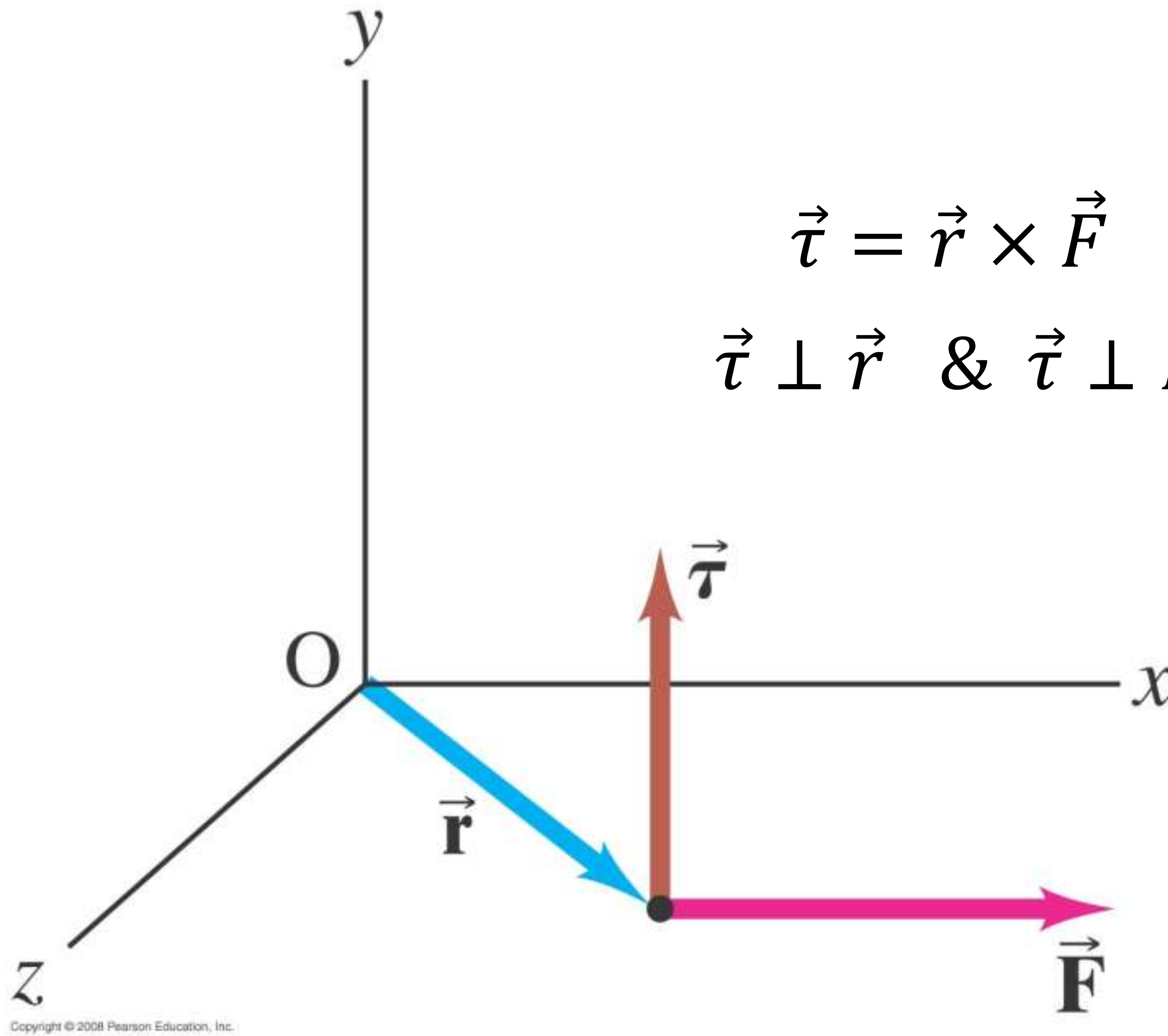
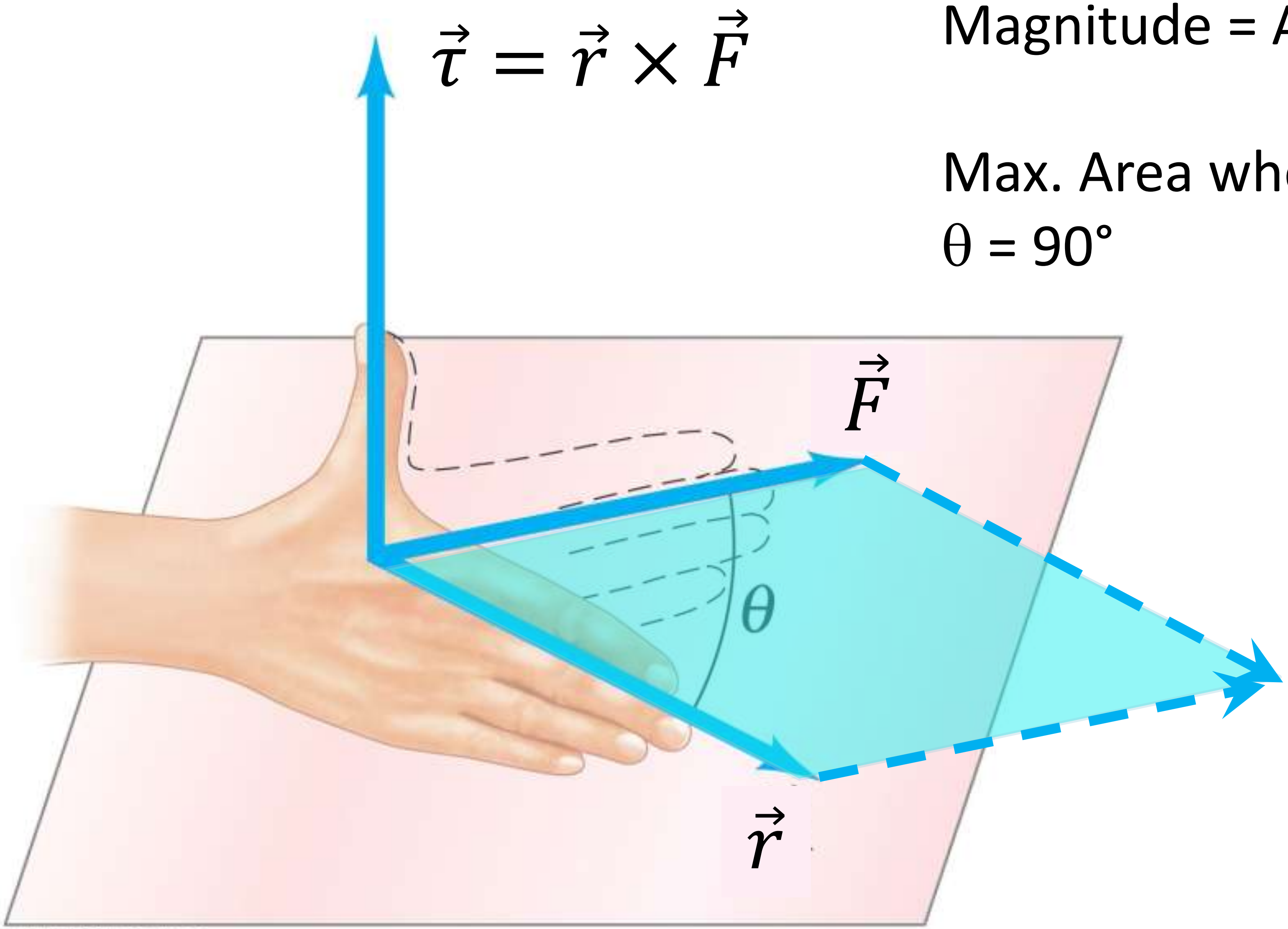
$$\vec{\tau} = \vec{r} \times \vec{F}$$

