

24 GEOMETRY AND MEASURE: PROPERTIES OF SHAPES

LEARNING OBJECTIVES

- Derive and apply the properties of special types of quadrilateral and triangle and other plane figures
- Know the properties of types of triangle
- Recall and use the properties and definitions of special types of quadrilateral

SPECIFICATION LINKS

- G1, G4, G6, G20, A8, A9, A17, A21

STARTER ACTIVITY

- **Properties of a triangle; 5 minutes; page 156**

You may wish to encourage the student to sketch the triangles, marking on any equal sides or angles.

MAIN ACTIVITIES

- **Quadrilaterals; 25 minutes; page 157**

Ask the student to complete the table of information about quadrilaterals. They should fill in the columns as follows:
Sketch it! – the student should sketch the shape using a ruler and mark on any equal sides, parallel sides or right angles using appropriate notation.

Sides – the student should indicate any special properties the quadrilateral has (e.g. all sides are equal).

Angles – the student should indicate any special angle properties particular to that quadrilateral (e.g. pairs of equal angles).

Diagonals – the student should indicate any special properties of the diagonals (e.g. bisect/intersect at right angles).

Lines of symmetry – the student should indicate how many lines of symmetry the shape has.

Sum of internal angles – the student should recognise that this is always 360° .

- **Using the properties of quadrilaterals; 15 minutes; page 158**

Full instructions are given on the activity sheet.

PLENARY ACTIVITY

- **How many?; 5 minutes**

Ask the student to decide how many quadrilaterals there are that:

a) contain a right angle

b) have at least one pair of parallel sides

c) contain an obtuse angle.

HOMEWORK ACTIVITY

- **Quadrilaterals on coordinate grids; 30 minutes; page 159**

Full instructions are given on the activity sheet.

SUPPORT IDEA

- **Quadrilaterals** Describe a quadrilateral to the student and challenge them to sketch it. Then swap roles.

EXTENSION IDEA

- **Quadrilaterals** Draw up a similar table and test the student on non-quadrilateral 2D shapes.

PROGRESS AND OBSERVATIONS

STARTER ACTIVITY: PROPERTIES OF A TRIANGLE

TIMING: 5 MINS

LEARNING OBJECTIVES

- Know the properties of types of triangle

EQUIPMENT

none

1. Draw lines to match each statement to at least one of the types of triangle below.
Some statements will apply to more than one type of triangle.



A all angles are equal

B two angles are equal

C no angles are equal

D may contain a right angle

E all sides have equal length

F two sides have equal length

G no sides have equal length

H has no lines of symmetry

I has one line of symmetry

J has three lines of symmetry

K the sum of the internal angles is 180°

scalene triangle

isosceles triangle

equilateral triangle

MAIN ACTIVITY: QUADRILATERALS

TIMING: 25 MINS

LEARNING OBJECTIVES

- Recall and use the properties and definitions of special types of quadrilateral

EQUIPMENT

- ruler



1. Complete this table to show information about some different types of quadrilateral.

Name of shape	Sketch it!	Sides	Angles	Diagonals	Lines of symmetry	Sum of internal angles
square						
rectangle						
rhombus						
parallelogram						
trapezium						
kite						

MAIN ACTIVITY: USING THE PROPERTIES OF QUADRILATERALS TIMING: 15 MINS

LEARNING OBJECTIVES

- Recall and use the properties and definitions of special types of quadrilateral

EQUIPMENT

none

1. Decide if these statements are true or false. Explain each of your answers to your tutor.

- All quadrilaterals contain at least one right angle.
- A square is also a rhombus.
- At least two of the angles in a rhombus must be obtuse.
- A parallelogram must contain two obtuse angles.

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2. List all the quadrilaterals whose diagonals are perpendicular.

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3. Quadrilateral ABCD has four sides of equal length. Angle ABC is twice the size of angle BCD.

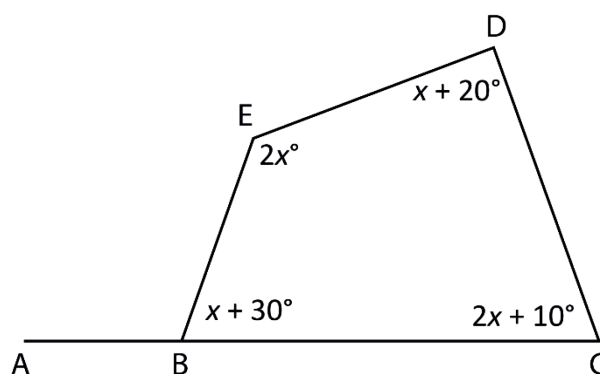
- What is the name of the quadrilateral?
- Work out the size of angle ABC.

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4. Look at this drawing.

- Form and solve an equation to calculate the value of x .
- Use your answer to part a) to work out the size of angle ABE.

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HOMEWORK ACTIVITY: QUADRILATERALS ON COORDINATE GRIDS TIMING: 30 MINS

LEARNING OBJECTIVES

- Derive and apply the properties of special types of quadrilateral

EQUIPMENT

- ruler



1. Here is a blank coordinate grid.

- a) On the coordinate grid, plot and label these points: A (2, 6), B (−4, 3) and C (−5, −1).

