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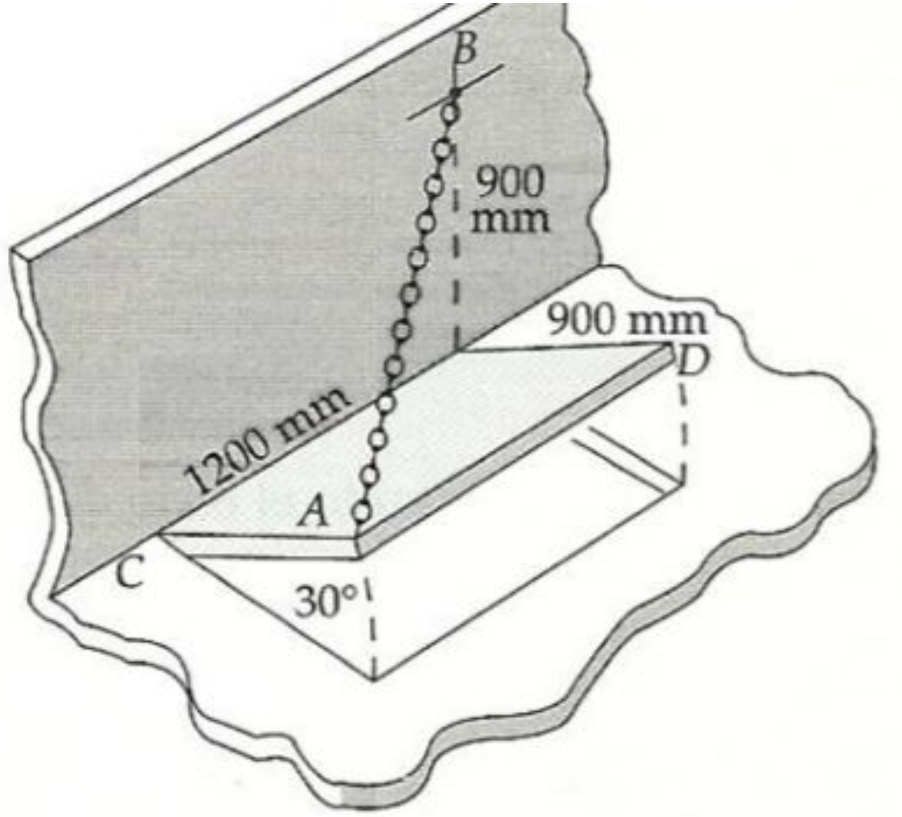
Estabilidad I

