TI-*nspire*™

Grade level: 9-12
Subject: Mathematics
Time required: Approximately 90 minutes

Angles in Polygons

by – Matt Rhodes

Activity overview

- *This is a self-contained activity that is designed to incorporate the TI-Nspire Navigator system thereby providing for a paperless activity that can be easily managed during and after the class period.*

- *Students will investigate the relationships of the interior and exterior angles in a polygon. They will make observations through inductive reasoning and the n^{th} term.*

Concepts

Polygons, regular polygons, interior and exterior angles, diagonals, convex /concave, inductive reasoning and the n^{th} term, triangle sum theorem.

Teacher preparation

*Students should know navigation on the TI-*Nspire. *They will need to be able to move from page to page as well as within frames of a page layout. Also, they need a basic understanding of the* Calculate *tool (expressions are provided for them), the* Segment *tool and the* Regular Polygon *tool.*

Classroom management tips

Students can be placed in groups of 3-4 or this activity can be presented as a teacher led discussion and discovery.

TI-Nspire Applications

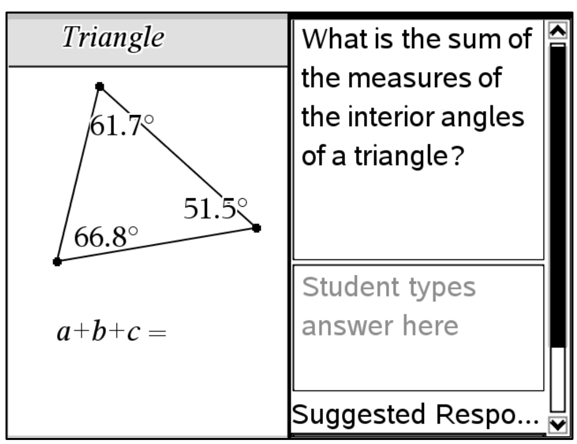
*The following applications are used (either TI-*Nspire *or TI-*Nspire *CAS will work):*

- *Graphs and Geometry*
- *Lists and Spreadsheets*
- *Open Response Questions*
- *Calculator*

Step-by-step directions

Problem 1

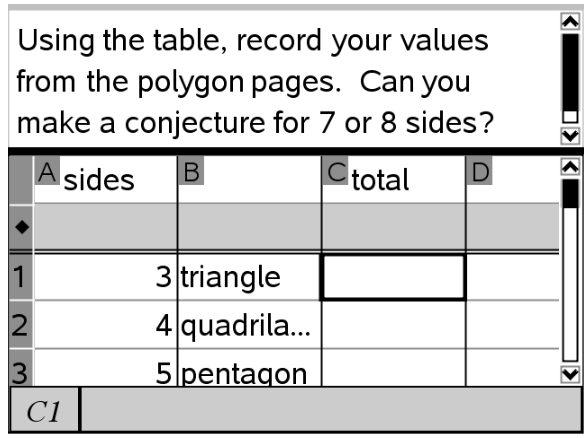
Have the students open the file and read the instructions on page 1.2. Then advance to 1.3. To choose the *Calculate* tool, press menu 1 8. Once the tool is active, select the expression under the polygon. The handheld will then prompt the user to "Select a." Select one of the angle measures. Then, select the other two angles. The sum will then float with the cursor. Move to a convenient location on the screen and drop off your number by pressing enter.



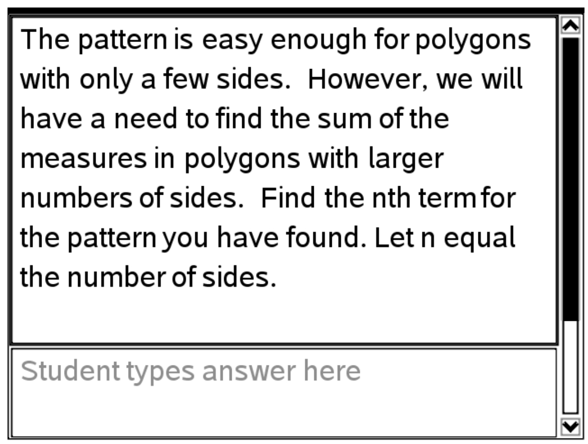
Note – Answers are provided in the *Suggested Response* field each time a question is asked.

Advance through pages 1.4, 1.5 and 1.6 following the same instruction as before.

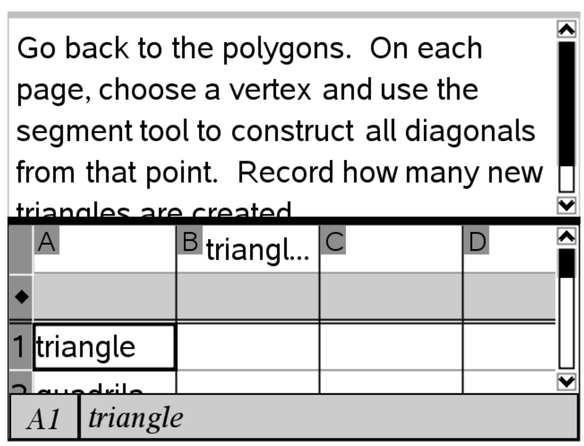
Record the discovered sums from pages 1.3-1.6 in the appropriate fields on page 1.7. Make a conjecture for a heptagon and octagon (900° and 1080° respectively).



