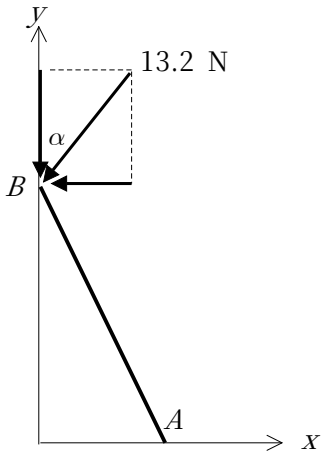
정 역 학　　연습문제 풀이　　제3장

<3.1~3.8절>

3.1　$\alpha = 30°$



$P_x = -P\sin\alpha = -(13.2\text{ N})\sin30° = -6.60\text{ N}$

$P_y = -P\cos\alpha = -(13.2\text{ N})\cos30° = -11.431\text{ N}$

$x_{B/A} = -0.086\text{ m}, \quad y_{B/A} = 0.122\text{ m}$

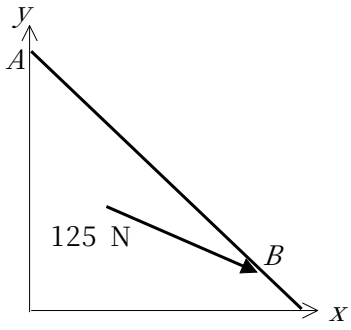
$\mathbf{M}_A = (x_{B/A}\,\mathbf{i} + y_{B/A}\,\mathbf{j})\times(P_x\,\mathbf{i} + P_y\,\mathbf{j})$

$= [x_{B/A}\,P_y - y_{B/A}\,P_x]\mathbf{k}$

$= [(-0.086\text{ m})(-11.431\text{ N}) - (0.122\text{ m})(-6.60\text{ N})]\mathbf{k}$

$= 1.788\text{ N·m}\,\mathbf{k} = 1.788\text{ N·m}\rangle$

3.9　$d_{CB} = \sqrt{(0.240\text{ m})^2 + (0.0466\text{ m})^2} = 0.24448\text{ m}$



$F_x = (125\text{ N})\dfrac{0.240\text{ m}}{0.24448\text{ m}} = 122.7\text{ N}$

$F_y = -(125\text{ N})\dfrac{0.0466\text{ m}}{0.24448\text{ m}} = -23.82\text{ N}$

$x_{B/A} = 0.306\text{ m}, \quad y_{B/A} = -0.2866\text{ m}$

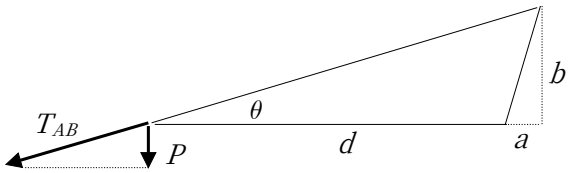
$\mathbf{M}_A = (x_{B/A}\,\mathbf{i} + y_{B/A}\,\mathbf{j})\times(P_x\,\mathbf{i} + P_y\,\mathbf{j})$

$= [x_{B/A}\,F_y - y_{B/A}\,F_x]\mathbf{k}$

$= [(0.306\text{ m})(-23.82\text{ N}) - (-0.2866\text{ m})(122.7\text{ N})]\mathbf{k}$

$= 27.9\text{ N·m}\,\mathbf{k} = 27.9\text{ N·m}\rangle$

3.12　$M_D = 900\text{ N·m}$



$\tan\theta = \dfrac{b}{d+a} = \dfrac{0.9\text{ m}}{2.8\text{ m} + 0.2\text{ m}} = 0.3$

$\theta = \tan^{-1}0.3 = 16.70°$

$P = T_{AB}\sin\theta$

$M_D = (2.8\text{ m})\,P = (2.8\text{ m})\,T_{AB}\sin\theta$

$\Rightarrow \quad T_{AB} = \dfrac{M_D}{(2.8\text{ m})\sin\theta} = \dfrac{(900\text{ N}\cdot\text{m})}{(2.8\text{ m})\sin16.70°} = 1119\text{ N}$　　(교재 답 1148 N 오류)

<다른 방법>

$\mathbf{r} = a\mathbf{i} + b\mathbf{j} = (0.2\text{ m})\mathbf{i} + (0.9\text{ m})\mathbf{j}$

