

Christmas Tree + Flashing Lights

Teacher Notes & Answers

7 8 9 10 11 12



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. We will then use some conditional formatting to create blinking lights for your Christmas Tree.

Drawing a Square

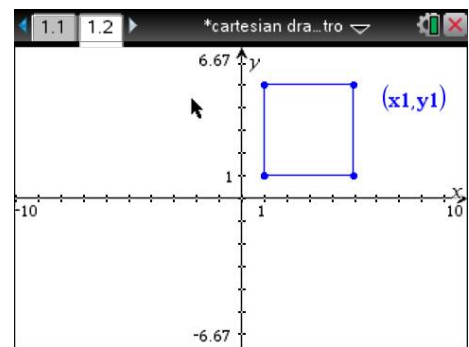
Here is a diagram of the square that you will draw.

Firstly, you must identify the points used to create the image. In this case the four vertices of the square.

The four vertices' coordinates are:

(1, 5) (5, 5) (5, 1) (1, 1)

Let's write them in a tabular form.



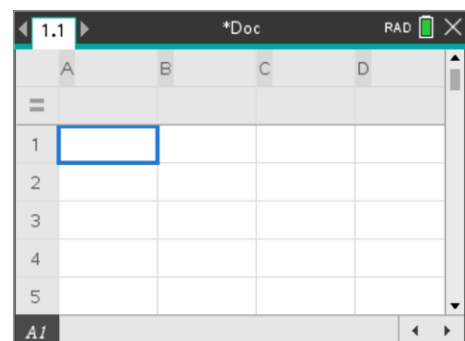
Be systematic, write them in the order you would follow if you were joining each point to the previous one.

For our first image this will be all the data you require.

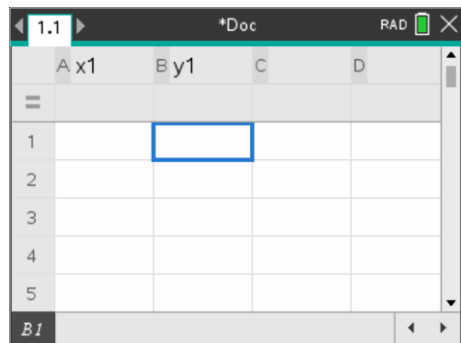
x	y
1	5
5	5
5	1
1	1

Drawing a square on your calculator:

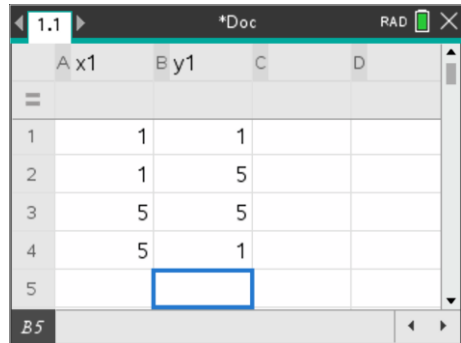
Insert a Lists and Spreadsheet application into a new document.



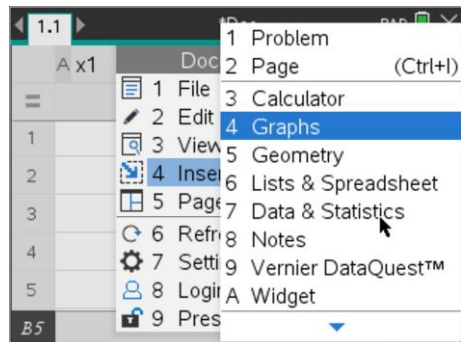
Name the first two columns: x1 and y1



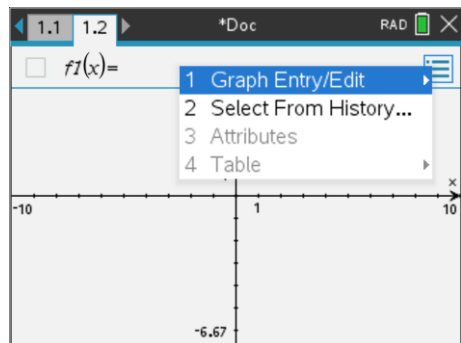
It is here that you enter the coordinates.



