General procedure guidelines for the Cavendish experiment:

1.) Carefully remove the glass cover of the Cavendish balance and then measure the mass of both the large and small masses with an electronic balance.

2.) Verify that the smaller boom is at an equilibrium position such that an displacement in the small boom will not cause the smaller boom to hit either side of the glass. If the boom is not in *approximately* "center", then you can torque the boom clockwise or counter-clockwise with a small twist in the top screw. Please ask the TA before doing so.

3.) Press the record button. What happens when someone walks by?

4.) The first plan of action will be to observe what happens when the large boom is at a "middle" position. Begin recording data. You will see the damped cosine wave oscillating about an equilibrium angle. Note that the displacement caused by the large masses is approximately zero at this point, therefore in the notation of the manual $\boldsymbol{\theta_D \approx 0}$.

The angular frequency of a damped harmonic oscillator has the form:

$$\boldsymbol{\omega_0^2 = \omega_d^2 + b^2}$$

$$\boldsymbol{\Rightarrow \omega_d^2 = \omega_0^2 - b^2}$$

Where b is the damping constant of the $\frac{K}{I}$ system. Recall: $\boldsymbol{x(t) = x_0\, e^{-b\,t} \cos(\omega_d t)}$

But $\boldsymbol{\omega_0^2 = \frac{K}{I}}$ for some torsion constant K and the moment of inertial for the small boom with the small lead balls, and $\boldsymbol{\omega_d = \frac{2\,\pi}{T}}$ period of our simple harmonic motion. Therefore:

$$\boldsymbol{K = \left(\frac{4\,\pi^2}{T^2} + b^2\right)}$$

By fitting the damped harmonic function **x(t)** to your data, what do you find **b** to be? What is the reduced Chi-squared value for this particular value of **b**? Is it reasonable to throw it out? Why or why not?

5.) Set the booms at their maximum displacement angles using the static method and then find the corresponding $\boldsymbol{\theta_D}$. Follow the lab manual on how to find **G**, and don't forget to propagate your uncertainties through to find $\Delta \boldsymbol{G}$!