Module
ISOMETRIC DRAWING

Presented By: Prof. Kavita Thakur

Introduction

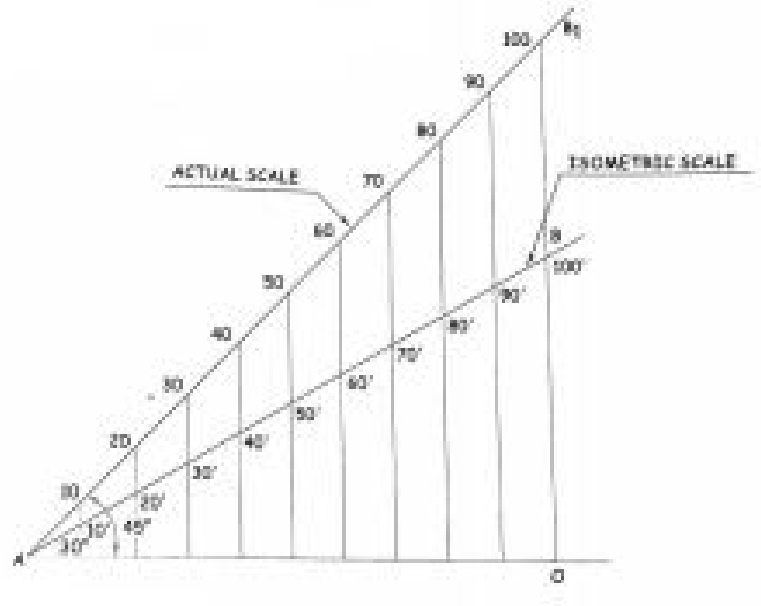
$\angle B_1AO = 45°$ $\angle BAO = 30°$

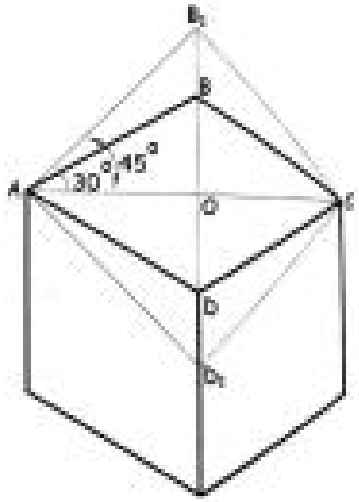
$\because \cos 45° = \frac{AO}{AB_1} = \frac{1}{\sqrt{2}}$ and $\cos 30° = \frac{AO}{AB} = \frac{\sqrt{3}}{2}$

$\therefore \frac{AB}{AB_1} = \frac{2}{\sqrt{3}} \times \frac{1}{\sqrt{2}} = \sqrt{\frac{2}{3}} \simeq 0.816 = \frac{9}{11}$ (approximately)

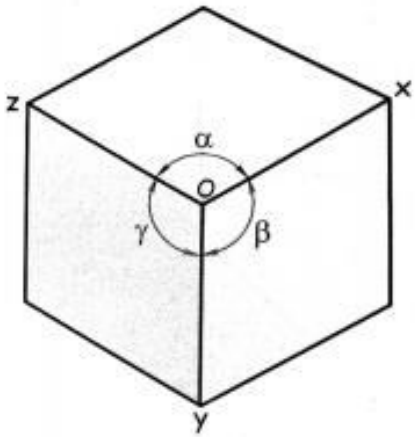
$\frac{AB}{AB_1} = \frac{\text{Isometric length}}{\text{True length}} = 0.816$

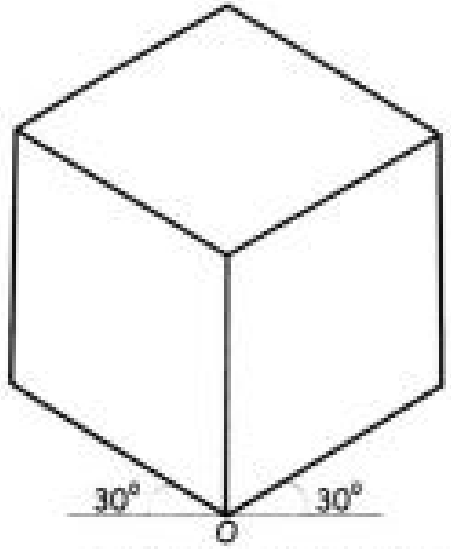
$\therefore$ Isometric length = 0.816 × True length



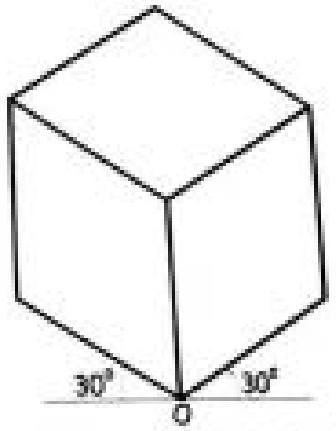


$\alpha = \beta = \gamma$
$ox = oy = oz$





Isonomial Drawing of Cube



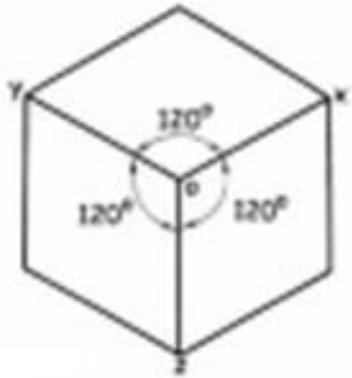
Isometric Projection of Cube

Introduction contd…

Isometric Axes, Lines and Planes

Isometric Axes

The three mutually perpendicular edges of the cube, *OX, OY* and *OZ* are foreshortened equally and are at equal inclination of 120° to each other and are called *Isometric Axes*.

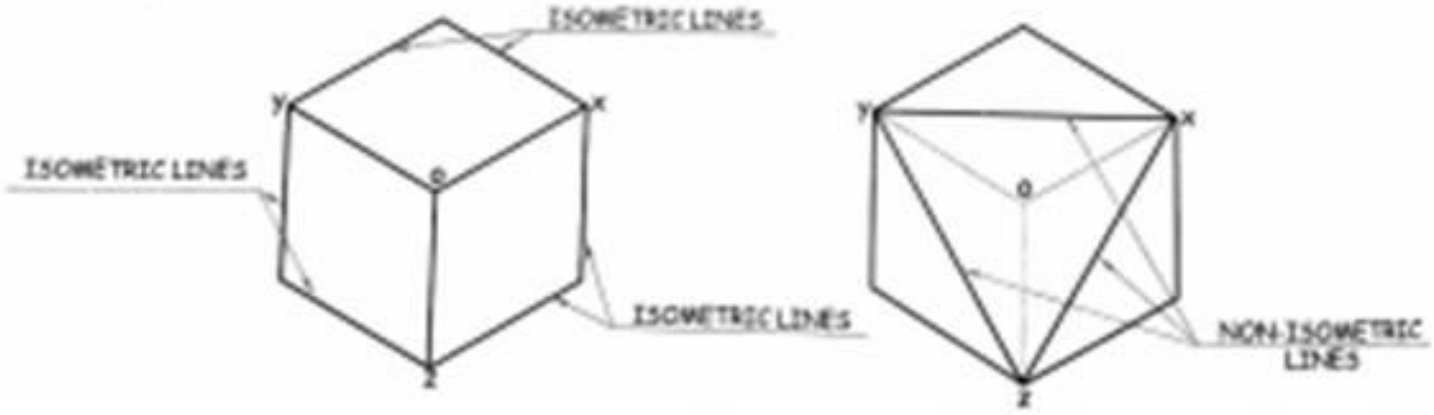


Isometric Lines

The lines which are parallel to isometric axes are called *Isometric Lines*. We can mark or measure the true dimension on these lines.

Non Isometric Lines

The lines which are not parallel to isometric axes are called *Non Isometric Lines*. The lines *XY, YZ* and *XZ* are non-isometric lines. Since the non-isometric lines are not parallel to the isometric axes, they are not foreshortened in the same projection as the isometric lines. So we can not mark or measure true dimension on these lines. To draw non-isometric lines their ends should be located and then joined.



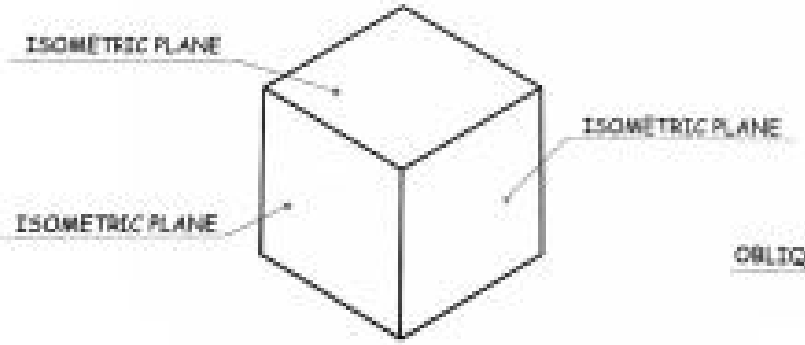
Introduction contd…

Isometric Plane

The plane formed by isometric lines are called isometric planes.

Non Isometric Plane

The plane formed by non-isometric lines are called non isometric plane (oblique plane).



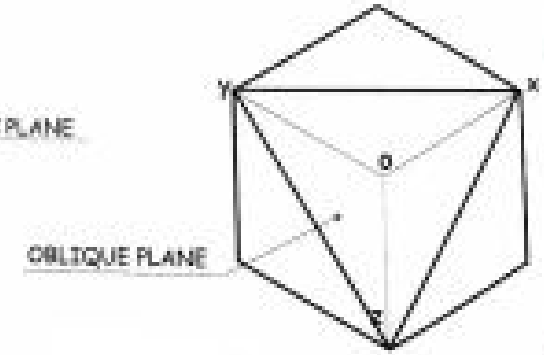
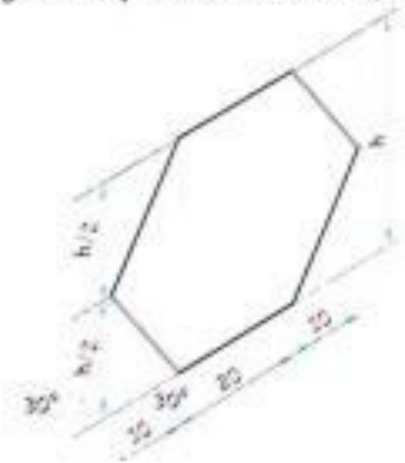
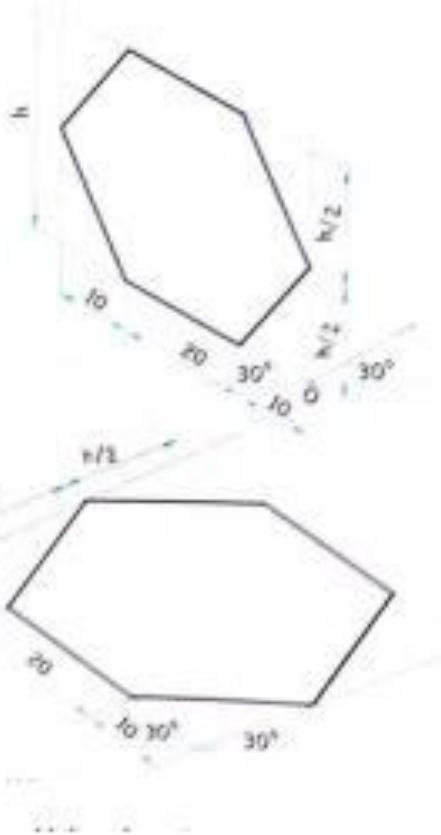
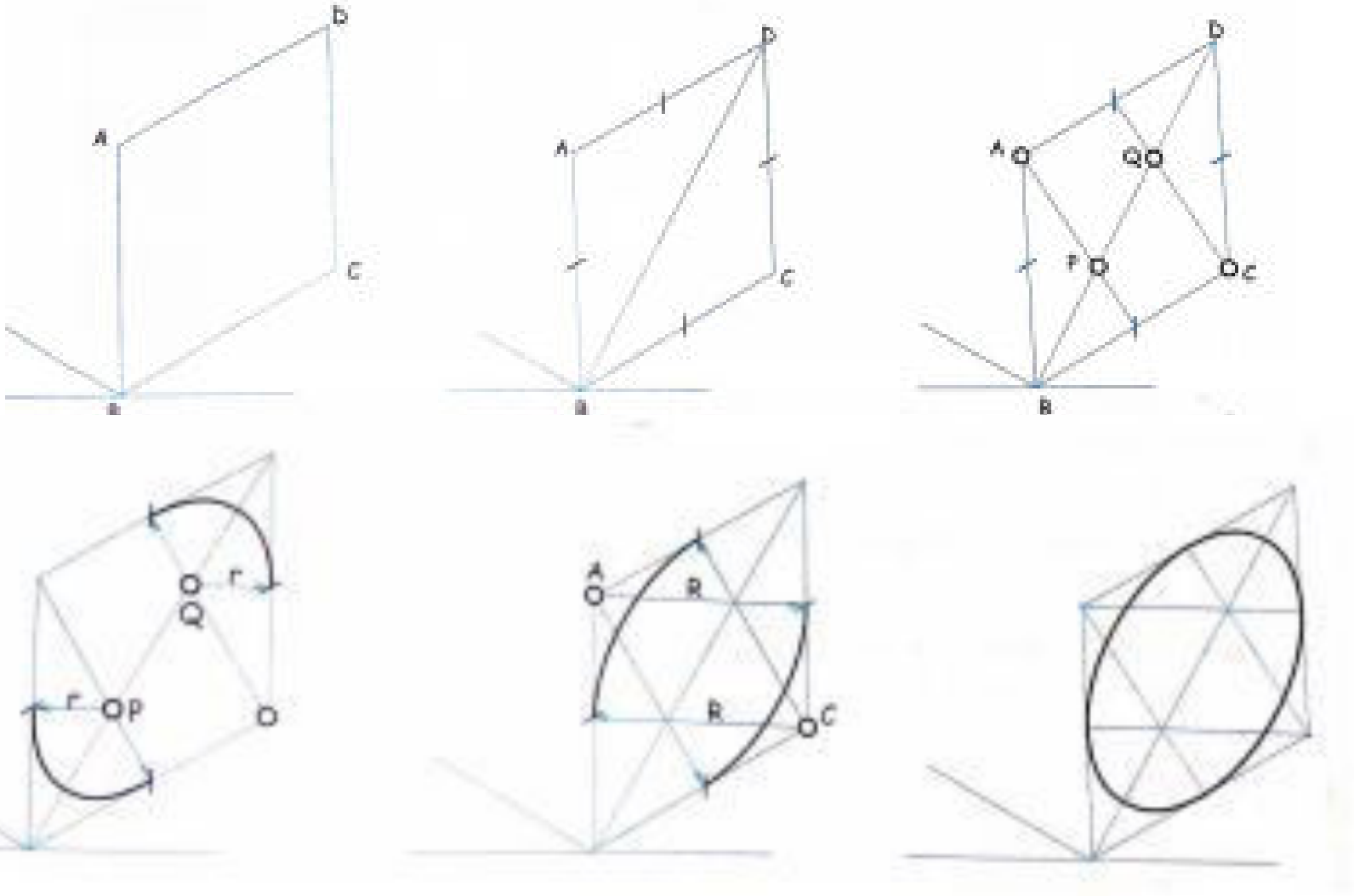


Figure to be placed in different isometric planes.

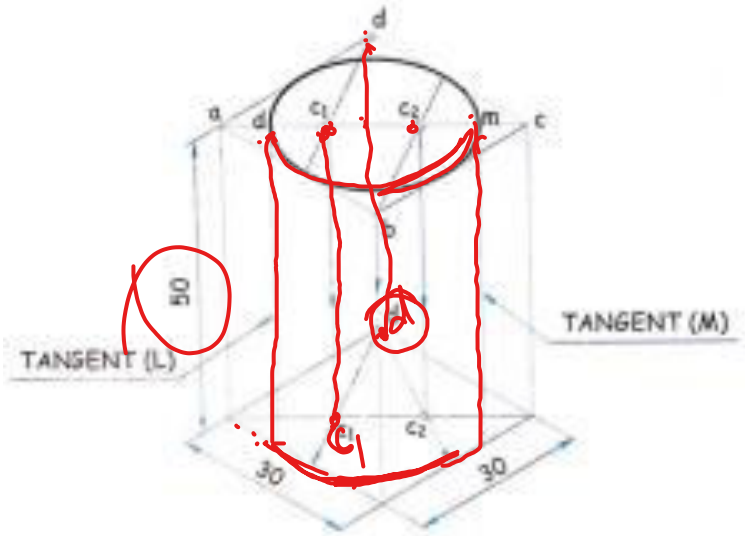


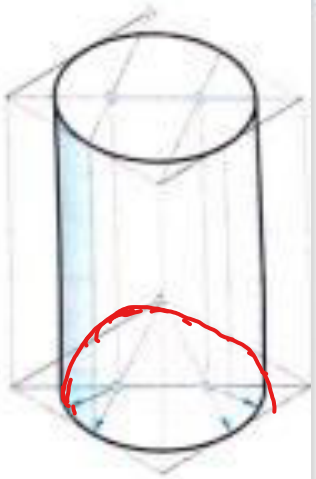


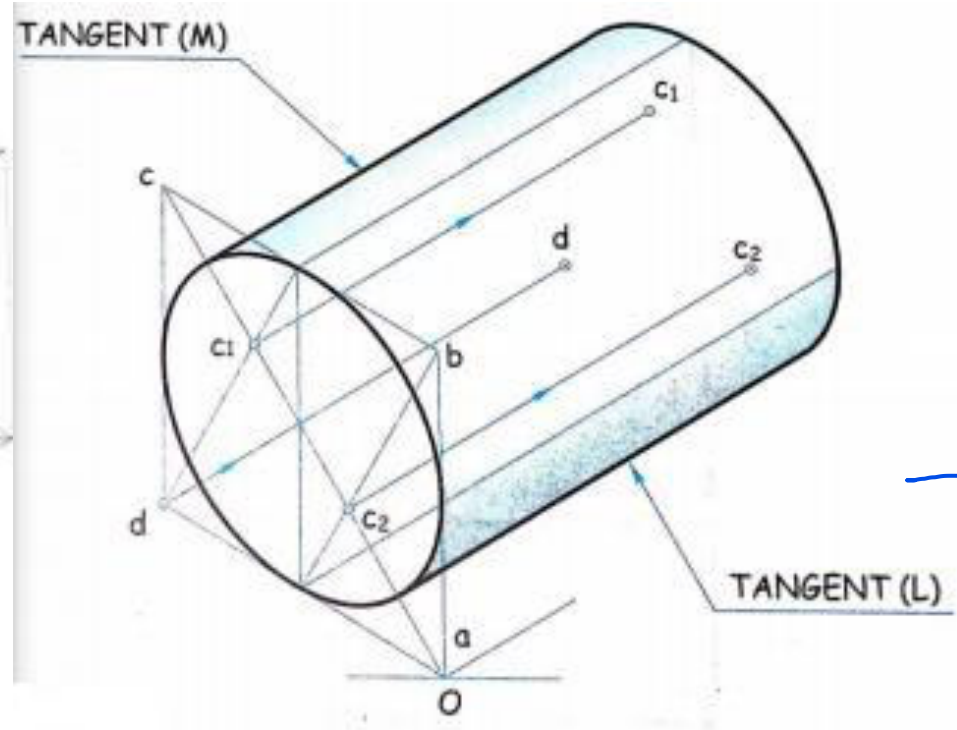
IsoCircle (Four Center Method)

