





Cross product is a geometric area directed along an axis  $\perp$  to the area.

Direction is established by the right-hand rule:

curl fingers from right hand from  $\vec{r}$  to  $\vec{F}$ .

The thumb points in the direction of the cross-product.

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

$r$  = lever arm (m)

$F$  = force (N)

$\phi$  = angle between lines of action of  $\vec{F}$  and  $\vec{r}$

(3)

Most useful 2D Form for Torque

$$\uparrow = F_x d_y + F_y d_x$$

$d_y$  = y-distance from axis of rotation

$d_x$  = x-distance from axis of rotation

$F_x$  = x-component of force.

$F_y$  = y-component of force

+ and - torques are assigned  
the same way as  $\theta$ ,  $\omega$ , and  $\alpha$ .

+ counter-clockwise

- clockwise