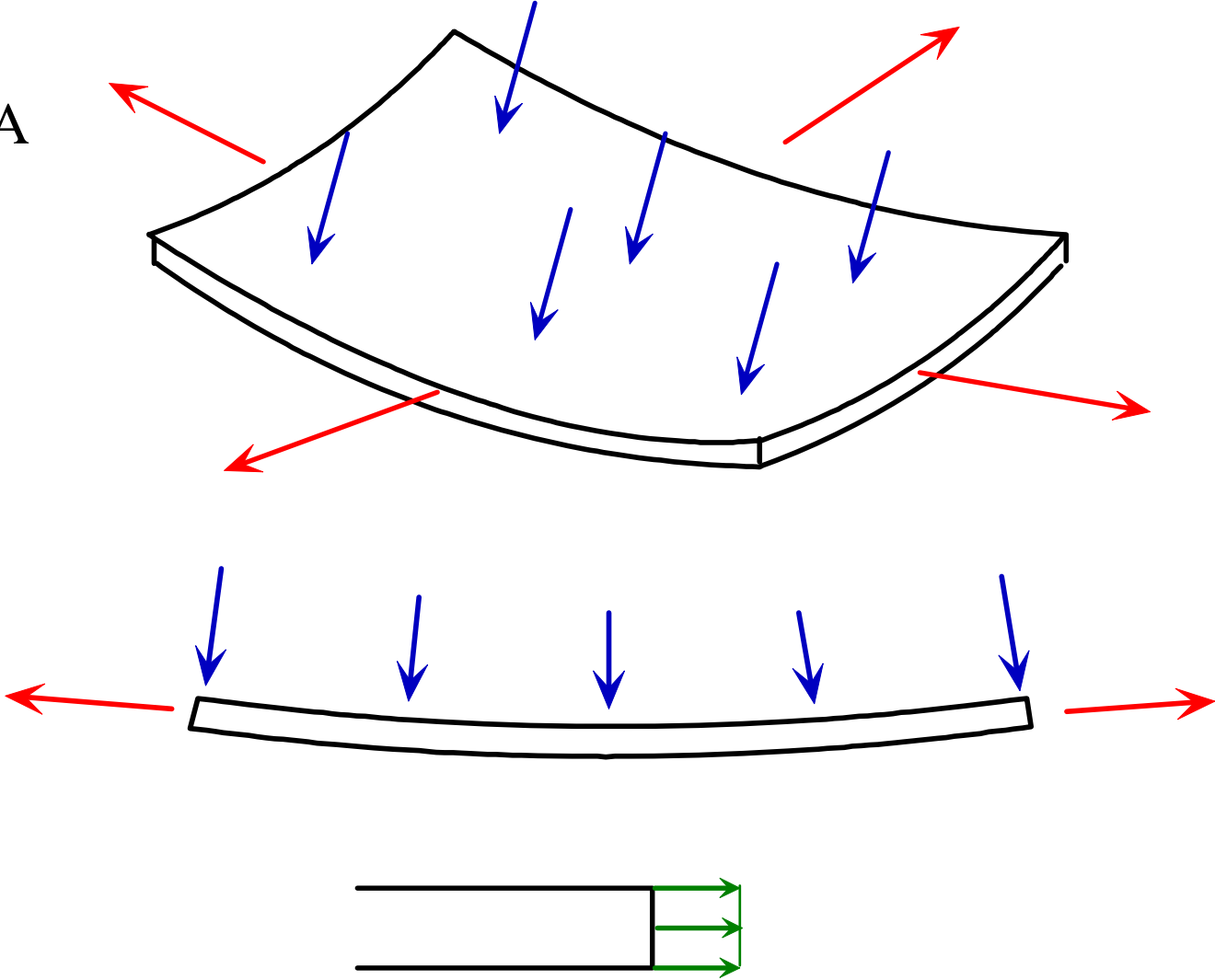
ELEMENTOS BIDIMENSIONALES

PLACA

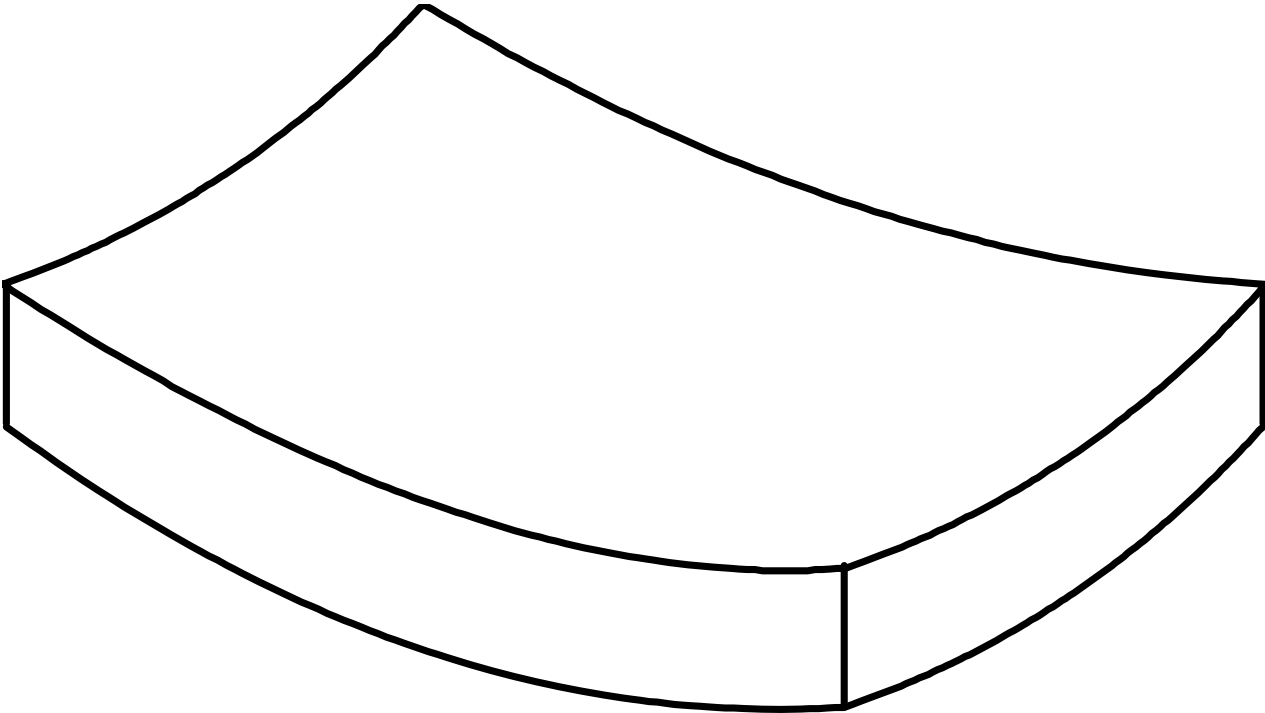


ELEMENTOS BIDIMENSIONALES

MEMBRANA



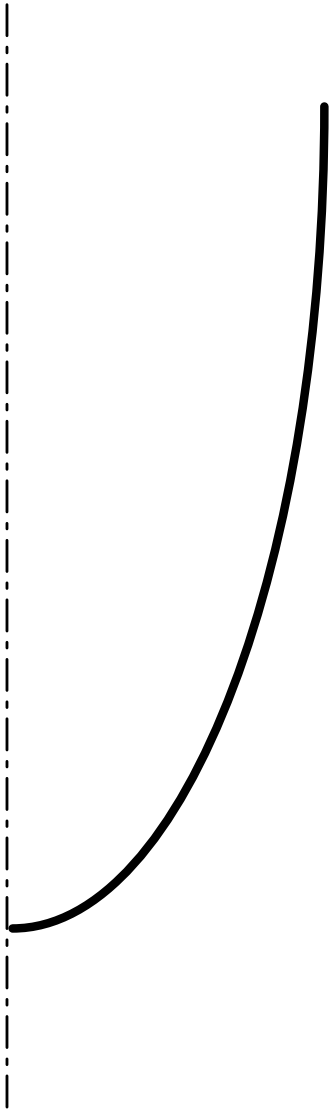
