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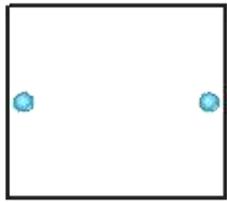
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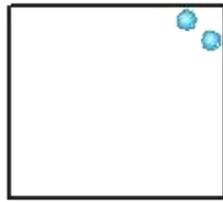
## Chapter 14: Symmetry

### Exercise 14.1 (Page 268)

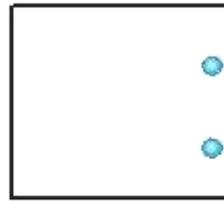
**Q1.** Copy the figures with punched holes and find the axes of symmetry for the following:



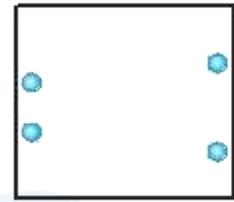
(a)



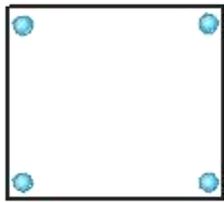
(b)



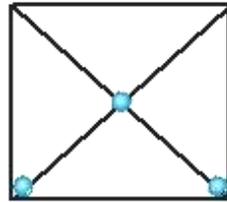
(c)



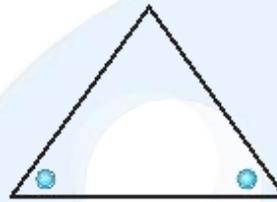
(d)



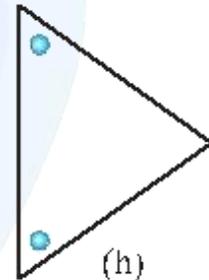
(e)



(f)



(g)



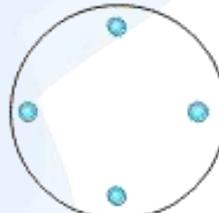
(h)



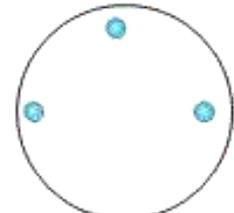
(i)



(j)



(k)



(l)

**Difficulty Level: Easy**

**What is given /known:**

The figure with punched holes.

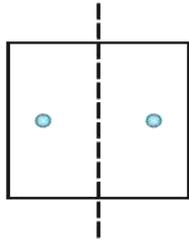
**What is unknown:**

The axis of symmetry.

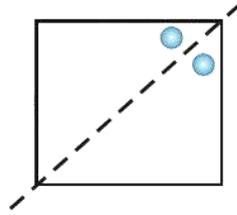
**How can you use the known information to arrive at the solution?**

This question is very simple. You have to draw different lines and check which line will divide it into exactly same parts, that line will be called the line of symmetry.

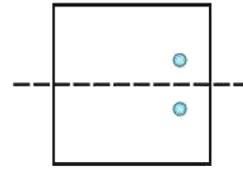
**Solution:**



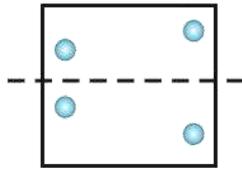
(a)



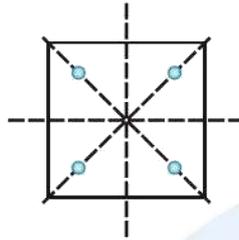
(b)



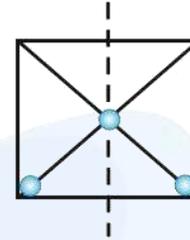
(c)



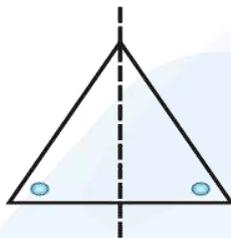
(d)



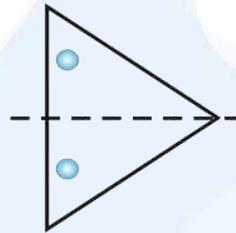
(e)



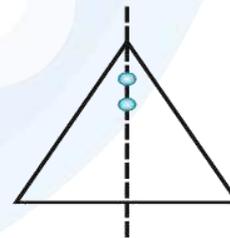
(f)



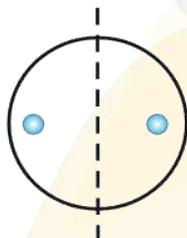
(g)



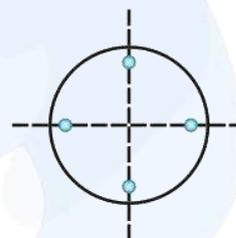
(h)



