Worksheet 11: Oscillations

Name: _____ **Due December 4, 2024**

Partner: _____ Pencil only: use of Pen is forbidden.

As usual, turn your Excel document into the Google drive. Plots should use the class template, AND have proper axis labels, rational sig-figs on the axes, labels, a good trendline, etc.

I. **Static measurement of vertical spring.**
Measure y for m = 100, 150, 200, … 400 g.
Plot y vs. m.

Quantity	Units	Result
Slope		±
Computed k		±

II. **Dynamic measurement of vertical spring.**
Measure 10T for m = 100, 150, 200, … 400 g.
Plot T^2 vs. m.

Quantity	Units	Result
Slope		±
Computed k		±

III. **Springs: dependence on amplitude.**
Measure 10T for various x_0.
Plot T vs. x_0.

Quantity	Units	Result
Intercept		±
Average T		±

• Compare the agreement of the values of k from parts I and II. Which result is more believable?

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• We normally wouldn't find the average of many values on a plot, like we did in part III. Why it reasonable for this particular plot? How well does the average agree with the intercept?

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IV. **Pendulum: dependence on length.**
Measure 10T for various L.
Plot T^2 vs. L.

Quantity	Units	Result
Slope		±
Computed g		±

V. **Pendulum: dependence on mass.**
Measure 10T for various m with L = 50 cm.
Plot T vs. m.

Quantity	Units	Result
Intercept		±
Average T		±
c_0 (from part VI)		±

VI. **Pendulum: dependence on amplitude.**
Measure 10T for various θ_0 with L = 50 cm.
Plot T vs. θ_0.
Using θ_0 in radians, fit $T = c_0 + c_1\theta_0 + c_2\theta_0^2$.

Quantity	Units	Result
c_0		±
c_2		±
c_2 / c_0		±
Expected c_2 / c_0		±

• How significant is either mass or amplitude when determining the period of a pendulum? Your answers should be numeric rather than merely descriptive.

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