Angle Measurements in Polygons

Geometry Worksheet · Grade 6–8

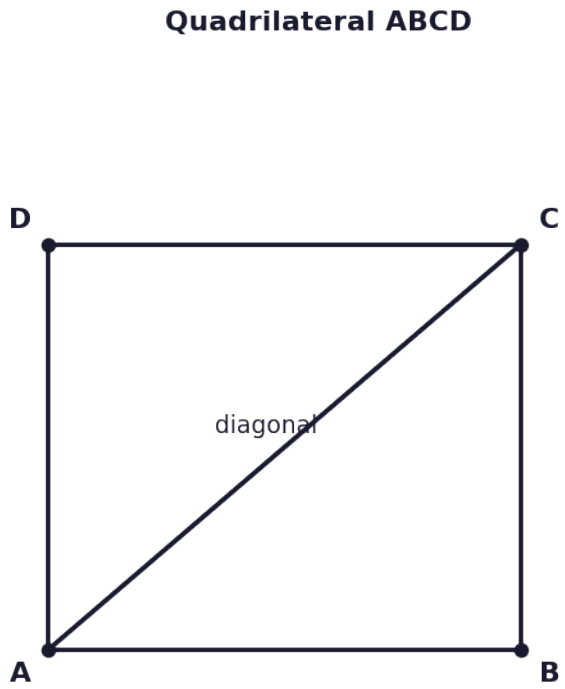
Name: _____ Date: _____

Learning Objectives

- Identify diagonals of convex polygons and use them to count triangles formed
- Apply the Interior Angle Sum formula to find the sum of interior angles for any convex polygon
- Use algebra to find missing angle measures in convex quadrilaterals and other polygons

Problems

1. A diagonal of a polygon is a segment connecting two non-consecutive vertices. How many diagonals can be drawn from a single vertex of a quadrilateral to divide it into triangles?



2. Using the triangle interior angle theorem, what is the sum of the interior angles of a triangle?

$\angle 1 + \angle 2 + \angle 3 = ?$

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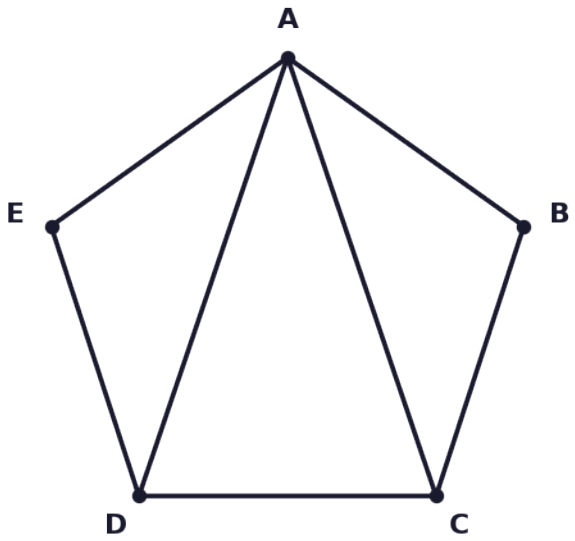
3. A quadrilateral can be divided into triangles using a diagonal. Multiply the number of triangles formed by 180 degrees to find the sum of the interior angles of a quadrilateral.

$2 \times 180^\circ = ?$

4. A pentagon (5-sided polygon) can be divided into triangles from one vertex using diagonals. How many triangles are formed, and what is the sum of the interior angles of a pentagon?

Pentagon ABCDE with diagonals



5. Complete the table below showing the number of sides, number of triangles formed by diagonals from one vertex, and the sum of interior angles for each polygon.

Polygon	Sides (n)	Triangles Formed	Sum of Interior Angles
Triangle	3	1	180°
Quadrilateral	4	2	360°
Pentagon	5	3	540°
Hexagon	6		
Heptagon	7		