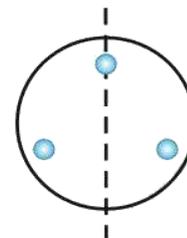
(i)



(j)



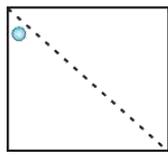
(k)



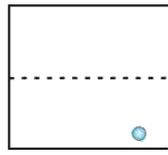
(l)

- (a) It has one line of symmetry
- (b) It has one line of symmetry
- (c) It has one line of symmetry
- (d) It has one line of symmetry
- (e) It has four lines of symmetry
- (f) It has one line of symmetry
- (g) It has one line of symmetry
- (h) It has one line of symmetry
- (i) It has one line of symmetry
- (j) It has one line of symmetry
- (k) It has two lines of symmetry
- (l) It has one line of symmetry

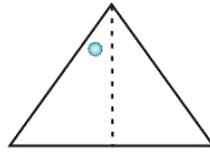
**Q2.** Given the line(s) of symmetry, find the other hole(s):



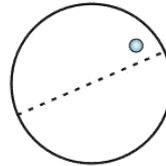
(a)



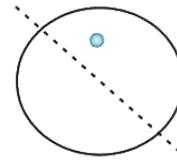
(b)



(c)



(d)



(e)

**Difficulty Level: Easy**

**What is given /known:**

The line of symmetry and the one whole

**What is unknown:**

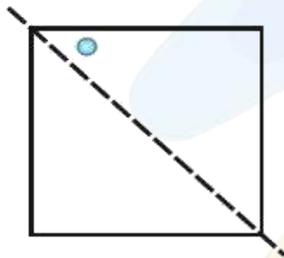
The other hole.

**Reasoning:**

In this question a line of symmetry and a hole is given, you have to find the other hole.

The other hole should be at that place such that if it is divided by any line of symmetry, it will divide it in equal parts.

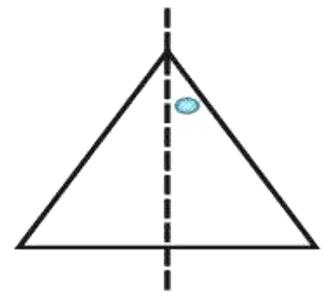
**Solution:**



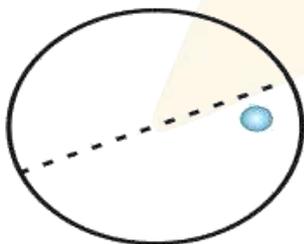
(a)



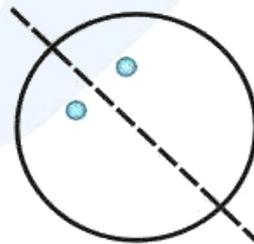
(b)



(c)

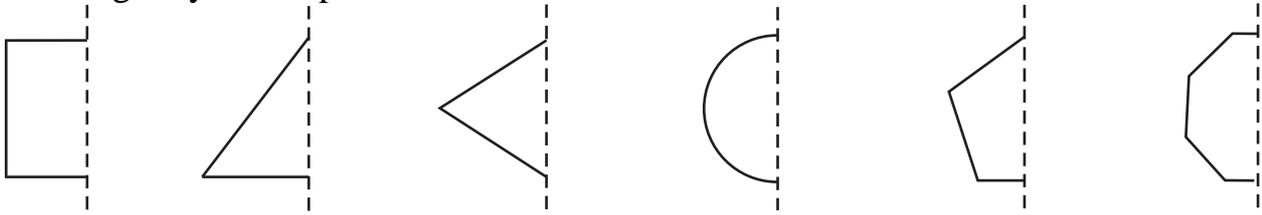


(d)



(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 Q 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?



**Difficulty Level: Moderate**

**What is known:**

The mirror line (i.e. the line of symmetry) is given as a dotted line.

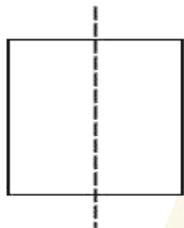
**What is unknown:**

Complete each figure performing reflection in the dotted (mirror) line and also recall the name of the figure you complete.

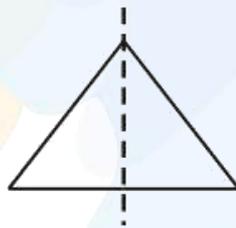
**Reasoning:**

In this question you have to complete the figure, performing reflection in the dotted (mirror) line. To solve this question, you might perhaps place a mirror along the dotted line and look into the mirror for the image. By doing this you can get the hint which figure is formed and how to complete it.

