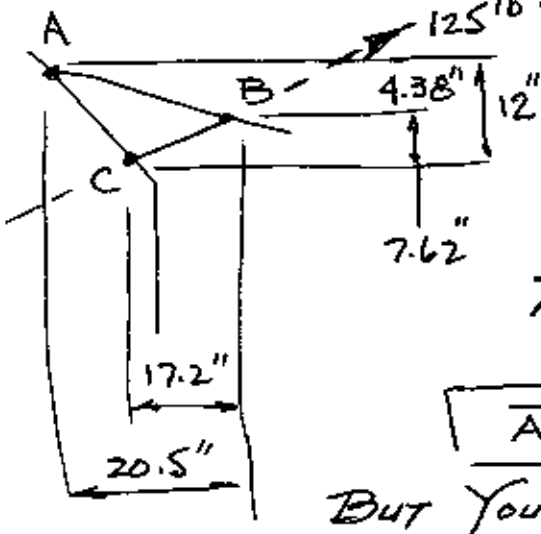
MECH 234 — M. MILANO — HW3.10

CAR TAILGATE



? M_A = (dist $\overline{AB}$)(⊥ comp. of F_B)

I. TRY CROSS PRODUCT FIRST!

$\overrightarrow{AB}$ = ? need $|AB| = \sqrt{20.5^2 + 4.38^2} = 20.96"$ — NOT REALLY!

$$\overrightarrow{AB} = 20.5\,\hat{i} - 4.38\,\hat{j}$$

BUT YOU'LL NEED THE UNIT VECTOR for $\vec{F}$

① GET DIRECTION from pt. C to pt B (DIR. for LINE of ACTION)

$\overrightarrow{CB} = 17.2\,\hat{i} + 7.62\,\hat{j}$, now need $|CB| = \sqrt{17.2^2 + 7.62^2} = 18.81"$

UNIT VECTOR $\hat{u}_{CB} = \frac{17.2}{18.81}\hat{i} + \frac{7.62}{18.81}\hat{j} = .914\hat{i} + .405\hat{j}$

$\therefore \vec{F} = F\hat{u} = 125^{lb}(.914\hat{i}) + 125^{lb}(.405\hat{j}) = 114.25\hat{i} + 50.625\hat{j}$

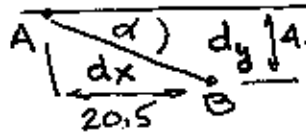
② $M_A = \overrightarrow{AB} \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 20.5 & -4.38 & 0 \\ 114.25 & 50.625 & 0 \end{vmatrix}$

$= \hat{i}[0-0] - \hat{j}[0-0] + \hat{k}[(20.5)(50.625) - (-4.38)(114.25)]$

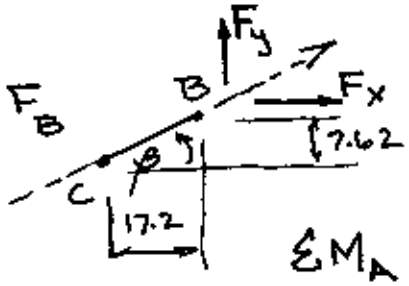
$M_A = 1538.23$ in lb. $\hat{k}$ (ccw) or 128.2 ft·lb.

II. OR, USE $(F_x)(Y\,dist) + (F_y)(X\,dist) = \Sigma M$

GET ANGLES:



$\alpha = \arctan\frac{4.38}{20.5} = 12° = \alpha$



$\beta = \arctan\frac{7.62}{17.2} = 23.9° = \beta$

$\Sigma M_A = (F_x)(d_y) + (F_y)(d_x) =$

$= (125^{lb}\cos 23.9°)(4.38") + (125^{lb}\sin 23.9°)(20.5")$

$= 1538.73$ in lb. ↻ or 128.2 ft·lb. ↻ ccw