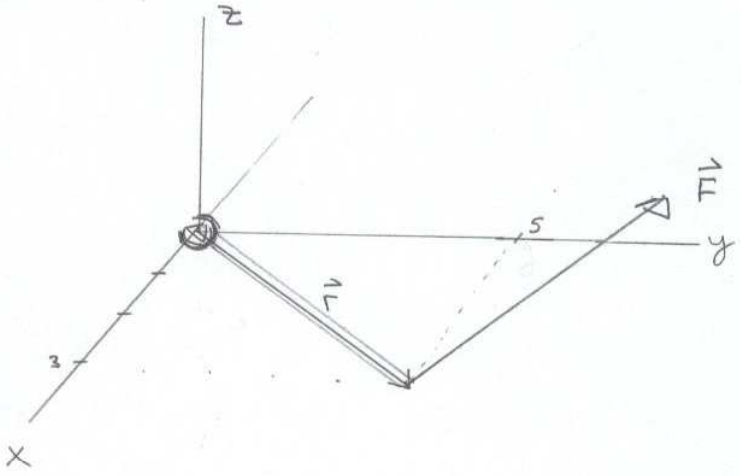
ex) if $\vec{r} = (3\hat{i} + 5\hat{j})\,m$ & $\vec{F} = (-4\hat{i} + 2\hat{j})\,N$

FIND the torque $\vec{\tau}$ exerted by $\vec{F}$ about the origin.



$\vec{\tau} = \vec{r} \times \vec{F} = (r_y F_z - r_z F_y)\hat{i} + (r_z F_x - r_x F_z)\hat{j} + \ldots$ run for the hills!

There's a better way! We can model $\vec{r} \times \vec{F}$ as a determinant:

$$\vec{\tau} = \vec{r} \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ r_x & r_y & r_z \\ F_x & F_y & F_z \end{vmatrix} = \hat{i}(\;) - \hat{j}(\;) + \hat{k}(\;)$$

$$\vec{\tau} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 5 & 0 \\ -4 & 2 & 0 \end{vmatrix} Nm = \hat{i}(5.0 - 2.0) - \hat{j}(3.0 - (-4)0) + \hat{k}(3.2 - (-4)5)\,Nm$$

$$\vec{\tau} = 26\,Nm\,\hat{k}$$