Work, Power, and Machines

Work

- Definition
  - force applied over a distance
  - distance must be in the same direction as the force
  - SI Unit of Joules
- Equation (Linear)
  - Work = Force x Distance
  - W = F x D

Power

- Definition
  - the rate at which work is done
- Equation (Linear)

$$P = \frac{Work}{t} = \frac{Fd}{t} = Fv$$

- Unit of Measure
  - Joule/second (J/s) or Watt (W)
- Conversion
  - 1hp = 746 W

Why Do We Use Machines?

- To decrease the amount of force needed to move an object or to change the direction that the force is applied
- Machines give us a mechanical advantage
  - Mechanical Advantage - number of times a machine multiplies the effort force
    - If you apply 20N into a machine that has a MA of 4, there will be 80N of force out of the machine.

Efficiency

- Definition
  - how well the machine works by comparing the useful work done by a machine to the work put into the machine
- Equations

$$\%\ Efficiency = \frac{Work_{out}}{Work_{in}} x\, 100\%$$

or

$$\%\ Efficiency = \frac{Power_{out}}{Power_{in}} x\, 100\%$$

Sample Problem

- A 1500 kg corvette has a 650 hp engine in it. If the corvette can travel from 0 to 60 mph (26.8 m/s) in 2.96 seconds, what is the efficiency of the engine?