College of Technological Studies

Department of Civil Engineering Technology

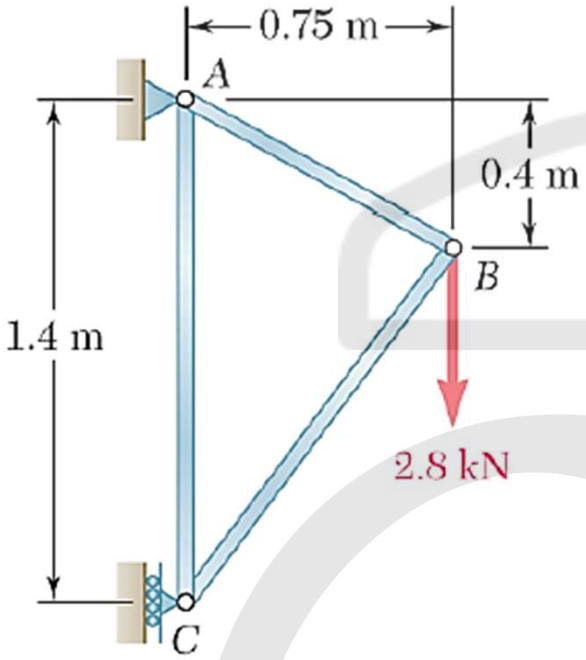
CE 278 Structural Analysis

Tutorial (4)

Plane Truss Analysis

Method of Joints (MOJ)

Example (1): Using the method of joints, determine the force in each member of the truss shown.



$+\uparrow \Sigma F_y = 0: \quad -A_y - 2.8\ \text{kN} = 0 \qquad A_y = -2.8\ \text{kN}$

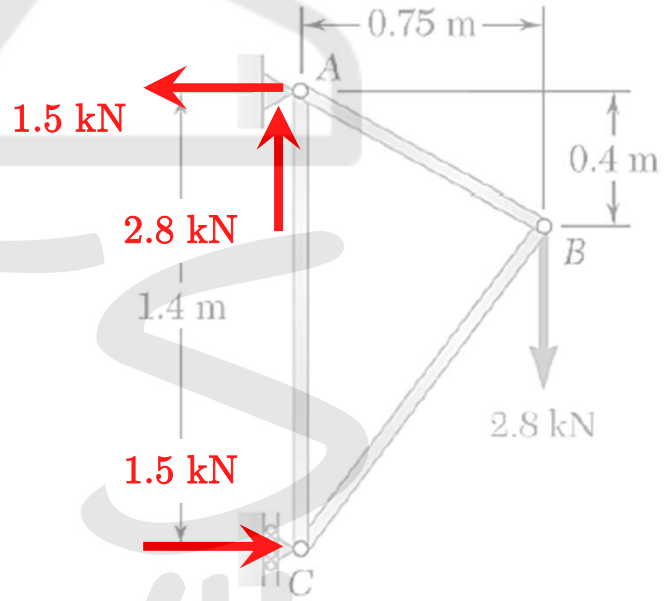
$\mathbf{A}_y = 2.8\ \text{kN} \uparrow$

$+\circlearrowleft \Sigma M_A = 0: \quad C(1.4\ \text{m}) - (2.8\ \text{kN})(0.75\ \text{m}) = 0$

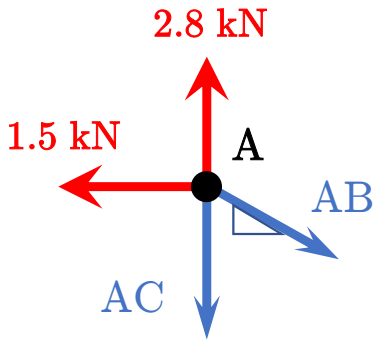
$C = 1.500\ \text{kN} \qquad \mathbf{C} = 1.500\ \text{kN} \rightarrow$

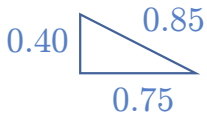
$\pm\rightarrow \Sigma F_x = 0: \quad A_x + 1.500\ \text{kN} = 0$

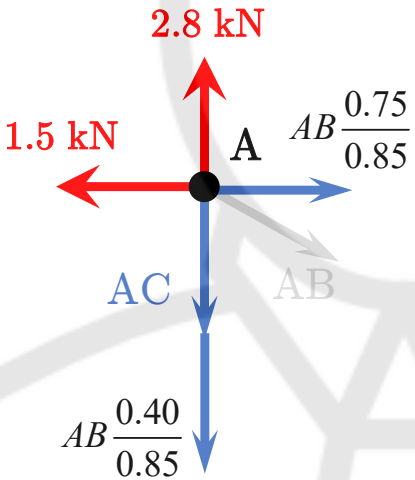
$A_x = -1.500\ \text{kN} \qquad \mathbf{A}_x = 1.500\ \text{kN} \leftarrow$

