

# Statics with Pulleys

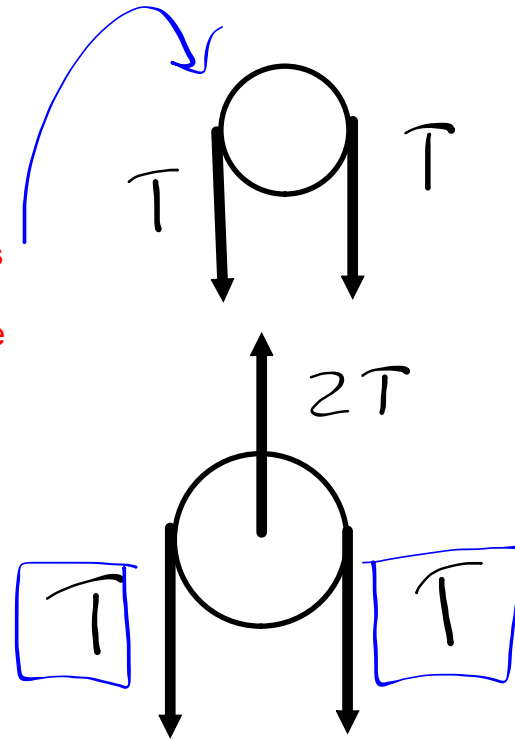
Assumption:

- 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)



$$\sum F_y = 0$$

$$T + T + ? = 0$$

$$2T + ? = 0$$

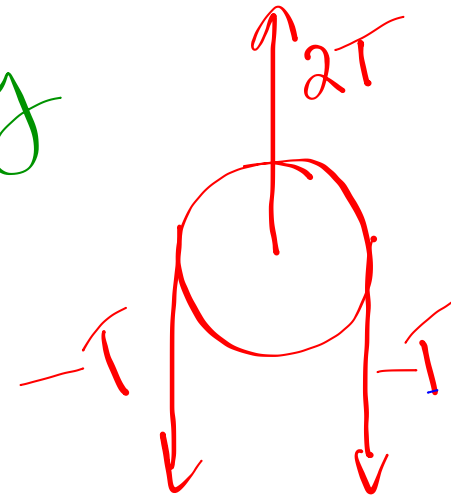
$$? = -2T$$

Number the pulleys ...

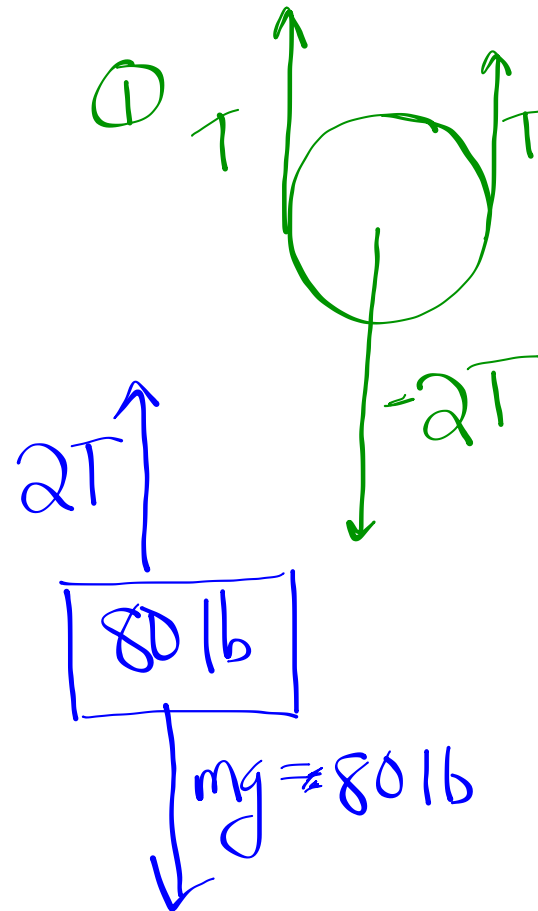
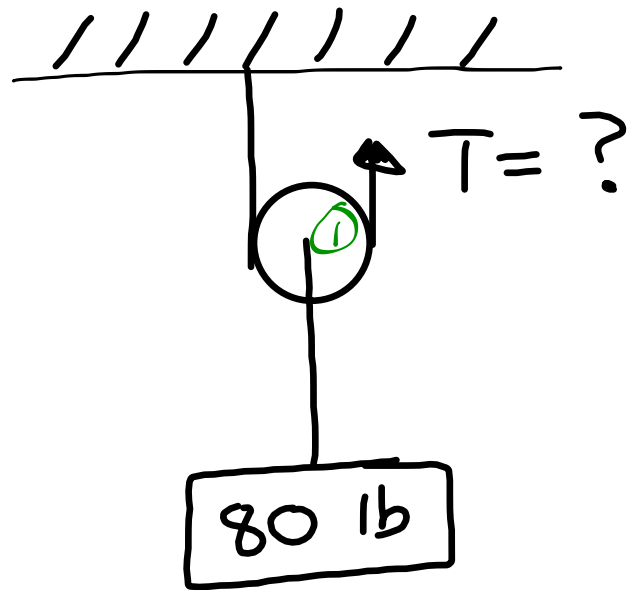
- draw a picture
- draw FBD's for each pulley