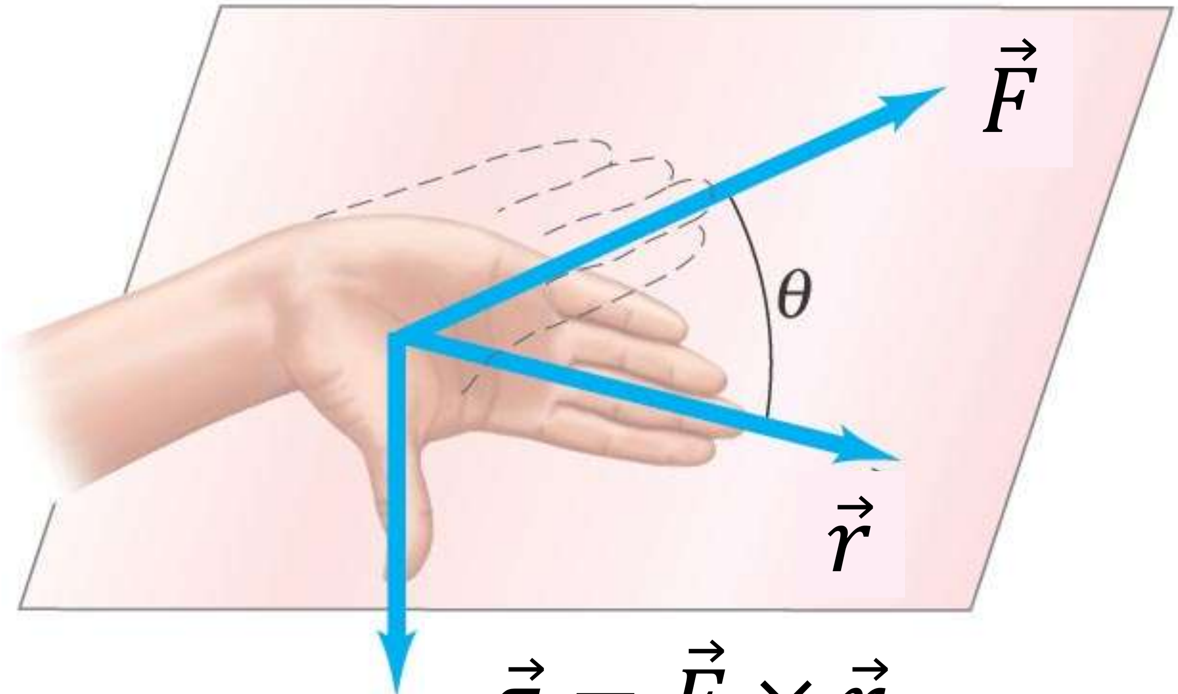
$$\vec{\tau} \perp \vec{r} \quad \& \quad \vec{\tau} \perp \vec{F}$$





