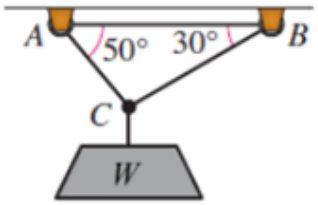


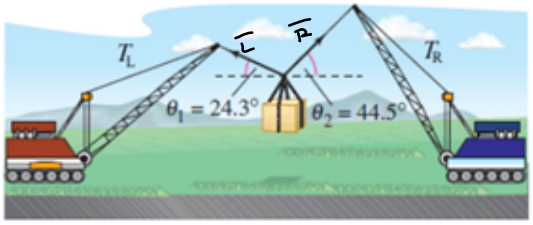
tension in $\overline{AC}$

tension in $\overline{BC}$

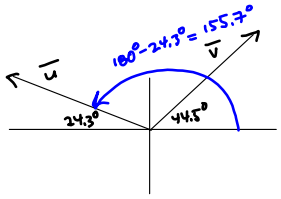
See page 2 for similar exercise.
Ask if you want to see this one.

The cranes shown in the figure are lifting an object that weighs 20,190 pounds. Find the tension in the cable of each crane. (Round your answers to the nearest whole number.)

1360 x 768



Forces Balanced
Left - right = 0
up - down = 20190
$\bar{L} + \bar{R} = \langle 0, 20190 \rangle$
$T_L = \|\bar{L}\|$
$T_R = \|\bar{R}\|$



$\bar{L} = T_L \langle \cos(155.7°), \sin(155.7°) \rangle$
$= T_L \langle a, b \rangle$

$\bar{R} = T_R \langle \cos(44.5°), \sin(44.5°) \rangle$
$= T_R \langle c, d \rangle$

$\bar{L} + \bar{R} = T_L \langle a, b \rangle + T_R \langle c, d \rangle = \langle 0, 20190 \rangle$
$= \langle aT_L, bT_L \rangle + \langle cT_R, dT_R \rangle = \langle aT_L + cT_R, bT_L + dT_R \rangle$
$= \langle 0, 20190 \rangle$

Let $x = T_L$, $y = T_R$

$\Rightarrow \langle ax + cy, bx + dy \rangle = \langle 0, 20190 \rangle$

$\Rightarrow \begin{matrix} ax + cy = 0 \\ bx + dy = 20190 \end{matrix} \Rightarrow \begin{bmatrix} a & c \\ b & d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 20190 \end{bmatrix}$

Augmented coefficient matrix

$\left[\begin{array}{cc|c} a & c & 0 \\ b & d & 20190 \end{array}\right] \xrightarrow{-\frac{b}{a}R1 + R2} \left[\begin{array}{cc|c} a & c & 0 \\ 0 & -\frac{bc}{a} + d & 20190 \end{array}\right]$

make zero

$(a)(-\frac{b}{a}) = -b$

$-\frac{b}{a}c + d$

$\Rightarrow -\frac{bc + ad}{a} y = 20190$

$\Rightarrow y = 20190 \left(\frac{a}{ad - bc}\right)$

$= 20190 \left(\frac{\cos(155.7°)}{(\cos(155.7°)\sin(44.5°) - \sin(155.7°)\cos(44.5°))}\right)$

```
180-24.3
              155.7
20190(cos(155.7)
/(cos(155.7)sin(
44.5)-sin(155.7)
cos(44.5))
     19736.95419
```

$\approx$ 19737 lbs $\approx y = T_R = \|\bar{R}\|$

Substitute Back in:

$\left[\begin{array}{cc|c} a & c & 0 \\ 0 & -\frac{bc}{a} + d & 20190 \end{array}\right]$ is saying $ax + cy = 0$, $\left(-\frac{bc}{a} + d\right)y = 20190$

$ax + cy = 0 \Rightarrow$

$ax = -cy$

$x = \frac{-cy}{a} = \frac{-\cos(44.5°)}{\cos(155.7)} y \approx$

```
/(cos(155.7)sin(
44.5)-sin(155.7)
cos(44.5))
     19736.95419
-cos(44.5)/cos(1
55.7)*Ans
     15445.84247
```

$\approx x \approx$ $T_L = \|\bar{L}\| \approx$ 15446 lbs

$\Rightarrow$ $ax+cy=0$
$bx+dy=20190$ $\longrightarrow$ $ax=-cy$ $\longrightarrow$ $x=-\frac{c}{a}y$

Substitution

$\Rightarrow b\left(-\frac{c}{a}y\right)+dy=20190$

$\left(-\frac{bc}{a}+d\right)y=20190$

$\frac{-bc+ad}{a}y=\frac{ad-bc}{a}y=20190$

$\Rightarrow y=\frac{20190a}{ad-bc}$, etc. for y. calculator

Then $x=-\frac{c}{a}y$ for x (calculator).