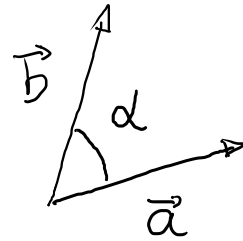


## PRODOTTO SCALARE ( $\cdot$ )

$$\vec{a} \cdot \vec{b} = |\vec{a}| \cdot |\vec{b}| \cdot \cos \alpha$$

$$\vec{a} \cdot \vec{b} = a_x b_x + a_y b_y + a_z b_z$$



## PRODOTTO VETTORIALE ( $\times$ ) ( $\sigma \wedge$ )

$$\vec{a} \times \vec{b} = \vec{v} \quad |\vec{v}| = |\vec{a}| \cdot |\vec{b}| \sin \alpha$$

dir.  $\vec{v}$  è ortogonale al piano di  $\vec{a}$  e  $\vec{b}$   
verso  $\vec{v}$  è dato dalla regola mano dx

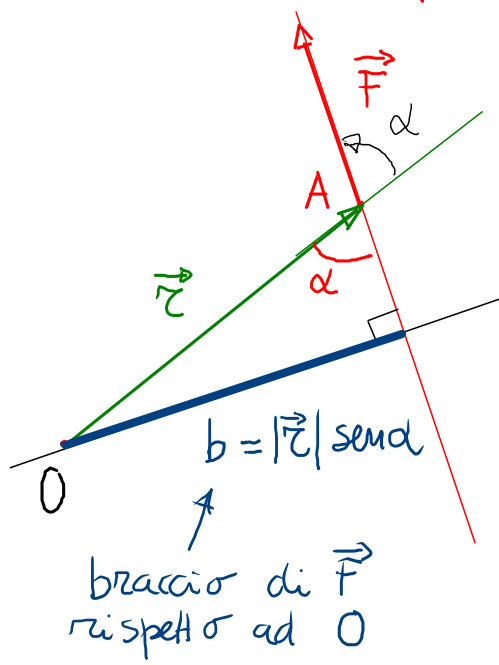
$$v_x = a_y b_z - b_y a_z$$

$$v_y = -a_x b_z + b_x a_z$$

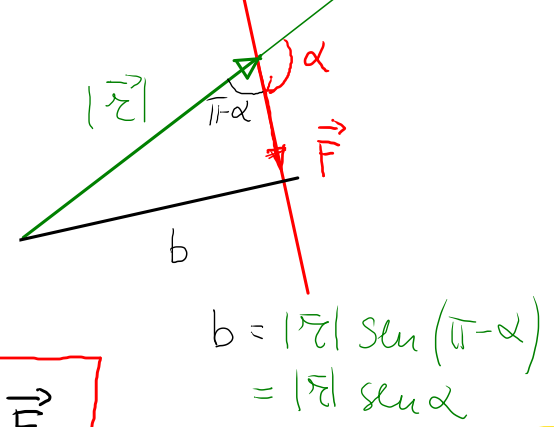
$$v_z = a_x b_y - b_x a_y$$

⚠ è anticommutativo  
 $\vec{a} \times \vec{b} = -(\vec{b} \times \vec{a})$

$\vec{M}$ : MOMENTO di una forza  $\vec{F}$  rispetto al punto  $O$



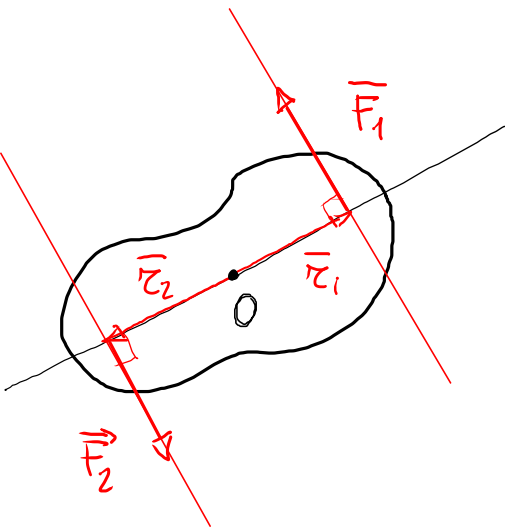
ALTRO ESEMPIO



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

$$|\vec{M}| = |\vec{r}| \cdot |\vec{F}| \sin \alpha$$
$$|\vec{M}| = b \cdot |\vec{F}|$$

$$[\vec{M}] = m \cdot N \quad (\text{non Joule !!})$$



$|\vec{F}_1| = |\vec{F}_2| = F$   
 $\vec{F}_1$  e  $\vec{F}_2$  stessa direzione  
 verso opposto

} COPPIA  
DI  
FORZE

$$|\vec{r}_1| = |\vec{r}_2| = b$$

$$\Sigma \vec{F} = \vec{F}_1 + \vec{F}_2 = 0$$

$$\Rightarrow \vec{a} = 0$$

il corpo non trasla  
MA RUOTA attorno ad O

$$\vec{M}_1 = \vec{r}_1 \times \vec{F}_1$$

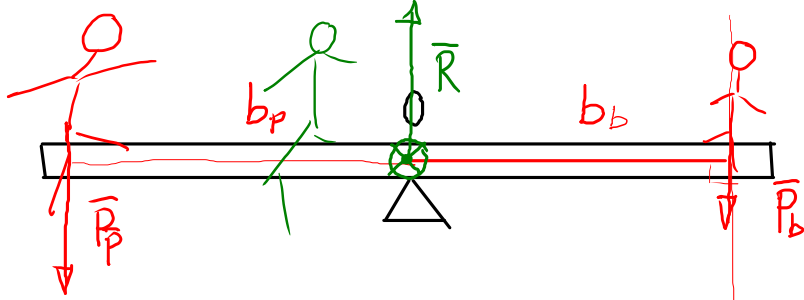
$$\vec{M}_2 = \vec{r}_2 \times \vec{F}_2$$

$$|\vec{M}_1| = |\vec{r}_1| \cdot |\vec{F}_1| = bF$$

$$|\vec{M}_2| = |\vec{r}_2| \cdot |\vec{F}_2| = bF$$

} entrambi uscenti

$$\Sigma \vec{M} = \vec{M}_1 + \vec{M}_2 \neq 0 \Rightarrow \text{il capo ruota}$$



$$P_b = m_b g$$

$$P_p = m_p g$$

$$|\vec{M}_b| = |\vec{P}_b| \cdot b_b = m_b g b_b$$

$$|\vec{M}_p| = |\vec{P}_p| \cdot b_p = m_p g b_p$$

$$\Sigma \vec{M} = 0$$

$$\vec{M}_b + \vec{M}_p = 0$$

$$m_b g b_b = m_p g b_p$$

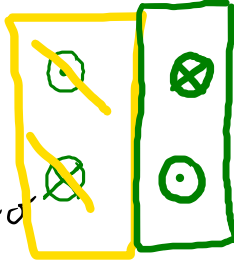
$$b_p = \frac{m_b}{m_p} \cdot b_b$$

$$\vec{R} = -(\vec{P}_p + \vec{P}_b) = -(m_b + m_p) \vec{g}$$

No! si!

↻ entrante  
orario

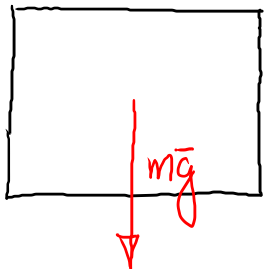
↺ uscente  
anti-orario



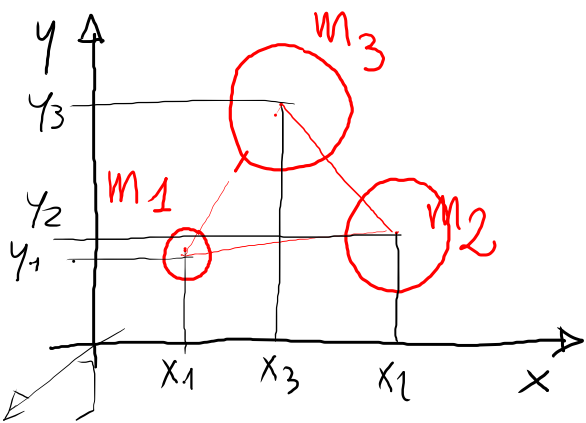
scusatelo! per errore ho invertito i simboli ⊙ e ⊗

# BARICENTRO

1) CORPI OMOGENEI  $\rightarrow$  centro geometrico



2) SISTEMA A MOLTI CORPI (N)



$$x_B = \frac{m_1 x_1 + m_2 x_2 + m_3 x_3}{m_1 + m_2 + m_3} = \frac{\sum_i m_i x_i}{\sum_i m_i}$$

$$y_B = \frac{\sum_i m_i y_i}{\sum_i m_i}$$

$$\left[ z_B = \frac{\sum_i m_i z_i}{\sum_i m_i} \right]$$