

Chapter 11 Polygons and Interior Angle Sums

Teacher Guide and Diagnostic Answer Key

Teacher Guide

Teacher Chapter-at-a-Glance

Materials
Pacing
Ask: what is $n-2$ actually counting?

Mastery Decision Guide

A missed Tripwire does not automatically mean “redo the chapter.” Confirm the likely misconception, reteach the smallest prerequisite or representation that addresses it, and then use a fresh item before moving on.

Missed Tripwire #1 → The student used $n \times 180^\circ$ instead of counting $n-2$ triangles. Next move: Draw diagonals from one vertex, count the triangles, then connect the count to $(n-2) \times 180^\circ$.

Confirmation and Fresh Recheck

Confirm with: Ask the student to draw diagonals from one vertex and count the triangles before writing any formula.

Fresh recheck: Use a nonagon for the interior sum and a regular polygon with exterior angle 40° for reverse reasoning.

Decision rule: Move forward only when the fresh response is secure and the reasoning survives the changed representation or context.

Diagram Production Notes — Chapter 11

Use the diagram master IDs:

Ch11-D01 — Polygons Split into Triangles

Ch11-D02 — Formula Meaning Box

Ch11-D03 — Regular Pentagon

Ch11-D04 — Regular vs Irregular Pentagon

Ch11-D05 — Missing Angle in Pentagon

Ch11-D06 — Interior and Exterior Angle Pair

Diagrams must show how the polygon splits from one vertex into triangles. Do not draw diagonals from multiple vertices in the formula-meaning diagram, because that can confuse the count. For regular polygons, use matching side marks and matching angle arcs. For irregular polygons, avoid equal markings unless equality is intended.

Glossary

area — flat space inside a 2-D shape; measured in square units.

circumference — distance around a circle.

composite shape — a figure made from two or more simpler shapes.

diameter — segment across a circle through its centre; twice the radius.

exterior angle — angle formed outside a polygon when a side is extended.

interior angle — angle inside a polygon.

perimeter — total distance around a polygon or other straight-sided figure.

polygon — closed 2-D shape made only of straight sides.

radius — distance from the centre of a circle to its edge.

regular polygon — polygon with all sides and all interior angles equal.

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Angles — Chapters 2, 8–11

Area — Chapters 3–7

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Common Trap Index

Trap 1 — Reading the end mark as the length. Recalculate: subtract start mark from end mark.

Trap 2 — Calling a circle a polygon. Recalculate: check every part of the polygon definition.

Trap 3 — Confusing perimeter and area. Recalculate: name the measurement before choosing a formula.

Trap 4 — Using a slanted side as height. Recalculate: locate the perpendicular height.

Trap 5 — Adding a cut-out instead of subtracting it. Recalculate: mark included and removed regions.

Trap 6 — Using radius as diameter or diameter as radius. Recalculate: label r or d before calculation.

Trap 7 — Squaring the diameter in circle area. Recalculate: find radius first.

Trap 8 — Reading the wrong protractor scale. Recalculate: align baseline with 0° and check reasonableness.

Trap 9 — Confusing angle relationships. Recalculate: identify the relationship before subtracting.

Trap 10 — Treating irregular polygons as regular. Recalculate: divide by number of sides only when regularity is established.

Ready to Learn Check

Quick check before starting. A wrong response below points to a prerequisite worth confirming before the chapter builds on it.

1. How many sides does a pentagon have?

Correct answer: 5

Likely wrong answer: 6 or another name/side count

Possible misconception: Polygon names and side counts are not secure.

Next move: Count the straight sides and connect 5 sides to pentagon.

2. What do the angles inside one triangle add to?

Correct answer: 180°

Likely wrong answer: 360°

Possible misconception: Triangle angle sum is not secure.

Next move: Review one triangle as the base unit for polygon triangulation.

3. What does regular polygon mean?

Correct answer: All sides and all interior angles are equal.

Likely wrong answer: Only the sides are equal, or “it looks even.”

Possible misconception: Regularity is being treated as appearance rather than a definition.

Next move: Mark equal sides and angles explicitly on a regular polygon.

Ready-to-Learn item 1

Correct answer: 5

Likely wrong answer: 6 or another name/side count

Misconception: Polygon names and side counts are not secure.

Next move: Count the straight sides and connect 5 sides to pentagon.

Ready-to-Learn item 2

Correct answer: 180°

Likely wrong answer: 360°

Misconception: Triangle angle sum is not secure.

