Finding Your Way Around
the TI-83+/84+ Graphing Calculator
Statistics 1
MathBits.com

Line of Best Fit

A **line of best fit** (or "trend" line) is a straight line that best represents the data on a scatter plot. This line may pass through some of the points, none of the points, or all of the points.

You can examine lines of best fit with:
1. paper and pencil only,
2. a combination of graphing calculator and paper and pencil,
3. or solely with the graphing calculator.

Example: Is there a relationship between the fat grams and the total calories in fast food?

Sandwich	Total Fat (g)	Total Calories
Hamburger	9	260
Cheeseburger	13	320
Quarter Pounder	21	420
Quarter Pounder with Cheese	30	530
Big Mac	31	560
Arch Sandwich Special	31	550
Arch Special with Bacon	34	590
Crispy Chicken	25	500
Fish Fillet	28	560
Grilled Chicken	20	440
Grilled Chicken Light	5	300

Paper and Pencil Solution:

Can we predict the number of total calories based upon the total fat grams?

1. Prepare a scatter plot of the data on graph paper.

2. Using a strand of spaghetti, position the spaghetti so that the plotted points are as close to the strand as possible.

3. Find two points that you think will be on the "best-fit" line.

4. We are choosing the points (9, 260) and (30, 530). You may choose different points.

Our assistant, Bibs, helps position the strand of spaghetti.

5. Calculate the slope of the line through your two points (rounded to three decimal places).

$$\frac{530-260}{30-9} = \frac{270}{21} \approx 12.857$$

6. Write the equation of the line.

$$y - y_1 = m(x - x_1)$$
$$y - 260 = 12.857(x - 9)$$
$$y = 12.857(x - 9) + 260$$

Choose two points that you think will form the line of best fit.

7. This equation can now be used to predict information that was not plotted in the scatter plot.
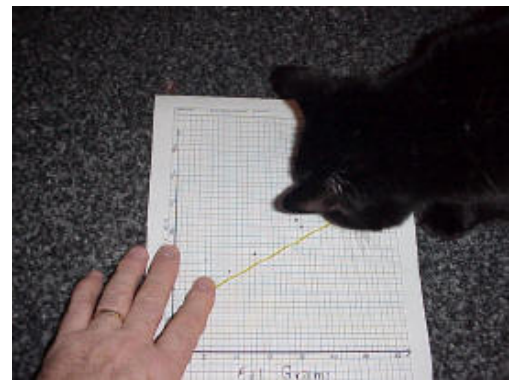*Question:* Predict the total calories based upon 22 grams of fat.
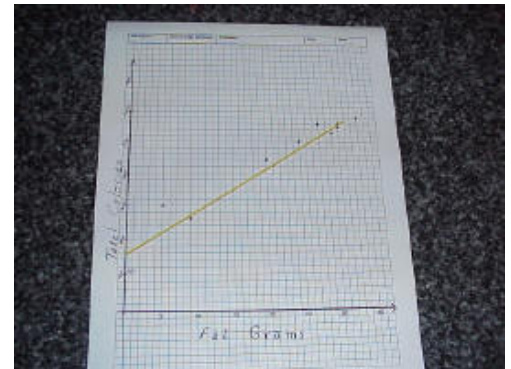
$$y = 12.857(22 - 9) + 260$$
$$y = 12.857(13) + 260$$
$$y = 427.141$$

ANS: 427.141 calories

Predicting:
- If you are looking for values that fall within the plotted values, you are *interpolating.*
- If you are looking for values that fall outside the plotted values, you are *extrapolating.* **Be careful** when extrapolating. The further away from the plotted values you go, the less reliable is your prediction.

In step 4 above, we chose two points to form our line-of-best-fit. It is possible, however, that someone else will choose a different set of points, and their equation will be slightly different.

Your answer will be considered CORRECT, as long as your calculations are correct for the two points that you chose. So, if each answer may be slightly different, which answer is the REAL "line-of-best-fit?

So who has the REAL "line-of-best-fit"?

To answer this question, we need the assistance of a graphing calculator. We saw that different people may choose different points and arrive at slightly different equations for their lines of best fit. All of them are "correct", but which one is actually the "best"? Simply stated, the graphing calculator has the capability of determining which line will "actually" represent the REAL line-of-best-fit.

Graphing Calculator Solution:

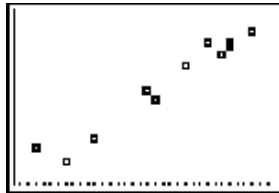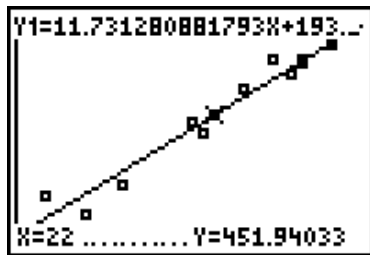| Can we predict the number of total calories based upon the total fat grams?	
1. Enter the data in the calculator lists. Place the data in L_1 and L_2. **STAT, #1Edit**, type values into the lists	
2. Prepare a scatter plot of the data. Set up for the scatterplot. **2nd StatPlot** - choices shown at right. Choose **ZOOM #9 ZoomStat**. Graph shown below. 	
3. Have the calculator determine the line of best fit. **STAT → CALC #4 LinReg(ax+b)** Include the parameters L_1, L_2, Y_1. (**Y_1** comes from **VARS → YVARS, #Function, Y_1**) You now have the values of *a* and *b* needed to write the equation of the **line of best fit.** See values at the right. $y = 11.73128088x + 193.8521475$	

4. Graph the line of best fit. Simply hit **GRAPH**.

　　To get a predicted value **within the window**, hit TRACE, up arrow, and type the desired value.

```
Y1=11.7312808179X+193._

                              ■
                            ■
                          ■
                  ■      ■
                ■ ■
              ■ ■
          ■
    ■

X=22 .........Y=451.94033
```

The screen above shows *x* = 22.
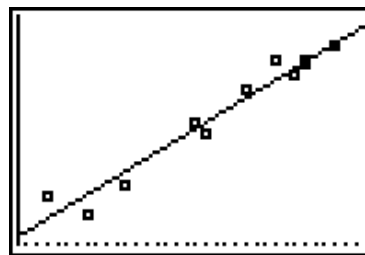
Question: Predict the total calories based upon 22 grams of fat.
ANS: 451.940 calories

Compare this answer with the answer we got by hand.

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