1 | **Precessional Velocity**

Taking the setup, we can figure the sum of the angular momentums and leverage it to figure the spin angular momentum.

Let's first define a system: $\hat{i}$ is "right" on the figure, $\hat{j}$ "in" the page, $\hat{k}$ "up" the figure.

We note that the normal spin of the flywheel gives us:

$$\vec{L}_s = I\vec{\omega}_s\hat{i} \tag{1}$$

As the flywheel is rotating at a constant speed, we have actually no torque that this contributes to the net system — that is $\frac{d\vec{L}_s}{dt} = 0$.

Furthermore, we can figure torque—and subsequent angular momentum contribution—of gravity as follows:

$$\vec{\tau}_g = lmg\hat{j} \tag{2}$$

The total net torque on the system, then:

$$\begin{align} \vec{\tau}_{net} &= \vec{\tau}_g + 0 \tag{3} \\ &= \vec{\tau}_g \tag{4} \end{align}$$

We also have that:

$$\vec{\tau}_{net} = \frac{\vec{L}_{net}}{dt} \tag{5}$$