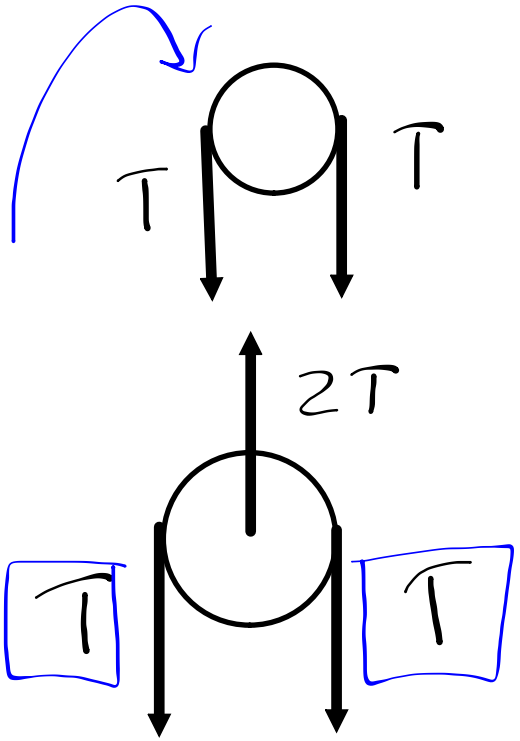
# Statics with Pulleys

Assumption:

- Pulleys are massless and frictionless

Two things to know:

- The tension in a string or rope is ALWAYS the same and acts as a pulling force in both directions (this means that the tension along one side of a pulley is always the same as the tension along the other side)




- The rules of statics apply (this means that the total of the upwards forces will always equal the total of the downwards forces on any pulley)

$$\Sigma F_y = 0$$

$$T + T + ? = 0$$

$$2T + ? = 0$$

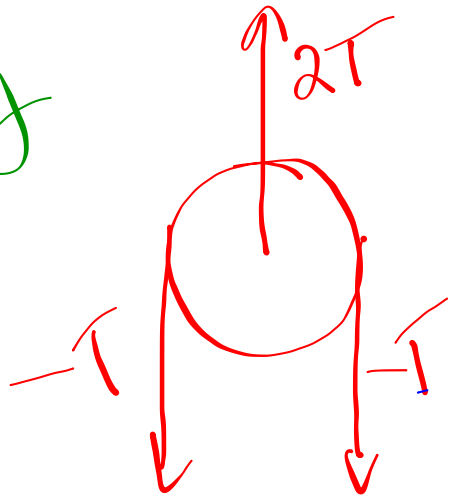
$$? = 2T$$

# Number the pulleys ...

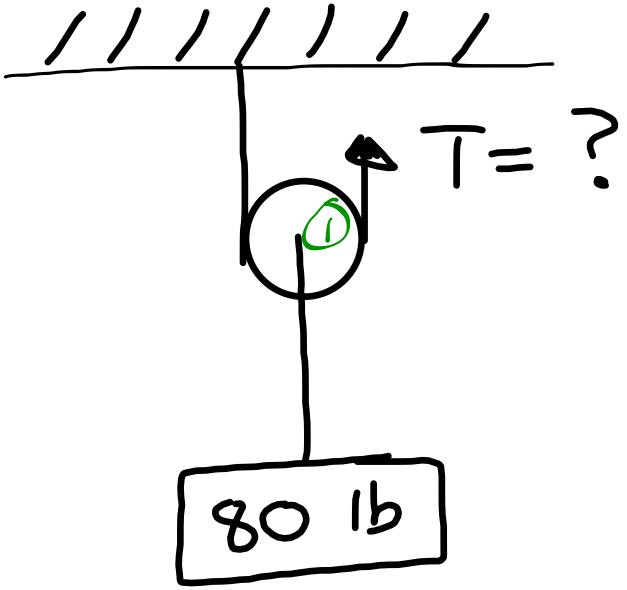
- draw a picture
- draw FBD's for each pulley

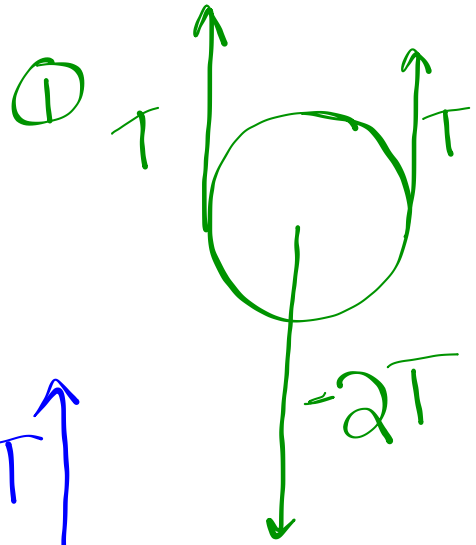
# Follow the signs ...