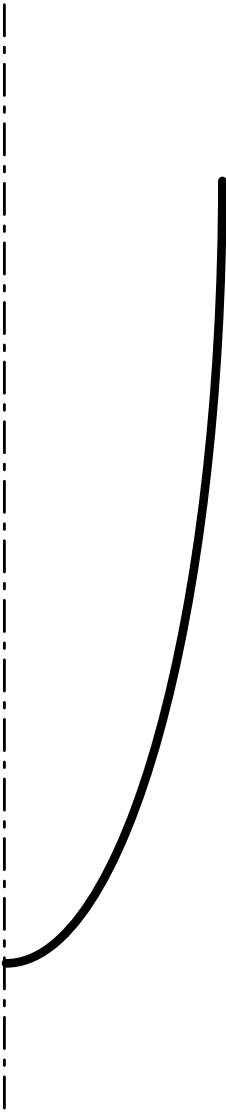
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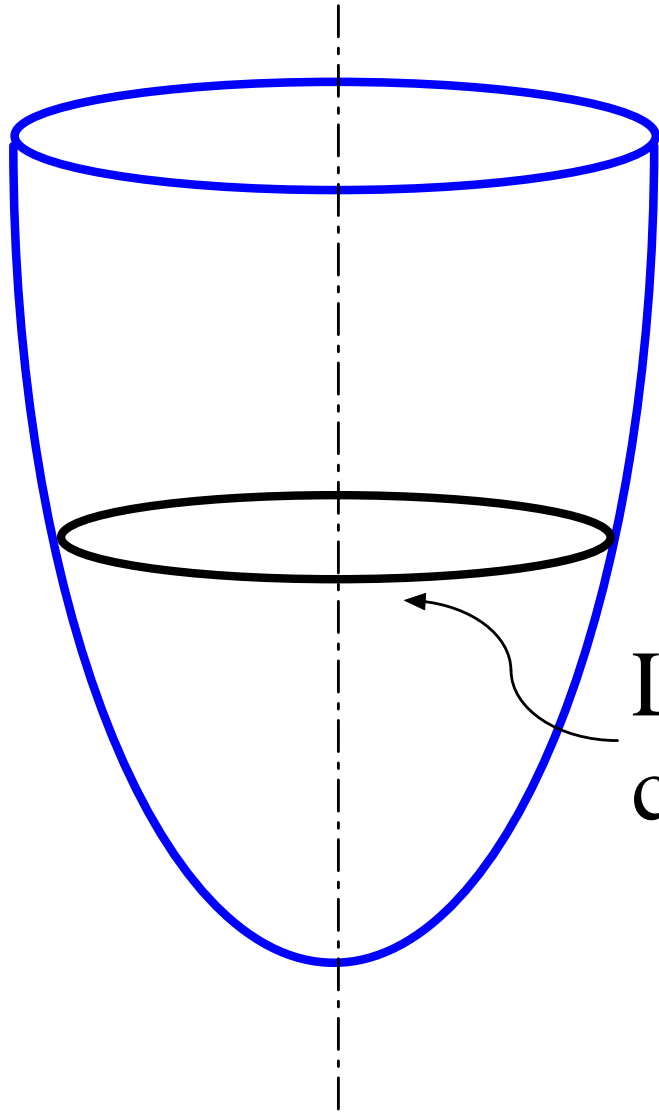
MEMBRANAS DE REVOLUCIÓN



