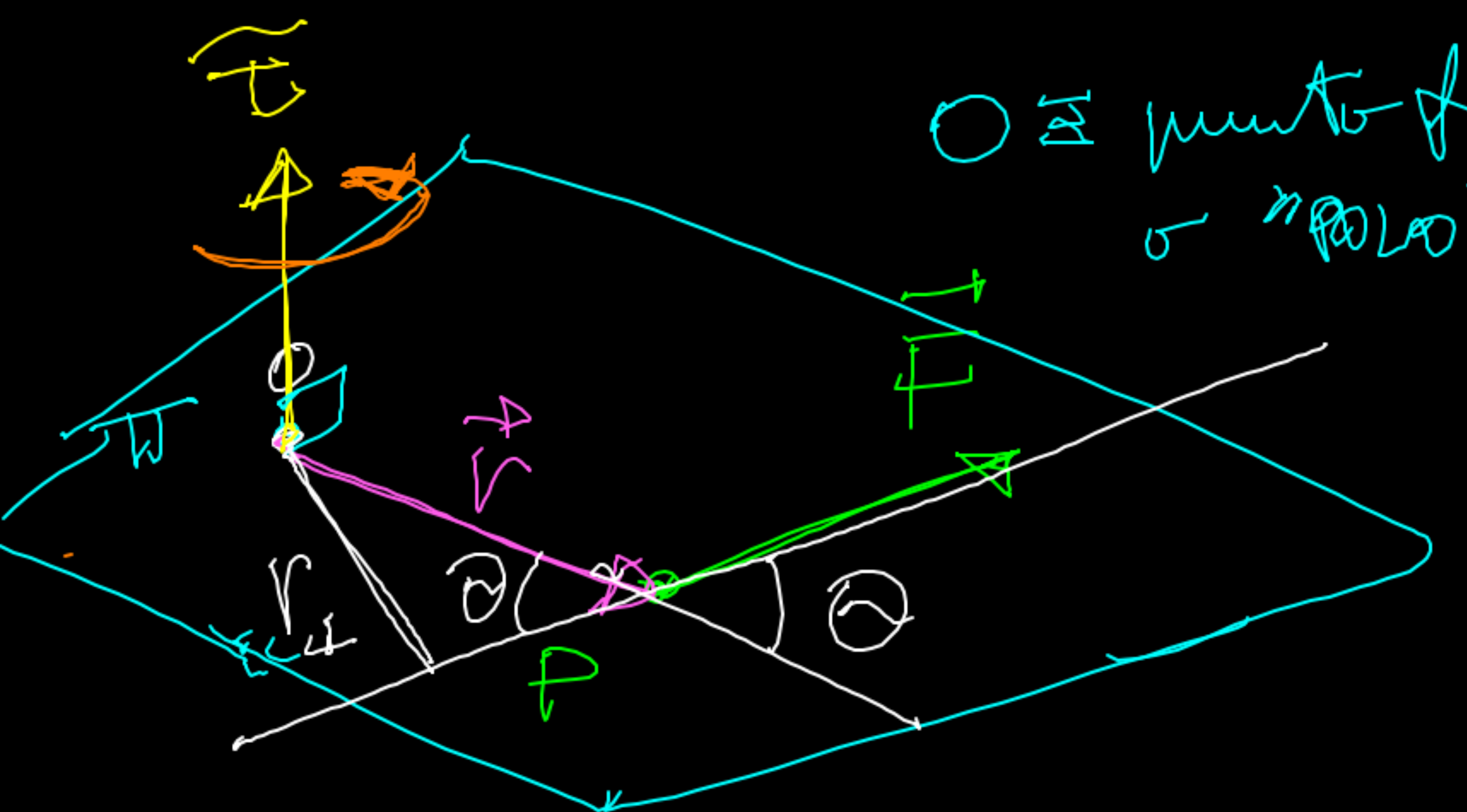
