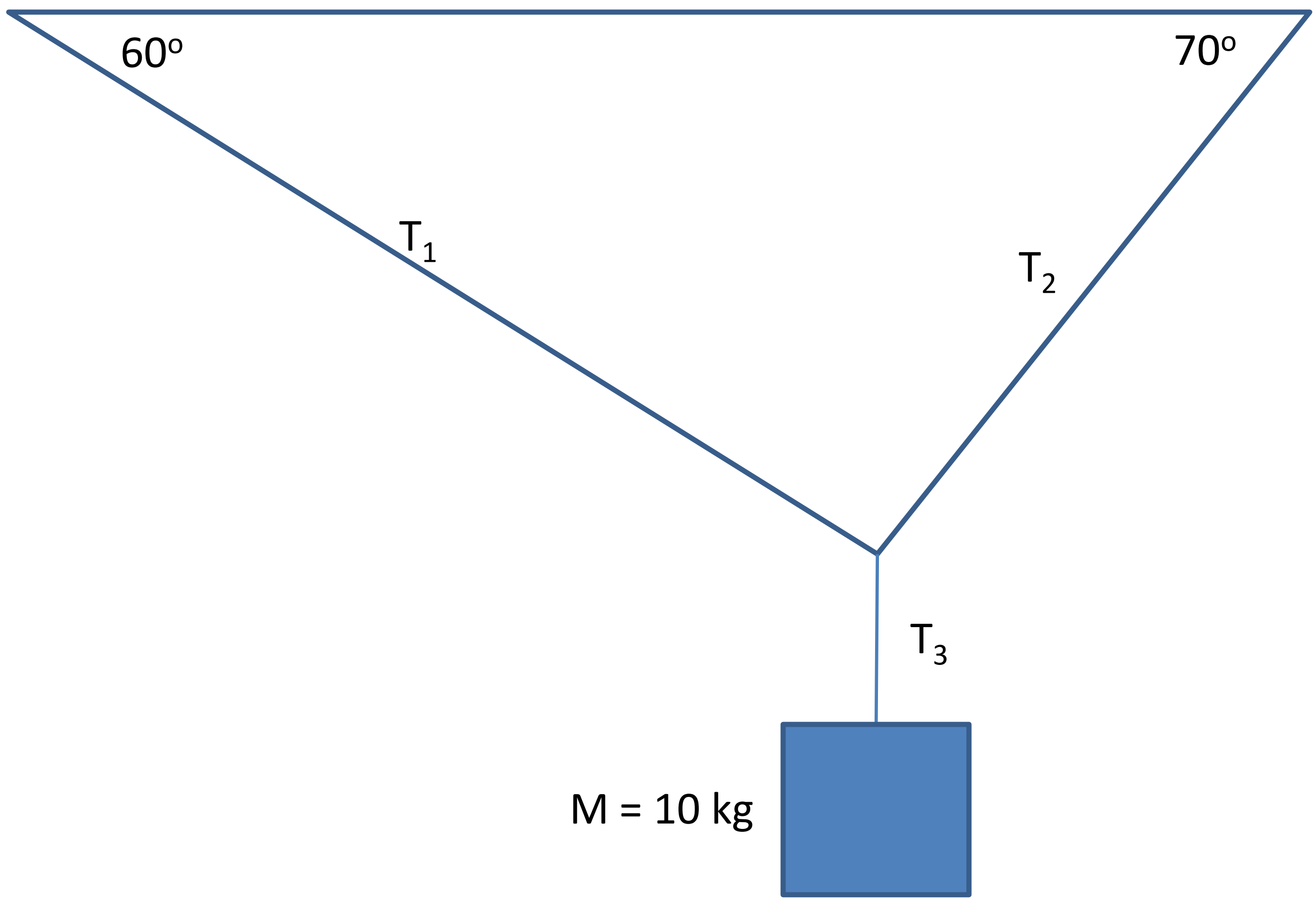
How to Solve Static Tension Problems

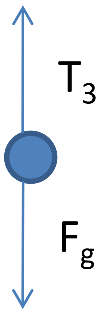
Without Knowing the Tensions!

Find the Tension in the Strings



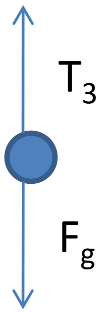
First look at the Object and T_3

- Free Body Diagram of the Box



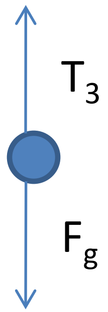
First look at the Object and T_3

- Set up the Fnet Equation



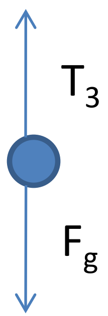
First look at the Object and T_3

- $Fnet=T_3-F_g$



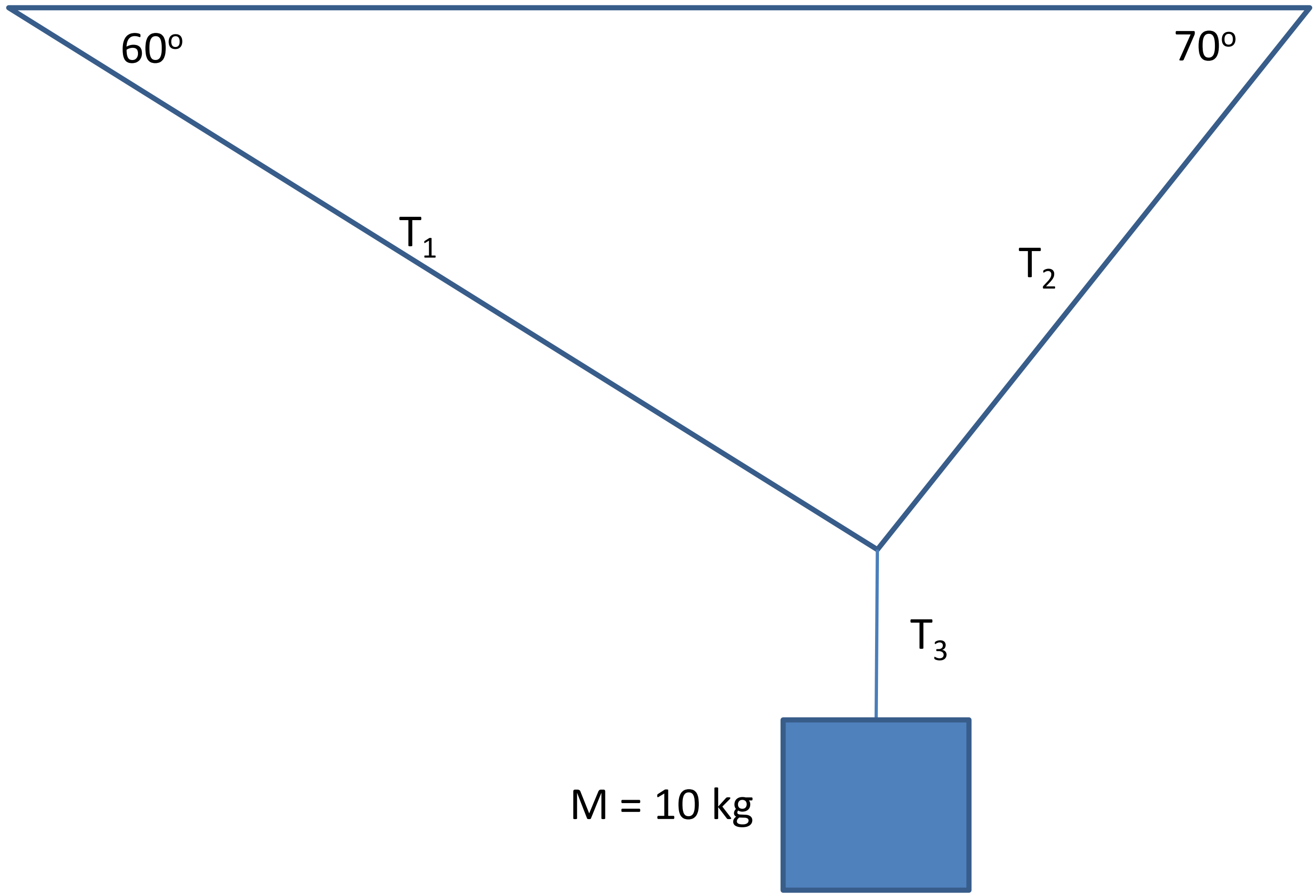
First look at the Object and T_3

- $Fnet = T_3 - F_g$
- Since the Box is not moving $a_{net} = 0$
- Therefore $Fnet = 0$

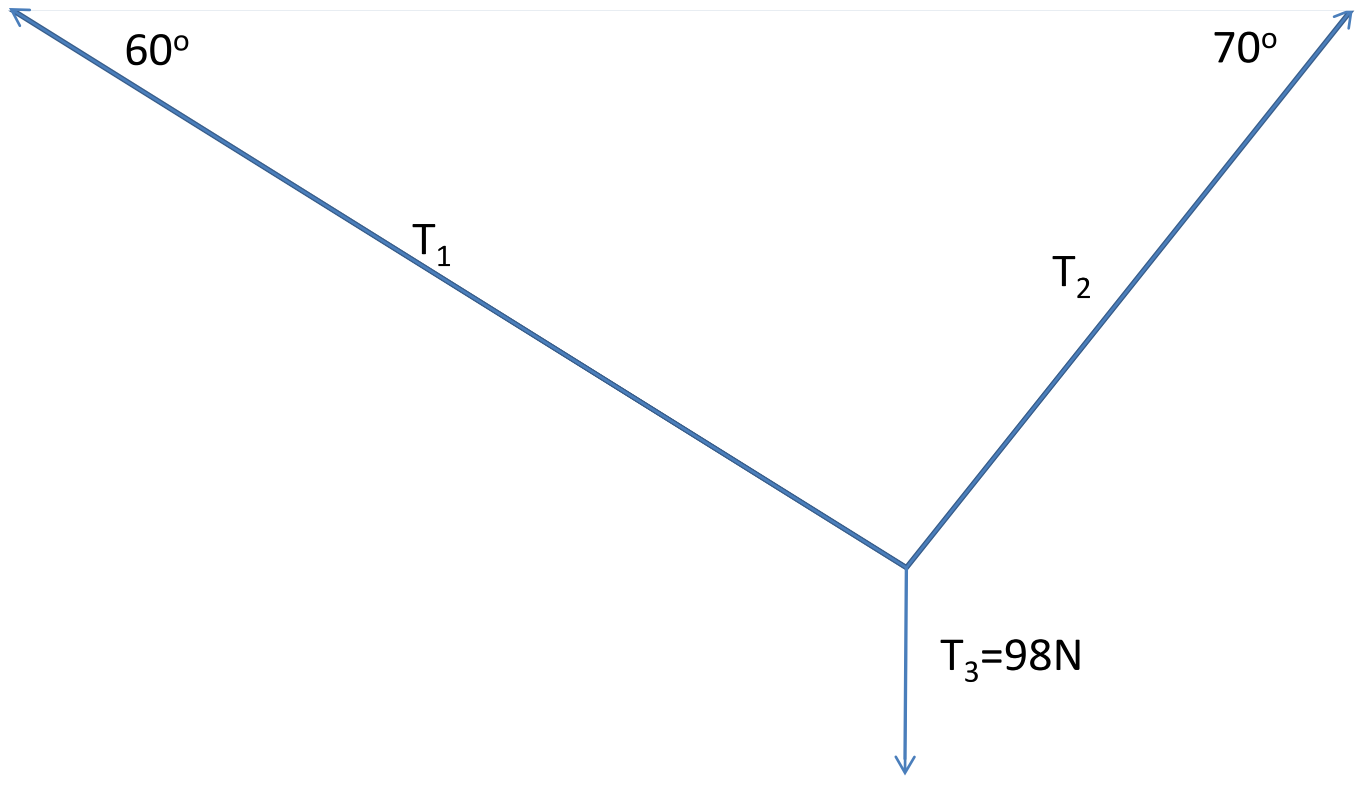


- $0 = T_3 - F_g$
- $T_3 = F_g$
- $T_3 = m(9.8m/s/s)$
- $T_3 = 10kg(9.8m/s/s)$
- $T_3 = 98N$

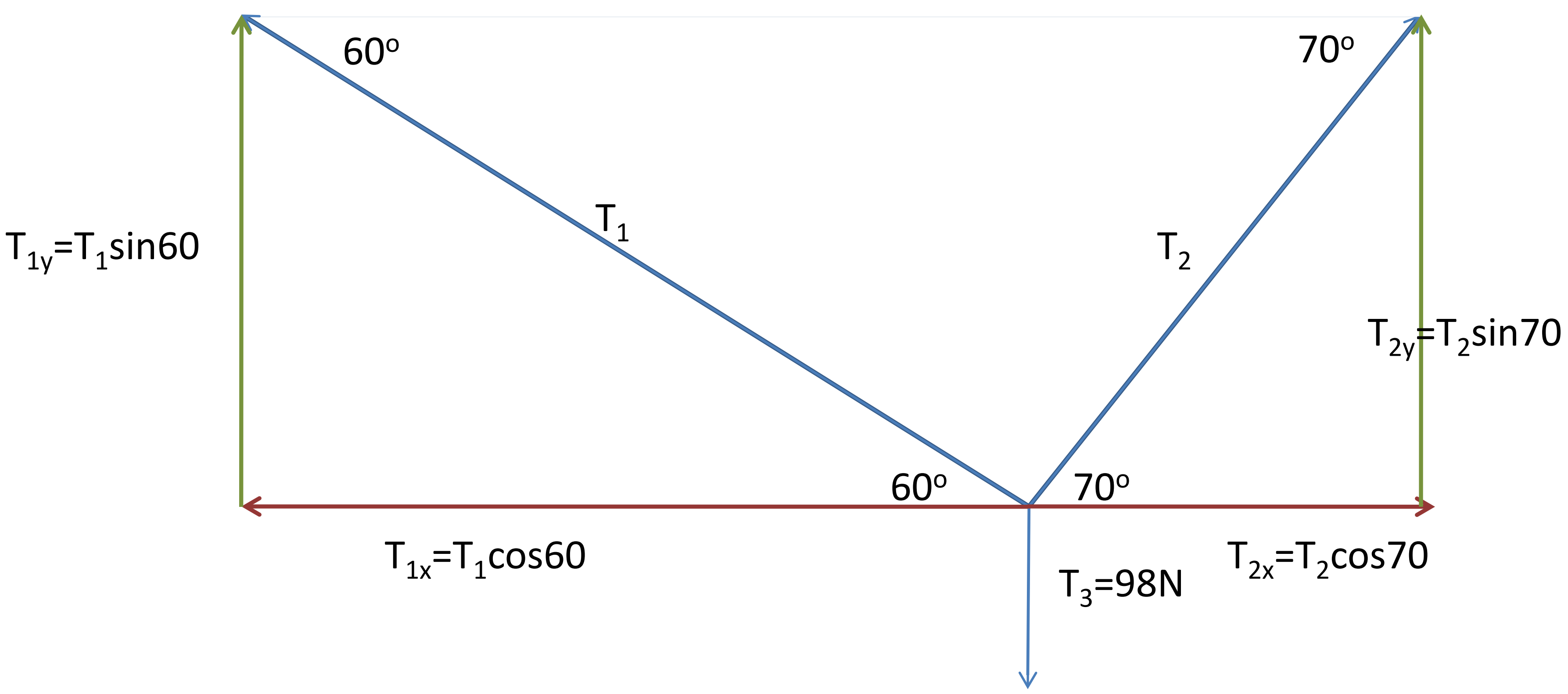
Back to the original problem: Find the Tension in the Strings



