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ENGINEERING GRAPHICS

DEPARTMENT OF MECHANICAL ENGINEERING

SYLLABUS (THEORY)

:

Branch / Year / Sem : MECH/I/I

Sub.Name :ENGINEERING GRAPHICS **Staff Name** :PRADEEP.P

L T P C
3 0 0 3

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12

Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6 + 12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS

SUBJECT IN-CHARGE **HOD**

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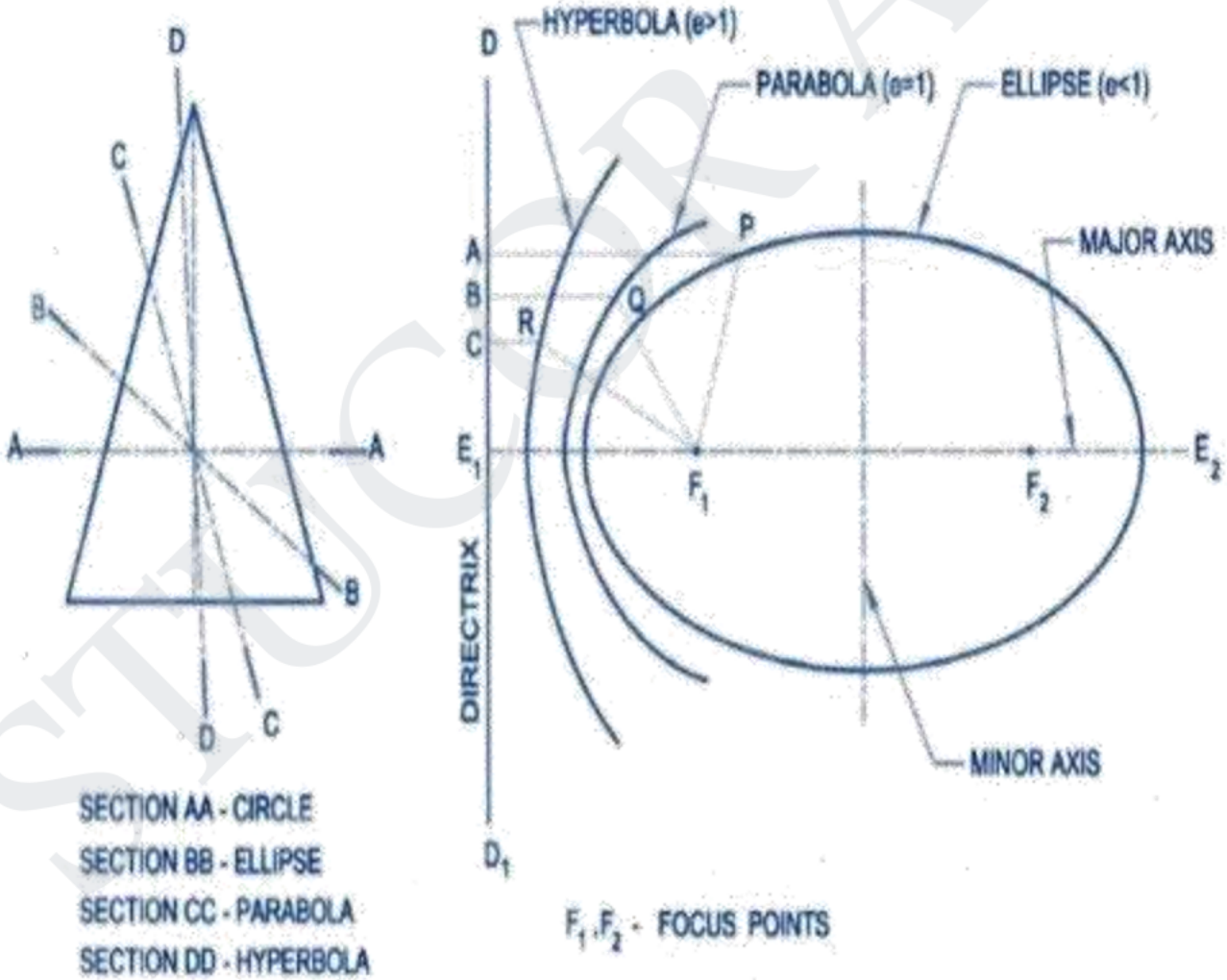
Unit-I

Engineering Curves



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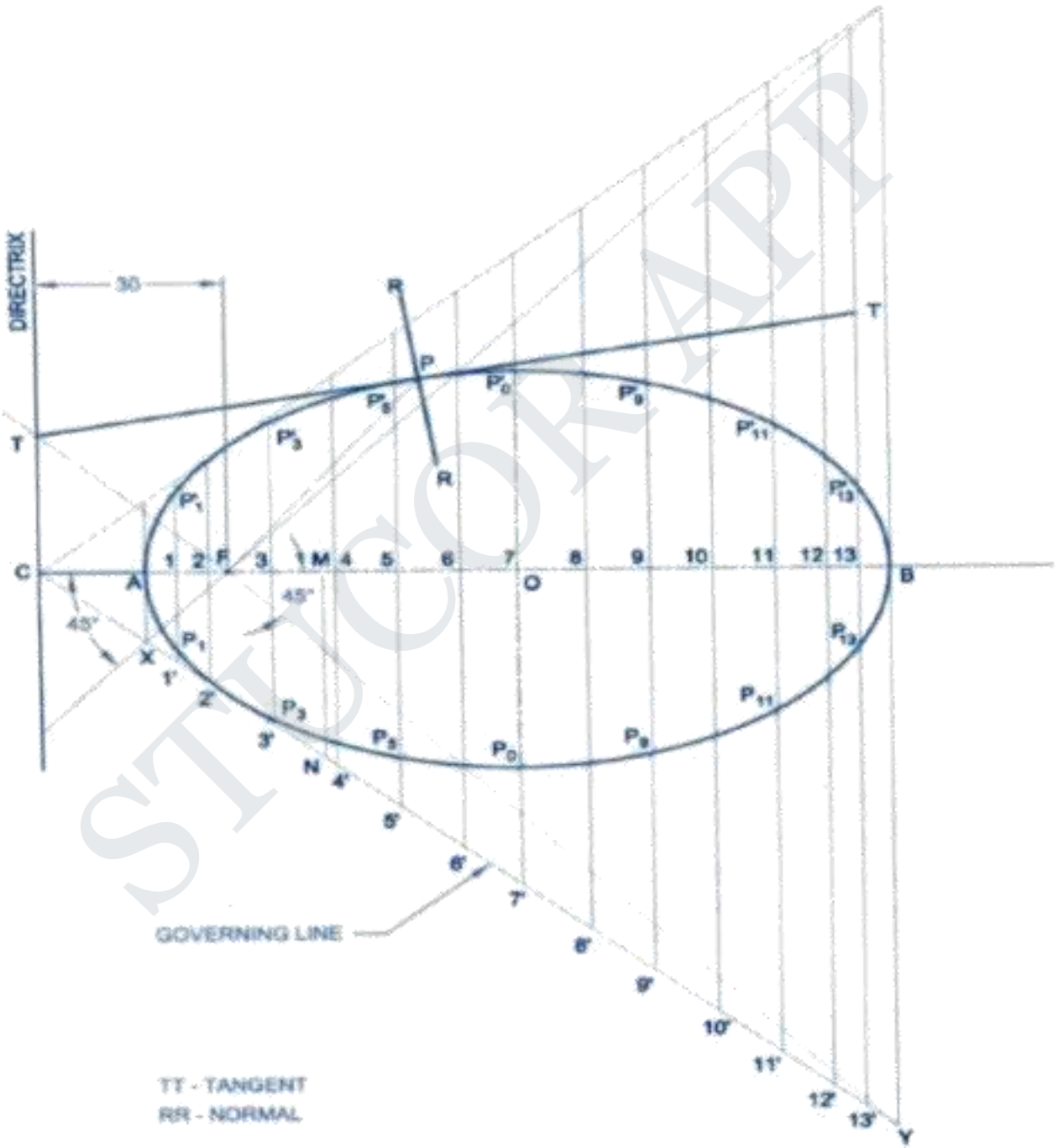
Construct an ellipse by eccentricity



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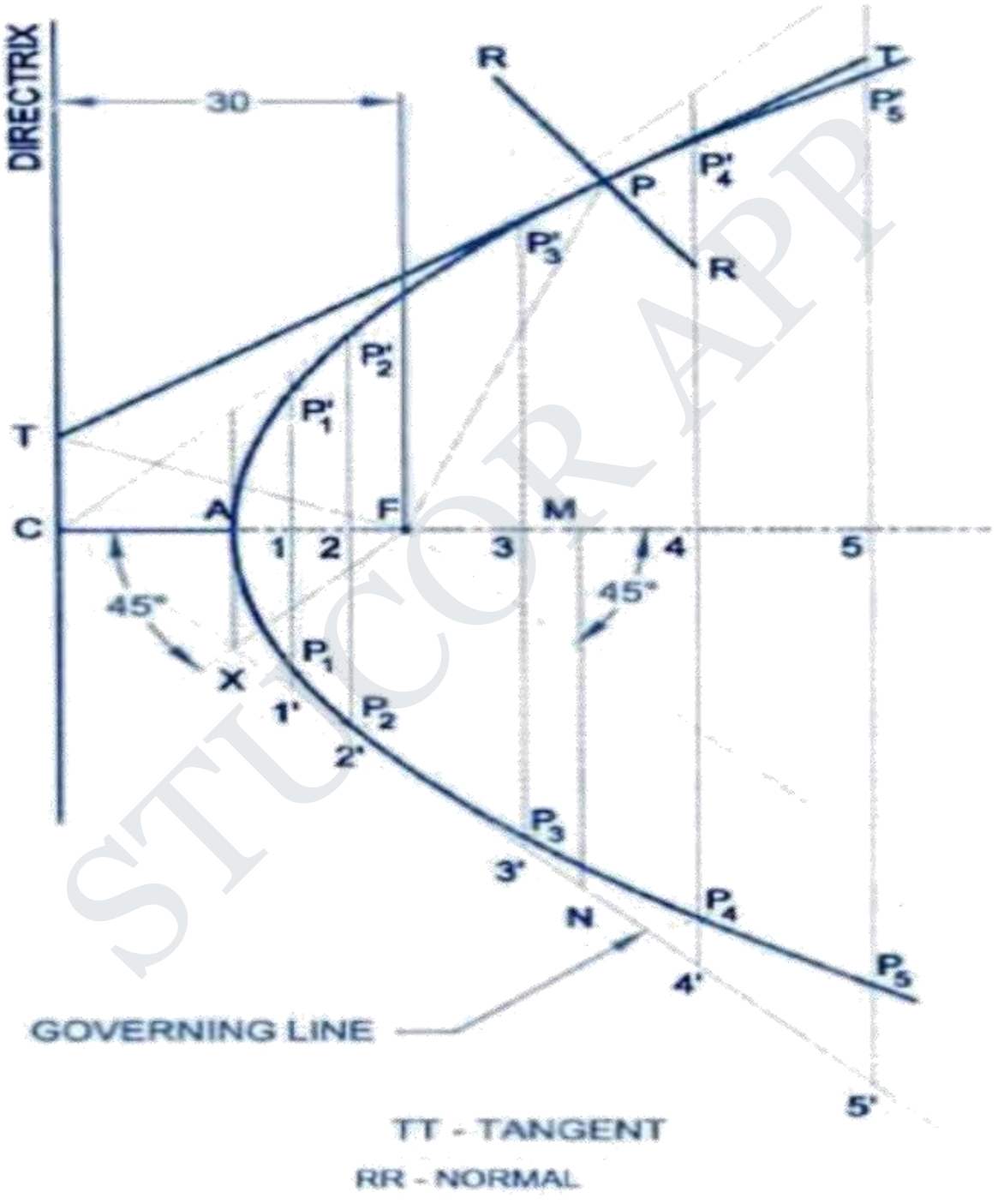
Construct a parabola by eccentricity



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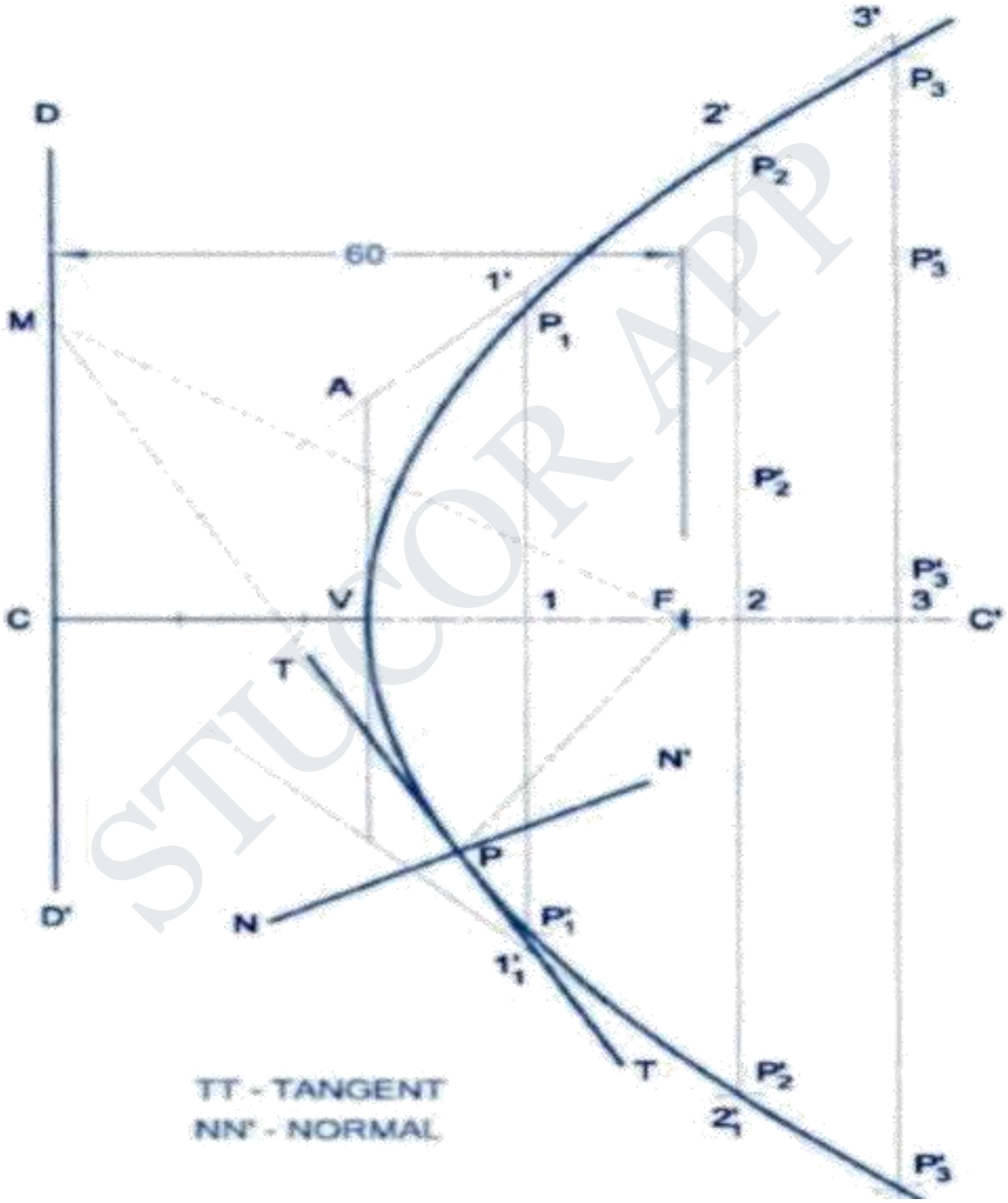
Construct a hyperbola by eccentricity



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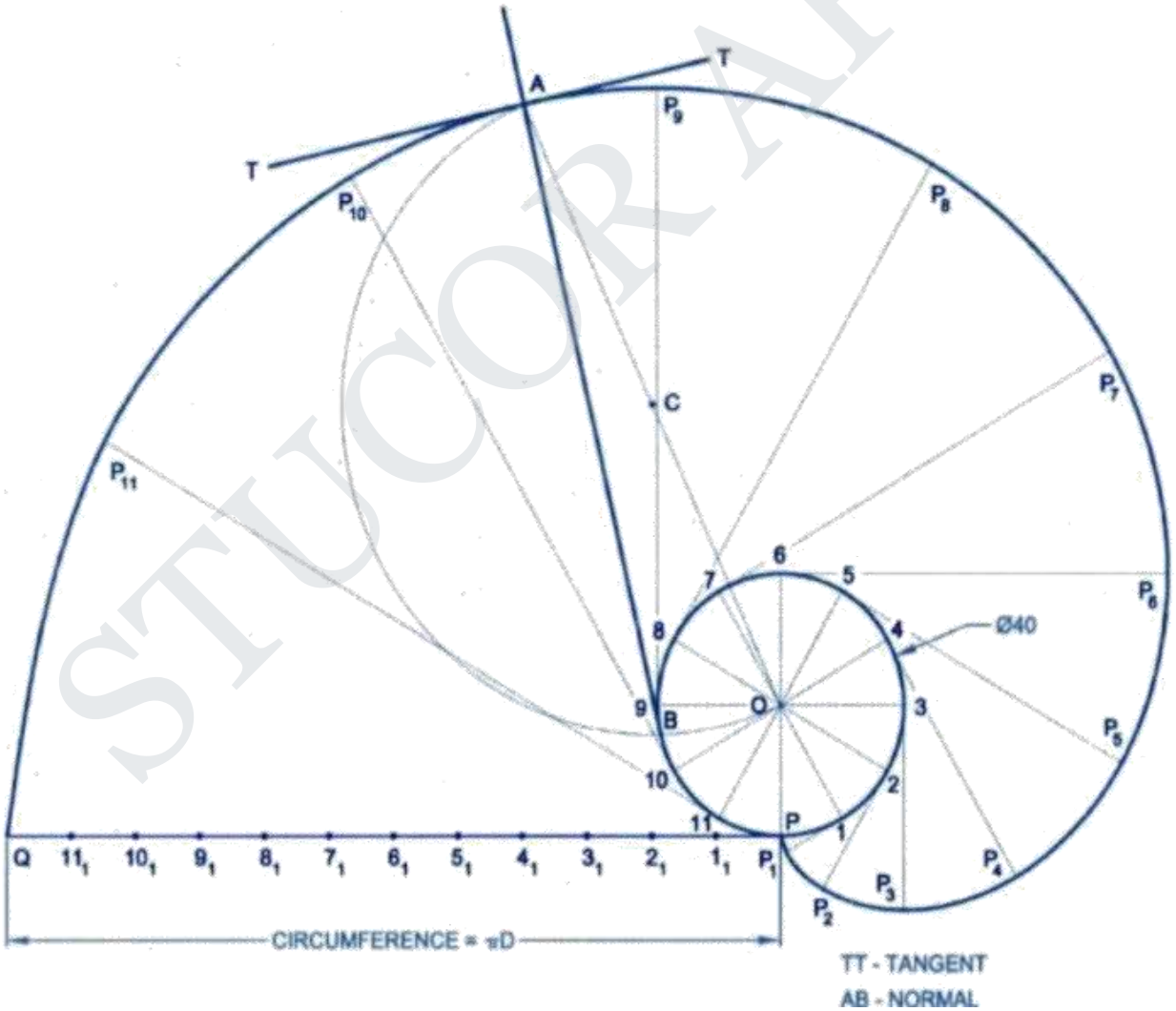
SPECIAL CURVES

INVOLUTE:

An involute is the locus of a point on a string, as the string unwinds itself from a line or polygon, or a circle, keeping always the string taut.

INVOLUTE OF A CIRCLE AND SQUARE



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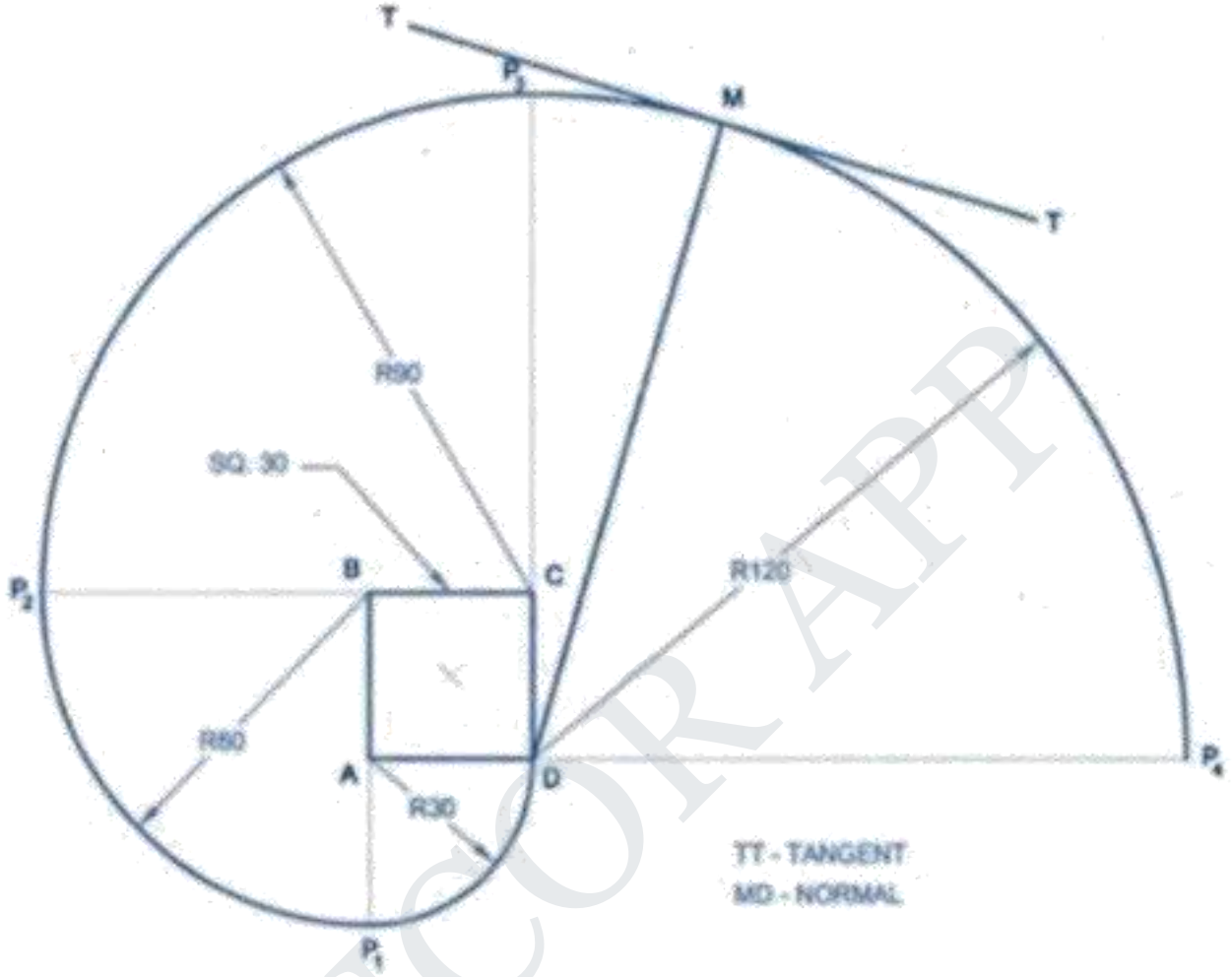

CYCLOIDAL:

Cycloid curves are formed by a point on the circumstance of a circle, rolling upon a line or an another circle. The rolling circle is called the generating circle. The line on which the generating circle rolls is called base line. The circle on which the generating circle rolls is called directing or base circle. A cycloid is a curve traced by a point on the circumference of a circle which rolls without slipping along a line

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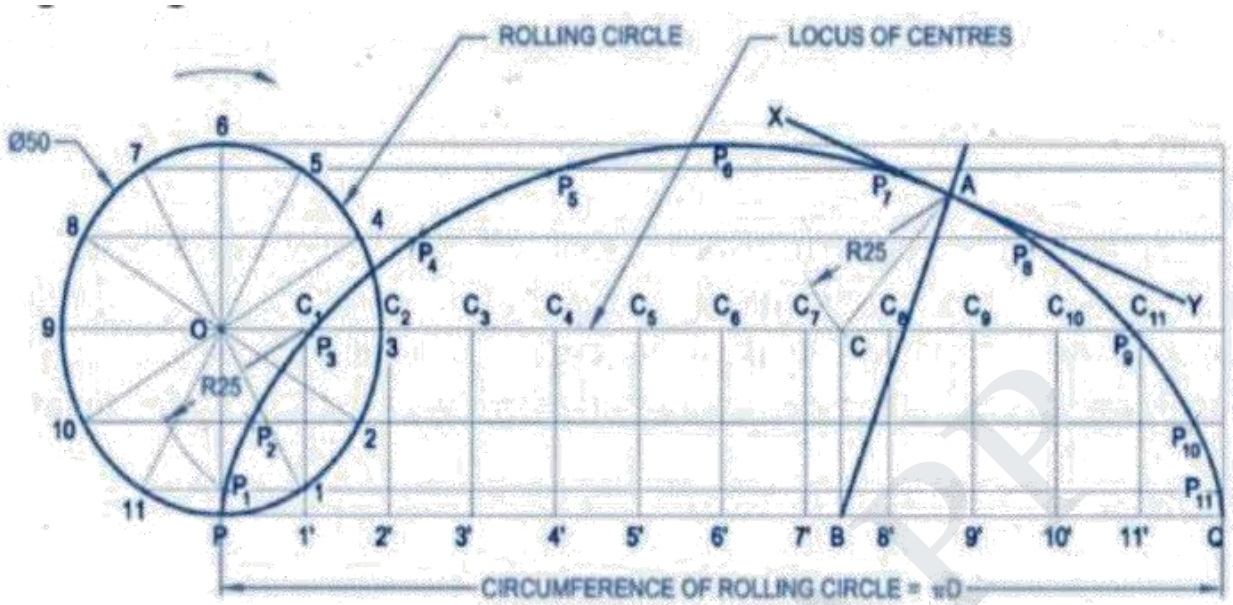
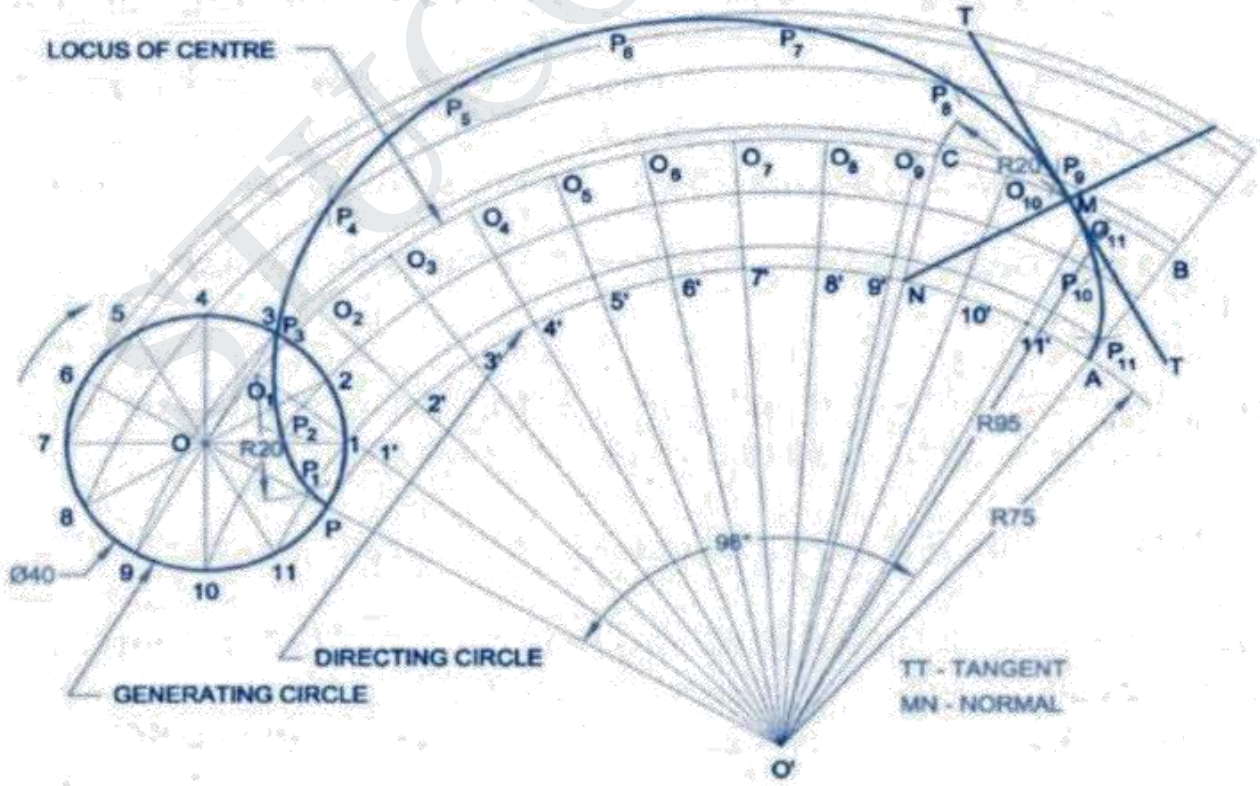


EPICYCLOID:

An epicycloids is a curve traced by a point on the circumference of a circle which Rolls without slipping on the outside of an another circle.



