

## Inscribed Regular Polygons

by – Johanna Bowman

### Activity overview

*Students will calculate the changing area and perimeter of inscribed regular polygons as the number of sides increase. The measurements will be recorded and then listed in a spreadsheet for analysis. Students will be learning how to use the measurement tool on the TI-Nspire and the Hide/Show function to identify each separate polygon. Students will be asked to predict the general results for the given process with a 50 sided regular polygon.*

### Concepts

*Regular Polygons  
Geometric Analysis  
Inductive Reasoning*

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### Teacher preparation

*Load calculator activity on each student calculator. Have viewscreen or multi-media projector available to display instructor's calculator activity for discussion.*

### Classroom management tips

*Students may need to work in pairs for peer assistance. An assessment rubric and an explanation of expectations should be provided.*

### TI-Nspire Applications

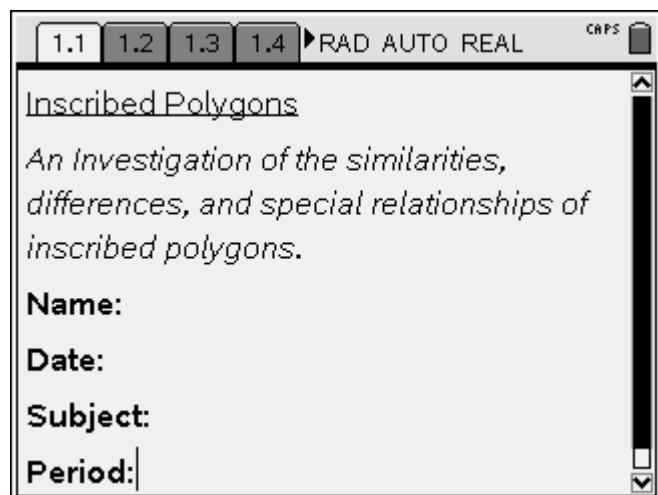
None

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### Step-by-step directions

*Students should open the calculator activity as the instructor displays the same activity on the viewscreen or projector. Students should enter the information on this page and then immediately save the file with the correct filename. The students will be able to re-open the file and it will allow them to quickly save the document at the end of class when they might forget to name the file and save it.*

*The overview of the lesson should be discussed and an assessment rubric with an explanation of expectations should be provided.*



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Grade level: 8-10

Subject: Geometry

Time required: 45 to 90 minutes

Materials: TI-Nspire Calculator Activity

Students should make the observation that the equilateral triangle is inscribed in the given circle and that the calculator tools can be used to quickly measure the area and the perimeter of the triangle.

It should also be noted that the triangle is much smaller than the circle and that should lead to the discussion of how much smaller is the triangle. Does the triangle cover half or more than half of the circle? How can that relationship be determined?

Students should use the calculator tools to measure the areas and perimeters and then determine the ratio of the triangle to the circle for both comparisons.

A calculator page can be inserted to allow the students to work within the document and to learn to navigate back and forth between the pages.

Answers should be entered into the note page with the correct units of measurement. Students should be encouraged to write brief explanations about their work.

Some students may have difficulty in seeing the overlapping polygons. The Hide/Show function can be used here to hide the triangle as the student measures the perimeter and area of the square.

The students should be encouraged to compare the increase in area and make other observations about the relationships within the figure.

The image displays three sequential pages from a TI-Nspire calculator activity. Each page has a top navigation bar with tabs labeled 1.1, 1.2, 1.3, and 1.4, and a mode indicator set to 'RAD AUTO REAL'. The first page shows a circle with an inscribed equilateral triangle. The second page is a 'Question' page with the text: 'What is the relationship between the inscribed equilateral triangle and the circle? (Find the ratios of the areas and the perimeters.)' Below the question is an 'Answer' field with a dropdown arrow. The third page shows the same circle, but with an inscribed square overlaid on the triangle.

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The student can easily use the measurement tool to calculate the perimeter and the area. The answers should include units of measurement.

TI-Nspire calculator interface showing a question: "Find the area and perimeter of the inscribed square." The interface includes a navigation bar with tabs 1.2, 1.3, 1.4, and 1.5, and a status bar with "RAD AUTO REAL" and "CRPS". Below the question is an "Answer" section with a dropdown arrow. The answer section contains two input fields: "Area:" and "Perimeter:".

The Hide/Show tool may be used to identify the pentagon in the figure. It is also possible to use the Attributes Tool to change the thickness of the lines on the pentagon.

The measurements should be recorded on the next page, and students should be encouraged to make other observations about the relationships in the figure.

There should be a discussion of the changes in the areas as the number of sides of the inscribed polygon increase.

A similar analysis about the increasing perimeters should be investigated.

Measurements of the pentagon should be entered with the correct units of measurement.

TI-Nspire calculator interface showing a diagram of a circle with an inscribed pentagon. The interface includes a navigation bar with tabs 1.3, 1.4, 1.5, and 1.6, and a status bar with "RAD AUTO REAL" and "CRPS". A mouse cursor is visible over the diagram.

