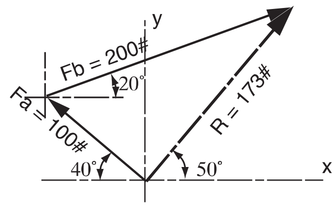
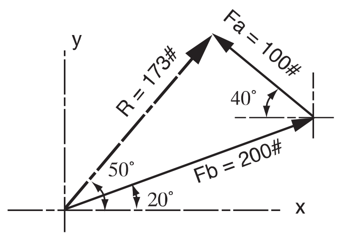
Chapter 2 Problem Solutions

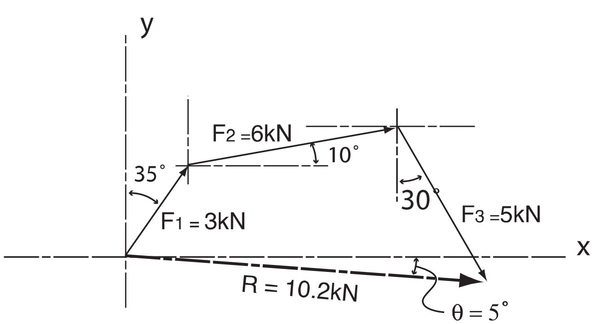
2.1



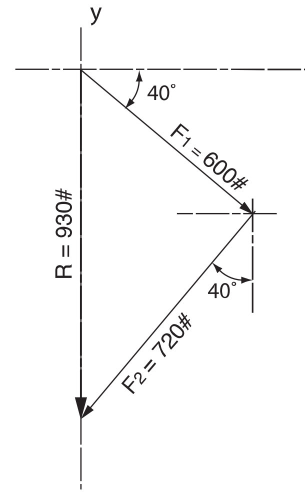
or



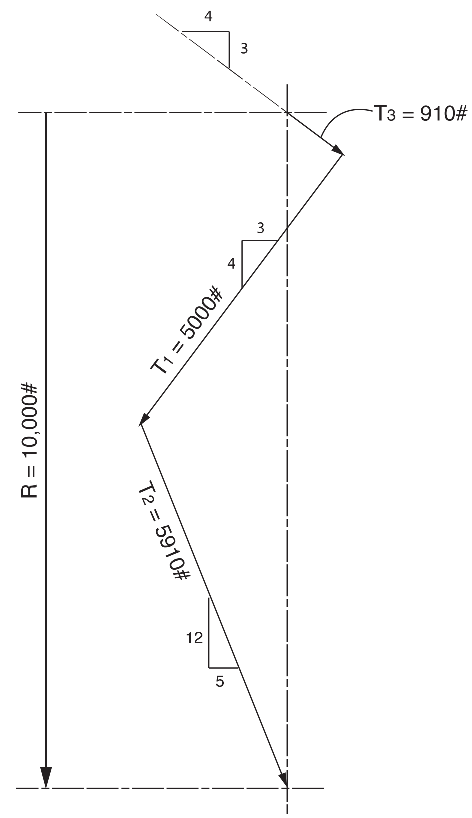
2.2



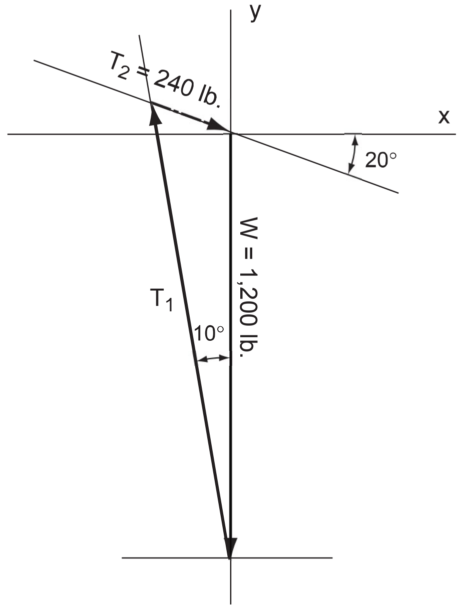
2.3



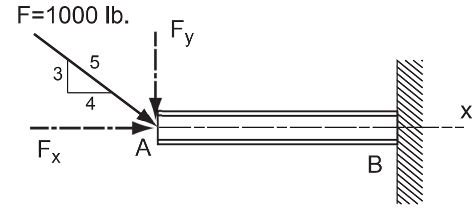
2.4

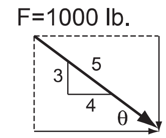


2.5



2.6





By similar triangles:

$$\frac{F_x}{4} = \frac{F_y}{3} = \frac{F}{5}$$

$$\therefore\ F_x = \tfrac{4}{5}F = \tfrac{4}{5}(1000\#) = 800\#$$

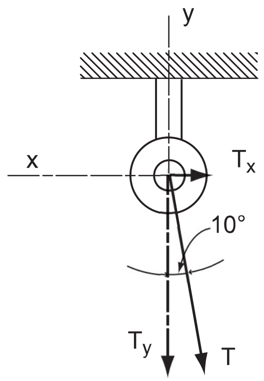
$$F_y = \tfrac{3}{5}F = \tfrac{3}{5}(1000\#) = 600\#$$

