LSRL - Least Squares Regression Line

ALWAYS add the predicting hat

More on this shortly

$$\hat{y} = a + bx$$

y-intercept

slope

Use the context of the problems and write words in place of y and x.

The TI has selections for both versions of the equation (for reasons we need not discuss here). We tend to favor the one that is easiest to find on the menu but either is OK

$$\hat{y} = ax + b$$

slope

y-intercept

Use your calculator to find the LSRL-

- Put data in L_1 and L_2. Stat → Calc → 8. LinReg(a + bx) → L_1, L_2, Y_1
- Note: Make sure your diagnostics are on: 2nd → Catalog → Scroll down to Diagnostics On → Enter
- Y_1: Vars → Y-Vars → 1. Function → Y_1

LSRL - Least Squares Regression Line

$$\hat{y} = a + bx$$

y-intercept

slope

You must be able to interpret the slope and y-intercept IN CONTEXT!!!

Slope: For every increase of one (unit) in (context of x), there is an predicted average (increase, decrease) in (context of y) of (slope)(units).

Example: y = height of a plant in cm, x = age in months, where $\hat{y}$ = 1.2 + 2.3x
For every additional month, there is a predicted average increase in the plant's height of 2.3 cm.

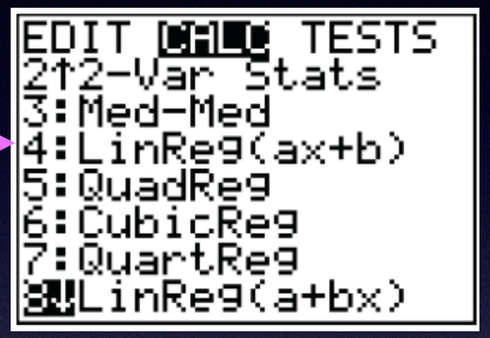
***y*-intercept:** When the (context of x) is 0 (unit), I would predict that the (context of y) would be (y-intercept).

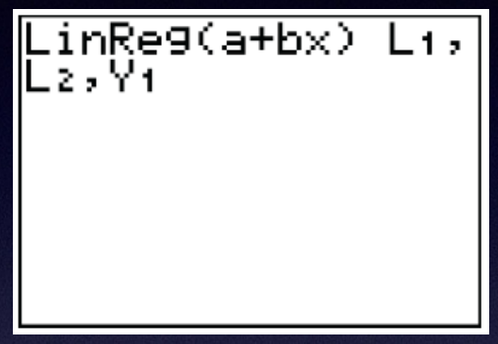
Example: y = height of a plant in cm, x = age in months, where $\hat{y}$ = 1.2 + 2.3x
When the plant is 0 months old, I would predict that the height would be 1.2cm.

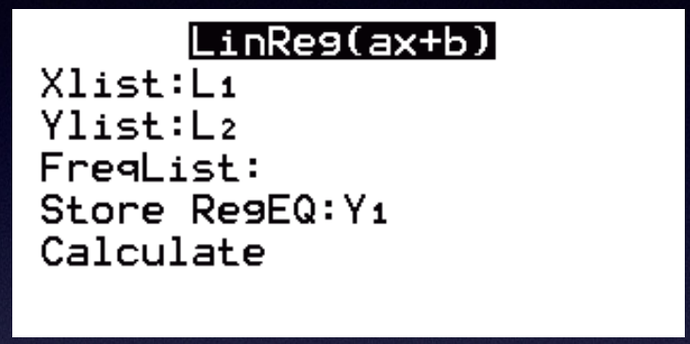
Remember the y-intercept may not be a meaningful value, like this one - recognize **extrapolation.**

