Experiment 2: Circular Motion

1. When you fit the “F vs R” data with Hookes’ law, what values did you find for the spring force constant, $k$, and the position where the spring is unstretched, $r_0$?

2. Do you think that your measurements support a claim that the spring obeys a simple Hookes’ law linear dependence of force on length? Explain why or why not.

3. When you fit the “R vs Omega” data with Eq. (1), what values did you obtain for $r_0$, $\omega_c$ and $\chi^2$?

4. Use your value of $k$ from data (see question 1) and the mass of 0.0085 kg (8.5 grams) to calculate the theoretical value of $\omega_c$. Does this calculated value agree with what you found by fitting the data (see question 3)?

(Questions continue on the back of this page)
5. Do you think that your measurements agree with the prediction of the shape of R vs Omega and the value of $\omega_c$ given by Eq. (1)? Explain why or why not.

6. In the table for R vs Omega, compare your largest value of $\omega$ to the critical value $\omega_c$. How close did you come to destroying your apparatus?

7. If you think about looking at the rotating mass from the side, we have considered the spring force and circular acceleration as both horizontal since we never included gravity in the calculation. However, there is also gravity pulling down on the mass but the mass is not accelerating downward so the spring force must have a small vertical component which means the spring cannot be exactly horizontal. On your homework, you calculated this angle and the expected distance of the center of the mass below the horizontal. Record those values here. Look carefully from the side at the mass when it is rotating slowly with a radius close to 5 cm. Judging by eye, does what you see seem consistent with what you calculated?

8. (Optional Question) On your plot for Force versus Radius, look closely at the fitted line at the point where the radius is equal to your fitted value of $r_0$. It will help to use the cursor control to expand the vertical scale a bit. Do you see any evidence that your spring has a non-zero initial tension?