14 Symmetry

Learn and Remember

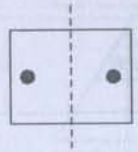
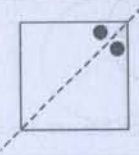
1. A plane figure is symmetrical about a line if it is divided into two identical parts by that line. This line is called the line of symmetry or axis.
2. Mirror reflection leads to symmetry under which the left-right orientation have to be taken.
3. Rotation turns an object about a fixed point. This fixed point is called centre of rotation.
4. Angle of rotation is the angle by which the object rotates.
5. If after a rotation, an object looks exactly the same, we say that it has a rotational symmetry.
6. The number of times of an object looks exactly the same is called the order of rotational symmetry.

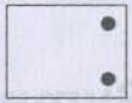
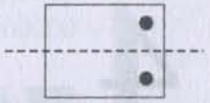
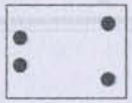
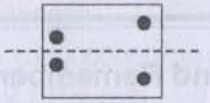
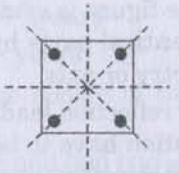
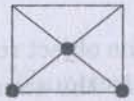
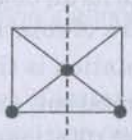
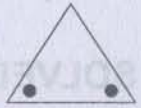
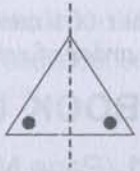
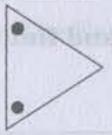
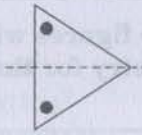
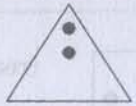
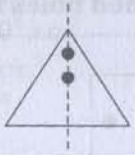
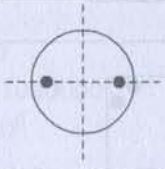
TEXTBOOK QUESTIONS SOLVED

Exercise 14.1 *(Page No. 268-270)*

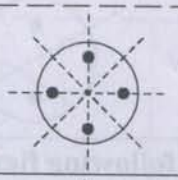
Q1. Copy the figures with punched holes and find the axes of symmetry for the following:

Sol.

S.No.	Punched holes figures	The axes of symmetry
(*a*)		 (rectangle)
(*b*)		 (square)

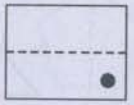
(c)		
(d)		
(e)		 (square)
(f)		
(g)		
(h)		
(i)		
*(j)		

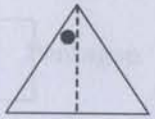
*Answers is differ from NCERT.

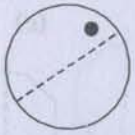
*(k)		
(l)		

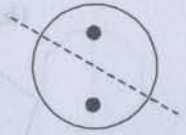
Q2. Given the line(s) of symmetry, find the other hole(s):

(a) 

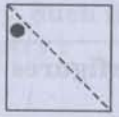
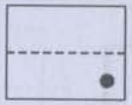
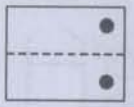
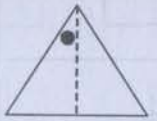
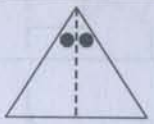
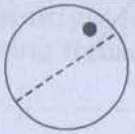
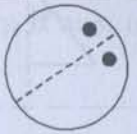
(b) 

(c) 

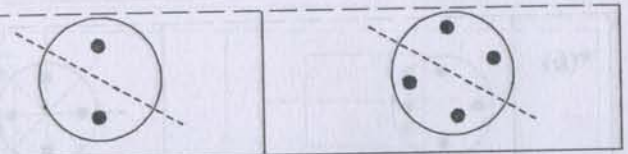
(d) 

(e) 

Sol.

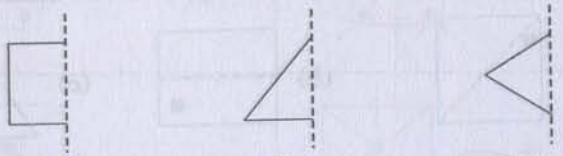
S.No.	Line(s) of symmetry	Other holes on figures
(a)		
(b)		
(c)		
(d)		

(e)

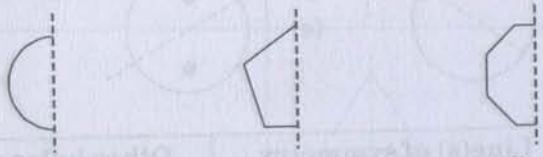


Q3. In the following figures, the mirror line (*i.e.*, the line of symmetry) is given as a dotted line. Complete each figure performing reflection in the dotted (mirror) line. (You might perhaps place a mirror along the dotted line and look into the mirror for the image).