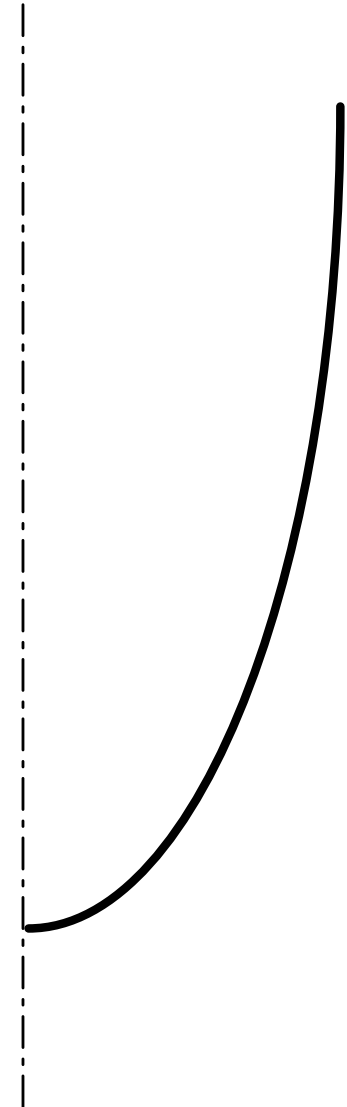
MEMBRANAS DE REVOLUCIÓN



MEMBRANAS DE REVOLUCIÓN

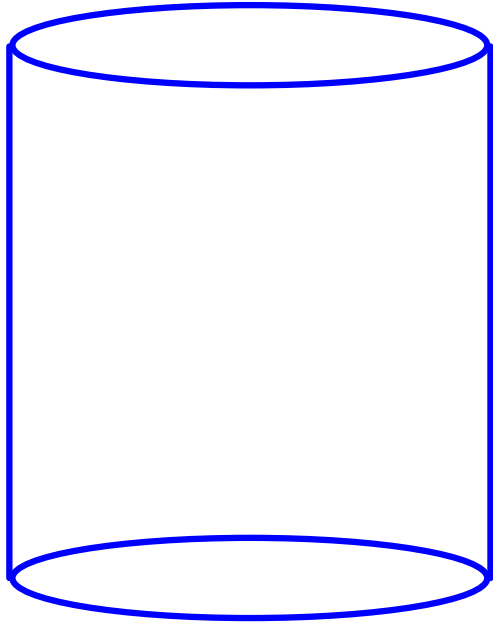


Línea
circunferencial

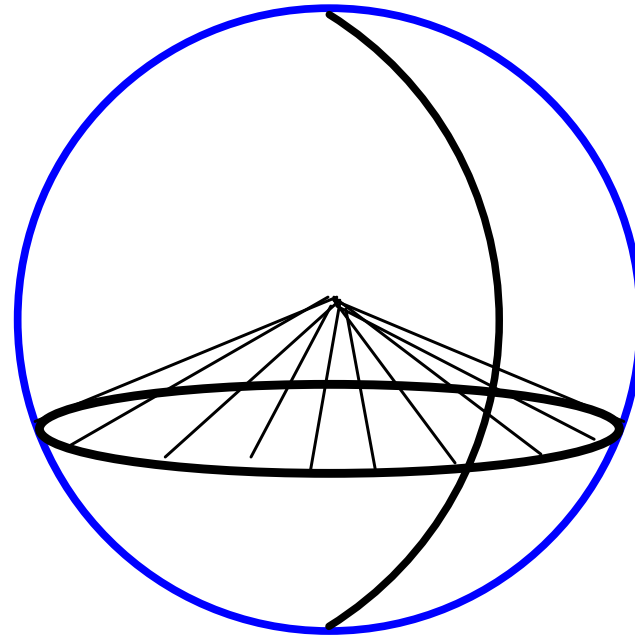


EJEMPLOS

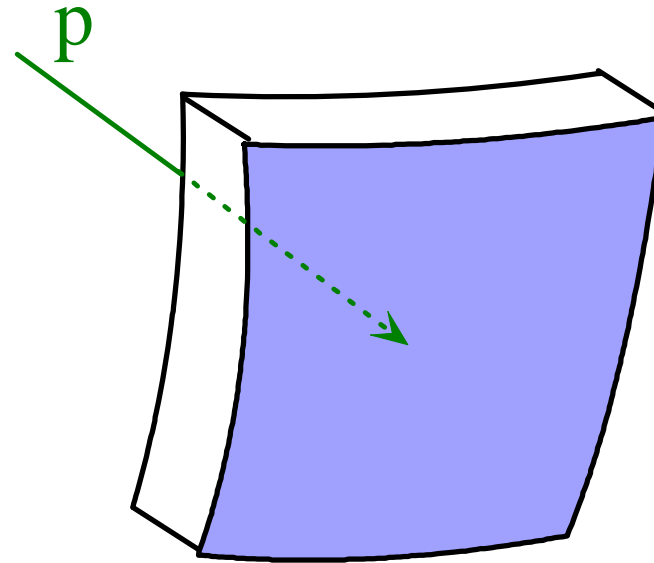
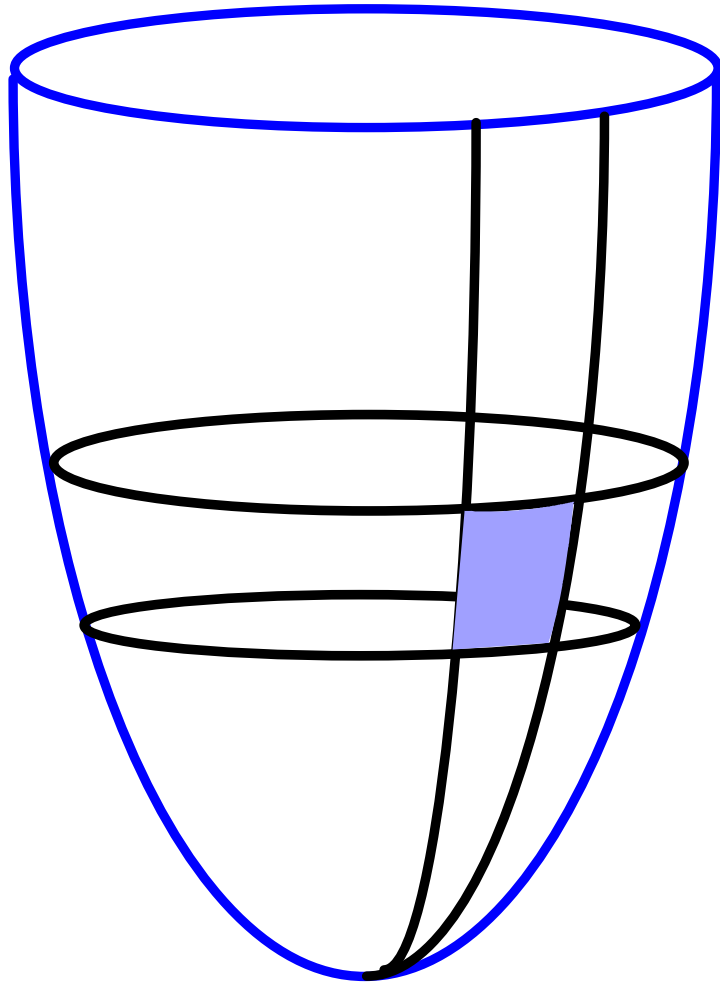
CILINDRO



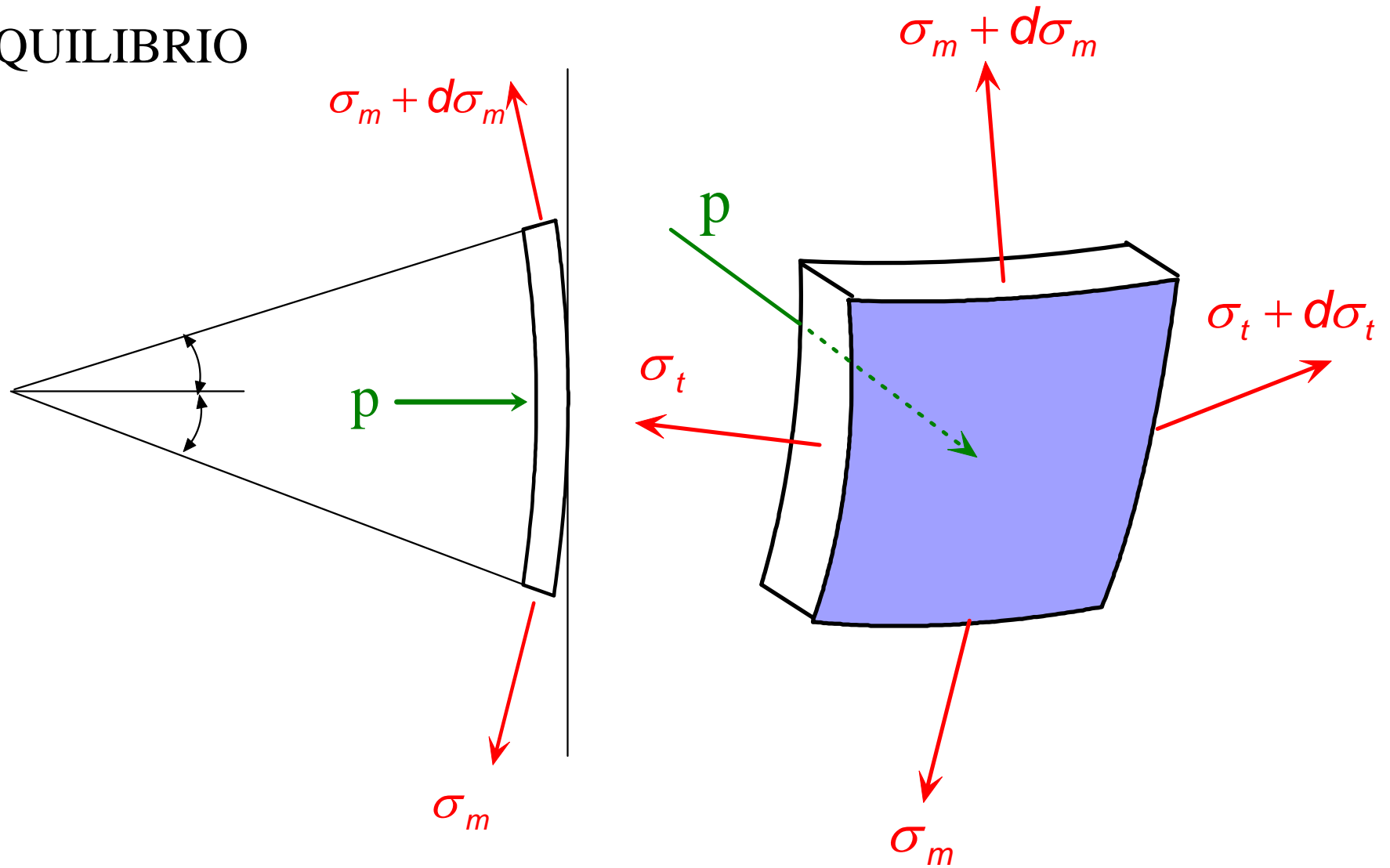
ESFERA



TENSIONES EN MEMBRANAS DE REVOLUCIÓN BAJO PRESIÓN



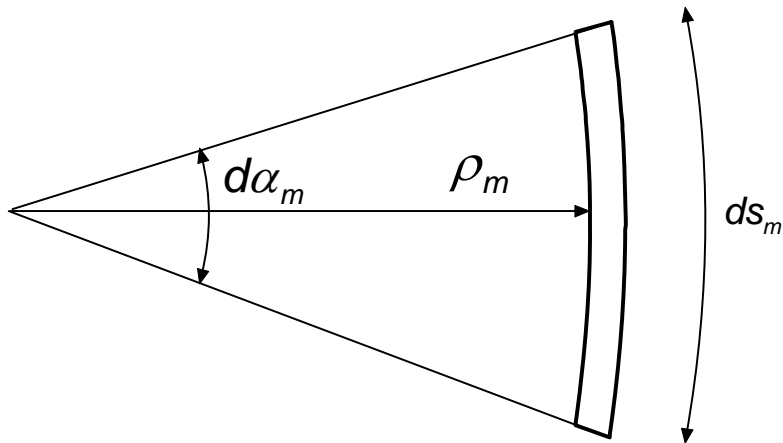
EQUILIBRIO



Suma de fuerzas nula en la dirección de p :

$$p \cdot ds_m \cdot ds_t - (2\sigma_m + d\sigma_m) \operatorname{sen} \frac{d\alpha_m}{2} \cdot e \cdot ds_t - (2\sigma_t + d\sigma_t) \operatorname{sen} \frac{d\alpha_t}{2} \cdot e \cdot ds_m = 0$$

$$p \cdot ds_m \cdot ds_t - (2\sigma_m + d\sigma_m) \frac{d\alpha_m}{2} \cdot e \cdot ds_t - (2\sigma_t + d\sigma_t) \frac{d\alpha_t}{2} \cdot e \cdot ds_m = 0$$



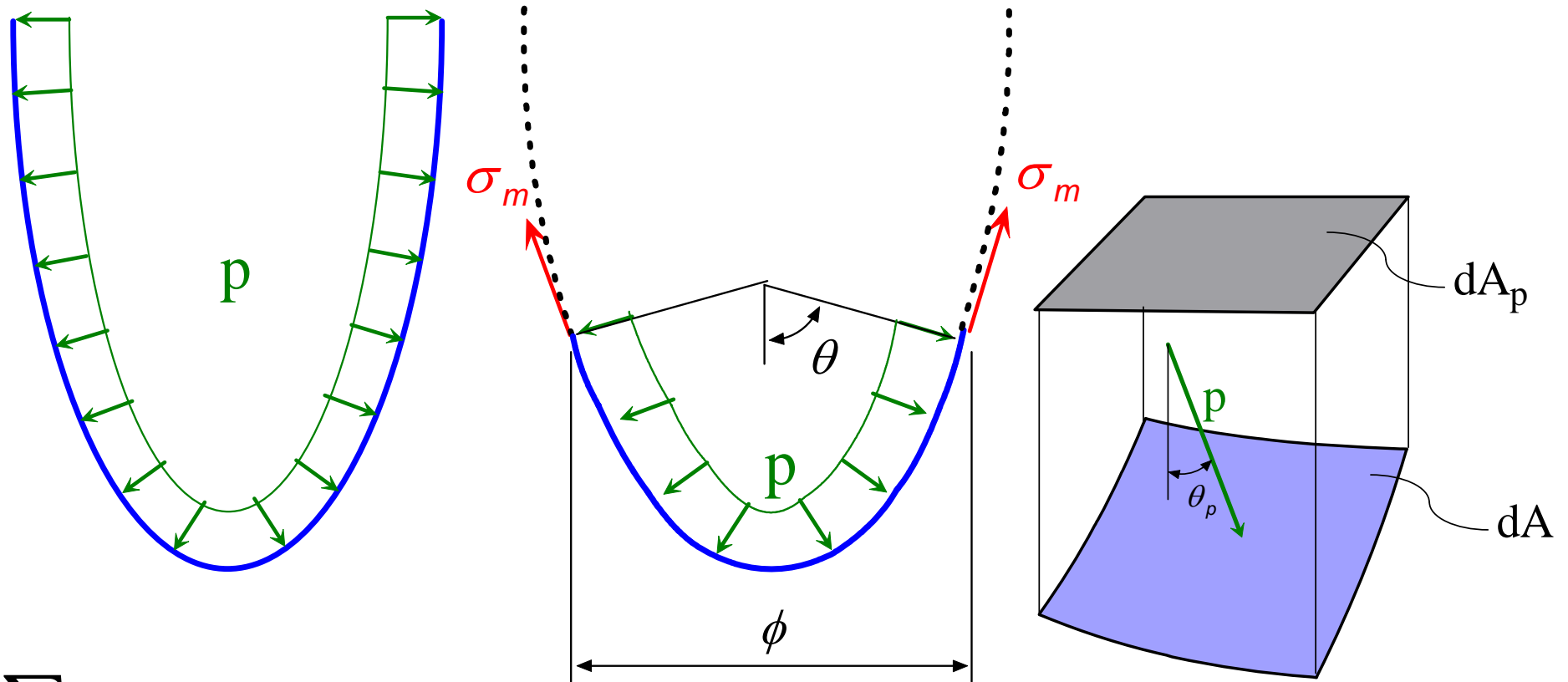
$$\frac{d\alpha_t}{2} = \frac{1}{2} \frac{ds_t}{\rho_t}$$

$$p \cdot ds_m \cdot ds_t - (2\sigma_m + d\sigma_m) \frac{1}{2\rho_m} \cdot e \cdot ds_m \cdot ds_t - (2\sigma_t + d\sigma_t) \frac{1}{2\rho_t} \cdot e \cdot ds_m \cdot ds_t = 0$$

$$p - \frac{\sigma_m}{\rho_m} e - \frac{\sigma_t}{\rho_t} e = 0 \quad \longrightarrow$$

Ecuación de
Laplace

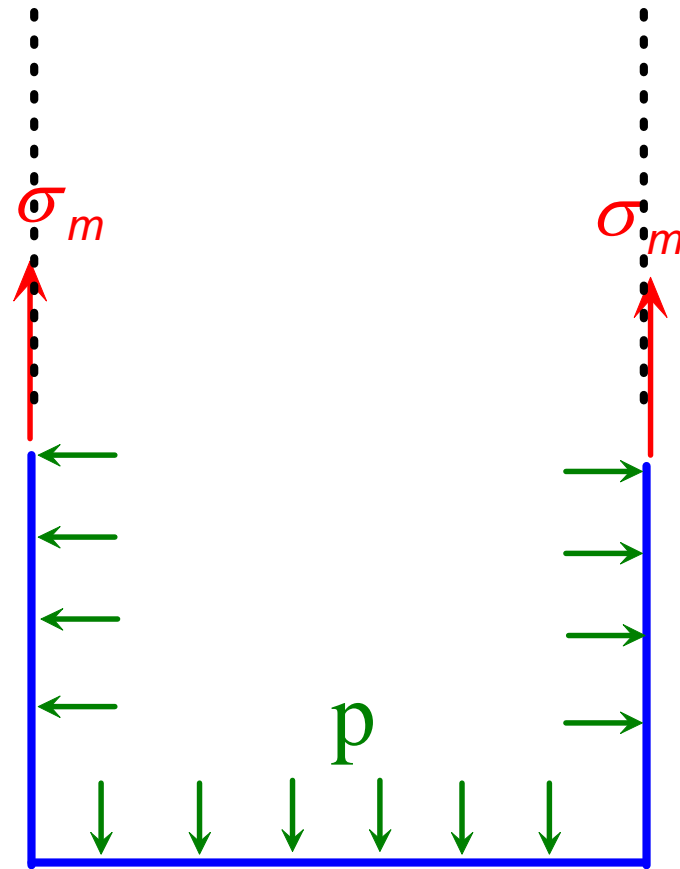
MEMBRANAS BAJO PRESIÓN CONSTANTE (Depósitos de gas)



$$\sum F_v = 0$$

$$\rightarrow \sigma_m \cdot e \cdot \text{sen } \theta \cdot \pi \cdot \phi - p A_p = 0$$

Depósito de gas cilíndrico



$$\sum F_v = 0$$

$$\sigma_m = \frac{p \cdot D}{4e}$$

Ec. de Laplace:

$$\frac{p}{e} = \frac{\sigma_m}{\rho_m} + \frac{\sigma_t}{\rho_t} \quad \rightarrow$$

Depósito de gas esférico

Simetría: $\sigma_m = \sigma_t$

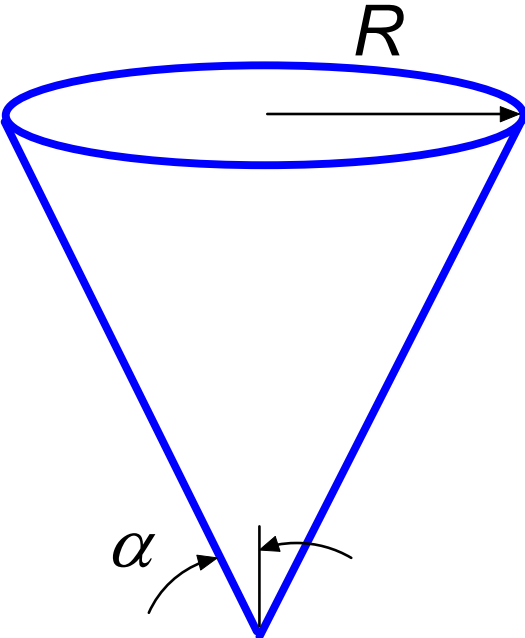
$$\rho_m = \rho_t = \frac{D}{2}$$

Ec. de Laplace:

$$\frac{p}{e} = \frac{\sigma_m}{\rho_m} + \frac{\sigma_t}{\rho_t} \quad \longrightarrow \quad \frac{p}{e} = \frac{\sigma_m}{D/2} + \frac{\sigma_m}{D/2} \quad \longrightarrow \quad \sigma_m = \sigma_t = \frac{p \cdot D}{4e}$$

CASOS ESPECIALES

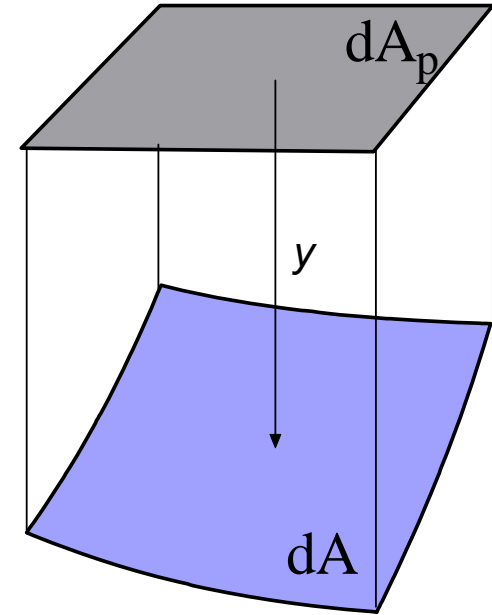
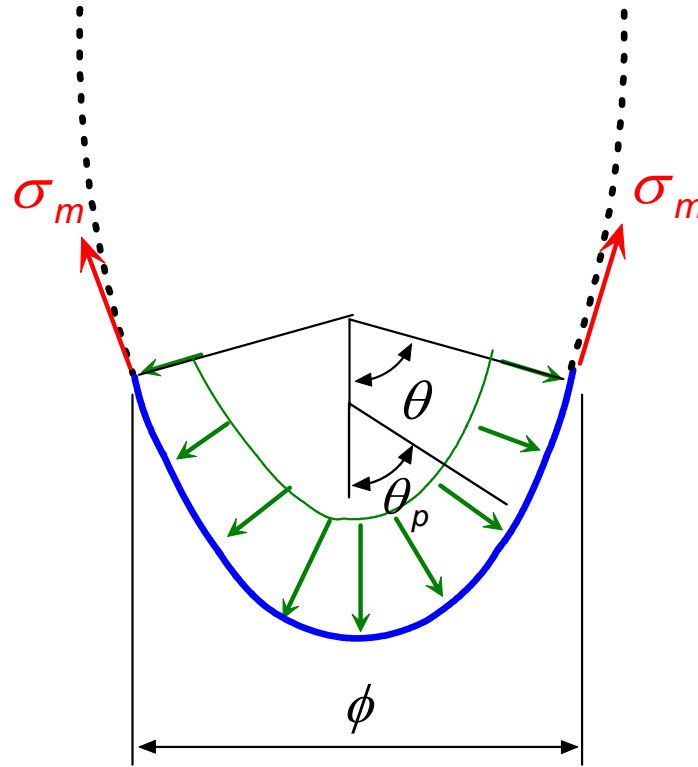
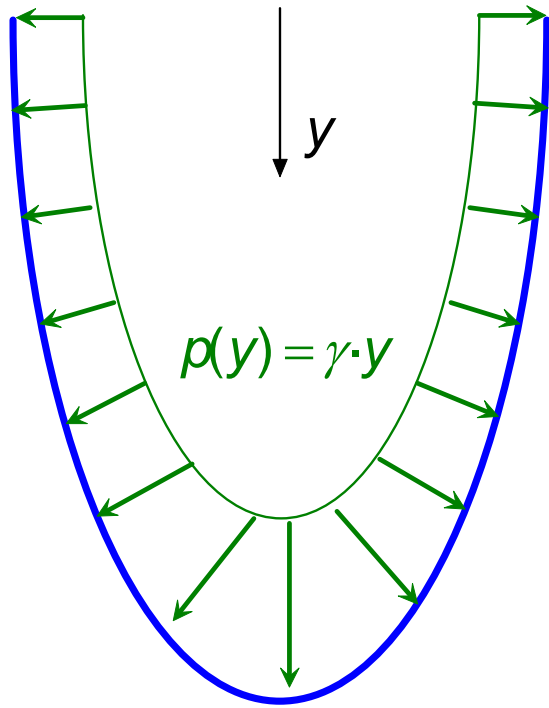
CONO



TORO



MEMBRANAS BAJO PRESIÓN LINEAL (Depósitos de líquido)



$$\sum F_V = 0$$

$$\text{sen } \theta_p \cdot dA = dA_p \longrightarrow \gamma \iint_A y \cdot dA_p \longrightarrow \text{Peso de la columna de líquido}$$

