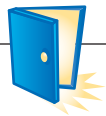
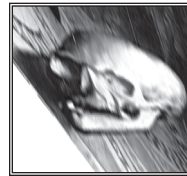




The German painter Hans Holbein II (1497–1543) used a technique called anamorphosis to hide a stretched skull in his portrait *The Ambassadors* (1533). You can see the skull in the original painting if you look across the page from the lower-left. The painting was originally hung above a doorway so people would notice the skull as they walked through the door. Holbein may have been making a political statement about these two French ambassadors who were members of England's court of King Henry VIII.

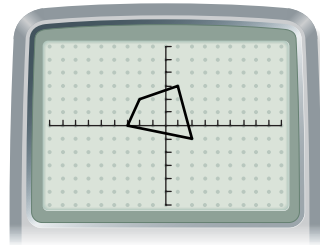


Investigation

Changing the Shape of a Graph

In this investigation you will learn how to stretch or shrink a graph vertically.

- Step 1 Name the coordinates of the vertices of this quadrilateral.

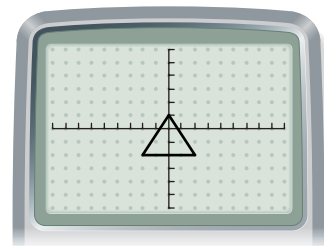


Procedure Note

For this investigation, use a friendly window with a factor of 2.

- Step 2 Graph the quadrilateral on your calculator. Use list L_1 for the x -coordinates of the vertices and list L_2 for the y -coordinates of the vertices.
- Step 3 Each member of your group should choose one of these values of a : 2, 3, 0.5, or -2 . Use your value of a to define list L_3 and list L_4 as follows
- $$L_3 = L_1$$
- $$L_4 = a \cdot L_2$$
- Graph a second quadrilateral using list L_3 for the x -coordinates of the vertices and list L_4 for the y -coordinates of the vertices.
- Step 4 Share your results from Step 3. For each value of a , describe the transformation of the quadrilateral in Step 2. What was the result for each vertex?
- Step 5 Organize your results from this first part of the investigation.

Step 6 Graph this triangle on your calculator. Use list L1 for the x -coordinates of the vertices and list L2 for the y -coordinates of the vertices.

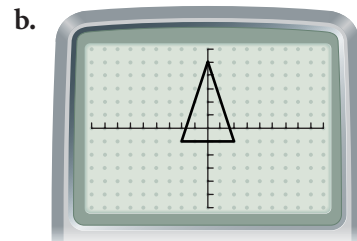
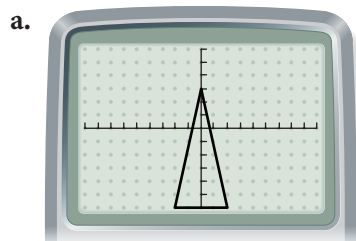


Step 7 Describe how definitions a and b below transform the triangle. Use list L3 for the x -coordinates of the vertices of the image and list L4 for the y -coordinates of the vertices of the image. Check your answers by graphing on your calculator.

a. $L_3 = L_1$
 $L_4 = -0.5 \cdot L_2$

b. $L_3 = L_1$
 $L_4 = 2 \cdot L_2 - 2$

Step 8 Write definitions for list L3 and list L4 in terms of list L1 and list L2 to create each image below. Check your definitions by graphing on your calculator.



Next, see how you can stretch and shrink the graph of a function.

Step 9 Each member of your group should choose an equation from the list below. Enter your equation into Y1 and graph it on your calculator.

$$Y_1(x) = -1 + 0.5x$$

$$Y_1(x) = |x| - 2$$

$$Y_1(x) = -x^2 + 1$$

$$Y_1(x) = 1.4^x$$

Step 10 Enter $Y_2(x) = 2 \cdot Y_1(x)$ and graph it. [▶] [□] See **Calculator Note 9B** for specific instructions for your calculator. ◀]

Step 11 Look at a table on your calculator and compare the y -values for Y_1 and Y_2 .

Step 12 Repeat Steps 10 and 11, but use these equations for Y_2 .

a. $Y_2(x) = 0.5 \cdot Y_1(x)$

b. $Y_2(x) = 3 \cdot Y_1(x)$

c. $Y_2(x) = -2 \cdot Y_1(x)$

Step 13 Write an equation for $R(x)$ in terms of $B(x)$. Then write an equation for $B(x)$ in terms of $R(x)$.