Are you able to recall the name of the figure you complete?

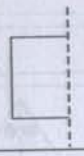
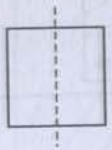
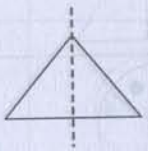


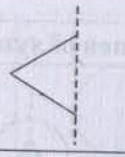
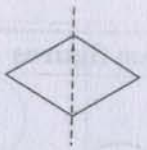
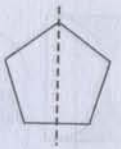
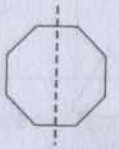
(*a*) (*b*) (*c*)



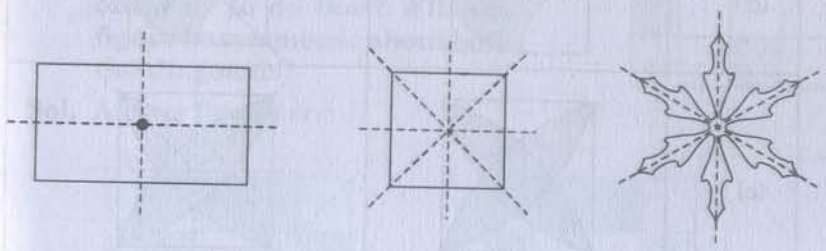
(*d*) (*e*) (*f*)

Sol.

S.No.	Question figures	Complete figures	Name of the figures
(*a*)			Square
(*b*)			Triangle

(*c*)			Rhombus
(*d*)			Circle
(*e*)			Pentagon
(*f*)			Octagon

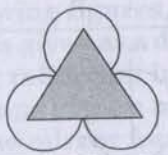
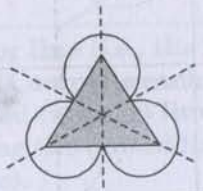
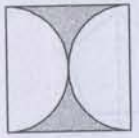
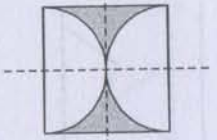
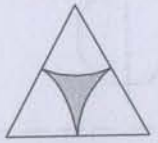
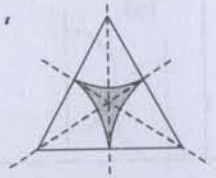
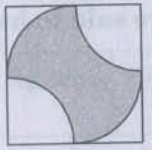
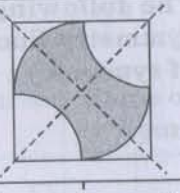
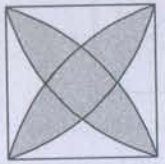
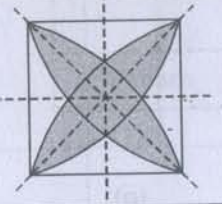
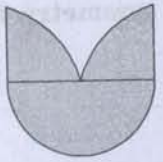
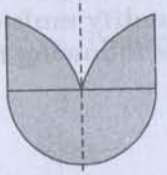
Q4. The following figures have more than one line of symmetry. Such figures are said to have multiple lines of symmetry :

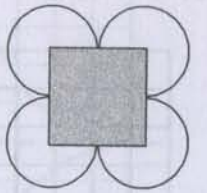
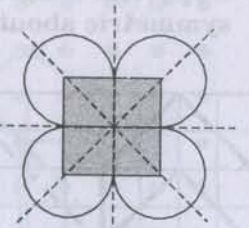
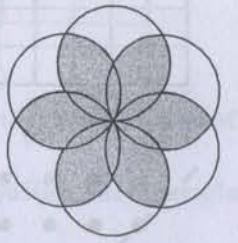
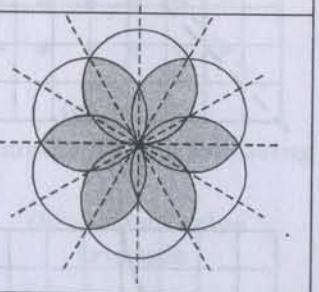


(*a*) (*b*) (*c*)

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

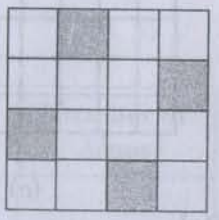
Sol.

