

## 2.5 Notes: Polynomial Models

Objective: Create and use regression models to make predictions.

Modeling means: Creating an equation that fits data. Another name for modeling is regression. Regression analysis helps us predict the unknown using patterns of the known data.

Linear Regression:

$$y = mx + b$$

$$m = 1$$

$$b = 5$$

$$y = x + 5$$

Ex: Find the equation of the line that passes through the points:  $(-3, 2), (3, 8)$

$$m = \frac{\Delta y}{\Delta x}$$

$$m = \frac{8 - 2}{3 - (-3)} = \frac{6}{6} = 1$$

$$2 = 1(-3) + b$$

$$2 = -3 + b$$

$$5 = b$$

Plug in a point into your equation

1. What kind of regression to choose?

2 points

Linear

3 points

Quadratic

4 points

Cubic

etc...

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

a)  $(4, -1), (-3, 13)$

x	y
4	-1
-3	13

$$y = -2x + 7$$

b)  $(7, -5), (-1, 3)$

Steps to calculating a regression equation on the calculator

1) 2nd 0 CATALOG and turn Diagnostic ON

1) Press STAT and choose EDIT

2) List all of your x values in L1 and all of your y values in L2. You are making an (x, y) table.

3) Press STAT again and use the right arrow to select CALC.

4) Choose the type of regression needed to solve the problem.

c)  $(-3, 15), (1, 11), (0, 6)$

x	y
-3	15
1	11
0	6

$$y = 2x^2 + 3x + 6$$

5) Tell the calculator where you stored your data. L1, L2

To store your regression as a graph

- d)  $(0, 9), (2, 21), (-1, 0), (3, 36)$

x	y
0	9
2	21
-1	0
3	36

$$y = x^3 - 2x^2 + 6x + 9$$

- 1) Press **STAT**, scroll down to **Store RegEQ**:
- 2) Press **VARS** and use the right arrow to select **Y-VARS**. Choose **Function** and select **Y1**. (You will get an arrow if there is already a function stored in Y1.)
- 3) You are now ready to graph!

3. Let  $x$  = the number of years after 1985

**World Gold**

	Year	Production (millions of troy ounces)
0	1985	49.3
5	1990	70.2
10	1995	71.8
15	2000	82.6

SOURCES: The World Almanac and World Gold

- a) Find a polynomial function that best models the set of values

$$y = .038x^3 - .956x^2 + 8.01x + 49.3$$

- b) Estimate the world gold production for 2010, 2020, and 2025

$$\begin{aligned} 2010: x = 25 & \quad y = 245.8 \\ 2020: x = 35 & \quad y = 787.8 \\ 2025: x = 40 & \quad y = 1272.1 \end{aligned}$$

↑  
Adjust window

4. Let  $x$  = the number of years after 1970

**Life Expectancy**

	Year of Birth	Female (years)
0	1970	74.7
10	1980	77.4
20	1990	78.8
30	2000	79.7

SOURCE: U.S. Bureau of the Census

- a) Find a polynomial function that best models the set of values

$$y = .000133x^3 - .0105x^2 + .362x + 74.7$$

- b) Estimate the life expectancy for women born in 1960, 1981, and the year you were born.

$$\begin{aligned} 1960: x = -10 \\ 1981: x = 11 \\ 1994: x = 24 \end{aligned}$$

$$\begin{aligned} y = 69.9 \text{ years} \\ y = 77.59 \text{ years} \\ y = 79.18 \text{ years} \end{aligned}$$

Example 5. Explain the difference between best fit vs. more likely.