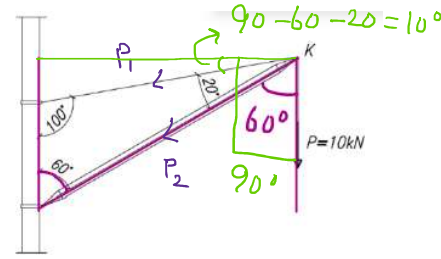
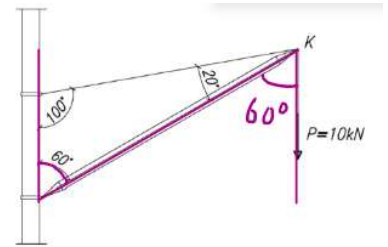
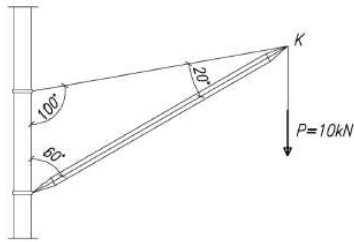


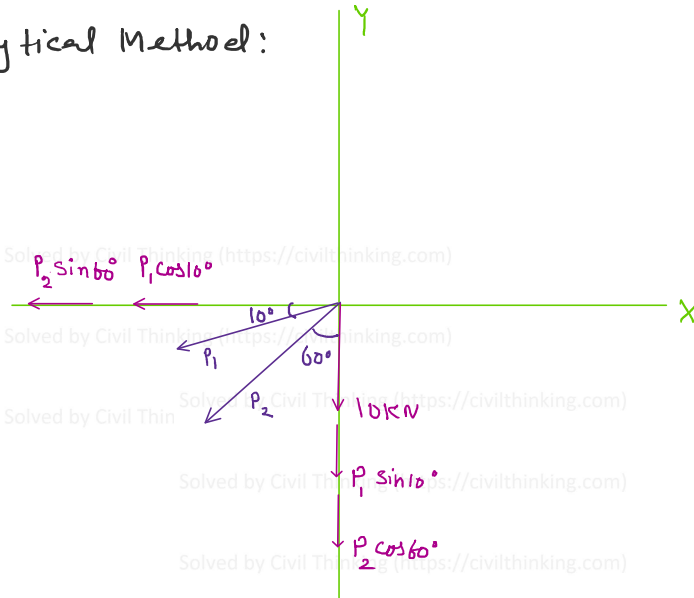
Statics: Force System: **Concurrent Force System** Solved Problem using **graphic method and analytical method**

Please find the force in bar of the rotary crane loaded by force $P = 10 \text{ kN}$ as presented below.



Resolve p_1 and p_2 into y and x components.

Analytical Method:



$$\sum F_x = -P_2 \sin 60^\circ - P_1 \cos 10^\circ = 0$$

$$\Rightarrow P_2 \sin 60^\circ = -P_1 \cos 10^\circ$$

$$\Rightarrow P_2 = -P_1 \frac{\cos 10^\circ}{\sin 60^\circ}$$

$$\Rightarrow P_2 = -25.34 \frac{\cos 10^\circ}{\sin 60^\circ}$$

$$= -25.34 * (\cos(10)/\sin(60)) = -28.8 \text{ kN}$$

Since p_2 is negative, it means the force is compressive.

$$\sum F_y = -10 \text{ kN} - P_1 \sin 10^\circ - P_2 \cos 60^\circ = 0$$

$$\Rightarrow -10 - P_1 \sin 10^\circ - \left(-P_1 \frac{\cos 10^\circ}{\sin 60^\circ}\right) \cos 60^\circ = 0$$

$$\Rightarrow -10 - P_1 \sin 10^\circ + P_1 \left(\frac{\cos 10^\circ \cdot \cos 60^\circ}{\sin 60^\circ}\right) = 0$$

$$\sin(10) = 0.174$$

$$\frac{(\cos(10) * \cos(60))}{\sin(60)} = 0.5686$$

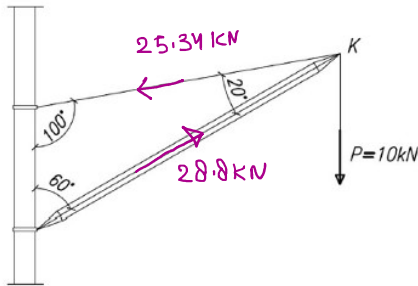
$$\Rightarrow -10 - 0.174 P_1 + 0.5686 P_1 = 0$$

$$\Rightarrow -10 + P_1 (0.5686 - 0.174) = 0$$

$$\Rightarrow P_1 = \frac{10}{0.5686 - 0.174} = 10 / (0.5686 - 0.174) = 25.34 \text{ kN}$$

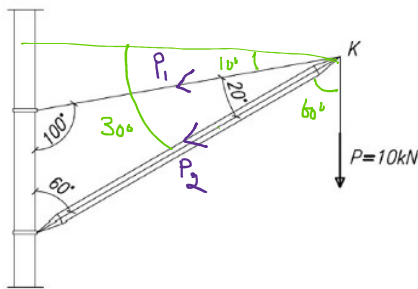
$$\Rightarrow P_1 \leq 25.34 \text{ kN}$$

Final Answers:



Solved by Civil Thinking (<https://civilthinking.com>)

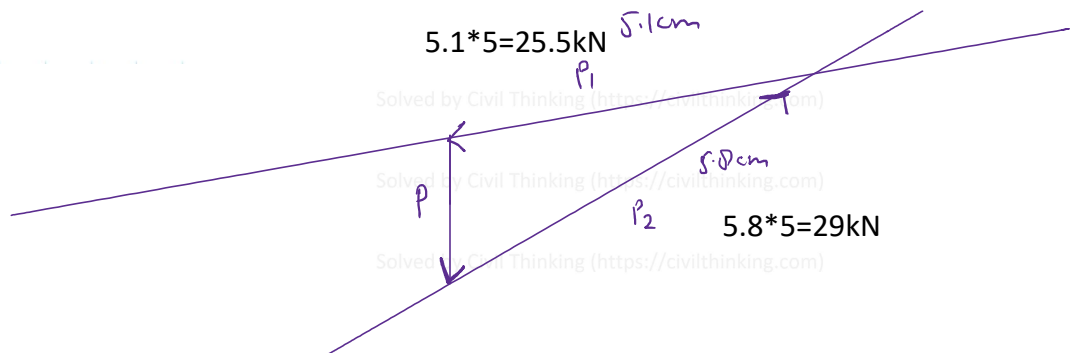
Graphical Method:



scale: Solved by Civil Thinking (<https://civilthinking.com>)

$$\left. \begin{aligned} 1 \text{ cm} &= 5 \text{ kN} \\ \Rightarrow 1 \text{ kN} &= \frac{1}{5} \text{ cm} \end{aligned} \right\} \Rightarrow P = 10 \text{ kN} = \frac{10}{5} = 2 \text{ cm}$$

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