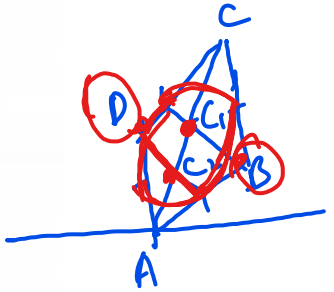


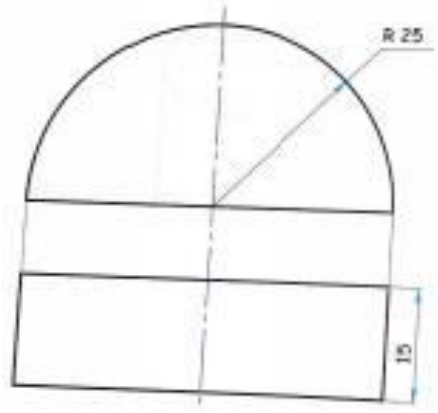
Isometric Projection of Cylinder

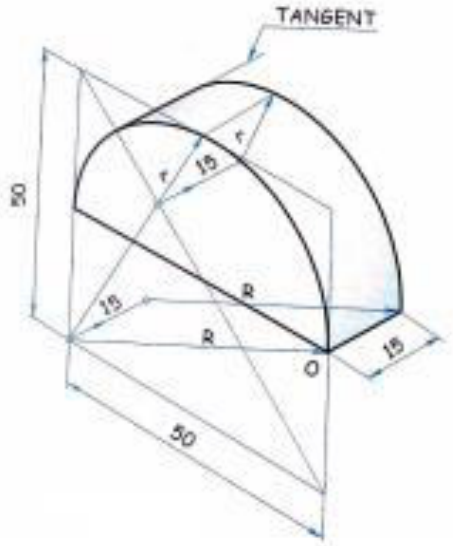






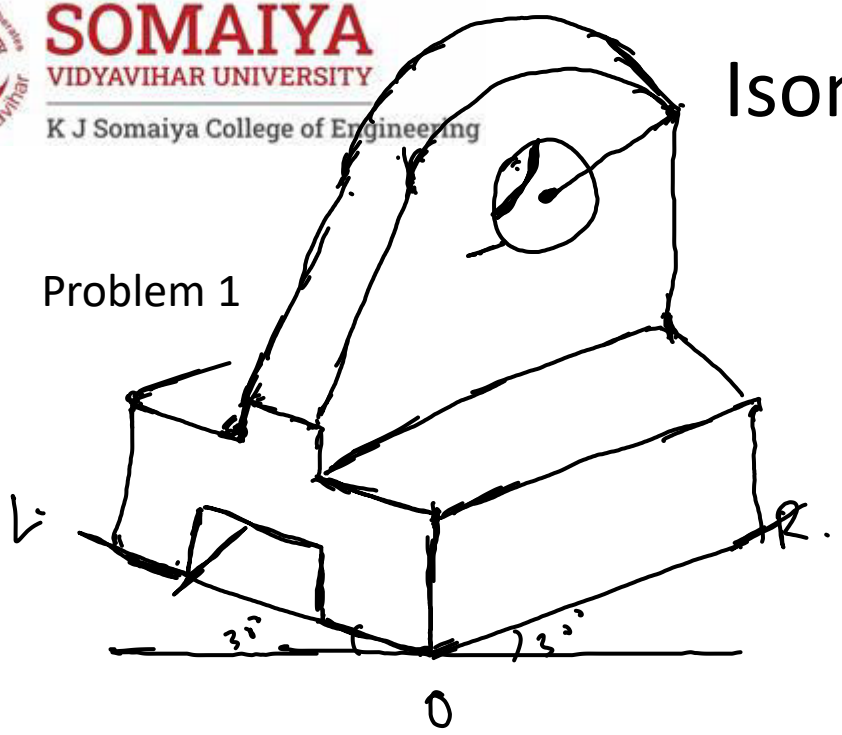


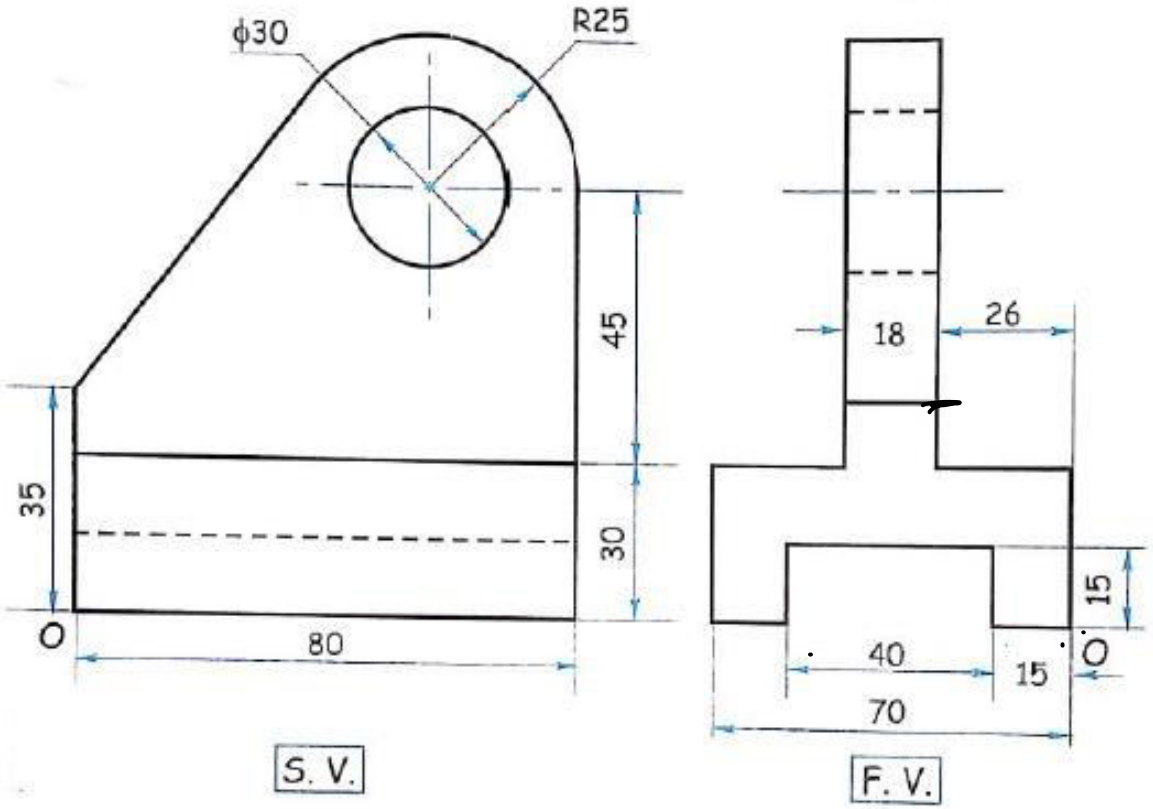




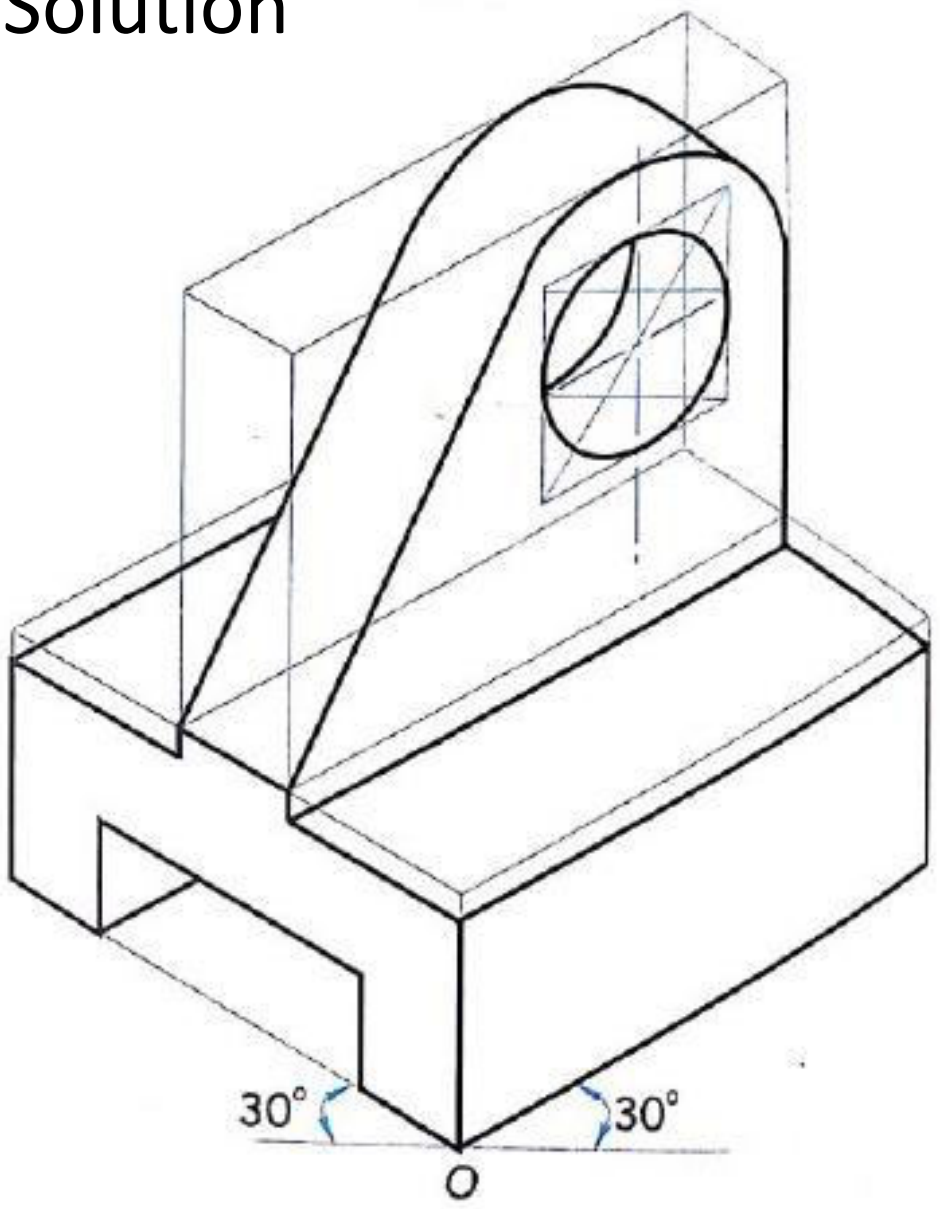
Isometric Drawing

Problem 1

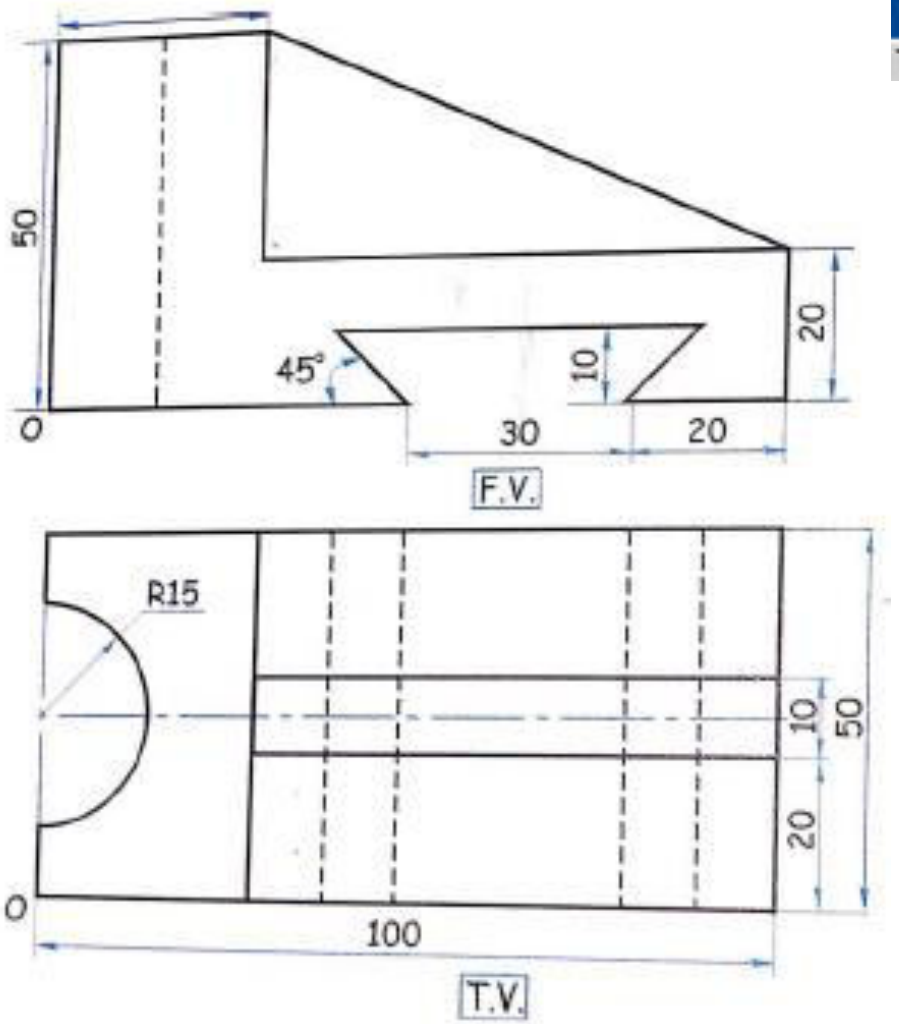


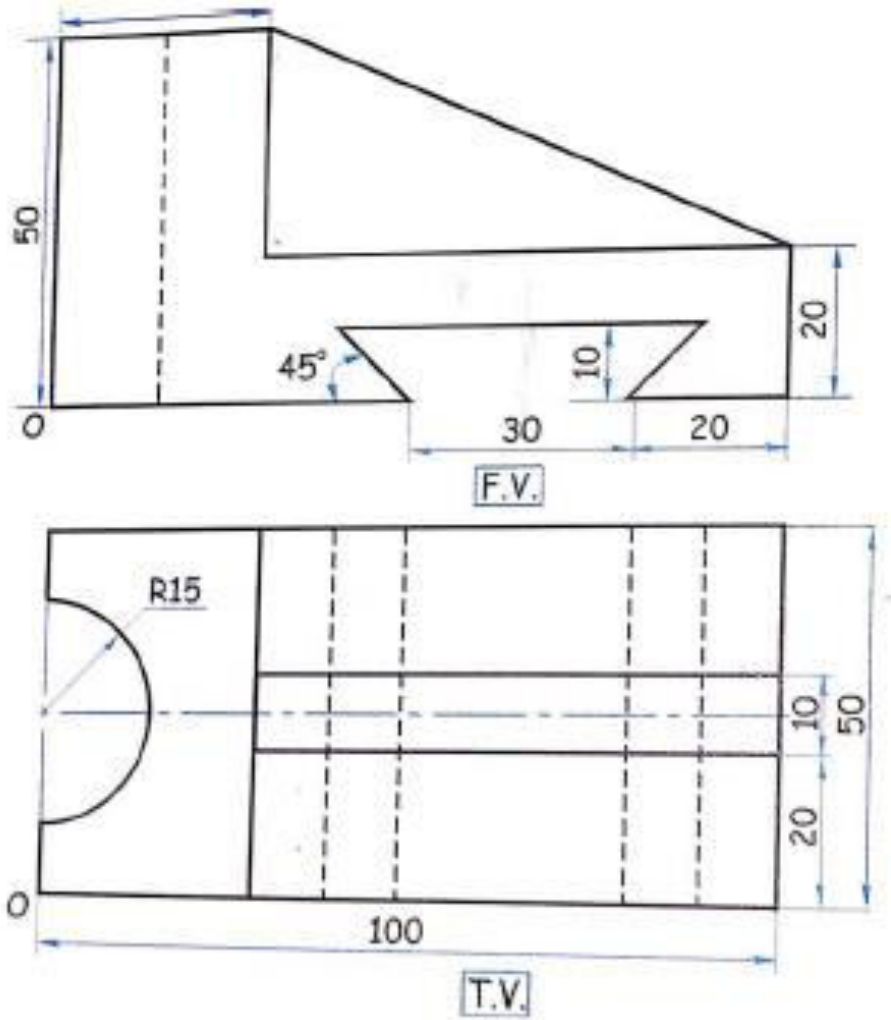


Solution

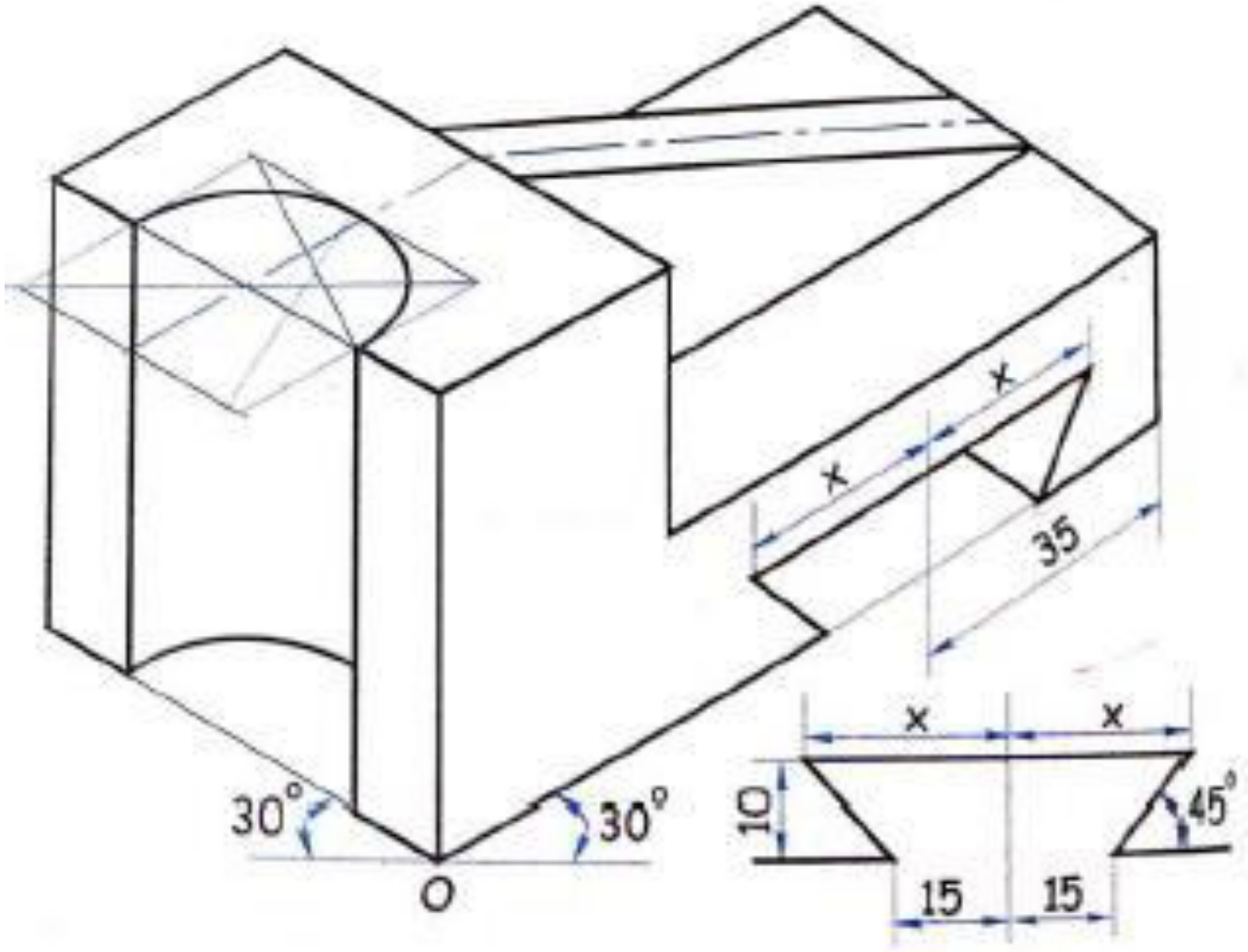


Problem 2



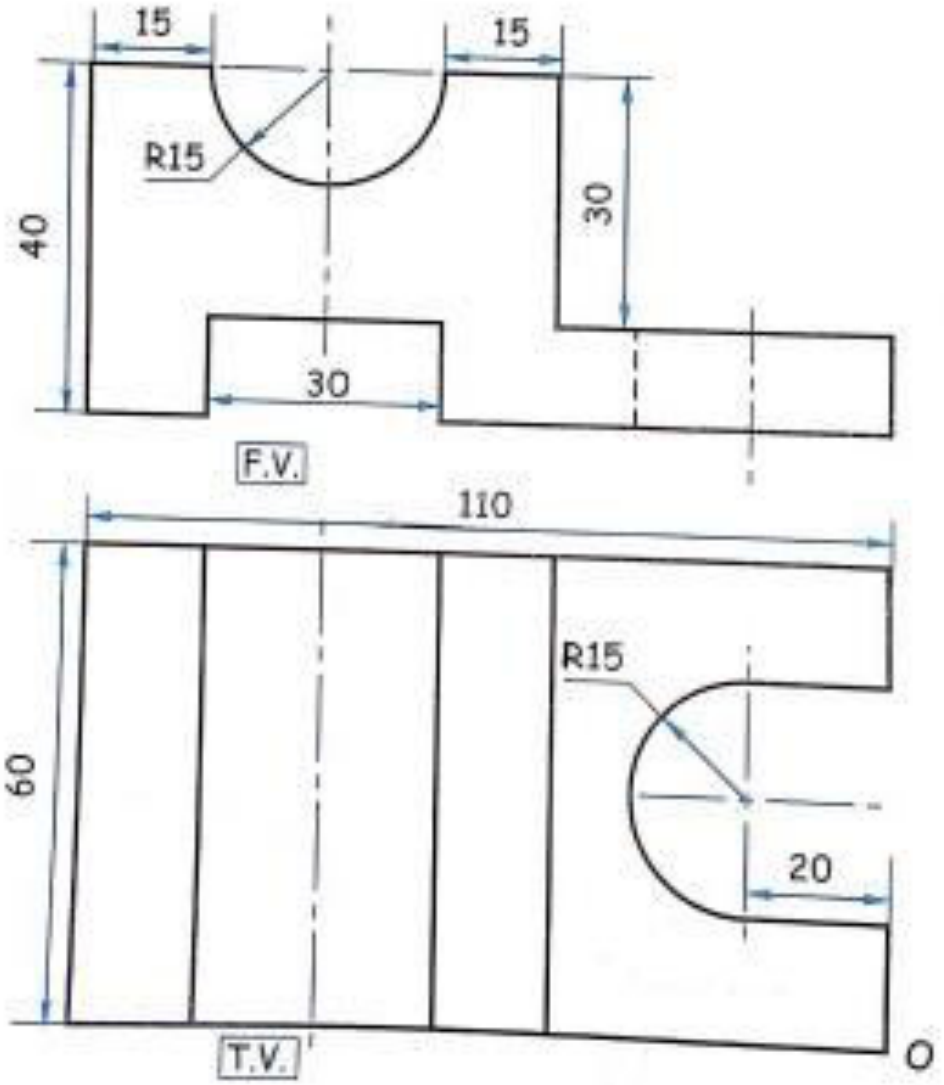

50
45°
10
20
30
20
F.V.
R15
10
50
20
100
T.V.

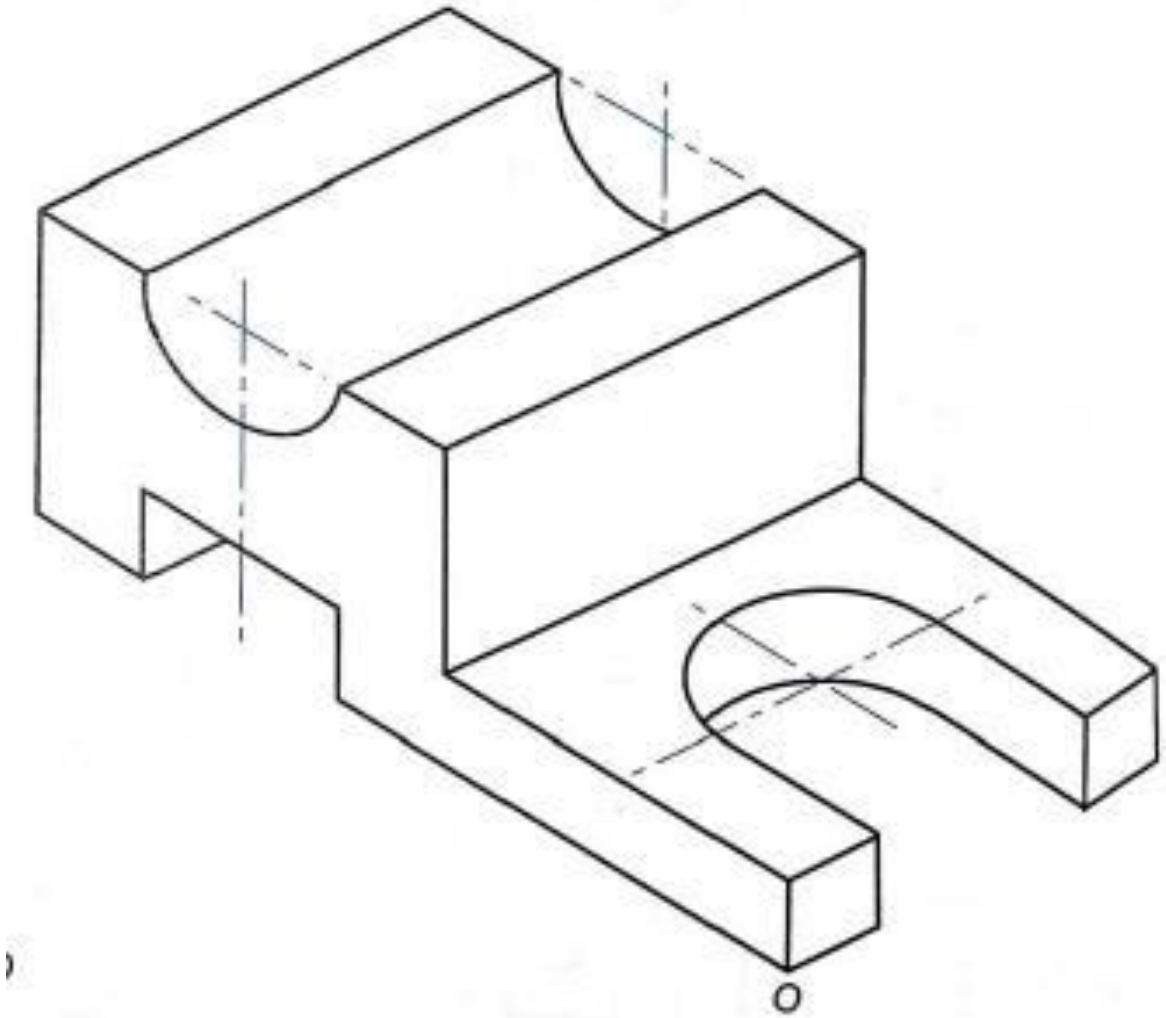
Solution



Problem 3

Solution

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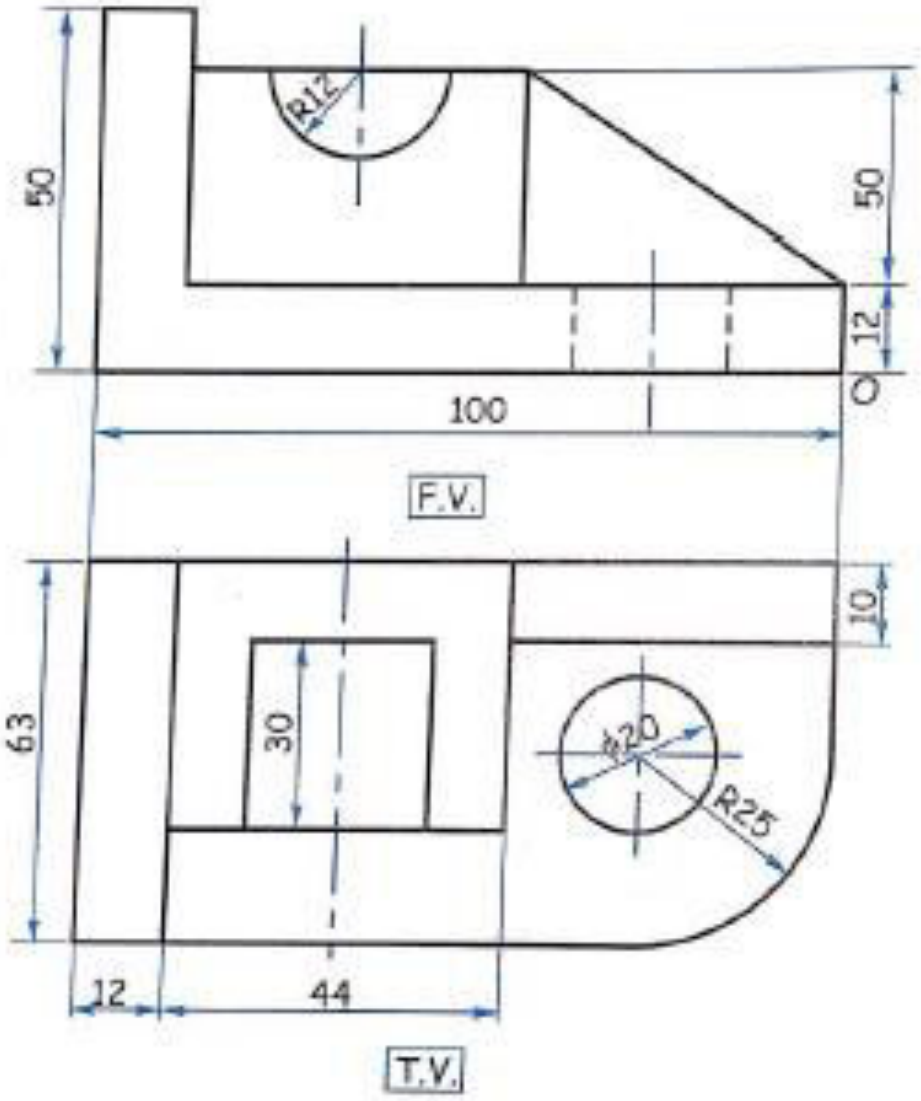
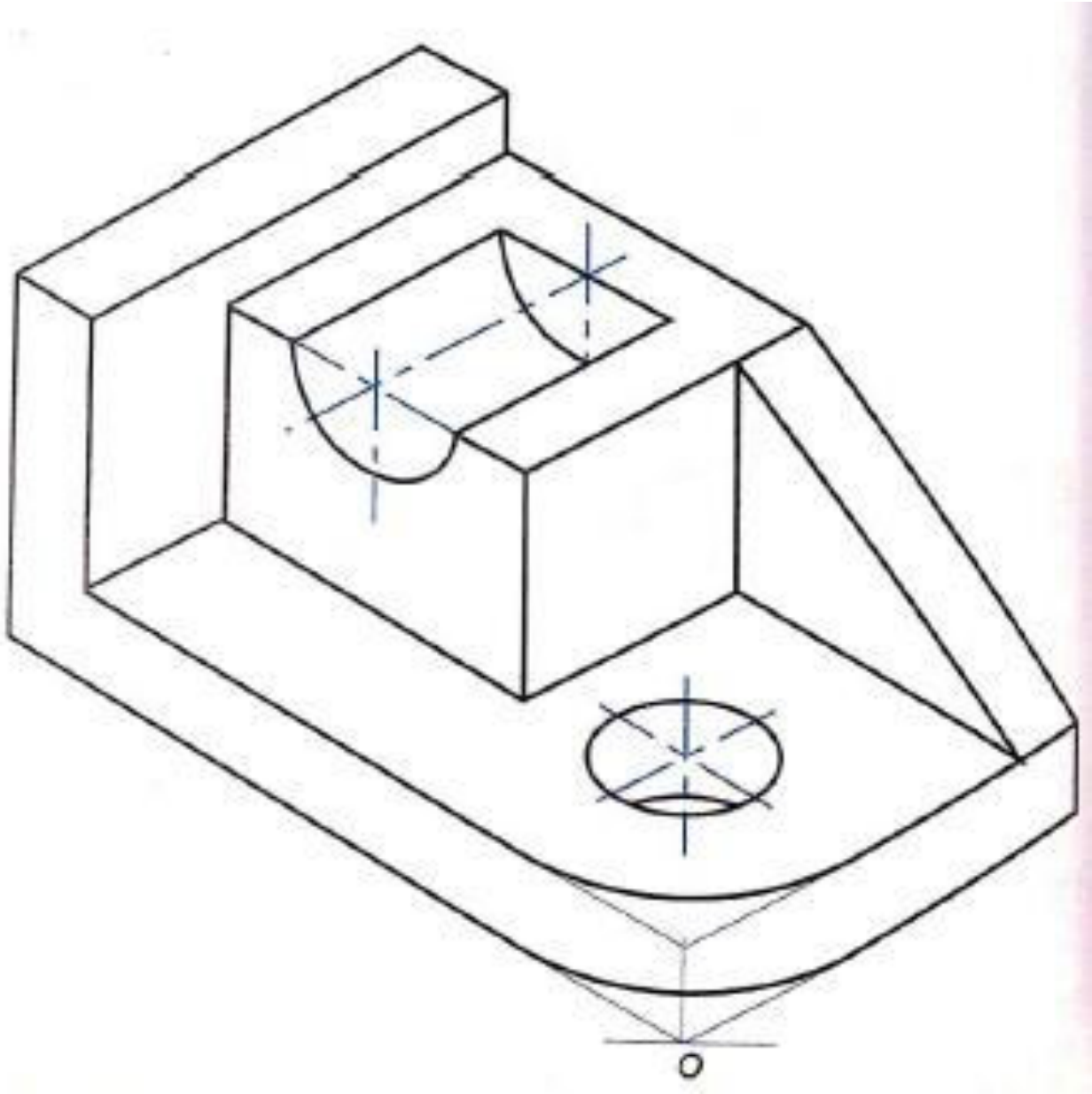
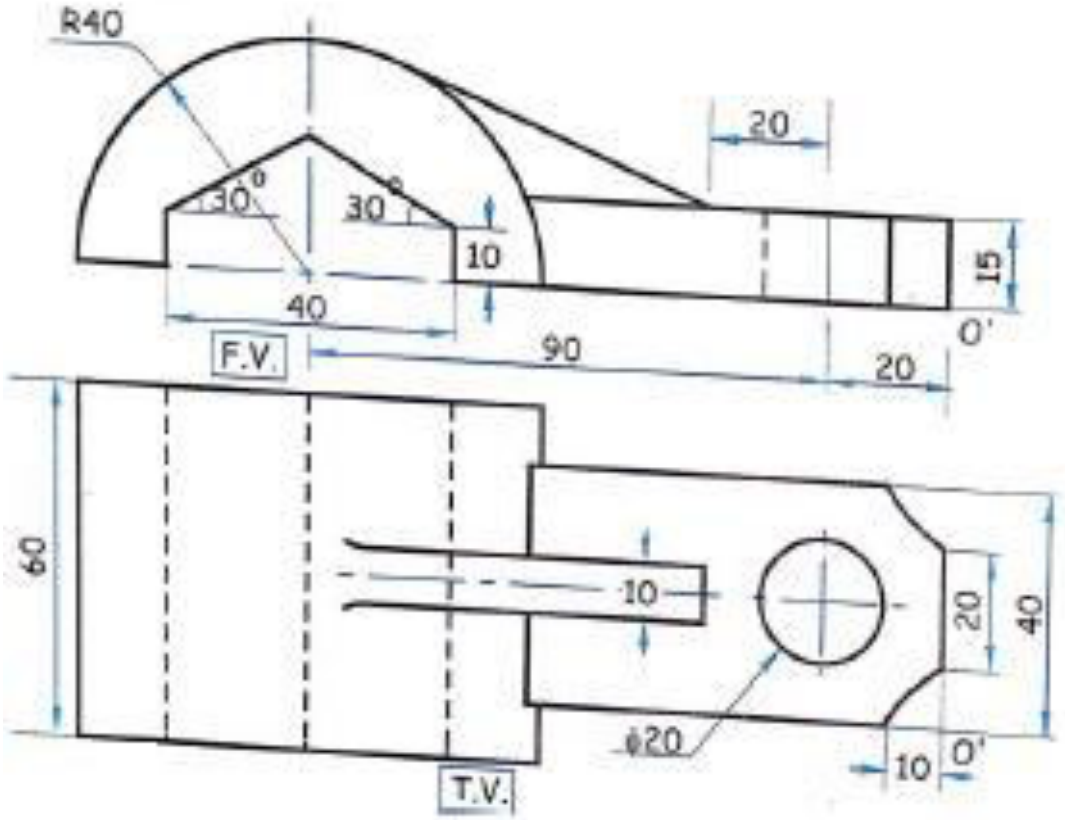
Problem 4

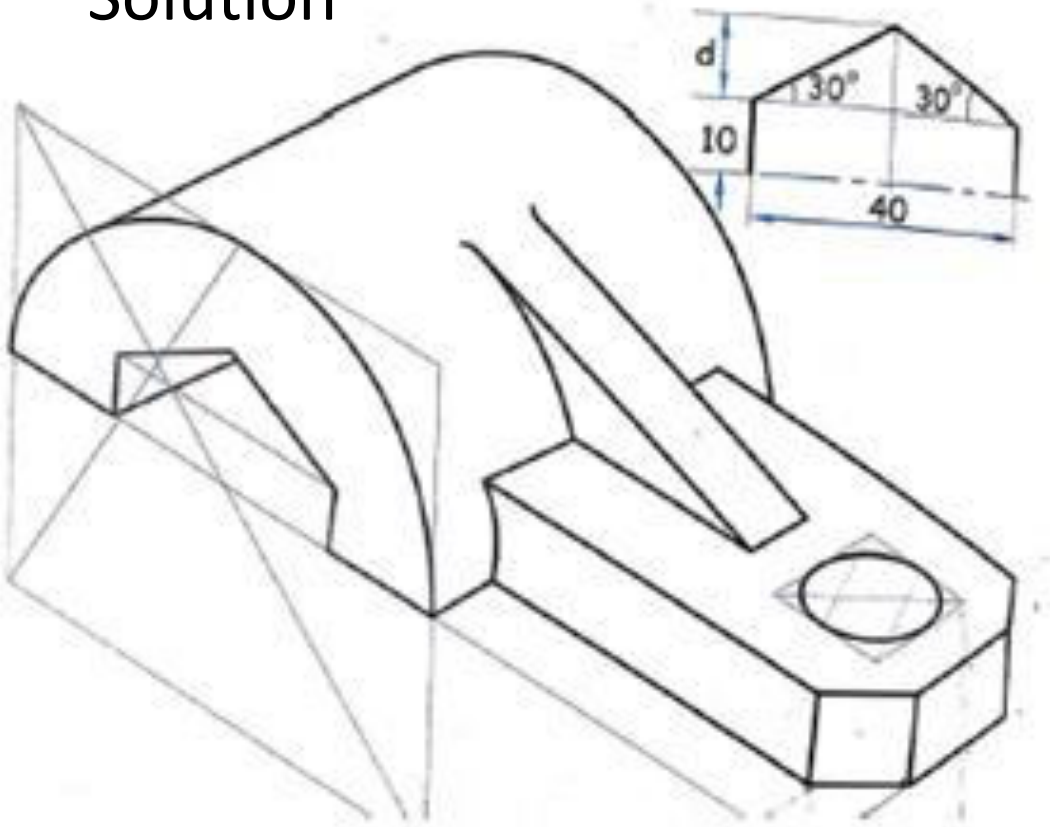




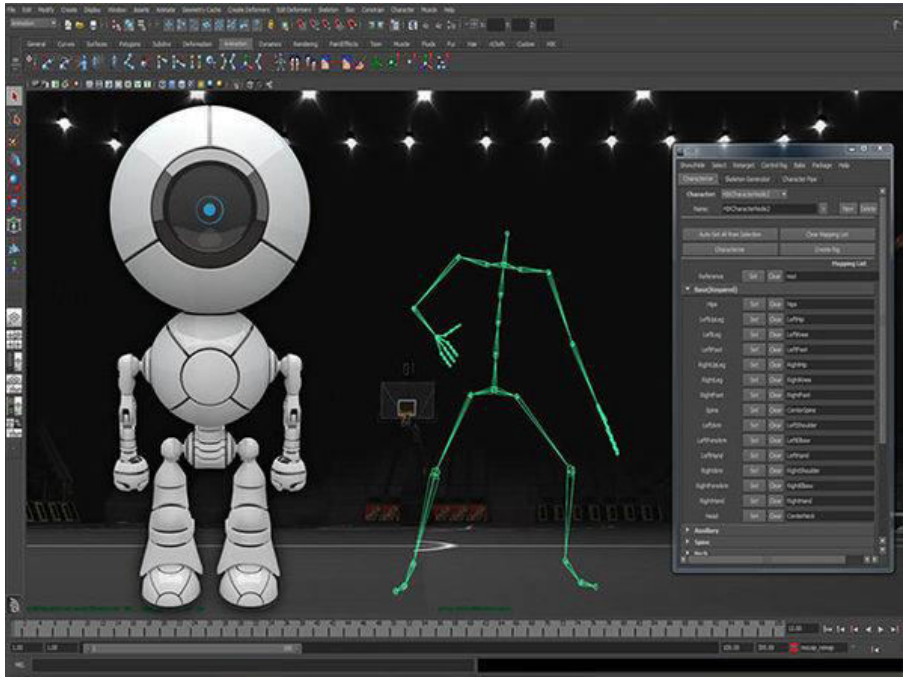
Problem 5

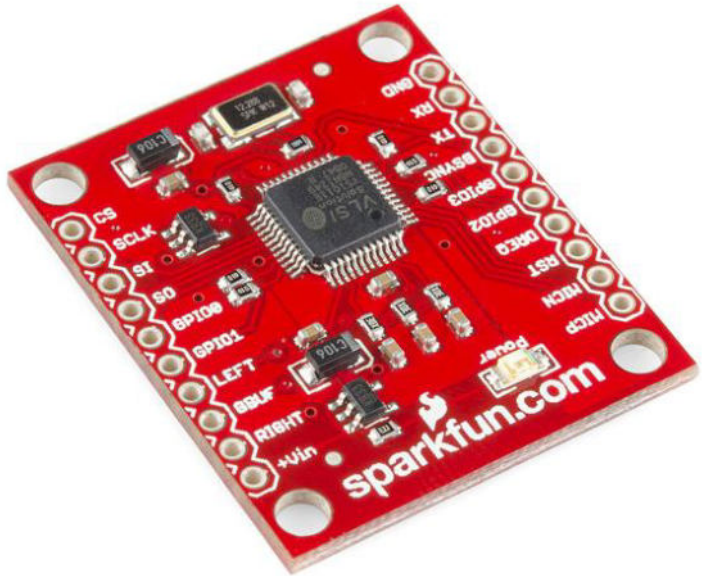


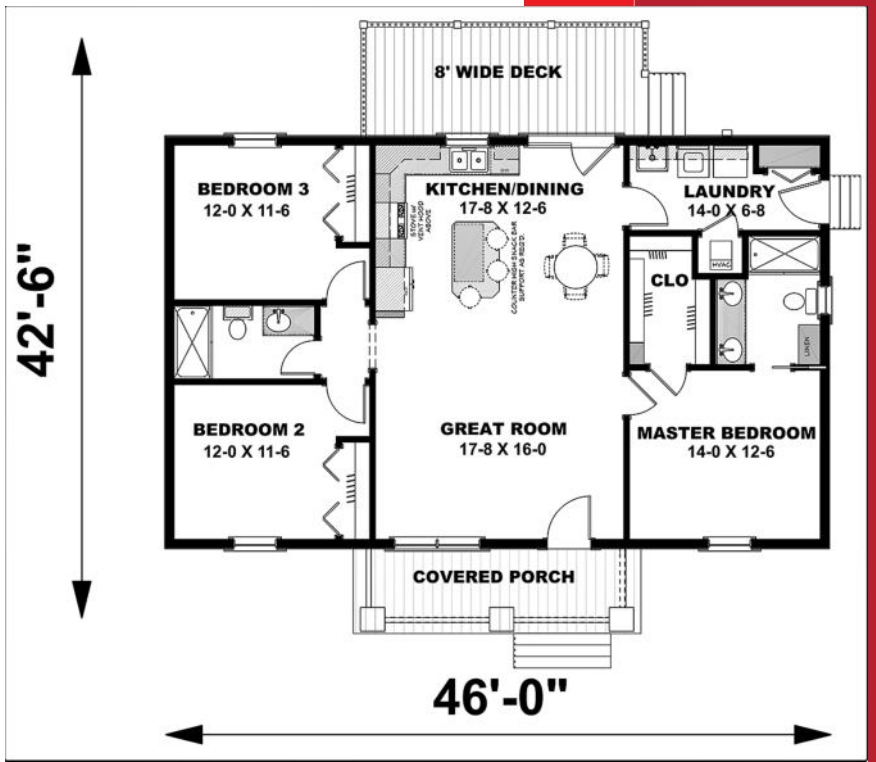
Solution



Why is this course IMPORTANT !!







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What you will learn ?

Engineering Drawing Syllabus !!

Mod. I

Types of lines, Dimensioning, Drawing Sheets, Scales, Pencils etc.
Projection of points and **Projections of lines** inclined to both planes
Projection of Planes: Triangular, Square, Rectangular, Pentagonal, Hexagonal and circular planes inclined to one reference plane and perpendicular to other.

Mod. II

Orthographic projections of simple machine parts by first angle method as recommended by Indian standards, Sectional views of simple machine parts (full section)

Mod. III

Introduction to **Isometric drawing** and construction of isometric drawing of machine parts

Mod. IV

Introduction to **Projection of Solids**, Classification of Solids and Projection of right **regular solids** (prism, pyramid, cylinder, and cone) inclined to both reference planes (excluding spheres, hollow and composite solids)

Mod. V

Projection of **sectional views for solids** (prism, pyramid, cylinder, and cone) cut by plane perpendicular to one and inclined to other reference planes (excluding curved cutting planes).
Lateral surface development of prism, pyramid, cylinder, cone with section plane inclined to one reference plane only. (excluding reverse development)

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Course Objectives

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Course Outcomes	After successful completion of the course students should be able to:
1	Familiarize with the conventions and standards along with the principles of projections applied to lines and points
2	Apply the principles of orthographic projections to draw elevation, plan, End view, Isometric views etc.
3	Apply the principles of orthographic projections to draw to draw various views of regular solid objects
4	Apply the fundamentals of solid geometry and develop lateral surfaces of solids

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Course Outcomes

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Course Outcomes	After successful completion of the course students should be able to visualize and draw :
CO1	Projection of lines and planes
CO2	Orthographic and sectional views of any 3D object
CO3	Isometric drawing
CO4	Projection of regular solids
CO5	Section and lateral development of regular solids

References

Name/s of Author/s	Title of Book	Name of Publisher with country
N.D. Bhatt	Engineering Drawing (Plane and solid geometry)	Charotar Publishing House Pvt. Ltd
N.D. Bhatt V.M. Panchal	Machine Drawing	Charotar Publishing House Pvt. Ltd
P. S. Gill	Engineering Graphics and Drafting	S.K. Kataria & Sons
P.J. Shah	Engineering Graphics	S. Chand Publications
Dhananjay Jolhe	Engineering Drawing	Tata McGraw Hill

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Scheme

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Course Code	Course Title						
111U06C105	Engineering Drawing						
	TH		P		TUT		Total
Teaching Scheme(Hrs.)	02		--		01*		03
Credits Assigned	02		--		01		03
Examination Scheme	Marks						
	CA		ESE	TW	O	P&O	Total
	ISE	IA					
	30	20	50	--	--	--	100

* Batch wise Tutorial

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Terms and Conditions

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- Please check your MS Team account regularly for announcements
- Always sit for the lecture with an unruled book and drawing instruments
- Be NEAT in your drawings !
- Tutorial submissions should be done on a separate A3 sized drawing book – scan and upload as pdf file
- You will need to scan and upload the solutions to the MS Teams Assignment folder
- Timely submissions is required
- Failure of submitting Term Work – YOU LOOSE A YEAR !!