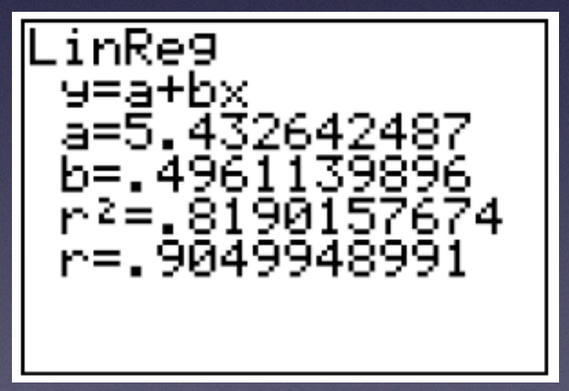
How to find the LSRL

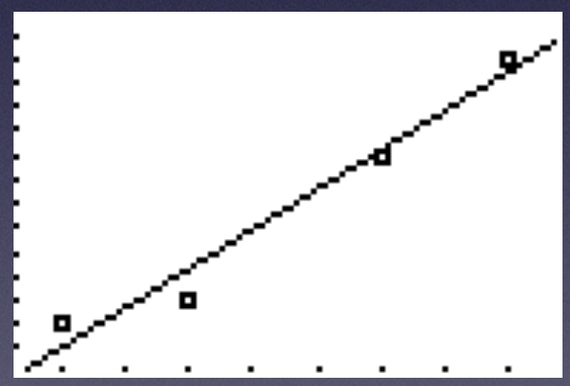
Or this one. Either is fine







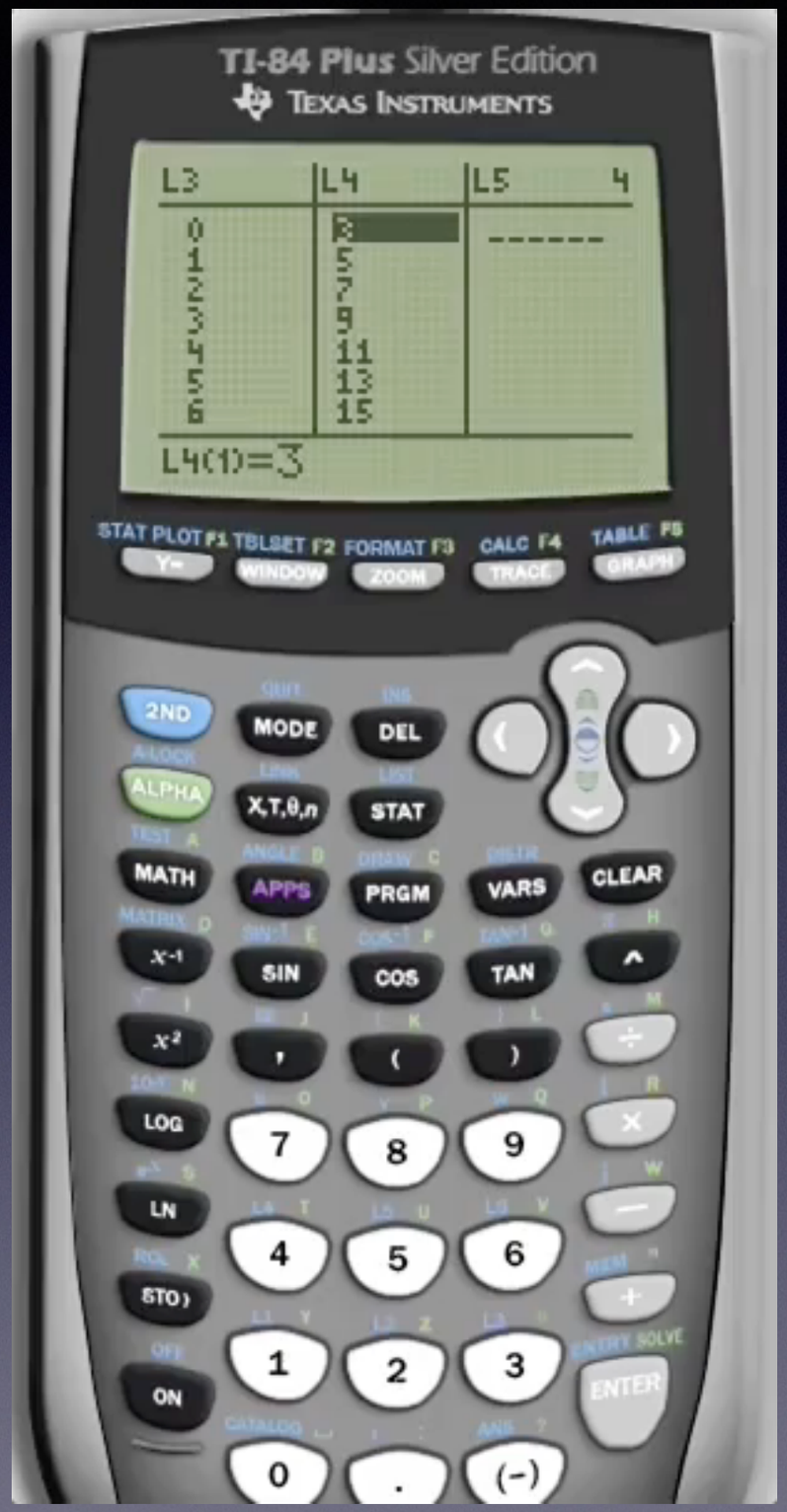




