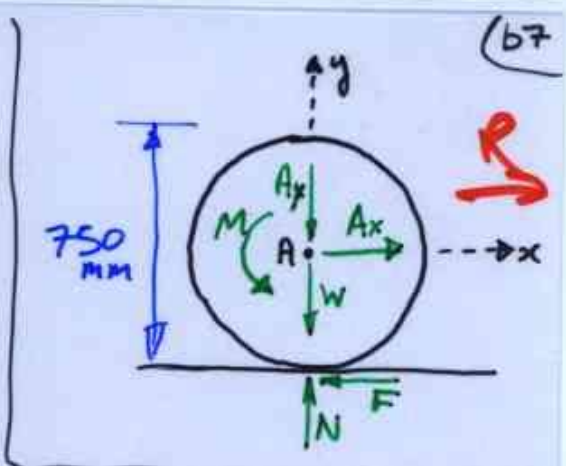
PROBLEM 2/89

Rolling Rear wheel of car.
FRONT WHEEL DRIVE & ACCELERATING TO RIGHT.



Axle Forces: $A_x = 240N \Rightarrow +240\hat{i}$
$A_y = 2000N \Rightarrow -2000\hat{j}$

Road friction: $F = 160N \Rightarrow -160\hat{i}$

" Support: $N = 2400N \Rightarrow +2400\hat{j}$

WHEEL weight: $W = 400N \Rightarrow -400\hat{j}$

$M = 3Nm$ Bearing friction

Sum to get nett force on wheel:

$\hat{i}(240 - 160) + \hat{j}(-2000 + 2400 - 400)$

$\vec{R} = 80\hat{i}$ ... (comment!) N

Moment about A:

$\vec{M} = +3Nm$

all of $\vec{A}_x, \vec{A}_y, \vec{W}, \vec{N}$ have zero moment about A

leaves $\vec{F}$: $M_F = -F(0.75/2)$ Nm

$= -(160)(0.75)/2 = -60\,Nm$

total $\vec{M}_A = 3 - 60 = -57\,Nm$

find Posn of resultant...

moment arm ... $57/80 = 0.712\,m$ above A
By inspection

Alternatively: $\vec{r} \times \vec{R} = -57\,Nm$ $\vec{r} = x\hat{i} + y\hat{j} + 0\hat{k}$
UNKNOWN

$$\Rightarrow \begin{Vmatrix} \hat{i} & \hat{j} & \hat{k} \\ x & y & 0 \\ 80 & 0 & 0 \end{Vmatrix} = -57\hat{k}$$

$\Rightarrow \hat{i}(0) + \hat{j}(0) + \hat{k}((x)(0) - 80y) = -57\hat{k}$

$-80y = -57$

$y = 57/80 = +0.712\,m$ Again