S.No.	Problem figures	Lines of symmetry
(a)		
(b)		
(c)		
(d)		
(e)		
(f)		

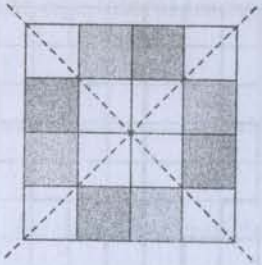
(g)		
(h)		

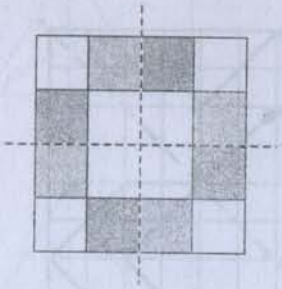
Q5. Copy the figure given here.

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?



Sol. Answer figures are:

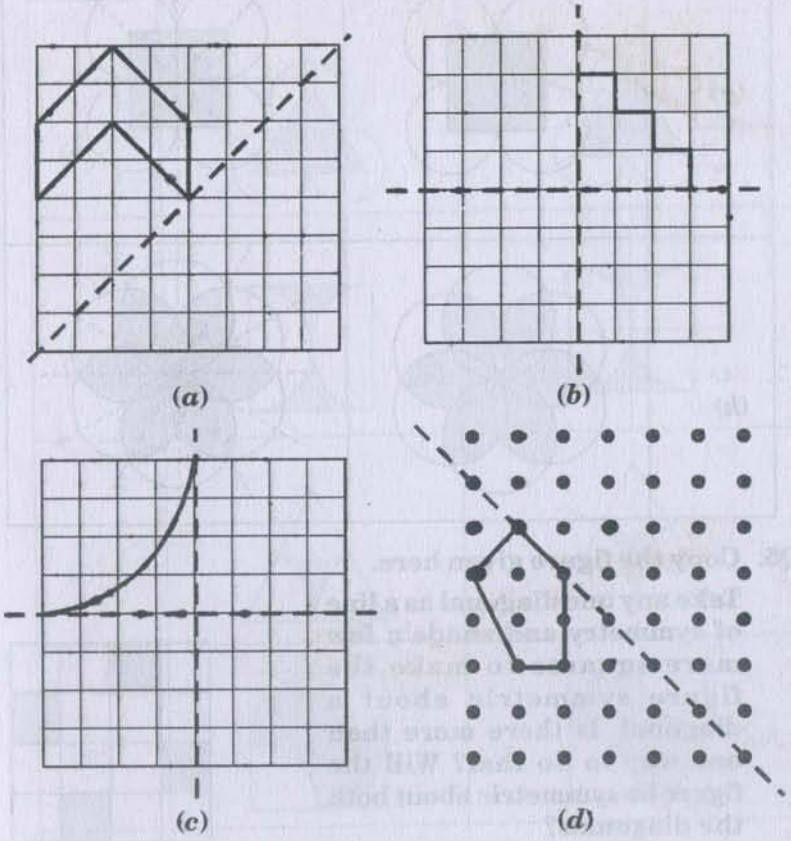




Yes, there is more than one way.

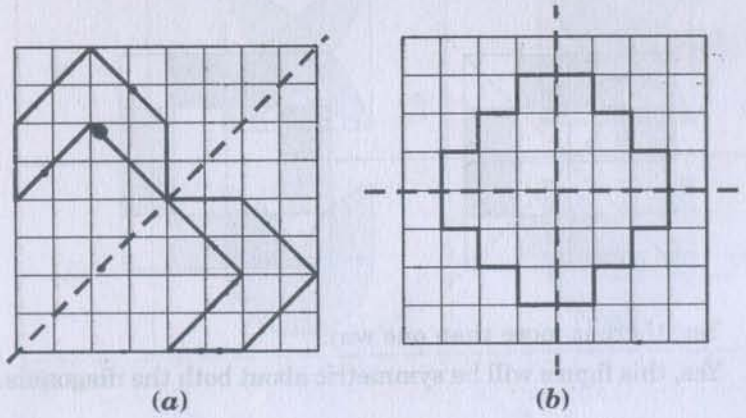
Yes, this figure will be symmetric about both the diagonals.