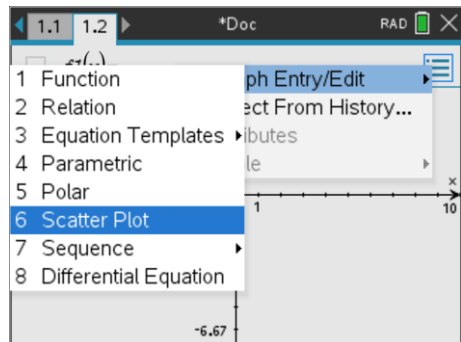
Now add a Graphs application, this is where the *drawing* will be displayed.



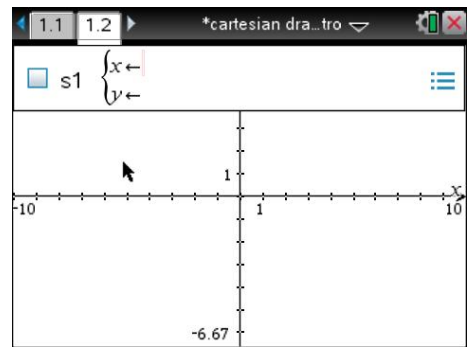
Select the Graph Entry/Edit type.



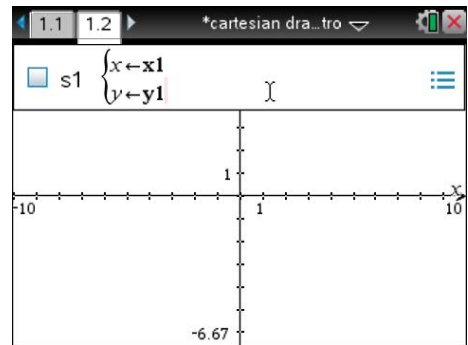
You need to select Scatter Plot.



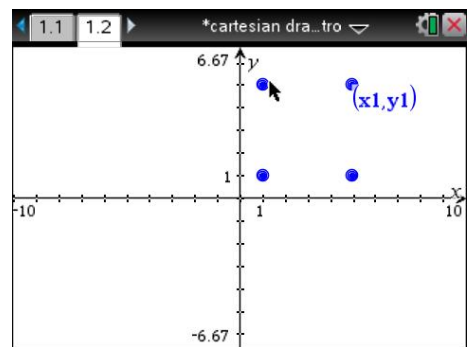
Now this Graph entry method should be displayed. (S1 = Scatter Plot 1)



Let x be $x1$ and y be $y1$, the variables we defined in the Lists & Spreadsheet application.



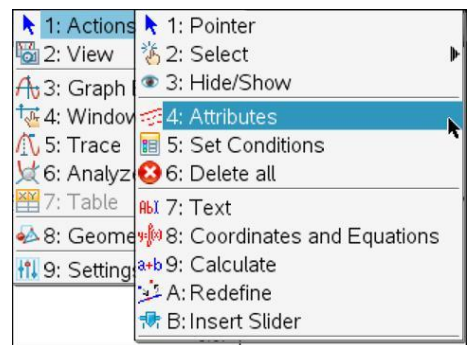
Your points will be displayed.



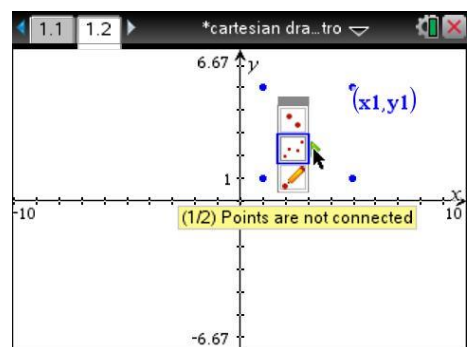
Next we have to join them up, press:

menu > **Actions** > **Attributes**

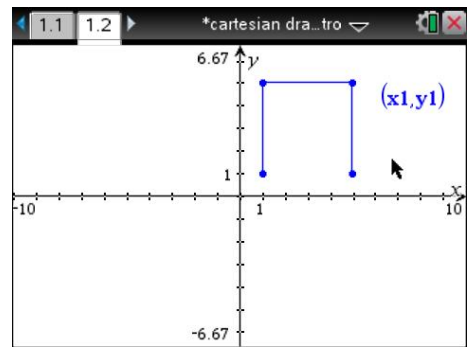
Click on one of the points.