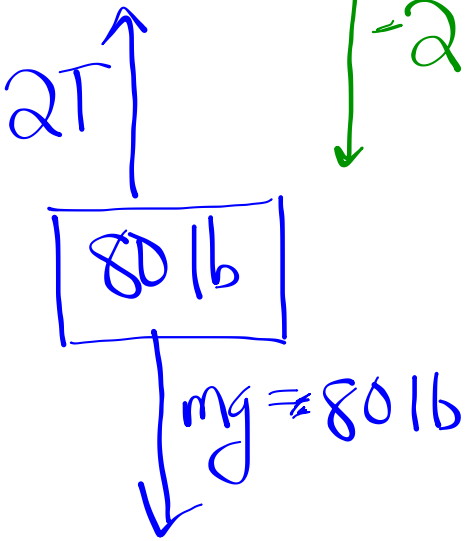
- Make T positive
- Forces point up - leave them positive
- Forces pointing down - put a − sign in front



# Example 1



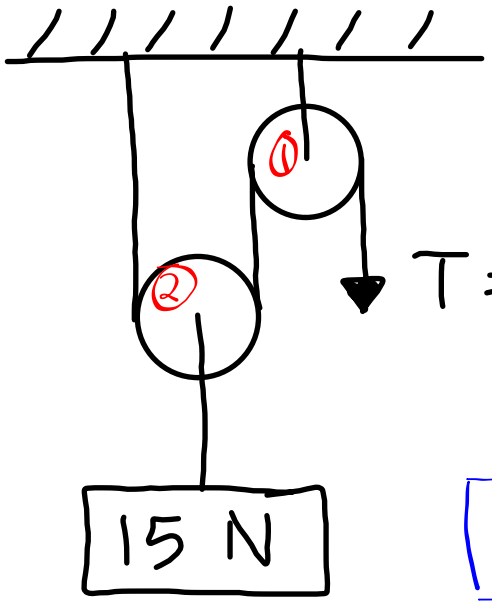

$$\Sigma F_y = 0$$

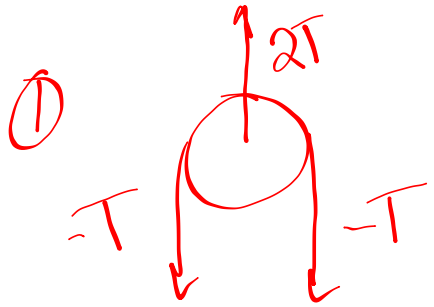
$$2T + -80 = 0$$

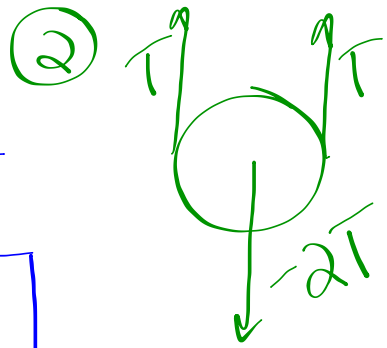
$$2T = 80$$

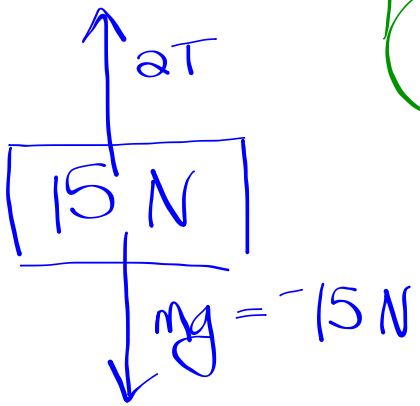
$$T = 40 \text{ lb}$$

# Example 2



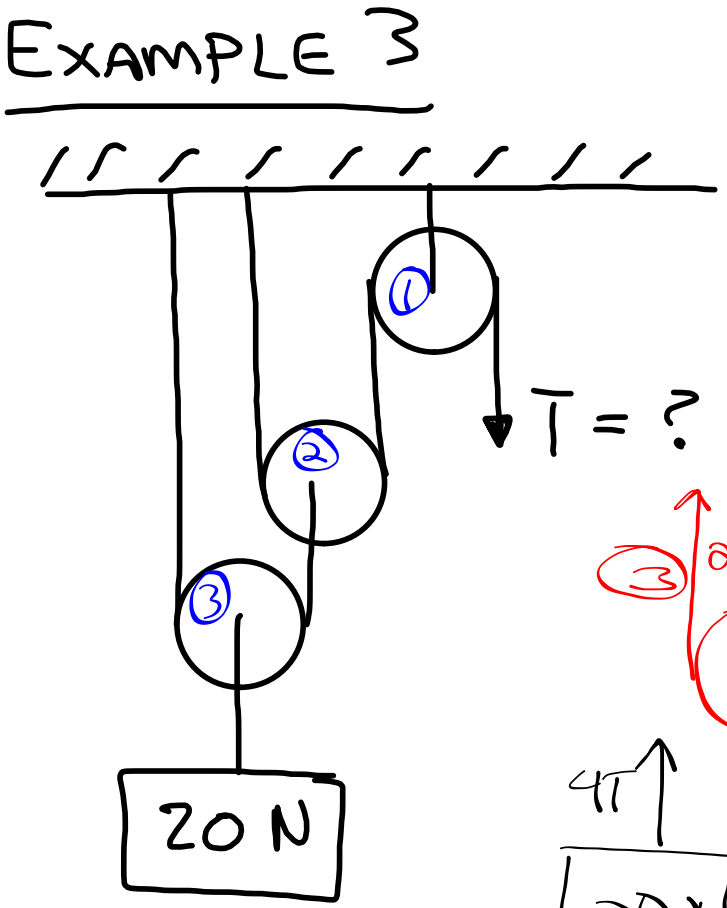