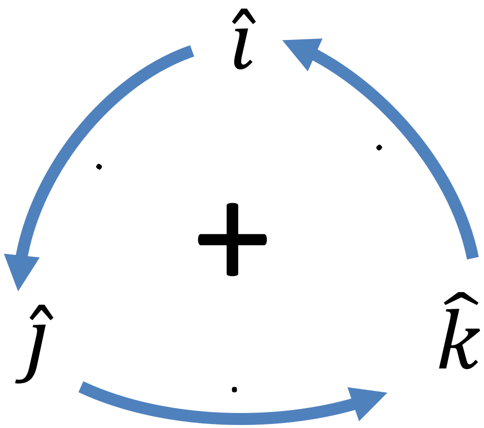
Magnitude = Area

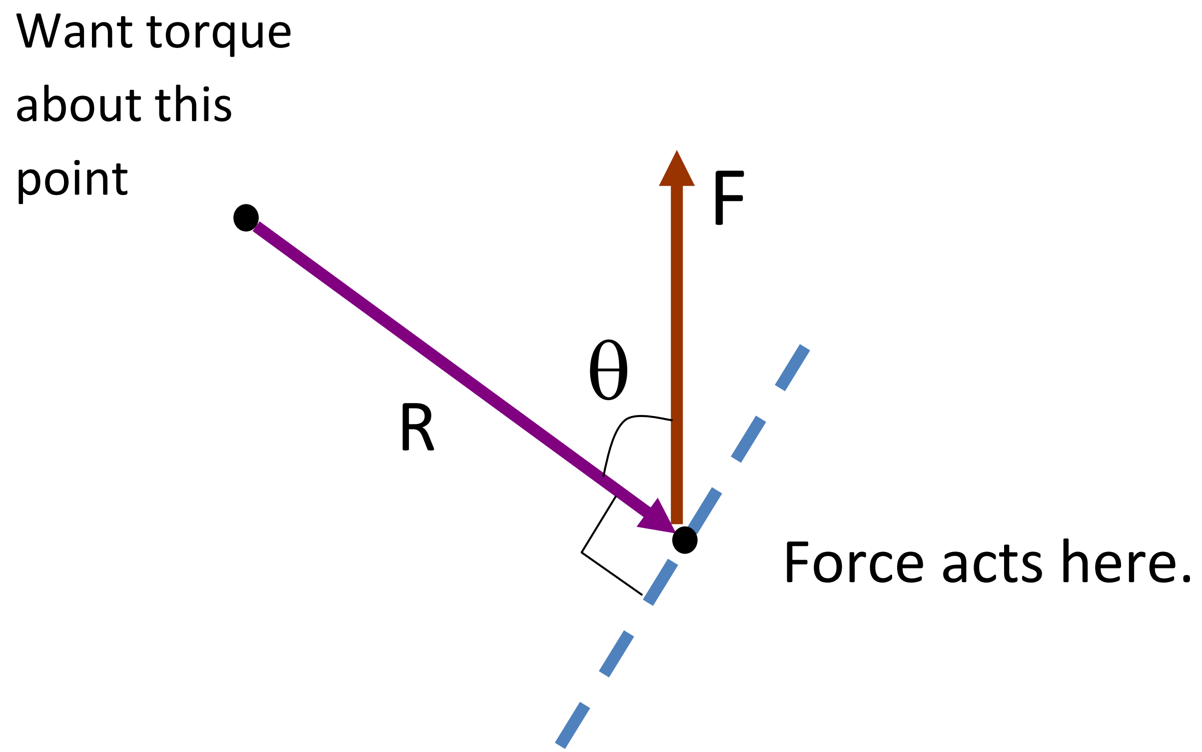
Max. Area when
θ = 90°



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

RHR and unit vectors

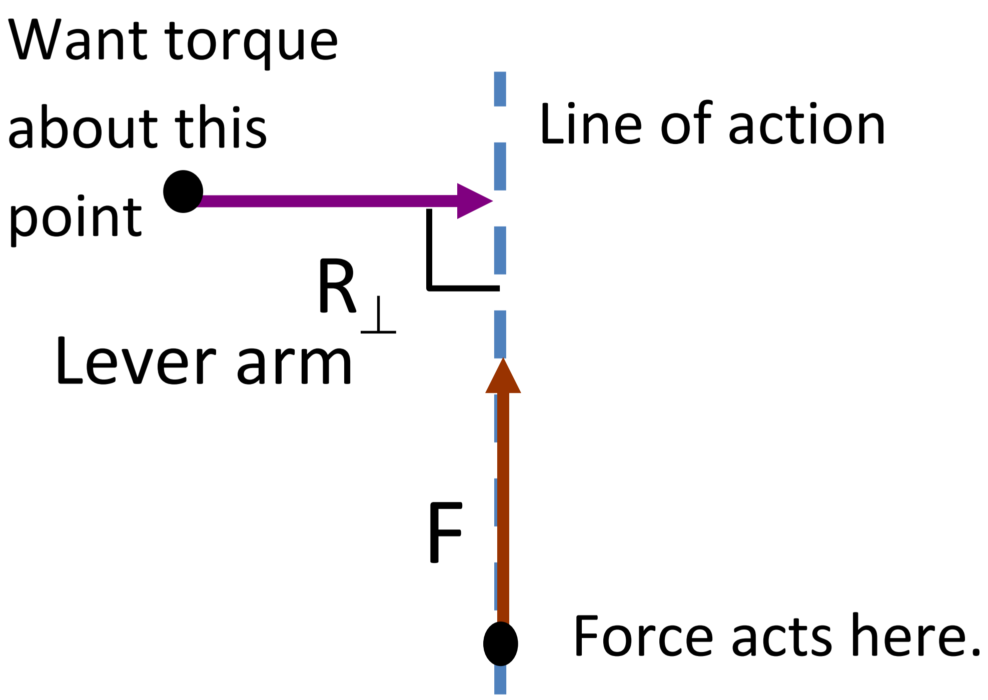




$\tau = rF_{\perp} = rF\sin\theta$

Note: $F_{\perp}$ means the component of F perpendicular to R – not the vertical component of F.

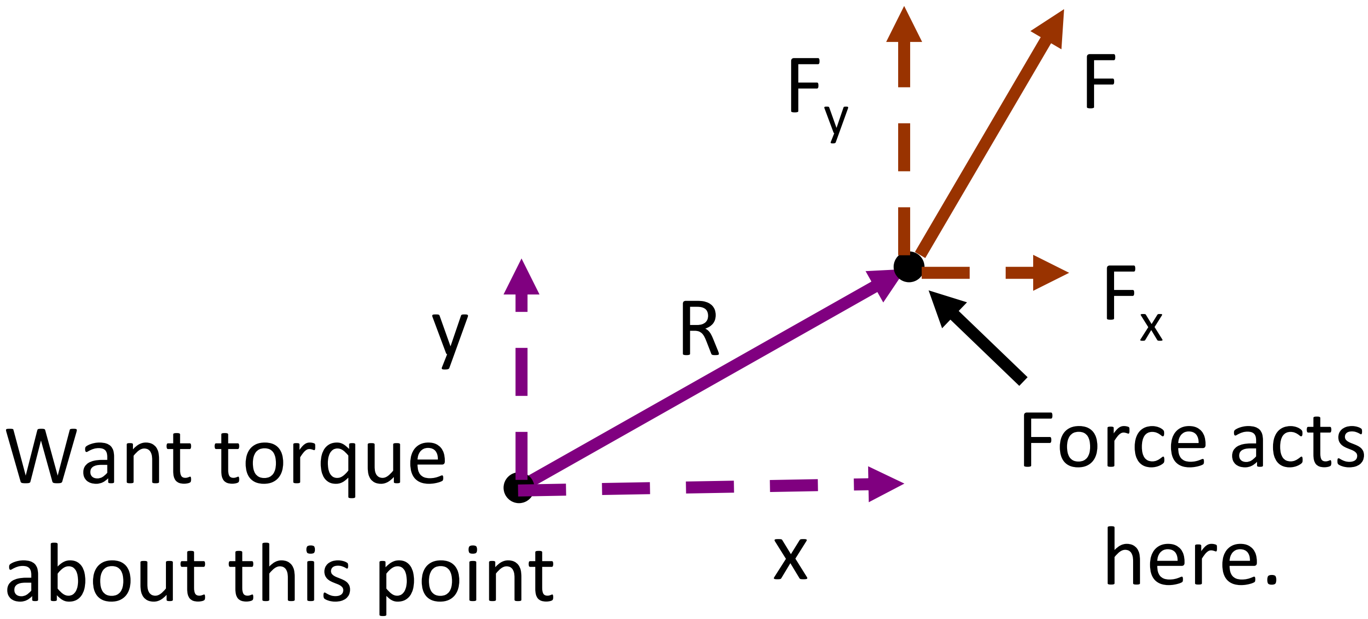
Use this method if both R and θ are easy to find.