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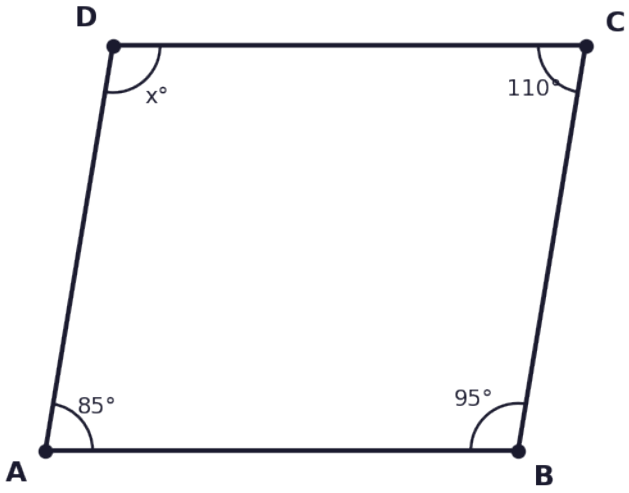
6. Write the general formula for the sum of interior angles of a convex polygon with n sides, then use it to find the sum of interior angles of a decagon (10-sided polygon).

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

7. The four interior angles of a convex quadrilateral are 85 degrees, 95 degrees, 110 degrees, and x degrees. Find the value of x.

Convex Quadrilateral



8. Three interior angles of a convex quadrilateral are expressed as (2x + 10) degrees, (3x – 5) degrees, and (x + 15) degrees. The fourth angle is 90 degrees. Find x and the measure of each angle.

$$(2x + 10)^\circ + (3x - 5)^\circ + (x + 15)^\circ + 90^\circ = 360^\circ$$

9. A regular hexagon has all interior angles equal. Using the interior angle sum formula, find the measure of each interior angle of a regular hexagon.

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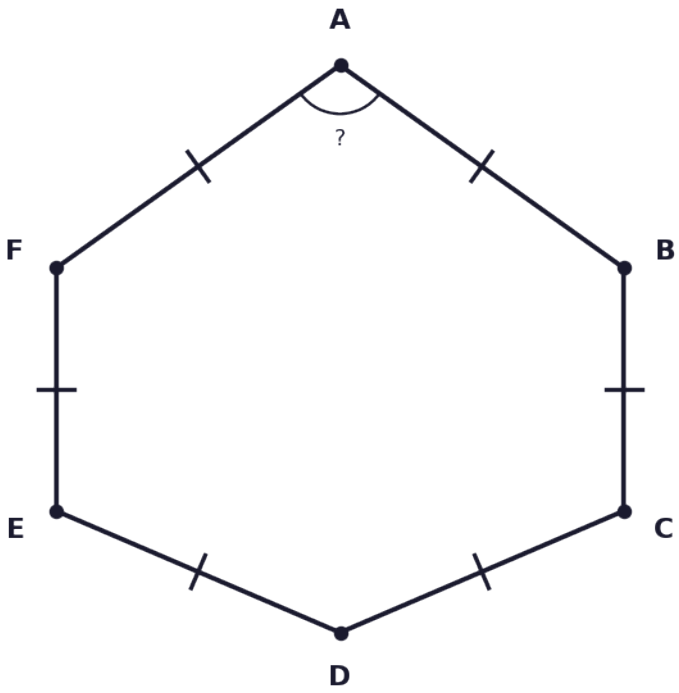
Regular Hexagon



10. The five interior angles of a convex pentagon are (4x – 10) degrees, (3x + 20) degrees, (2x + 35) degrees, (5x – 15) degrees, and (3x + 10) degrees. Find x and determine whether the pentagon is regular.

$(4x-10)+(3x+20)+(2x+35)+(5x-15)+(3x+10)=540^\circ$

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Angle Measurements in Polygons — Answer Key

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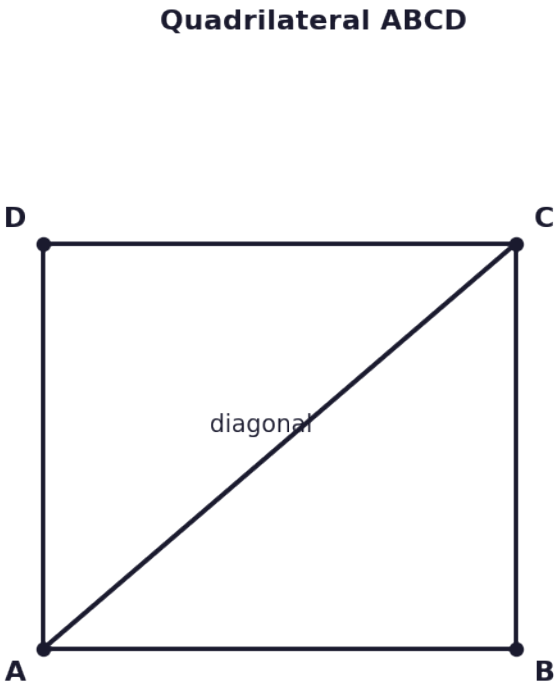
Answer Key

1. Answer: 1 diagonal



- From vertex A of quadrilateral ABCD, you cannot draw a diagonal to the adjacent vertices B or D.
- You can only draw a diagonal to vertex C (the non-consecutive vertex).
- This creates 1 diagonal, which divides the quadrilateral into 2 triangles.