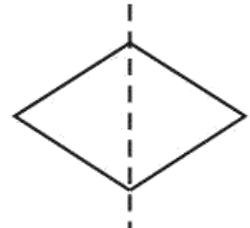
**Solution:**



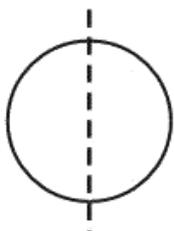
(a) Square



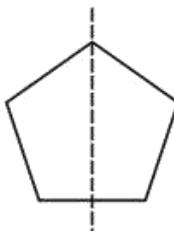
(b) Triangle



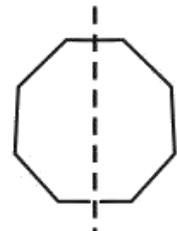
(c) Rhombus



(d) Circle



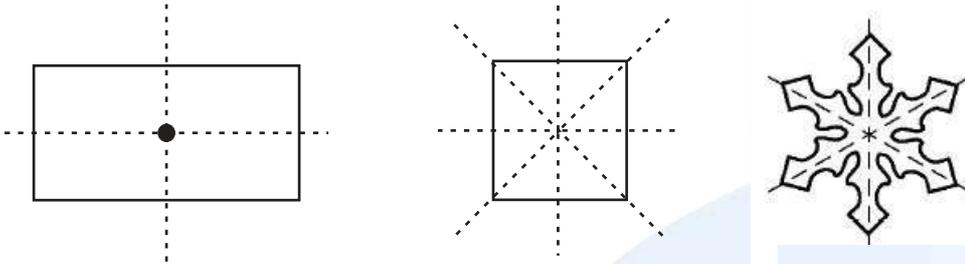
(e) Pentagon



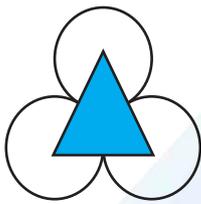
(f) Octagon

- (a) The shape formed is a square.
- (b) The shape formed is a triangle.
- (c) The shape formed is a rhombus.
- (d) The shape formed is a circle.
- (e) The shape formed is a pentagon.
- (f) The shape formed is an octagon.

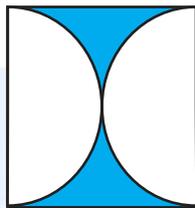
**Q4.** The following figures have more than one line of symmetry. Such figures are said to have multiple lines of symmetry.



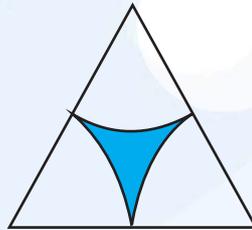
Identify multiple lines of symmetry, if any, in each of the following figures:



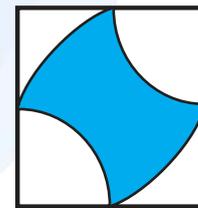
(a)



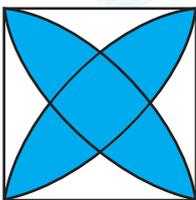
(b)



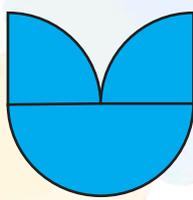
(c)



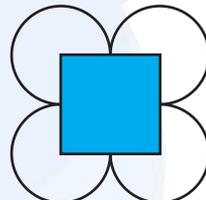
(d)



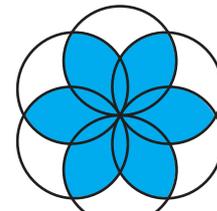
(e)



(f)



(g)



(h)

**Difficulty Level: Moderate**

**What is given/known:**

Different figures.

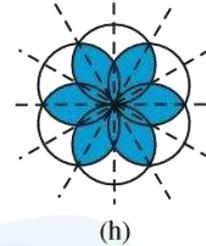
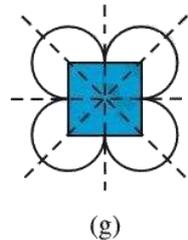
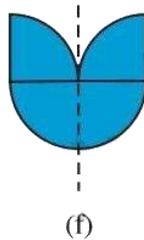
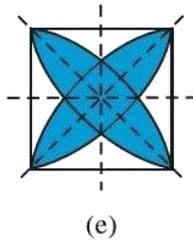
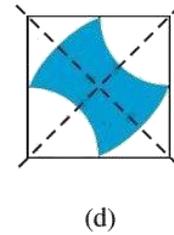
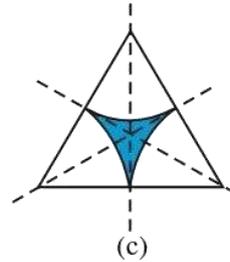
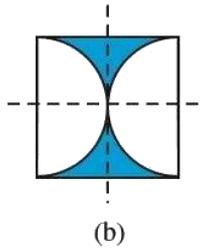
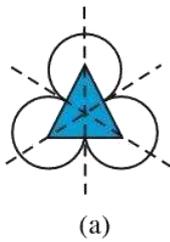
**What is unknown:**

Multiple lines of symmetry.

