ISOMETRIC PROJECTION

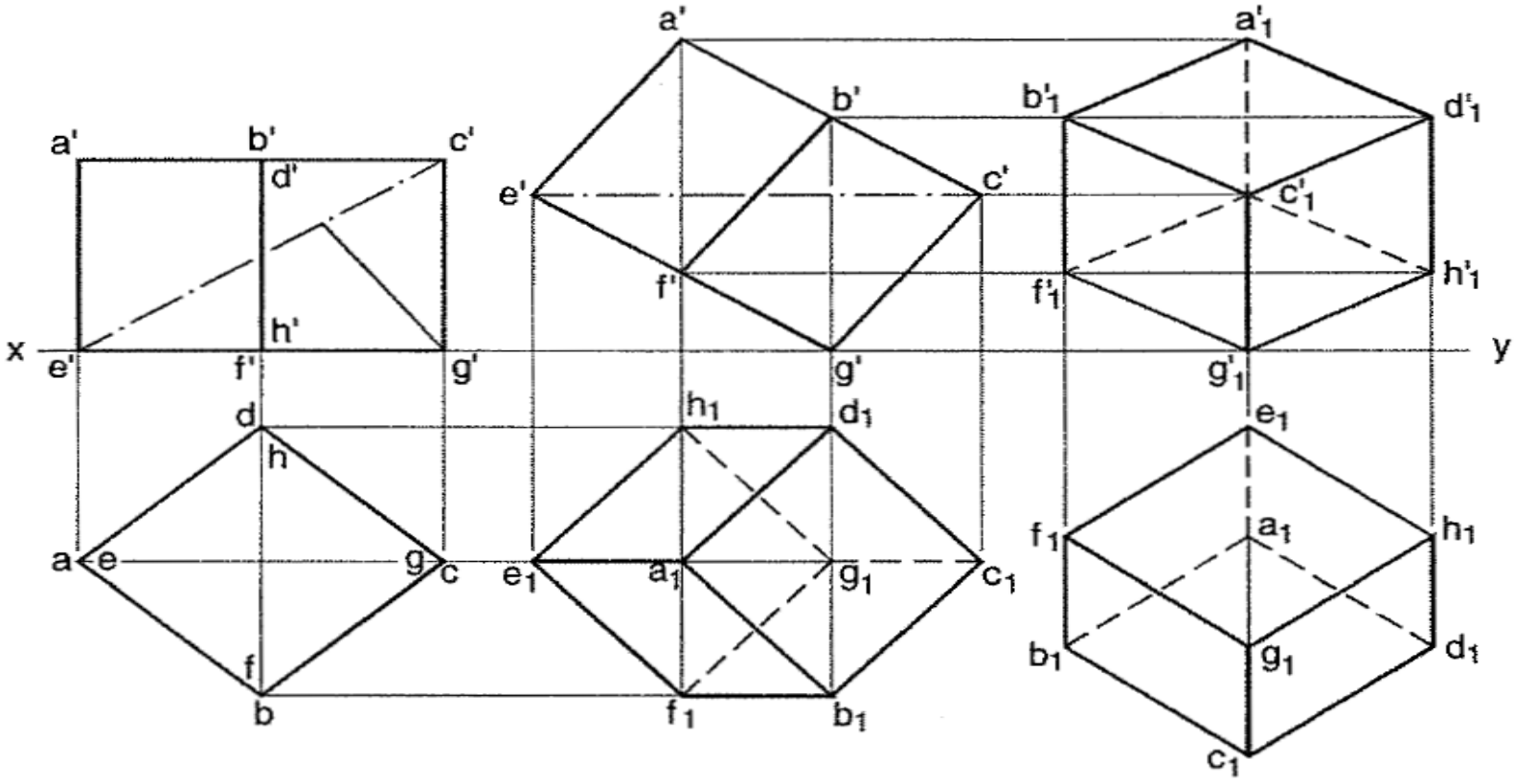
What is Isometric Projection ???

Isometric projection is a type of pictorial projection in which the three dimensions of a solid are not only shown in one view, but their actual sizes can be measured directly from it.

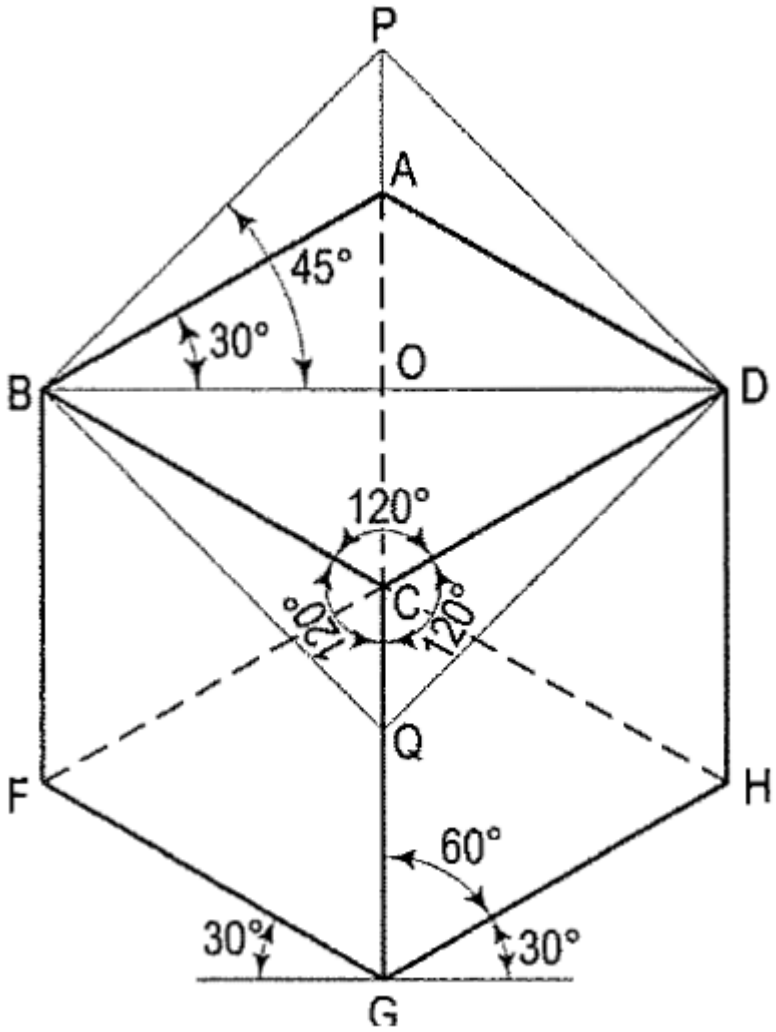
Isometric projection is a method for visually representing three-dimensional objects in two dimensions in technical and engineering drawings. It is a projection in which the three coordinate axes appear equally foreshortened and the angle between any two of them is 120 degrees.