Let's see it done on the calculator

Here we will see L_3 represent the x variable and L_4 represent y

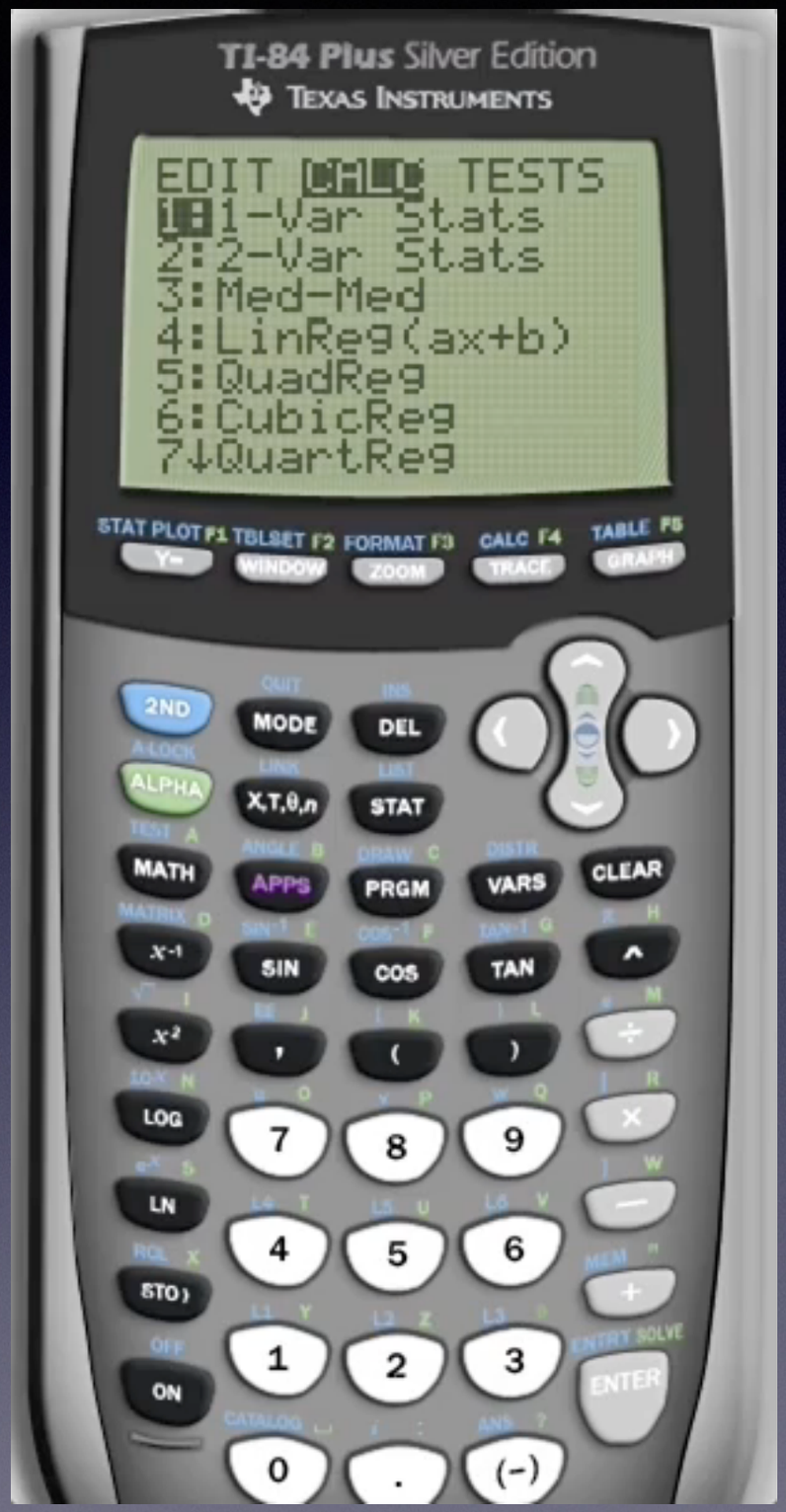
These are just points on the line $y = 2x + 3$



