Manual Fit

Name ______________________

Class ______________________

Problem 1 – Match the graph, Part 1

The vertex form for the equation of a parabola is $y = a(x - h)^2 + k$. If needed, graph $y = a(x)^2$ with various values of a and explore.

- In vertex form or in standard form, what happens when $0 < a < 1$?

- If $a > 1$, the graph will be narrow and open up. If $a < -1$, the graph will be what?

Enter the lists shown at the right. Create a scatter plot of $\mathbf{L_1}$ and $\mathbf{L_2}$. Then, enter the vertex form of the parabola in $\mathbf{Y_1}$ with an initial guess for each value for a, h, and k. See how the equation fits and then adjust the values to make the graph fit the data.

L1	L2	L3 1
1	3	------
.5	3.5	
1.5	3.5	
0	5	
2	5	
-.5	7.5	
2.5	7.5	

L1(1) = 1

- What is the vertex of the parabola?

- What was your value of a for the parabola?

- What is the equation of the parabola you fit to the data?

Problem 2 – Match the Graph, Part 2

Repeat the process from Problem 1 to find the equation of a parabola that matches the data in $\mathbf{L_1}$ and $\mathbf{L_2}$.

- To make the parabola open down, what must be true about the value of a?

L1	L2	L3 1
-3	-2.25	0
-2	-1	.5
-1	-.25	1
0	0	1.5
1	-.25	2
2	-1	3
3	-2.25	4

L1(1) = -3

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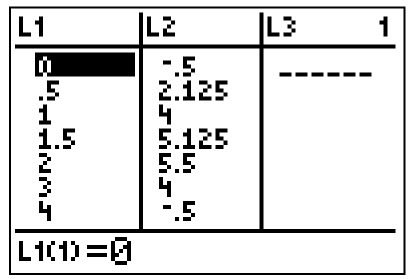
- To make the parabola wide, what must be true about the value of *a*?

- What is the equation of your parabola that fits the data?

Problem 3 – Match the Double Arches

Next, you will match the second half of double arches. First, graph **Y_1=(–1.5*(x + 2)^2 + 5.5)/(-4<=x and x<=0)**



L1	L2	L3 1
0	-.5	------
.5	2.125	
1	4	
1.5	5.125	
2	5.5	
3	4	
4	-.5	

L1(1) =0

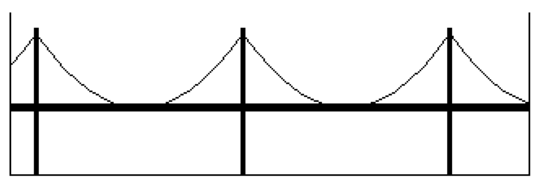
- What do you notice about the two parabolas that formed the double arches?

- The vertex of the left arch is (–2, 5.5). What is the vertex of the right arch?

- What is the equation of your parabola that matches the data?

Problem 4 – The Main Cables of a Suspension Bridge

Here is a picture of a suspension bridge. Several loops of cable are represented. See the graph below to match an equation to a particular part of the graph.



- What is the equation of the piece of the graph labeled *A*?

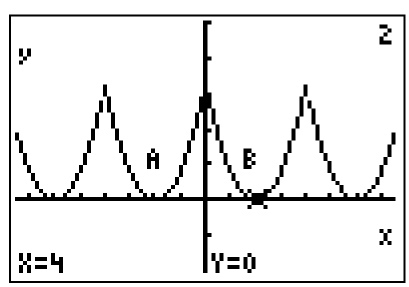
- What is the equation of the piece of the graph labeled *B*?

  A: $y = 0.2(x - 4)^2$

  B: $y = 0.2(x - 12)^2$

  C: $y = 0.2(x + 4)^2$

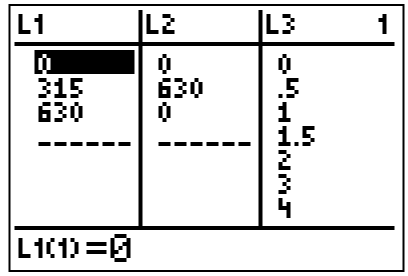
  D: $y = 0.2(x + 12)^2$



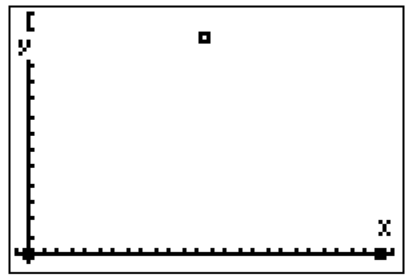
Extensions/Homework – The St. Louis Arch

The St. Louis Arch, the "Gateway" to America, is a shape that looks like a parabola to the casual observer.

- Use what you know about the vertex form to write an equation to match its shape and dimensions. Enter **L_1** and **L_2** shown and create a scatter plot with an appropriate window. What is the equation?



Using the same data, match the graph in standard form ($y = a * x^2 + b * x + c$) by changing the **Y=** equation. Important things to remember are; what does the value of a do to the graph, and what would your y-intercept be (c in the equation)?



- What is your equation in standard form?

- How are the two equations similar?

- How are the two equations different?

- Expand the vertex form and convert it to standard form to make a final comparison.

Extensions/Homework – Other Arches

- Hang a chain (or necklace) against a piece of graph paper and trace its graph (or take a digital photo). Write an equation in vertex form to match the shape of the curve.

- Place a laminated piece of graph paper behind a drinking fountain and take a digital photo. Write an equation to match the shape of the curve.

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