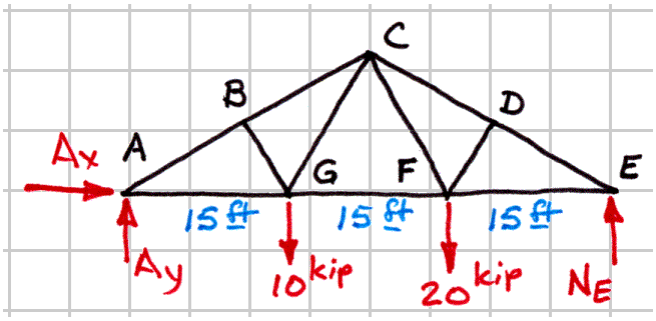
1-9* (10 %)

From an overall free-body diagram, the equations of equilibrium

$\rightarrow \Sigma F_x = 0:$ $\quad A_x = 0$

$\uparrow \Sigma F_y = 0:$ $\quad A_y - 10 - 20 + N_E = 0$

$\circlearrowleft \Sigma M_A = 0:$ $\quad 45N_E - 15(10) - 30(20) = 0$



are solved to get

$A_x = 0$ kip

$A_y = 13.3333$ kip $\uparrow$

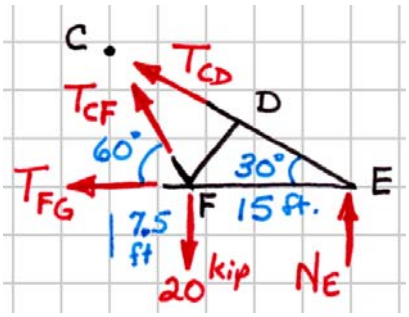
$N_E = 16.6667$ kip $\uparrow$

Then, from a free-body diagram of the right hand section of the truss, the equations of equilibrium

$\circlearrowleft \Sigma M_F = 0:$ $\quad 15N_E + 15(T_{DE} \sin 30°) = 0$

$\circlearrowleft \Sigma M_E = 0:$ $\quad 15(20) - 15(T_{CF} \sin 60°) = 0$

$\circlearrowleft \Sigma M_C = 0:$ $\quad 22.5N_E - 7.5(20) - (15 \cos 30°)T_{FG} = 0$



are solved to get

$T_{CD} = -33.3333$ kip $\cong 33.3$ kip (C) ..... **Ans.**

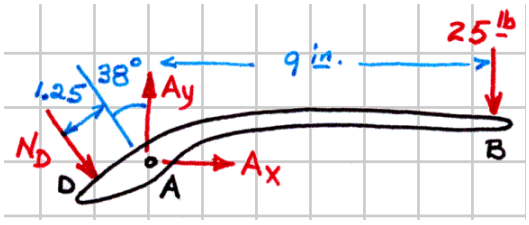
$T_{CF} = +23.094$ kip $\cong 23.1$ kip (T) ..... **Ans.**

$T_{FG} = +17.32$ kip $= 17.32$ kip (T) ..... **Ans.**

(T_{CD} 為**compressive force**要註明清楚，或以負號表示)

未標單位	扣1分/個
方向或正負號未標	扣1分/個
算式對答案錯	扣2分/個

1-17* (10 %)



$\circlearrowleft \Sigma M_A = 0:$ $\quad 1.25N_D - 9(25) = 0$

$N_D = 180.0$ lb ..... **Ans.**

$\rightarrow \Sigma F_x = 0:$ $\quad A_x + N_D \sin 38° = 0$

$\uparrow \Sigma F_y = 0:$ $\quad A_y - 25 - N_D \cos 38° = 0$

$A_x = -110.8$ lb $\qquad A_y = 166.8$ lb

A $= 200.3$ lb ◣ $56.4°$ ..... **Ans.**

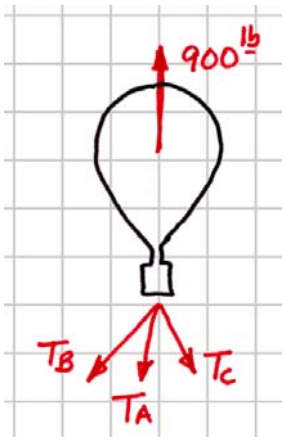
少算一個答案 扣5分/個

未標單位 扣1分/個

未標角度或方向 扣1分/個

1-25* (20%)

The components of the three tension forces are



$$\mathbf{T}_A = T_A \frac{20\mathbf{i} + 30\mathbf{j} - 50\mathbf{k}}{\sqrt{20^2 + 30^2 + 50^2}}$$
$$= 0.32444T_A\mathbf{i} + 0.48666T_A\mathbf{j} - 0.81111T_A\mathbf{k}$$

$$\mathbf{T}_B = T_B \frac{16\mathbf{i} - 25\mathbf{j} - 50\mathbf{k}}{\sqrt{16^2 + 25^2 + 50^2}}$$
$$= 0.27517T_B\mathbf{i} - 0.42995T_B\mathbf{j} - 0.85990T_B\mathbf{k}$$

$$\mathbf{T}_C = T_C \frac{-25\mathbf{i} - 15\mathbf{j} - 50\mathbf{k}}{\sqrt{25^2 + 15^2 + 50^2}}$$
$$= -0.43193T_C\mathbf{i} - 0.25916T_C\mathbf{j} - 0.86387T_C\mathbf{k}$$