How do we find and graph the LSRL? → $\hat{y} = a + bx$

These are just points on the line $y = 2x + 3$

Notice the value of *r*

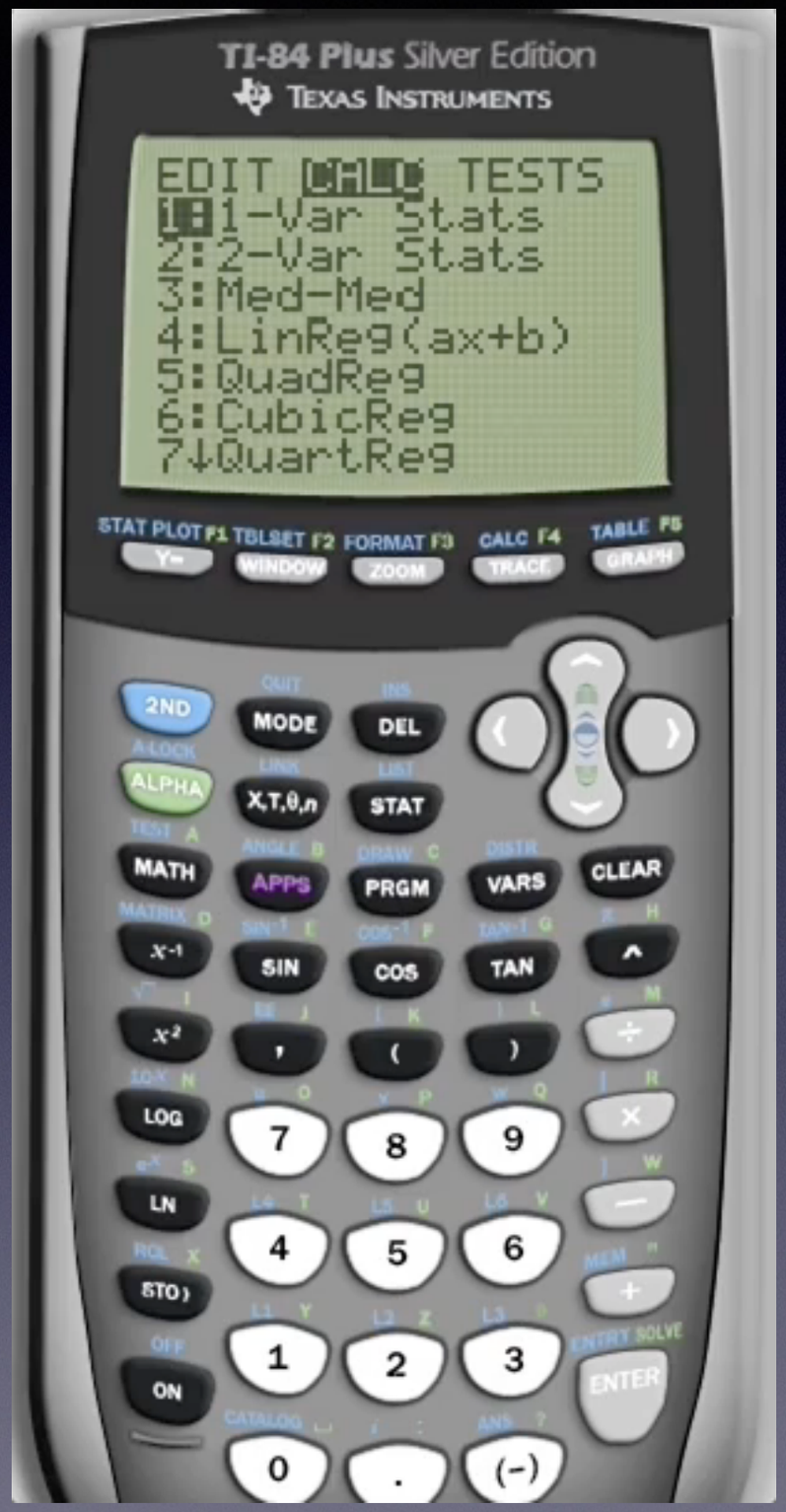


How do we find and graph the LSRL? → $\hat{y} = a + bx$

These are just points on the line $y = 2x + 3$

Notice the value of *r*

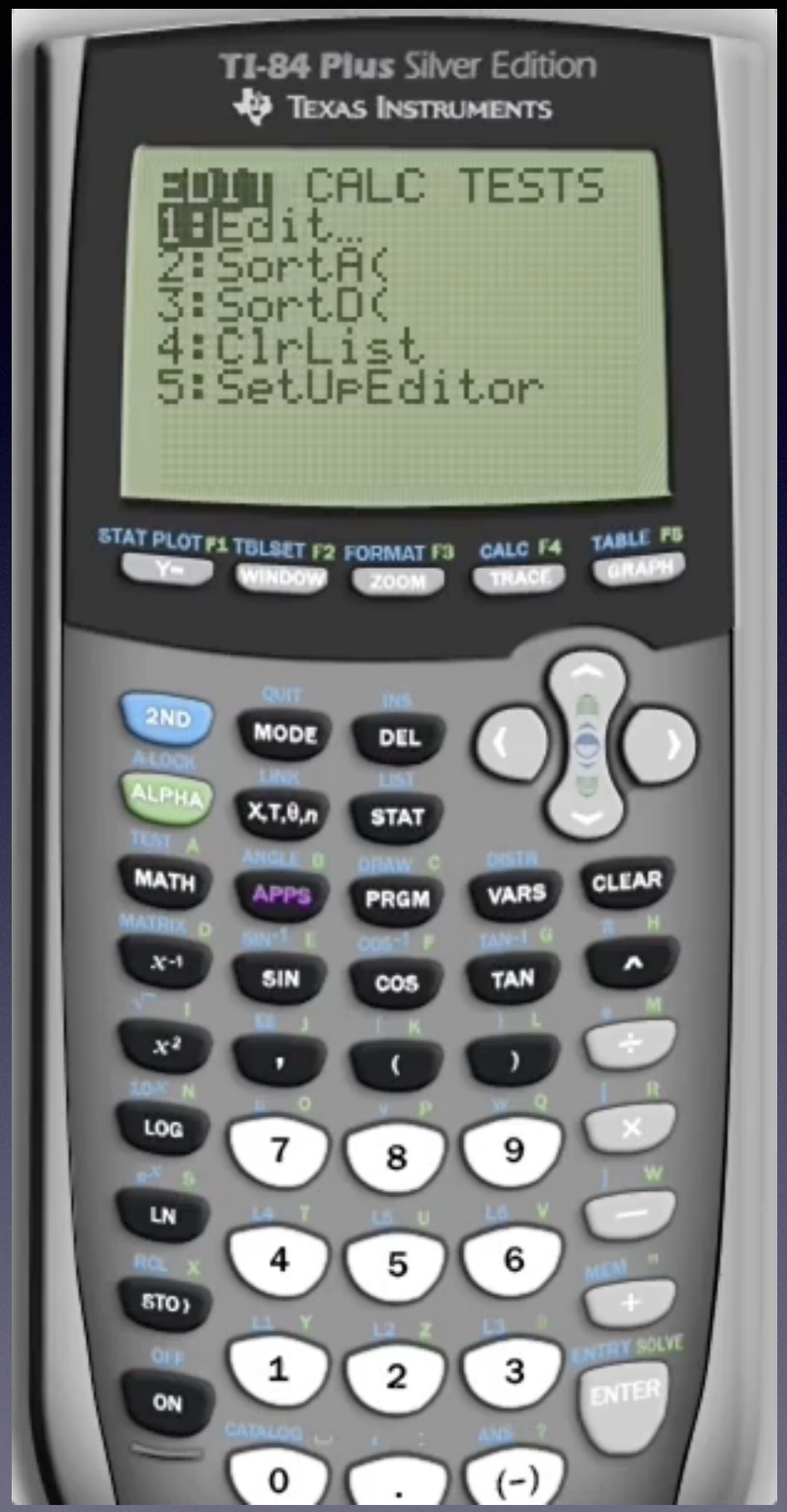
Let's do this again and see how the line fits perfectly.



What do we mean by predicting?

