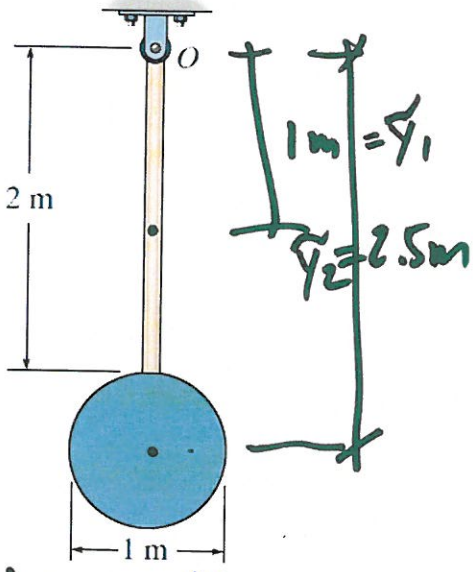
17-10

The pendulum consists of a 4-kg circular plate and a 2-kg slender rod. Determine the radius of gyration of the pendulum about an axis perpendicular to the page and passing through point O.



add this column if you also want $\bar{y}$.

shape	mass (kg)	$\bar{y}$ (m)	$\tilde{y}m$ (kg m)	I_G (kg m^2)	md^2 (kg-m^2)	$I_G + md^2$ (kg-m^2)
▯	2	1	2	$\frac{1}{12}ml^2 = \frac{1}{12}2\times 2^2 = 2/3$	$2(1^2) = 2$	2.67
○	4	2.5	10	$\frac{1}{2}mr^2 = \frac{1}{2}4(0.5^2) = 0.5$	$4(2.5^2) = 25$	25.5
						$\Sigma = 28.17$ kg-m^2

$I_O = 28.17$ kg-m^2

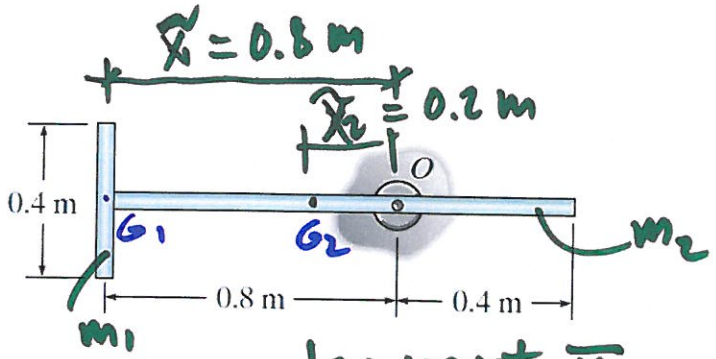
Radius of gyration:

$$k_O = \sqrt{\frac{I_O}{m}} = \sqrt{\frac{28.17}{(2+4)}} = 2.17\ \text{m}$$

Ans.

17-11

The assembly is made of the slender rods that have a mass per unit length of 3 kg/m. Determine the mass moment of inertia of the assembly about an axis perpendicular to the page and passing through point *O*.



$m_1 = 3\ kg/m\ (0.4) = 1.2\ kg$

$m_2 = 3\ kg/m\ (1.2) = 3.6\ kg$

if you also want $\bar{x}$

Shape	mass (kg)	$\tilde{x}$ (m)	$\tilde{x}m$ (kg·m)	I_G (kg·m²)	md^2 (kg·m²)	$I_G + md^2$ (kg·m²)
	1.2	-0.8	-0.96	$\frac{1}{12}ml^2 = \frac{1}{12}(1.2)0.4^2 = 0.016$	$1.2\,(0.8^2) = .768$	.784
	3.6	-0.2	-0.72	$\frac{1}{12}ml^2 = \frac{1}{12}3.6\times1.2^2 = .432$	$3.6\,(0.2^2) = .144$	.576

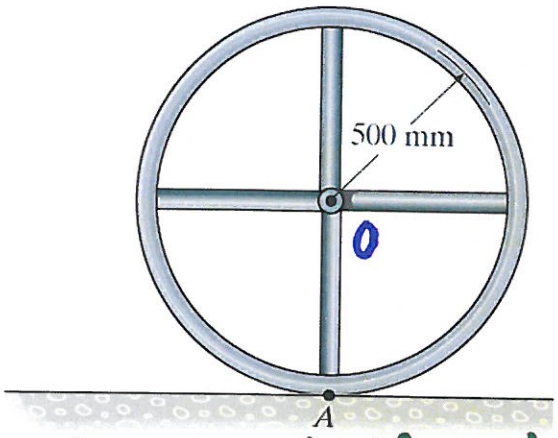
$\Sigma = 1.36\ kg\cdot m^2$

$$I_O = 1.36\ kg\cdot m^2$$

Ans.

17-13

The wheel consists of a thin ring having a mass of 10 kg and four spokes made from slender rods, each having a mass of 2 kg. Determine the wheel's moment of inertia about an axis perpendicular to the page and passing through point *A*.



Find I_O (O ≡ center of mass of the wheel)

shape	m (kg)	I_G (kg-m²)	md^2 (kg-m²)	$I_G + md^2$ (kg-m²)
○	10	$mr^2 = 10 \times .5^2 = 2.5$	Ø	2.5
4× ▯	4×2	$4 \times \frac{1}{12} ml^2 = 4 \times \frac{1}{12} \times 2 \times .5^2 = .1667$	$4 \times md^2 = 4 \times 2 \times .25^2 = .5$	.667

$I_O = \Sigma = 3.17$ kg-m²

Apply parallel-axis theorem:

$$I_A = I_G + md^2 = 3.17 + (10 + 4\times2) \times (0.5^2)$$

$$I_A = 7.67 \text{ kg.m}^2$$

Ans.