**Reasoning:**

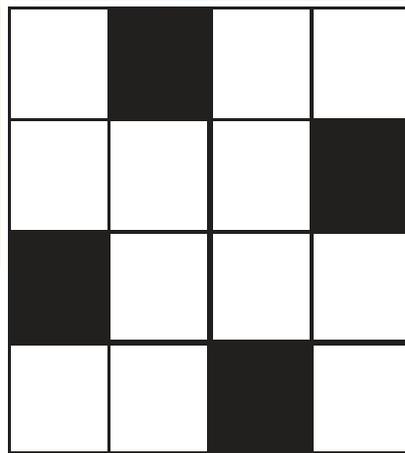
In this question you have to identify multiple of lines of symmetry. For this cut the figure by using different lines, the line which cuts the figure in two same parts are called lines of symmetry and a figure has more than one line of symmetry then we can say that it has multiple lines of symmetry.

**Solution:**



- (a) It has three lines of symmetry
- (b) It has two lines of symmetry
- (c) It has three line of symmetry
- (d) It has two line of symmetry
- (e) It has four lines of symmetry
- (f) It has one line of symmetry
- (g) It has four lines of symmetry
- (h) It has six lines of symmetry

**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 and diagonal. Is there more than one way to do that? Will the figure be symmetric about both the diagonals?



**Difficulty level: Easy**

**What is known:**

A figure with some part shaded.

**What is unknown:**

To make the given figure symmetric and diagonal.

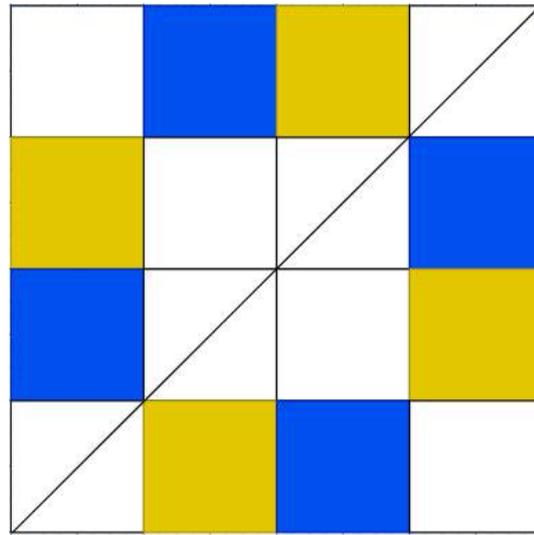
Is there more than one way to do that?

Will the figure be symmetric about both the diagonals?

**Reasoning:**

Take any one diagonal as a line of symmetry and shade a few more squares to make the figure symmetric and diagonal.

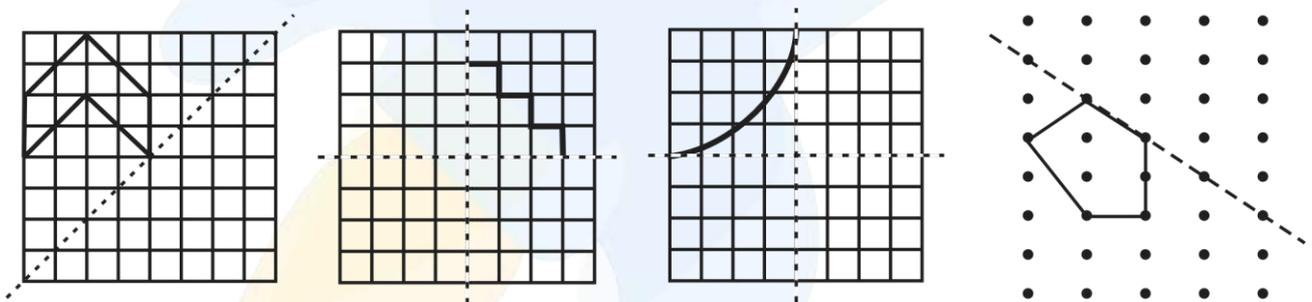
**Solution:**



Yes, the figure has more than one line of symmetry.

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

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



**Difficulty Level: Moderate**

**What is known**

The mirror line (i.e. the line of symmetry) is given as a dotted line.