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Drawing Instruments and Accessories

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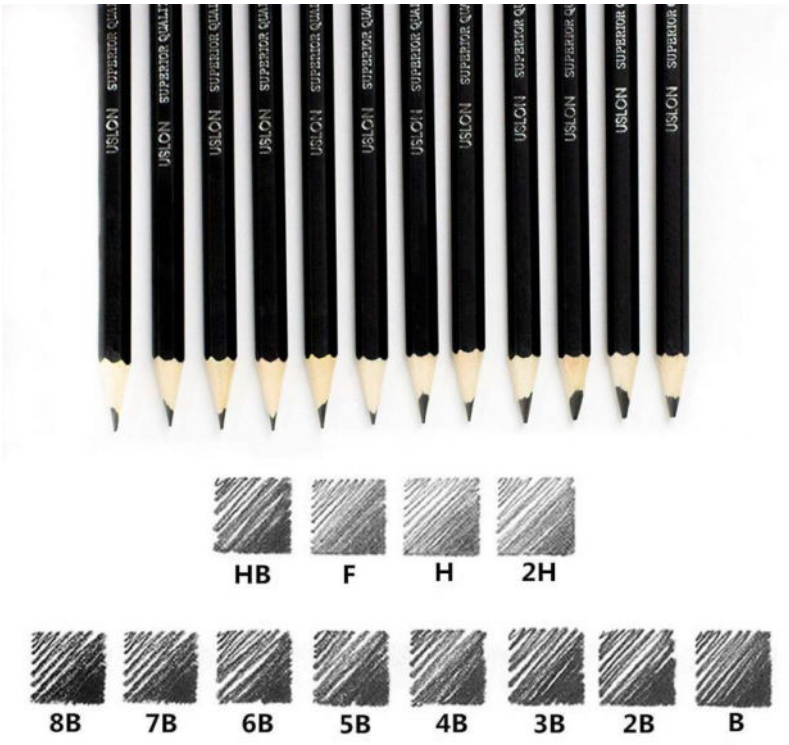
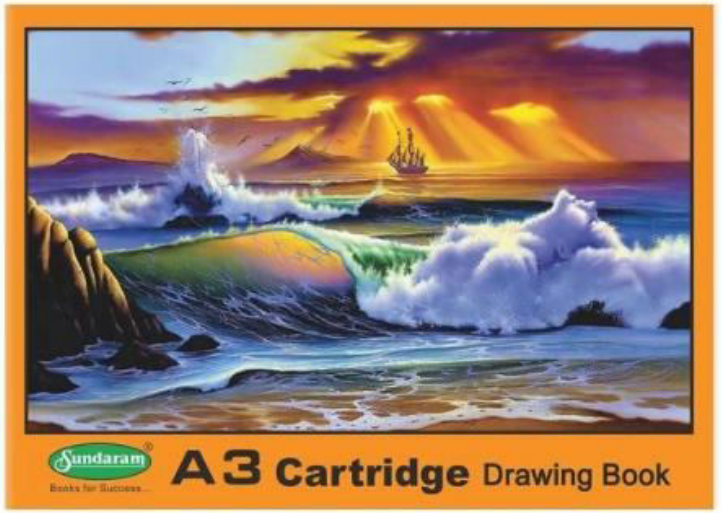


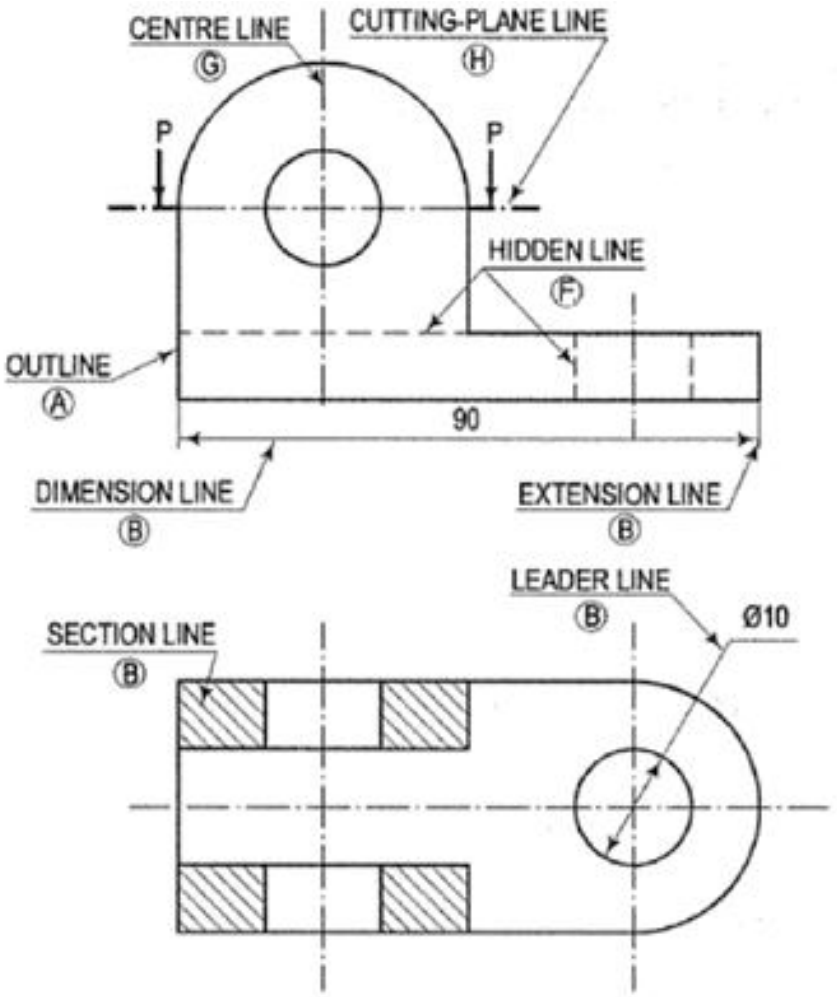


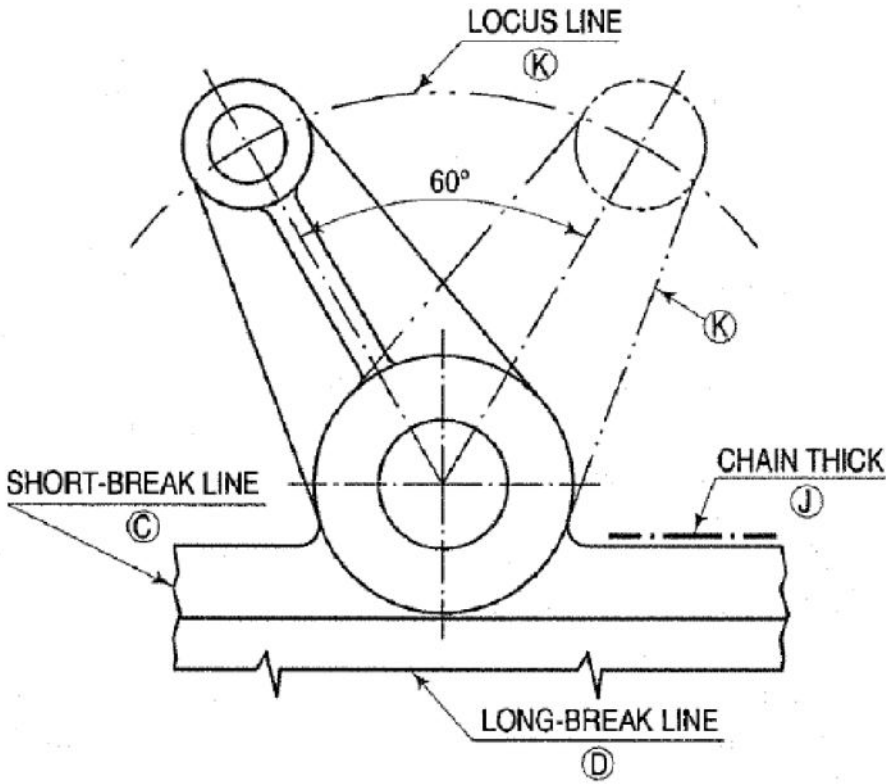
Types of lines

Type of lines !!

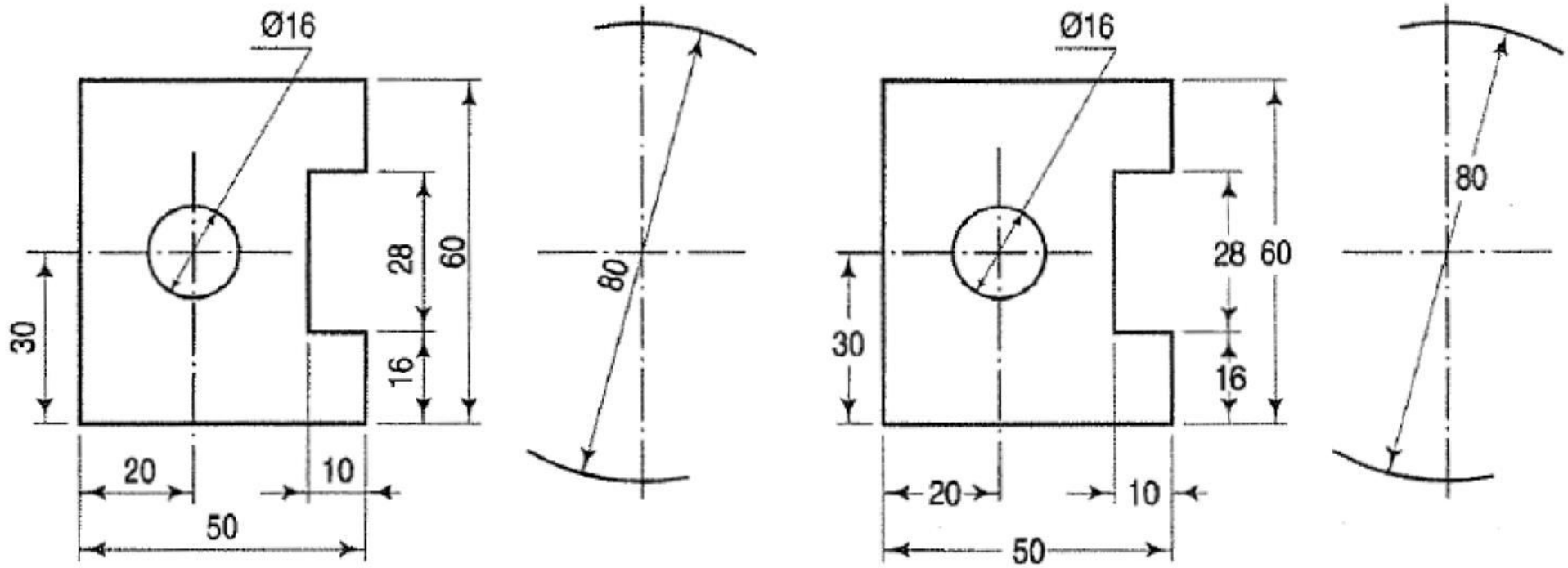
Line	Description	General applications
A	Continuous thick or Continuous wide	Visible outlines, visible edges; crests of screw threads; limits of length of full deph thread,lines of cuts and section arrows; parting lines of moulds in views; main representations in diagrams, maps, flow charts; system lines(structural metal engg.)
B	Continuous thin (narrow) (straight or curved)	Imaginary lines of intersection; grid, dimension, extension, projection, short centre, leader, reference lines; hatching; outlines of revolved sections; root of screw threads; interpretation lines of tapered features; framing of details; indication of repetitiv details;
C 	Continuous thin (narrow) freehand	Limits of partial or interrupted views and sections, if the limit is not a chain thin line
D 	Continuous thin (narrow) with zigzags (straight)	Long-break line
E	Dashed thick (wide)	Line showing permissible of surface treatment
F	Dashed thin (narrow)	Hidden outlines; hidden edges
G	Chain thin Long-dashed dotted (narrow)	Centre line; lines of symmetry; trajectories; pitch circle of gears, pitch circle of holes,
H 	Chain thin (narrow) with thick (wide) at the ends and at changing of position	Cutting planes
J	Chain thick or Long-dashed dotted (wide)	Indication of lines or surfaces to which a special requirement applies
K	Chain thin double-dashed or long-dashed double-dotted (narrow)	Outlines of adjacent parts Alternative and extreme positions of movable parts Centroidal lines Initial outlines prior to forming Parts situated in front of the cutting plane

Type of lines !!

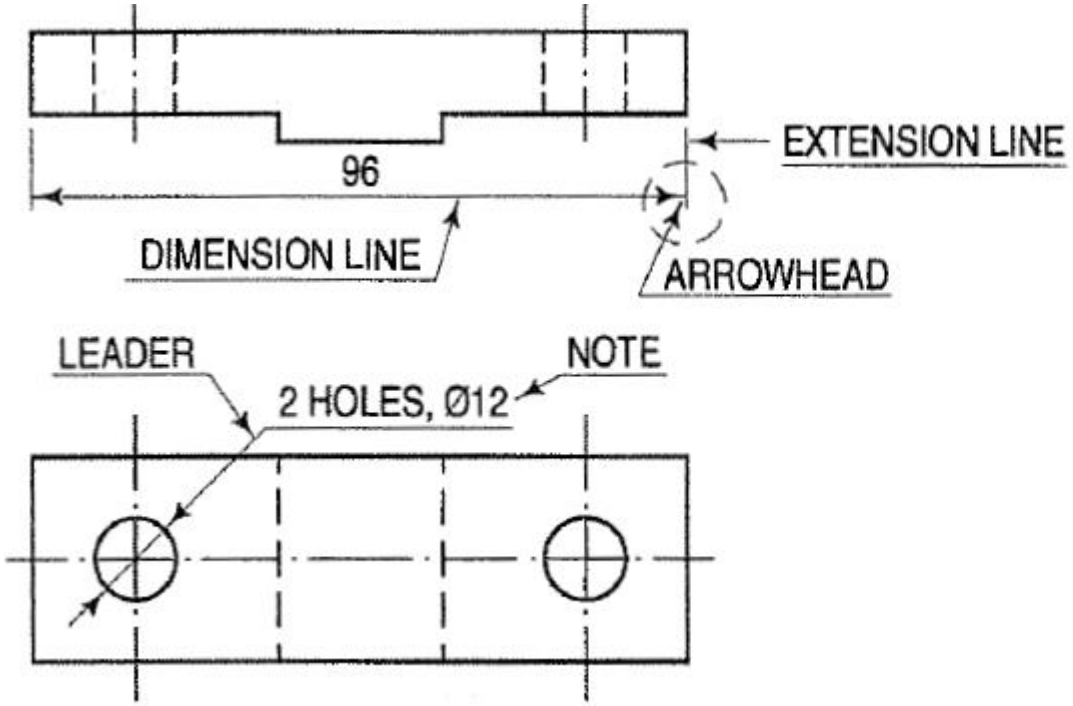


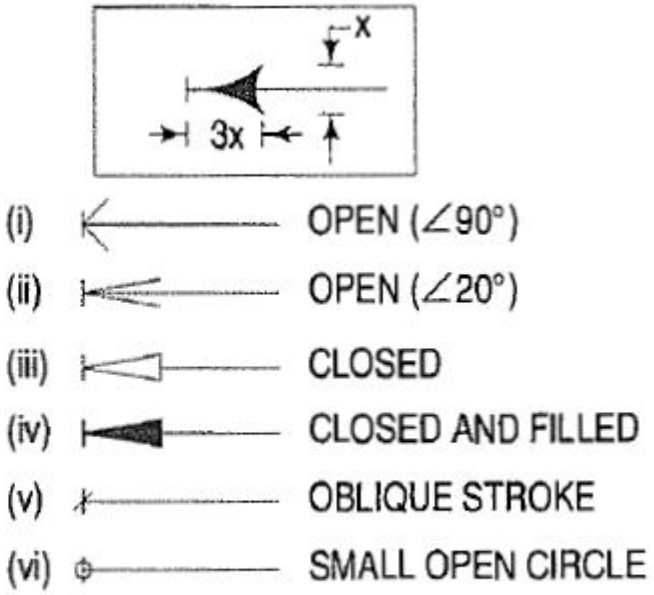


Dimensioning



Aligned and Unidirectional System





Dimension lines Vs Extension lines

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Ways to dimension features !

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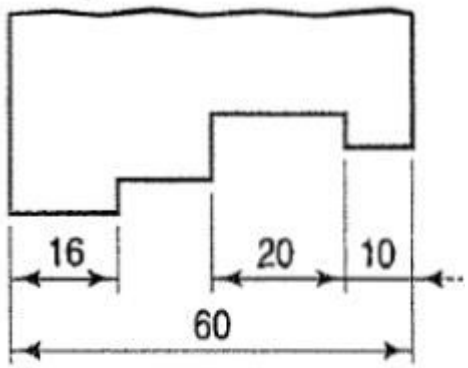
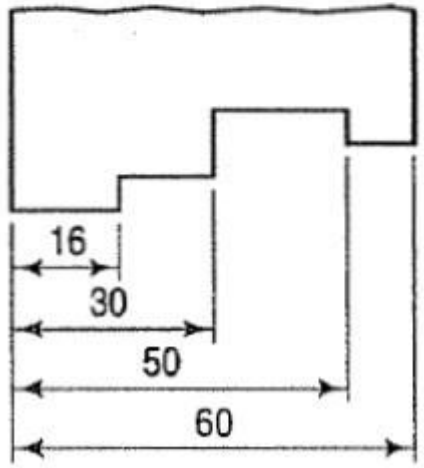
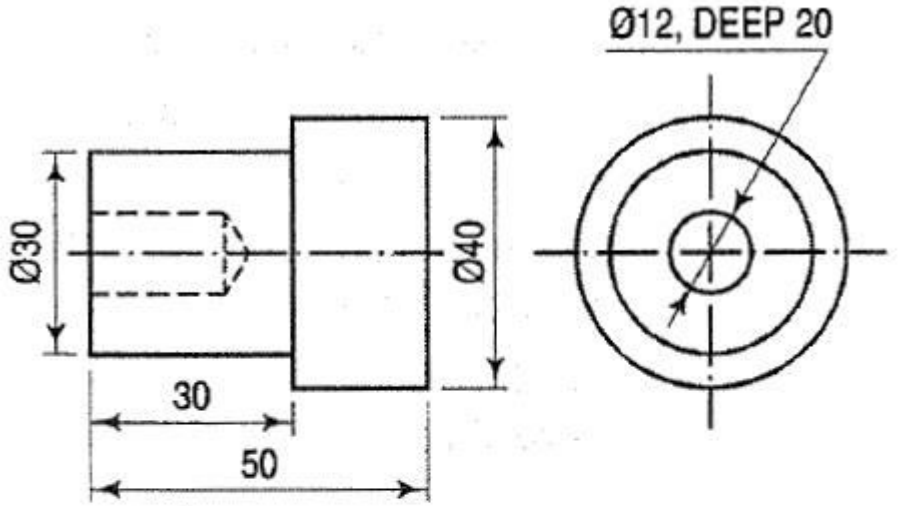
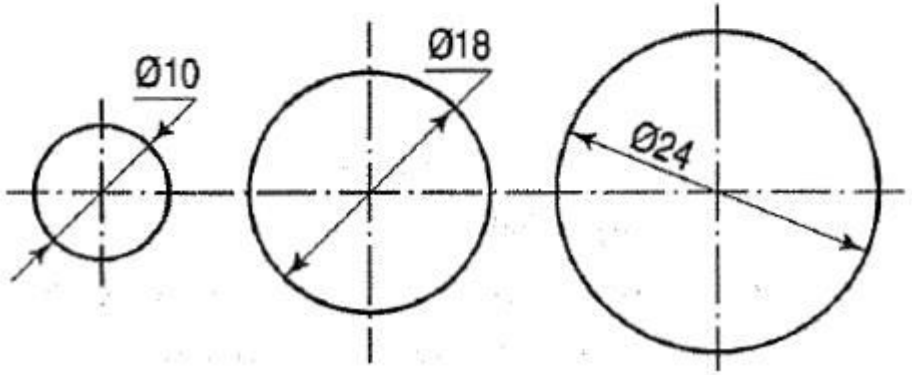
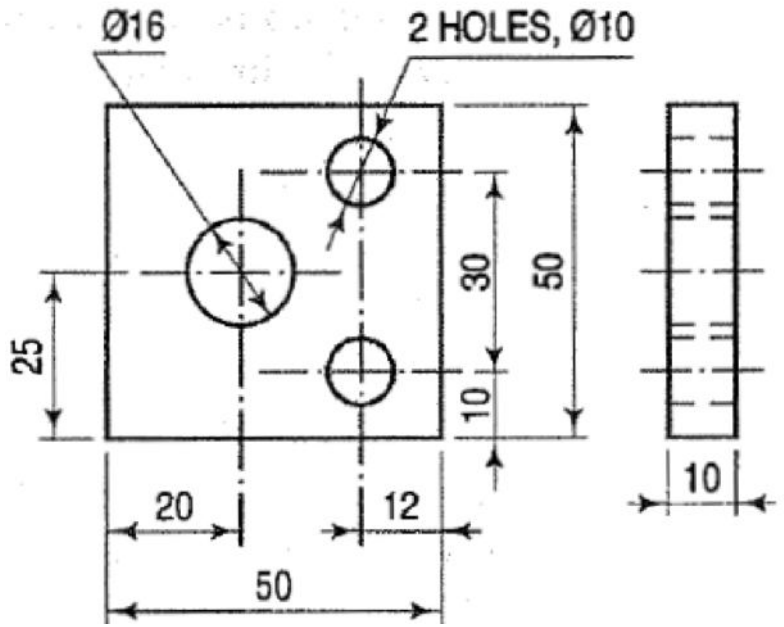


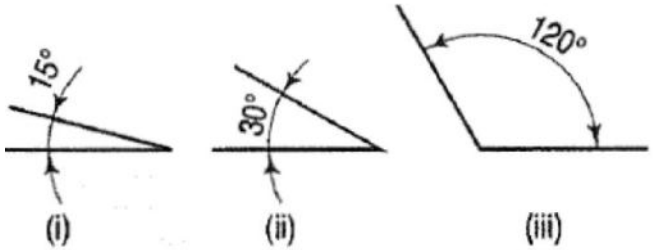


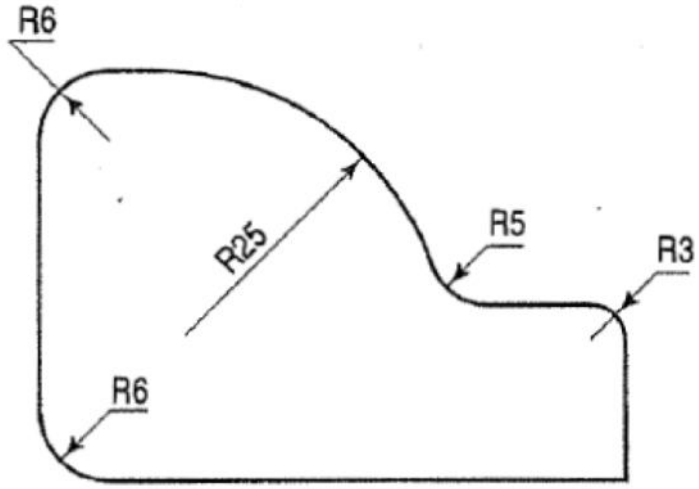


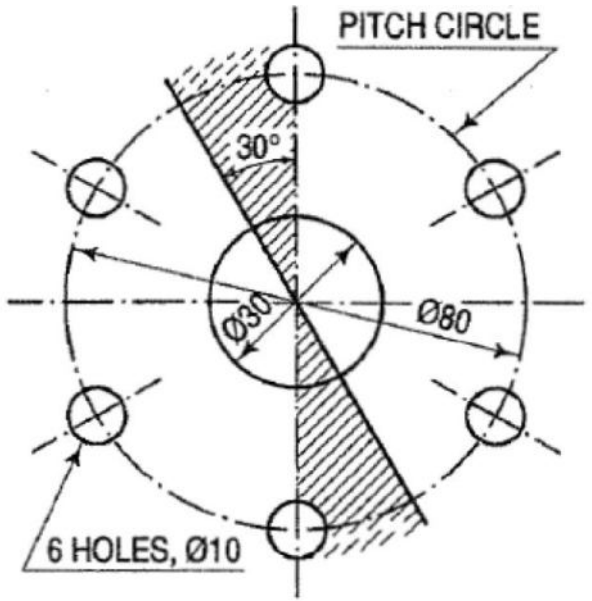


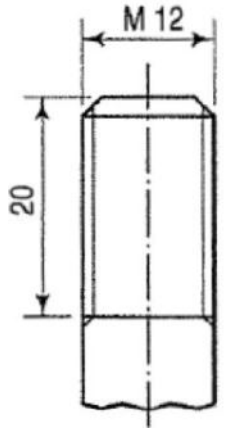


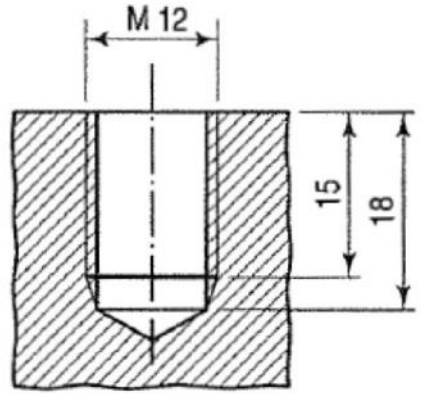
Ways to dimension features !

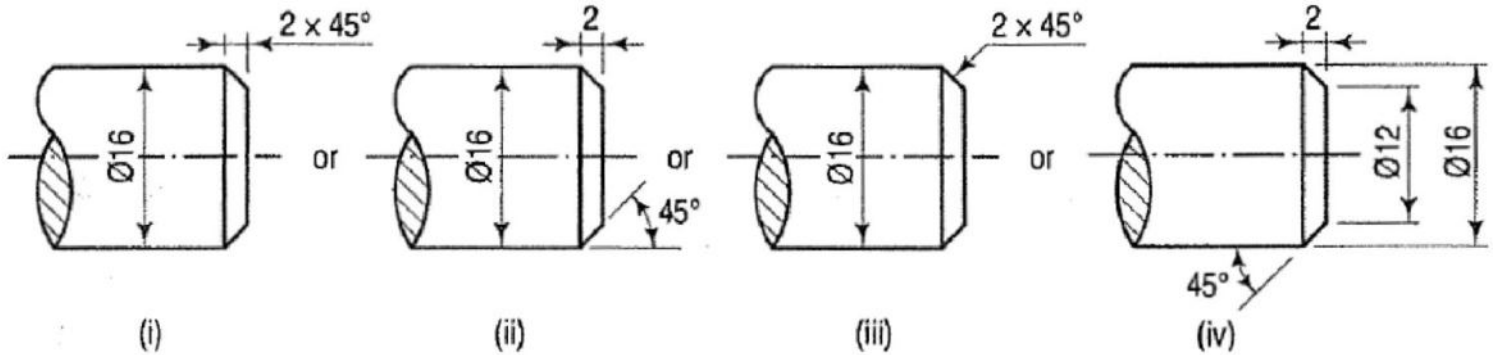




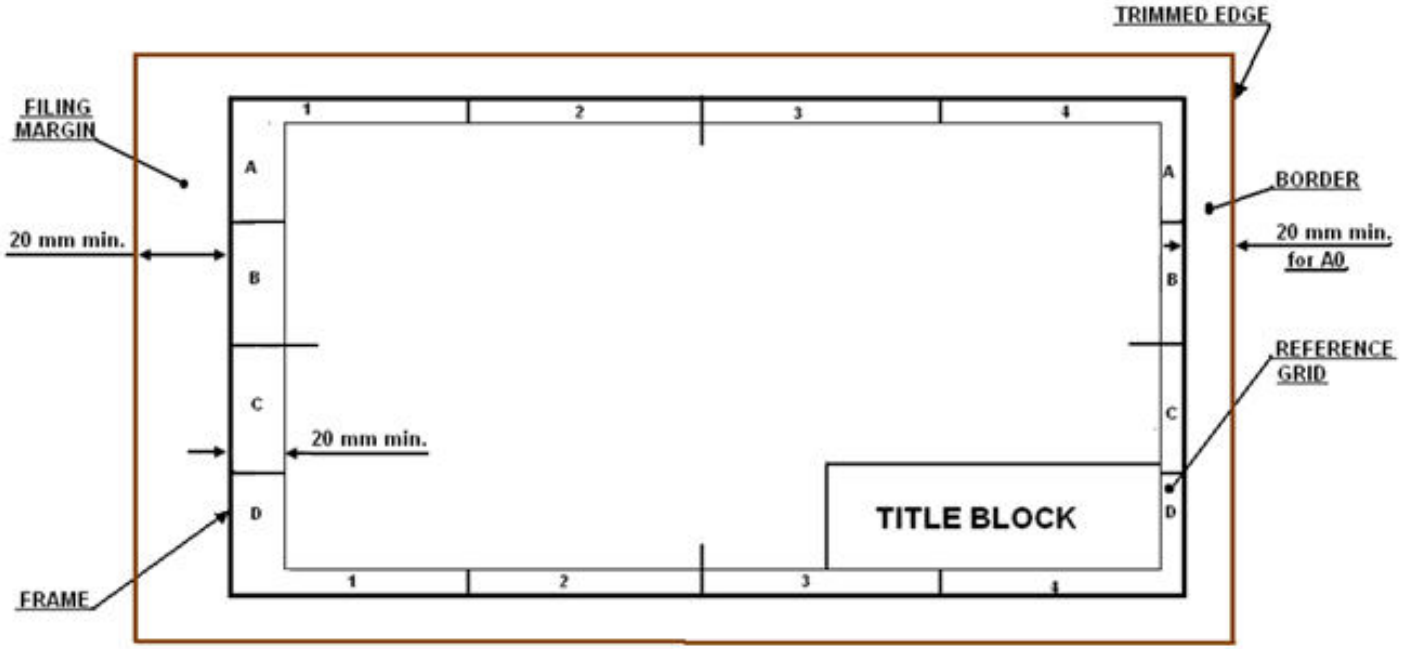


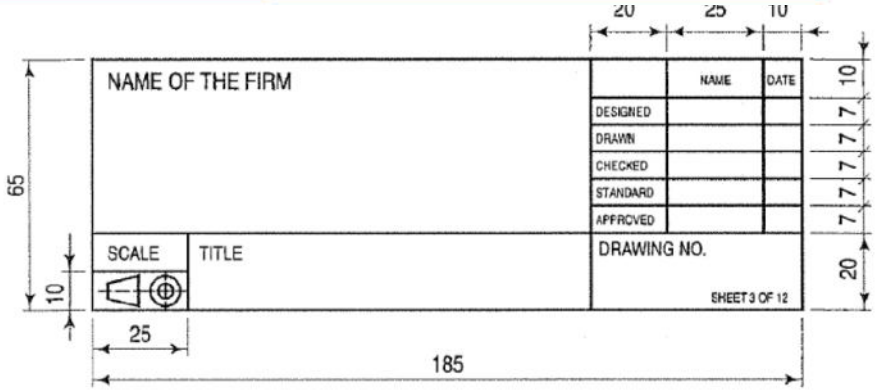


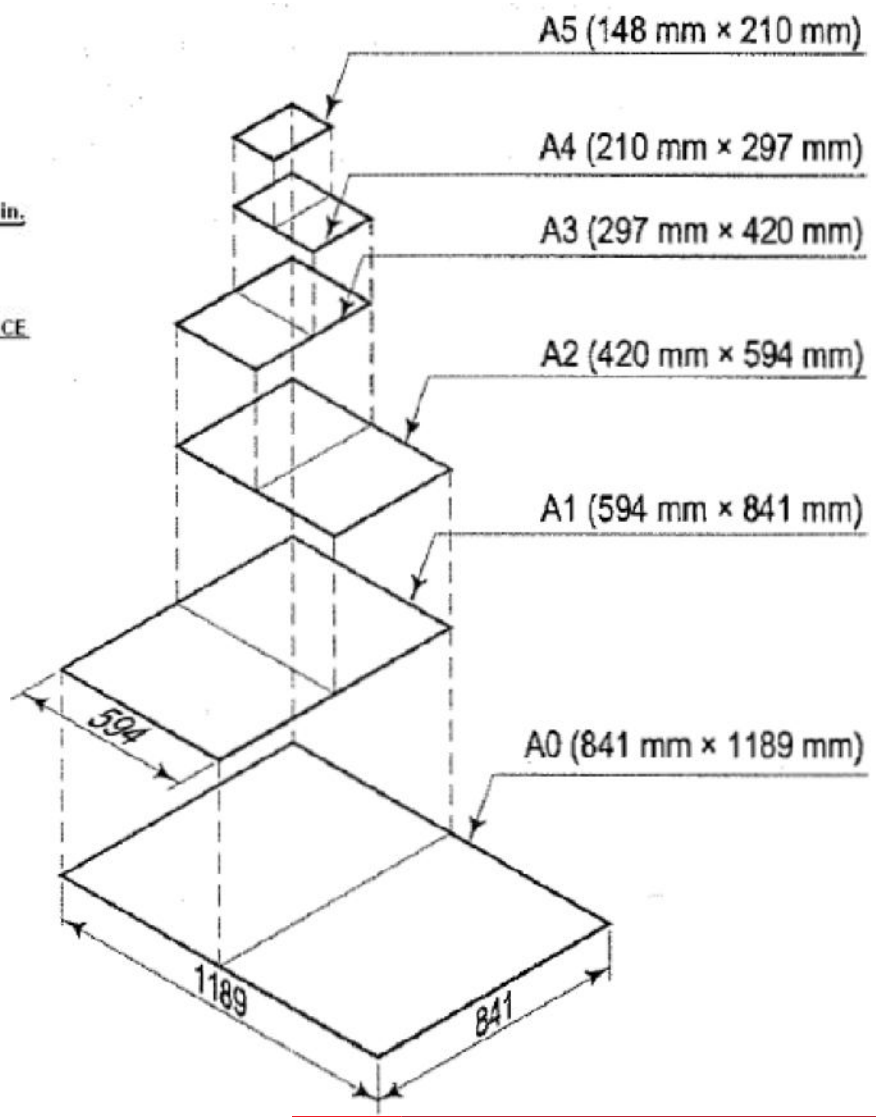




Drawing sheet layout and size







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Scales

Metals

Scaling is used for shrinking a large object on paper

OR

To enlarge an object which otherwise is too small to draw on the paper.