$$\hat{y} = a + bx$$

We'll make some slight changes to a couple of y values and then notice

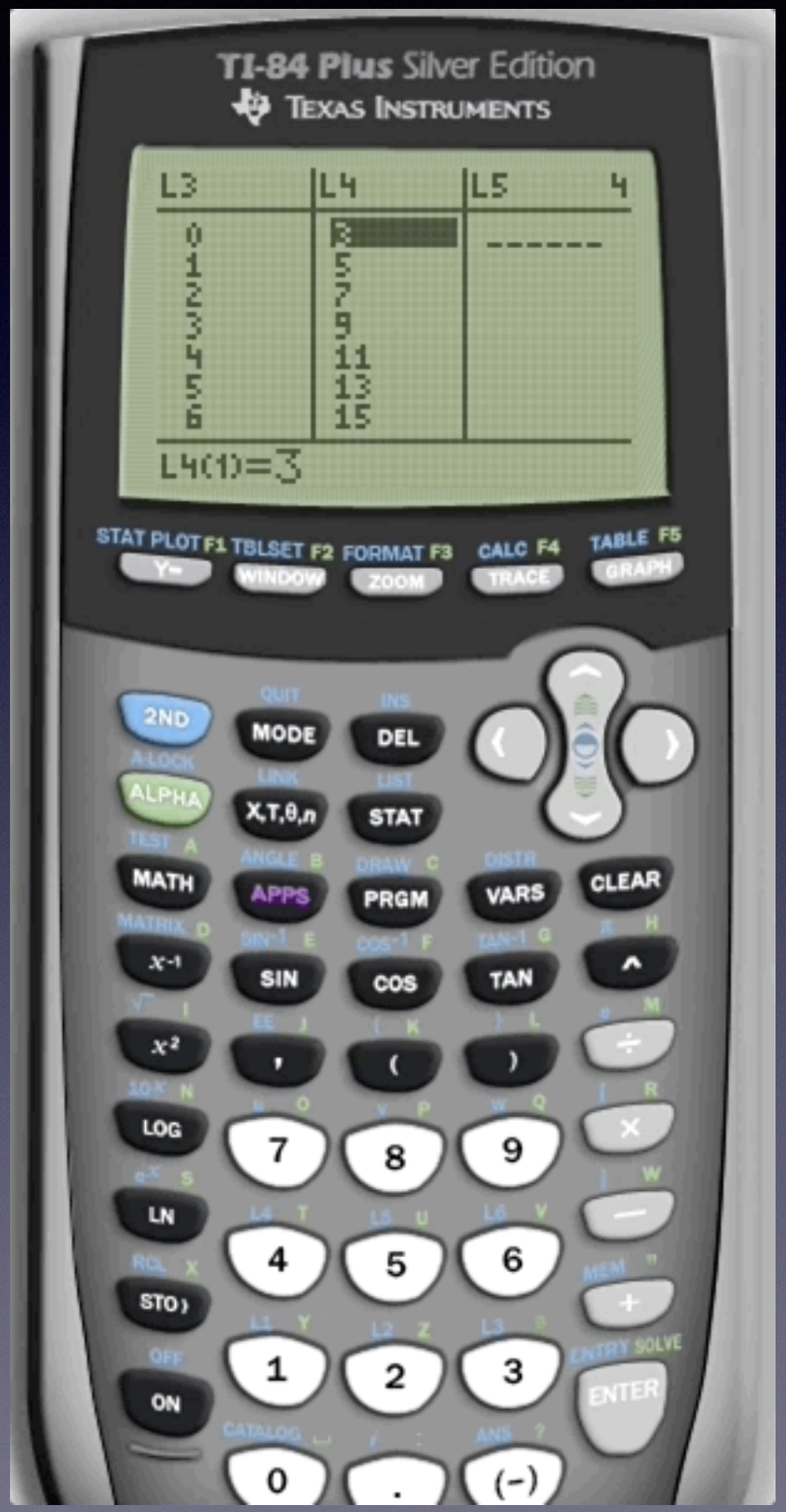


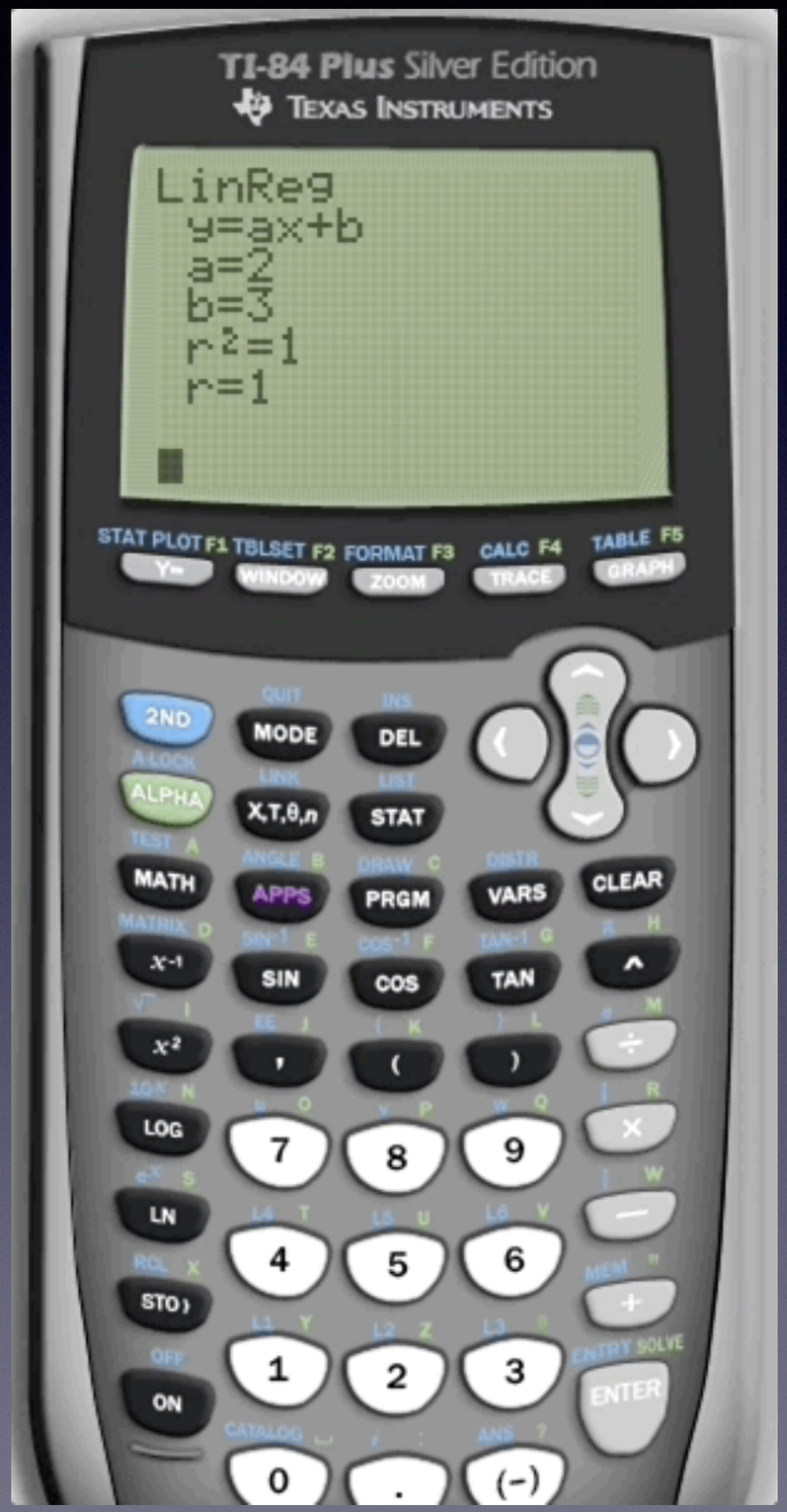
What do we mean by predicting?