Next move: Review one triangle as the base unit for polygon triangulation.

Ready-to-Learn item 3

Correct answer: All sides and all interior angles are equal.

Likely wrong answer: Only the sides are equal, or “it looks even.”

Misconception: Regularity is being treated as appearance rather than a definition.

Next move: Mark equal sides and angles explicitly on a regular polygon.

Practice

Assign the full set or select items for targeted review. Teacher solutions follow each question.

1. quadrilateral

Solution: 1. Quadrilateral: $(4 - 2) \times 180^\circ = 360^\circ$

2. pentagon

Solution: 2. Pentagon: $(5 - 2) \times 180^\circ = 540^\circ$

3. hexagon

Solution: 3. Hexagon: $(6 - 2) \times 180^\circ = 720^\circ$

4. heptagon

Solution: 4. Heptagon: $(7 - 2) \times 180^\circ = 900^\circ$

5. octagon

Solution: 5. Octagon: $(8 - 2) \times 180^\circ = 1080^\circ$

6. decagon Find one interior angle.

Solution: 6. Decagon: $(10 - 2) \times 180^\circ = 1440^\circ$

7. regular pentagon

Solution: 7. Regular pentagon: $540^\circ \div 5 = 108^\circ$

8. regular hexagon

Solution: 8. Regular hexagon: $720^\circ \div 6 = 120^\circ$

9. regular octagon

Solution: 9. Regular octagon: $1080^\circ \div 8 = 135^\circ$

10. regular decagon Find the missing angle.

Solution: 10. Regular decagon: $1440^\circ \div 10 = 144^\circ$

11. Quadrilateral: 80° , 90° , 100° , x

Solution: 11. Quadrilateral: $80^\circ + 90^\circ + 100^\circ = 270^\circ$ $360^\circ - 270^\circ = 90^\circ$

12. Pentagon: 90° , 110° , 120° , 100° , x

Solution: 12. Pentagon: $90^\circ + 110^\circ + 120^\circ + 100^\circ = 420^\circ$ $540^\circ - 420^\circ = 120^\circ$

13. Hexagon: 100° , 115° , 125° , 130° , 140° , x

Solution: 13. Hexagon: $100^\circ + 115^\circ + 125^\circ + 130^\circ + 140^\circ = 610^\circ$ $720^\circ - 610^\circ = 110^\circ$

14. Find one exterior angle of a regular pentagon.

Solution: 14. $360^\circ \div 5 = 72^\circ$

15. Find one exterior angle of a regular hexagon.

Solution: 15. $360^\circ \div 6 = 60^\circ$

16. Find one exterior angle of a regular octagon.

Solution: 16. $360^\circ \div 8 = 45^\circ$

17. A regular polygon has one exterior angle of 30° . How many sides does it have?

Solution: 17. $360^\circ \div 30^\circ = 12$ The polygon has 12 sides.

18. A student says a pentagon has interior angle sum $5 \times 180^\circ$. Explain the mistake.

Solution: 18. The formula is not $n \times 180^\circ$. A pentagon has $5 - 2 = 3$ triangles, so the sum is $3 \times 180^\circ = 540^\circ$.

19. A student divides the interior angle sum of an irregular hexagon by 6 to find each angle. Explain why this is not safe.

Solution: 19. Dividing by 6 only works if the hexagon is regular. An irregular hexagon can have unequal angles.

20. A student says exterior angles add to 180° . Explain the mistake.

Solution: 20. Exterior angles of a polygon add to 360° , not 180° .

Chapter Answer Key

Tripwire Check

The student is not correct.

The formula is:

$$(n - 2) \times 180^\circ$$

For a hexagon:

$$(6 - 2) \times 180^\circ$$

$$4 \times 180^\circ = 720^\circ$$

The correct interior angle sum is:

$$720^\circ$$

Worksheet 1: Guided Practice

1.

Polygon	Number of Sides	$n - 2$	Interior Angle Sum
3			
4			

540°			
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2.

a.

$$(5 - 2) \times 180^\circ = 3 \times 180^\circ = 540^\circ$$

b.

$$(6 - 2) \times 180^\circ = 4 \times 180^\circ = 720^\circ$$

3.

$$540^\circ \div 5 = 108^\circ$$

Each interior angle is 108° .

