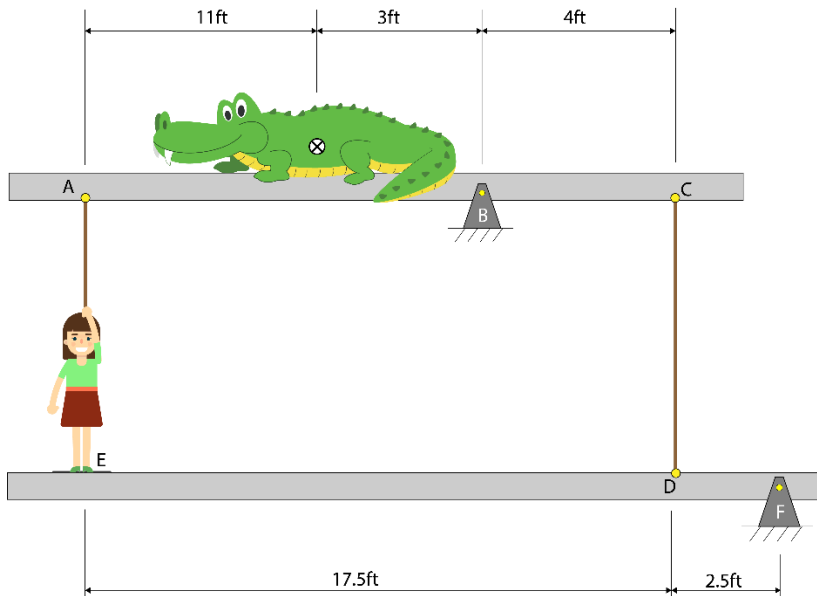


**NOTE:** Use engineering format for problems 1 through 4. Use non-engineering format for problem 5. This is an individual assignment.

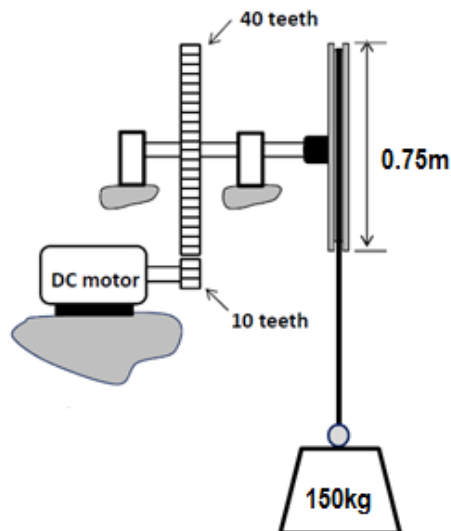
1. A 145lb engineering student who is standing on beam EDF pulls vertically downward on a rope attached to beam ABC. A second rope is attached vertically between points C and D. If the alligator weighs 985lbs and the center of gravity of the alligator (the place where the weight can be lumped) is 3ft to the left of the pinned connection at point B, then what is the pulling force of the student? [36.63lbf](#)



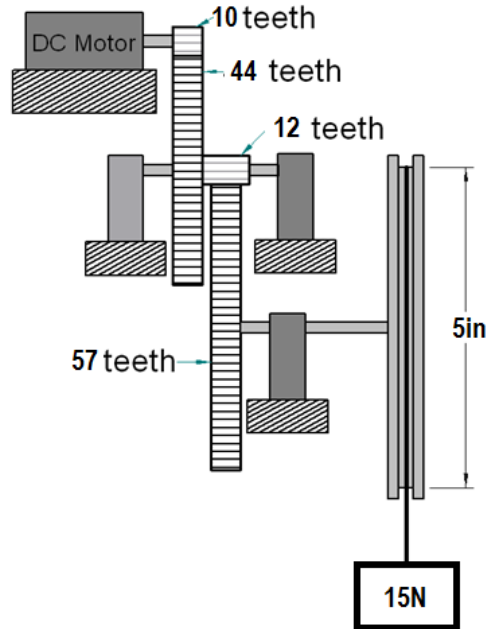
**Tips:**

- Neglect the weight of the beams.
- Draw 2 FBDs, one for each beam.
- Initially treat this as two separate beam problems, and then combine the resulting equations to solve for the rope tension at A.
- The force in the rope is always in tension (can't push with a rope).

2. A 150kg mass is lifted by a pulley with a diameter of 0.75m. The motor and gear train have a system efficiency of 76%. If the 150kg mass is lifted upward 2.75m in one second, what is the DC power that must be delivered to the motor? [5.32kW](#)



3. The DC motor spins at 4200 RPM. Find the
  - a. Rate of rotation (RPM) of the gear with 57 teeth. **200.96 RPM**
  - b. Velocity (m/s) that the weight moves as it is being lifted by the gearmotor. **1.34m/s**
  - c. Current provided to the motor if the voltage supplied is 24V and its efficiency is 35%. **2.39A**



4. Recall the data that you collected during the last class.
  - a. Complete the table below.
  - b. Show hand calculations for one data point, where the calculations include all relevant units.
  - c. Provide a plot of Efficiency versus Voltage. Be sure to use proper plotting format. Include the appropriate trendline for your data with the equation and  $r^2$  value displayed on the plot.
  - d. Plot Lift Speed (cm/s) versus Voltage. Be sure to use proper plotting format. Include the appropriate trendline for your data with the equation and  $r^2$  value displayed on the plot.

Test	measured quantities						computed quantities					
	mass (grams)	pulley diameter (cm)	height change (cm)	lift time (s)	voltage (V)	current (A)	RPM (rev/min)	PE change of weight (J)	electrical power (W)	electrical energy (J)	vertical lifting speed (cm/s)	system efficiency (%)
1												
2												
3												
4												

5. Review the project ideas in your Idea Wallet. Choose your top two ideas. Write a few sentences about each idea, why you like it, and why you think your team should do that project. You will use this as a basis for discussion with your group when you start to narrow down the project ideas.