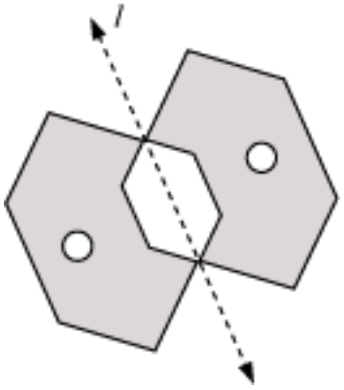
Symmetry and Recognition of Solids

- A figure is said to be symmetrical, if it is in an evenly balanced proportion.
- A figure has line of symmetry, if a line can be drawn dividing the figure into two identical parts in such a way that the two parts are image to each other with respect to the line. The line is called the **line of symmetry.**

  Example:

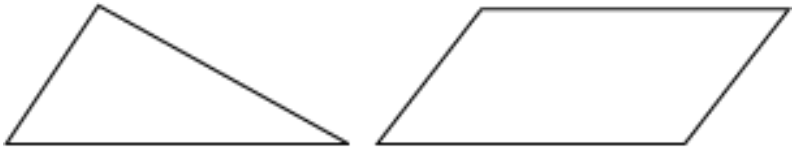


In this figure, the line *l* divides the above figure into two identical parts such that the two parts are image to each other with respect to the line. This line *l* is known as the line of symmetry. So, this figure has a line of symmetry.

- A figure may have no line of symmetry, only one line of symmetry, or multiple lines of symmetry.

  Example:

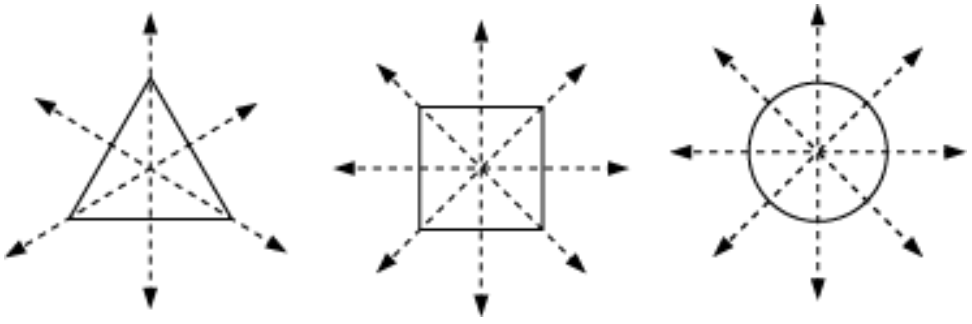
  - A scalene triangle and a parallelogram has no line of symmetry.



Scalene triangle Parallelogram

- An isosceles triangle, English alphabets A, B etc. shows one line of symmetry.

- An equilateral triangle, a square, a circle, etc., show multiple lines of symmetry.

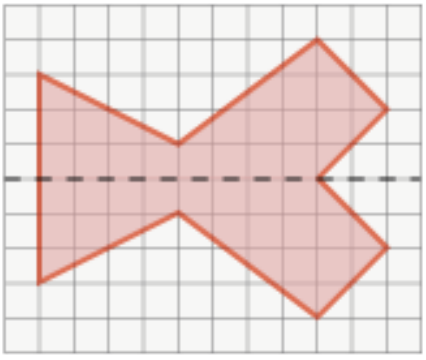


- If a vertical line divides the figure into two identical parts such that the two parts are image to each other with respect to the line, then we say that the figure has a vertical line of symmetry.
  Example: In the previous example, the isosceles triangle and the English alphabet A have vertical lines of symmetry.

- If a horizontal line divides a figure into two identical parts such that the two parts are image to each other with respect to the line, then we say that the figure has a horizontal line of symmetry.
  Example: In the previous example, the English alphabet B has a horizontal line of symmetry.

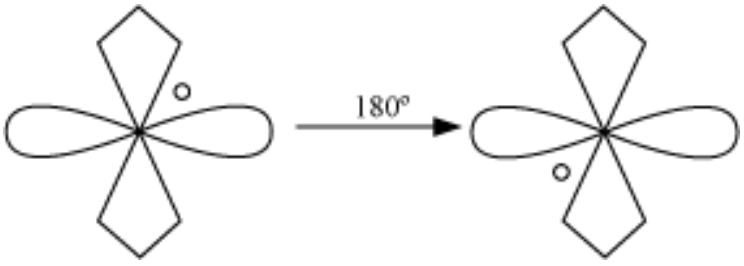
- The complete figure can be obtained by tracing the given figure below its line of symmetry.

