

Quadrilaterals and Polygons: math practice, Grade 10 – download the PDF

21 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

1 Interior angle sums

★ ★ ★

Find the sum of the interior angles of (a) a hexagon, (b) an octagon, (c) a 15-gon.

2 A regular nonagon

★ ★ ★

A tile has the shape of a regular 9-gon. Find each exterior angle and each interior angle.

3 Angles of a parallelogram

★ ★ ★

In parallelogram $PQRS$, $\angle P = 68^\circ$. Find the other three angles and justify.

4 Opposite sides

★ ★ ★

In parallelogram $ABCD$, $AB = 3x + 2$ and $CD = 5x - 6$ (in centimeters). Find x and the length of $\overline{AB}$.

5 True or false?



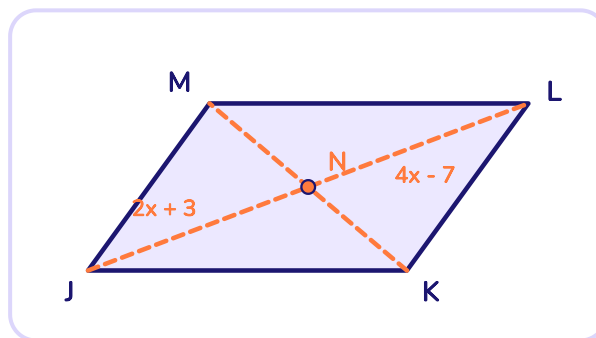
Decide whether each statement is true or false, and justify with a reason or a counterexample.

- a. Every square is a rectangle.
- b. Every rectangle is a rhombus.
- c. The diagonals of every parallelogram are congruent.

6 Diagonals that bisect



The diagonals of parallelogram $JKLM$ meet at N . Given $JN = 2x + 3$ and $NL = 4x - 7$, find x and the length of diagonal $\overline{JL}$.



7 A garden bed



A garden bed is a trapezoid with parallel sides of **12 ft** and **20 ft**. A fence runs across the bed through the midpoints of the two slanted sides. How long is this fence?

8 Angles in a pentagon



The five interior angles of a convex pentagon measure

x° , $(x + 10)^\circ$, $(x + 20)^\circ$, $(x + 30)^\circ$, $(x + 40)^\circ$. Find all five angles.

9 How many sides?

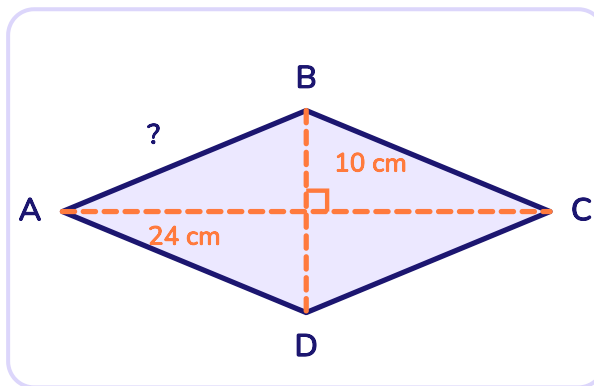


Each interior angle of a regular polygon measures 156° . How many sides does it have?

10 A rhombus from its diagonals



The diagonals of a rhombus measure **10 cm** and **24 cm**. Find the side length, the perimeter, and the area.



11 A rectangular screen

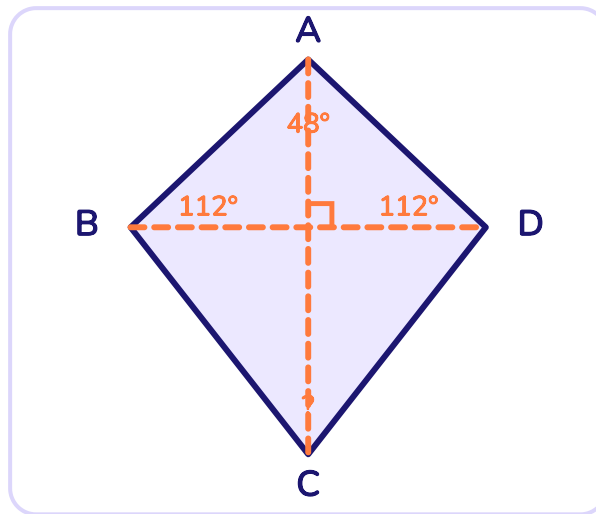


In rectangle $ABCD$, $AC = 7x - 5$ and $BD = 4x + 10$. (a) Find x and the diagonal length. (b) The short side is **18 cm**. Find the long side.