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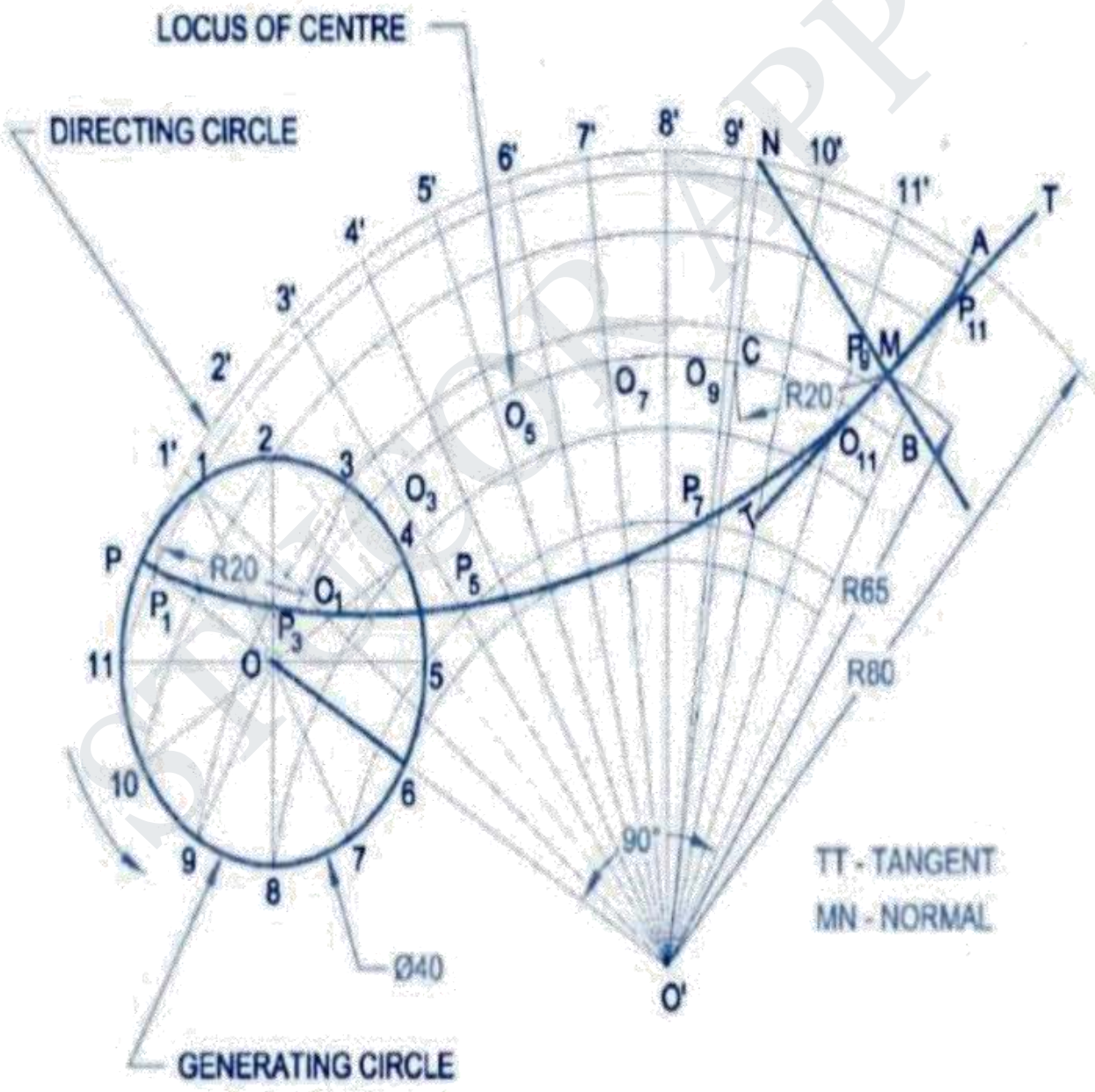
HYPOCYCLOID:

A hypocycloid is a curve traced by a point on the circumference of a circle when it rolls without slipping on the inside of another circle.



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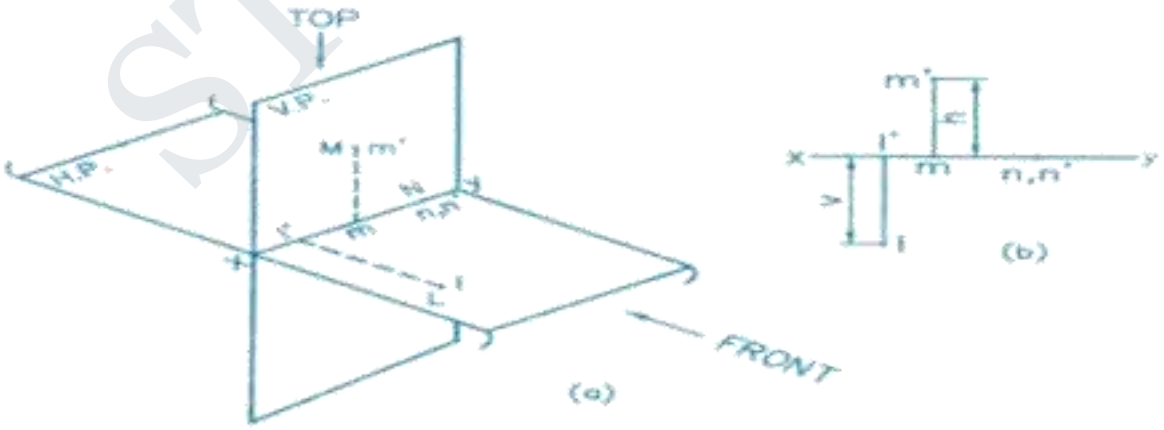
Projection of Points:

A point is simply a space location of infinitesimal size. It may represent the corner of an object, the intersection of two lines or a designated spot in space. The projection obtained on vertical plane VP is called the elevation and on horizontal plane **HP,** the plan. The intersection line of the vertical plane and the horizontal plane is known as ground line or reference line.

Position of points:

(i) In front of the VP and above the HP
(ii) In front of the VP and in the HP
(iii) In the VP and above the HP
(iv) Behind the VP and above the HP
(v) Behind the VP and in the HP
(vi) Behind the VP and below the HP
(vii) In the VP and below the HP
(viii) In front of the VP and below the HP
(ix) In the VP and HP



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GENERAL PROCEDURE TO DRAW PROJECTION OF POINTS

1. From given data identify the quadrant
2. Draw the XY line and projection
3. Along this projector mark by dots the distances of the given point form the HP and VP, on the corresponding side of the XY line, depending upon the quadrant in which the point lies, to locate the front view and the top view, respectively.
4. Make the front view and the top view bold and rub off the unwanted length of the projector to complete the solution.

Important Questions

1. Draw the involutes of a circle of diameter 40mm and draw the tangent and the normal to the involutes at any points on the curve.
2. Draw the front, top, and side views of the object shown below.
3. Draw the coin cure, if the distance of focus from the directory is 70mm and the eccentricity is ¾. Also draw a tangent and a normal at any point on the curve.
4. A circle of 50mm diameter rolls as a horizontal line for ¾ of a revolution clockwise. Draw the path traced by point P on the circumference of the circle. Also draw a tangent and normal at any point on the cure
5. Draw a hyperbola when the distance between its focus and directrix is 50mm and eccentricity is 3/2. Also draw the tangent and normal at a point 23mm from the directrix.
6. The focus of a conic is 50mm front the directory. Draw the locus of a point P moving in such a way that its distance from the directrix is equal to its distance from the focus. Name the cure. Draw a tangent to the curve at a point 60mm from the directrix.
7. Draw the involutes of a circle of diameter 40mm and draw the tangent and the normal to the involutes at any point on the cure.

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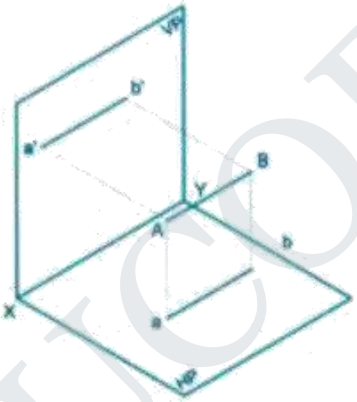
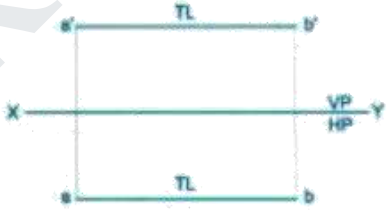
15 # UNIT-II

PROJECTION OF LINES AND PLANES

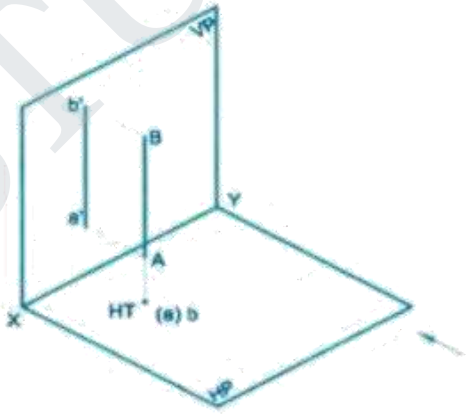
A *straight* line is the shortest distance between two points. Projections of the ends of any line can be drawn using the principles developed for projections of points. Top views of the two end points of a line, when joined, give the top view of the line. Front views of the two end points of the line, when joined, give the front view of the line. Both these Projections are straight lines.

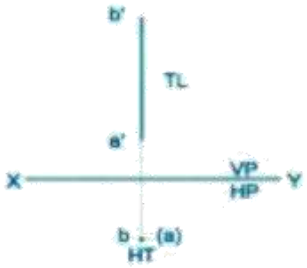
Projection of straight lines





Line Parallel to both HP & VP





Line Perpendicular to HP

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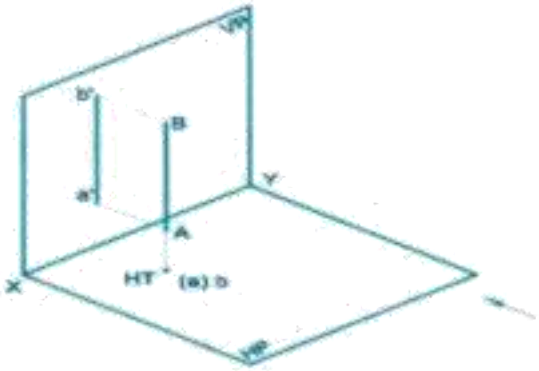
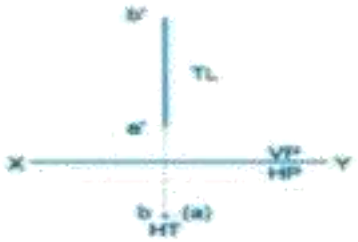
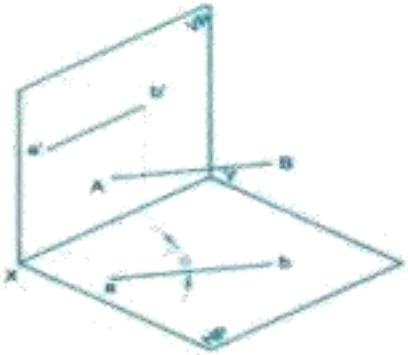
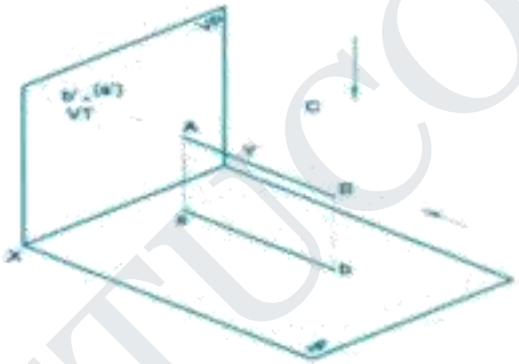


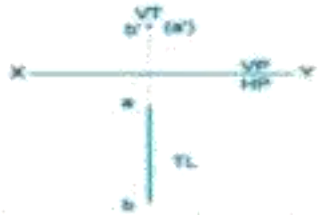


Line Perpendicular to HP

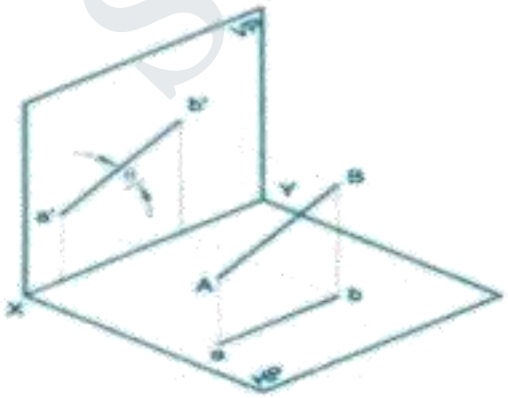


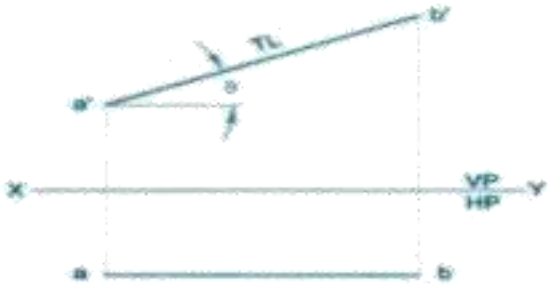
Line Inclined to VP & Parallel to HP





Line Perpendicular to VP





Line Inclined to HP & Parallel to VP

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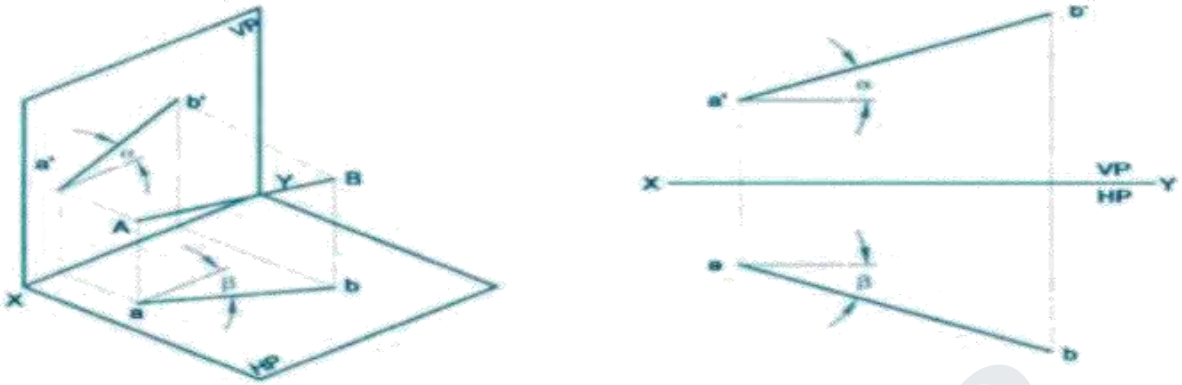
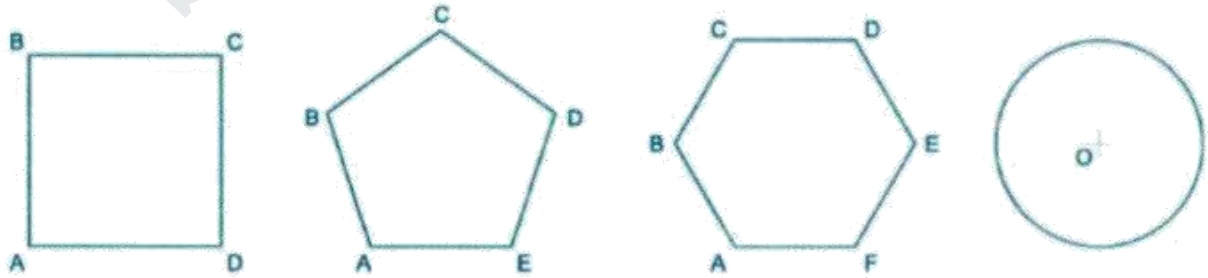


Line Inclined to both HP & VP

Line contained by a plane perpendicular to both HP & VP

Projection of Plane Surfaces:

A plane is a two dimensional object having length and breadth only. Its thickness is always neglected; various shapes of plane figures are considered such as square, rectangle, circle, pentagon, hexagon, etc.



(i) SQUARE (ii) PENTAGON (iii) HEXAGON (iv) CIRCLE

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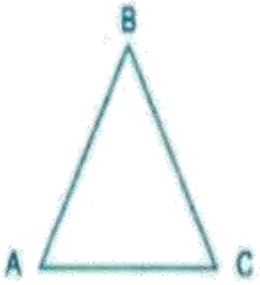
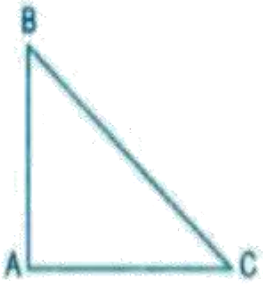
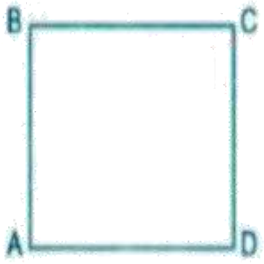


(v) EQUILATERAL TRIANGLE



(vi) RIGHTANGLE TRIANGLE



(vii) RECTANGLE

TYPES OF PLANES:

1. Perpendicular planes which have their surface perpendicular to anyone of the reference planes and parallel or inclined to the other reference plane.

2. Oblique planes which have their surface inclined to both the reference planes.

TRACE OF PLANE:

The trace of a plane is the line of intersection or meeting of the plane surface with the reference plane; if necessary the plane surface is extended to intersect the reference plane. The intersection line of the plane surface with **HP** is called the **Horizontal Trace** (HT) and that of **VP** is called the **Vertical Trace** (VT).

A plane figure is positioned with reference to the reference planes by referring its surface in the following possible positions.

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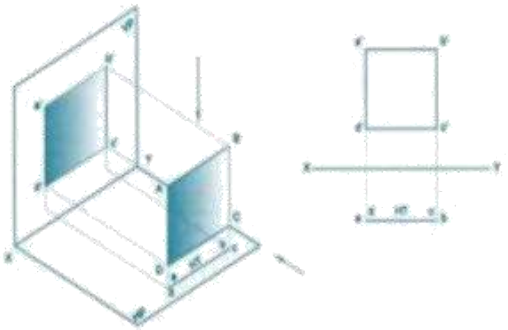
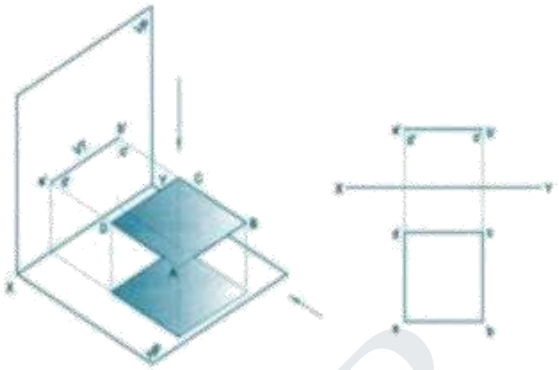
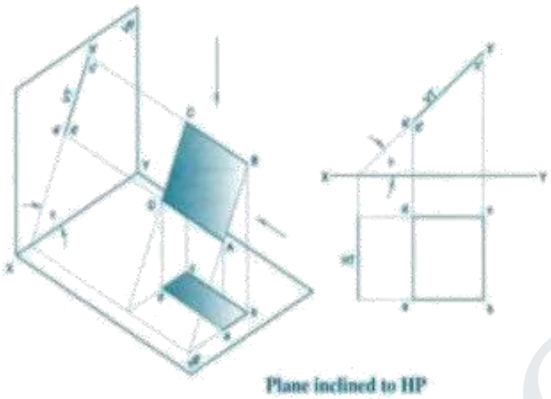


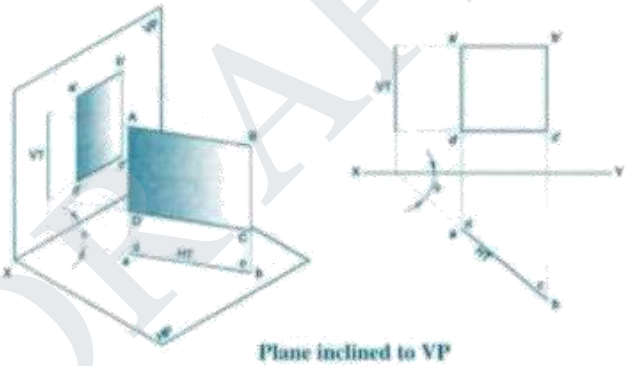
Plane Perpendicular to HP



Plane Perpendicular to VP

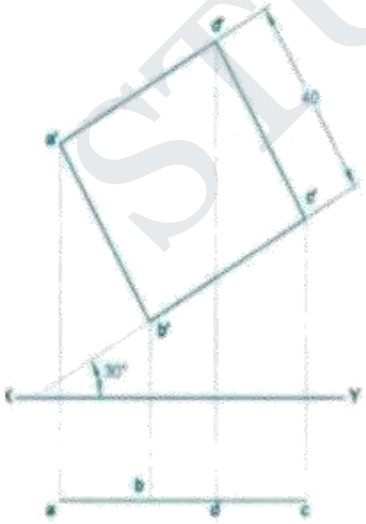


Plane inclined to HP



Plane inclined to VP

1. surface of the plane kept perpendicular to **HP** and parallel to **VP**



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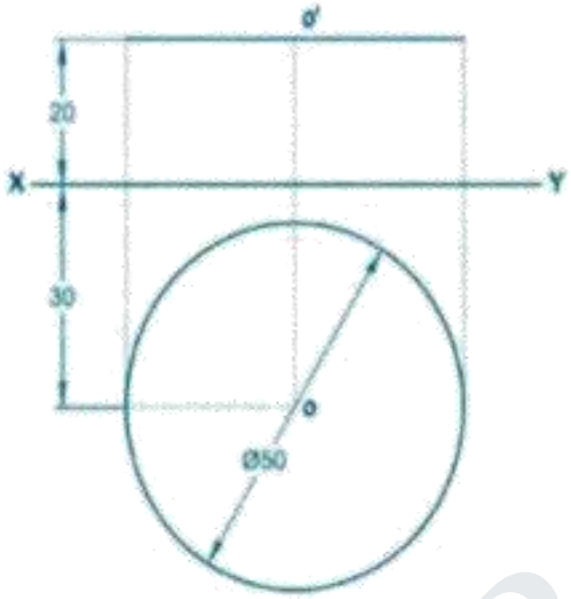
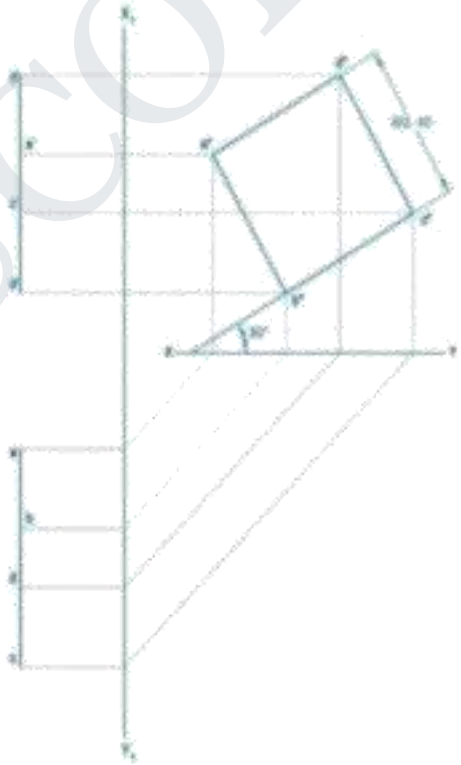
2. surface of the plane kept perpendicular to **VP** and parallel to



HP

3. surface of the plane kept perpendicular to both **HP** and **VP**



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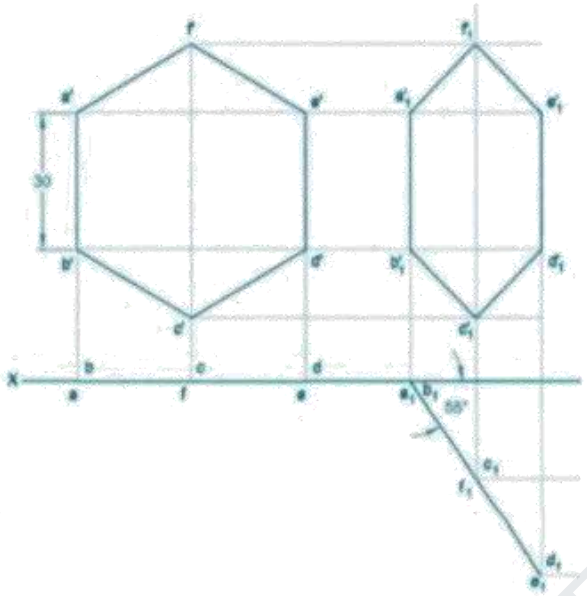
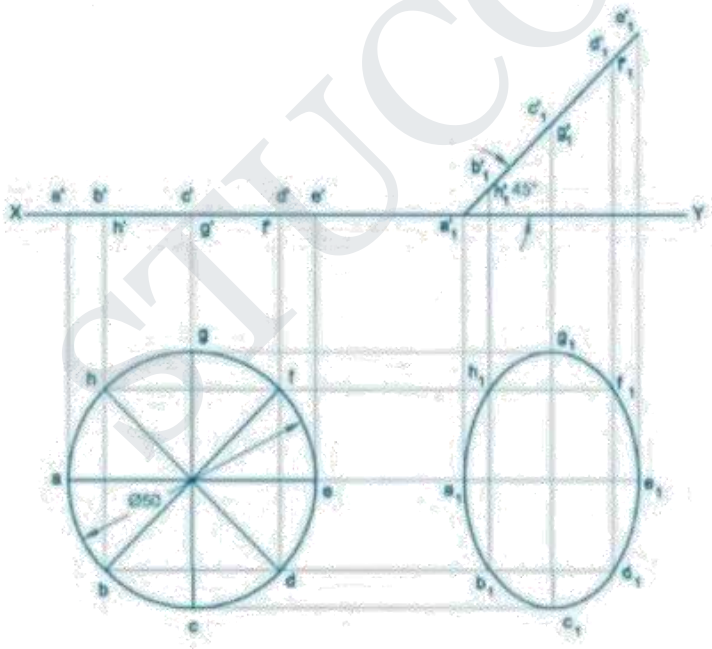
4. surface of the plane kept perpendicular to **HP** and inclined to **VP**



5. surface of the plane kept perpendicular to **VP** and inclined to **HP**



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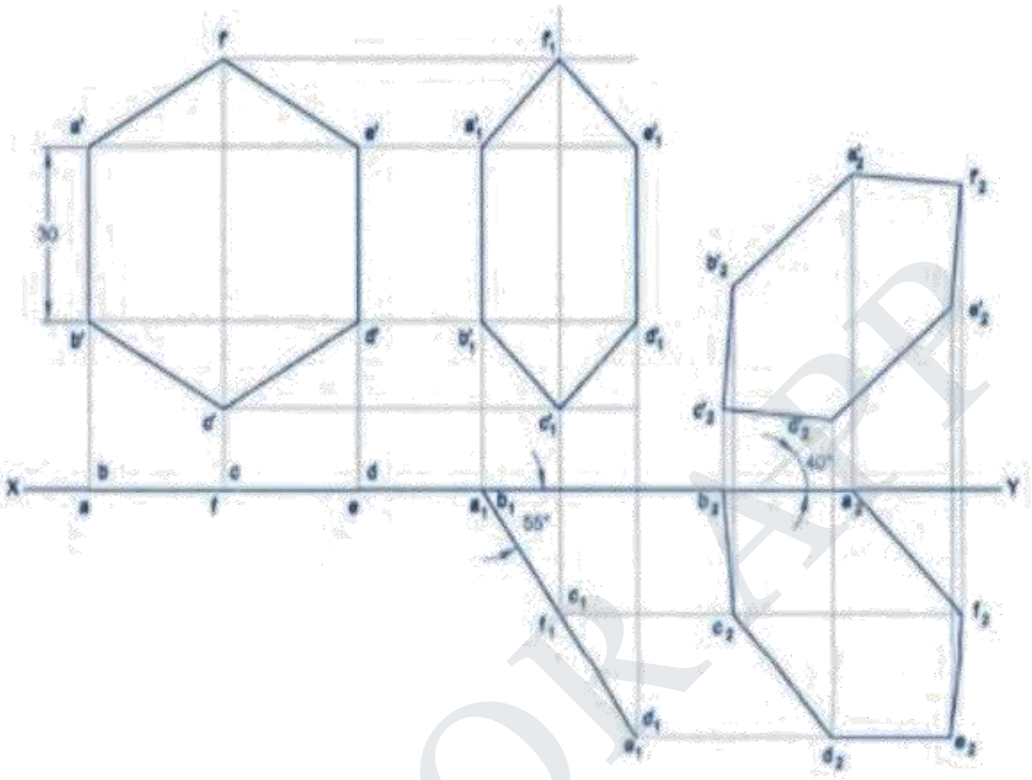
6. surface of the plane kept inclined to HP and VP



Important Questions

1. A line PS 65mm has its end p, 15mm above the hp and 15mm in front of the VP. It is inclined at 55°to the hp and 35® to the VP. Draw its projections.
2. A pentagon of sides 30mm rests on the ground on one of its corners with the sides containing the corners being equally inclined to the ground. The side opposite to the corner on which it rests is inclined at 30°to the VP and is parallel to the hp .The surface of the pentagon makes 50°with the ground. Draw the top and front views of the pentagon.

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3. A line CD, inclined at 25® to the HP, measures 80mm in top view. The end C is in the first quadrant and 25mm and 15mm from the HP and the VP respectively. The end D is at equal distance from the both the reference planes. Draw the projections, fine true length and true inclination with the VP.
4. A straight line ST has its end S, 10mm in front of the VP and nearer to it. The mid-point M line is 50mm in front of the VP and 40mm above HP. The front and top view measure 90mm and 120mm respectively. Draw the projection of the line. Also find its true length and true inclinations with the HP and VP.
5. A regular pentagon of 30mm side, is resting on one of its edges on HP which is inclined at 45® to VP. Its surface is inclined at 30® to HP. Draw its projections.
6. A line PQ has its end P, 10mm above the HP and 20mm in front of the VP. The end Q is 85mm in front of the VP. The front view of the line measures 75mm. the distance between the end projectors is 50mm. draw the projections of the line and find its true length and its true inclinations with the VP and hp.

