

TI-Nspire

Max/Min Modeling Task

Aim

To find the maximum and minimum values to a problem through analysing data gathered from manipulating a model of the problem.

Calculator objectives

By the end of this unit, you should be able to:

- Model a geometric problem using a G&G page
- Collect data generated by manipulating your model
- Analyse the data using a regression
- Find the maximum and minimum values

Contents

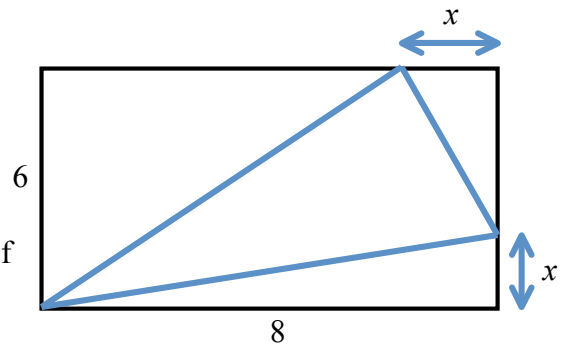
Plane geometry view – construction
Data Capture
Quadratic Regression
Graph Trace

Problem (standard calculus max/min question):

Show that the area of the triangle, H , is given by:

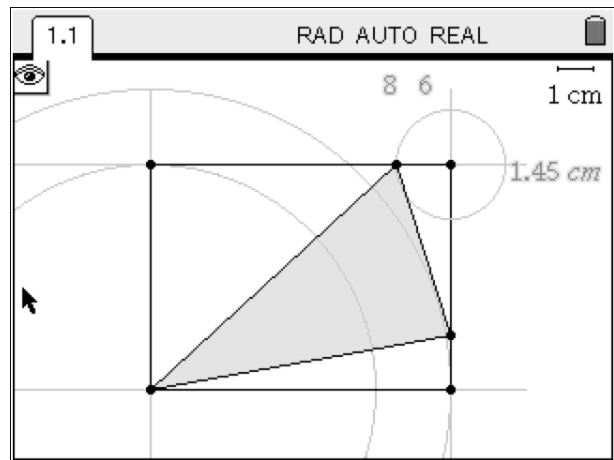
$$H(x) = 24 - 4x + \frac{1}{2}x^2$$

Hence find the greatest and least possible values of the area of the triangle.



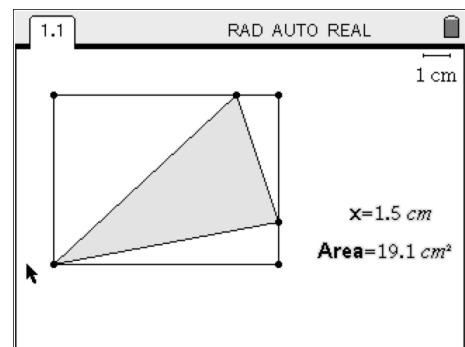
Task (Year 10/11): Using the GDC, explore the problem:

1. In a G&G page (Plane Geometry View), construct the diagram.



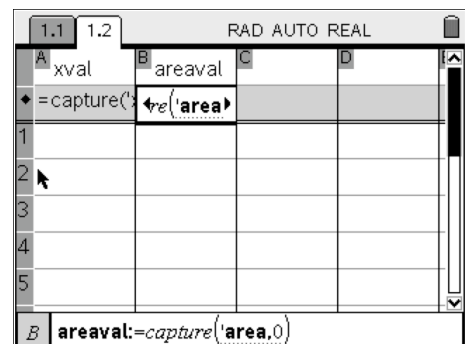
2. Measure the area of the triangle (Ⓜenu, 7:Measurements, 2:Area) and the size of x :

Assign each of these values to the variables 'x' and 'Area', by selecting the value and pressing ⓀⓃⓉⓁ ⓈⓉⓂⓂⓂ.



3. In a L&S page: label the first two columns 'xval' and 'areaval'. In column A capture the value of 'x', and in column B capture the value of the 'area', from the G&G page. Do this by:

Ⓜenu, 3:Data, 2: Data Capture, 2: Manual ...



4. Go back to the G&G page. Capture a set of data, by moving your moveable point on the triangle. Press $\text{ctrl} + \text{click}$ to capture a data point.

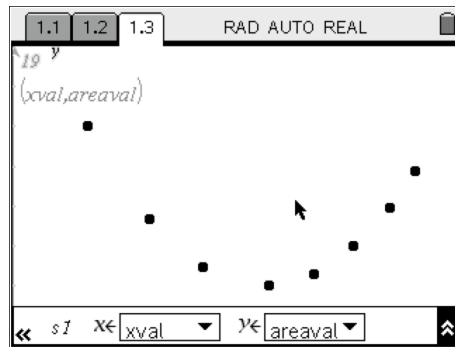
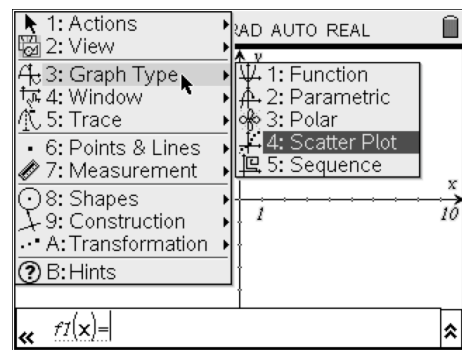
5. The captured data can be viewed in the L&S page.

	xval	areaval		
=capture(')	=capture(')			
1	1.5	19.125		
2	2	18		
3	2.7	16.845		
4	3.3	16.245		
5	4.05	16.0013		

6. (Alternative approach – jump to step 11).

