

Quadrilateral Properties in Action

Classify, draw, compare, and calculate.

GRADE 7 • 7.MG.3

7.MG.3 "Excerpt: The student will compare and contrast quadrilaterals based on their properties and determine unknown side lengths and angle measures of quadrilaterals."

NAME _____

DATE _____

Use properties, not appearance alone

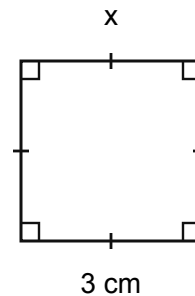
Name all valid families: a square is also a rectangle, rhombus and parallelogram. Here, trapezoids have exactly one parallel pair. Diagonals join opposite vertices; symmetry reflects a figure onto itself.

Worked example

This square has one side labeled 3 cm. Find x and name its families.

All four marked sides are congruent, so $x = 3$ cm. Four right angles make it a rectangle; four congruent sides make it a rhombus. It is a square, rectangle, rhombus and parallelogram.

Worked square

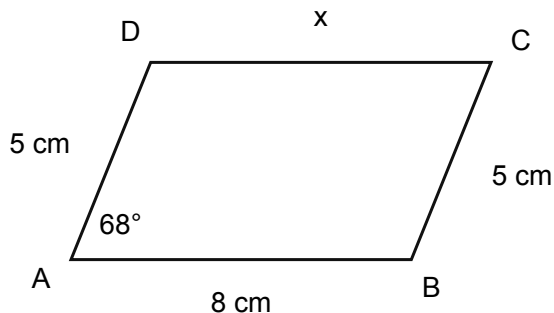


Use a pencil and ruler. Do not measure the drawings. Use given measures and mathematical properties.

1. Use parallelogram properties

In ABCD, find side $CD = x$ and angles B, C and D. Explain how opposite sides, opposite angles and adjacent angles determine your answers.

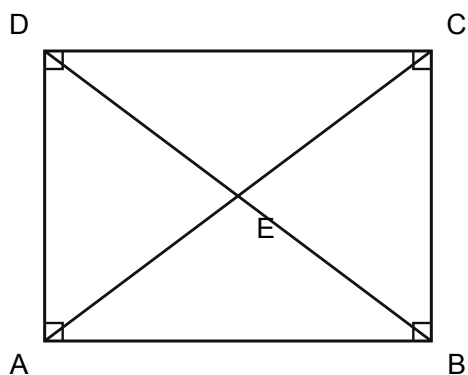
Parallelogram ABCD



2. Compare rectangle diagonals

The diagonals of rectangle ABCD meet at E. $AC = 10$ cm. Find BD, AE and BE. State the two diagonal properties you use. Are these diagonals perpendicular in this non-square rectangle?

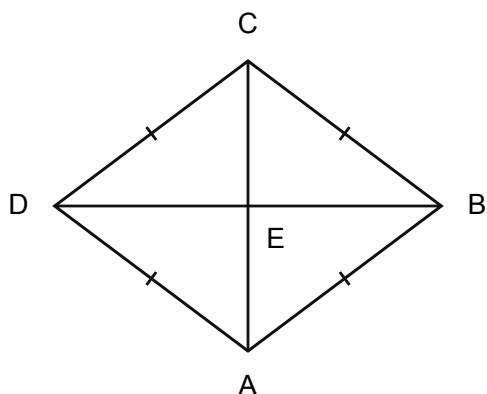
Rectangle ABCD



3. Compare rhombus diagonals

The diagonals of rhombus ABCD meet at E. $AC = 6$ cm and $BD = 8$ cm. Find AE, BE and angle AEB. Explain why unequal diagonals do not prevent this figure from being a rhombus.

Rhombus ABCD



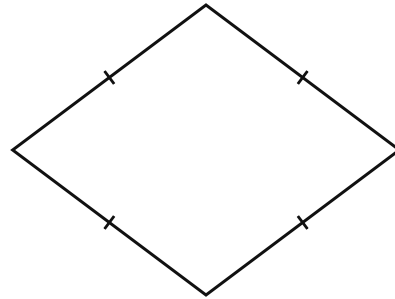
4. Draw and compare reflection symmetry

For R and S, give every applicable name from parallelogram, rectangle, rhombus, square and trapezoid. Draw every line of symmetry on each figure. Explain how the symmetry lines relate to the diagonals.

R: a non-square rectangle



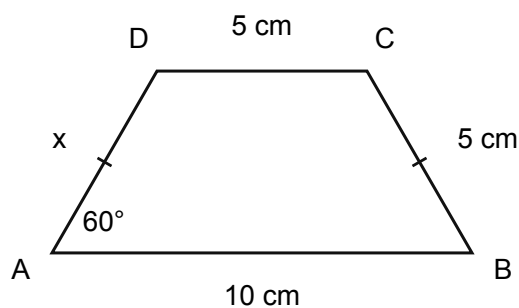
S: a non-square rhombus



5. Reason about an isosceles trapezoid

AB and CD are parallel. Use the marked congruent legs to find $AD = x$. Find angle D, explaining the parallel-line relationship. How many pairs of parallel sides does this trapezoid have?

