

# MATHEMATICS

## Chapter 15: Visualising Solid Shapes



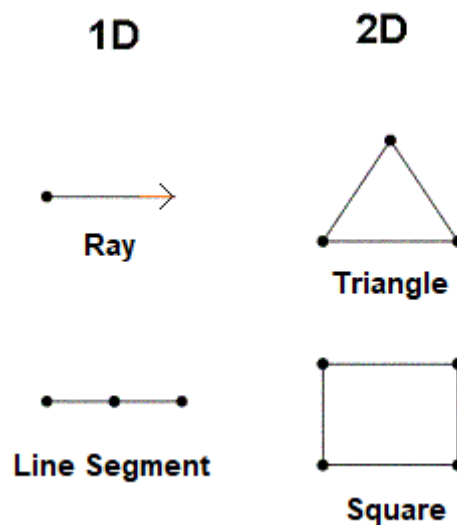
## Visualising Solid Shapes

### Dimensions

- Dimension is a measurable length along a direction.
- Dimensions are length, breadth (or width) or height (or depth).
- A point is dimensionless.
- Based on the number of dimensions a figure has, there are one-dimensional, two-dimensional and three-dimensional figures.

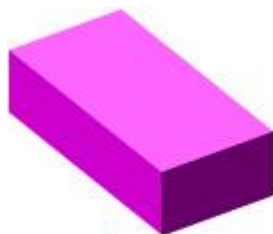
### 1D and 2D figures

- One-dimensional figures do not enclose any area and have only one direction.  
Example: A ray or a line segment.
- Two-dimensional figures have an area associated with them.  
They have length and breadth or width.  
They are usually plane figures, like squares, rectangles and circles.



### Solid Shapes

- Solid shapes have length, breadth or width and depth or height.
- They are called 3D or three-dimensional shapes.
- Example: Cuboids, Cylinders, Spheres and Pyramids.



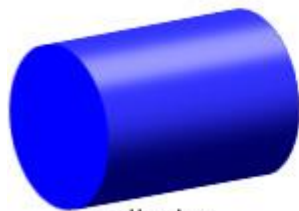
rectangular  
prism



sphere



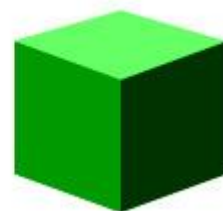
cone



cylinder



pyramid

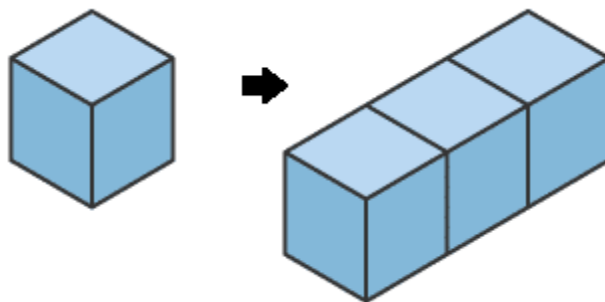


cube

## Perspectives of a Solid Shape

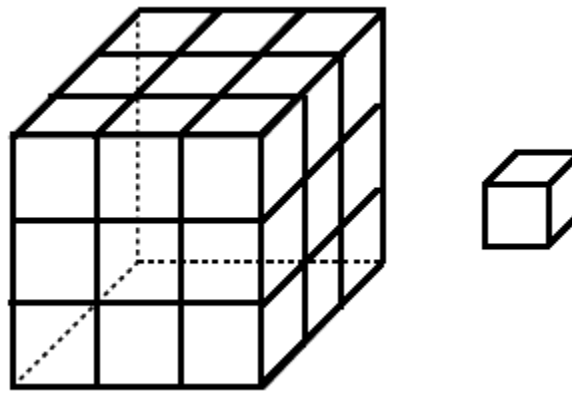
### Visualising solid shapes

- Solid shapes can be visualised in different ways.
- Solid shapes can be formed by placing some solid shapes side by side to form a new solid shape.
- Example: (i) A cylinder is formed by stacking up circles vertically.  
(ii) Cubes can be formed by placing cubes side by side.



### Visualising solid objects by viewing the smallest unit

- A solid can be visualised by breaking it down to the smallest unit.
- For example, a cube of dimensions (3cm x 3cm x 3cm) can be made up of 27 small cubes of dimensions (1cm x 1cm x 1cm).