Then the x-, y-, and z-components of the force equilibrium equation give

x: $0.32444T_A + 0.27517T_B - 0.43193T_C = 0$

y: $0.48666T_A - 0.42995T_B - 0.25916T_C = 0$

z: $-0.81111T_A - 0.85990T_B - 0.86387T_C + 900 = 0$

$T_A = 418.214 \text{ lb} \cong 418 \text{ lb}$ ..... **Ans.**

$T_B = 205.219 \text{ lb} \cong 205 \text{ lb}$ ..... **Ans.**

$T_C = 444.876 \text{ lb} \cong 445 \text{ lb}$ ..... **Ans.**

未標單位 扣1分/個

z方向等式寫錯(未寫900) 扣2分/個

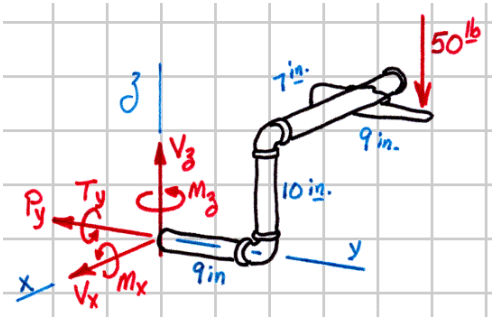
1-67 (20%)

From a free-body diagram of the pipe the moment equilibrium equation

$$\Sigma \mathbf{M}_{cut} = \mathbf{0}:$$

$$\left(M_x\mathbf{i} + T_y\mathbf{j} + M_z\mathbf{k}\right) + \left(-7\mathbf{i} + 18\mathbf{j} + 10\mathbf{k}\right) \times \left(-50\mathbf{k}\right) = \mathbf{0}$$

has x-, y-, and z-components



x:	$M_x - 900 = 0$	$M_x = 900$ lb·in. ..... **Ans.**
y:	$T_y - 350 = 0$	$T_y = 350$ lb·in. ..... **Ans.**
z:	$M_z = 0$	$M_z = 0$ lb·in. ..... **Ans.**

and the force equilibrium equation has components

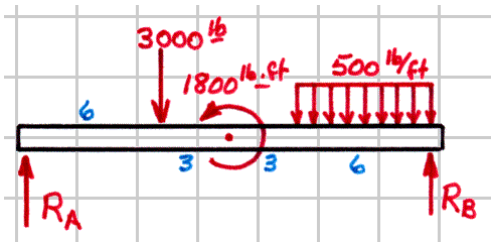
$\Sigma F_x = 0$:	$V_x = 0$	$V_x = 0$ lb ..... **Ans.**
$\Sigma F_y = 0$:	$P_y = 0$	$P_y = 0$ lb ..... **Ans.**
$\Sigma F_z = 0$:	$V_z - 50 = 0$	$V_z = 50$ lb ..... **Ans.**

未標單位 扣1分/個

少算一個答案 扣3分/個

1-77 (20%)

(a) From a free-body diagram of the entire beam, the equations of equilibrium give



$$\uparrow \Sigma F_y = 0: \qquad R_A + R_B - 3000 - 500(6) = 0$$

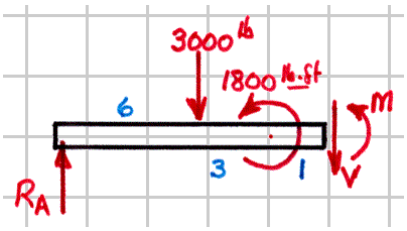
$$\circlearrowleft \Sigma M_B = 0:$$

$$[500(6)](3) + 3000(12) + 1800 - 18R_A = 0$$

$R_A = 2600$ lb ..... **Ans.**

$R_B = 3400$ lb ..... **Ans.**

(b) Next, from a free-body diagram of the left end of the beam, the equations of equilibrium give



$$\uparrow \Sigma F_y = 0: \qquad (2600) - 3000 - V = 0$$

$$\circlearrowleft \Sigma M_{cut} = 0: \qquad M + 1800 + 3000(4) - (2600)(10) = 0$$

$V = -400$ lb ..... **Ans.**

$M = 12,200$ lb·ft ..... **Ans.**

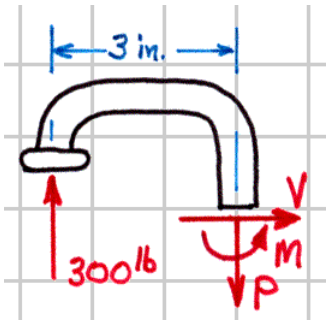
未標單位 扣1分/個

少算一個答案 扣5分/個

若圖上標示V為向上則答案V會為 +400 lb (答案需與所標示方向相符)

1-83 (20%)

From a free-body diagram of the upper half of the clamp, the equations of equilibrium give



$\rightarrow \Sigma F_x = 0: \qquad V = 0$

$\uparrow \Sigma F_y = 0: \qquad 300 - P = 0$

$\circlearrowleft \Sigma M_{cut} = 0: \qquad M - 3(300) = 0$

$P = 300$ lb (T) ..... **Ans.**

$V = 0$ lb ..... **Ans.**

$M = 900$ lb·ft ..... **Ans.**

未標單位 扣1分/個

少算一個答案 扣6分/個

(單位可能隨版本不同，但請在圖上標上之後答案的單位也要一致)

(V=0也要寫出來)