



# CONSERVATION OF ANGULAR MOMENTUM

Duke Talented Identification Program

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6 August 2009



## Angular velocity ( $\omega$ )

- ❖ The velocity of a body moving in a circular path.
- ❖ Also called the rotational velocity.
- ❖ Measured in radians per second or degrees per second.



# Angular momentum (L)

- ❖ A measure of the amount of spin or orbital motion an object has.
- ❖ A vector (a quantity with both magnitude and direction) quantity.
- ❖ Given by  $L = I \omega$ , where  $I$  is the moment of inertia.



# Moment of inertia (I)

- ❖ Rotational analog of mass.
- ❖ Plays much the same role in rotational dynamics as mass does in basic dynamics.
- ❖ Depends on how the body's mass is distributed.
- ❖ For a body with a given rotation axis and a given total mass,
$$I = \sum m_i r_i^2$$
 where  $r_i$  is the distance from the axis of rotation.
- ❖ The farther from the axis of rotation the mass is located, the larger the I.

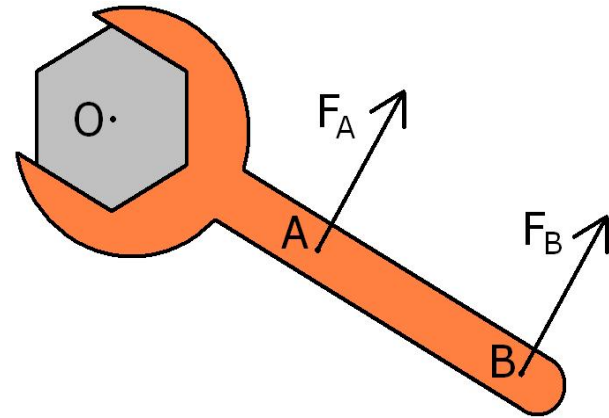
# Torque ( $\tau$ ):

- ❖ A twisting force.
- ❖ Defined as the change in angular momentum

$$\vec{\tau} = \frac{d}{dt} \vec{L}$$

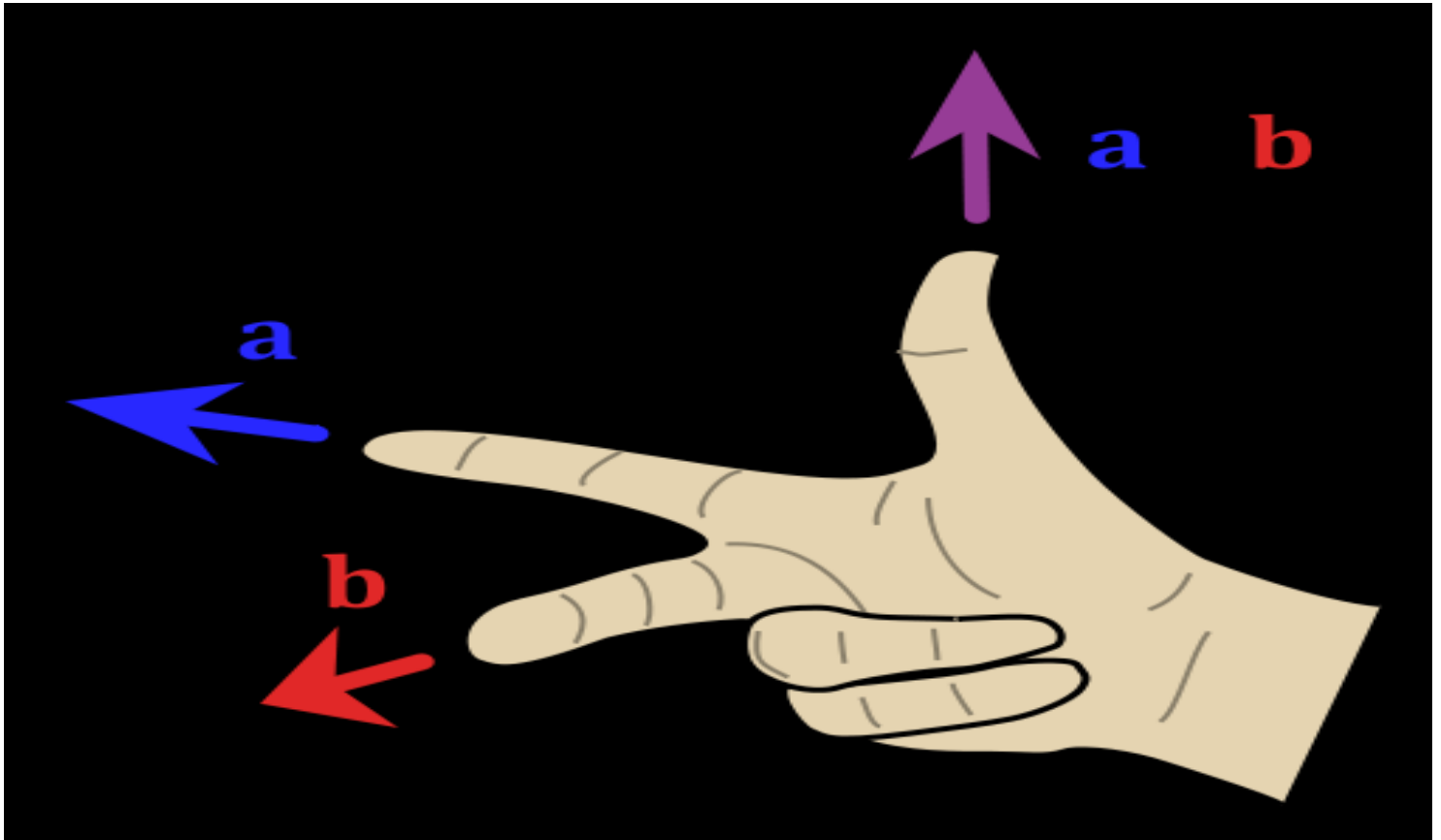
- ❖ Given by :

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



● ● ● | Right hand rule

# Right hand rule



# What does it mean by conservation of angular momentum?

- ❖ An object in motion tends to remain in motion and at a constant speed unless acted upon by external force.
- ❖ Total angular momentum conserved if net external torque on a system is zero.

