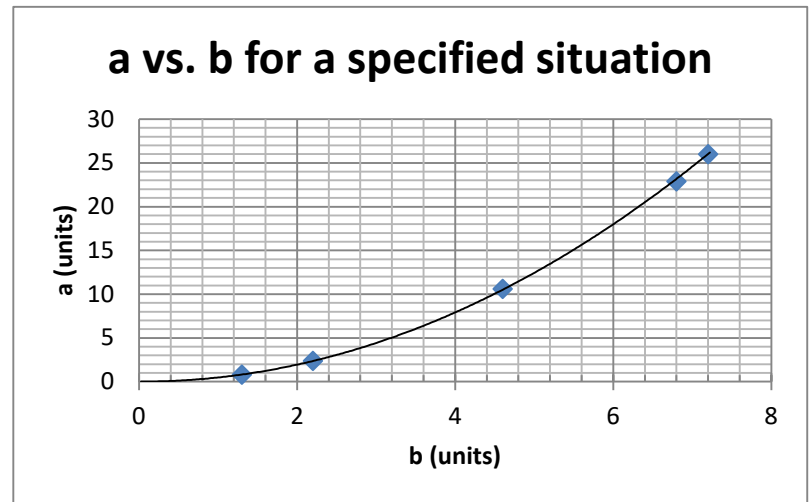


IB Physics

Summary of Steps in Graphical Data Analysis

Step 1: Graph the data! Plot a graph of the independent variable (x axis) vs. the dependent variable (y axis). Make sure you include all of the components that a scientific graph should have (i.e. descriptive title, labeled axes, units, scientific symbols for variables, appropriate scale, etc...). Draw a line (it may be a straight line or a curve) of best fit that best approximates your data. For discussion purposes we will use this set of data.

a (units)	b (units)
0.8	1.3
2.4	2.2
10.6	4.6
22.9	6.8
26.0	7.2



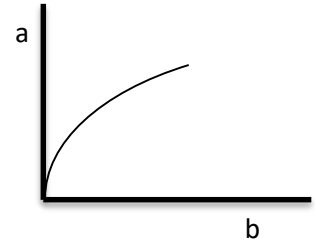
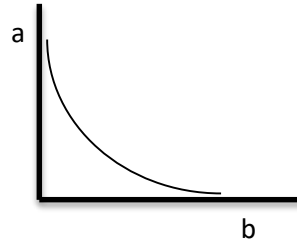
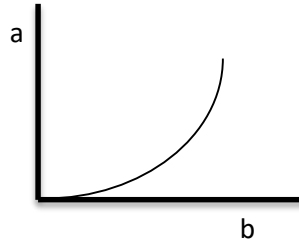
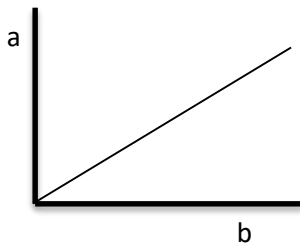
Step 2: Examine the Shape of the Graph! For us there are 4 possible shapes:

a) Linear

b) exponential

c) inverse

d) Root



Step 3: Determine the proportionality statement!

(The symbol \propto means “proportional to”)

a) Linear relationship: a is directly proportional to b. Written as $a \propto b$

b) Exponential relationship: a is directly proportional to b^2 or b^3 or b^n . Written as $a \propto b^n$ where $n > 1$

c) Inverse relationship: a is directly proportional to b^{-1} or b^{-2} or b^n . Written as $a \propto b^n$ where $n \leq -1$

d) Root relationship: a is directly proportional to $b^{0.1}$ or $b^{0.5}$ or b^n . Written as $a \propto b^n$ where $0 < n < 1$

***** If you are dealing with a linear relationship then move on to step 6. Otherwise continue on...*****

Step 4: Based on the relationship determined in step 3 create a new table of values. For our example we have a rising curve (or exponential relationship). Therefore we know that the proportionality statement is

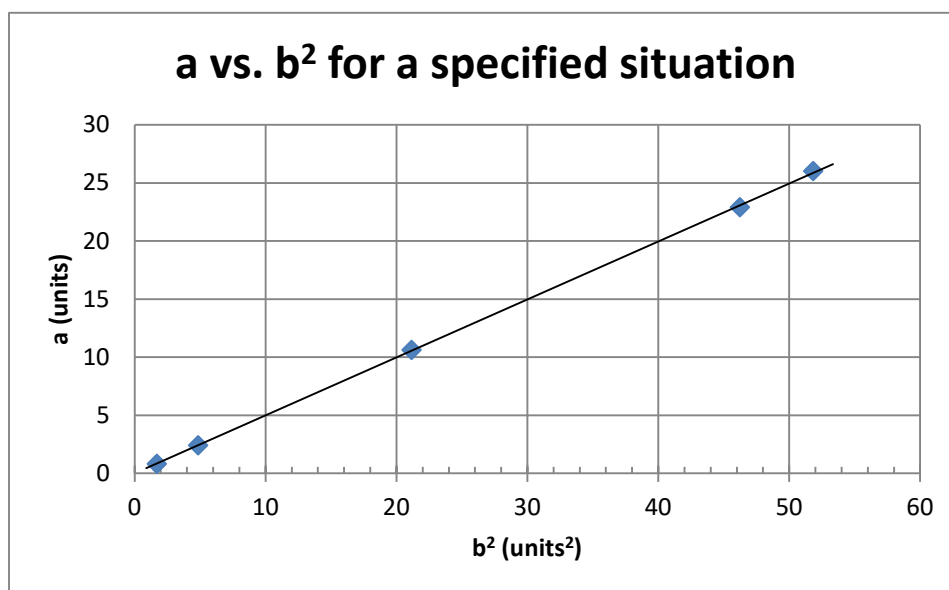
IB Physics

$a \propto b^n$ where $n > 1$, but we want to determine whether n is 1, 2, 3 or 53. So we will start with $n = 2$. Therefore our new table of values will include b^2 .

a (units)	b (units)	b^2 (units ²)
0.8	1.3	1.7
2.4	2.2	4.8
10.6	4.6	21.2
22.9	6.8	46.2
26	7.2	51.8

Step 5: Graph the New Data. In our example we would graph a vs. b^2 . If we find that the new graph of a vs. b^2 is a straight line going through the origin then we can conclude that the correct proportionality statement is $a \propto b^2$, or that $n = 2$! We can move on to step 6.

However, if the new graph is still a curve or it does not go through the origin then we must try $n = 3$. And if that doesn't work we need to try $n = 4$. And so on until we get the correct proportionality.



Step 6: Transform the proportionality statement into an equation. Suppose you conclude that $a \propto b^2$, then the corresponding equation would be $a = kb^2$, where k is a constant number (e.g. $a = 2.5b^2$ or $a = 0.7b^2$, etc...). How do we determine the value of k ? It is equal to the slope of the straight line graph from step 5! In our example from above the slope of the a vs. b^2 graph is 0.5. Therefore we can conclude that the relationship between a and b is $a = 0.5b^2$.