

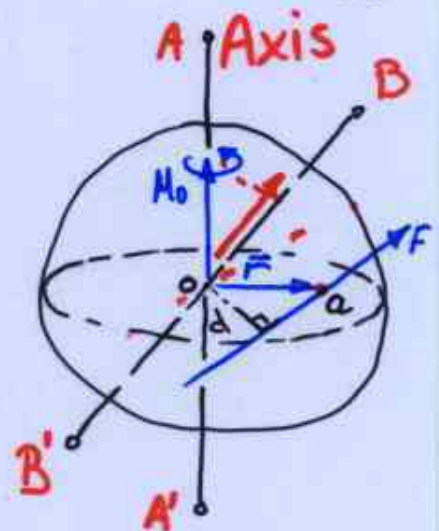
# 3-D : moment & couple

(b9)

Sometimes just like 2-D case  
Force  $\vec{F}$  & point  $O$  define a plane  
moment of  $\vec{F}$  about an AXIS A-A'  
normal to this plane is

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

same as before.



If we WANT moment about Axis B-B', need to do a bit more work.

note: if B-B' was parallel to  $\vec{F}$ , moment would be ZERO.

$$\vec{M}_B = ((\vec{r} \times \vec{F}) \cdot \vec{n}) \vec{n}$$

WHERE  $\vec{n}$  is a unit VECTOR along axis B-B'

TO UNDERSTAND THIS... BREAK INTO PIECES

$$(\vec{r} \times \vec{F}) = \vec{M}_O \text{ as before.}$$

$$\text{So } (\vec{r} \times \vec{F}) \cdot \vec{n} \equiv \vec{M}_O \cdot \vec{n} = \|\vec{M}_O\| \|\vec{n}\| \cos \theta$$

$$\|\vec{n}\| = 1 \text{ so } \Rightarrow \|\vec{M}_O\| \cos(\theta)$$

NOTE THIS IS A SCALAR.

last bit ... mult by  $\vec{n}$

so  $\vec{M}_B$  is VECTOR  $\parallel$  to  $\vec{n}$

with magnitude of  $\vec{M}_O$

Projected onto  $\vec{n}$