(i)	Reducing scales	1 : 2	1 : 5	1 : 10
		1 : 20	1 : 50	1 : 100
		1 : 200	1 : 500	1 : 1000
		1 : 2000	1 : 5000	1 : 10000
(ii)	Enlarging scales	50 : 1	20 : 1	10 : 1
		5 : 1	2 : 1	
(iii)	Full size scales			1 : 1

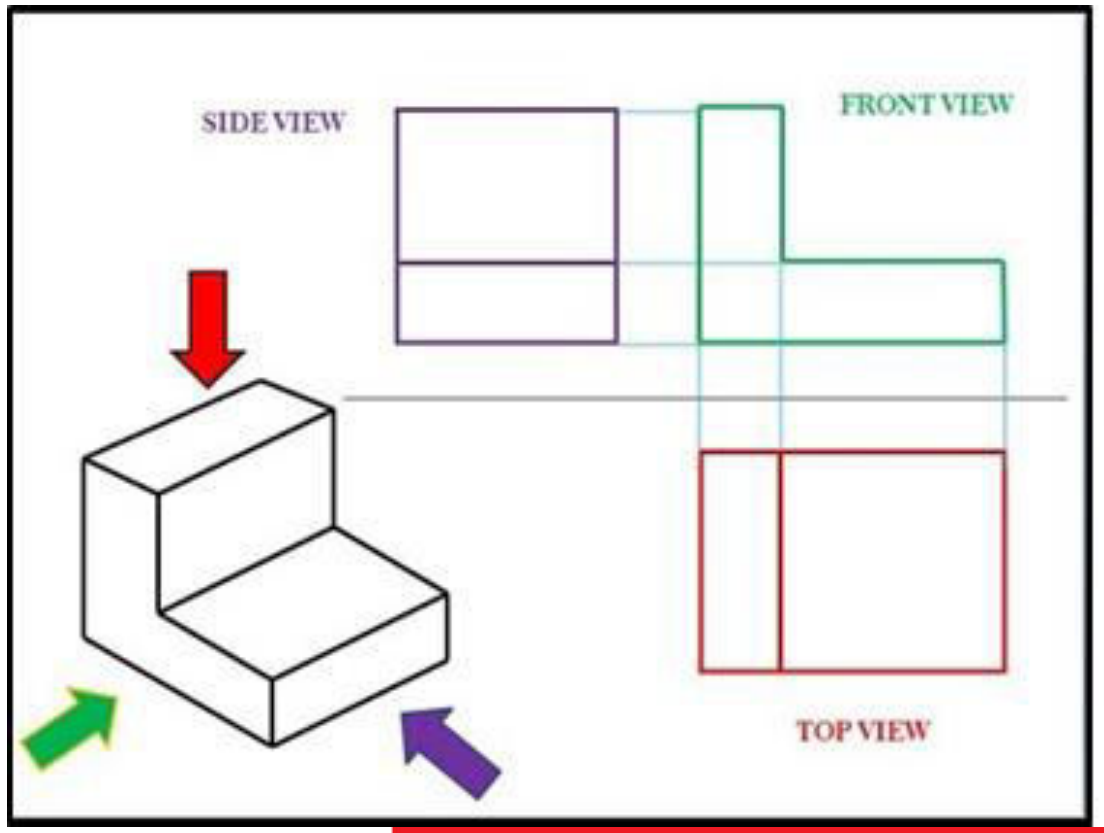
Projection of Points

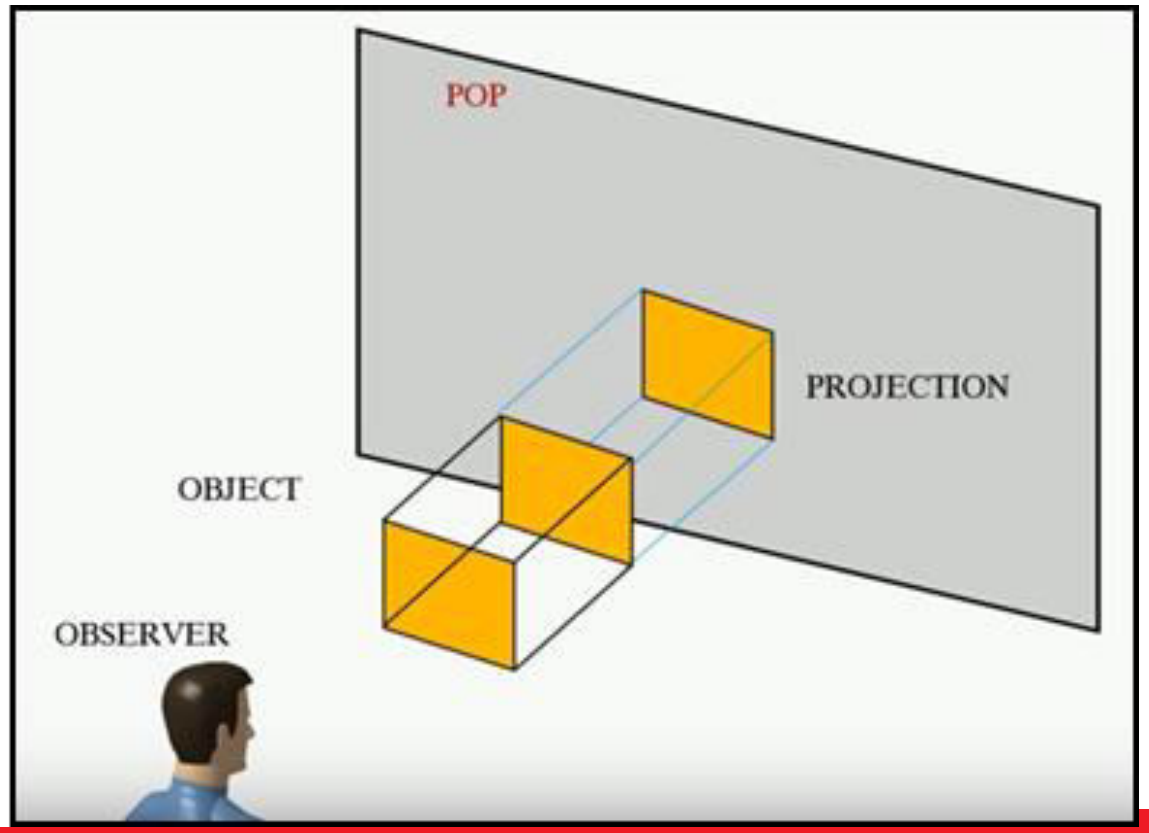
What is Projection ?

- In engineering, 3-dimensonal objects and structures are represented graphically on a 2-dimensional media. The act of obtaining the image of an object is termed "projection". The image obtained by projection is known as a "view". A simple projection system is shown in figure .
- All projection theory are based on two variables:
  - Lines of projection (sight): I*t is an imaginary ray of light between an observer's eye and an object.*
  - Plane of projection: *It is an imaginary flat plane which the image is created.*

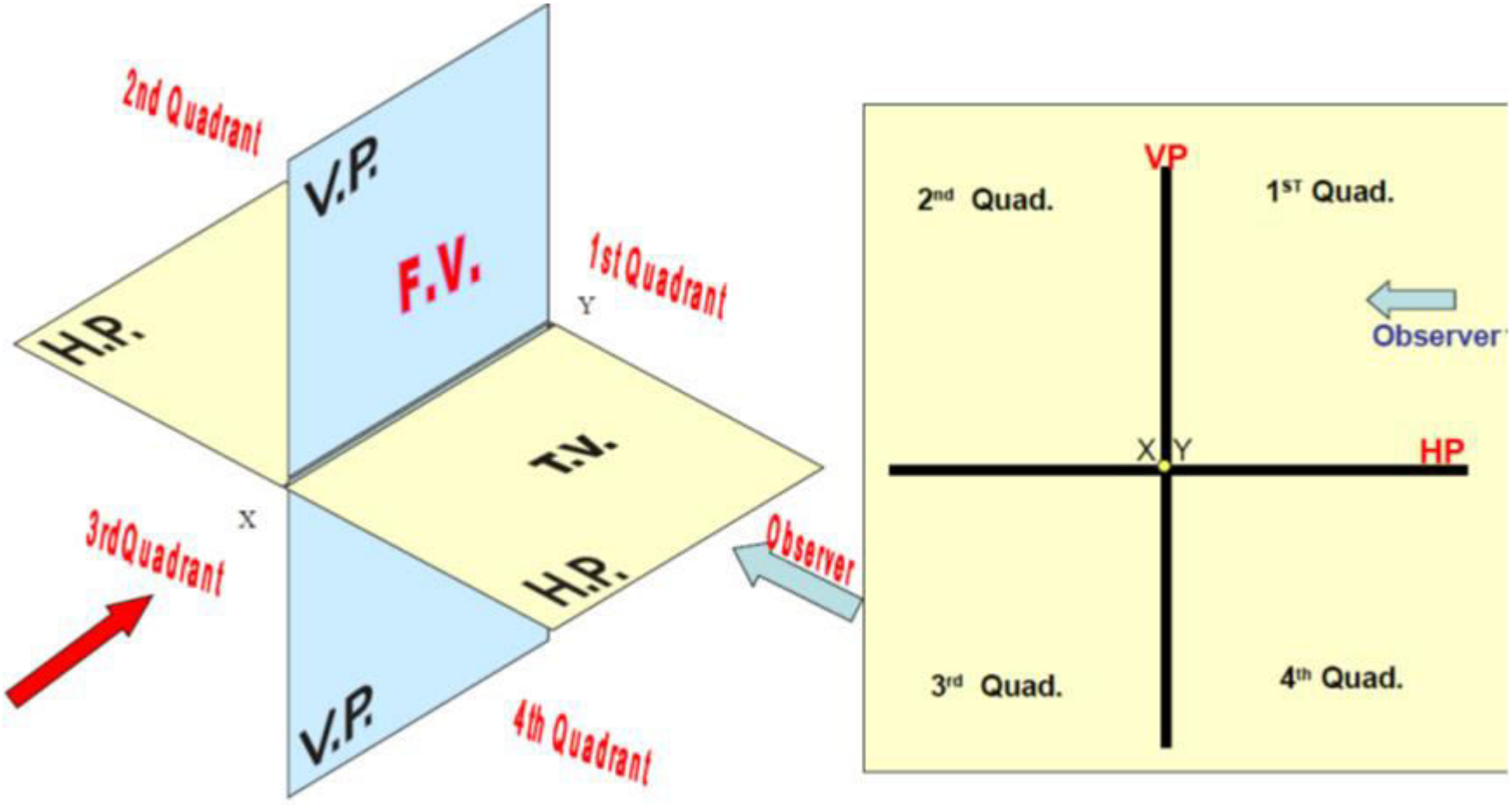
What is Projection ?

Orthographic Projection: The projection in which the projectors are parallel to each other and perpendicular to the plane

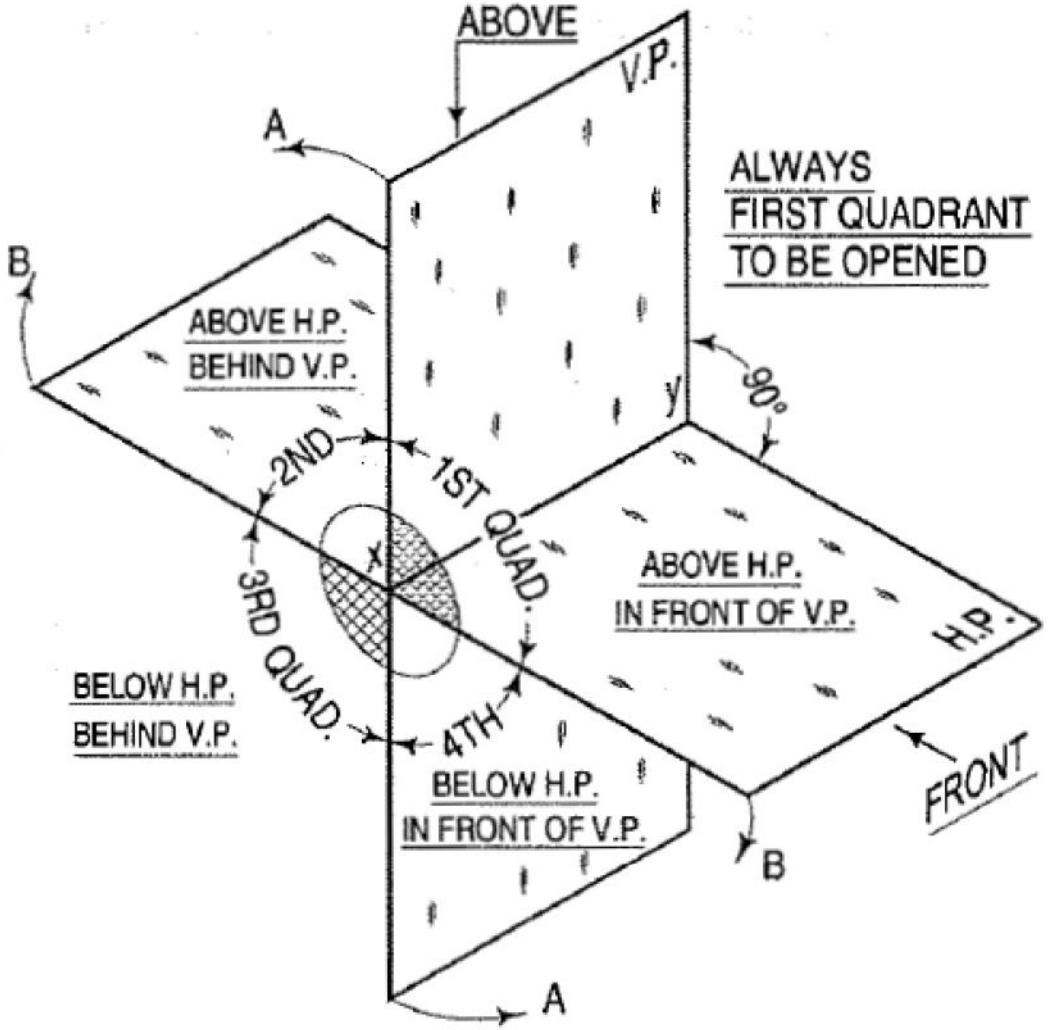


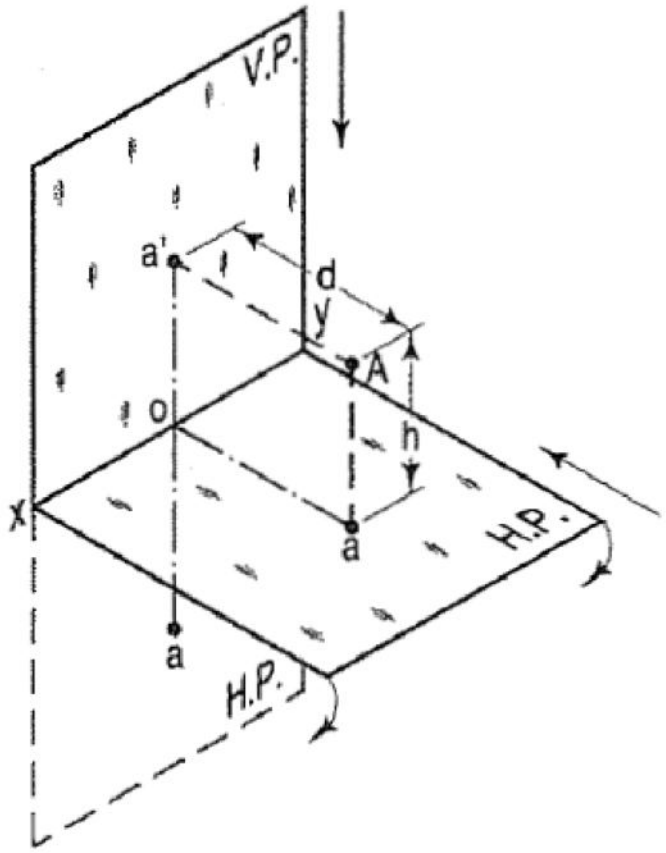


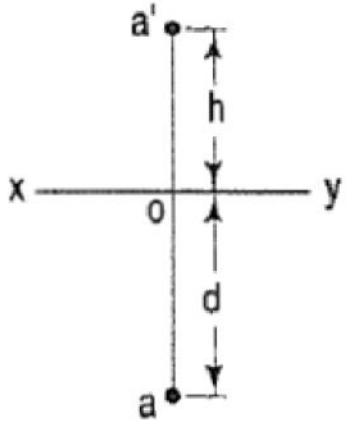
Quadrant System



Quadrant System

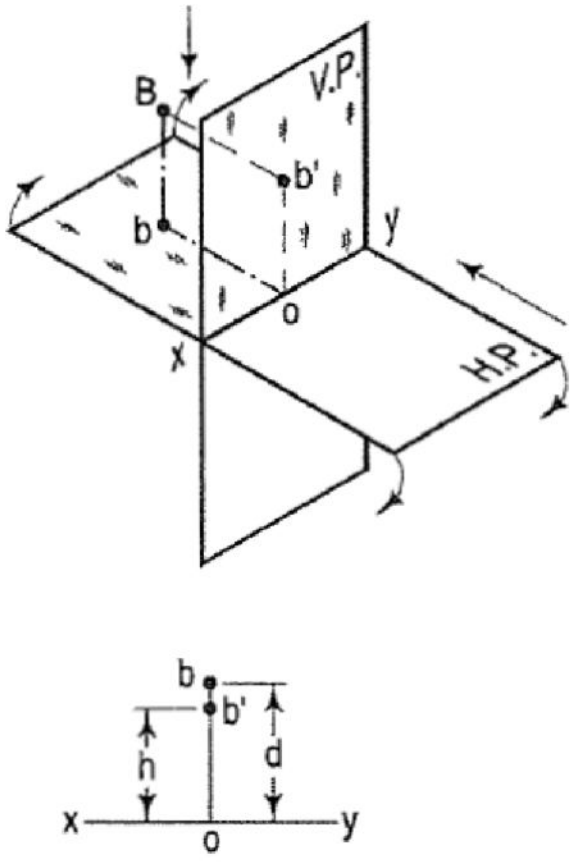




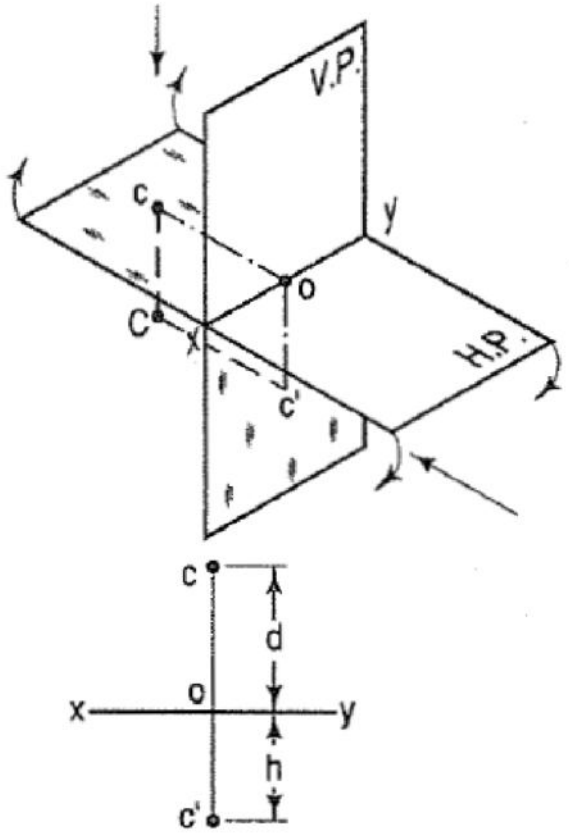


First Quadrant

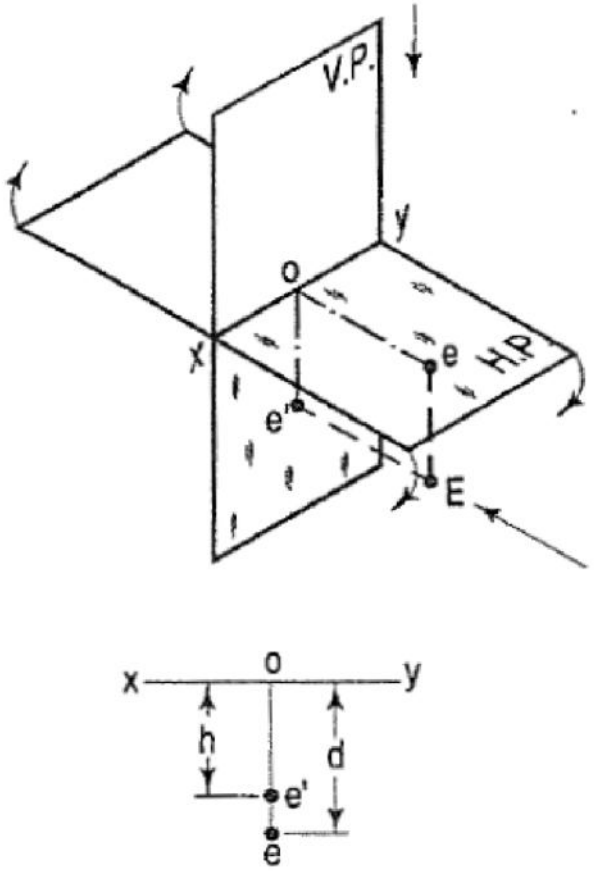
Projection of Points in various Quadrants



Second Quadrant

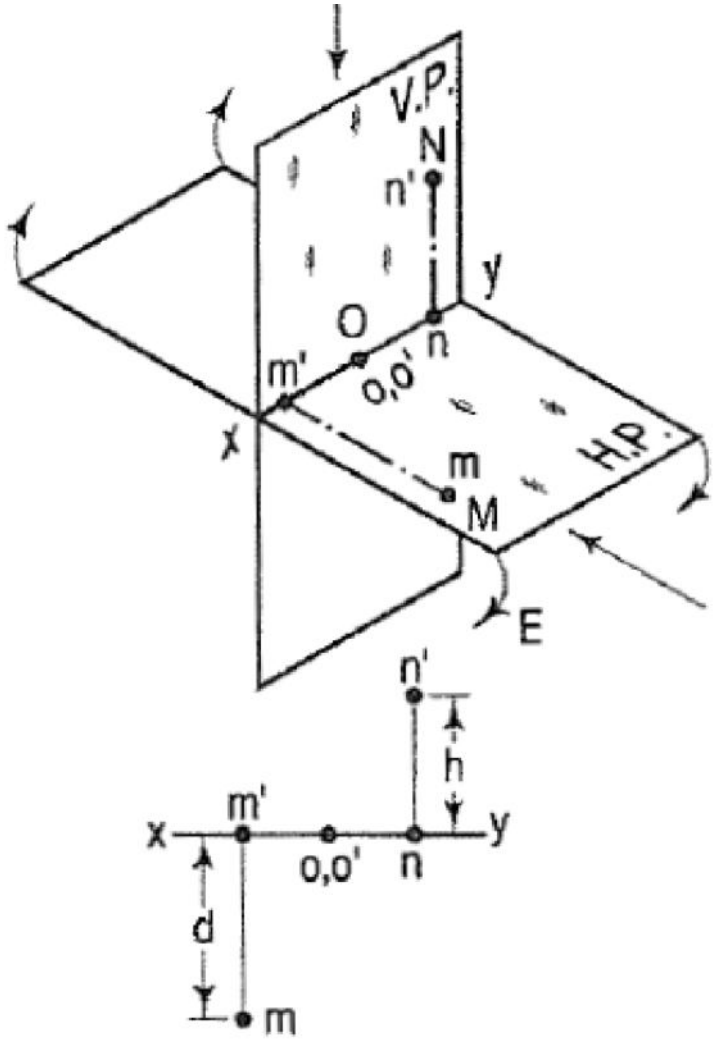


Third Quadrant



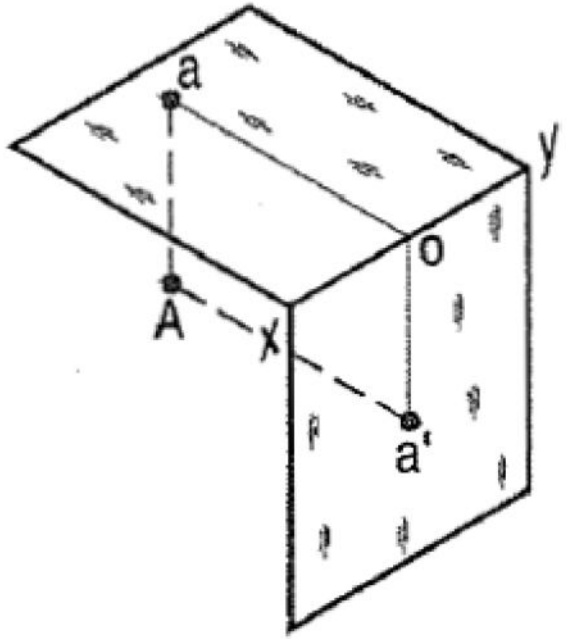
Fourth Quadrant

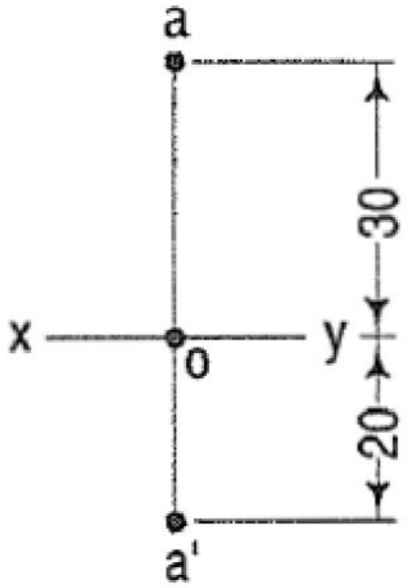
Special Cases



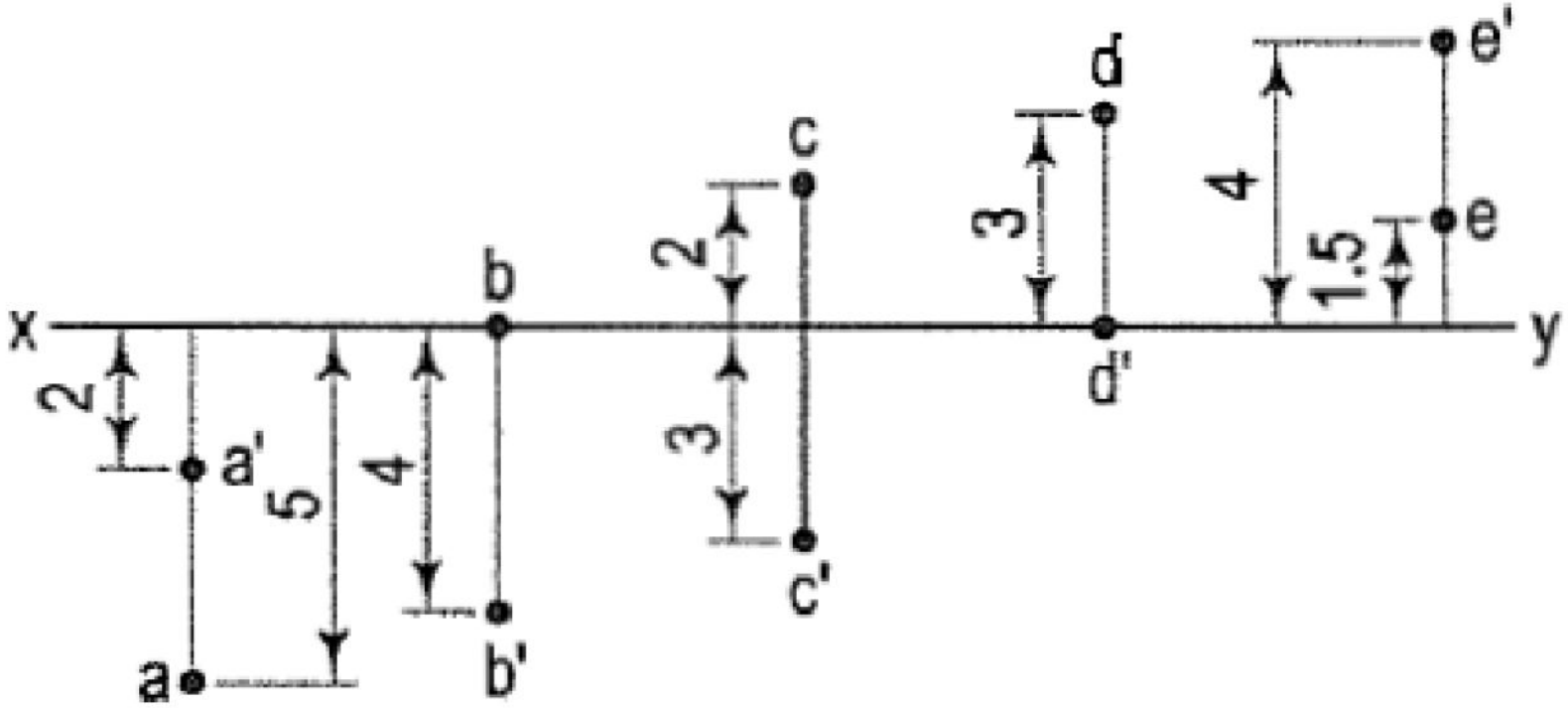
Problems

A Point A is 20 mm below HP and 30 mm behind VP. Draw its projections





Problems



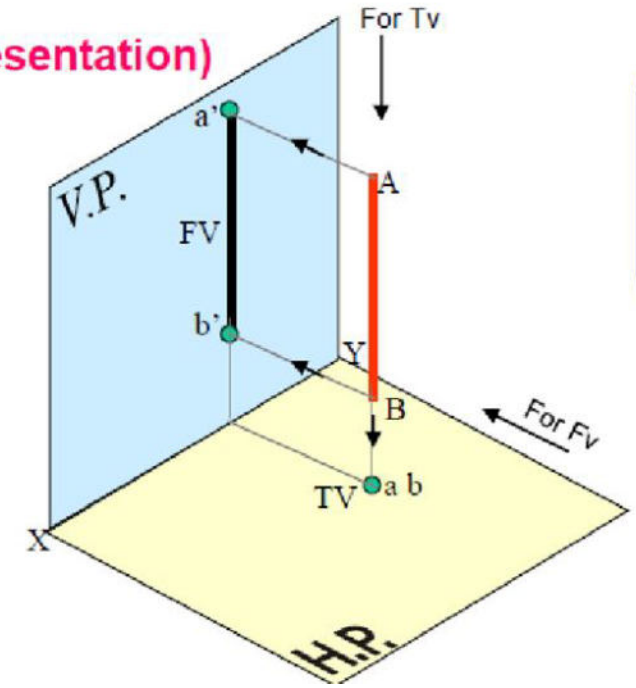
Projection of Lines

Line in First Quadrant – Case I

(Pictorial Presentation)

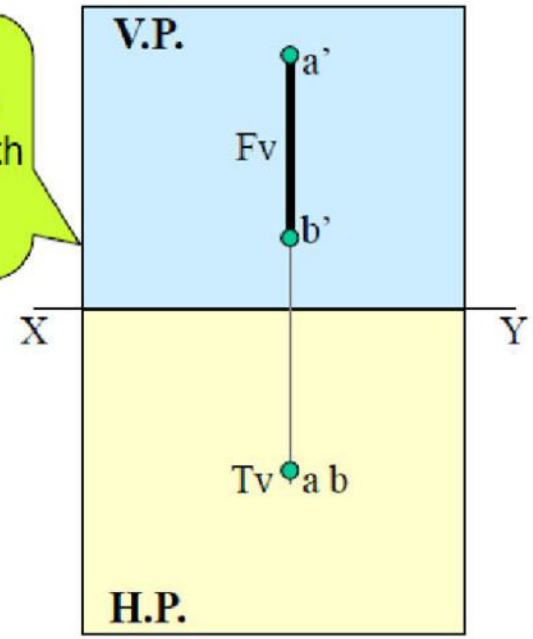
1.

A Line perpendicular to Hp & // to Vp



Note:
Fv is a vertical line Showing True Length
&
Tv is a point.

