Pixels and Step Size on the TI-85: A Technical Exercise

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Recall that to graph a function on the TI-85 you choose **GRAPH** from the keyboard, the **y(x)=** from the bar menu and define your function,

say y1=x^2.

Next **EXIT** this menu and chose **RANGE** from the bar menu and enter your range for the values of x and y, and the scale for each axis.

Say xMin=-3.15, xMax=3.15, xScl=1, yMin=-3.15^2, yMax=3.15^2, and yScl=1.

Finally choose **GRAPH** from the bar menu and set back and let the machine do its thing. The point of this exercise is to explore just how the TI-85 goes about drawing that nice little picture on its screen.

The TI-85 selects sample values for x between xMin and xMax inclusively, approximates via some mysterious "numerical process" the corresponding values of y(x), just x^2 in this case, and "plots the point (x,y(x))" by lighting a little spot, called a pixel, above the sample x value on the x-axis and across from a spot on the y-axis that it thinks is pretty close to representing the corresponding value for y(x). Then it connects the consecutive spots by "straight lines" in the **DrawLine FORMT** or just leaves them as they are in the **DrawDot FORMT.**

The method for approximating y(x) most surely depends on how we define the function y(x), but the way the machine chooses the sample values for x is always the same. It chooses them *uniformly distributed,* one for each pixel from xMin to xMax; that is to say, consecutive sample values are all the same distant apart. If we knew the number of sample points, pixels, on the x-axis then we could determine just how far apart they must be.

Ex 1. Suppose there were 11 sample points, all the same distance apart from xMin=0 to xMax =10, inclusive. How far apart must they be?_____

Ex 2. Suppose there were 100 sample points from -25 to 25, how far apart must they be?_____

Ex 3. Suppose we know that all the sample points are .5 units apart on the range xMin=0 to xMax=20. How many sample points are there including both xMin and xMax?_____

Ex 4. Experiment with **TRACE** from the GRAPH bar menu using the above function and range to determine the number of sample points (pixels) on the x-axis of your machine. Including xMin and xMax there are _____ equally spaced sample points on the x-axis.(It's cheating to look in your manual.)

Ex 5. If we want to sample at every integer value for x, with 0 exactly in the center, we must choose xMin=_____ and xMax=_____ (Check out the range after using **ZINT** from the **ZOOM** menu.)

Ex 6. Can you guess the effect on the value of xMin and xMax from using **ZDECM** from the **ZOOM** menu?_____ Explain?_____
_____

Ex 7. If xMin=0 what is the largest value possible we can choose for xMax so that both x=6 and x=9 are sample points?_____ Use **TRACE** to verify that 6 & 9 are sample points. Explain why this is the biggest value for xMax that works._____
_____
_____

Ex 8. If xMin=0 what is the largest value possible we can choose for xMax so that both x=5 and x=9 are sample points?_____

Ex 9. If xMin =0 what is the largest value possible we can choose for xMax so that both of two positive integers x=n and x=m are sample points? _____ (Of course the answer is in terms of some integer related to the integers n and m.)

Ex 10. Counting xMin and xMax there are an odd number of pixels on the x-axis of the TI-85. Explain why this guarantees that the center of the range of x values is always a sample point. (Recall that the center of the interval from xMin to xMax is given by the formula (xMin + xMax)/2 and the length of the interval is xMax - xMin.)_____
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