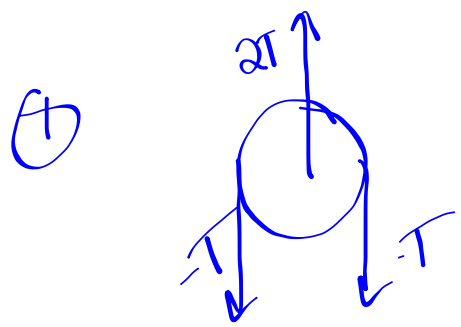

$$\Sigma F_y = 0$$

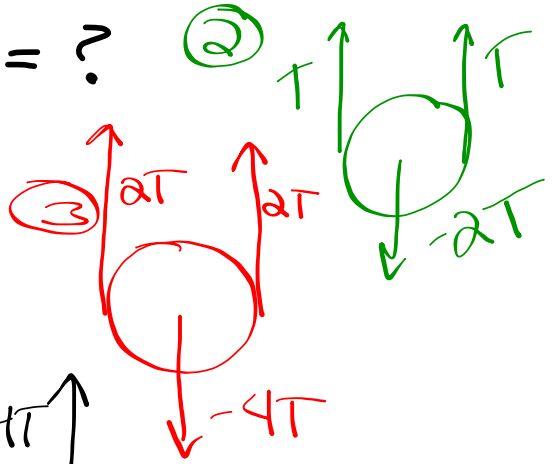
$$2T + -15 = 0$$

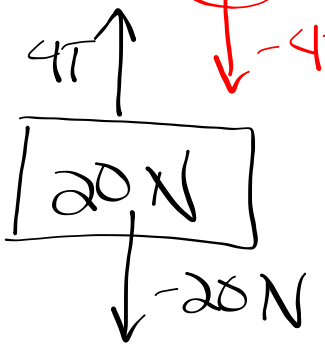
$$T = 7.5\,N$$

# Example 3



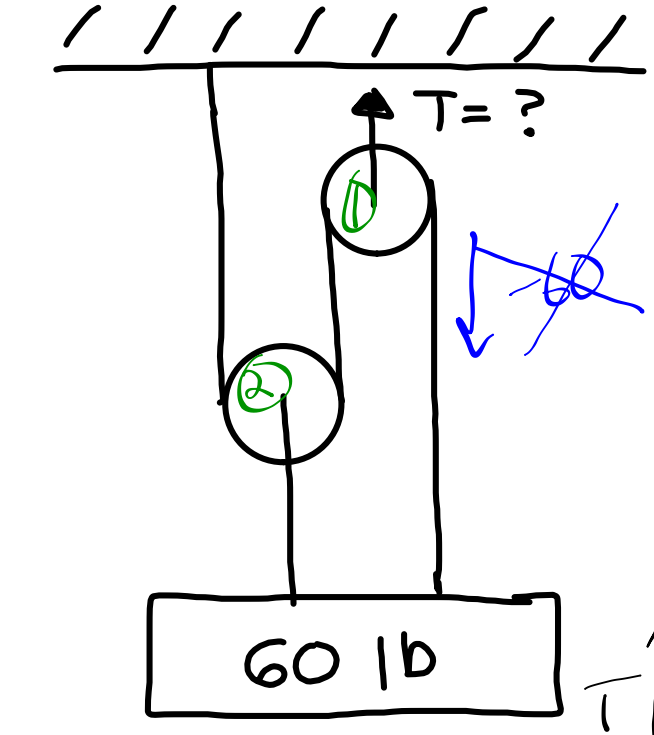



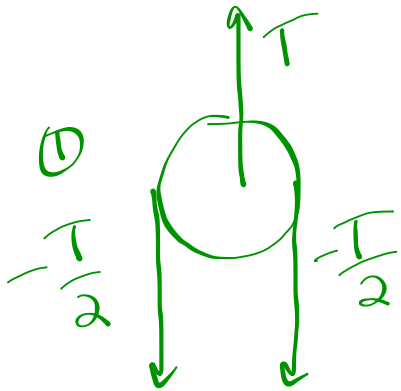

$\Sigma F_y = 0$

$4T - 20 = 0$

$T = 5$

# Example 4



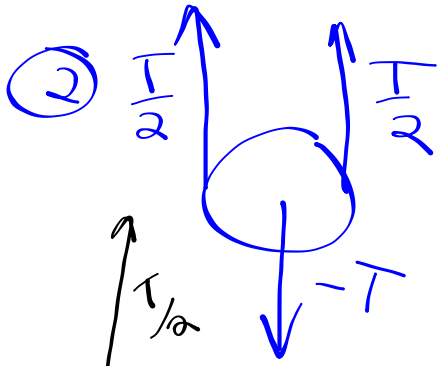



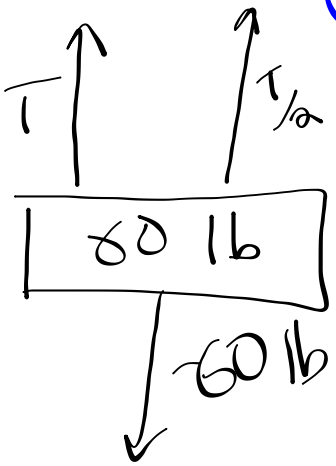

$\Sigma F_y = 0$

$T + x + x = 0$

