Building Curves

ID: 8961

Time required
75 minutes

Activity Overview

In this activity, students approach performing the basic operations—addition, subtraction, multiplication, and division—on the polynomials from a graphical perspective. Given the graphs of two functions, they plot points that lie on the graph of the sum of the functions and draw conclusions about its behavior. Next, they calculate a regression, informed by what they know about the degree of the polynomials they are adding, to fit the points they plotted. Finally, they find the sum of the functions algebraically and compare it with the result of the regression.

Topic: Polynomials and Polynomial Equations

- *Add, subtract, multiply and divide any pair of polynomials in one variable.*
- *Graph a polynomial of any degree.*
- *Use a polynomial function to model data.*

Teacher Preparation

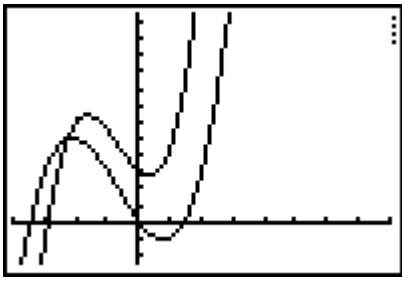
- *This activity is designed to be used in an Algebra 2 or Pre-calculus classroom. This activity is intended to be mainly **student-centered**, with some periods of teacher-led discussion.*
- *Prior to beginning this activity, students should have an introduction to basic polynomial (linear, quadratic, cubic, and quartic) functions, their graphs, and the concept of degree.*
- *If time considerations are a factor, Problems 1 and 2 can be performed in class and Problems 3 and 4 assigned as homework.*
- ***To download the calculator program BLDCURVE and student worksheet, go to education.ti.com/exchange and enter "8961" in the keyword search box.***

Associated Materials

- *BuildingCurves_Student.doc*
- *BLDCURVE.8xp (program)*

Problem 1 – Adding Polynomials

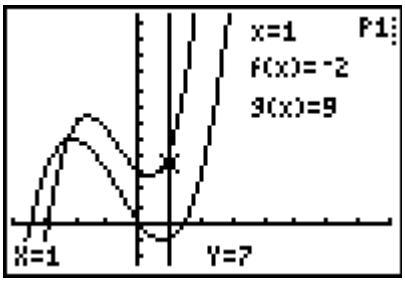
In this problem, students will build the graph of $(f+g)(x)$ from the graphs of $f(x)$ and $g(x)$. Run the **BLDCURVE** program and choose **1:AddPolys.**



Discuss with students what $(f + g)(x)$ means. In the graph of $(f + g)(x)$, each y-value is found by adding $f(x)$ and $g(x)$.

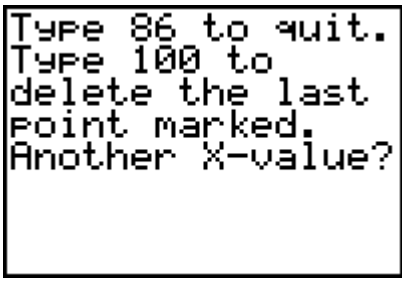
Then have students look at the graphs and make a hypotheses for $(f + g)(x)$.

When students enter 1, the graph will draw a vertical line at $x = 1$ and displays the values of $f(1) = -2$ and $g(1) = 9$. Students should plot a point on the top curve where it intersects with the vertical line.

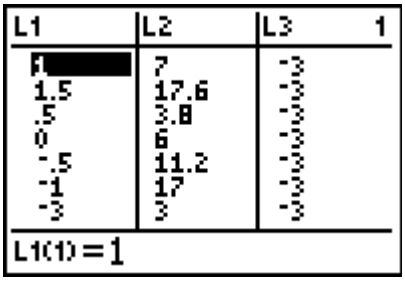


They might see that $(f + g)(1) = -2 + 9 = 7$.

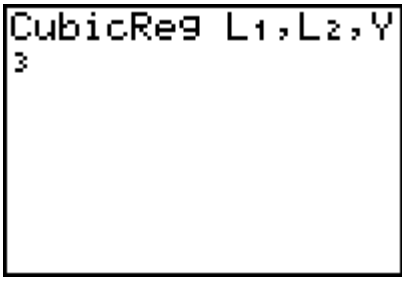
Students are to continue to choose x-values and use the trace key to marks intersection points. They should have a total of 10 marked points when finished.



Students can then enter **86** to return to the menu and choose **Exit**. Pressing [STAT] [ENTER] will allow them to see the x- and y-values of the points they plotted in L1 and L2 respectively.



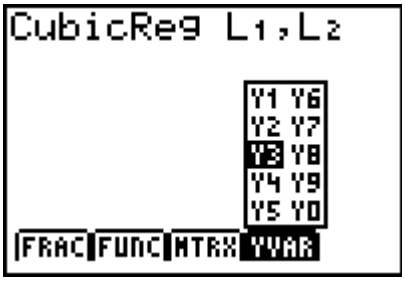
To perform a cubic regression, to find an equation through the points they plotted, students need to press [STAT], arrow to the CALC menu and choose **CubicReg**. Then enter **L1, L2, Y3**.



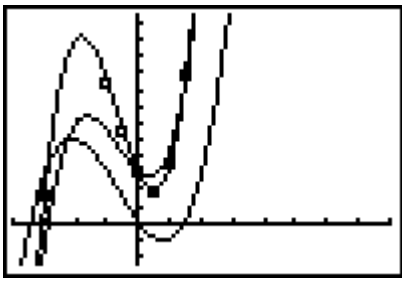
To enter L1, L2, or Y3, press the following keys.
L1: [2nd] [L1] **L2:** [2nd][L2] **Y3:** [VARS] [▶] [1] [3].

If using Mathprint OS:

Students can enter Y3 using the shortcut menu. To do this, press [ALPHA] [F4] and select **Y3**.



Students should see that the degree of $(f+g)(x)$ is also 3.



The are given the functions for f(x) and g(x) to find $(f + g)(x)$ algebraically and compare it with the regression equation.

$f(x) = x^3 + 2x^2 - 5x$

$g(x) = 2x^3 + 4x^2 - 3x + 6$

$(f + g)(x) = 3x^3 + 6x^2 - 8x + 6$

Problem 2 – Subtracting Polynomials

Students will repeat the process from Problem 1 to build the curve $(f - g)(x)$. They should run **BLDCURVE** and select **2:SubPolys**. After they have plotted 10 points, they will answer the questions on the worksheet.

Students should see that the degree of $f(x)$, $g(x)$, and $(f - g)(x)$ is 4. Once again, they will be given the functions for $f(x)$ and $g(x)$ and will need to find $(f - g)(x)$ algebraically.

$f(x) = x^4 + 3x^3 - 2x^2 + 6x + 1$

$g(x) = -x^4 + 3x^2 - 4x + 3$

$(f - g)(x) = 2x^4 + 3x^3 - 5x^2 + 10x - 2$

Problem 3 – Multiplying Polynomials

Students run **BLDCURVE** and select **3:MultPolys** to build the curve of $(f * g)(x)$.

Students should see that the degree of $(f * g)(x)$ is 4 or the degree of $f(x)$ multiplied by the degree of $g(x)$, both of which are 2. They will be given the functions for $f(x)$ and $g(x)$ and will need to find $(f * g)(x)$ algebraically.

$f(x) = x^2 + 4$

$g(x) = -2x^2 + 3x + 5$

$(f * g)(x) = -2x^4 + 3x^3 - 3x^2 + 12x + 20$

Problem 4 – Dividing Polynomials

Students run **BLDCURVE** and select **4:DivPolys** to build the curve of $(f \div g)(x)$.

Students should see that the degree of $(f \div g)(x)$ is 2 or the degree of $g(x)$, 1, subtracted from the degree of $f(x)$, 3. They will be given the functions for $f(x)$ and $g(x)$ and will need to find $(f \div g)(x)$ algebraically.

$f(x) = x^3 - x^2 + 3x + 5$

$g(x) = x + 1$

$(f \div g)(x) = x^2 - 2x + 5$