- b) ABCD is a parallelogram. Mark on the point D and write down the coordinates of D.

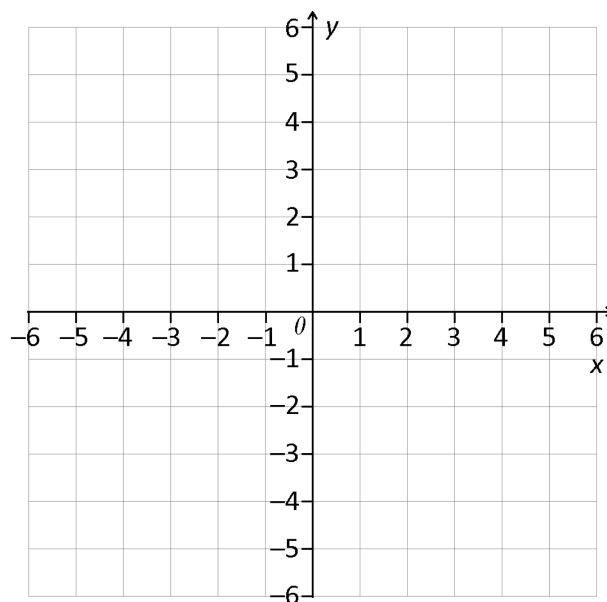
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- c) Work out the length of line AB.
Give your answer to 1 decimal place.

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- d) Work out the length of line BC.
Give your answer to 1 decimal place.

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2. The points A, B and C are three of the vertices of a kite.

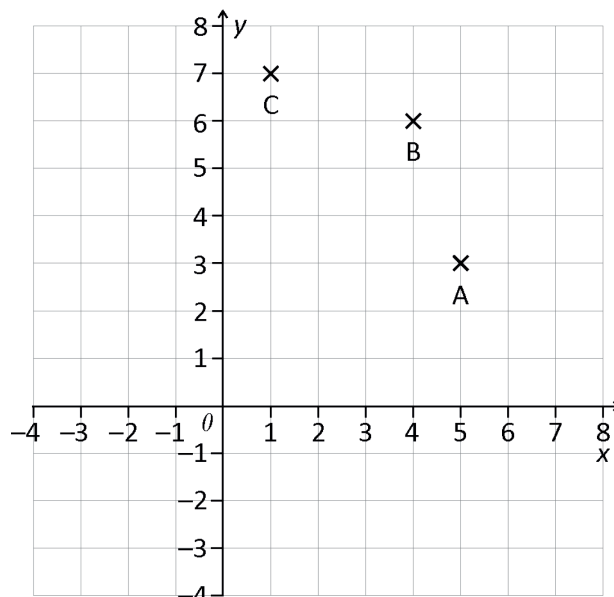
- a) Write down four possible pairs of coordinates for the vertex D.

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- b) Draw a straight line on the grid indicating the possible positions of D.

- c) Work out the equation of the line going through these points.

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3. Make a set of revision cards showing six different quadrilaterals and listing all their properties.

24 ANSWERS

STARTER ACTIVITY: PROPERTIES OF A TRIANGLE

1. scalene triangle: C, D, G, H, K isosceles triangle: B, D, F, I, K equilateral triangle: A, E, J, K

MAIN ACTIVITY: QUADRILATERALS

1. Check student's sketches.

Name of shape	Sides	Angles	Diagonals	Lines of symmetry	Sum of internal angles
square	All sides are equal and opposite sides are parallel.	All angles are 90° .	Diagonals bisect at right angle and are equal in length.	4	360°
rectangle	Two pairs of sides are equal and opposite sides are parallel.	All angles are 90° .	Diagonals bisect and are equal in length.	2	360°
rhombus	All sides are equal and opposite sides are parallel.	Diagonally opposite angles are equal.	Diagonals bisect at right angles.	2	360°
parallelogram	Two pairs of sides are equal and opposite sides are parallel.	Diagonally opposite angles are equal.	Diagonals bisect.	0	360°
trapezium	One pair of opposite sides is parallel.			0 or 1 if isosceles trapezium	360°
kite	Two pairs of sides are equal.	One pair of diagonally opposite angles is equal.	Diagonals are perpendicular; one diagonal is bisected.	1	360°

MAIN ACTIVITY: USING THE PROPERTIES OF QUADRILATERALS

- False – any sketch of a quadrilateral without a right angle will justify this.
 - True – a square has all the properties of a rhombus.
 - False – a square is a type of rhombus and has four right angles.
 - False – a rectangle is a parallelogram and has four right angles.
- square, rhombus, kite
- rhombus
 - 120°
- $6x + 60 = 360$, $x = 50^\circ$
 - 100°

HOMEWORK ACTIVITY: QUADRILATERALS ON COORDINATE GRIDS

- Check student's graph.
 - (1, 2)
 - 6.7
 - 4.1
- Student's own answers
 - Check line shows $y = x + 2$.
 - $y = x + 2$
- Student's own work

GLOSSARY

Diagonal of a quadrilateral

The straight line joining opposite vertices