Physics   Name _____
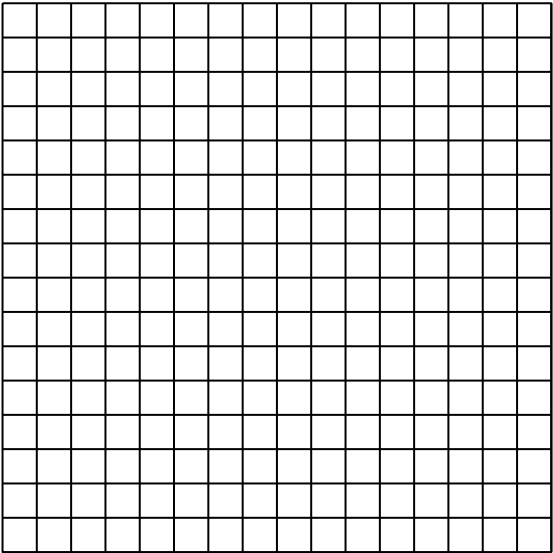Vaughan

Interpreting Graphs

Part 1: Graph all four sets of data and answer the questions on the next page.
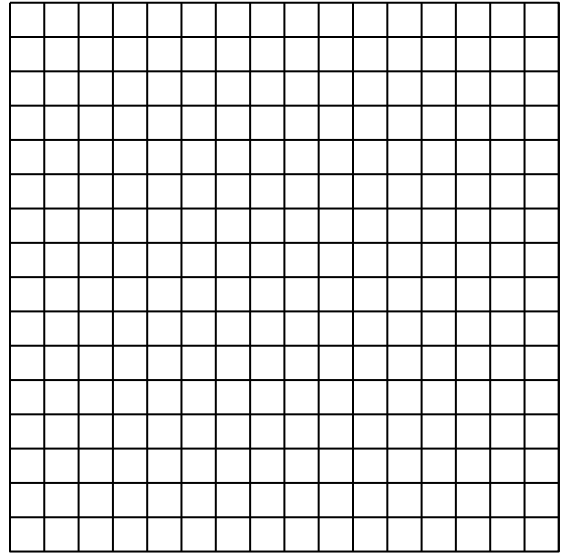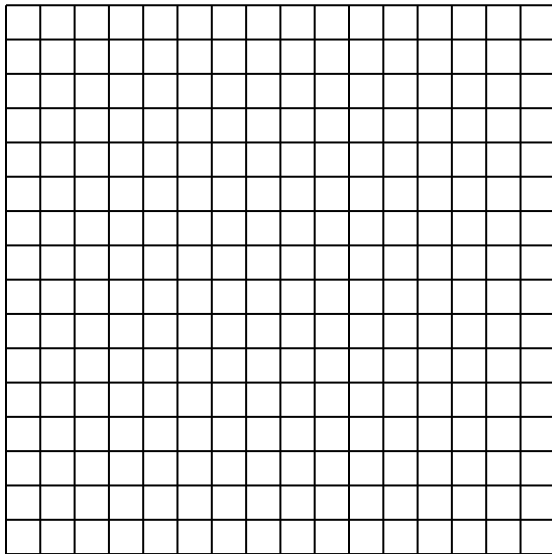
Graph A			Graph B	
Voltage (volts)	Current (amps)		velocity (m/s)	energy (Joules)
1	3		0	0
2	6		1	2
3	9		2	8
4	12		3	18
5	15		4	32

	Graph C
Time (s)	Position (m)
0	2
1	5
2	6
3	3
4	2

	Graph D
frequency (Hz)	wavelength (m)
10	80
20	40
30	27
40	20
50	16

1) Which graph shows a direct relationship between the variables? _____

2) Which graph has the general equation of $y=kx^2$? _____

3) Which graph is a hyperbola? _____

4) Which graph is not a simple relationship? _____

5) Which graph shows an inverse relationship? _____

6) Use graph B to interpolate the energy when the velocity is 2.5 m/s. _____

7) Use graph A to extrapolate the current when the voltage is 8 volts. _____

8) What is the difference between interpolation and extrapolation?

_____

_____

Part 2: The data below was collected by measuring the distance traveled by an object over a period of time. Plot the data.

time (s)	distance (m)
0	0
1	3
2	12
3	27
4	48
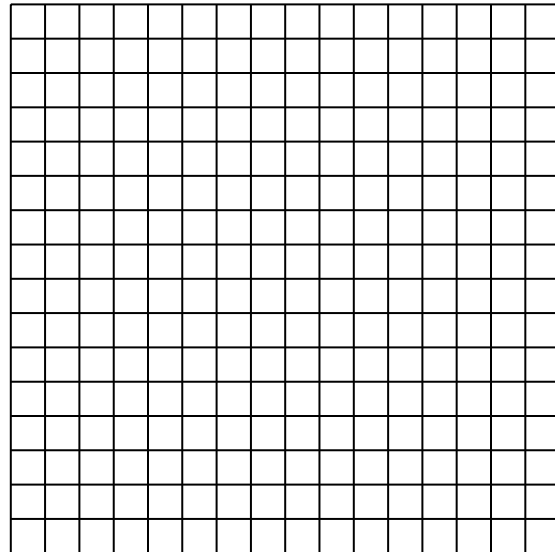
a) What seems to be the relationship between time and distance? Write an equation for the relationship using d for distance, t for time and k for the constant

_____

b) Is the distance traveled between 0 and 1 s or 3 s and 4 s greater? _____

c) What is happening to the slope of the line as time increases? _____

d) There is no one "slope of the line" for the relationship above but we can find the "instantaneous slope," which is the slope at any one point.

- To do this, you need to draw a tangent line to the curve at the point where you want to know the slope. A tangent line is a line that will touch the curve only at one point. The instantaneous slope at a point is the slope of the tangent line at that point. **Find the instantaneous slope at a time of 2 seconds. Be sure to show your plug in and answer with units.**

What physical quantity does the slope represent? (Use the units to find out)

Part 3: Straightening the Curve

When the relationship between two variables is non-linear, the graph of the data will be a curve. Straightening the curve is the name of a method that can be used to determine exactly the equation of the non-linear relationship. Let's look at an example in order to illustrate this tool.

In Part 1, Graph B had a squared relationship that could fit into the general form of $y = kx^2$. How did we know this? When compared to graphs of our known relationships, that is the one it most looked like. In other words, we guessed.

Step 1: Plot the original points (We have done this already).

Step 2: Guess which of the general relationships the plot most resembles. (Look at the shape of the graph and see which type of graph this shape best represents).

What does $y = kx^2$ really mean? It means that the dependant variable (y) is directly proportional to the *square* of the independent variable (x).

Therefore, a straight-line graph should be produced if we plot y versus x^2!

To test this, we will make a new column on our data table that will contain the squared values of the original x data, which you will do on the next page.

If our guess was that our original graph was a hyperbola/inverse relationship, a straight line should result if we plot y vs 1/x. Therefore, we need to create a new column of decimal values for 1/x to plot on the horizontal axis of a new graph.

Step 3: Create a new data column. This data column will contain the changed values of the independent variable's data. We will always change ONLY the data that is plotted on the HORIZONTAL AXIS.

Step 4: Plot the new data. If the data comes out as a linear relationship, you guessed right! If not, you guessed wrong and you need to try again (go back to step 2).

	Graph B	
velocity (m/s)		energy (Joules)
0		0
1		2
2		8
3		18
4		32
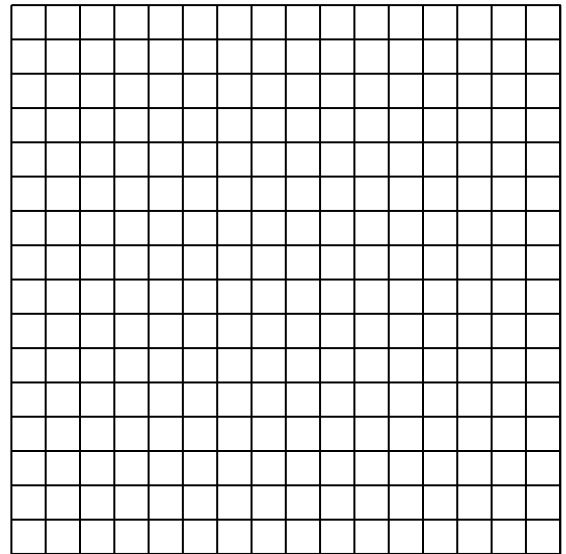
Step 5: Find the value and units of the constant of proportionality.

To determine the value of the constant or proportionality, find the slope of the straightened line. Use the units of the dependant variable and the changed independent variable to find the units of the constant. Show this calculation below. Be sure to plug in your units on your calculation and have units for your answer.

Write the exact equation for this set of data. (If you want to clean up the units on the constant of proportionality, here's a hint: 1 Joule = 1 kg*m^2/s^2)

Find the exact equation for the relationship given by this set of data below.

Mass (kg)	Time (s)
0.1	0.44
0.5	0.99
0.9	1.32
1.5	1.71
1.8	1.87
2.3	2.12