

Properties of 2D Shapes

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

The diagram shows a shape with four sides.



Write down the mathematical name of this shape.

It has 4 sides, so it is a quadrilateral.

Both pairs of opposite sides are parallel, and there are no right angles.

So it is a parallelogram.

Answer: Parallelogram

2 (2 marks)

(a) Here are five angles.

25° 90° 118° 180° 245°

Write down the angle from the list that is obtuse.

An obtuse angle is more than 90° but less than 180°.

118° is the only angle in the list between 90° and 180°.

Answer: 118°

Tip: 245° is more than 180°, so it is a reflex angle, not an obtuse angle.

- (b) Explain why a triangle cannot have two obtuse angles.

An obtuse angle is more than 90° .

Two obtuse angles would add up to more than $90^\circ + 90^\circ = 180^\circ$.

But the three angles of a triangle add up to exactly 180° .

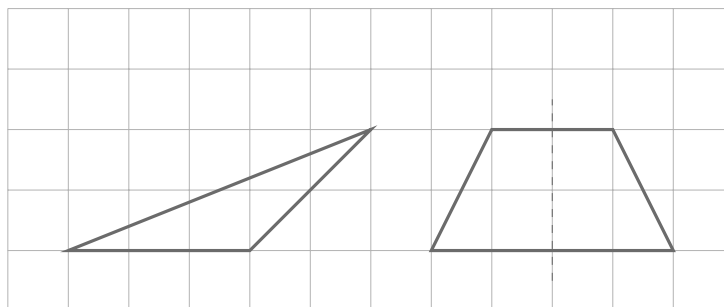
So there would be nothing left for the third angle.

Answer: Two obtuse angles add up to more than 180° , but the angles in a triangle add up to 180°

Tip: Give a reason with numbers. Saying “it would not look like a triangle” does not get the mark.

3 (2 marks)

Here is a grid. Example answers:



- (a) On the grid, draw a triangle that has an obtuse angle.

An obtuse angle is between 90° and 180° .

Draw one side along a grid line, then draw the next side leaning back so that the angle between them is more than 90° .

See the triangle on the left of the grid.

Answer: Any triangle with one angle between 90° and 180°

- (b) On the same grid, draw a trapezium that has one line of symmetry.

A trapezium has exactly one pair of parallel sides.

For a line of symmetry, the two sloping sides must slope by the same amount in opposite directions.

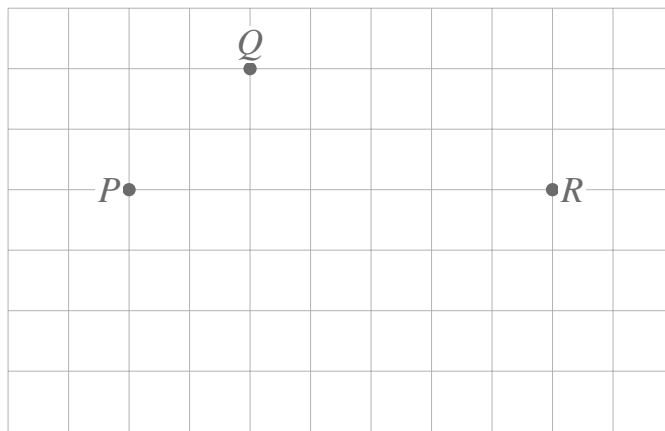
See the shape on the right of the grid (its line of symmetry is dashed).

Answer: An isosceles trapezium, e.g. the one shown

Tip: Make the two parallel sides different lengths. If they are the same length, you have drawn a rectangle or parallelogram, not a trapezium.

4 (1 mark)

Points P , Q and R are three of the corners of a kite $PQRS$.
The line PR is a line of symmetry of the kite.