Orthographic Pattern

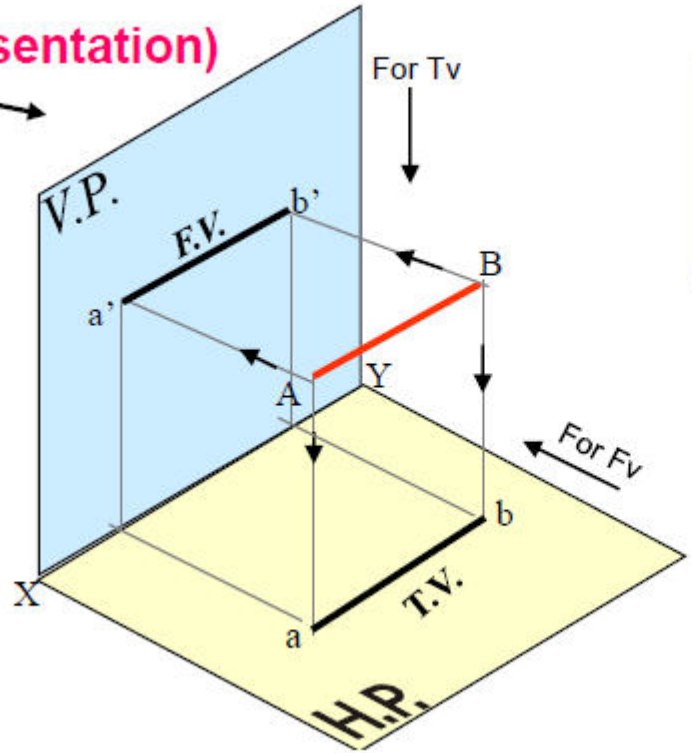


Line in First Quadrant – Case II

(Pictorial Presentation)

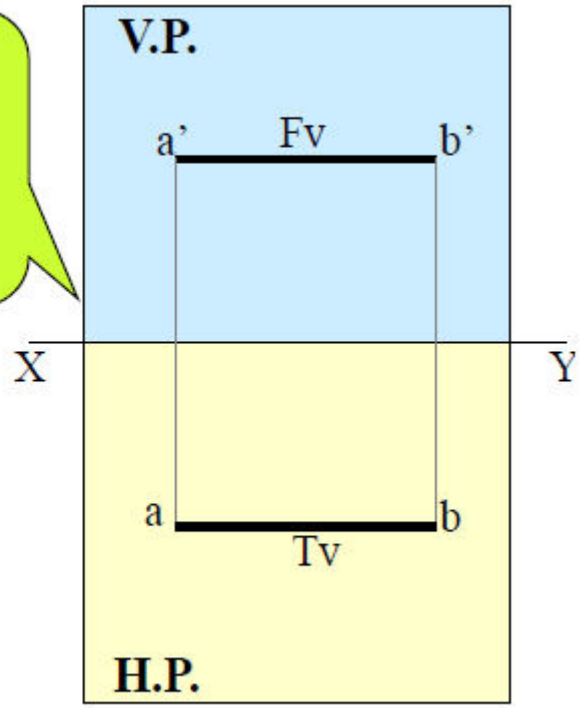
2.

A Line
// to Hp
&
// to Vp



Note:
Fv & Tv both are
// to xy
&
both show T. L.

Orthographic Pattern

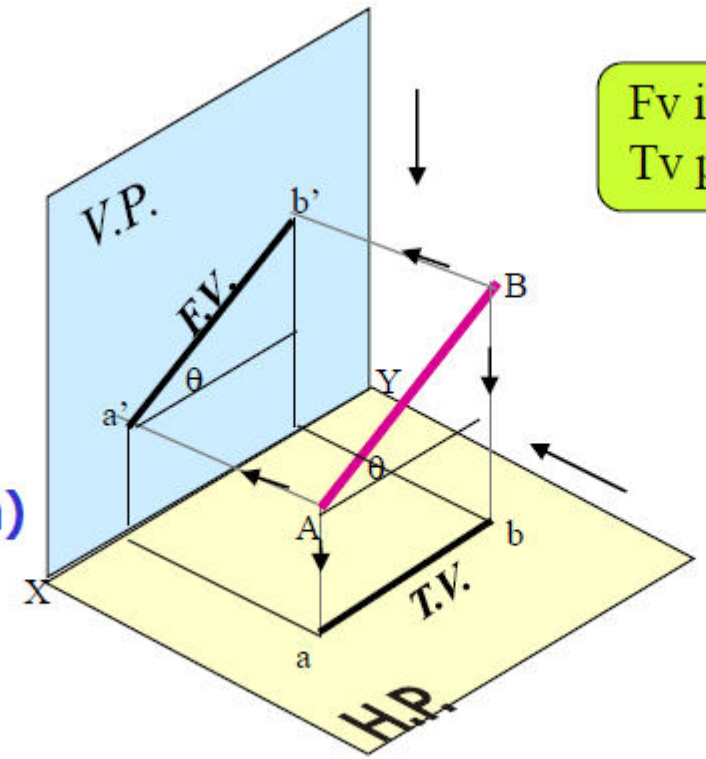


Line in First Quadrant – Case III

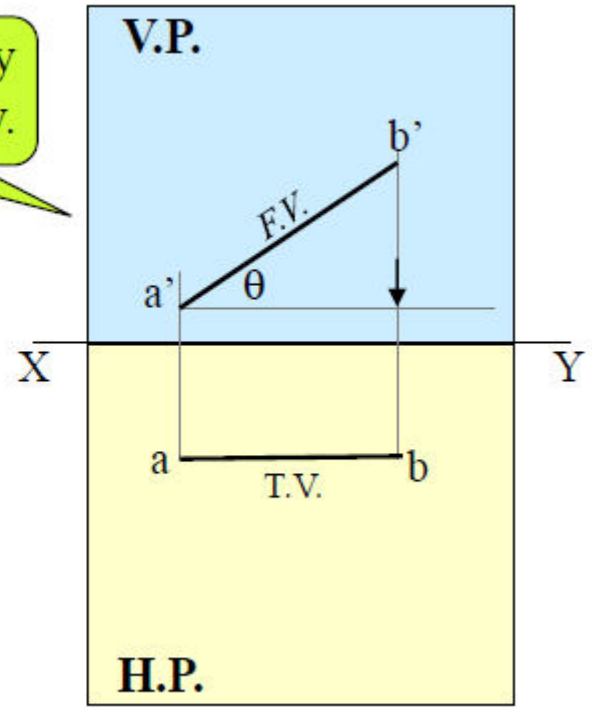
3.

A Line inclined to Hp
and
parallel to Vp

(Pictorial presentation)



Fv inclined to xy
Tv parallel to xy.

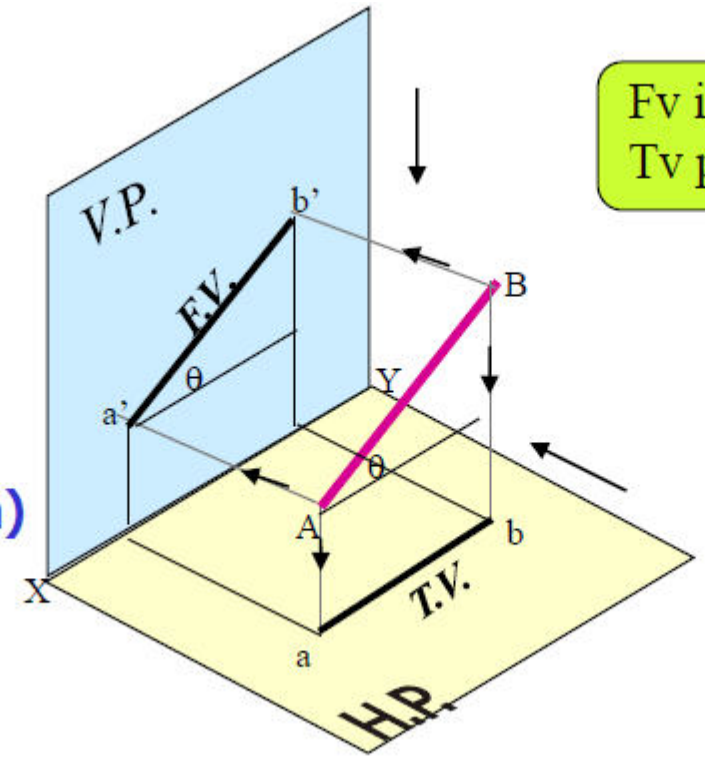


Line in First Quadrant – Case IV

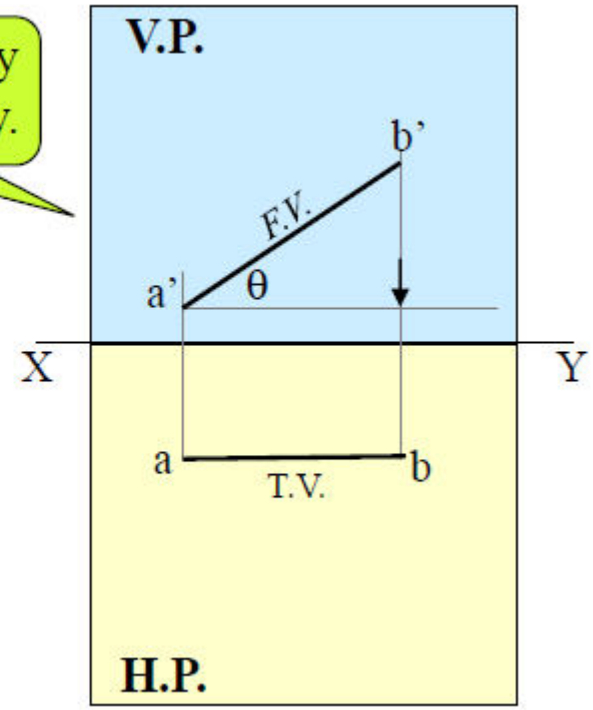
3.

A Line inclined to Hp
and
parallel to Vp

(Pictorial presentation)



Fv inclined to xy
Tv parallel to xy.

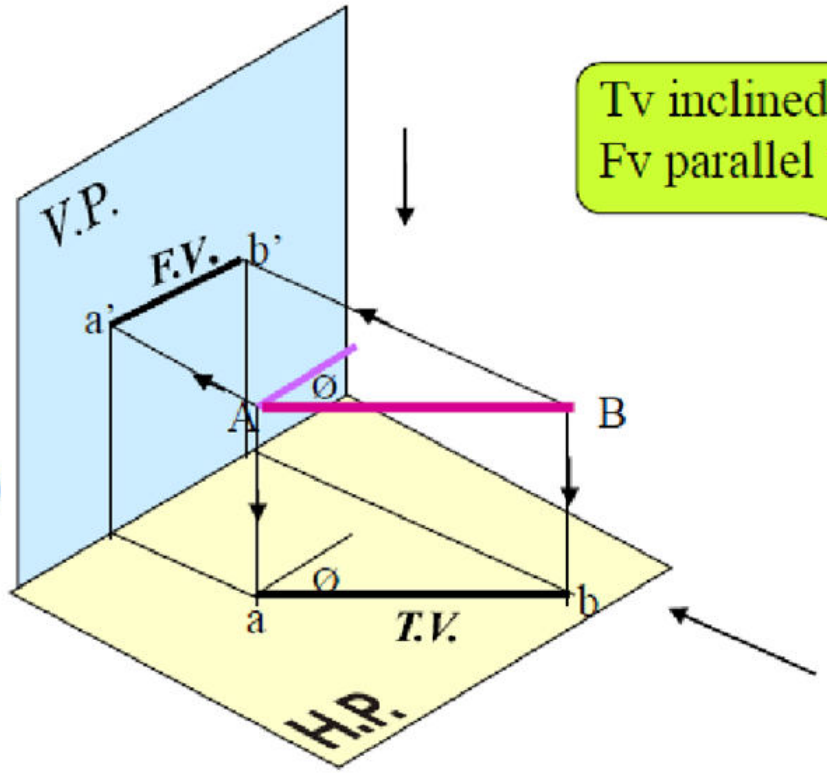


Line in First Quadrant – Case V

4.

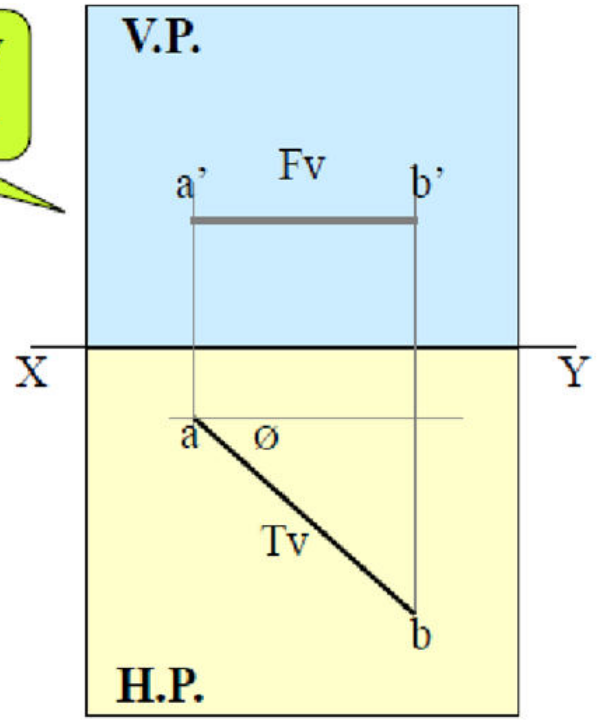
A Line inclined to Vp
and
parallel to Hp

(Pictorial presentation)



Tv inclined to xy
Fv parallel to xy.

Orthographic Projections



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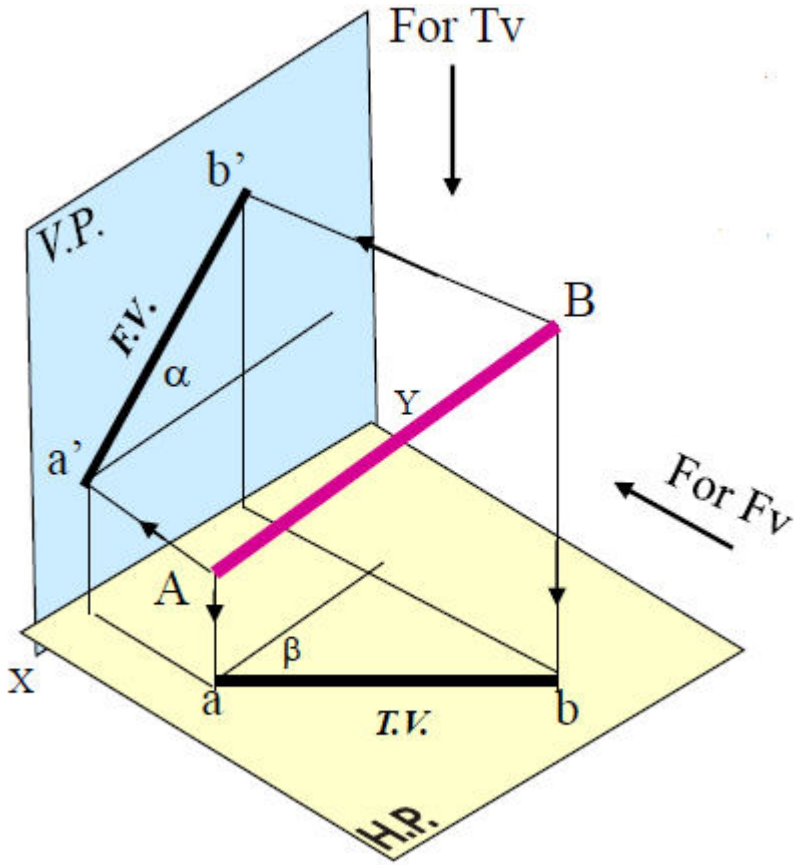
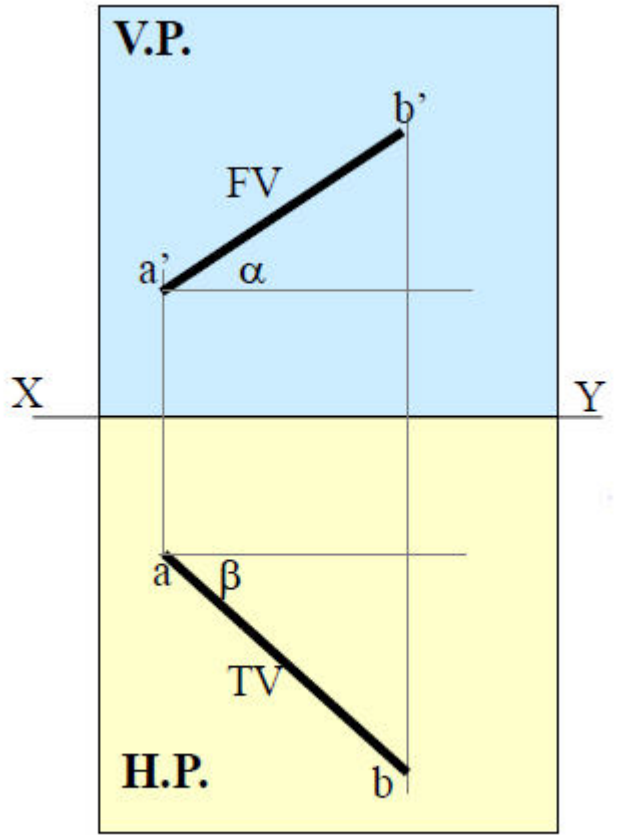
Lines inclined to both planes !





Are the angles shown here the real inclinations ?

What about the true length of the line ?

How to find the true length and inclinations of the line ?

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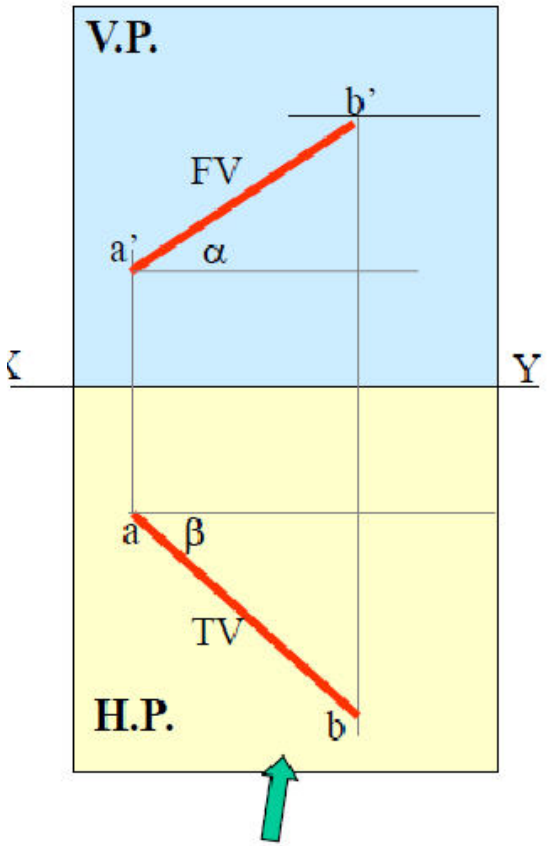
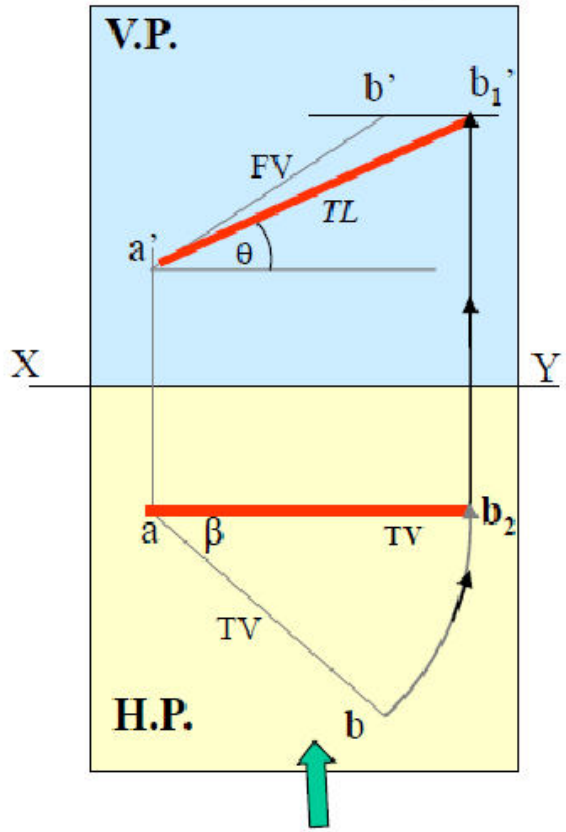
Orthographic Projections
Means Fv & Tv of Line AB
are shown below,
with their apparent Inclinations
α & β



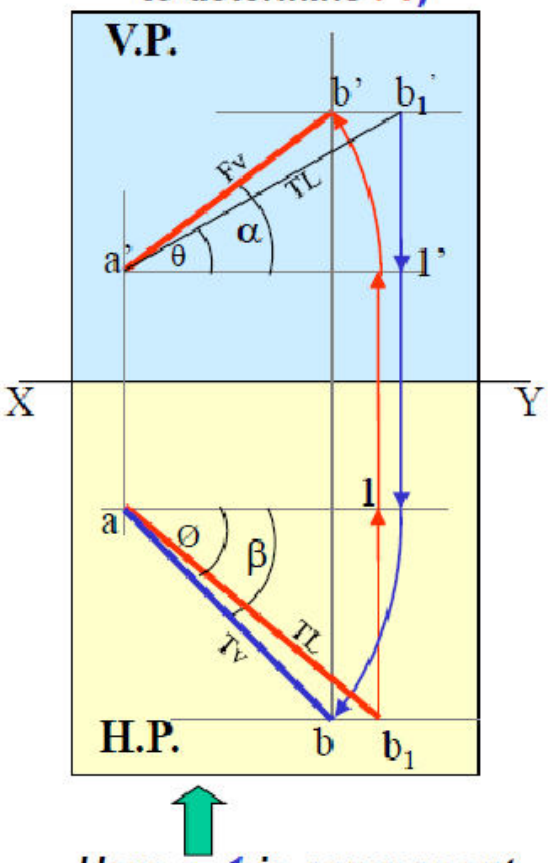
Here TV (ab) is not // to XY line
Hence it's corresponding FV
a' b' is not showing
True Length &
True Inclination with Hp.

Note the procedure
When Fv & Tv known,
How to find True Length.
(Views are rotated to determine
True Length & it's inclinations
with Hp & Vp).



In this sketch, TV is rotated
and made // to XY line.
Hence it's corresponding
FV a' b1' Is showing
True Length
&
True Inclination with Hp.

Note the procedure
When True Length is known,
How to locate Fv & Tv.
(Component a-1 of TL is drawn
which is further rotated
to determine Fv)



Here a -1 is component
of TL ab1 gives length of Fv.
Hence it is brought Up to
Locus of a' and further rotated
to get point b'. a' b' will be Fv.
Similarly drawing component
of other TL(a' b1') Tv can be drawn.

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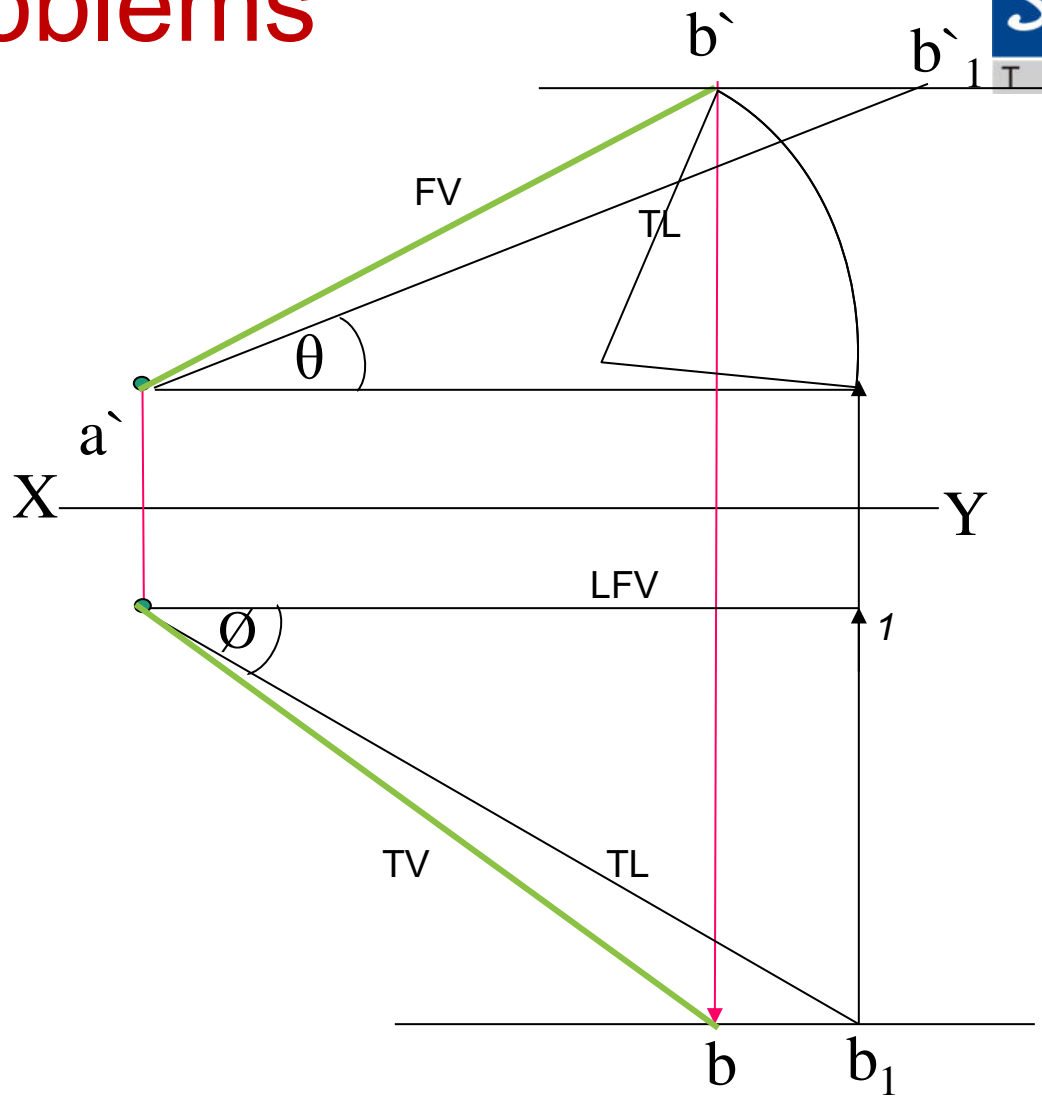
Description	Notation
Actual line	AB
F.V. of line	$a'b'$
T.V. of line	ab
S.V. of line	$a''b''$
Line assumed parallel to the V.P.	AB_1
Corresponding true length of assumed line AB_1	$a'b_1'$
Corresponding plan length of assumed line AB_1	ab_1
Line assumed parallel to the H.P.	AB_2
Corresponding true length of assumed line AB_2	ab_2
Corresponding elevation length of assumed line AB_2	$a'b_2'$
True Inclination of a line with the H.P.	θ
True Inclination of a line with the V.P.	ϕ
Apparent Inclination of F.V. of a line with the XY line	α
Apparent Inclination of T.V. of a line with the XY line	β

Problems

Line AB is 75 mm long and it is 30º and 40º inclined to HP and VP respectively. End A is 12mm above HP and 10 mm in front of VP. Draw the projections. Assume line is in the first quadrant.

Given Data:
TL
True inclinations to HP and VP (θ and ϕ)
Position of point A wrt. HP and VP



Problems

A line AB, 50 mm long has its end A in both HP and VP. It is inclined at 30º to HP and 45º to VP. Draw the projections.

Given Data:

TL

True inclinations to HP and VP (θ and ϕ)

Position of point A wrt. HP and VP

Problems

Line AB is 75 mm long makes 45º inclination with VP while its FV makes 55º. End A is 10mm above HP and 15 mm in front of VP. If the line is in the first Quadrant, draw the projections and find its inclination with HP.

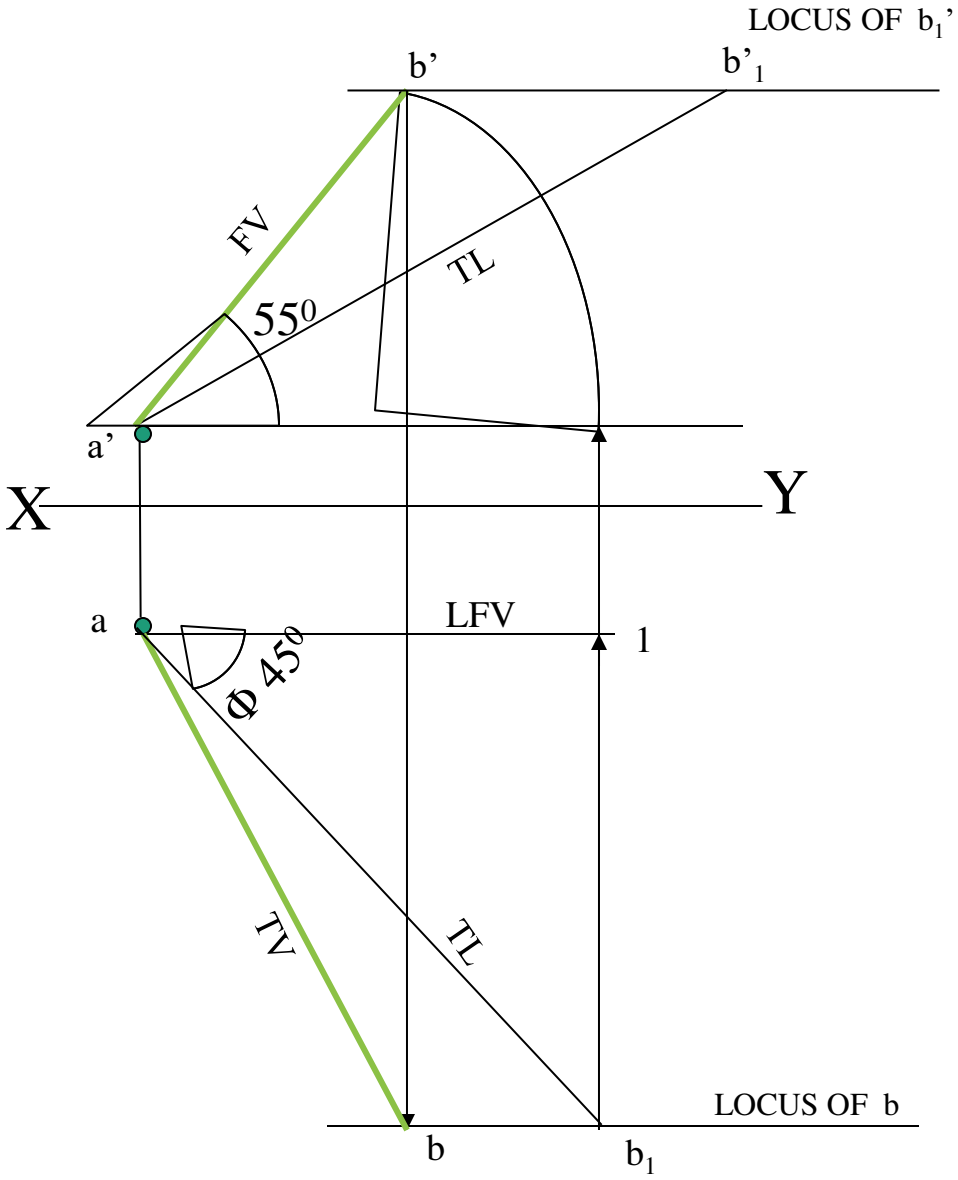
Given Data:

TL

True inclinations to VP (ϕ)

Apparent inclination with HP (α)

Position of point A wrt. HP and VP



Problems

FV of line AB is 50^0 inclined to XY and measures 55 mm long while it's TV is 60^0 inclined to XY line. If end A is 10 mm above HP and 15 mm in front of VP, draw it's projections, find TL, inclinations of line with HP & VP.

