

Christmas Tree with Lights



Teacher Notes & Answers

7 8 9 10 11 12



TI-84 Plus CE



Practical Activity



Student



50 min

Introduction

Cartesian coordinates are a way of identifying the location of points on a 2 dimensional plane (x,y) or in 3 dimensional space(x,y,z). We can use these points systematically to construct diagrams and/or pictures. In the activity you will use your mathematical and artistic skills to create an image. We will start with a simple image then move you to a more challenging one. Then you will be able to construct your own using the skills and knowledge you gain.

Drawing a square - Introduction

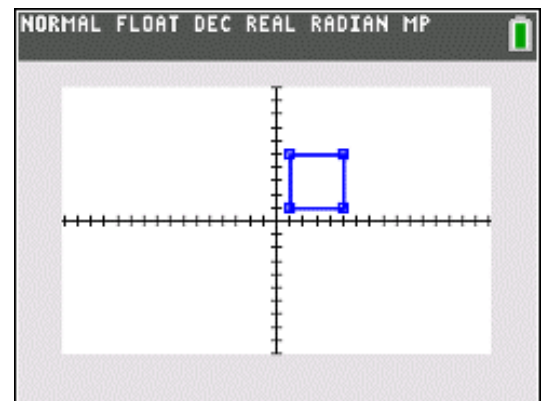
Here is a diagram of the square that you will draw. Firstly, you must identify the points used to create the image.

In this case the four vertices of the square.

Question 1

The four vertices' coordinates are
(1,5) (1 , 1) (5 , 1) (5 , 5)

Let's write them in a tabular form.



Be systematic, write them in the order you would follow if you were joining them to the previous one.

x	y
1	5
1	1
5	1
5	5

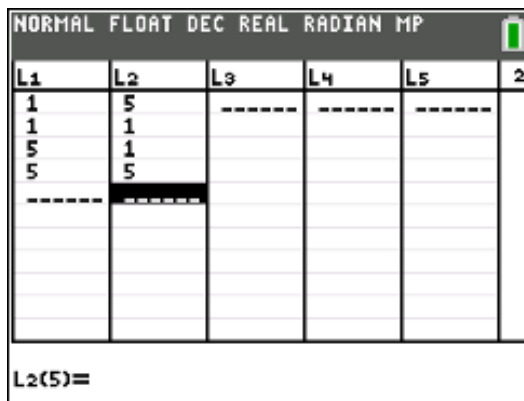
For our first image this is all the data you require.

Teacher Notes:

This solution shows the joining of points moving anticlockwise around the square. Students may also go clockwise in which case their order of points will be: (1,5) (5,5) (5,1) (1,1).

Drawing a square on your calculator

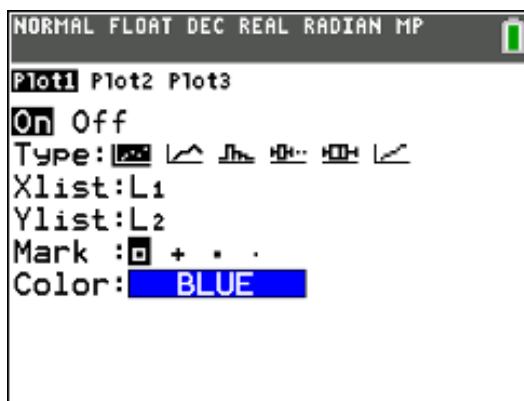
First enter these points into the List Editor. (Press **stat**, **1** to access the List Editor.)



Now let's use these points to create a scatter plot. Press **2nd**, **stat plot** and set Plot1 On and as a scatterplot of the data in L1 and L2.

Teacher Notes:

Make sure that you have cleared or switched off any functions in the **y = function** editor.

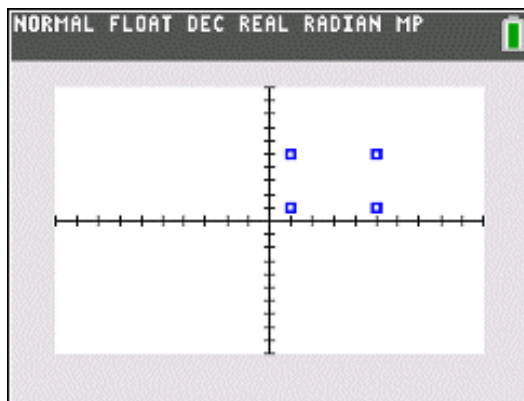


If you now press **graph** at the standard zoom settings (ZStandard), your "square" will look like a rectangle.