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7. Draw the projections of a circle of 70mm diameter resting on the H.P on a point A of the circumference. The plane is inclined to the HP such that the top view of it is an ellipse of minor axis 40mm. the top view of the diameter, through the point A is making an angle of 45® with the V.P. determine the inclination of the plane with the HP
8. The projections of a line measure 80mm in the top view and 70mm in the front view. The midpoint of the line is 45mm in front of VP and 35mm above HP. one end is 10mm in front of VP and nearer to it. The other end is nearer to HP.Draw the projections of the line. Find the true length and true inclinations.
9. Draw the projection of a circle of 70mm diameter resting on the H.P. on a point A of the circumference. The plane is inclined to the HP such that the top view of it is an ellipse of minor axis 40mm. the top view of the diameter through the point A is making an angle of 45 with the V.P. determine the inclination of the plane with the HP.
10. A pentagon of side 30mm rests on the ground on one of its corners with the sides containing the corner being equally inclined to the ground. The side opposite to the corner on which it rests is inclined at 30® to the VP and is parallel to the HP. The surface of the pentagon makes 50® with the ground. Draw the top and front views of the pentagon.
11. A line PF, 65mm has its end P, 15mm above the HP and 15mm in front of the VP. It is inclined at 55®to the VP. Draw its projections.

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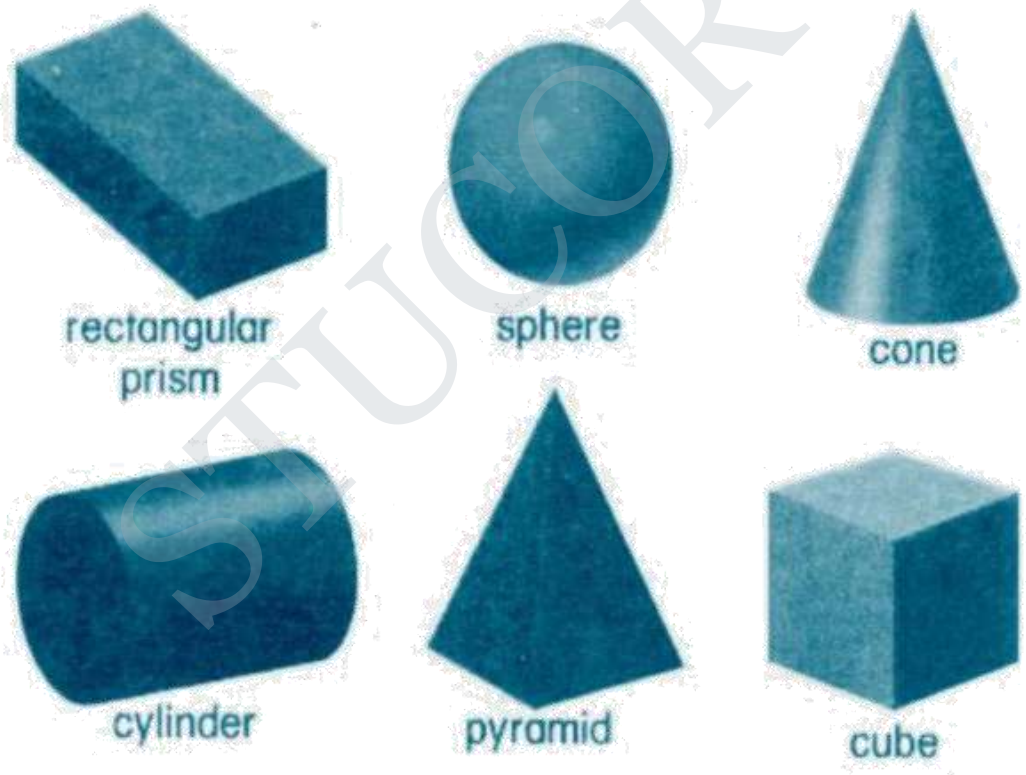
UNIT-III

PROJECTION OF SOLIDS AND SECTION OF SOLIDS

Projection of Solids:

Projection of Solids:

A solid is a three dimensional object having length, breadth and thickness. It is
Completely bounded by a surface or surfaces, which may be curved or plane. The shape of a solid is described orthographically by drawing its two orthographic projections, usually, on the two principal planes of projection i.e., **HP** and VP.



The following are the different positions which the axis of a solid can take with respect to the reference planes:

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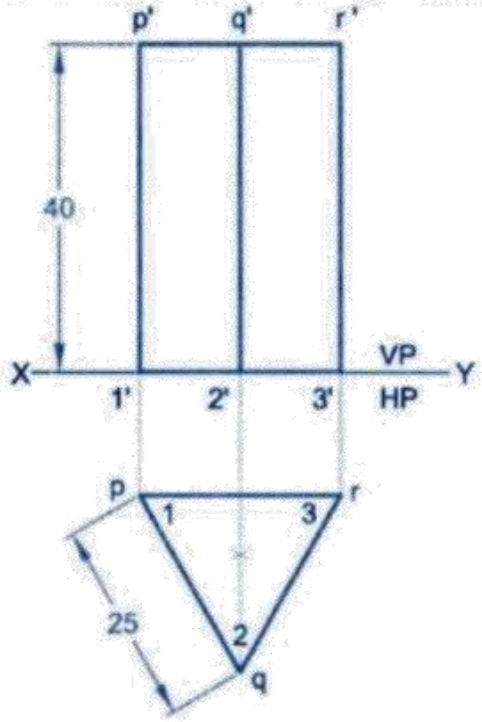
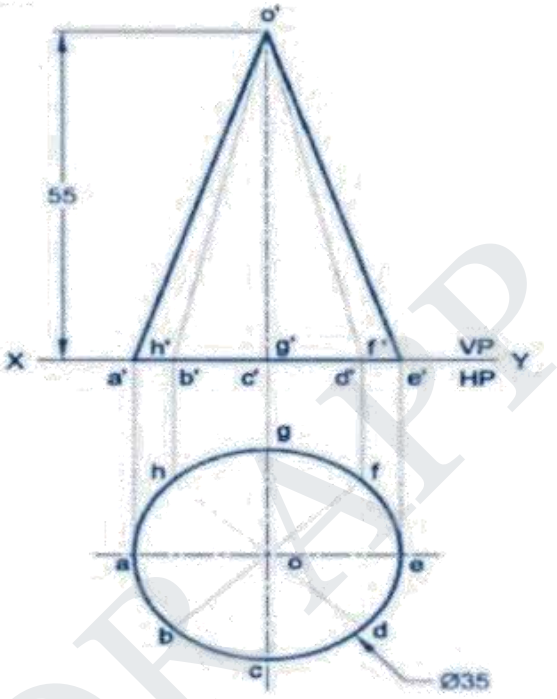
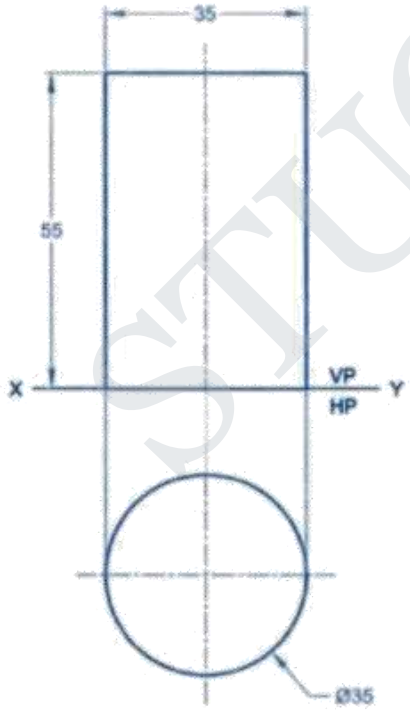
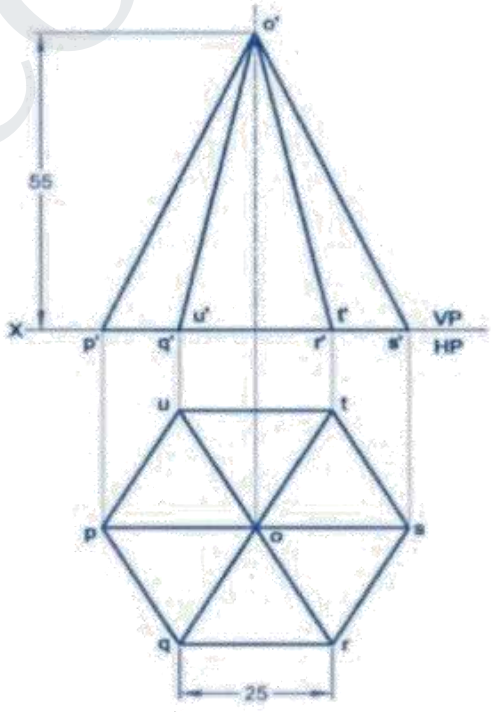
1. Axis perpendicular to **HP** and parallel to VP.
(CONE AND PYRAMID)









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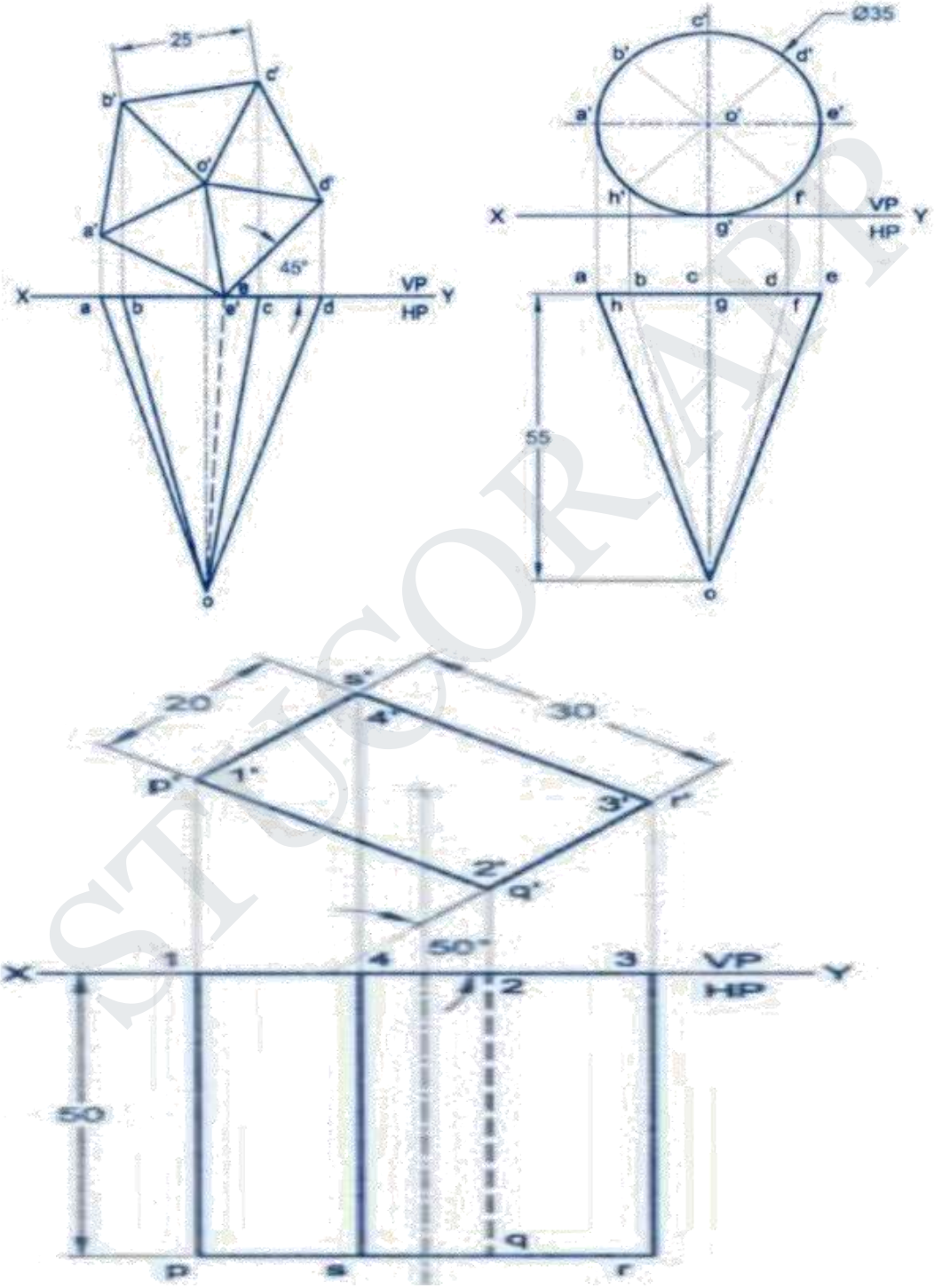
2. Axis perpendicular to VP and parallel to HP
(PYRAMID, CONE, PRISM)



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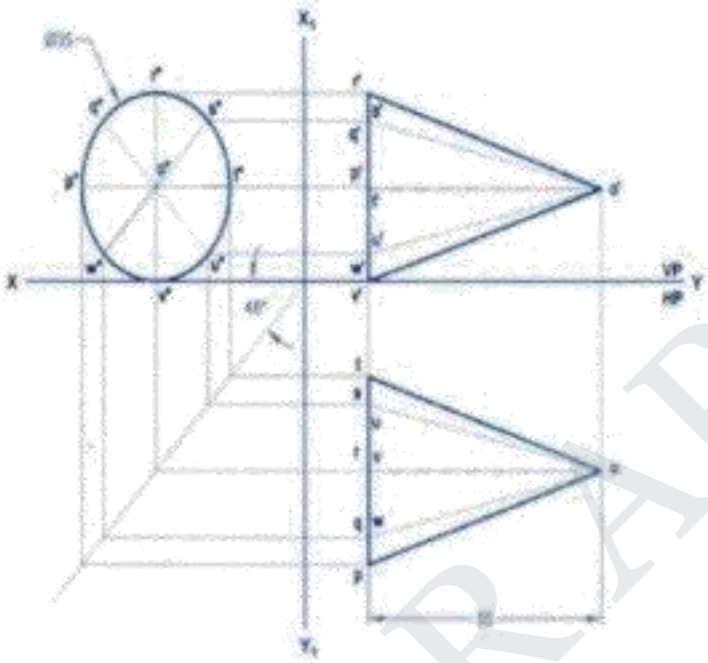
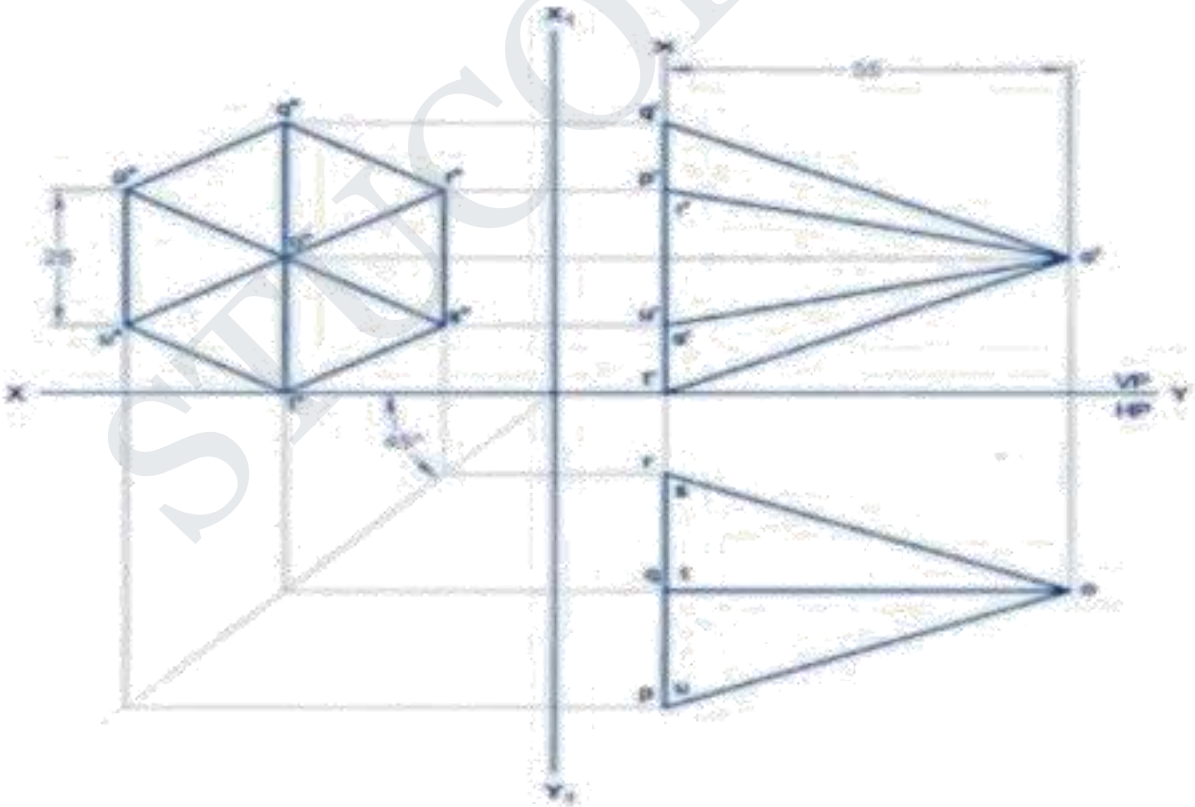
3. Axis parallel to both **HP** and **VP**, i.e., axis perpendicular to a profile plane.





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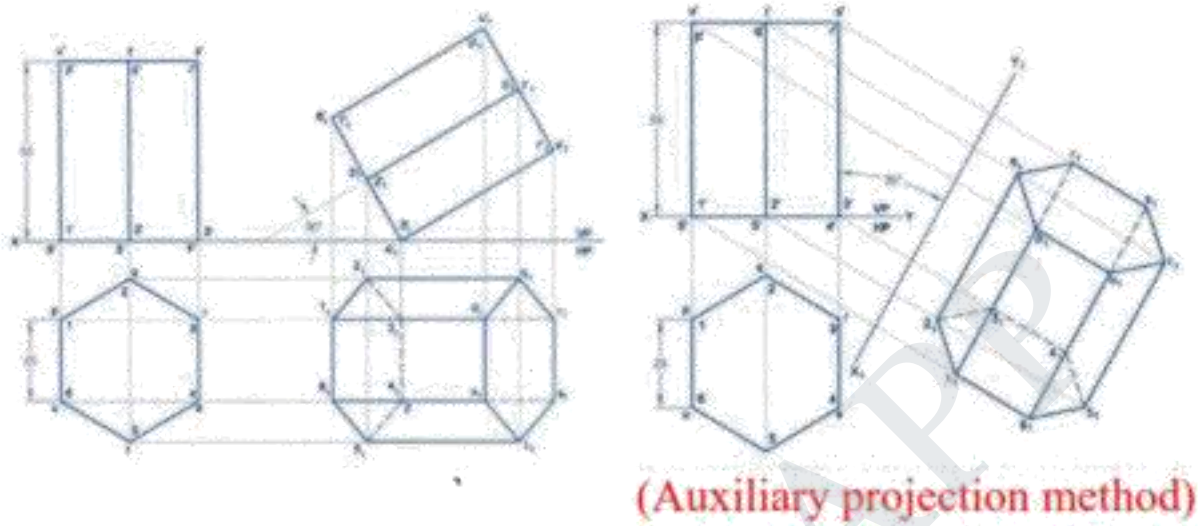
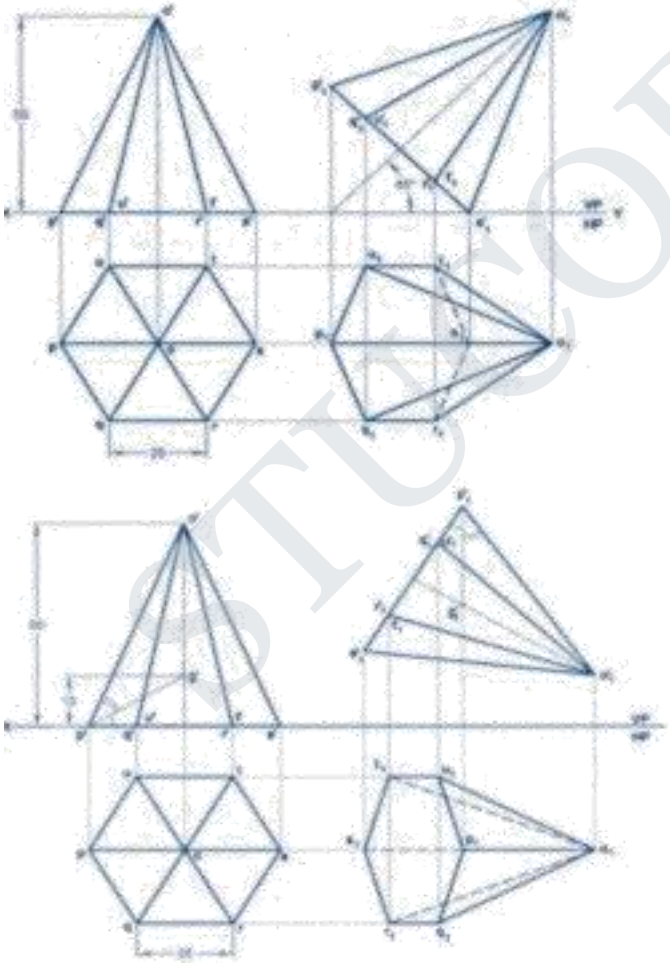
4. Axis inclined to **HP** and parallel to **VP.**



(Auxiliary projection method)



(freely suspeded method)

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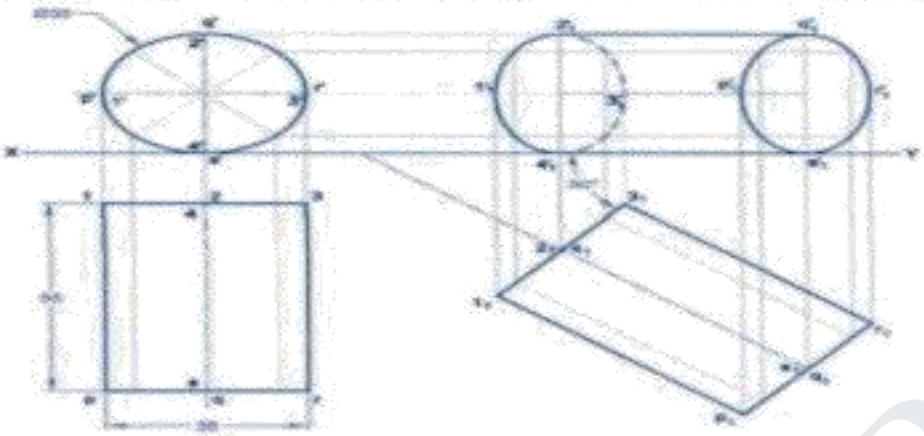
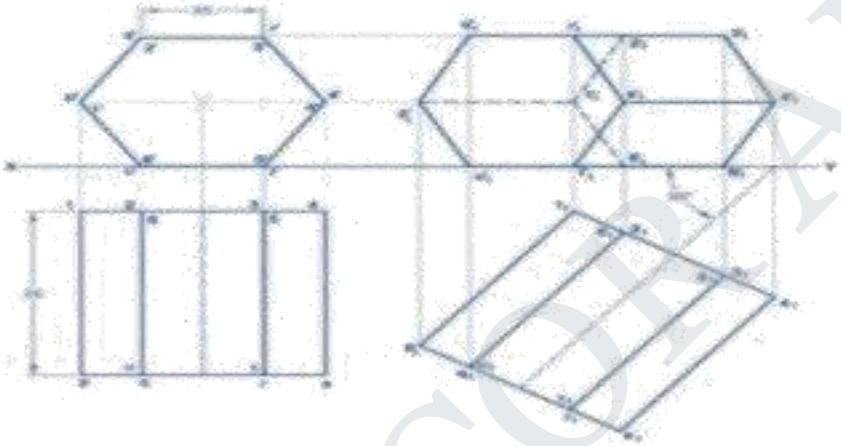
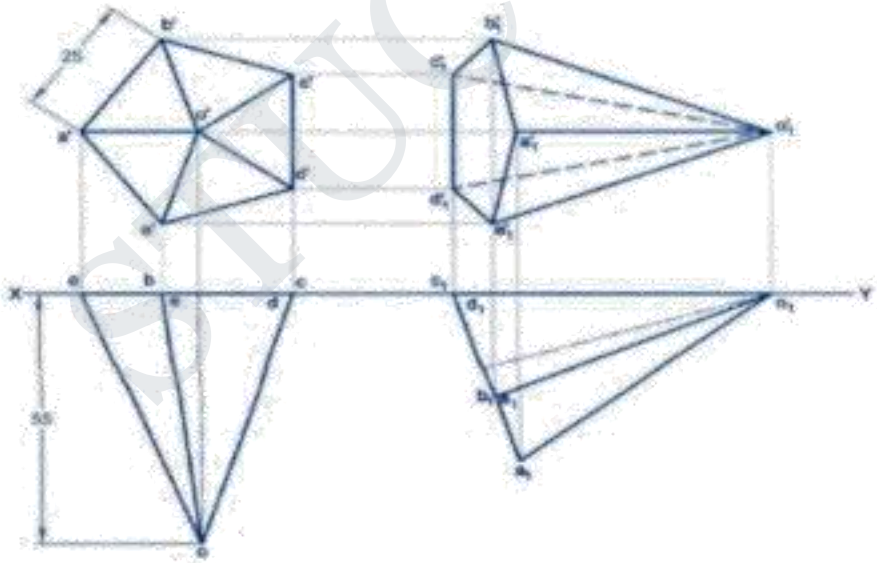
5. Axis inclined to **VP** and parallel to **HP.**







6. Axis inclined to both **HP** and **VP. (Not For University Syllabus)**

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SECTION OF SOLIDS:

The hidden or internal parts of an object are shown by sectional views in technical drawings. The sectional view of an object is obtained by cutting through the object by a Suitable plane known as the section plane or cutting plane and removing the portion lying between the plane and the observer. The surface produced by cutting the object is called the section and its projection is called a sectional plan or sectional elevation. The section is indicated by thin section lines uniformly spaced and inclined at 45°.

A sectional view of an object is obtained by projecting the retained portion of the

Jet which is left behind when object is cut by an imaginary section plane and the portion the object between the section plane and the observer is assumed as removed.

The object is cut by a section plane AA. The front half of the object between the

Section plane and the observer are removed. The view of the retained portion of the object is projection VP. The top view is projected for the whole uncut object.