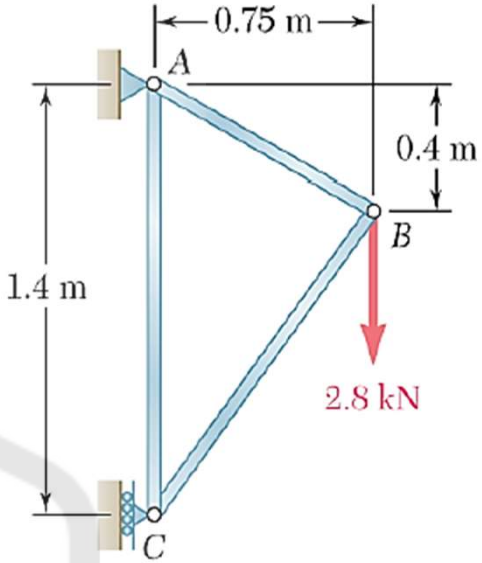


Joint A:







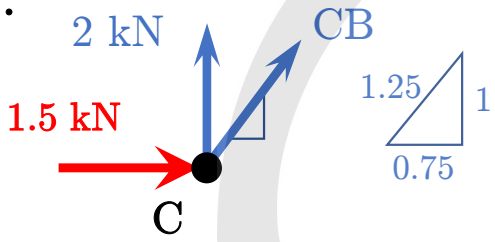


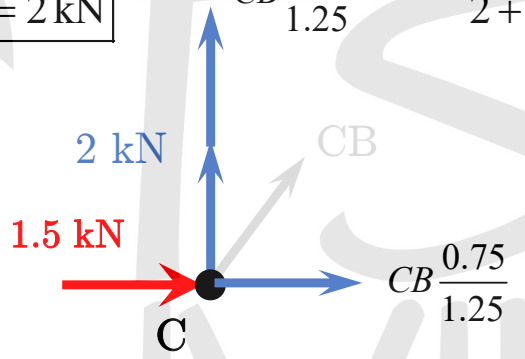
$$\sum F_x = 0 \qquad -1.5 + AB\frac{0.75}{0.85} = 0 \qquad \boxed{AB = 1.7\,\text{kN}}$$

$$\sum F_y = 0 \qquad 2.8 - AC - (1.7)\frac{0.40}{0.85} = 0 \qquad \boxed{AC = 2\,\text{kN}}$$

$$\sum F_y = 0 \qquad 2 + CB\frac{1}{1.25} = 0 \qquad \boxed{CB = -2.5\,\text{kN}}$$

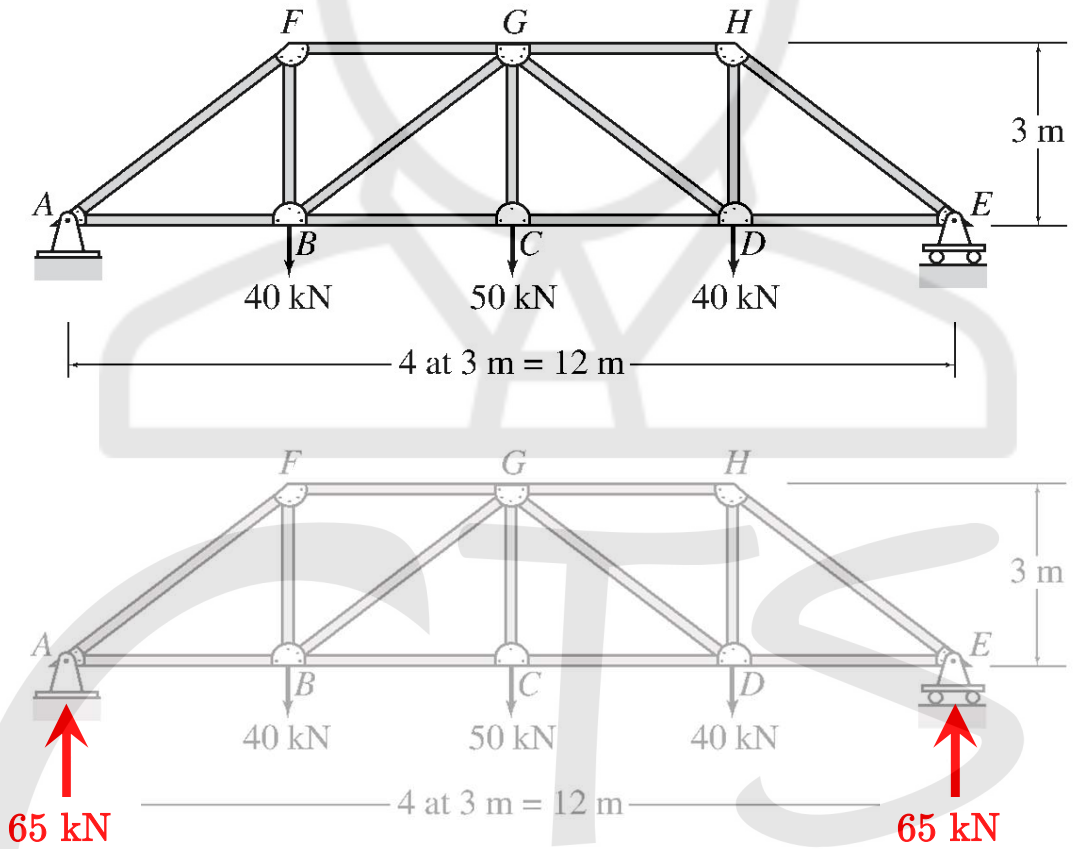
Joint C:

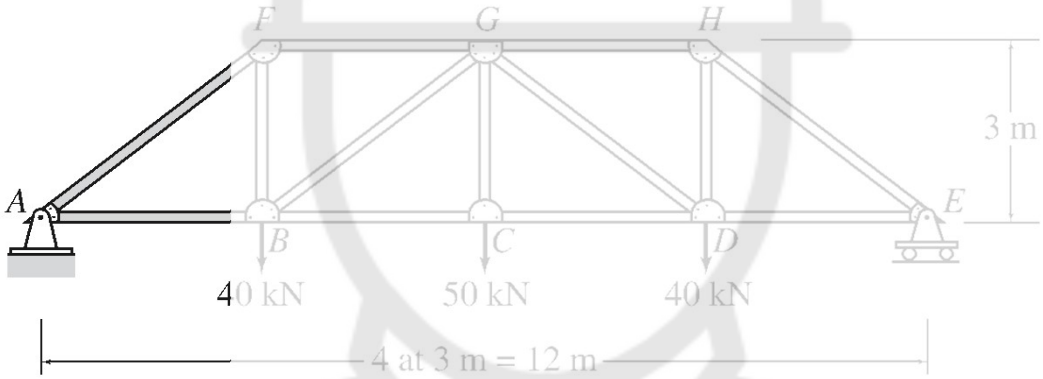




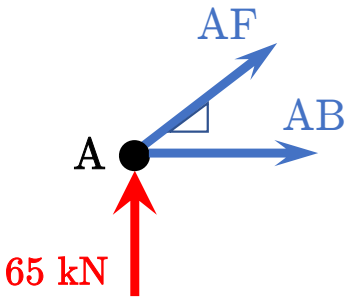
Member	Force (kN)	Type
AB	1.7	T
AC	2	T
CB	-2.5	C

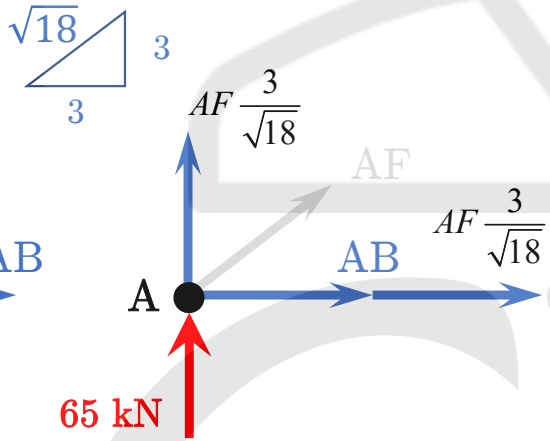
Example (2): Using the method of joints, determine the force in each member of the truss shown.





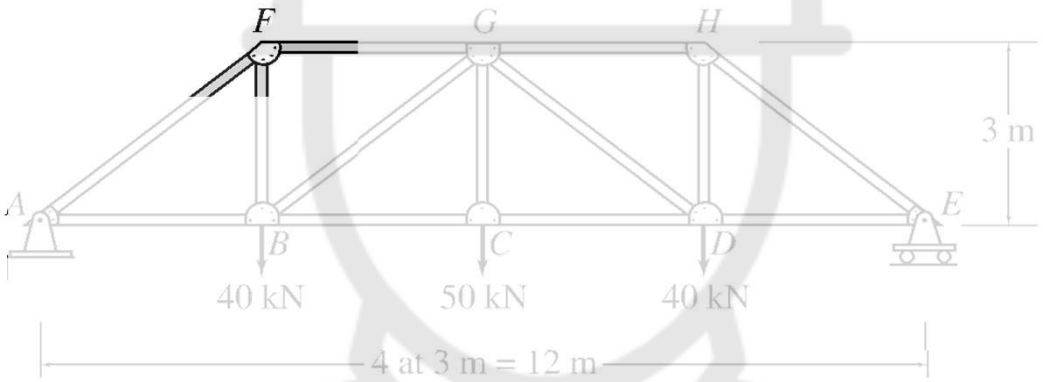
Joint A:



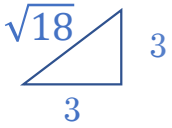


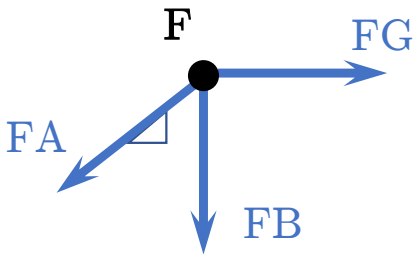
$$\sum F_y = 0 \qquad 65 + AF\frac{3}{\sqrt{18}} = 0 \qquad \boxed{AF = -65\sqrt{2}\ \text{kN}}$$