Isometric Projection of Cube

- If a cube is placed on one of its corners on the ground with a solid diagonal perpendicular to the V.P., the front view is the *isometric projection* of the cube.



Isometric View of a Cube



Isometric Projection (Contd….)

(a) All the faces of the cube are equally inclined to the V.P. and hence, they are seen as similar and equal rhombuses instead of squares.

(b) The three lines *CB, CD* and CG meeting at C and representing the three edges of the solid right-angle are also equally inclined to the V.P. and are therefore, equally foreshortened. They make equal angles of 120° with each other. The line CG being vertical, the other two lines *CB* and *CD* make 30° angle each, with the horizontal.

(c) All the other lines representing the edges of the cube are parallel to one or the other of the above three lines and are also equally foreshortened.

(d) The diagonal *BD* of the top face is parallel its true length.

Terms used in Isometric Projection

- The three lines *CB, CD* and CG meeting at the point C and making 120° angles with each other are termed *isometric axes*.

- The lines parallel to these axes are called *isometric lines*.

- The planes representing the faces of the cube as well as other planes parallel to these planes are called *isometric planes*.

Isometric Projection (Contd….)

- As all the edges of the cube are equally foreshortened, the square faces are seen as rhombuses.

- The rhombus *ABCD* shows the isometric projection of the top square face of the cube in which *BD* is the true length of the diagonal.

- Construct a square *BQDP* around *BD* as a diagonal. Then *BP* shows the true length of *BA.*

Isometric Scale (Contd…)

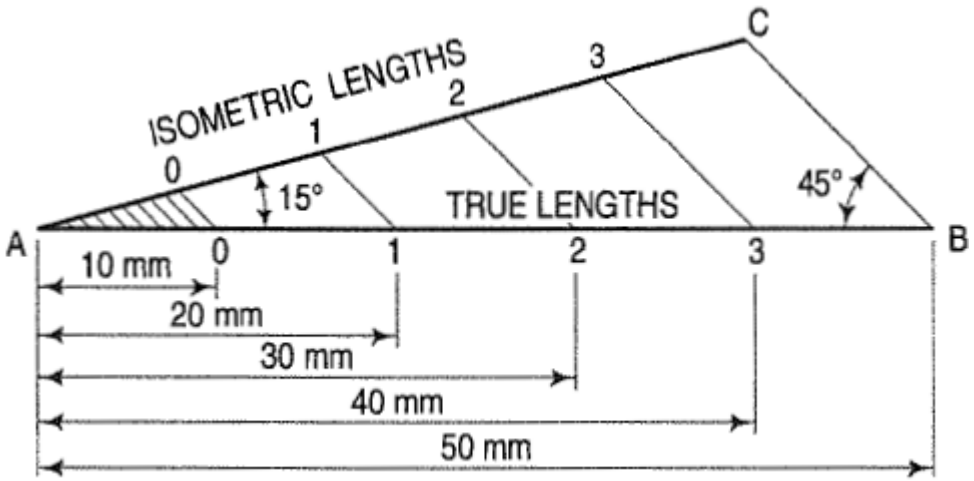
In triangle ABO, $\frac{BA}{BO} = \frac{1}{\cos 30^\circ} = \frac{2}{\sqrt{3}}$

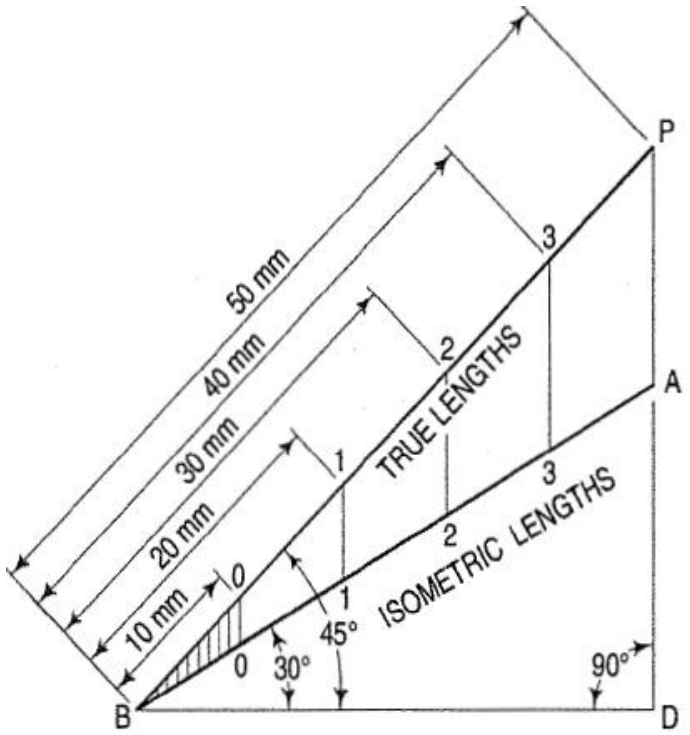
In triangle PBO, $\frac{BP}{BO} = \frac{1}{\cos 45^\circ} = \frac{\sqrt{2}}{1}$

$$\frac{BA}{BP} = \frac{2}{\sqrt{3}} \times \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{\sqrt{3}} = 0.815$$

The ratio, $\frac{\text{isometric length}}{\text{true length}} = \frac{BA}{BP} = \frac{\sqrt{2}}{\sqrt{3}} = 0.815$ or $\frac{9}{11}$ (approx.).

Thus, the isometric projection is reduced in the ratio $\sqrt{2} : \sqrt{3}$, i.e. *the isometric lengths are 0.815 of the true lengths.*





Isometric View vs Projection

- If the foreshortening of the isometric lines in an isometric projection is disregarded and instead, the true lengths are marked

  The view obtained will be exactly of the same shape but larger in proportion (about 22.5%) than that obtained by the use of the isometric scale.