Draw a Free Body Diagram



Find the x and y components of each

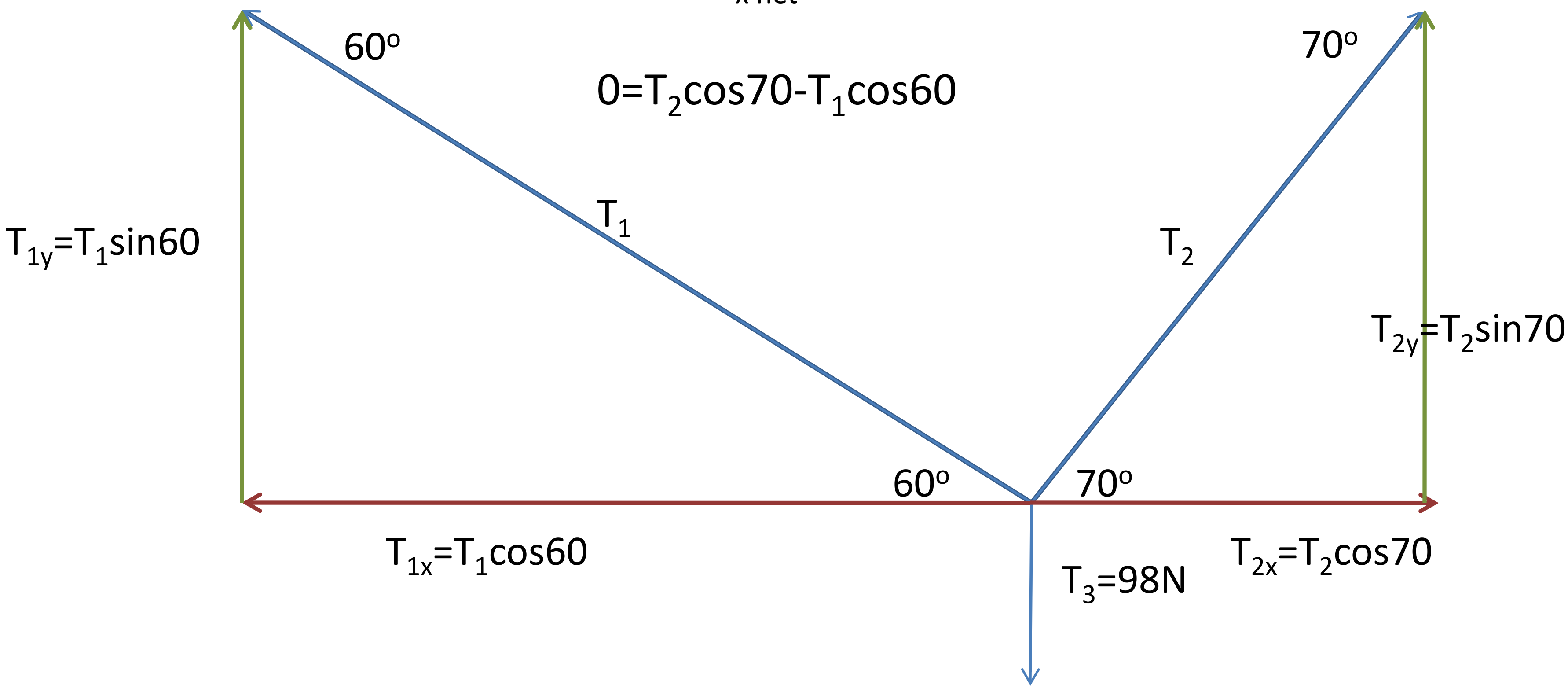


Set up the Fnet in x

$F_{x\ net}=T_2\cos70-T_1\cos60$

Again $F_{x\ net}$ will be 0 since nothing is moving

$0=T_2\cos70-T_1\cos60$

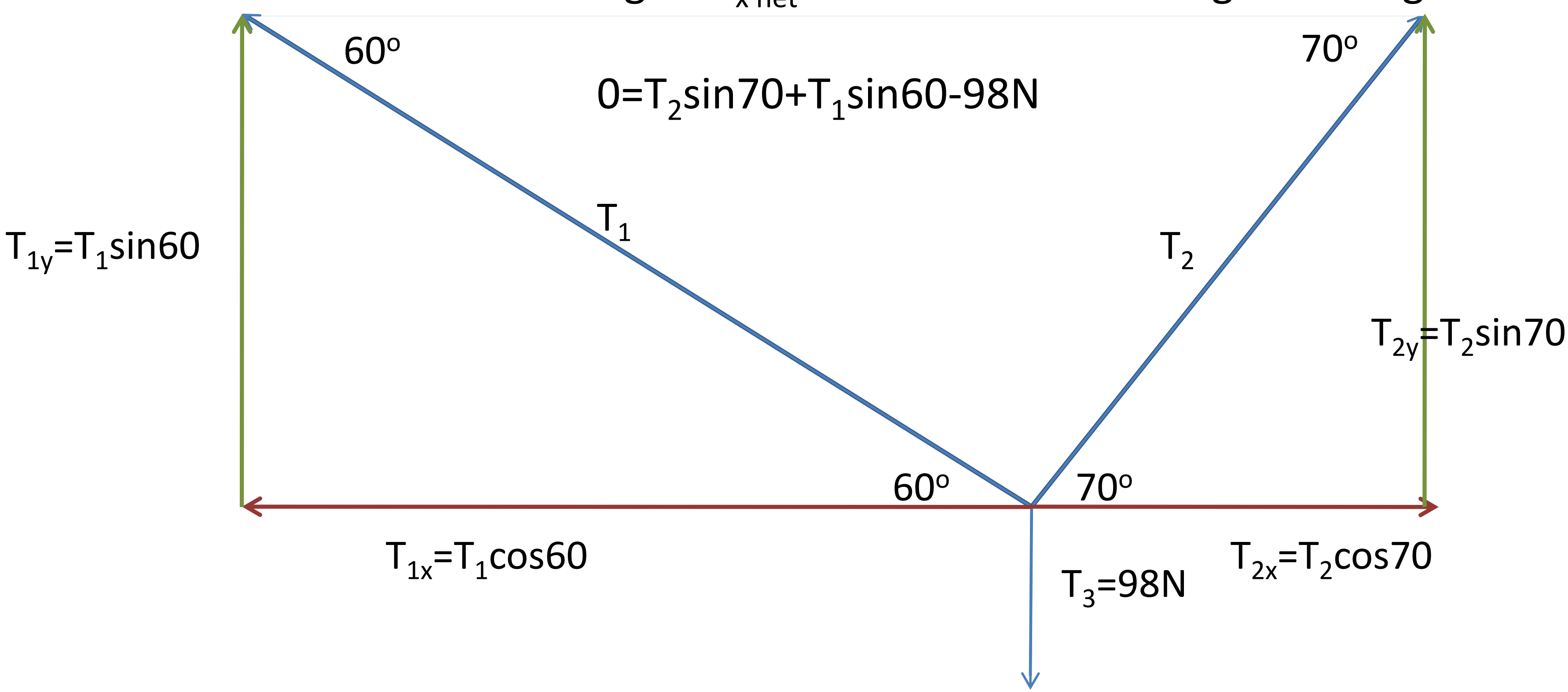


Set up the Fnet in y

$F_{y\ net}=T_2\sin70+T_1\sin60-T_3$

Again $F_{x\ net}$ will be 0 since nothing is moving

$0=T_2\sin70+T_1\sin60-98N$



Math Fun

- Now you have two equations and two unknowns.
- $0=T_2\cos70-T_1\cos60$
- $0=T_2\sin70+T_1\sin60-98N$

Math Fun Continued

- Solve for T_1 in terms of T_2 in one equation
- $0=T_2\cos70-T_1\cos60$
- $T_2\cos70=T_1\cos60$
- $T_2\cos70/\cos60=T_1$

- Now you will plug that into the other equation

Math Fun

- $0 = T_2 \sin 70 + T_1 \sin 60 - 98N$
- $T_2 \cos 70 / \cos 60 = T_1$

- Put together this means:
- $0 = T_2 \sin 70 + [T_2 \cos 70 / \cos 60] \sin 60 - 98N$

- Now solve for T_2

Math Fun

- $0=T_2\sin70+[T_2\cos70/\cos60]\sin60-98N$
- $0=T_2(.939)+[T_2(.684)]\sin60-98N$
- $0=T_2(.939)+[T_2(.593)]-98N$
- $98N = T_2(.939 + .593)$
- $98N = T_2(1.532)$
- $98N/1.532 = T_2$
- $63.96N = T_2$

Math Fun

- To solve for T_1 go back to the other equation

- $T_2\cos70/\cos60=T_1$

- $T_2\cos70/\cos60=T_1$

- $T_2(.684)=T_1$

- We just found that $63.96N = T_2$

Therefore:

- $63.96N(.684)= T_1$

- $43.75N = T_1$

AND DONE!

- On Wednesday we looked at a problem where you knew the tension of one of the strings to see the set up. This problem shows that you do not need that information in order to solve. Simply set up a system of equations and go from there!