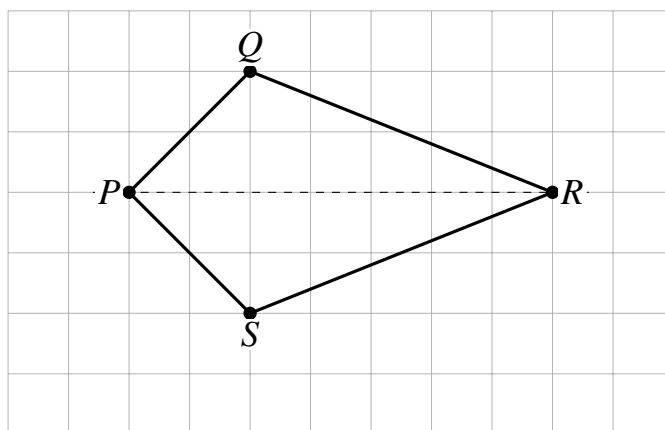
On the grid, plot the point S and complete the kite $PQRS$.

PR is a line of symmetry of the kite (shown dashed).

Q is 2 squares above the line PR .

So S is 2 squares below the line PR , directly under Q .

Join P to Q , Q to R , R to S and S to P .

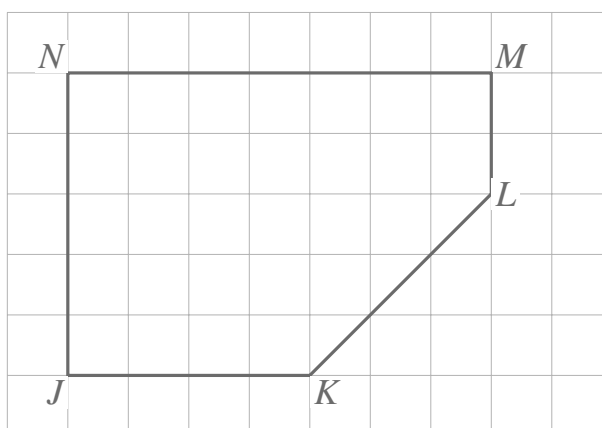


Answer: S is 2 squares below PR , directly below Q

Tip: Reflect Q in the line of symmetry PR . If S is even one square out, the shape is not a kite.

5 (3 marks)

Here is polygon $JKLMN$ on a square grid.



(a) Write down the mathematical name of the polygon.

Count the sides: the polygon has 5 sides.

A polygon with 5 sides is a pentagon.

Answer: Pentagon

- (b) Write down two sides of the polygon that are parallel to each other.

JK and NM are both horizontal, so they are parallel.

(JN and LM are both vertical, so they are also parallel.)

Answer: JK and NM (or JN and LM)

Tip: Parallel sides go in exactly the same direction and never meet. They do not have to be the same length.

- (c) What type of angle is angle JKL ?

Angle JKL is the angle at K , between KJ and KL .

KJ goes along the grid line and KL leans away from it, so the angle is more than 90° .

It is less than 180° , so it is obtuse.

Answer: Obtuse

6 (2 marks)

- (a) Write down the number of lines of symmetry of a regular pentagon.

A regular pentagon has 5 equal sides.

There is a line of symmetry from each corner to the middle of the opposite side.

So it has 5 lines of symmetry.

Answer: 5

- (b) Write down the order of rotational symmetry of a parallelogram.

Turn the parallelogram about its centre.

It looks the same after a half turn and again after a full turn.

So the order of rotational symmetry is 2.

Answer: 2

Tip: A parallelogram has rotational symmetry of order 2, but it has **no** lines of symmetry.

7 (3 marks)

Write down the mathematical name of the shape that

- (a) has 4 equal sides and 4 right angles

A quadrilateral with 4 equal sides and 4 right angles is a square.

Answer: Square

- (b) has 2 pairs of parallel sides, no right angles and sides that are not all equal

2 pairs of parallel sides: a parallelogram, rectangle, rhombus or square.

No right angles rules out the rectangle and the square.

Sides not all equal rules out the rhombus.

So it is a parallelogram.

Answer: Parallelogram

- (c) is a triangle with exactly 2 equal sides and 2 equal angles

A triangle with exactly 2 equal sides and 2 equal angles is an isosceles triangle.

Answer: Isosceles triangle

Tip: Do not write equilateral. An equilateral triangle has **3** equal sides and 3 equal angles.

8 (2 marks)

Write down two properties of the diagonals of a rhombus.

The diagonals of a rhombus cross at right angles (they are perpendicular).

They bisect each other (cut each other in half).

They also bisect the angles of the rhombus.

Any two of these are fine.

Answer: For example: they cross at right angles, and they cut each other in half

Tip: The diagonals of a rhombus are **not** usually the same length. That is only true for a square.

Marks: 1 mark for each correct property.

9 (2 marks)

The perimeter of an equilateral triangle is 27 cm.

A square has sides the same length as the sides of the triangle.

Work out the perimeter of the square.

An equilateral triangle has 3 equal sides.

One side = $27 \div 3 = 9$ cm

The square has 4 sides of 9 cm.

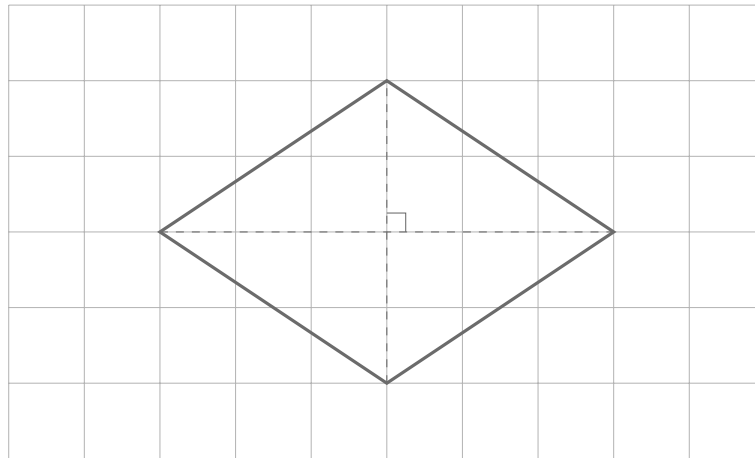
Perimeter of the square = $4 \times 9 = 36$ cm

Answer: 36 cm

Marks: 1 mark for $27 \div 3$ (or 9). 1 mark for 36.

10 (2 marks)

A rhombus has diagonals of length 6 cm and 4 cm.
On the centimetre grid, draw the rhombus.



The diagonals of a rhombus cut each other in half at right angles.

Draw a 6 cm line across the grid. Its midpoint is 3 cm from each end.

Through the midpoint, draw a 4 cm line at right angles to it, with 2 cm on each side.

Join the four ends of the diagonals to make the rhombus.

All four sides are the same length, as they should be.

Answer: See diagram: diagonals 6 cm and 4 cm crossing at right angles at their midpoints

Tip: The diagonals must cut each other in half at right angles. If they do not cross at their midpoints, the shape is not a rhombus (it may be a kite).

Marks: 1 mark for a rhombus. 1 mark for diagonals of 6 cm and 4 cm.

11 (3 marks)

$ABCD$ is a kite.

$$AB = BC = (x + 3) \text{ cm}$$

$$AD = CD = (3x - 1) \text{ cm}$$

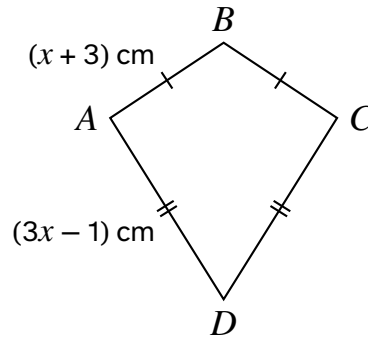


Diagram **NOT** accurately drawn

The perimeter of the kite is 36 cm.

Work out the length of AD .

$$AB = BC = x + 3 \text{ and } AD = CD = 3x - 1$$

$$\text{Perimeter} = 2(x + 3) + 2(3x - 1)$$

$$= 2x + 6 + 6x - 2 = 8x + 4$$

$$8x + 4 = 36$$

$$8x = 32, \text{ so } x = 4$$

$$AD = 3 \times 4 - 1 = 11 \text{ cm}$$

Check: the sides are 7, 7, 11 and 11, and $7 + 7 + 11 + 11 = 36$ ✓

Answer: 11 cm

Tip: The question asks for the length of AD , not the value of x . Substitute $x = 4$ back in to finish.

Marks: 1 mark for $2(x + 3) + 2(3x - 1)$ or $8x + 4$. 1 mark for $x = 4$. 1 mark for 11.