Physics I Honors; Mr. Flint Name _____ Period ____

Interpreting Graphs

In laboratory investigations, you generally control one variable (the independent variable) and measure the effect it has on another variable (the dependent variable) while holding all other factors constant. For example, you might measure the force required to make a cart accelerate at different rates while you keep its mass constant. After the data are collected, you then make a graph of acceleration versus force using techniques for good graphing.

There are three mathematical relationships that show up all the time in natural phenomena. If the dependent variable on the *x* axis varies directly with the independent variable on the *y* axis, the graph will be a straight line as shown in graph **A**. If *y* varies inversely with *x*, the graph will be a hyperbola as shown in graph **B**. The third relationship, in which *y* varies directly with the square of *x*, gives a parabola as shown in graph **C**.

Sometimes you need information about a value that you have not determined experimentally. Reading from the graph between points is called *interpolation*. Reading from a graph beyond the limits of your experimentally determined data points is called *extrapolation*. Extrapolation must be used with caution because you cannot be sure that the relationship between the variables remains the same beyond the limits of your investigation.

Think about these…

1.) Suppose you recorded the following data during a study of the relationship of force and acceleration. Prepare a graph showing these data and attach it to this paper. Use the "How to Graph Scientific Data" guide. Your data may not be perfectly linear. Never "connect the dots"—use a line or curve of best fit instead.

Acceleration (m/s^2)	Force (N)
0	0.0
1	6.0
2	12.5
3	19.0
4	25.0
5	31.5
6	37.0

The first data column is always the independent variable and is plotted on the x–axis. The second data column is always the dependent variable and is plotted on the y–axis.

Make the y–axis of your graph extend to at least 45 N.

a.) Describe the relationship between force and acceleration as shown on your graph.

b.) Calculate the slope of your graph. The formula for slope is on your Formula Card. Remember to include units with your slope.

c.) The unit for the slope of line lets you learn about another physical quantity (physical measurement). The unit for force in this exercise is the Newton and 1 N = 1 kg m/s^2. What physical quantity does your slope represent?

d.) Write the equation for the line of best fit you have from your graph. Use the slope–intercept form of a linear equation written as $y=mx + b$ where m is the slope of the line and b is the y–intercept for the line.

e.) What is the value of the force when the acceleration is 4.3 m/s^2?

f.) What is the value for the acceleration when the force is 42 N?

2.) The following data show the distance an object travels in certain time periods. Prepare a graph showing these data on a separate sheet of graph paper and attach it to this page.

Time (s)	Distance (m)
0	0.0
1	1.6
2	5.8
3	13.1
4	23.2
5	35.8
6	52.4

Remember that you should draw a line or curve of best fit instead of "connecting the dots."

a.) Describe the relationship between x and y and write a general equation for the curve

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

c.) Is the slope of the tangent to the curve greater between 1 s and 2 s or between 4 s and 5 s?