$\tau = R_\perp F$

Use this method if the lever arm is easy to find.

Often used for vertical or horizontal forces.

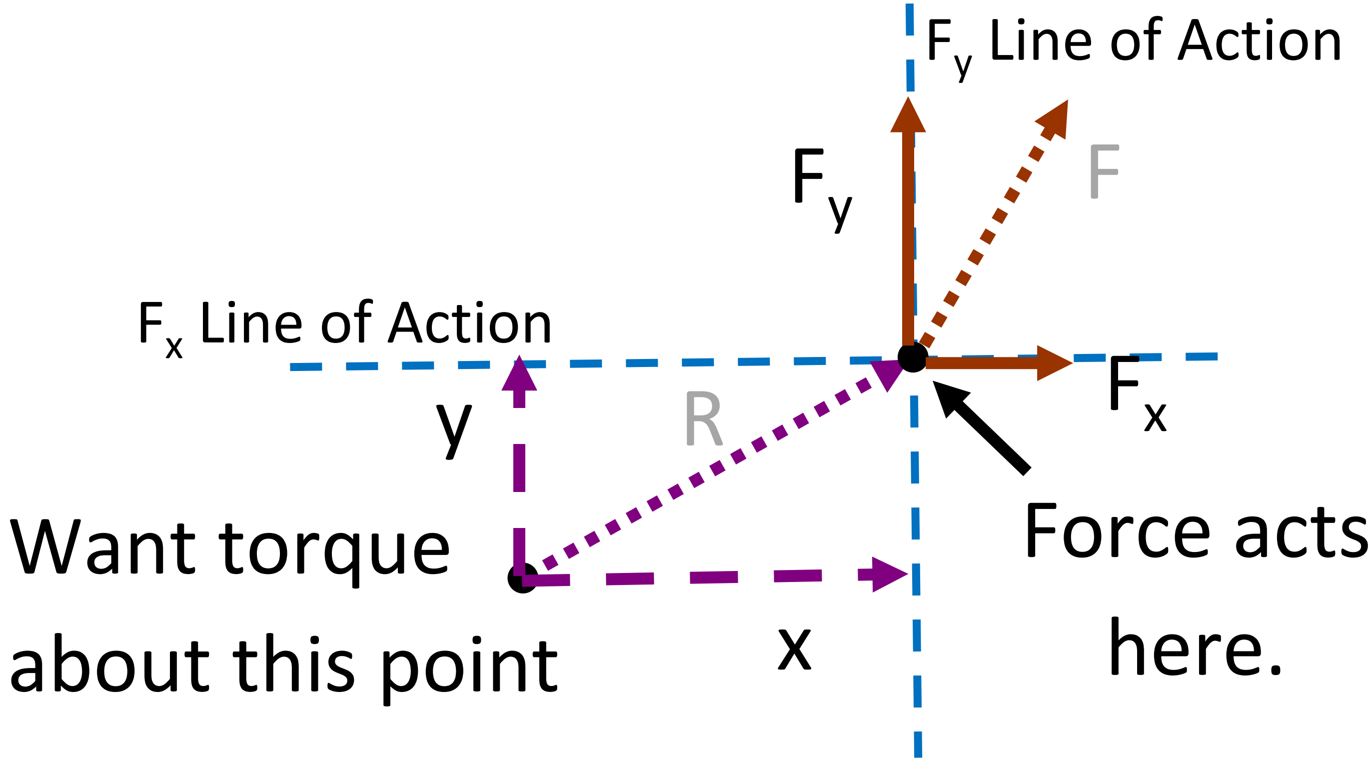


$$\vec{\tau} = \vec{R} \times \vec{F}$$

$$= (\hat{i}x + \hat{j}y) \times (\hat{i}F_x + \hat{j}F_y)$$

$$= \hat{k}(xF_y - yF_x)$$

Easier to Treat as Lever Arm Twice



$$\tau_z = +xF_y - yF_x$$