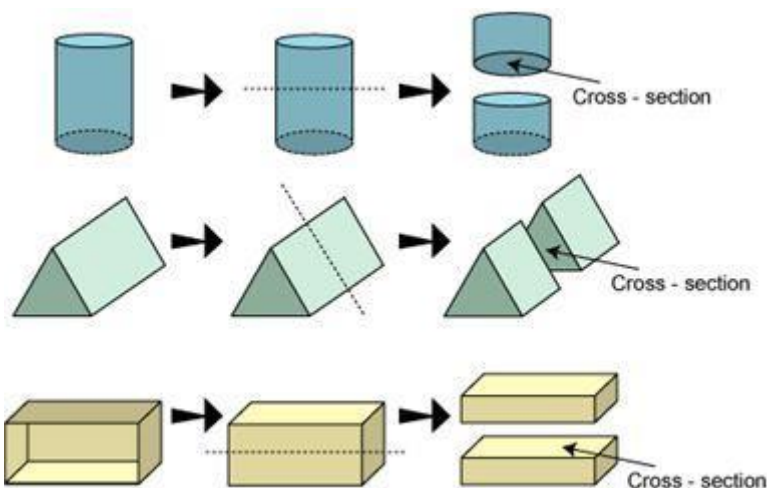
### Viewing sections of a solid by slicing or cutting

- If you cut or slice a solid we get to view the cross-section.

Example: If a loaf of bread is cut vertically, then the cross-section is almost a square. But if it is cut or sliced horizontally, the cross-section is a rectangle.

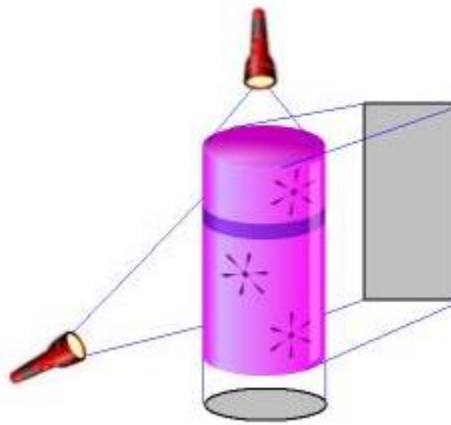
- Similarly, other solid shapes can be sliced in order to find their 2D cross-sectional shapes.

Example: A cucumber cut vertically gives a circle.



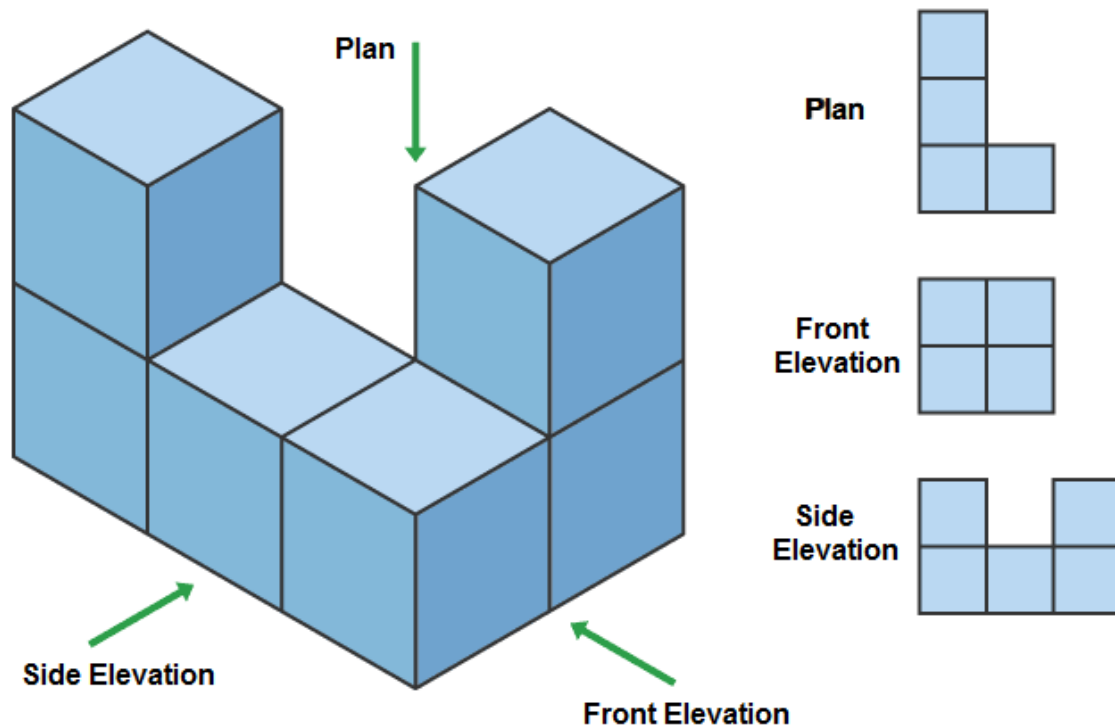
### Viewing sections of a solid by using shadows

- Shadows can be used to view 3D objects as 2D shapes.
- Example: The shadows of a cylinder are shown below.



