TEST 5 Symmetry

Marks: /40

Time: 45 minutes

Name: .... Date: ....

INSTRUCTIONS TO CANDIDATES

1. Answer **all** the questions.
2. Calculators may **not** be used.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [ ] at the end of each question.

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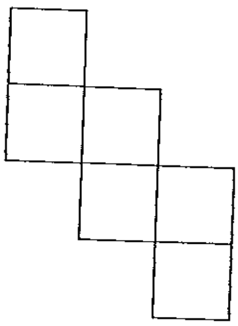
1 The diagram shows a figure which is made up of six squares.

(a) State the order of rotational symmetry of the figure.

(b) Add one more square to the figure so that it will have one line of symmetry. Indicate also the line of symmetry.

Answer (b) [1]



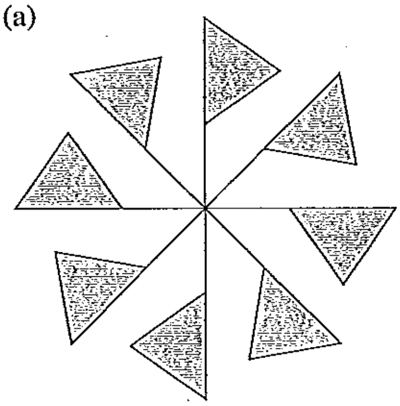
Answer (a) .... [1]

2 For each of the figures below, write down

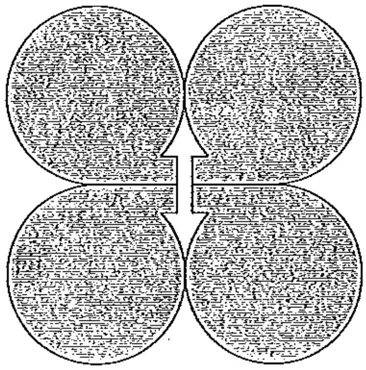
(i) the number of lines of symmetry if any,

(ii) the order of rotational symmetry.

(a)



(b)



Answer *(a)* (i) ....

(ii) .... [1]

(b) (i) ....

(ii) .... [1]

---

3 Rewrite the letters shown below in the boxes provided to form a pattern having

(a) line symmetry,

(b) rotational symmetry.

d q b o p

Answer

(a)

[1]

(b)

[1]

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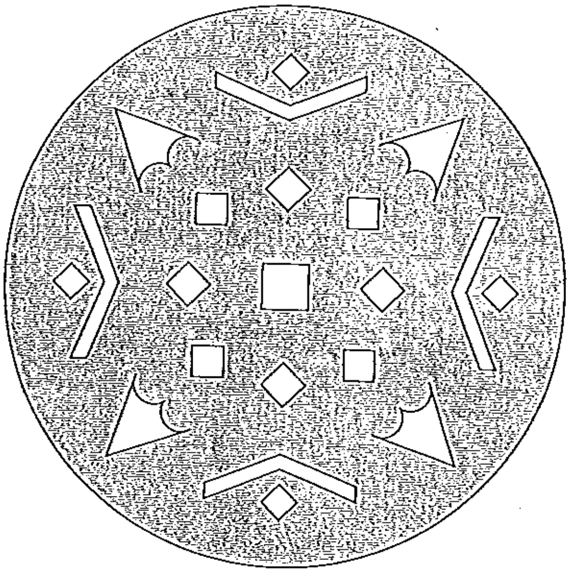
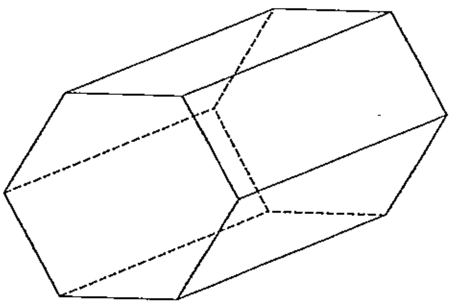
4 (a) Anne created a paper design as shown below by folding a piece of paper and cutting it. Write down the number of lines of symmetry of the paper design.



(b) The diagram shows a prism which has a regular hexagon as a cross-section.



Write down
(i) the number of planes of symmetry,
(ii) the number of axis (axes) of rotational symmetry
of the prism.

Answer (a) .... [1]

(b) (i) ....

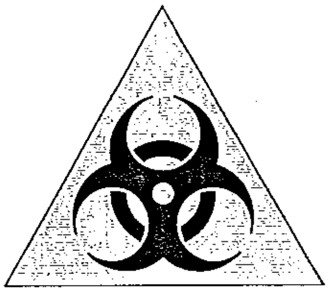
(ii) .... [2]

5 (a) Name a quadrilateral that has

(i) no axis of symmetry,

(ii) one axis of symmetry.