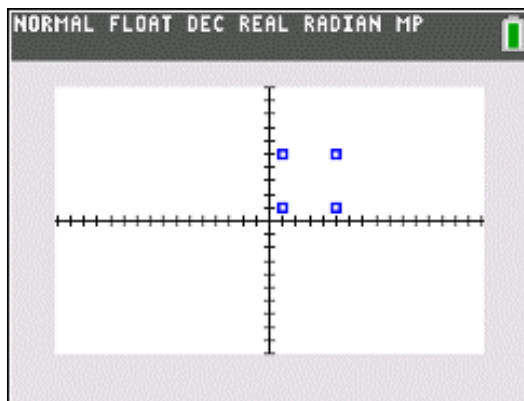
Question 2

Why does the shape appear rectangular?

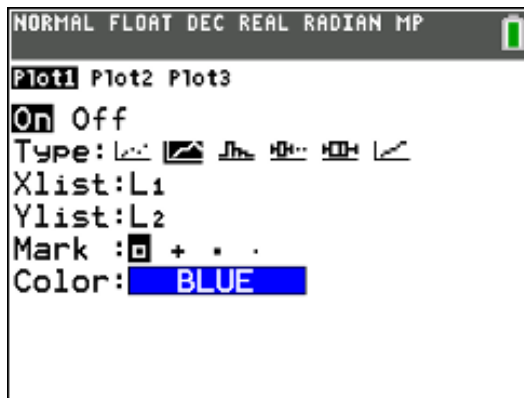
This is because your calculator has a rectangular screen and the standard zoom setting stretches the x-axis.



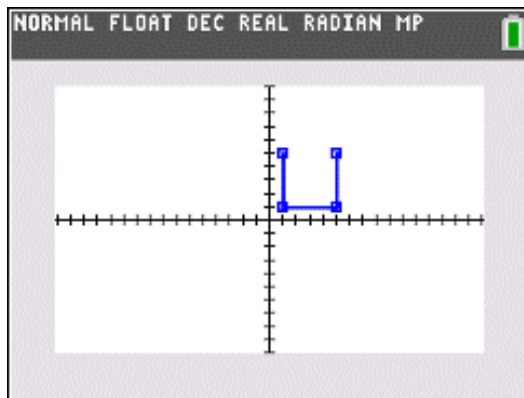
You can fix this by selecting ZSquare (zoom, 5) and your coordinates will now be displayed as a square.



Return to the **stat plot** menu for Plot1 and change the Type to connected line plot.



Press **graph** again. You will notice that the shape is not completed.

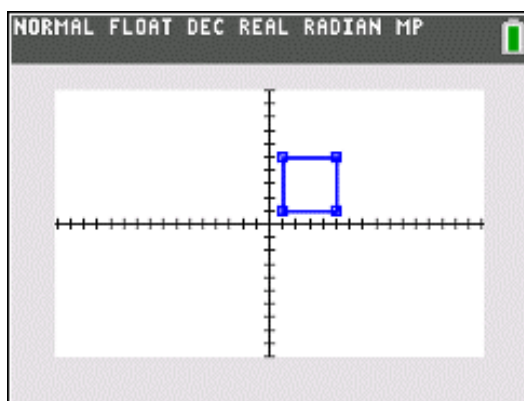


In order to join the shape up the initial point must be added to the end of your points again.

L1	L2	L3	L4	L5	2
1	5				
1	1				
5	1				
5	5				
1	5				

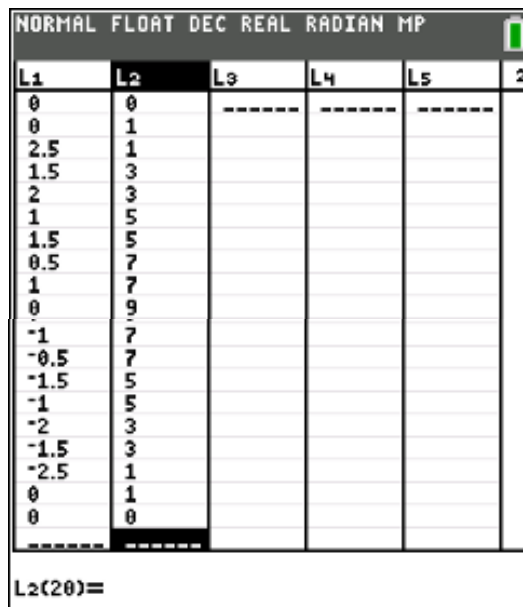
L2(6)=

Your shape should now be complete.