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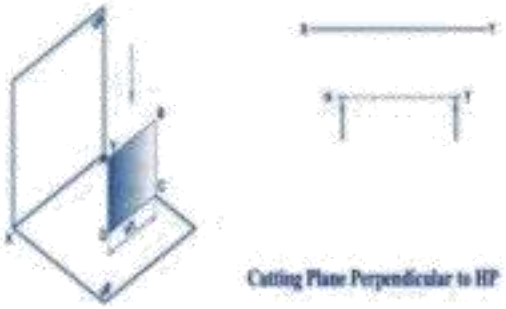
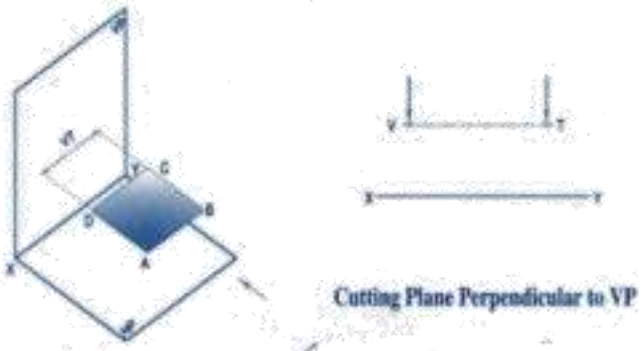
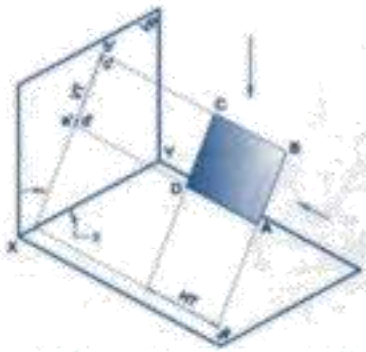


Cutting Plane Perpendicular to HP



Cutting Plane Perpendicular to VP

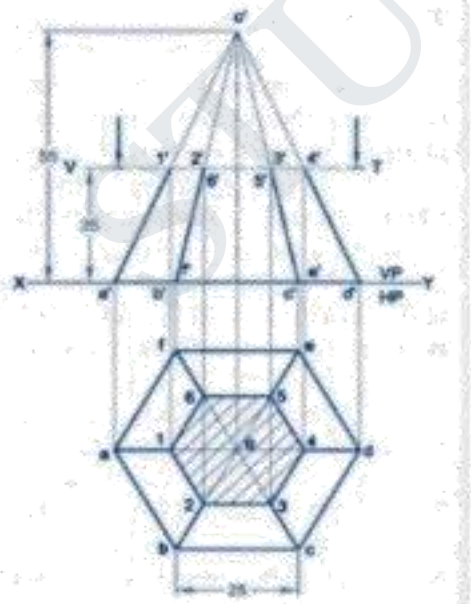


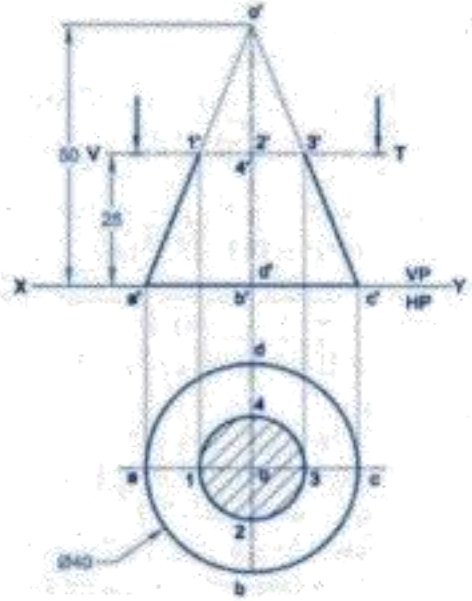
Cutting Plane inclined to HP

Types of sectional views of solids:

By using the five different types of perpendicular section planes we .obtain the following five types of sectional views of solids:

1. Section of solids obtained by **horizontal planes.**





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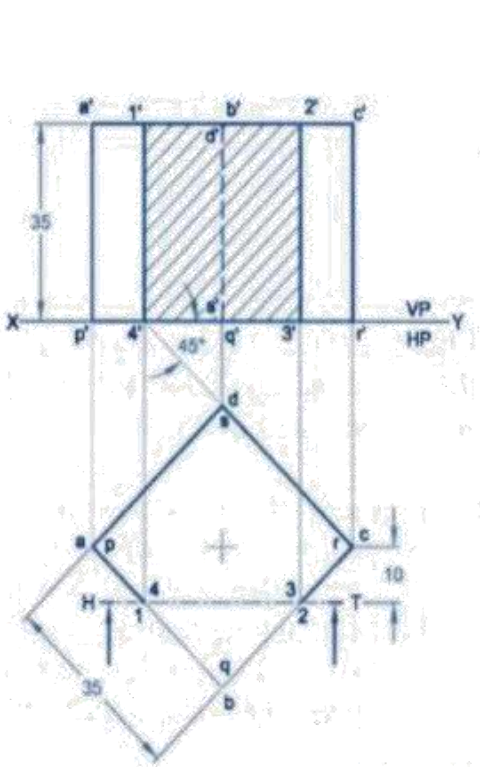
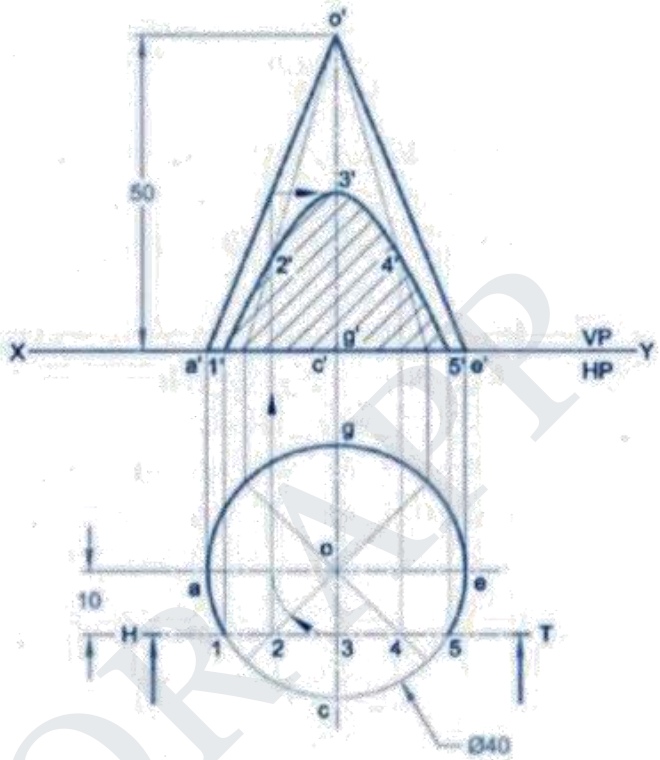
2. Section of solids obtained by **vertical planes.**

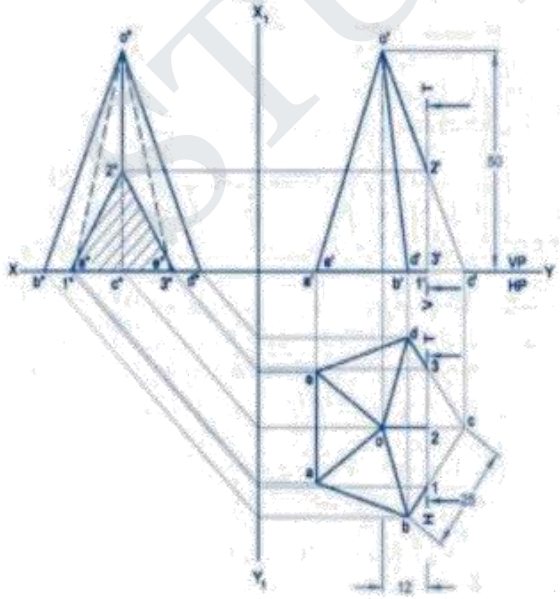


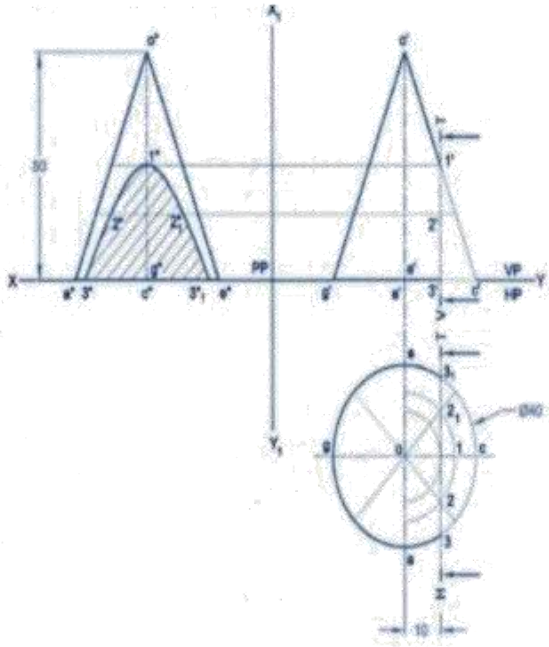


3. Sections of solids obtained by **auxiliary inclined planes.**

4. Section of solids obtained by **auxiliary vertical planes.**

5. Section of solids obtained by **profile planes.**





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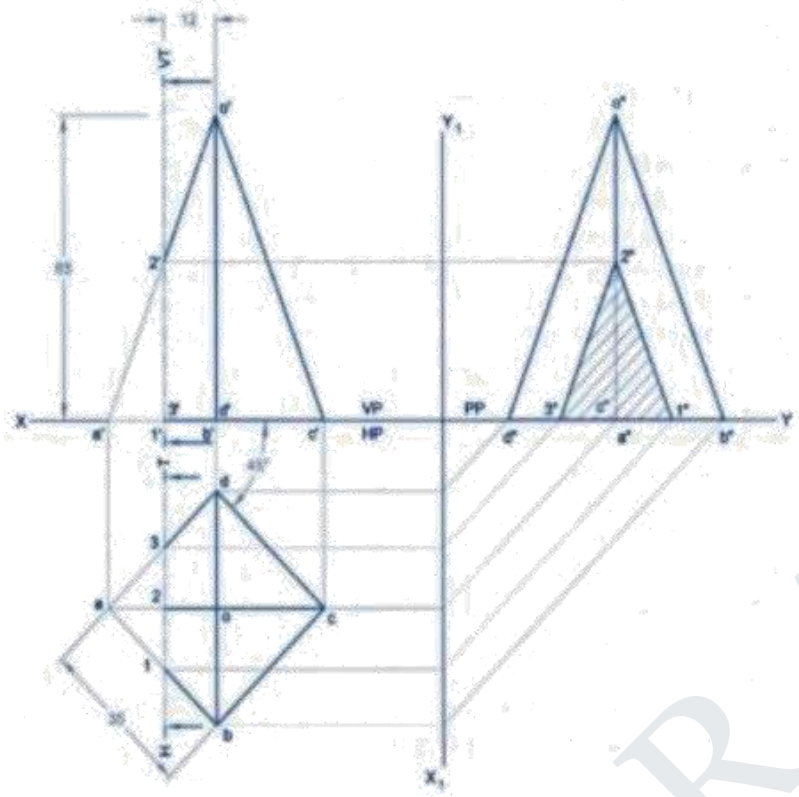

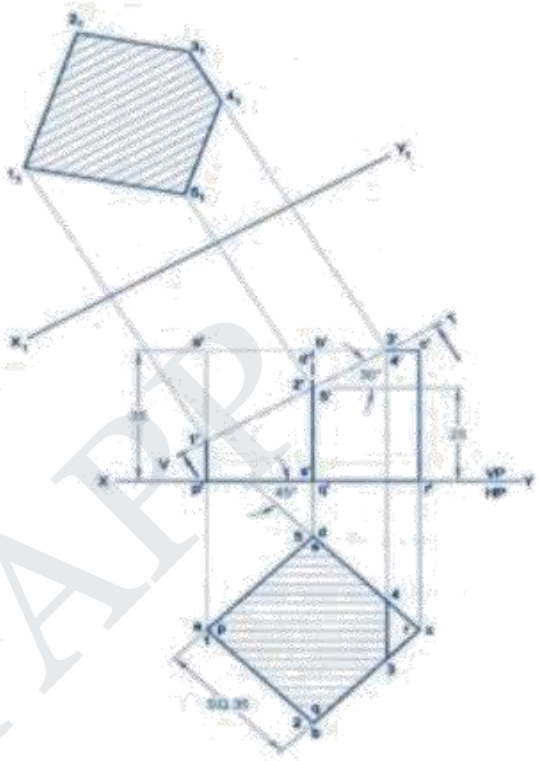

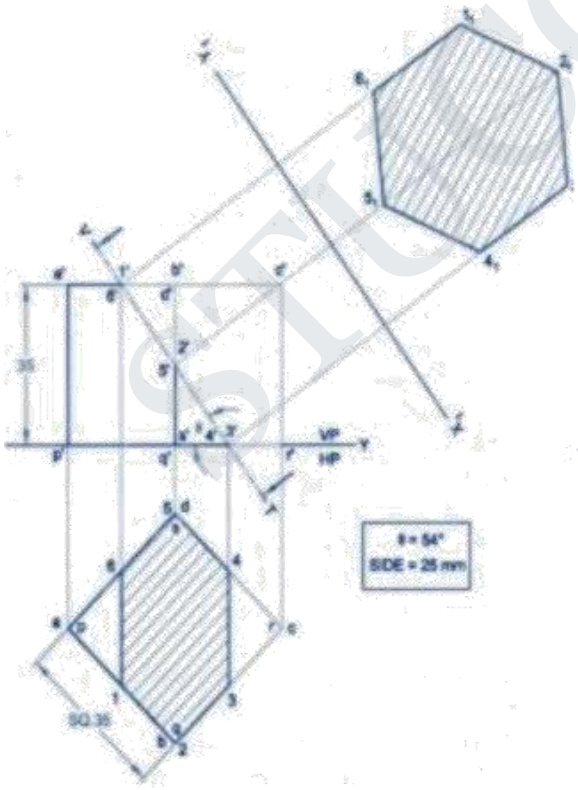

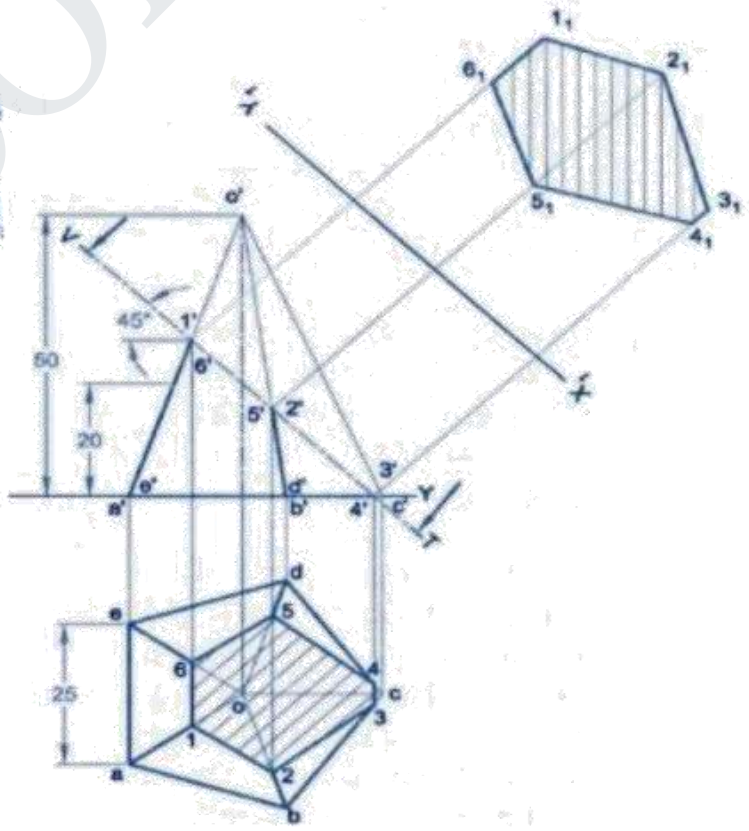

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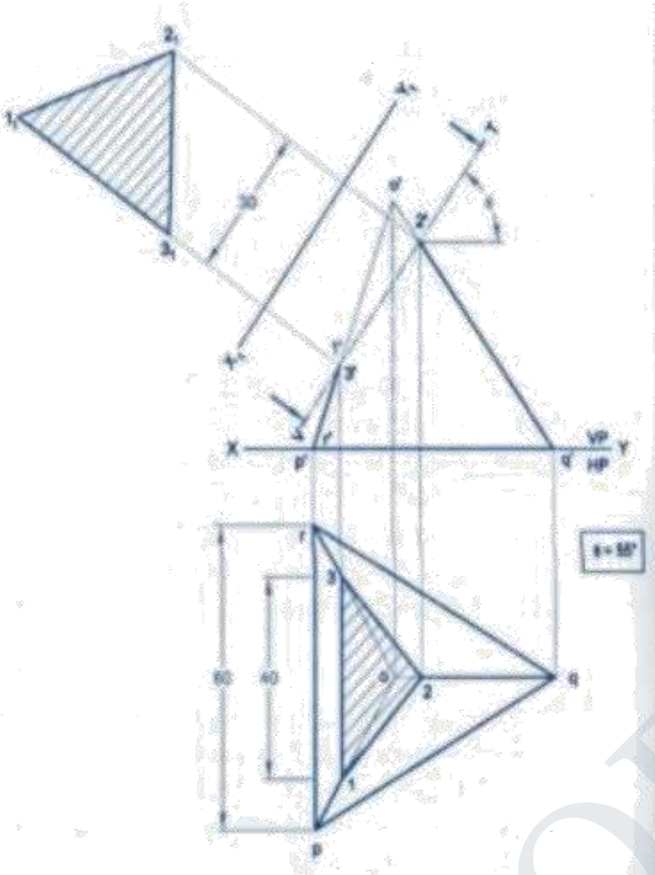

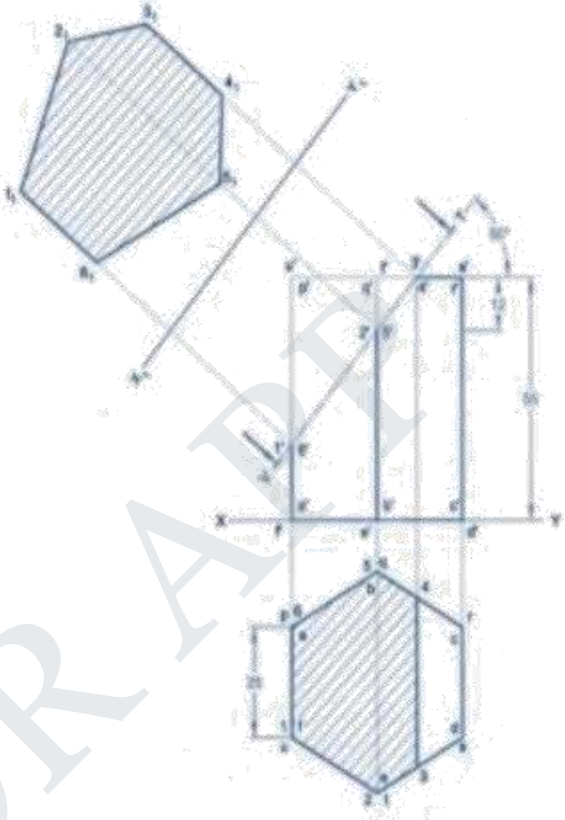

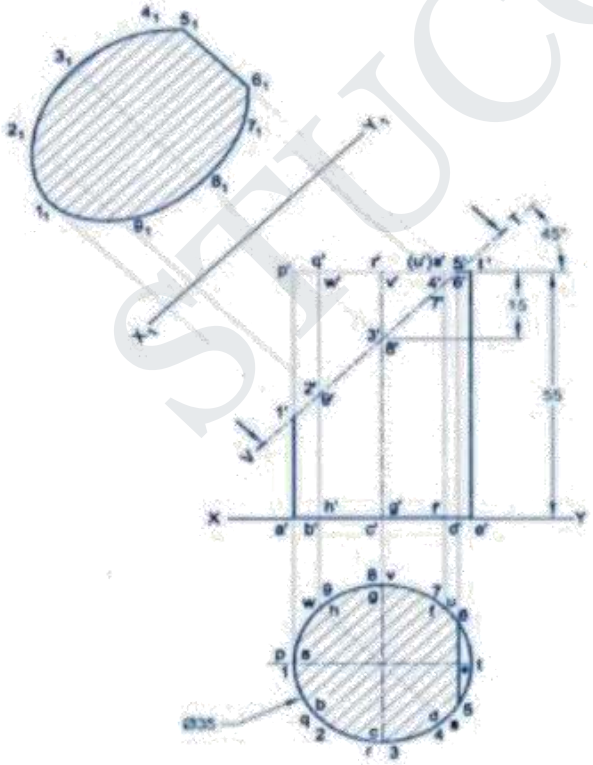

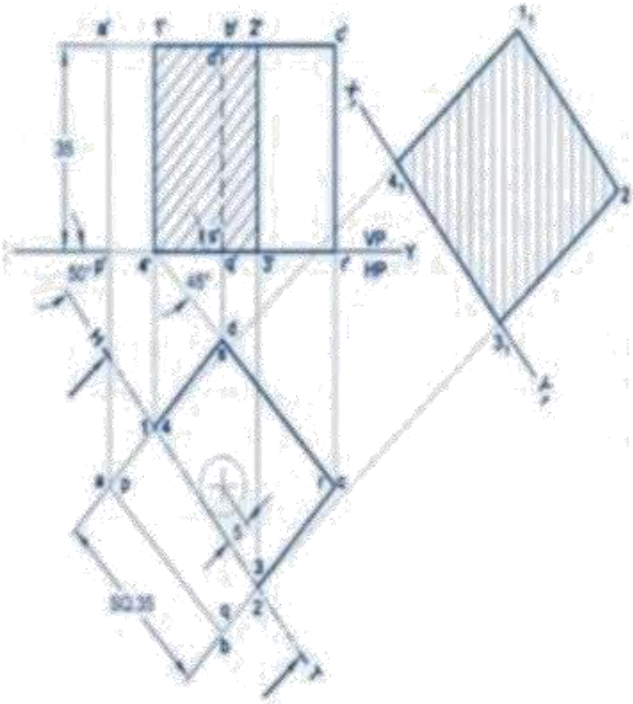

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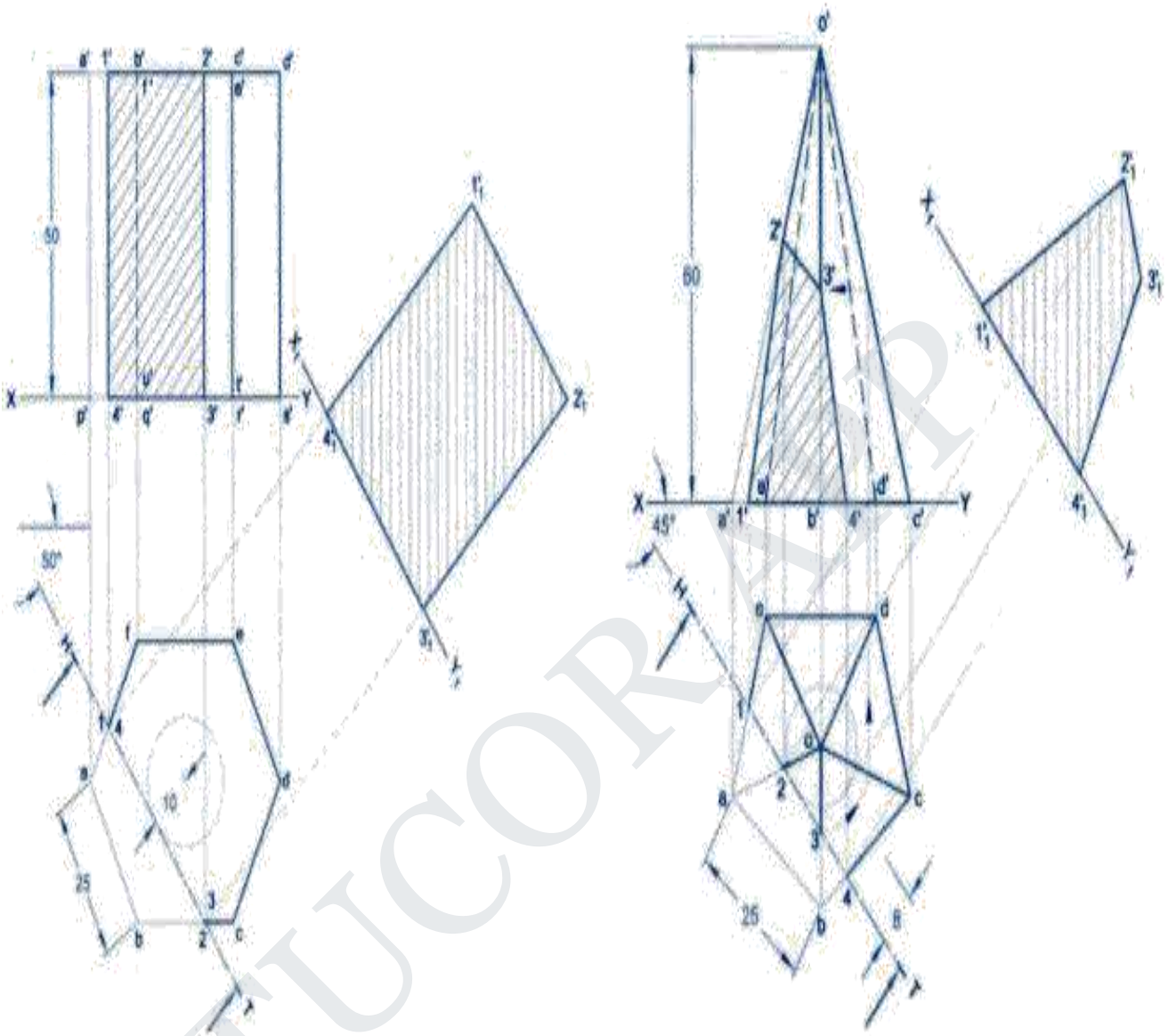

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Important Questions

1. A tetrahedron of edges 30mm rests on one of its edges on the VP. That edges is normal to the hp. one of the faces containing the resting edge is inclined at 30°to the VP. Draw the projections of the tetrahedron.
2. A cube of 70mm long edges has its vertical faces equality inclined to the VP. It is cut by an auxiliary inclined plane in such a way that the true shape of the cut part is a regular hexagon. Determine the inclination of the cutting plane with the HP. Draw front view, sectional top view and true shape of the section.
3. A regular pentagonal lamina ABCDF of side 30mm has one of its edges parallel to the VP and inclined at 30® to the HP. The pentagon is inclined 45®to the VP. Draw projections.
4. A pentagonal prism of 30-mm side of base and 70mm height is resting on one of its edges of the base in such a way that the base makes an angels of 45® HP, and the axis is parallel to VP. Draw the projections of the prism.
5. Draw the top front views of a right circular cylinder of base 45mm diameter and 60mm long when it line on HP, such that its axis is inclined at 30® to HP and the axis appears to parallel to the VP in the top view.
6. Draw the projection of a cylinder of diameter 40mm and axis 70mm long when it rests on the VP on one of its base points. The axis if cylinder is parallel to VP and inclined at 30® to VP.
7. A hexagonal pyramid of bases side 30mm and axis length 60mm is resting on VP one of its base edges with the face containing the resting edges perpendicular to both HP and VP. Draw its projections.

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8. A cone of base diameter 60mm and axis 70mm is resting on HP on its base. It is cut by a plane perpendicular to VP and parallel to a contour generator and is10mm away from it. Draw the front view, sectional top view and the true shape of the section.
9. An equilateral triangular prism 20mm side of base and 50mm long rests with one of its shorter edges on HP such that the rectangular face containing the edge on which the prism rests is inclined at 30® to HP. This shorter edge resting on HP is perpendicular to VP.
10. A square pyramid of base 40mm and axis 70mm lone has one of its triangular faces on VP and the edge of base contained by that face is perpendicular to VP. Draw its projections.
11. A hexagonal prism of side of base 35mm and axis length 55mm rests with its base on HP such that two of the vertical surfaces are perpendicular to VP. It is cut by a plane inclined at 50® to HP and perpendicular to VP and passing through a point an the axis at a distance 15mm from the top. Draw its front view, sectional top view and true shape of section.
12. An equilateral triangular prism 20mm side of base and 50mm rests with are of its shorter edges on H.P. such that the rectangular face containing the edge on which the prism rests is inclined at30 to H.P. the shorter edge resting on HP is perpendicular to VP.
13. Draw the projections of a hexagonal pyramid with side of the base 30mm and axis on HP such that the triangular face containing that side is perpendicular to HP and axis is parallel to VP.
14. A vertical cylinder 40mm diameter is cut by a vertical section plane making 30 to VP in such a way that the true shape of the section is a rectangle of 25mm and 60mm side. Draw the projections and true shape of the section.
15. A tetrahedron of edges 30mm rests on one of its edges on the VP. That edge is normal to the HP. One of the faces containing the resting edge is inclined at30® to the VP. Draw the projections of the tetrahedron.
16. A cone of base diameter 60mm and altitude 80mm rests on the HP with its axis inclined at30® to the HP and parallel to the VP. Draw its front and top views.

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UNIT-IV

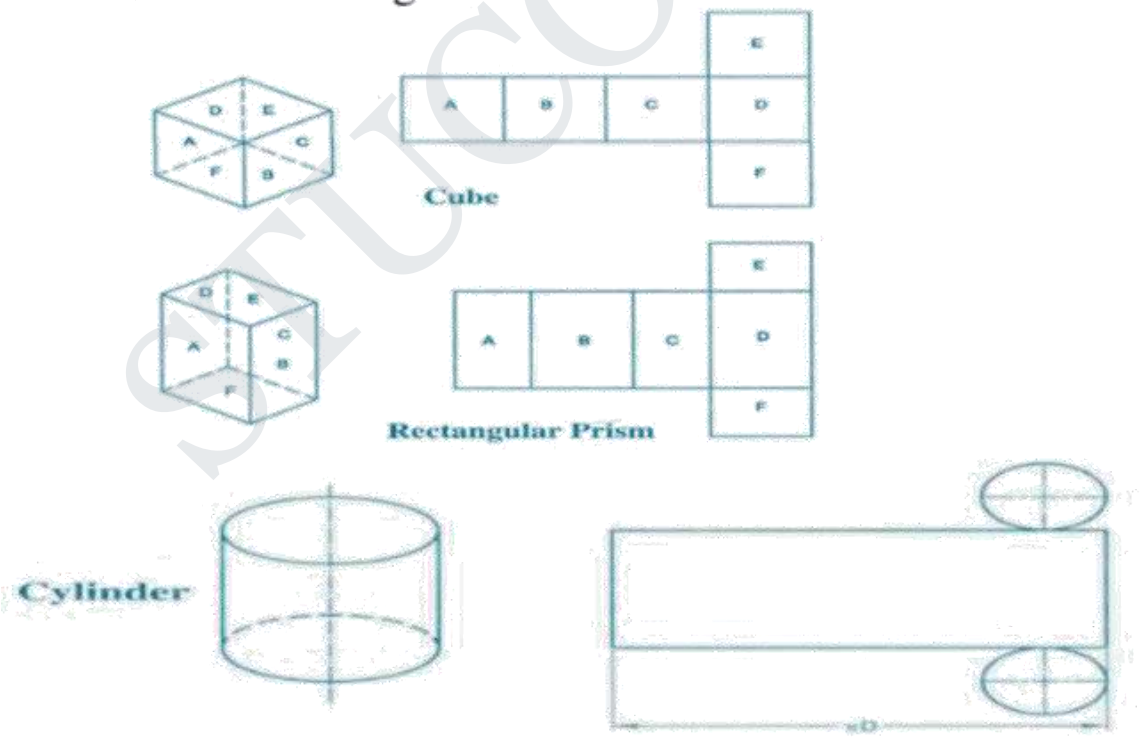
Development of surfaces:

A layout of the complete surface of a three dimensional object on a plane surface is called its development or pattern. Development is a term frequently used in sheet metal work where it means the unfolding or unrolling of a detail into a flat sheet called a pattern

There are three methods of pattern development; (i) Parallel line, (ii) Radial line and (iii) Triangulation.

Parallel Line Method:

This method can only be used to develop objects (or parts thereof) having a constant cross-section for their full length, for example, prisms and cylinders and related forms. Parallel lines, parallel to the axis of the detail, are shown on a view which shows them as their true lengths.



Examples for Parallel Line Development

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1. After drawing the given views, determine the view in which the right section of the solid appears as an edge view. Here it should be noted that top views of right prisms and cylinders are equivalent to their right sections will have to be found in the form of an auxiliary view.

2. Layout the stretch-out line of the development parallel to the edge view of the right section.

3. Locate the distance between lateral comer edges by measuring from the true size views in the right section and then transferring these measurements to the stretch-out line. Name their points.

4. Draw the lateral fold lines perpendicular to the stretch-out line through the points already plotted.

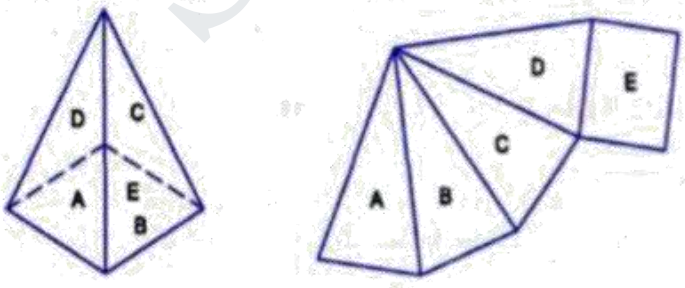
5. The development should be commenced at the shortest line, so that the least amount of welding or other joining effort is required.

6. Join all end points forming the boundary of the pattern in proper order. Only the boundary of the pattern should be made bold, leaving all other lines as thin lines.

7. Check up that the point where the development ends is the same point as the beginning point on the right section.

Radial Line Method:

This method of development is used for right and oblique pyramids and cones. It employs radial lines which are slant edges from vertex to base comer points for pyramids, and radial surface lines on the cone surface from the vertex to the base.



Square Pyramid

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Development of Right Cones

The development of any right cone is a sector of a circle since the radial surface Lines are all of the same true length. The angle at centre of the sector depends on the base radius and the slant height of the cone. Let the radius of the base of the cone be **R,** the slant height of the cone be **L,** and the angle at the centre of the development be θ.