Select the middle attribute and change it to: "Points are Connected".



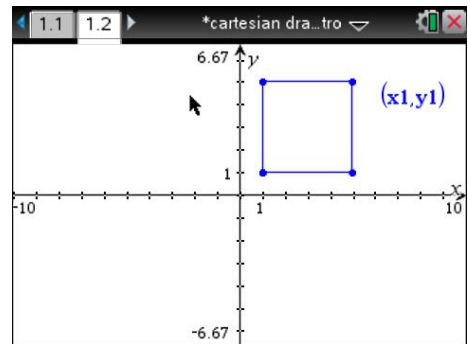
You will notice now the shape is not completed.



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

	A	x1	B	y1	C	D
=						
2		1		5		
3		5		5		
4		5		1		
5		1		1		
6						

Your shape should be complete.



Drawing a Christmas Tree on your Calculator

Now try this set of data:

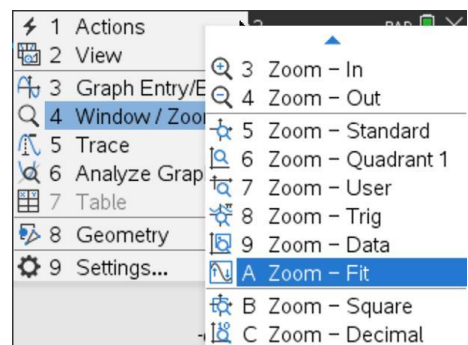
X ₁	0	0	2.5	1.5	2	1	1.5	0.5	1	0
Y ₁	0	1	1	3	3	5	5	7	7	9
X ₁	-1	-0.5	-1.5	-1	-2	-1.5	-2.5	0	0	
Y ₁	7	7	5	5	3	3	1	1	0	

You may notice your image goes outside of the calculator window. You can change the window settings to ensure that all the data you entered will fit. Press:

[menu] > **Window/Zoom** > **Zoom - Fit**.

All your points should be visible now.

Note that the window is no longer 'square', it has been stretched to fit.



Adding the Lights:

Multiple sets of data can be graphed.

To create our lights, we will label the extra columns:

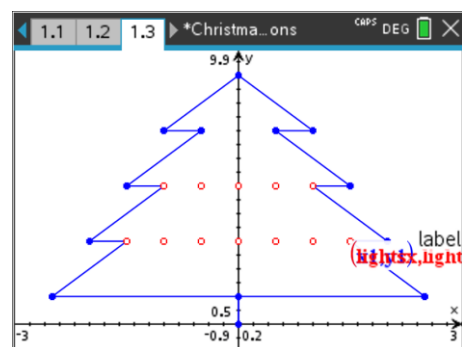
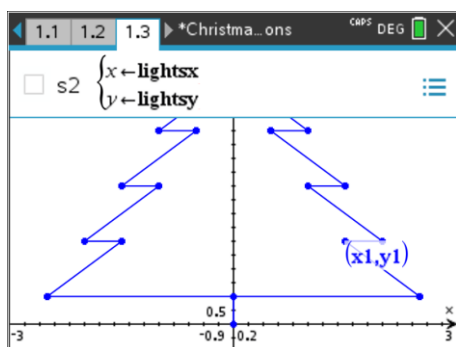
lightsx and lightsy

Graph them on the same axes as the tree.

	x1	y1	lightsx	lightsy
1	0	0	-1	5
2	0	1	-0.5	5
3	2.5	1	0	5
4	1.5	3	0.5	5
5	2	3	1	5

Here are two lines of lights, they don't need to be joined together.

