Fit A Bit

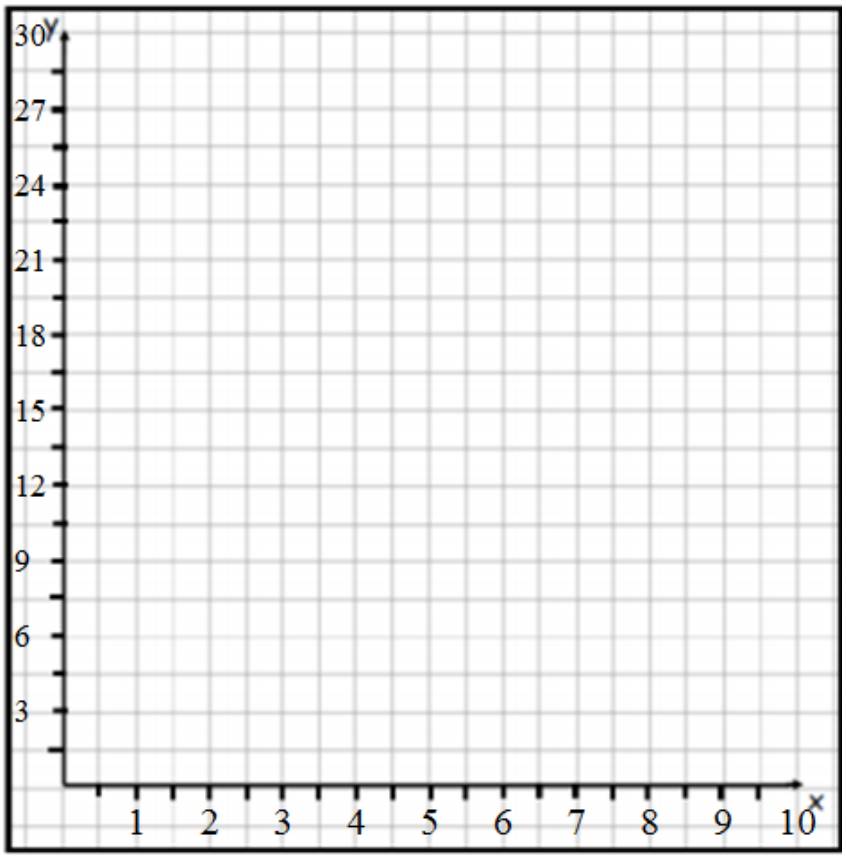
In Physics this school year we will often seek to understand the relationship between two variables – both with a graph and an equation. This exercise will help you out all year with labs, test questions, and deeper understanding of God's handiwork in our world.

Part 1

Goal: To determine the relationship between the data set of x and y:

x	y
2	6
3	9
5	15
9	27

1. In order to graph effectively, you always need to keep your scale consistent for the x-axis and consistent for the y-axis. This little tutorial will help you understand how to do this:
    a. Look at the x values above. They start at 2 and end at 9. This means you want your x-axis to go far enough to be able to graph those values while having even spacing in between. In order to use most of the graph, we will use every two spaces as one unit. (See the x-axis values below)
    b. Look at the y values above. They start at 6 and end at 27. This means we want our y-axis to go up to about 30. Again in order to use most of the graph, we will use every two spaces as three units. (See the y-axis values below)
    c. Graph the values above on the axes below.



2. Using a ruler or a straight-edge, draw a best-fit line through the maximum amount of points. DO NOT CONNECT THE DOTS!!!

3. If a linear graph fits much of the data, then the relationship between x and y is directly proportional which means the equation is y = kx, where k is a constant.

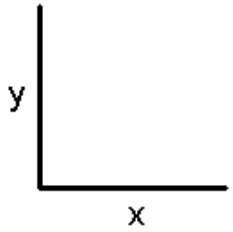
Is the relationship of the data linear?_____

4. Calculate the slope of your graph using the rise from one point that your best-fit line goes through divided by another point that your best-fit line goes through. This slope is your k value. Place your slope in the space provided below for your equation.

$$Slope = M = \frac{Rise}{Run} = \frac{Y_2 - Y_1}{X_2 - X_1}$$

Equation for your data: **y = _____ x**

Sketch what a linear graph looks like:

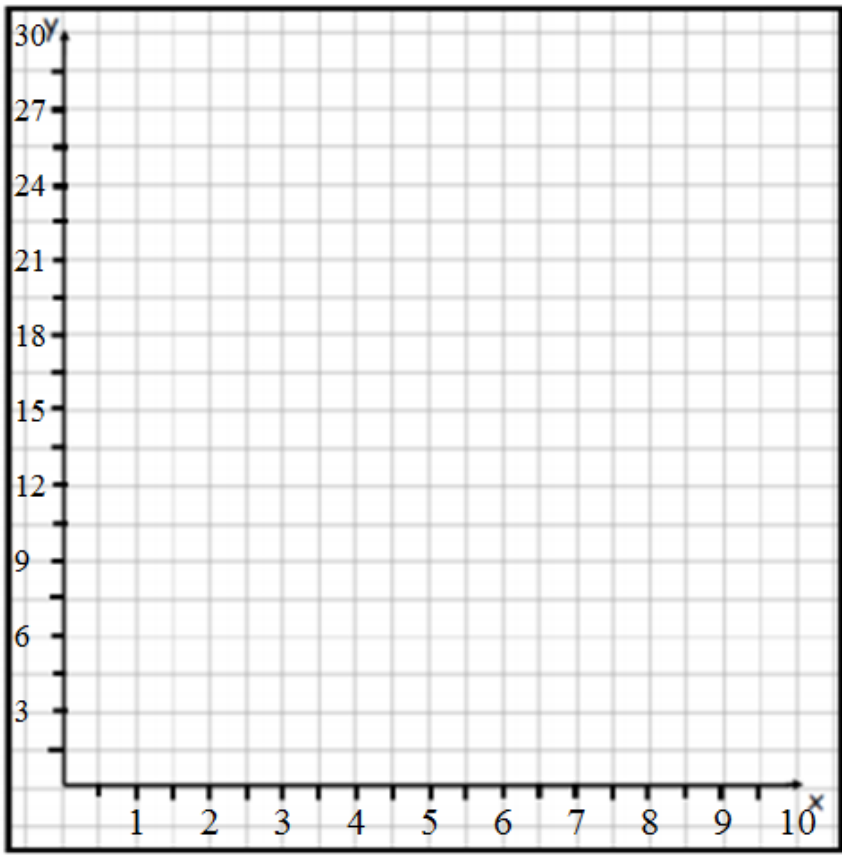


Part 2

Goal: To determine the relationship between the data set of x and y:

x	y
2	24
3	16
4	12
8	6
12	4

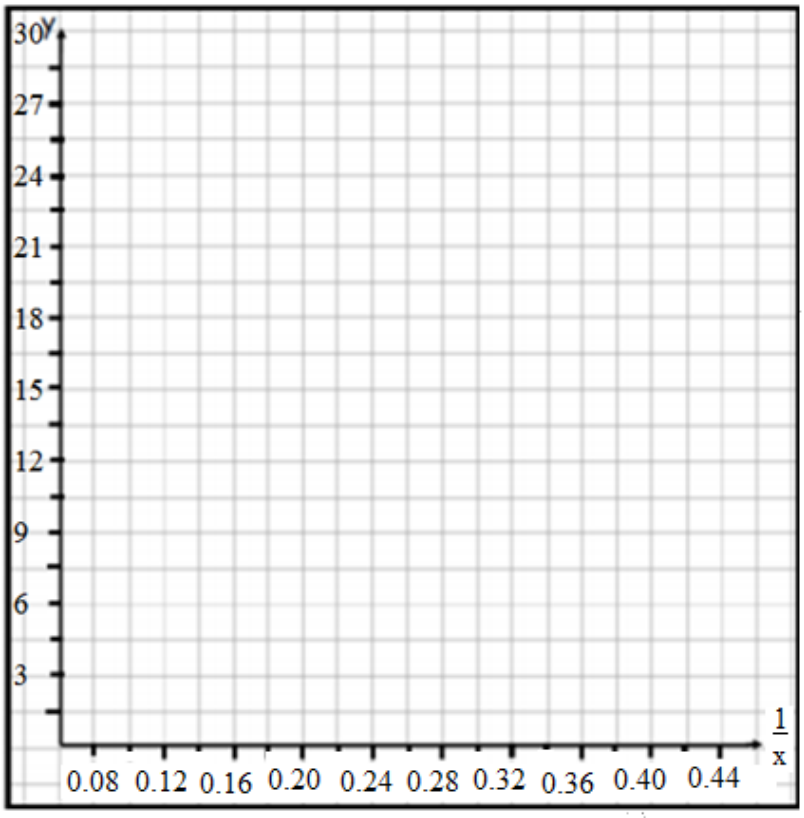
1. Graph your data below.



Is the relationship of the data linear?_____

2. If data is not linear and is showing a decrease in the dependent variable (y) as the independent variable increases (x), then it may be an inverse relationship.
3. To determine if this relationship is inversely proportional, we have to look at our data in a different way. We call this **linearization**. In order to do this, we want to manipulate our x data (independent variable) to 1/x or 1 divided by x. In the table below, take all of your x-values and in your calculator take 1 divided by that value or use the x^{-1} button to do (x value)$^{-1}$. As an example, for the first point you would take 1/2 or 2^{-1} on your calculator and put the result 0.5 in your table. Keep going for every x-value in your table.

x	1/x	y
2	0.50	24
3		16
4		12
8		6
12		4



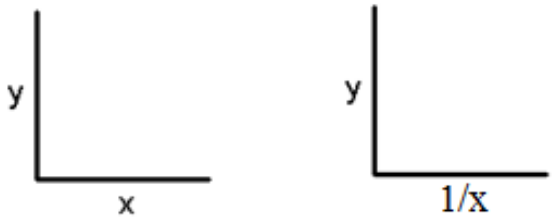
4. Now graph the new 1/x values on the x-axis and the y-values on the y-axis. If the data comes out linear, then your data set was inversely proportional, draw a best-fit line, and calculate the slope of your data. Place your slope in the space provided below for your equation.

What type of relationship was this data?_____

Write the equation of your data by filling in two spaces in the equation below. The first space will be the slope of the linear graph and the second space will be what you did to your x data to get it linearized.

y = _____ (1/x)

Sketch the initial graph of an inversely proportional relationship and the final graph you got after the graph was linearized.



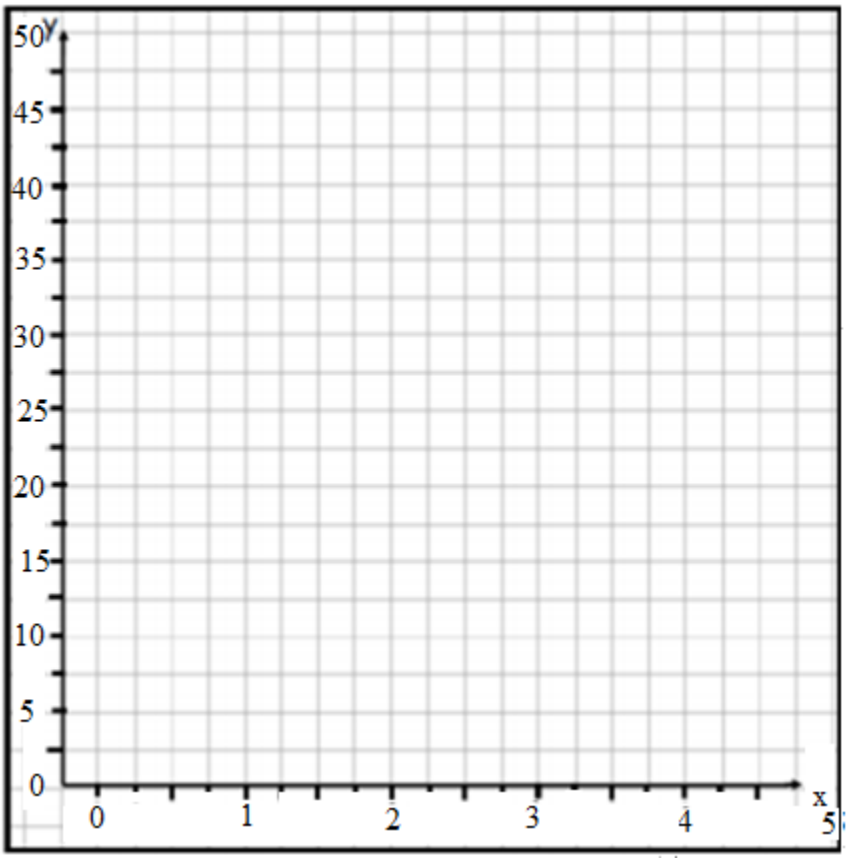
Initial Graph **Final Graph**

Part 3

Goal: To determine the relationship between the data set of x and y:

x	y
0	0
1	2
2	8
3	18
4	32
5	50

1. Graph your data below.

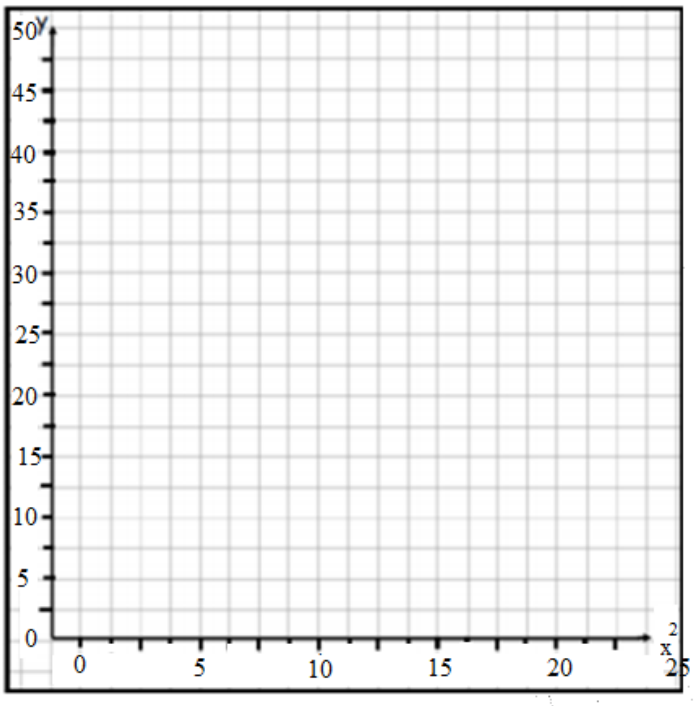


Is the relationship of the data linear?_____

2. If data is not linear and is showing a greater and greater increase in the dependent variable (y) as the independent variable increases (x), then it may be a quadratic (or squared) relationship.
3. To determine if this relationship is quadratic, we must again try to linearize. Let's take the x-data and square each value and place it in the table below.

x	x^2	y
0	0	0
1		2
2		8
3		18
4		32
5		50

4. Now graph the new x^2 values on the x-axis and the y-values on the y-axis. If the data comes out linear, then your data set was quadratic, draw a best-fit line, and calculate the slope of your data. Place your slope in the space provided below for your equation.

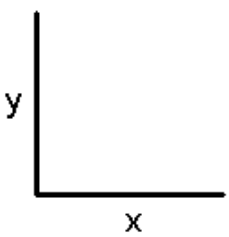


What type of relationship was this data?_____

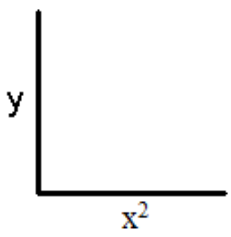
Write the equation of your data by filling in two spaces in the equation below. The first space will be the slope and the second space will be what you did to your x data to get it linearized.

y = _____ x^2

Sketch the initial graph of an inversely proportional relationship and the final graph you got after the graph was linearized.

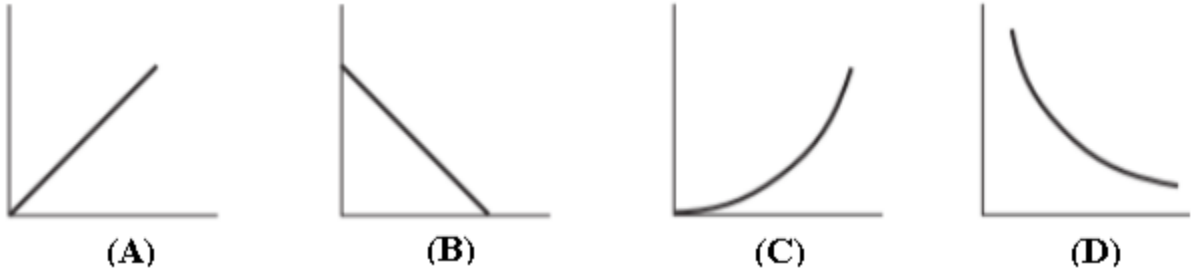


Initial Graph



Final Graph

Fit A Bit - Graphing Activity Self Assessment



1. Which graph above would be considered directly proportional?
2. Which graph above would be considered inversely proportional?
3. Which graph above would be considered a quadratic or a squared relationship?

4. Which graph above would be linearized by graphing the x-data as 1/x?
5. Which graph above would not need linearization?
6. Which graph above would be linearized by graphing the x-data as x^2?

7. Which graph above would best show the relationship between **d** and **t** in the equation:

$$\boldsymbol{d} = v \cdot \boldsymbol{t}$$

8. Which graph above would best show the relationship between **P** and **V** in the equation:

$$\boldsymbol{P} = k \cdot \frac{1}{\boldsymbol{V}}$$

9. Which graph above would best show the relationship between **a** and **m** in the equation:

$$\boldsymbol{a} = \frac{Fnet}{\boldsymbol{m}}$$

10. Which graph above would best show the relationship between **K** and **v** in the equation:

$$\boldsymbol{K} = \frac{1}{2} m \cdot \boldsymbol{v^2}$$