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TI-Nspire CAS



Investigation



Student



90min

Problem Statement:

What is the perimeter of Australia? The answer to this question depends on the purpose. The driving distance is significantly different from the sailing distance which is different again from the coastal distance. The driving distance restricts movement to roads. Sailing incorporates an extra distance for clearance from the shore. Coastal distance can include islands increasing the perimeter by more than 60%. For the purpose of this activity the calculation is approximate to give an indication for anyone preparing a driving or sailing venture around Australia.

Equipment

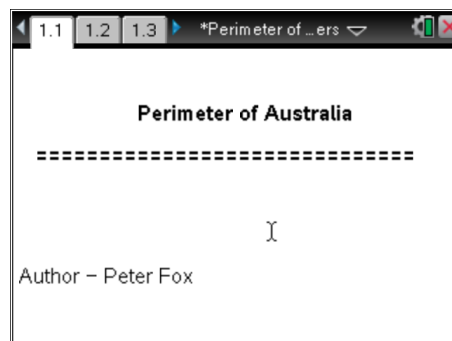
For this activity you will need:

- Internet Access (To answer specific questions)
- TI-nspire CAS document – Perimeter of Australia
- TI-nspire CAS

Introduction – Setting up the calculations

Open the Perimeter of Australia document.

Press the **Home** key, select **My Documents** and navigate to the Perimeter of Australia activity and open the document.

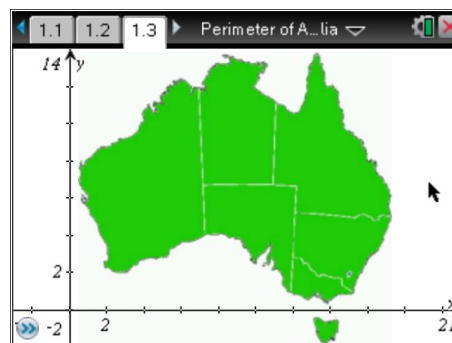


Page 1.2 contains a brief introduction for the activity.

Navigate to page 1.3 by pressing **CTRL + Right Arrow**.

The graph contains a map of Australia. The object is to place a set of points around the mainland of Australia.

More points increase accuracy at the expense of more calculations, so choose points carefully.

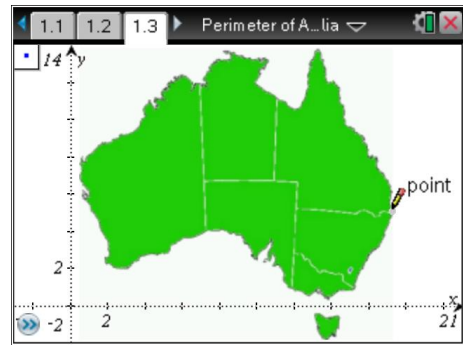


Use the **menu** and select **Points and Lines** followed by **Points**.

The mouse changes to a pencil. Place at least 12 points around Australia that represent a dot-to-dot outline, without excluding too much of the land features.

The order of the points does not matter.

Press **escape** once all the points have been placed.

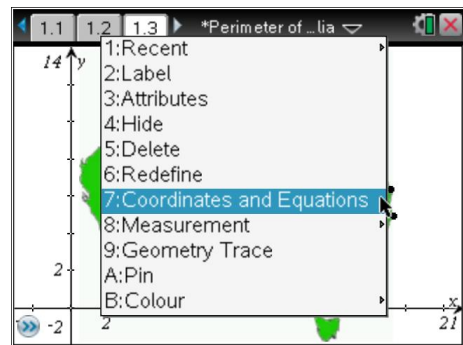


To display the coordinates of each point, place the mouse over the top of one of the points and press **CTRL + Menu**.

From this menu select **Coordinates and Equations**.

Repeat this process for each of the plotted points.

If the screen becomes too busy, work with just a selection of points at a time.



Note:

CTRL + Menu is equivalent to a right mouse click on a computer.

Recording Results

- Record all your results in a table (as shown below). Record the points in order with their corresponding state in the table. At this point only the first two columns will be completed. A sample set of data is included below. Do NOT use the sample data in your calculations.

State/Territory	Coordinates	Formula with Points	Computed Distance	Scaled Distance
QLD	(17.2, 6.38)			
QLD	(13.2, 13.7)			
QLD				
NT				

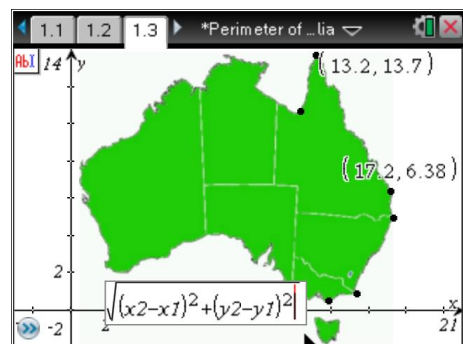
The next step is to write the formula for calculating the distance between two points on the Cartesian plane.

Press **menu** , from the **Actions** menu select **Text**.

In the text box, enter the expression for the distance between two points: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Note that the *subscript* on the x and y coordinates does not appear smaller on the calculator screen.

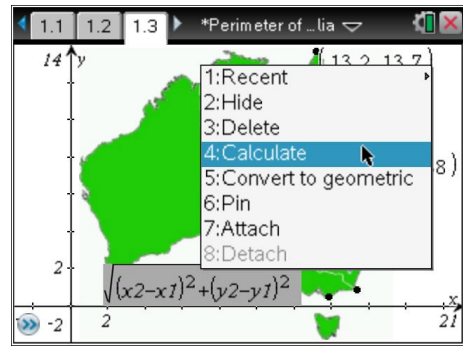
ie: x_2 should be read as x_2



Once the formula has been entered, move the mouse over the formula, the word *text* will appear.

Press **CTRL + menu**, from this menu select **calculate**.

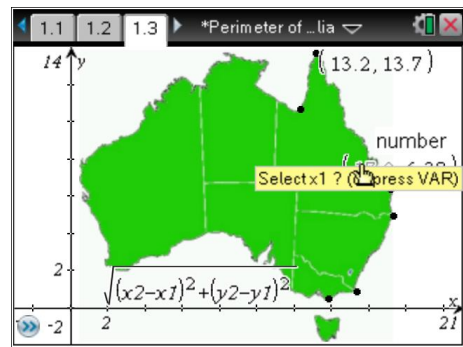
The mouse will change to a magnifying glass with a small question mark inside.



Move the mouse to highlight x_1 ($x1$). Click on the corresponding coordinate for x_1 and the proceed to click on x_2 followed by y_1 and y_2 as directed by the help text attached to the mouse.

When all four variables have been identified the answer is computed automatically and remains attached to the mouse.

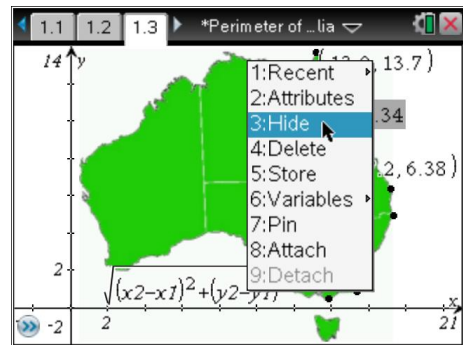
Move the mouse a suitable location to display the distance and click the mouse to place the measurement.



Note:

As more calculations are completed the screen may become very busy. To hide measurements, hover over them with the mouse and press **CTRL + menu** and select **Hide**.

Hidden measurements can be displayed again by using the **menu** key, select **Actions** followed by **hide/show** and then select the measurements to be hidden or displayed.



- The calculations must be recorded in the table. A sample set of calculations have been provided. The scale distance will be computed later. Complete the calculations for all your points on the mainland.

State/Territory	Coordinates	Formula with Points	Computed Distance	Scaled Distance
QLD	(17.2, 6.38)			
QLD	(13.2, 13.7)	$\sqrt{(17.2 - 13.2)^2 + (6.38 - 13.7)^2}$	8.34	
QLD				
NT				

3. The scaled distance on the map is 1unit : 240km. Use this scale to convert each of the computed distances into an actual distance and include these in the table.
4. Determine the total distance around mainland Australia using your approximation.
5. Produce another table of values and include measurements for Tasmania.
6. Calculate the total distance around Australia and comment on your total would be effected if other islands and bays around Australia's coastline were to be included.
7. Use the internet to research the coastal distance around Australia and compare this value with your answer.
8. Use the internet to research the road distance around Australia and explain why your measurement varies from this distance.
9. Which mode of transport would your approximation best suit?