

Geometer's Sketchpad Image Modeling Instructions

The image

First save image as JPEG.



Photo credit:

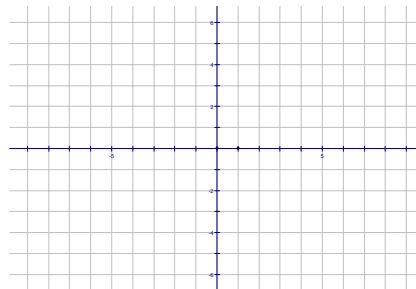
<http://mathdemos.gcsu.edu/mathdemos/bulbdemo/>, Used with permission
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GSP does not have Insert Picture, so you must copy and paste your photo. Ways to do that:

1. If you want the entire photo: Right-click photo, select Copy OR
2. If you want just part of the photo: Start Menu>Accessories>Paint Open photo in Paint. Use rectangle selection tool to frame the part of the image you want, then Edit > Copy. OR
3. If the size of the photo is a problem (i.e., you only see part of it in Paint or GSP tells you it is too big to Paste), you can use Photoshop. Open Photo from inside Standard Edit Mode for Photoshop. Select Image > Resize> Image Size > 5 in width (height automatic) with Resampling selected. Select rectangle tool and then frame part of photo wanted. Edit > Copy. If you need to do this, you may need to get help from Ed Tech. PhotoShop can be tricky.

Modeling the digital image in Geometer's Sketchpad

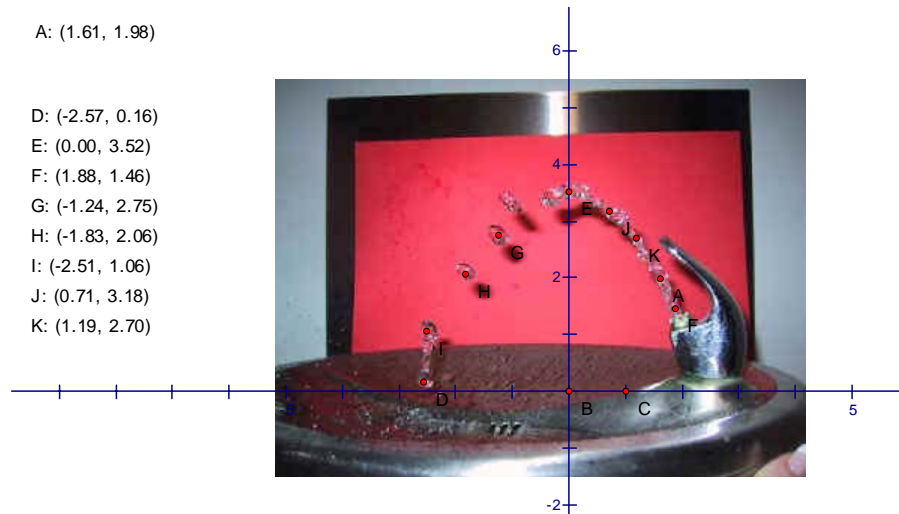
Open Geometer's Sketchpad. Start Menu > Open GSP 4.06
Select Graph>Show Grid.



Select Edit > Paste. Drag image to line up with grid. I suggest placing the y-axis along the axis of symmetry and the x-axis across the widest part of the U-shape. You can resize the image by selecting it and then holding SHIFT while dragging corners to the right size. Select Arrow Tool, then click on white space to deselect the image.

Select Point Tool, select Edit>Select All Points. This will label two points automatically created by the grid as points A and B. Now make the points along your curve: to plot points, select the point tool and visually click points along the image's curve. For errors, select the arrow tool, click on point then delete or better yet, use Edit>Undo. After all points are marked, with point tool depressed, choose Edit>Select All Points (if this isn't available, then the point tool is not selected.). Immediately select Measure>Coordinates. All points are now labeled and coordinates are written on the side. Save your work.

Delete the coordinates for points A and B (which are on the x-axis, but not part of your curve) by: Select Arrow Tool, click in any white area to deselect all the points. Then click on any points labeled A or B and Edit>Clear Coordinates or press the Delete key. Note: occasionally, the points on the x-axis are B and C or some other combination. Delete the appropriate points. Save your work. It should look like this.

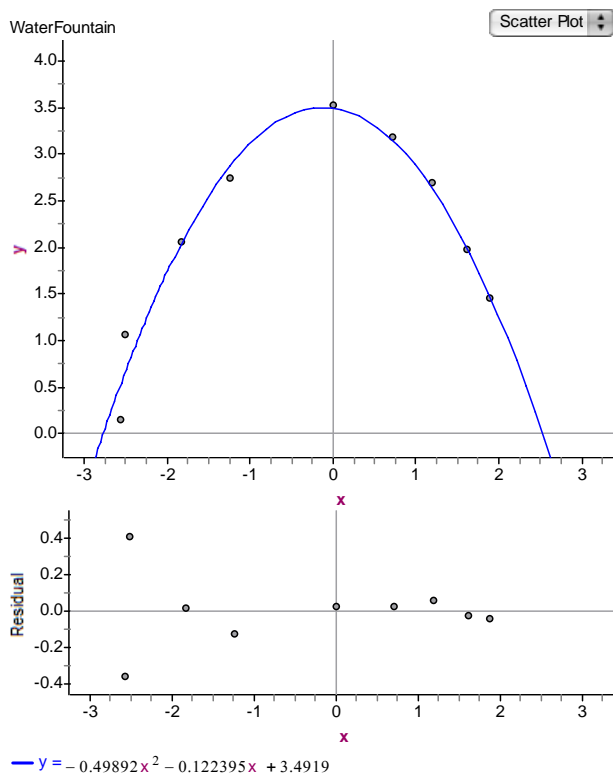


Modeling with a Parabola—using your calculator

Put the coordinates for the points on your curve in your calculator’s lists L1 and L2. Use STAT CALC>QUADREG L1, L2, Y1 to find the quadratic regression equation.

Using Fathom

Open Fathom. Type your x-values and y-values from the GSP coordinates in a table. Create a scatter plot with your coordinates. In the Graph menu, select Plot Functions and type in your quadratic regression equation. (Note: the x on the screen keypad means multiply, use x on your keyboard.) You may need to choose ‘smallest’ in the upper left to see your equation. Choose OK when you are done. In the Graph menu, choose Make Residual Plot. You can ‘pull’ on the axis in Fathom to adjust the scale. Make this graph window an appropriate size, keeping it consistent with the proportions of your image and copy as picture (in Edit menu) and paste it into your Word document. Make sure it is large enough to read the scales on the two graphs and the equation.



Modeling with other U-shaped curves:

You must model your image with at least one other U-shaped curve, either a semi-ellipse or a catenary. *Recall: multiply by -1 to reflect over the x-axis.*

Semi-ellipse in Fathom

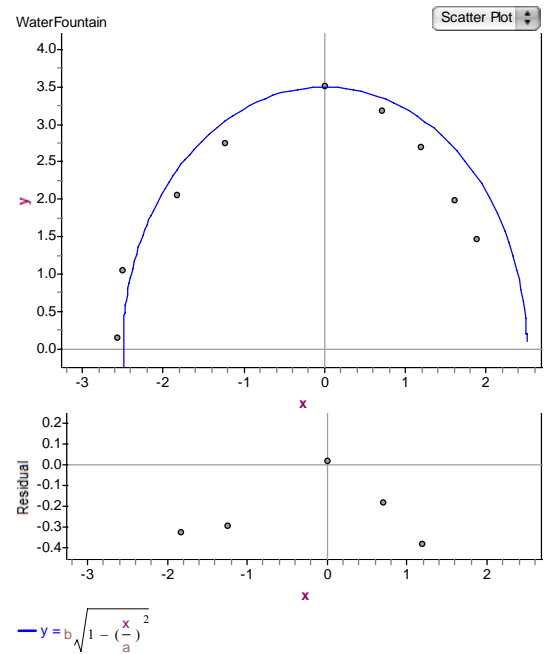
Create another scatter plot in Fathom using the same x and y values. Create two sliders by dragging the slider icon on the top ribbon into the workspace. Name one slider *a* and one slider *b* (instead of V1 and V2.) In the Graph menu, choose

Plot Function and type in $b\sqrt{1-\left(\frac{x}{a}\right)^2}$. Move *a* and *b* on the

sliders to adjust your curve. Make a residual plot and write down the values for your sliders in the equation,

$$y = 3.5\sqrt{1-\left(\frac{x}{2.5}\right)^2}$$

document.



Catenary in Fathom

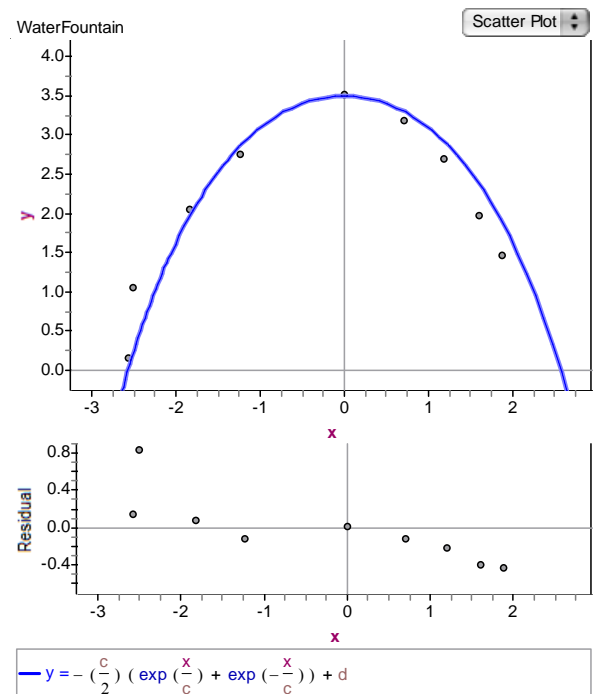
Create another scatter plot in Fathom using the same x and y values. Create two sliders by dragging the slider icon on the top ribbon into the workspace. Name one slider *a* and one slider *b* (instead of V1 and V2.) In the Graph menu, choose

