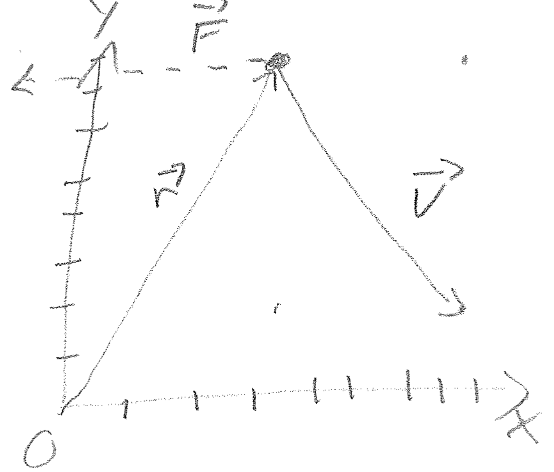
11-33 $\vec{r} = (3.0\,m\,\hat{x},\ 8m\,\hat{y})$ $m = 3.0\,kg$

$\vec{v} = (5.0\,m/s\,\hat{x},\ -6.0\,m/s\,\hat{y})$

$\vec{F} = (-7.0N\,\hat{x})$



Compared to origin,

a) what's angular momentum?

$$\vec{L} = \vec{r} \times m\vec{v}$$

How to do cross products in unit vector notation?

$$\vec{L} = \vec{r} \times m\vec{v} = m(r_x\hat{x} + r_y\hat{y} + r_z\hat{z}) \times (v_x\hat{x} + v_y\hat{y} + v_z\hat{z})$$

(from Eq. 3-30) $$= m\left[(r_y v_z - v_y r_z)\hat{x} + (r_z v_x - v_z r_x)\hat{y} + (r_x v_y - v_x r_y)\hat{z}\right]$$

$$= 3.0\,kg\,(0\,\hat{x} + 0\,\hat{y} + (3.0(-6.0) - 5.0 \cdot 8.0)\hat{z})$$

$$\vec{L} = -174\ kg\,m^2/s\ \hat{z}$$

b) $\vec{\tau} = \vec{r} \times \vec{F} = (0\,\hat{x} + 0\,\hat{y} + (7.0 \cdot 0 - 8.0 \cdot (-7.0))$

$$= +56\ N \cdot m\ \hat{z}$$

c) Just like $\vec{F} = m\vec{a} = \frac{d\vec{p}}{dt}$ in linear motion,

for rotational motion $\vec{\tau} = \frac{d\vec{L}}{dt}$,

and we just found $\vec{\tau}$ in b, so

$$\frac{d\vec{L}}{dt} = \vec{\tau} = 56\ kg\,\frac{m^2}{s^2}\ \hat{z}$$