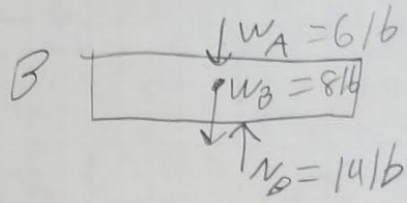
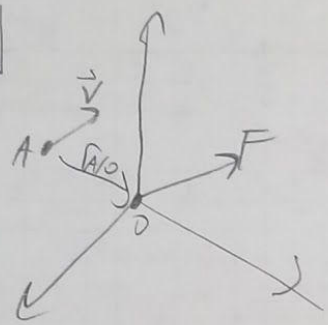
Exam 1 | AEM 2011 | Spring 2019

1



2



a) $\vec{M}_A = \vec{r}_{A/O} \times \vec{F}_O$

$$= \begin{vmatrix} i & j & k \\ 0 & -2 & -2 \\ 3 & 3 & -1 \end{vmatrix}$$

$\vec{M}_A = (2+6)\hat{i} - (0-(-6))\hat{j} + (0-(-6))\hat{k}$

$\boxed{\vec{M}_A = 8\hat{i} - 6\hat{j} + 6\hat{k}}$

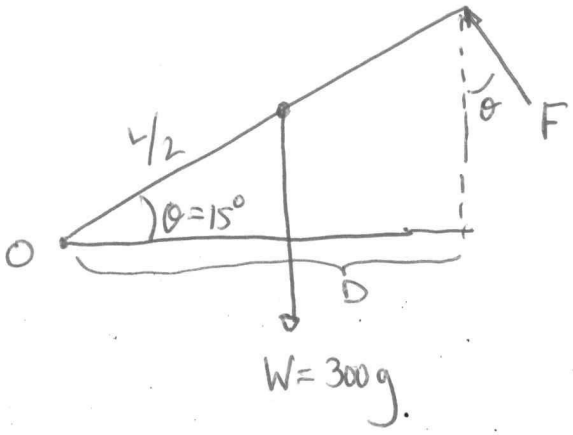
B.) $M_{AN} = \hat{n} \cdot \vec{M}_A$

$= \frac{1}{\sqrt{2}}(1\hat{j} - 1\hat{k}) \cdot (8\hat{i} - 6\hat{j} + 6\hat{k})$

$M_{AN} = \frac{6}{\sqrt{2}} - \frac{6}{\sqrt{2}} = \frac{12}{\sqrt{2}}$

$\boxed{M_{AN} = \frac{12}{\sqrt{2}} = 8.49}$

(3)



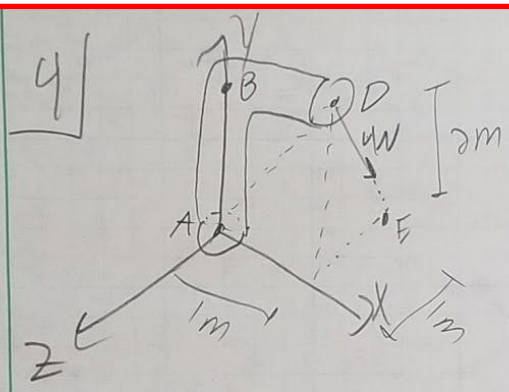
$$\Sigma M_O = 0 = -W\left(\frac{L}{2}\cos\theta\right) + D\left(\frac{F}{\cos\theta}\right)$$

$$\Rightarrow \quad F = \frac{WL}{2D}\cos\theta^2$$

Use $W = 300 \cdot g$, $g = 9.81$, $L = 10$, $D = 9$, $\theta = 15^\circ$

$$\Rightarrow \boxed{F = 1525.5\ N}$$

4



$\vec{F} = 4 \cdot \frac{1}{\sqrt{3}}(-2\hat{j} - 1\hat{k})$

$\vec{F} = \frac{8}{\sqrt{3}}\hat{j} - \frac{4}{\sqrt{3}}\hat{k}$

$\vec{m} = \vec{r}_{AD} \times \vec{F}_D$

$= -\frac{4}{\sqrt{3}} \begin{vmatrix} i & j & k \\ 1 & 2 & 0 \\ 0 & 2 & -1 \end{vmatrix}$

$= \frac{4}{\sqrt{3}}\left(-2\hat{i} - (-1)\hat{j} + (-2\hat{k})\right)$

$\vec{m} = -\frac{8}{\sqrt{3}}\hat{i} + \frac{4}{\sqrt{3}}\hat{j} - \frac{8}{\sqrt{3}}\hat{k}$

5.) a.) no
B.) yes
C.) yes
D.) no