Problem 1

The input to a gearbox has a measured 32 foot pounds of torque at 700 rpm. The output has 207 foot pounds of torque at 100 rpm.

- What is the power at the input?
- What is the power at the output?
- What is the efficiency of the gearbox?

$700\ \text{rpm} \rightarrow 73.3\ \text{rad/s}$

$100\ \text{rpm} \rightarrow 10.5\ \text{rad/s}$

$$P_{in} = M\omega = (32\ \text{ft lbs})(73.3\ \text{rad/s}) = \boxed{2345.7\ \frac{\text{ft lbs}}{\text{s}} = 4.26\ \text{hp}}$$

$$P_{out} = M\omega = (207\ \text{ft lbs})(10.5\ \text{rad/s}) = \boxed{2167.7\ \frac{\text{ft lbs}}{\text{s}} = 3.94\ \text{hp}}$$

$$\eta = \frac{P_{out}}{P_{in}} = \boxed{.924 = 92.4\%}$$