

Global Teacher Empowerment Network GTEN
 Saturday 25 March 2023 16.00 – 18.00 London Time

PROPERTIES OF QUADRILATERALS

IDENTIFY TRANSFORMATIONS & SETS OF SIMILAR & CONGRUENT RECTANGLES

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TESSellation

MATCH THE QUADRILATERALS

1

LIFELONG LEARNING
 Build skills and understanding on a spiral path

There is always more to learn.
 Our learning experience
 is like being on an infinite spiral ramp
 that goes round and round,
 on and on for our entire lifetime.

2

PROPERTIES OF QUADRILATERALS
 Programme for the GTEN workshop Saturday 25 March 2023

When you see this symbol, and you see a question in green, do the activity and answer the question on the worksheet. [Download the worksheet.](#)

Today we are working on:

- Properties of quadrilaterals
- Similarity
- Congruence
- Tessellation
- Symmetry
- Area

Upper secondary

Lower secondary

Upper primary

Lower primary

Early years

11. Summary
10. Learning objectives
9. Table of properties. Defining properties by diagonals.
8. Areas of quadrilaterals
7. Minimum number of properties to define a shape
6. Card sorting of properties of quadrilaterals and sketching
5. Helixes and curvature.
4. Identifying and naming quadrilaterals.
3. Properties of parallelograms.
2. Is a square a rectangle?
1. Tessellation of quadrilaterals

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WHAT DO WE KNOW ABOUT QUADRILATERALS?
<https://aiminghigh.aimssec.ac.za/properties-of-quadrilaterals/>

PROPERTIES OF QUADRILATERALS
<https://aiminghigh.aimssec.ac.za/properties-of-quadrilaterals/>

Sort the cards. Sketch the quads. Make a poster.

Do all quadrilaterals tessellate?

How can you be sure?

Cut out some identical (congruent) quadrilaterals by cutting through several layers of scrap paper at the same time.

Try to make a tessellation pattern using your quadrilaterals.

Is it possible? Explain your answer!

4

WHAT DO WE KNOW ABOUT QUADRILATERALS?

Notice that, at every vertex of the tessellation, the 4 vertices of the quadrilateral meet.

The 4 angles always add up to 360° so the quadrilaterals tessellate the plane.

5

IS A SQUARE A RECTANGLE?

<https://aiminghigh.aimssec.ac.za/is-a-square-a-rectangle/>

How many rectangles can you see in this diagram?

There are more than 10.

Is a square a rectangle?

ACTIVITY FOR ALL

SQUARE

RECTANGLE

What is the same and what is different about these two shapes?

- Is a square a rectangle? Answer the question **yes or no**. Thumbs up 👍 or Thumbs Down 👎 (use **REACTIONS on Zoom**).
- Does a square have all those properties? List the properties of a rectangle.

6

The frame is a 4 by 3 grid made up of squares.

- Using this template record all possible different rectangles.
- Explain how you know that you have found all the rectangles?

7

- Sort the rectangles in boxes 1-14 into sets that contain copies of the **same** rectangle. Use language like 1 by 3 rectangle.
- What do we call 'the same' in mathematics? That is shapes with all corresponding angles and all corresponding lengths equal. Two shapes that are the same in all respects are called **CONGRUENT**.
- Sort the rectangles in boxes 1-14 into sets that contain copies of **similar** rectangles.
- Give properties of **SIMILAR** shapes i.e. **ENLARGEMENTS** of each other. **SIMILAR** shapes have all pairs of corresponding lengths in the same ratio and corresponding angles equal.

8

ANSWERS

5. Sort the rectangles in boxes 1-14 into sets that contain copies of the *same* or *congruent* rectangles.
 {3}; {5, 8, 10, 12}; {1, 4}; {2}; {6, 11}; {7}; {9}; {13}; {14}

7. Sort the rectangles in boxes 1-14 into sets that contain copies of *similar* rectangles.
 {3, 6, 11, 13}; {5, 7, 8, 10, 12}.