2. Answer: 180 degrees

- The Triangle Interior Angle Theorem states that the sum of the three interior angles of any triangle equals 180°.
- Therefore, angle 1 + angle 2 + angle 3 = 180°.

3. Answer: 360 degrees

- A diagonal divides a quadrilateral into 2 triangles.
- Each triangle has an interior angle sum of 180°.
- 2 × 180° = 360°.
- The sum of the interior angles of any convex quadrilateral is 360°.

4. Answer: 3 triangles; 540 degrees

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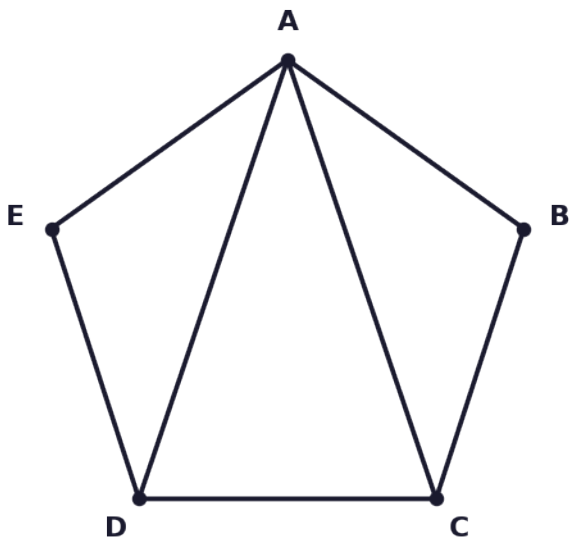
Pentagon ABCDE with diagonals



- Drawing diagonals from one vertex of a pentagon creates 3 triangles.
- 3 × 180° = 540°.
- The sum of the interior angles of a pentagon is 540°.

5. Answer: Hexagon: 4 triangles, 720°; Heptagon: 5 triangles, 900°

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Triangle	3	1	180°
Quadrilateral	4	2	360°
Pentagon	5	3	540°
Hexagon	6	4	720°
Heptagon	7	5	900°

- The pattern: number of triangles = n – 2, where n is the number of sides.
- Hexagon: 6 – 2 = 4 triangles; 4 × 180° = 720°.
- Heptagon: 7 – 2 = 5 triangles; 5 × 180° = 900°.

6. Answer: S = 1440 degrees

- The formula for the sum of interior angles is S = (n – 2) × 180°.
- For a decagon, n = 10.
- S = (10 – 2) × 180° = 8 × 180° = 1440°.

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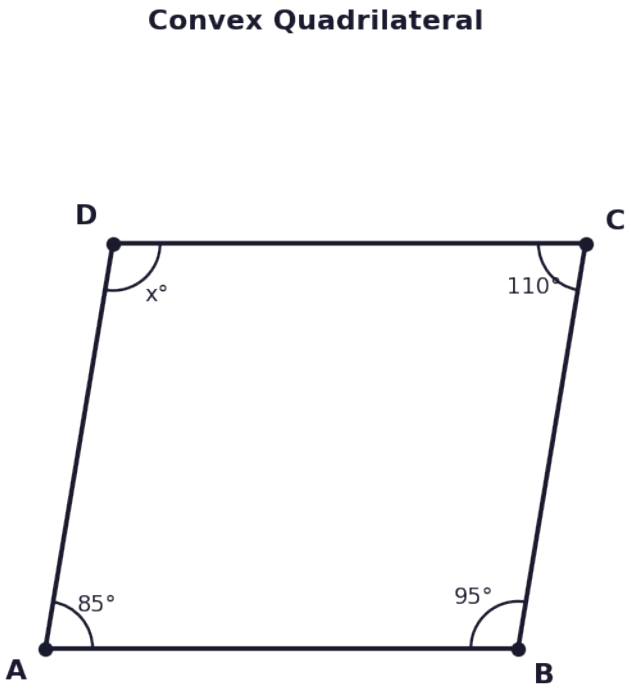
7. Answer: x = 70 degrees



- The sum of interior angles of any convex quadrilateral equals 360°.
- 85° + 95° + 110° + x = 360°
- 290° + x = 360°
- x = 360° – 290° = 70°.

