

Grade 8

Quadrilaterals & Polygons

Advanced geometry practice with properties, angle reasoning, regular polygons, diagonals, symmetry and coordinate challenges.

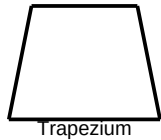
Complete Pack

6 worksheets + 6 answer keys • 36 questions • supporting vector diagrams

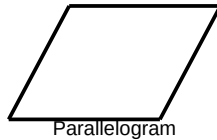
Designed to be more reasoning-focused than the Grade 7 geometry work.

1. Quadrilateral Properties

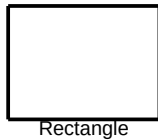
Show your working and use the diagram where it helps.



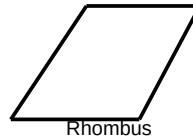
Trapezium



Parallelogram



Rectangle



Rhombus

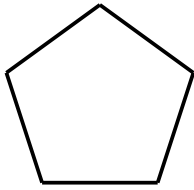
1. Classify each displayed quadrilateral as a square, rectangle, parallelogram, rhombus, kite or trapezium where appropriate. Give one supporting property.
2. A parallelogram has one angle of 68° . Find all four interior angles.
3. A rectangle is 14 cm by 9 cm. Find its perimeter and area. Explain why every rectangle is a parallelogram.
4. A rhombus has side length 11 cm and diagonals 14 cm and 18 cm. Find its perimeter and area.
5. A quadrilateral has angles 82° , 97° , 104° and x° . Find x .
6. Is the statement "A square is both a rhombus and a rectangle" always true, sometimes true or never true? Explain.

Answer Key — 1. Quadrilateral Properties

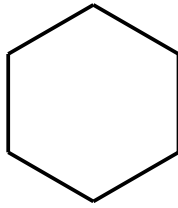
1. Use the defining properties shown in class; rectangle: four right angles; parallelogram: two pairs of parallel sides; rhombus: four equal sides; square: both; kite: two pairs of adjacent equal sides; trapezium: at least one pair of parallel sides.
2. 68° , 112° , 68° , 112° .
3. Perimeter 46 cm; area 126 cm^2 . A rectangle has two pairs of opposite parallel sides.
4. Perimeter 44 cm; area 126 cm^2 .
5. $x = 77^\circ$, since quadrilateral angles total 360° .
6. Always true.

2. Angles in Quadrilaterals & Polygons

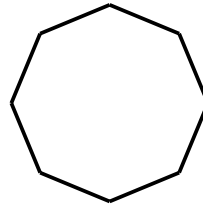
Show your working and use the diagram where it helps.



Regular 5-gon



Regular 6-gon



Regular 8-gon

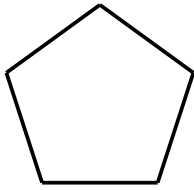
1. Find the missing angle in a quadrilateral with angles 73° , 91° , 112° and x° .
2. The angles of a quadrilateral are x° , $(x + 20)^\circ$, $(2x + 10)^\circ$ and $(x - 5)^\circ$. Find x and all four angles.
3. A regular polygon has each interior angle equal to 135° . How many sides does it have?
4. The exterior angle of a regular polygon is 24° . Find the number of sides and each interior angle.
5. A pentagon has interior angles 105° , 118° , 132° , 97° and x° . Find x .
6. A regular polygon has 12 sides. Find its interior-angle sum, each interior angle and each exterior angle.

Answer Key — 2. Angles in Quadrilaterals & Polygons

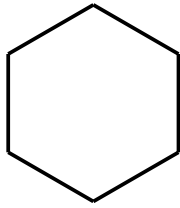
1. $x = 84^\circ$.
2. $x = 67.5^\circ$; angles are 67.5° , 87.5° , 145° and 62.5° .
3. 8 sides.
4. 15 sides; interior angle 156° .
5. $x = 88^\circ$.
6. Sum 1800° ; each interior angle 150° ; each exterior angle 30° .

3. Regular & Irregular Polygons

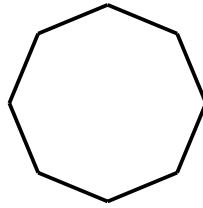
Show your working and use the diagram where it helps.



Regular 5-gon



Regular 6-gon



Regular 8-gon

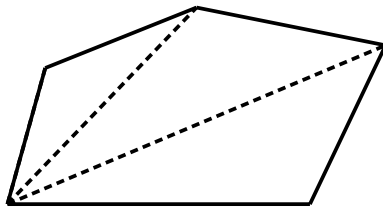
1. Complete for regular 5-, 6-, 8- and 10-gons: interior-angle sum, each interior angle and each exterior angle.
2. A regular polygon has 15 sides. Find each exterior and interior angle.
3. Explain the difference between a regular and irregular polygon. Give one example of each.
4. A regular polygon has each interior angle 156° . Find its number of sides.
5. A regular polygon has an exterior angle of 18° . Find its number of sides.
6. A 9-gon has interior angles of 135° each. Can it be regular? Prove your answer.

Answer Key — 3. Regular & Irregular Polygons

1. 5-gon: $540^\circ, 108^\circ, 72^\circ$; 6-gon: $720^\circ, 120^\circ, 60^\circ$; 8-gon: $1080^\circ, 135^\circ, 45^\circ$; 10-gon: $1440^\circ, 144^\circ, 36^\circ$.
2. Exterior 24° ; interior 156° .
3. Regular polygons have all sides and angles equal; irregular polygons do not.
4. 15 sides.
5. 20 sides.
6. No. A regular 9-gon has each interior angle 140° .

4. Diagonals, Symmetry & Shape Reasoning

Show your working and use the diagram where it helps.



diagonals from one vertex

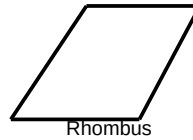
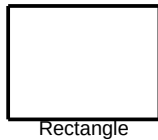
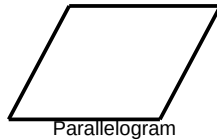
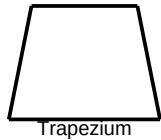
1. How many diagonals can be drawn from one vertex of a decagon? State the formula.
2. Find the total number of diagonals in a decagon.
3. A polygon has 35 diagonals. How many sides does it have?
4. A regular hexagon has what order of rotational symmetry and how many lines of symmetry?
5. A rectangle that is not a square has how many lines of symmetry and what order of rotational symmetry?
6. Describe a quadrilateral with exactly one line of symmetry. Then name one with two lines of symmetry.

Answer Key — 4. Diagonals, Symmetry & Shape Reasoning

1. 7; formula $n - 3$.
2. 35; formula $n(n-3)/2$.
3. 10 sides.
4. Order 6; six lines.
5. Two lines; rotational order 2.
6. A kite can have one line; a non-square rectangle has two.

5. Coordinate & Composite Polygon Challenges

Show your working and use the diagram where it helps.



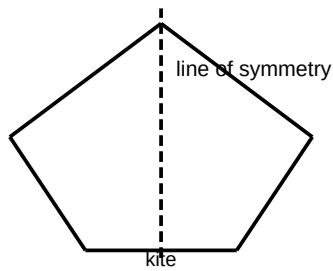
1. Plot A(1,1), B(7,1), C(7,4), D(1,4). Identify the quadrilateral and find area and perimeter.
2. A(0,0), B(6,0), C(6,3), D(4,5), E(0,5) form a pentagon. Find its area by splitting it into simpler shapes.
3. A regular hexagon has side length 8 cm. Find its perimeter. If its apothem is 6.9 cm, estimate its area using $A = \frac{1}{2} \times \text{perimeter} \times \text{apothem}$.
4. A 6 cm $\times$ 4 cm rectangle is attached to a 4 cm $\times$ 4 cm square along a full side. Find the outside perimeter and total area.
5. Points $(-2,1)$, $(4,1)$, $(5,5)$, $(-1,5)$ form a quadrilateral. Determine whether both pairs of opposite sides are parallel.
6. Choose five different interior angles for a pentagon and verify that their sum is 540° .

Answer Key — 5. Coordinate & Composite Polygon Challenges

1. Rectangle; area 18 square units; perimeter 18 units.
2. Area 32 square units.
3. Perimeter 48 cm; area $\approx 165.6 \text{ cm}^2$.
4. Area 40 cm^2 ; outside perimeter 32 cm.
5. Both pairs are parallel, so it is a parallelogram.
6. Answers vary; any five different angles totaling 540° are valid.

6. Quadrilaterals & Polygons — Challenge

Show your working and use the diagram where it helps.



1. The angles of a quadrilateral are in the ratio 2:3:4:6. Find all four angles.
2. A regular polygon has 20 sides. Find its interior-angle sum and each interior angle.
3. A polygon has an interior-angle sum of 1440° . How many sides does it have?
4. A regular polygon has each interior angle 150° . A second regular polygon has twice as many sides. Find the second polygon's number of sides and each interior angle.
5. A quadrilateral has diagonals that bisect each other at right angles. Name a family that fits, and explain why the information may not identify one unique shape.
6. Explain why the sum of one exterior angle at each vertex of any convex polygon is 360° .

Answer Key — 6. Quadrilaterals & Polygons — Challenge

1. Total 15 parts; each part 24° . Angles: 48° , 72° , 96° , 144° .
2. Sum 3240° ; each interior angle 162° .
3. 10 sides.
4. First polygon has 12 sides; second has 24 sides and each interior angle 165° .
5. A rhombus fits; a square also fits, so the description is not unique.
6. The exterior angles represent one complete turn around the polygon, so their sum is 360° .