

## Investigating the Sum of Polygon Angle Measures

by – Christine Kasitz

### Activity overview

*In this activity, students will investigate the relationship between the number of sides of a polygon and the sum of the measures of the angles of the polygon.*

### Concepts

*Determining the measures of the angles of polygons  
Developing the Polygon Angle-Sum Theorem*

### California Standards

Geometry: Grades Eight Through Twelve - Mathematics Content Standards.

The geometry skills and concepts developed in this discipline are useful to all students. Aside from learning these skills and concepts, students will develop their ability to construct formal, logical arguments and proofs in geometric settings and problems.

**12.0** Students find and use measures of sides and of interior and exterior angles of triangles and polygons to classify figures and solve problems.

**13.0** Students prove relationships between angles in polygons by using properties of complementary, supplementary, vertical, and exterior angles.

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### Teacher preparation

*The teacher needs to be familiar and have basic knowledge of the Nspire calculator.*

*The teacher should work through the activity prior to working with the students. Students should know and understand the Triangle Angle-Sum Theorem. Copies of this document along with the student worksheet should be printed and handed out to each student.*

*Introduce the activity by first reviewing the Triangle Angle-Sum Theorem.*

### Classroom management tips

*Keep an eye on the students and ask students to help each other.*

### TI-Nspire Applications

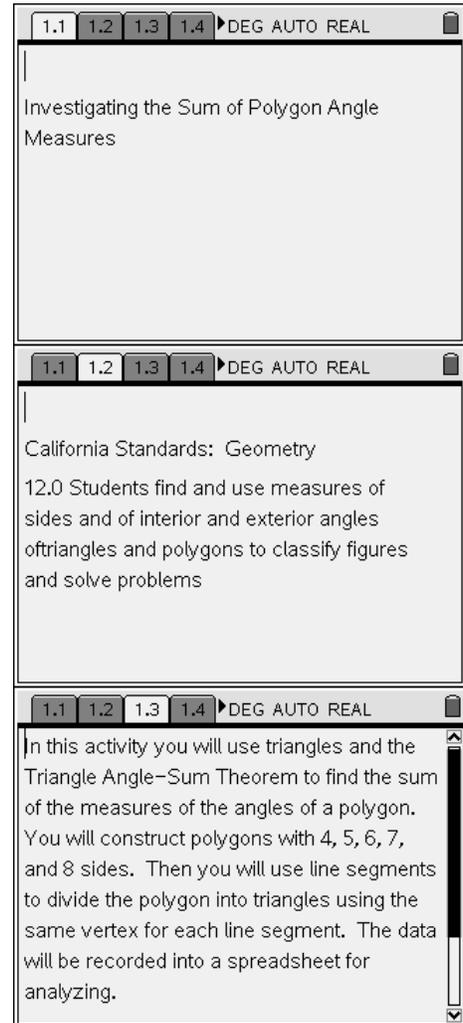
*Totaldegrees.tns*

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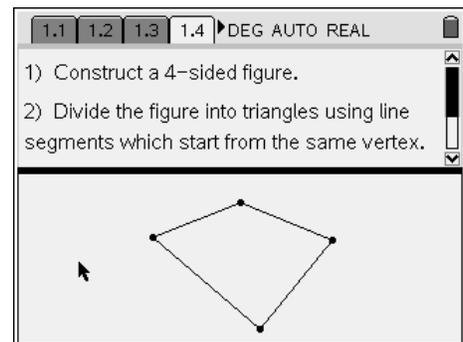
### Step-by-step directions

1) Download and open the file totaldegrees.tns or if you do not have access to this file, open a New Document.

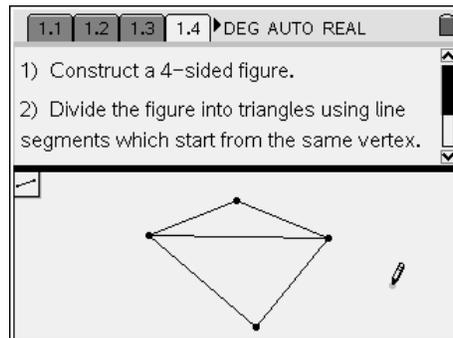
2) Read through Page 1.2 of the Activity



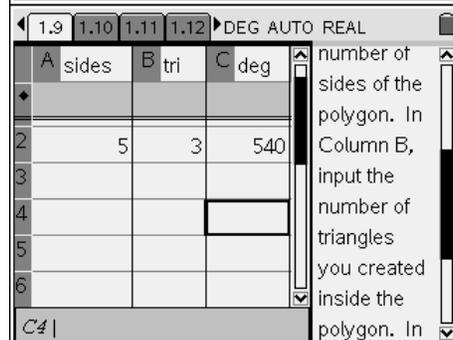
3) Construct a 4-sided figure.