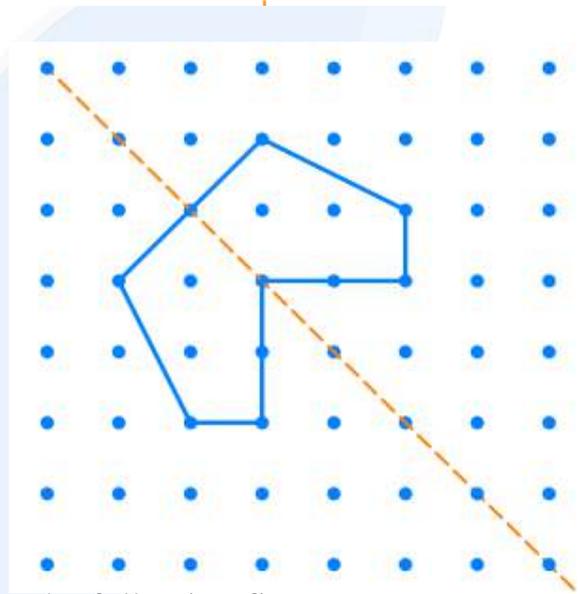
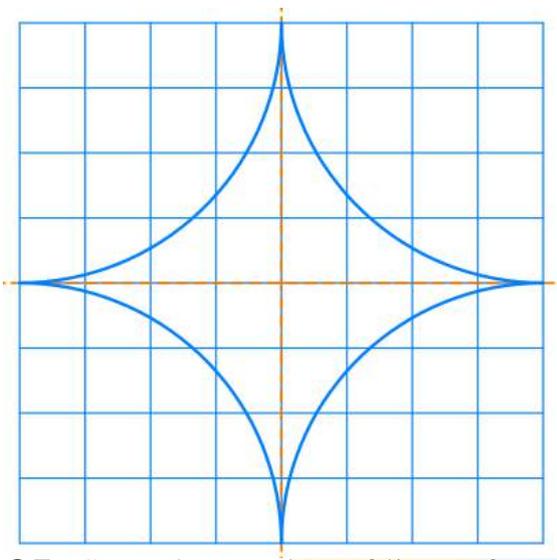
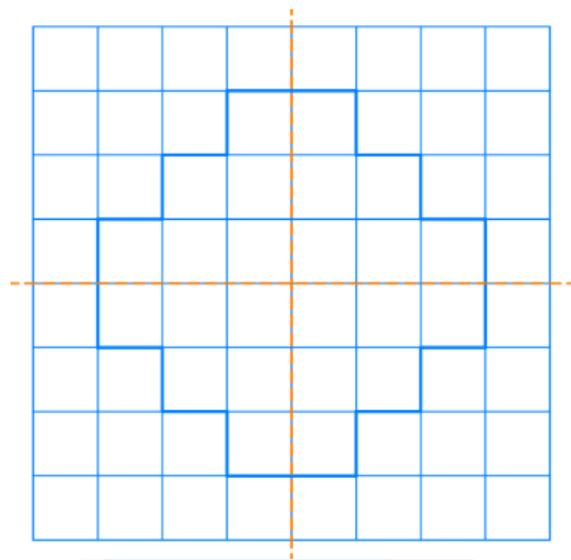
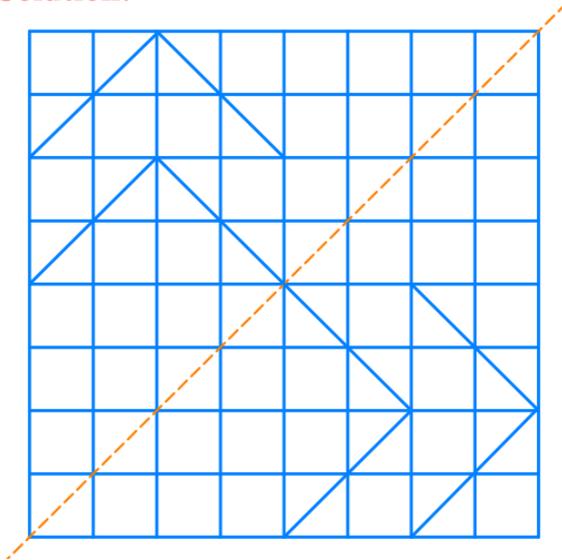
**What is unknown**

Complete each figure performing reflection in the dotted line.

**Reasoning:**

In this question you have to complete the figure, performing reflection in the dotted (mirror) line. To solve this question, you might perhaps place a mirror along the dotted line and look into the mirror for the image. By doing this you can get the hint which figure is formed and how to complete it.