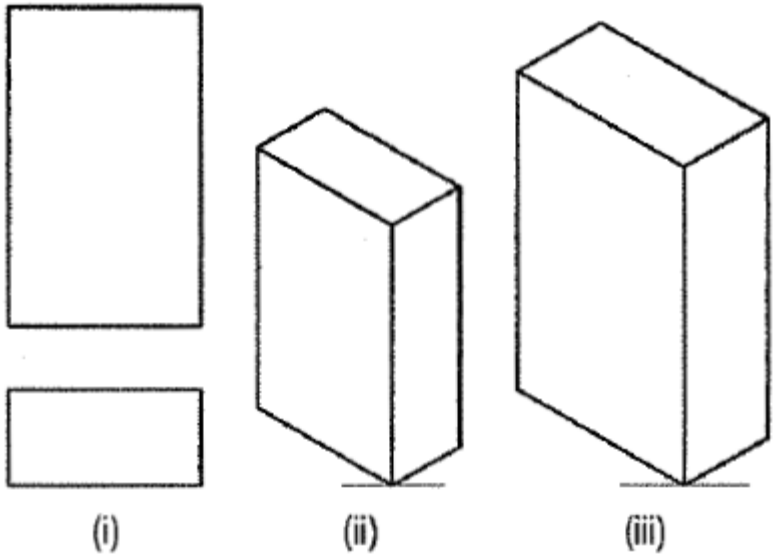
- Due to the ease in construction and the advantage of measuring the dimensions directly from the drawing, it has become a general practice to use the true scale instead of the isometric scale.

- The view drawn with the true scale is called *isometric drawing* or ***isometric view***, while that drawn with the use of **isometric scale** is called ***isometric projection***.

Isometric View

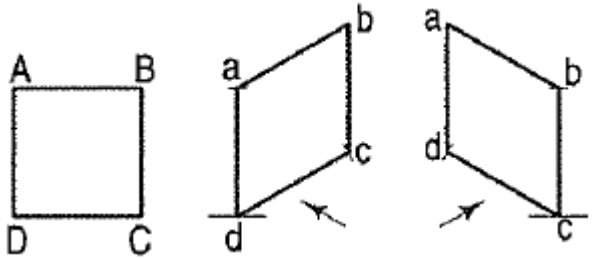
- The vertical edges are shown by vertical lines

- The horizontal edges are represented by lines, making 30° angles with the horizontal.

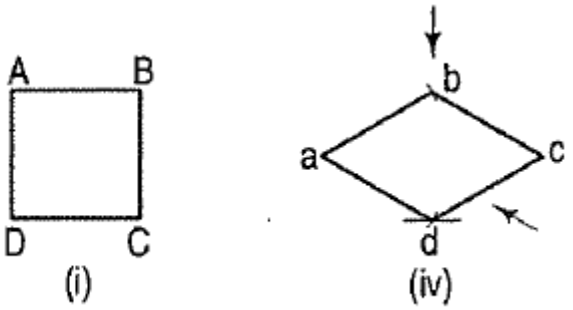


Isometric View (Contd…)

- *The* front *view* of *a square is given in* fig. (i). *Draw its isometric view.*

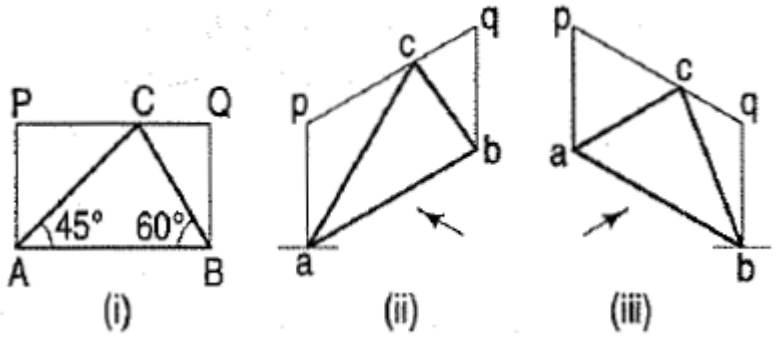


- *The* top *view* of *a square is given in* fig. (i). *Draw its isometric view.*



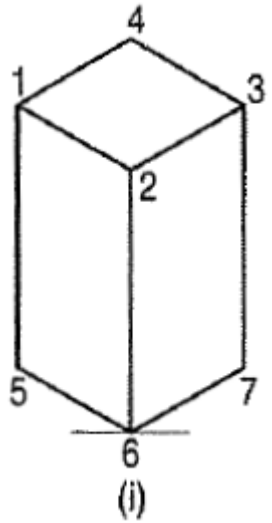
Isometric View (Contd…)

The front view of *a triangle having its surface parallel to the V.P.* is *shown in fig. (i). Draw its isometric view.*



Isometric View (Contd…)

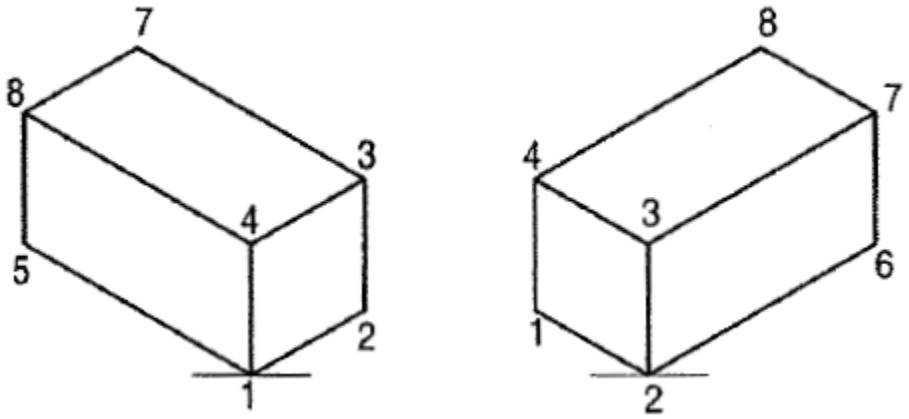
- *Draw the isometric view of a square prism, side of the base 20 mm long and the axis 40 mm long, when its axis is (i) vertical and (ii) horizontal*
  - When the axis is vertical, the ends of the prism will be horizontal.
  - Draw the isometric view (the rhombus 1-2-3-4) of the top end.
  - Its sides will make 30°-angles with the horizontal.
  - The length of the prism will be drawn in the third direction, i.e. vertical.



