Modeling with Quadratic Functions Notes

Writing an Equation of a Parabola

**Example 1:** A parabola contains the points \(F(0,0), (-1, -2),\) and \((1,6)\). Set up the system you would solve to find the parabola passing through the points.

Substitute the \((x,y)\) values into \(y = ax^2 + bx + c\) to write a system of equations.

- Use \((0,0)\)
  \[y = ax^2 + bx + c\]
  \[0 = a(0)^2 + b(0) + c\]
  \[0 = c\]

- Use \((-1,-2)\)
  \[y = ax^2 + bx + c\]

- Use \((1,6)\)
  \[y = ax^2 + bx + c\]

Using Quadratic Regression

**Example 2:** The table shows a meteorologist’s predicted temperatures for a November day in Arlington, Texas.

a. What is the quadratic model for this data?

  Step 1: From the home screen, go to 1: New Document, then 4: Add Lists & Spreadsheet

  Step 2: Input data into columns A and B. Be sure to go to the very top (next to the A and B) and give each column an appropriate, 1 word, name.

  Step 3: To view the data in a graph (which is helpful when trying to determine whether the data is quadratic or not), place the blue box over a number and press Menu, 3: Data, and 9: Quick Graph. You will have to go to your axes to select the appropriate variables to see the graph.

  Step 4: Select the Lists & Spreadsheets window, and make sure the blue box is in the right-most column of typed data. Press Menu, 4: Statistics,
1: Stat Calculations, and 6: Quadratic Regression since the data looks like it may follow a quadratic curve. The wizard will prompt you to select your x list and y list by pressing the side arrow button. When you have done that, press OK. You will then see the following page:

This page gives us a, b, c, and $r^2$.

$R^2$ is called the Correlation Coefficient and if it is close to 1, it means that the graph is quadratic. Our $r^2 = 0.9919$ which means that we can say it is quadratic.

You find the equation by plugging in a, b, and c into $y = ax^2 + bx + c$.

Since $a = -0.469$, $b = 14.716$, and $c = -36.121$, the equation is $y = -0.469x^2 + 14.716x - 36.121$.

b. Use your model to predict the high temperature for the day. At what time does the high temperature occur?

Step 1: In the calculator, press CTRL + Doc to add a graph page.

Step 2: On the graph page, press up to show the $f1(x)$ function that the calculator saved the regression to. Then press ENTER.

Step 3: You can find the Maximum by looking at the table and pressing CTRL + T or by going to Menu, 6: Analyze Graph, 3: Maximum. The maximum temperature in this case is 79.4 degrees at about 3:42 PM.