θ = (Radius of the base circle /True slant length) X 360 =(R / L) X 360

In this method of development the surface of the object is divided into a number of triangles. The true sizes of the triangles are found and then these triangles are drawn in order, side by side, to produce the pattern. **It** is simple to realize that to find the true sizes of the triangles, it is first necessary to find the true length of their sides.

1. When the top and bottom edges of a sheet metal detail are parallel to the **HP** the true lengths of these edges may be taken directly from the top view.
2. In case of circular edges, chordal distance may be taken and transferred to the development. Though such lengths are not theoretically accurate they are satisfactory for development work.
3. For all transition pieces having inclined top and bottom edges, **TL** construction must be carried out if these edges are curved.
4. A well defined labeling system should be used in order that the construction technique may be progressive and easy to understand.

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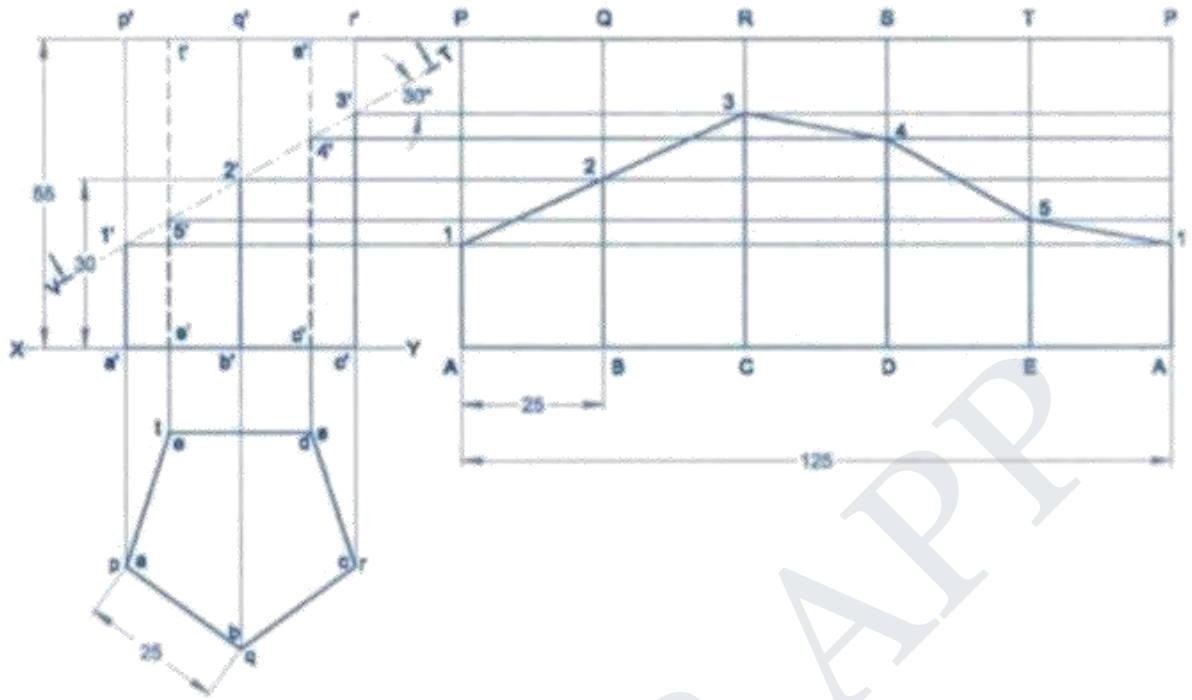

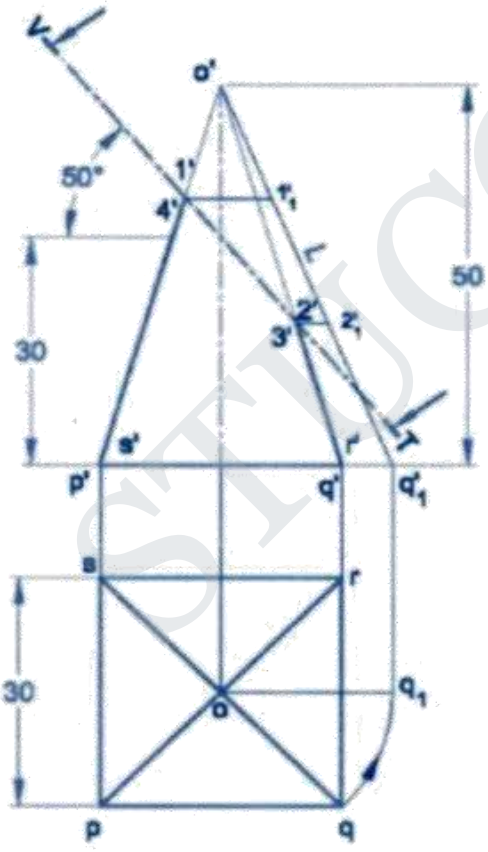

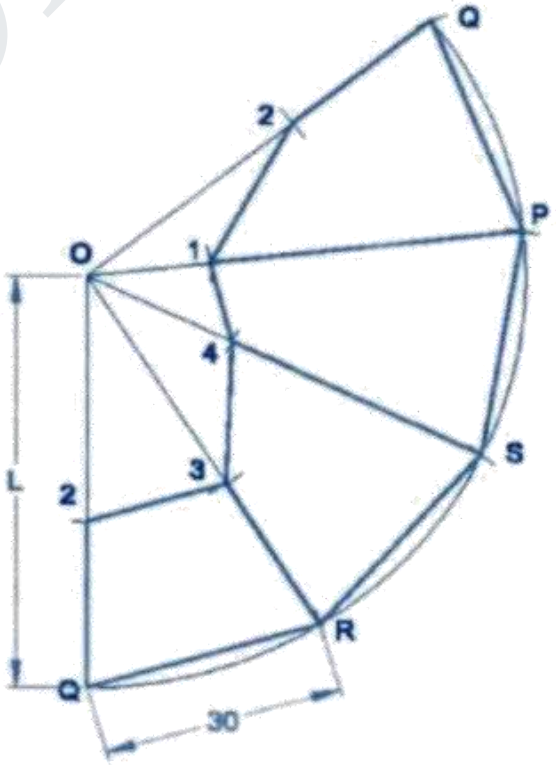

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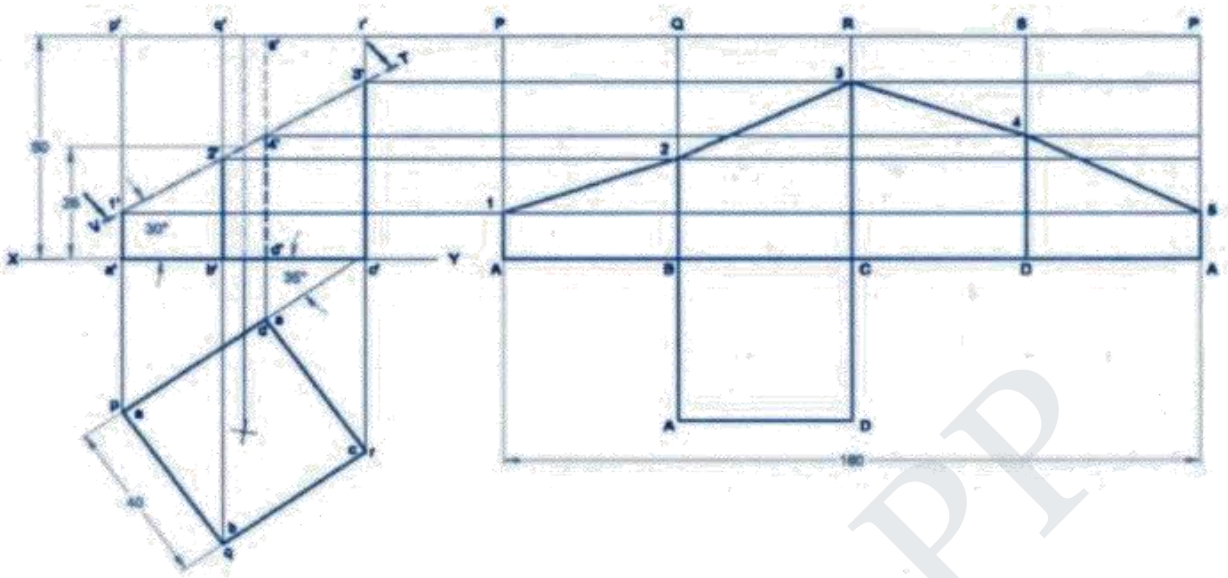

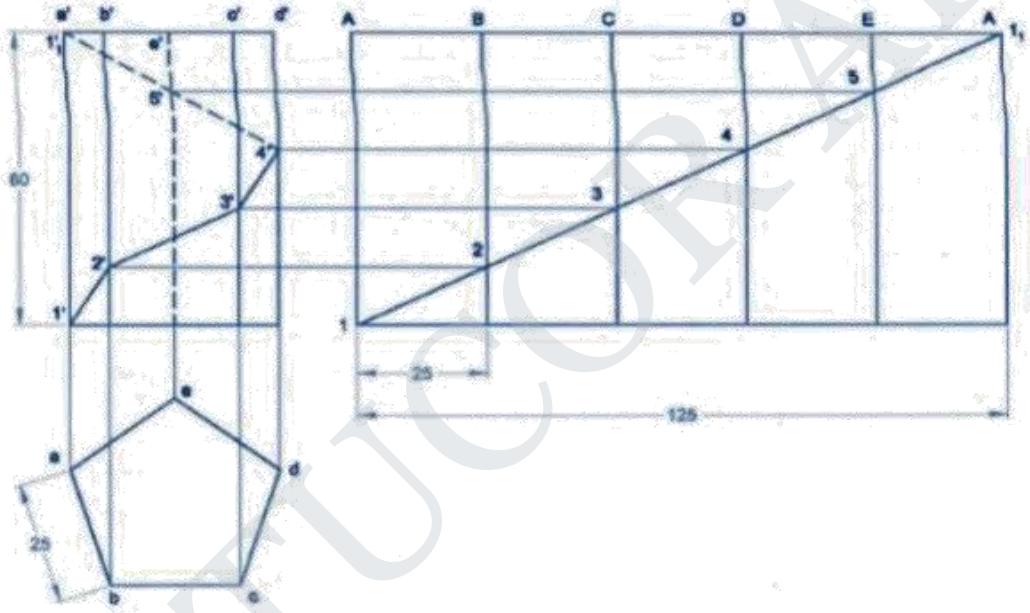

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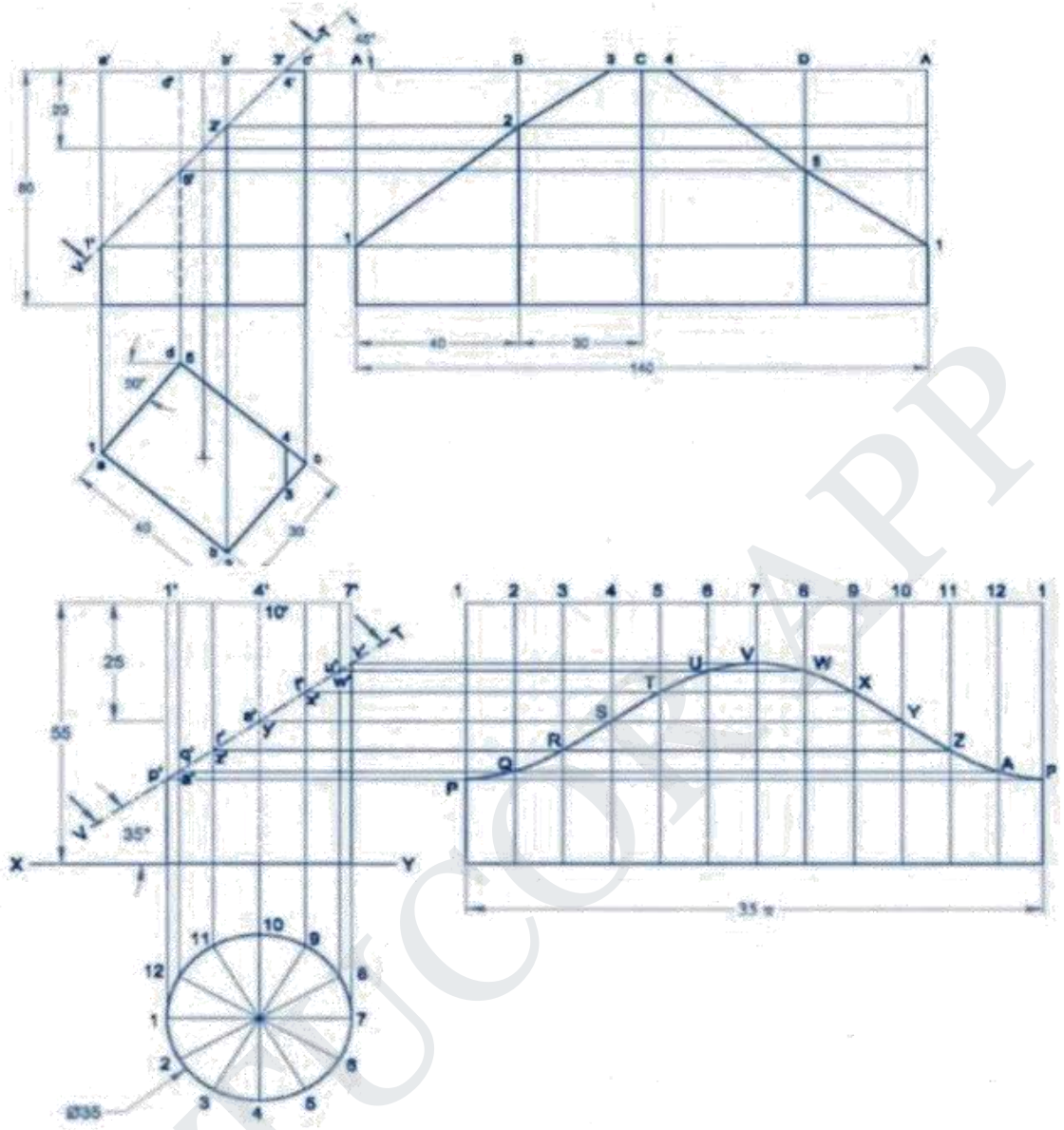

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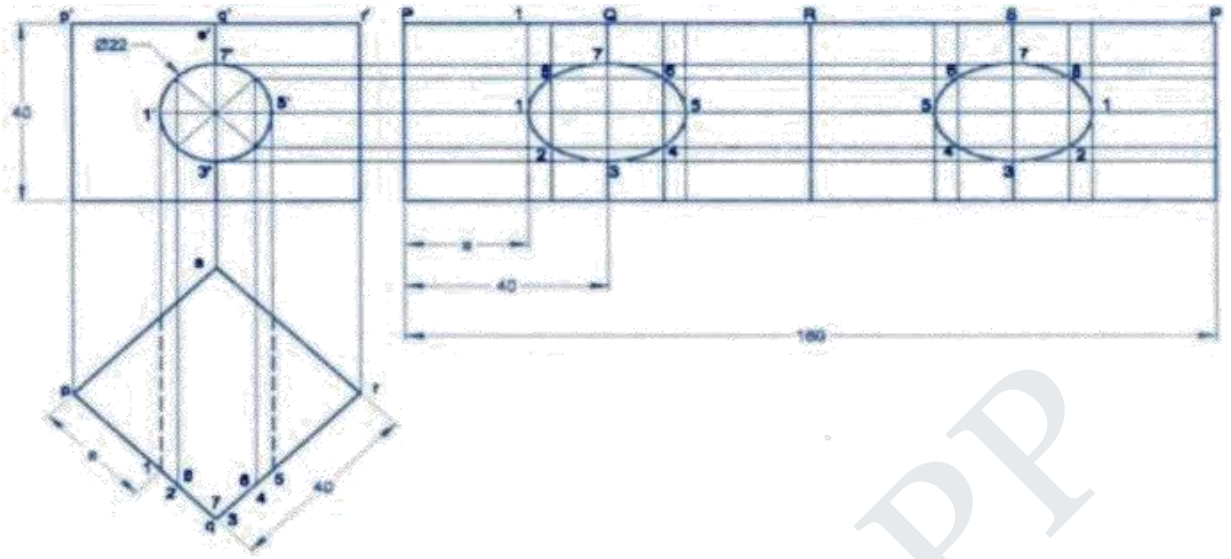

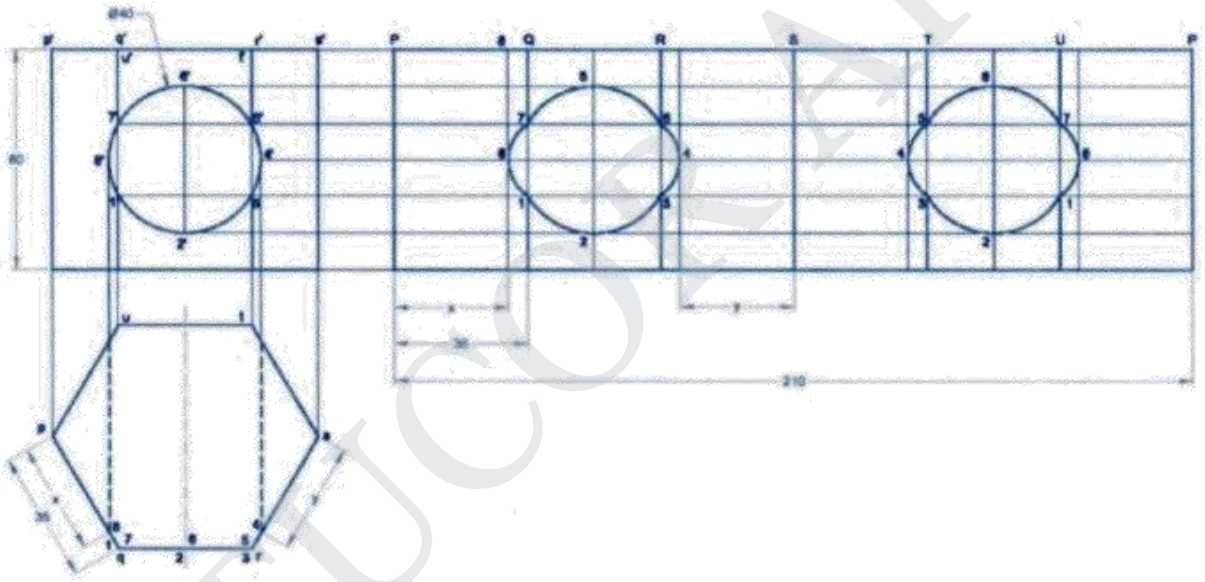

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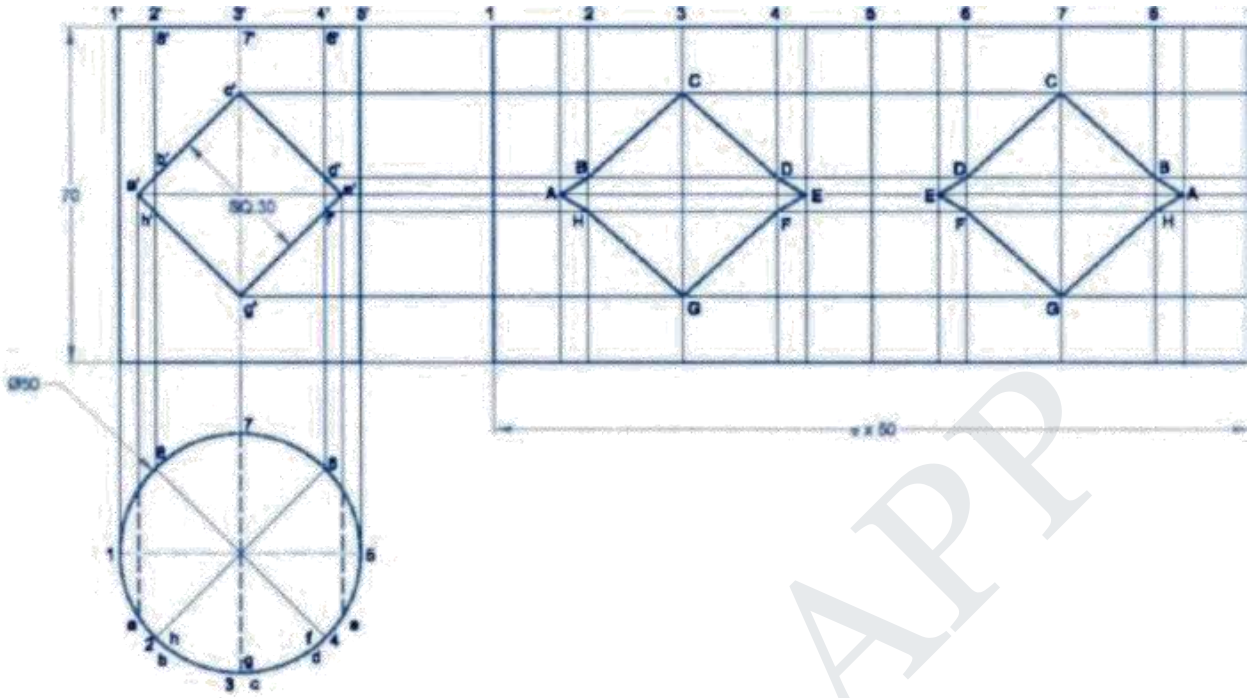

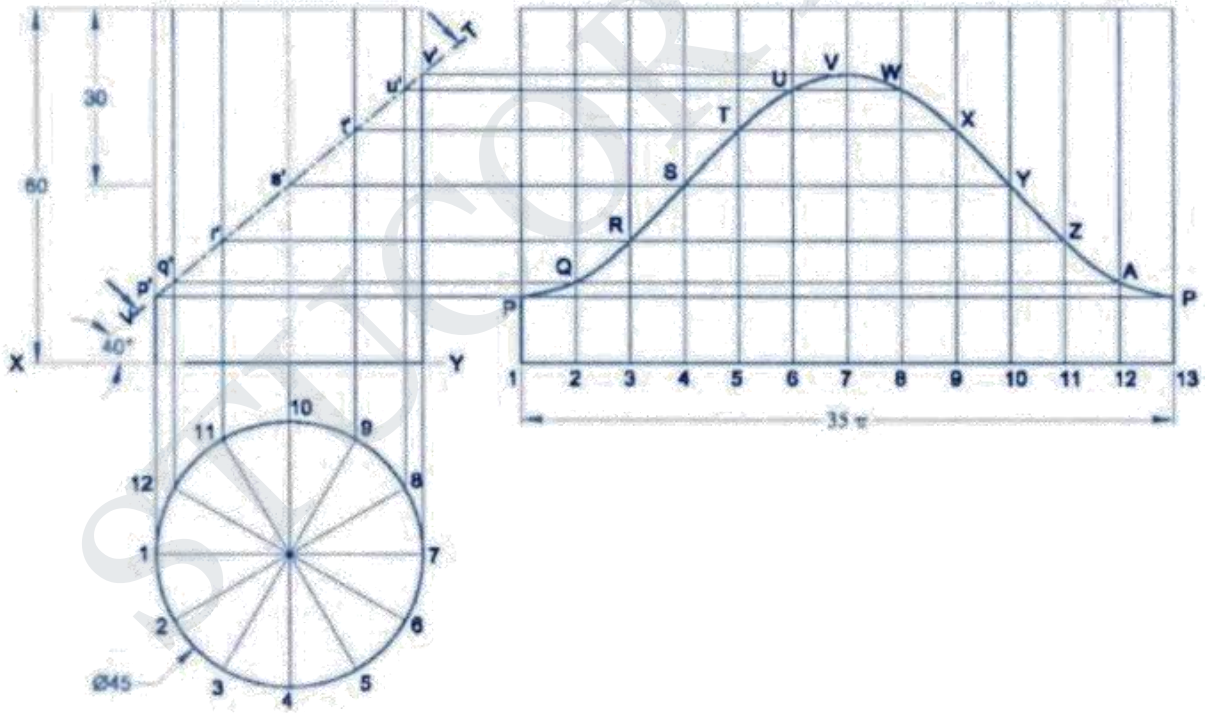

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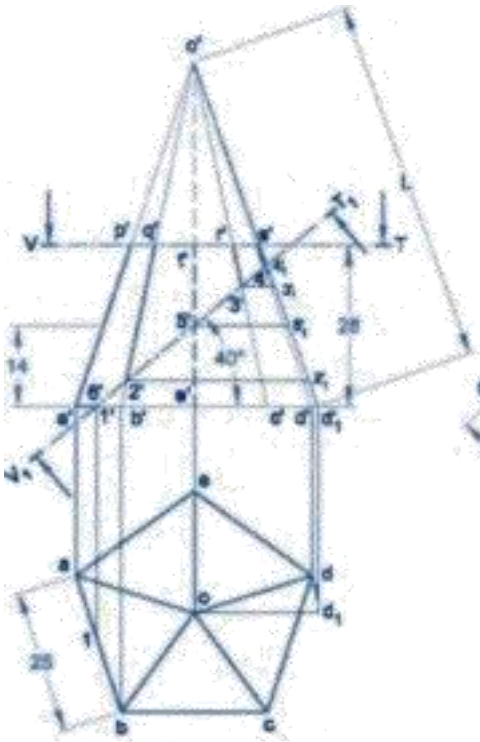

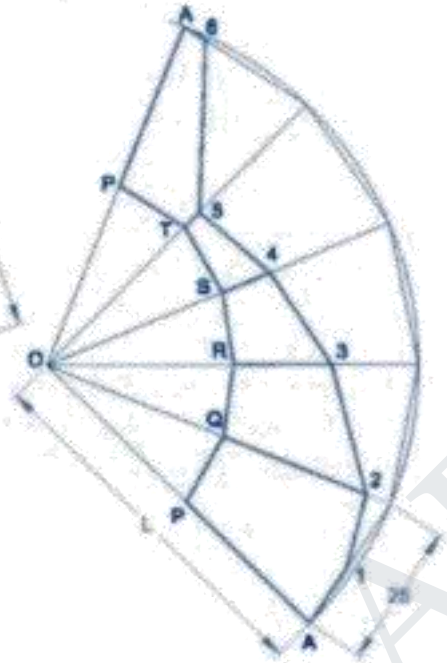

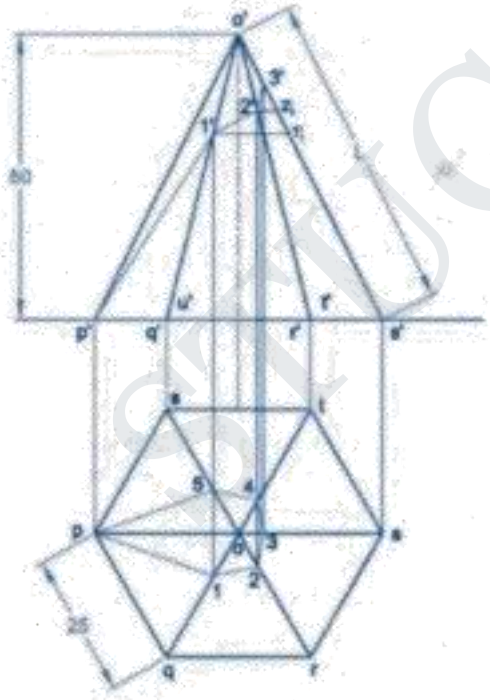

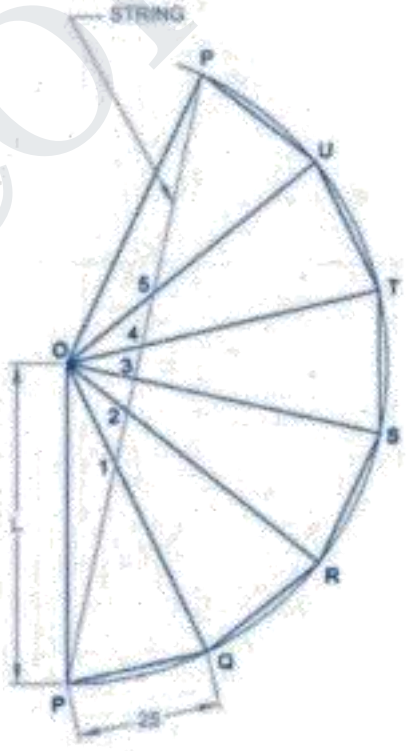

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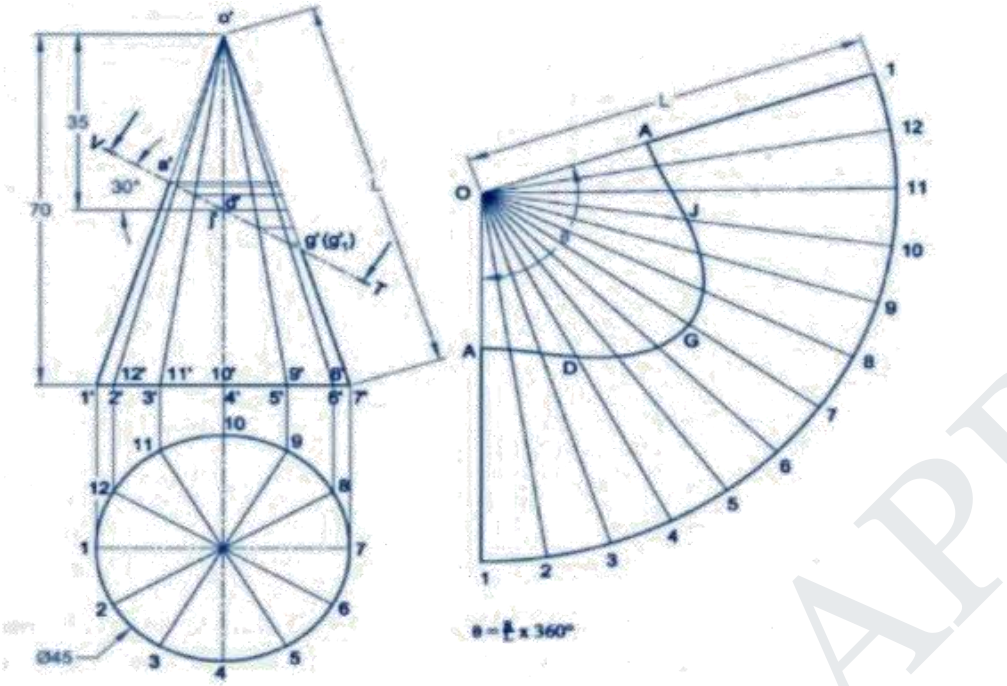

