

TECHNOLOGY Quadratic Regression

Write a quadratic function that contains the three data points (0, 250), (1, 324), and (2, 366).

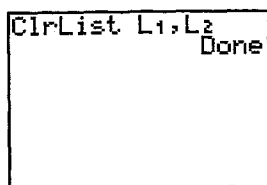


Figure 6.7a

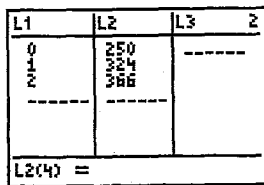


Figure 6.7b

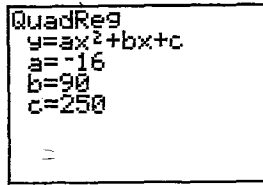
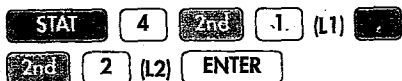


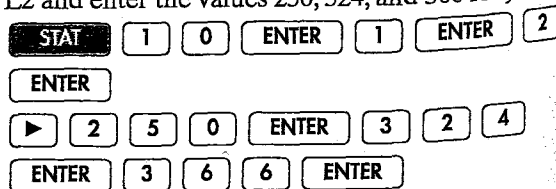
Figure 6.7c

For Figure 6.7a,
Clear the lists where the three data points will be stored.



For Figure 6.7b,
Enter the coordinate pairs by choosing option 1, EDIT, under the STAT menu.

Enter the values 0, 1, and 2 for x in L1, and then move to L2 and enter the values 250, 324, and 366 for y .



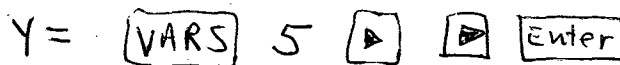
For Figure 6.7c,
Exit the EDIT menu.



Calculate the quadratic function by choosing option 5, QuadReg, under the STAT CALC menu.



Write the function, substituting the given values for a , b , and c into the standard form of the quadratic function. The result is $y = -16x^2 + 90x + 250$.

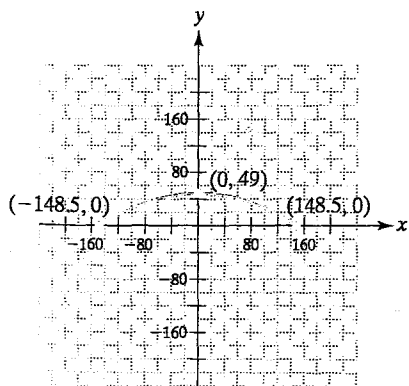


APPLICATION

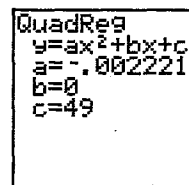
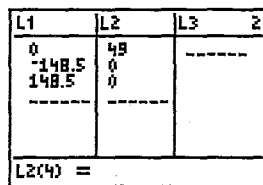
The Ohmishima bridge joining the Japanese islands of Ohmishima and Hakatajima is the longest single-span two-hinged solid rib arch bridge in Japan. The lower width of the arch is 297 meters, and the maximum height of the arch is 49 meters. Determine a quadratic function that will model the arch of the bridge.

Discussion

Superimpose a sketch of the bridge on a coordinate plane, placing the origin in the center of the lower width. This will yield 148.5 units ($\frac{1}{2}$ of 297 feet) on each side of the y -axis. Label the three intercepts.



Using the three intercepts, (0, 49), (-148.5, 0), and (148.5, 0), as data points, we observe that the arch is parabolic in shape and a quadratic function model the data. Since the numbers are not easily manipulated by hand, determine a quadratic regression function on your calculator.



Write the quadratic function by replacing a , b , and c in the standard form of the quadratic equation.

$$y = -0.002222x^2 + 0x + 49$$

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Check the function by graphing it on your calculator.

Note that the value for a was rounded in our function. Therefore, the x -intercepts are not exact. For accuracy's sake, an engineer would not round values as we did.