### Different views of a Solid

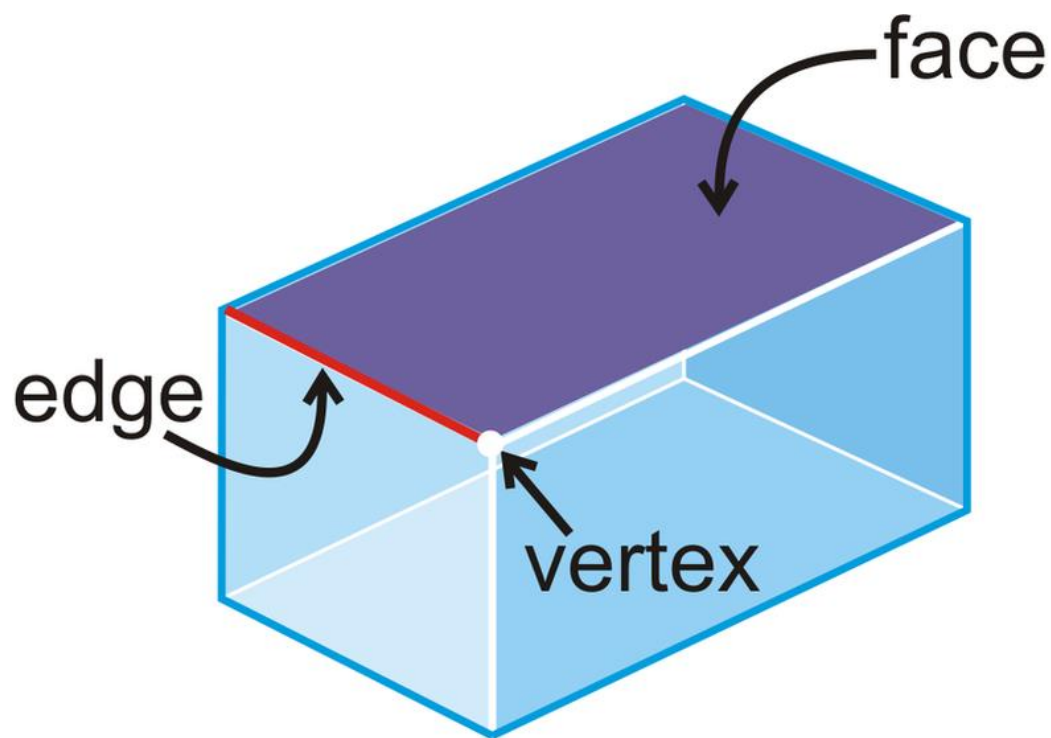
- A solid can be visualised by looking at it from different angles, namely: (i) Front view (ii) Top view (iii) Side view.
- Example: The different views of a figure are shown below.



### Quantities Associated with a Solid

#### Faces, edges and vertices

- The corners of a solid shape are called its vertices.
- The line segment joining two vertices is called an edge, or when two planes of a solid meet it forms an edge.
- The surfaces of a solid shape are called as its face.



The table below shows the number of faces, edges and vertices some solid shapes have.

Name of the shape	Number of surfaces	Number of plane surfaces	Number of curved surfaces	Number of edges	Number of vertices
Cube	6	6	0	12	8
Cuboid	6	6	0	12	8
Cylinder	3	2	1	2	0
Cone	2	1	1	0	1
Sphere	1	0	1	0	0

## Nets of Solid Shapes

### Building 3-D objects

A net is a flattened out skeletal outline or a blueprint of a solid which can be folded along the edges to create solid. The same solid can have multiple nets.

Example: A net for a cube box.



## Representing 3D Shapes on a Paper

### Drawing solids on a flat surface

- Solid shapes can be represented on a 2D flat surface like paper.
- This is done by drawing oblique sketches, to make it appear 3D. This is called as 2D representation of a 3D solid.

### Obliques sketches

- Oblique sketches do not have the exact length of a solid shape but appears exactly like the solid shape.
- Example: Drawing an oblique sketch of a cube:

**Step 1:** Draw the front and the opposite faces.

**Step 2:** Join the corresponding corners. (Figure 1)

**Step 3:** Redraw using dotted lines for hidden edges. (Figure 2)

This gives the oblique sketch of the cube.

