Activity Plan Template

Title: Discovering the Sum of Interior Angles through Polygon Triangulation

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Topic: Sum of interior angles of a regular polygon.

Connection to Core Curriculum: Common Core State Standards for Mathematics, Grade 8, 8.G.A.5: Use informal arguments to establish facts about angle sums and exterior angles of triangles and about the angles created when parallel lines are cut by a transversal. This activity extends the triangle-angle-sum reasoning to the interior-angle sums of polygons through triangulation.

Overview: Students use the Interactive Polygon Simulator and a Student Investigation Worksheet to divide regular polygons into nonoverlapping triangles. They record results for polygons with 3–10 sides, identify the relationship between sides and triangles, derive a general expression for the interior-angle sum and apply it to a 20-sided polygon. Students must explain their reasoning before using the simulator to check their answers.

Objectives: By the end of the activity, students will be able to:
(1) construct a triangulation from one vertex of a regular polygon
(2) explain why an n-sided polygon forms $n - 2$ triangles
(3) derive $S = (n - 2) \times 180°$ using the 180° angle sum of a triangle
(4) calculate and justify the interior-angle sum of a 20-sided polygon without relying on the simulator's results display.

Materials Needed: Student Investigation Worksheet: Sum of Interior Angles of a Regular Polygon; computers or tablets with access to the Interactive Polygon Simulator; projector or shared display; pencil and paper.

Technology: Interactive Polygon Simulator (custom browser-based HTML applet developed by Emmanuel Bakonua). Students access the applet through the Fall 2026 class webpage by selecting "E. Bakonua's Page" and then "Assignment 2." The simulator allows students to select regular polygons, choose a vertex, draw diagonals and reveal results and a comparison table.

Role of Technology: The simulator makes the partition of a polygon into triangles visible and allows students to compare many cases quickly. Drawing diagonals supports the conceptual link between geometric construction and the numerical pattern in the worksheet. The results and comparison table provide delayed feedback not the starting point for learning: students first predict, count, calculate and justify. The hidden symbolic row can confirm the generalization after students formulate their own rule.

Web Reference:
Fall 2026 class student pages:
https://www.usu.edu/math/schneit/Math5010/StudentPages/studentPagesF2026
Navigation: Open the class webpage → select "E. Bakonua's Page" → click "Assignment 2" to access both the Interactive Polygon Simulator and the Student Investigation Worksheet.

Activity Plan:

1. Launch and pose the problem (1 minute).
Teacher: Display a pentagon with no diagonals. Ask, "How could we find the sum of all its interior angles without measuring them one at a time?" Elicit the known fact that a triangle's interior angles sum to 180°. Do not present the polygon formula.
Students: Offer ideas and predict how dividing a pentagon into triangles could help. Evidence: Students connect the new problem to the angle sum of a triangle.

2. Task 1 — Investigate and record (5–6 minutes).
Teacher: Distribute the worksheet. Briefly demonstrate selecting a polygon and choosing one vertex, without completing the investigation for students. Direct students to investigate the triangle, quadrilateral, pentagon, hexagon, heptagon, octagon, nonagon and decagon. For each, they draw diagonals from one vertex to all nonadjacent vertices, count the triangular regions and calculate the sum using 180° per triangle. Ask, "What are you counting: diagonals or triangles?" and "Why does multiplying the number of triangles by 180° give the polygon's interior-angle sum?"
Students: Fill all four worksheet columns, then use "Check my results" to verify only after recording their calculations. Note that a triangle requires no diagonals. Evidence: The table correctly connects each polygon's side count, triangle count and angle sum.

3. Task 2 — Identify the pattern (2 minutes).
Teacher: Ask students to compare the number-of-sides and number-of-triangles columns. Prompt, "What relationship exists between the number of sides and the number of triangles formed? and "Can you explain that relationship using a polygon you constructed?"
Students: Write a sentence describing the relationship and share geometric justification with a partner.
Anticipated response: The number of triangles is always two less than the number of sides.
Evidence: Students explain the relationship using triangulation and not merely a pattern of numbers.

4. Task 3 — Generalize (2–3 minutes).
Teacher: Introduce n as the number of sides and ask students to complete both expressions on their worksheet independently. Ask, "What does $n - 2$ represent?" and "Why is the result multiplied by 180°?" Only after discussion reveal the simulator comparison table and if useful, its hidden generalization row.
Students: Write "number of triangles = $n - 2$" and "sum of interior angles = $(n - 2) \times 180°$," then explain each term.
Evidence: Students connect the algebraic rule to the geometric triangles.

5. Task 4 — Apply and justify (2 minutes).
Teacher: Ask students to determine the sum of the interior angles of a 20-sided polygon without selecting "Check my results." Require a written explanation before verification.
Students: Reason that $20 - 2 = 18$ triangles, so the angle sum is $18 \times 180° = 3240°$. They then use the simulator, if time permits, to check.
Evidence: Students transfer the generalization to a polygon outside the investigation table and justify the result.

6. Closing question (1 minute, if available).
Teacher: Ask, "Why does our formula subtract two?" Collect a brief oral or written explanation.
Students: Explain that drawing diagonals from one vertex partitions an n-sided convex polygon into $n - 2$ triangles.
Evidence: Their explanation references the construction rather than memorizing the formula.

Background: The sum of the interior angles of a triangle is 180°. Diagonals drawn from one vertex of a regular (and therefore convex) n-sided polygon divide its interior into n − 2 nonoverlapping triangles. Their angle sums together equal the polygon's interior-angle sum. Hence S = (n − 2) × 180°.

Extensions: Ask students to find the number of sides when the interior-angle sum is given. Students should support any claim with triangulation.

Included documents: Student Investigation Worksheet: Sum of Interior Angles of a Regular Polygon (Tasks 1–4) and Interactive Polygon Simulator HTML applet. Both are accessible on the Fall 2026 class webpage under "E. Bakonua's Page" → "Assignment 2."

References:

Common Core State Standards Initiative. (2010). Common Core State Standards for Mathematics, Grade 8 Geometry (8.G.A.5).

Bakonua, E. (2026). Interactive Polygon Simulator [Interactive web application]. Available through E. Bakonua's Page, Assignment 2, on the Fall 2026 class student pages: https://www.usu.edu/math/schneit/Math5010/StudentPages/studentPagesF2026

Bakonua, E. (2026). Student Investigation Worksheet: Sum of Interior Angles of a Regular Polygon. Available through E. Bakonua's Page, Assignment 2, on the Fall 2026 class student pages: https://www.usu.edu/math/schneit/Math5010/StudentPages/studentPagesF2026