

Fig. 2

# Mechanics Overview

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- » Forces
- » Moments
- » Pneumatics
- » Drive train physics
- » Mechanism physics

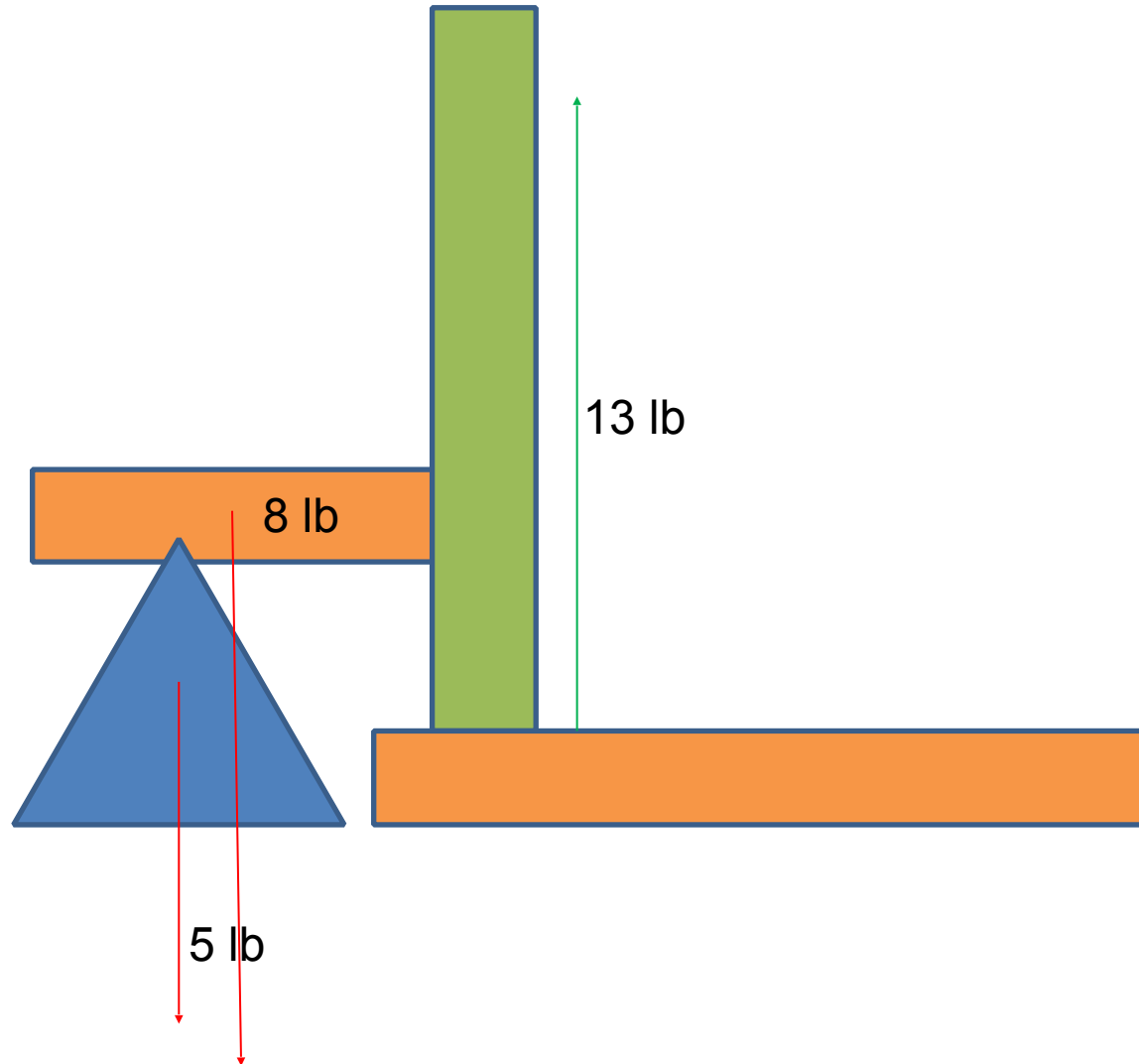
# Forces

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- » Applied by pressing on something
- »  $F=ma$
- » Broken down into x and y
- » Pounds (Standard)
- » Newtons (Metric)

