Symmetry

12.1 Introduction

Sirisha was getting ready. She noticed something interesting written on her T-shirt.

Of the three words written on her T-shirt "THE WOW FACTOR", only "WOW" was looking the same in the mirror.

She then took out same old alphabet cards and started checking to find which alphabet remained the same in their mirror image.

Sirisha started playing with mirror. She kept the mirror along different letters and saw their reflection.

Do This

Match each letter with its mirror image. The dotted line with every letter shows the mirror.

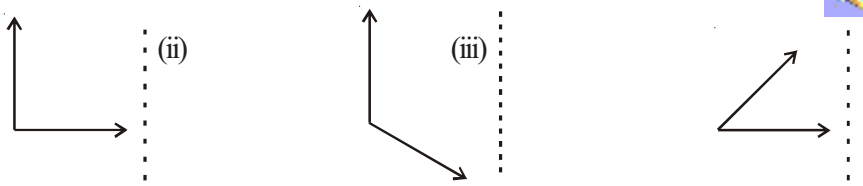
	Alphabet	Image
(i)	B	ь
(ii)	L	ꓭ
(iii)	N	ᴎ
(iv)	M	И
(v)	P	T
(vi)	T	⊥

Can you think of more such alphabets and words which will remain the same in their mirror image?

Try These

1. Place a mirror along the dotted lines and draw their mirror images.

(i) (ii) (iii)



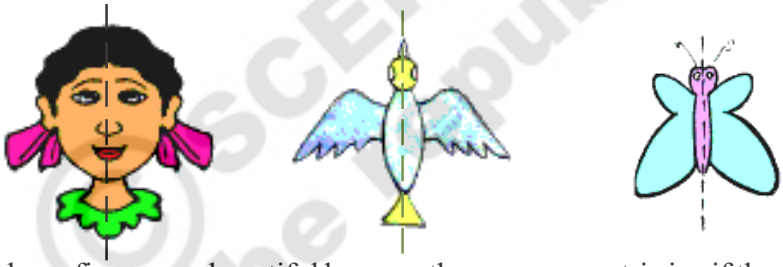
Do you observe any change?

Are angles in the images equal to the angles in the given figures?

While getting the reflection you might also observed that with the verticle line of axis of reflection symmetry the left hand side angle becomes right hand side angle in the image. similarly with the horizontal line of axis of reflection symmetry top and bottom interchange with each other.

12.2 Line Symmetry

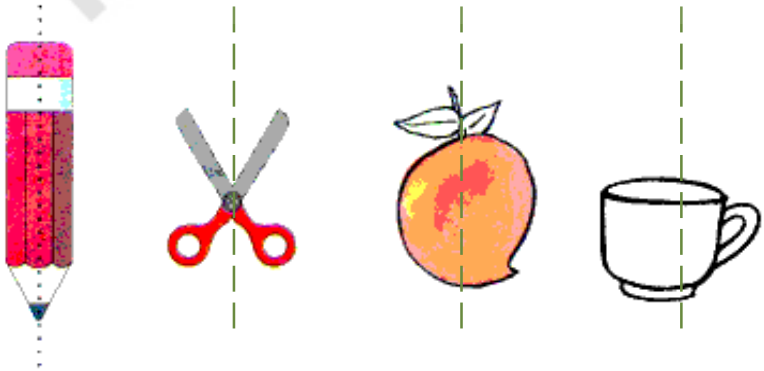
Observe the following figures. What do you notice?



The above figures are beautiful because they are symmetric i.e. if the figure is folded along the given dotted line each part coincides with the other part exactly. It is called line symmetry and the line along which the paper is folded is called **line of symmetry or axis of symmetry**.

Do This

In the figures given below find which are symmetric figures.



Can we find line of symmetry for every figure?

Mohit places a mirror on the dotted line and finds if the figure is completed by the image or not. Do you think what Mohit is doing right?

Observe the following figures

(i) (ii) (iii)

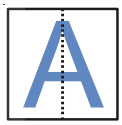
M G 

We can see that the first and the third figures are symmetric. First figure M has a line of symmetry vertically at its middle and third figure bird has a line of symmetry, horizontally.