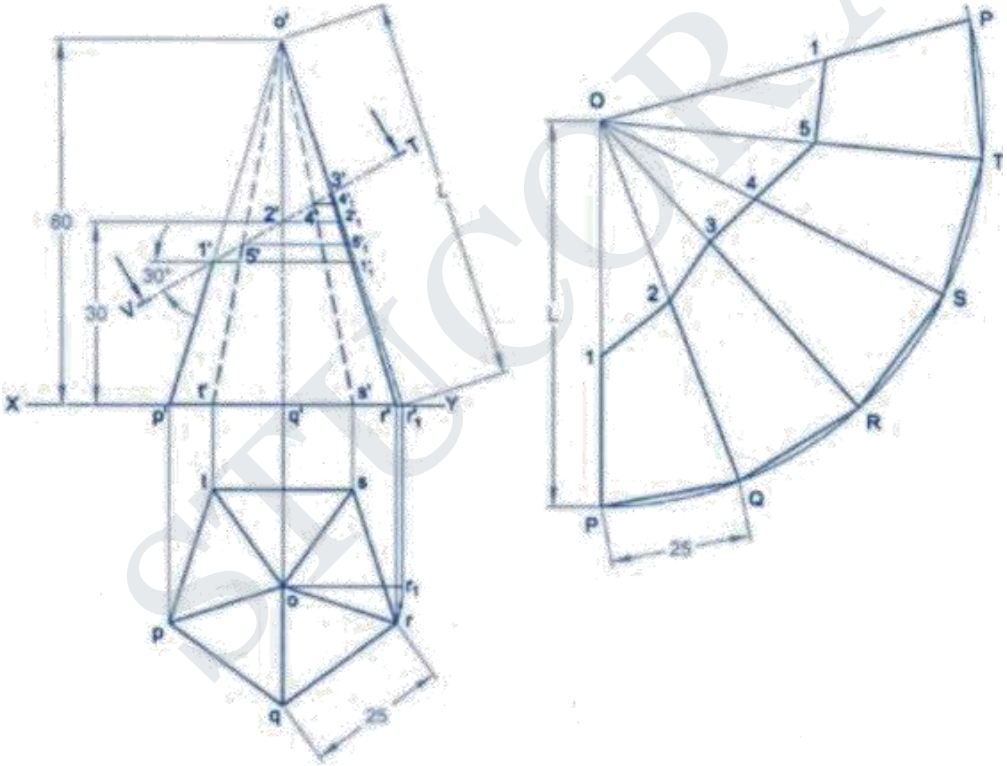

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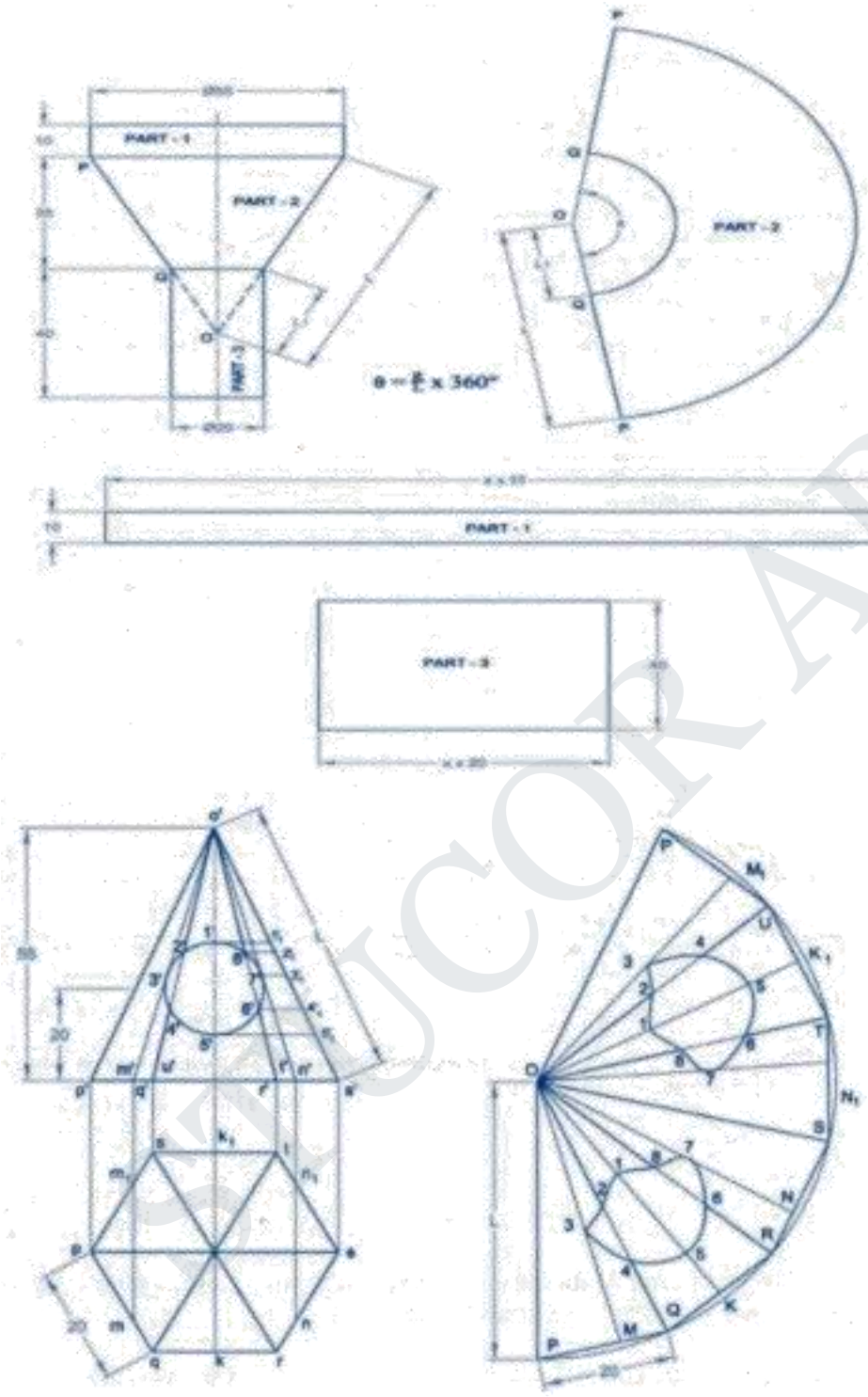

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Isometric Projection:

The isomeric projection of an object is obtained on a vertical plane of projection by placing the object in such a way that its three mutually perpendicular edges make equal inclinations with the plane of projection. Since the three mutually perpendicular edges of an object are projected in the isometric projection at equal axonometric angles, the angles between those edges in the isometric projection will be at 12°. The lengths of the three mutually perpendicular edges of the object in the isometric projection are foreshortened in the same proportion.

Isometric Scale:

In the isometric projection, all the edges of an object along the direction of the three isometric axes are foreshortened to **0.816** times their actual lengths. To facilitate an easy and quick method of measurement of the lengths of the different edges in their reduced sizes while drawing the isometric projection of the object, a special scale called **isometric scale** is constructed.

The view drawn to the actual scale is called the **isometric view** or Isometric Drawing while that drawn using the isometric scale is called the **Isometric Projection**.

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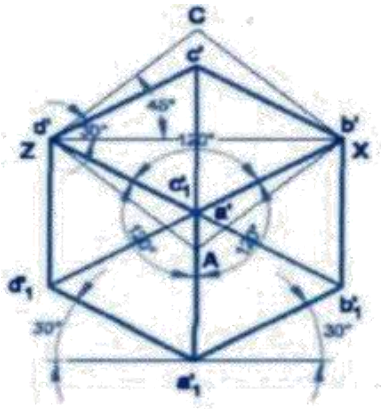

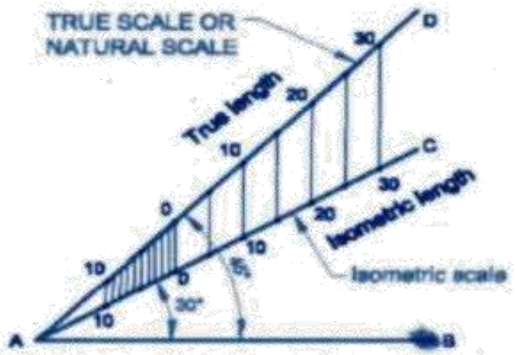

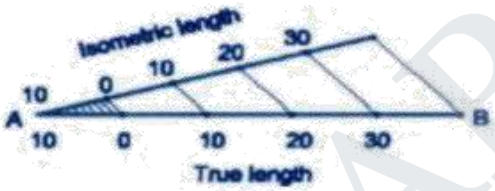

Importance Points in Isometric:

1. For drawing the isometric, the object must be viewed such that either the front -right or the left edges becomes nearest.
2. All vertical edges of the object remain vertical in isometric
3. The horizontal edges of the object which are parallel to the isometric axes are drawn at **30°** to the horizontal.
4. The inclined edges which are not parallel to the isometric axes should not be drawn at the given inclination in isometric. These inclined edges are drawn by first locating the end points in isometric and then joined.
5. All circles are represented as ellipses in isometric.
6. All construction lines have to be retained as thin lines and the visible edges are to be shown as thick lines.

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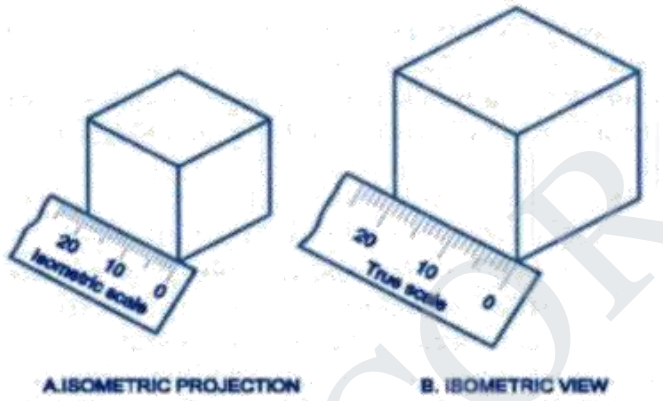
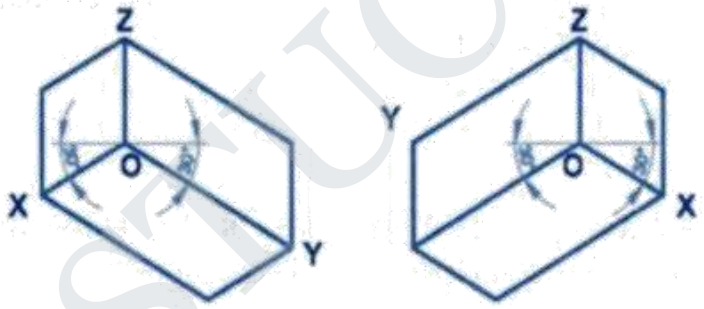
7. Generally the hidden edges need not be shown in isometric unless otherwise required either for locating a comer, or an edge, or face, or mentioned.
8. Unless otherwise specifically mentioned to draw the isometric view or isometric drawing all dimension lines parallel to the isometric unless otherwise if mentioned.
9. No dimensions are indicated in isometric unless otherwise mentioned.
10. The given orthographic views need not be drawn unless required for consideration



A.ISOMETRIC PROJECTION B. ISOMETRIC VIEW



ISOMETRIC PROJECTIOS WITH DIFFERENT FACES VISIBLE

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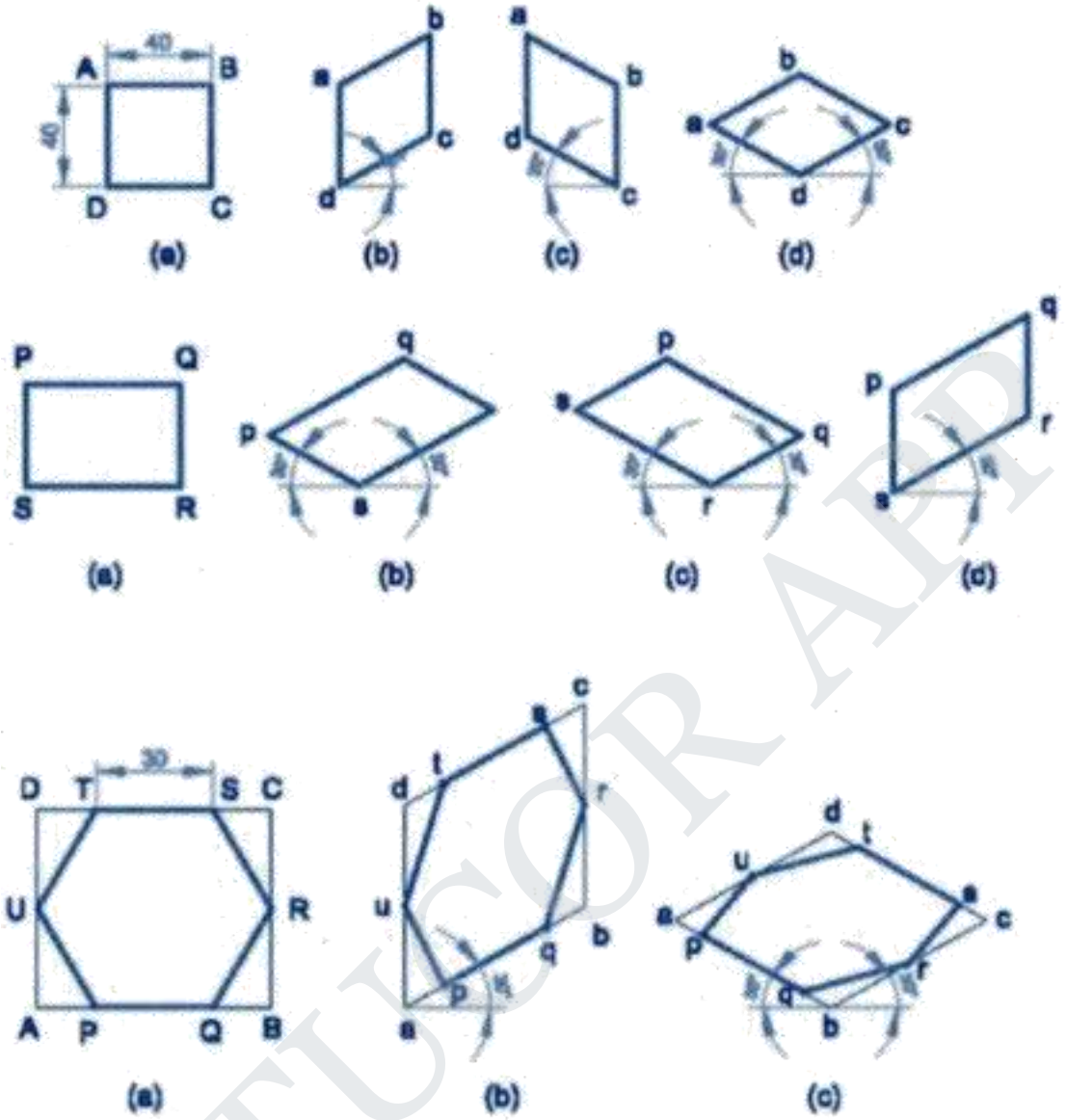
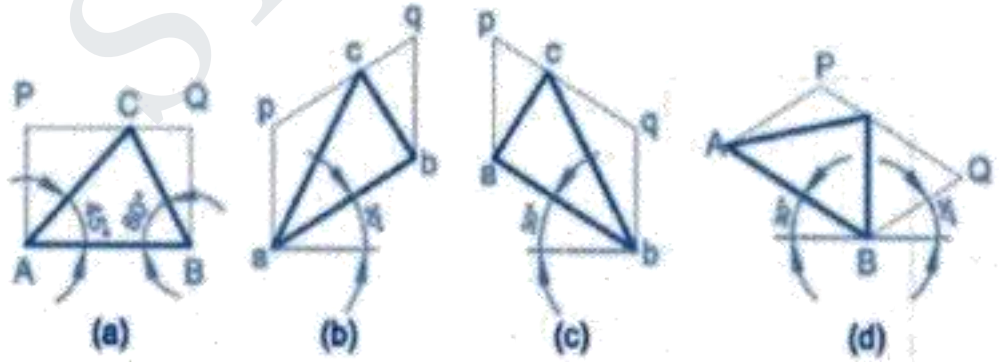


Isometric view of different geometrical surfaces



Isometric view of triangle

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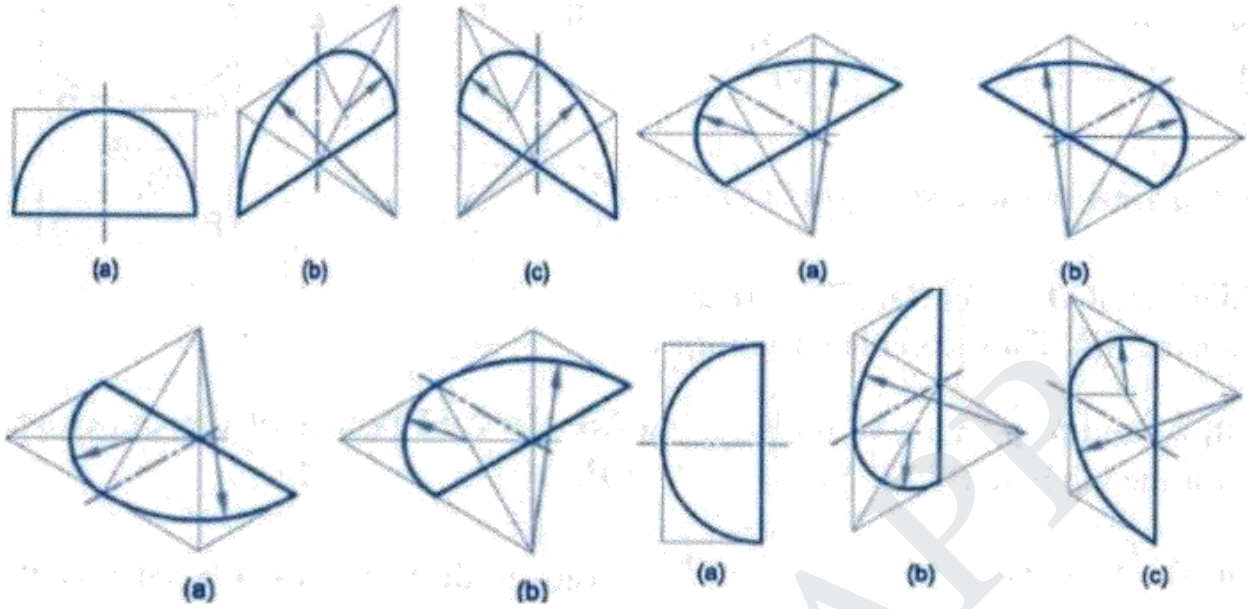
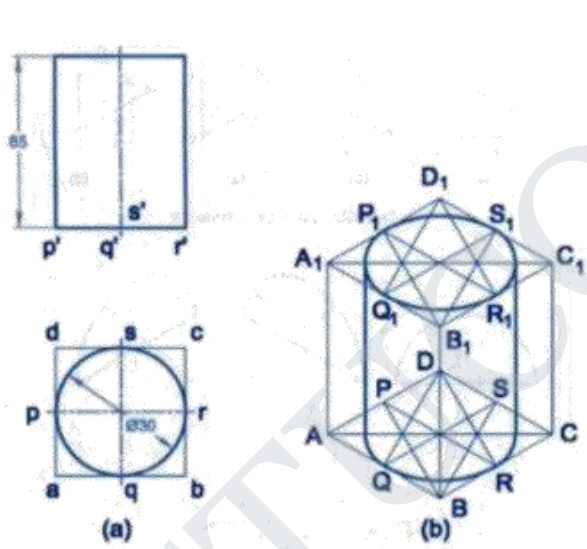
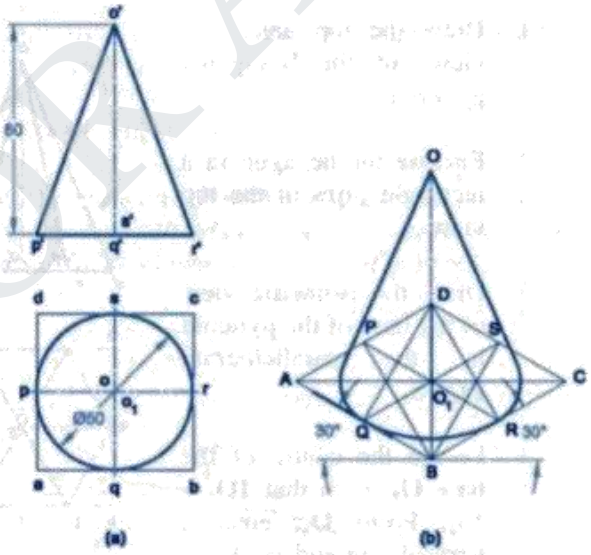


Isometric view of semi circle



Isometric for cylinder



Isometric for cone

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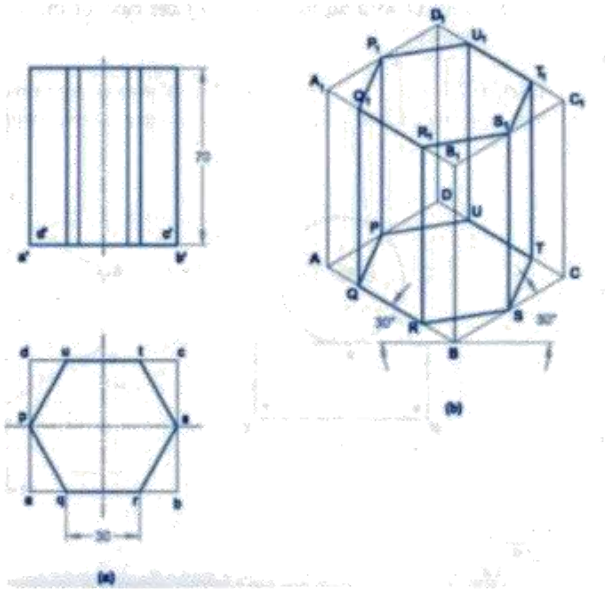
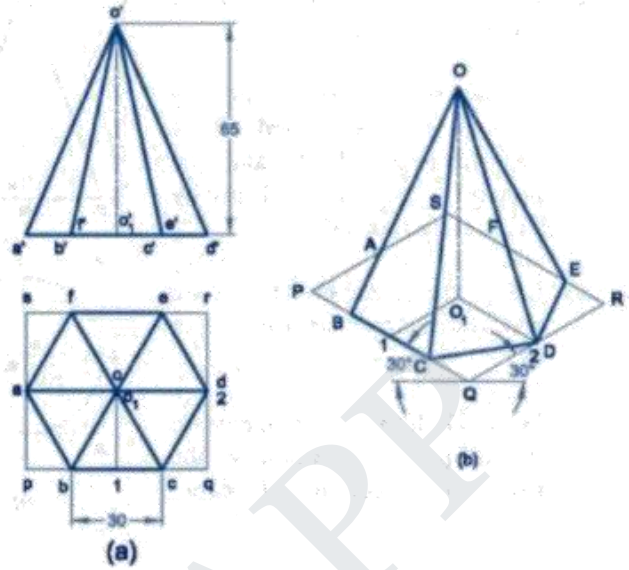


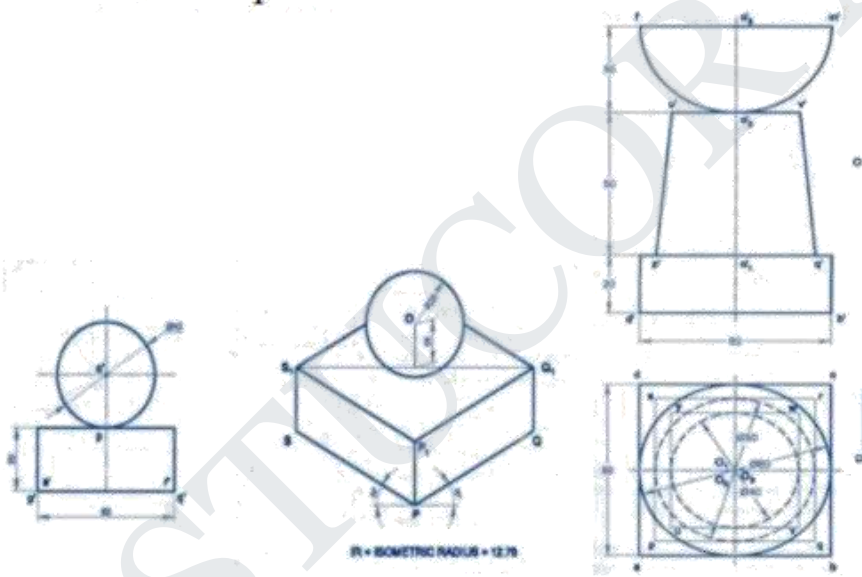
Isometric for prism

Isometric for prism



Isometric for pyramid

Isometric for pyramid



Isometric for combination solid

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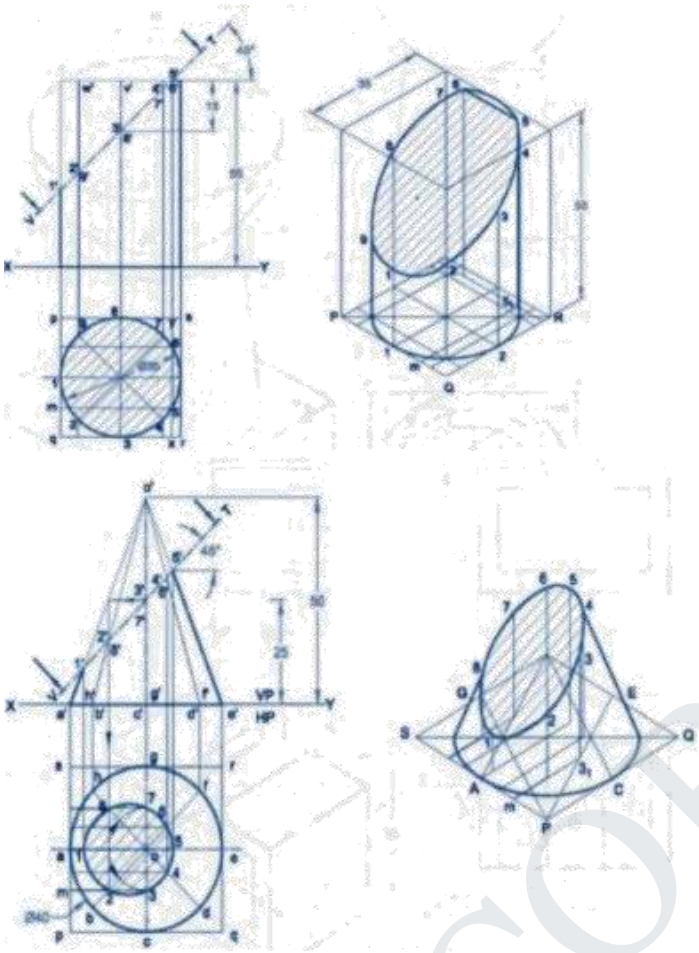
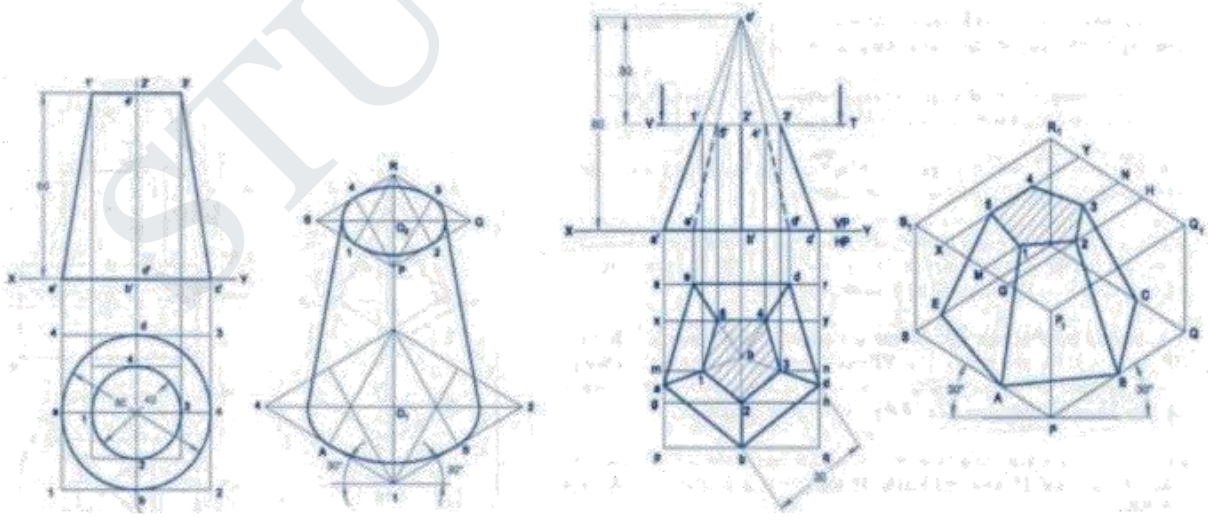


Isometric for cutting model in cylinder and cone



Isometric for cutting model in cone and pyramid

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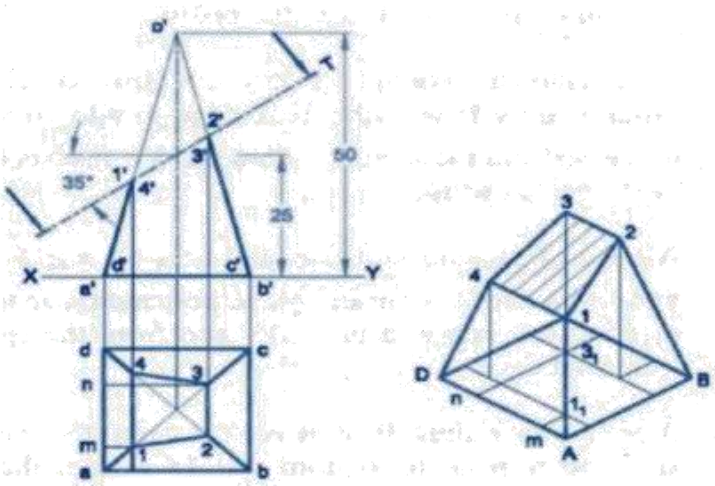

Isometric for cutting model square pyramid

Important Questions

1. A cylinder of diameter 40mm and height50mm is resting vertically on one of its end on the hp. It is cut by a plane perpendicular to the vp and inclined at 30®to the hp. The plane meets the axis at a point 30mm from the base. Draw the development of the lateral surface of the lower portions of the truncated cylinder.
2. A hexagonal prism of base side 20mm and height 40mm has a square hole of side 16mm at the centre. The axes of the square and hexagon coincide. One of the faces of the square is parallel to the face of the hexagon. Draw the isometric projection of the prism with hole to full scale.
3. A right circular cone, 40mm base and 50mm height, rests on its base on HP. A section plane perpendicular to VP and inclined to HP AT 45®cuts the cone bisecting axis. Draw projections of the truncated cone and develop its lateral surface.
4. A pentagonal pyramid of 40mm edge of base and height 70mm rests with its base on HP. One of the bases edges is perpendicular to VP and line on the left of axis of the pyramid. A section plane perpendicular to VP and inclined at 30®to VP cut the axis of the pyramid at a point 30mm above the base of the pyramid. Draw the isometric projection of the truncated pyramid.

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5. A pentagonal pyramid of base edge 25mm and height 60mm rests vertically on its base on the HP such that one of its base edge parallel to VP. It is cut by a plane, inclined at 60 to HP and passes through a point 35mm from the apex. Draw the development of the lateral surface of the pyramid.
6. An object consists of a hemispherical vessel of 80mm diameter which is placed centrally over a cylinder of 50mm diameter and height of 60mm. the cylinder in turn is placed centrally over a square prism of 60mm base side and 20mmh height. Draw the isometric projection of the object.
7. Draw the development of the lateral surface of the lower portion of a cylinder of diameter 50mm and axis 70mm. the solid is cut by a sectional plane inclined at 40®to HP and perpendicular to VP and passing through the midpoint of the axis.
8. Draw the isometric projection of the object from the view shown in figure.
9. A regular hexagonal pyramid side of base 20mm and height 60mm is resting vertically on its base on HP, such that two of the sides of the base are perpendicular the VP. It is cut by a plane inclined at 40® to HP and perpendicular to VP. The cutting plane bisects the axis of the pyramid. Obtain the development of the lateral surface of the truncated pyramid.
10. A cylinder of 50mm diameter and 75mm height stands with its base on HP. It is cut by a section plane inclined at 45® to HP and perpendicular to VP passing through a point on the axis 20mm below the top end. Draw the isometric projection at the truncated cylinder.
11. A cylinder of diameter 40mm and height 50mm is resting vertically on one of its ends on the HP. It is cut by a plane perpendicular to the VP and inclined at 30® to the HP. The plane meets the axis at a point 30mm from the base. Draw the development of the lateral surface of the lower portion of the truncated cylinder.
12. A hexagonal prism of base side 20mm and height 40mm has a square hole of side 16mm at center. The axis of the square and hexagon coincide. One of the faces of the square hole is parallel to the face of the hexagon. Draw the isometric projection of the prism with hole of full scale.

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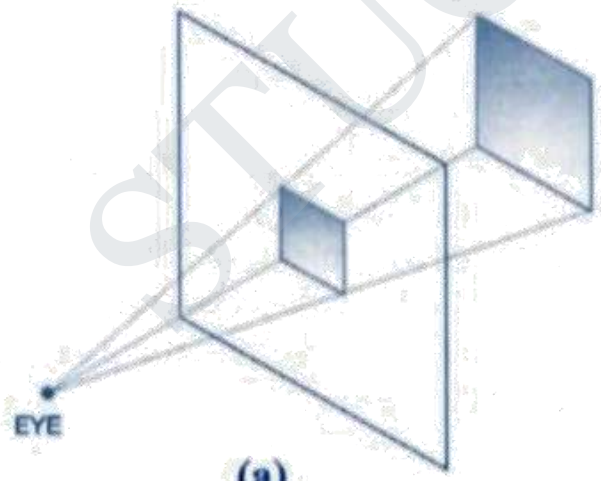
UNIT-V

Perspective Projection:

The perspective projection, also sometimes called scenographic projection or central projection, is the form of pictorial drawing which most nearly approaches the pictures as seen by the eyes.

Perspective projection is sometimes called **scenographic projection or central projection,** since the lines of sight converge to a single point or centre. Perspective obtained will depend on the relative position of the object, picture plane and point of sight. In this projection, the eye is assumed to be situated at a definite position relative to the object. The picture plane (vertical plane) is placed between the object and the eye. Visual rays from the eye to the object pierce the picture plane and form an image on it. This image is known as **perspective** of the object.



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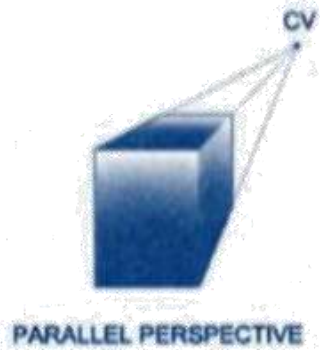

(d)

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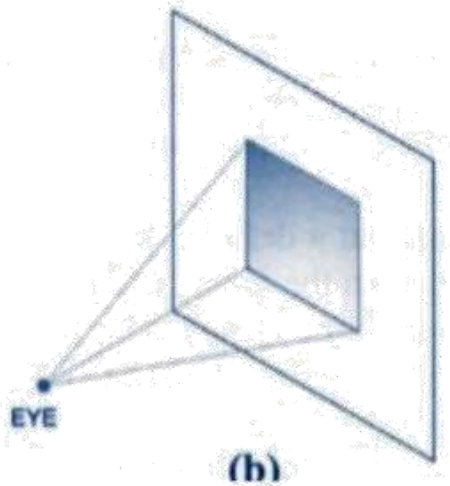
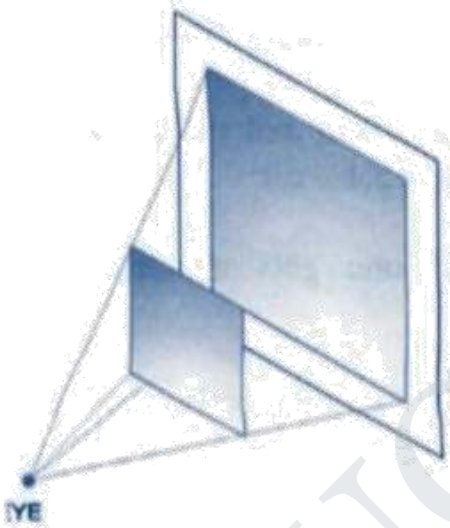


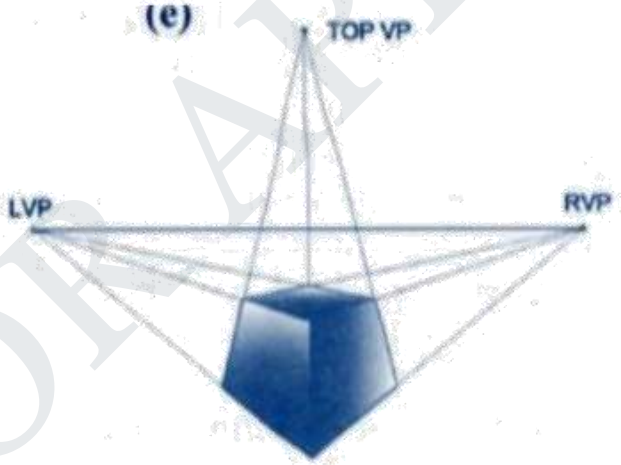
(b)



(c)

TWO POINT PERSPECTIVE

(e)



THREE POINT PERSPECTIVE

(f)

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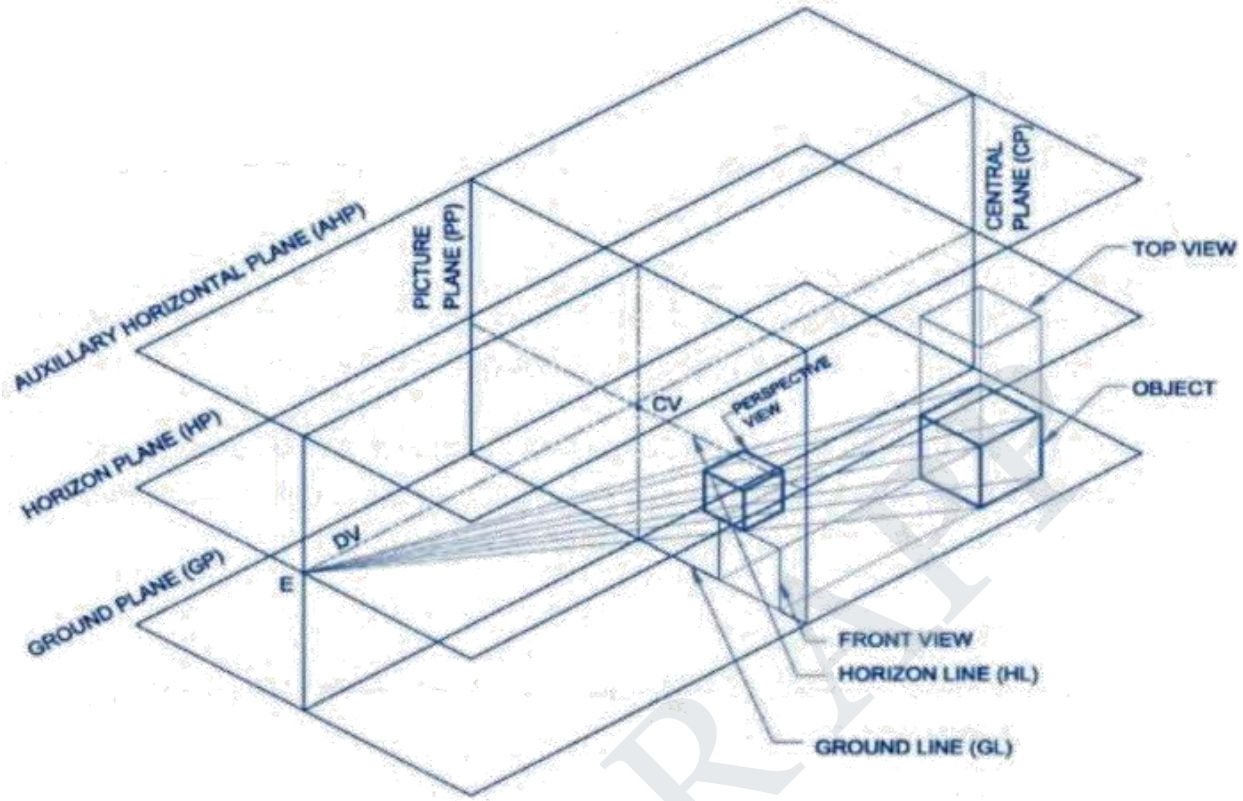
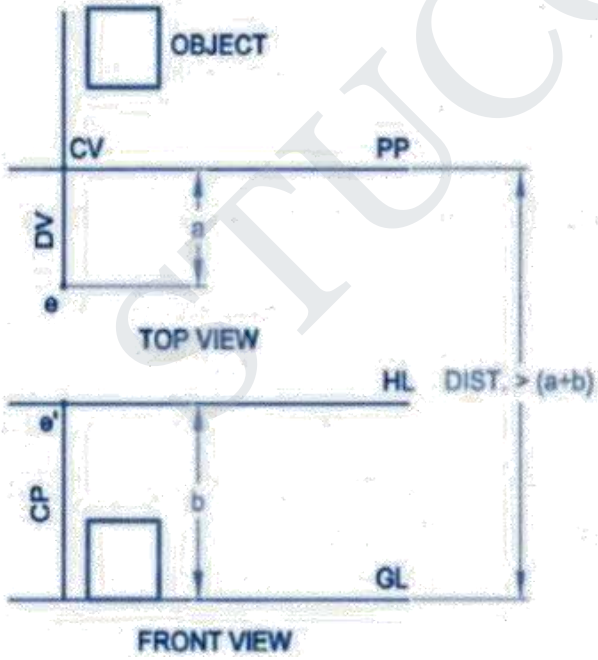


CV - CENTRE OF VISION
DV - DIRECTION OF VISION
E - STATION POINT (OR) EYE LEVEL



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Visual Ray Method:

The points at which the visual rays joining the station point and the object pierces the picture plane in both the top and profile views, are projected to intersect each other to give points in the perspective. Since the perspective view is obtained by the intersection of the visual ray, this method is called Visual Ray Method.

IMPORTANCE POINT IN VISUAL RAY METHOD:

1. Draw the PP line to represent the picture plane in the top view
2. Draw the plan of the object based on its position with respect to the PP
3. Draw the Ground Plane, the GP at any convenient distance from PP and project the front view based on the position of object with respect to GP.
4. Locate the position of the central plane with respect to the object and represent it as a line in both the views. On it mark the top view (s) and front view (s') of the station point based on this position with respect to PP and GP.
5. Join all plan points with s and note the intercepts of each line with PP line
6. From each intercept, with PP, draw projector vertically till it meets the line joining the elevation of the corresponding point and s' to get the perspective.
7. Follow the above step to get the perspective of other points of the object
8. Join all these points in proper sequence to get the perspective of the objective

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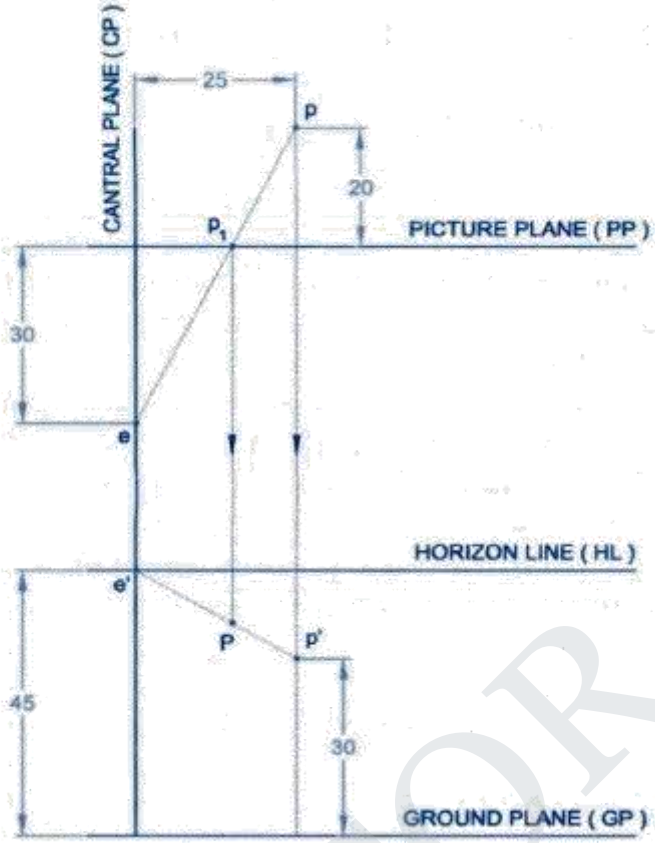
Perspective view of the point P.



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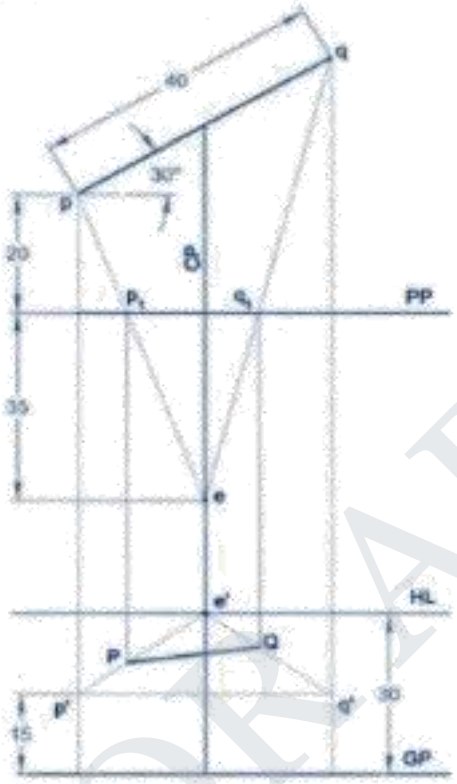
Perspective view of line



Perspective view of plane

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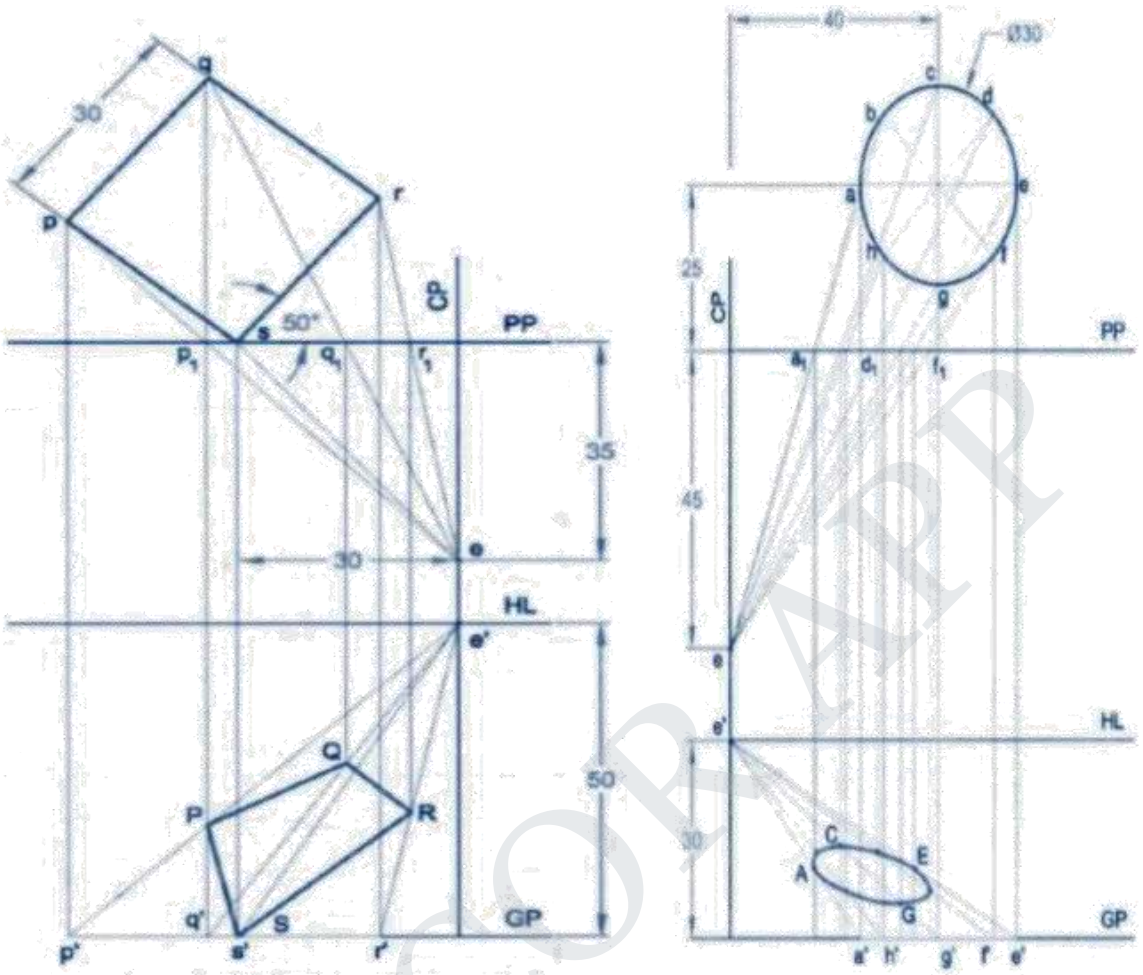

Perspective view of square prism & pyramid

(Resting on the ground on one of its faces /on the ground vertically with an edge of base parallel)

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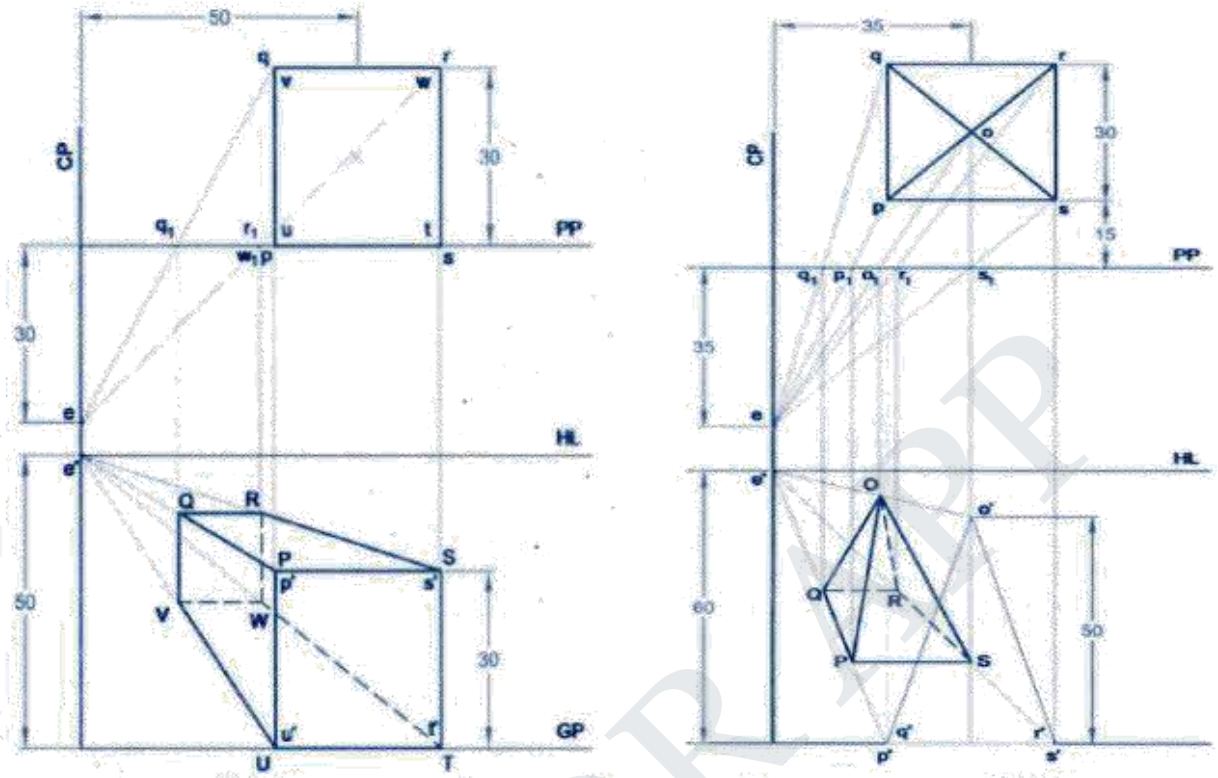

On the ground on its base with a face parallel

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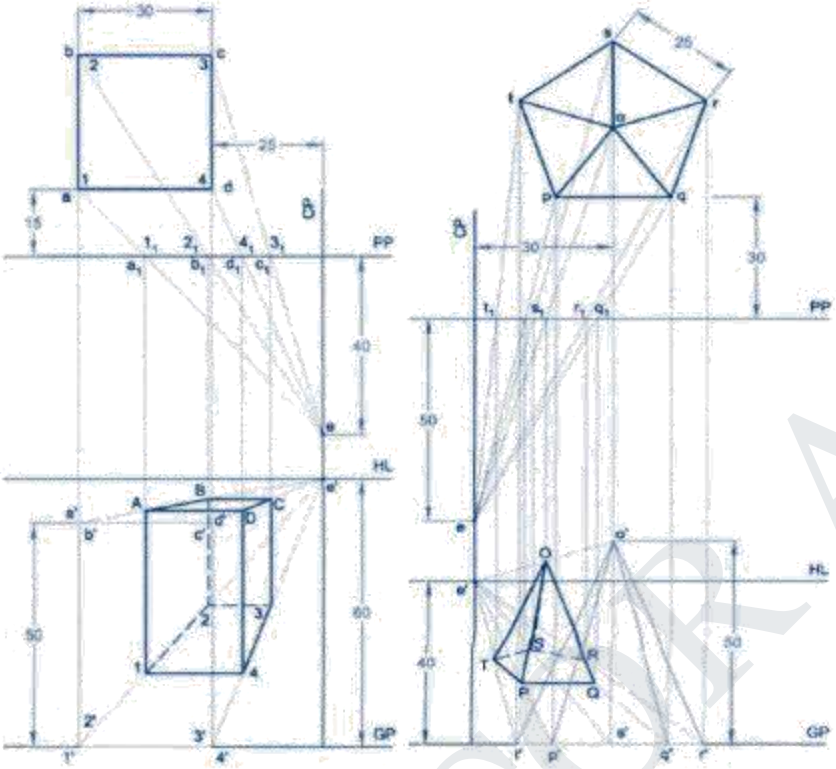
Perspective view of CONE



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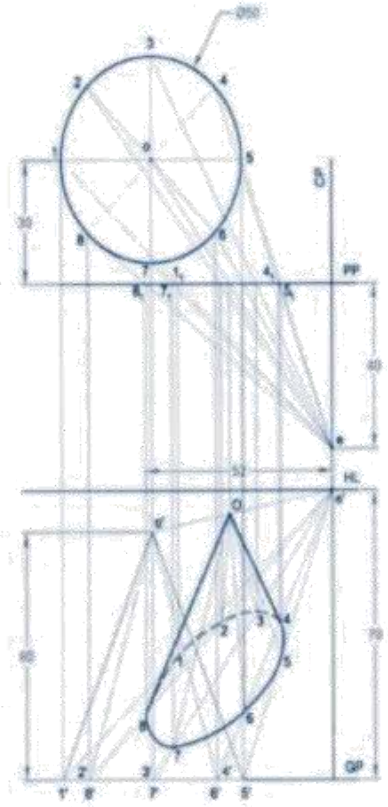

Free Hand Sketching:

In order to achieve a complete shape description, it is necessary to get more than one projection, and therefore, additional planes of projection are used to project more views on them, for the object. As such, the orthographic system of projection is also called multi-view projection method.

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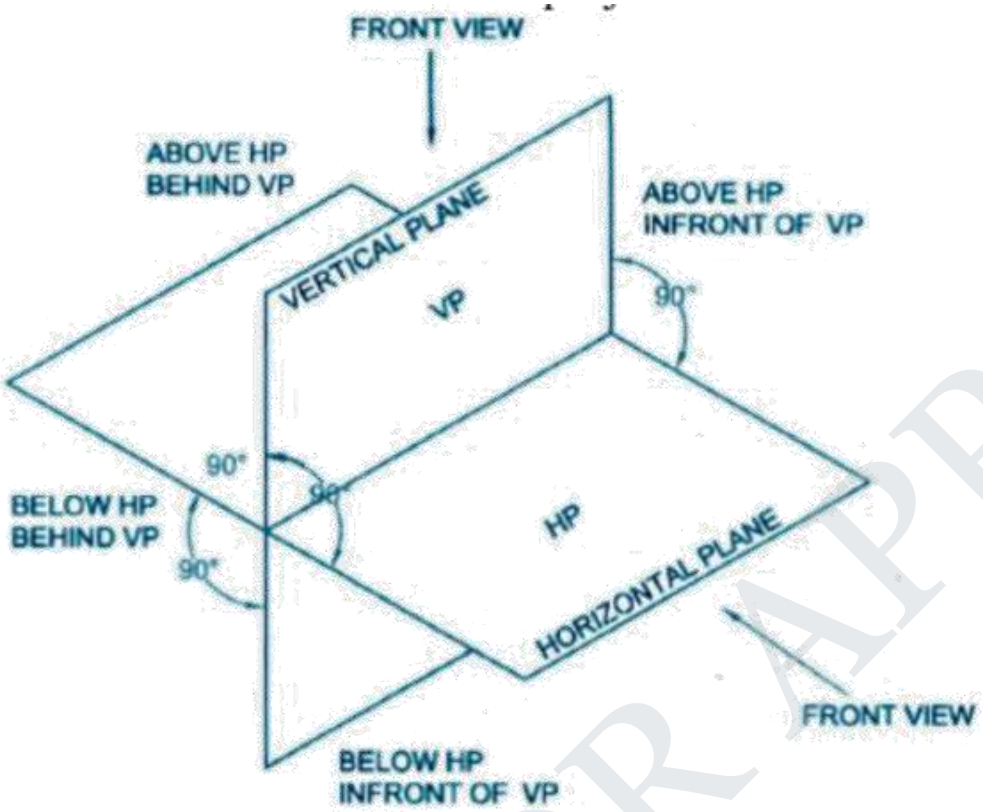
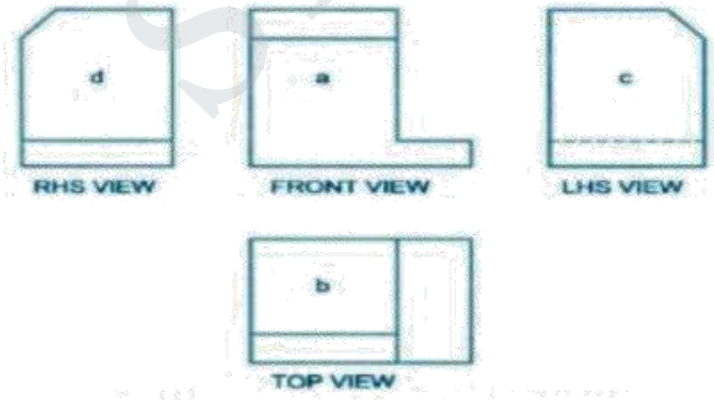


In the orthographic projection drawing, for getting the different views of an object, three main planes are usually used. One of these set up in vertical position is called the vertical plane of projection (VP) or Frontal Plane (FP). The second, set up in horizontal position, i.e., perpendicular to the VP, is called Horizontal Plane (HP). The third, plane set up perpendicular to the vertical and horizontal planes is called Profile Plane (PP).



FIRST ANGLE PROJECTION

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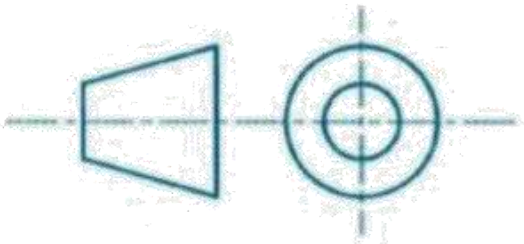
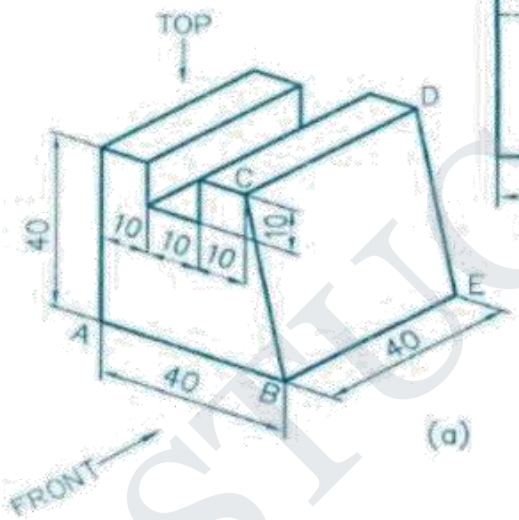
Symbol of projection

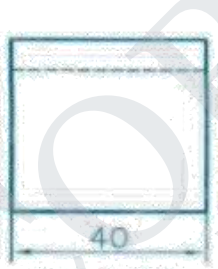


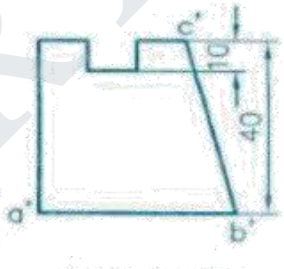
FIRST ANGLE PROJECTION

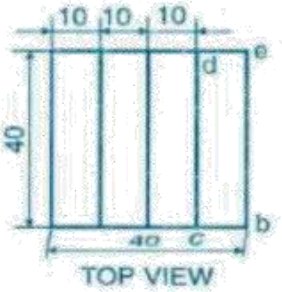
THIRD ANGLE PROJECTION

In the first angle projection, the profile view is projected on the opposite side, i.e., Left view is projected on the right plane and vice versa, where as in the third angle projection, it is projected on the same side plane i.e., left view is projected on the left plane.









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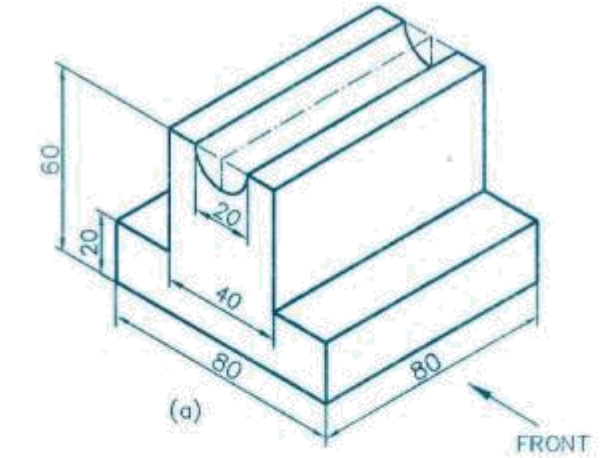

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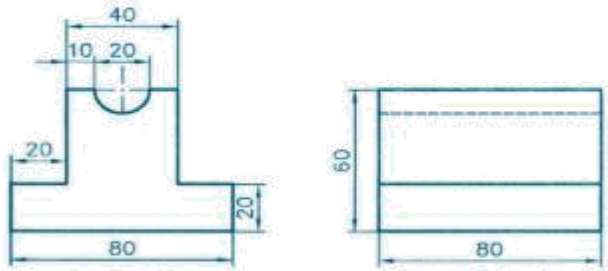

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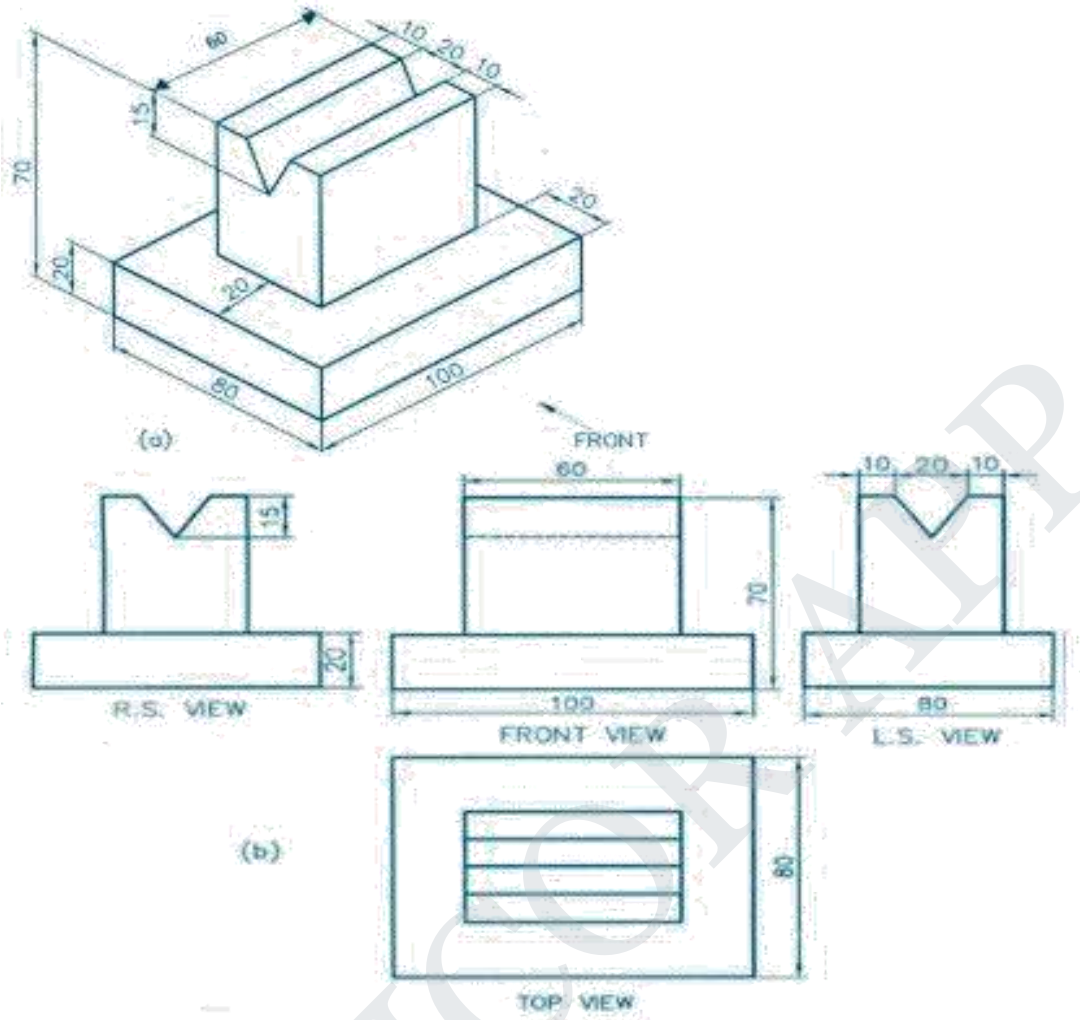

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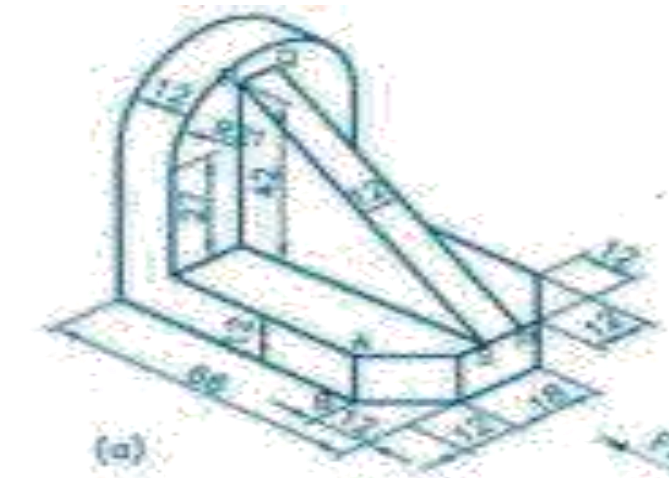

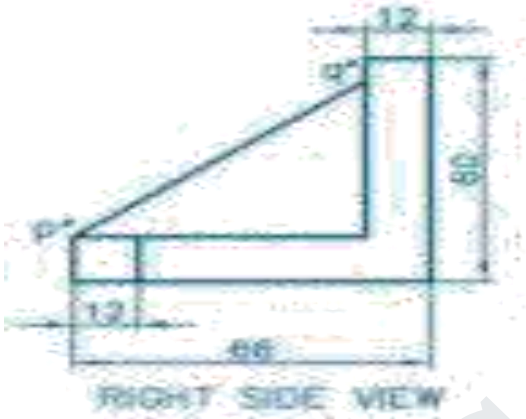

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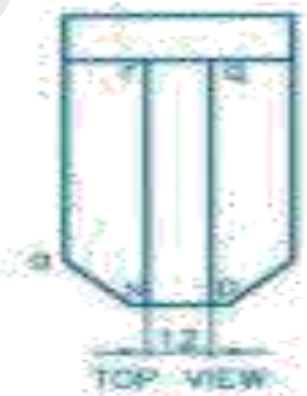

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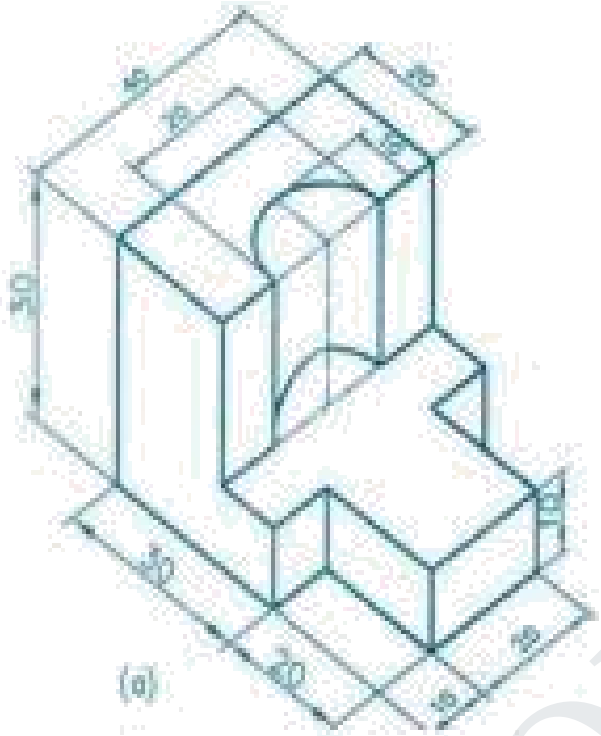

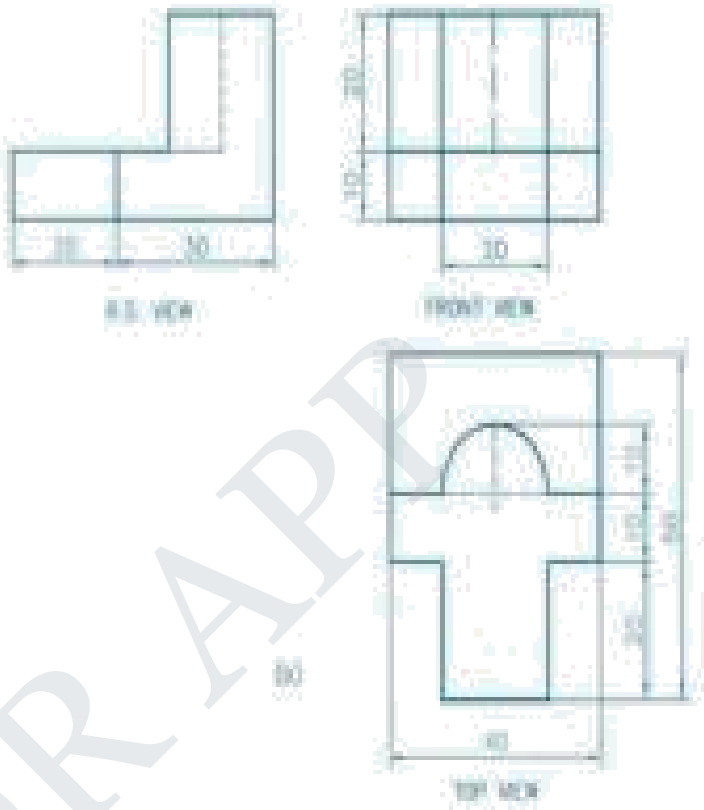

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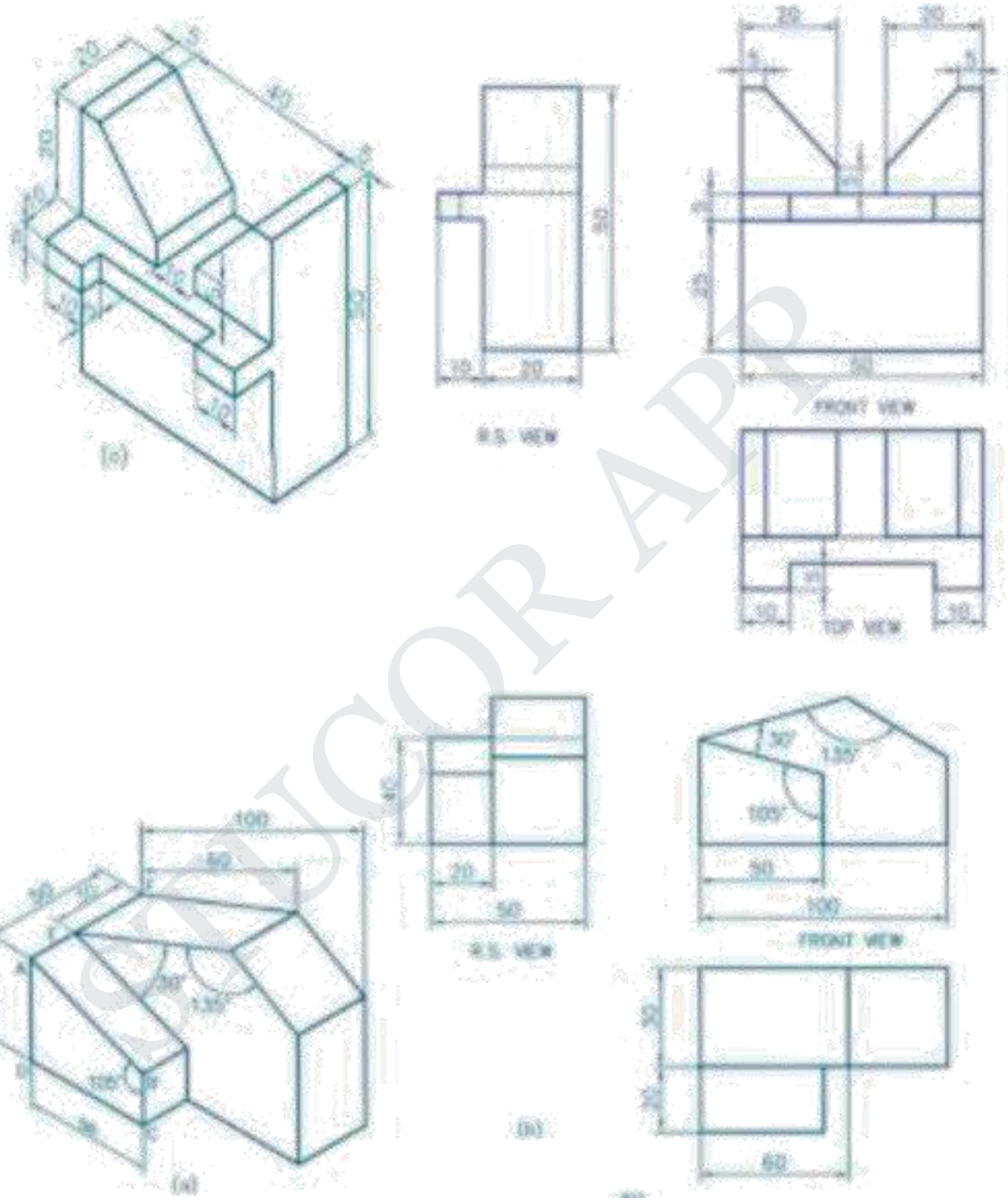

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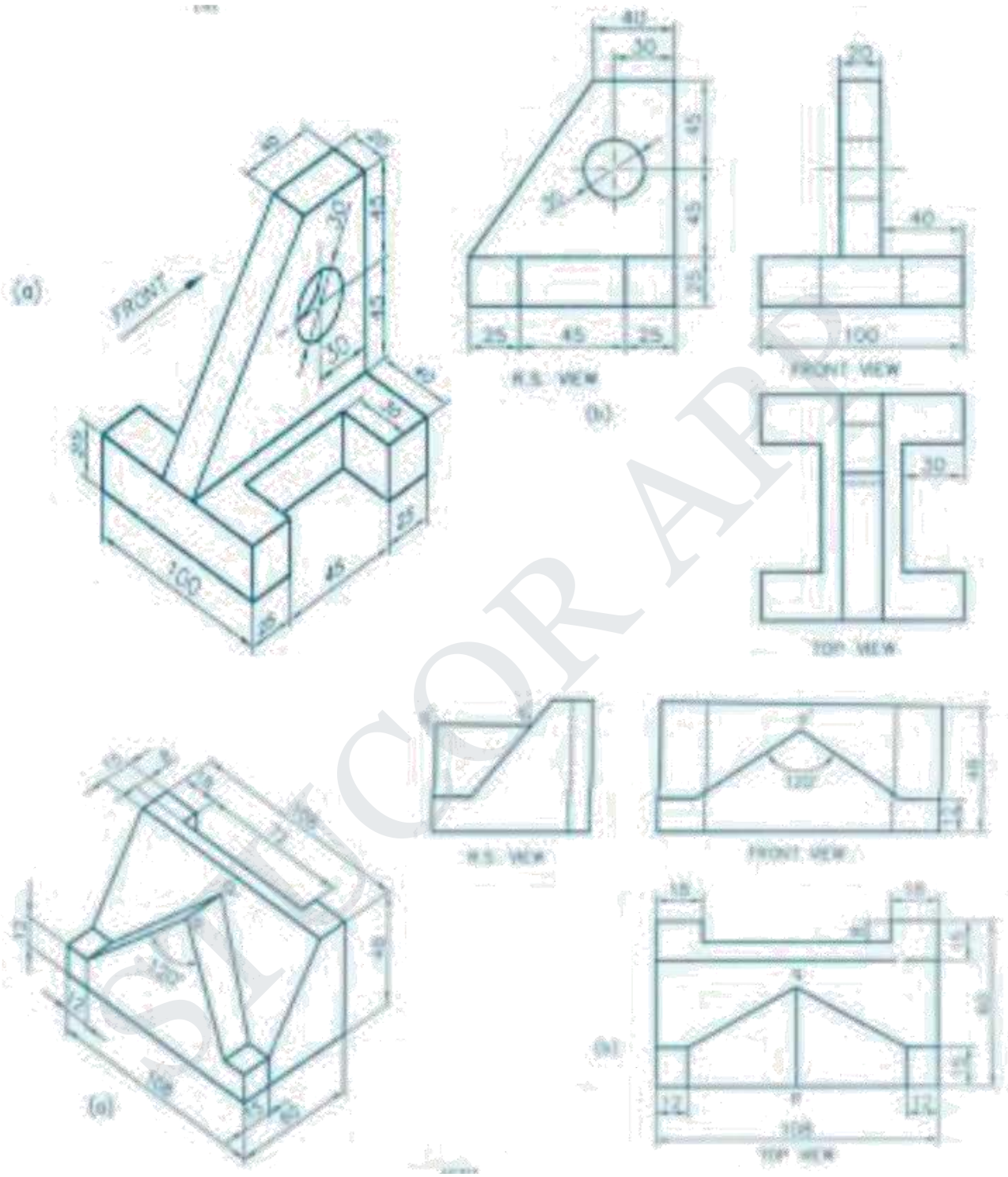

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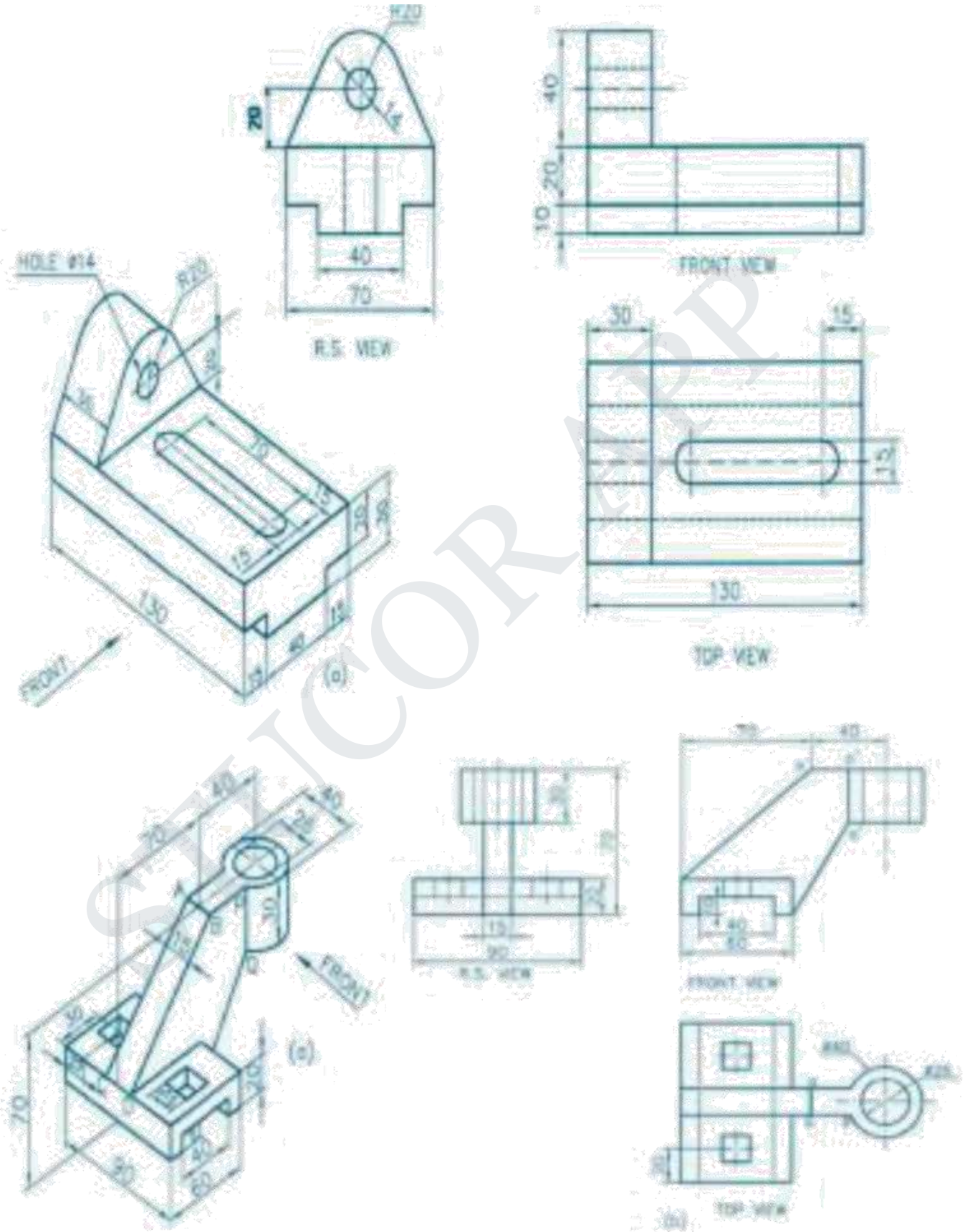

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Important Questions

1. A regular hexagonal pyramid of base edge 20mm and height 35mm rests on its base on the ground plane with one of its base edges touching the picture plane. The station point is 30mm above the ground plane and 40mm in front of the pp. the center plane is 30mm to the right of the axis. Draw the perspective projection of the pyramid.
2. Draw by freehand, front view (from X), top view and a suitable side view of the object shown in figure1. Add necessary dimensions of the part.
3. A square prism of 25mm side of base and height 40mm rests with its base on ground such that one of the rectangular faces is inclined at 30®to the picture plane. The nearest vertical edge touches the picture plane. The station point is 50mm in front of the picture plane, 60mm above the ground and lies opposite to the nearest vertical edge the touches the picture plane. Draw the perspective view.
4. Draw the front, top and side views of the isometric view of the object shown in figure 1.
5. Draw the perspective view of a square prism of edge of base 40mm and length 60mm lying on a rectangular face on the ground, with a corner on PP and the bases equally inclined to PP. the station point is 60mm in front of PP and 80mm above GL and lies in a central plane, which is passing through the centre of the prism.

   Make free hand sketches of front, top and right side views of the 3D object shown blow

6. Draw the perspective projection of a cube of 25mm edge, lying on a face on the ground plane, with an edge touching the picture plane and all vertical faces equally inclined to the picture plane. The station point is 50mm in front of the

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picture plane, 35mm above the ground plane and lies in a center plan which is 10mm to the left of the cube.

7. Make free hand stretches of the front, top and right side view of the object shown below.
8. Draw the perspective projection of a cub of 25mm edge, lying in a face on the ground plane, with an edge touching the picture plane and all vertical faces equally inclined to the picture plane. The station point is 50mm in front of the picture plane, 35mm above the ground plane and plane and lies in a central plane which is 10mm to the left of the centre of the cube.
9. Draw the front, top, and right side view of the object shown below.
10. A regular hexagonal pyramid of base edge 20mm and height 35mm rests on its base on the ground plane with one of its base edges touching the picture plane. The station point is 30mm above the ground plane and 40mmin front of the PP. the center plane is 30mm to the right of the axis. Draw the perspective projection of the pyramid.

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KEYPOINTS & NOTATIONS

IMPORTANT NOTATION IN ENGINEERING GRAPHICS

HP means the Horizontal Plane

VP means the Vertical Plane

FV means the Front View

TV means the Top View

SV means the Side View

STV means the Sectional Top View

GR means the Ground

TL means the True Length

CP means the Cutting Plane

PPP means the Picture Plane for Perspective Projection.

KEY POINTS ABOUT THE PROJECTIONS OF POINTS:

1. *The front view and the top view of a point are always on the same vertical line.*

2. *The distance of the front view of a point from the* XY *line is always equal to the distance of the given point from the HP.*

3. *If a given point is above the* Hp, *its front view is above the* XY *line. If the given point is below the* Hp, *its front view is below the* XY *line.*

4. *The distance of the top view of a point from the* XY *line is always equal to the distance of the given point from the VP.*

5. *If a given point is in front of the VP, its top view is below the* XY *line. If the given point is behind the VP, its top view is above the* XY *line.]*

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KEY POINTS ABOUT THE POSITIONS OF A POINT AND ITS PROJECTIONS:

Dihedral Angle or Quadrant	*Position of the Given Point*	*Position in the Front View*	*Position in the Top View*
FIRST	*Above the HP, in front of the VP*	*Above XY*	*Below XY*
SECOND	*Above the HP, behind the VP*	*Above XY*	*Above XY*
THIRD	*Below the HP, behind the VP*	*Below XY*	*Above XY*
FOURTH	*Below the HP, in front of the VP*	*Below XY*	*Below XY*

PROJECTIONS OF A LINE INCLINED TO BOTH THE REFERENCE PLANES:

Case I:

If a straight line is projected when it is inclined at *e* to the HP and either parallel to the VP or inclined to the VP, then:

(i) The length in the top or plan view remains the same and

(ii) If one end point in the FV remains at constant distance from *XY,* the other end point will also remain at the same distance from XY, *provided the angle with the* HP *does not change.* In other words, if point *A* of a straight line *AB* is fixed, point *B* will have its front view b' on a path parallel to the XY line.

Case II:

If a straight line is projected when it is inclined at *q;* to the VP and either parallel to the HP or inclined to the HP, then:

(i) The length in the front view remains the same and

(ii) If one end point in the TV remains at a constant distance and if the angle from *XY* with the VP does not change, the other end point will also remain at the same distance from *XY.* In other words, if point *A* of a straight line *AB* is fixed, point *B* will have its top view *b* on a path parallel to the *XY* line.

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KEY POINTS TO REMEMBER ABOUT PROJECTIONS OF PLANES:

I. Plane perpendicular to one reference plane and parallel to the other (one step)

If it is parallel to the VP and perpendicular to the HP, its front view is drawn with the true shape and size and the top view is a horizontal line.

If it is parallel to the HP *and perpendicular to the VP, its top view is drawn with the true shape and size and the front view is a horizontal line.*

II. When a plane is perpendicular to one and inclined to the other, two steps are required to draw the projections (two steps)

Step I:

If the given plane is perpendicular to the VP and inclined to the HP, assume it to be parallel to the HP *in Step I. If it is perpendicular to the* HP *and inclined to the VP, assume it to be parallel to the VP in Step I.*

Step II:

Rotate the plane to make it inclined to one reference plane, as required, keeping it perpendicular to the other.

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III. *When a plane is inclined to both reference planes, three steps are required to draw the projections*

Step I:

The plate is assumed to be parallel to the VP, perpendicular to the HP, and have one of its edges, say, $A_1 B_1$ perpendicular to the HP.

Step II:

The plate is assumed to be inclined to the VP at an angle Φ, while remaining perpendicular to the HP. The other edge, say, A_2B_2 also remains perpendicular to the HP. As relations with the HP do not change, projection on the HP, that is, the top view, remains as a straight line and front views are at the same distance from XY as the corresponding points are from XY in Step 1.

Step III:

The plate is assumed to be rotated so that A_2B_2 becomes AB, inclined at e to the HP. However, none of the lines or points changes their relations with the VP. Hence, in the front view the shape does not change and the distances of various points from the XY line in the top view remain the same in Step II and Step III.

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