9

SIMILARITY AND ENLARGEMENT

9. For pairs of similar rectangles, compare the lengths of the edges and decide on the scale factors of the enlargements.

e.g. {3, 11} The edge lengths in 11 are double the edges lengths in 3. The scale factor of the enlargement from 3 to 11 is 2. The scale factor of the enlargement from 11 to 3 is $\frac{1}{2}$.

{5, 7} The edge lengths in 7 are double the edges lengths in 5. The scale factor of the enlargement from 5 to 7 is 2. The scale factor of the enlargement from 7 to 5 is $\frac{1}{2}$.

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SIMILARITY AND TRANSFORMATIONS

10. Describe the transformations that move one congruent shape to another.

Rotation of 90° clockwise about the marked point
 1 to 4 and also 8 to 10

Translation 1 unit up
 5 to 8

Translation 2 units up
 6 to 11

Rotation of 90° and translation
 5 to 10 and also 5 to 12;
 and 8 to 12 (which can be a single rotation).

Translation or Reflection
 10 to 12
 6 to 11

11

What can you discover about parallelograms?
<https://aiminghigh.aimssec.ac.za/properties-of-parallelograms/>

ACTIVITY FOR ALL

PROPERTIES OF PARALLELOGRAMS

Use two rulers to draw a parallelogram. Then make a copy on tracing paper.

Try to discover which lengths and angles in a parallelogram are equal by matching lengths and angles in the copy to lengths and angles in the original.

Describe these patterns.

12

Sort the quadrilaterals into sets and name them

13

Squares {1, 6, 8, 11}
 Rectangles {7, 13, 14, 16}
 Kites {3, 4, 5}
 Trapezia {2, 9, 12, 15}
 Non-convex quadrilateral sometimes described as an arrowhead {10}

14

These pictures show a parallelogram made from the core of a toilet roll.

What can you deduce from these diagrams?

What is the curvature of the helix shown as a pink line on the diagrams?

15

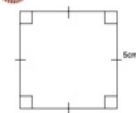
SELF ASSESSMENT AND LEARNING IN A GROUP – FASMED RESEARCH

A1 The diagonals of the shape are equal	A2 The shape has at least one side that is 5cm long	A3 The diagonals of the shape bisect each other at right angles	A4 The shape has 4 equal angles	A5 The shape has two pairs of parallel sides
B1 The shape has at least one side that is 4cm long	B2 The diagonals of the shape bisect each other	B3 The shape has 4 equal angles	B4 Opposite sides of the shape are equal	B5 The shape has at least one side that is 6cm long
C1 The diagonals of the shape are not equal	C2 The shape has at least one side that is 12cm long	C3 The shape has at least one side that is 7cm long	C4 The shape contains at least one 55° angle	C5 Opposite sides of the shape are parallel

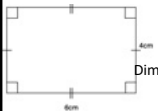
Name the quadrilaterals described by each set of cards.
 Sketch the quadrilaterals.
 Decide on the minimal number of properties required to define the quadrilateral.

16

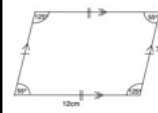
MINIMAL SET OF PROPERTIES THAT DEFINE THE SHAPE



SQUARE
Generic A3 A4
Dimensions A2



RECTANGLE
Generic B2 B3
Dimensions B1 B3 B5



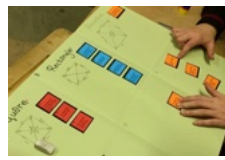
PARALLELOGRAM
Generic C5
C2 C3 C4

A1 The diagonals of the shape are equal	A2 The shape has at least one side that is 5cm long	A3 The diagonals of the shape bisect each other at right angles	A4 The shape has 4 equal angles	A5 The shape has two pairs of parallel sides
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SELF ASSESSMENT AND LEARNING IN A GROUP – FASMED RESEARCH

