

# Rolamento, Torque e Momento Angular

E-aula (20-05)

# Exemplo 3

Uma bola homogênea, de massa  $M=6\text{kg}$  e Raio  $R$ , rola suavemente, a partir do repouso, descendo uma rampa inclinada de ângulo  $\theta=30^\circ$ .

- a) A bola desce uma distância vertical  $h=1,2\text{ m}$  para chegar à base da rampa. Qual é a velocidade da bola ao chegar à base da rampa?
- b) Quais são o módulo e a orientação da força de atrito que age sobre a bola quando desce a rampa rolando?

loiô



loio



Vamos desenhar as forças!

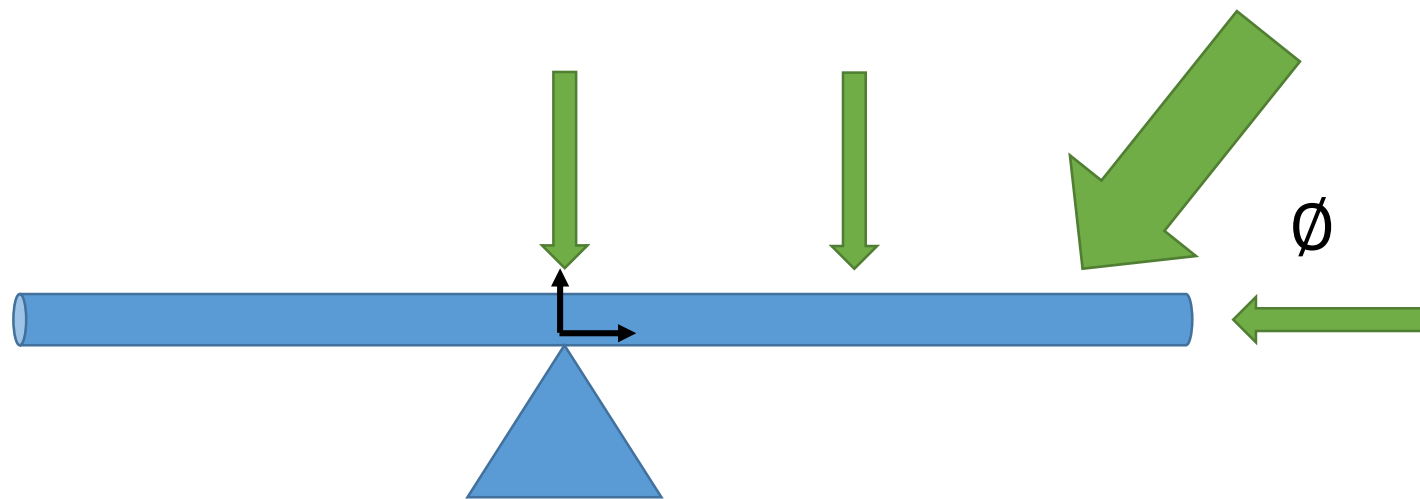
loio



$$a_{CM,x} = -\frac{g}{\frac{I_{CM}}{MR_0^2} + 1}$$

# Torque

Relembrando:  $\tau = rF \text{sen}\phi$



# Torque

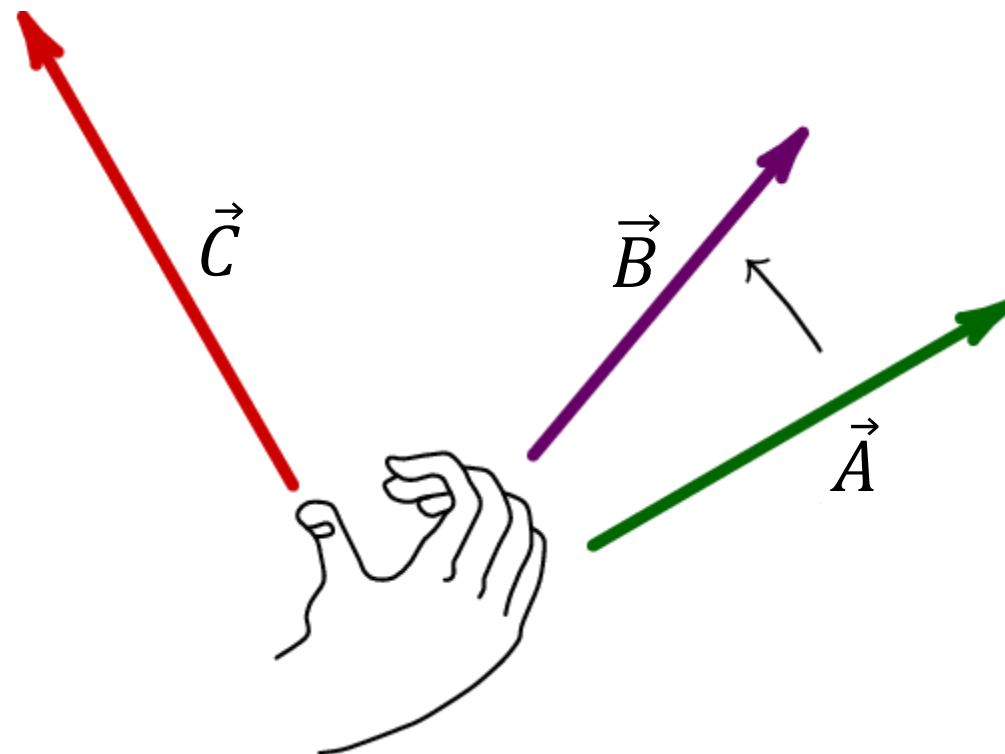
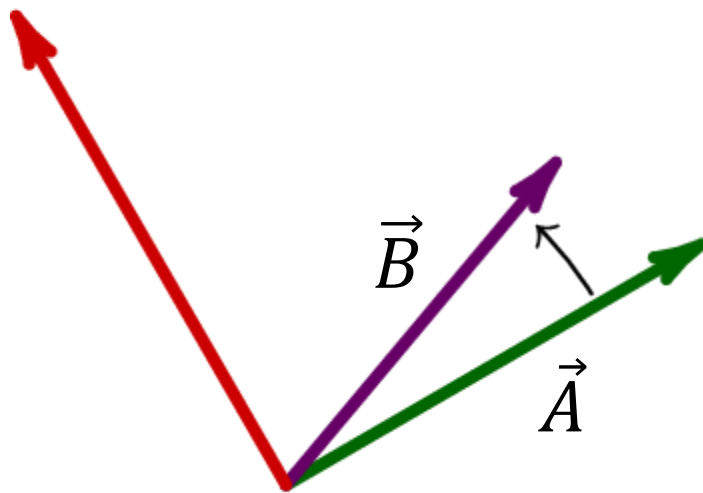
Relembrando:  $\tau = rF \text{sen}\theta$