(i)

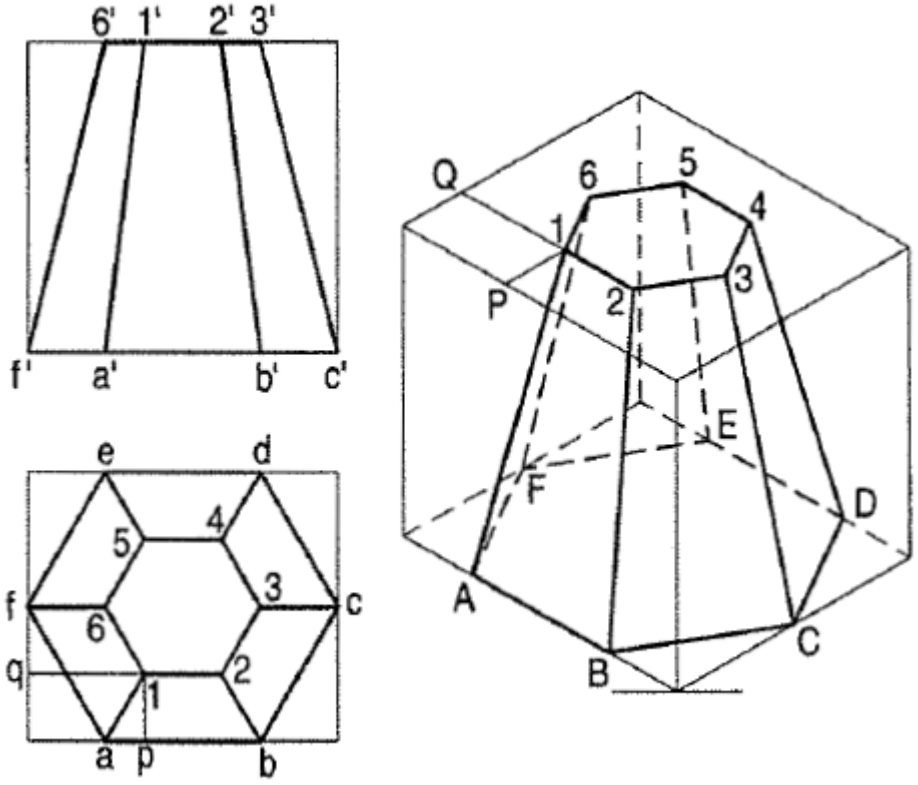
Isometric View (Contd…)

When the axis is horizontal, the ends will be vertical. The ends can be drawn in two ways as shown in figures . In each case, the length is shown in the direction of the third isometric axis.



Isometric View (Contd…)

Draw the isometric view of the frustum of the hexagonal pyramid



Isometric View (Contd…)

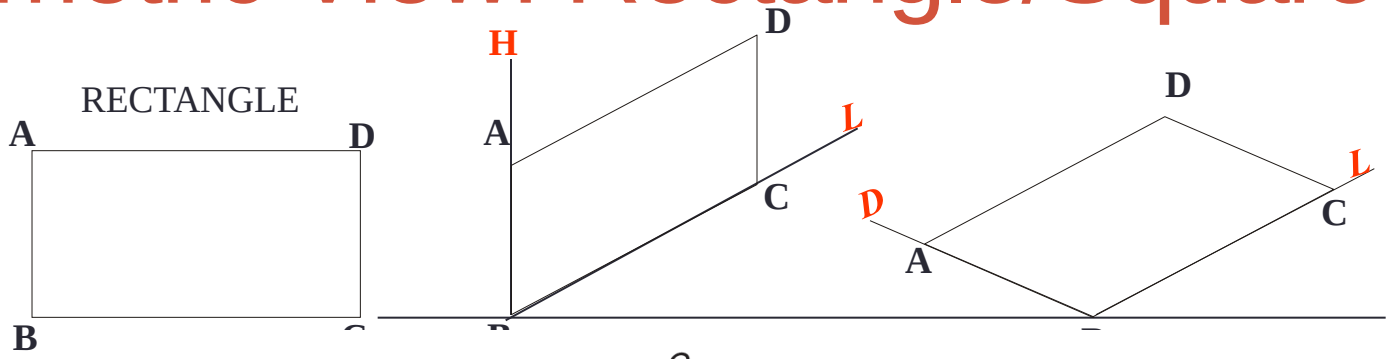
(i) Enclose the front view and the top view in rectangles.

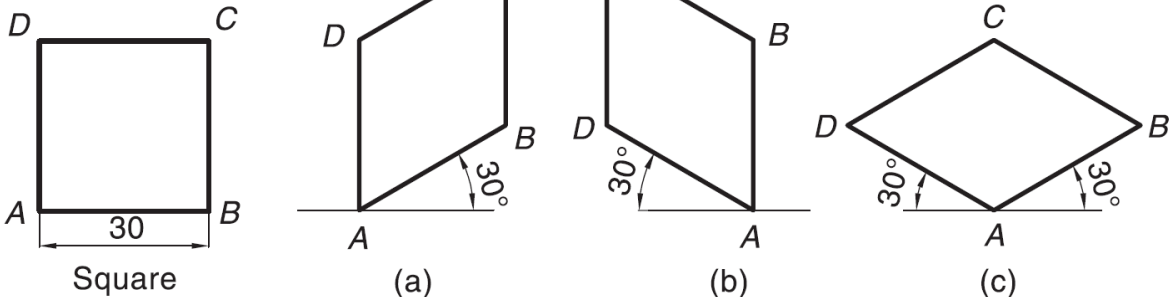
(ii) Draw the isometric view of the rectangular box