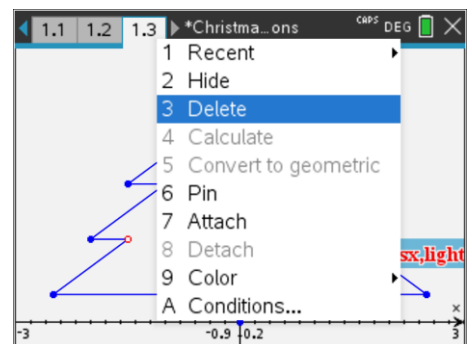
lightsx	-1	-0.5	0	0.5	1	-1.5	-1	-1.5	-0.5	0	0.5	1	1.5
lightsy	5	5	5	5	5	3	3	3	3	3	3	3	3



These will be the points that we will make flash different colours.

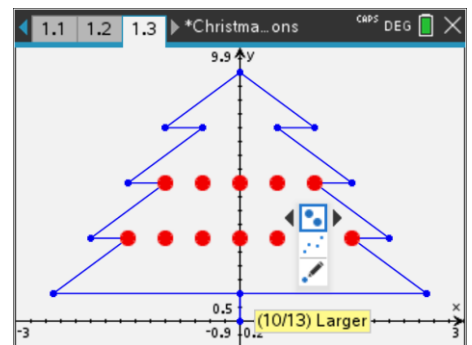
First let us delete the **labels** for the sets of points (x1,y1) and (lightsx , lightsy)

Select the labels, then press: **ctrl** + **menu** and delete them.

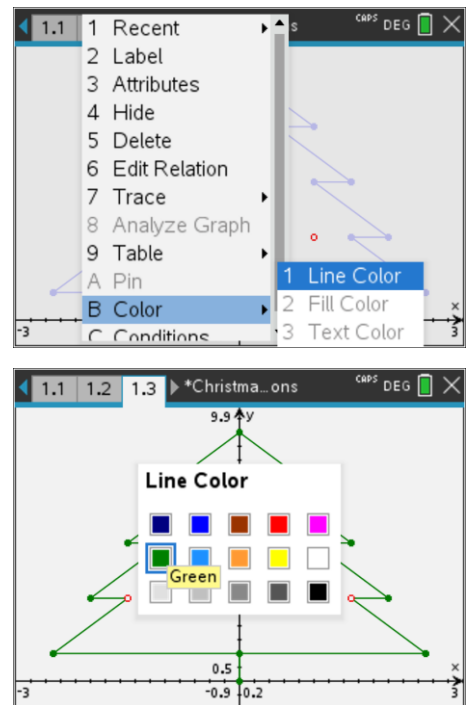


The points that represent the Christmas lights can be altered by changing their attributes to make them more decorative.

Select the lights scatterplot and change their attributes to: "Larger".



You can also select the tree and change its colour to green.



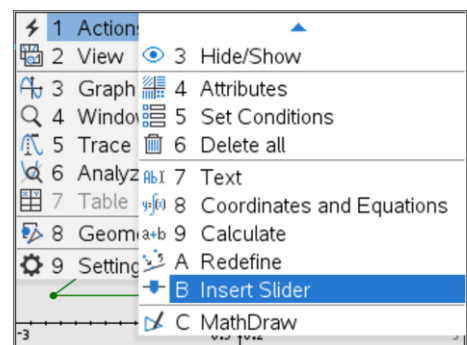
Flashing Lights:

Teacher Notes:

This part involves the students creating sliders which have a limited range of values. 0,1,2 and 3. We then us one line of code when(blink=1,7,when(blink=2,6,when(blink=3,2,9))) inserted into the conditions part of the scatter plot settings. The command “when(blink=1,7,#) means when the slider value is 1 the line colour is 7 which aligns to red.

This is the part which will prove most challenging for the students. The # part of the command corresponds to what happens when blink does not equal 1. In this case, a series of ‘nested’ instructions are used. In coding this is referred to as “IF <condition> THEN <instruction - when condition is true > ELSE <instruction – when condition is false>”

Create a slider, call it: “blink”.

