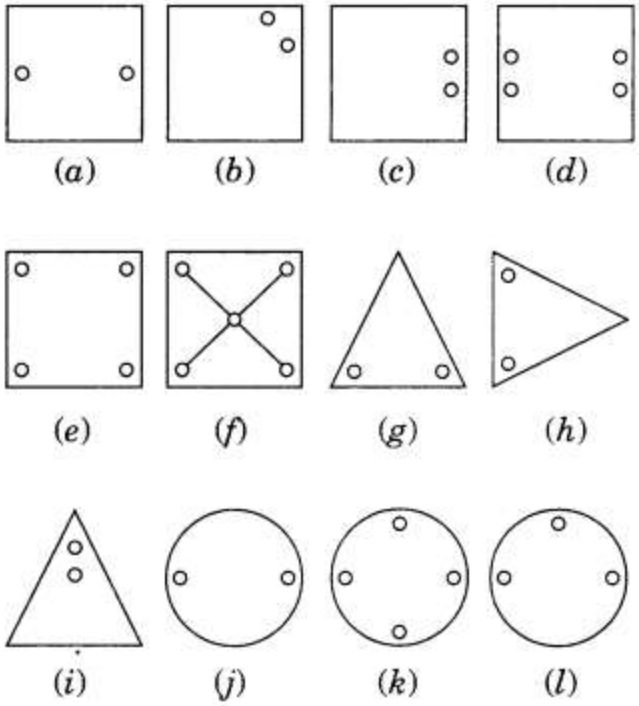
CHAPTER-14

Symmetry

Ex 14.1:-

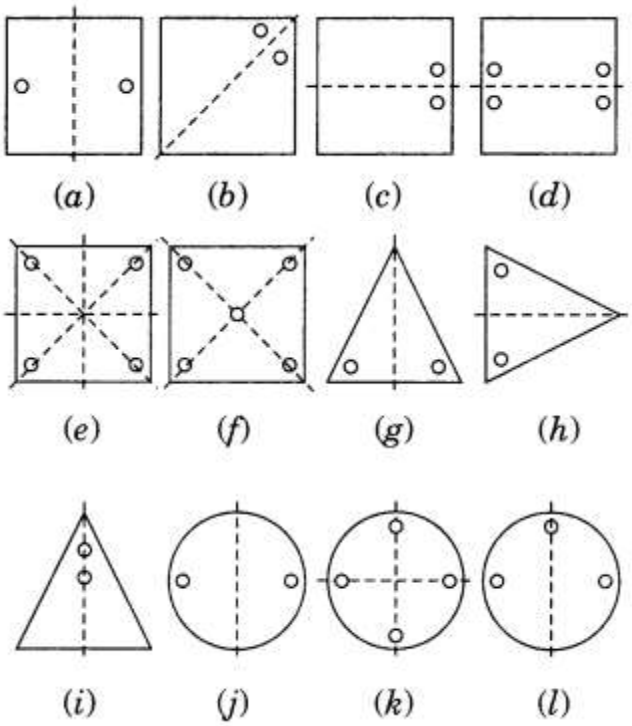
Question 1

Copy the figures with punched holes and find the axis of symmetry for the following:



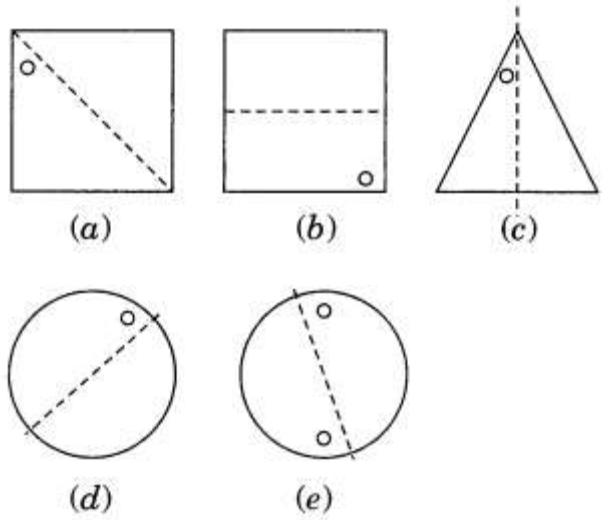
Solution:

The axis of symmetry is shown by following line.

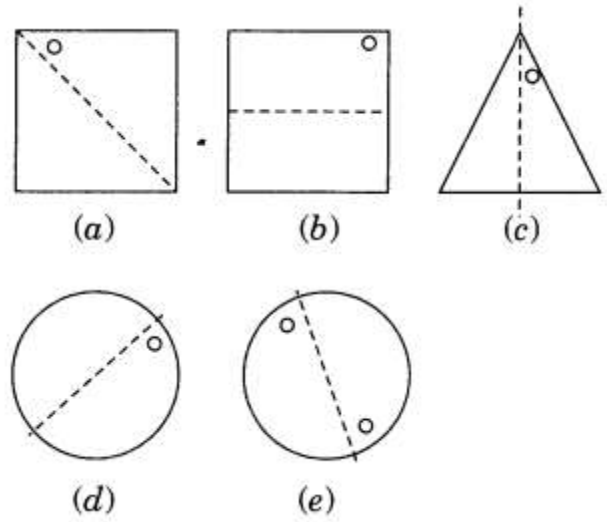


Question 2

Give the line(s) of symmetry, find the other hole(s):

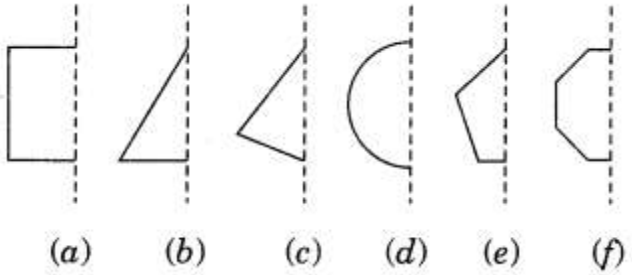


Solution:



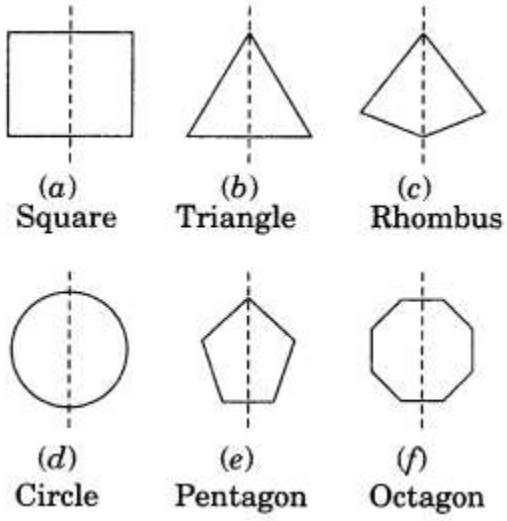
Question 3

In the following figures, the mirror line (i.e., the line of symmetry) is given as dotted line. Complete each figure performing reflection in the dotted (mirror) line. (You might perhaps place a mirror along the dotted line and look into the mirror for the image). Are you able to recall the name of the figure you complete?



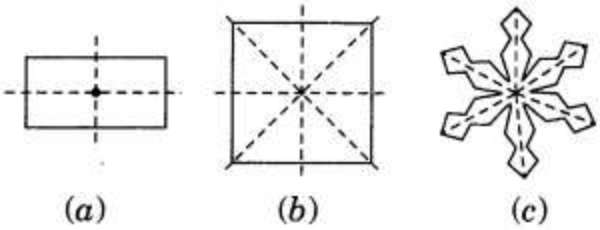
Solution:

Following are the complete figures.

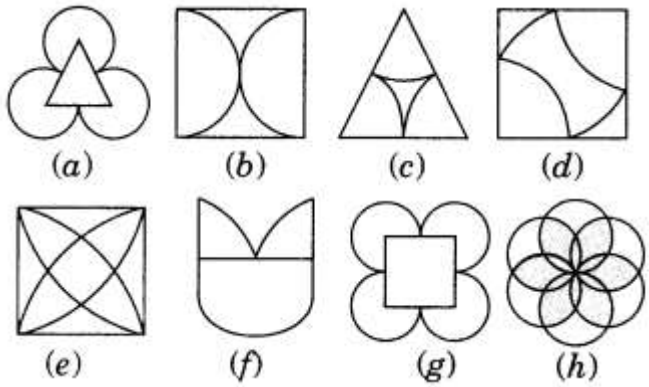


Question 4

The following figures have more than one line of symmetry. Such figures are said to have multiple lines of symmetry.



Identify multiple lines of symmetry, if any, in each of the following figures:



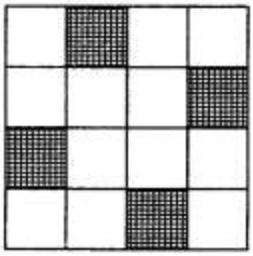
Solution:

Here, figure (6), (d), (e), (g) and (h) are the multiple lines of symmetry.

Question 5

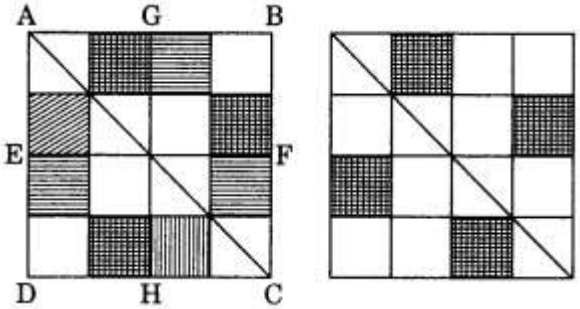
Copy the figure given here.

Take any one diagonal as a line of symmetry and shade a few more squares to make the figure symmetric about a diagonal. Is there more than one way to do that? Will the figure be symmetric about both the diagonals?



Solution:

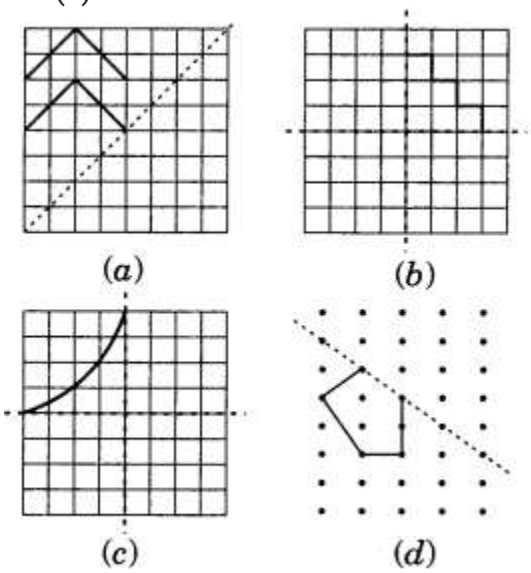
(i) Let us take a diagonal as the axis of symmetry and shade the square as shown in the figure.



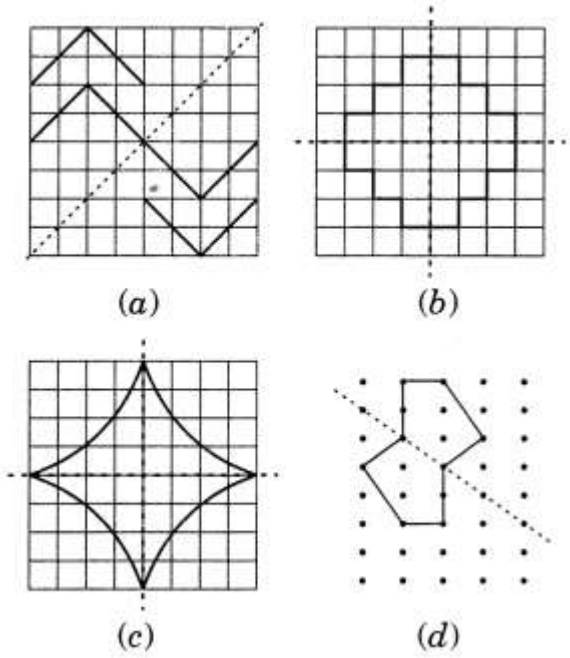
(ii) Yes, there are more than the line of symmetry i.e. BD, EF and GH.
(iii) Yes, the figure is symmetric about both the diagonals.

Question 6

Copy the diagram and complete each shape to be symmetric about the mirror line(s).



Solution:



Question 7

State the number of lines of symmetry for the following figures:
(a) An equilateral triangle
(b) An isosceles triangle
(c) A scalene triangle
(d) A square
(e) A rectangle
(f) A rhombus
(g) A parallelogram
(h) A quadrilateral
(i) A regular hexagon
(j) A circle

Solution:

Figure	Number of lines of symmetry
(a) An equilateral triangle	3
(6) An isosceles triangle	1
(c) A scalene triangle	0
(d) A square	4
(e) A rectangle	2

(f) A rhombus	2
(g) A parallelogram	0
(h) A quadrilateral	0
(i) A regular hexagon	6
(j) A circle	Infinite

Question 8

What letters of the English alphabet have reflectional symmetry (i.e. symmetry related to mirror reflection) about

(a) a vertical mirror

(b) a horizontal mirror

(c) both horizontal and vertical mirrors.

Solution:

(a) Alphabet of vertical mirror reflection symmetry are

A, H, I, M, O, T, U, V, W, X, Y

(b) Alphabet of horizontal mirror reflection symmetry are:

B, C, D, E, H, I, K, O, X

(c) Alphabet of both horizontal and vertical mirror reflection symmetry are:

H, I, O, X.

Question 9

Give three examples of shapes with no line of symmetry.

Solution:

Example 1: Scalene triangle has no line of symmetry.

Example 2: Quadrilateral has no line of symmetry.

Example 3: Alphabet R has no line of symmetry.

Question 10

What other name can you give of the line of symmetry of

(a) an isosceles triangle?

(b) a circle?

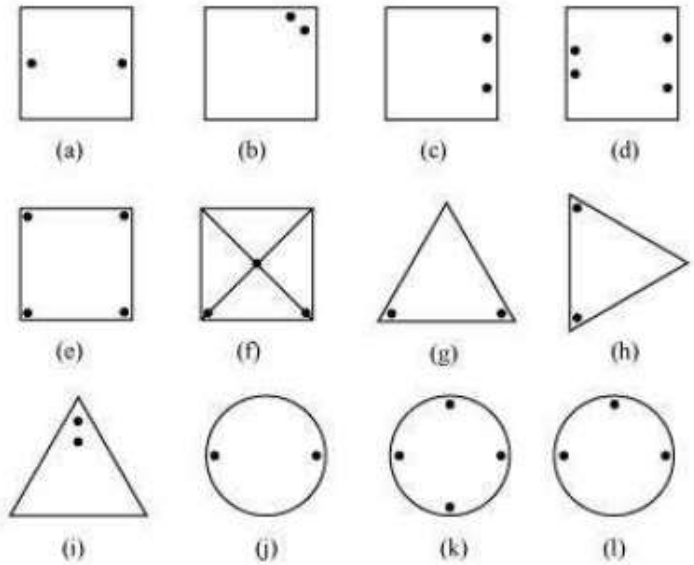
Solution:

(a) Median of an isosceles triangle is its line of symmetry.

(b) Diameter of a circle is its line of symmetry.

Question 1:

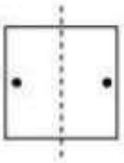
Copy the figures with punched holes and find the axes of symmetry for the following:



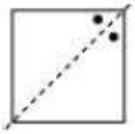
Answer:

The axes of symmetry in the given figures are as follows.

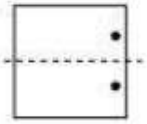
(a)



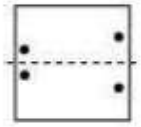
(b)



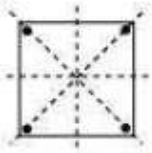
(c)



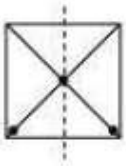
(d)



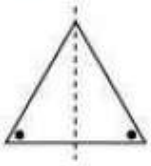
(e)



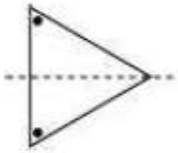
(f)



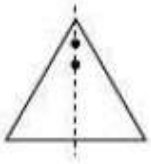
(g)



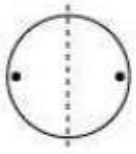
(h)



(i)

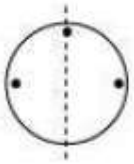


(j)



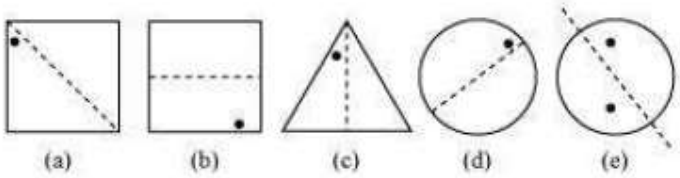
(k)

(I)



Question 2:

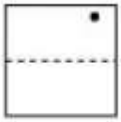
Given the line(s) of symmetry, find the other hole(s):



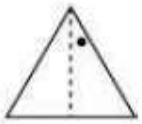
Answer:

(a)

(b)

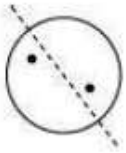


(c)



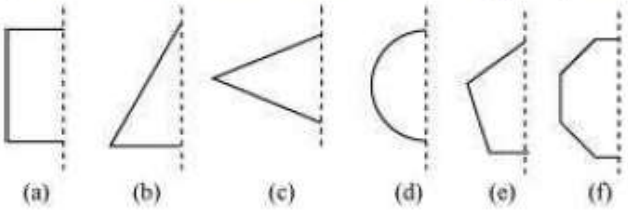
(d)

(e)



Question 3:

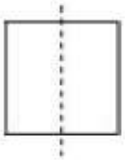
In the following figures, the mirror line (i.e., the line of symmetry) is given as a dotte line. Complete each figure performing reflection in the dotted (mirror) line. (You migh perhaps place a mirror along the dotted line and look into the mirror for the image). Ar you able to recall the name of the figure you complete?



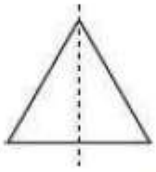
Answer:

The given figures can be completed as follows.

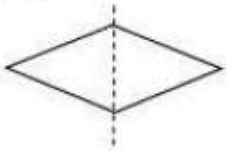
(a) It will be a square.



(b) It will be a triangle.

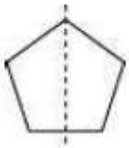


(c) It will be a rhombus.

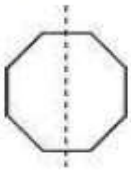


(d) It will be a circle.

(e) It will be a pentagon.

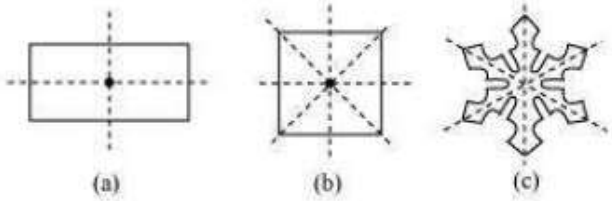


(f) It will be an octagon.

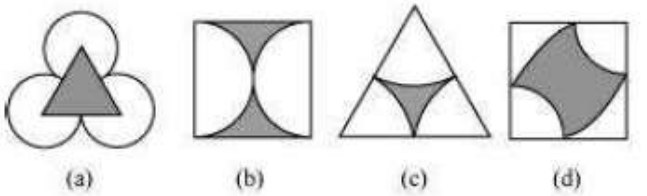


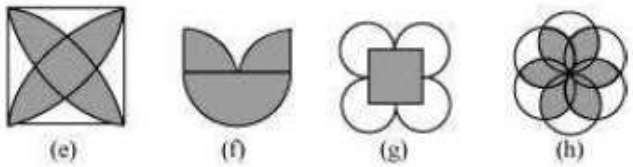
Question 4:

The following figures have more than one line of symmetry. Such figures are said t have multiple lines of symmetry.



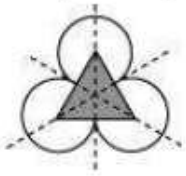
Identify multiple lines of symmetry, if any, in each of the following figures:



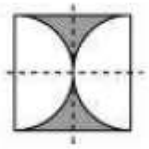


Answer:

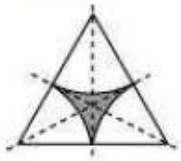
(a) The given figure has 3 lines of symmetry. Hence, it has multiple lines of symmetry.



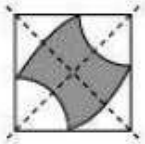
(b) The given figure has 2 lines of symmetry. Hence, it has multiple lines of symmetry.



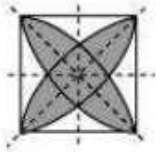
(c) The given figure has 3 lines of symmetry. Hence, it has multiple lines of symmetry.



(d)The given figure has 2 lines of symmetry. Hence, it has multiple lines of symmetry.

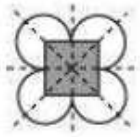


(e) The given figure has 4 lines of symmetry. Hence, it has multiple lines of symmetry.



(f) The given figure has only 1 line of symmetry.

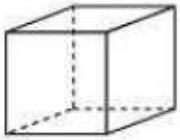
(g) The given figure has 4 lines of symmetry. Hence, it has multiple lines of symmetry.

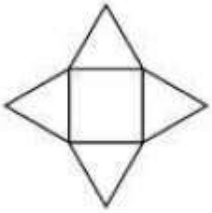


(h) The given figure has 6 lines of symmetry. Hence, it has multiple lines of symmetry.

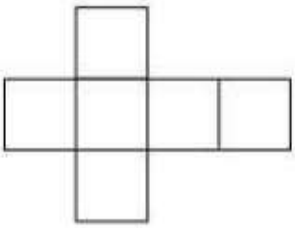
Question 5:

Match the nets with appropriate solids:

(a) 

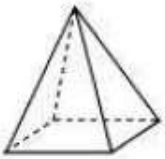
(i) 

(b) 

(ii) 

(c) 

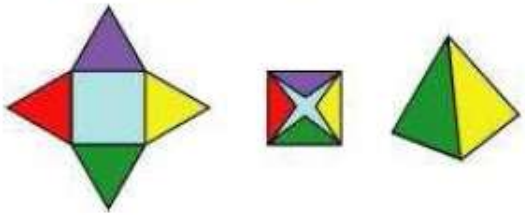
(iii) 

(d) 

(iv) 

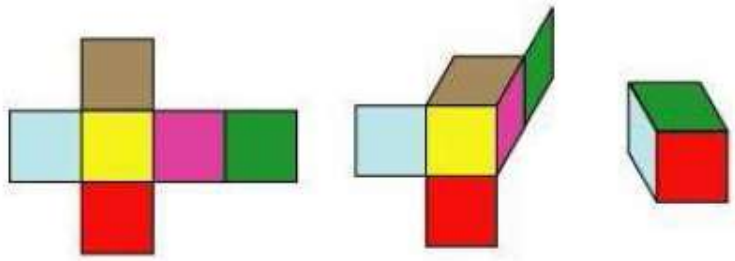
Answer:

Consider net (i). It can be folded as follows.



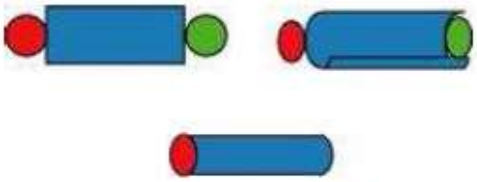
It is a net of a pyramid. Hence, (d) is the correct matching option.

Consider net (ii). It can be folded as follows.



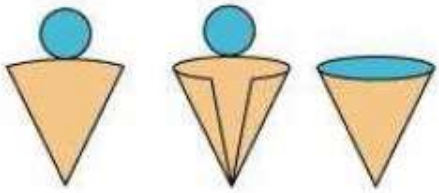
It is a net of a cube. Hence, (a) is the correct matching option.

Consider net (iii). It can be folded as follows.



It is a net of a cylinder. Hence, (b) is the correct matching option.

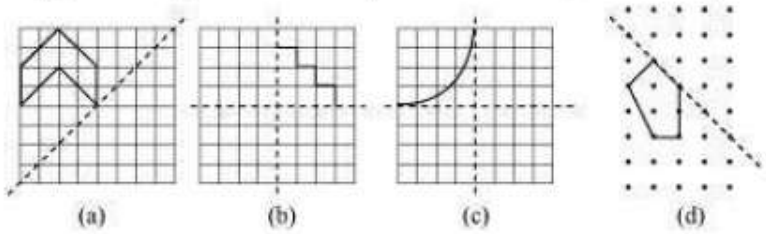
Consider net (iv). It can be folded as follows.



It is a net of a cone. Hence, (c) is the correct matching option.

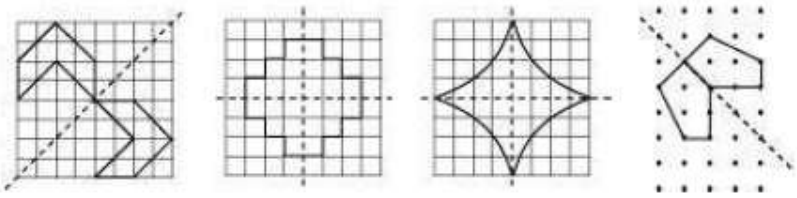
Question 6:

Copy the diagram and complete each shape to be symmetric about the mirror line (s):



Answer:

The given figures can be completed about the given mirror lines as follows.



(a) (b) (c) (d)

Question 7:

State the number of lines of symmetry for the following figures:

(a) An equilateral triangle

(b) An isosceles triangle

(c) A scalene triangle

(d) A square

(e) A rectangle

(f) A rhombus

(g) A parallelogram

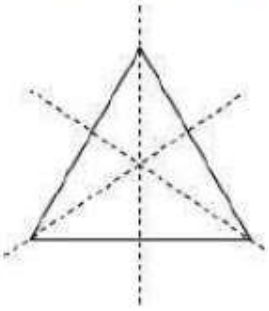
(h) A quadrilateral

(i) A regular hexagon

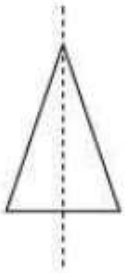
(j) A circle

Answer:

(a) There are 3 lines of symmetry in an equilateral triangle.

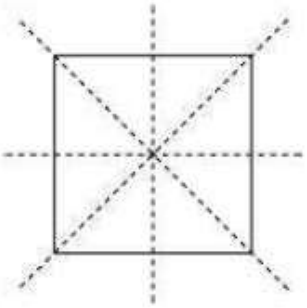


(b)There is only 1 line of symmetry in an isosceles triangle.



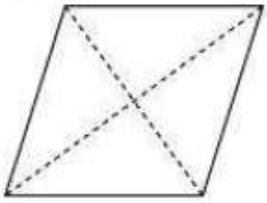
(c) There is no line of symmetry in a scalene triangle.

(d)There are 4 lines of symmetry in a square.



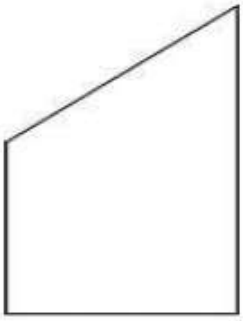
(e) There are 2 lines of symmetry in a rectangle.

(f)There are 2 lines of symmetry in a rhombus.

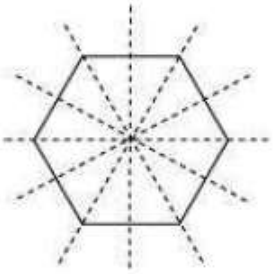


(g) There is no line of symmetry in a parallelogram.

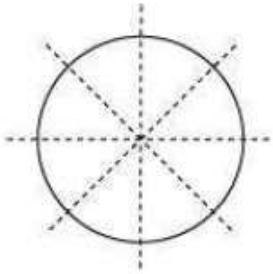
(h) There is no line of symmetry in a quadrilateral.



(i) There are 6 lines of symmetry in a regular hexagon.



(j)There are infinite lines of symmetry in a circle. Some of these are represented as follows.



Question 8:

What letters of the English alphabet have reflectional symmetry (i.e., symmetry related to mirror reflection) about.

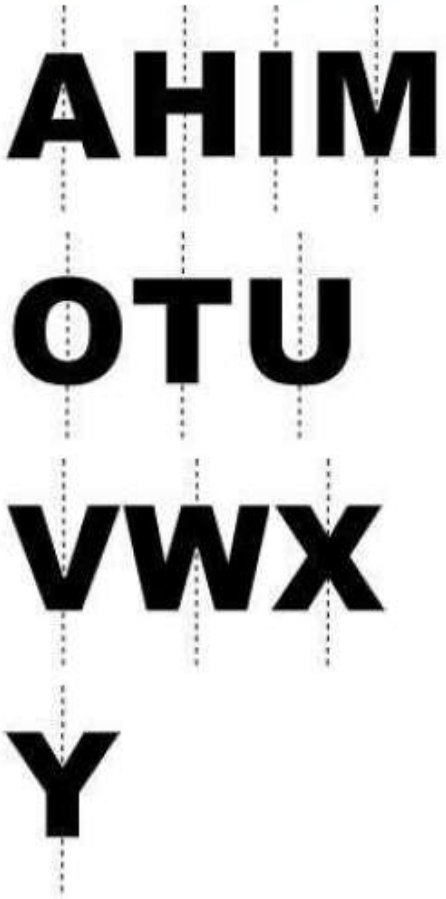
(a) a vertical mirror

(b) a horizontal mirror

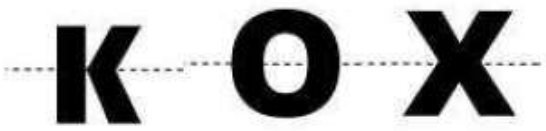
(c) both horizontal and vertical mirrors

Answer:

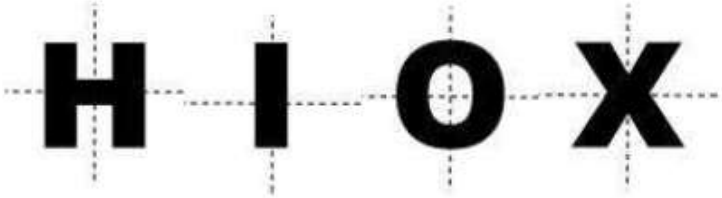
(a) A, H, I, M, O, T, U, V, W, X, Y are the letters having a reflectional symmetry about a vertical mirror.



(b) B, C, D, E, H, I, K, O, X are the letters having a reflectional symmetry about a horizontal mirror.



(c) H, I, O, X are the letters having a reflectional symmetry about both the vertical mirror and the horizontal mirror.

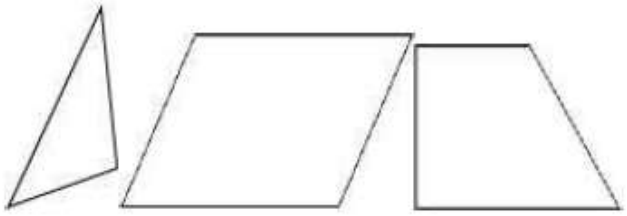


Question 9:

Give three examples of shapes with no line of symmetry.

Answer:

A scalene triangle, a parallelogram, and a trapezium do not have any line of symmetry.



Question 10:

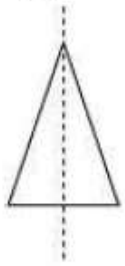
What other name can you give to the line of symmetry of

(a) an isosceles triangle?

(b)a circle?

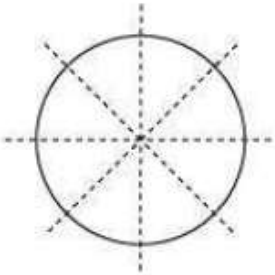
Answer:

(a) An isosceles triangle has only 1 line of symmetry.



Therefore, this line of symmetry is the median and also the altitude of this isosceles triangle.

(b) There are infinite lines of symmetry in a circle. Some of these are represented as follows.

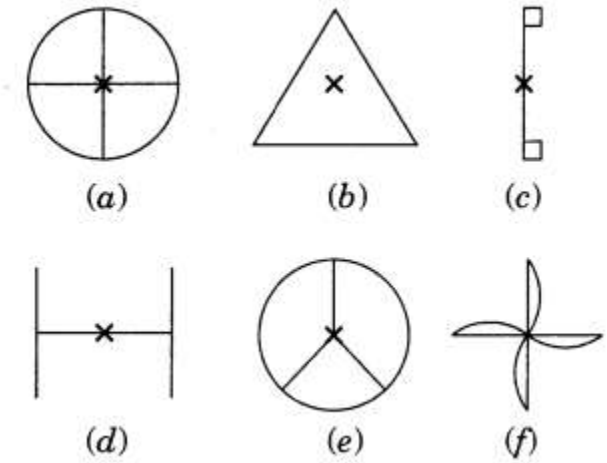


It can be concluded that each line of symmetry is the diameter for this circle.

Ex 14.2:-

Question 1.

Which of the following figures have rotational symmetry of order more than 1?

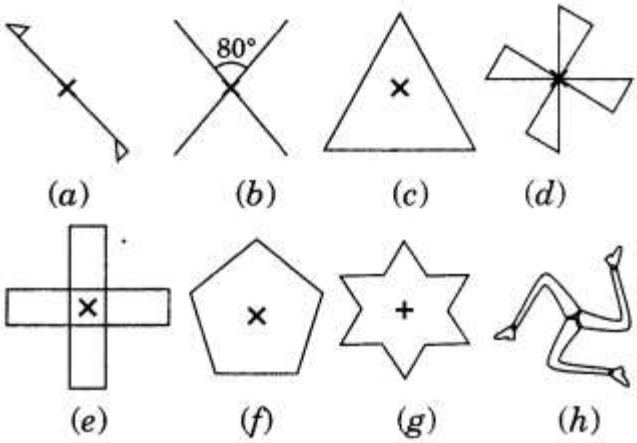


Solution:

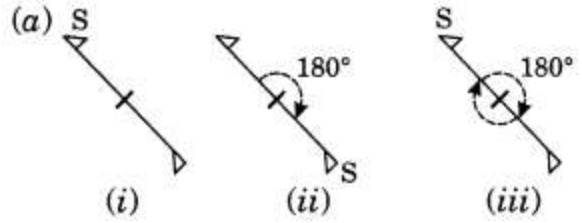
The figure (a), (b), (d), (e) and (f) have rotational symmetry more than 1.

Question 2.

Give the order of rotational symmetry for each figure:

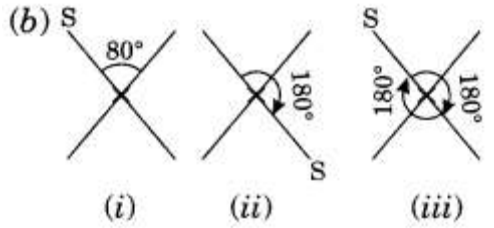


Solution:



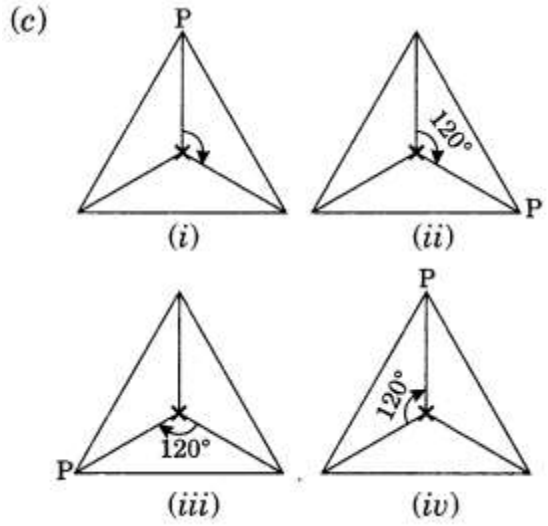
Let us take a point S on one end of the given figure. Rotating by 180°, S comes at other end and then again rotating by 180°, it comes at its original position.

∴ Order of rotational symmetry = $360^\circ 180^\circ = 2$



Let us take any point S in figure (1). It takes two rotations to come back to its original position.

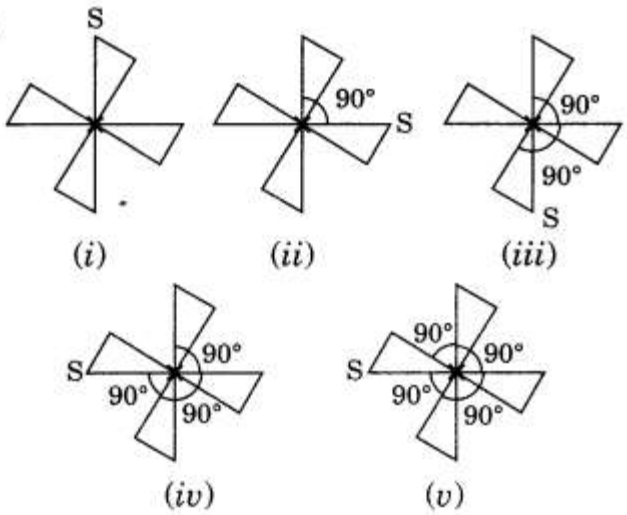
∴ Order of rotational symmetry = $360^\circ 180^\circ = 2$



Let us mark any vertex of the given figure. It takes three rotations to come back to its original shape.

∴ Order of rotational symmetry = $360^\circ 120^\circ = 3$

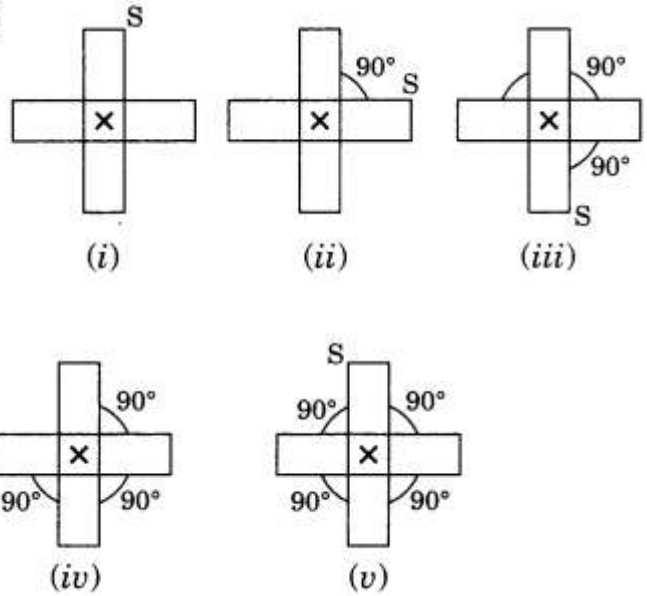
(d)



(i) (ii) (iii) (iv) (v)

Order of rotational symmetry = $360° \div 90° = 4$

(e)



(i) (ii) (iii) (iv) (v)

∴ Order of rotational symmetry = $360° \div 90° = 4$

(f) The given figure is a regular pentagon which can take one rotation at an angle of 72°.

∴ Order of rotational symmetry = $360° \div 72° = 5$

(g) The given figure requires six rotations each through an angle of 60°

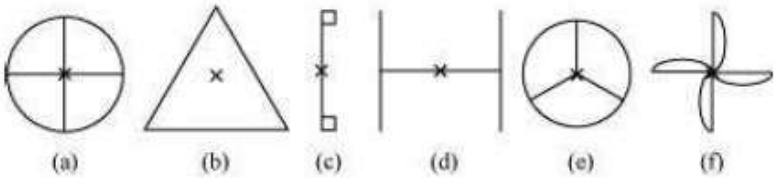
∴ Order of rotational symmetry = $360° \div 60° = 6$

(h) The given figure requires three rotations, each through an angle of 120°.

∴ Order of rotational symmetry = $360° \div 120° = 3$

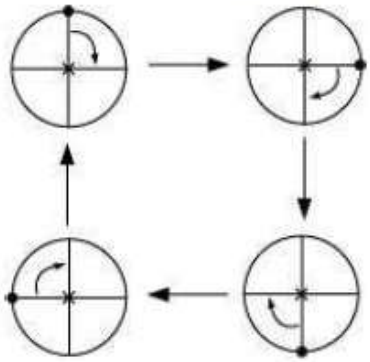
Question 1:

Which of the following figures have rotational symmetry of order more than 1:

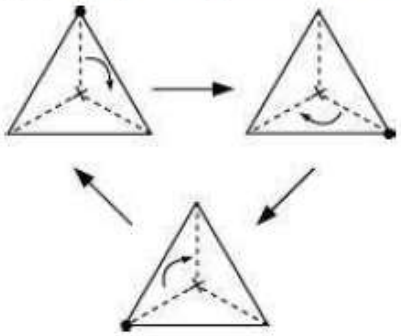


Answer:

(a) The given figure has its rotational symmetry as 4.

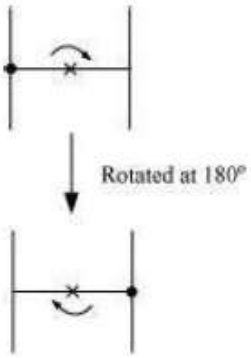


(b) The given figure has its rotational symmetry as 3.

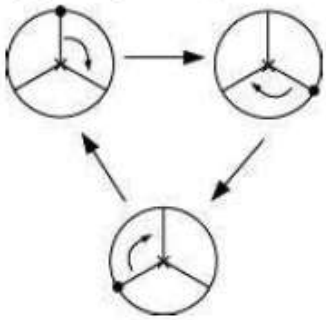


(c) The given figure has its rotational symmetry as 1.

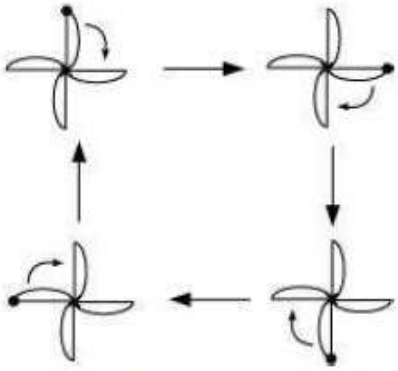
(d) The given figure has its rotational symmetry as 2.



(e) The given figure has its rotational symmetry as 3.



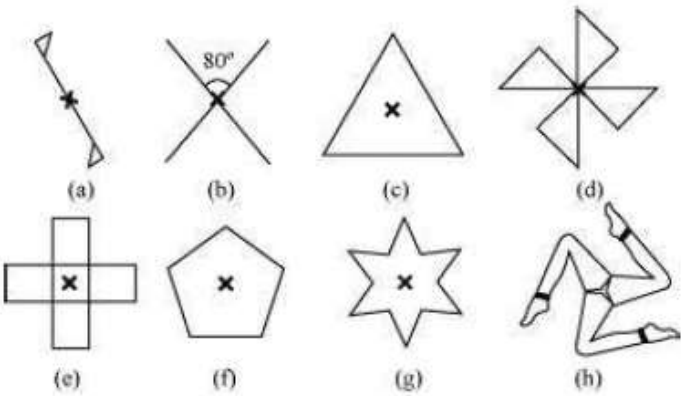
(f) The given figure has its rotational symmetry as 4.



Hence, figures (a), (b), (d), (e), and (f) have rotational symmetry of order more than 1.

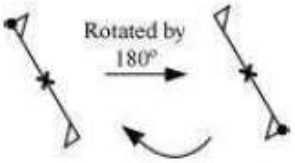
Question 2:

Give the order of rotational symmetry for each figure:

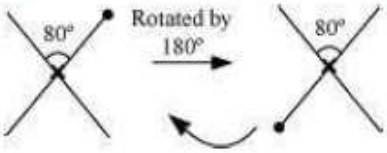


Answer:

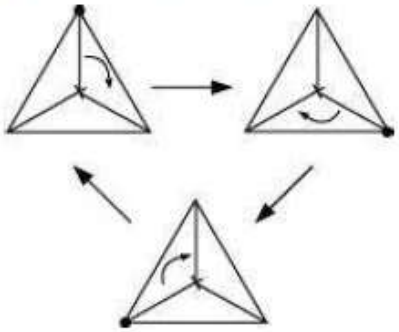
(a) The given figure has its rotational symmetry as 2.



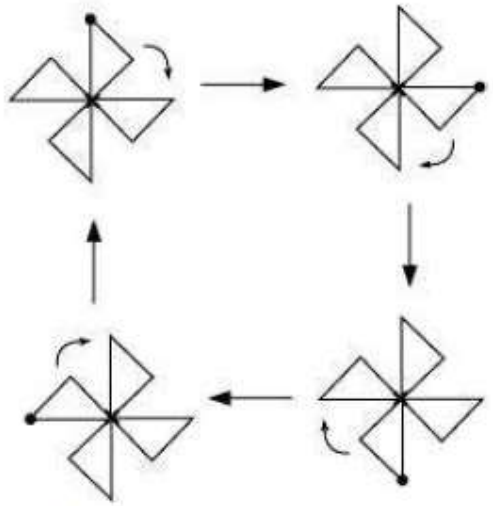
(b) The given figure has its rotational symmetry as 2.



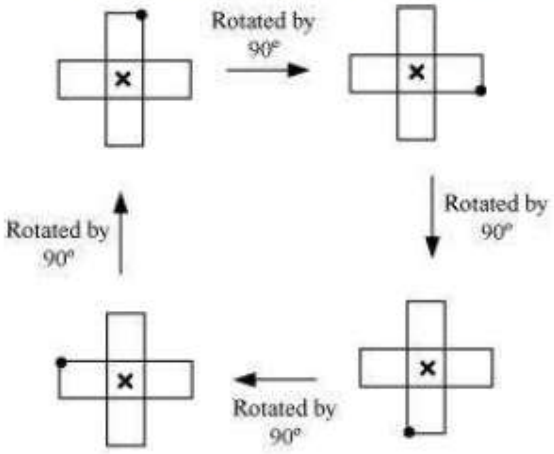
(c) The given figure has its rotational symmetry as 3.



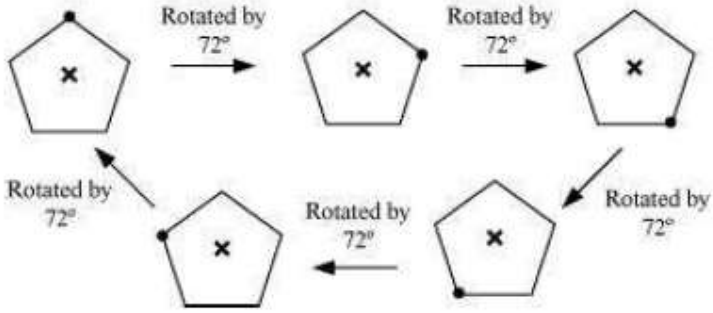
(d) The given figure has its rotational symmetry as 4.



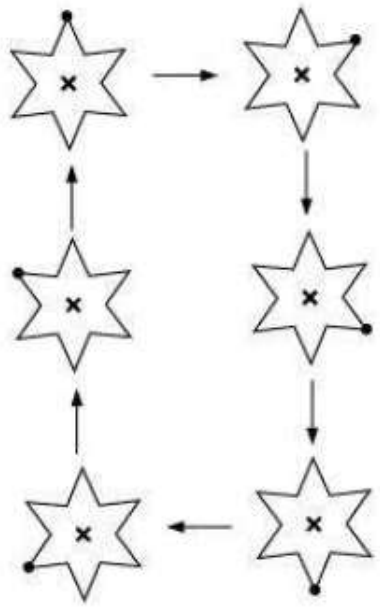
(e) The given figure has its rotational symmetry as 4.



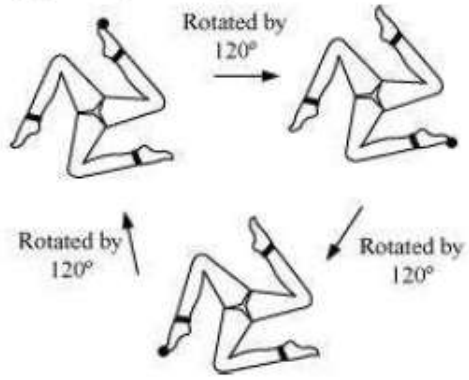
(f) The given figure has its rotational symmetry as 5.



(g) The given figure has its rotational symmetry as 6.



(h) The given figure has its rotational symmetry as 3.



Ex 14.3:-

Question 1

Name any two figures that have both line symmetry and rotational symmetry.

Solution:

English alphabet H and O both have line symmetry and rotational symmetry.

Question 2

Draw, wherever possible, a rough sketch of

(i) a triangle with both line and rotational symmetries of order more than 1.

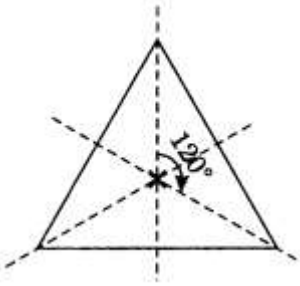
(ii) a triangle with only line symmetry and no rotational symmetry of order more than 1.

(iii) a quadrilateral with a rotational symmetry of order more than 1 but not a line symmetry.

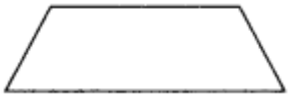
(iv) a quadrilateral with line symmetry but not a rotational symmetry of order more than 1.

Solution:

(i) Equilateral triangle has 3 rotational symmetries.



(ii) Not possible.

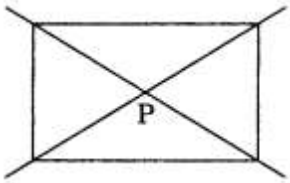
(iii) 

(iv) Not possible.

Question 3

If a figure has two or more lines of symmetry, should it have rotational symmetry of order more than 1?

Solution:



Yes. The above figure has two lines of symmetry and also rotational symmetry of order 2.

Question 4

Fill in the blanks:

Shape	Centre of rotation	Order of rotation	Angle of rotation
Square			
Rectangle			
Rhombus			
Equilateral triangle			
Regular hexagon			
Circle			
Semicircle			

Solution:

Shape	Centre of rotation	Order of rotation	Angle of rotation
Square	Point of intersection of diagonals	4	90°
Rectangle	Point of intersection of diagonals	4	90°
Rhombus	Point of intersection of diagonals	4	90°
Equilateral triangle	Point of intersection of medians	3	120°
Regular hexagon	Point of intersection of diagonals	6	60°
Circle	Centre	Infinite	Every angle
Semicircle	Centre	4	90°

Question 5

Name the quadrilaterals which have both line and rotational symmetry of order more than 1.

Solution:

Square, rectangles and rhombus are such quadrilateral which have both line and rotational symmetry.

Question 6

After rotating by 60° about a centre, a figure looks exactly the same as its original position. At what other angles will this happen for the figure?

Solution:

If a figure is rotated through the angles 120°, 180°, 240°, 300° and 360°, it looks exactly the same.

Question 7

Can we have a rotational symmetry of order more than 1 whose angle of rotation is
(i) 45°?
(ii) 17°?

Solution:

(i) Yes
(ii) No

Question 1:

Name any two figures that have both line symmetry and rotational symmetry.

Answer:

Equilateral triangle and regular hexagon have both line of symmetry and rotational symmetry.

Question 2:

Draw, wherever possible, a rough sketch of

(i) a triangle with both line and rotational symmetries of order more than 1.

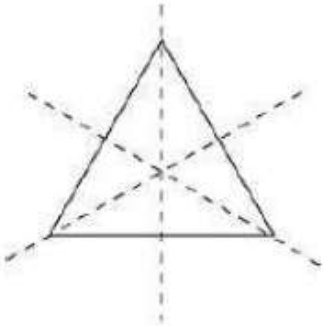
(ii) a triangle with only line symmetry and no rotational symmetry of order more than 1.

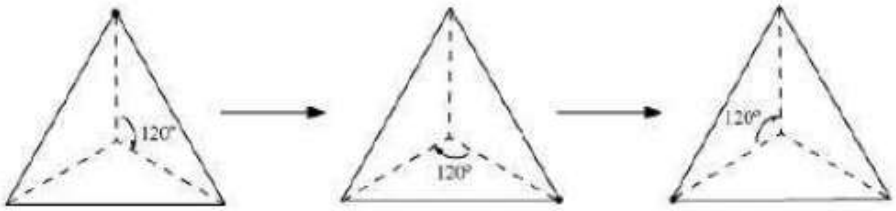
(iii) a quadrilateral with a rotational symmetry of order more than 1 but not a line symmetry.

(iv) a quadrilateral with line symmetry but not a rotational symmetry of order more than 1.

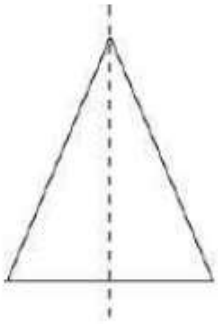
Answer:

(i) Equilateral triangle has 3 lines of symmetry and rotational symmetry of order 3.

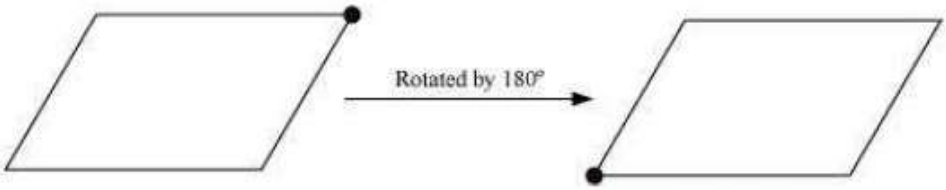




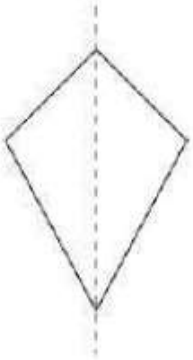
(ii) Isosceles triangle has only 1 line of symmetry and no rotational symmetry of order more than 1.



(iii) A parallelogram is a quadrilateral which has no line of symmetry but a rotational symmetry of order 2.



(iv)A kite is a quadrilateral which has only 1 line of symmetry and no rotational symmetry of order more than 1.



Question 3:

If a figure has two or more lines of symmetry, should it have rotational symmetry of order more than 1?

Answer:

Yes. If a figure has two or more lines of symmetry, then it will definitely have its rotational symmetry of order more than 1.

Question 4:

Fill in the blanks:

Shape	Centre of Rotation	Order of Rotation	Angle of Rotation
Square	-	-	-
Rectangle	-	-	-
Rhombus	-	-	-
Equilateral Triangle	-	-	-
Regular Hexagon	-	-	-
Circle	-	-	-
Semi-circle	-	-	-

Answer:

The given table can be completed as follows.

Shape	Centre of Rotation	Order of Rotation	Angle of Rotation
Square	Intersection point of diagonals	4	90º
Rectangle	Intersection point of diagonals	2	180º
Rhombus	Intersection point of diagonals	2	180º
Equilateral Triangle	Intersection point of medians	3	120º
Regular Hexagon	Intersection point of	6	60º

	diagonals		
Circle	Centre	Infinite	Any angle
Semi-circle	Centre	1	360º

Question 5:

Name the quadrilaterals which have both line and rotational symmetry of order more than 1.

Answer:

Square, rectangle, and rhombus are the quadrilaterals which have both line and rotational symmetry of order more than 1. A square has 4 lines of symmetry and rotational symmetry of order 4. A rectangle has 2 lines of symmetry and rotational symmetry of order 2. A rhombus has 2 lines of symmetry and rotational symmetry of order 2.

Question 6:

After rotating by 60° about a centre, a figure looks exactly the same as its original position. At what other angles will this happen for the figure?

Answer:

It can be observed that if a figure looks symmetrical on rotating by 60º, then it will also look symmetrical on rotating by 120º, 180º, 240º, 300º, and 360º i.e., further multiples of 60º.

Question 7:

Can we have a rotational symmetry of order more than 1 whose angle of rotation is

(i) 45°?

(ii) 17°?

Answer:

It can be observed that if the angle of rotation of a figure is a factor of 360º, then it will have a rotational symmetry of order more than 1.

It can be checked that 45º is a factor of 360º but 17º is not. Therefore, the figure having its angle of rotation as 45º will have its rotational symmetry of order more than 1. However, the figure having its angle of rotation as 17º will not be having its rotational symmetry of order more than 1.