Polynomial Regression on the TI-83/84

take note

Key Concept The $(n + 1)$ Point Principle

For any set of $n + 1$ points in the coordinate plane that pass the vertical line test, there is a unique polynomial of degree at most n that fits the points perfectly.

This means you only need...

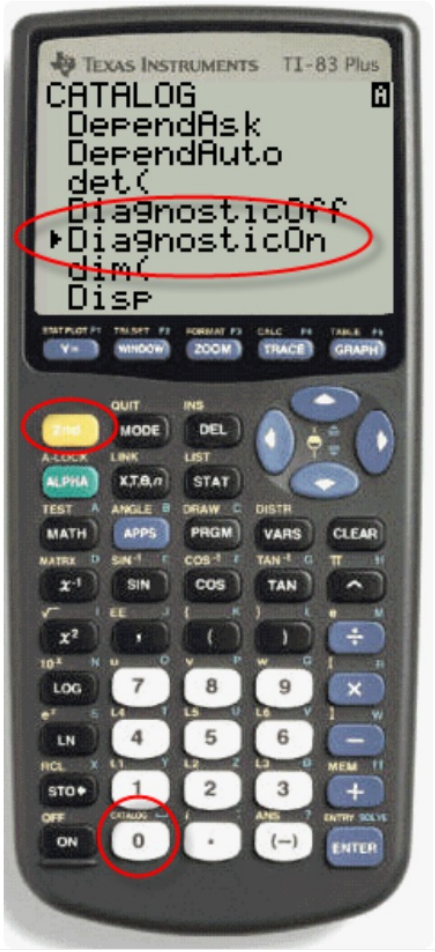
- 2 points to determine a linear function
- 3 points to determine a quadratic function
- 4 points to determine a cubic function
- 5 points to determine a quartic function

Calculator's have the ability to determine the closest polynomial function to your data. Let's see how it is done!

GET READY!

First things first, let's get your calculator ready...

Press 2nd, 0 and scroll down to "DiagnosticOn". Press "Enter" twice.



Given the following points, find the polynomial that most closely fits the data. $(0, -3), (1, -1), (2, 5)$, and $(-1, -7)$

Steps:

1. Select "stat", and "Edit".
2. Enter the x values under L_1 and the y values under L_2.

   If you need to clear out pre-existing data, use your arrow keys to scroll up to L_1 or L_2 and hit "clear".
3. Go back to "stat", and arrow to the right once so you are in the CALC menu. Options 4-7 should be chosen based on your data. Since we have 4 points, select Option 6: CubicReg. Make sure your Xlist and Ylist say L_1 and L_2. Then, "Enter" (5 or 6 times) until you your calculator calculates the data.
4. The letters a,b,c,d,e, etc. are the coefficients/constants in standard form and the R^2 rates how close the fit is. The closer to 1, the better!

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$a = 1, b = -1, c = 2$, and $d = -3$. The polynomial function is $y = x^3 - x^2 + 2x - 3$.

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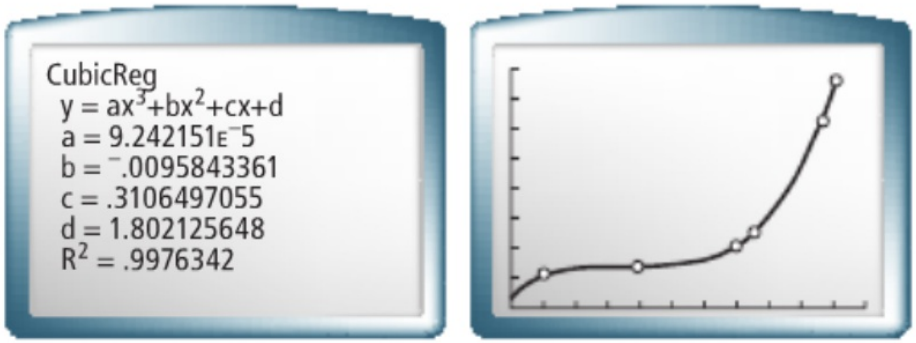
Problem 2 Using Interpolation and Extrapolation

Cheese Consumption The table shows average annual consumption of cheese per person in the U. S. for selected years from 1910 to 2001.

A Use CUBICREG. Model the data with a cubic function. Graph the function with a scatter plot of the data.



Number of years after 1900.

Cheese Consumption

Year	Pounds Consumed
10	4
40	5
70	8
75	10
95	25
101	30

SOURCE: U.S. Department of Agriculture

Since R^2 is close to 1, the fit is good. The cubic model is approximately $y = 0.0000924x^3 - 0.00958x^2 + 0.311x + 1.802$.

B **Would a quartic polynomial get us a closer fit? What indicates this?**

C **Type in the function you found in part A into Y= . Either use the table or graph to estimate cheese consumption in the years 1980, 2000, and 2012.**

F(1980) = **F(2000) =** **F(2012) =**

Find a polynomial function whose graph passes through each set of points.

1. $(0, 5)$ and $(2, -13)$
2. $(-5, 14)$ and $(1, -16)$
3. $(-2, -16)$, $(3, 11)$, and $(0, 2)$
4. $(-1, -15)$, $(1, -7)$, and $(6, -22)$
5. $(-2, -4)$ and $(8, 1)$
6. $(7, 13)$, $(10, -11)$, and $(0, 4)$
7. $(-1, 8)$, $(5, -4)$, and $(7, 8)$
8. $(-1, 9)$, $(0, 6)$, $(1, 5)$, and $(2, 18)$

For each set of data, compare two models and determine which one best fits the data. Which model seems more likely to represent each set of data over time?

9. **U.S. Federal Spending**

Year	Total (billions $)
1965	630
1980	1,300
1995	1,950
2005	2,650

10. **World Population**

Year	Average Growth Rate (%)
1972	1.96
1982	1.73
1992	1.5
2002	1.22

11. **U.S. Homes**

Year	Average Sale Price (thousands $)
1990	149
1995	158
2000	207

12. **U.S. Crude Oil and Petroleum**

Month (2008)	Products Supplied (millions of barrels/day)
2	19.782
4	19.768
6	19.553