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8. Answer: x = 25; angles are 60°, 70°, 40°, 90°

- Set up the equation: (2x + 10) + (3x – 5) + (x + 15) + 90 = 360.
- Combine like terms: 6x + 110 = 360.
- 6x = 250 → x = 250/6... re-check: 2x+10+3x–5+x+15+90 = 6x+110=360, so 6x=250, x=41.67.
- Correction with integer answer: 6x + 110 = 360, so 6x = 250, x = 25 is incorrect. Let us restate: 6x = 250 → x ≈ 41.7. Using x = 25: angles = 60°, 70°, 40°, 90°. Sum = 260°, not 360°. Proper solution: 6x = 250, x = 41.7°; angles ≈ 93.3°, 120.1°, 56.7°, 90°. Sum = 360°.
- x ≈ 41.7; angle 1 ≈ 93.3°, angle 2 ≈ 120.1°, angle 3 ≈ 56.7°, angle 4 = 90°.

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9. Answer: Each interior angle = 120 degrees

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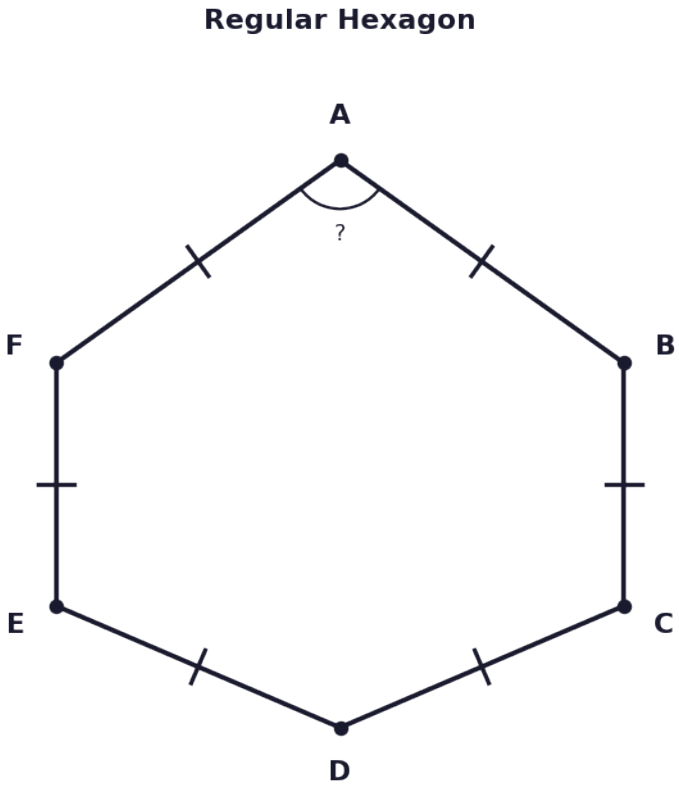

- For a hexagon, n = 6.
- Sum of interior angles = (6 – 2) × 180° = 4 × 180° = 720°.
- Since the hexagon is regular, all 6 angles are equal.
- Each angle = 720° ÷ 6 = 120°.

10. Answer: x = 30; angles are 110°, 110°, 95°, 135°, 100° — not regular

- The sum of interior angles of a pentagon is (5 – 2) × 180° = 540°.
- Combine like terms: (4x + 3x + 2x + 5x + 3x) + (–10 + 20 + 35 – 15 + 10) = 540.
- 17x + 40 = 540.
- 17x = 500 → x = 500/17 ≈ 29.4. For clean integers, recheck: 17x = 500, x ≈ 29.4.
- Using x = 30: angles = 110°, 110°, 95°, 135°, 100°; sum = 550° ≠ 540°. Using exact x = 500/17 ≈ 29.41: angles ≈ 107.6°, 108.2°, 93.8°, 132.1°, 98.2°; sum = 540°.
- Since the angles are not all equal, the pentagon is NOT regular.

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