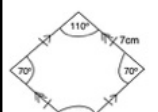
D1 The diagonals of the shape bisect each other at right angles	D2 All four sides are equal	D3 The shape contains at least one 70° angle	D4 Opposite sides of the shape are parallel	D5 The shape has at least one side that is 7cm long
E1 The shape has at least one side that is 5cm long	E2 One diagonal bisects the other diagonal into two 2cm segments	E3 The shape has two pairs of equal sides	E4 The diagonals of the shape intersect each other at right angles	E5 The shape has at least one side that is 4cm long
F1 The shape contains exactly one pair of parallel sides	F2 The shape has more than one side that is 10cm long	F3 The shape contains at least one 60° angle	F4 The shape has a side that is 6cm long	F5 The shape contains a pair of opposite sides that are equal



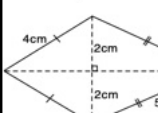
Name the quadrilaterals described by each set of properties.
Sketch the quadrilaterals.
Decide on the minimal number of properties required to define the quadrilateral.

18

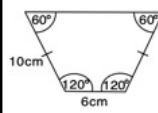
PROPERTIES OF QUADRILATERALS



RHOMBUS
Generic D2
Dimensions D3 D5



KITE
Generic E3 F4
Dimensions E1 E2 E5



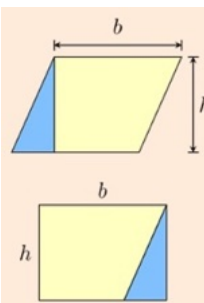
TRAPEZIUM (TRAPEZOID)
Generic F1
ISOSCELES TRAPEZIUM
Generic F1 F2
Dimensions F2 F3 F4 F5

D1 The diagonals of the shape bisect each other at right angles	D2 All four sides are equal	D3 The shape contains at least one 70° angle	D4 Opposite sides of the shape are parallel	D5 The shape has at least one side that is 7cm long
E1 The shape has at least one side that is 5cm long	E2 One diagonal bisects the other diagonal into two 2cm segments	E3 The shape has two pairs of equal sides	E4 The diagonals of the shape intersect each other at right angles	E5 The shape has at least one side that is 4cm long
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AREAS


What can you deduce from these diagrams?



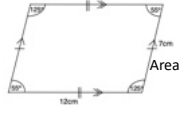
SQUARE
RECTANGLE
PARALLELOGRAM
AREA = BASE X HEIGHT



Area = 25cm²

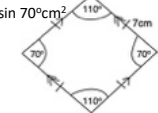


Area = 24cm²



Area = Base x Height
= 12 x (7 sin55°) cm²
= 84 sin55° cm²

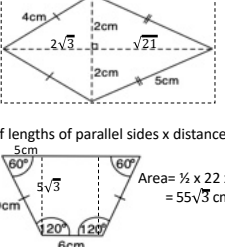
RHOMBUS
KITE
AREA = ½ PRODUCT OF LENGTHS OF DIAGONALS