# Force example

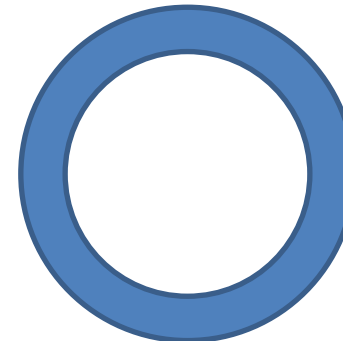
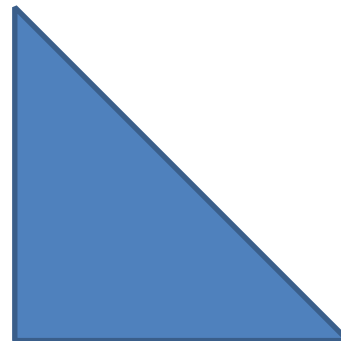
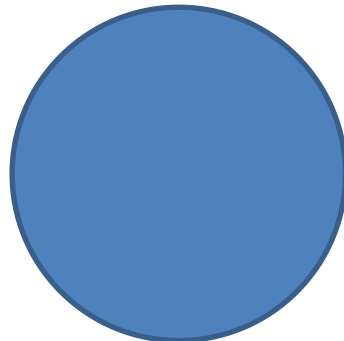
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# Center of Mass

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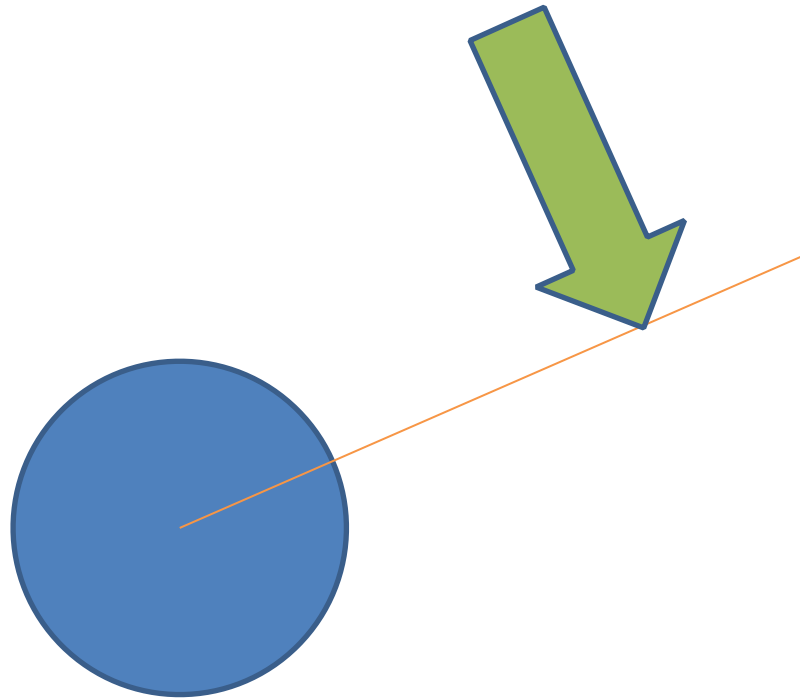
- » Where is the force of gravity acting on average
- » Can be considered a single force
- » Very important in robots
- » Want it low and to the center usually



