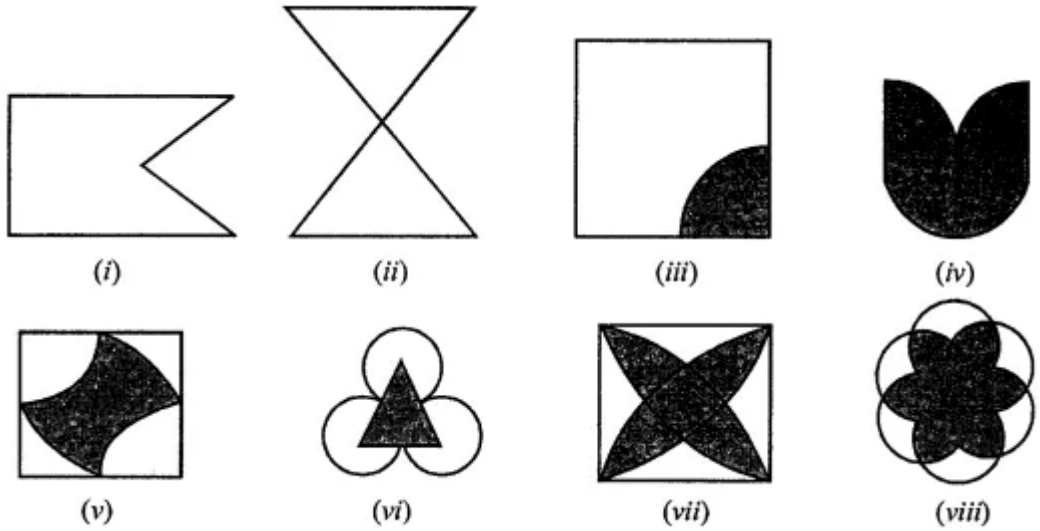
Chapter 14

Symmetry

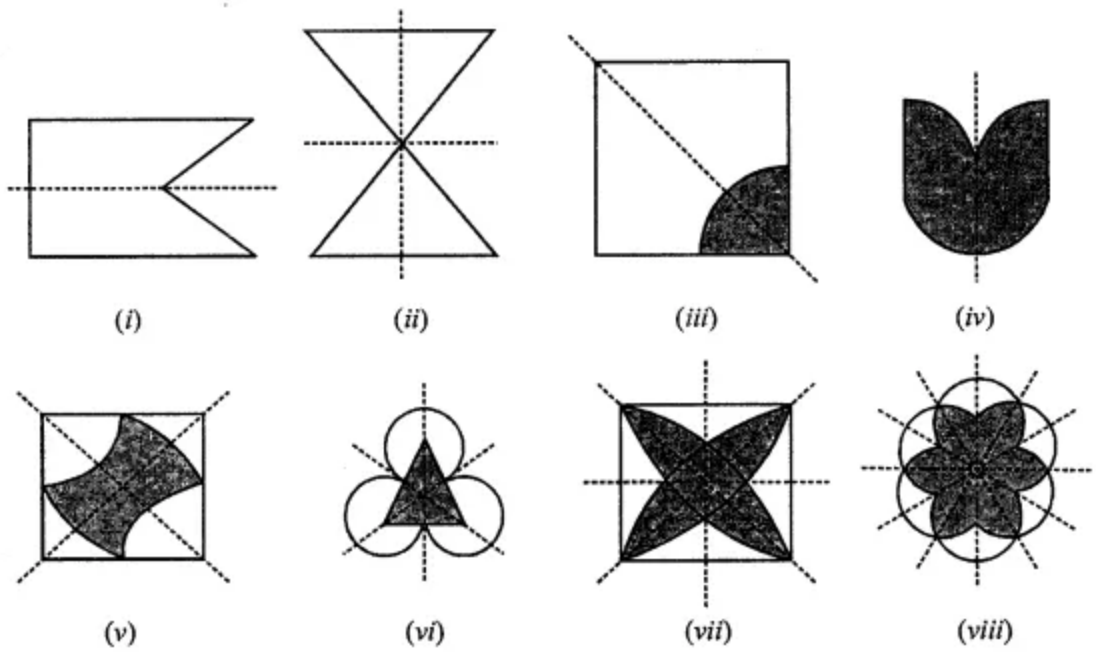
Exercise 14.1

Question 1.
Draw all lines of symmetry, if any, in each of the following figures:

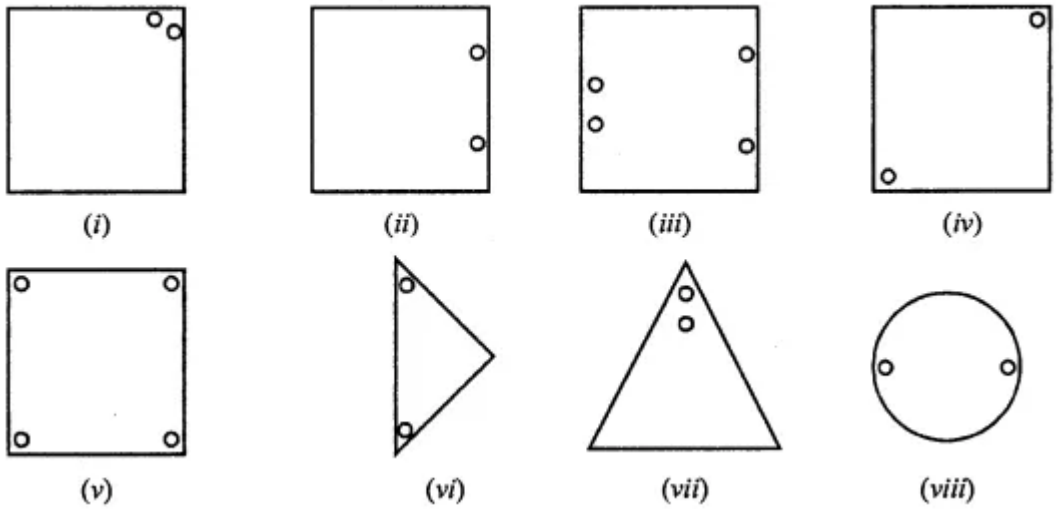


Solution:

The line/lines of symmetry have been drawn as given below:

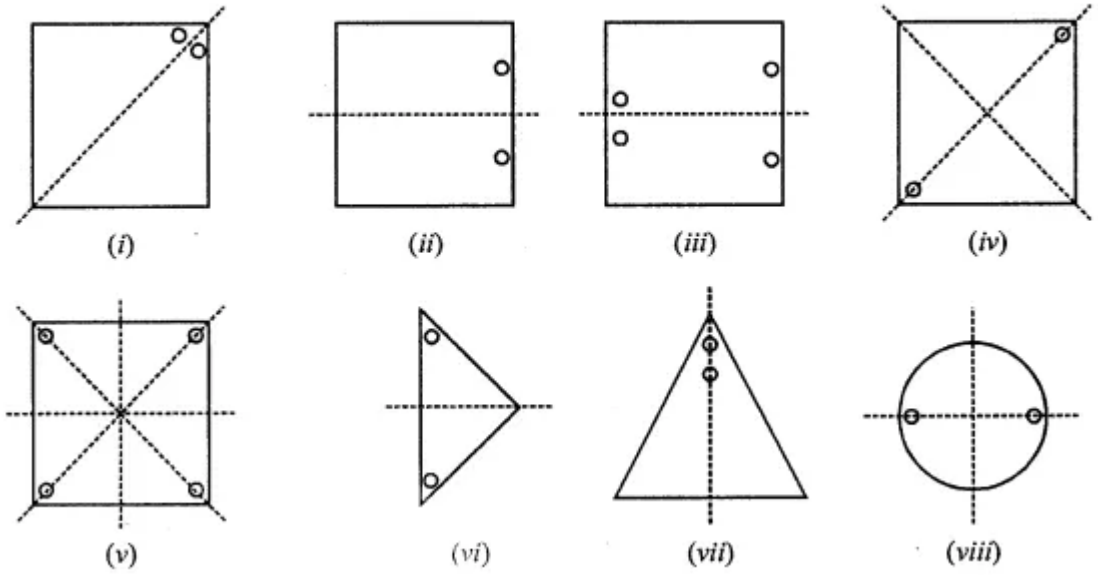


Question 2.
Copy the figures with a punched hole(s) and draw all the axes of symmetry in each of the following:

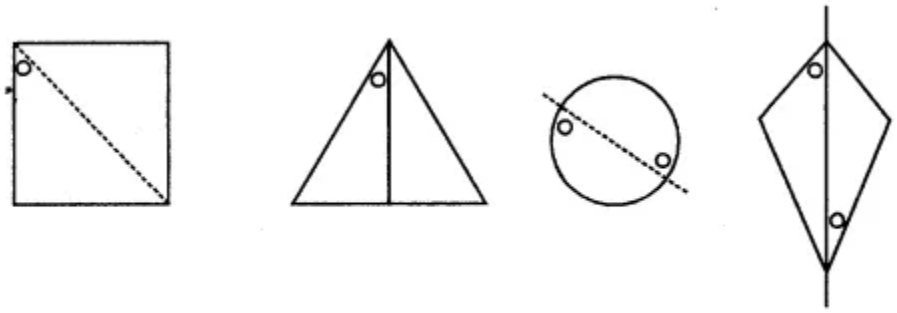


Solution:

The line/lines of symmetry have been drawn as given below:



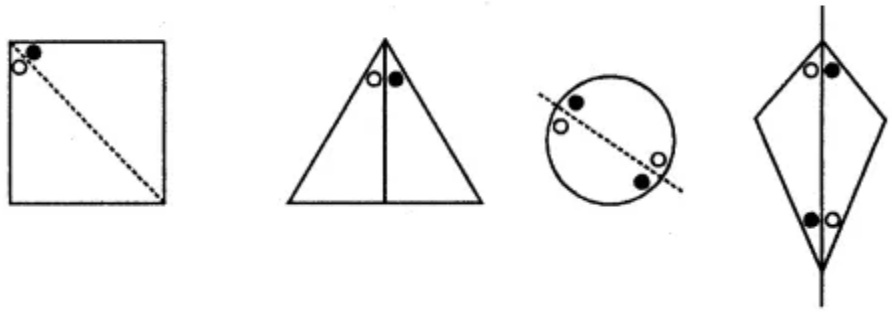
Question 3.
In the following figure, mark the missing hole(s) in order to make them symmetrical about the dotted line:



(*i*) (*ii*) (*iii*) (*iv*)

Solution:

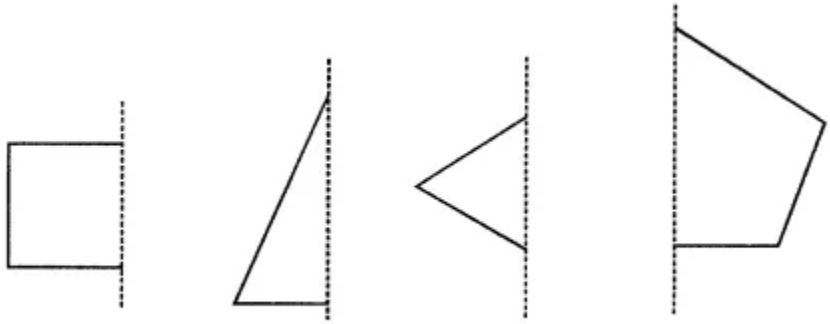
The lines of symmetry have been drawn and the required holes are marked by dark punches (small circles) as given below:



(*i*) (*ii*) (*iii*) (*iv*)

Question 4.

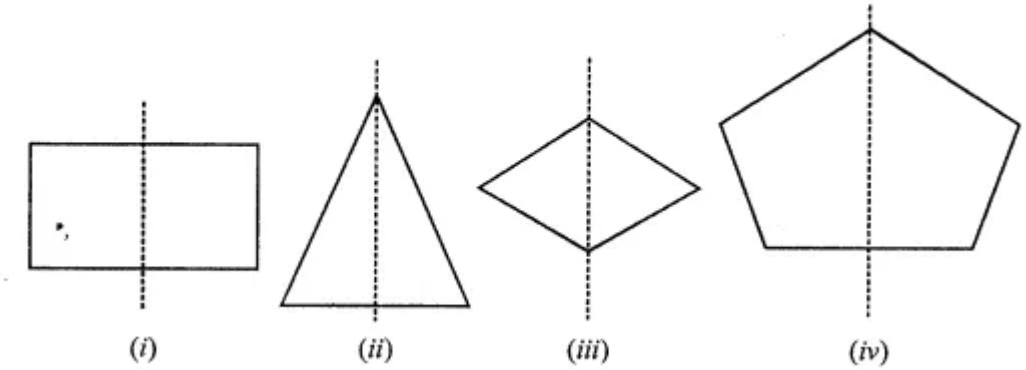
In the following figures, the mirror line (line of symmetry) is given as dotted line. Complete each figure by performing reflection in the mirror (dotted) line and name the figure you complete:



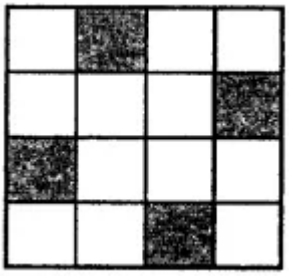
(*i*) (*ii*) (*iii*) (*iv*)

Solution:

Each figure is given, has been completed along with the mirror (dotted) line:

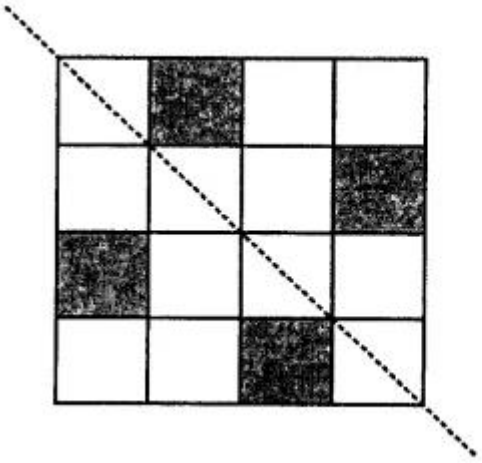


Question 5.
Copy the adjoining figure.
Take any one diagonal as a line of symmetry and shade a few more squares to make the figure symmetric about a diagonal. Is there more than one way to do that? Will the figure be symmetric about both the diagonals?

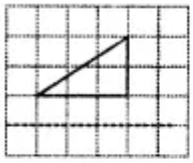


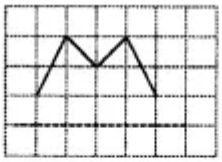
Solution:

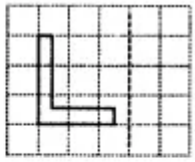
We get the same figure if we shade according to the
other diagonal as a line of symmetry.
Also, we get the same figure of we shade
by taking the line joining the mid-point of the opposite sides.
Yes, the figure is symmetrical about both diagonals.