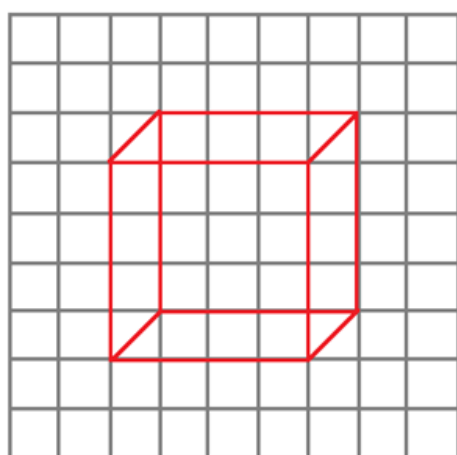


Figure 1

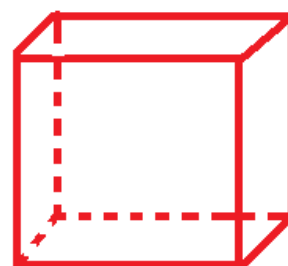
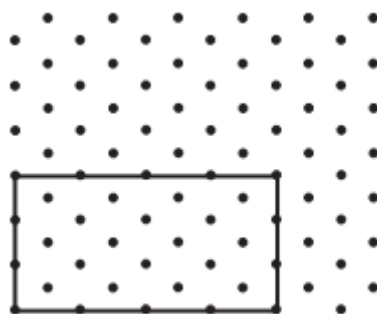


Figure 2

### Isometric sketches

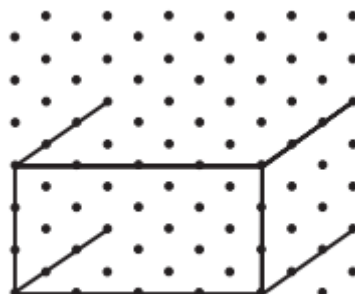
- Isometric sketches have measurements equal to that of the solid.
- They are usually drawn on an isometric dotted paper.
- Example: Drawing an isometric sketch of a cuboid of dimensions  $4 \times 3 \times 3$ :

**Step 1:** Draw a rectangle to show the front face of the cuboid.



Step 1

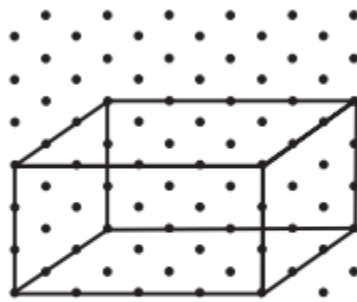
**Step 2:** Draw four parallel line segments of length three starting from the four corners of the rectangle.



Step 2

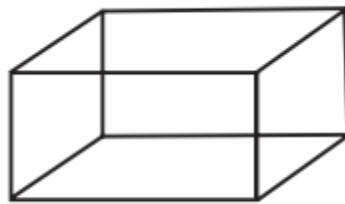
**Step 3:** Connect the corresponding corners using appropriate line segments.





