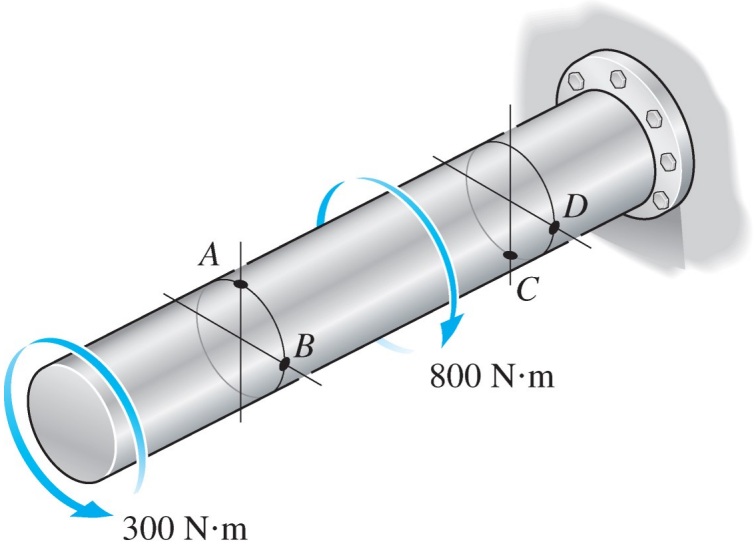
Name:

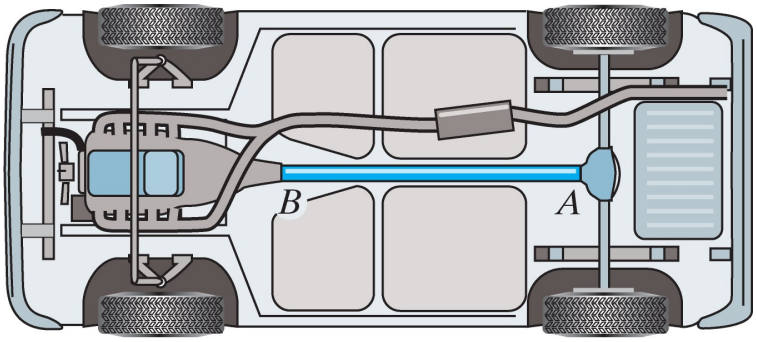
Homework 4

Due 22 Sep 2020

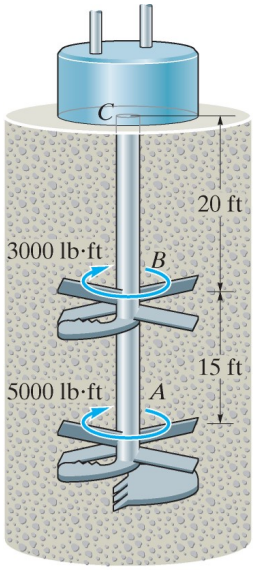
1. Determine the internal torque at each section and sketch the shear stress on a volume element at A, B, C, and D.



