

Symmetry

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 (3 marks)

Write down the number of lines of symmetry of

(a) a rectangle

A rectangle has a vertical and a horizontal line of symmetry through its centre.

The diagonals are not lines of symmetry.

Answer: 2

Tip: The answer is not 4. A rectangle's diagonals are **not** lines of symmetry (unless it is a square).

(b) an equilateral triangle

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

That makes 3 lines.

Answer: 3

(c) a kite

A kite has one line of symmetry.

It goes through the two corners where the equal sides meet.

Answer: 1

2 (1 mark)

Write down the order of rotational symmetry of a rectangle.

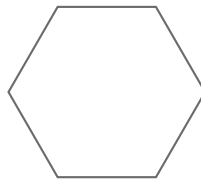
A rectangle looks the same after a half turn and after a full turn.

So the order of rotational symmetry is 2.

Answer: 2

3 (2 marks)

Here is a regular hexagon.



(a) Write down the number of lines of symmetry of the hexagon.

There is a line through each pair of opposite corners: 3 lines.

There is a line through the middles of each pair of opposite sides: 3 lines.

Total: $3 + 3 = 6$ lines.

Answer: 6

(b) Write down the order of rotational symmetry of the hexagon.

Turn the hexagon through one full turn.

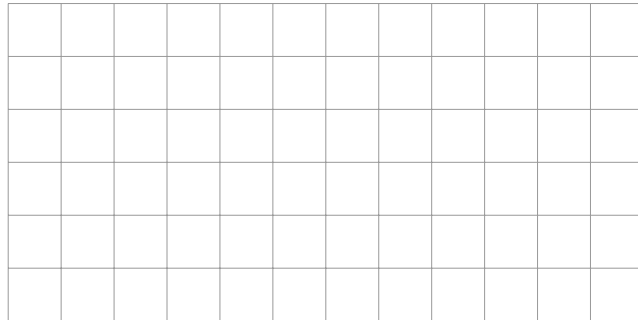
It looks the same 6 times (once every 60°).

So the order is 6.

Answer: 6

4 (2 marks)

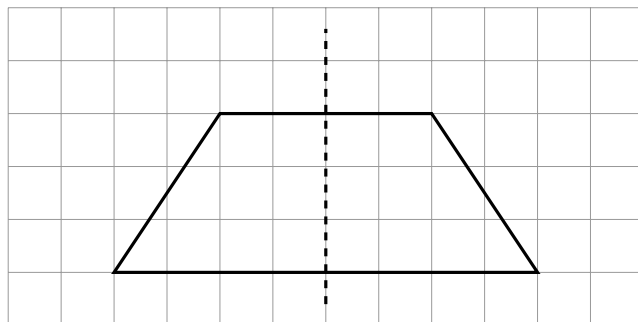
On the grid, draw a quadrilateral that has
exactly one line of symmetry
and
exactly one pair of parallel sides.



A quadrilateral with exactly one pair of parallel sides is a trapezium.

If the two sloping sides are the same length (an isosceles trapezium), it has one line of symmetry.

For example (line of symmetry dashed):



Answer: An isosceles trapezium

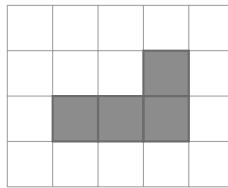
Tip: A kite has one line of symmetry but no parallel sides. A rectangle has two pairs of parallel sides and two lines of symmetry.

Marks: 2 marks for a correct isosceles trapezium. 1 mark for a quadrilateral with exactly one line of symmetry, or with exactly one pair of parallel sides, but not both.

5 (2 marks)

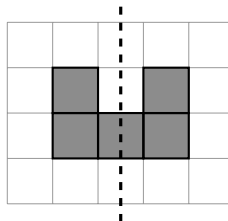
Here are some shaded squares on a grid.

- (a) Shade **one** more square so that the shape has exactly one line of symmetry.



For example, shade the square above the left-hand end.

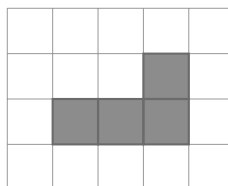
This makes a U shape with one vertical line of symmetry (dashed):



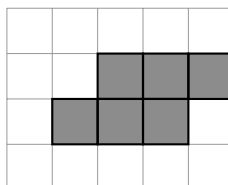
(Other answers are possible.)

Answer: e.g. the square above the left-hand end, making a U shape

- (b) Shade **two** more squares so that the shape has rotational symmetry of order 2



For example, shade these two squares:



The shape looks the same after a half turn.

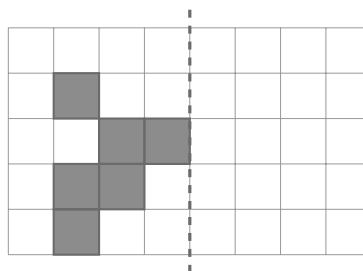
(Other answers are possible.)

Answer: See diagram

Tip: Order 2 means the shape looks the same after a half turn (180°). Turn the page upside down to check.

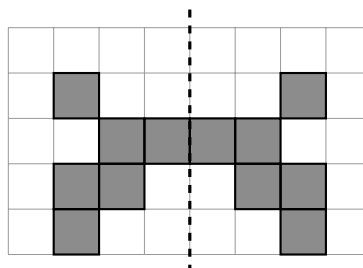
6 (2 marks)

Reflect the shaded shape in the dashed line.



Reflect each shaded square in the dashed line.

Each new square is the same distance from the mirror line, but on the other side:



Answer: See diagram

Marks: 2 marks for fully correct. 1 mark for 4 or 5 correct squares.

7 (3 marks)

$ABCDEF$ is a hexagon.

The hexagon has rotational symmetry of order 2

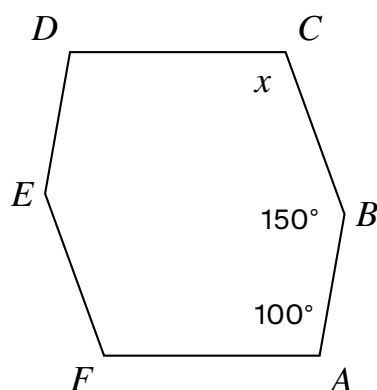


Diagram **NOT** accurately drawn

Work out the value of x .

You must show all your working.

The angles in a hexagon add up to $4 \times 180^\circ = 720^\circ$.

Rotational symmetry of order 2 means the hexagon looks the same after a half turn.

So opposite angles are equal: angle D = angle A = 100° and angle E = angle B = 150° , and angle F = angle C = x .

$$100 + 150 + x + 100 + 150 + x = 720$$

$$500 + 2x = 720$$

$$2x = 220$$

$$x = 110$$

Answer: $x = 110$

Tip: The angles in a hexagon add up to 720° , not 360° . From one corner a hexagon splits into 4 triangles, and $4 \times 180 = 720$.

Marks: 1 mark for 720. 1 mark for using the symmetry, e.g. $720 - 2 \times (100 + 150)$. 1 mark for 110.

8 (5 marks)

$ABCD$ is a kite.

The diagonal AC is a line of symmetry of the kite.

All measurements are in centimetres.

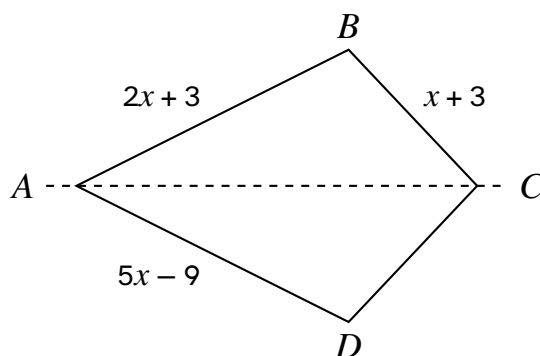


Diagram **NOT** accurately drawn

(a) Find the value of x .

AC is a line of symmetry, so reflecting in AC takes B to D .

So $AB = AD$

$$2x + 3 = 5x - 9$$

$$3 + 9 = 5x - 2x$$

$$12 = 3x$$

$$x = 4$$

Answer: $x = 4$

Tip: Use the line of symmetry to decide which sides are equal. AB and AD are reflections of each other in AC .

Marks: 1 mark for using the symmetry to write $AB = AD$. 1 mark for $2x + 3 = 5x - 9$ rearranged, e.g. $3x = 12$. 1 mark for 4.

(b) Work out the perimeter of the kite.

$$AB = AD = 2 \times 4 + 3 = 11 \text{ cm}$$

$$BC = DC = 4 + 3 = 7 \text{ cm (by symmetry)}$$

$$\text{Perimeter} = 11 + 11 + 7 + 7 = 36 \text{ cm}$$

Answer: 36 cm

Tip: Remember CD is equal to BC , even though it is not labelled. A kite has two pairs of equal sides.

Marks: 1 mark for 11 or 7. 1 mark for 36.