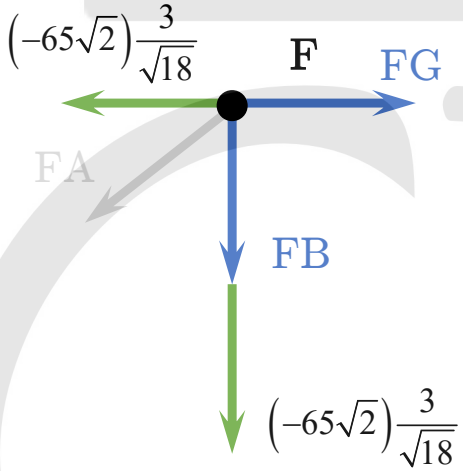
$$\sum F_x = 0 \qquad AB + \left(-65\sqrt{2}\right)\frac{3}{\sqrt{18}} = 0 \qquad \boxed{AB = 65\text{kN}}$$



Joint F:

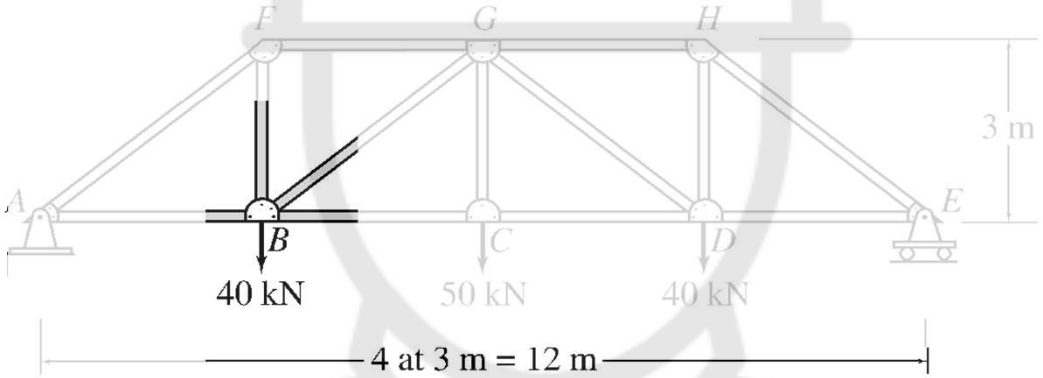




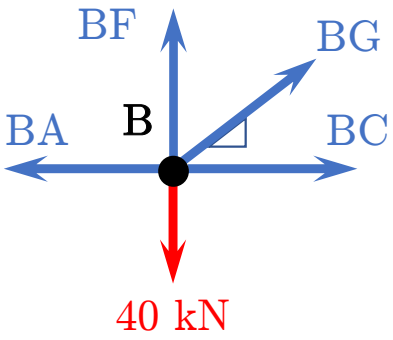


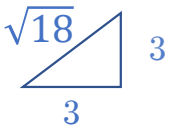
$$\sum F_x = 0 \qquad FG - \left[\left(-65\sqrt{2}\right)\frac{3}{\sqrt{18}}\right] = 0 \qquad \boxed{FG = -65\text{kN}}$$

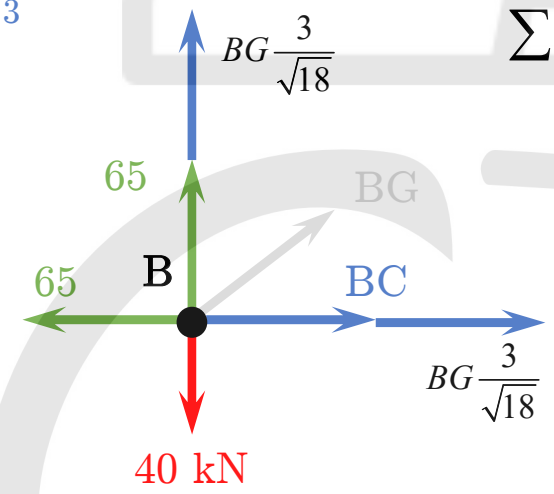
$$\sum F_y = 0 \qquad -FB - \left[\left(-65\sqrt{2}\right)\frac{3}{\sqrt{18}}\right] = 0 \qquad \boxed{FB = 65\text{kN}}$$



Joint B:





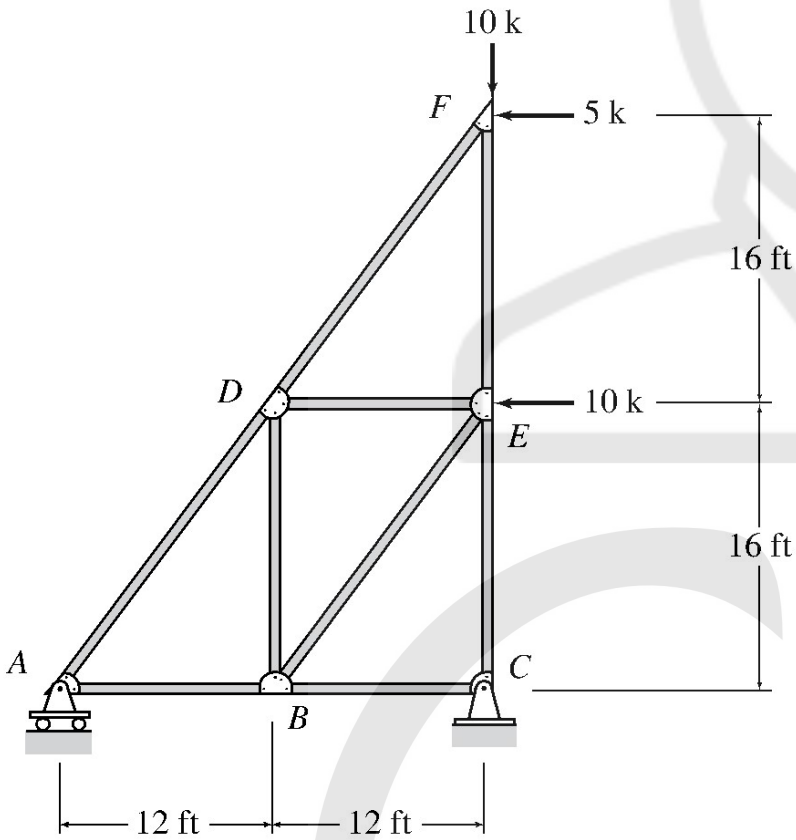


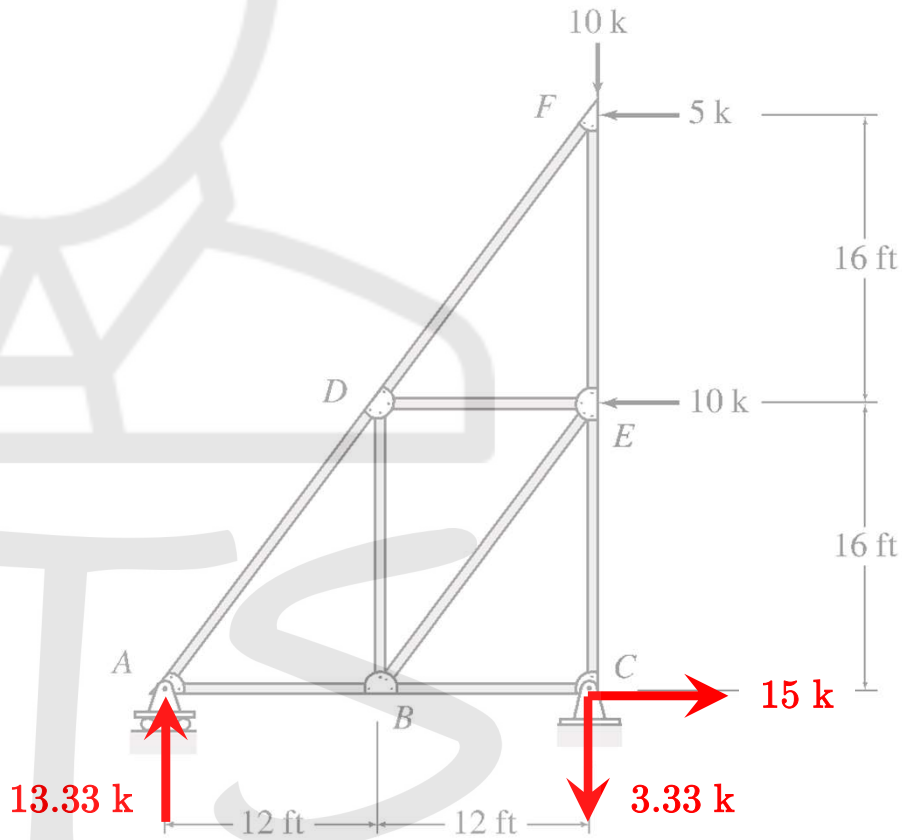
$$\sum F_y = 0 \qquad \left[BG\frac{3}{\sqrt{18}}\right] + 65 - 40 = 0 \qquad \boxed{BG = -25\sqrt{2}\,\text{kN}}$$

$$\sum F_x = 0 \qquad -65 + BC + \left[\left(-25\sqrt{2}\right)\frac{3}{\sqrt{18}}\right] = 0 \qquad \boxed{BC = -90\text{kN}}$$

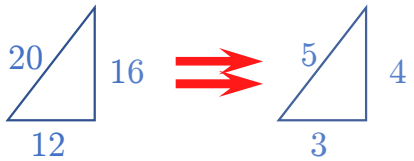
Member	Force (kN)	Type
AF	$-65\sqrt{2}$	C
AB	65	T
FG	-65	C
FB	65	T
BG	$-25\sqrt{2}$	C
BC	-90	C

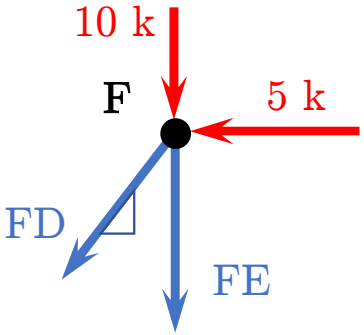
Example (3): Using the method of joints, determine the force in each member of the truss shown.