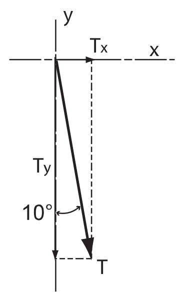
$$\sin\theta = \frac{3}{5} \quad \text{and} \quad \cos\theta = \frac{4}{5}$$

$$\therefore\ F_x = F\cos\theta = (1000\#)\left(\tfrac{4}{5}\right) = 800\#$$

$$F_y = F\sin\theta = (1000\#)\left(\tfrac{3}{5}\right) = 600\#$$

2.7



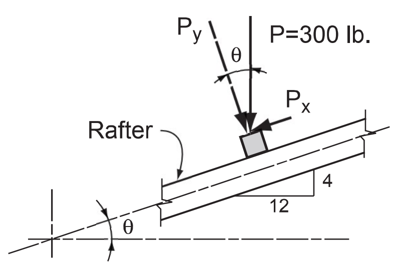


$T_x = T\sin 10°$

$T_y = T\cos 10°$

$\therefore\ T = \frac{T_y}{\cos 10°} = \frac{250N}{0.985} = 254N$

2.8



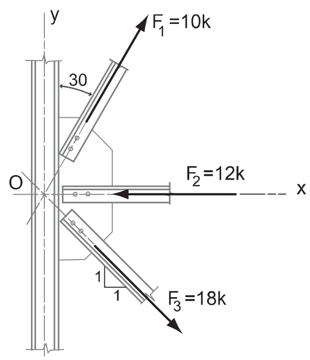
Purlin Detail

$\theta = \tan^{-1}\left(\frac{4}{12}\right) = 18.43°$

$P_x = P\left(\frac{4}{12.65}\right) = (300\#)(0.316) = 94.9\#$

$P_y = P\left(\frac{12}{12.65}\right) = (300\#)(0.949) = 285\#$

2.9



$F_{1y} = +F_1\cos 30° = 10k(0.866) = 8.66k$

$F_{1x} = +F_1\sin 30° = 10k(0.50) = 5k$

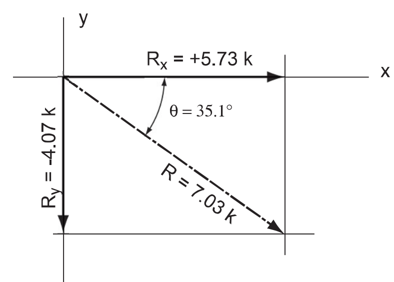
$F_2 = -F_{2x} = -12k$

$F_{3x} = +\frac{1}{\sqrt{2}}(F_3) = +\frac{18k}{\sqrt{2}}$

$F_{3y} = -\frac{1}{\sqrt{2}}(F_3) = -\frac{18k}{\sqrt{2}}$

$R_x = \Sigma F_x = +5k - 12k + \frac{18k}{\sqrt{2}} = +5.73k$

$R_y = \Sigma F_y = +8.66k - \frac{18k}{\sqrt{2}} = -4.07k$



Resultant

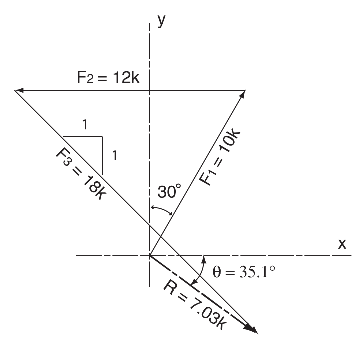
$\tan\theta = \frac{R_y}{R_x} = \frac{4.07}{5.73} = 0.710$

$\theta = \tan^{-1}(0.710) = 35.4°$ from horizontal

$\sin\theta = \frac{R_y}{R}$

$R = \frac{R_y}{\sin\theta} = \frac{R_y}{\sin 35.4°}$

$\therefore\ R = \frac{4.07k}{(0.579)} = 7.03k$



Graphical solution using the tip-to-tail method