4) Draw line segments which start from the same vertex and create triangles.



5) Record your data in the spreadsheet on Page 1.9 or on the student worksheet.



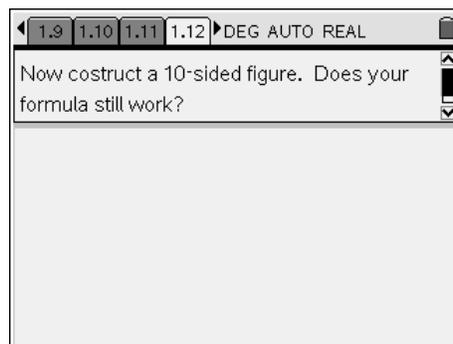
6) Repeat Steps 3 – 5 for 5, 6, 7, and 8 sided polygons.

7) Analyze the data in the table.

--Look for a pattern

--Write a formula to describe the pattern.

8) Now construct a 10-sided figure. (Answer Question 2 on the Worksheet)

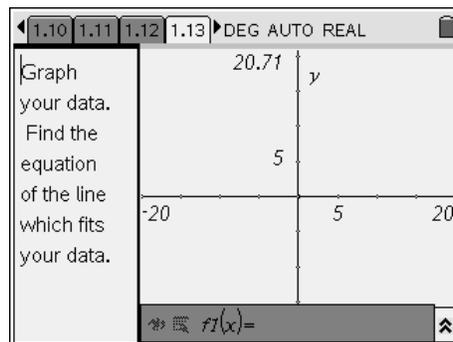


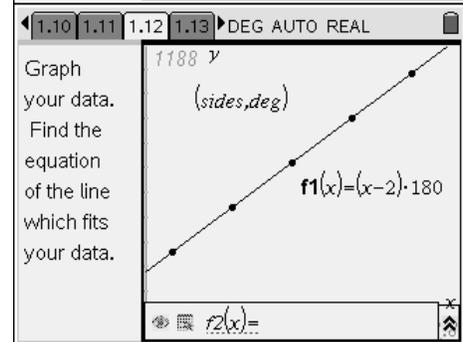
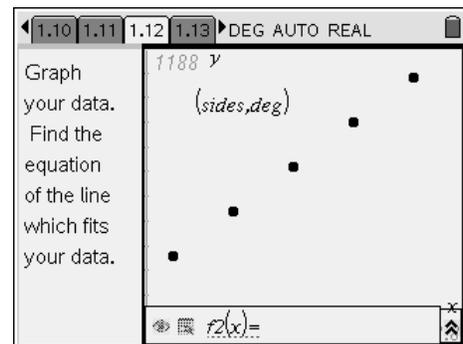
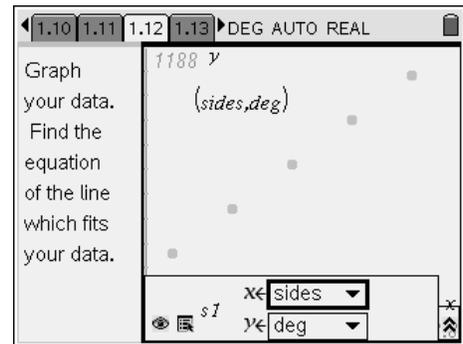
9) Graph your data from your table.

--Menu -> 3: Graph Type, 3: Scatterplot

--Graph the data

--Return to a function graph: Menu -> 3: Graph Type, 1: Function





10) Find the equation of a function which matches the graph. Record your results on the worksheet.

11) Using both your formula and function, finish answering the questions in your calculator file or on the worksheet.

Assessment and evaluation (NOTE: this section can be separate or included in the step-by-step directions.)

- Provide students the desired number of multisided polygons and ask students to find the sum of the interior angles.
- Ask students to find the value of each angle inside of the polygon.
- Give the students the sum of the angles and have them find the number of sides of the polygon.