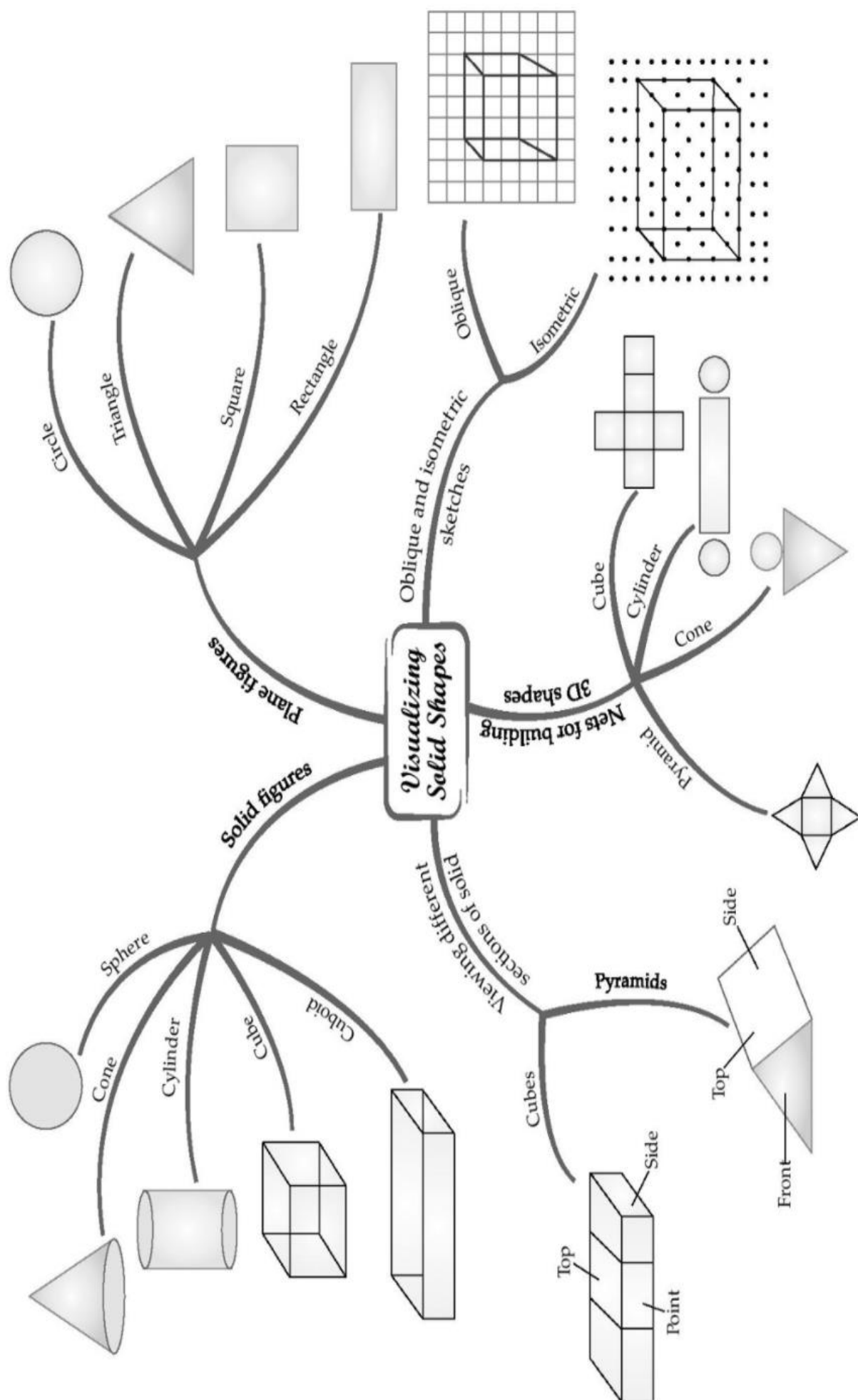
Step 3

**Step 4:** The figure thus obtained is the isometric sketch of the cuboid.



Step 4

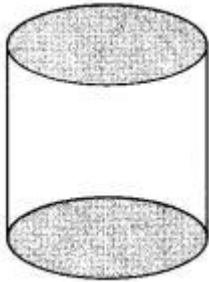
# CHAPTER - 15 VISUALIZING SOLID SHAPES



## Important Questions

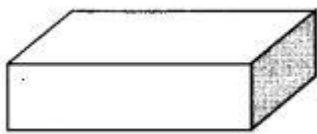
### Multiple Choice Questions-

Question 1. The name of the solid shape is



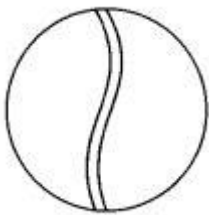
- (a) cone
- (b) cylinder
- (c) sphere
- (d) cube

Question 2. The name of the solid shape is



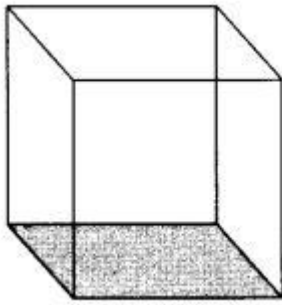
- (a) cuboid
- (b) cube
- (c) pyramid
- (d) cone

Question 3. The name of the solid shape is



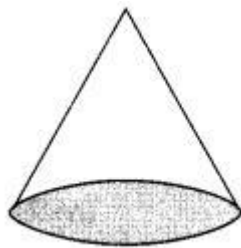
- (a) cylinder
- (b) cone
- (c) sphere
- (d) cube

Question 4. The name of the solid shape is



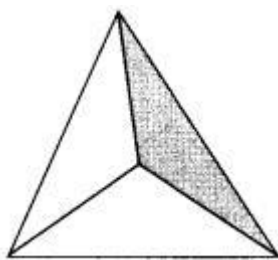
- (a) cube
- (b) cylinder
- (c) cone
- (d) sphere