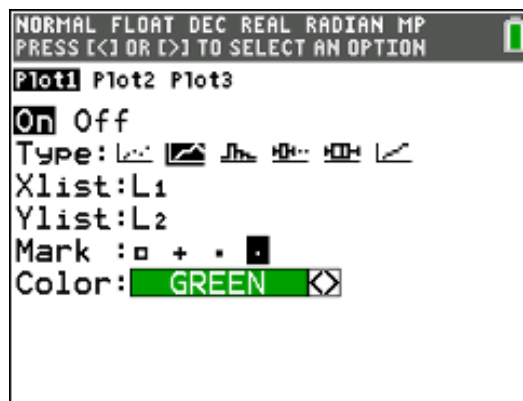


Drawing a Christmas Tree on your calculator - Now try this set of data

L1	L2
0	0
0	1
2.5	1
1.5	3
2	3
1	5
1.5	5
0.5	7
1	7
0	9
-1	7
-0.5	7
-1.5	5
-1	5
-2	3
-1.5	3
-2.5	1
0	1
0	0

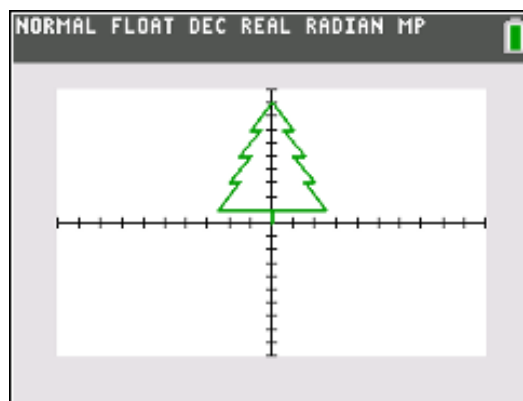


Change the mark setting in Plot1 to the small dot and the colour to Green.



When you press **graph**, the appearance of your Christmas tree will be different depending on the zoom or window settings that you select.

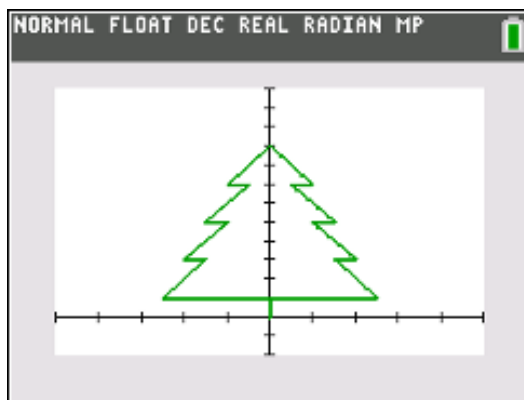
The image here is for ZStandard. You might like to also explore ZSquare and ZoomStat.



You can also change the shape and position by changing the **window** settings.

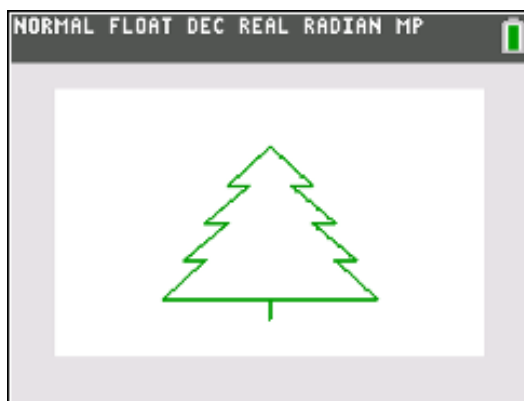
```
NORMAL FLOAT DEC REAL RADIAN MP
WINDOW
Xmin=-5
Xmax=5
Xscl=1
Ymin=-2
Ymax=12
Yscl=1
Xres=1
ΔX=0.037878787878788
TraceStep=0.075757575757...
```

The settings above will produce this image.