(b) The diagram below shows the international symbol for a 'Biological Hazard'. Write down the order of rotational symmetry of the symbol.



Answer (a) (i) ....

(ii) .... [2]

(b) .... [1]

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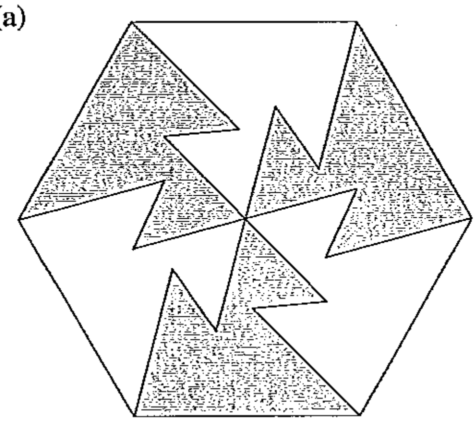
6 Each of the figures below has rotational symmetry of order r.

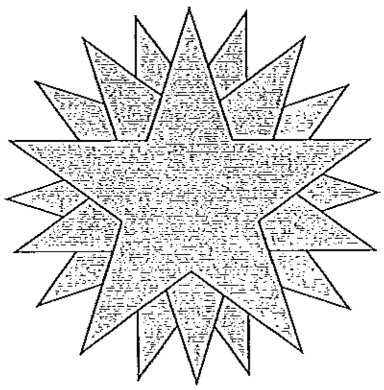
(i) Write down the value of r.

(ii) State the number of lines of symmetry if any.

(a)



(b)



Answer (a) (i) $r =$ ....

(ii) .... [2]

(b) (i) $r =$ ....

(ii) .... [2]

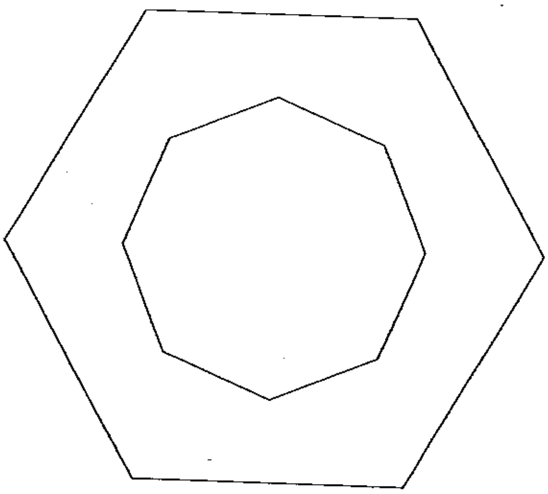
7 The diagram shows a regular octagon inside a hexagon.

(a) Draw all the lines of symmetry on the diagram.

(b) Mark with a cross, the centre of rotational symmetry.

Answer (a), (b)

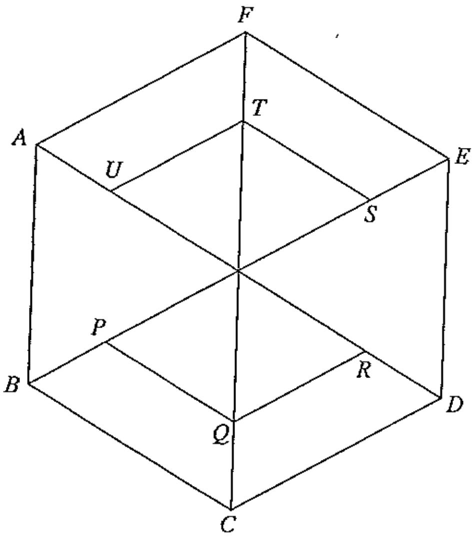
[2]



8 In the diagram, *ABCDEF* is a regular hexagon. Given that $PQ = QR = ST = TU$, write down

(a) the number of lines of symmetry,

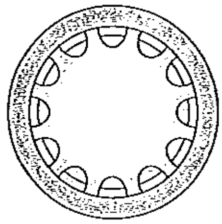
(b) the order of rotational symmetry of the hexagon.



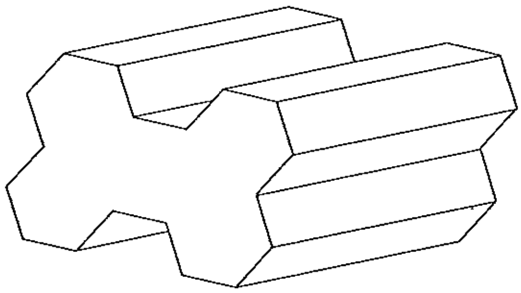
Answer (a) ....

(b) .... [2]

9 (a) The diagram below shows the hubcap of a car. Write down the order of rotational symmetry of the hubcap.



(b) For the given solid shown below, state the number of planes of symmetry.



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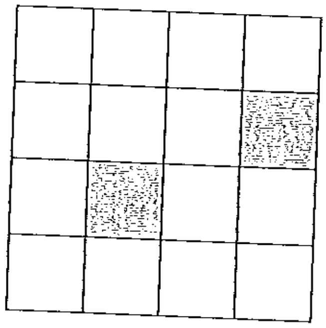
Answer (a) .... [1]

(b) .... [1]

10 (a) Shade one more square so that the completed square grid has one line of symmetry.

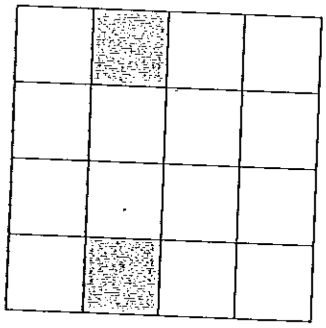
Answer (a)



[1]

(b) Shade two more squares so that the completed square grid has two lines of symmetry.

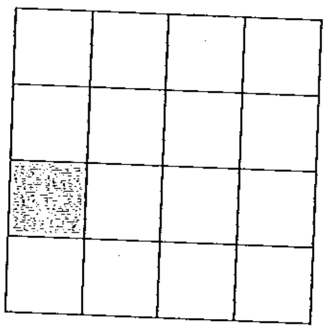
Answer (b)



[1]

(c) Shade one more square so that the completed square grid has rotational symmetry of order 2.

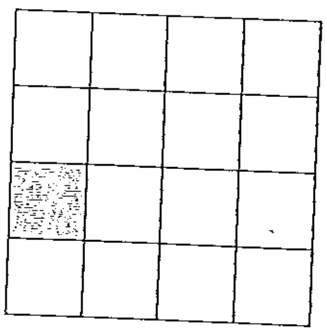
Answer (c)



[1]

(d) Shade three more squares so that the completed square grid has rotational symmetry of order 4.

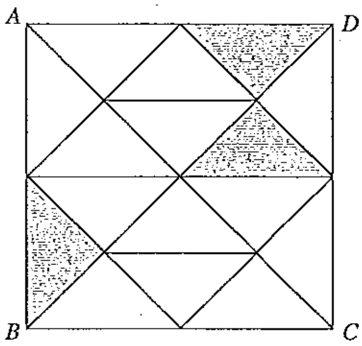
Answer (d)



[1]

11 **(a)** Shade three more small triangles so that the resulting square *ABCD* has rotational symmetry of order 2.

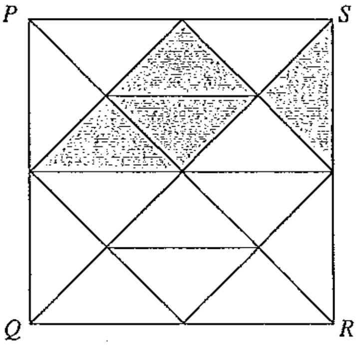
Answer (a) [1]



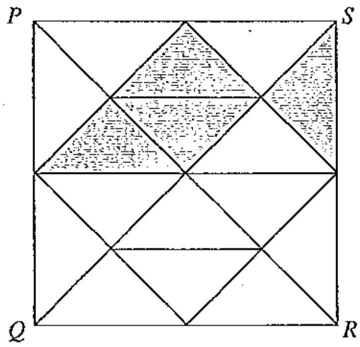
(b) Shade two more small triangles so that the resulting square *PQRS* has one line of symmetry. Show two different ways.

Answer (b) (i), (ii) [2]

(i)



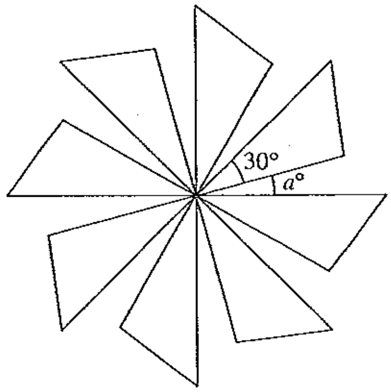
(ii)



12 The figure shown has rotational symmetry of order n.

(a) Find the value of n.

(b) Calculate the value of a.



Answer (a) $n =$ .... [1]

(b) $a =$ .... [1]

13 **(a)** Add one more line to the figure in Diagram I so that it has line symmetry.

Answer (a) [1]

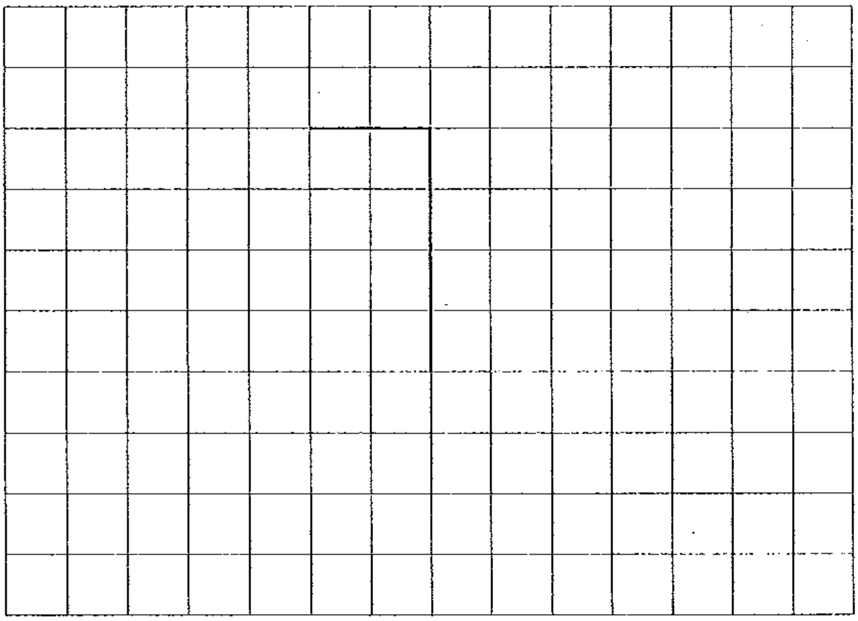


Diagram I

(b) Add one more line to the figure in Diagram II so that it has rotational symmetry. Mark with a cross, the centre of rotational symmetry.

Answer (b) [1]

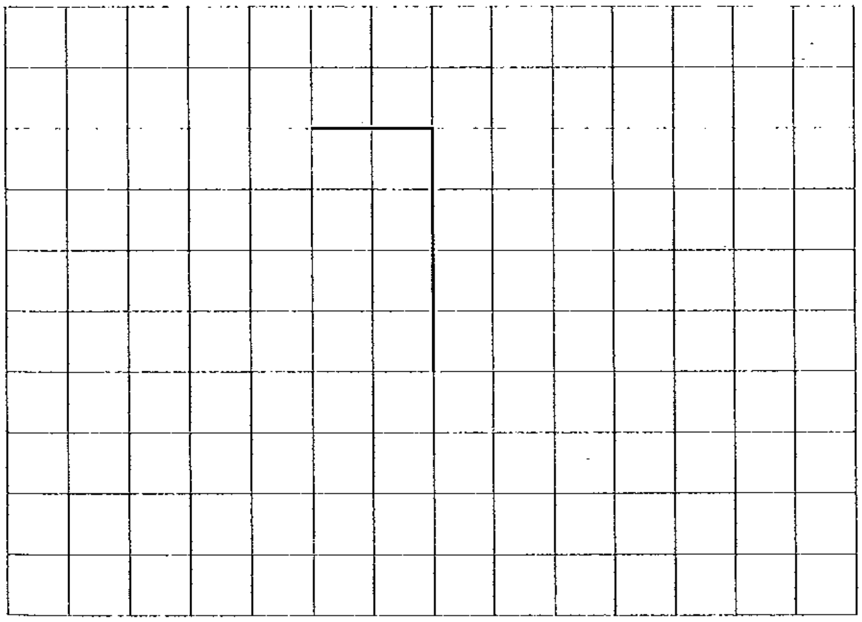


Diagram II

14 (a) (i) Complete Diagram I to make a quadrilateral *ABCD* which has *AC* as its line of symmetry.

(ii) Name the special type of quadrilateral *ABCD*.

Answer (a) (i)

[1]

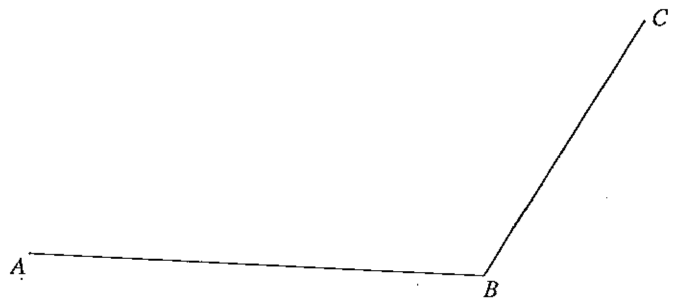


Diagram I

(b) (i) Complete Diagram II to make a quadrilateral *ABCD* which has rotational symmetry of order 2.

(ii) Name the special type of quadrilateral *ABCD*.

Answer (b) (i)

[1]

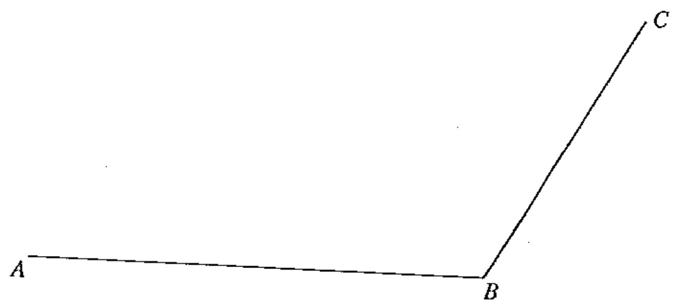
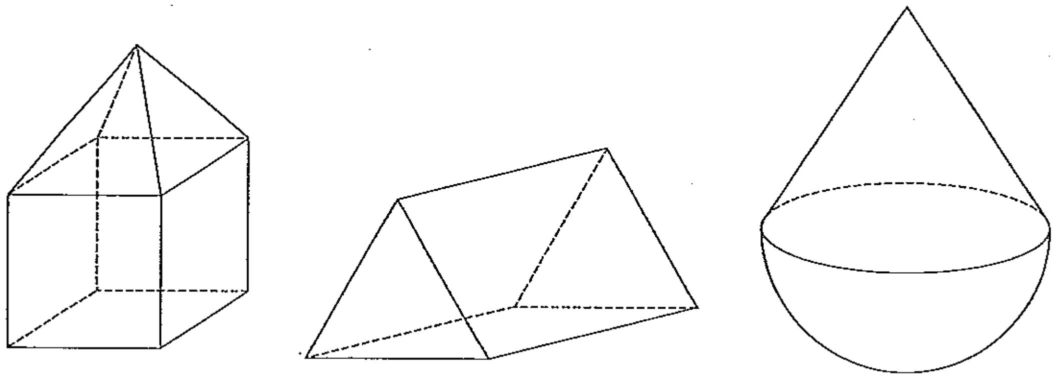


Diagram II

Answer (a) (ii) .... [1]

(b) (ii) .... [1]

15 The diagram shows three solids A, B and C. Solid A is made up of a square pyramid placed on top of a cube. Solid B is a prism which has an equilateral triangle as a cross-section. Solid C is made up of a hemisphere and a cone. Complete the table below.



Solid *A* Solid *B* Solid *C*

Answer [3]

Solid	No. of plane symmetry	No. of axis (axes) of rotational symmetry
A		
B		
C		

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(b) 1 cm : 1.2 km
= 1 cm : 120 000 cm
∴ the scale of the map is **1 : 120 000.**

(c) $\frac{6}{5}$ km is represented by 1 cm.

1 km is represented by $\frac{5}{6}$ cm.

∴ 1 km^2 is represented by $\left(\frac{5}{6}\text{ cm}\right)^2 = \frac{25}{36}\text{ cm}^2$.

∴ 54 km^2 is represented by $54 \times \frac{25}{36} = 37\frac{1}{2}\text{ cm}^2$.

The area on the map representing the vineyard is

$\mathbf{37\frac{1}{2}\text{ cm}^2}$.

10. (a) 1 cm represents 150 cm or 1.5 m.
∴ 6 cm represents 6 × 1.5 = 9 m.
The length of the wall of the library is **9 m.**

(b) $\frac{3}{2}$ m is represented by 1 cm.

1 m is represented by $\frac{2}{3}$ cm.

∴ 1 m^2 is represented by $\left(\frac{2}{3}\text{ cm}\right)^2 = \frac{4}{9}\text{ cm}^2$.

∴ 18 m^2 is represented by $18 \times \frac{4}{9} = 8\text{ cm}^2$.

The area representing the reading corner on the plan is **8 cm^2.**

(c) 1 cm represents $\frac{3}{2}$ m. 1st plan

∴ 1 cm^2 represents $\left(\frac{3}{2}\text{ m}\right)^2 = \frac{9}{4}\text{ m}^2$.

∴ 36 cm^2 represents $36 \times \frac{9}{4} = 81\text{ m}^2$.

The actual area of the reference section of the library is 81 m^2.

50 cm or $\frac{1}{2}$ m is represented by 1 cm. 2nd plan

1 m is represented by 2 cm.
∴ 1 m^2 is represented by $(2\text{ cm})^2 = 4\text{ cm}^2$.
∴ 81 m^2 is represented by $81 \times 4 = 324\text{ cm}^2$.
The area representing the reference section of the library on the second plan is **324 cm^2.**

Alternative method:

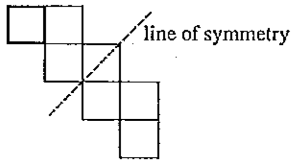
$\frac{150\text{ cm}}{50\text{ cm}} = 3$

∴ the scale of the first plan to the second plan is 1 : 3.
1 cm represents 3 cm.
1 cm^2 represents $(3\text{ cm})^2 = 9\text{ cm}^2$
∴ 36 cm^2 represents $36 \times 9 = 324\text{ cm}^2$.
The area representing the reference section of the library on the second plan is **324 cm^2.**

Test 5: Symmetry

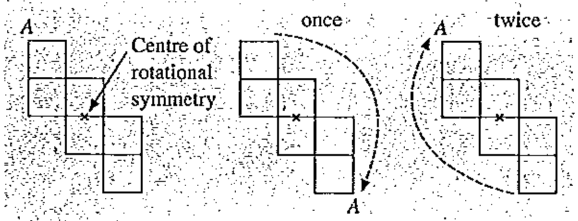
1. (a) Order of rotational symmetry = **2**

(b)



Teacher's Tip

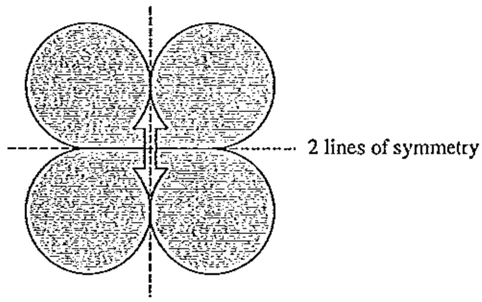
1. **Line symmetry** — A figure has line symmetry if it can be folded on a line so that one half would fit exactly on top of the other half.
2. **Rotational symmetry** — A figure has rotational symmetry if the shape can be rotated less than 360° about a point so that it matches the original figure. The point of rotation is called the **centre of rotational symmetry.**
3. **Order of rotational symmetry** — The number of ways a figure can map onto itself by rotation until it gets back to its original position.



The diagram shows that the figure has rotational symmetry of order 2.

2. (a) (i) No. of lines of symmetry = **0**
(ii) Order of rotational symmetry = **8**

(b) (i) No. of lines of symmetry = **2**



(ii) Order of rotational symmetry = **2**

3. (a)

p	b	o	d	q

or

b	p	o	q	d

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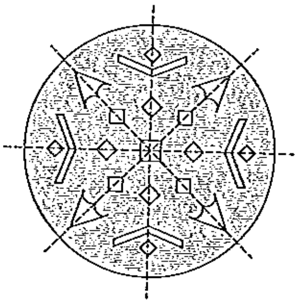
(b)

p	b	o	q	d

or

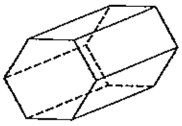
b	p	o	d	q

4. (a)



No. of lines of symmetry = **4**

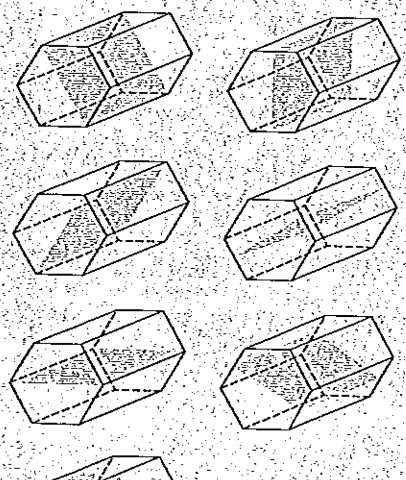
(b)

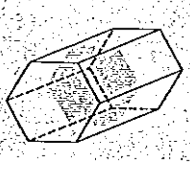


(i) No. of planes of symmetry = **7**
(ii) No. of axes of rotational symmetry = **7**

Teacher's Tip

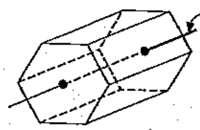
1. **Plane symmetry** — A solid has plane symmetry if it can be sliced into two matching halves, one, the exact mirror image of the other by a plane. The plane is called the plane of symmetry.





The diagrams above shows the 7 planes of symmetry.

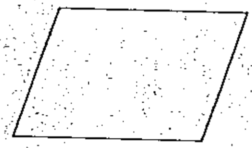
2. **Axis of rotational symmetry** — is a line around which a solid may rotate and yet occupy the same space.



The diagram shows one of the axis of rotational symmetry.

5. (a) (i) **A parallelogram.**

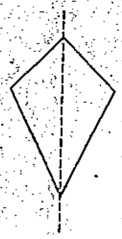
Teacher's Tip



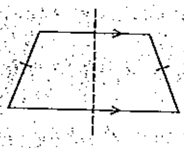
A parallelogram has no axis of symmetry but it has rotational symmetry of order 2.

(ii) **A kite or an isosceles trapezium.**

Teacher's Tip



Kite



Isosceles trapezium

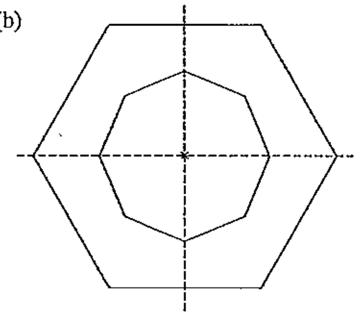
Both the kite and the isoceles trapezium has only one axis of symmetry and rotational symmetry of order 1. (A figure with order of rotational symmetry 1 is said to have no rotational symmetry.)

(b) Order of rotational symmetry = **3**

6. (a) (i) $r = 3$
(ii) No. of lines of symmetry = **0**

(b) (i) $r = 5$
(ii) No. of lines of symmetry = **5**

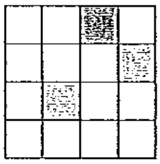
7. (a), (b)



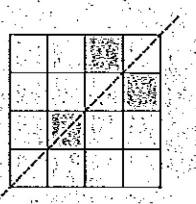
8. (a) No. of lines of symmetry = **2**
   (b) Order of rotational symmetry = **2**

9. (a) Order of rotational symmetry = **12**
   (b) No. of planes of symmetry = **3**

10. (a)

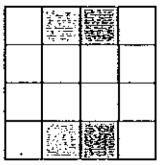


Teacher's Tip

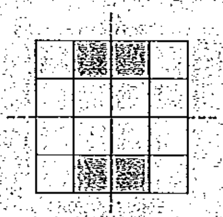


One line of symmetry

(b)

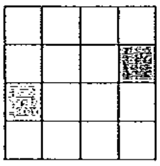


Teacher's Tip

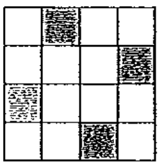


Two lines of symmetry

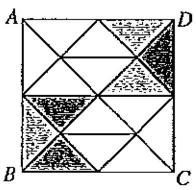
(c)



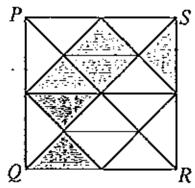
(d)



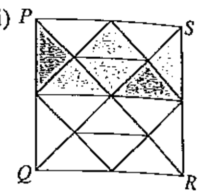
11. (a)



(b) (i)



(ii)



12. (a) $n = \mathbf{8}$

(b) $a° = \dfrac{360° - 8(30°)}{8}$

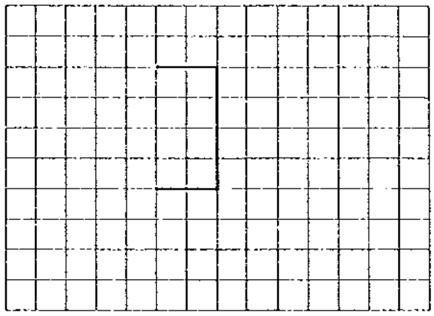
$= \dfrac{360° - 240°}{8}$

$= \dfrac{120°}{8}$

$= 15°$

$\therefore a = \mathbf{15}$

13. (a)



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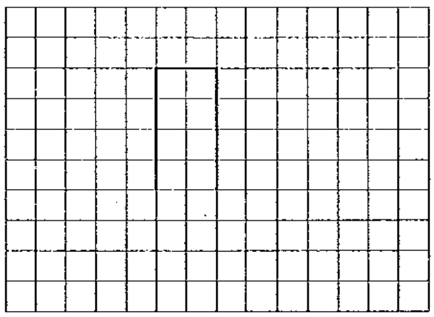
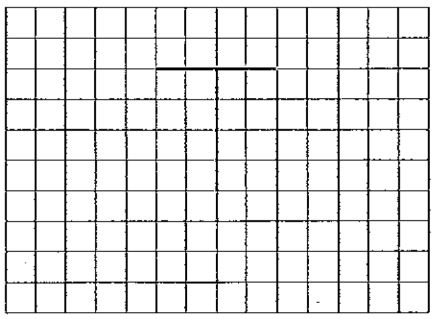


or



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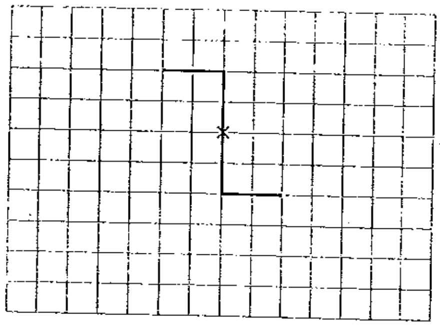
(b)



14. (a) (i)

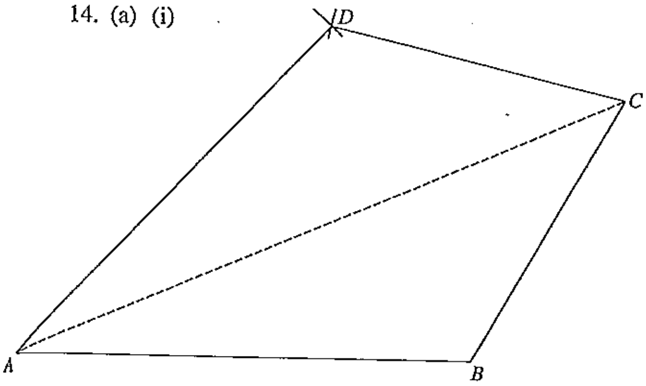


Diagram I

(ii) *ABCD* is a kite.

(b) (i)

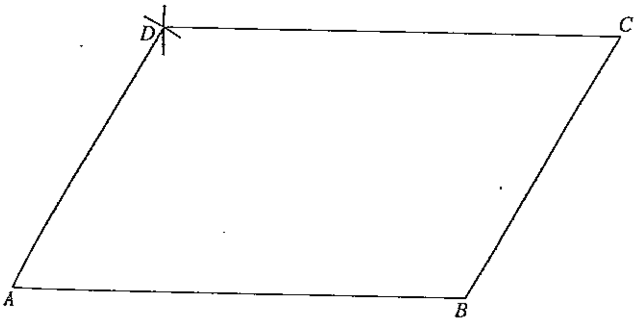


Diagram II

(ii) *ABCD* is a parallelogram.

15.

Solid	No. of plane symmetry	No. of axis (axes) of rotational symmetry
A	4	1
B	4	4
C	Infinite	1

Test 6: Angle Properties of Polygons

Section A

1. **Teacher's Tip**

   1. A regular polygon has all sides of the same length and all angles equal.
   2. For a regular n-sided polygon, each interior angle $= \frac{(n-2)\times 180°}{n}$.

Each interior angle

$= \frac{(18-2)\times 180°}{18}$ $n = 18$

$= 16 \times 10°$

$= \mathbf{160°}$

Alternative method:

Each exterior angle

$= \frac{360°}{18}$ Sum of the exterior angles of a polygon is 360°.

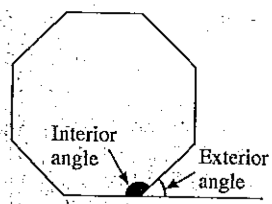
$= 20°$

$\therefore$ each interior angle

$= 180° - 20°$ supplementary angles

$= \mathbf{160°}$

Teacher's Tip



Notice that the two angles form a straight line.
$\therefore$ interior angle + exterior angle = 180° (supplementary angle).

2. Let n be the number of sides of the polygon.

$(n-1)\,70° + 80° = 360°$

$70n - 70 + 80 = 360$ Sum of the exterior angles of a polygon is 360°.

$70n = 350$

$n = \frac{350}{70}$

$= 5$

$\therefore$ the polygon has **5 sides.**