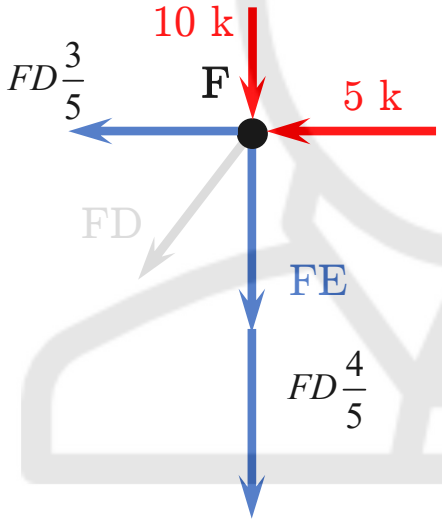


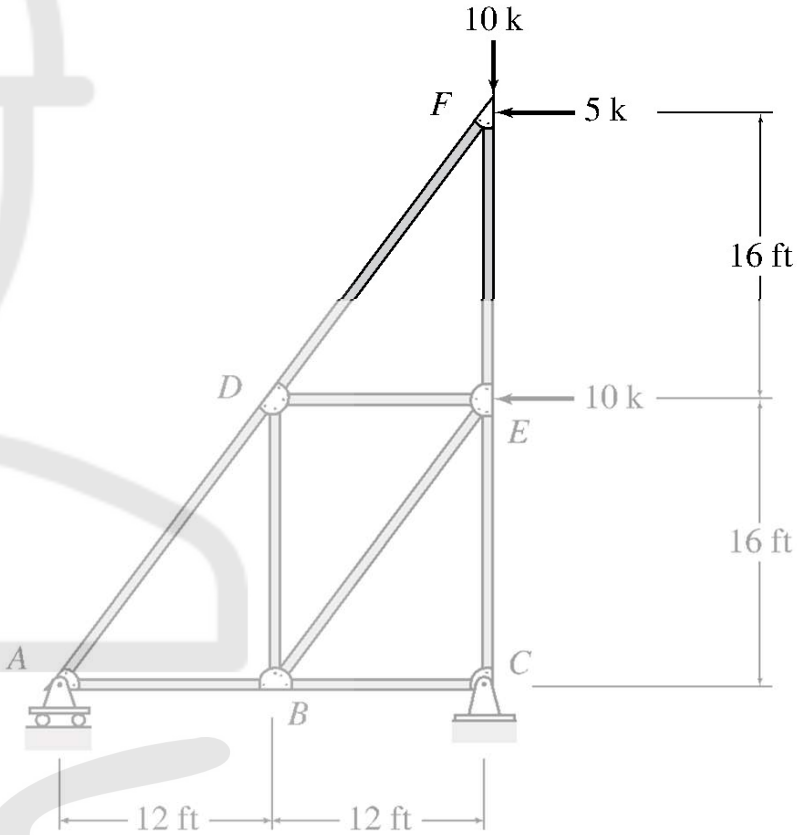


Joint F:





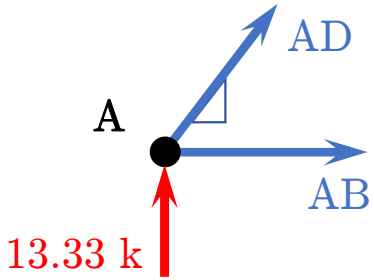


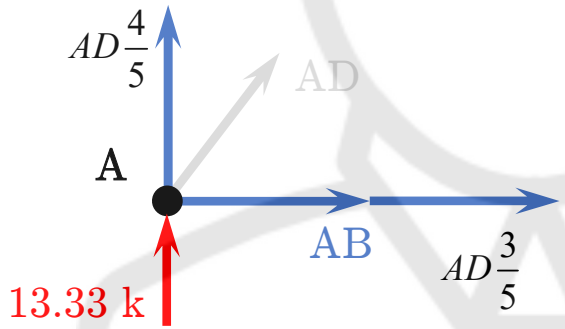


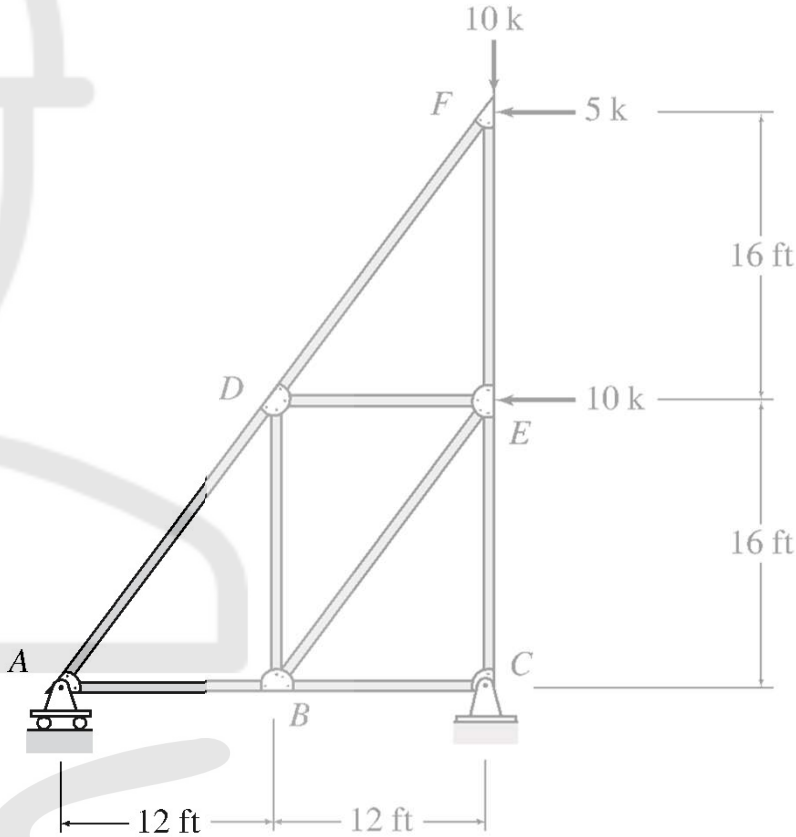
$$\sum F_x = 0 \qquad -5 - FD\frac{3}{5} = 0 \qquad \boxed{FD = -\frac{25}{3}\text{k}}$$

$$\sum F_y = 0 \qquad -10 - FE - \left[\left(-\frac{25}{3}\right)\frac{4}{5}\right] = 0 \qquad \boxed{FE = -\frac{10}{3}\text{kN}}$$

Joint A:



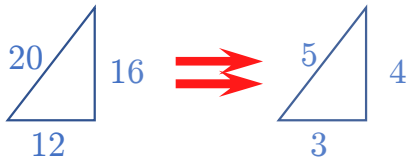


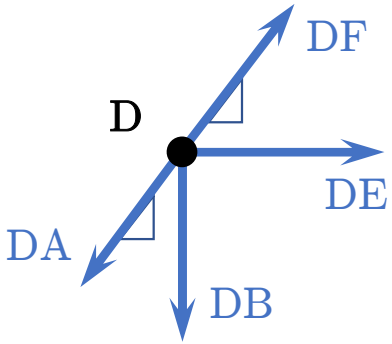


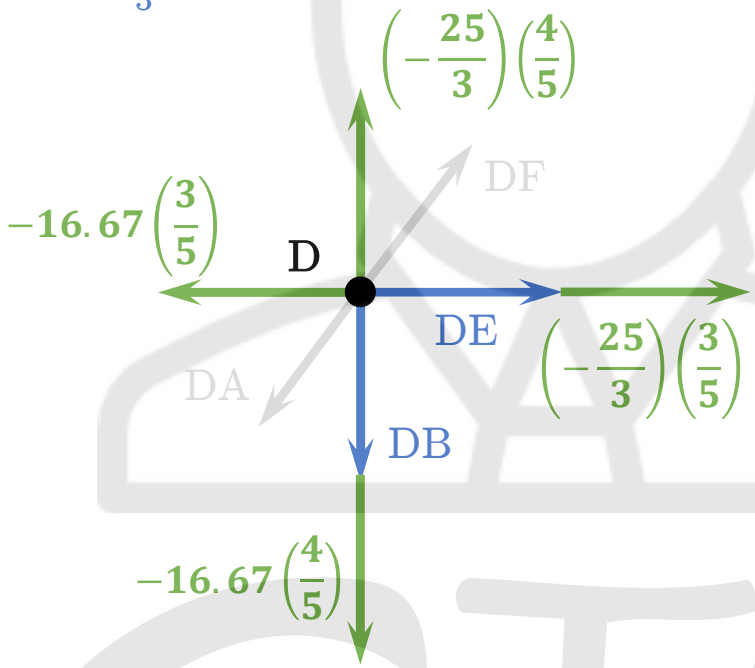
$$\sum F_y = 0 \qquad AD\frac{4}{5} + 13.33 = 0 \qquad \boxed{AD = -16.67\text{k}}$$