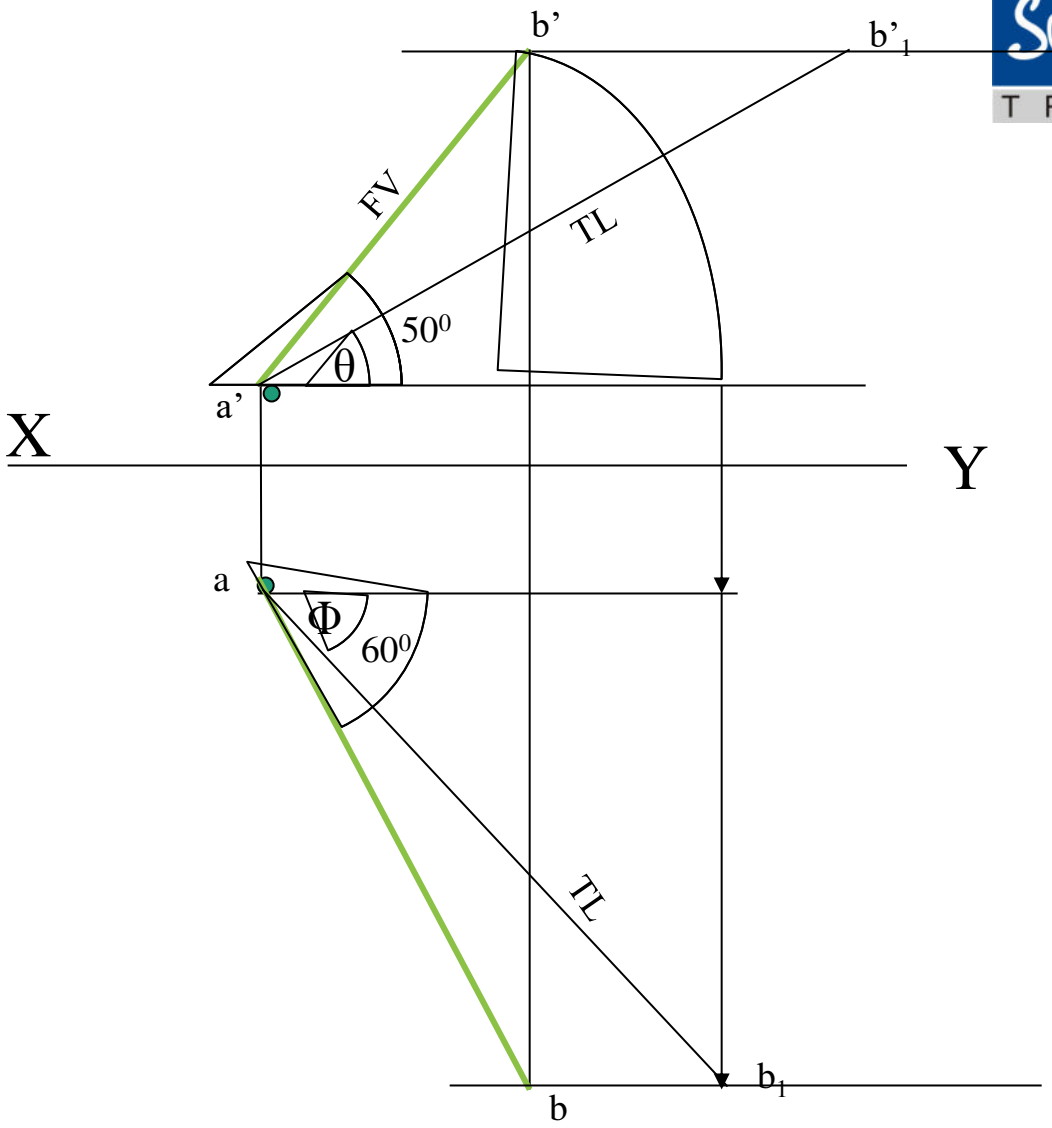
Given Data:

FV

Apparent inclinations to VP (ϕ)

Apparent inclination to HP (β)

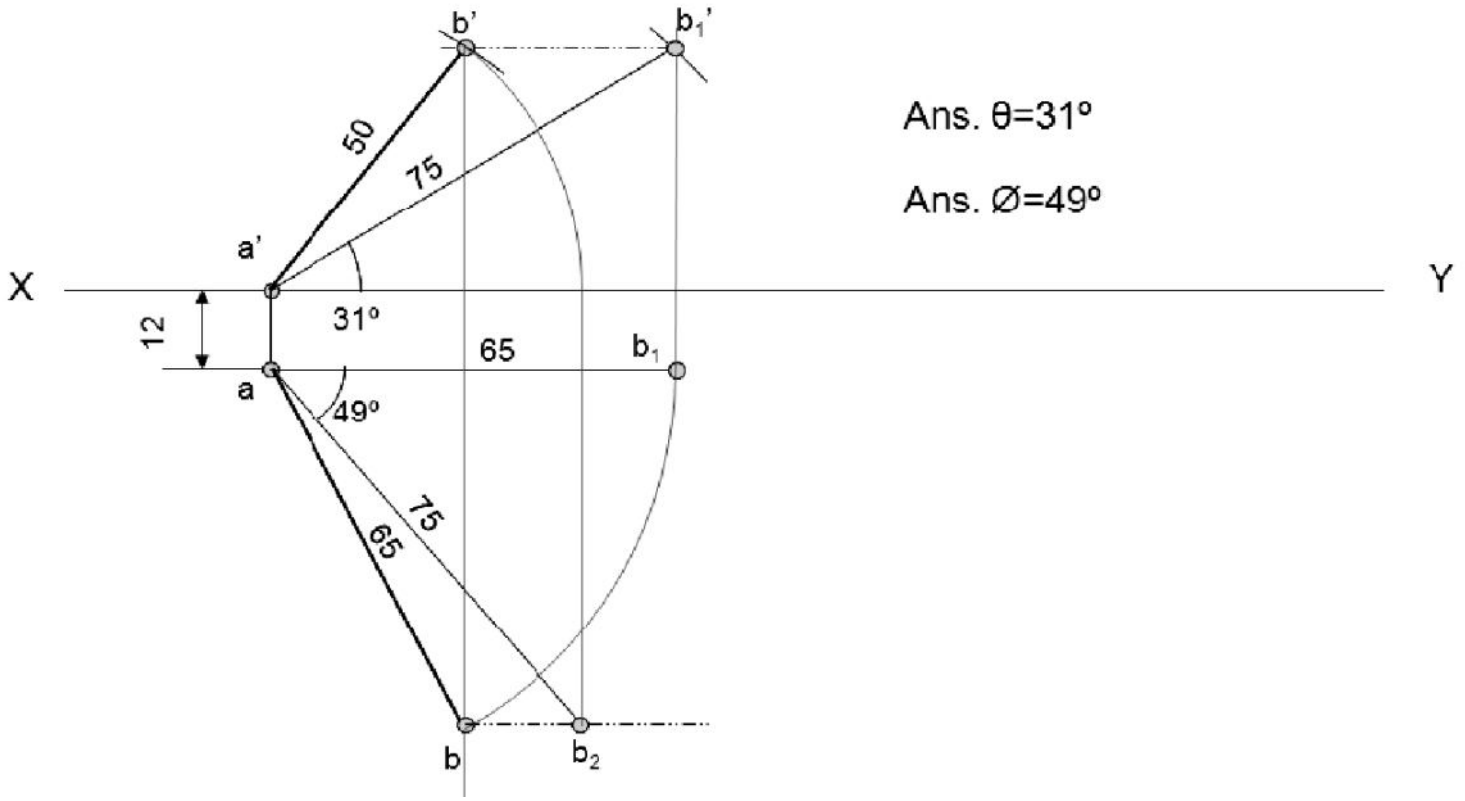
Position of point A wrt. HP and VP



Problems

The top view of a 75 mm line AB measures 65 mm, while its front view measures 50 mm. Its one end A is in HP and 12 mm in front of VP. Draw the projections of AB and determine its inclination with HP and VP.

Given Data:
TV and TL
FV
Position of point A wrt. HP and VP

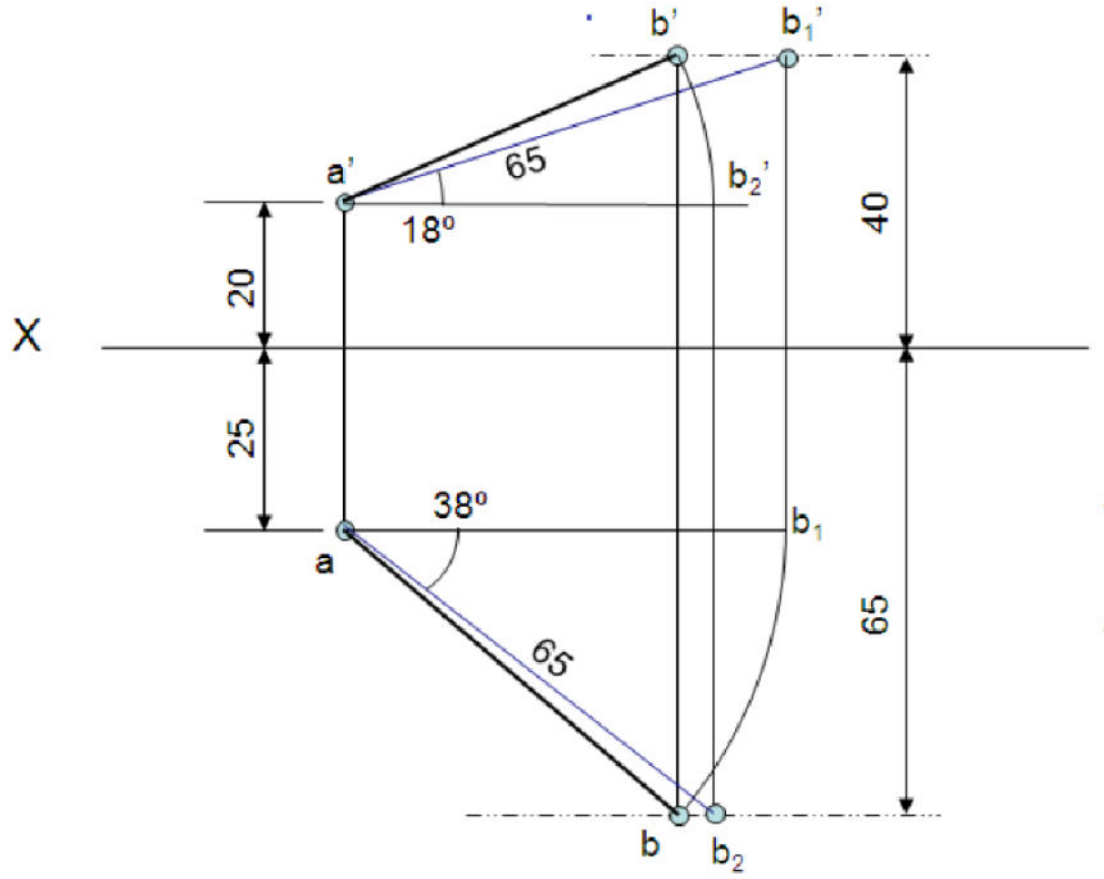


Ans. θ=31°

Ans. Ø=49°

Problems

The top view of a 75 mm line AB measures 65 mm, while its front view measures 50 mm. Its one end A is in HP and 12 mm in front of VP. Draw the projections of AB and determine its inclination with HP and VP.



Ans. θ=18°

Ans. Ø=38°

Given Data:

TV and TL

FV

Position of point A wrt. HP and VP

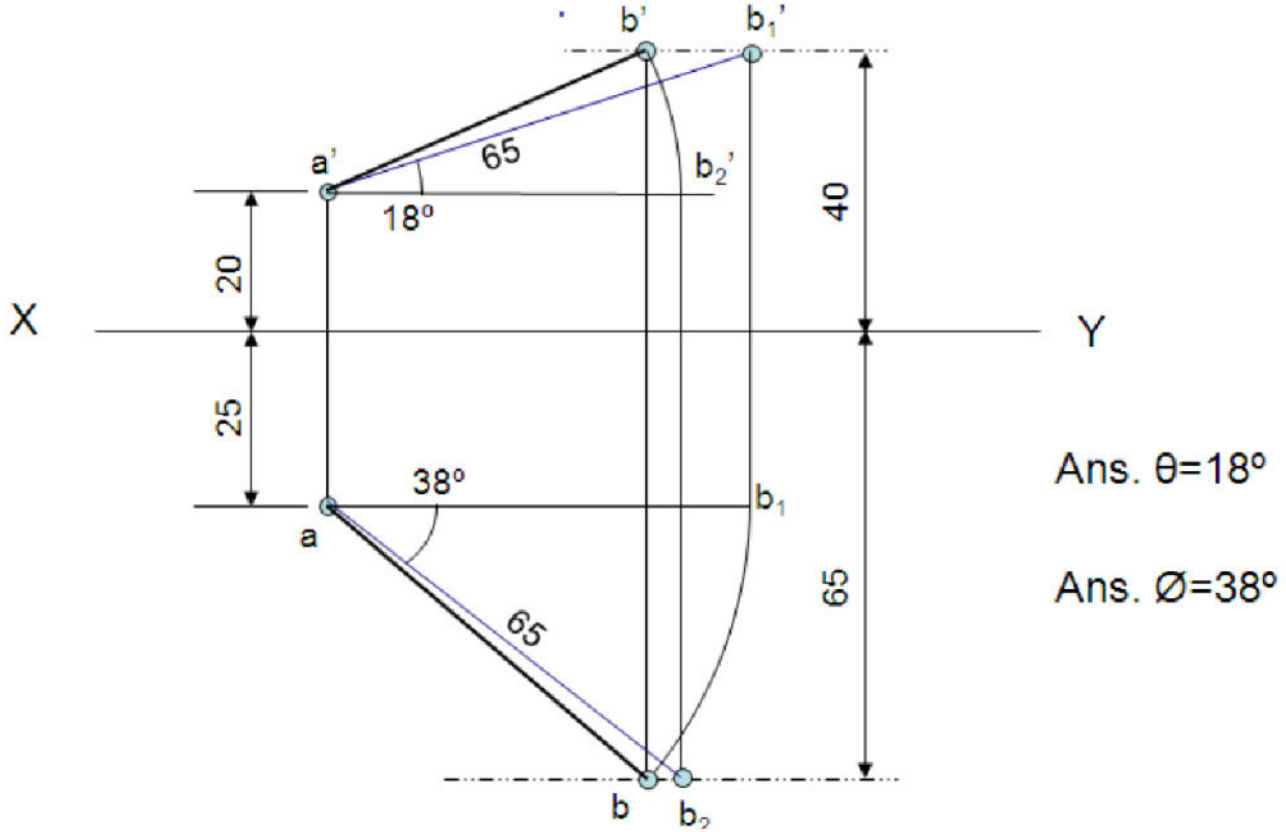
Problems

A line AB is 65 mm long has its end A 20 mm above HP and 25 mm in front of VP. The end B is 40 mm above HP and 65 mm in front of VP. Draw the projections of AB and show its inclination with HP.

Given Data:

TL

Position of point A and B wrt. HP and VP



Ans. θ=18°

Ans. Ø=38°

Problems

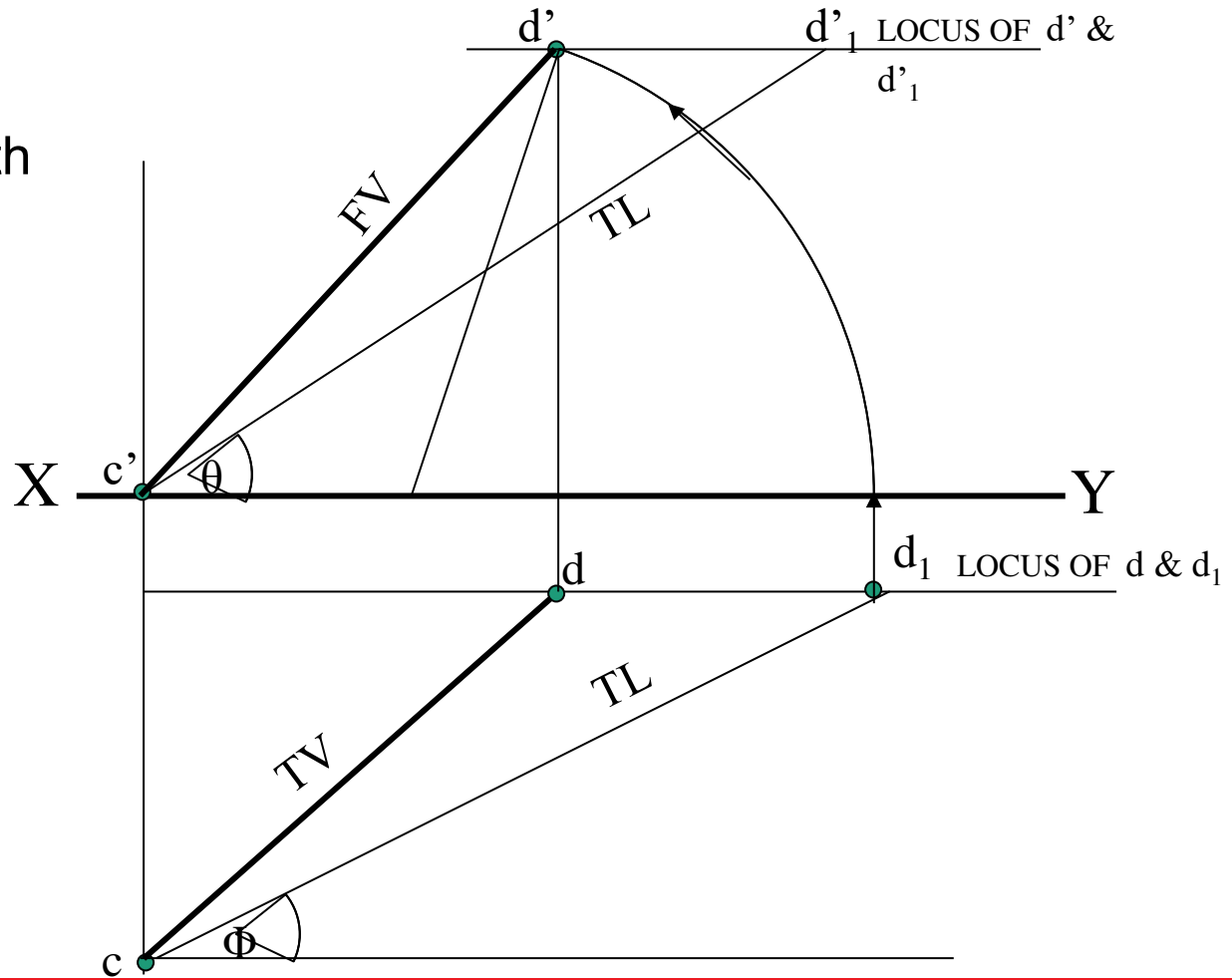
T.V. of a 75 mm long Line CD, measures 50 mm. End C is in HP and 50 mm in front of VP. End D is 15 mm in front of VP and it is above HP. Draw projections of CD and find angles with HP and VP.

Given Data:

TL, TV

Position of point C wrt. HP and VP

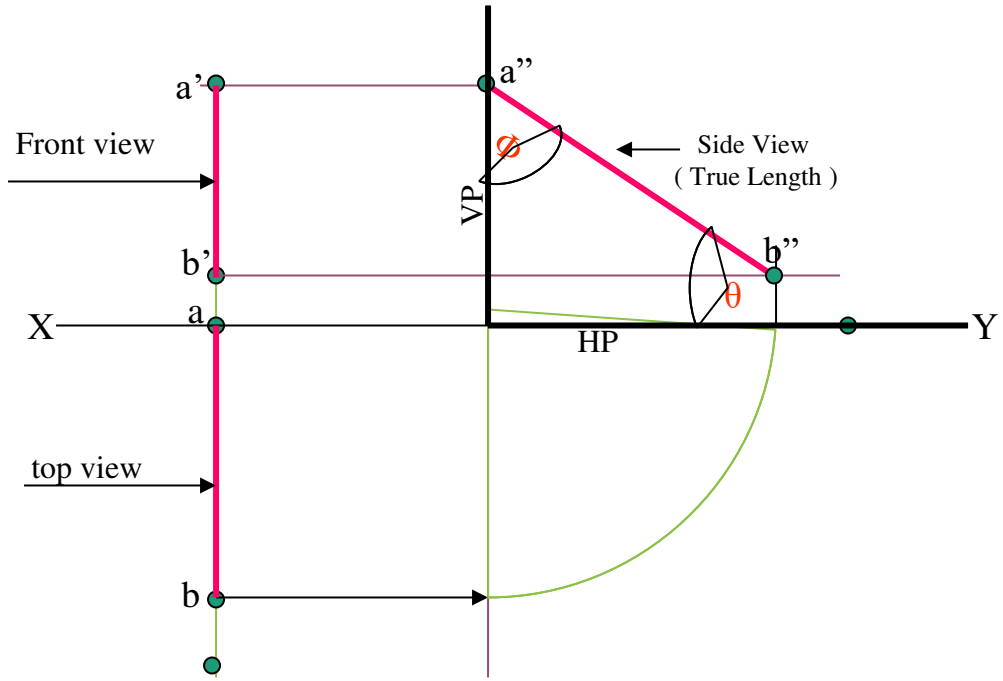
Position of point D wrt. VP



Problems

A line AB, 75mm long, has one end A in VP.
Other end B is 15 mm above HP
and 50 mm in front of VP.Draw the projections of the line when sum of it's
Inclinations with HP & VP is 90^0,
Find the true angles with reference planes.

Given Data:
TL
Position of point B wrt. HP and VP
Position of point A wrt. VP



Line in two quadrants

Problems

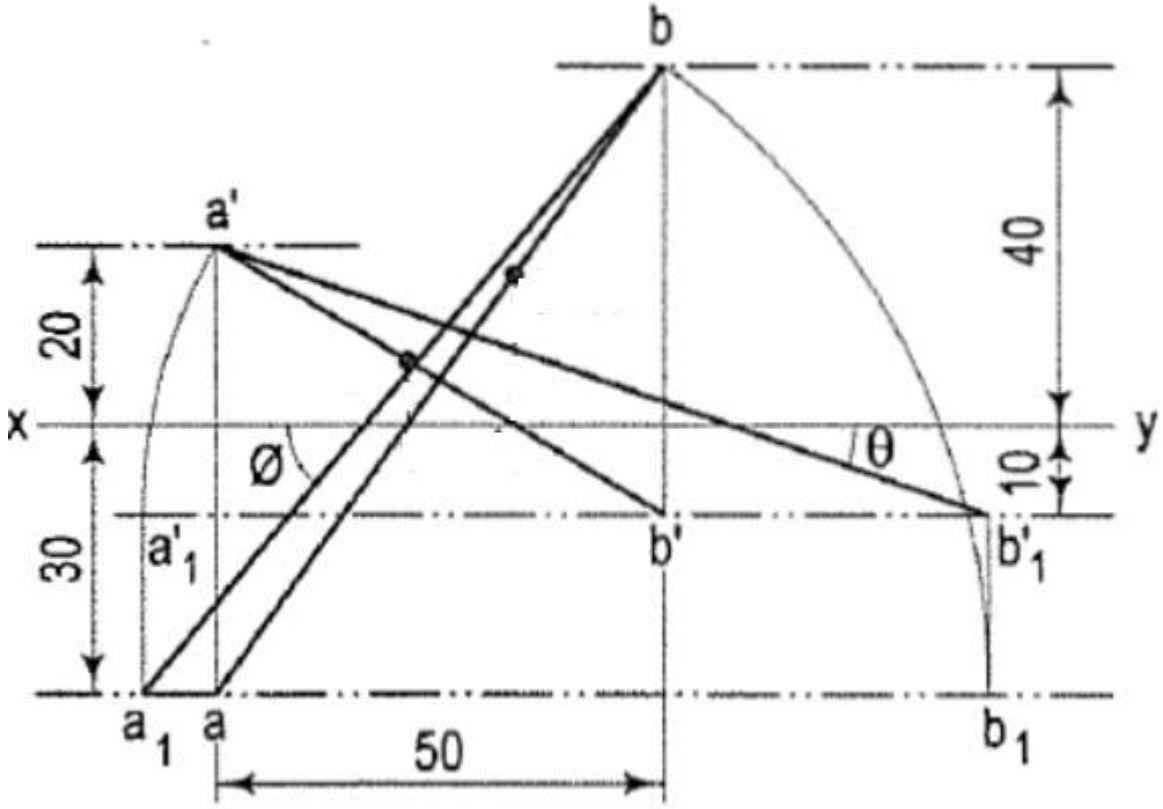
The projectors of the ends of a line AB are 50 mm apart . The end A is 20 mm above the HP and 30 mm in front of the VP. The end B is 10 mm below the HP and 40 mm behind the VP. Determine the true length and its inclinations with the two planes.

Given Data:

Distance between end projectors

Position of point A wrt. HP and VP

Position of point B wrt. HP and VP



Problems

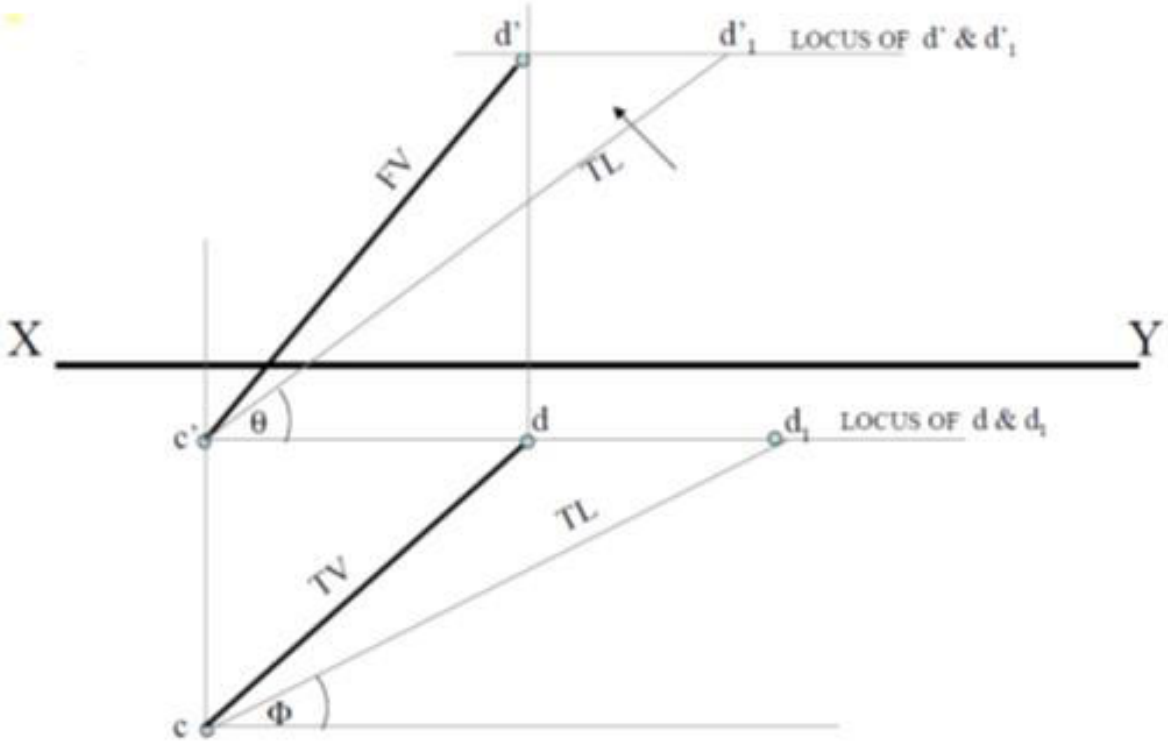
The top view of a 75 mm long line CD measures 50 mm. The end C is 15 mm below HP and 50 mm in front of VP. End D is 15 mm in front of VP and it is above HP. Draw the projections of CD and find angles with HP and VP

Given Data:

TL, TV

Position of point C wrt. HP and VP

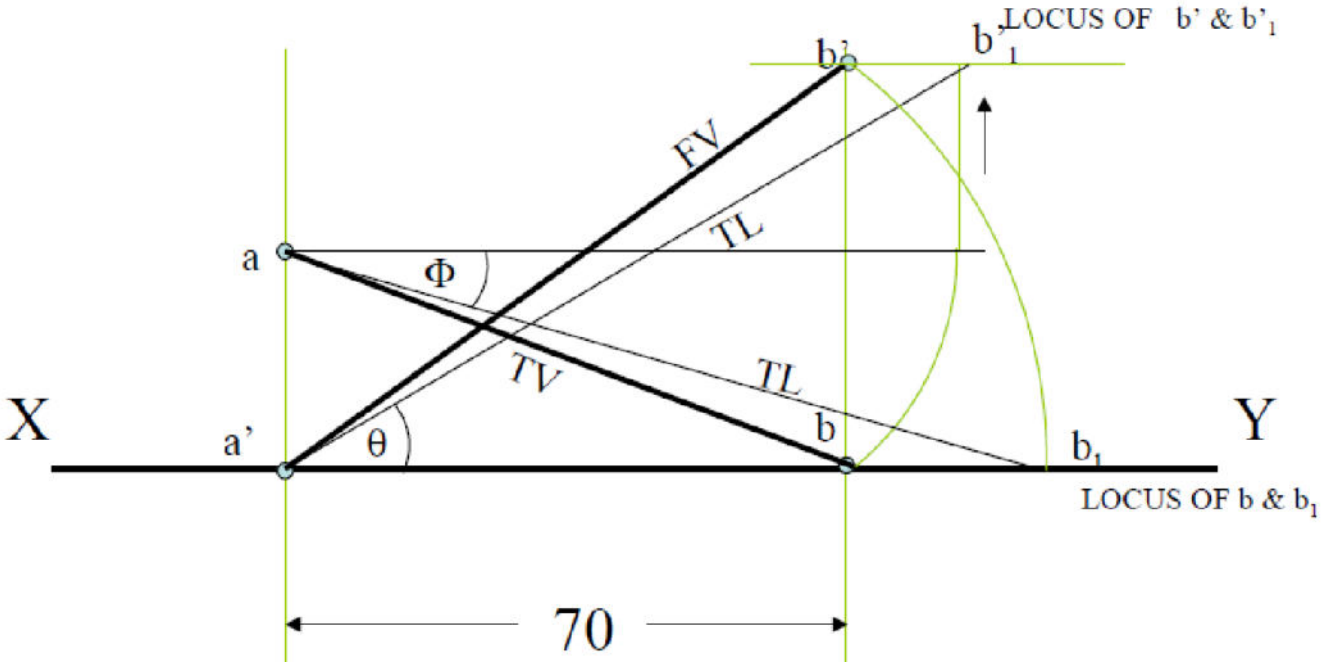
Position of point D wrt. VP



Problems

End A of a line AB is in HP and 25 mm behind VP. End B is in VP and 50 mm above HP. Distance between the end projectors is 70 mm. Draw the projections and find the angles made by the line with HP and VP.

Given Data:
TL, TV
Position of point C wrt. HP and VP
Position of point D wrt. VP



Problems

Problems

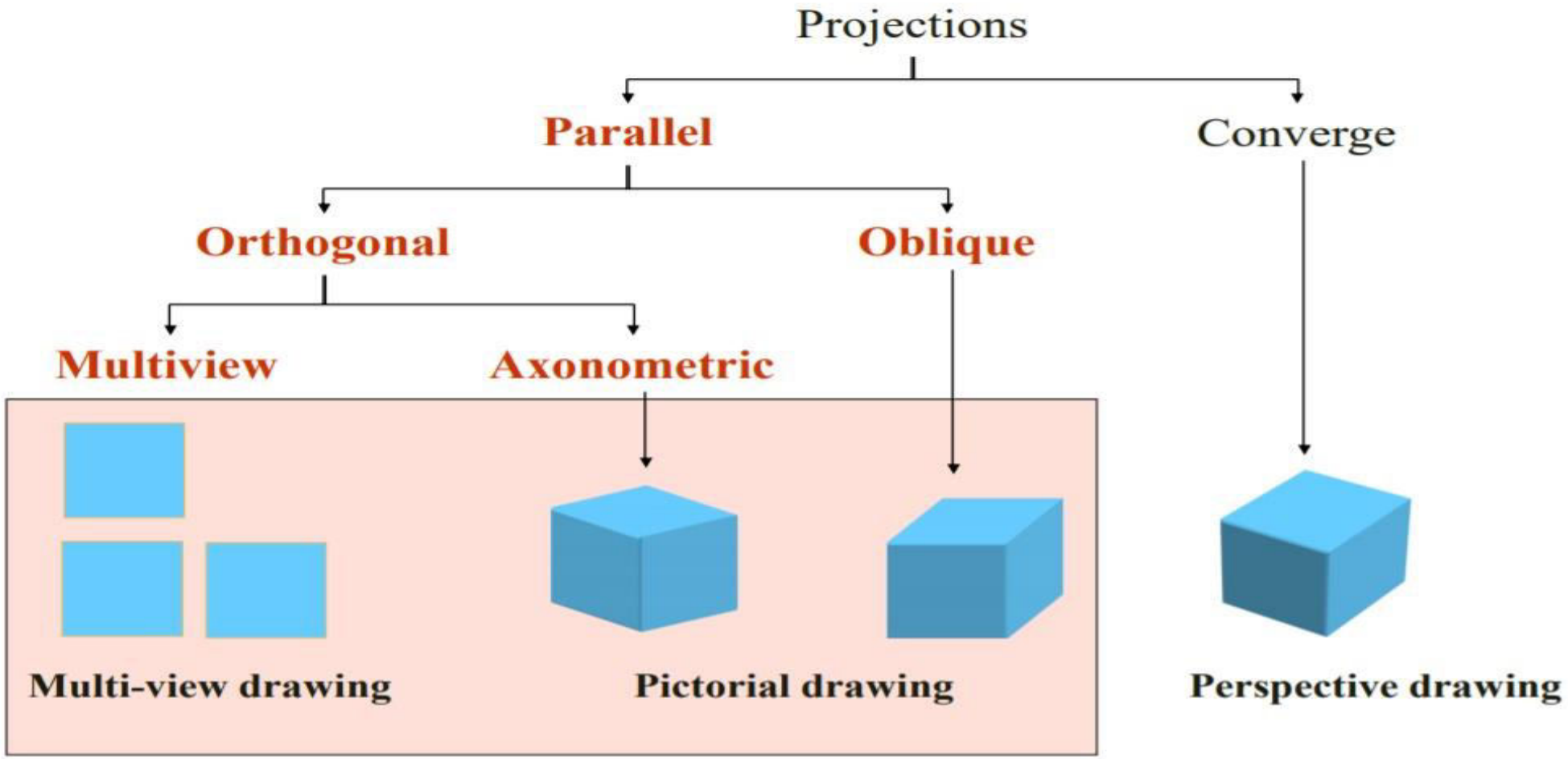
Orthographic Projection

Presented By: Kavita Thakur

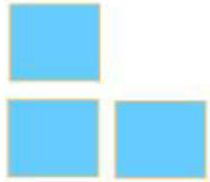
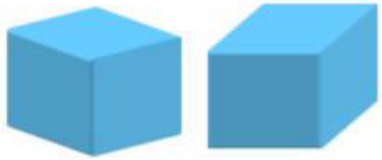
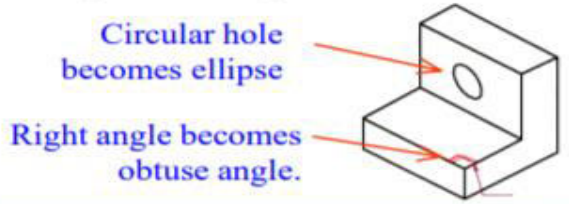
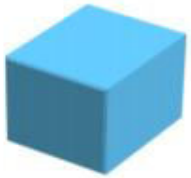
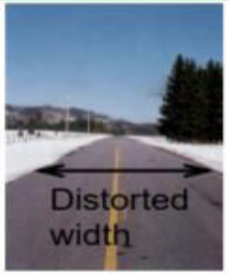
Theory of Projection

- Projection Methods are used to represent a 3D object on a 2D surface.
- The act of obtaining the image of an object is termed "projection".
- The image obtained by projection is known as a "view".
- All projection theory are based on two variables:
  - Lines of projection (sight): *Imaginary ray of light between an observer's eye and an object.*
  - Plane of projection: *Imaginary flat plane which the image is created.*

Different Projection Methods



View Comparison

Type		
Multi-view drawing 	● Accurately presents object's details, i.e. size and shape.	● Require training to visualization.
Pictorial drawing 	● Easy to visualize.	● Shape and angle distortion 
Perspective drawing 	● Object looks more like what our eyes perceive.	● Difficult to create ● Size and shape distortion 