To get a better view of our tree, go into the **format** settings (2nd, zoom) and switch the axes off.

```
NORMAL FLOAT DEC REAL RADIAN MP
PRESS [◀] OR [▶] TO SELECT AN OPTION
RectGC PolarGC
CoordOn CoordOff
GridOff GridDot GridLine
GridColor: MEDGRAY
Axes: Off K)
LabelOff LabelOn
ExprOn ExprOff
BorderColor: 1
Background: Off
Detect Asymptotes: On Off
```



Adding our Christmas Lights

Now let's put some data into L3 and L4 that we can use in a scatterplot to provide some Christmas lights.

Question 3

If we want the lights to be on each of the eight pointy corners of the Christmas tree image, what coordinates do we need to use for the data in L3 and L4? The first one has been done for you.

(2.5, 1) (2, 3) (1.5, 5) (1, 7)

(-2.5, 1) (-2, 3) (-1.5, 5) (-1, 7)

Set up a scatterplot for Plot2 and choose the first mark option and set the colour to Red.

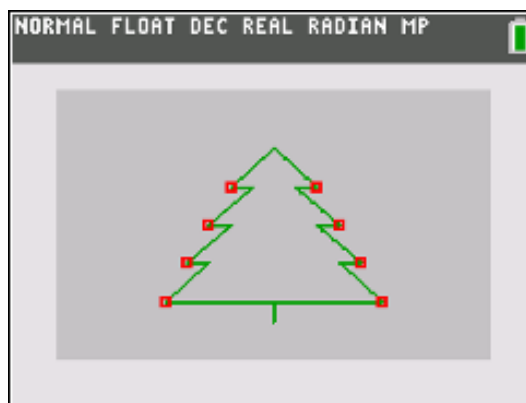
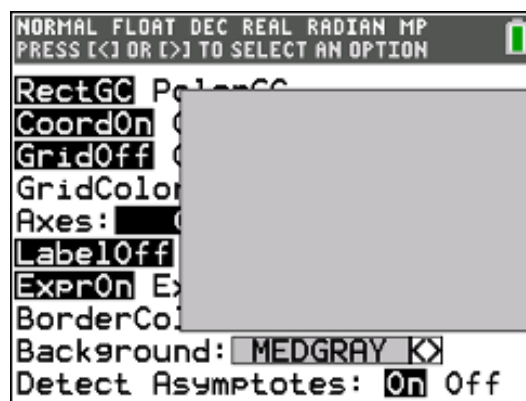
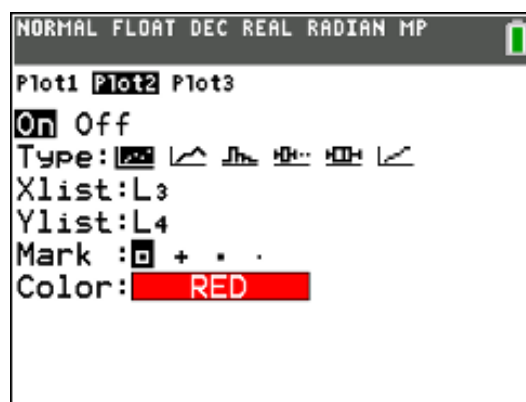
Teacher Notes:

Notice that photographs can also be used as backgrounds. Students might like to experiment by transferring a photo from their phone or the internet to use as a background.

Return to the **format** menu and change the background to **MedGray**.

L1	L2	L3	L4	L5	4
0	0	2.5	1	-----	
0	1	2	3		
2.5	1	1.5	5		
1.5	3	1	7		
2	3	-2.5	1		
1	5	-2	3		
1.5	5	-1.5	5		
0.5	7	-1	7		
1	7	-----	-----		
0	9				
-1	7				

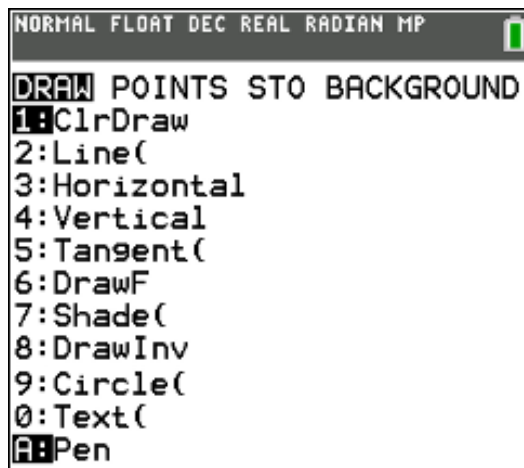
L4(9)=



Adding more features from the Draw menu

Press **2nd**, **prgm** to access the Draw menu.