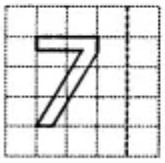


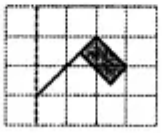
Question 6.
Draw the reflection of the following figures/letter in the given mirror line shown dotted:

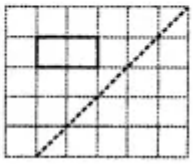

(*i*)


(*ii*)


(*iii*)

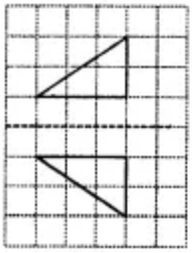

(*iv*)

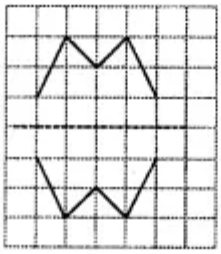

(*v*)

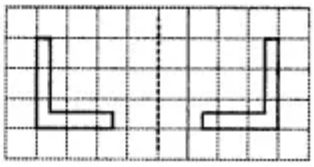

(*vi*)

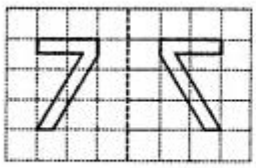
Solution:

The reflection of the given figure/letter in the given mirror line shown dotted have been drawn as given below:

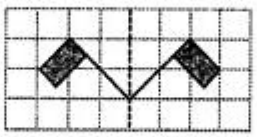

(*i*)


(*ii*)

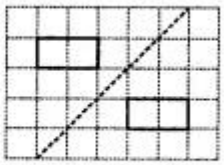

(*iii*)



(iv)



(v)



(vi)

Question 7.
What other names can you give to the line of symmetry of
(i) an isosceles triangle
(ii) rhombus
(iii) circle?
Solution:

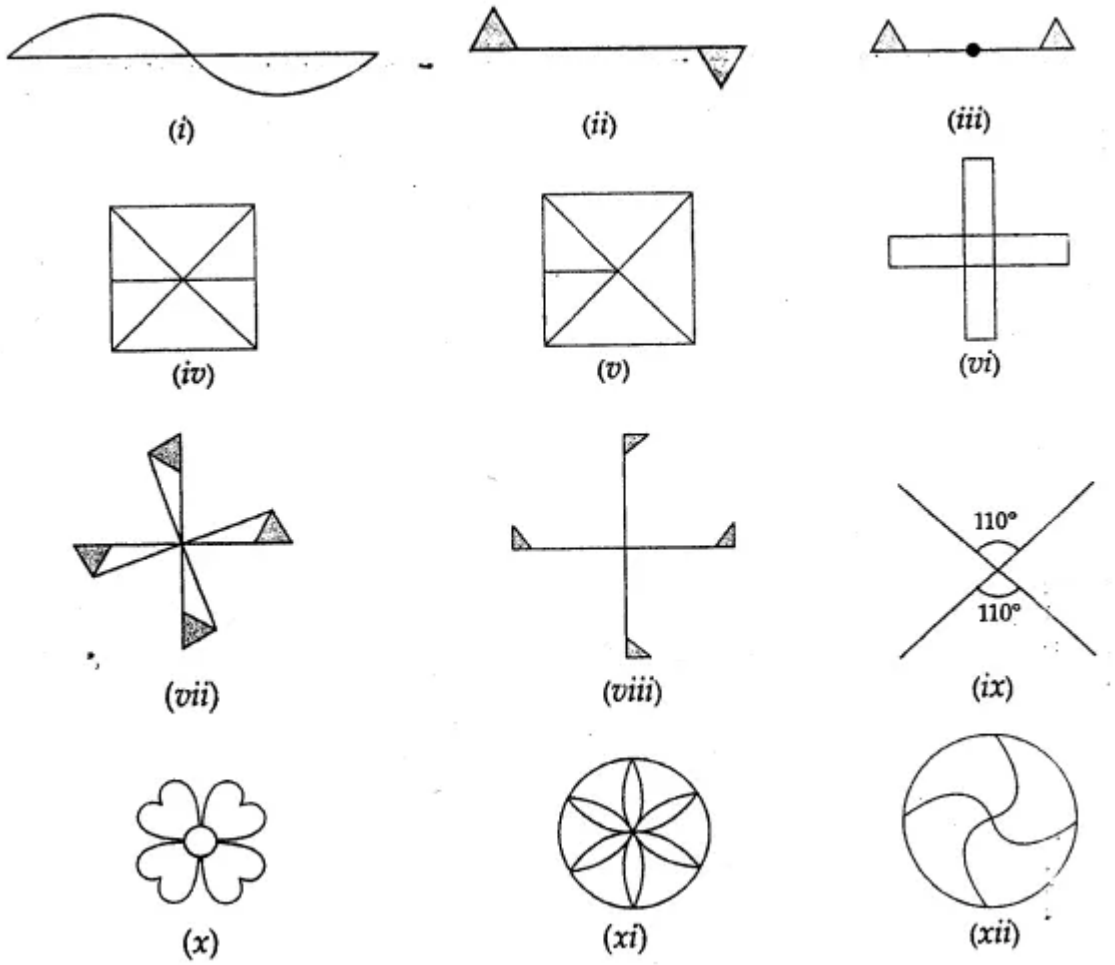
(i) An isosceles triangle: We can be called the line of symmetry as the angle bisector or median of the triangle.