Question 5. The name of the solid shape is



- (a) cylinder
- (b) cone
- (c) cuboid
- (d) sphere

Question 6. The name of the solid shape is



- (a) cylinder
- (b) cone
- (c) sphere
- (d) pyramid

Question 7. The number of vertices of a cube is

- (a) 8
- (b) 12
- (c) 6

(d) 3

Question 8. The number of edges of a cube is

(a) 8

(b) 12

(c) 6

(d) 3

Question 9. The number of faces of a cube is

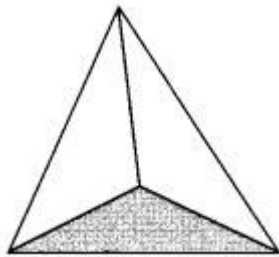
(a) 8

(b) 12

(c) 6

(d) 3

Question 10. The number of vertices of the solid shape is



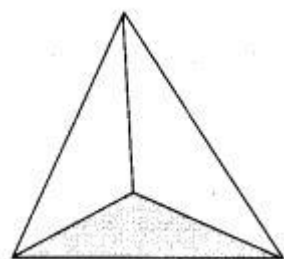
(a) 1

(b) 2

(c) 3

(d) 4

Question 11. The number of faces of the solid shape is



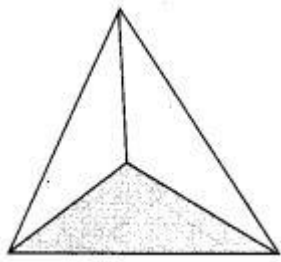
(a) 1

(b) 2

(c) 3

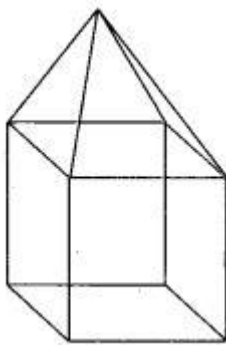
(d) 4

Question 12. The number of edges of the solid shape is



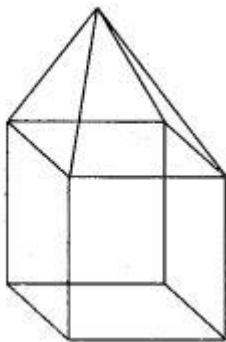
- (a) 1
- (b) 2
- (c) 3
- (d) 6

Question 13. The number of vertices of the solid shape is



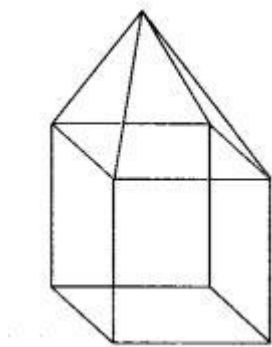
- (a) 9
- (b) 4
- (c) 6
- (d) 8

Question 14. The number of faces of the solid shape is



- (a) 4
- (b) 6
- (c) 9
- (d) 8

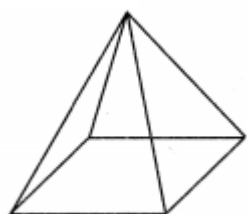
Question 15. The number of edges of the solid shape is



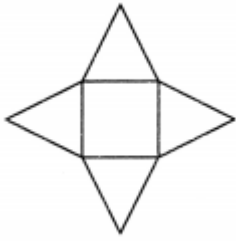
- (a) 16
- (b) 9
- (c) 6
- (d) 4

### Very Short Questions:

1. If three cubes of dimensions  $2\text{ cm} \times 2\text{ cm} \times 2\text{ cm}$  are placed end to end, what would be the dimension of the resulting cuboid?
2. Answer the following:
  - (i) Why a cone is not a pyramid?
  - (ii) How many dimension a solid have?
  - (iii) Name the solid having one curved and two flat faces but no vertex.
3. Write down the number of edges on each of the following solid figures:
  - (i) Cube
  - (ii) Tetrahedron
  - (iii) Sphere
  - (iv) Triangular prism
4. What cross-section do you get when you give a horizontal cut to an ice cream cone?
5. Determine the number of edges, vertices and faces in the given figure.

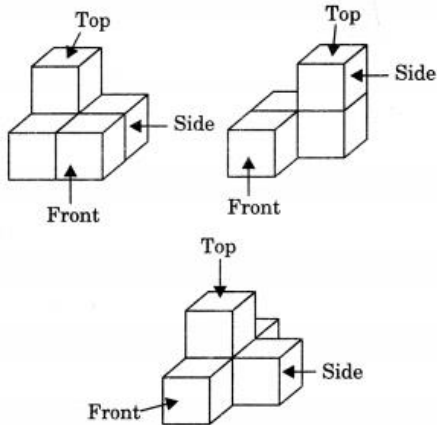


6. Draw the sketch of two figure that has no edge.
7. Draw the sketches of two figures that have no vertex.
8. Draw the sketches of two figures that have no vertex.
9. What shape would we get from the given figure?