Any line along which we can fold a figure so that the two parts of it coincide exactly is called a line of symmetry. It can be horizontal, vertical or diagonal.

Play with alphabet

Write English alphabet A on a tracing paper, draw a dotted line vertically on it at the centre and fold it along the dotted line. Do the two parts coincide? The dotted line is a line of symmetry and the alphabet has vertical symmetry.



Similarly let us check the line of symmetry in the case of the alphabet B. Here we can see that the alphabet has horizontal line of symmetry.

Try This

Write the letters of English alphabet A to Z and find out which have

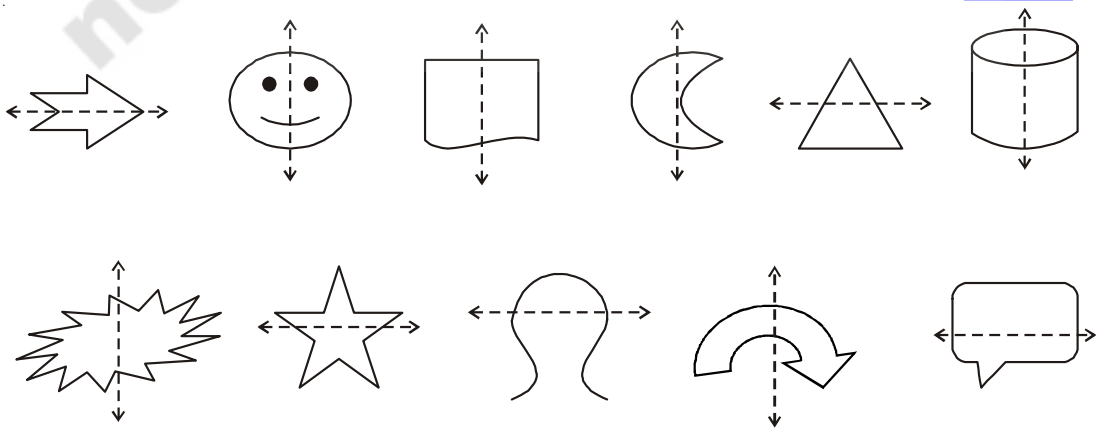
(i) Vertical lines of symmetry.

(ii) Horizontal lines of symmetry.

(iii) No lines of symmetry.

Do This

Check whether the dotted line represents the line of symmetry or not.



Try These

Draw any five objects which have a line of symmetry.

Draw any five objects which are not symmetric.

Activity

Take a piece of paper. Fold it in half and open.

Spill a few drops of ink and fold.

Press the halves together. Now open the fold.

Will you find a symmetric design?

Draw a line of symmetry for the figure.

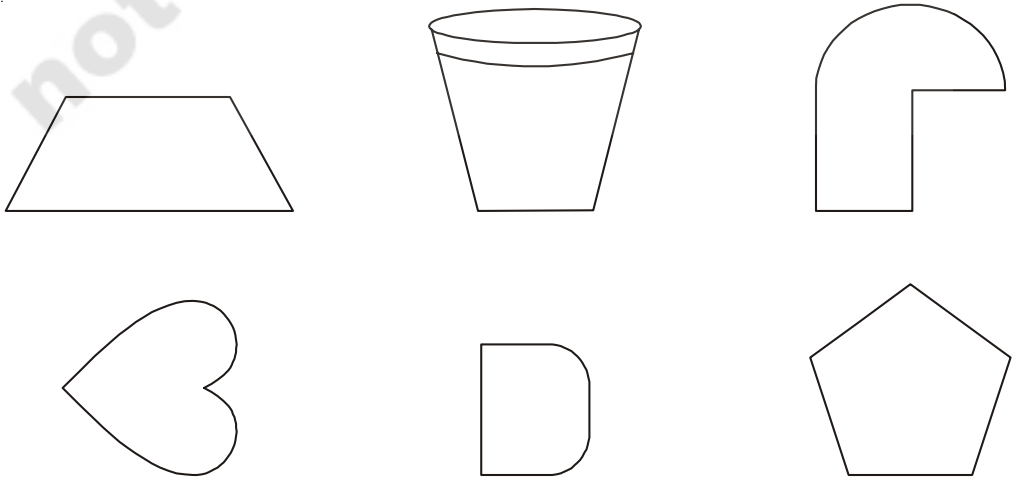
Make some more such symmetric figures with different colours.