12 Angles of a kite



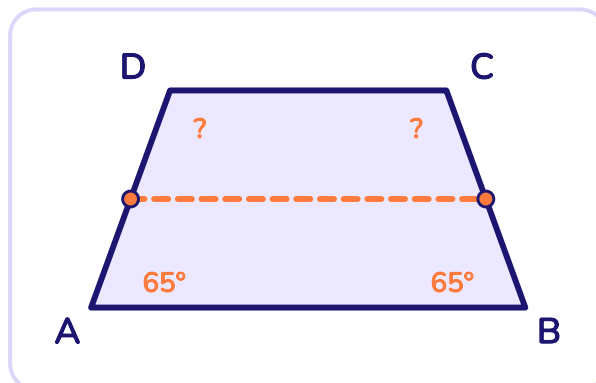
In kite $ABCD$ with $AB = AD$ and $CB = CD$, $\angle A = 48^\circ$ and $\angle B = 112^\circ$. Find $\angle D$, $\angle C$, and the angle that diagonal $\overline{AC}$ makes with side $\overline{AB}$.



13 Isosceles trapezoid angles



In isosceles trapezoid $ABCD$ with bases $\overline{AB}$ and $\overline{DC}$, the base angles at A and B measure 65° . Find $\angle C$ and $\angle D$, and check the angle sum.



14 Which condition is enough?

For each description of quadrilateral $WXYZ$, say whether it proves a parallelogram, and name the criterion or explain why not.

- a. $WX = YZ = 7$ and $\overline{WX} \parallel \overline{YZ}$.
- b. Sides in order measure 5, 8, 5, 8.
- c. Sides in order measure 5, 5, 8, 8.
- d. $\overline{WX} \parallel \overline{YZ}$ only.

15 Coordinate proof: parallelogram

Given $A(-2, -1)$, $B(4, 1)$, $C(6, 6)$, $D(0, 4)$. (a) Prove that $ABCD$ is a parallelogram. (b) Is it a rectangle?

16 Coordinate proof: rectangle

Show that $P(0, 0)$, $Q(4, 2)$, $R(3, 4)$, $S(-1, 2)$ are the vertices of a rectangle, then find its area.

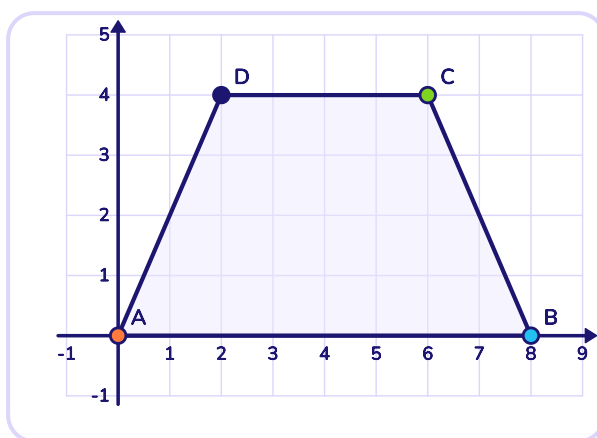
17 Coordinate proof: rhombus

Let $A(-3, 0)$, $B(0, 4)$, $C(3, 0)$, $D(0, -4)$. (a) Prove that $ABCD$ is a rhombus. (b) Find its area. (c) Why is it not a square?

18 Coordinate proof: trapezoid

★★★

Let $A(0, 0)$, $B(8, 0)$, $C(6, 4)$, $D(2, 4)$. (a) Show that $ABCD$ is an isosceles trapezoid. (b) Find the midsegment length and the area.



19 Algebra with a parallelogram

★★★

(a) In parallelogram $ABCD$, $\angle A = (3x + 15)^\circ$ and $\angle C = (5x - 25)^\circ$. Find all four angles. (b) A parallelogram-shaped banner has a perimeter of **76 in**, and its longer side is **6 in** more than its shorter side. Find both side lengths.

20 A mystery polygon

★★★

The interior angles of a convex polygon add up to **1980°**. (a) How many sides does it have? (b) How many diagonals can be drawn from one vertex? (c) How many diagonals does it have in all?

21 Joining the midpoints

★★★

Take $A(0, 0)$, $B(8, 2)$, $C(10, 8)$, $D(2, 6)$, and let M , N , P , Q be the midpoints of $\overline{AB}$, $\overline{BC}$, $\overline{CD}$, $\overline{DA}$. (a) Find the four midpoints. (b) Prove that $MNPQ$ is a parallelogram. (c) Explain why this works for any quadrilateral.



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