TI-Nspire calculator interface showing a question: "Find the area and perimeter of the inscribed pentagon." The interface includes a navigation bar with tabs 1.4, 1.5, 1.6, and 1.7, and a status bar with "RAD AUTO REAL" and "CRPS". Below the question is an "Answer" section with a dropdown arrow. The answer section contains two input fields: "Area:" and "Perimeter:".

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The overlapping polygons may again be isolated or emphasized by using the Hide/Show tool or Attributes to change the thickness of the lines. Lines can also be made dotted or dashed instead of solid.

Encourage the students to investigate the different tools available to assist them in their work.

Isolate the hexagon and measure the perimeter and the area.

Measurements should be entered for the hexagon with correct units labeled.

At the point the students should transfer the measurements to the spreadsheet to compare the increasing areas and perimeters.

Depending on the length of the lesson, the analysis and prediction can be mathematical or theoretical in nature.

A written prediction should be expressed in complete sentences on the last page.

The image displays three sequential pages from a TI-Nspire calculator activity. The top page (page 1.8) shows a circle with an inscribed regular hexagon and several overlapping triangles formed by connecting vertices. A mouse cursor is positioned near the center of the circle. The middle page (page 1.9) contains a 'Question' field with the text 'Find the area and perimeter of the inscribed hexagon.' Below it is an 'Answer' field with a dropdown arrow, containing the labels 'Area:' and 'Perimeter:'. The bottom page (page 1.10) contains instructions: 'Transfer your measurements to the spreadsheet on the next page. Make an observation about the changes in area and in perimeter.' and 'Make a prediction for an inscribed regular polygon with 50 sides. Write your prediction on the last page.'

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Numerical entries are transferred to this spreadsheet.

The image shows two screenshots of a TI-Nspire calculator interface. The top screenshot displays a spreadsheet with three columns: 'A sides', 'B area', and 'C perimeter'. The rows are numbered 1 through 5. The 'A sides' column contains the values 3, 4, 5, 6, and 7. The 'B area' and 'C perimeter' columns are empty. The bottom screenshot shows a text entry field with the label 'Prediction:' and a large empty space for writing.

	A sides	B area	C perimeter
1	3		
2	4		
3	5		
4	6		
5	7		

A written summary and prediction should be included in complete sentences.

## Assessment and evaluation

- *Students should be given an assessment rubric and an explanation of expectations prior to the activity.*

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## Activity extensions

- *Some students will want to continue the pattern of inscribed polygons.*
- *Students should be encouraged to use circumscribed polygons in the same type of pattern and compare results.*
- *The history of mathematics and art can be explored to investigate similar geometric relationships in two and three dimensions.*

Student TI-Nspire Document  
*Inscribed Regular Polygons*

1.1 1.2 1.3 1.4 ▶ RAD AUTO REAL CRPS

**Inscribed Polygons**  
*An Investigation of the similarities, differences, and special relationships of inscribed polygons.*

**Name:**  
**Date:**  
**Subject:**  
**Period:**

1.1 1.2 1.3 1.4 ▶ RAD AUTO REAL CRPS ctr1

1.4 1.5 1.6 1.7 ▶ RAD AUTO REAL CRPS

**Question**

Find the area and perimeter of the inscribed pentagon.

**Answer** ⌵

Area:  
 Perimeter:

1.7 1.8 1.9 1.10 ▶ RAD AUTO REAL CRPS

Transfer your measurements to the spreadsheet on the next page. Make an observation about the changes in area and in perimeter.

Make a prediction for an inscribed regular polygon with 50 sides.

Write your prediction on the last page.

1.1 1.2 1.3 1.4 ▶ RAD AUTO REAL CRPS ctr1

1.2 1.3 1.4 1.5 ▶ RAD AUTO REAL CRPS

**Question**

Find the area and perimeter of the inscribed square.

**Answer** ⌵

Area:  
 Perimeter:

1.5 1.6 1.7 1.8 ▶ RAD AUTO REAL CRPS ctr1

1.8 1.9 1.10 1.11 ▶ RAD AUTO REAL CRPS

	A sides	B area	C perimeter
◆			
1		3	
2		4	
3		5	
4		6	
5			
A7			

1.1 1.2 1.3 1.4 ▶ RAD AUTO REAL CRPS

**Question**

What is the relationship between the inscribed equilateral triangle and the circle? (Find the ratios of the areas and the perimeters.)

**Answer** ⌵

1.3 1.4 1.5 1.6 ▶ RAD AUTO REAL CRPS

1.6 1.7 1.8 1.9 ▶ RAD AUTO REAL CRPS

**Question**

Find the area and perimeter of the inscribed hexagon.

**Answer** ⌵

Area:  
 Perimeter:

1.9 1.10 1.11 1.12 ▶ RAD AUTO REAL CRPS

**Prediction:**