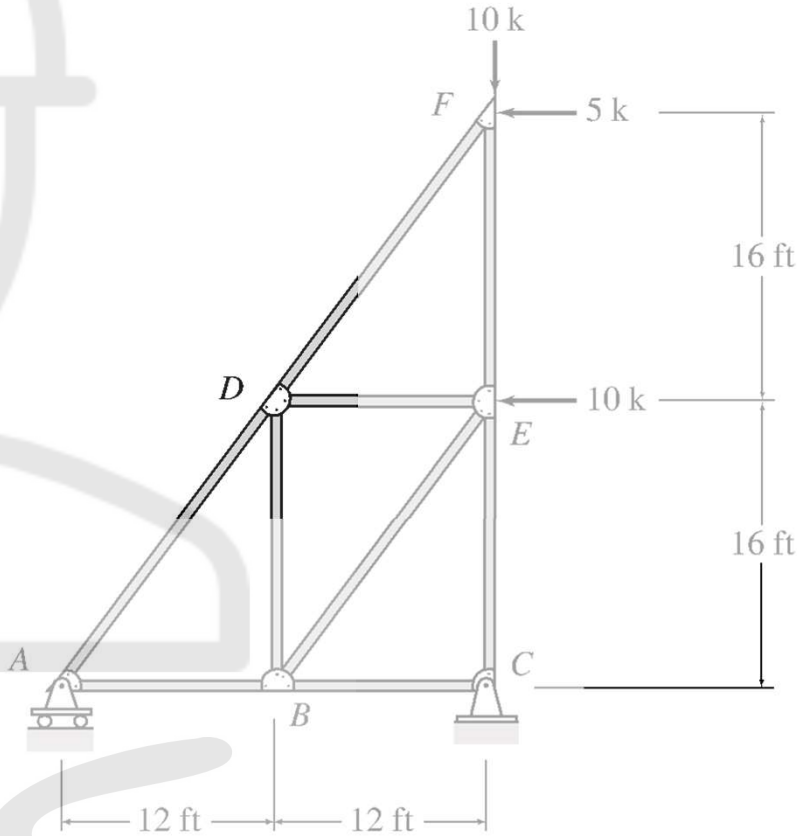
$$\sum F_x = 0 \qquad AB + \left[(-16.67)\frac{3}{5}\right] = 0 \qquad \boxed{AB = 10\text{k}}$$

Joint D:





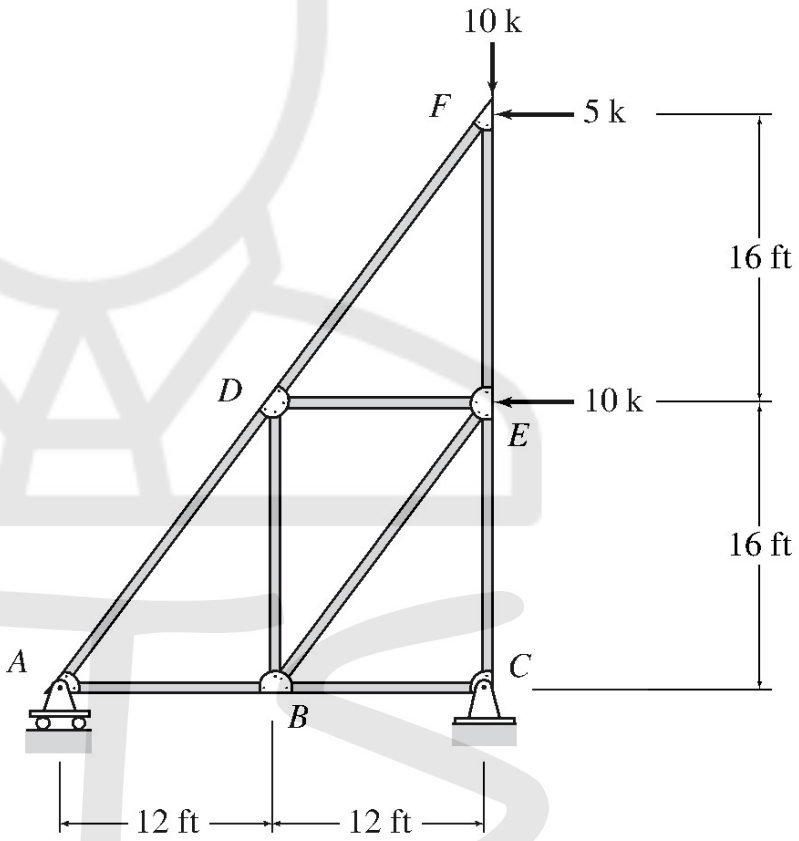




$$\sum F_x = 0 \qquad -\left[-16.67\left(\frac{3}{5}\right)\right] + DE + \left[\left(-\frac{25}{3}\right)\left(\frac{3}{5}\right)\right] = 0 \qquad \boxed{DE = 5\text{k}}$$

$$\sum F_y = 0 \qquad \left[\left(-\frac{25}{3}\right)\left(\frac{4}{5}\right)\right] - DB - \left[-16.67\left(\frac{4}{5}\right)\right] = 0 \qquad \boxed{DB = 6.67\text{k}}$$

Member	Force (kN)	Type
FD	$-\frac{25}{3}$	C
FE	$-\frac{10}{3}$	C
AB	10	T
AD	-16.67	C
DE	-5	C
DB	6.67	T



Questions?