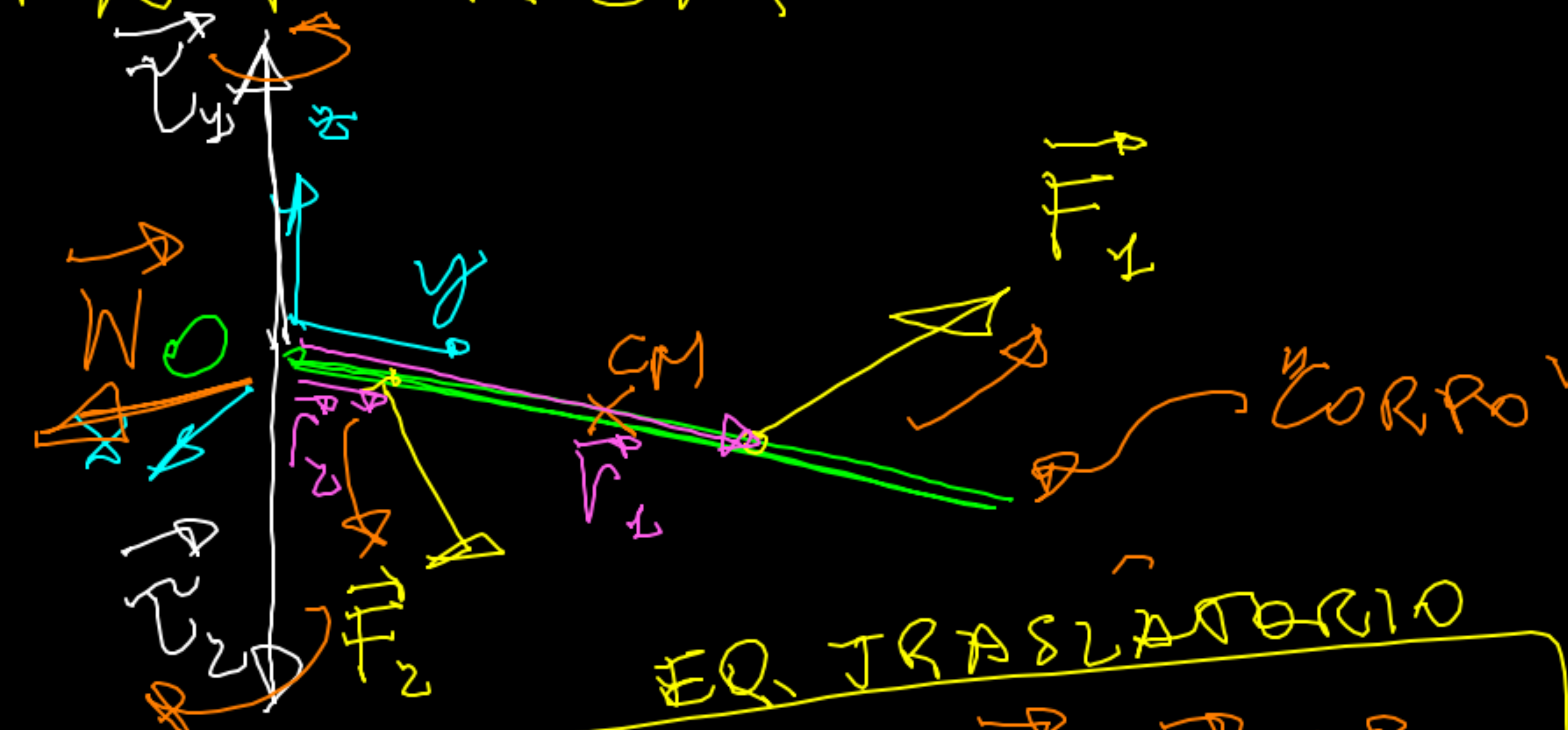
MOMENTO DI UNA FORZA