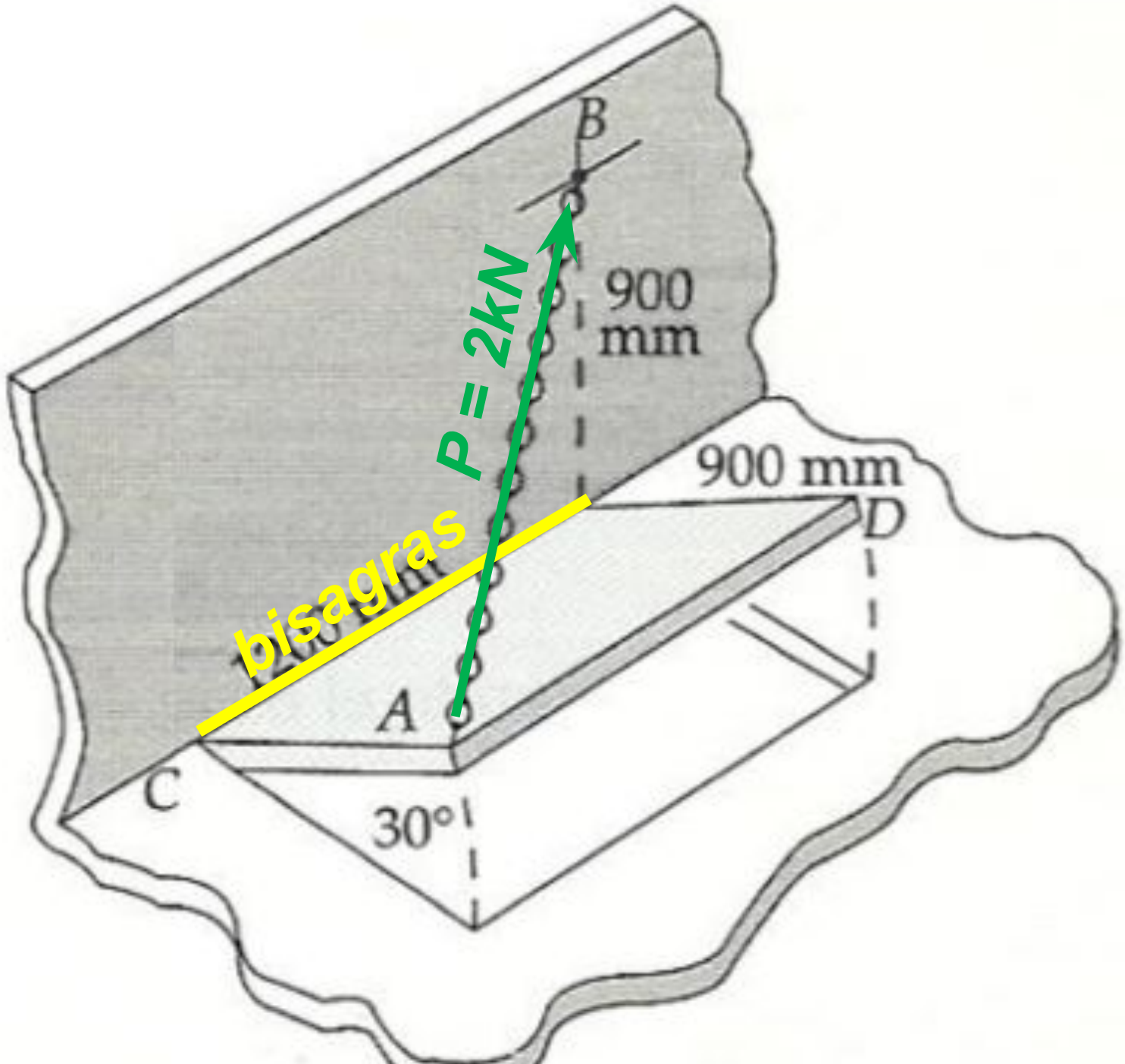
Sistemas de fuerzas 3D

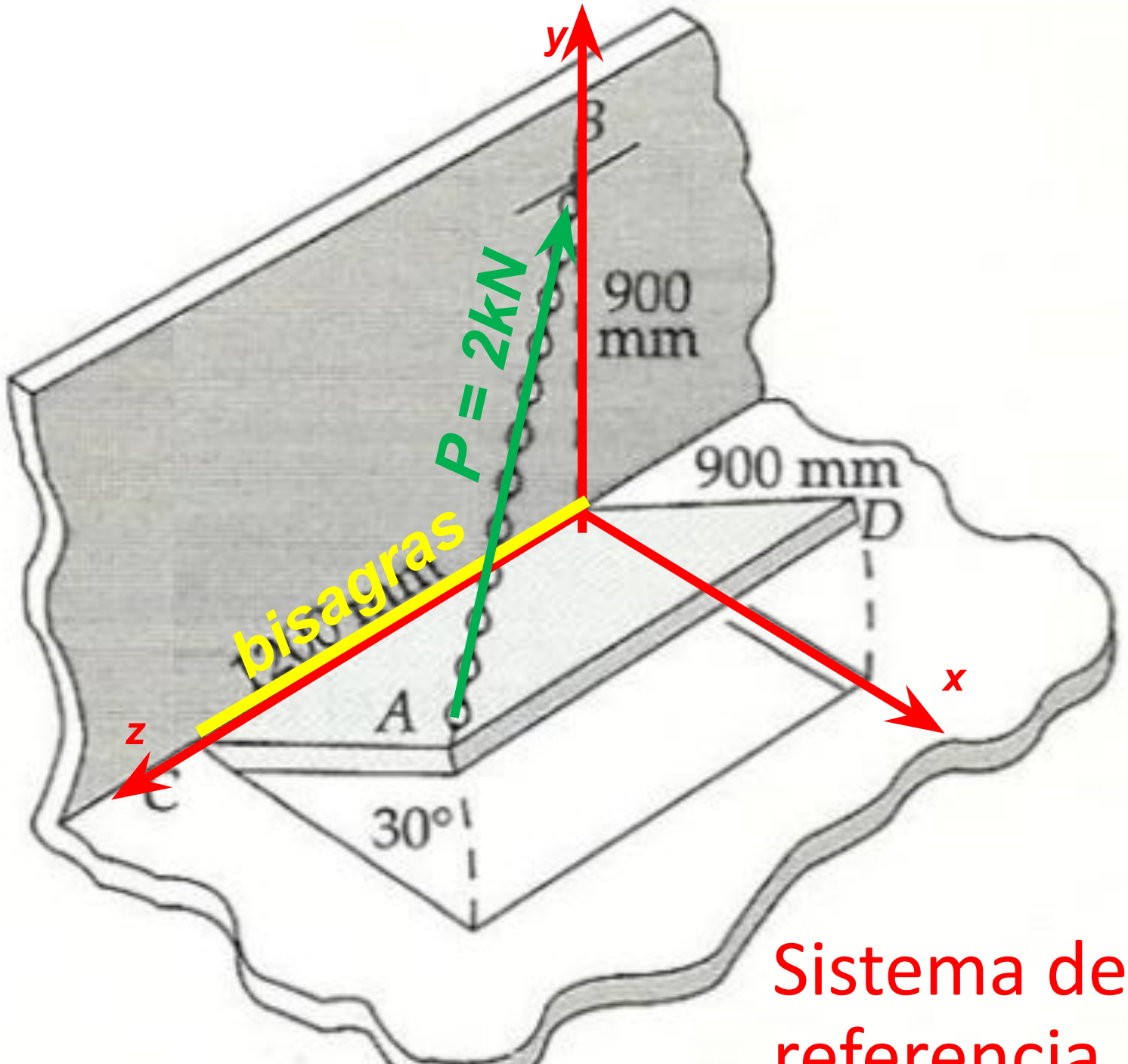
Fuerzas concentradas 3D

Ejercicio 19.8

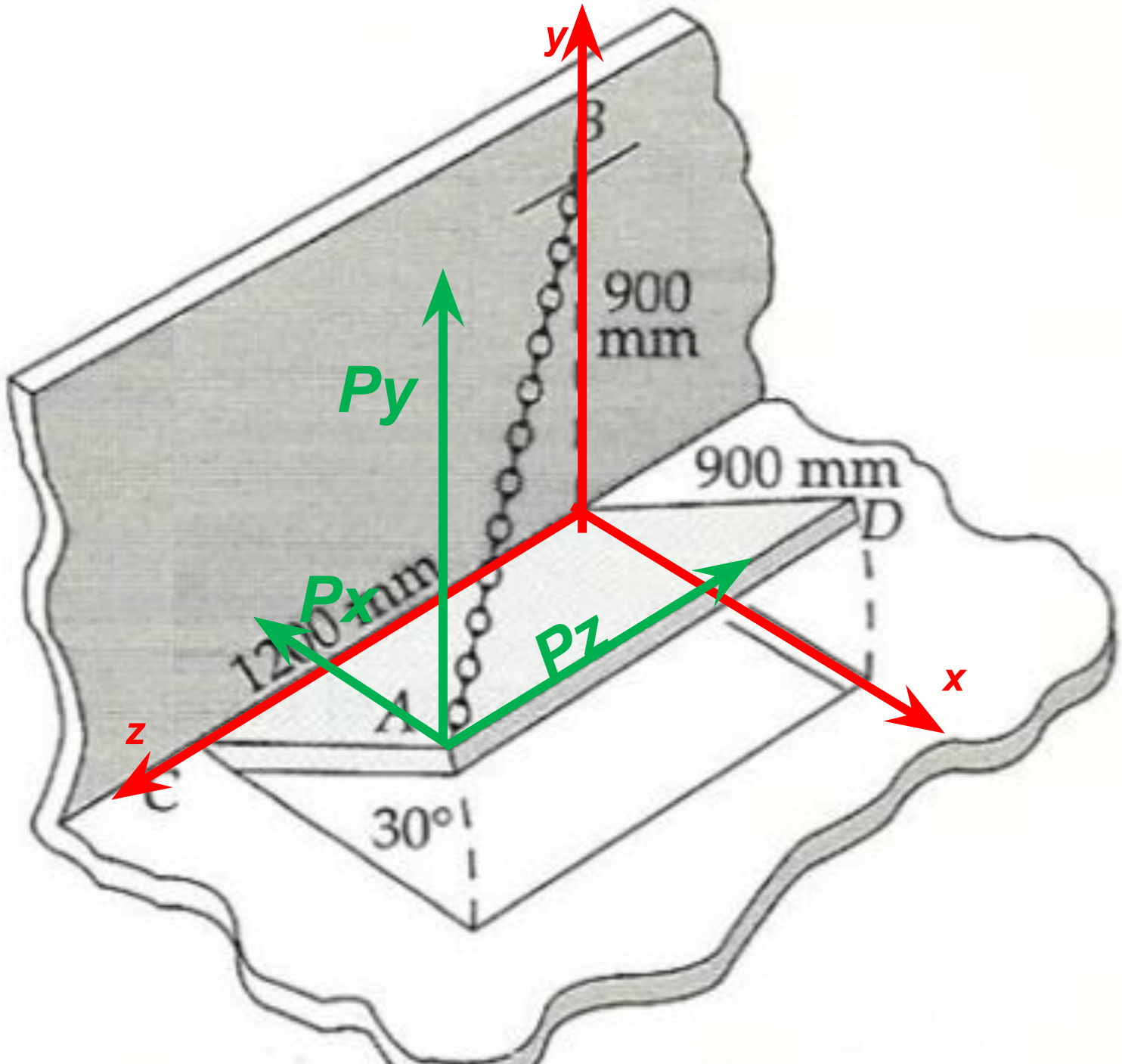
En el problema de la puerta de la figura 3, la cadena AB mantiene la trampilla abierta a 30°. Si la tensión T de la cadena es T = P3, determinar el módulo del momento ejercido por la cadena respeto del eje de las bisagras.

