

## 3-D moment couple ctd.

(b10)

## VARIGNON'S THEOREM IN 3D

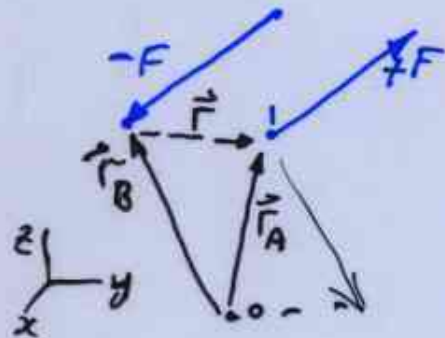
$$\vec{M}_O = \sum(\vec{r} \times \vec{F}) = \vec{r} \times \vec{R} \quad \text{where } \vec{R} = \sum \vec{F}$$

Couples in 3-D same as 2D really

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

WHY?

$$\begin{aligned} \Rightarrow \vec{M}_O &= +\vec{r}_A \times \vec{F} - \vec{r}_B \times \vec{F} \\ \vec{M} &= (\vec{r}_A - \vec{r}_B) \times \vec{F} \\ \vec{M} &= \vec{r} \times \vec{F} \end{aligned}$$



RESULTANTS:

$$\vec{R} = \sum \vec{F} \quad \text{AND} \quad \vec{M} = \sum \vec{M} \quad \text{like 2D.}$$

forces couple

"WRENCH RESULTANT" when resultant force  $\vec{F}$  IS PARALLEL TO THE RESULTANT couple.

Positive when  $\vec{F}$  &  $\vec{M}$  are aligned

