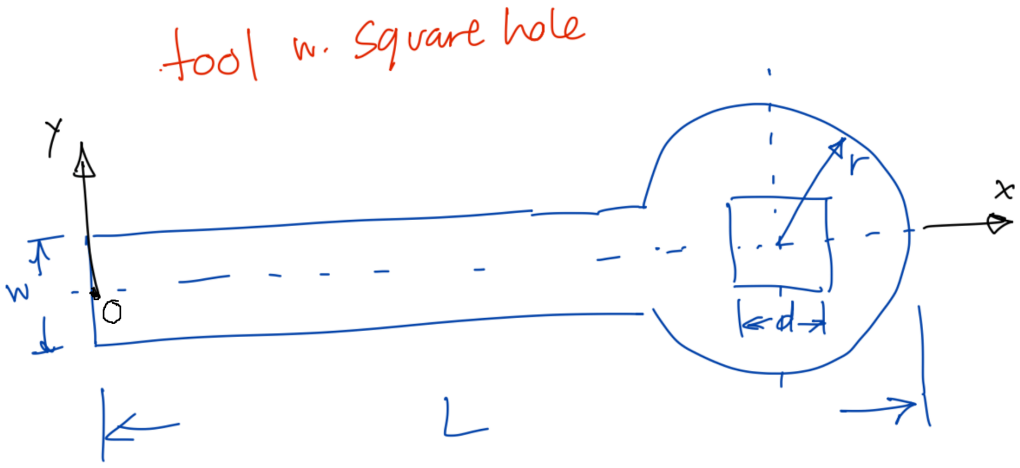
21-R-KIN-MS-51



Determine the moment of inertia of the wrench at point O about each axis described below. The tool has a thickness of $1cm$ and a density of $7500kg/m^3$.

Axis perpendicular to the page at O.

Axis parallel to y direction at O.

$w = 2cm$

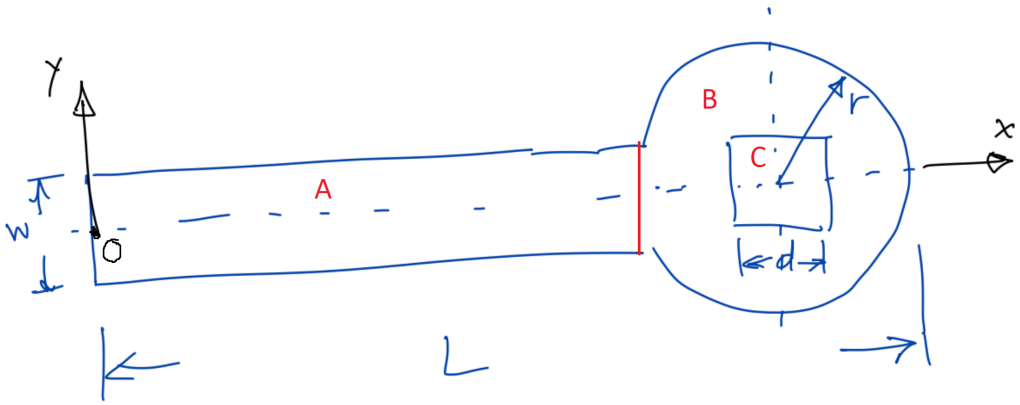
$L = 20cm$

$r = 3cm$

$d = 2cm$

Solution:

Find the moment of inertia of individual components about O and sum them up.



Thickness $T = 1cm$, density $\rho = 0.0075kg/cm^3$

Shape i	A	B	C
Mass m_i	$w(L-2r)T\rho$	$\pi r^2 T\rho$	$d^2 T\rho$
Centre of gravity x_{gi}	$\frac{L-2r}{2}$	$L-r$	$L-r$
Moment of inertia, z-axis, I_{zi}	$\frac{1}{12}m_A(w^2+(L-2r)^2)+m_A x_{gA}^2$	$\frac{1}{2}m_B r^2+m_B x_{gB}^2$	$\frac{1}{2}m_C(2d^2)+m_C x_{gC}^2$
Moment of inertia, y-axis, I_{yi}	$\frac{1}{12}m_A(T^2+(L-2r)^2)+m_A x_{gA}^2$	$\frac{1}{12}m_B(3r^2+T^2)+m_B x_{gB}^2$	$\frac{1}{2}m_C(d^2+T^2)+m_C x_{gC}^2$

$I_{zO} = I_{zA} + I_{zB} - I_{zC} = (24.8000 + 62.2389 - 8.7900)kg \cdot cm^2 * (1m/100cm)^2 = 0.00782kg \cdot m^2$

$I_{yO} = I_{yA} + I_{yB} - I_{yC} = (24.7250 + 61.7794 - 8.7450)kg \cdot cm^2 * (1m/100cm)^2 = 0.00778kg \cdot m^2$