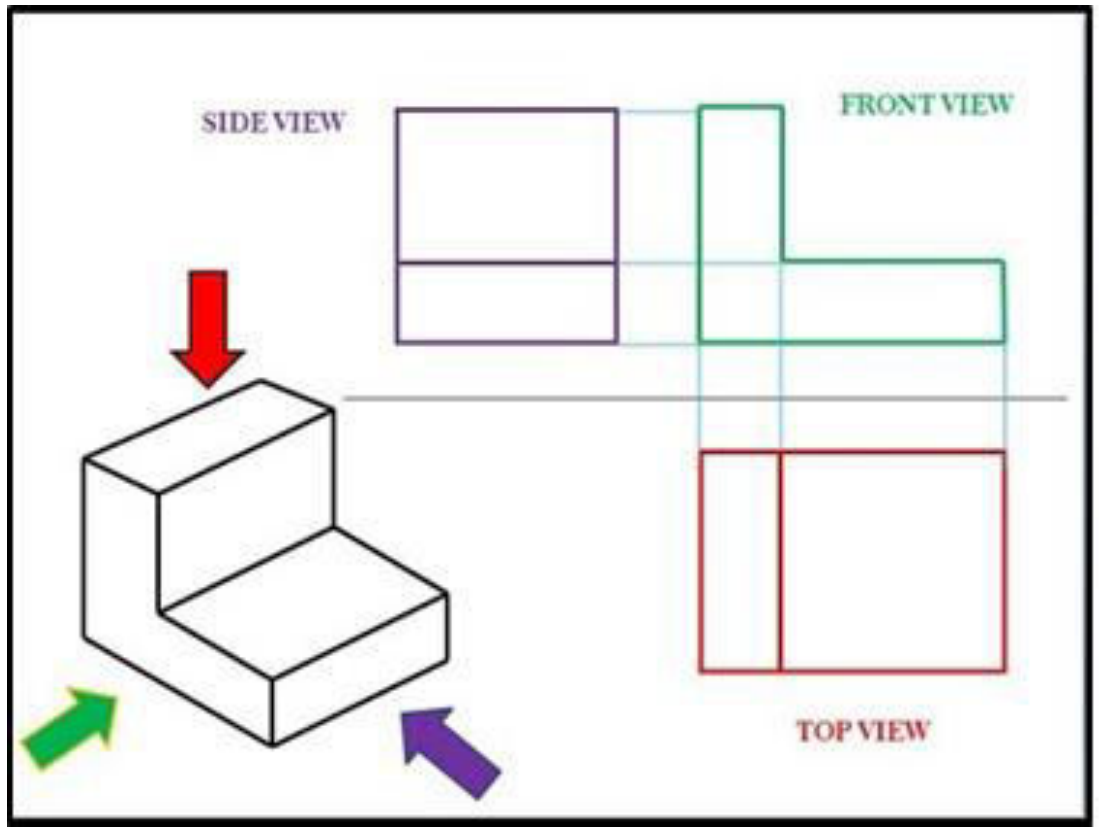
ORTHOGRAPHIC PROJECTION

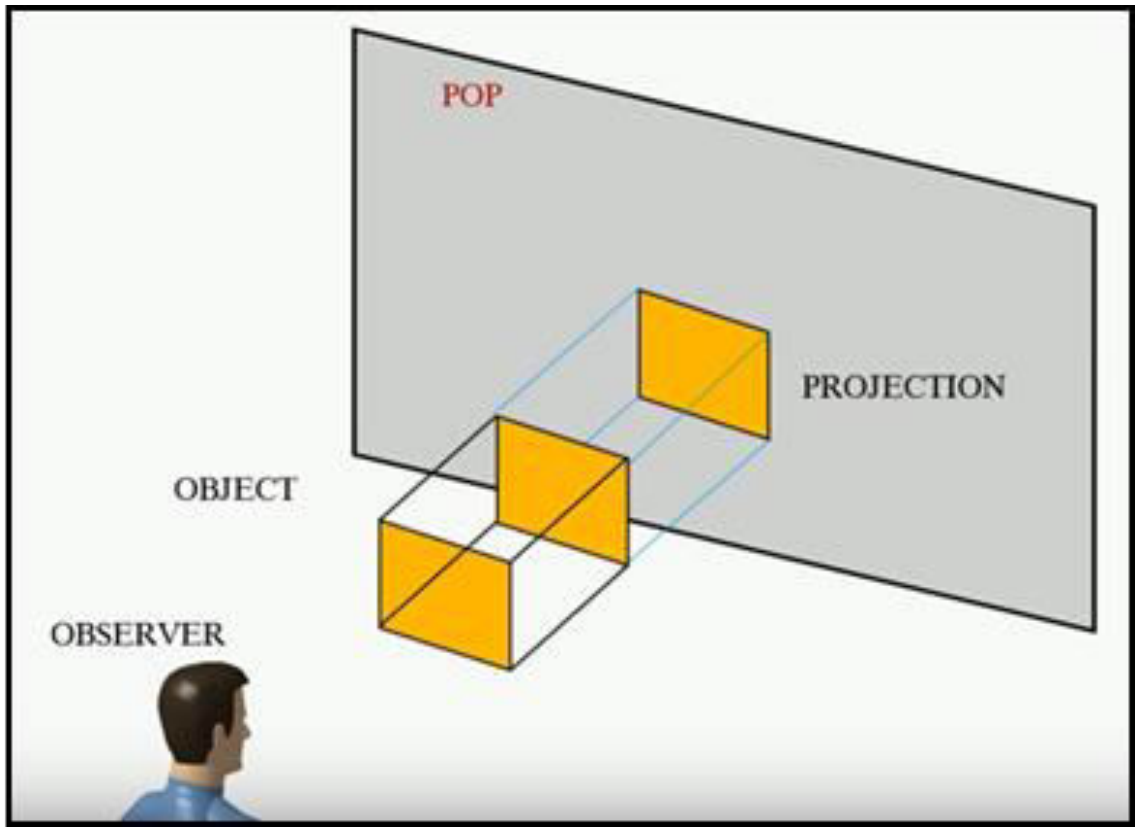
Orthographic Projection is a technical drawing in which different views of an object are projected on different reference planes observing perpendicular to respective reference plane.

The Different Reference planes are:	The Different views are :
Horizontal Plane (HP)	Top View (TV) – Projected on HP
Vertical Plane (VP)	Front View (FV) – Projected on VP
Side or Profile Plane (PP)	Side View (SV) – Projected on PP

Orthographic Projection

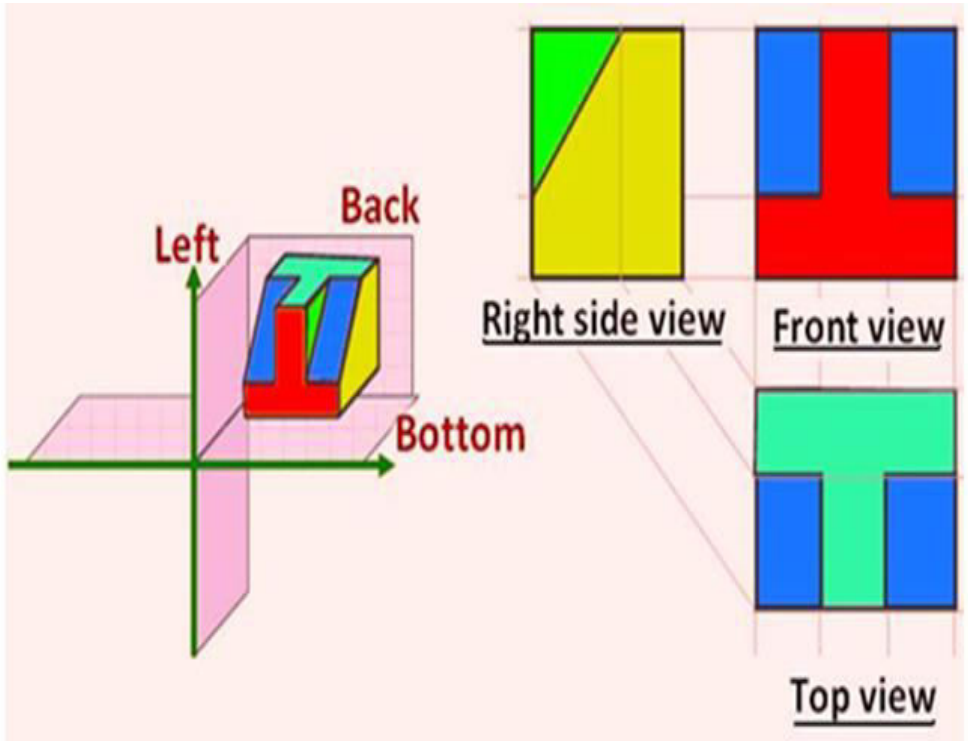
Orthographic Projection: The projection in which the projectors are parallel to each other and perpendicular to the plane

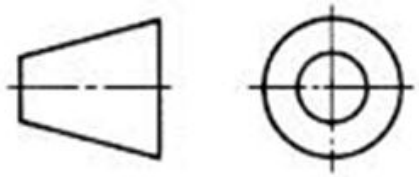




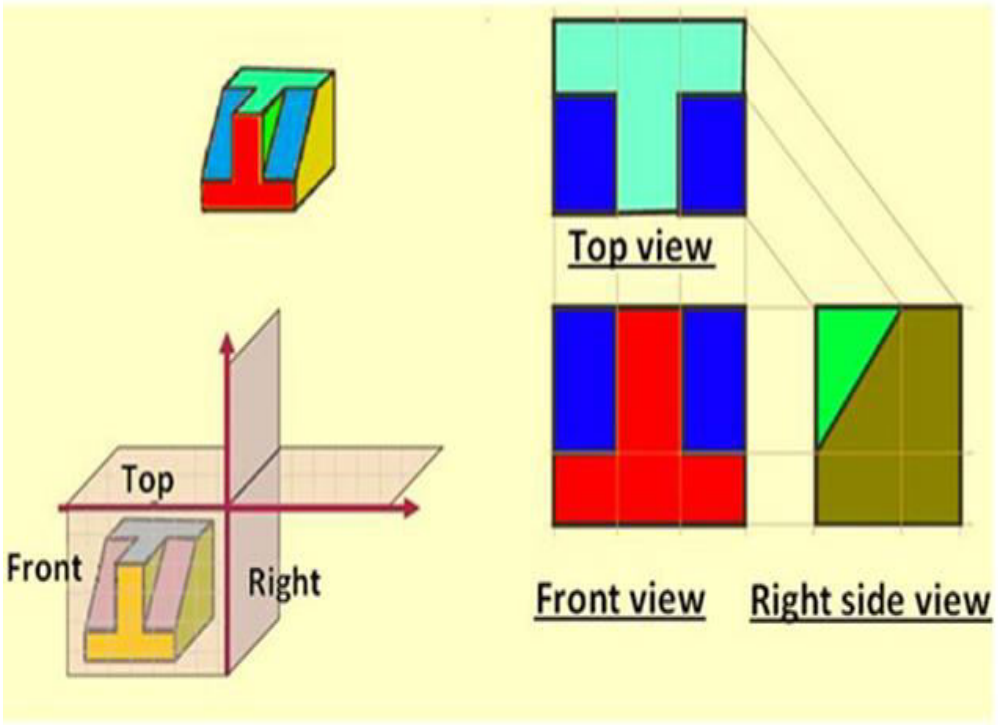
First & Third angle Projection Method

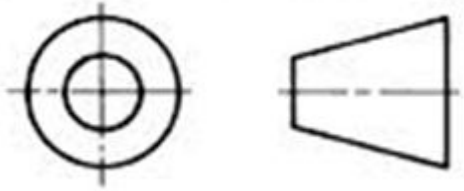
First Angle Projection Method



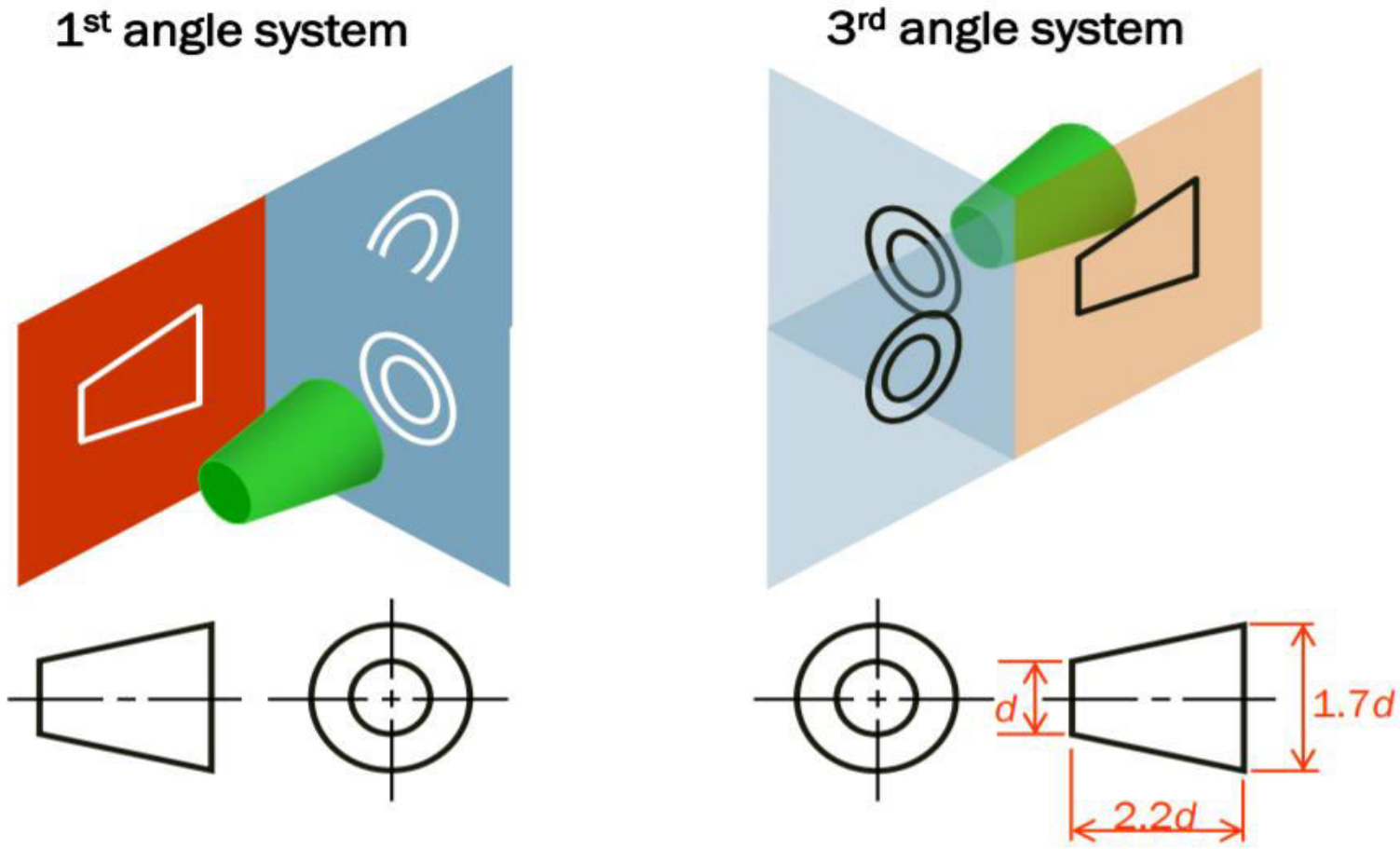


Third Angle Projection Method





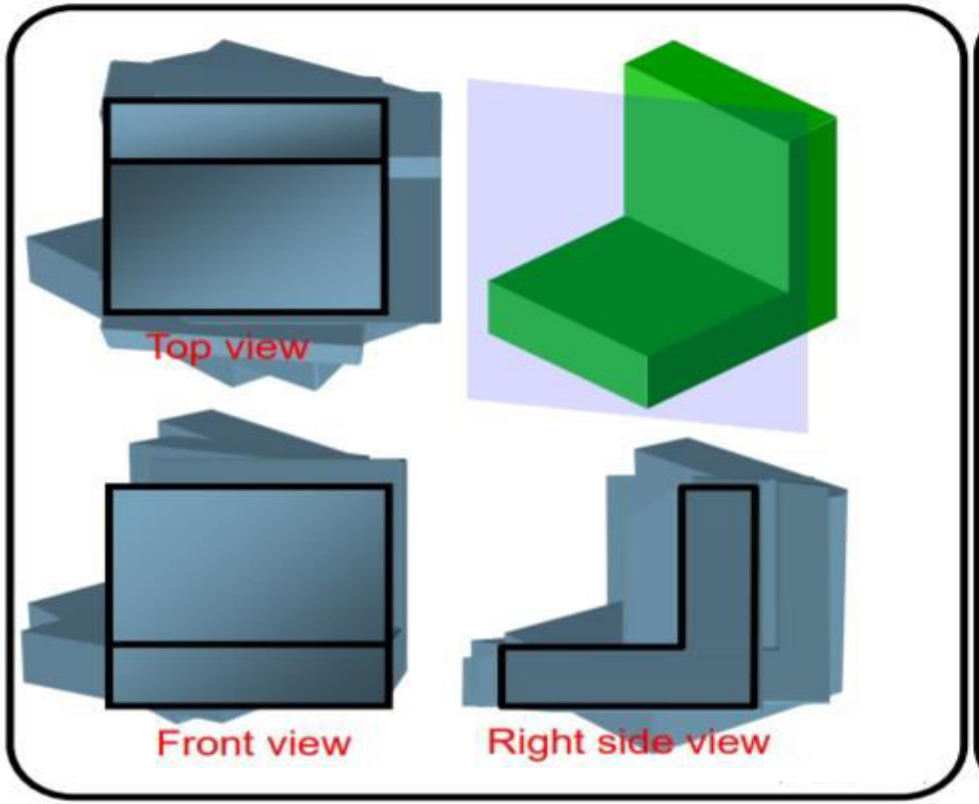
Projection Symbols



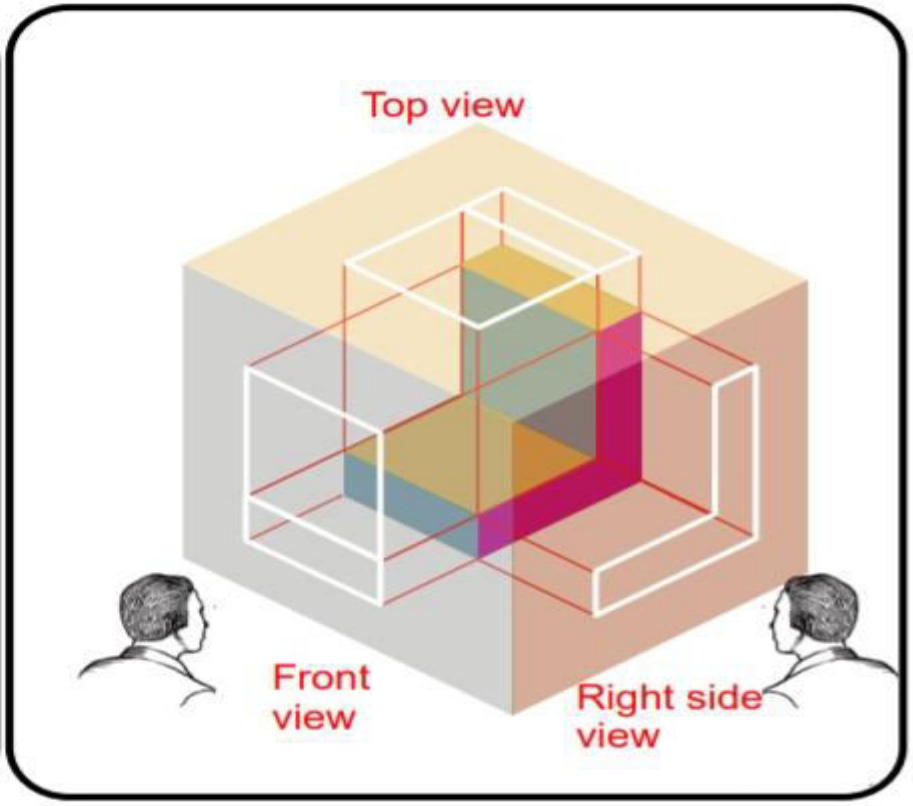
Methods of Orthogonal Projections

1. Natural Method : Revolves the object with respect to the observer.
2. Glass Box Method / Transparent Method : The observer moves around the object.

1.

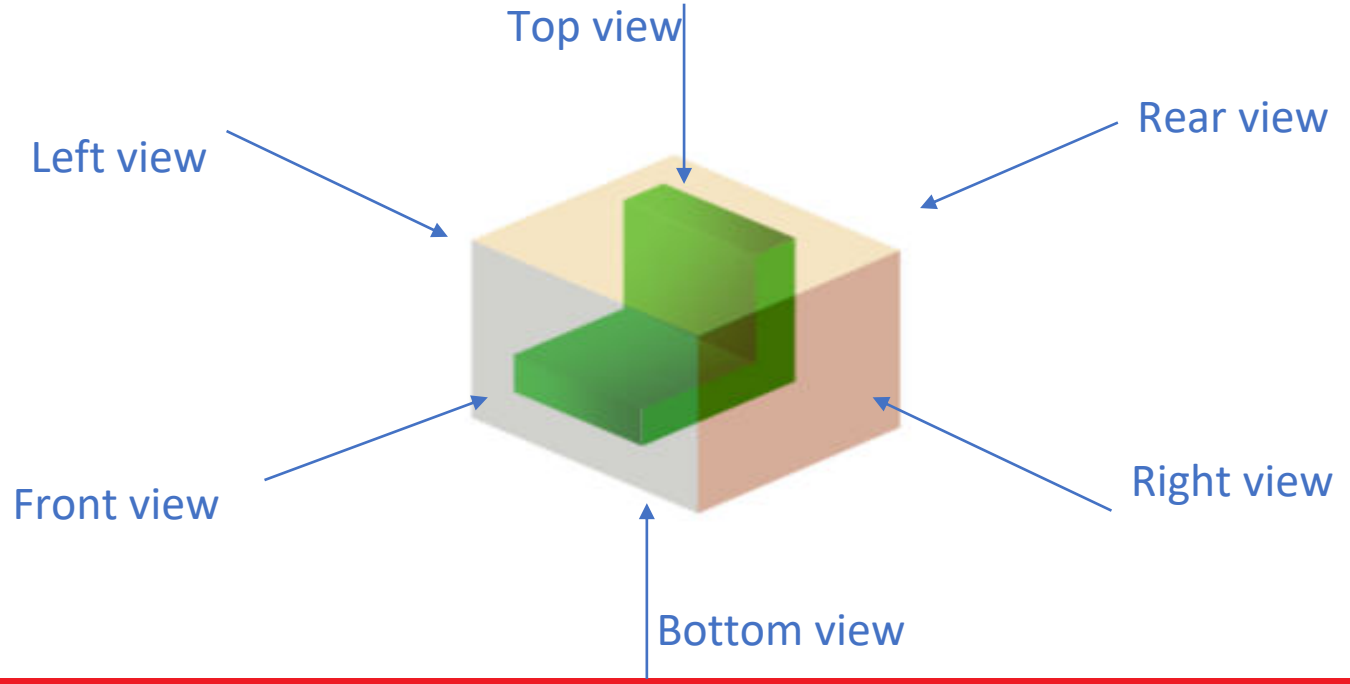


2.

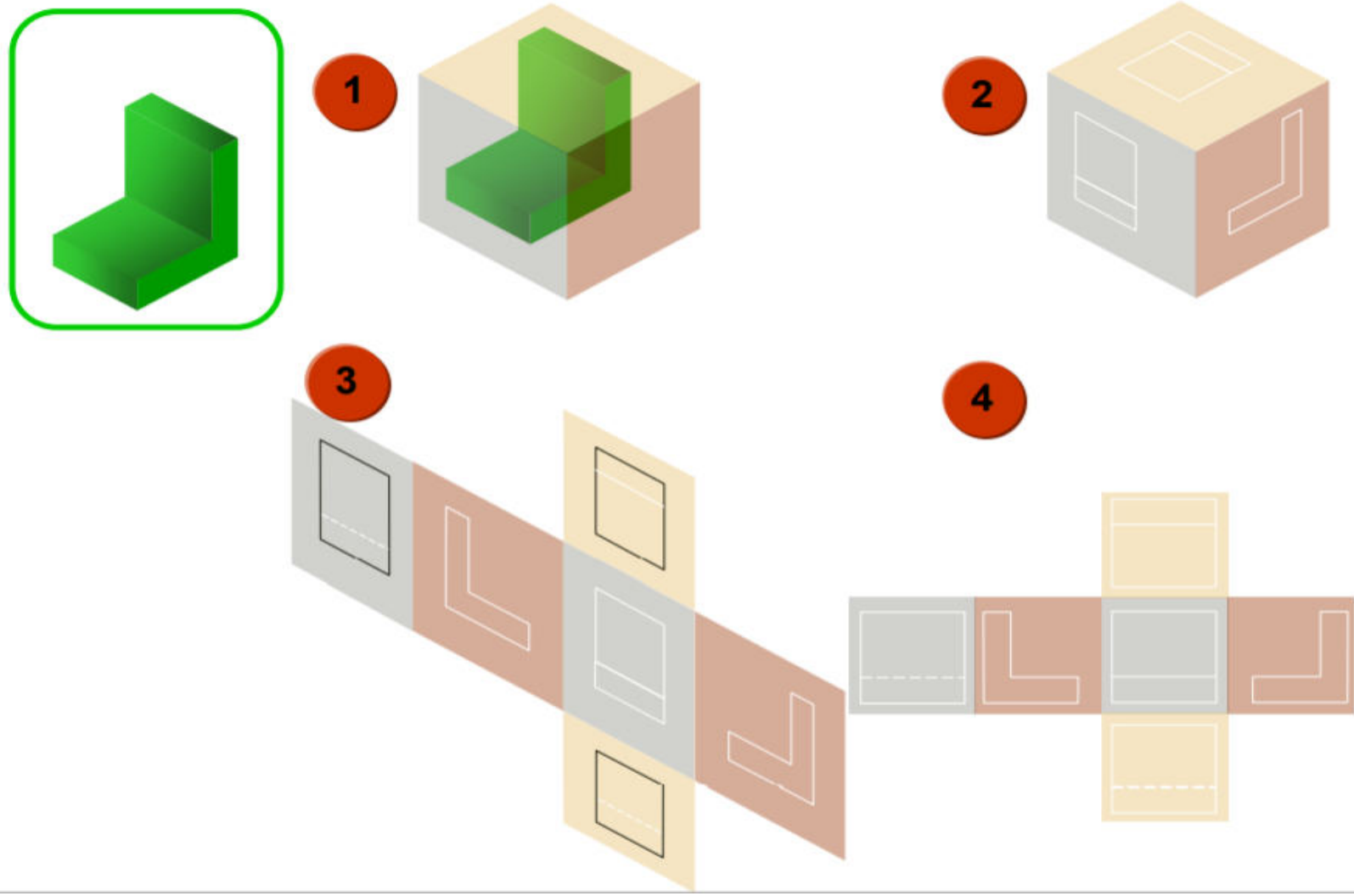


Glass Box Method

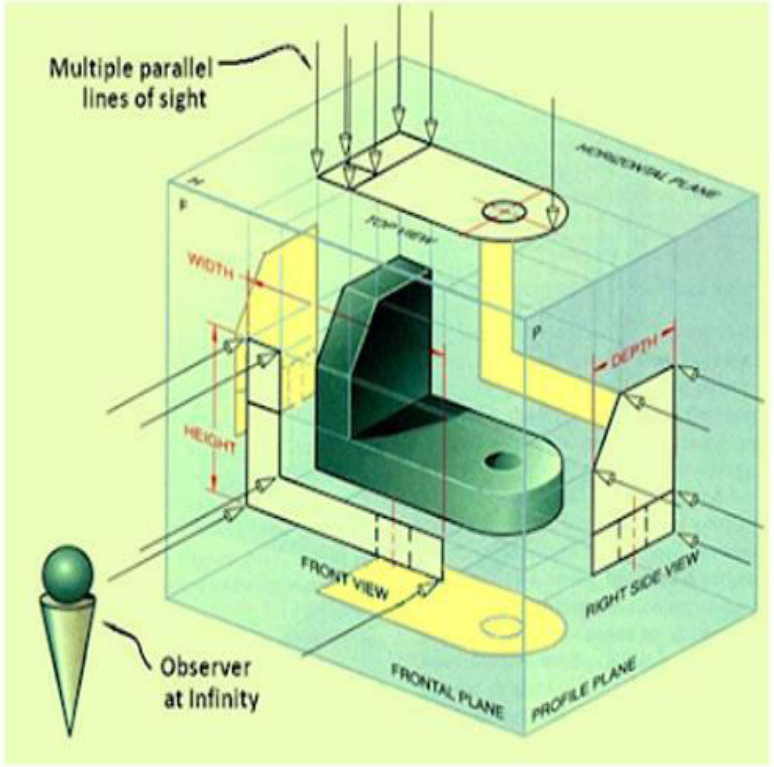
- The object is assumed to be placed in a glass box.
- The 6 sides of the box will be made by the 6 mutually perpendicular planes of projection that are located around the object. Each views will be projected on those planes.
- Unfolding the box produces an arrangement of the six views.