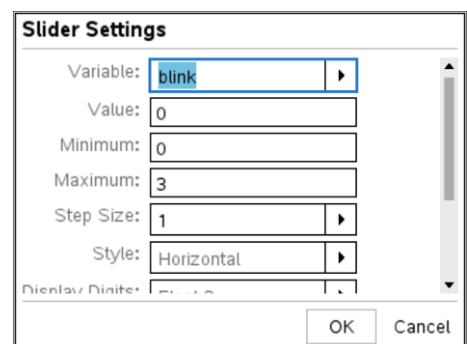


Note the values:

Minimum = 0

Maximum =3

Step Size 1



Select the lights scatterplot. Press: **ctrl** + **menu** and select conditions.

The conditional attributes can control when a graph, point or set of points are visible and their colour.

Blink is the value of the slider either 0, 1, 2 or 3

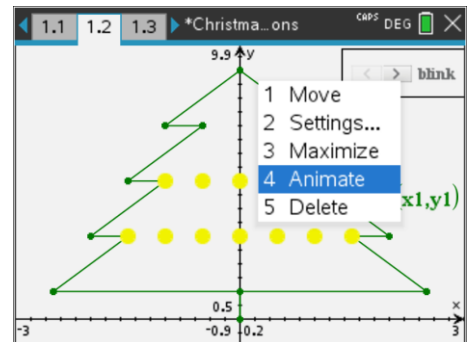
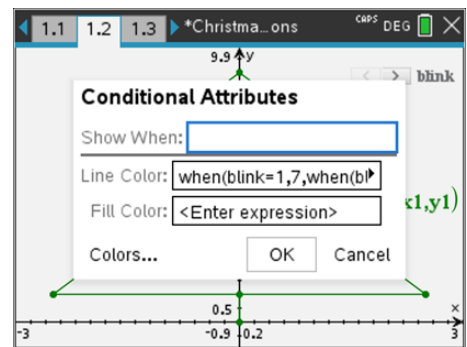
As the slider values change so do the colour of the lights.

Here is the code to enter into the line colour:

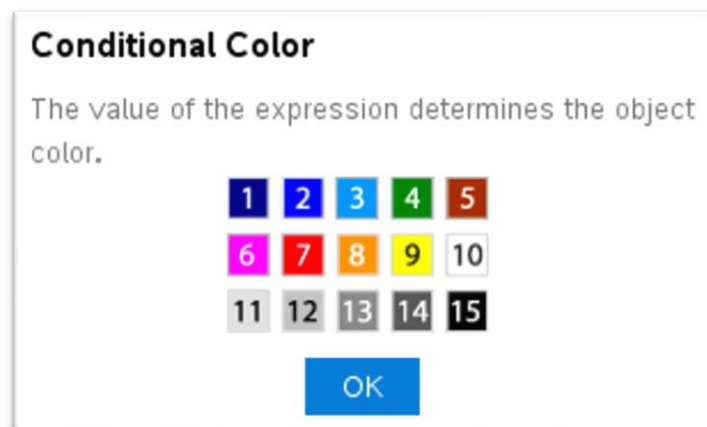
when(blink=1,7,when(blink=2,6,when(blink=3,2,9)))

Now select the slider, press **ctrl** + **menu** and select Animate.

You should now have flashing lights!



For your Reference



Extension:

Now you have built the basic Christmas tree, try adding more features such as:

- More lights
Additional lights can be added to the existing lightx and lighty lists.
- Another set of lights with alternate blinking
Students can create additional lists and set up the scatterplot accordingly.
- A star on the top
This will require to think a lot more about coordinates, shape and proportion.
- Ornaments on the tree
This could be several other sets of lists so as to generate different colours and use the attributes for each scatterplot to change the size of the plotted points.

- Presents underneath the tree
This reapplies the idea of a square from the first part of the activity, but could include other shapes.
- A bushier looking tree.
This could be as simple making a series of dilations or translations of the existing x1 and y1 lists and plotting them.
Example: a small dilation or translation in the x direction only.