Inked-string Patterns

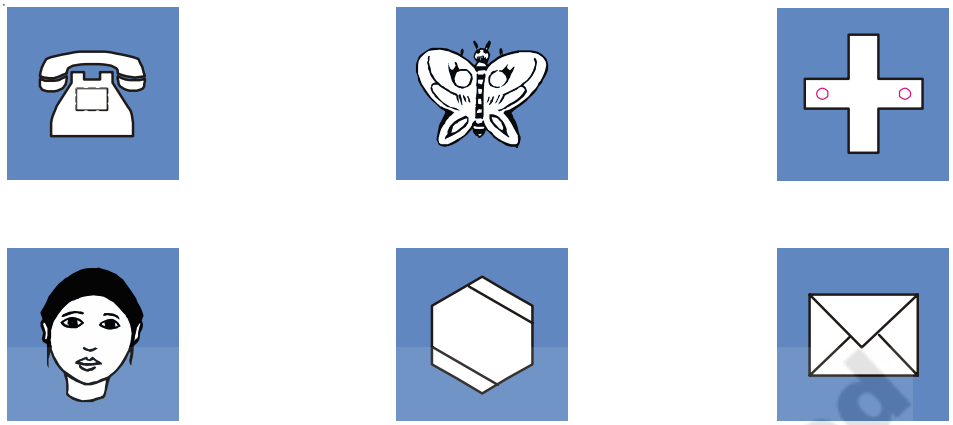
Fold a paper into half and open. On one half-portion, place short length of string, which is dipped in different of coloured inks or paints. Now press the two halves and open fold. Study the figure you obtain. Is it symmetric? Identify the line of symmetry.

Exercise - 12.1

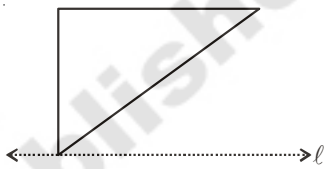
1. Check whether the given figures are symmetric or not? Draw the line of symmetry as well.



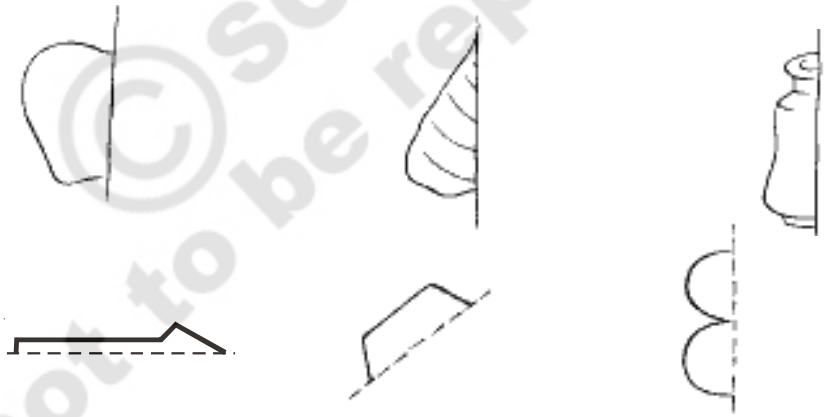
2. Draw a line of symmetry for each of the figures, wherever possible.



3. In the figure, ℓ is the line of symmetry.
Complete the diagram to make it symmetric.



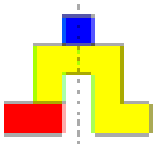
4. Complete the figures such that the dotted line is the line of symmetry.

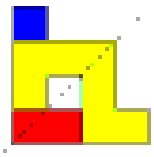


Game

There are three different shapes given below :
Minakshi and Rahul try to make different symmetric shapes using the three given shapes.


