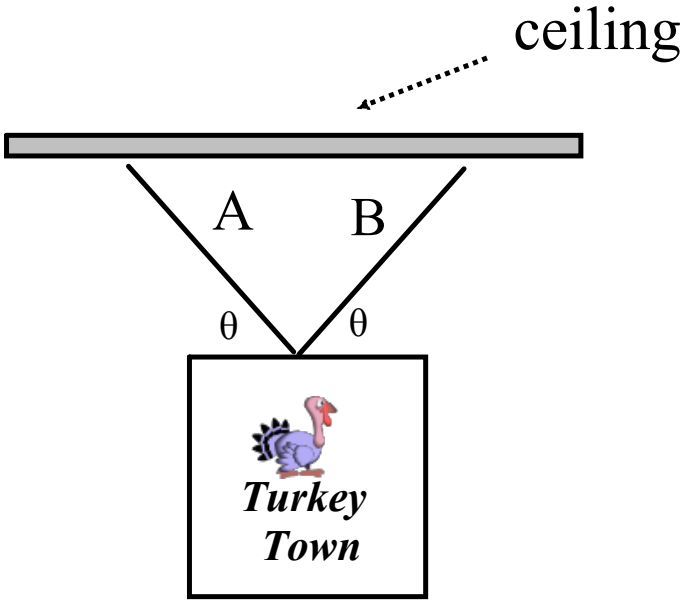
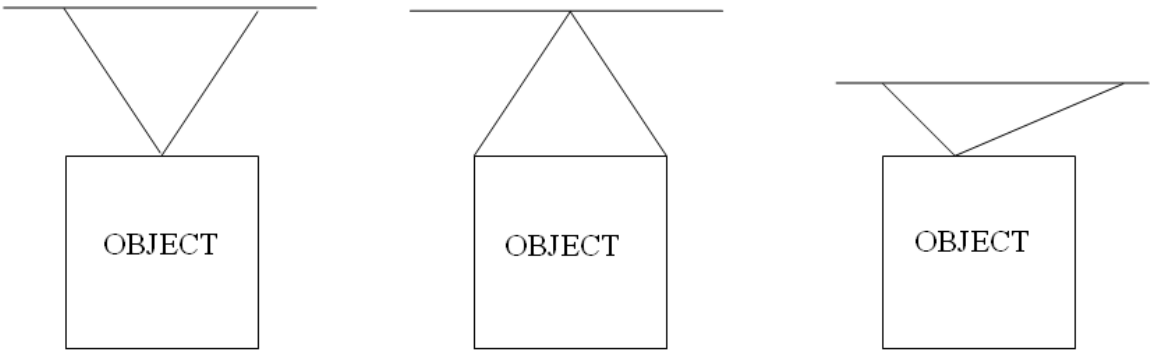
Type II - Signs/Pictures/Hanging Objects

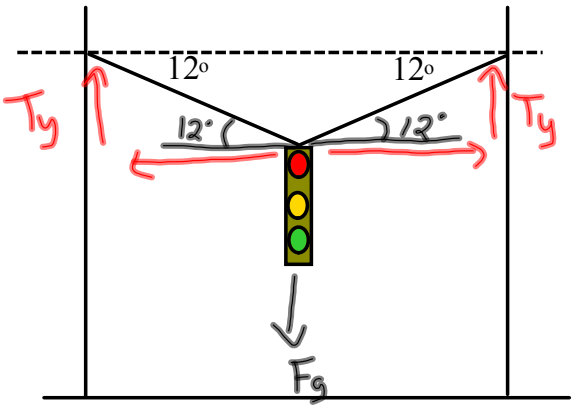
If an object is hung by a rope (wire, chain, etc.), we can resolve the force of tension along the rope.



An object can be hung in a variety of ways.



Example



A traffic light hangs in the center of the road from cables as shown in the figure. (a) If the mass of the traffic light is 65 kg, what is the magnitude of the force that each cable exerts on the light to prevent it from falling? (b) What is the tension in each cable?

(a) The y-component of the tension in each cable must add together to support the light's weight; the light is in static equilibrium. Since the angles are the same the tension in each cable and their components are the same.

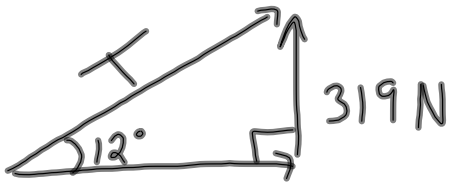
$$F_{net_y} = T_y + T_y + F_g$$

$$0 = 2T_y - (65)(9.81)$$

$$637.65 = 2T_y$$

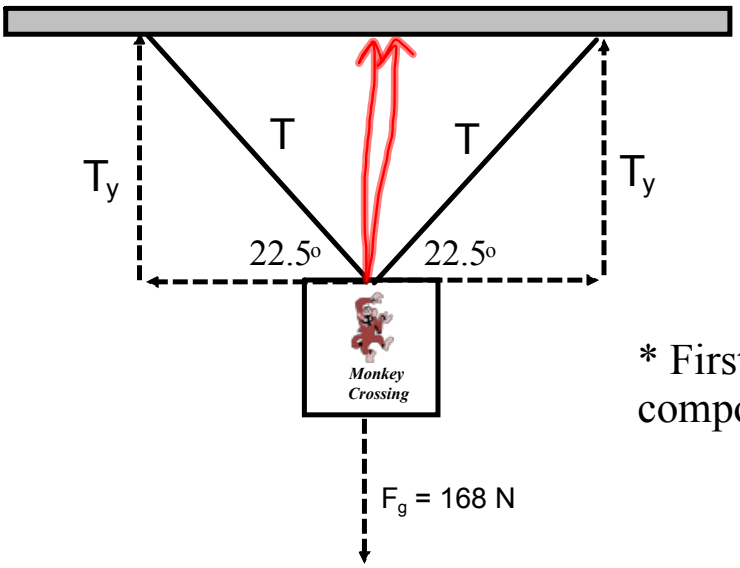
$$\boxed{319\ N = T_y}$$

(b) Use trig to solve for the tension in each cable.



$$\sin 12 = \frac{319}{T}$$

$$T = \frac{319}{\sin 12} = \boxed{1533\ N}$$



A sign that weighs 168 N is supported by two ropes, A and B, that make 22.5° angles with the horizontal. Determine the tension along the ropes.

* First label the diagram to view the components of each rope's tension.

Determine y-component of tension:

Fnety = 0 N

Fnety = 2Ty + Fg

0 N = 2Ty - 168 N

Ty = 84 N

Determine tension in each rope (remember they are the same if the angles are the same):

$T = (Ty)/(\sin\theta^\circ)$

$T = 84\ N/\sin 22.5$

T = 220 N