$\mathbf{T}_{AB} = T_{AB}(-\cos\theta\,\mathbf{i} - \sin\theta\,\mathbf{j}) = T_{AB}(-\cos16.70°\,\mathbf{i} - \sin16.70°\,\mathbf{j})$

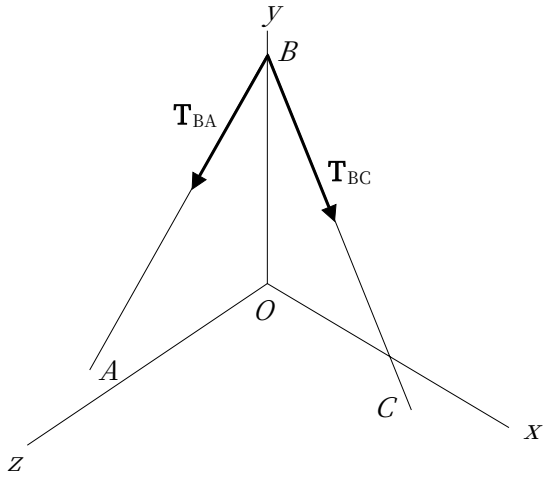
$= T_{AB}(-0.9578\,\mathbf{i} - 0.2887\,\mathbf{j})$

$\mathbf{M}_D = \mathbf{r}\times\mathbf{T}_{AB} = [(0.2\text{ m})\mathbf{i} + (0.9\text{ m})\mathbf{j}]\times[T_{AB}(-0.9578\,\mathbf{i} - 0.2887\,\mathbf{j})]$

$= [(0.2)(-0.2887) - (0.9)(-0.9578)]\,T_{AB}\,\mathbf{k}\,(\text{m}) = 0.8043\,T_{AB}\,\mathbf{k}\,(\text{m})$

$M_D = 0.8043\,T_{AB}\,(\text{m}) = 900\,(\text{N·m}) \quad \Rightarrow \quad T_{AB} = 1119\text{ N}$

3.21



$\mathbf{r} = (8.4\text{ m})\,\mathbf{j}$

$\mathbf{T}_{BA} = \boldsymbol{\lambda}_{BA} T_{BA}$

$$= \frac{(777\text{ N})}{\sqrt{(0.9\text{ m})^2 + (8.4\text{ m})^2 + (7.2\text{ m})^2}}[(-0.9\text{ m})\mathbf{i} + (-8.4\text{ m})\mathbf{j} + (7.2\text{ m})\mathbf{k}]$$

$$= (-63\text{ N})\mathbf{i} + (-588\text{ N})\mathbf{j} + (504\text{ N})\mathbf{k}$$

$\mathbf{T}_{BC} = \boldsymbol{\lambda}_{BC} T_{BC}$

$$= \frac{(990\text{ N})}{\sqrt{(5.1\text{ m})^2 + (8.4\text{ m})^2 + (1.2\text{ m})^2}}[(5.1\text{ m})\mathbf{i} + (-8.4\text{ m})\mathbf{j} + (1.2\text{ m})\mathbf{k}]$$

$$= (510\text{ N})\mathbf{i} + (-840\text{ N})\mathbf{j} + (120\text{ N})\mathbf{k}$$

$\mathbf{F}_B = \mathbf{T}_{BA} + \mathbf{T}_{BC}$

$= [(-63\text{ N})\mathbf{i} + (-588\text{ N})\mathbf{j} + (504\text{ N})\mathbf{k}] + [(510\text{ N})\mathbf{i} + (-840\text{ N})\mathbf{j} + (120\text{ N})\mathbf{k}]$

$= (447\text{ N})\mathbf{i} + (-1428\text{ N})\mathbf{j} + (624\text{ N})\mathbf{k}$

$\mathbf{M}_O = \mathbf{r} \times \mathbf{F}$

$= [(8.4\text{ m})\,\mathbf{j}] \times [(447\text{ N})\mathbf{i} + (-1428\text{ N})\mathbf{j} + (624\text{ N})\mathbf{k}]$

$= 5240\,\mathbf{i} - 3750\,\mathbf{k}\ (\text{N}\cdot\text{m}) = 5.24\,\mathbf{i} - 3.75\,\mathbf{k}\ (\text{kN}\cdot\text{m})$