Shapes

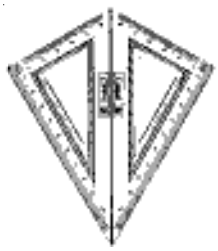

Symmetry Shapes (i)


Symmetry Shapes (ii)

Trace the three shapes and make different symmetric shapes. Check with your friends. Who make more symmetric shapes.

12.3 Multiple Lines of Symmetry

A Kite



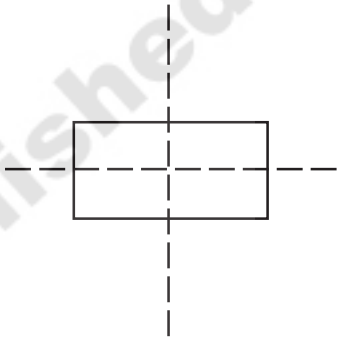
There are two set sequare in your instrument box one has angles of measure 30º, 60º, 90º.

Take two such identical set-squares. Place them side by side to form a 'kite' shape as shown here.

How many lines of symmetry does this shape have?

Do you think that some shapes may have more than one line of symmetry?

A Rectangle



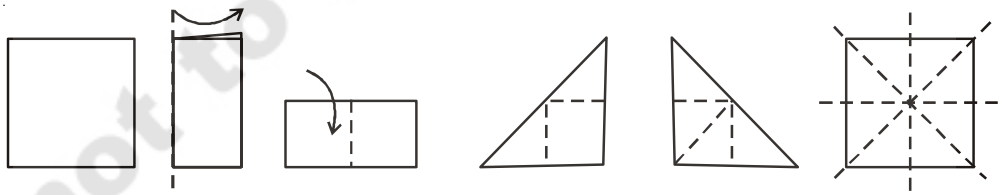
Take a rectangular sheet (like a post-card). Fold it once length wise so that one half fits exactly over the other half. Is this fold a line of symmetry? Why?

Open it up now and again fold along its width in the same way. Is this second fold also a line of symmetry? Why?

Do you find that these two lines are the lines of symmetry? Take a square piece of paper. Fold it into half vertically so that the edges coincide. Open the fold and you will find that the two halves made by the fold are congruent. The fold at the centre becomes a line symmetry for the paper. Try to fold the paper at different angles so that it becomes a line of symmetry.

How many folds are possible?

There are four lines of symmetry for a square.



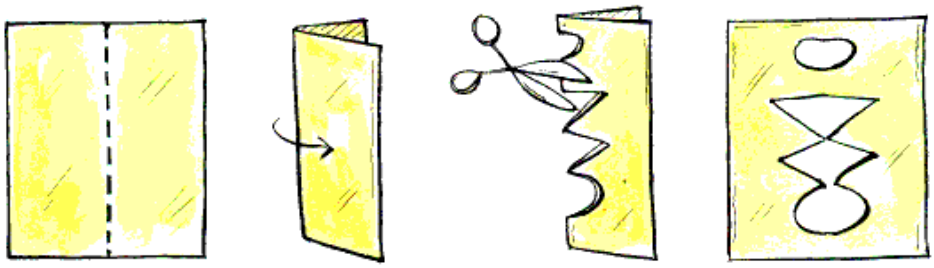
Square paper | Vertical fold | Horizontal fold | Diagonal fold 1 | Diagonal fold 2 | Opened appear

Think of an equilateral triangle and an isosceles triangle. How many lines of symmetry, does each of these figures have?

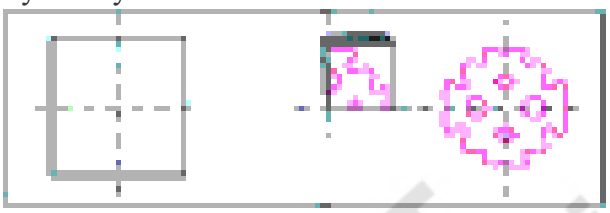
Paper cutting using symmetry

Remember how you decorate your class room on independence day or on republic day, with colour papers cut in various designs. Do you know how to cut these designs?

Take a square paper and fold at the middle vertically. Draw a design on the fold as shown in the figure and cut off the paper on edges. Then open to see a symmetric design with one line of symmetry.