Q6. Copy the diagram and complete each shape to be symmetric about the mirror line(s):

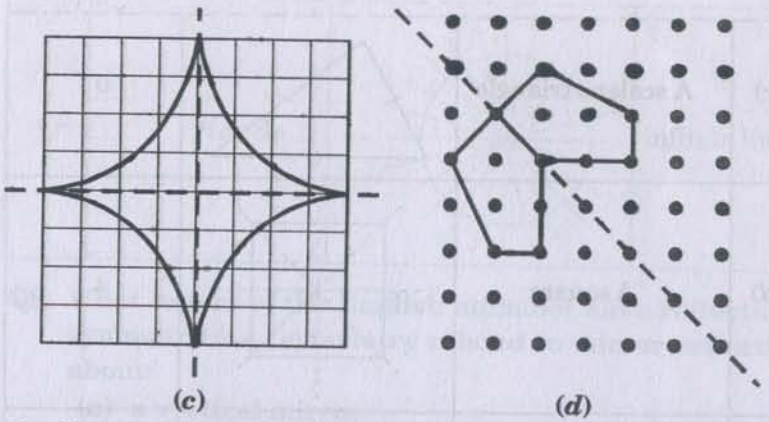


(*a*) (*b*) (*c*) (*d*)

Sol.



(*a*) (*b*)



(*c*) (*d*)

Q7. State the number of lines of symmetry for the following figures:

(*a*) An equilateral triangle **(*b*) An isosceles triangle**

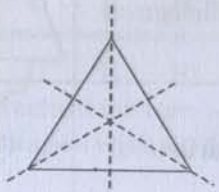
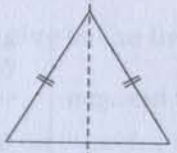
(*c*) A scalene triangle **(*d*) A square**

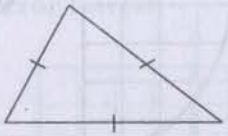
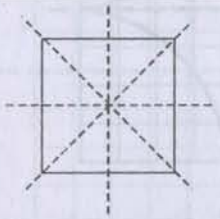
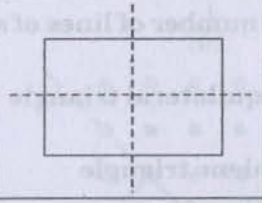
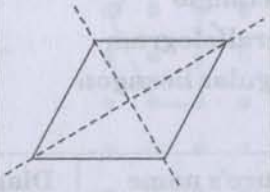
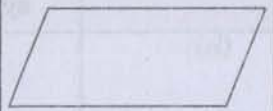
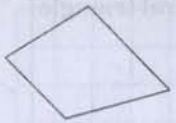
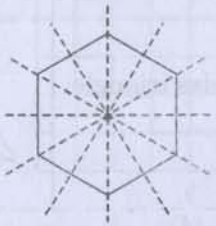
(*e*) A rectangle **(*f*) A rhombus**

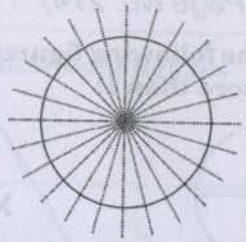
(*g*) A parallelogram **(*h*) A quadrilateral**

(*i*) A regular hexagon **(*j*) A circle.**

Sol.

S.No.	Figure's name	Diagram with symmetry	Number of lines
(*a*)	An equilateral triangle		3
(*b*)	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 lines

Q8. 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.

Sol. (a) Vertical mirror — A, H, I, M, O, T, U, V, W, X and Y

mirror

A	A
H	H
I	I
M	M
O	O
T	T

mirror

U	U
V	V
W	W
X	X
Y	Y

(b) Horizontal mirror — B, C, D, E, H, I, O and X

B C D E H I O X

mirror

B C D E H I O X

(c) Both horizontal and vertical mirrors — H, I, O and X.

Q9. Give three examples of shapes with no line of symmetry.

Sol. The three examples are:

(i) Quadrilateral (ii) Scalene triangle

(iii) Parallelogram.

Q10. What other name can you give to the line of symmetry of:

(a) an isosceles triangle?

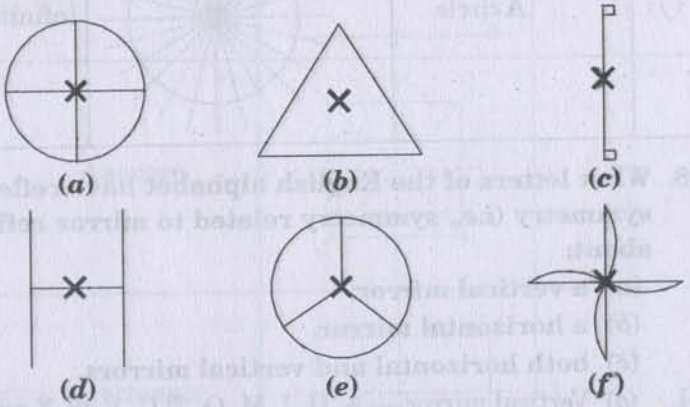
(b) a circle.

Sol. (a) The line of symmetry of an isosceles triangles is median or altitude.

(b) The line of symmetry of a circle is diameter.

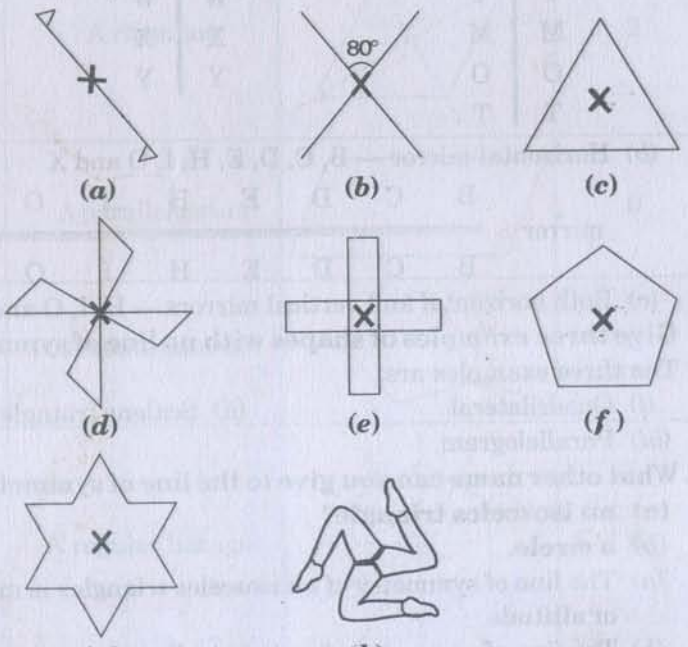
Exercise 14.2 *(Page No. 274)*

Q1. Which of the following figures have rotational symmetry of order more than 1:

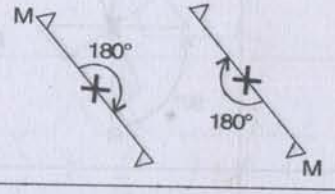
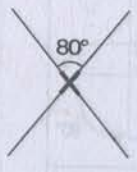
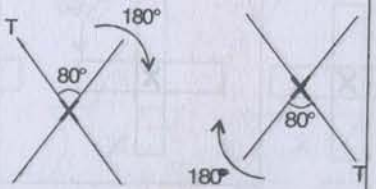
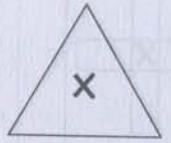
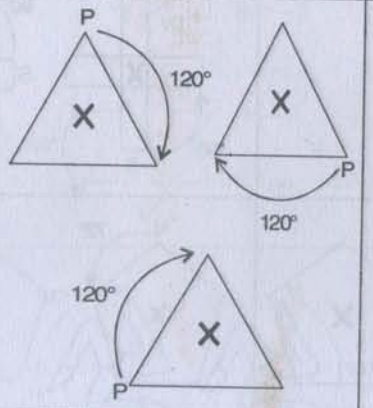
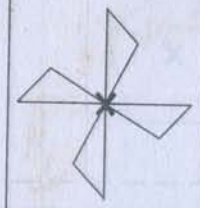
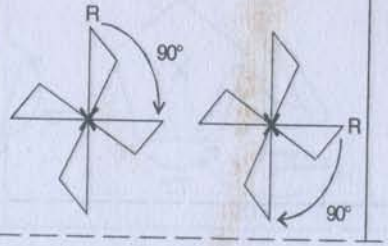