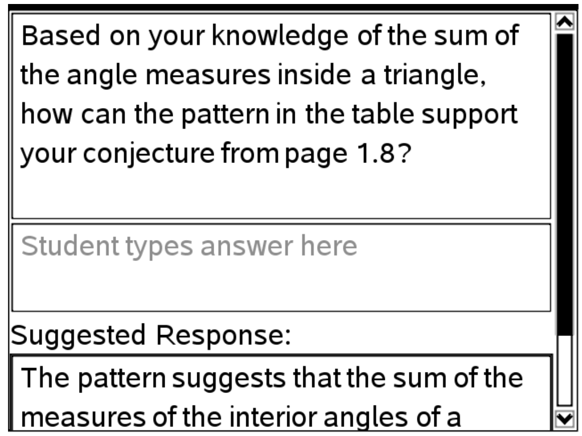
Using the pattern that was established on page 1.7, find the n^{th} term. Be sure to emphasize that in this formula, n is the number of sides (column 1 from our table).



Go back to each polygon and draw all diagonals from one vertex. To choose the segment tool press menu 6 5. Then select the endpoints of each diagonal to draw the line segment. Record the total number of triangles from each polygon in the table on 1.9.



Since each triangle from our chart in 1.9 represents 180° in each polygon, the number of triangles multiplied by 180 equals the totals for the interior angles that we found on page 1.7.



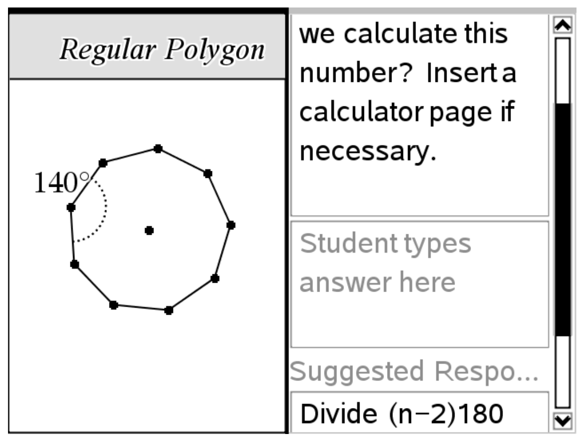
Problem 2

Press menu 8 5 to activate the *Regular Polygon* tool.

Press enter to begin the polygon and then move away from your initial point. Press enter again and you will begin with a 16-gon, by default. Move clockwise around your polygon to choose a smaller number of sides.

Press menu 7 4 to activate the *Angle Measure* tool. Select three points to define the angle you wish to measure, keeping the vertex in the middle.

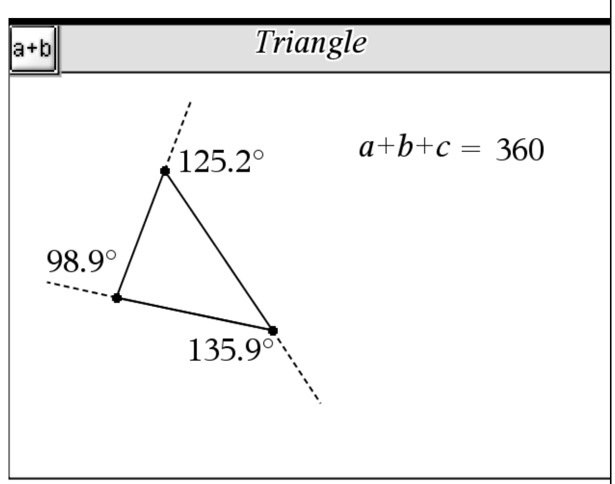
This measurement can be found quickly by taking the sum of the interior angels, (n - 2)180 and dividing it by the number of sides, n.

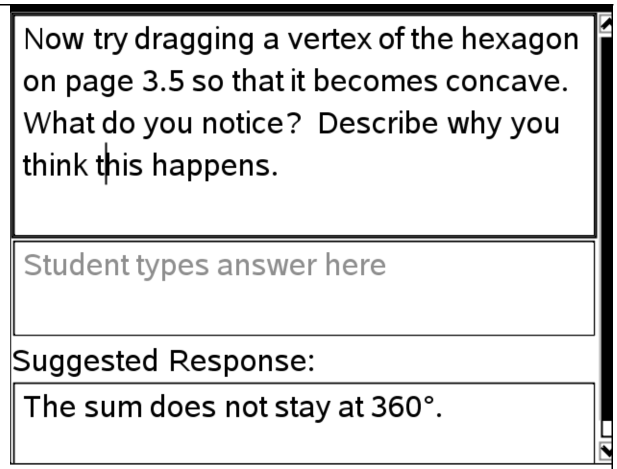


Problem 3

As in Problem 1, you are given polygons with premeasured angles. Of course, we are looking only at exterior angles this time. Sum the measures as we did previously.

Here, the observation is obvious. The sum of the exterior angles of any polygon is 360°.



When the polygon becomes concave, the underlying triangles are compromised and the entire proof falls apart. Ideas: • This is an excellent time for class discussions. Be sure to hear what the students suggest. Great teaching moments arise. • Point out different ways to make the polygon concave. Of course, pulling one point "inside" forces concavity, however you can also pull a point "out" too far and arrive at the same situation.	
Problem 4 Example problems and answers are provided.	

Assessment and evaluation

Use the tools of the Navigator *software for ongoing formative assessment during the activity.*

Activity can be collected and graded using the Portfolio *tool.*

Student TI-Nspire Document

Angles in Polygons.tns