**Solution:**



**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              |

**Difficulty Level: Easy**

**What is given /known**

Different figures.

**What is unknown**

The number of lines of symmetry for the given figures.

**Reasoning**

This question is very simple. You have to draw different lines and check which line will divide it into exactly same parts, that line will be called the line of symmetry.

**Solution:**

- (a) It has three lines of symmetry.
- (b) It has one line of symmetry.
- (c) It has no line of symmetry.
- (d) It has four lines of symmetry.
- (e) It has two lines of symmetry.
- (f) It has two lines of symmetry.
- (g) It has no line of symmetry.
- (h) It has no line of symmetry.
- (i) It has six lines of symmetry.
- (j) It has infinitely many lines of symmetry

**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.

**Difficulty Level: Easy****What is known:**

English alphabets.

**What is unknown**

Letters of the English alphabet that have reflectional symmetry

**Reasoning:**

In this question you have to find out letters of the English alphabet have reflectional symmetry. In reflectional symmetry one half is the reflection of the other half. That is, a figure which does not change upon undergoing a reflection has reflectional symmetry. Remember this concept and find out the letters of English alphabets with reflectional symmetry.

**Solution:**

- (a) A,H,I,M,O,T,U,V,W,X,Y
- (b) B,C,D,E,H,I,O,X
- (c) O,X,I,H

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

**Difficulty level: Easy****What is unknown:**

Any three shapes with no line of symmetry.

**Solution:**

A quadrilateral, scalene triangle and a parallelogram.

**Q10.** What other name can you give to the line of symmetry of –  
(a) an isosceles triangle?                      (b) a circle?

**Difficulty Level:** Easy

**What is given /known**

Name of the shapes

**What is unknown**

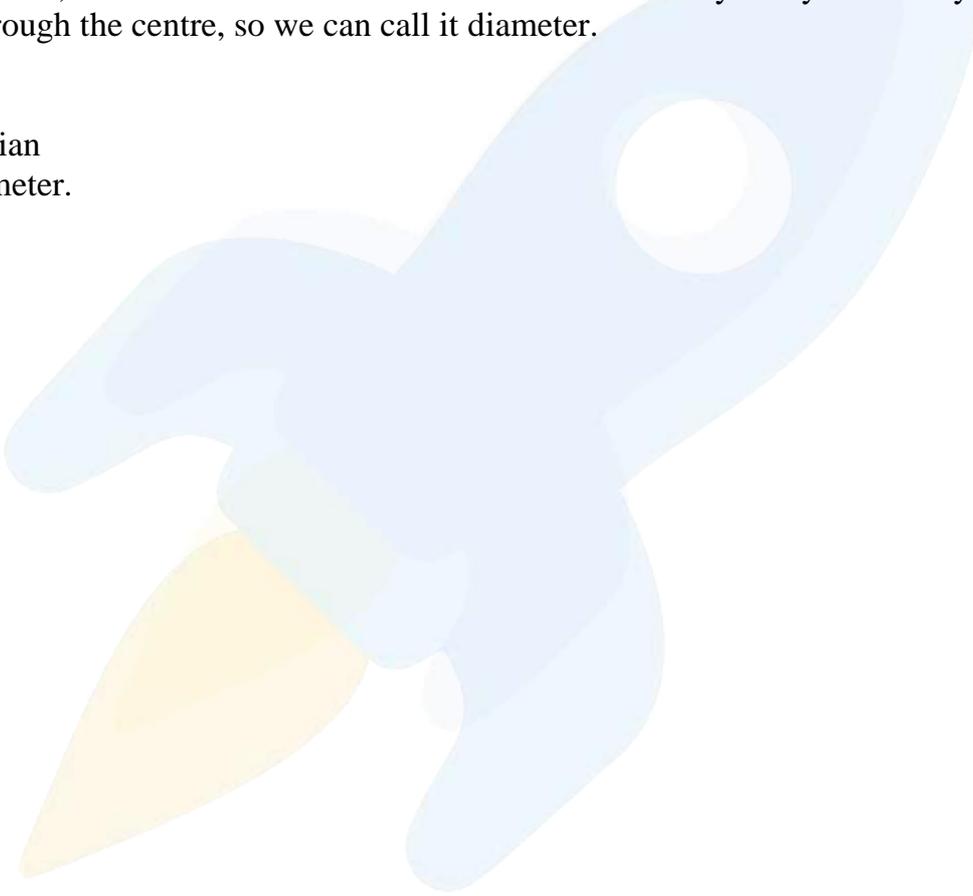
Another name can you give to the line of symmetry of an isosceles triangle & a circle.