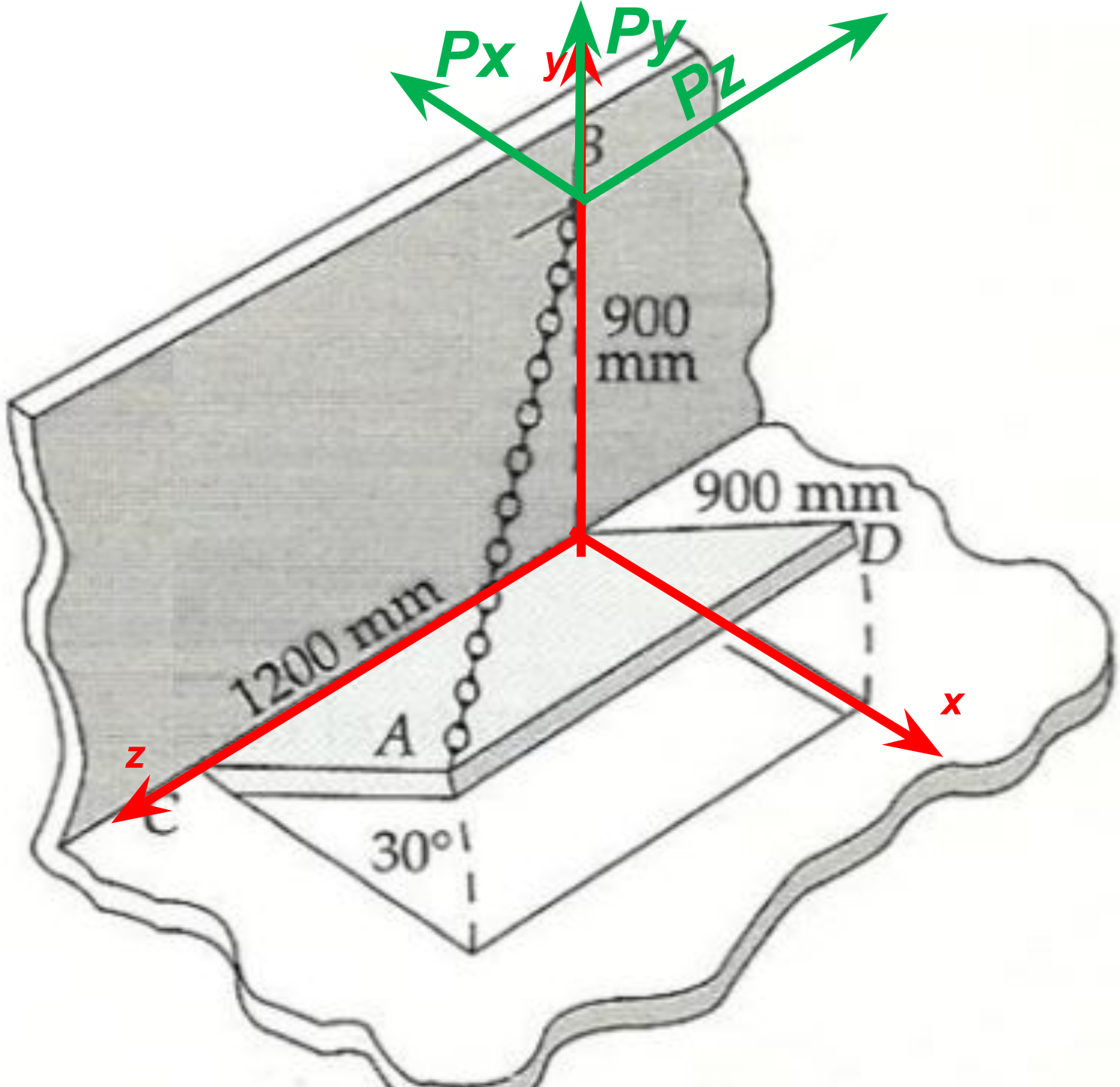



B
900
mm
P = 2kN
900 mm
D
bisagras
A
C
30°

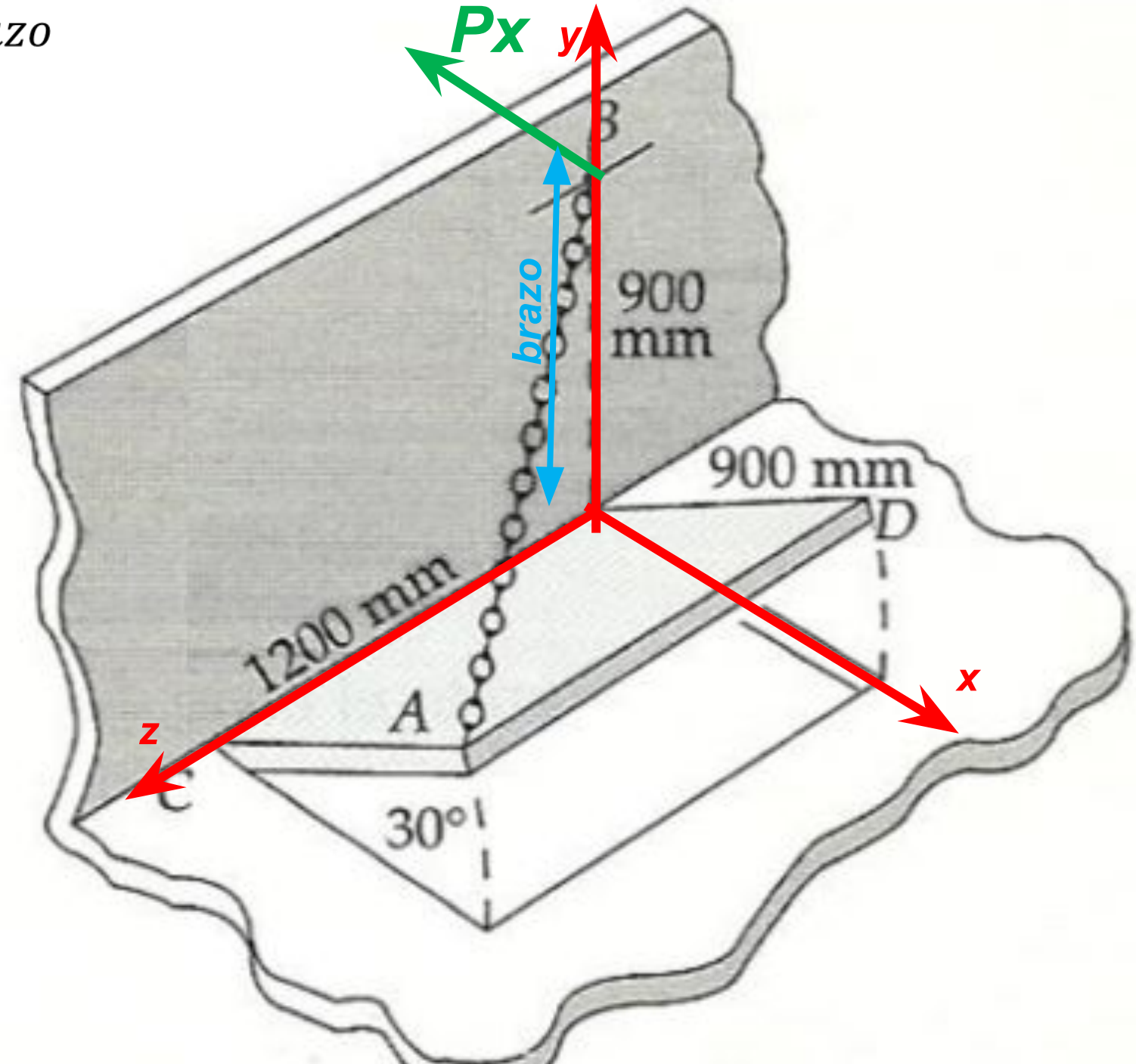


Sistema de referencia