### Short Questions :

- For the solids given below sketch the front, side and top view



- Match the following:

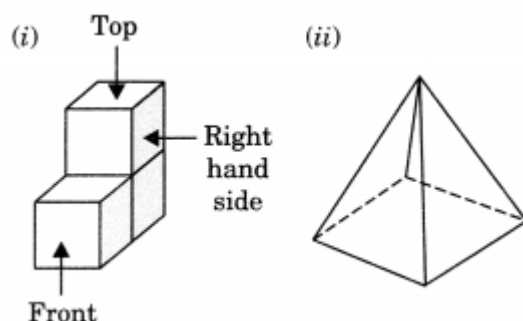
Column I		Column II
(i)		(a)
(ii)		(b)
(iii)		(c)
(iv)		(d)
(v)		(e)

- Complete the following table:



Name of solid	Number of vertices (V)	Number of faces (F)	Number of edges (E)
(i) Cube	_____	_____	_____
(ii) Cuboid	_____	_____	_____
(iii) Cone	_____	_____	_____
(iv) Cylinder	_____	_____	_____
(v) Triangular pyramid	_____	_____	_____
(vi) Rectangular pyramid	_____	_____	_____

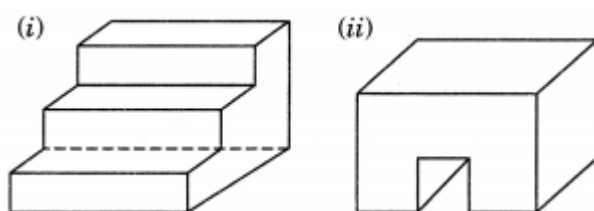
4. Draw a plan, front and side elevations of the following solids.



5. Name the solid that would be formed by each net:

### Long Questions :

- Name the solids that have:
  - 1 curved surface
  - 4 faces
  - 6 faces
  - 5 faces and 5 vertices
  - 8 triangular faces
  - 6 triangular faces and 2 hexagonal faces.
- Draw the top, side and front views of the given solids:



- Draw the net of a cuboid having same breadth and height, but length double the breadth.
- Draw the nets of the following:

- (i) Triangular prisms
- (ii) Tetrahedron
- (iii) Cuboid.

### Answer Key-

#### Multiple Choice questions-

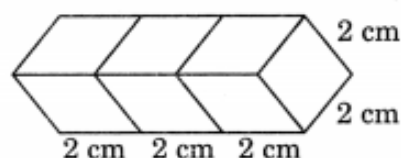
1. (b) cylinder
2. (a) cuboid
3. (c) sphere
4. (a) cube
5. (b) cone
6. (d) pyramid
7. (a) 8
8. (b) 12
9. (c) 6
10. (d) 4
11. (d) 4
12. (d) 6
13. (a) 9
14. (c) 9
15. (a) 16

#### Very Short Answer :

1. Length of the resulting cuboid =  $2\text{ cm} + 2\text{ cm} + 2\text{ cm} = 6\text{ cm}$

Breadth =  $2\text{ cm}$

Height =  $2\text{ cm}$



Hence the required dimensions =  $6\text{ cm} \times 2\text{ cm} \times 2\text{ cm}$ .

2. (i) Cone is not a pyramid because its base is not a polygon.  
 (ii) Three.  
 (iii) Cylinder
3. (i) 12

(ii) 6

(iii) 0

(iv) 9

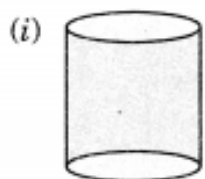
4. Circle

5. Edges = 8

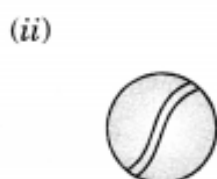
Vertices = 5

Faces = 5

6.

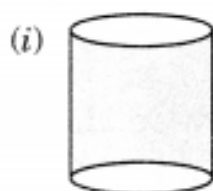


Cylinder



Sphere

7.