**Reasoning:**

As it is given in the question, you have to find out the other name for lines of symmetry of an isosceles triangle and a circle. We know that an isosceles triangle has one line of symmetry and this is a line segment joining a vertex to the midpoint of the opposing side, bisecting it. So, we can call it median and a circle has infinitely many lines of symmetry passing through the centre, so we can call it diameter.

**Solution:**

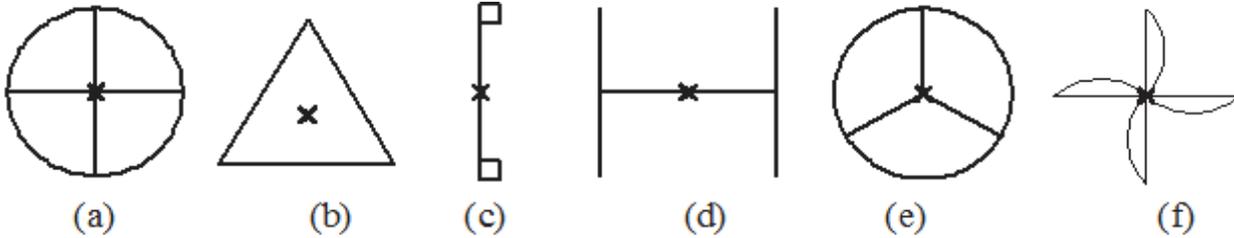
- (a) Median
- (b) Diameter.



## Chapter 14: Symmetry

### Exercise 14.2 (Page 274)

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



**Difficulty Level:** Easy

**What is given /known**

Figures

**What is unknown**

The figures have rotational symmetry of order more than 1.

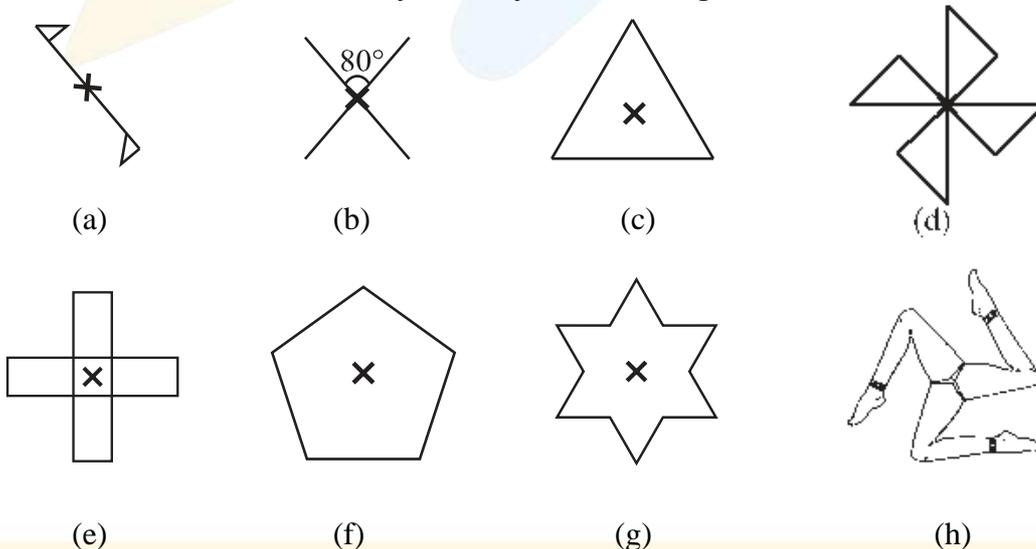
**Reasoning:**

To solve this question, remember the concept of rotational symmetry. Rotational symmetry is when an object is rotated around a centre point (turned) a number of degrees and the object appears the same. The order of symmetry is the number of positions the object looks the same in a  $360^\circ$  rotation.

**Solution:**

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

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



**Difficulty Level: Easy**

**What is given /known**

Figures.

**What is unknown**

The order of rotational symmetry

**Reasoning:**

To solve this question, remember the concept of rotational symmetry. Rotational symmetry is when an object is rotated around a centre point (turned) a number of degrees and the object appears the same. The order of symmetry is the number of positions the object looks the same in a  $360^\circ$  rotation.

**Solution:**

<b>Figure</b>	<b>Order of rotational symmetry</b>
a	2
b	2
c	3
d	4
e	4
f	5
g	6
h	3

## Chapter 14: Symmetry

### Exercise 14.3 (Page 275)

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

**Difficulty Level: Low**

#### What is unknown

The figures that have both line symmetry and rotational symmetry.

#### Reasoning:

To solve this question, remember the concept of line symmetry and rotational symmetry. The 'Line of Symmetry' is the imaginary line where you could fold the image and have both halves match exactly. Rotational symmetry is when an object is rotated around a centre point (turned) a number of degrees and the object appears the same. The order of symmetry is the number of positions the object looks the same in a  $360^\circ$  rotation.

#### Solution:

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 rotational symmetry of order more than 1.

**Difficulty Level: Low**

#### What is unknown

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 rotational symmetry of order more than 1.

#### Reasoning

To solve this question, remember the concept of rotational symmetry. Rotational symmetry is when an object is rotated around a centre point (turned) a number of degrees and the object appears the same. The order of symmetry is the number of positions the object looks the same in a  $360^\circ$  rotation.

**Solution:**

- (i) An equilateral triangle has both line and rotational symmetry of order more than 1.
- (ii) An isosceles triangle has only one- line symmetry and no rotational symmetry of order more than 1.
- (iii) Parallelogram has two order of rotational symmetry but no line of symmetry.
- (iv) A kite is a quadrilateral which has only one line of symmetry but not rotational symmetry of order more than 1.

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

**Difficulty Level: Easy**

**What is unknown**

The figures have rotational symmetry of order more than 1.

**Reasoning**

Rotational symmetry is when an object is rotated around a centre point (turned) a number of degrees and the object appears the same. The order of symmetry is the number of positions the object looks the same in a  $360^\circ$  rotation.

**Solution:**

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 – Shape; Centre of Rotation; Order of Rotation; Angle of Rotation; for each of the figures respectively.

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

**Difficulty level: Medium**

**What is known:**

Shapes

**What is unknown:**

Centre of rotation, order of rotation and angle of rotation.

### Reasoning:

**Centre of rotation:** In case of polygon centre of rotation is intersecting point of diagonals and in case of circle centre of rotation is centre of the circle.

**Order of rotation:** In case of regular polygon order of rotation is always equals to the number of sides and in case of circle order of rotation is infinite.

**Angle of rotation:** In case of regular polygon angle of rotation is always equals to the measurement of one angle and in case of circle angle of rotation is at every point.

### Solution:

Shape	Centre of Rotation	Order of Rotation	Angle of Rotation
Square	Intersecting points of diagonals	4	$90^\circ$
Rectangle	Intersecting points of diagonals	2	$180^\circ$
Rhombus	Intersecting points of diagonals	2	$180^\circ$
Equilateral triangle	Intersecting points of medians	3	$120^\circ$
Regular Hexagon	Intersecting points of diagonals	6	$60^\circ$
Circle	Mid- point of diameter	Infinite	At every point
Semi-circle	Mid- point of diameter	1	$360^\circ$

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

**Difficulty Level:** Low

**What is given /known**

Figures

**What is unknown**

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

**Reasoning:**

To solve this question, you have to use the concept of line symmetry and rotational symmetry. The 'Line of Symmetry' is the imaginary line where you could fold the image and have both halves match exactly. Rotational symmetry is when an object is rotated around a centre point (turned) a number of degrees and the object appears the same. The order of symmetry is the number of positions the object looks the same in a  $360^\circ$  rotation.

**Solution:**

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

**Q6.** After rotating by  $60^\circ$  about a centre, a figure looks the same as its original position. At what other angles will this happen for the figure?

**Difficulty level: Medium**

**What is known:**

Angle of rotation  $60^\circ$

**What is unknown:**

At what other angles the figure looks the same as its original.

**Reasoning:**

If a figure looks same as the original on one angle, then it will look same as original on all multiple of that angle.

**Solution:**

If figure looks the same as its original position by rotating at an angle of  $60^\circ$  it will also look same by rotating at angle of  $120^\circ$ ,  $180^\circ$ ,  $240^\circ$ ,  $300^\circ$ ,  $360^\circ$  as these are its multiples.

**Q7.** Can we have a rotational symmetry of order more than 1 whose angle of rotation is – (i)  $45^\circ$  (ii)  $17^\circ$

**Difficulty Level: Low**

**What is known:**

Angle of rotations

**What is unknown**

The figures have rotational symmetry of order more than 1 with the angles  $45^\circ$  and  $17^\circ$

**Reasoning**

If the given angle is a factor of  $360^\circ$ , then the figure will have rotational symmetry of order more than one otherwise not.

**Solution:**

(i)  $45^\circ$  is a factor of  $360^\circ$ , so the figure will have a rotational symmetry of order more than 1 and there would be 8 rotations.

(ii)  $17^\circ$  is not a factor of  $360^\circ$ , so the figure will not have a rotational symmetry of order more than 1.

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