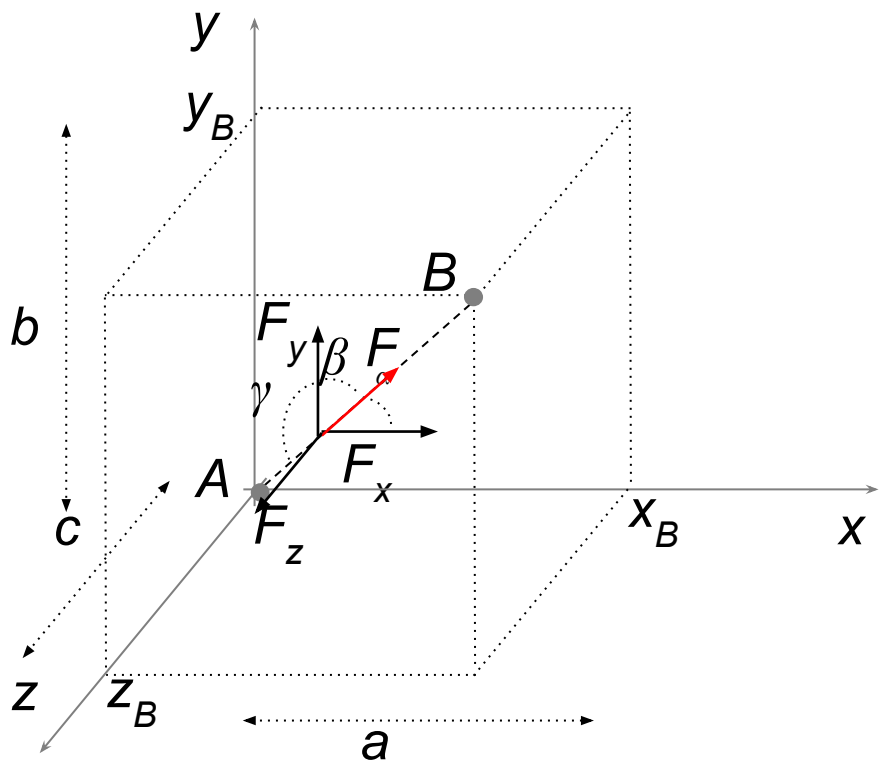

y
B
900
mm
Py
900 mm
D
Px
Pz
x
z
A
C
30°


Px
y
Py
Pz
B
900
mm
900 mm
D
1200 mm
A
z
x
C
30°

$$M_{bisagra} = F_x \cdot brazo$$