Here, the dotted line is the line of symmetry of the figure.Thus, the complete figure will be represented as:



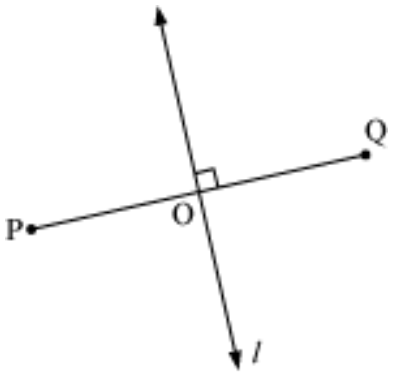
- By rotating a figure at an angle of 180°, if it looks the same, then we say that the figure has **point symmetry**.
    - Point symmetry of a figure exists when it is built around a single point, which is called the centre of the figure.
    - For every point in the figure (having point symmetry), there is another point found directly opposite to it on the other side of the centre at the same distance.

For example, the following figure has point symmetry.



Here, O is called its centre.

- The line of symmetry of the line segment PQ will be the perpendicular bisector of PQ.



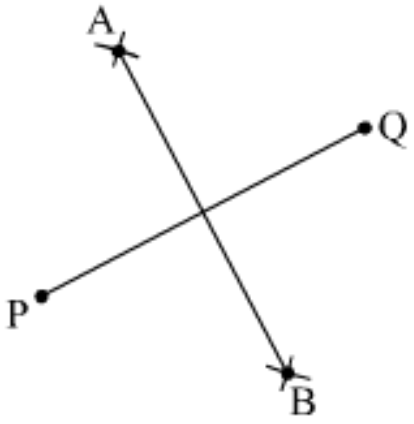
- **Construction of line of symmetry of two given points P and Q:**

  Step 1: Join the points P and Q.

  Step 2: Taking centres P and Q and radius more than half of PQ, mark arcs on both sides of PQ.

  Step 3: Name the arcs as A and B and join points A and B.

  AB is the required line of symmetry for the points P and Q.

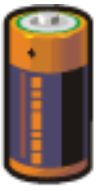


- We see a few shapes in our day- to-day life which are not flat. Some of these shapes are solids.

(Cricket ball : a sphere)

(Brick : a cuboid)

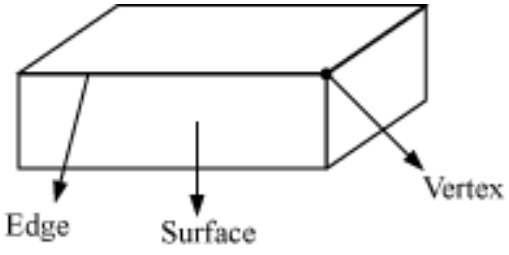
(Ice cream : a cone)

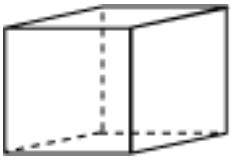
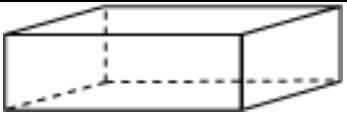


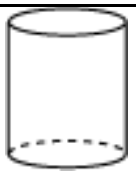
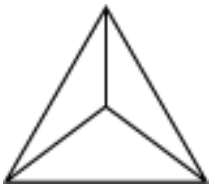
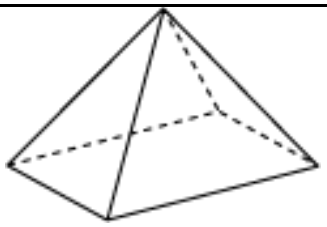
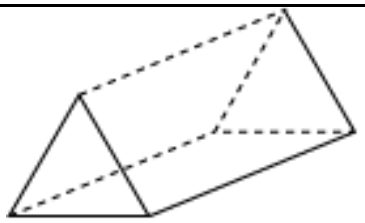
(Battery : a cylinder)

(Die : a cube)

- Each side of a cuboid is flat, called a **flat surface** (or surface). Two faces meet at a line segment called an **edge**. Three edges meet at a point called the **vertex.**



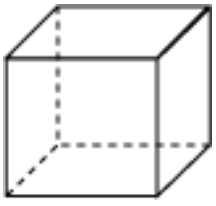
Solid	Figure	Properties
Cube		6 faces 12 edges 8 vertices (corners)
Cuboid		6 faces 12 edges

		8 vertices
Cylinder		2 flat faces (circles) 1 curved face
Cone		1 flat surface 1 curved surface 1 vertex
Triangular Pyramid		4 faces 6 edges 4 vertices
Square pyramid		5 faces 8 edges 5 vertices
Triangular prism		5 faces 9 edges 6 vertices

- For any polyhedron, F + V – E = 2, where F is the number of faces, V is the number of vertices and E is the number of edges.

  This relationship is called Euler's formula.

  Example: Verify Euler's formula for the given solid.



Solution:

The given figure is a cube.

We have

Number of vertices, $V = 8$

Number of edges, $E = 12$

Number of faces, $F = 6$

Thus, $F + V – E = 6 + 8 – 12 = 14 – 12 = 2$

Hence, Euler’s formula is verified.