Take a square paper and fold at the middle vertically and horizontally. Draw a design on the fold as shown in the figure and cut off the paper on edges. Then open to see a symmetric design with two lines of symmetry.



Take a square paper and fold it into half vertically, horizontally and diagonally. Draw a design on the fold as shown in the figure and cut off the paper on edges. Then open to see a symmetric design with four lines of symmetry. Create more such designs.

Think, Discuss and Write

1. If the paper is folded four times how many lines of symmetry can be formed with paper cutting.
2. To cut four similar figures side by side by folding the paper, how many folds are needed?

How to draw a Symmetric Figure?

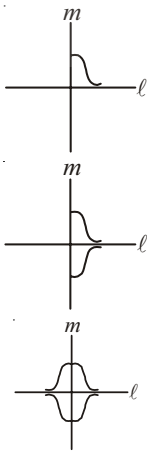
(i) Let us start drawing a figure as shown in the adjucent figure.

(ii) We want to complete it so that we get a figure with two lines of symmetry. Let the two lines of symmetry be ℓ and m.

(iii) Draw a curve so that it is a mirror image of the previous curve in line ℓ.

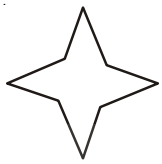
(iv) Draw a curve so that it is a mirror image of the previous curves in the symmetric line m.

Try to make some more figures that have two lines of symmetry. Think of a figure that has six lines of symmetry.

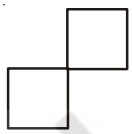


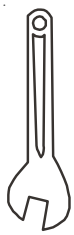
Exercise - 12.2

1. Write any five man made things which have two lines of symmetry.
2. Write any five natural objects which have two or more than two lines of symmetry.
3. Find the number of lines of symmetry for the following shapes.

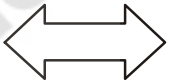
(i) 

(ii) 

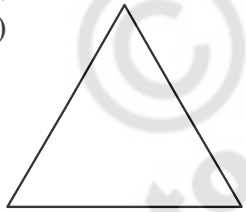
(iii) 

(iv) 

(v) 

(vi) 

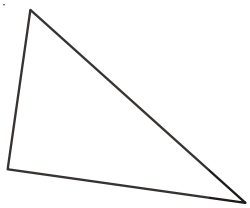
4. Draw the possible number of lines of symmetry.

(i) 

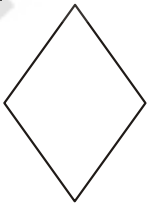
Equilateral triangle

(ii) 

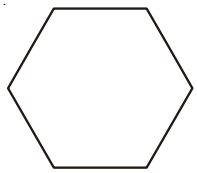
Isosceles triangle

(iii) 

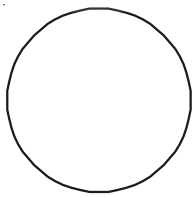
Scalene triangle

(iv) 

Rhombus

(v) 

Hexagon

(vi) 

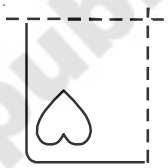
Circle

5. From the above problem, complete the following table.

Shape	Number of lines of symmetry
Equilateral triangle	
Isosceles triangle	
Scalene triangle	
Rhombus	
Hexagon	
Circle	

6. A few folded sheets and designs drawn about the fold are given. In each case, draw a rough diagram of the complete figure that would be seen when the design is cut off.