$$\hat{y} = a + bx$$

Notice how exact linear correlation looks

Not that this really happens in the real world but…

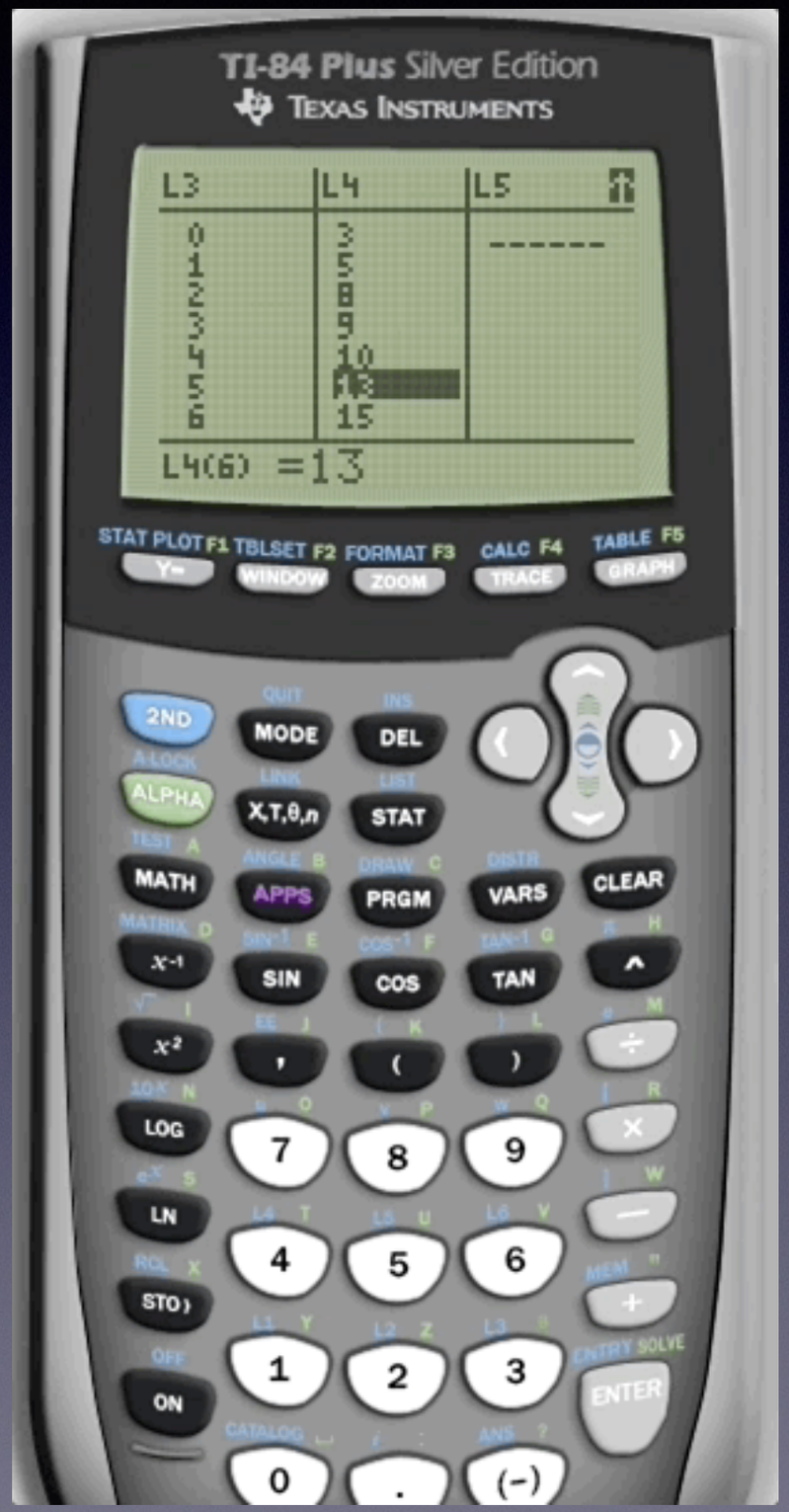


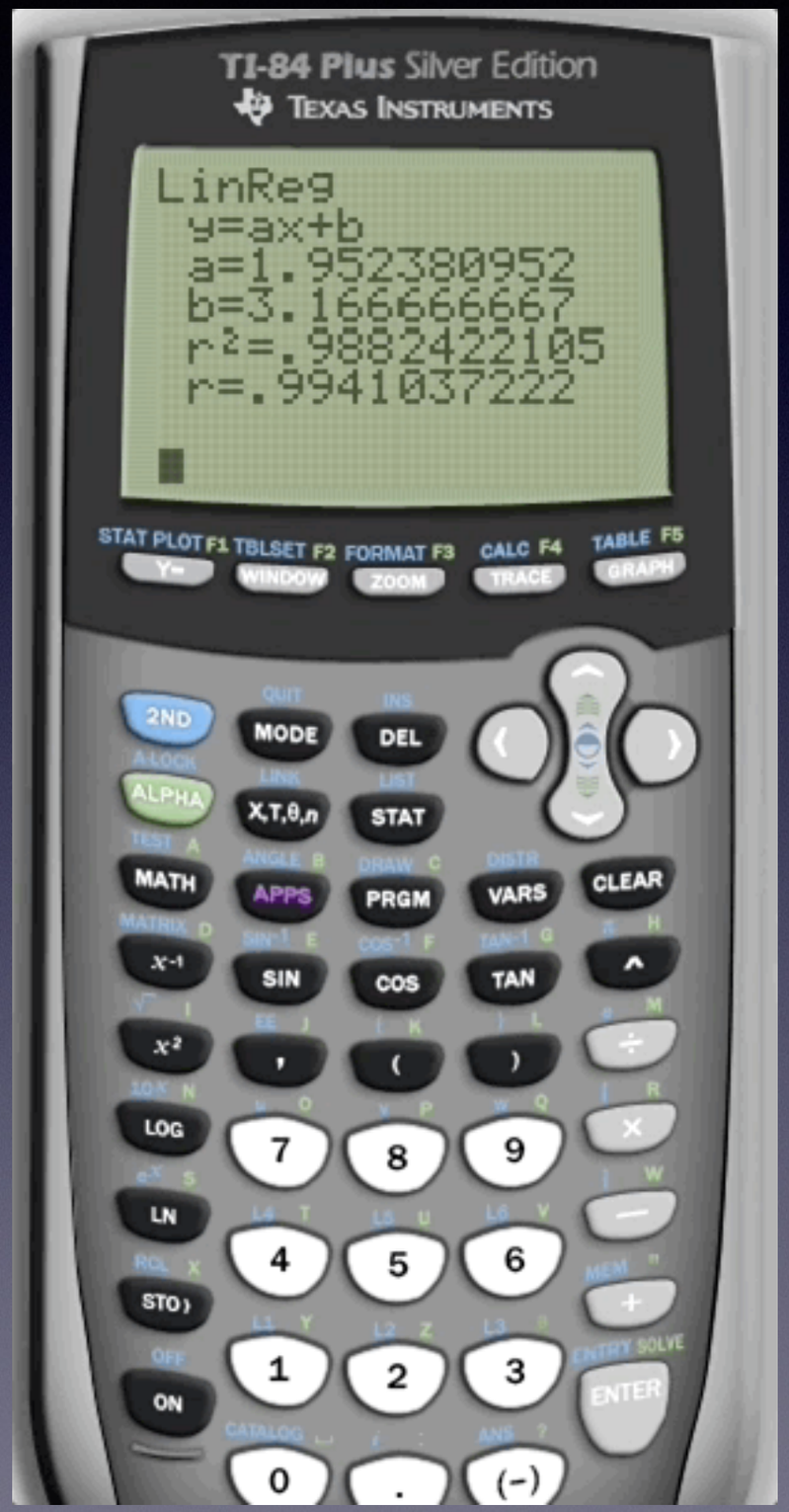


What do we mean by predicting?

$$\hat{y} = a + bx$$

Now notice the change when a few values deviate just a little bit.