Plot Function and type in $\frac{a}{2}\left(e^{\frac{x}{a}} + e^{-\frac{x}{a}}\right) + b$. Note: e^{\wedge} is

found under Functions: Arithmetic: exp (see equation at bottom of graph on right.) Move *a* and *b* on the sliders to adjust your curve. Make a residual plot and write down the values for your sliders in the equation,

$$y = \frac{-1.3}{2}\left(e^{\frac{x}{1.3}} + e^{-\frac{x}{1.3}}\right) + 4.8$$

document. Note: if you do both the semi-ellipse and the catenary, then you need two additional sliders, named *c* and *d* for the catenary, or to be completely done with the semi-ellipse if you are reusing the sliders.

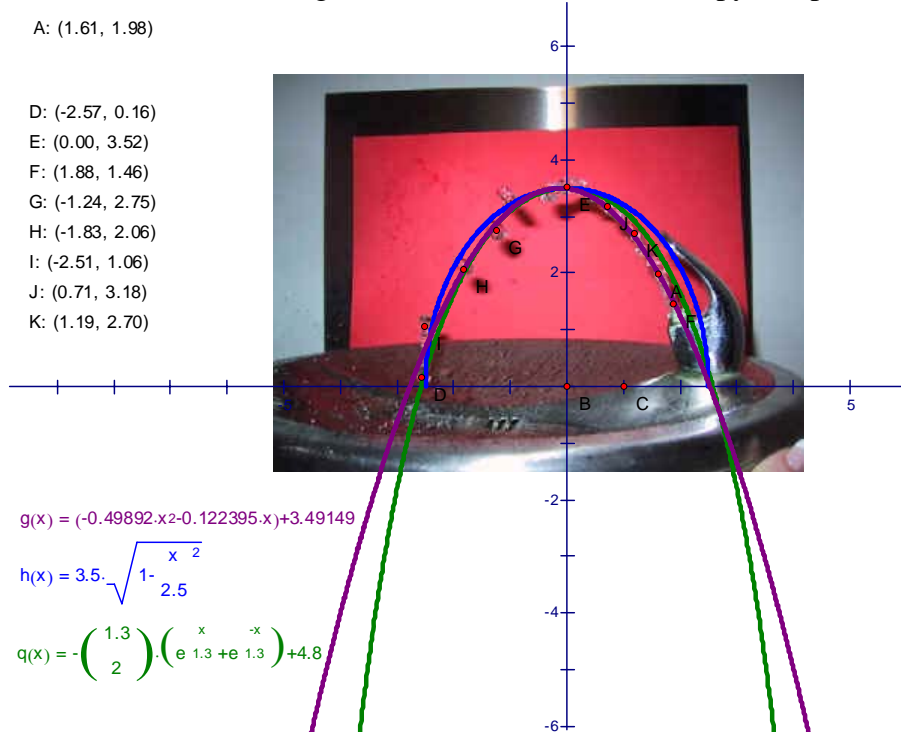


Graphing the curves on the image in GSP

To graph a curve on the image in GSP: Select Graph > Plot New Function. Type your equation (the part after $y =$; do not round any coefficients) in the window and click OK. Your equation is now graphed on your grid. Common sense test: your curve should be a close approximation to your photo. If it is not, check your work. Move your equation so it doesn't overlap any objects: choose the arrow tool, click on white space to deselect the graph and then select and drag the equation box to an empty area. Save your work. Right click the curve to change the color and change its thickness. Right click the equation to match the color of the curve. Do this again for the second curve. Note: in GSP, square root is under Functions: sqrt() and *e* is found under Values, use with the exponent symbol, \wedge .

Copy your GSP work to Word

Make the GSP sketch window smaller so you just see your work (no extra blank space.) Select Arrow Tool. Draw rectangle around your work. The entire rectangle area will be copied so just include your work, do not include large blank areas. Select Edit>Copy and paste this into your report.



Now you have the graphs, equations and residual plots for your image. Read the instructions for your analysis and report!