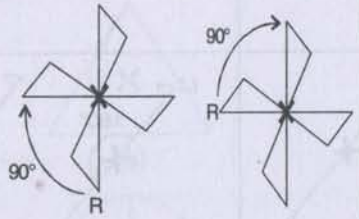
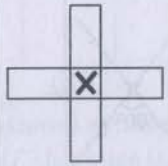
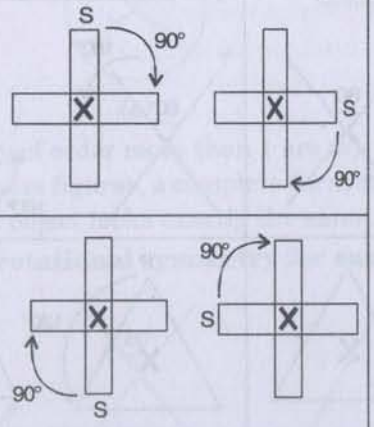
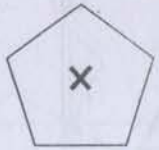
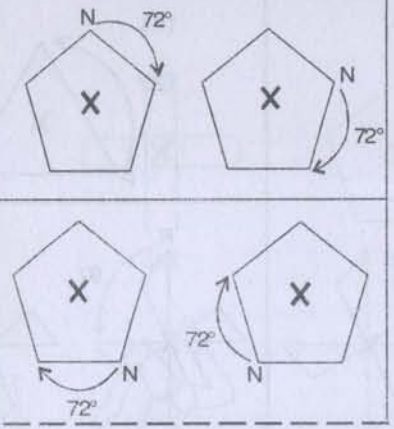
Sol. Rotational symmetry of order more than 1 are (a), (b), (d), (e) and (f) because in these figures, a complete turn, more than 1 number of times, an object looks exactly the same.

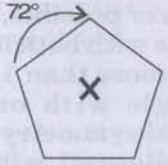
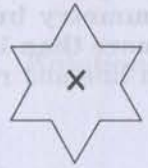
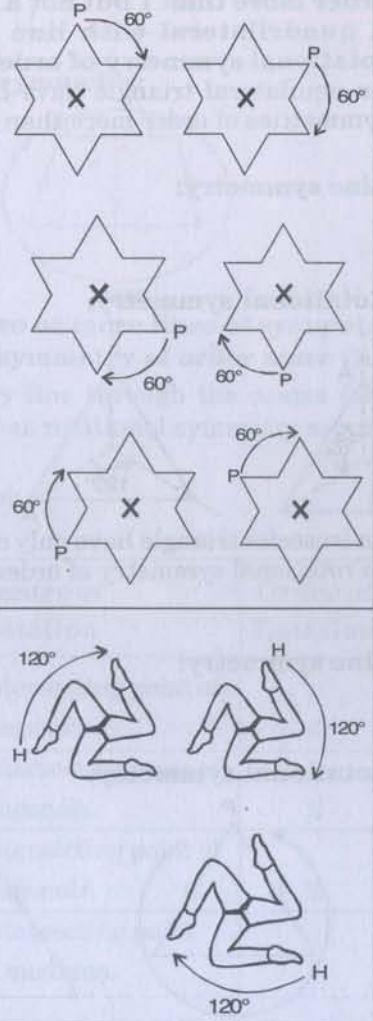
Q2. Give the order of rotational symmetry for each figure:



Sol.