$2x = -T$

$x = -\frac{T}{2}$



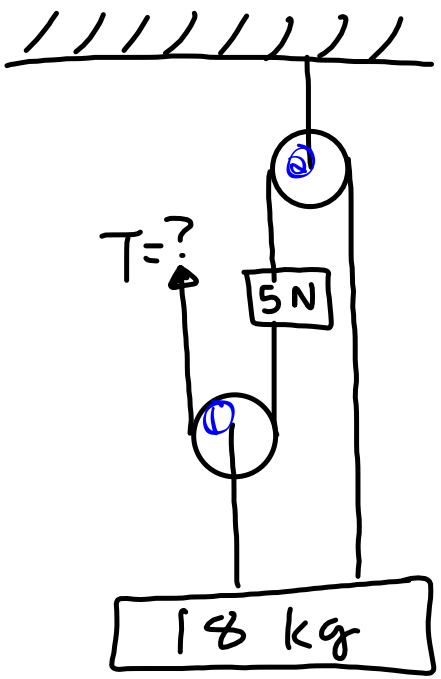

$\Sigma F_y = 0$

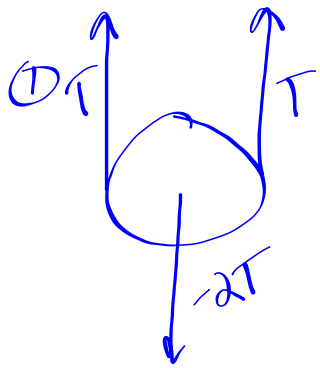
$T + \frac{T}{2} + -60 = 0$

$\frac{3}{2}T = 60$

$\boxed{T = 40 \text{ lb}}$

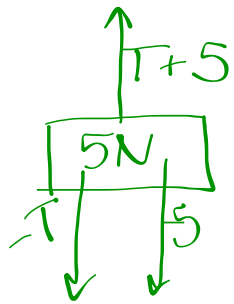
# EXAMPLE 5

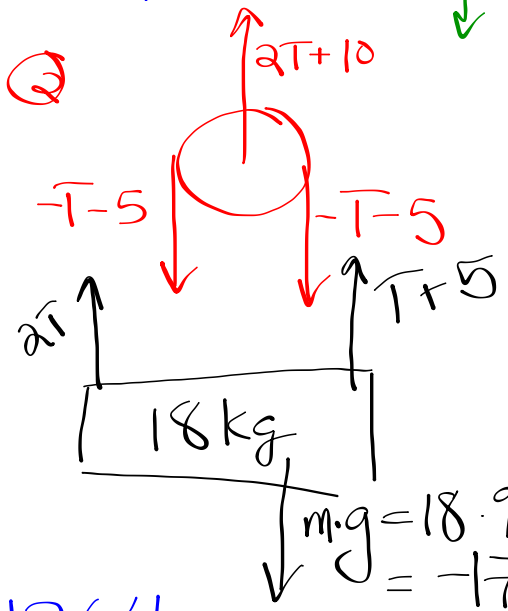



$\Sigma F_y = 0$

$? + -T + -5 = 0$




$m \cdot g = 18 \cdot 9.8 = -176.4$

$\Sigma F_y = 0$

$2T + T + 5 - 176.4 = 0$

$3T = 171.4$

$T = 57.1\ N$