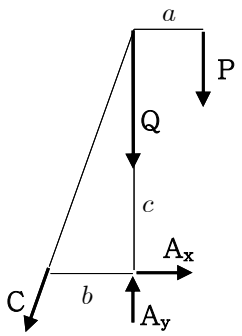
4.50 P = 900 N, Q = 4000 N, T = 1950 N, a = 2.1 m, b = 3 m, c = 7.2 m

$\alpha = \tan^{-1}\frac{7.2}{3} = \tan^{-1}(2.4) = 67.38°$

$\overline{BC} = \sqrt{3^2+7.2^2} = 7.8$ (m)

(a) S; known P, Q, a, b, c
unknown reaction **C**, **A**
유형 1&2 (줄, 힌지)
method 힘의 평형, 모멘트 평형

M; 자유물체도(F.B.D.)



A; $+\circlearrowleft\Sigma M_B = 0$; $c\ A_x - a\ P = 0$

$\Rightarrow\ A_x = \frac{a}{c}\ P = \frac{2.1}{7.2}$ (900 N) = 262.5 N

$\Sigma F_x = 0$; $-T\cos\alpha + A_x = 0$

$\Rightarrow\ T = \frac{7.8}{3}\ A_x = 2.6$ (262.5 N) = 682.5 N $\Rightarrow$ **C** = 683 N $\swarrow 67.4°$

$\Sigma F_y = 0$; $A_y - T\sin\alpha - (P+Q) = 0$

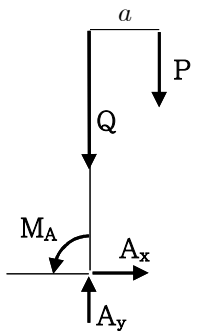
$\Rightarrow\ A_y = \frac{7.2}{7.8}\ T + P + Q = \frac{12}{13}(682.5\text{ N}) + (4900\text{ N}) = 5530$ N

$A = \sqrt{A_x^2+A_y^2} = \sqrt{(262.5)^2+(5530)^2} = 5536$ N

$\theta = \tan^{-1}\frac{A_y}{A_x} = \tan^{-1}\frac{5530}{262.5} = \tan^{-1}(21.07) = 87.28°$ $\Rightarrow$ **A** = 5540 N $\nearrow 87.3°$

(b) S; known P, Q, a
unknown reaction **A**, $\mathbf{M}_A$
유형 3 (고정)
method 힘의 평형, 모멘트 평형

M; 자유물체도(F.B.D.)



A; $+\circlearrowleft\Sigma M_A = 0$; $M_A - a\ P = 0$

$\Rightarrow\ M_A = a\ P = (2.1\text{ m})(900\text{ N}) = 1890.0$ N · m

$\Rightarrow$ $\mathbf{M}_A$ = 1890 N · m $\circlearrowleft$

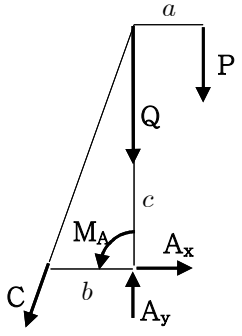
$\Sigma F_x = 0$; $A_x = 0$

$\Sigma F_y = 0$; $A_y - (P+Q) = 0$

$\Rightarrow\ A_y = P + Q = 4900$ N $\Rightarrow$ **A** = 4900 N $\uparrow$

(c) S; known P, Q, T, a, b, c
unknown reaction **C**, **A**, $\mathbf{M}_A$
유형 1&3 (줄, 고정)
method 힘의 평형, 모멘트 평형

M; 자유물체도(F.B.D.)



A; $\mathbf{C} = \mathbf{T} = 1950\ \text{N}\ \measuredangle 67.4°$ ⇒ $\mathbf{C} = 1950\ \text{N}\ \measuredangle 67.4°$

$\Sigma F_x = 0;\ -T\cos\alpha + A_x = 0$

$\Rightarrow\ A_x = T\cos\alpha = (1950\ \text{N})\ \frac{3}{7.8} = 750\ \text{N}$

$\Sigma F_y = 0;\ A_y - T\sin\alpha - (P+Q) = 0$

$\Rightarrow\ A_y = \frac{7.2}{7.8}\ T + P + Q = \frac{12}{13}(1950\ \text{N}) + (4900\ \text{N}) = 6700\ \text{N}$

$A = \sqrt{A_x^2 + A_y^2} = \sqrt{(750)^2 + (6700)^2} = 6742\ \text{N}$

$\theta = \tan^{-1}\frac{A_y}{A_x} = \tan^{-1}\frac{6700}{750} = \tan^{-1}(8.933) = 83.61°$ ⇒ $\mathbf{A} = 6740\ \text{N}\ \angle 83.6°$

$+\circlearrowleft\Sigma M_B = 0;\ M_A + c\ A_x - a\ P = 0$

$\Rightarrow\ M_A = -c\ A_x + a\ P = -(7.2\ \text{m})\ (750\ \text{N}) + (2.1\ \text{m})\ (900\ \text{N})$

$= -3510\ \text{N}\cdot\text{m}$ ⇒ $\mathbf{M}_A = 3510\ \text{N}\cdot\text{m}\ \circlearrowleft$

R; (예: (a)와 (b)에서는 모멘트 식을 먼저 사용하지만, (c)에서는 힘 평형 식을 먼저 사용)

T; (예: 모멘트 반력 방향이 (b)에서는 반시계방향인데, (c)에서는 시계방향)