(ii) Rhombus: The lines of symmetry of the rhombus are also called as the diagonals of the rhombus as they bisect each other at right angles.

(iii) Circle: The lines of symmetry of a circle are also called the diameters of the circle. As the diameter of a circle is infinite, so the lines of symmetry of a circle are also infinite.

Exercise 14.2

Question 1.
Which of the following figures have rotational symmetry? In the case of rotational symmetry, find the order of rotational symmetry.



Solution:

(i) In figure (i) the rotational symmetry is of order is 2.

(ii) In figure (ii) the rotational symmetry is of order 2.

(iii) In figure (iii) there is no rotational symmetry.

(iv) In figure (iv) the rotational symmetry is of order 2.

(v) In figure (v) there is no rotational symmetry.

(vi) In figure (vi) there is rotational symmetry of order 4.

(vii) In figure (vii) there is rotational symmetry of order 1.

(viii)In figure (viii) there is no rotational symmetry.

(ix) In figure (ix) there is rotational symmetry of order 2.

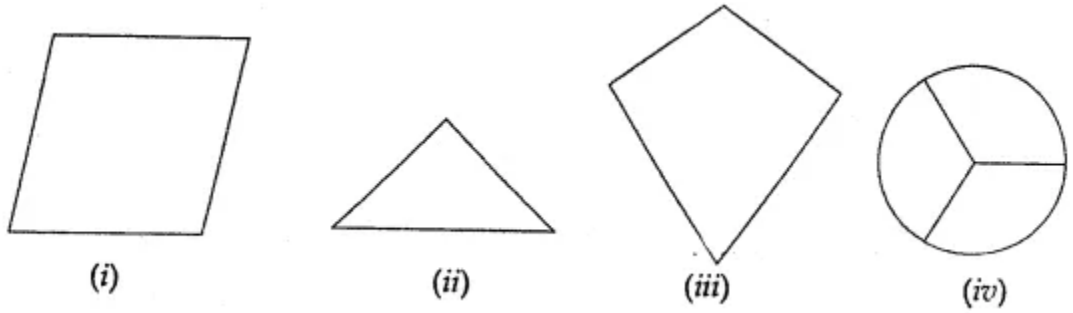
(x) In figure (x) there is rotational symmetry of order 4.

(xi) In figure (xi) there is rotational symmetry of order 6.

(xii) In figure (xii) there is rotational symmetry of order 4.

Question 2.

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



Solution:

From the given figure,

Figure (i) and (iv) i.e., rhombus and circle have

rotational symmetry more than order 1.

A rhombus has 2 and a circle has many.

Question 3.

Name any two figures that have both lines of symmetry and rotational symmetry.

Solution:

Rhombus and an equilateral triangle have

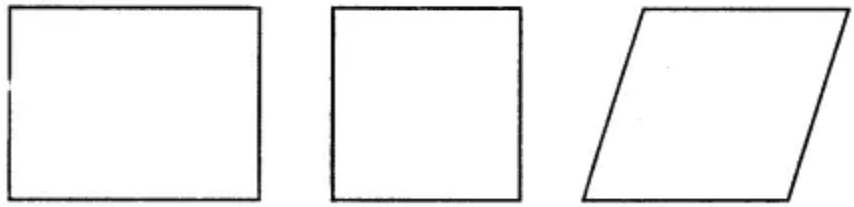
both line of symmetry and rotational symmetry.

Question 4.

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

Solution:

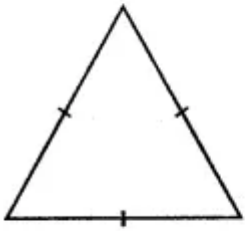
In a quadrilateral, rectangle, square and rhombus have both line of symmetry as well as rotational symmetry.



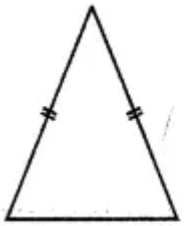
Rectangle Square Rhombus

Question 5.
Draw a rough sketch of:
(i) a triangle with both line and rotational symmetries of order more than 1.
(ii) a triangle with only one line of symmetry and no rotational symmetry of order more than 1.
(iii) a triangle with no line symmetry but rotational symmetry of order 1.
(iv) a quadrilateral with no line symmetry but rotational symmetry of order more than 1.
(v) a quadrilateral with line symmetry but not rotational symmetry of order more than 1.
Solution:

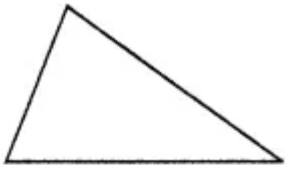
(i) A triangle with both line and rotational symmetry of order more than 1.
It is an equilateral triangle.



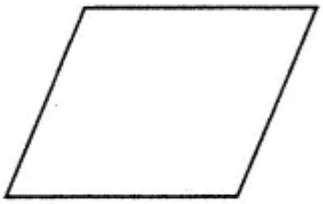
(ii) A triangle with only one line of symmetry but no rotational symmetry of order more than 1.
It is an isosceles triangle.