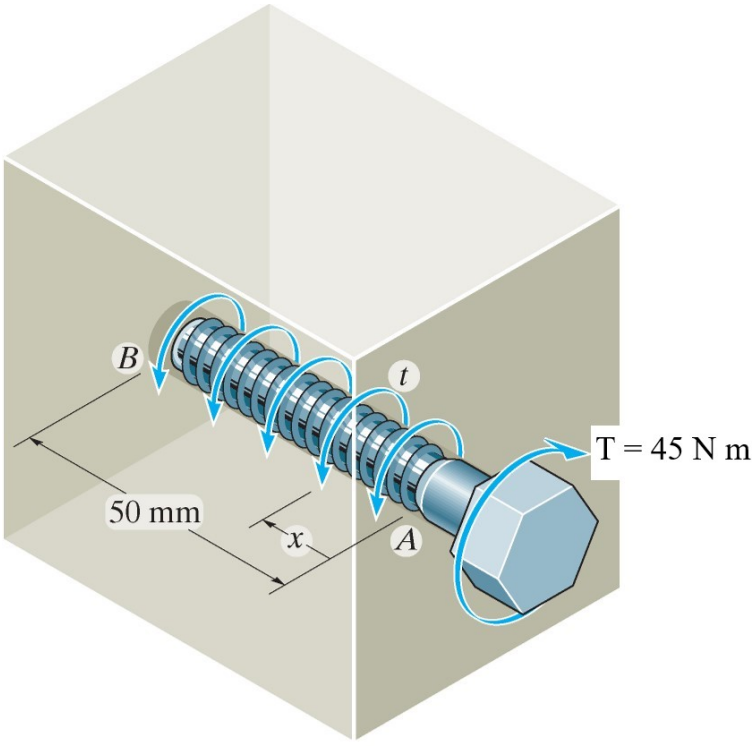
2. The drive shaft AB is to be designed as a thin-walled tube. The engine delivers 150 hp while the shaft turns 1000 rpm. Find the minimum thickness of the shaft's wall for an outer diameter of 2.0 in if the allowable shear stress is $\tau_{allow} = 6.0$ ksi.



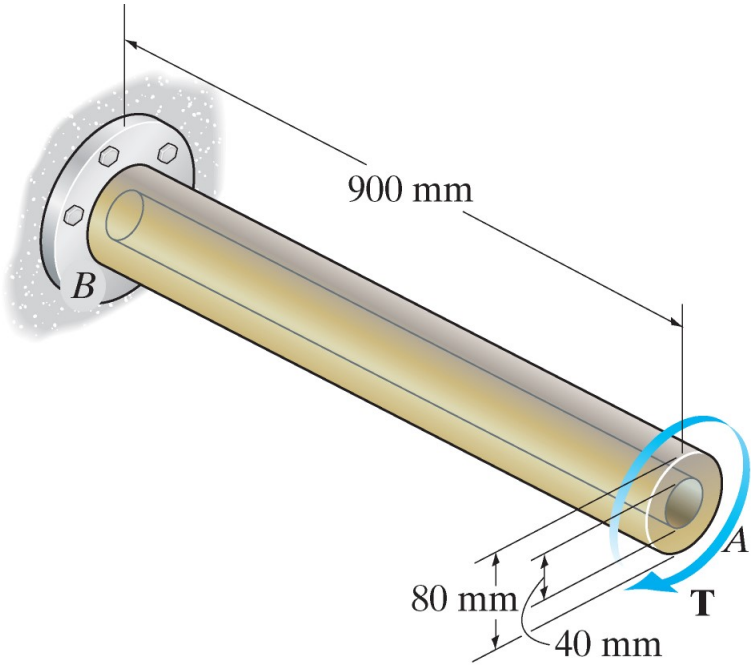
3. The soil mixer shown is connected to an A-36 steel tubular shaft with an inside diameter of 1.5 in and an outside diameter of 3.0 in. Determine the angle of twist at A relative to B and the absolute maximum shear stress for the torque shown.



4. The A-36 Steel bolt shown is tightened such that there is a reactive torque on the shank. The reactive torque is expressed as $t = kx^2\,\mathrm{N \cdot m/m}$ for x in meters. If a torque of $T = 45\,\mathrm{N \cdot m}$ is applied to the bold head find the value of the constant k and the amount of twist in the shank. Assume the shank has a radius of 5 mm



5. The aluminum alloy tube (2014-T6, outside) is bonded to an A-36 steel rod (inside) as shown. If a torque of $7\,\text{kN}\cdot\text{m}$ is applied find the maximum shear stress in each material and plot the shear stress as a function of radial position.



6. For an arbitrary maximum shear stress, compare the torque carrying capacity between two cross-sectional shapes: the circular tube shown (inside) and the rounded rectangular tube (outside) shown. For both cases the wall thickness is 0.1 in