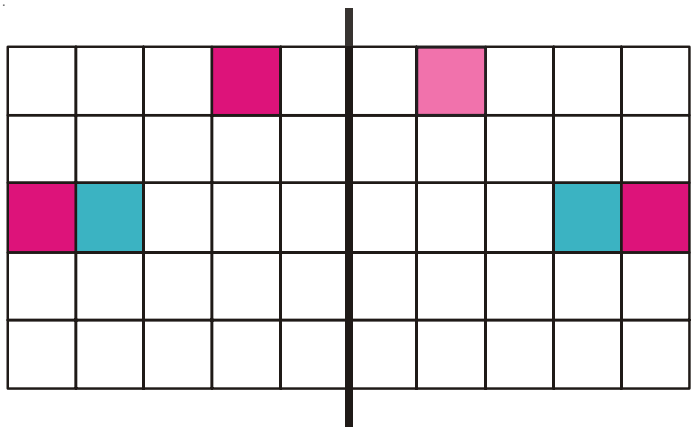
Paper is folded vertically once



Paper is folded vertically & horizontally

Class room project

Take a squared paper. A squared paper is what you would have used in your arithmetic notebook in earlier classes. Draw a vertical line of symmetry on the paper (as shown in the figure). Colour any one square on one side of the vertical axis. Then ask a student to find the square which is symmetrical to the first one and colour it. After she does this, she can choose any other square and colour it also. The next student will now do the same.



Home project

Collect symmetrical figures from your environment and prepare a scrap book. Also collect Rangoli patterns and draw them in your scrap book. Try and locate symmetric portions of these patterns alongwith the lines of symmetry. Here are few examples:



WHAT HAVE WE DISCUSSED?

1. A figure is said to have line symmetry if a line can be drawn dividing the figure into two identical parts. This line is called a line of symmetry.
2. A figure may have no line of symmetry, only one line of symmetry, two lines of symmetry or multiple lines of symmetry. Here are some examples.

Number of lines of symmetry	Example
No line of symmetry	A scalene triangle
Only one line of symmetry	An isosceles triangle
Two lines of symmetry	A rectangle
Three lines of symmetry	An equilateral triangle
Countless lines of symmetry	A circle

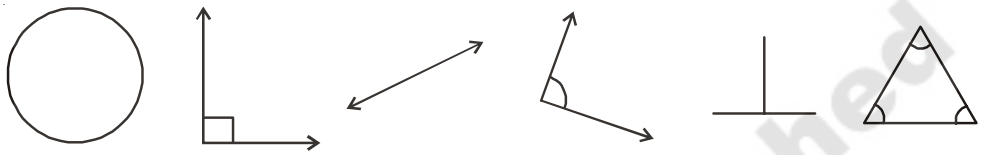
3. The line symmetry is closely related to mirror reflection. When dealing with mirror reflection, we have to take into account the left ↔ right changes in orientation.
4. Symmetry has plenty of applications in everyday life as in art, architecture, textile technology, design creations, geometrical reasoning, Kolams, Rangoli etc.

CHAPTER - 13

Practical Geometry

13.1 Introduction

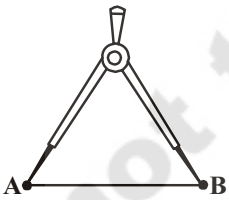
Copy the following shapes in your notebook with a pencil.



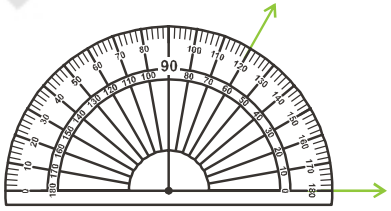
Do they look exactly the same? Measure their sides and angles by ruler and protractor.

What do you find? You will find their measures are not exactly the same. To make them exactly same we need to draw them of accurate sizes. For this we need to use tools. We will learn to construct such figure, in this chapter by using compasses, ruler and protractor. Ruler, compasses and protractor are our tools. These are all a part of our geometry box. Let us observe the geometry box.

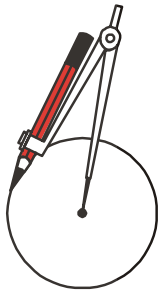
What all is there in the geometry box? Besides the ruler, compasses and protractor we have a divider and set squares. The ruler is used for measuring lines, a comapsses for constructing, protractor measures angles and the divider is to make equal line segments or mark points on a line.



Divider



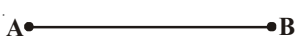
Protractror



Compass

13.2 A Line Segment

Let A and B be two points on a paper. Then the straight path from A to B is called a line segment AB, denoted by $\overline{AB}$.



The distance between the points A and B is called the length of AB. Thus a line segment has a definite length, which can be measured.

13.2.1 Construction of a Line Segment of a given Length

We can construct a line segment of given length in two ways.