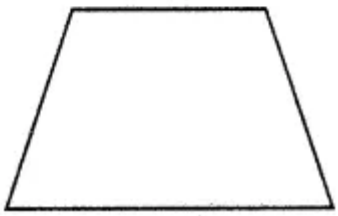
(iii) A triangle having no line symmetry
but rotational symmetry of order 1.
It is a scalene triangle.



(iv) A quadrilateral with no line symmetry
but rotational symmetry of order more than 1.
It is a parallelogram.



(v) A quadrilateral, with the line of symmetry
but not rotational symmetry of order more than 1.
It is an isosceles trapezium.



Question 6.
If a figure has two or more than two lines of symmetry, can it have rotational symmetry of order more than one?

Solution:

If it has two or more lines of symmetry, then,

yes, it can have rotational symmetry of order more than one.

A circle is its example.

Question 7.

A figure looks exactly the same as its original figure after rotation of 60°. At what other angles will this figure appear the same?

What can you say if the angle of rotation is

(i) 72°

(ii) 45°

(iii) 50°?

Solution:

A figure looks exactly the same as its original after rotation of 60°.

It will also like the same after rotation of 120°, 180°, 240°, 300°, and 360°.

(i) If the angle of rotation of symmetry is 72°

then it will look exactly the same after it rotates after 144°, 216°, 288°, 360°.

(ii) If the angle of rotation of symmetry is 45°,

then it will look exactly the same after 90°, 135°, 180°, 225°, 270°, 315°, and 360°.

(iii) If the angle of rotation is 50°, then it is not possible.

Question 8.

Can a figure possessing rotational symmetry have an angle of rotation of measure

(i) 180°

(ii) 120°

(iii) 90°

(iv) 30°

(v) 15°

(vi) 17°?

Solution:

(i) 180° : Yes, it can have as $\frac{360}{180}$ = 2°

(ii) 120° : Yes, it can have as $\frac{360}{120}$ = 3°

(iii) 90° : Yes, it can have as $\frac{360}{90}$ = 4°

(iv) 30° : Yes, it can have as $\frac{360}{30}$ = 12°

(v) 15° : Yes, it can have as $\frac{360}{15}$ = 24°

(vi) 17° : No, it cannot have as $\frac{360}{17}$ is not exactly divisible.

Objective Type Questions

Question 1.
Fill in the blanks:
(i) The hands of a clock rotate only in ..... direction.
(ii) While opening the cap of a bottle, the direction of rotation is .....
(iii) The number of lines of symmetry of an isosceles right-angled triangle is .....
(iv) A figure has ..... symmetry if it is its own image under a reflection.
(v) The centre of rotation of an equilateral triangle is the point of intersection of its .....
(vi) The centre of rotation of a rhombus is the point .....
(vii) A regular polygon of n-sides has ..... the number of lines of symmetry.
(viii) The angle of rotational symmetry in an equilateral triangle is .....
(ix) The angle of rotational symmetry in a regular pentagon is .....
(x) If after a rotation of 45° about a fixed point the figure looks exactly the same, then the order of rotational symmetry is .....
Solution:

(i) The hands of a clock rotate only in a clockwise direction.

(ii) While opening the cap of a bottle, the direction of rotation is anticlockwise.

(iii) The number of lines of symmetry of an isosceles right-angled triangle is one.

(iv) A figure has line symmetry if it is its own image under a reflection.

(v) The centre of rotation of an equilateral triangle is
the point of intersection of its medians/angle bisector/altitude.

(vi) The centre of rotation of a rhombus is the point intersection of its diagonals.

(vii) A regular polygon of n-sides has n number of lines of symmetry.

(viii) Angle of rotational symmetry in an equilateral triangle is $\frac{360}{3}$ = 120°.

(ix) Angle of rotational symmetry in a regular pentagon is $\frac{360}{5}$ = 72°.

(x) If after a rotation of 45° about a fixed point the figure looks exactly the same, then the order of rotational symmetry is $\frac{360}{45}$ = 8.

Question 2.
State whether the following statements are true (T) or false (F):
(i) The letter A has line symmetry but no rotational symmetry.
(ii) A rhombus is also a parallelogram and hence it does not have line symmetry.
(iii) A parallelogram has two lines of symmetry.
(iv) The order of rotational symmetry of a rhombus is four.
(v) A circle has exactly four lines of symmetry.
(vi) In a regular pentagon, the perpendicular bisector of the sides are the only lines of symmetry.
(vii) In a regular hexagon, the perpendicular bisector of the sides are the only lines of

symmetry.
(viii) In a rectangle, the angle of rotational symmetry is 90°.
(ix) A semicircle has rotational symmetry of order 2.
(x) An isosceles triangle has neither a line symmetry nor a rotational symmetry.
(xi) If a figure possesses a rotational symmetry, then it must look exactly the same atleast once up to a rotation of 180°.
(xii) The angle of rotation of a figure is obtained by dividing 360° by the order of rotational symmetry.
(xiii) A regular triangle has 3 lines of symmetry and rotational symmetry of order 3.
(xiv) A regular pentagon has 5 lines of symmetry and rotational symmetry of order 5.
Solution:

(i) The letter A has line symmetry but no rotational symmetry. (True)

(ii) A rhombus is also a parallelogram

and hence it does not have line symmetry. (False)

Correct:

As rhombus is a special type of ||gm which has all sides equal.

