

Patricia Carroll Bowling

Grade Level 8, 9, 10

Geometry

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**Activity Overview**

Using the on-screen directions and the more detailed directions here, students will investigate the number of diagonals in each polygon with three through ten sides, then develop a formula for the relationship between the number of sides and the number of diagonals of the polygons. Some prior familiarity with constructing segments and basic functions of the TI-nspire is needed. Students should be able to navigate between pages. Students should be able to use the menu functions on each screen.

**Concepts**

Geometry: polygons, number of diagonals for convex polygons

Data analysis: quadratic regression

**Teacher Preparation**

Load .tns file “polygons–diagonals” onto handhelds. Print copies of instructions for students.

Print polygon chart for students.

This activity will cover the first two and the fourth columns of the chart. The chart can be printed “as is” or by selecting only the first two and the fourth columns to print.

**TI–Nspire Applications**

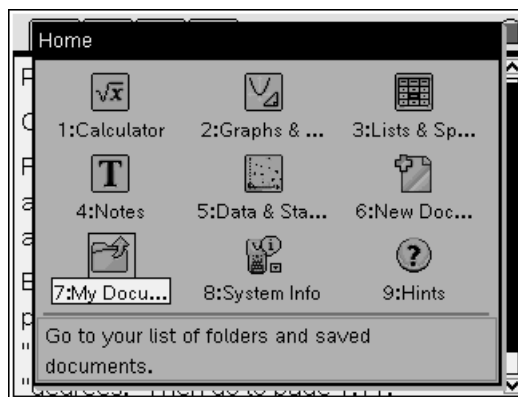
TI-nspire graphs and geometry, lists and spreadsheets, statistics calculations.

**Evaluation**


1. Complete the activity and the accompanying chart.
2. Write about the patterns involved in the chart.
3. Suggest an alternate way to discover this information.

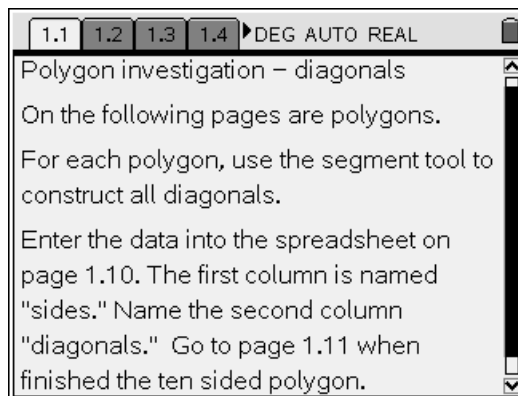
Suggestions: This can be done as a teacher led activity or self-directed activity by students. When doing the regression equation, discuss the answers to some of the open ended questions such as does the data look linear or quadratic. What does a number such as  $-1.E-12$  mean when returned by the calculator in a statistical calculation?


Turn on the calculator.  
Go to the home screen.  
Select "My Documents."  
Select "polygons-diagonals."  
Hit enter.



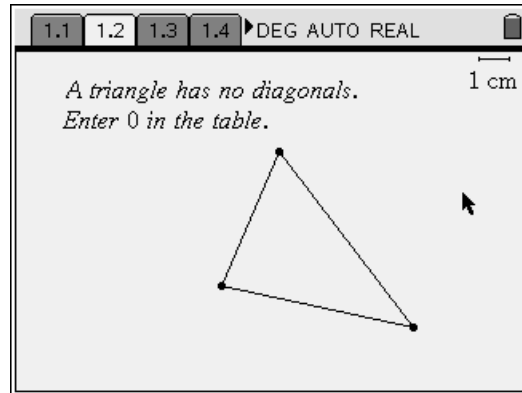
Read through the instructions on the first page (1.1).

The quickest way to get to page 1.10 is to use  and the up arrow on the navpad to get to a page of thumbnails. Select the one you want using the navpad, then hit enter.

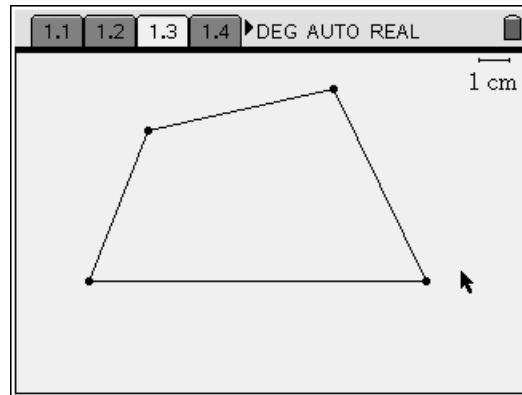


To return to a page use  and the down arrow on the navpad. Again select the page you want and hit enter.

The triangle is already completed. Record the number of diagonals on the chart. Later, it will be transferred to page 1.10.

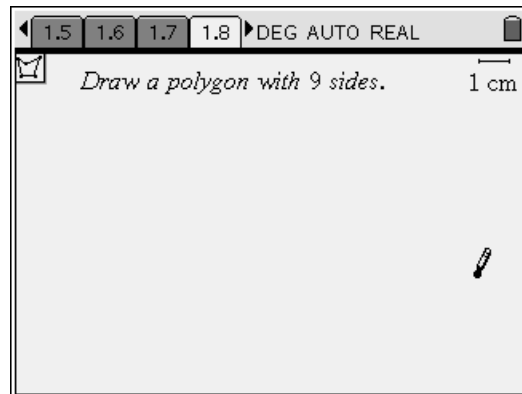


Repeat the process of drawing the diagonals and counting them on pages 1.3 through 1.9.



