

Quadrilateral Properties: Parallelograms to Kites

Grade 10 – Geometry math · Worksheet · Standards: G-CO.C.11

Name: _____ Date: _____ Class: _____

These problems cover G-CO.C.11: the properties of parallelograms, tests that prove a quadrilateral is a parallelogram, and the special cases of rectangles, rhombuses, squares, trapezoids and kites.

Early problems use one property. Later problems combine algebra, coordinates and two-column proofs about diagonals and sides.

Standards: G-CO.C.11 · **Level:** Grade 10 Geometry

Problem 1 Opposite sides of a parallelogram (easy)

In parallelogram $ABCD$, $AB = 14.5$ and $BC = 9$. Find CD , AD and the perimeter.

Problem 2 Angles of a parallelogram (easy)

In parallelogram $ABCD$, $m\angle A = 68^\circ$. Find the other three angles.

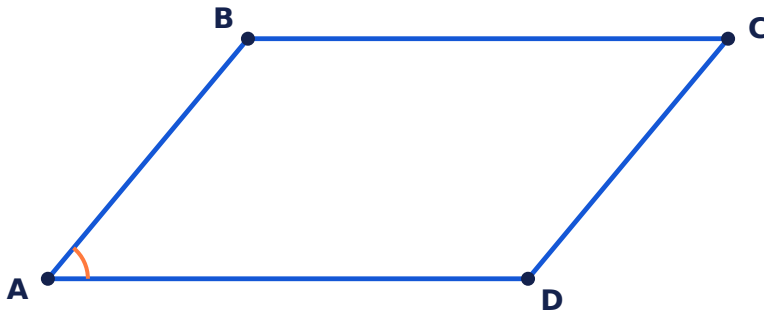


Figure for Problem 2.

Problem 3 Diagonals that bisect (easy)

The diagonals of parallelogram $ABCD$ meet at E . $AE = 6.5$ and $BE = 9.25$. Find CE , DE , AC and BD .

Problem 4 Opposite sides with algebra (easy)

In parallelogram $ABCD$, $AB = 4x - 7$ and $CD = 2x + 9$. Find x and AB .

Problem 5 Consecutive angles with algebra (medium)

In parallelogram $ABCD$, $m\angle A = (4x + 6)^\circ$ and $m\angle B = (6x - 16)^\circ$. Find x and both angles.

Problem 6 Diagonals with algebra (medium)

The diagonals of parallelogram $ABCD$ meet at E . $AE = 3x + 1$ and $EC = 5x - 9$. Find x and AC .

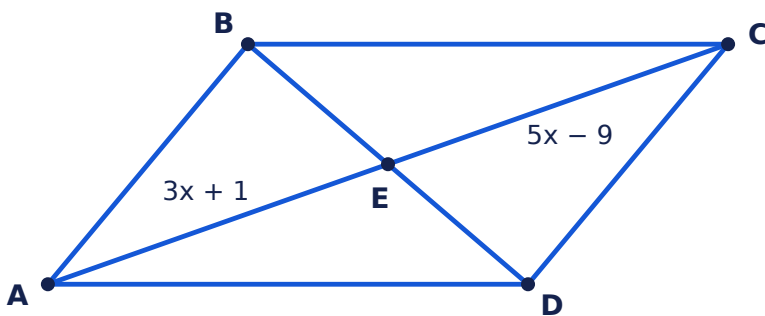


Figure for Problem 6.

Problem 7 Is it a parallelogram (medium)

Decide whether each description guarantees a parallelogram. Name the test or give a reason it fails.

- Opposite sides measure 9 and 9, and 14 and 14.
- Opposite angles measure 70° and 70° , and 110° and 110° .
- One pair of opposite sides is parallel and the other pair is congruent.
- The diagonals bisect each other.

Problem 8 Make it a parallelogram (medium)

In quadrilateral $ABCD$, $AB = 2x + 5$, $CD = 4x - 9$, $AD = 3y - 1$ and $BC = y + 7$. Find x and y so that $ABCD$ is a parallelogram.

Problem 9 Parallelogram on the plane (medium)

The vertices of quadrilateral $ABCD$ are $A(1, 2)$, $B(6, 3)$, $C(8, 7)$ and $D(3, 6)$. Use the midpoints of the diagonals to decide whether it is a parallelogram.

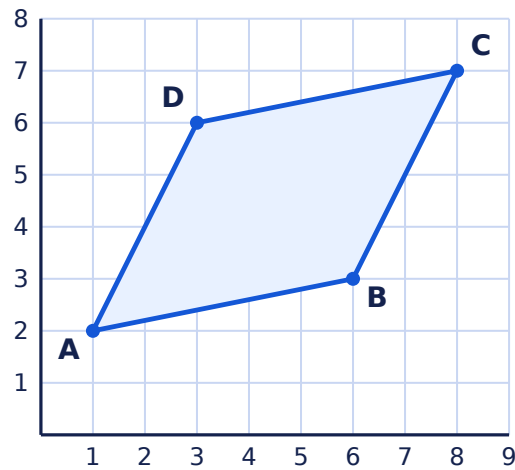


Figure for Problem 9.

Problem 10 Rectangle diagonals (medium)

The diagonals of rectangle $ABCD$ measure $AC = 5x - 3$ and $BD = 3x + 11$. Find x and the length of each diagonal.

Problem 11 Diagonal of a rhombus (medium)

A rhombus has a perimeter of 52 and one diagonal of 10. Find the side length, the other diagonal and the area.

Problem 12 Angles of a rhombus (medium)

In rhombus $ABCD$, $m\angle DAB = 64^\circ$. Find $m\angle ABC$, $m\angle CAB$ and $m\angle ABD$.

Problem 13 Trapezoid midsegment (medium)

The midsegment of a trapezoid measures $(3x + 11)$, and the bases measure $(4x + 2)$ and $(6x - 8)$. Find x , both bases and the midsegment.

Problem 14 Isosceles trapezoid (medium)

In isosceles trapezoid $ABCD$, one base angle measures 72° . The diagonals measure $2x + 9$ and $4x - 7$. Find the other angles of the trapezoid and the length of each diagonal.

Problem 15 Building a kite (hard)

A kite maker builds a kite with a horizontal crossbar of 24 inches. Two sides at the top measure

15 inches and the two sides at the bottom measure 20 inches. The long spine is perpendicular to the crossbar. Find the length of the spine and the area of the kite.

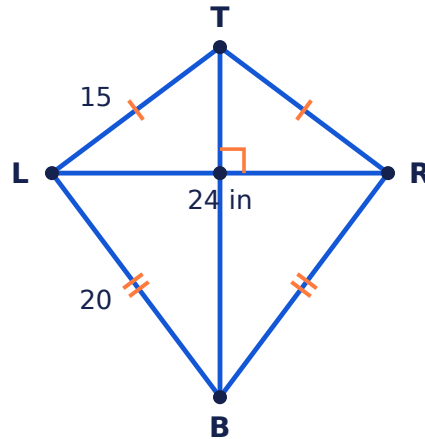


Figure for Problem 15.

Problem 16 Garden bed fence (hard)

A parallelogram-shaped garden bed has sides of 18 feet and 11.5 feet, and one corner measures 65° . Find the other three corner angles, the perimeter, and the cost of fencing at \$8.50 per foot.

Problem 17 Prove the diagonals bisect each other (hard)

Given: $ABCD$ is a parallelogram with diagonals meeting at E . Prove: $AE \cong CE$ and $BE \cong DE$. Write a two-column proof.

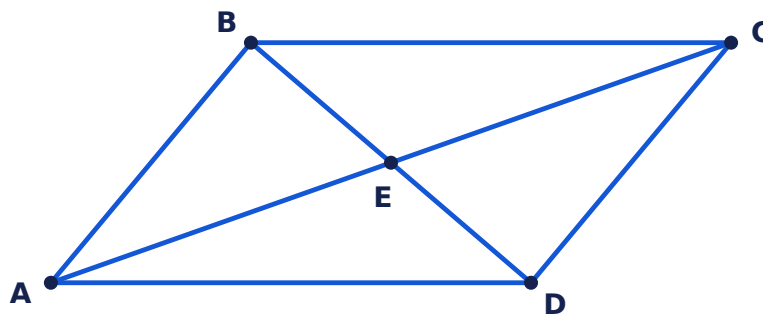


Figure for Problem 17.

Problem 18 Prove the converse (hard)

Given: $AB \cong CD$ and $AD \cong BC$ in quadrilateral $ABCD$. Prove: $ABCD$ is a parallelogram. Draw diagonal AC and write a two-column proof.

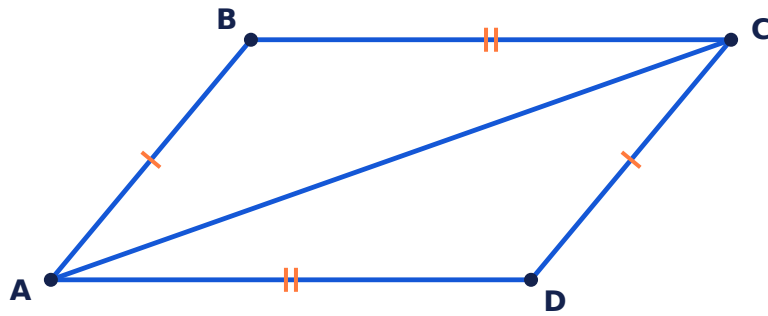


Figure for Problem 18.

Problem 19 Prove rectangle diagonals congruent (hard)

Quadrilateral $PQRS$ is a rectangle with diagonals PR and QS . Prove that the two diagonals have the same length by writing a two-column proof.

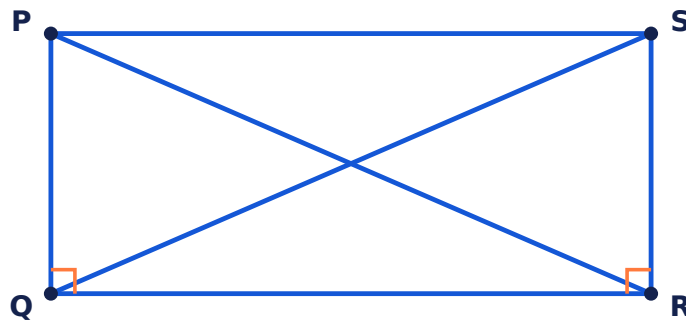


Figure for Problem 19.

Problem 20 Coordinate proof of a rhombus (hard)

Show that the quadrilateral with vertices $A(0, 0)$, $B(4, 3)$, $C(9, 3)$ and $D(5, 0)$ is a rhombus, and show that its diagonals are perpendicular.