DATA ANALYSIS

LEARNING GOALS

- Students will be able to take a set of experimental data, determine the equation that describes the data and compare the experimental equation to theory

GENERAL PROCESS

The **straightening the graph technique** involves the following steps:

a) Graph the raw data. Use this graph to guess the type of relationship (e.g. E α x^2 or E α $\sqrt[2]{v}$, etc)
b) Use your guess to create a new data table, as in the previous examples. Graph the new data.
c) If the graph is straight, your guess was right. Use y=mx+b to determine the equation for your data but remember to replace *x* and *y* with the **variables** on the x and y axis and include **units**. If the graph is not straight, your guess was wrong and you have to guess again.

The goal is to manipulate the data in order to get a straight graph. Once you have a straight graph, you know that the relationship you have guessed is correct and you can find the equation for the data from your graph.

LAB EXAMPLE: ACCELERATION & MASS

An experiment will be performed to determine the relationship between the mass of a cart and its acceleration when the force is kept constant.

Data:

1. Set up the equipment as shown.
2. Measure the mass of the cart: _____ g = _____ kg
3. Hang a 100.0 g mass from the end of the rope. Carefully release the cart.
4. Use the slope of the v-t graph to determine the acceleration.
5. Add a 500 g block to the cart and repeat.
6. Repeat for several masses

Total Mass (kg) ± _____ (x-variable)					
Acceleration (m/s^2) ± _____ (y-variable)					

Analysis:

1. Use the straightening the graph technique to determine the equation that describes this relationship. Follow the steps above and sketch your graphs on the next page

Raw Data Graph Straightened Graph

2. The force is provided by the 100.0 g mass. Calculate the force (i.e. force of gravity) that this mass provides:

Comparing to Theory:

Newton's 2nd Law gives the accepted relationship between acceleration and mass of a moving object: $\vec{a} = \frac{\vec{F}_{net}}{m}$.

1. Based on the theory, what should the constant of proportionality have been?

2. Was your experimental constant of proportionality larger or smaller than the theoretical one? Why is this?

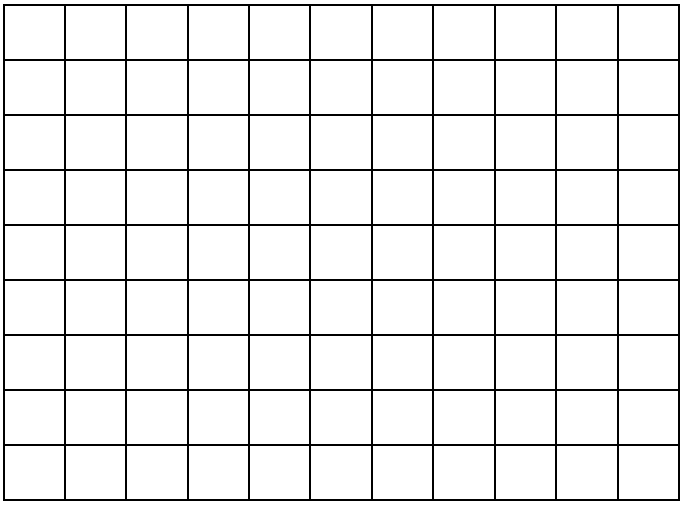
3. Determine the percent deviation between your constant of proportionality and the theoretical constant.

4. List and quantify sources of experimental uncertainty in this lab.

EXTRA PRACTICE

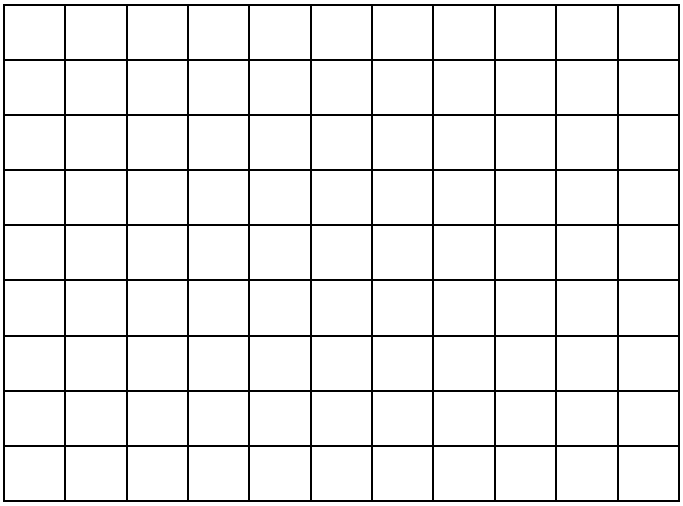
Graph the following data on the grid provided.

Distance (m)	Time (s)
1.0	0.63
5.0	1.4
10.	2.0
20.	2.8



What type of relationship does it appear to be? _____

Based on the previous example, fill in the data table below. (Remember – you only manipulate the **x-values.**)



Find the equation for your straight line. Replace *x* and *y* with the **variables** on the x and y axis. Don't forget units.