Area = 49 sin 70° cm²

Area = 2(2√3 + √21) cm²

TRAPEZIUM
Area = ½ Sum of lengths of parallel sides x distance between

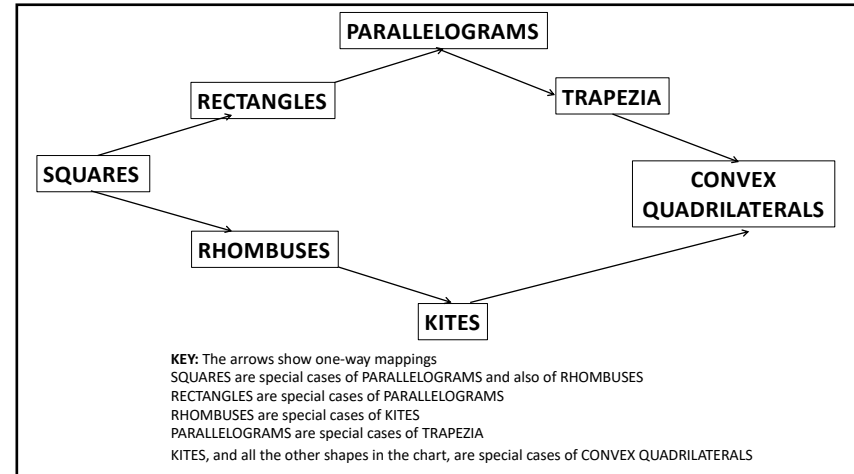


Area = ½ x 22 x 5√3
= 55√3 cm²

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	DEFINING PROPERTIES	OTHER PROPERTIES					
		Opposite edges are parallel	Opposite edges are equal	At least one pair parallel edges	4 equal angles	Exactly 2 pairs equal angles (not all equal)	At least one diagonal is perpendicular to the other
SQUARE	Diagonals equal and bisect each other at right angles		✓	✓	✓	✓	✓
RECTANGLE	Diagonals equal and bisect each other		✓	✓	✓	✓	
RHOMBUS	Diagonals bisect each other at right angles		✓	✓	✓	✓	✓
KITE	One diagonal bisects the other at right angles						✓
PARALLELOGRAM	Diagonals bisect each other		✓	✓	✓	✓	
ISOSCELES TRAPEZIUM	2 pairs adjacent angles equal				✓	✓	
TRAPEZIUM (Trapezoid USA)	One pair parallel edges				✓		

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PROPERTIES OF QUADRILATERALS LEARNING OBJECTIVES

To embed and reinforce knowledge about quadrilaterals. In doing this activity students:

- Name and classify quadrilaterals according to their properties
- Identify the minimal information required to define a quadrilateral. This develops critical thinking – a generic skill.
- Sketch quadrilaterals with given conditions.

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PROPERTIES OF QUADRILATERALS SUMMARY

WHAT IS THIS SHAPE?


ISOCELES TRAPEZIUM (TRAPEZOID)
 F1 F2 F3 F4 F5

IDENTIFY SETS OF SIMILAR RECTANGLES, CONGRUENT RECTANGLES AND TRANSFORMATIONS MOVING ONE TO ANOTHER

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AN AIMING HIGH LEARNING PACK IS A WEBPAGE CONTAINING
A learning activity with links to:

- PDF of the worksheet
- Templates and instructions for making resources
- Videos
- Notes for Teachers with
 - solutions
 - curriculum links and learning objectives
 - diagnostic quizzes
 - suggestions for teaching
 - key questions to guide learning
 - follow up ideas and links
- Inclusion Guides for School and Home Learning with
 - a starter activity for a mixed-age group to do together
 - a collection of learning activities to suit all ages from 4 to 18+
 - Solutions with suggestions for teaching and assessment.

<https://aiminghigh.aimssec.ac.za/>

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PROPERTIES OF QUADRILATERALS AND RELATED RESOURCES

Properties of Parallelograms
<https://aiminghigh.aimssec.ac.za/properties-of-parallelograms/>

Properties of Quadrilaterals
<https://aiminghigh.aimssec.ac.za/properties-of-quadrilaterals/>

Is a square a rectangle? <https://aiminghigh.aimssec.ac.za/is-a-square-a-rectangle/>

Bendy Quads <https://aiminghigh.aimssec.ac.za/bendy-quads/>

Kite in a Square <https://aiminghigh.aimssec.ac.za/kite-in-a-square/>

Circle Inscribed in a Quadrilateral
<https://aiminghigh.aimssec.ac.za/circle-inscribed-in-quadrilateral/>

Wholesome Rectangles <https://aiminghigh.aimssec.ac.za/wholesome-rectangles/>

AIMSSEC YouTube Channel <https://www.youtube.com/@MathsToys>

GTEN website <https://gtenmaths.org/>

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Thanks for coming to this workshop.

Use the AIMSSEC ideas
on AIMING HIGH and add comments.

Share what you have learned
with other teachers.

Try to help all your learners to have a
'YES I CAN'
attitude to mathematics.



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