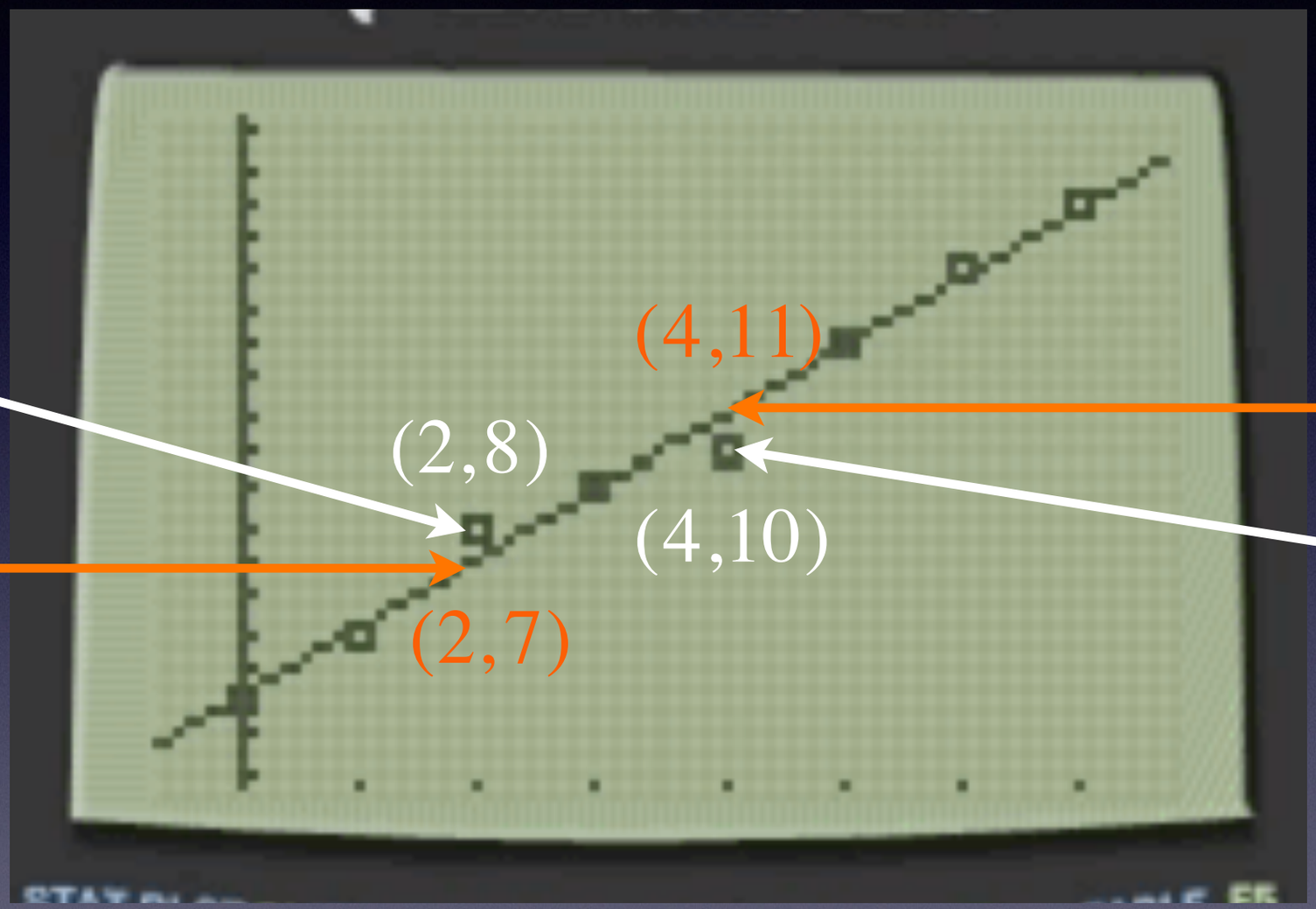




What do we mean by predicting?

$$\hat{y} = a + bx$$

Notice the difference between predicted and actual y values



Two Lesser Known Properties of the LSRL

- The LSRL passes through $(\overline{x}, \overline{y})$

- The slope of LSRL can also be found with this equation -

$$b = r\frac{s_y}{s_x}$$

MINITAB Outputs

LSRL

y-intercept

independent variable
i.e. x

slope

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Regression Analysis: Score2 versus Score1

The regression equation is
Score2 = 1.12 + 0.218 Score1

Predictor      Coef  SE Coef      T      P
Constant     1.1177   0.1093  10.23  0.000
Score1      0.21767  0.01740  12.51  0.000