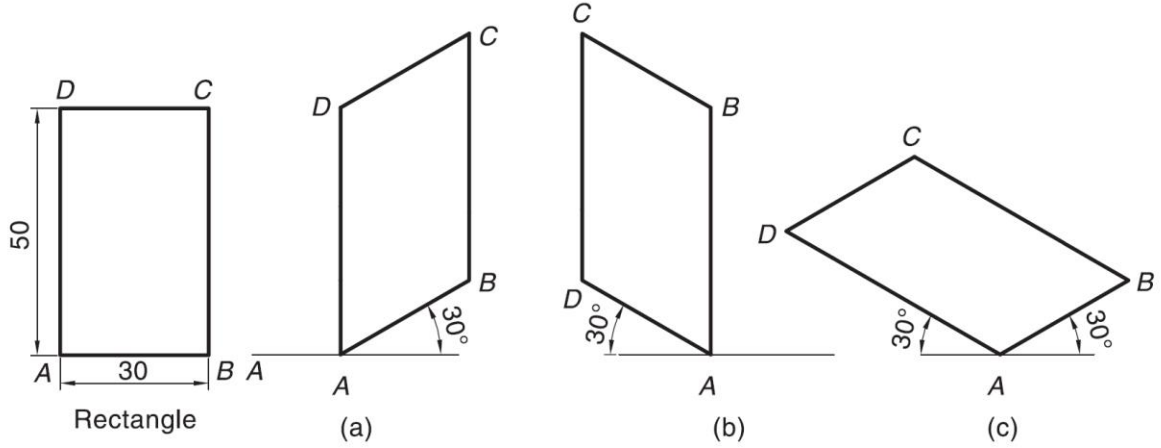
(iii) Locate the six points of the base of the frustum on the sides of
the bottom of the box. The upper six points on the top surface of the box are located by drawing isometric lines, e.g. P1 and Q1 intersecting at a point 1.

(iv) Join the corners and complete the isometric view as shown.