4.

$$90^\circ + 80^\circ + 100^\circ = 270^\circ$$

$$360^\circ - 270^\circ = 90^\circ$$

Worksheet 2: Independent Practice

1.

a. 540°

b. 720°

c. 1080°

d. 1260°

e. 1440°

2.

a.

$$180^\circ \div 3 = 60^\circ$$

b.

$$360^\circ \div 4 = 90^\circ$$

c.

$$540^\circ \div 5 = 108^\circ$$

d.

$$720^\circ \div 6 = 120^\circ$$

e.

$$1080^\circ \div 8 = 135^\circ$$

3.

a.

$$70^\circ + 100^\circ + 90^\circ = 260^\circ$$

$$360^\circ - 260^\circ = 100^\circ$$

b.

$$100^\circ + 100^\circ + 110^\circ + 120^\circ = 430^\circ$$

$$540^\circ - 430^\circ = 110^\circ$$

c.

$$120^\circ + 130^\circ + 110^\circ + 140^\circ + 115^\circ = 615^\circ$$

$$720^\circ - 615^\circ = 105^\circ$$

4.

a.

$$360^\circ \div 3 = 120^\circ$$

b.

$$360^\circ \div 4 = 90^\circ$$

c.

$$360^\circ \div 5 = 72^\circ$$

d.

$$360^\circ \div 6 = 60^\circ$$

e.

$$360^\circ \div 8 = 45^\circ$$

Worksheet 3: Mixed Practice & Application

1.

a. The student used $n \times 180^\circ$. The formula counts triangles inside the polygon, so it is $(n - 2) \times 180^\circ$.

b.

$$(10 - 2) \times 180^\circ = 8 \times 180^\circ = 1440^\circ$$

2.

No, the student is only correct if the pentagon is regular.

Every pentagon has interior angle sum 540° , but only a regular pentagon has five equal interior angles.

3.

A pentagon has interior angle sum:

$$540^\circ$$

Known angles:

$$85^\circ + 120^\circ + 110^\circ + 95^\circ = 410^\circ$$

Missing angle:

$$540^\circ - 410^\circ = 130^\circ$$

4.

a.

$$360^\circ \div 45^\circ = 8$$

The polygon has 8 sides.

b. octagon

c.

$$180^\circ - 45^\circ = 135^\circ$$

One interior angle is 135° .

5.

Exterior angles of a polygon make a full turn around the shape. A full turn is 360° , not 180° .

6.

a. Yes. Both hexagons have interior angle sum 720° .

b. No. The regular hexagon has equal angles, but the irregular hexagon does not have to.

c. The number of sides decides the total interior angle sum. Regularity decides whether the individual angles are equal.

Diagnostic Key — High-Leverage Items

Tripwire Check

Correct answer: No. A hexagon splits into 4 triangles, so $(6-2) \times 180^\circ = 720^\circ$.

Likely wrong answer: 1080° .

Misconception: The student used $n \times 180^\circ$ instead of counting $n-2$ triangles.

Next move: Draw diagonals from one vertex, count the triangles, then connect the count to $(n-2) \times 180^\circ$.

Tripwire Diagnostic

Correct answer: No. A hexagon splits into 4 triangles, so $(6-2) \times 180^\circ = 720^\circ$.

Likely wrong answer: 1080° .

Misconception: The student used $n \times 180^\circ$ instead of counting $n-2$ triangles.

Next move: Draw diagonals from one vertex, count the triangles, then connect the count to $(n-2) \times 180^\circ$.

Exit Ticket Diagnostic — High-Leverage Item

Correct answer: 120° for one interior angle of a regular hexagon.

Likely wrong answer: 720° or 60°

Misconception: The student is confusing total interior sum with one angle, or exterior angle with interior angle.

Next move: Find the total (720°), then divide by 6 because the hexagon is regular.

Variation Lab — Expected Ideas

1. Use $(n-2) \times 180^\circ$ because one vertex partitions an n -gon into $n-2$ triangles.

2. Regular means equal angles, so divide the total by n ; irregular polygons need not have equal angles.
3. Exterior angles total 360° ; for a regular polygon, $360^\circ \div \text{one exterior angle}$ gives the number of sides.

Transfer Check — Suggested Responses

Familiar: $(8-2) \times 180 = 1080^\circ$. Altered: $1080 \div 8 = 135^\circ$. Non-routine: $360 \div 30 = 12$ sides; interior angle $= 150^\circ$.
Repair: every pentagon totals 540° , but only a regular pentagon has five equal 108° angles.

Exit Ticket — Answers

1. 900°
2. 120°
3. An n -gon splits into $n-2$ triangles from one vertex.