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

# Torque

Relembrando:  $\tau = rF \sin\theta$

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



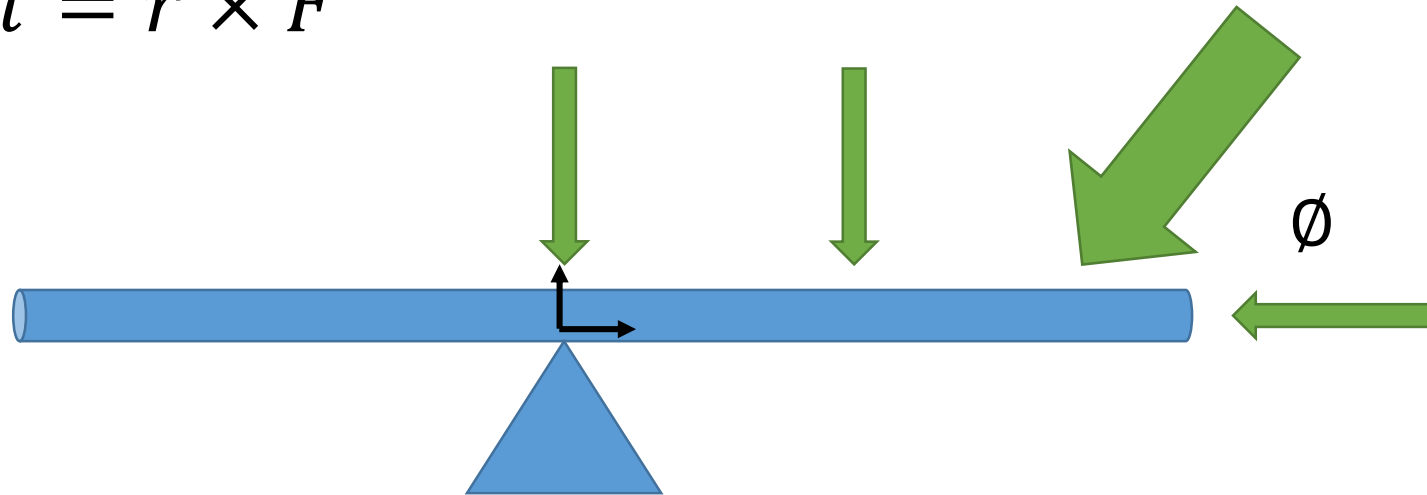


# Torque

Relembrando:

$$\tau = rF \sin \phi$$

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

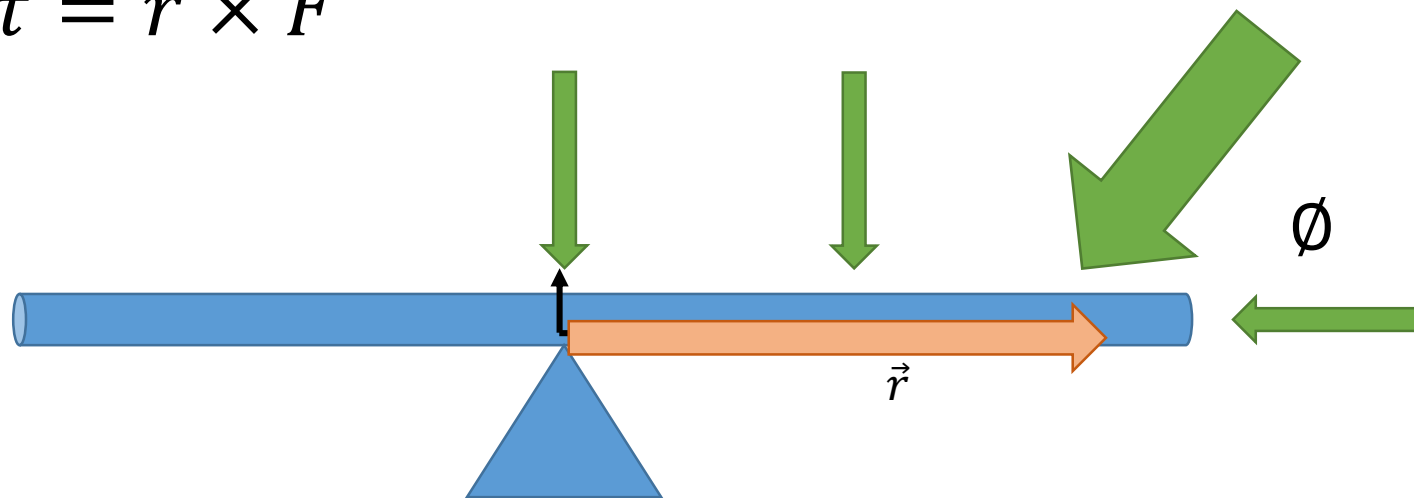


# Torque

Relembrando:

$$\tau = rF \text{sen}\phi$$

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

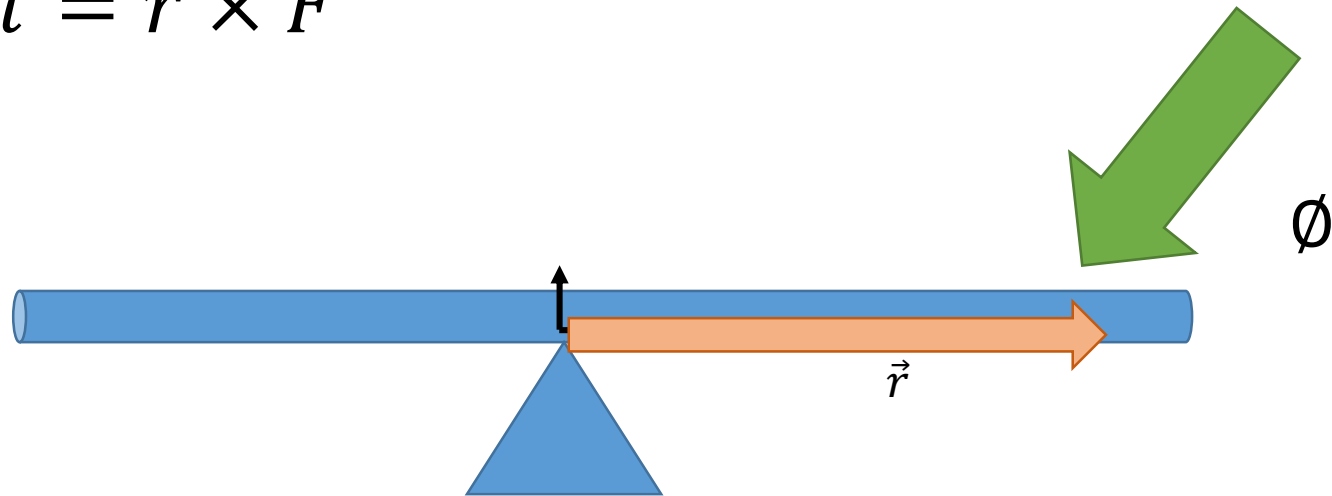


# Torque

Relembrando:

$$\tau = rF \sin \phi$$

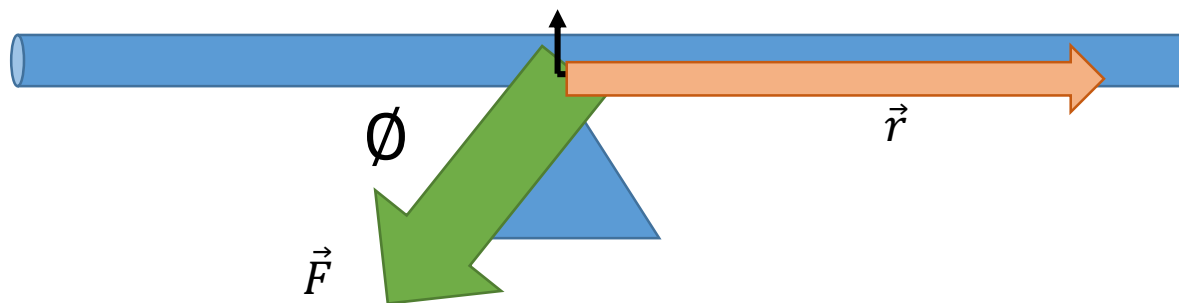
$$\vec{\tau} = \vec{r} \times \vec{F}$$



# Torque

Relembrando:  $\tau = rF \text{sen}\theta$

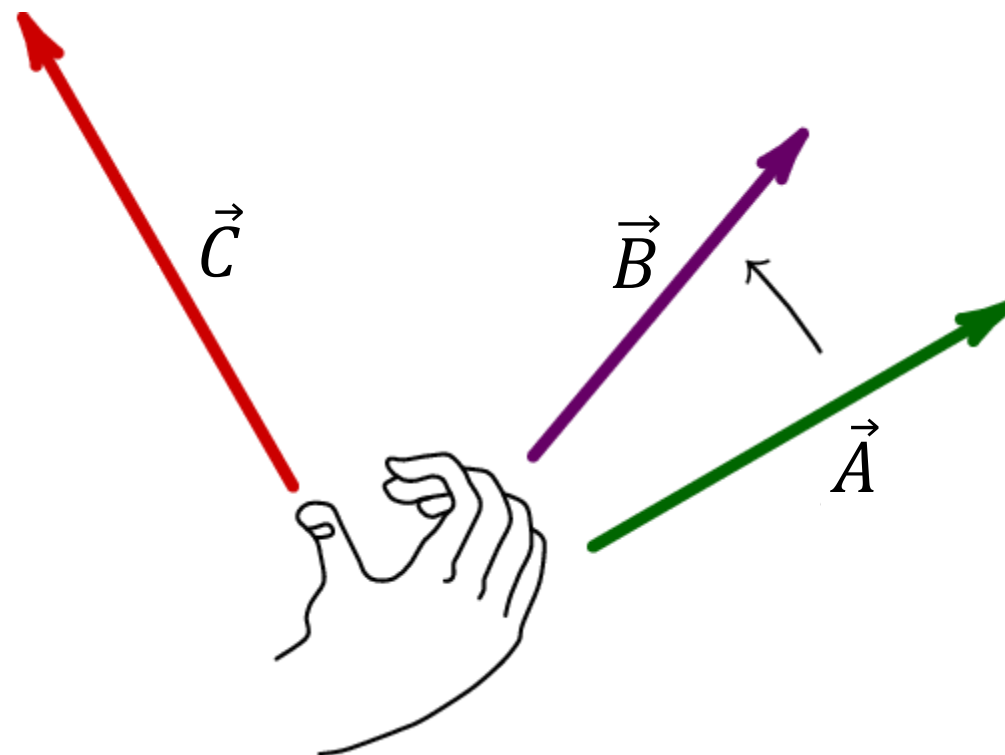
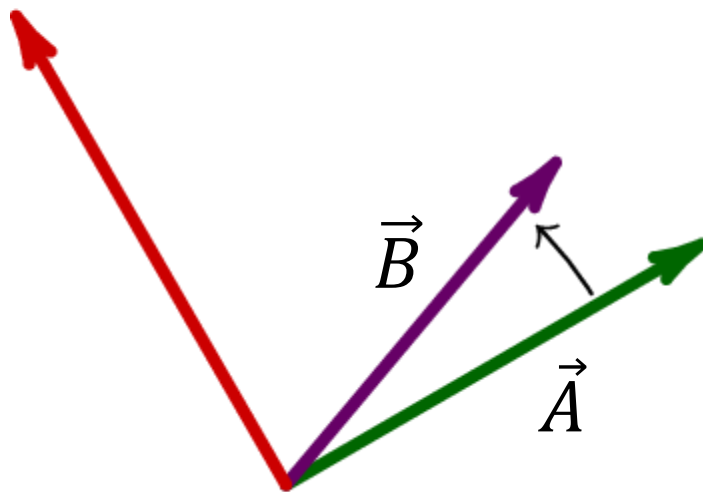
$$\vec{\tau} = \vec{r} \times \vec{F}$$



# Torque

Relembrando:  $\tau = rF \sin\theta$

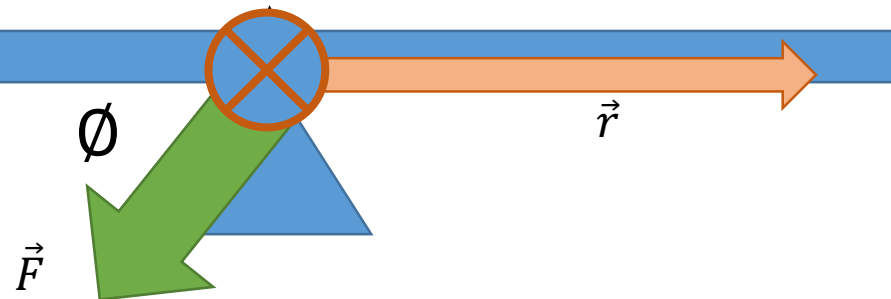
$$\vec{\tau} = \vec{r} \times \vec{F}$$



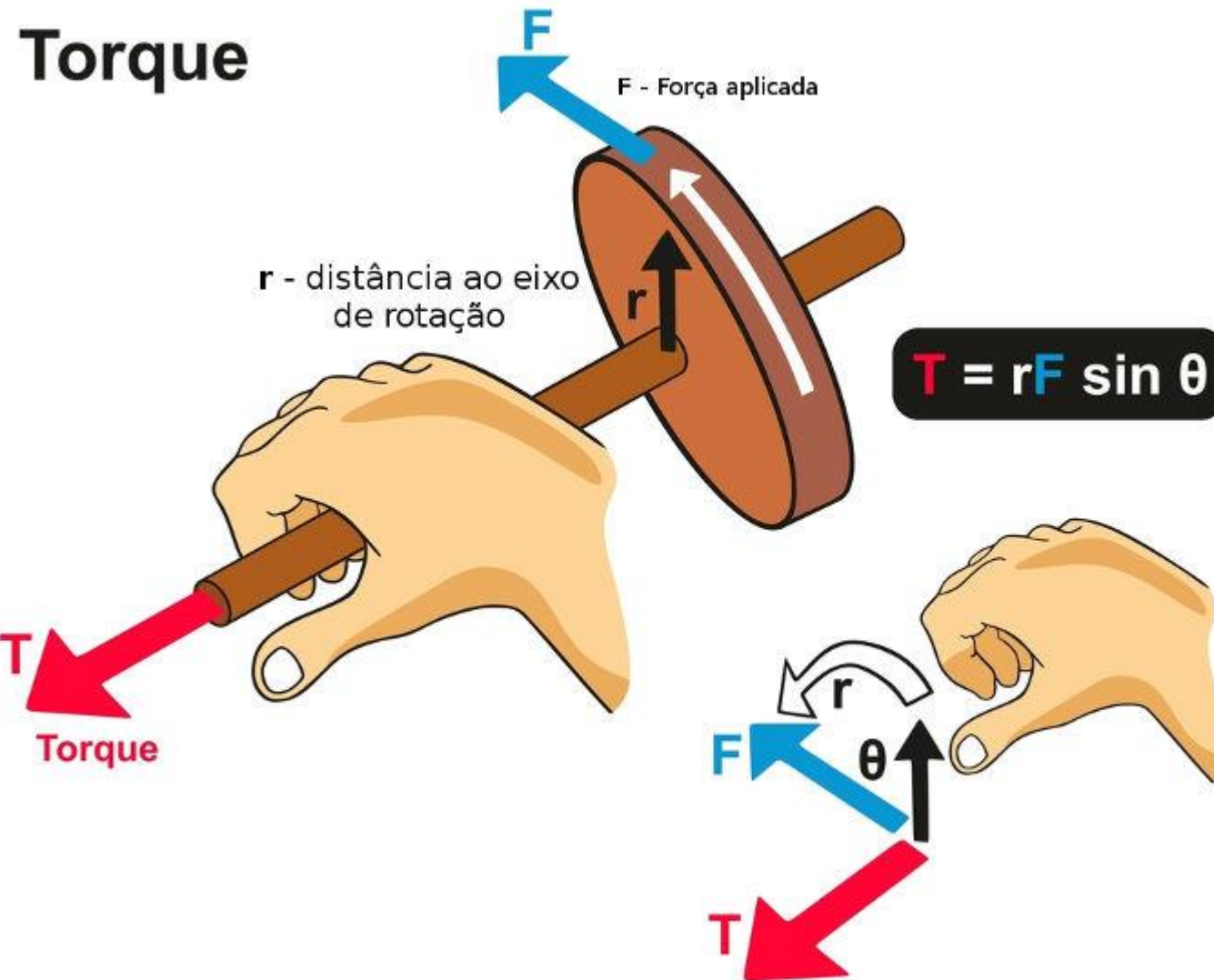
# Torque

Relembrando:  $\tau = rF \sin\theta$

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



# Torque



# Momento Angular

$$\vec{L} = \vec{r} \times \vec{p}$$



# Momento Angular

$$\vec{L} = \vec{r} \times \vec{p} = m(\vec{r} \times \vec{v})$$

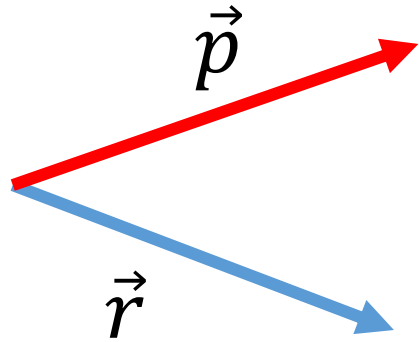
# Momento Angular

$$\vec{L} = \vec{r} \times \vec{p} = m(\vec{r} \times \vec{v})$$

$$[\vec{L}] = kg \cdot \frac{m^2}{s} = J \cdot s$$

# Momento Angular

$$\vec{L} = \vec{r} \times \vec{p} = m(\vec{r} \times \vec{v})$$



# Momento Angular

$$\vec{L} = \vec{r} \times \vec{p} = m(\vec{r} \times \vec{v})$$

