**PHYS211 Spreadsheet & Graphing**

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    Partner(s):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Experiments in physics involve data collection and analysis. Throughout the semester we will use excel spreadsheet program for data analysis and graphing. In this lab you will be introduced to tabulation of data, calculating new variables, and graphing using Excel.

***A. Tabulation of data and Calculating values for a new variable: Area = Length X Width.***

1. Enter the following length and width data in the excel spreadsheet program. Please note that the first raw is used for titles and their units. It is customary to put units in parenthesis.

|  |  |
| --- | --- |
| **Length (cm)** | **Width (cm)** |
| 5.12 | 4.30 |
| 2.54 | 2.33 |
| 15.1 | 10.5 |
| 25.2 | 20.7 |
| 30.5 | 25.3 |
| 175 | 155 |
| 16.5 | 14.5 |
| 54.7 | 49.7 |
| 5.44 | 4.56 |

2. Title the third column as Area with its units.

3. Enter the formula to calculate the area in cell C2 as,  =A2\*B2, and enter. Go back to cell C2 and move the mouse to the lower right corner until the white plus becomes a black plus. At this point click and drag down the mouse until cell C10 is highlighted and then release the mouse. Now the calculated area is displayed in the third column, C.

4. Insert your completed data table, below.

***B. Graphing Data***

Here you will enter some temperatures in degrees Celsius, convert the temperature to degrees Fahrenheit using this <https://www.convert-me.com/en/convert/temperature/>

and graph Tf versus Tc.

1. Start with a blank page in excel and title the first column as Tc (0C) and the second column as Tf (0F).  Enter the following temperatures in degrees Celsius in the first column: -40, -20, 0, 20, 40, 60, 80, 100, 120, 140, 160, and 180.

2. Convert the above temperatures to degrees Fahrenheit using this <https://www.convert-me.com/en/convert/temperature/>

and enter their values in the second column.

3. Graph Tf versus Tc: Tf on Y-axis and Tc on X-axis, and obtain the temperature conversion equation from the data fit.

 Temperature conversion equation:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. Insert your plot.

5. Now you will plot Tc versus Tf: Tc on Y-axis and Tf on X-axis, and obtain the temperature conversion equation from the data fit.

 Temperature conversion equation:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Insert your plot.

***C. Graphing Exercises***

1. The force, F as a function of distance, Z is given below, where k and F0 are constants.

**F = kz + F0**.

|  |  |
| --- | --- |
| **Z (m)** | **F (N)** |
| 0.5 | 7.5 |
| 1.0 | 12 |
| 1.5 | 17 |
| 2.0 | 21.5 |
| 2.5 | 24 |
| 3.0 | 30 |
| 3.5 | 32 |
| 4.0 | 37 |

Plot the above data points (F versus Z) to obtain a linear graph and determine k and F0 from the graph. Include units for k and F0.

k = \_\_\_\_\_\_\_\_\_\_\_\_\_\_            F0 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Insert your graph.

2. The distance, s as a function of time, t is given below, where *a* and *b* are constants.

                          s = a t2 + b

|  |  |
| --- | --- |
| **t (s)** | **s (m)** |
| 0 | 1 |
| 1 | 3 |
| 2 | 9 |
| 3 | 19 |
| 4 | 33 |
| 5 | 51 |
| 6 | 73 |
| 7 | 99 |

Plot s versus t. Your graph should be a curve. Add a 2nd order polynomial trendline and determine *a* and *b* from the displayed equation. Include units for *a* and *b*. Insert your graph.

*a* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    *b* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

To get a linear graph, you need to plot s versus t2. Create t2 in the 3rd column, plot s versus t2, and obtain a and b from the graph. Include units for a and b. Insert your graph.

*a* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    *b* = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. The emf, e in millivolt, of a thermocouple operating between a bath at temperature T and an ice water standard is given by;

 e = AT + BT2, where A and B are constants.

|  |  |
| --- | --- |
| **T (0C)**  | **e (mV)** |
| 0 | 0 |
| 10 | 0.8 |
| 20 | 2.6 |
| 30 | 5.4 |
| 40 | 9.2 |
| 50 | 14.0 |
| 60 | 19.8 |
| 70 | 26.6 |
| 80 | 34.4 |

Enter the above data and plot e versus T. Your graph should be a curve. Add an appropriate trendline and determine A and B from the displayed equation. Include units for A and B. Insert your graph.

A = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    B = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. The period, T as a function of mass, m is given by the following equation; where k is a constant.



|  |  |
| --- | --- |
| **m (kg)** | **T (s)** |
| 0.1 | 0.39 |
| 0.2 | 0.56 |
| 0.3 | 0.69 |
| 0.4 | 0.78 |
| 0.5 | 0.88 |
| 1.0 | 1.25 |
| 1.5 | 1.54 |
| 2.0 | 1.78 |
| 3.0 | 2.16 |
| 4.0 | 2.50 |
| 5.0 | 2.79 |

Plot T versus m, add a power trend line, and determine the coefficient of the power fit. Insert your graph.
 Coefficient of the power fit = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Using the above coefficient of the power fit calculate the value of k. k = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Plot a linear graph, and determine the slope, and then determine the constant k. Insert your graph.

 Slope = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    k = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**C**. **Write an overall Conclusion**