S.No.	Problem figures	Rotational figures	Order of rotational symmetry
(a)			2
(b)			2
(c)			3
(d)			4

S.No.	Problem figures	Rotational figures	Order of rotational symmetry
			
(e)			4
(f)			5

S.No.	Problem figures	Rotational figures	Order of rotational symmetry
			
(g)			6
(h)			3

Exercise 14.3 *(Page No. 275-276)*

Q1. Name any two figures that have both line symmetry and rotational symmetry.

Sol. Circle and square.

Q2. Draw, wherever possible, a rough sketch of

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

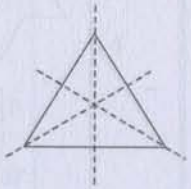
(*ii*) A triangle with only line symmetry and no rotational symmetry of order more than 1.

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

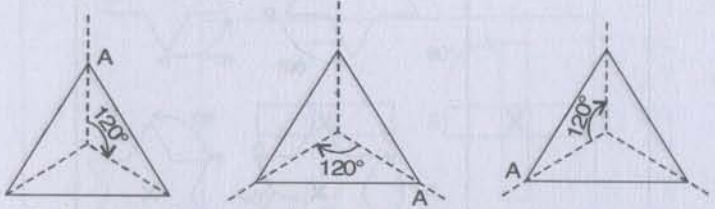
(*iv*) A quadrilateral with line symmetry but not a rotational symmetry of order more than 1.

Sol. (*i*) An equilateral triangle have both line and rotational symmetries of order more than 1.

Line symmetry:

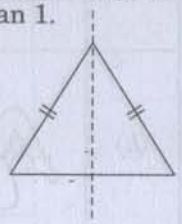


Rotational symmetry:

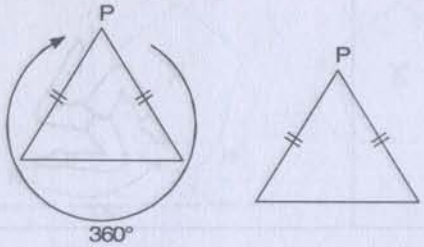


(*ii*) An isosceles triangle have only one line of symmetry and no rotational symmetry of order more than 1.

Line symmetry:



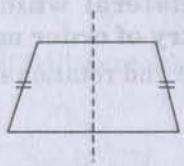
Rotational symmetry:



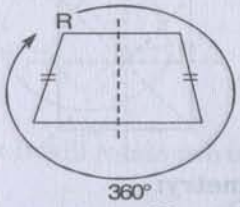
(*iii*) This case is not possible because order of rotational symmetry is more than 1 of a figure, must acertain the line of symmetry.

(*iv*) A trapezium which has equal non-parallel sides, a quadrilateral with line symmetry but not a rotational symmetry of order more than 1.

Line symmetry:



Rotational symmetry:



Q3. If a figure has two or more lines of symmetry, should it have rotational symmetry of order more than 1?

Sol. Yes, because every line through the centre forms a line of symmetry and it has rotational symmetry around the centre for every angle.

Q4. Fill in the blanks:

Sol.

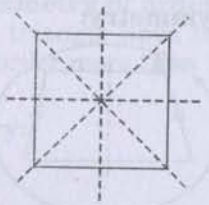
S.No.	Shape	Centre of Rotation	Order of Rotation	Angle of Rotation
1.	Square	Intersecting point of diagonals.	4	90°
2.	Rectangle	Intersecting point of diagonals.	2	180°
3.	Rhombus	Intersecting point of diagonals.	2	180°
4.	Equilateral triangle	Intersecting point of medians.	3	120°

5.	Regular hexagon	Intersecting point of diagonals.	6	60°
6.	Circle	Centre	infinite	at every point
7.	Semi-circle	Mid-point of diameter.	1	360°

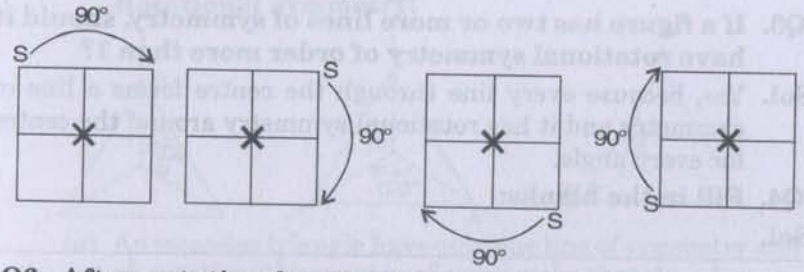
Q5. Name the quadrilateral which have both line and rotational symmetry of order more than 1.