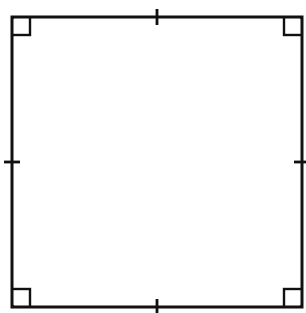
Isosceles trapezoid ABCD



6. Identify the square within the families

Use the marks to give every applicable name for T from the same five-name list. Draw every line of symmetry. State whether its diagonals are congruent and whether they are perpendicular. Explain how T combines rectangle and rhombus properties.

Figure T

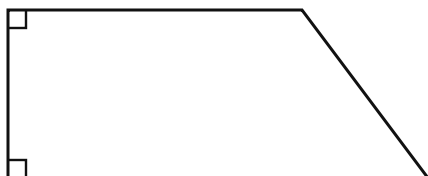


7. Test claims about whole families

Correct each claim using the earlier diagrams or a counterexample.

- A. Every rectangle has perpendicular diagonals.
- B. Every rhombus has congruent diagonals.
- C. Every trapezoid has one line of symmetry and congruent diagonals.

Counterexample for claim C: non-isosceles right trapezoid



TEACHER NOTES

Use inclusive names for parallelogram families and exactly one parallel pair for trapezoids. Accept equivalent explanations. Dashed key lines show reflection axes to be drawn by students; they are not supplied on the student figures.

TASK 1

$CD = x = 8$ cm. $B = 180^\circ - 68^\circ = 112^\circ$, $C = 68^\circ$, $D = 112^\circ$. Opposite sides and angles are congruent; adjacent angles are supplementary.

TASK 2

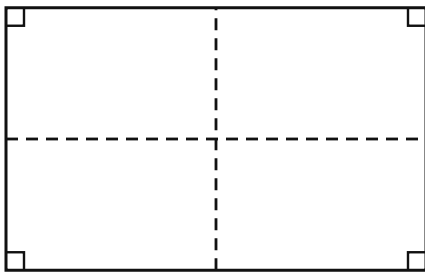
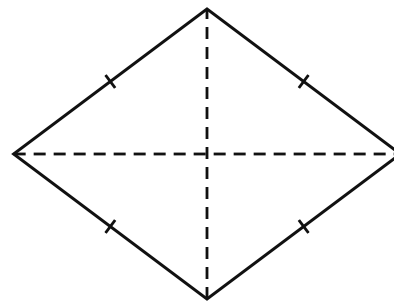
$BD = 10$ cm, $AE = 5$ cm and $BE = 5$ cm. Rectangle diagonals are congruent and bisect each other. In this non-square rectangle they are not perpendicular.

TASK 3

$AE = 3$ cm, $BE = 4$ cm and angle $AEB = 90^\circ$. Rhombus diagonals bisect each other and are perpendicular; they need not be congruent. All four sides of a rhombus are congruent.

TASK 4

R is a rectangle and parallelogram. Its two symmetry lines join midpoints of opposite sides; its diagonals are not symmetry lines. S is a rhombus and parallelogram. Its two symmetry lines are its diagonals. Each figure has two lines, but their locations differ.

R: a non-square rectangle**S: a non-square rhombus**

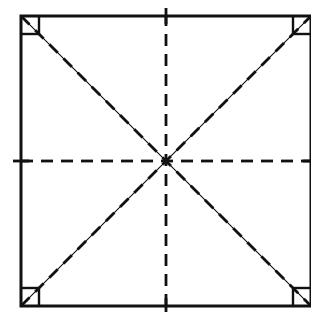
TASK 5

$AD = x = 5$ cm because the legs AD and BC are congruent. $D = 180^\circ - 60^\circ = 120^\circ$ because A and D are same-side interior angles between parallel bases. Exactly one pair of opposite sides is parallel. Use the marked legs and the parallel bases.

TASK 6

T is a square, rectangle, rhombus and parallelogram. It is not a trapezoid under our exactly-one-pair definition. It has four symmetry lines: two diagonals and two lines through opposite side midpoints. Its diagonals are both congruent (rectangle property) and perpendicular (rhombus property). Use all valid family names, not only the most specific name.

T: all four symmetry lines



TASK 7

A is false: the non-square rectangle in task 2 is a counterexample; squares do have perpendicular diagonals. B is false: task 3 has diagonals 6 and 8 cm; squares have congruent diagonals. C is false: those properties hold for an isosceles trapezoid, not every trapezoid. The non-isosceles right trapezoid shown has no symmetry line and unequal diagonals.