Example 7. A 100-lb weight hangs as shown. Find tensions in the two cables.

Solution. Draw the 3 forces on the weight in standard position. Since weight is not moving, the forces sum to zero (Newton's 2nd law):

\[ T_1 + T_2 + \langle 0, -100 \rangle = \langle 0, 0 \rangle \]

Rewrite the equation using (x,y)-coordinates for \( T_1 \) and \( T_2 \):

\[ (||T_1|| \cos(32^\circ), ||T_1|| \sin(32^\circ)) + (||T_2|| \cos(130^\circ), ||T_2|| \sin(130^\circ)) + \langle 0, -100 \rangle = \langle 0, 0 \rangle \]

The unknown tensions are the vector lengths \( ||T_1|| \) and \( ||T_2|| \), and setting x-coordinates and y-coordinates equal gives two equations:

\[ \begin{align*}
||T_1|| \cos(32^\circ) + ||T_2|| \cos(130^\circ) + 0 &= 0 \\
||T_1|| \sin(32^\circ) + ||T_2|| \sin(130^\circ) - 100 &= 0
\end{align*} \]

OR

\[ \begin{align*}
||T_1|| \cos(32^\circ) - ||T_2|| \cos(50^\circ) &= 0 \\
||T_1|| \sin(32^\circ) + ||T_2|| \sin(50^\circ) &= 100
\end{align*} \]

These equations match the ones at the top of P798, and I would complete the solution in exactly the way it is completed there.