# Torque and Moments

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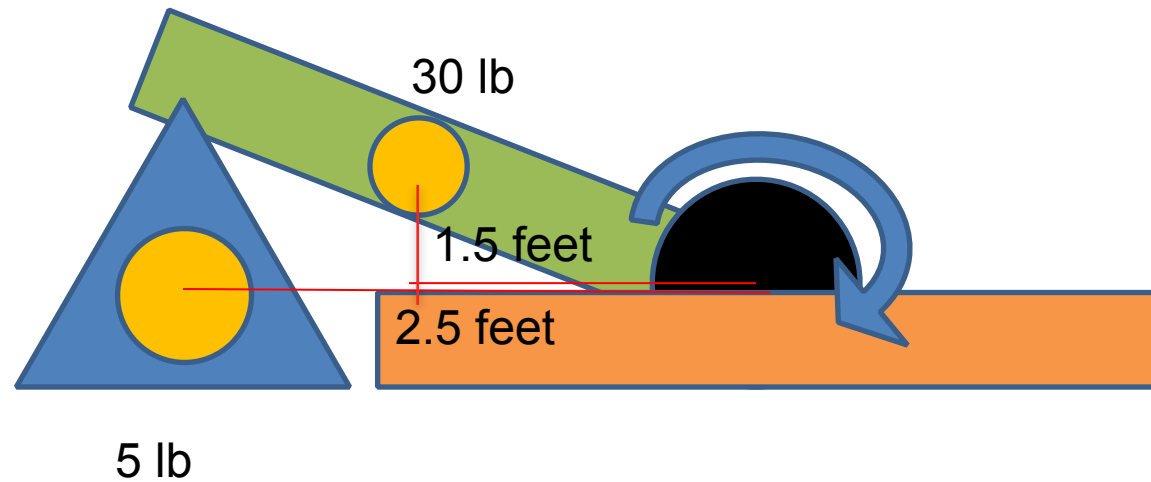
- » Torque=Force\*distance
- » Distance is perpendicular to the moment



# Moment Example

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- »  $30 * 1.5 = 45$
- »  $5 * 2.5 = 12.5$
- »  $45 + 12.5 = 67.5$
- » Overshooting?



# Other Physics

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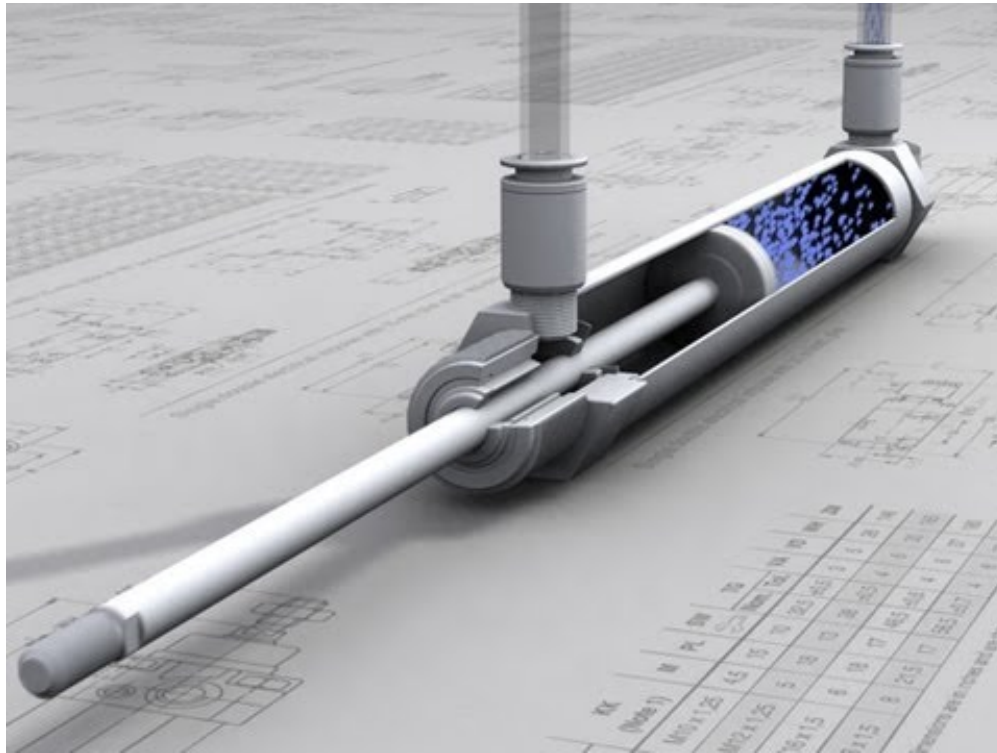
- » Pistons
- » Drive train calculations
- » Mechanism Calculations
- » High load and fatigue considerations