Cylinder



Sphere

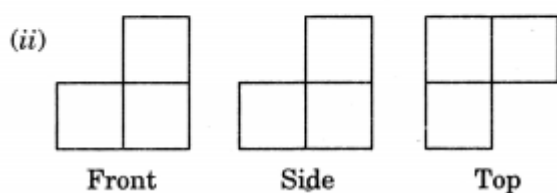
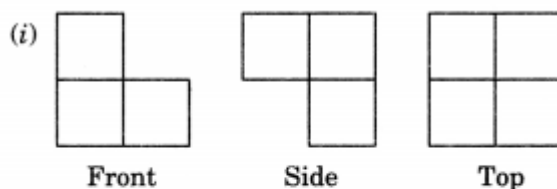
8. Sphere: Football, Earth, Round table

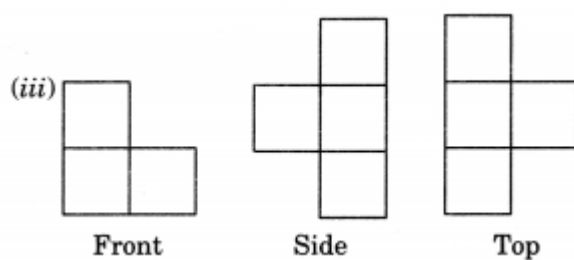
Cone: Conical funnel, ice cream cone, conical cracker.

9. From the given net, we get a rectangular pyramid.

### Short Answer :

1.



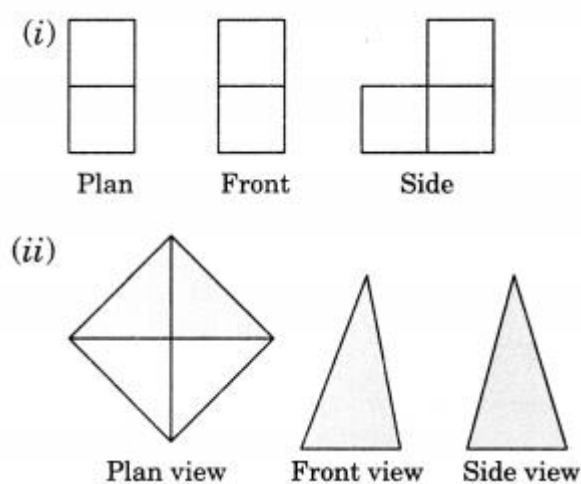


2. (i)  $\rightarrow$  (e)  
 (ii)  $\rightarrow$  (a)  
 (iii)  $\rightarrow$  (b)  
 (iv)  $\rightarrow$  (c)  
 (v)  $\rightarrow$  (d)

3.

Name of solid	Number of vertices (V)	Number of faces (F)	Number of edges (E)
(i) Cube	8	6	12
(ii) Cuboid	8	6	12
(iii) Cone	1	1	0
(iv) Cylinder	0	2	0
(v) Triangular pyramid	4	4	6
(vi) Rectangular pyramid	5	5	8

4.

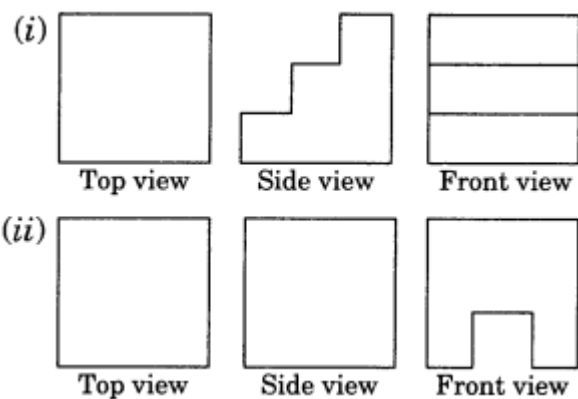


5. (i) Triangular pyramid  
 (ii) Square pyramid  
 (iii) Hexagonal pyramid

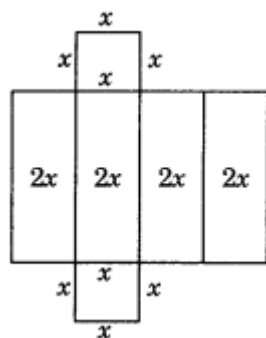
**Long Answer :**

1. (i) Cylinder  
(ii) Tetrahedron  
(iii) Cube and cuboid  
(iv) Square pyramid or rectangular pyramid  
(v) Regular octahedron  
(vi) Hexagonal prism.

2.

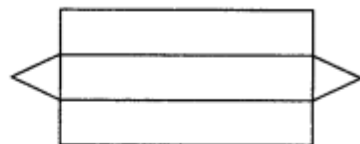


3.

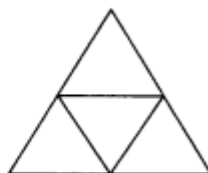


4.

(i) Triangular prisms:



(ii) Tetrahedron:



(iii) Cuboid:

