CBSE NCERT Solutions for Class 7 Mathematics Chapter 15

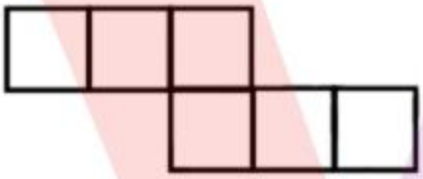
Back of Chapter Questions

Exercise - 15.1

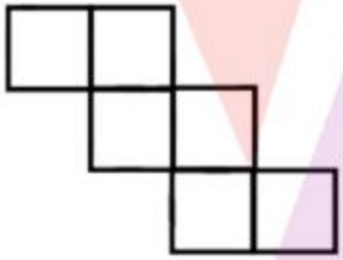
1. Identify the nets which can be used to make cubes (cut out copies of the nets and try it):

(i)

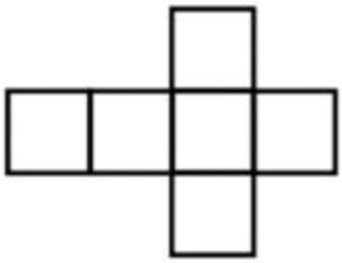
(ii)



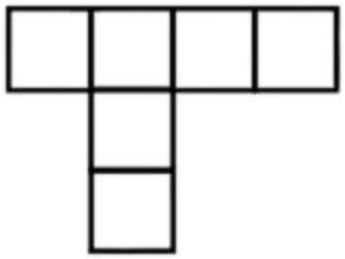
(iii)



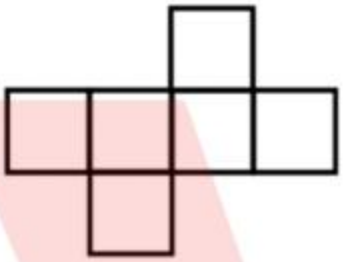
(iv)



(v)

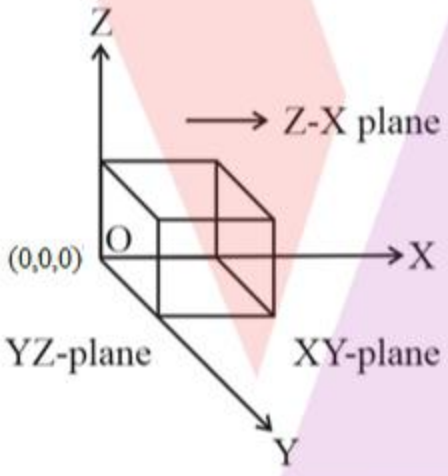


(vi)

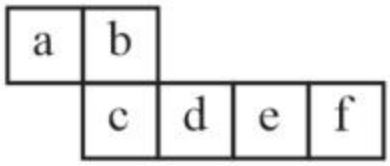


Solution:

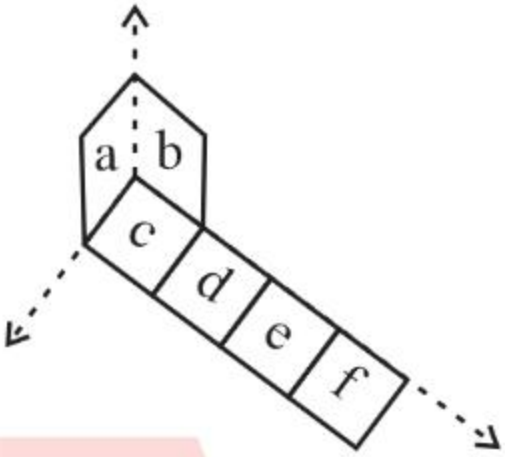
Consider a cube placed in a three-dimensional space as shown below:



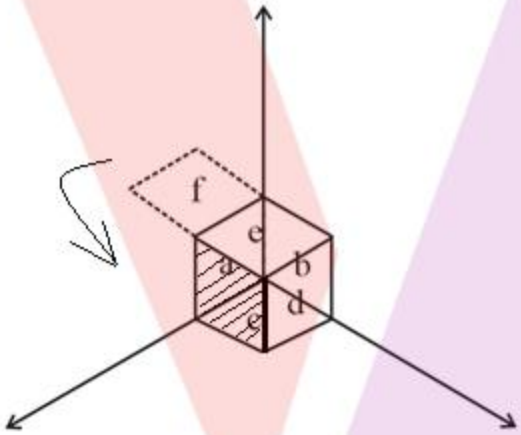
(i) Let us name the given net as follows;



(a) Consider face c as the base of the hypothetical cube. Faces a and b form two lateral faces of the hypothetical cube.



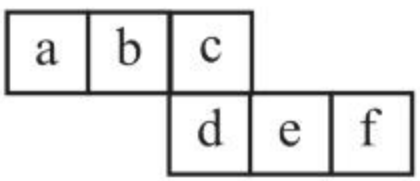
(b) Fold surfaces d and e to obtain two more faces of the cube. d forms face adjacent to b while e forms the top surface, opposite to the face c.



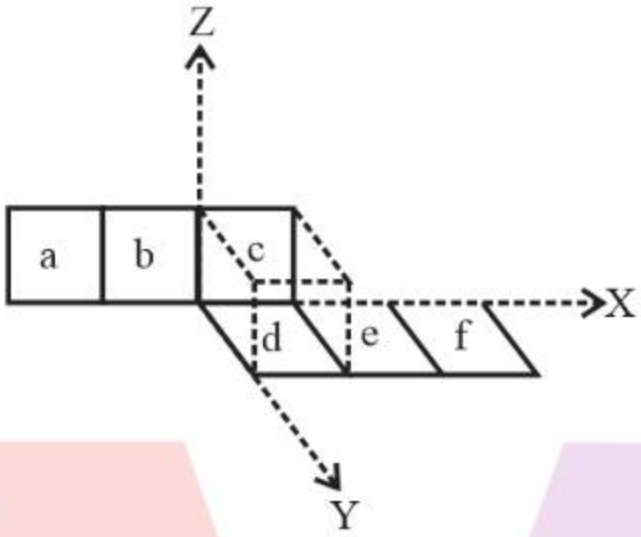
(c) Clearly, the surface f will have to overlap with a, and by no means can the front surface of the required cube be obtained.

Hence, a cube cannot be obtained using the given net.

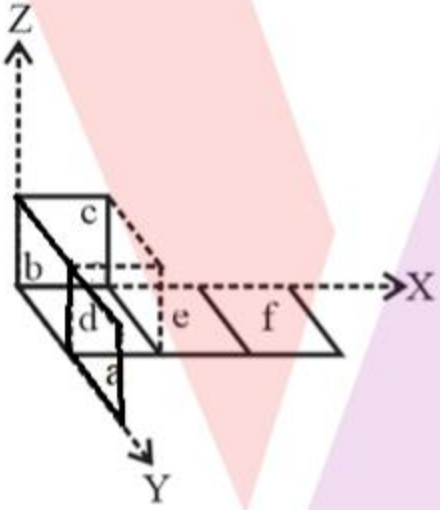
(ii) The given net can be named as follows:



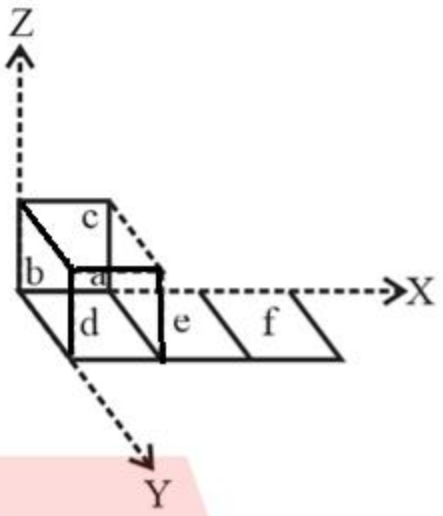
(a) Let the dotted lines represent the hypothetical cube to be obtained. Let us consider surface d to be the base. The surface c is folded parallel to XZ plane to form a lateral side of the cube as shown:



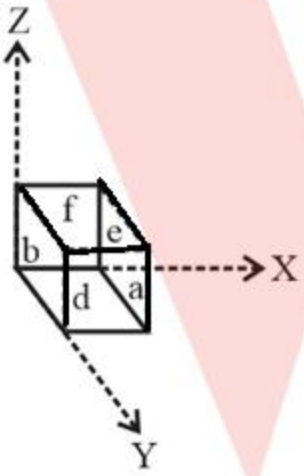
(b) Fold the surface b parallel to YZ plane to obtain a face adjacent to c.



(c) The surface a is folded parallel to XZ plane to obtain a face adjacent to b.

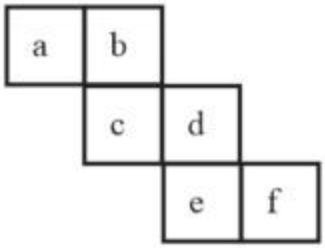


(d) Surfaces e and f are folded as shown to obtain the remaining two sides of the cube.

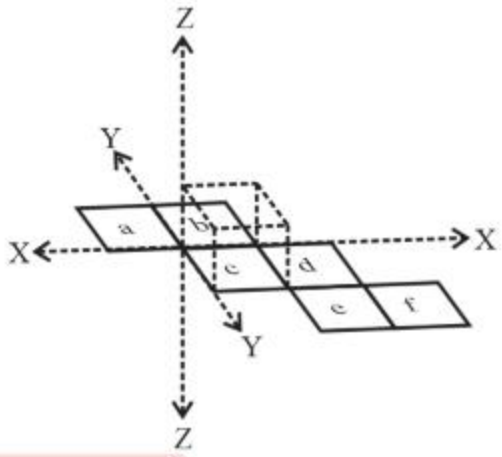


Hence, a cube can be obtained using the given net.

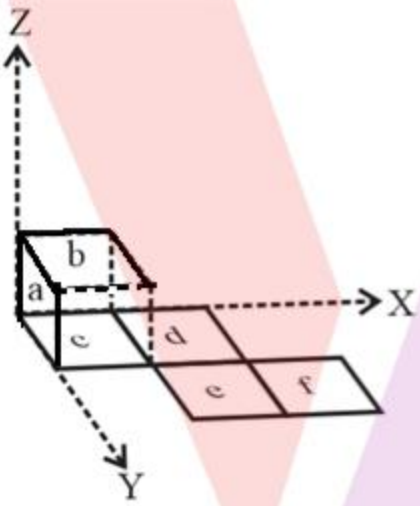
(iii) The given net can be named as follows:



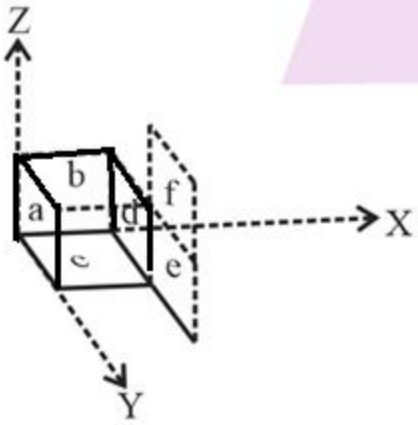
(a) Let the dotted lines represent the hypothetical cube to be obtained. Let us consider surface c to be the base. The given net placed in three-dimension is as shown below:



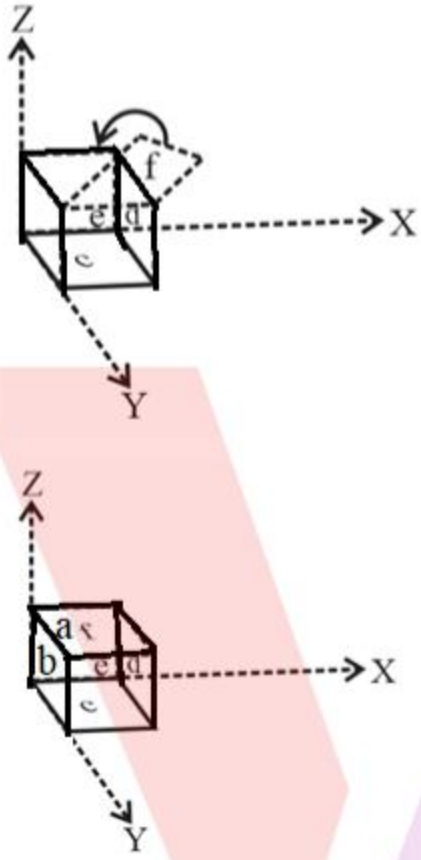
(b) Fold surfaces b and a parallel to ZX plane. Surface a is further folded parallel to ZY plane.



(c) The surface d is folded parallel to ZY plane to obtain a face adjacent to b.

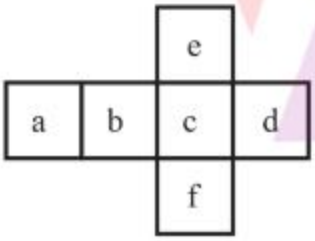


(d) Surface e forms face opposite to b when folded parallel to ZX plane. Surface f must then be folded to form the top surface of the cube.

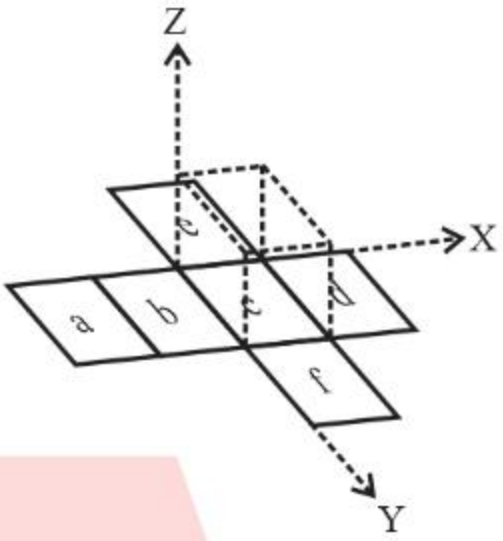


Hence, a cube can be obtained using the given net.

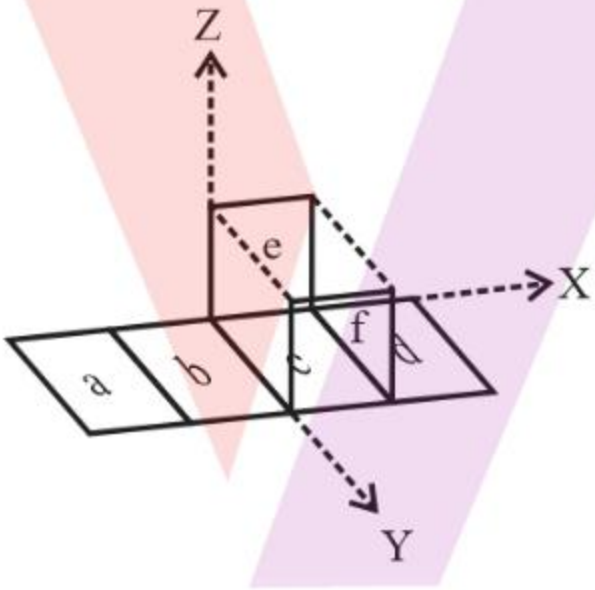
(iv) The given net can be named as follows:



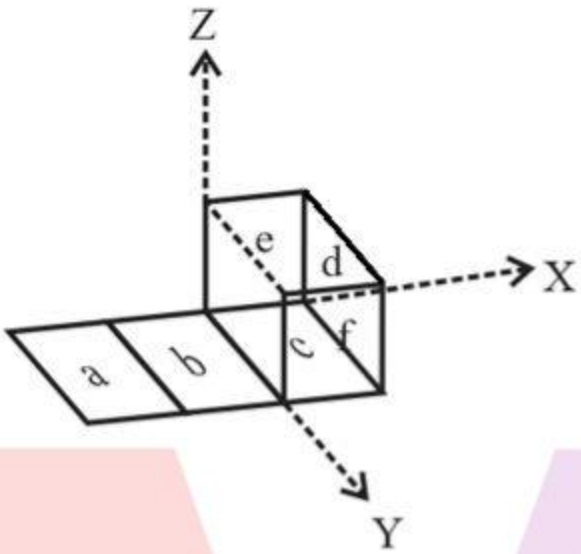
(a) Let the dotted lines represent the hypothetical cube to be obtained. Let us consider surface c to be the base. The given net placed in three- dimension is as shown below:



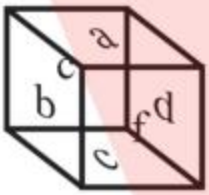
(b) Clearly, surfaces e and f can be folded parallel to XZ plane to obtain faces opposite to each other as shown:



(c) Surface d is folded parallel to ZY plane to form a face adjacent to f and e as shown:

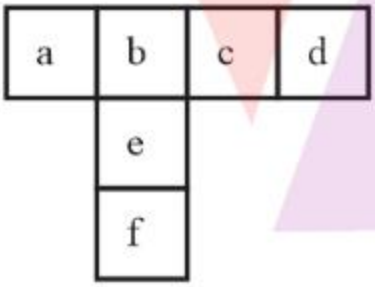


(d) Surfaces a and b can be folded to obtain the other two sides. b becomes the face opposite to d, while a becomes the top surface of the cube.

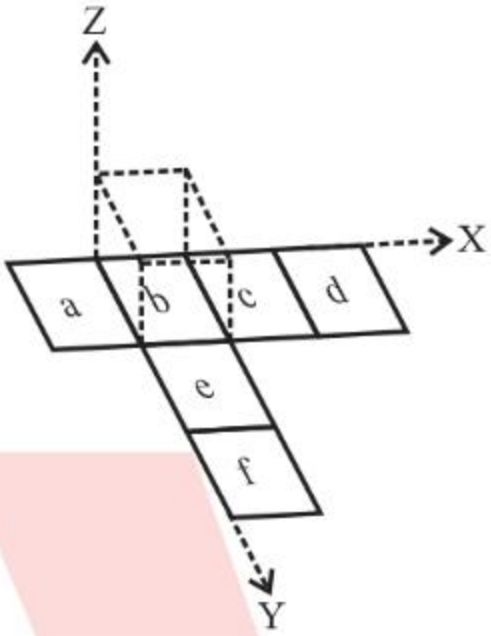


Hence, a cube can be obtained using the given net.

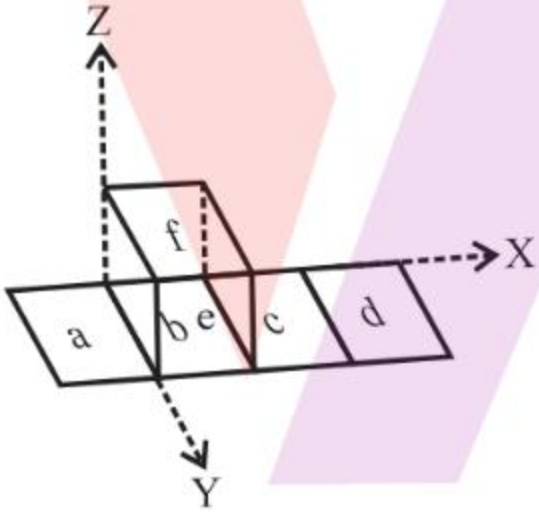
(v) The given net can be named as follows:



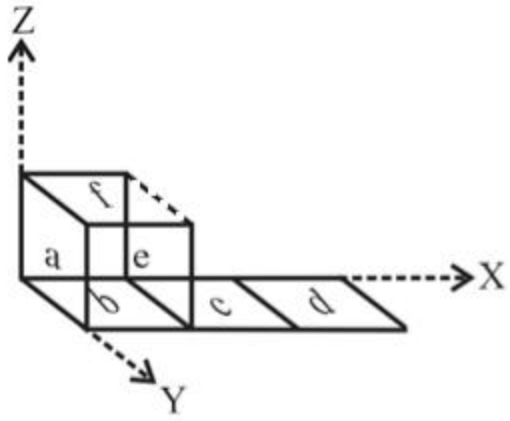
(a) Let the dotted lines represent the hypothetical cube to be obtained. Let us consider surface b to be the base. The given net placed in three- dimension is as shown below:



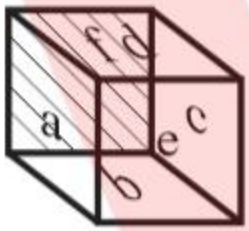
(b) Surface e is folded parallel to ZX plane and further, surface f is folded [parallel to XY plane.



(c) Surface a is folded parallel to YZ plane to form a face adjacent to e.

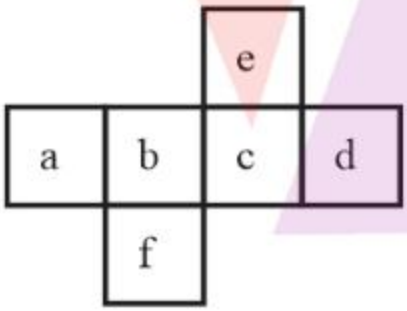


(d) Upon folding surfaces c and d, we observe that c forms face opposite to a, but d gets overlapped with f. Also, the solid obtained has no face opposite to e.

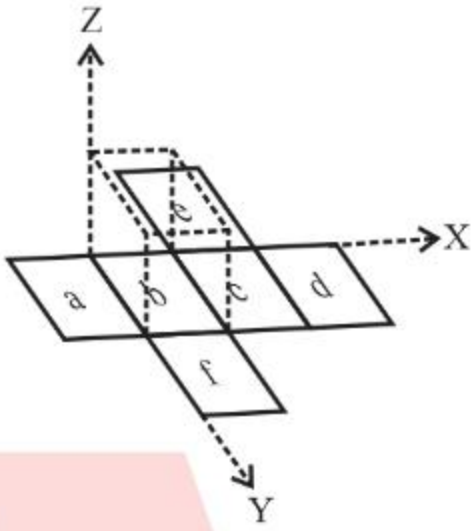


Hence, a cube cannot be obtained using the given net.

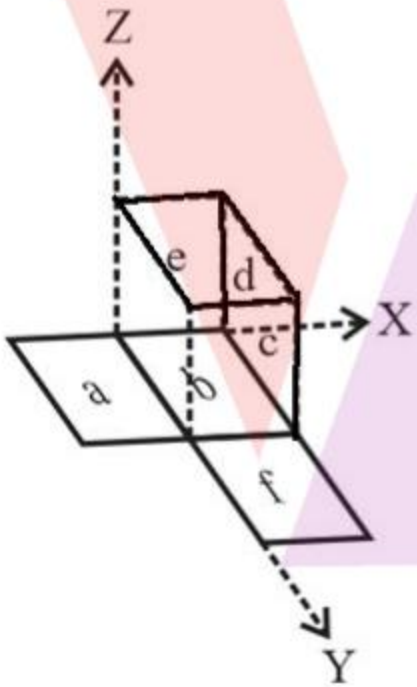
(vi) The given net can be named as follows:



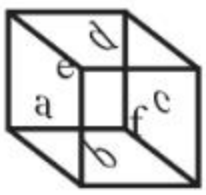
(a) Let the dotted lines represent the hypothetical cube to be obtained. Let us consider surface b to be the base. The given net placed in three- dimension is as shown below:



(b) Fold the surface c parallel to YZ plane. Further, d is folded along parallel to XY plane to obtain the top surface of the hypothetical cube. Consequently, e folded parallel to ZX plane forms a face adjacent to c.



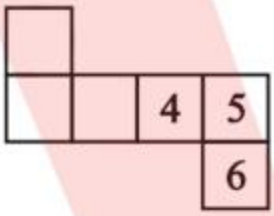
(c) Surface a is folded parallel to ZY plane and f is folded parallel to ZX plane to obtain the remaining two sides of the cube.

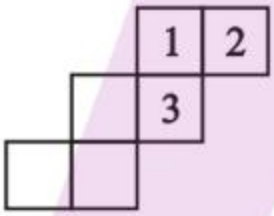


Hence, a cube can be obtained using the given net.

2. Dice are cubes with dots on each face. Opposite faces of a die always have a total of seven dots on them.

Here are two nets to make dice (cubes); the numbers inserted in each square indicate the number of dots in that box.

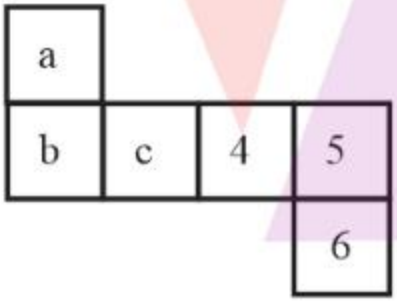




Insert suitable numbers in the blanks, remembering that the number on the opposite faces should total to 7.

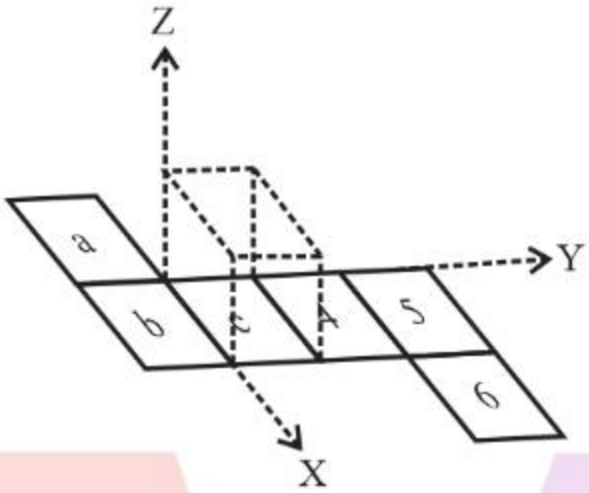
Solution:

(i) Let us name the given net as follows:

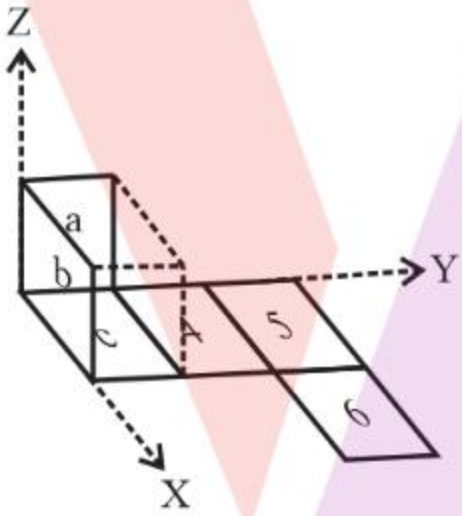


Now, we fold the given surfaces to obtain a cube.

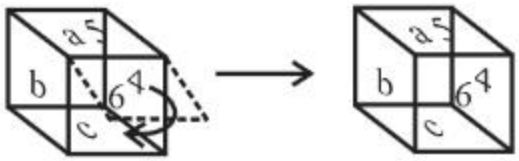
(a) Let the dotted lines represent the hypothetical cube to be obtained. Let us consider surface c to be the base. The given net placed in three- dimension is as shown below:



(b) Fold the surface b parallel to XZ plane. Consequently, surface a is folded parallel to YZ plane. a and b become adjacent faces as shown.



(c) Surface 4 is folded parallel to XZ plane and forms face opposite to b. Consequently, surface 5 is folded to form the top surface and hence 6 becomes the front face, opposite to a.



Therefore, we can observe that the faces that are opposite to each other are as follows:

c and 5

a and 6

b and 4

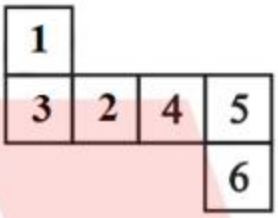
Since, the numbers on opposite faces sum up to 7,

$c + 5 = 7 \Rightarrow c = 2$

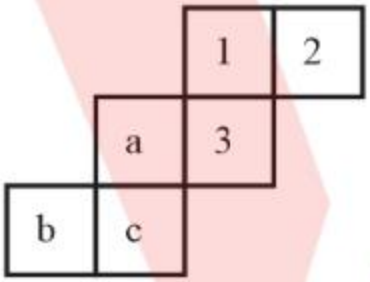
$a + 6 = 7 \Rightarrow a = 1$

$b + 4 = 7 \Rightarrow b = 3$

Hence, the net is as follows:

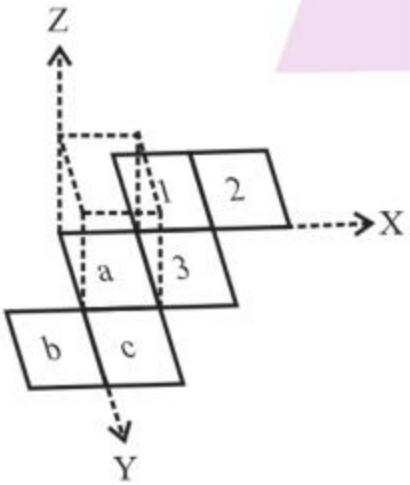


(ii) Let us name the given net as follows:

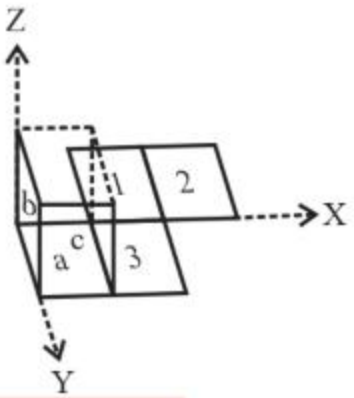


We fold the given surfaces to obtain a cube.

(a) Let the dotted lines represent the hypothetical cube to be obtained. Let us consider surface a to be the base. The given net placed in three- dimension is as shown below:

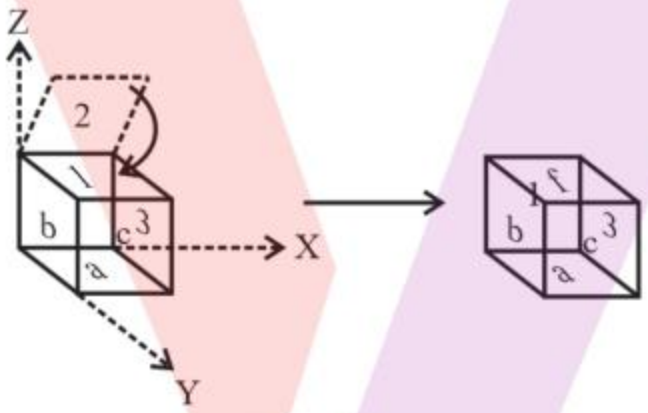


(b) Fold c parallel to XZ plane and further, b parallel to YZ plane.



(c) Fold 3 parallel to YZ plane. Consequently, fold 1 parallel to XZ plane.

2 is then folded to form the top surface of the required cube.



Therefore, we can observe that the faces that are opposite to each other are as follows:

c and 1

a and 2

b and 3

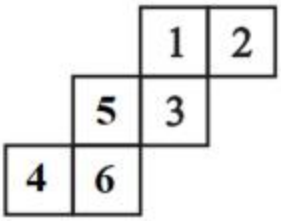
Since, the numbers on opposite faces sum up to 7,

$c + 1 = 7 \Rightarrow c = 6$

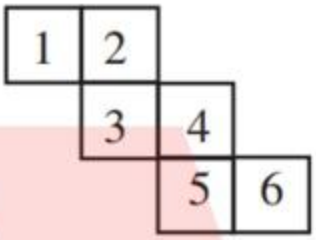
$a + 2 = 7 \Rightarrow a = 5$

$b + 3 = 7 \Rightarrow b = 4$

Hence, the net is as follows:

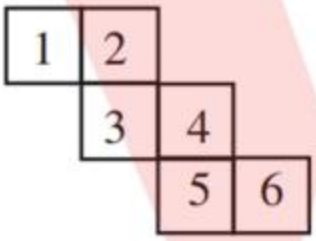


3. Can this be a net for a die? Explain your answer.

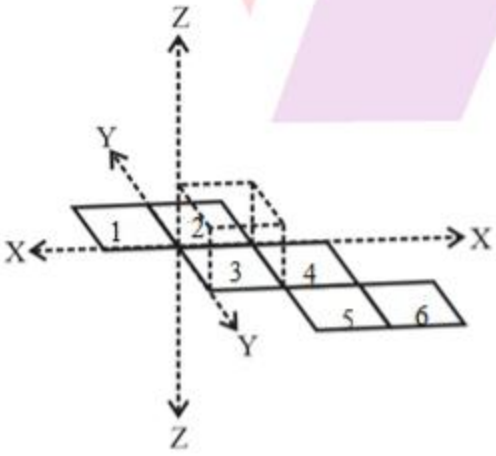


Solution:

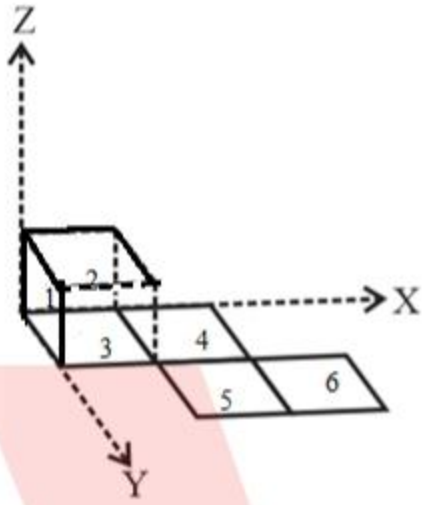
The given net is as follows:



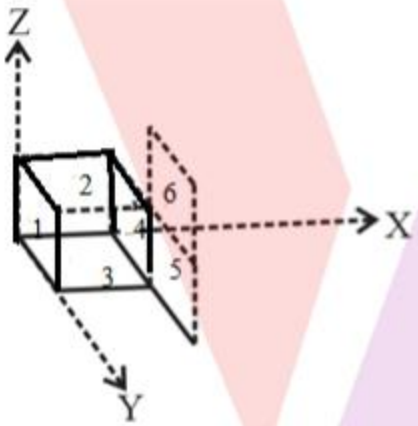
(a) Let the dotted lines represent the hypothetical cube to be obtained. Let us consider surface 3 to be the base. The given net placed in three- dimension is as shown below:



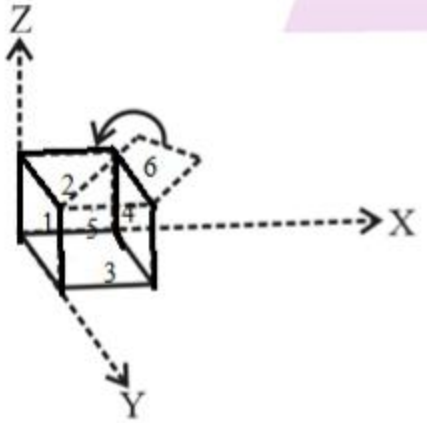
(b) Fold surfaces 2 and 1 parallel to ZX plane. Surface 1 is further folded parallel to ZY plane.

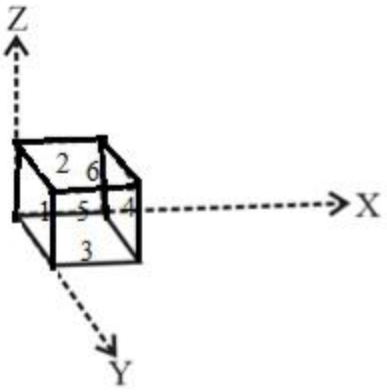


(c) The surface 4 is folded parallel to ZY plane to obtain a face adjacent to 2.



(d) Surface 5 forms face opposite to 2 when folded parallel to ZX plane. Surface 6 must then be folded to form the top surface of the cube.





From the obtained figure we can observe that the following pair of faces are opposite to each other.

3 and 6

2 and 5

4 and 1

We know that the numbers on the opposite faces of a die sum up to 7.

$\therefore 3 + 6 = 9$

Clearly, $9 \neq 7$

$2 + 5 = 7$

$7 = 7$

$4 + 1 = 5$

Clearly, $5 \neq 7$

Hence, 3 and 6, 4 and 1 cannot form a pair of opposite sides.

Therefore, it is not possible to obtain a die from the given net.

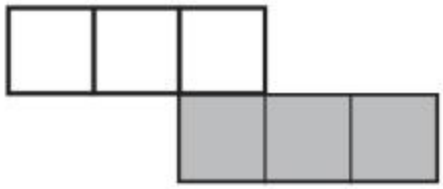
4. Here is an incomplete net for making a cube. Complete it in at least two different ways. Remember that a cube has six faces. How many are there in the net here? (Give two separate diagrams. If you like, you may use a squared sheet for easy manipulation.)

Solution:

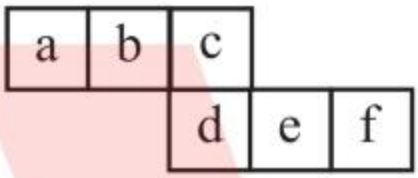
The given net has three faces.

The given net can be completed in order to obtain a cube as follows:

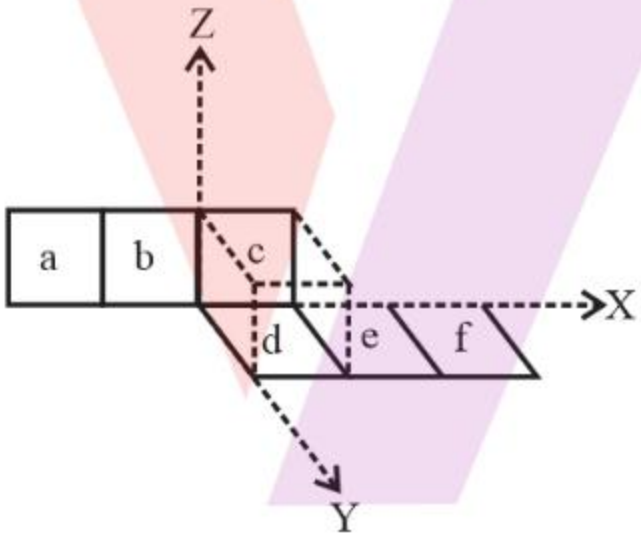
(i)



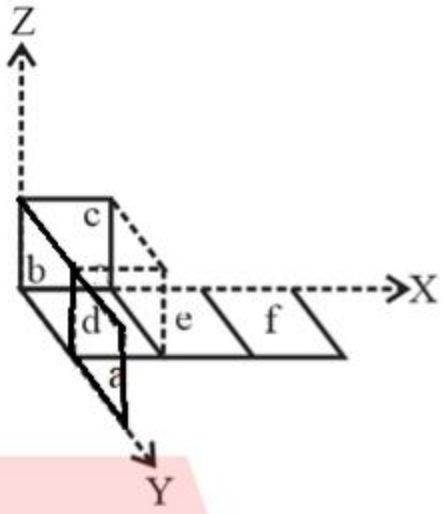
The given net can be named as follows:



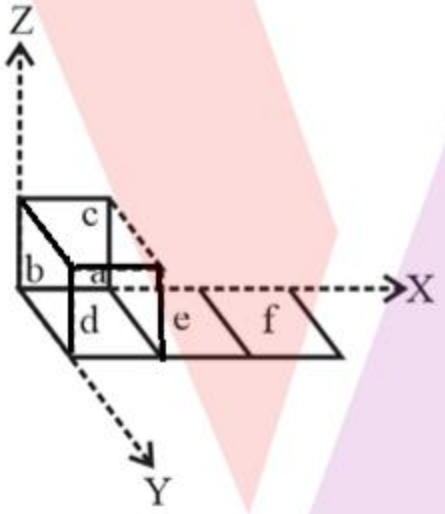
(a) Let the dotted lines represent the hypothetical cube to be obtained. Let us consider surface d to be the base. The surface c is folded parallel to XZ plane to form a lateral side of the cube as shown:



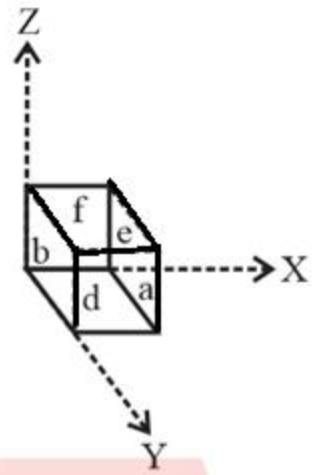
(b) Fold the surface b parallel to YZ plane to obtain a face adjacent to c.



(c) The surface a is folded parallel to XY plane to obtain a face adjacent to b.

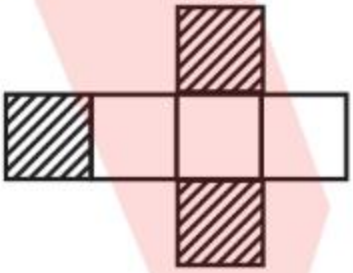


(d) Surfaces e and f are folded as shown to obtain the remaining two sides of the cube.

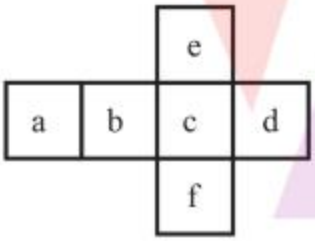


Hence, a cube can be obtained using the given net.

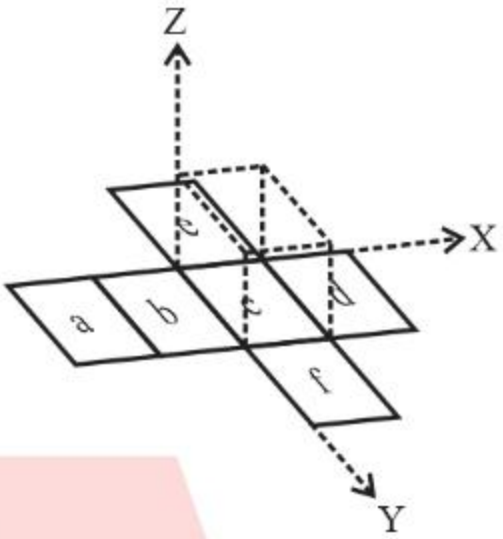
(ii)



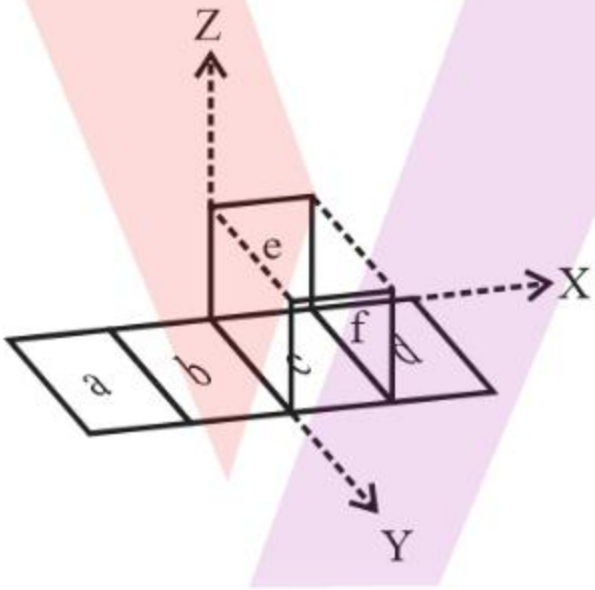
The given net can be named as follows:



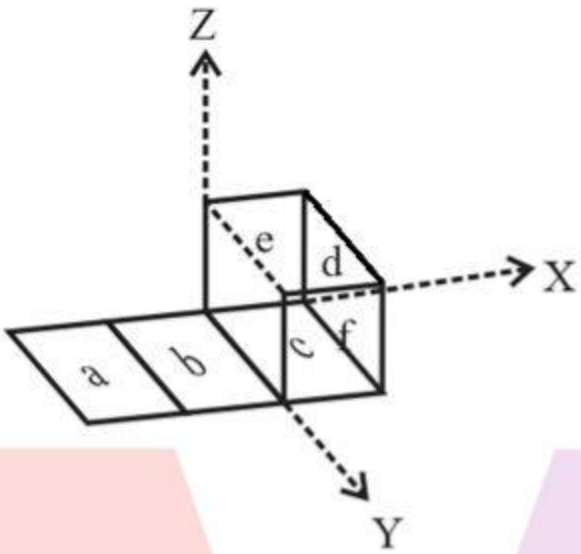
(a) Let the dotted lines represent the hypothetical cube to be obtained. Let us consider surface c to be the base. The given net placed in three- dimension is as shown below:



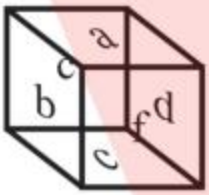
(b) Clearly, surfaces e and f can be folded parallel to XZ plane to obtain faces opposite to each other as shown:



(c) Surface d is folded parallel to ZY plane to form a face adjacent to f and e as shown:

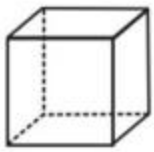


(d) Surfaces a and b can be folded to obtain the other two sides. b becomes the face opposite to d, while a becomes the top surface of the cube.



Hence, a cube can be obtained using the given net.

5. Match the nets with appropriate solids:

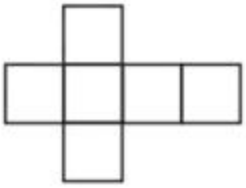
(a) 

(b) 

(c) 

(d) 

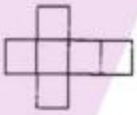
(i) 

(ii) 

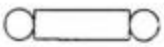
(iii) 

(iv) 

Solution:

Solids	Their nets
(a) 	(ii) 

A cube is a three-dimensional solid having six equal faces. Hence, when opened along the edges, it results in a net with a six squares as given above.

(b)  (iii) 

A cylinder is a three-dimensional solid, with two flat circular surfaces at its ends separated by a curved surface. Hence, the net contains two circles and a rectangle that can be rolled back to form a cylinder.

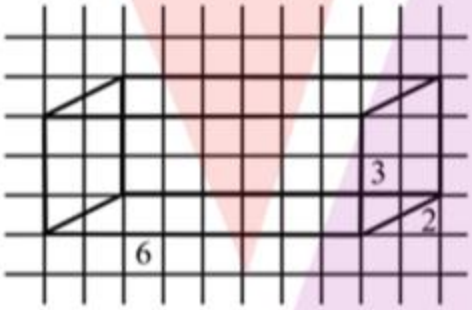
A cone is a three-dimensional solid, with a vertex at one end and a circular opening at the other end. Therefore, the net of a cone is as shown and can be obtained by slitting it along its slant surface.

The given figure is a square pyramid. It has a square for its base and four triangles for its lateral sides. Hence, the net consists of a square with four triangles, one at each of the edges of the square.

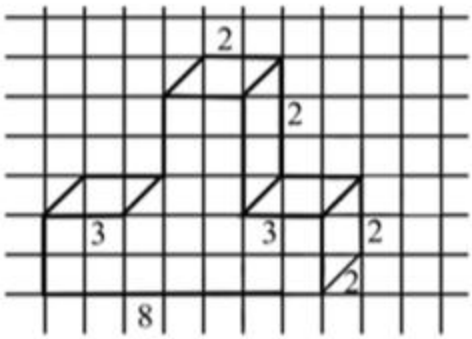
Exercise - 15.2

1. Use isometric dot paper and make an isometric sketch for each one of the given shapes:

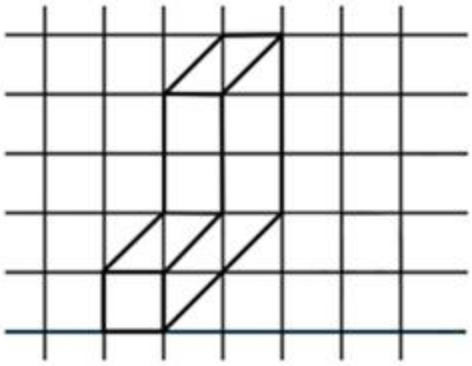
(i)



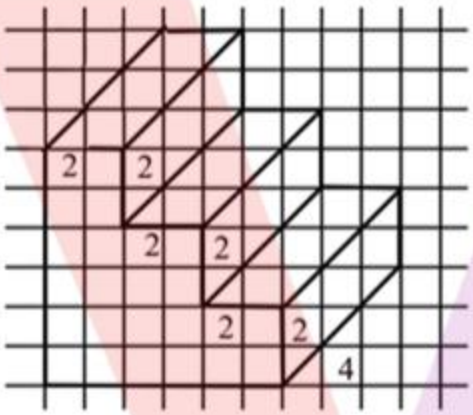
(ii)



(iii)



(iv)



Solution:

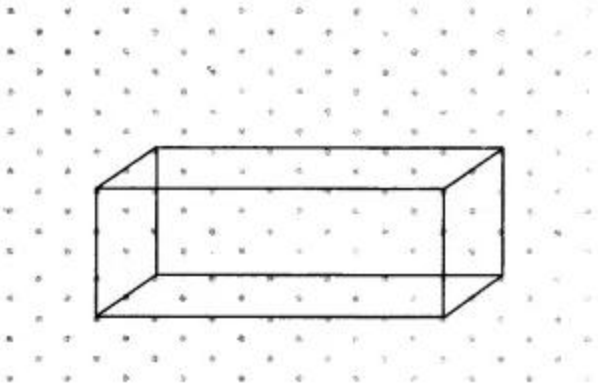
An isometric dot paper is a graph paper which uses a series of three dots forming a 60° grid of small triangles. This sheet is often used to draw sketches in which measurements agree with the actual measurements of the solid. Such sketches are called isometric sketches.

(i) From the given oblique sketch, we can observe that the length of the given cuboid is 6 units, breadth is 2 units and the height is 3 units.

(a) Draw a rectangle of dimensions 6 units and 3 units to represent the front face of the cuboid.

(b) Draw four parallel line segments of length 2 units starting from the four corners of the rectangle. This will represent the height of the rectangle.

(c) Draw a line segment to connect all the corners. This will give the reqiured cuboid.



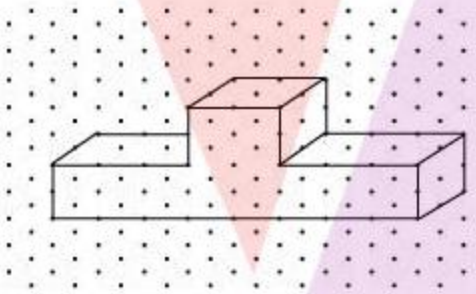
(ii) The given sketch can be visualized as a combination of two solids.

(a) Draw a rectangle of dimensions 8 units and 2 units. At a distance of 3 units from the one of the extreme end, draw a vertical line of length 2 units. This represents the front face of the solid.

(b) Draw four parallel line segments of length 2 units starting from the four corners of the rectangle. This will represent the height of the rectangle.

(c) Draw parallel line segments of length 2 units from the corners of the upper cuboid and join them to complete the solid.

(d) Draw a line segment to connect all the corners. This will give the reqiured solid.



(iii) The given oblique diagram can be redrawn to represent an isometric sketch as shown below:

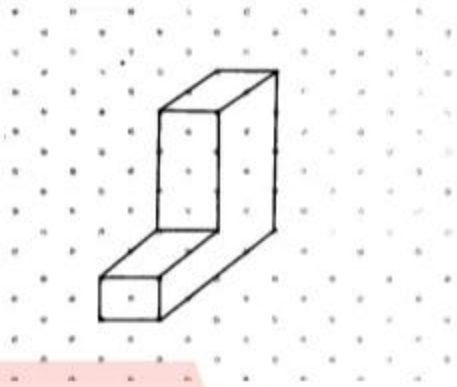
(a) Draw a square of dimensions 1 unit.

(b) Draw four parallel line segments. 2 bottom line segment is of length 4 units each and 2 upper line segment is of length 2 units each starting from the four corners of the square.

(c) Join two free end of upper line segment and draw parallel line segments of length 3 units as shown in figure and join them.

(d) From two free end of bottom line segment draw parallel line segments of length 4 units as shown in figure and join them.

(e) Draw line segments to connect all other corners. This will give the reqiured solid.



(iv) From the given oblique sketch, we can observe that the given figure can be visualized as a combination of three solids, with total length of 6 units and breadth of 4 units. The height increases by two units from one solid to another.

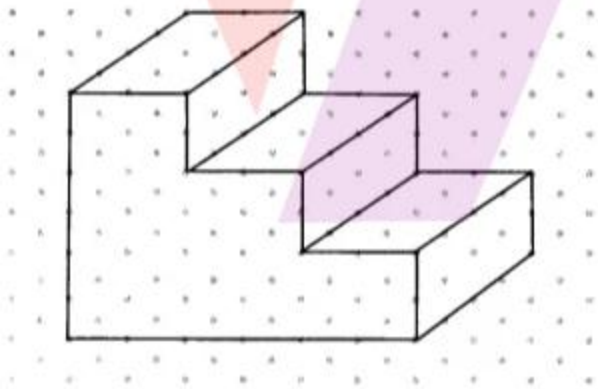
(a) Draw a line segment of 6 units by joining 7 dots on the sheet. This represents the total length of the solid.

(b) From the left corner draw a line segment of 4 units to represent the breadth.

(c) Draw a vertical line of 2 units to represent the height of the solid.

(d) Complete the figure by increasing the height by 2 units at every stage.

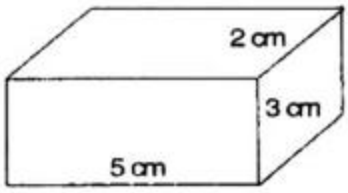
The figure obtained is as shown below:



2. The dimensions of a cuboid are 5 cm, 3 cm and 2 cm. Draw three different isometric sketches of this cuboid.

Solution:

The dimensions of given cuboid are 5 cm, 3 cm and 2 cm:



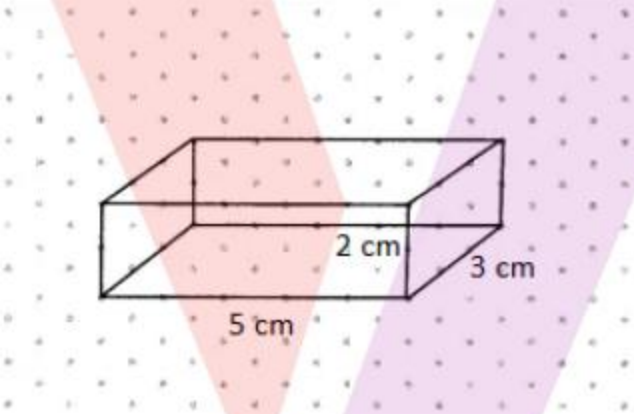
Three different isometric sketches are (1 unit = 1 cm):

(i) From the given oblique sketch, we can observe that the dimensions of the given cuboid are 5 cm, 3 cm, 2 cm.

(a) Draw a rectangle of dimensions 5 units and 2 units to represent the front face of the cuboid.

(b) Draw four parallel line segments of length 3 units starting from the four corners of the rectangle. This will represent the height of the rectangle.

(c) Draw a line segment to connect all the corners. This will give the reqiured cuboid.

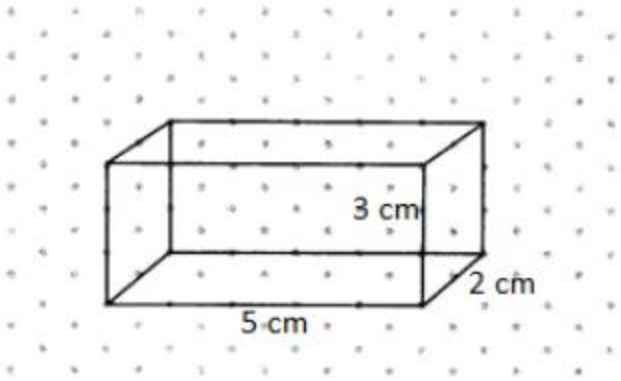


(ii) From the given oblique sketch, we can observe that the dimensions of the given cuboid are 5 cm, 3 cm, 2 cm.

(a) Draw a rectangle of dimensions 5 units and 3 units to represent the front face of the cuboid.

(b) Draw four parallel line segments of length 2 units starting from the four corners of the rectangle. This will represent the height of the rectangle.

(c) Draw a line segment to connect all the corners. This will give the reqiured cuboid.

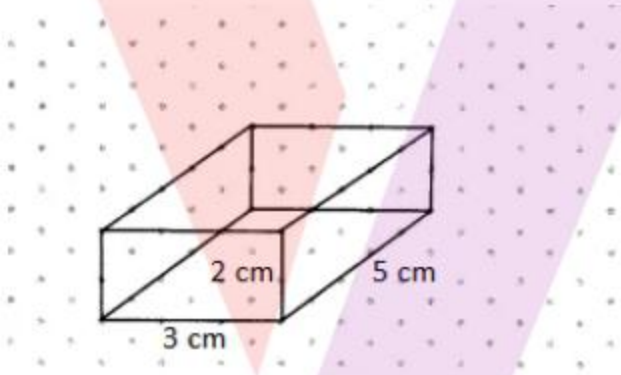


(iii) From the given oblique sketch, we can observe that the dimensions of the given cuboid are 5 cm, 3 cm, 2 cm.

(a) Draw a rectangle of dimensions 3 units and 2 units to represent the front face of the cuboid.

(b) Draw four parallel line segments of length 5 units starting from the four corners of the rectangle. This will represent the height of the rectangle.

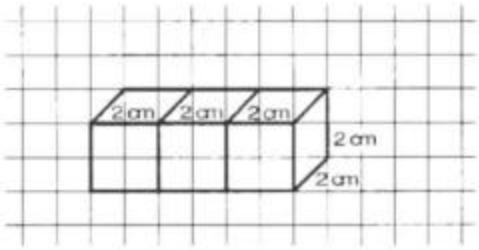
(c) Draw a line segment to connect all the corners. This will give the reqiured cuboid.



3. Three cubes each with 2 cm edge are placed side by side to form a cuboid. Sketch an oblique or isometric sketch of this cuboid.

Solution:

Oblique sketch:

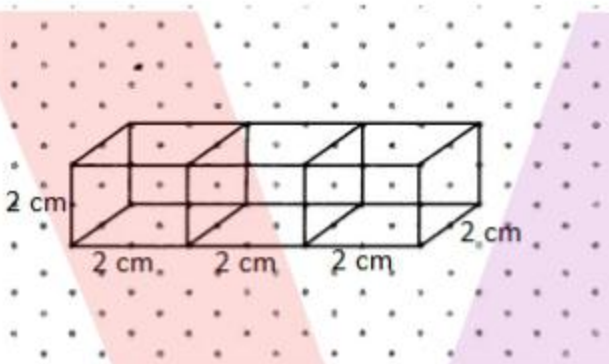


Isometric sketch: It can be noted that the dimensions of a cube are equal. Therefore, the length, breadth and height of each of the cube will be equal to 2 units.

(a) Draw three squares adjacent to each other of dimensions 2 units to represent the front face of the solid.

(b) Draw four parallel line segments of length 2 units starting from the four corners of each of the squares. This will represent the height of the rectangle.

(c) Draw a line segment to connect all the corners. This will give the required solid.



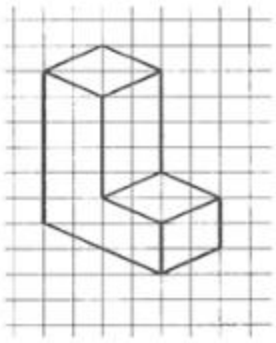
4. Make an oblique sketch for each one of the given isometric shapes:

Solution:

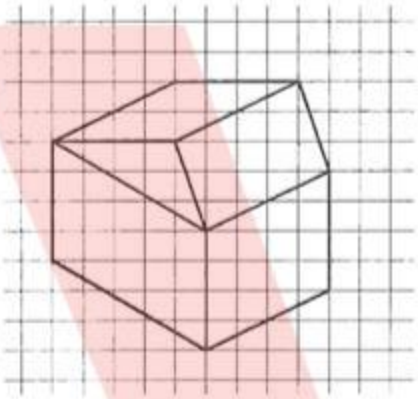
Oblique sketches are projective drawings in which only the frontal lines are in true proportions and all the other sides appear so, though the actual measures of the edges are not considered.

Since, the oblique sketches are not in accord with the actual measurements, the given isometric sketches can be drawn as follows to represent the corresponding oblique sketches.

(a)



(b)



5. Give (i) an oblique sketch and (ii) an isometric sketch for each of the following:

(a) A cuboid of dimensions 5 cm, 3 cm and 2 cm. (Is your sketch unique?)

(b) A cube with an edge 4 cm long.

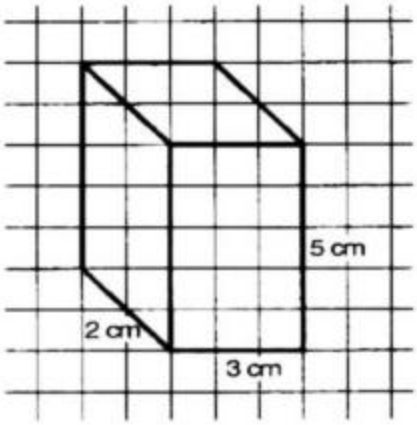
Note: An isometric sheet is attached at the end of the book. You could try to make some cubes or cuboids of dimensions specified by your friend.

Solution:

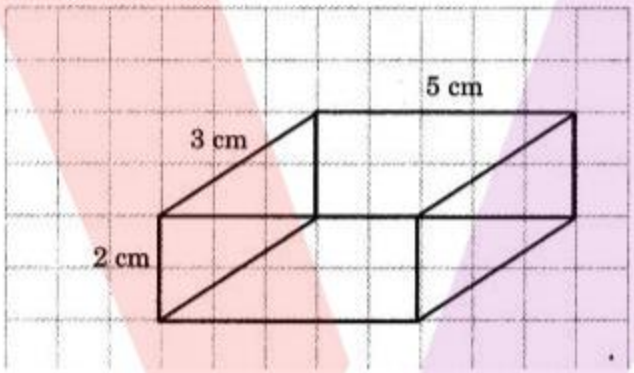
(a) A cuboid of dimension 5 cm, 3 cm and 2 cm.

The sketch is not unique. This is because, the same solid can be represented in many ways, two such representations are shown below:

(i) Oblique sketch



OR

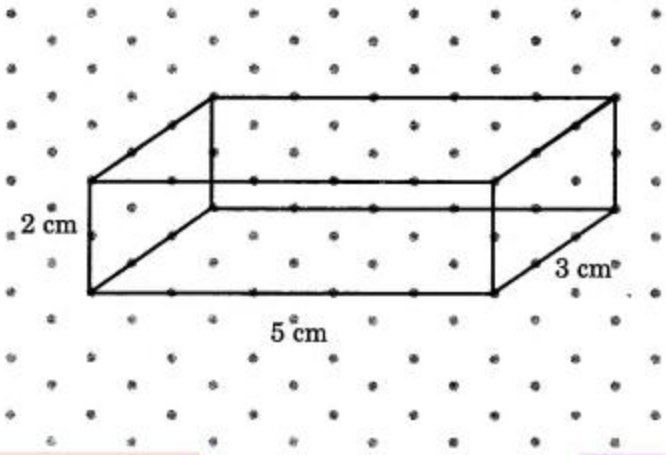


(ii) Isometric sketch of the above cuboid can be drawn as follows (1 unit = 1 cm):

(a) Draw a rectangle of dimensions 5 units and 2 units to represent the front face of the cuboid.

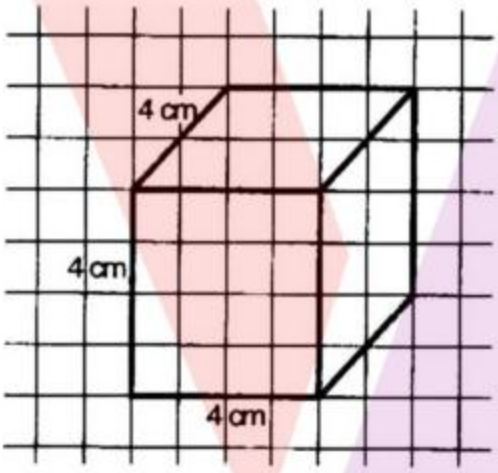
(b) Draw four parallel line segments of length 3 units starting from the four corners of the rectangle. This will represent the height of the rectangle.

(c) Draw a line segment to connect all the corners. This will give the reqiured cuboid.

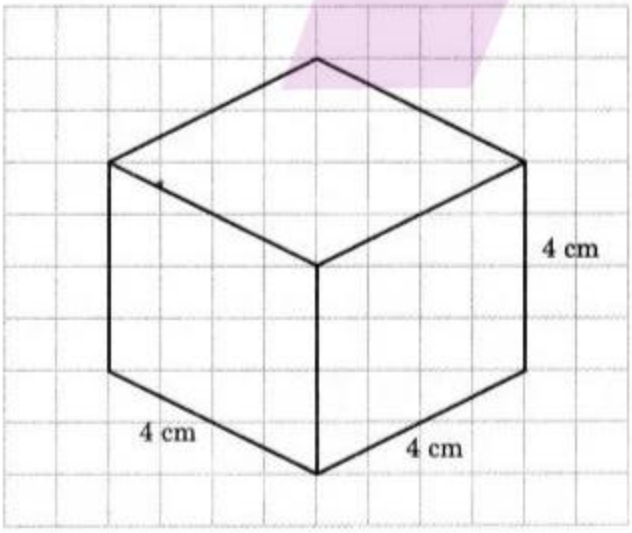


(b) A cube of dimension 4 cm long.

(i) Oblique sketch: The oblique sketch is not unique, since the same solid can be represented in many ways, two of which are as shown below:



OR

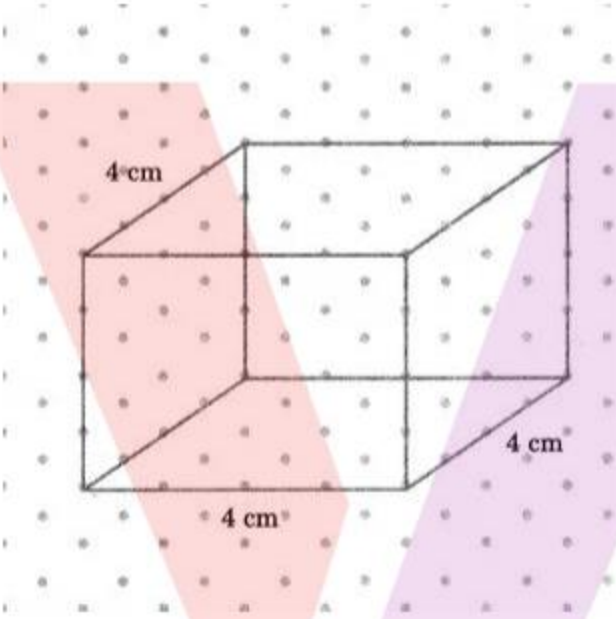


(ii) Isomeric sketch of the required cube of 4 units can be drawn as follows (1 unit = 1 cm):

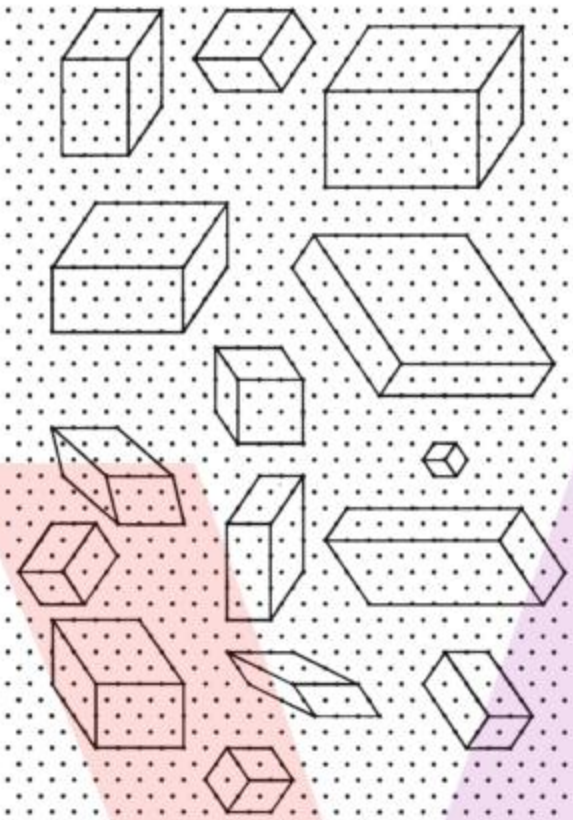
(a) Draw a square of dimensions 4 units to represent the front face of the cube.

(b) Draw four parallel line segments of length 4 units starting from the four corners of the square. This will represent the height of the square.

(c) Draw a line segment to connect all the corners. This will give the reqiured cube.



Note: Examples of isometric representation of various cubes and cuboids are given below:



Exercise - 15.3

1. What cross-sections do you get when you give a (i) vertical cut (ii)horizontal cut to the following solids?

(a) A brick

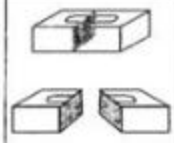
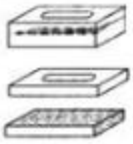
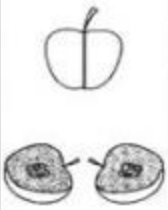
(b) A round apple

(c) A die

(d) A circular pipe

(e) An ice cream cone

Solution:

S.No.	Name of article	Figure	Vertical cut	Horizontal cut
(a)	A brick			
(b)	A round apple			
(c)	A die			
(d)	A circular pipe			
(e)	An ice-cream cone			

Exercise - 15.4

1. A bulb is kept burning just right above the following solids. Name the shape of the shadows obtained in each case. Attempt to give a rough sketch of the shadow.

(You may try to experiment first and then answer these questions).

A ball
(i)

A Cylindrical pipe
(ii)

A book
(iii)

Solution:

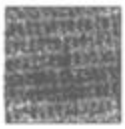
S.No.	Object	Shadow	Shape's name
(i)	A ball		Circle
(ii)	A cylindrical pipe		Rectangle
(iii)	A book		Rectangle

2. Here are the shadows of some 3 – D objects, when seen under the lamp of an overhead projector. Identify the solid(s) that match each shadow. (There may be multiple answers for these!)

A circle A square A triangle A rectangle

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

Solution:

S. No.	Shadow	Shape's Name	3-D objects
(i)		Circle	Chapatti, Football, Disc, Plate etc.
(ii)		Square	Die, Square paper sheet, cubical magic box, Chalk box etc.
(iii)		Triangle	Ice-cream cone, Birthday cap, etc.
(iv)		Rectangle	Geometry box, Book, Table etc.

3. Examine if the following are true statements:

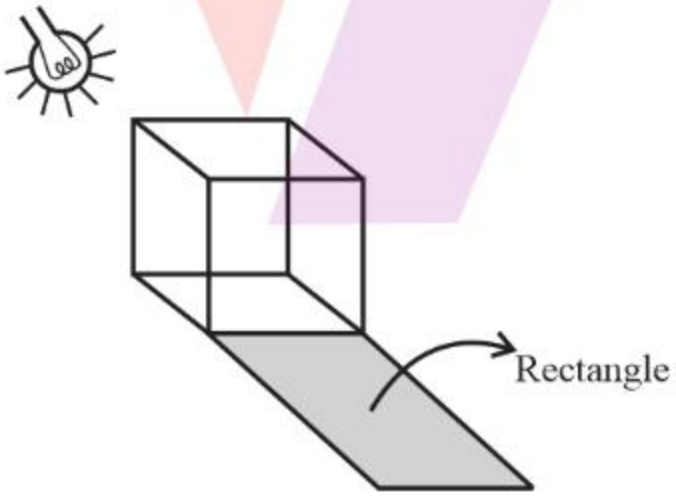
(i) The cube can cast a shadow in the shape of a rectangle.

(ii) The cube can cast a shadow in the shape of a hexagon.

Solution:

(i) True

The cube can cast a shadow in the shape of a rectangle.



(ii) False

The cube cannot cast shadow in the shape of a hexagon. A hexagon has six sides.

But at any instant, one can only see a maximum of three sides of a cube. Hence a single stream of light cannot cast a shadow of cube in the form of a hexagon.