O ≡ punto fisso o "POLO"



EQ. TRASLATORIO

$$\boxed{\sum \vec F_{ext} = 0 \Rightarrow \vec F_1 + \vec F_2 + \vec N = 0}$$

Momento di $\vec F$ rispetto ad "O"

$$\vec\tau = \vec r \times \vec F$$

$$|\vec\tau| = rF\sin\theta = r_\perp F$$

$$\vec r_1 \times \vec F_1 + \vec r_2 \times \vec F_2 = 0$$

$$\boxed{\vec\tau_1 + \vec\tau_2 = 0}$$

$$\boxed{\sum \vec\tau_{ext,O} = 0}$$

EQ. ROTATORIO

EQUILIBRIO STATICO DI UN CORPO RIGIDO

$$\boxed{\sum \vec{F}_{ext} = 0}$$

EQ. TRASLATORIO

"AND"

+

$$\boxed{\sum \vec{\tau}_{est,O} = 0}$$

EQ. ROTATORIO

ESEMPI

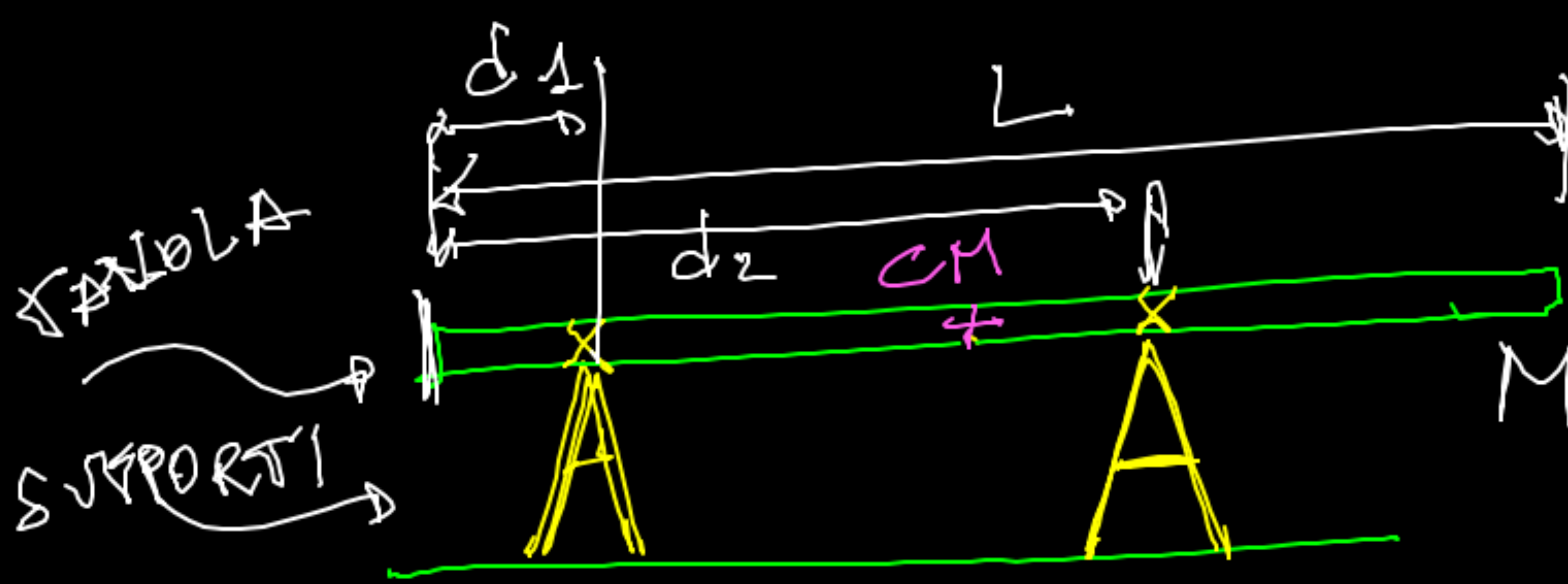
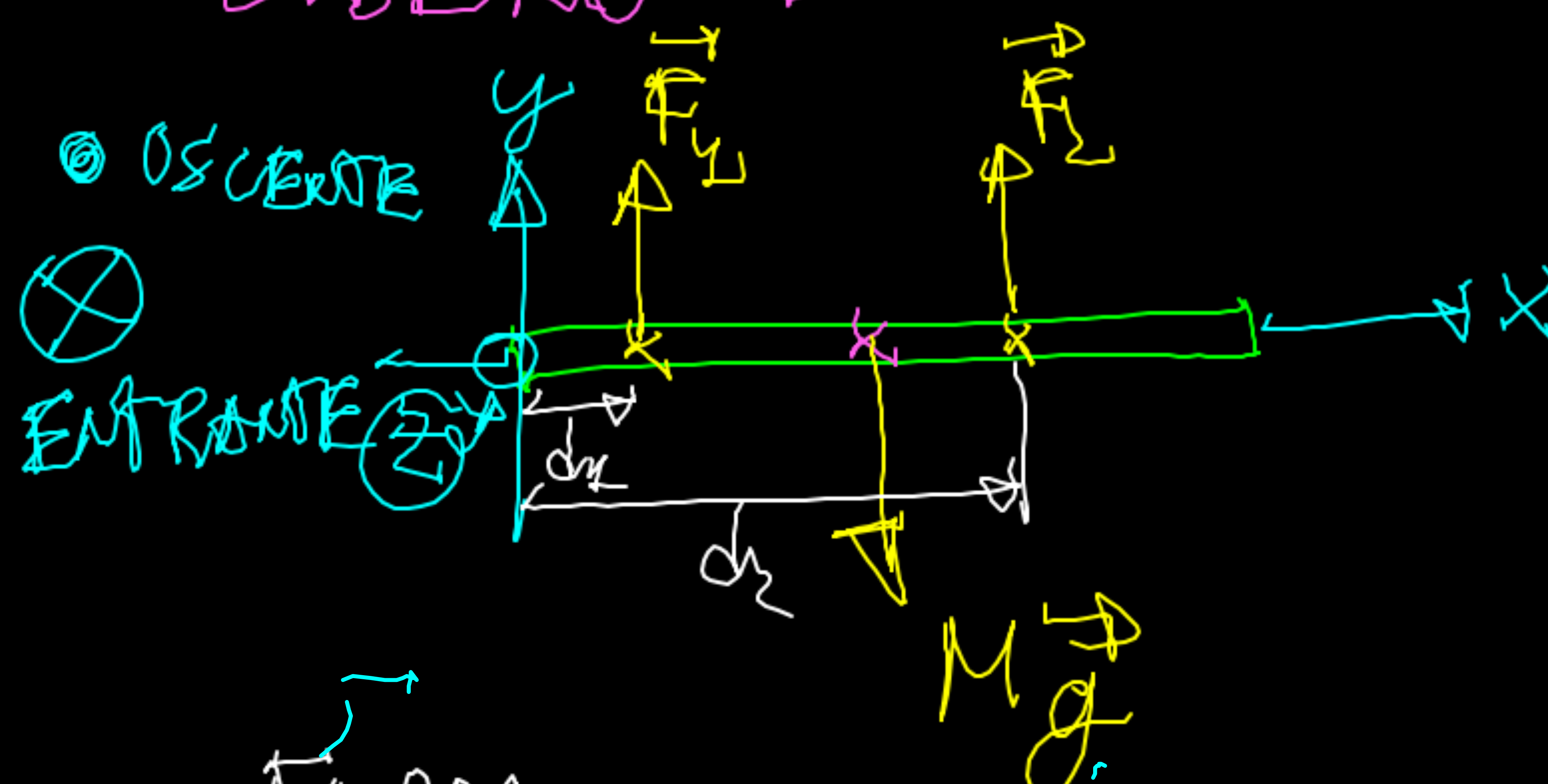


