Suite of Labs: Graphical Analysis

Introduction

The ability to interpret a relationship between variables graphically is one you will find useful in the study of physics. Fortunately for us, most all the physical phenomena we can measure fall into one of the following relationships between variables: none, direct, inverse, square, and square root. So, there are basically five shapes of graphs we will encounter in class (Refer to the "Graphical Methods Summary" sheet for more detail).

In this activity, you will visit a number of stations; at each you will have the chance to examine how a given variable responds to changes in another variable.

At each station you will:

1. Make a hypothesis, using the words in the "Written Relationship" column of the "Graphical Methods Summary" sheet. Replace "x" with the name of your independent variable and "y" with the name of your dependent variable for that station. Explain the reasoning behind your hypothesis.
2. Conduct your experiment. Set up a data table and record your data. Include units. Make sure your measurements have the correct number of significant figures. Include at least 6 data points per graph.
3. Input the data into LoggerPro using the correct units and significant figures. Use LoggerPro to make graphs and manipulate the data to find the best fit line. Write your equation for the graph that has the best fit line (don't forget the 5% rule for the y-intercept and units on your slope and y-intercept!). Print your data tables and graphs.
4. Write a conclusion, using the words in the "Written Relationship" column of the "Graphical Methods Summary" sheet. Compare this to your hypothesis.
5. Complete at least 3 stations to meet the standard.

Pick any Three Stations (Station 6 should be one to exceed the standard)

Station 1- Inertial Balance
Purpose: To determine the mathematical relationship between the number of added masses to the period of the balance.

Push the apparatus to the left or right. It will vibrate back and forth. The period is the amount of time for one complete cycle away from and back to its original position. Masses can be added to the holes.

Station 2- Simple Pendulum
Purpose: To determine the mathematical relationship between the period and the amplitude of a pendulum (angle to which the pendulum is pulled back).

Do not pull the pendulum back more than 30 degrees as the relationship starts to get more complicated! The period is the time for one complete cycle, a left swing and a right swing.

Station 3- G-Ball
Purpose: To determine the mathematical relationship between the time to fall and the drop height of a ball.

Press the button and hold it down. Release the ball (please drop it on to something soft!). The timer stops when the ball hits the ground.

Station 4- Plunger Cart and Ramp
Purpose: To determine the mathematical relationship between how far the plunger is depressed and the distance that the cart goes.

Put the plunger side of the cart against the barrier at the bottom of the ramp. Push the cart back and release.

Station 5-Syringe and Gas Pressure Sensor
Purpose: To determine the mathematical relationship between the pressure and the volume of air in a syringe.

Push in the plunger and read the pressure from the LabQuest screen. Do not press the plunger lower than 10ml.

***Station 6-Light Intensity Sensor (honors level)**
Purpose: To determine the mathematical relationship between distance and the intensity of a light source.

You will find this in the back room so that you can turn out the overhead lights and measure only the light from the given source.

Summative Assessment: Suite of Labs: Graphical Analysis

Name _____

Station #

_____ _____ _____

Hypothesis:

_____ _____ _____ makes an educated guess as to the result(s) (explains reasoning)
_____ _____ _____ clearly addresses the purpose statement

Data:

_____ _____ _____ is organized in a labeled table
_____ _____ _____ all numbers have units and correct significant figures
_____ _____ _____ includes a reasonable number of trials (at least 6 data points per graph)

Data Analysis:

_____ _____ _____ uses proper graphing techniques (title, labeled axes, units, sig figs, independent variable on x-axis, appropriate scales, best fit curve, etc)
_____ _____ _____ includes regression statistics and COR values for graphs, and (when appropriate) several different graphs to determine the best fit curve
_____ _____ _____ includes correct mathematical model of the graph w/ the curve best fitting the data (derivation of equation, units on slope and y intercept, variables are more descriptive than x and y, 5% rule)

Conclusion:

_____ _____ _____ relates to the purpose and is accurate as possible based upon the data available
_____ _____ _____ gives an explanation for results that differ from what is expected (both from your hypothesis and research you have done)

Final Grade _____/30 X100 = _____

Technology Rubric _____

Criteria	4 Exceeds the Standard	3 Meets the Standard	2 Partially Meets the Standard	1 Does Not Meet the Standard
Selection of Digital Tools	Independently evaluates, selects, and supports the choice of a certain device or software product, based on specific hardware or software features and appropriateness to task.	Independently evaluates, selects, and supports a choice of a certain device or software product based on appropriateness to task.	Requires assistance to evaluate, select, and support a choice of a certain device or software product based on appropriateness to task.	Does not evaluate, select, and support a choice or preference for a certain device or software product appropriate to the task.
Application of Digital Tools	Uses digital tool(s) with advanced proficiency to arrive at a correct solution or create a product according to assignment expectations.	Uses digital tool(s) effectively to arrive at a correct solution or create a product according to assignment expectations.	Uses digital tool(s) with moderate success to arrive at a solution or create a product according to assignment expectations.	Does not use digital tool(s) to arrive at a solution or create a product according to assignment expectations.