Chapter 10 Exercises

1. Use 2nd CATALOG to access the commands of this exercise. Use AxesOff and ClrDraw to clear your screen. Then plot the following pixels using Pxl-On:
   (a) (20,20)  (b) (50,50)  (c) (0,0)  (d) (0, 94)  (e) (62,0)  (f) (62,94)

2. Again use AxesOff and ClrDraw to clear your screen. Set your WINDOW to −8 ≤ X ≤ 8 and −5 ≤ Y ≤ 5. Then enter Pt-On. Use the movement keys to locate the following points (press ENTER when you locate each one):
   (a) (0,0)  (b) (5,5)  (c) (8,5)  (c) (8,−5)  (d) (−8,−5)  (e) (−8,5)

3. The function Line( allows you to draw a line on your screen by moving the cursor. Again use AxesOff and ClrDraw to clear your screen and use this function to draw two lines in the form of an X that connect the corners of your screen. Press ENTER at the start and end points.

4. As pointed out in the text on pages 169 and 170, when you graph an equation, points on the screen are plotted one at a time. However, as your experience in exercise 3 should have suggested, the individual rows and columns of pixels are only integers if you have the screen WINDOW values −47 ≤ X ≤ 47 −31 ≤ Y ≤ 31.
   (a) Set those values, enter ClrDraw and then Line(. Your screen should show a + in the middle of the screen and the values X = 0 and Y = 0 along its base. Move the cursor with the movement keys in the upper right corner of the calculator keyboard and notice how:
      (1) the + moves around and (2) the values of X and Y change.
   (b) In the Line( window, draw a line from (0,5) to (7,−10). To do this move the cursor to (0,5), press ENTER, then move the cursor to (7,−10) and again press ENTER.
   (c) Now change the WINDOW values back to −8 ≤ X ≤ 8 and −5 ≤ Y ≤ 5. Enter ClrDraw and Line(. 

5. Here are the approximate dimensions of a calculator display. If you darken your screen you will see that, as the figure shows, only part of the screen is actually used to convey information.
   (a) Calculate the area of the screen and the area of the useful portion to see what percent of the screen area serves as display.
   (b) In exercise 5 of Chapter 5 the Fibonacci numbers were introduced. Recall that they began 0, 1, 1, 2, 3, 5, 8, 13,..., with each new number the sum of the two previous to it. If you form the ratio of any number of this series after the second to the one preceding it –
1/1, 2/1, 3/2, 5/3, 8/5, 13/8,... – you come closer and closer to a mathematical constant often designated by the Greek letter \( \tau \) (tau, pronounced to rhyme with cow). That ratio is

\[
\frac{1 + \sqrt{5}}{2} = 1.618....
\]

Some people – many artists among them – believe that this ratio has special properties among which are the size of "the best" rectangle. How close do the dimensions of your screen come to this ratio? How close do the dimensions of your pixel area come to this ratio? Compare your results with the ratio for the usual 3" by 5" and 5" by 8" cards. (Notice that both of those pairs are successive terms in the Fibonacci sequence.

(c) Show that the ratio of the pixel area approximate dimensions 2 : 1.3/8, is equivalent to 16:11. Set your calculator [WINDOW] so that \(-8 \leq X \leq 8\) and \(-5.5 \leq Y \leq 5.5\) and enter in \(Y=\) the graph \(Y = X\). Be sure your calculator [MODE] is set to [FUNC]. Use [GRAPH] to graph this equation.

(d) Notice that your graph in (c) is not quite "perfect". If the dimensions were just right, there would be no wiggles in this 45° angle set of pixels. Adjust your values for \(Y\) downward 0.1 at a time – 5.4, 5.3, etc. – until the line comes out without those wiggles. What ratio do you obtain?

(e) The ratio 16 : 11 is close to 16 : 10 = 8 : 5. Try this ratio by setting \(-8 \leq X \leq 8\) and \(-5 \leq Y \leq 5\) in [WINDOW]. Again graph \(Y = X\).

(f) On this screen graph the circle \(Y = \sqrt{25 - X^2}\) and \(Y = -\sqrt{25 - X^2}\). Does the result seem reasonable?

(g) The ratio 16 : 11 is also close to 16 : 12 = 4 : 3 or 8 : 6. Try this ratio by setting \(-8 \leq X \leq 8\) and \(-5 \leq Y \leq 5\) in [WINDOW]. Again graph \(Y = X\), \(Y = \sqrt{25 - X^2}\) and \(Y = -\sqrt{25 - X^2}\).