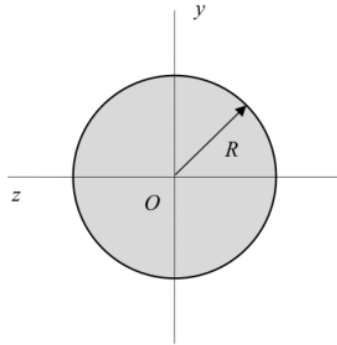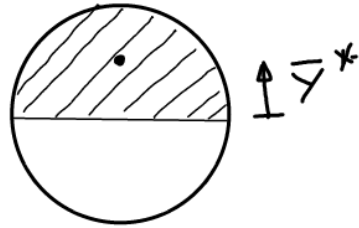Use the shear stress formula for a general shape cross section developed in lecture to determine an expression for the shear stress at the neutral axis along the symmetry axis y of the circular cross section beam shown below.
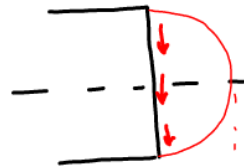

$$\tau = \frac{V A^* \bar{y}^*}{I t}$$

$\updownarrow \bar{y}^*$

w/ $A^* = \frac{1}{2}\pi R^2$

$\bar{y}^* = \frac{4R}{3\pi}$

$t = 2R$

$I = \frac{\pi}{4} R^4$

$\tau_{max} = \frac{4}{3}\tau_{ave}$

$\therefore$ $\tau = \frac{\left(\frac{\pi}{2}R^2\right)\left(\frac{4R}{3\pi}\right)}{\left(\frac{\pi}{4}R^4\right)(2R)} V = \frac{4}{3}\left(\frac{V}{\pi R^2}\right) = \tau_{ave}$