

[4.1절]

4.28 S; known ; $P = 300 \text{ N} \rightarrow$, $Q = 300 \text{ N} \rightarrow$, $a = 0.2 \text{ m}$, $b = 0.2 \text{ m}$, $c = 0.8 \text{ m}$, α unknown ; reaction **A, C**

\Rightarrow 모멘트 평형, 힘의 평형, 반력 유형 1&2

M; 자유물체도(F.B.D.)

A; (a) $\alpha = 0$

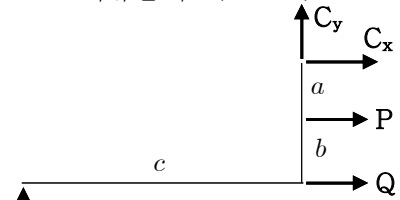
$$+\uparrow \Sigma M_C = 0 ;$$

$$-c A + a P + (a+b) Q = 0$$

$$\Rightarrow A = \frac{aP + (a+b)Q}{c}$$

$$= \frac{(0.2 \text{ m})(300 \text{ N}) + (0.4 \text{ m})300 \text{ N}}{0.8 \text{ m}} = 225 \text{ N}$$

$$\Rightarrow A = 225 \text{ N} \uparrow$$



$$\rightarrow \Sigma F_x = 0 ;$$

$$C_x + P + Q = 0 \Rightarrow C_x = -P - Q = -(300 \text{ N}) - (300 \text{ N}) = -600 \text{ N}$$

$$\uparrow \Sigma F_y = 0 ;$$

$$C_y + A = 0 \Rightarrow C_y = -A = -225 \text{ N}$$

$$C = \sqrt{C_x^2 + C_y^2} = \sqrt{(-600 \text{ N})^2 + (-225 \text{ N})^2} = 640.8 \text{ N}$$

$$\theta = \tan^{-1} \frac{C_y}{C_x} = \tan^{-1} \frac{-225 \text{ N}}{-600 \text{ N}} = \tan^{-1}(0.375) = 20.56^\circ$$

$$\Rightarrow C = 641 \text{ N} \nearrow 20.6^\circ$$

(b) $\alpha = 30^\circ$

M; 자유물체도(F.B.D.)

$$+\uparrow \Sigma M_C = 0 ;$$

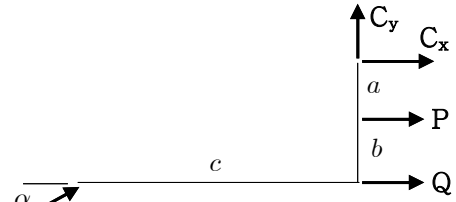
$$-c A \cos \alpha + (a+b) A \sin \alpha + a P + (a+b) Q = 0$$

$$\Rightarrow A = \frac{aP + (a+b)Q}{c \cos \alpha - (a+b) \sin \alpha}$$

$$= \frac{(0.2 \text{ m})(300 \text{ N}) + (0.4 \text{ m})300 \text{ N}}{(0.8 \text{ m}) \cos 30^\circ - (0.4 \text{ m}) \sin 30^\circ}$$

$$= 365.2 \text{ N}$$

$$\Rightarrow A = 365 \text{ N} \nearrow 60.0^\circ$$



$$\rightarrow \Sigma F_x = 0 ;$$

$$C_x + P + Q + A \sin \alpha = 0$$

$$\Rightarrow C_x = -P - Q - A \sin \alpha$$

$$= -(300 \text{ N}) - (300 \text{ N}) - (365.2 \text{ N}) \sin 30^\circ = -782.6 \text{ N}$$

$$\uparrow \Sigma F_y = 0 ;$$

$$C_y + A \cos \alpha = 0$$

$$\Rightarrow C_y = -A \cos \alpha = -(365.2 \text{ N}) \cos 30^\circ = -316.3 \text{ N}$$

$$C = \sqrt{C_x^2 + C_y^2} = \sqrt{(-782.6 \text{ N})^2 + (-316.3 \text{ N})^2} = 844.1 \text{ N}$$

$$\theta = \tan^{-1} \frac{C_y}{C_x} = \tan^{-1} \frac{-316.3 \text{ N}}{-782.6 \text{ N}} = \tan^{-1}(0.404) = 22.0^\circ$$

$$\Rightarrow C = 844 \text{ N} \nearrow 22.0^\circ$$

R; (예: $+\uparrow \Sigma M_A$ 에 비해 $+\uparrow \Sigma M_C$ 을 사용하는 장점

힘 평형 식 ($\rightarrow \Sigma F_x = 0$, $\uparrow \Sigma F_y = 0$)보다 모멘트 식 ($\Sigma M_C = 0$)을 먼저 사용하는 장점)

T; (예: a와 b의 A 비교, C 비교)