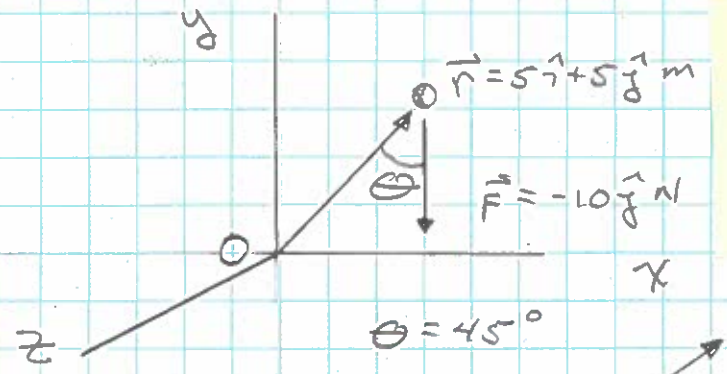
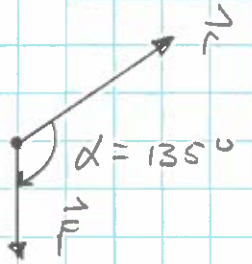
WB 12-6



$\theta = 45°$



Two ways to do this:

Torque about O:

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

$$|\vec{\tau}| = rF\sin\alpha$$

$$= 50 \text{ Nm}$$

$F = 10$ N

$r = \sqrt{5^2 + 5^2} = 7.071$ m

RHR $\Rightarrow$ $\vec{\tau}$ is into the page which is the $-z$ direction.

So, $\vec{\tau} = -50\hat{k}$ Nm

Another way:

$$\vec{\tau} = \vec{r} \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 5 & 5 & 0 \\ 0 & -10 & 0 \end{vmatrix}$$

$$= \hat{i}(5\cdot 0 - 0(-10)) - \hat{j}(5\cdot 0 - 0\cdot 0) + \hat{k}(5(-10) - 5\cdot 0)$$

$$\vec{\tau} = -50\hat{k} \text{ Nm}$$