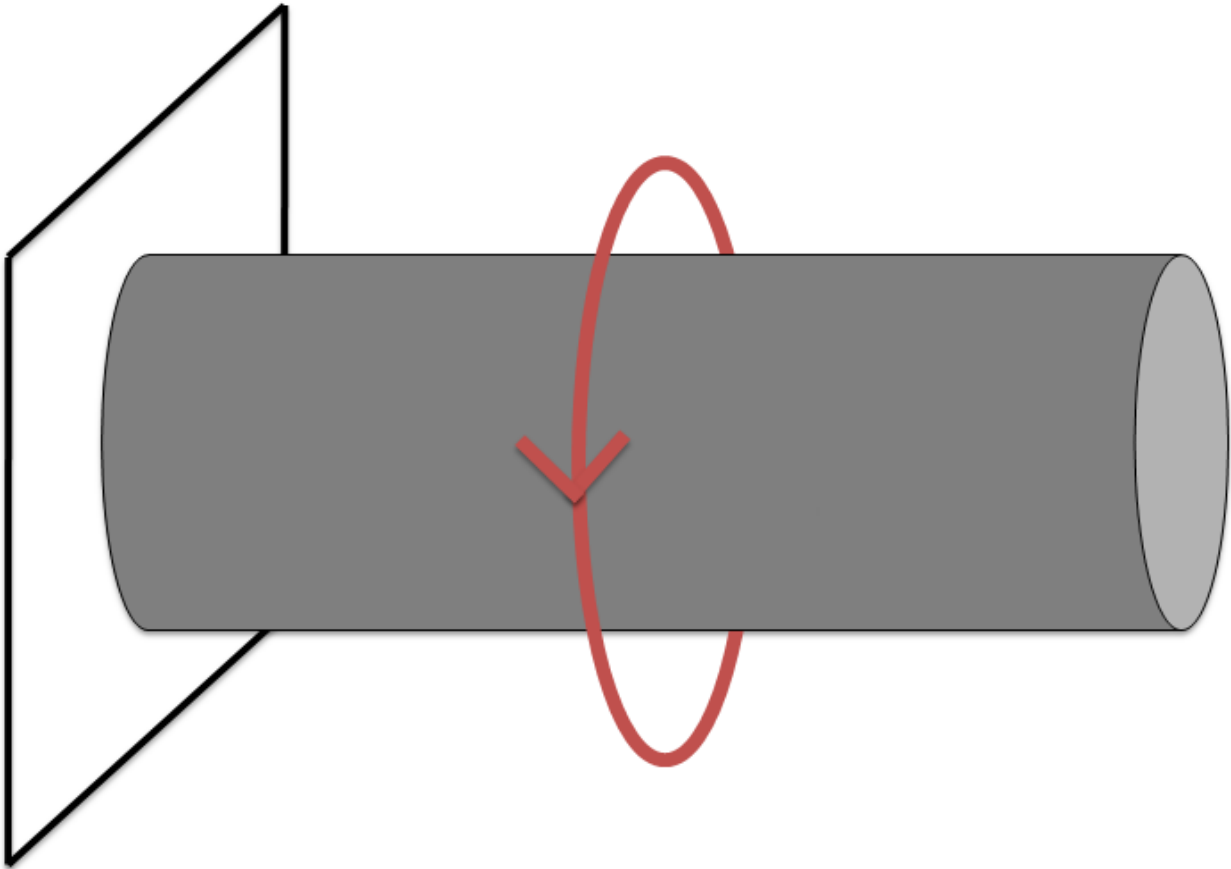


**Example Problem:**

A uniform bar ( $L=60\text{in}$ ) is clamped at only its left end. A torque  $T=2000$  inch-pounds is applied counter-clockwise at a point  $x=30\text{in}$  from the left clamp. The bar is made of steel ( $G=11.5\text{e}6$  psi) and has a diameter of 2 in.



Segment 1:  $x_1=0\text{in}$   $x_2=30\text{in}$

Segment 2:  $x_1 = 30\text{in}$   $x_2 = 60\text{in}$

In segment 2, the torque is 0lb. Both the stress and twist in this section is zero.

Segment 1:

$$J = \frac{\pi d^4}{32} = \frac{\pi * (2\text{in})^4}{32} = 1.57\text{in}^4$$

$$\tau = \frac{.5Td}{J} = \frac{.5 * 2000\text{in} \cdot \text{lb} * 2\text{in}}{1.57\text{in}^4} = 1273.24 \text{ psi}$$

$$\theta = \frac{TL}{JG} = \frac{2000 \text{ in} \cdot \text{lb} * 30 \text{ in}}{1.57\text{in}^4 * 11.5\text{e}6 \text{ psi}} = 3.321\text{e-}3 \text{ rad}$$