S = 0.127419   R-Sq = 95.7%   R-Sq(adj) = 95.1%

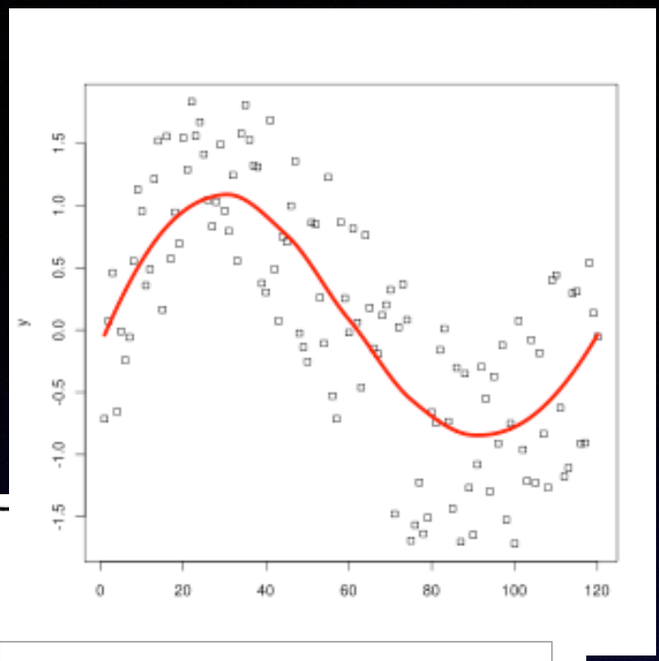
Analysis of Variance
Source           DF      SS      MS       F      P
Regression        1  2.5419  2.5419  156.56  0.000
Residual Error    7  0.1136  0.0162
Total             8  2.6556
```

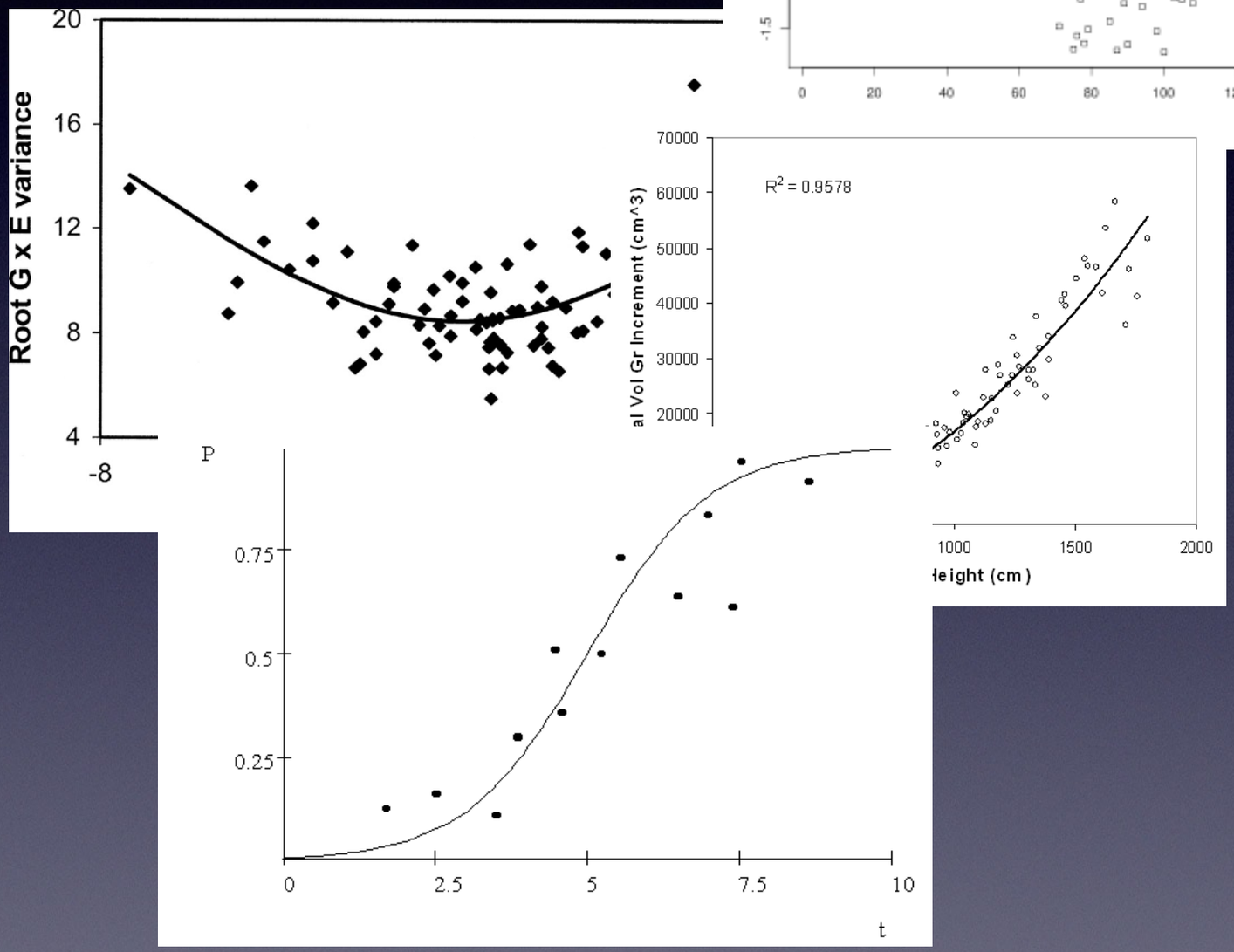
coefficient of determination
i.e. r^2

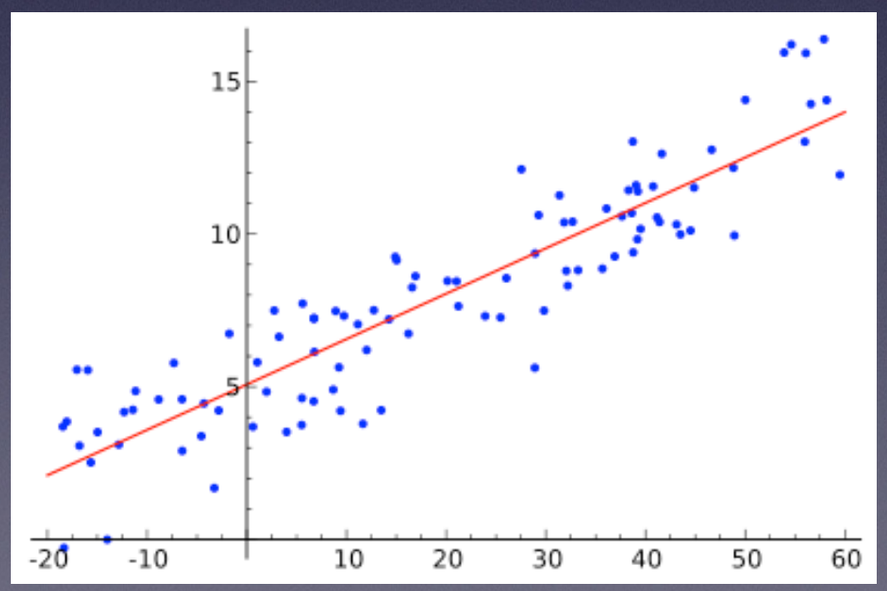
What is Regression?

Model math functions to fit our data

- Linear Regression
- Quadratic Regression
- Cubic Regression
- Power Regression
- Sinusoidal Regression
- Exponential Regression
- Logarithmic Regression
- Logistic Regression







You will choose the best fitting model and use that model to predict.