Activity extensions

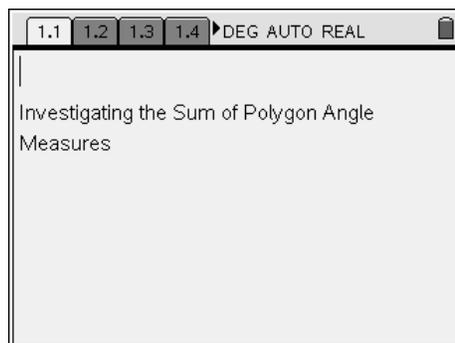
- Have students measure both interior and exterior angles to determine a relationship among the exterior angles.

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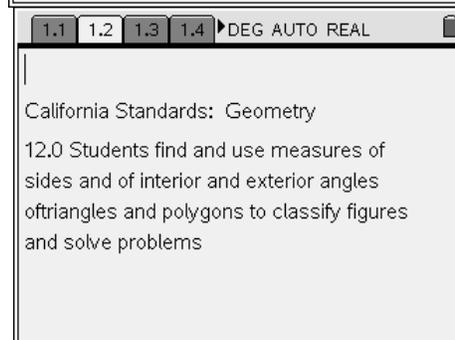
Student TI-Nspire Document

*Totaldegrees.tns*

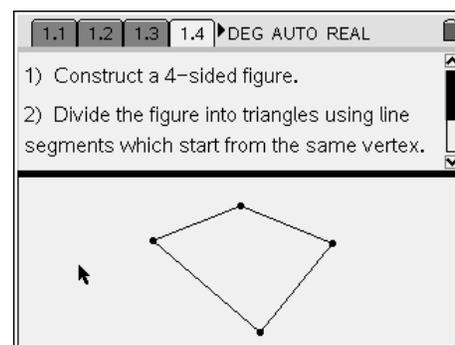
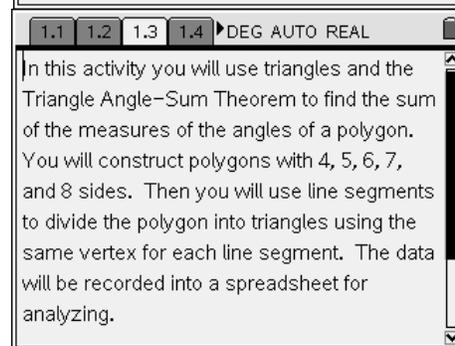
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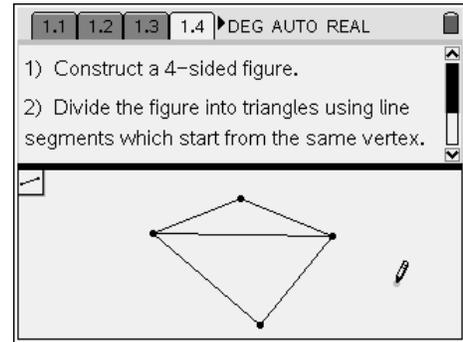
2) Read through Page 2 of the Activity



3) Construct a 4-sided figure.



4) Draw line segments which start from the same vertex and create triangles.



5) Record your data in the spreadsheet on Page 1.9 or on the student worksheet.

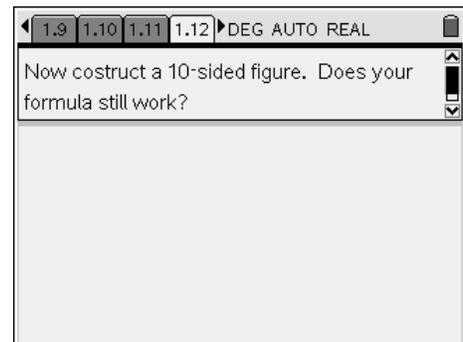
6) Repeat Steps 3 – 5 for 5, 6, 7, and 8 sided polygons.

7) Analyze the data in the table.

--Look for a pattern

--Write a formula to describe the pattern.

8) Now construct a 10-sided figure. (Answer Question 2 on the Worksheet)

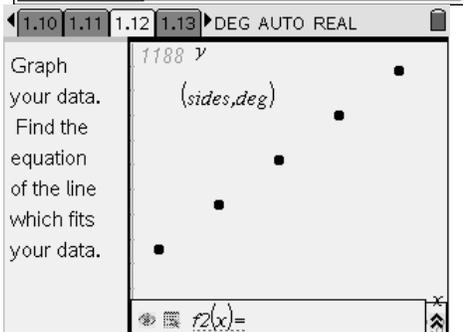
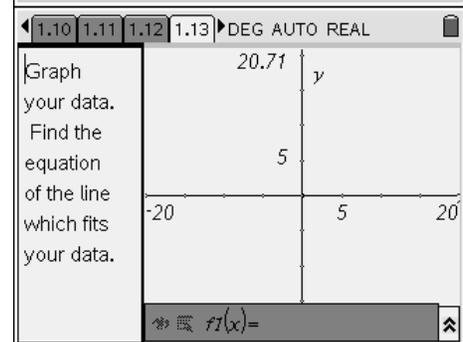