Follow the signs ...

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



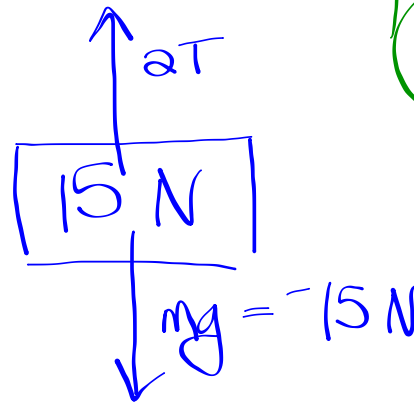
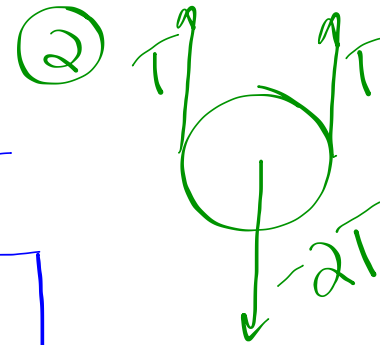
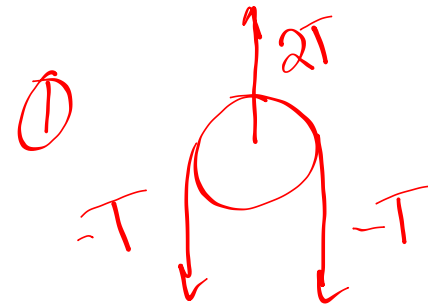
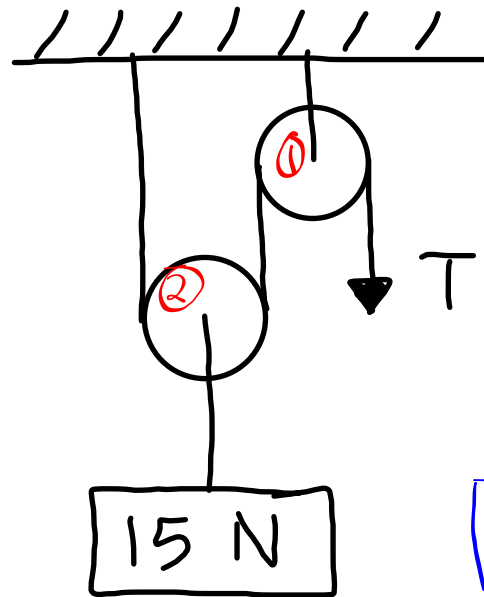
# EXAMPLE 1