# Pistons

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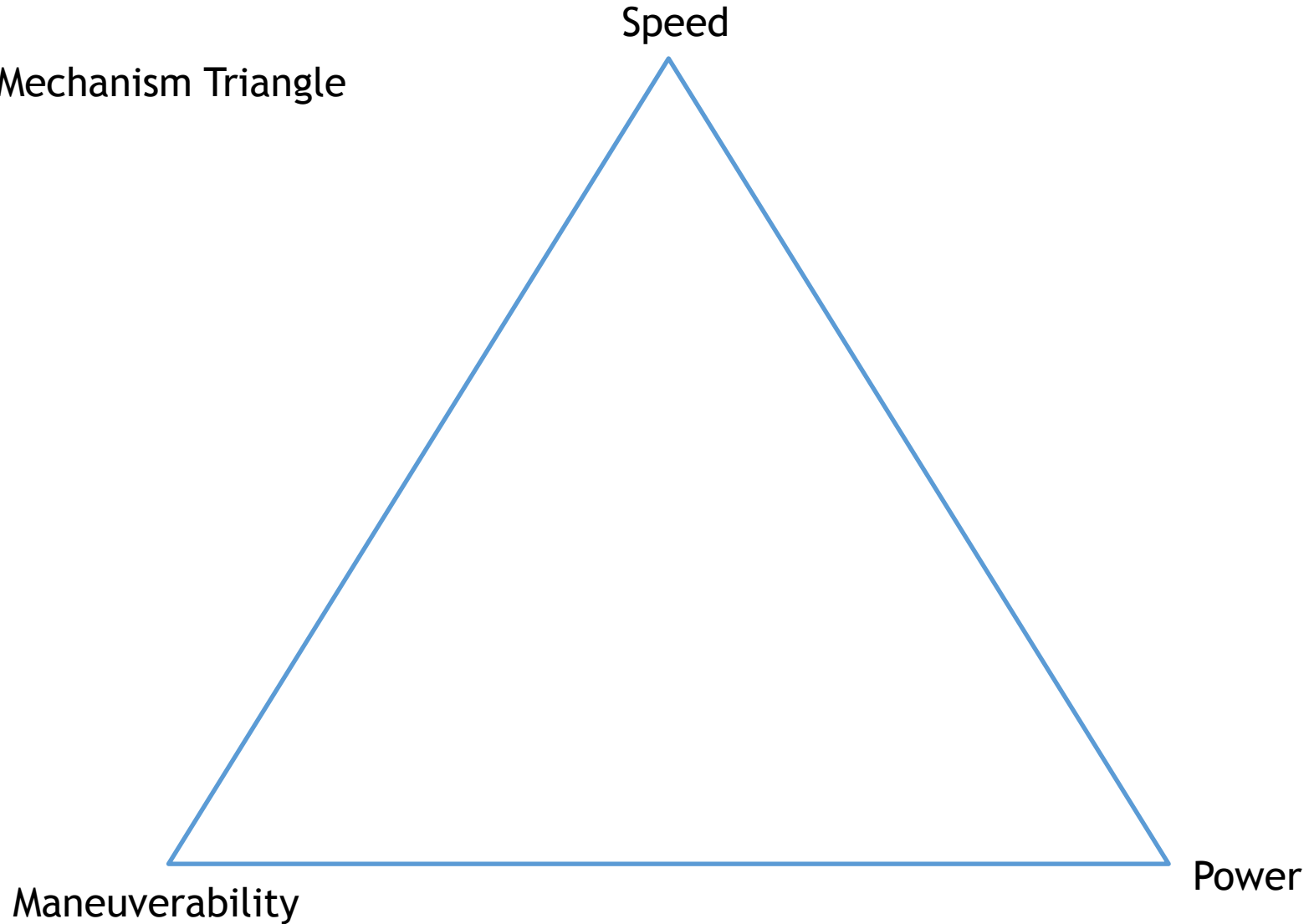
- »  $F = \text{Pressure} * \text{Area}$
- » 60 working PSI allowed on robot
- » So all come down to the area
- » Less force pulling in than out



# Drive train Calculations

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Phillip's Mechanism Triangle



# Drive train Calculations

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- » Wheel size
- » Gearbox ratios
- » Motors
- » Number of wheels
- » What do you need it to do?
  - Push more than your weight?
  - Hold its own in defense?
  - Speed or maneuverability?

# JVN Calculator

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- » Makes designing mechanisms and drive trains easy
- » Input your values and usually get an output result that you need

# Mechanics Overview

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- » Forces
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- » Drive train physics
- » Mechanism physics

# Your turn

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- » Do math for what forces and torques are needed based on design
- » Select penultimate actuators and gearboxes