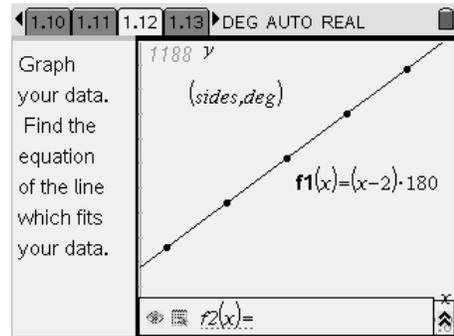
9) Graph your data from your table.

--Menu -> 3: Graph Type, 3: Scatterplot

--Graph the data

--Return to a function graph: Menu -> 3: Graph Type, 1: Function





- 10) Find the equation of a function which matches the graph.  
 Record your results on the worksheet.
- 11) Using both your formula and function, finish answering the  
 questions in your calculator file or on the worksheet.

## Screenshot Summary

The screenshots show the following content:

- Screenshot 1:** Title: Investigating the Sum of Polygon Angle Measures
- Screenshot 2:** California Standards: Geometry  
12.0 Students find and use measures of sides and of interior and exterior angles of triangles and polygons to classify figures and solve problems
- Screenshot 3:** In this activity you will use triangles and the Triangle Angle-Sum Theorem to find the sum of the measures of the angles of a polygon. You will construct polygons with 4, 5, 6, 7, and 8 sides. Then you will use line segments to divide the polygon into triangles using the same vertex for each line segment. The data will be recorded into a spreadsheet for analyzing.
- Screenshot 4:** 1) Construct a 4-sided figure.  
2) Divide the figure into triangles using line segments which start from the same vertex.
- Screenshot 5:** 1) Construct a 5-sided figure.  
2) Divide the figure into triangles using line segments which start from the same vertex.
- Screenshot 6:** 1) Construct a 6-sided figure.  
2) Divide the figure into triangles using line segments which start from the same vertex.
- Screenshot 7:** 1) Construct a 7-sided figure.  
2) Divide the figure into triangles using line segments which start from the same vertex.
- Screenshot 8:** 1) Construct a 8-sided figure.  
2) Divide the figure into triangles using line segments which start from the same vertex.
- Screenshot 9:**

A sides	B tri	C deg
4	2	360

In the table, fill in the columns with your data. In Column A input the number of sides of the
- Screenshot 10:**

**Question**

Analyze the data and look for a pattern. Write the formula below.

**Answer**
- Screenshot 11:** Now construct a 10-sided figure. Does your formula still work?
- Screenshot 12:**

Graph your data. Find the equation of the line which fits your data.

$f(x) =$

1.10 1.11 1.12 1.13 DEG AUTO REAL

**Question**

Record the equation of your line. How does it relate to the formula you found from analyzing the data from the table?

**Answer** 

1.11 1.12 1.13 1.14 DEG AUTO REAL

**Question**

Calculate the total degrees of a 35-sided figure using both your formula and equation. Analyze your results: are they the same, different? Why?

**Answer** 

1.12 1.13 1.14 1.15 DEG AUTO REAL

**Question**

Calculate the number of degrees of a 45-sided figure using both your formula and equation. Analyze your results: are they the same, different? Why?

**Answer** 

Appendix A

**Student Worksheet**  
**Investigating the Sum of Polygon Angle Measures**

NAME: \_\_\_\_\_

Class Period: \_\_\_\_\_

DATE: \_\_\_\_\_

1) Fill in the Table Below.

<b>Number of Sides of the Polygon</b>	<b>Number of Triangles Created</b>	<b>Total Degrees = # of Triangles x 180</b>

**Formula or Pattern:**

2) Now construct a 10-sided figure. Does your formula still work? Explain.

**3) Graph your data.**

**Record your function:** \_\_\_\_\_

**4) Compare your function and equation? Explain similarities and differences.**

**5) Calculate the total degrees of a 35-sided figure using both your formula and equation. Analyze your results: are they the same, different? Why?**

**6) Calculate the number of degrees of a 45-sided figure using both your formula and equation. Analyze your results: are they the same, different? Why?**