Firstly we will use option 9 to draw a larger yellow ball at the top of the tree.



After you have selected the 'Circle' option from the Draw menu, use the cursor keys to navigate to the top of the tree. Press **enter** to indicate the centre of your circle. Move the cursor and press **enter** again to indicate the size of your circle.

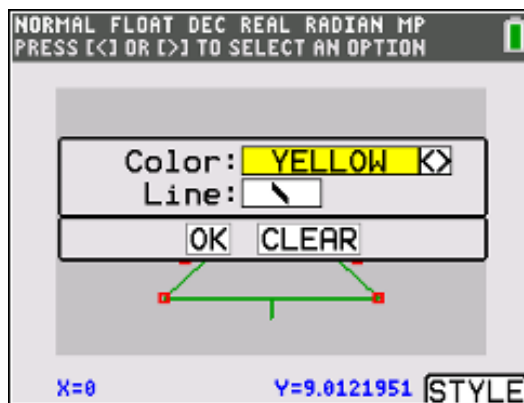
If you make a mistake at any time, you can undo what you have drawn by selecting option 1 **ClrDraw** from the Draw menu. But be aware that this will delete everything that you have added from the Draw menu.



While the Circle feature is active, the **Style** softkey can be selected by pressing the **graph** key.

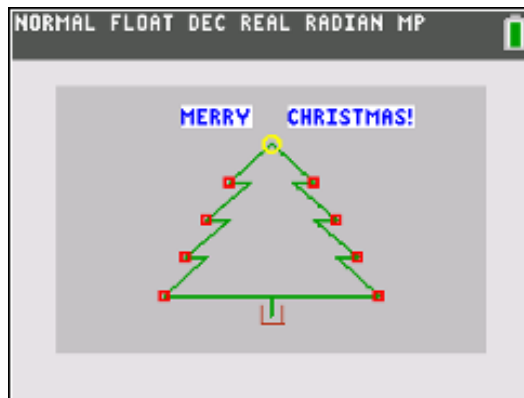
You may like to use this to make your circle yellow and the line thick.

In order to quit from any of the Draw features, press **2nd**, **mode** .

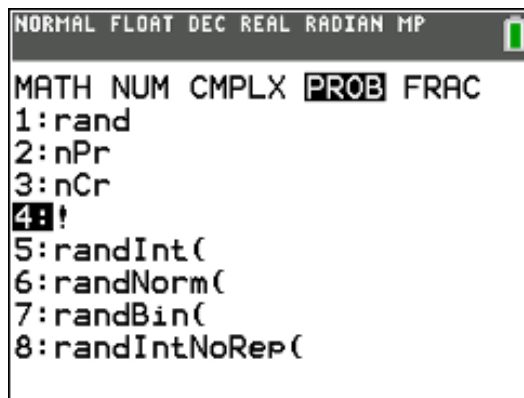


You could use the 'Text' option to add a message to your picture and the 'Pen' option to add more to it (such as a pot for the tree to stand in).

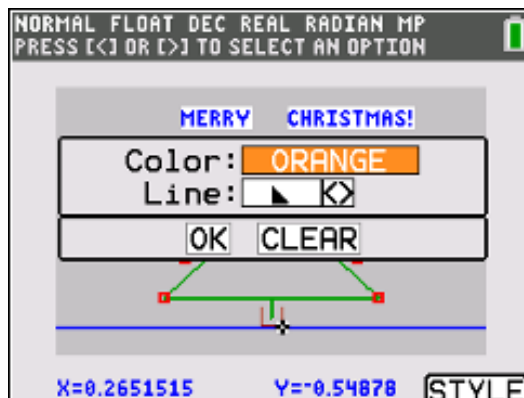
Remember to use the Style options to make the adjustments that you would like (e.g. for the colour).



Note: If you would like to use an exclamation mark in your text message, you can find it in the 'Prob' section of the **math** menu. (This actually represents a mathematical feature that you will learn about in later years.)



To complete the picture, select option 3 'Horizontal' from the **Draw** menu. Select the shade below line option from the Style menu and perhaps change to a new colour.



Here is the final result. Merry Christmas!

Teacher Notes (Extension):

We still have one more Stat Plot available for us to use. Challenge students to think of suitable coordinates to enter as data into L5 and L6 to draw a frame around our picture or perhaps a present under the tree? Remember, they learnt how to draw a square in the early part of this activity.