In a new G&G page, plot the set of ordered pairs (xval, areaval). You may need to change the window setting to see the data: the easiest way is to

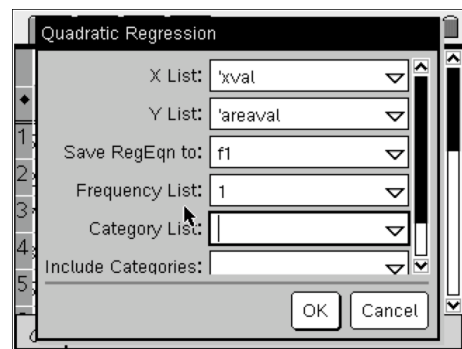
$\text{ctrl} + \text{4}$, 4: Window, 9: Zoom – Data.



7. Find the equation of the curve: Go back to your L&S page. Move to cell C1. Press:

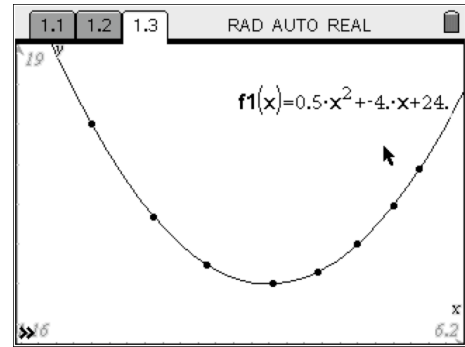
$\text{ctrl} + \text{4}$, 4: Statistics, 1: Stat Calculations, 6: Quadratic Reg...

and complete the *wizard* as shown opposite:



	areaval			
=capture(')				=QuadReg
1	19.125	Title	Quadrati...	
2	18	RegEqn	$a*x^2+b*x+...$	
3	16.845	a	0.5	
4	16.245	b	-4.	
5	16.0013	c	24.	

8. Go back to your G&G page with the plotted coordinate pairs, change the Graph Type back to 1: Function, select $f1(x)$ and press ENTER.



9. Find the max value of $y = f1(x)$ by tracing at $x = 0$ and 6 , and find the value of the minimum.

10. The data was collected at selected positions of the moveable point. Changing the data capture to be automatic will collect many more points, without the need to press $\text{ctrl} + \text{.}$ each time. This can be done using the current document by changing the syntax for the data capture in the L&S from:

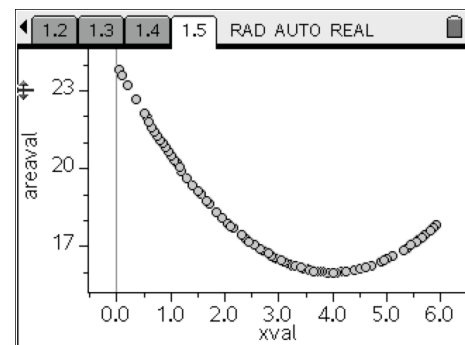
`xval:=capture('x,0)`

to

`xval:=capture('x,1)`

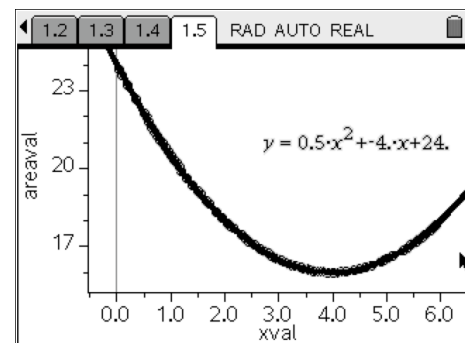
11. A quicker method to obtain the regression would be to open a D&S page.

Plot the *xval* against *areaval*.



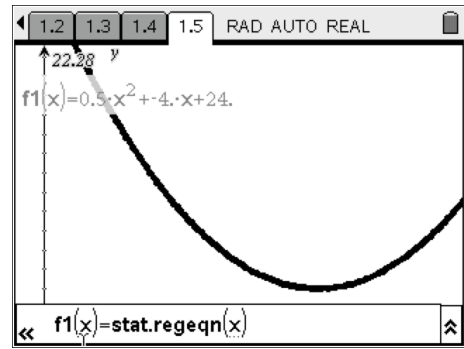
12. Select:
 menu , 4:Analyze, 6:Regression,
 4:Show Quadratic

You can trace on the regression curve, but it will not give the local minimum. Copy the curve and draw it in a G&G page to get the minimum and maximum values.



13. To find the minimum value, or to work with the regression curve in any way, open a G&G page and plot the function $f1(x) = \text{stat.RegEqn}(x)$ as shown.

You can find stat.RegEqn through the  key.



File of this problem:

