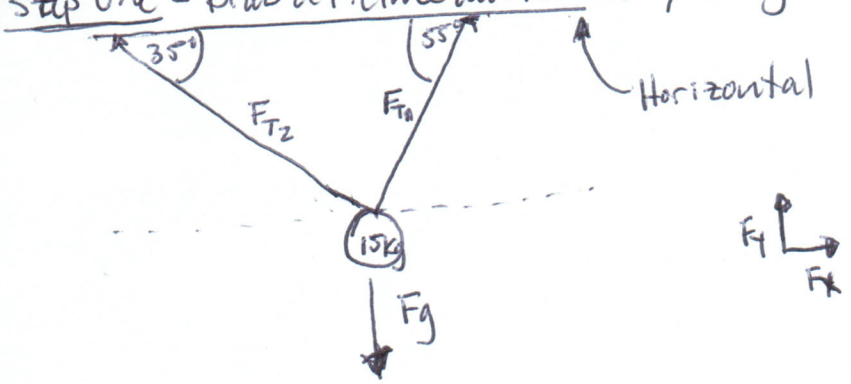
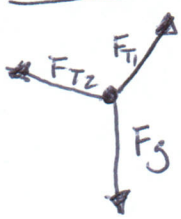
9/16/19 – Hanging Weight Review, Step by Step

Step One – Draw a Picture and Free Body Diagram

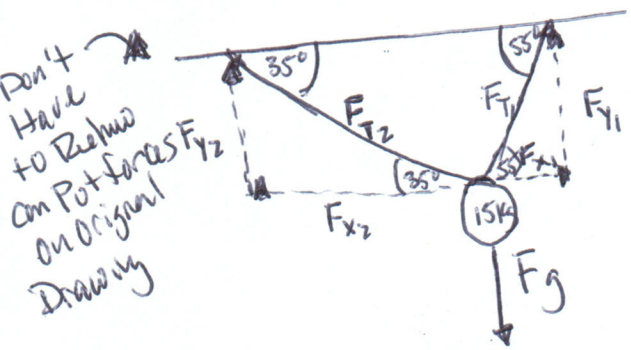


Free Body Diagram



Step 2 – Draw in x and y forces, Redraw force diagram with x and y Forces

Don't Have to Redraw can Put forces F_{y_2} on Original Drawing



Free Body Diagram

Step Three – Write Expressions for net Force and sum of Forces in the x and y direction

$F_{net} = 0$ ← why? because the object (the weight) is not accelerating (its not moving!) $a_{net} = 0$, $F_{net} = m\,a_{net} = m \cdot 0 = 0$

Because $F_{net} = 0$, $\sum F_x = 0$ and $\sum F_y = 0$ ← $\sum$ means "sum of", these are the net forces in the x and y direction

$$\sum F_x = F_{x_1} + F_{x_2} = 0$$
$$\sum F_y = F_{y_1} + F_{y_2} + F_g = 0$$

} Just add up the forces you put in your Free Body Diagram

Step 4 – Find F_x forces in terms of F_{T_1} and F_{T_2}

Need This here! What is the relationship between F_{x_1} and F_{T_1}?

$\cos\theta = \frac{adj}{hyp} = \frac{F_{x_1}}{F_{T_1}}$ → $\cos(55°) = \frac{F_{x_1}}{F_{T_1}}$ ← multiply Both sides by F_{T_1}

$\sum F_x = F_{T_1}\cos(55) - F_{T_2}\cos(35) = 0$ $F_{x_1} = F_{T_1}\cos(55)$

Can use the same development to get F_{x_2}

$F_{x_2} = F_{T_2}\cos(35)$ ← remember different Angles! negative because of direction

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Step 5 - Find F_y in terms of F_{T_2}

The relationship between F_{y_1} and F_{T_1} is $\sin\theta = \frac{opp}{hyp}$

$\sin(55) = F_{y_1} / F_{T_1}$ ← multiply both sides F_{T_1}

$$F_{T_1}\sin(55) = F_{y_1}$$

same thing for F_{y_2}, except diffnt angle!

$$F_{T_2}\sin(35) = F_{y_2}$$

$$\sum F_y = F_{y_1} + F_{y_2} + F_g = 0$$

$$F_g = -9.8\ m/s^2 \cdot 15\ kg = -147\ N$$

$$\sum F_y = F_{y_1} + F_{y_2} - 147N = 0$$

Step 6 - Solve for F_{T_1} in terms of F_{T_2} using Fx equation

$$\sum F_x = F_{T_1}\cos(55) - F_{T_2}\cos(35) = 0$$

$$+ F_{T_2}\cos(35) \quad + F_{T_2}\cos(35)$$

$$\frac{F_{T_1}\cos(55)}{\cos(55)} = \frac{F_{T_2}\cos(35)}{\cos(55)}$$

$$F_{T_1} = F_{T_2}\frac{\cos(35)}{\cos(55)} = F_{T_2}\frac{0.8}{0.6} = 1.3\,F_{T_2}$$

Step 7 - substitute one Tension Force for the other then solve

$$\sum F_y = F_{T_1}\sin(55) + F_{T_2}\sin(35) - 147 = 0$$

$$1.3\,F_{T_2}\sin(55) + F_{T_2}\sin(35) - 147 = 0$$

$$1.1\,FT_2 + F_{T_2}\cdot 0.6 - 147 = 0$$

$$1.7\,F_{T_2} - 147 = 0$$

$$F_{T_2} = \frac{147}{1.7}$$

$$F_{T_2} = 86.5\ N$$

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Step 8 - Use the Tension Force you calculated to calculate the other Force

$$F_{T_2} = 86.5\,N$$

$$F_{T_1} = 1.3\,F_{T_2} = 1.3 \cdot 86.5 = 112.5\,N$$