(iii) A parallelogram has two lines of symmetry. (False)

Correct:

It does not have any line of symmetry.

(iv) The order of rotational symmetry of a rhombus is four. (False)

Correct:

it has two order of rotational symmetry.

(v) A circle has exactly four lines of symmetry. (False)

Correct:

As a circle has infinite lines of symmetry.

(vi) In a regular pentagon,

the perpendicular bisector of the sides are the only lines of symmetry. (True)

(vii) In a regular hexagon,

the perpendicular bisector of the sides are the only lines of symmetry. (False)

Correct:

Its diagonals are also the lines of symmetry.

(viii)In a rectangle, the angle of rotational symmetry is 90°. (False)

Correct:

Its angles are 180°

(ix) A semicircle has rotational symmetry of order 2. (False)

Correct:

It has no order of rotational symmetry.

(x) An isosceles triangle has neither a line symmetry

nor a rotational symmetry. (False)

Correct:

It has one line of symmetry but no rotational symmetry.

(xi) If a figure possesses a rotational symmetry,

then it must look exactly the same at least once up to a rotation of 180°. (True)

(xii) The angle of rotation of a figure is obtained

by dividing 360° by the order of rotational symmetry. (True)

(xiii) A regular triangle has 3 lines of symmetry

and rotational symmetry of order 3. (True)

(xiv) A regular pentagon has 5 lines of symmetry

and rotational symmetry of order 5. (True)

Multiple Choice Questions

Choose the correct answer from the given four options (3 to 14):

Question 3.

A quadrilateral having four lines of symmetry is a

(a) parallelogram

(b) rectangle

(c) rhombus

(d) square

Solution:

A quadrilateral having four lines of symmetry is a square. (d)

Question 4.

The letter Z has

(a) one horizontal line of symmetry

(b) one vertical line of symmetry

(c) two lines of symmetry
(d) no line of symmetry
Solution:

The letter Z has no line of symmetry. (d)

Question 5.
A figure that does not have any rotational symmetry is
(a) circle
(b) parallelogram
(c) kite
(d) regular pentagon
Solution:

A figure that does not have any rotational symmetry is a kite. (c)

Question 6.
The number of lines of symmetry in the given figure is
(a) 1
(b) 3
(c) 6
(d) infinitely many

Solution:

The number of lines of symmetry in the given figure is 3. (b)

Question 7.
Rotating a figure by 60° anticlockwise is equivalent to a clockwise rotation of
(a) 60°
(b) 120°
(c) 240°
(d) 300°
Solution:

Rotating a figure by 60° anti-clockwise is equivalent
to a clockwise rotation of 360° − 60° = 300° (d)

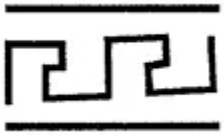
Question 8.
A figure having 1 line of symmetry and whose order of rotational symmetry is also 1 is
(a) rhombus
(b) parallelogram
(c) kite
(d) scalene triangle
Solution:

A figure having 1 line of symmetry and whose order of rotational symmetry is also 1 is a kite. (c)

Question 9.
The order of rotational symmetry of a line segment is
(a) 1
(b) 2
(c) 3
(d) 4
Solution:

The order of rotational symmetry of a line segment is 2. (b)

Question 10.
The order of the rotational symmetry in the given figure is
(a) 1
(b) 2
(c) 4
(d) infinitely many



Solution:

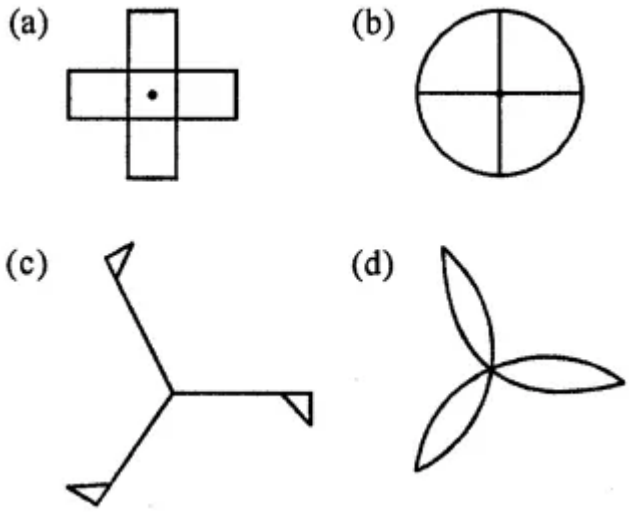
The order of the rotational symmetry in the given figure is 2. (b)

Question 11.
A possible angle of rotation of a figure having rotational symmetry of order greater than 1 is
(a) 36°
(b) 144°
(c) 150°
(d) 360°

Solution:

A possible angle of rotation of a figure having rotational symmetry of order greater than 1 is 360°. (d)

Question 12.
The figure which does not have both reflection and rotational symmetry is



Solution:

The figure which does not have both reflection and rotational symmetry is (c). (c)

Question 13.
In the word 'MATHS' which of the following pairs of letters have rotational symmetry?
(a) M and T
(b) A and S
(c) T and S
(d) H and S
Solution:

The word 'MATHS' which of the following pairs of letters have rotational symmetry H and S. (d)

Question 14.
The letter which has both reflection and rotational symmetry is
(a) H
(b) M
(c) S
(d) Y

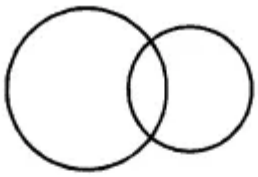
Solution:

The letter which has both reflection and rotational symmetry is H. (a)

Check Your Progress

Question 1.
Draw the line (or lines) of symmetry, if any of the following shapes and count their number.

(*i*)

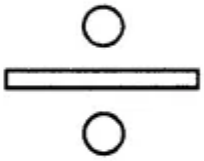


(*ii*)

(*iii*)

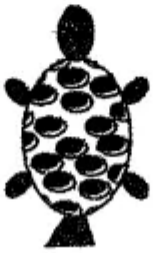
(*iv*)

(*v*)



(*vi*)

(*vii*)

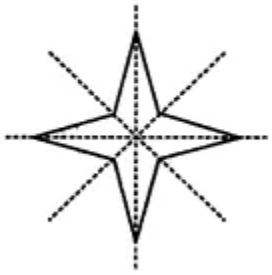


(*viii*)

(*ix*)

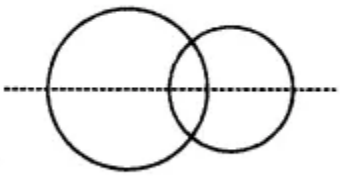
Solution:

Four



(*i*)

One

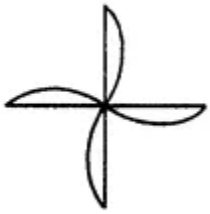


(*ii*)

None

(*iii*)

None

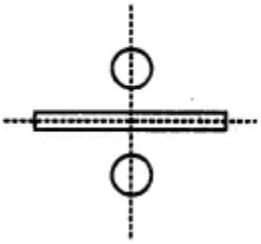


(*iv*)

None

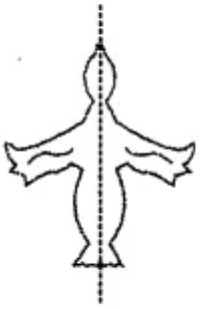
(*v*)

Two



(*vi*)

One



(*vii*)

One

(*viii*)

One

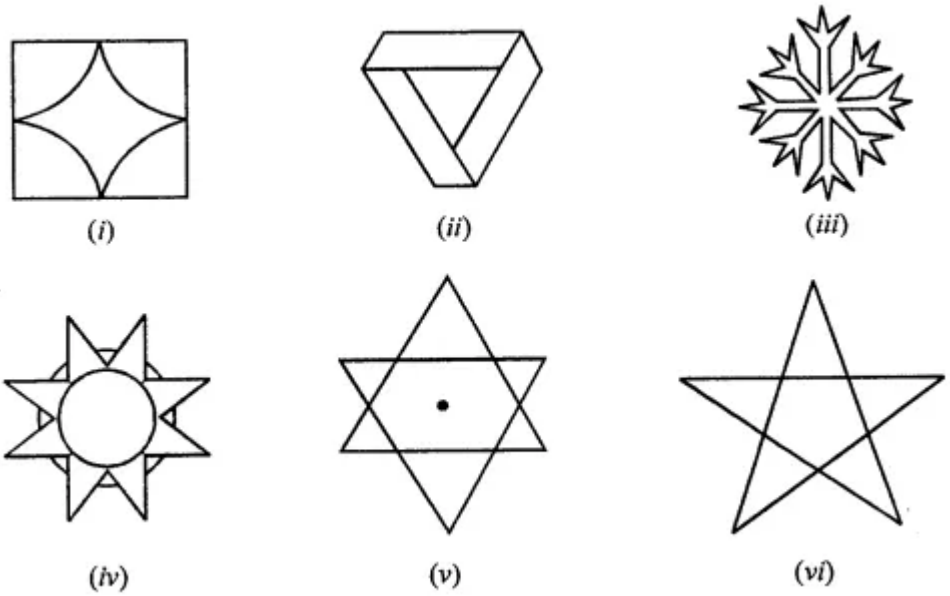
(*ix*).

Question 2.
For each of the given shape in Question 1, find the order of the rotational symmetry (If any).

Solution:

(i) 4
(ii) 1
(iii) 2
(iv) 4
(v) 5
(vi) 2
(vii) 1
(viii) 1
(ix) 1

Question 3.
Give the order of rotational symmetry of each of the following figures:



Solution:

(i) 4
(ii) 3
(iii) 8
(iv) 8
(v) 2
(vi) 5