Sol. Square has both line and rotational symmetry of order more than 1.

Line symmetry:



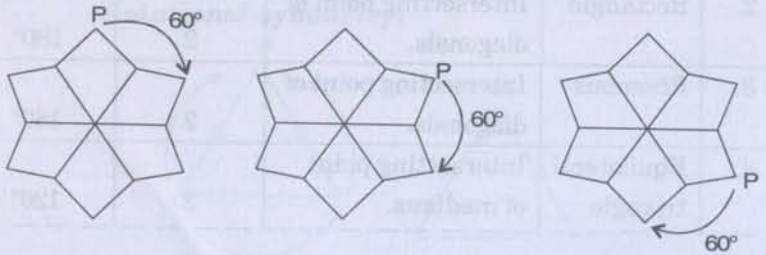
Rotational symmetry:

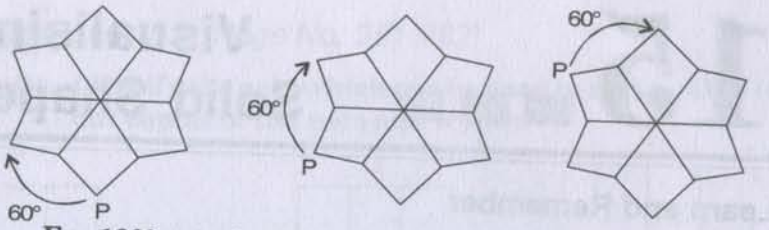


Q6. After rotating by 60° about a centre, a figure looks exactly the same as its original position. At what other angles will this happen for the figure?

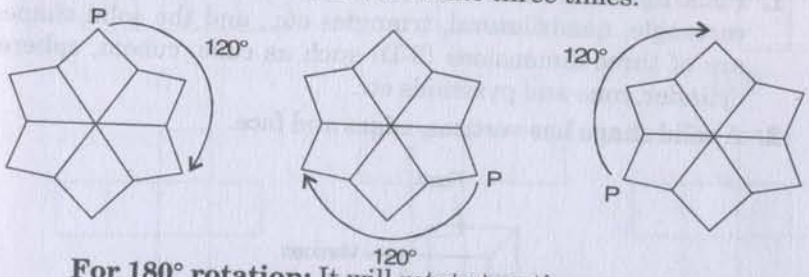
Sol. Other angles will be 120°, 180°, 240°, 300°, 360°

For 60° rotation: It will rotate six times.

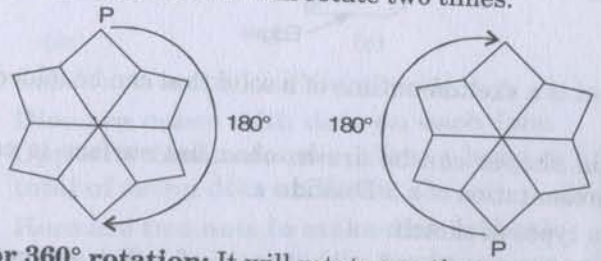




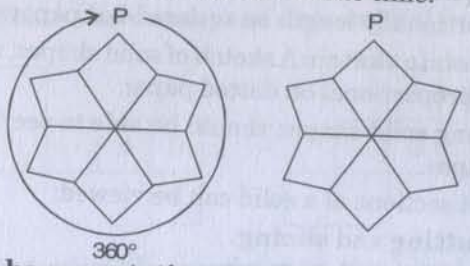
For 120° rotation: It will rotate three times.



For 180° rotation: It will rotate two times.



For 360° rotation: It will rotate one time.



Q7. Can we have a rotational symmetry of order more than 1 whose angle of rotation is

(*i*) 45°? **(*ii*) 17°?**

Sol. (*i*) If the angle of rotation is 45°, then symmetry of order is possible and would be 8 rotation.

(*ii*) If the angle of rotation is 17°, then symmetry of order is not possible because 360° is not completely divided by 17°.

❑❑