$$\begin{aligned}\sum F_y &= 0 \\ 2T + (-80) &= 0 \\ 2T &= 80\end{aligned}$$

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

## EXAMPLE 2

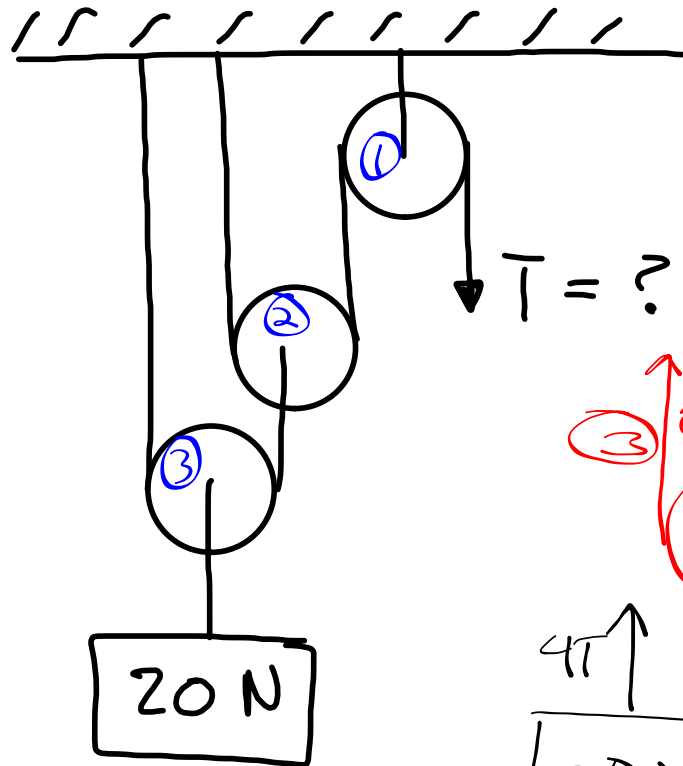


$$\sum F_y = 0$$

$$2T + -15 = 0$$

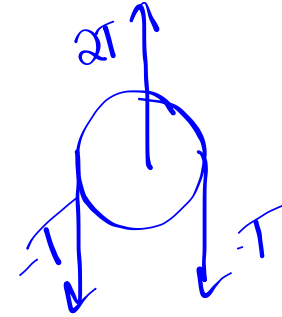
$$T = 7.5 \text{ N}$$

# EXAMPLE 3

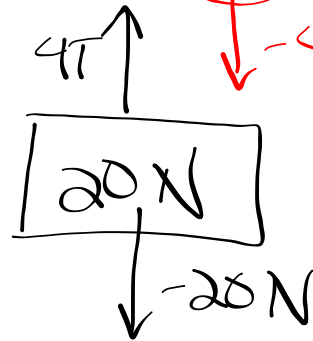
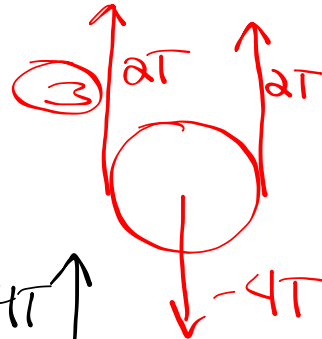
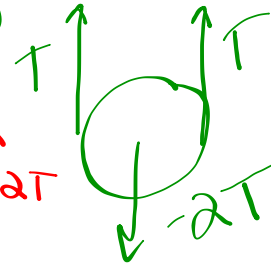


$T = ?$

①



②

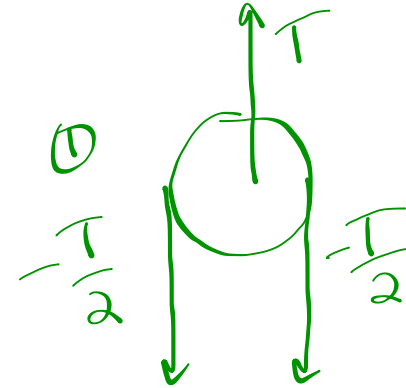
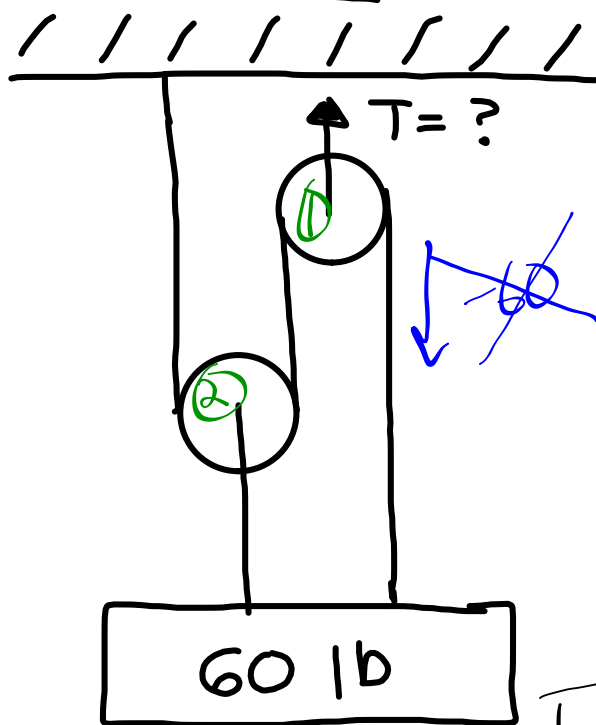


$$\sum F_y = 0$$

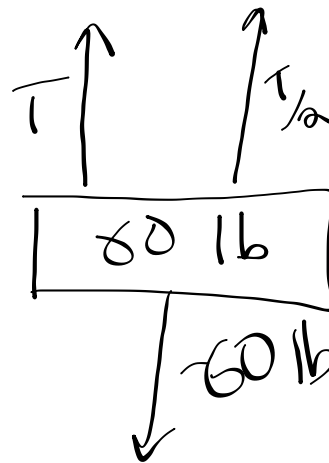
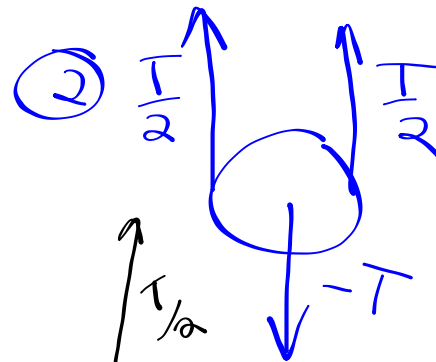
$$4T - 20 = 0$$

$$T = 5$$

# EXAMPLE 4

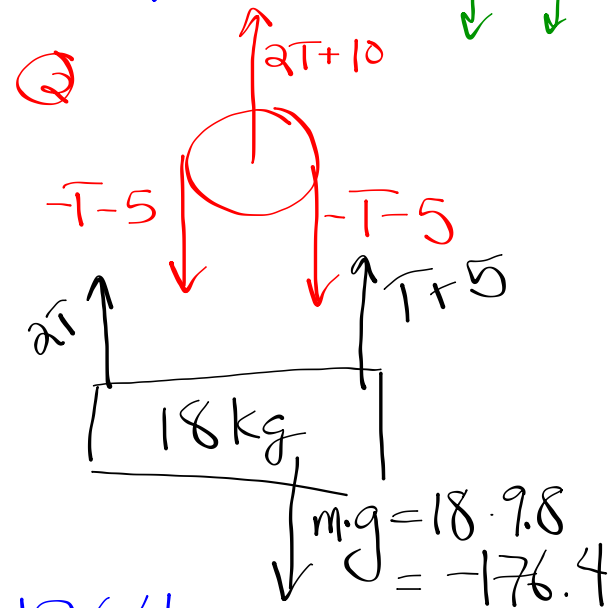
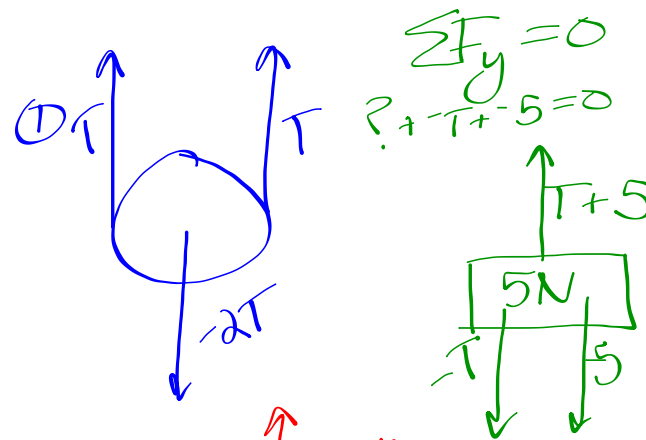
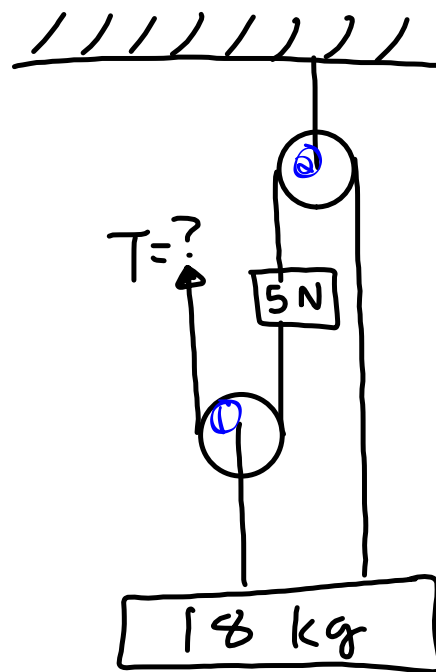


$$\begin{aligned}\sum F_y &= 0 \\ T + x + x &= 0 \\ 2x &= -T \\ x &= -\frac{T}{2}\end{aligned}$$



$$\begin{aligned}\sum F_y &= 0 \\ T + T/2 + -60 &= 0 \\ 3/2 T &= 60 \\ \boxed{T = 40 \text{ lb}}\end{aligned}$$

# EXAMPLE 5



$$\Sigma F_y = 0$$

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

$$3T = 171.4$$

$$T = 57.1 \text{ N}$$