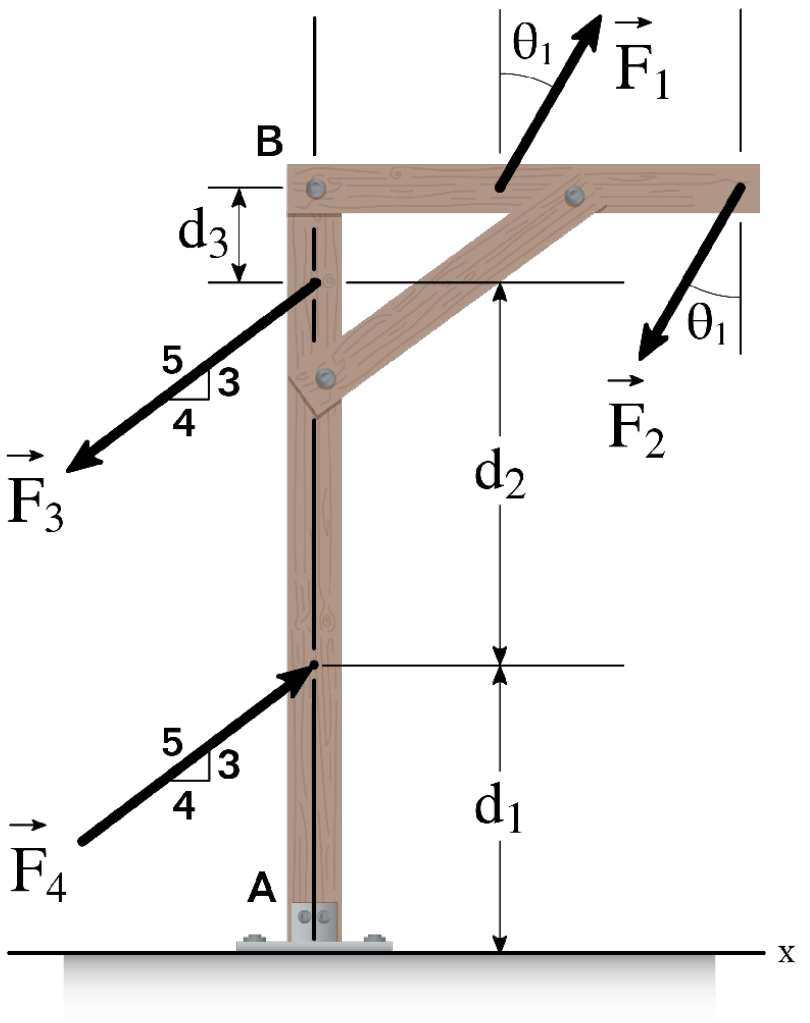

UBC Engineering

A wooden frame is acted upon by multiple forces. Simplify the loadings into a single resultant force and specify where the line of action intersects the vertical line AB, measured from A. The distance between point B and $\vec{F_1}$ is d_4 and the distance between $\vec{F_1}$ and $\vec{F_2}$ is d_5

Find the resultant force vector assuming the positive directions are up and right.

$$F_{Rx} = \Sigma F_x = (F_1 - F_2)\sin(\theta_1) + (F_4 - F_3)\frac{4}{5}$$

$$F_{Ry} = \Sigma F_y = (F_1 - F_2)\cos(\theta_1) + (F_4 - F_3)\frac{3}{5}$$

$\overrightarrow{F_R} = < F_{Rx}, F_{Ry} >$

Find the total resultant moment magnitude and direction about point A.

$$M_{AR\,CC} = \Sigma M_{A\,CC} = (d_1 + d_2 + d_3)(F_2 - F_1)\sin(\theta_1) + d_4 F_1 \cos(\theta_1) - (d_4 + d_5)F_2 \cos(\theta_1) + (d_1 + d_2)F_3\left(\frac{4}{5}\right) - d_1 F_4\left(\frac{4}{5}\right)$$

$$|M_{AR}| = |M_{AR\,CC}|$$

If $M_{AR\,CC} > 0$, moment points out of page

If $M_{AR\,CC} < 0$, moment points into page

Specify where the line of action intersects the vertical line AB, measured from A, assuming up is positive.

$$d_{intersect} F_{Rx} = -M_{AR\,CC}$$

$$d_{intersect} = -\frac{M_{AR\,CC}}{F_{Rx}}$$