On page 1.8, you'll draw your own nonagon (9 sided polygon.)

To do this select **(menu)** **8** **4**. You will need to mark nine different points, then return to the first point you created as a tenth entry to finish the polygon.



The screen shot at right shows the polygon tool in the upper left corner. This will show up after you select **(menu)** **8** **4**. The pointer will also change to a pencil.

Then draw a decagon on page 1.9 and repeat the process.

Go to page 1.10.

In the box next to the letter B (which is highlighted at right) type “diagonals.”

Enter the results you’ve found in your investigation for each polygon.

	A (...)	B	C	D	E	F	G
1		3					
2		4					
3		5					
4		6					
5		7					

Go to page 1.11.

Read the instructions.

To read the bottom of the screen, you will need to scroll down.

Alternatively, when you want to move down the page, hold **ctrl** and **3**.

Now, using the data on page 1.10, generate a formula for the number of diagonals in a convex polygon with any number of sides.

On page 1.12, change graph type to scatter plot. In the x box, select "sides." In the y box, select "diagonals."

Change the window to zoom – data.

Does the data look linear?

Go to page 1.12.

Select **menu** **3** **3**.

- 1: Tools
- 2: View
- 3: Graph Type
  - 1: Function
  - 2: Parametric
  - 3: Scatter Plot
- 4: Window
- 5: Trace
- 6: Points & Lines
- 7: Measurement
- 8: Shapes
- 9: Construction
- A: Transformation

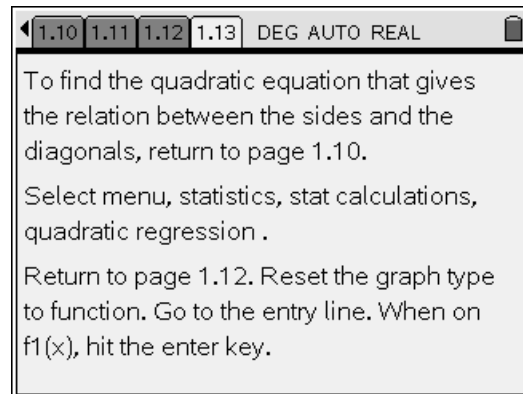
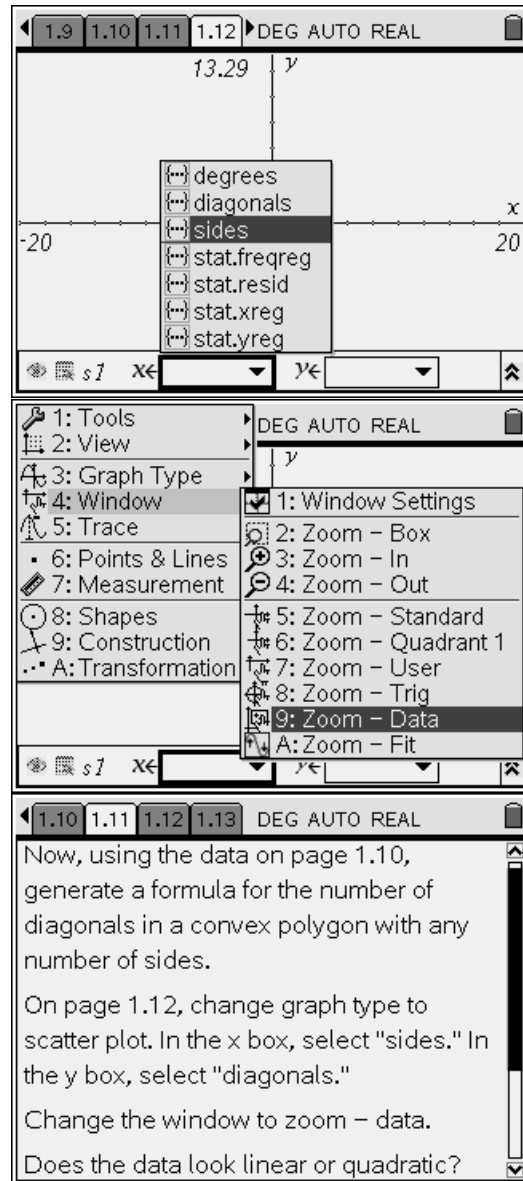
In the x box, select sides.  
 In the y box, select diagonals.

Select **menu** **4** **9**.

Answer the question: does the data look linear or quadratic?

On the regression page, x List is sides;  
 y List is diagonals; Save in f1(x), frequency is 1; 1<sup>st</sup> result column is c[1].  
 The square brackets are above the left parentheses.

What is the equation that shows the relationship between the number of sides of a polygon and the number of diagonals?



This will show up on your data page. You can use menu, actions, resize if you can't read all of the information. Expand the column to the size needed, then hit enter.

Note: when a value such as  $-1.E-12$  shows up in your table, the value is 0 for all practical purposes. Why? Can you explain why the calculator returns this answer?

Can you find the number of diagonals of a polygon with 20 sides? 30 sides? 100 sides?