DIAGRAMMA DI CORPO LIBERO DELLA TAVOLA



$\vec{\text{FORZE}}$ ESTERNE

COND. DI EQ.

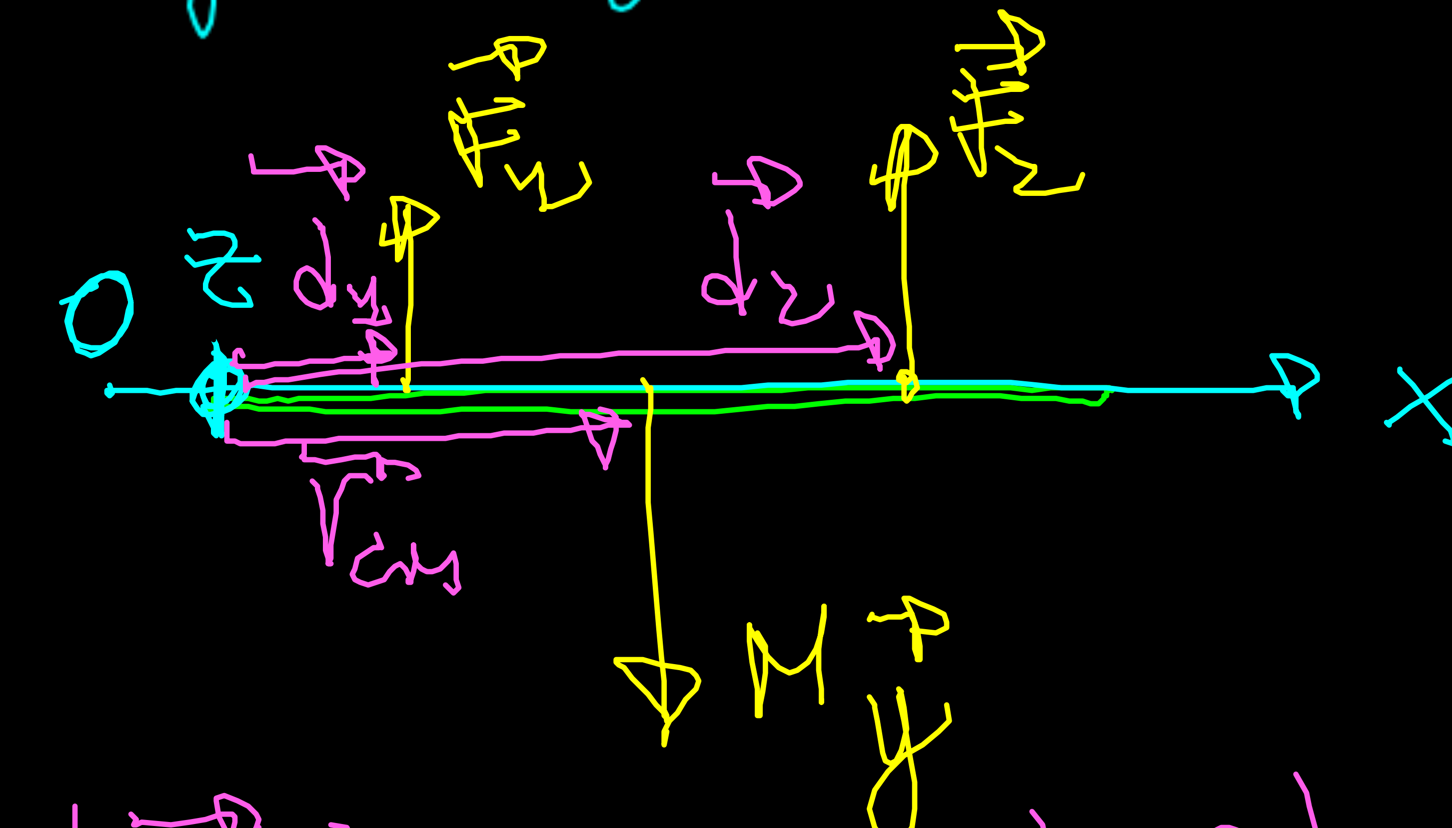
TR. $\vec{F}_1 + \vec{F}_2 + M\vec{g} = 0$

$\left(\; x \quad 0 = F_{1x} + F_{2x} \; \right)$

$y \quad F_{1y} + F_{2y} - Mg = 0$

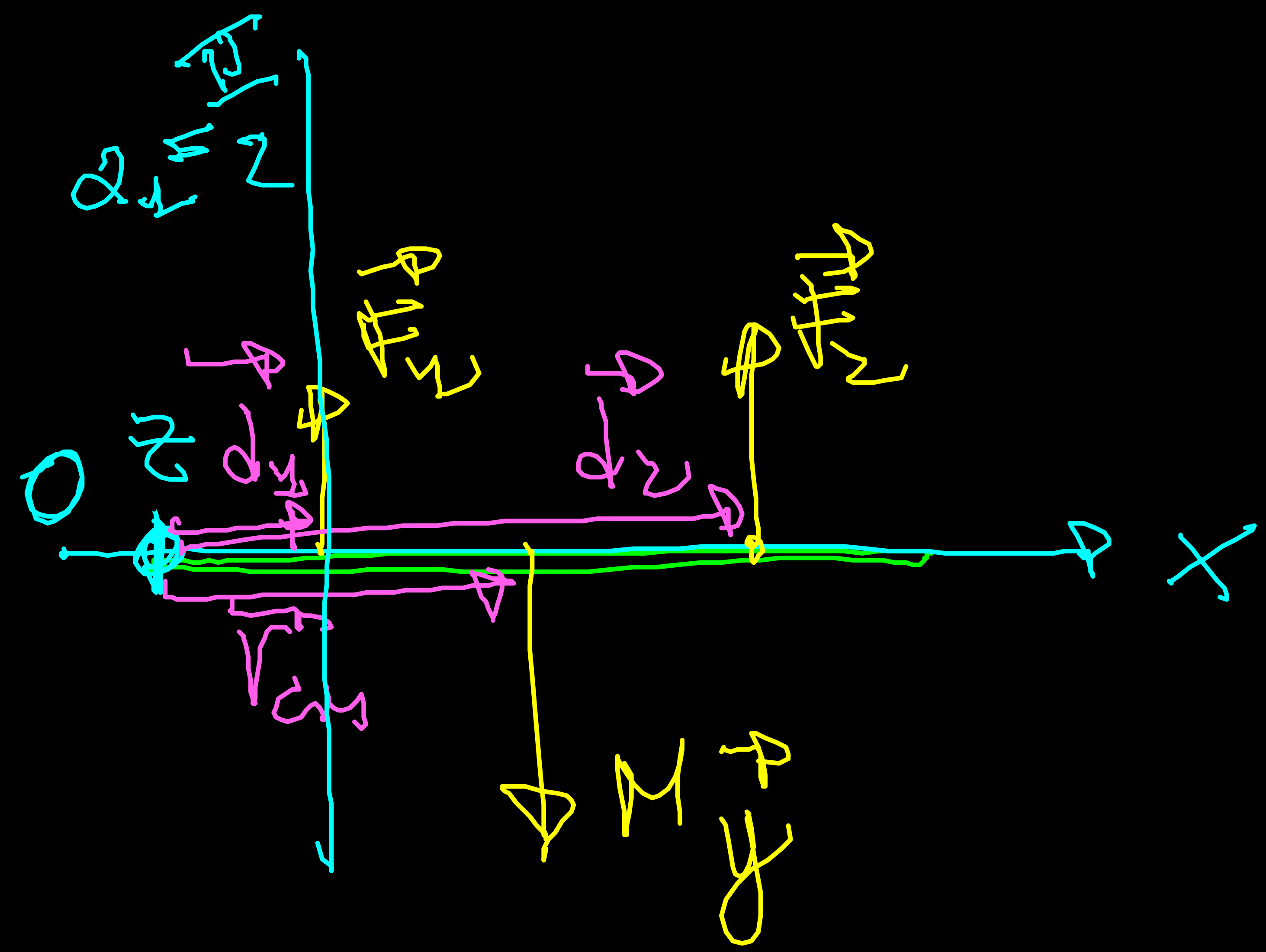
ROT.

$\vec{\tau} = \vec{r} \times \vec{F}$



$|\vec{d}_1| = d_1 \qquad |\vec{d}_2| = d_2$

$|\vec{r}_{CM}| = L/2$



$$\tau_{1z} = (\vec{d}_1 \times \vec{F}_1)_z = d_1 F_1 \sin\alpha_1 = d_1 F_1$$

$$+\ \tau_{2z} = (\vec{d}_2 \times \vec{F}_2)_z = d_2 F_2$$

$$+\ \tau_{3z} = (\vec{r}_{cm} \times M\vec{g})_z = -\frac{L}{2} M g$$

$$= 0$$

$$\sum \vec{\tau}_{est,O} = 0$$

$$\sum \tau_{est,z,O} = 0$$

x

y

$$F_{1y} = F_1$$

$$F_{2y} = F_2$$

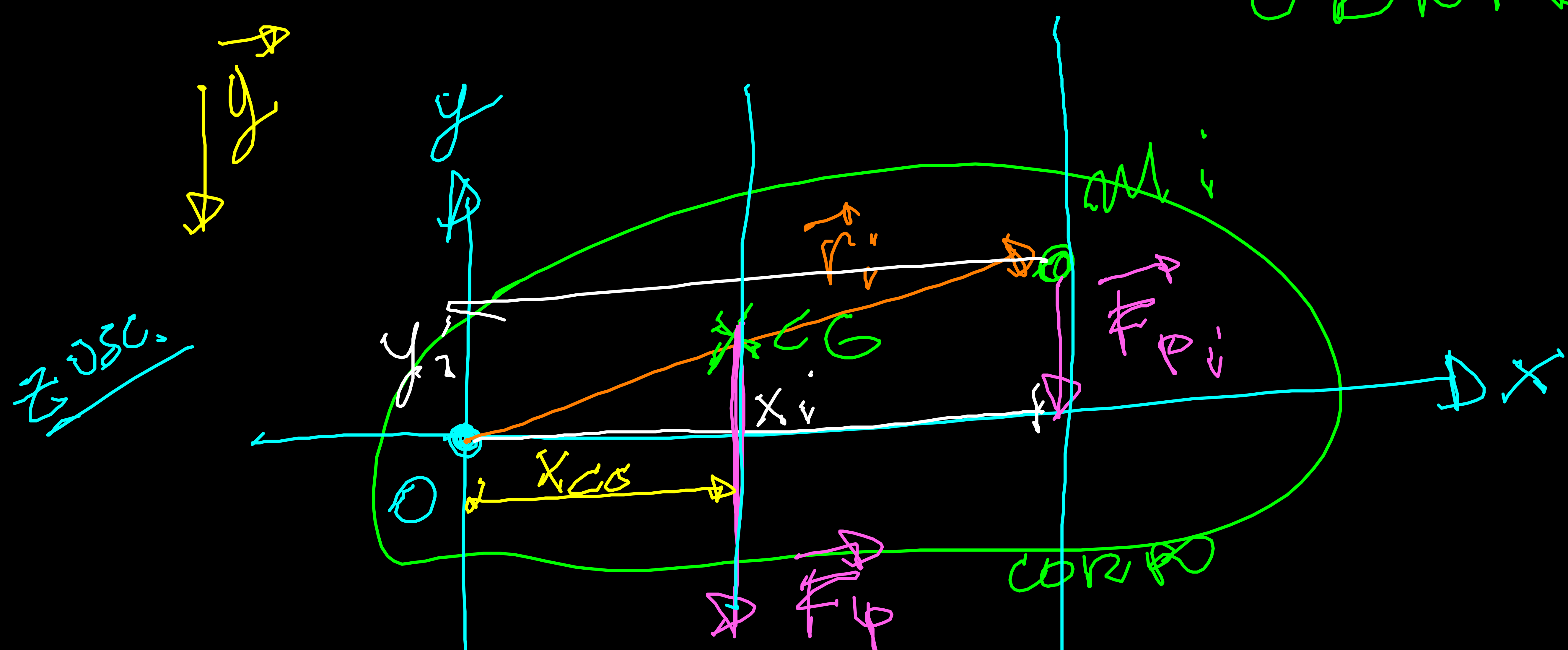
$$\boxed{d_1 F_1 + d_2 F_2 - M g \frac{L}{2} = 0}$$

EQ. ROT.

$$\boxed{F_1 + F_2 - M g = 0}$$

EQ. TRASL.

CENTRO DI GRAVITÀ (BARICENTRO)



ROTAZIONI ⟹ MOMENTI

$$\vec\tau_i = \vec r_i \times \vec F_{p_i} \quad \text{(rispetto ad O)}$$

$$(\vec\tau_i)_z = \tau_{iz} = -(m_i g)\, x_i$$

somma ⟶ $\tau_z = \sum -(m_i g)\, x_i$

CG ⟶ $\tau'_z = -F_p\, x_{CG}$

$$\vec F_p = \sum \vec F_{p_i} = \sum m_i \vec g$$

$$(\vec F_p)_y = -\sum m_i g = -g \underbrace{\sum m_i}_{M} = -Mg$$

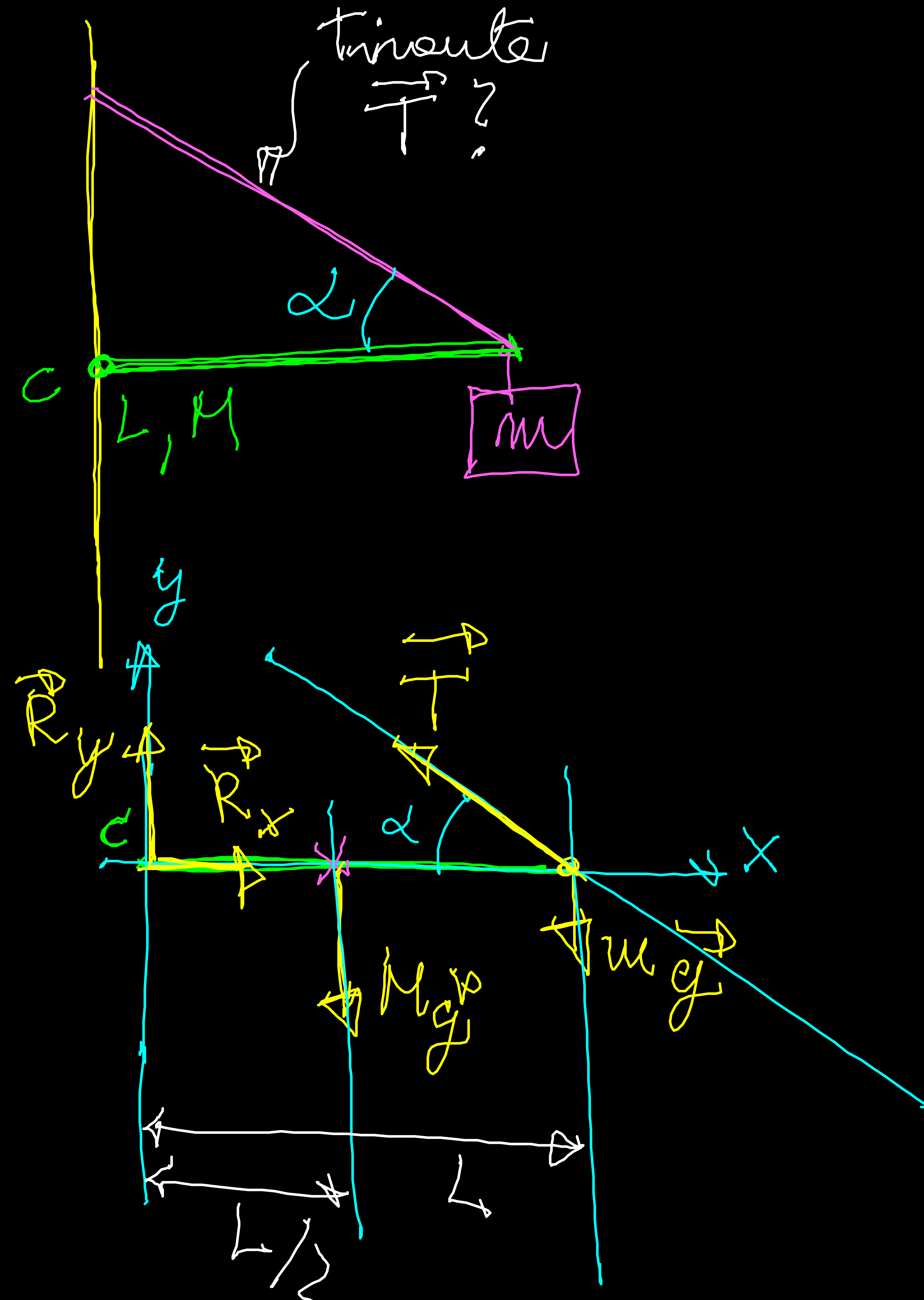
g costante

CG deve essere tale che $\tau_z = \tau'_z$

$$-F_p\, x_{CG} = -\sum (m_i g)\, x_i$$

$$x_{CG} = \frac{\sum m_i g x_i}{Mg} = \overbrace{\frac{\sum m_i x_i}{M}}^{x_{CM}}$$

α
m
M
L



Tirante
$\vec{T}$?
α
C
L, M
m
y
$\vec{R}_y$
$\vec{R}_x$
$\vec{T}$
α
x
$M\vec{g}$
$m\vec{g}$
L
$L/2$