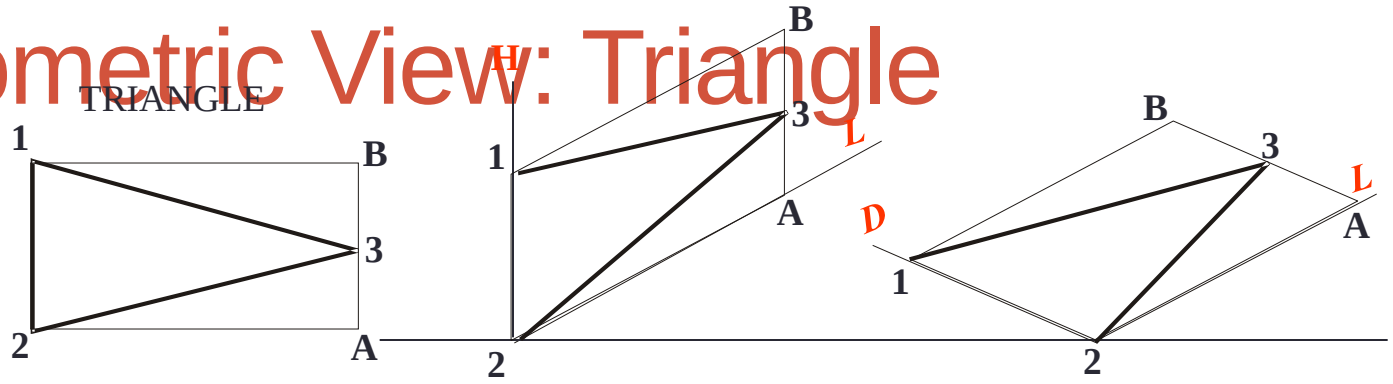
Isometric View: Rectangle/Square

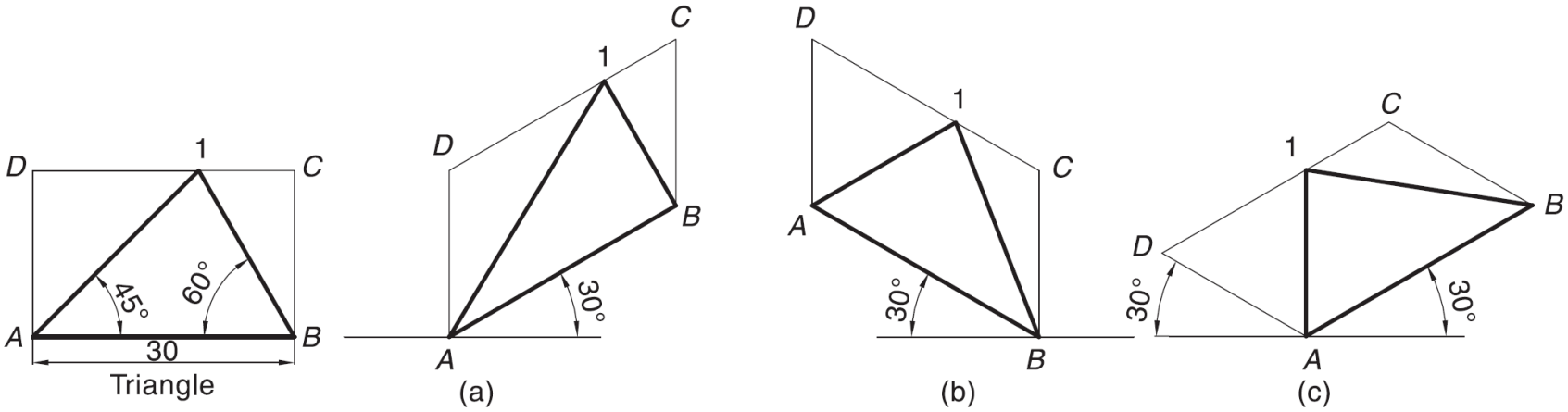




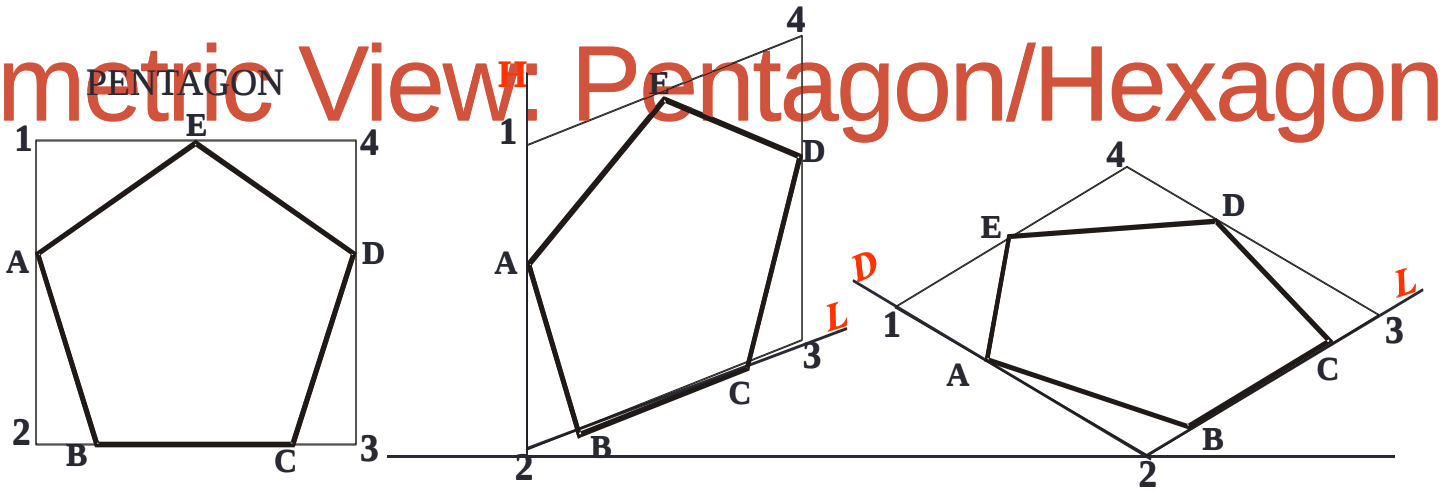


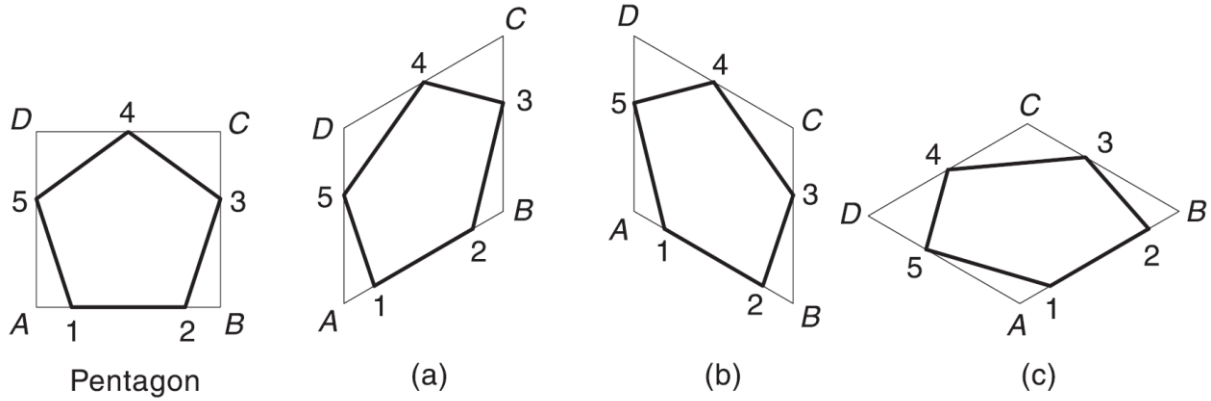
Isometric View: Triangle

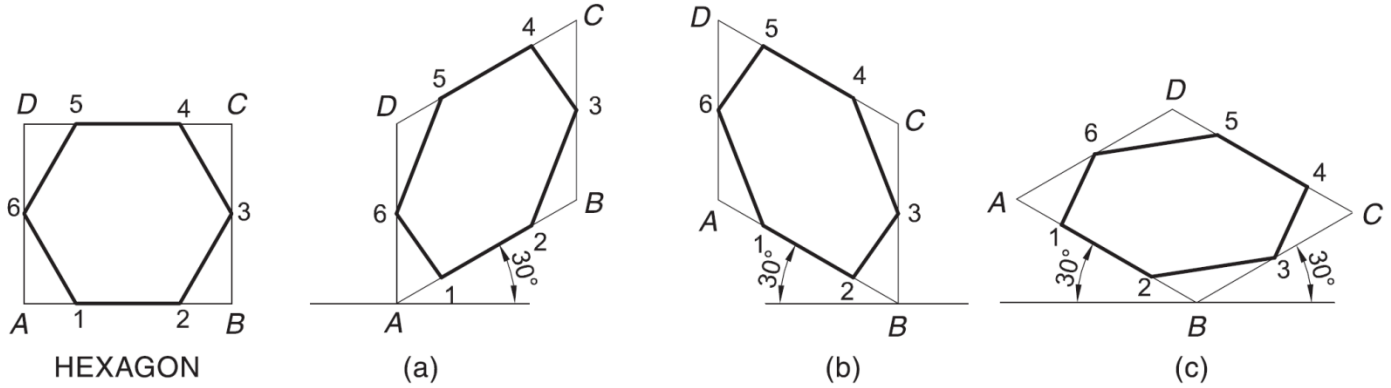




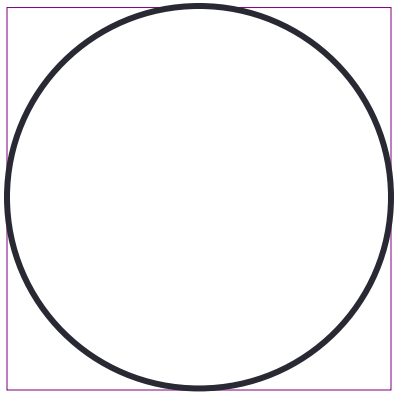
Isometric View: Pentagon/Hexagon

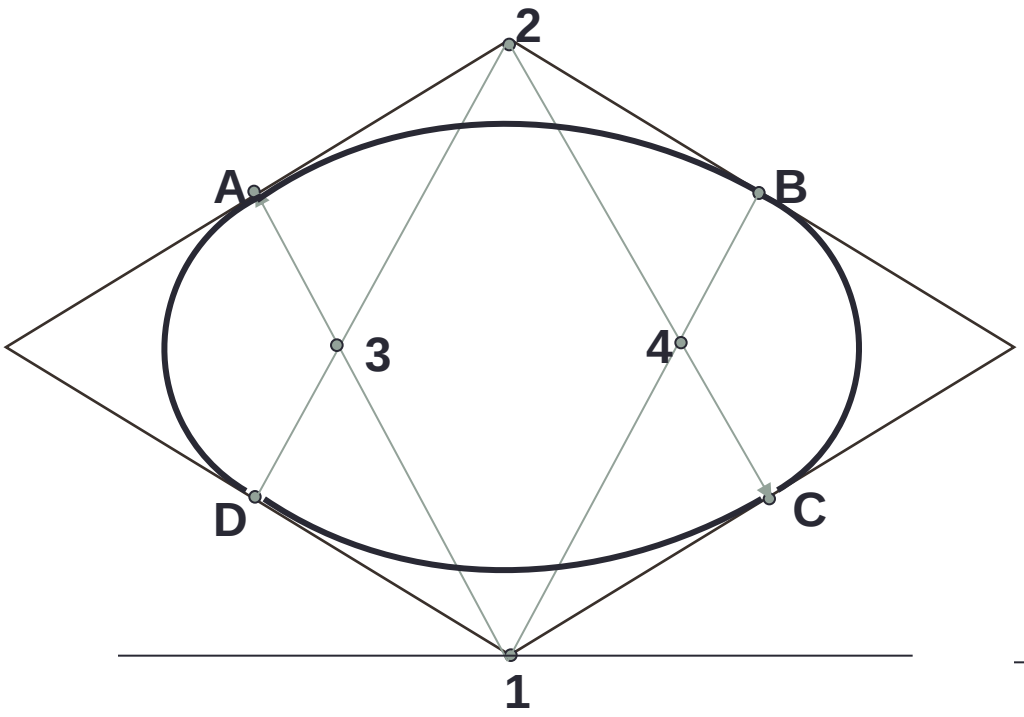


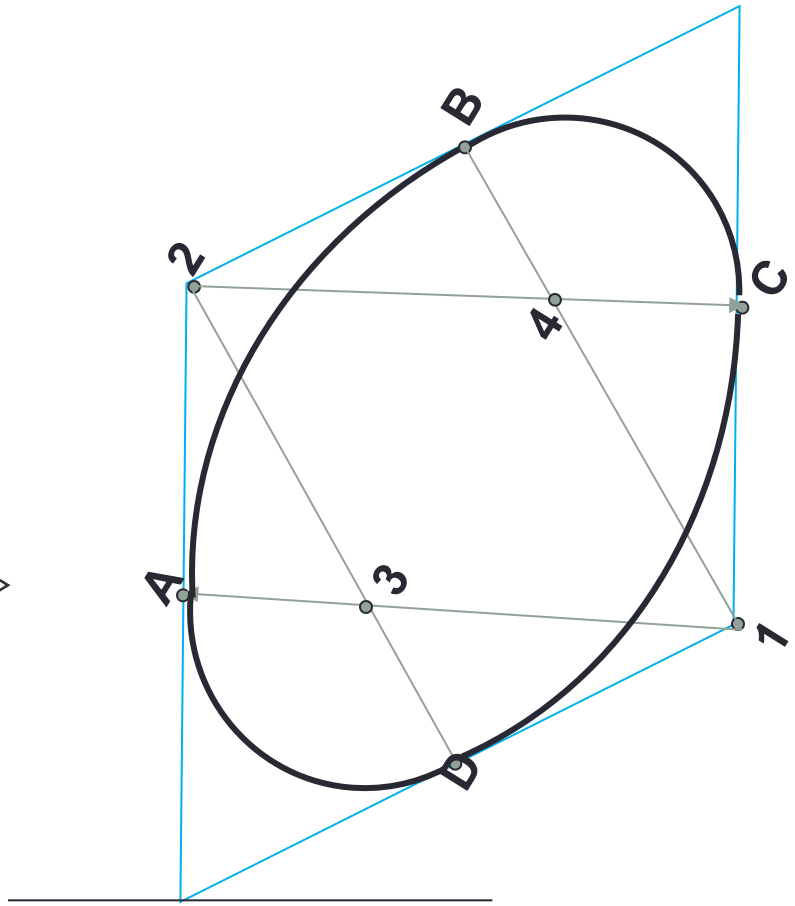




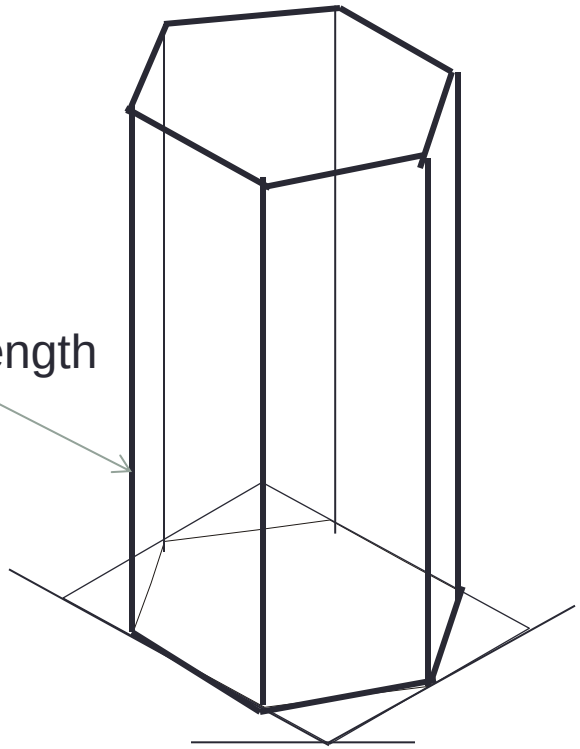
I View: Circle





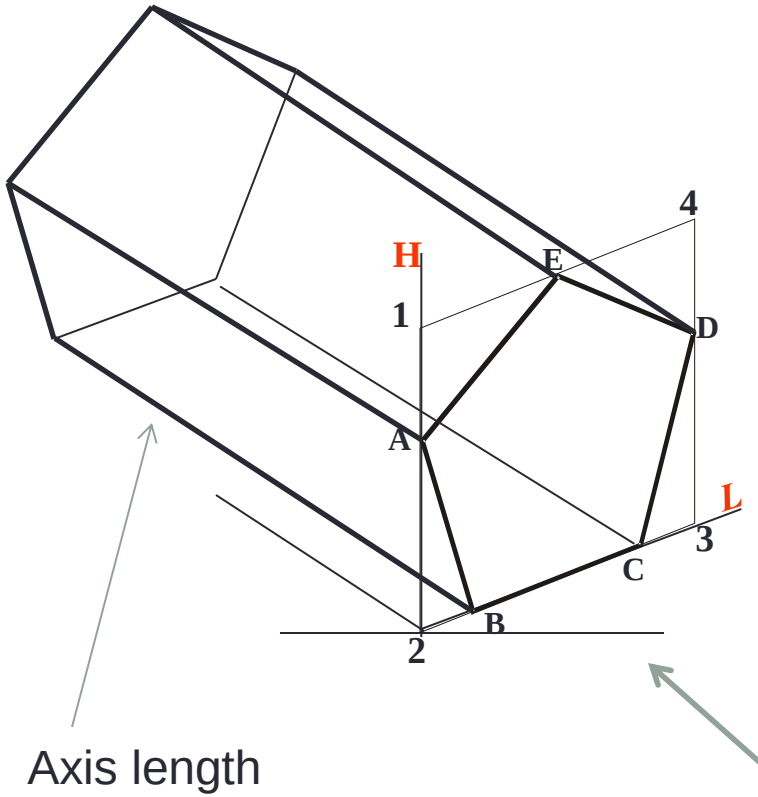


Isometric View: Prism



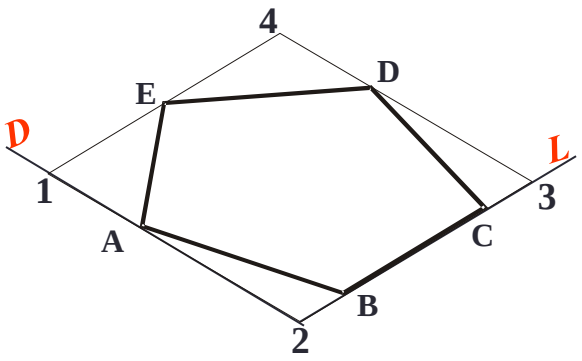
ISOMETRIC VIEW OF
HEXAGONAL PRISM
STANDING ON H.P.

ISOMETRIC VIEW OF
PENTAGONAL PRISM
LYING ON H.P.

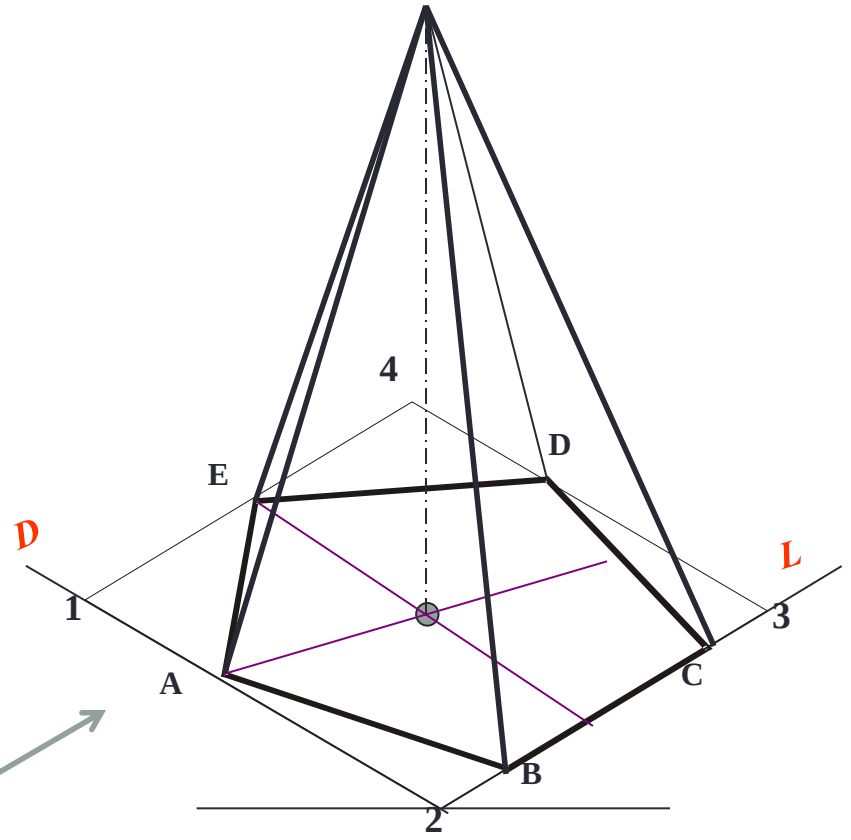


Isometric View: Pyramid

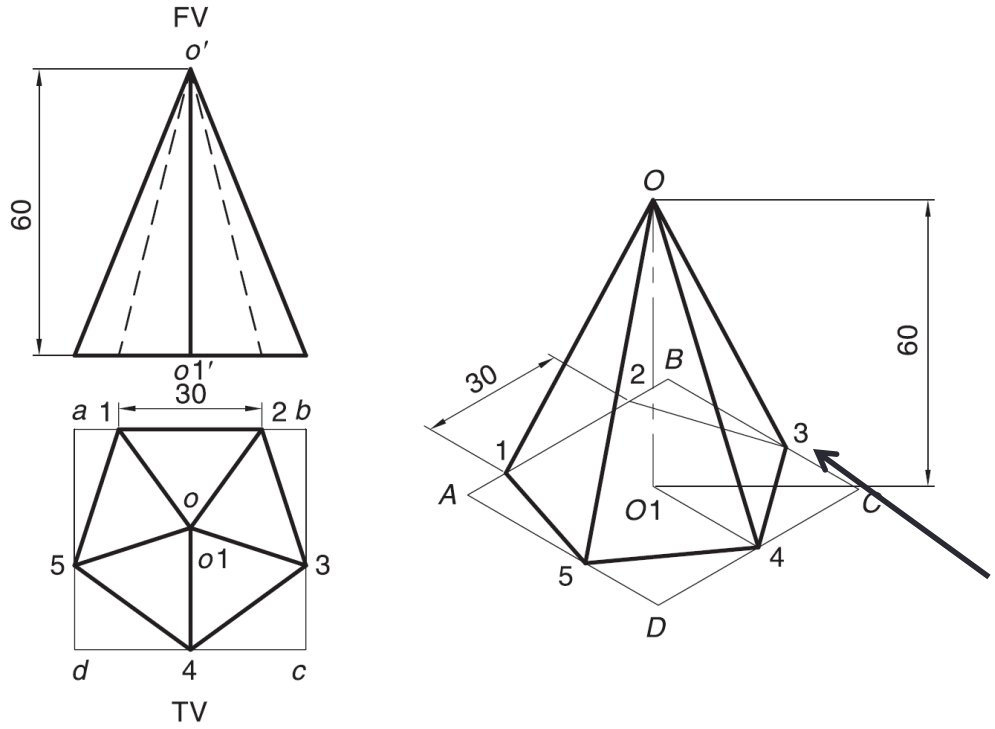
ISOMETRIC VIEW OF BASE OF
PENTAGONAL PYRAMID
STANDING ON H.P.



ISOMETRIC VIEW OF
PENTAGONAL PYRAMID
STANDING ON H.P.
(Height is added from center of pentagon)



Isometric View: Pyramid



Isometric View: Prism