Pitágoras 3D

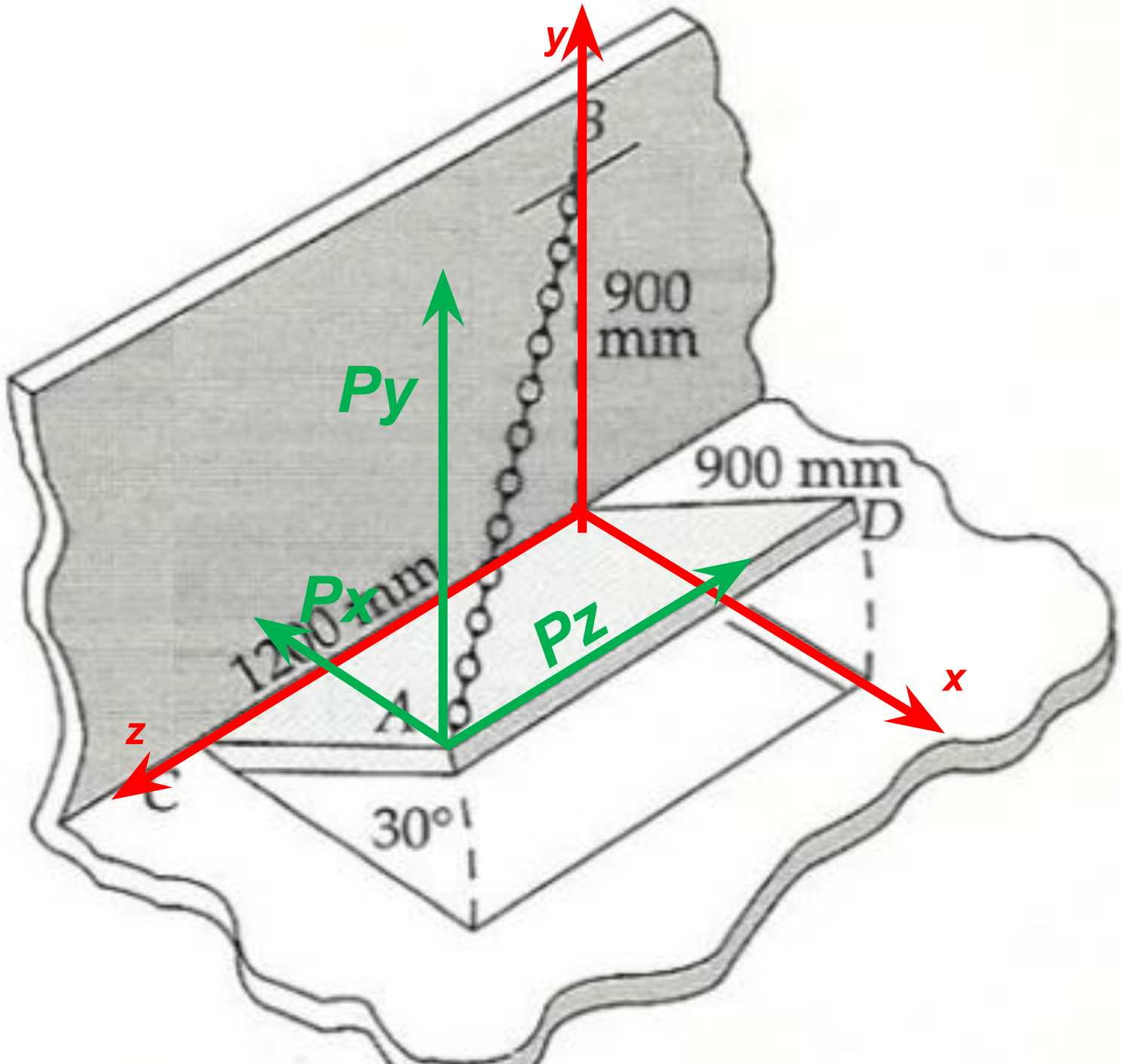


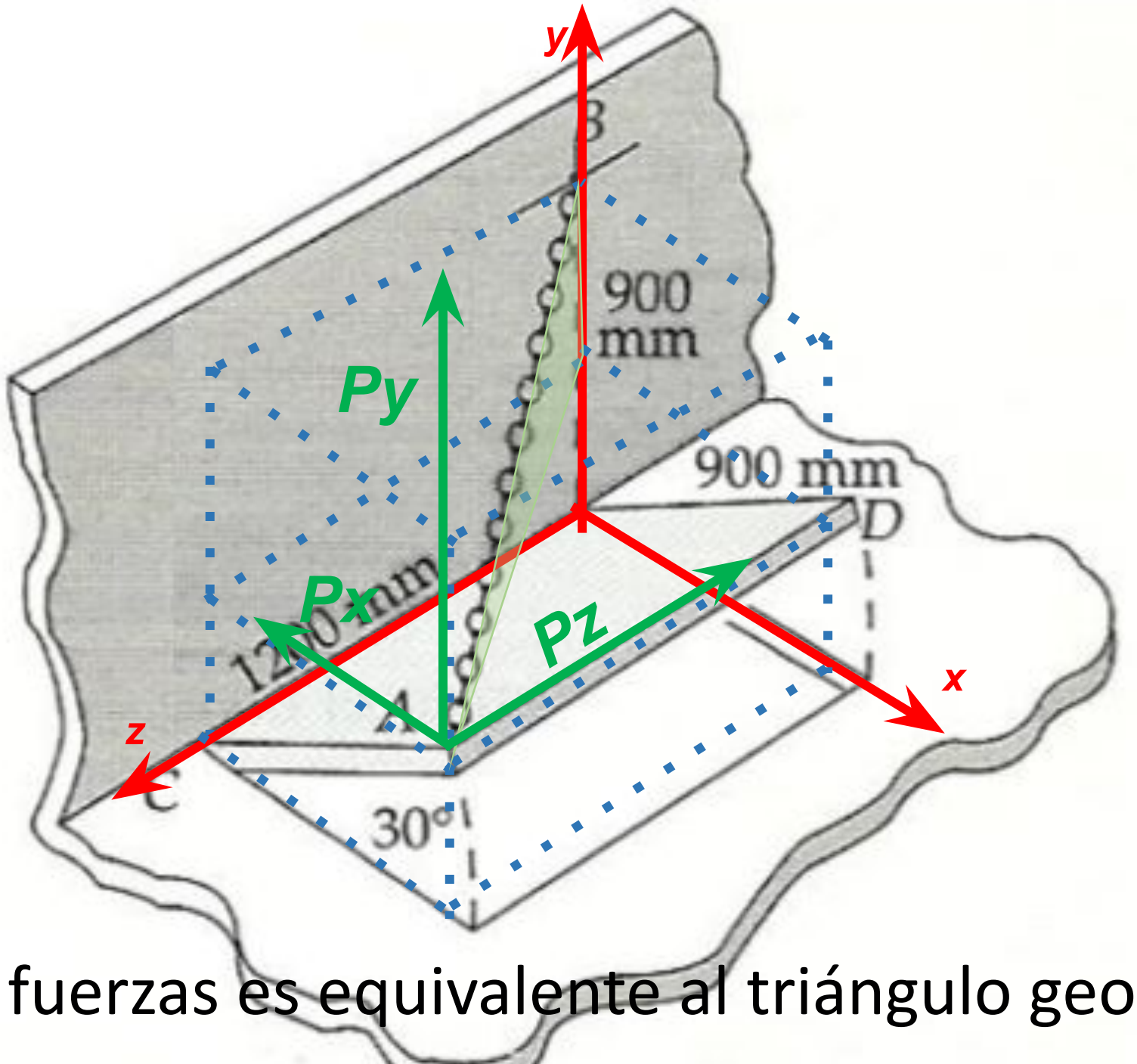
$$F_x = \left|\vec{F}\right| \cdot \frac{a}{\sqrt[2]{a^2 + b^2 + c^2}}$$

$$F_y = \left|\vec{F}\right| \cdot \frac{b}{\sqrt[2]{a^2 + b^2 + c^2}}$$

$$F_z = \left|\vec{F}\right| \cdot \frac{c}{\sqrt[2]{a^2 + b^2 + c^2}}$$

$$\vec{F} = \left(F_x; F_y; F_z\right) = \left|\vec{F}\right| \cdot \left(cos(\alpha); cos(\beta); cos(\gamma)\right)$$

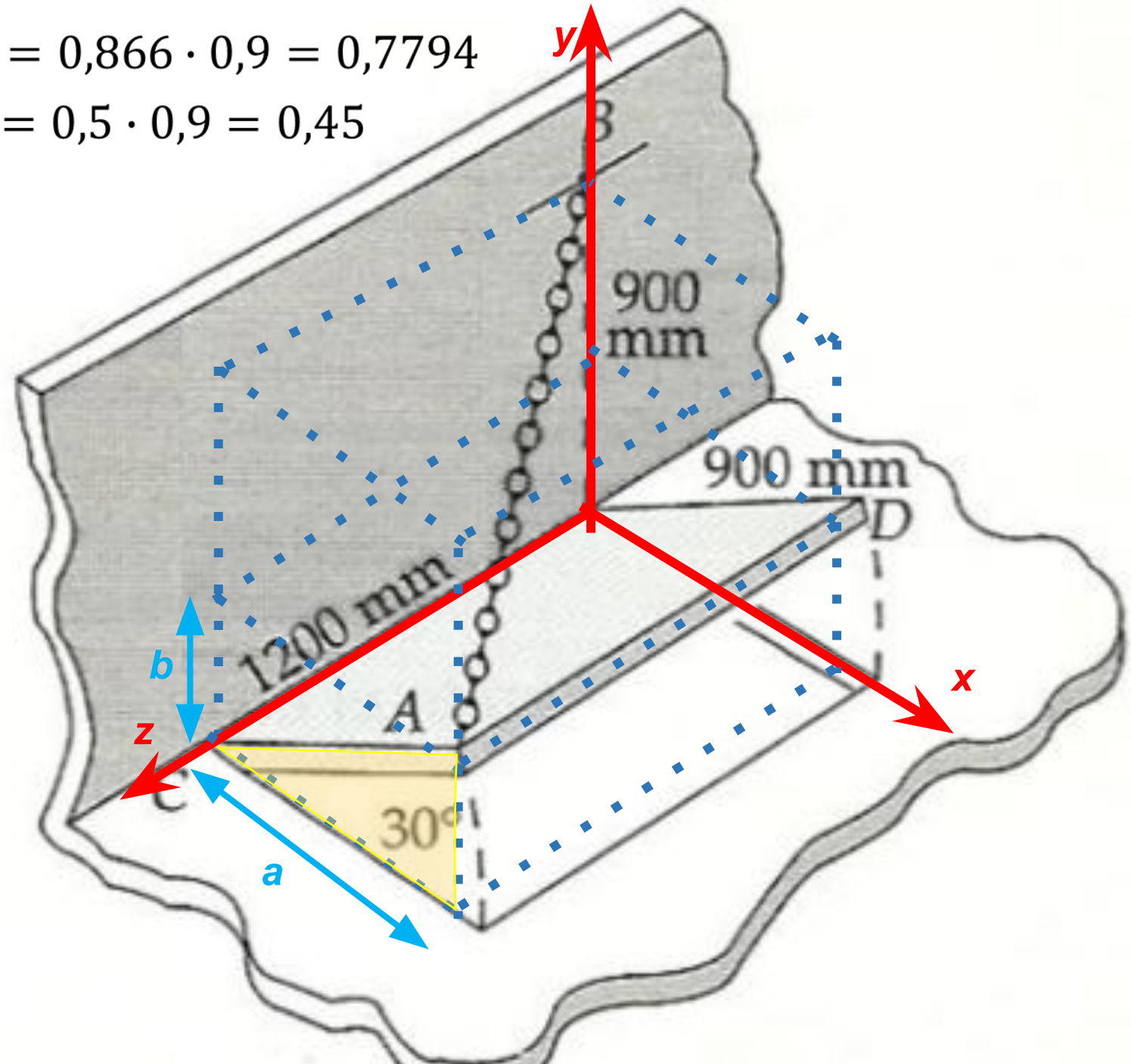

y
B
900
mm
Py
900 mm
D
Px
Pz
x
z
A
C
30°



Triangulo de fuerzas es equivalente al triángulo geométrico

$$a = cos(30º) \cdot 0{,}9 = 0{,}866 \cdot 0{,}9 = 0{,}7794$$

$$b = sin(30º) \cdot 0{,}9 = 0{,}5 \cdot 0{,}9 = 0{,}45$$



$$F_x = \left|\vec{F}\right| \cdot \frac{a}{\sqrt[2]{a^2 + b^2 + c^2}}$$

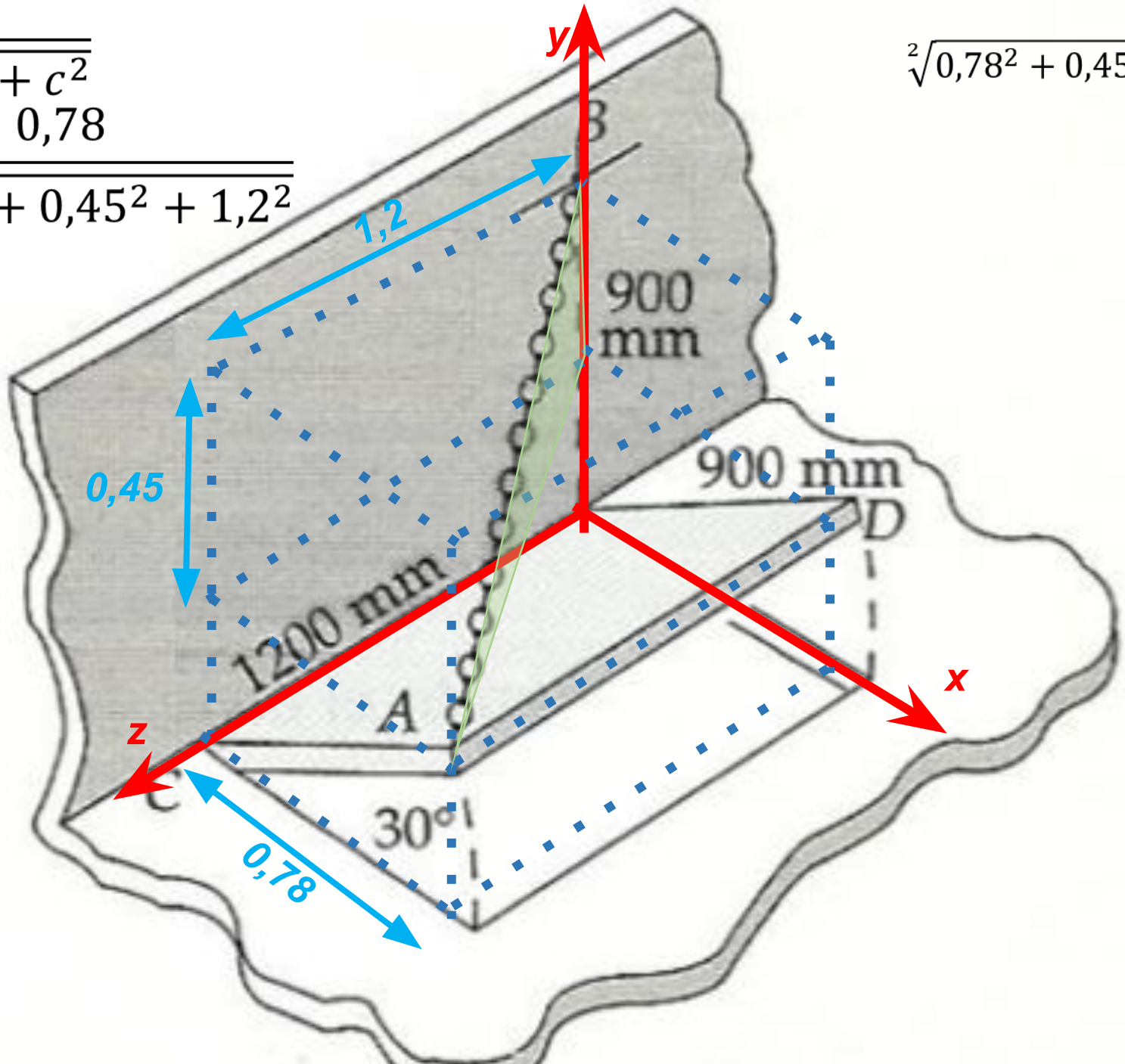
$$F_x = 2\ kN \cdot \frac{0{,}78}{\sqrt[2]{0{,}78^2 + 0{,}45^2 + 1{,}2^2}}$$

$$F_x = 2\ kN \cdot \frac{0{,}78}{15}$$

$$F_x = 2\ kN \cdot 0{,}52$$

$$F_x = 1{,}04\ kN$$

$$\sqrt[2]{0{,}78^2 + 0{,}45^2 + 1{,}2^2} = 1{,}5$$



$$M_{bisagra} = F_x \cdot brazo$$

$$M_{bisagra} = 1{,}04\ kN \cdot 0{,}9\ m$$

$$\boxed{M_{bisagra} = 0{,}936\ kNm}$$