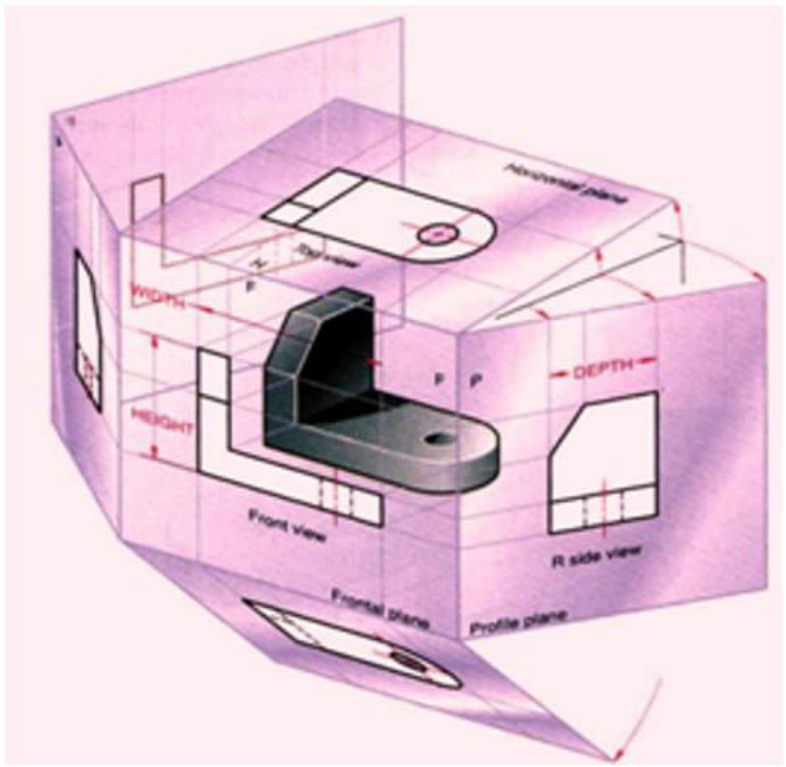


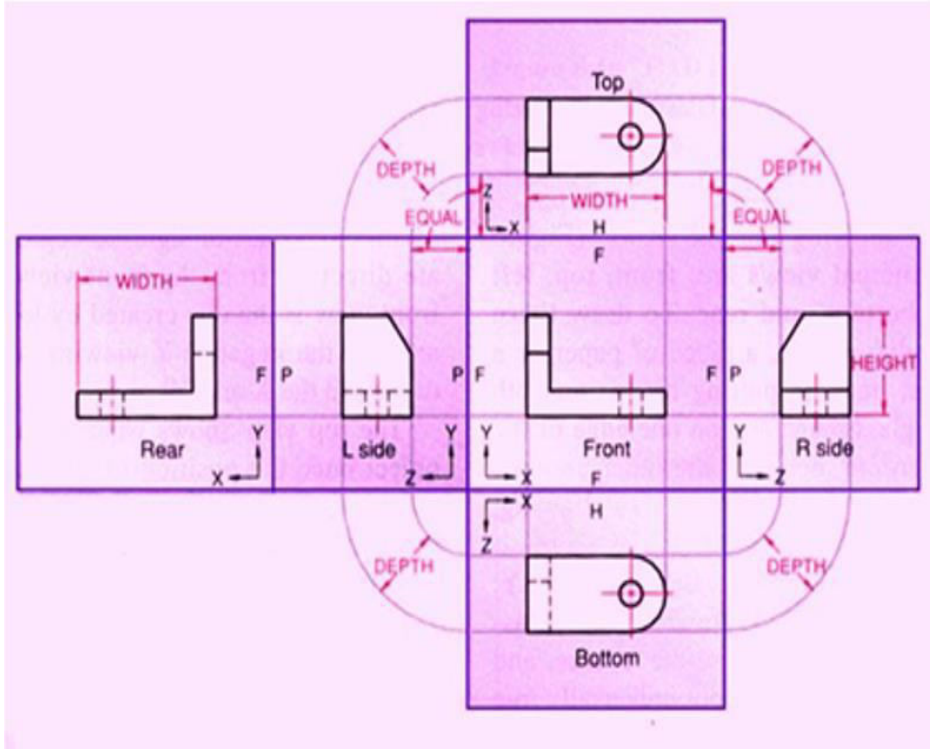
Problem solving Steps



Method of Orthographic Projection

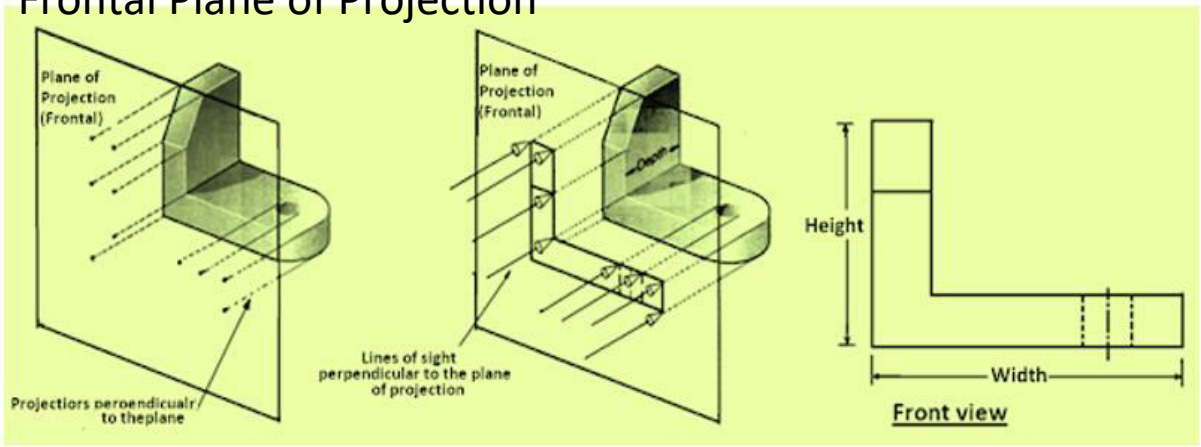




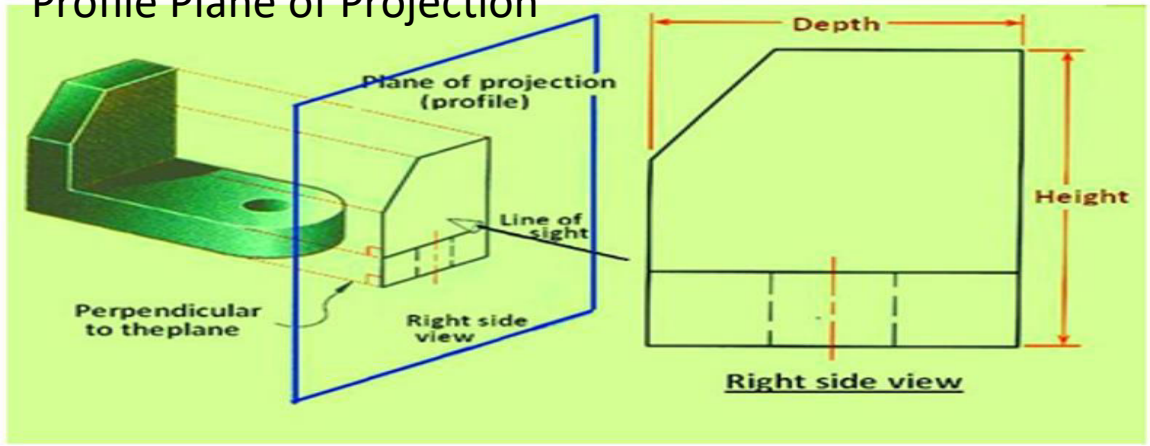


Method of Orthographic Projection

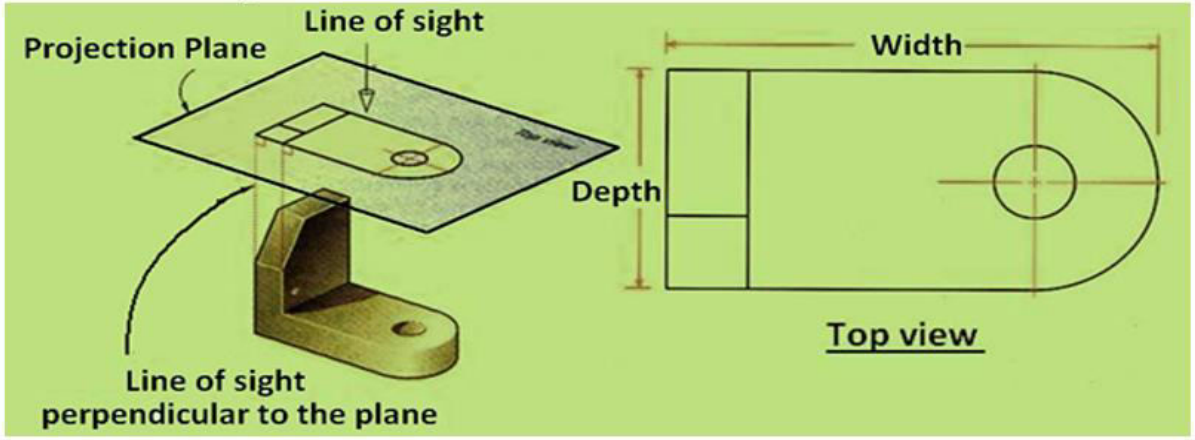
Frontal Plane of Projection

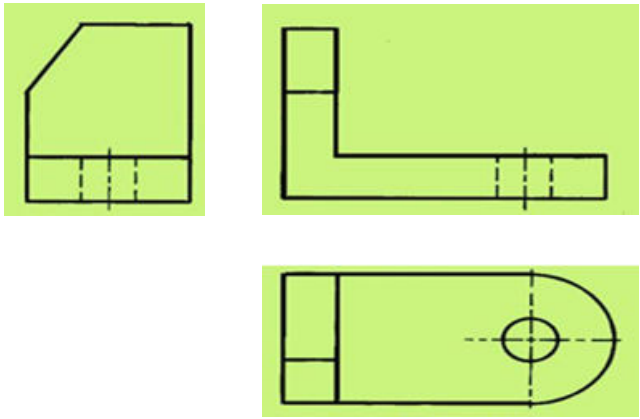


Profile Plane of Projection



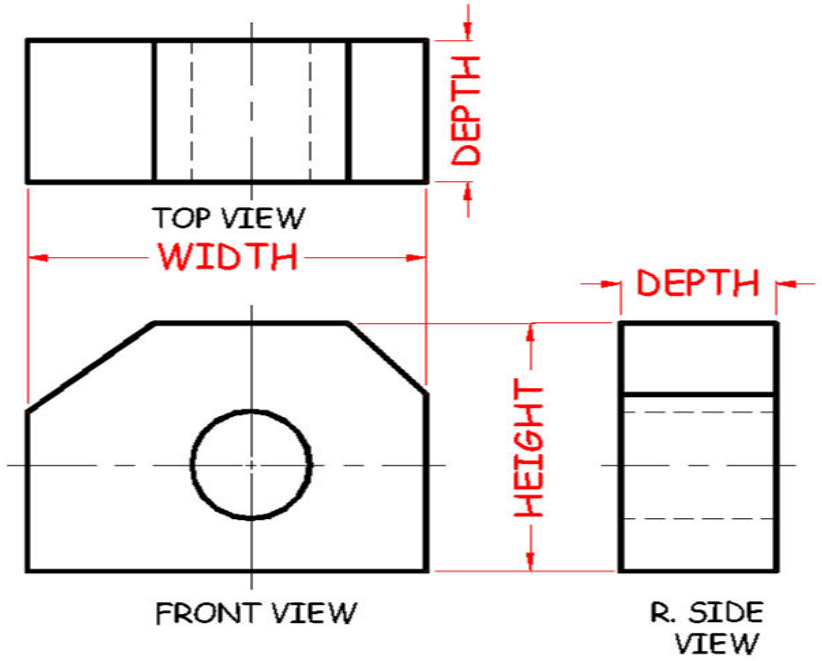
Horizontal Plane of Projection

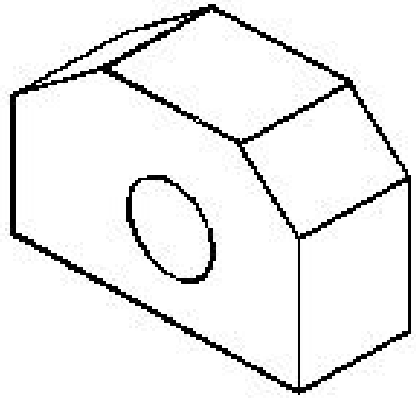




Object Dimensions

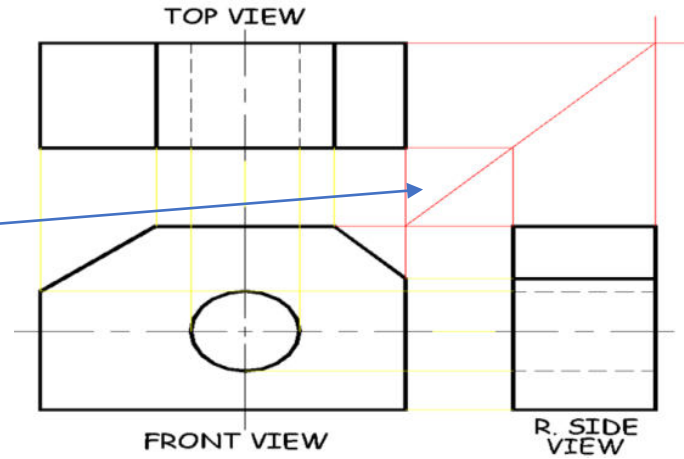
- Top View
  Shows width & depth
- Front View
  Shows width & height
- Side View
  Shows height & depth





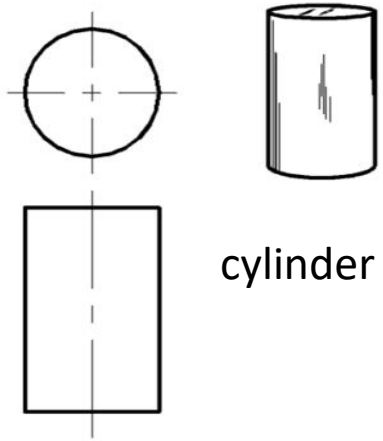
(Third angle projection)

- Depth can be projected between views by using a 45° line

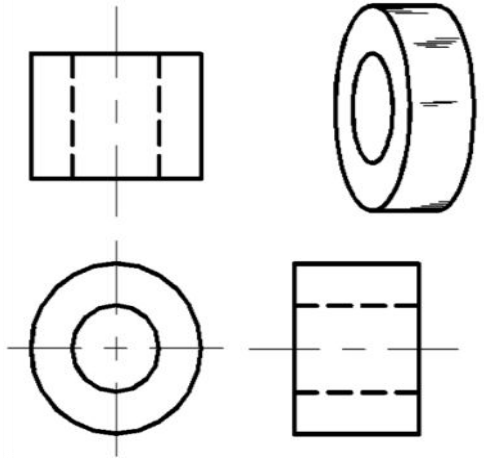


Choosing Views

- Views should be visually balanced within the working space.
- Complex objects require 3 views describe its shape fully.
- Simple objects require only two views. Third view would add nothing to the description.
- Some curved surfaces do not show as curves in all views.



cylinder



wheel

Line Types

Lines signify more than just the geometry of the object so its important to use the appropriate line type.

- Is the feature visible or hidden from view?
- Is the line part of the object or part of a dimension?
- Is the line indicating symmetry?

Illustration	Application
Thick	Outlines, visible edges, surface boundaries of objects, margin lines
Continuous thin	Dimension lines, extension lines, section lines leader or pointer lines, construction lines, boarder lines
Continuous thin wavy	Short break lines or irregular boundary lines – drawn freehand
Continuous thin with zig-zag	Long break lines
Short dashes, gap 1, length 3 mm	Invisible or interior surfaces
Short dashes	Center lines, locus lines Alternate long and short dashes in a proportion of 6:1,
Long chain thick at end and thin elsewhere	Cutting plane lines

Precedence of Lines

- Visible lines takes precedence over all other lines.
- Hidden lines and cutting plane lines take precedence over center lines
- Center lines have lowest precedence
- *NOTE:*

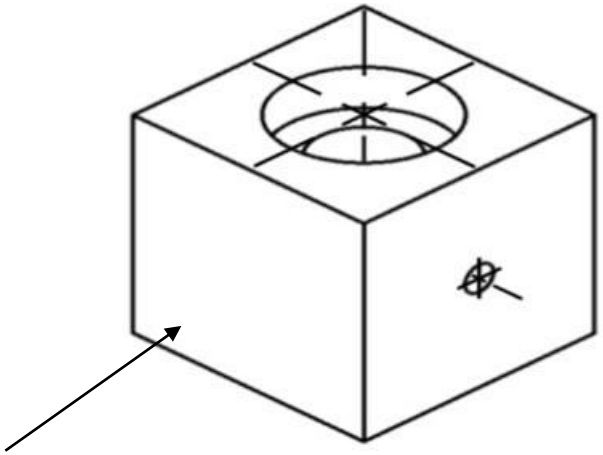
When the Visible line coincides with hidden or center line

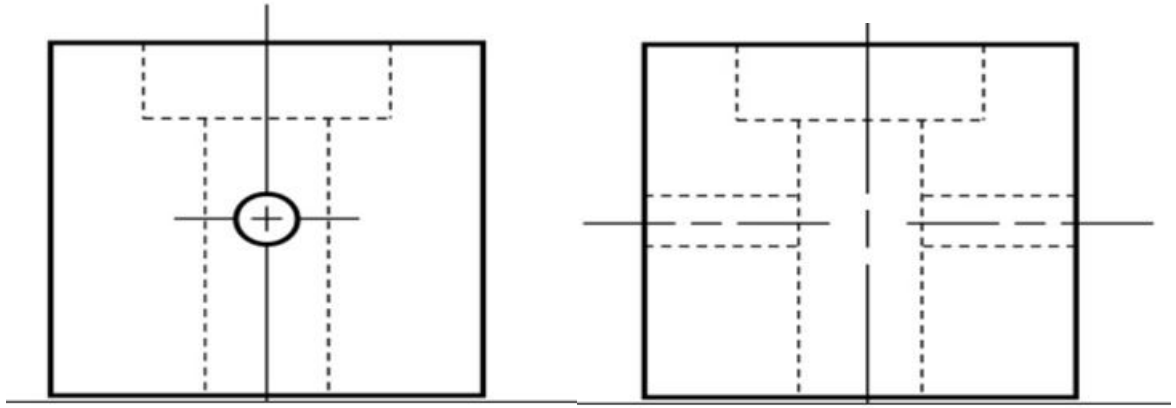
- Visible line is shown

Hidden line coincides with center line

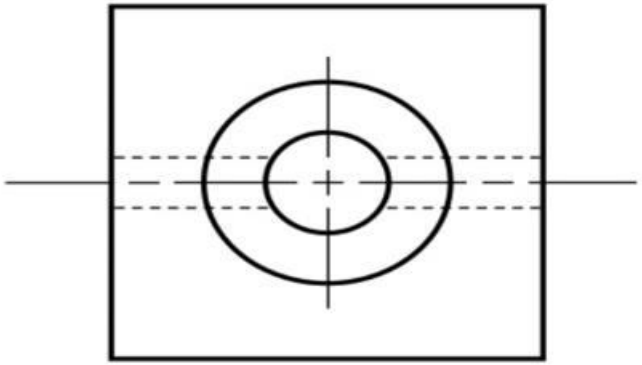
- Hidden line is shown

Precedence of Lines



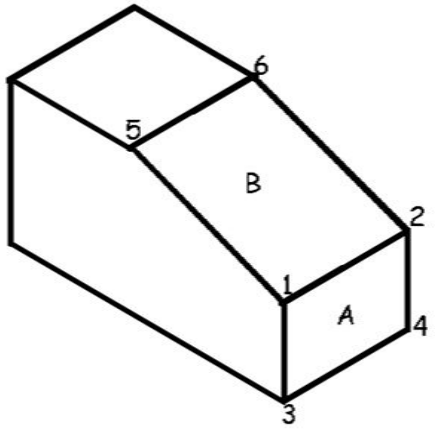


1. Visible
2. Hidden
3. Center



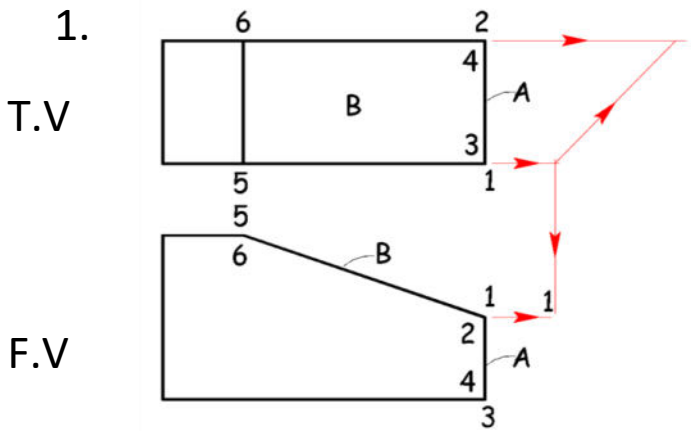
Straight Edges

- Edges that are perpendicular to a plane of projection appear as a point.



- Edges that are parallel to a plane of projection appear as lines
- Edges that are inclined to a plane of projection appear as foreshortened lines

1.



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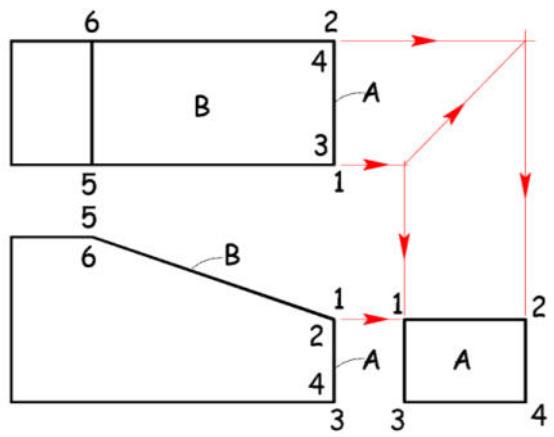

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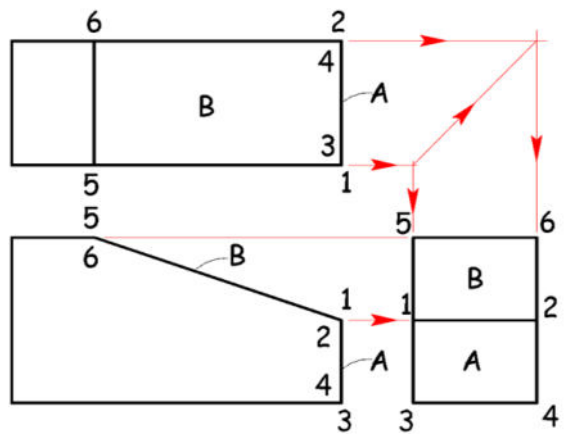
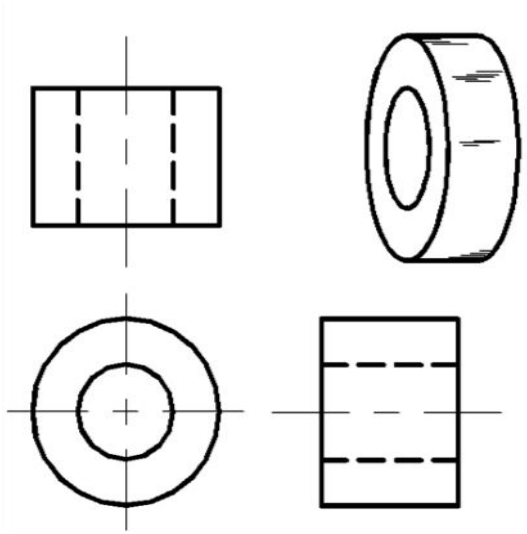
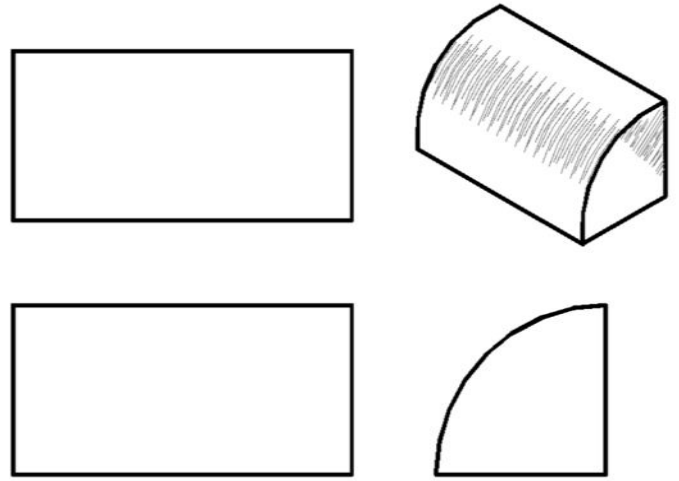


Curved Edges

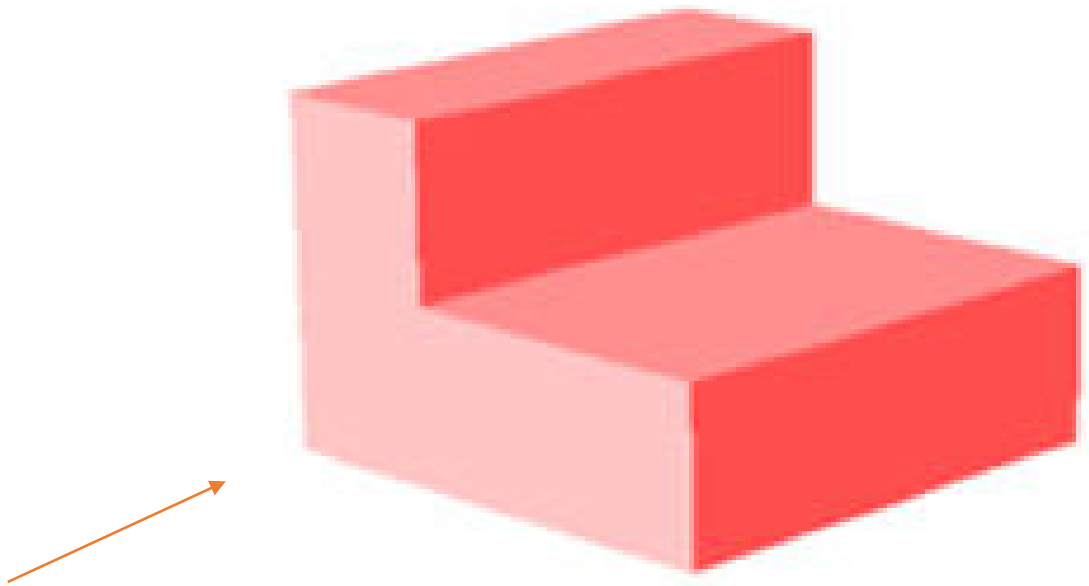
- Curved edges project as straight lines on the plane to which they are perpendicular
- Curved edges project as curved lines on the planes to which they are parallel or inclined

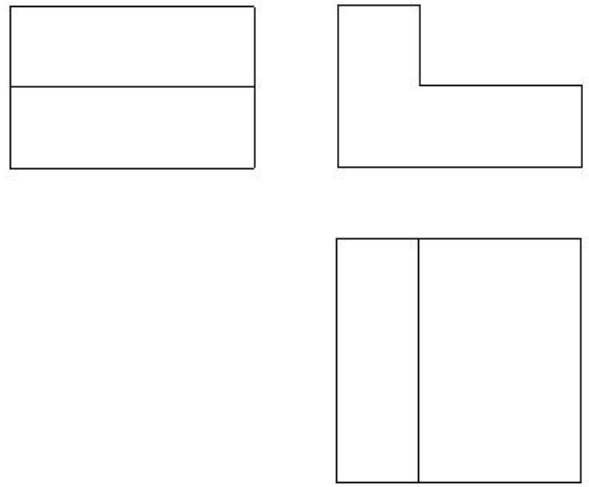




Normal Surfaces

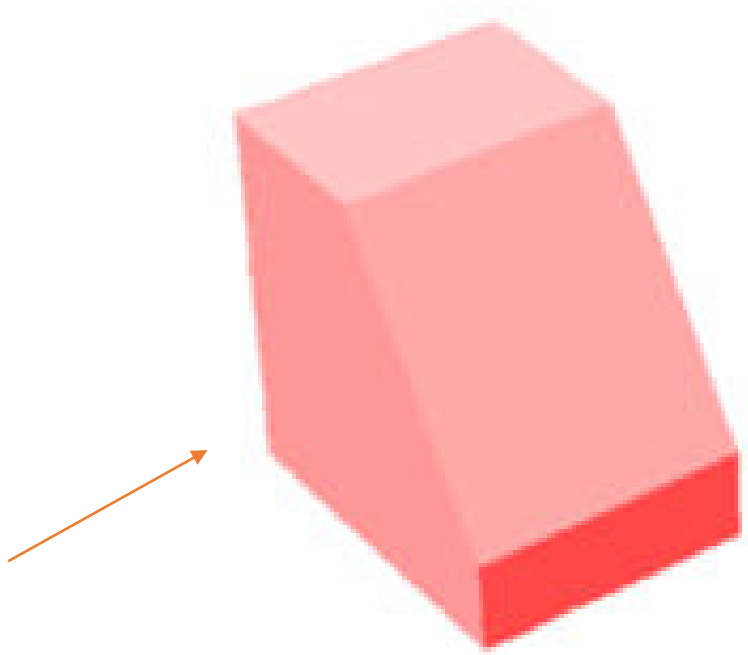
- Normal surfaces appear as an edge in two opposite principal views, and appear a surface in all other principal views.

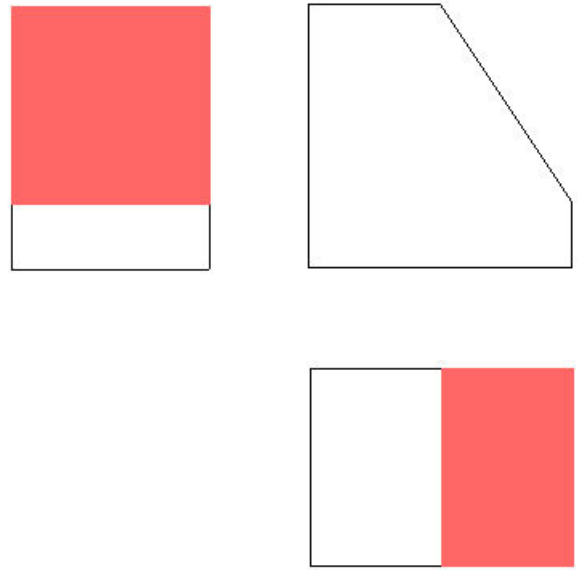




Inclined Surfaces

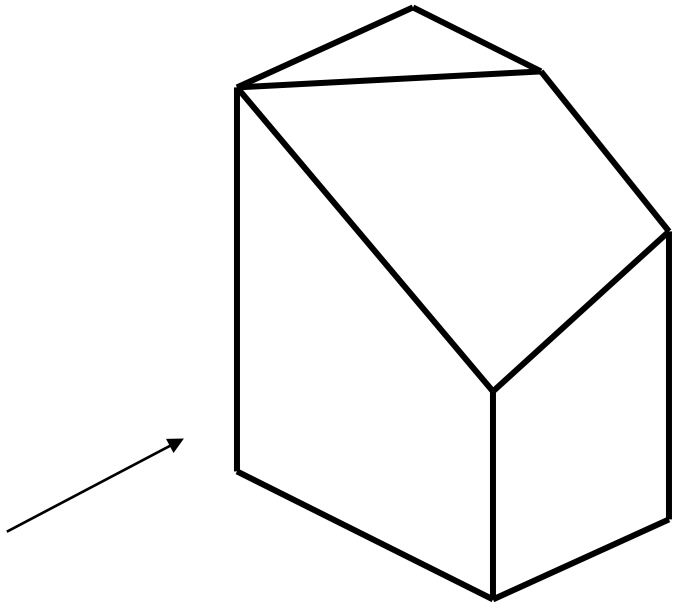
- Inclined surfaces appear as an edge in two opposite principal views, and appear foreshortened (not true size) in all other principal views.

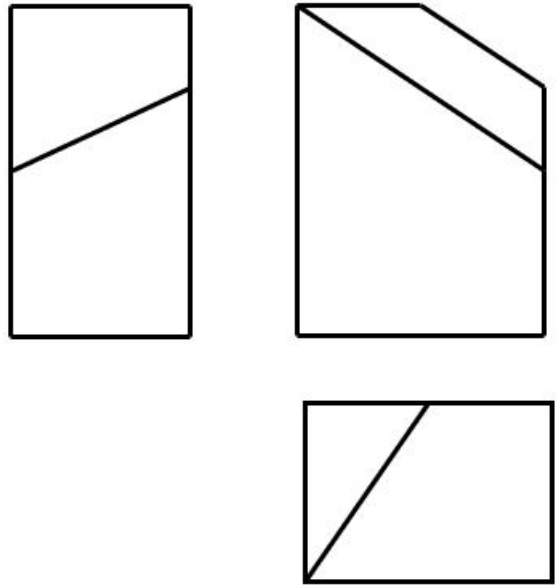




Oblique Surfaces

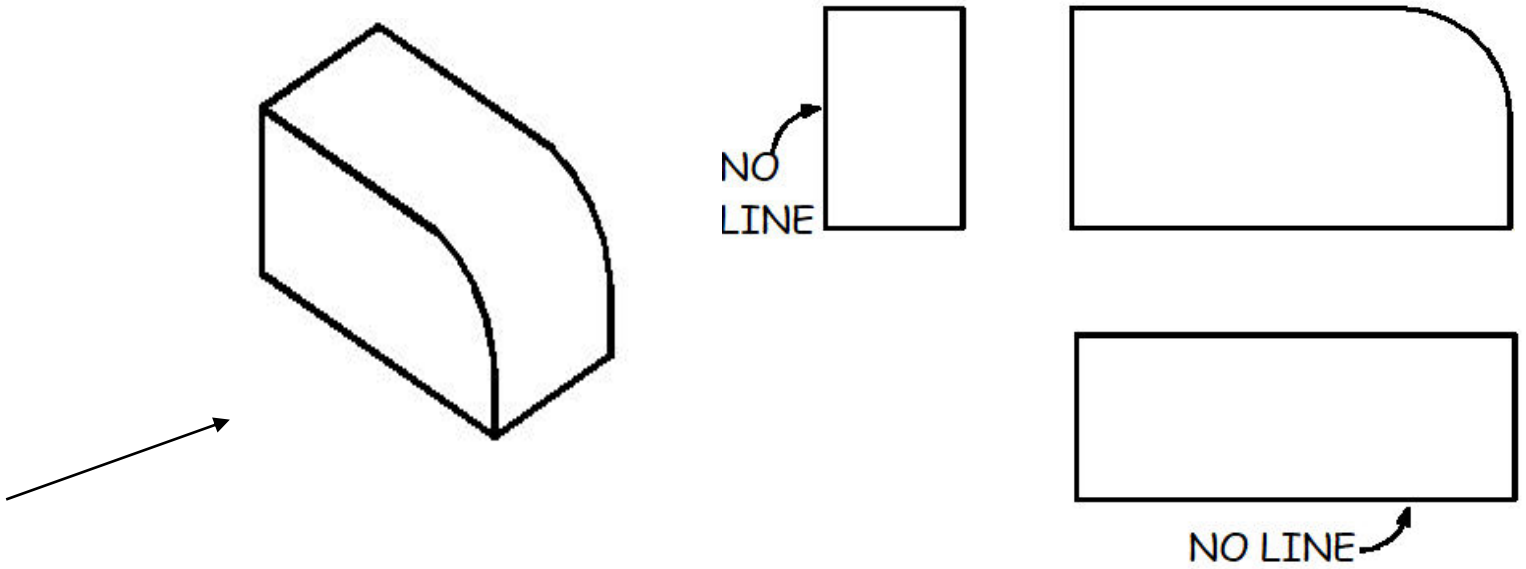
- Oblique surfaces do not appear either as an edge or true size in any principal view.





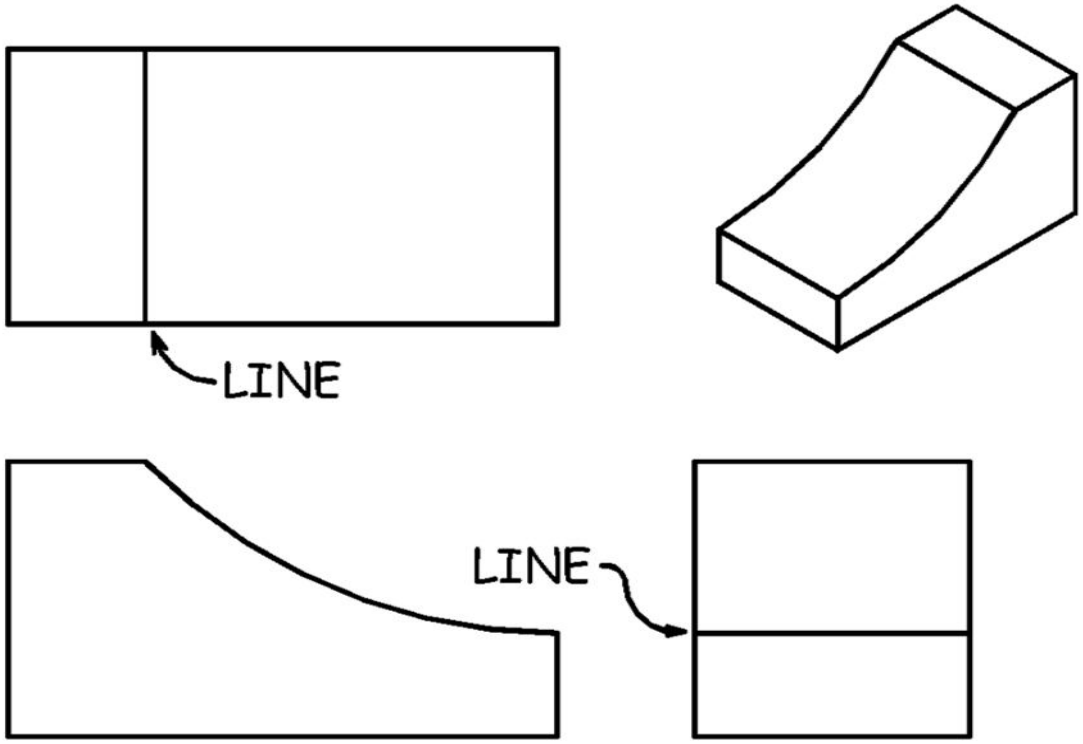
Intersections & Tangencies

- Where a curved surface is *tangent* to a plane surface, no line should be shown where they join



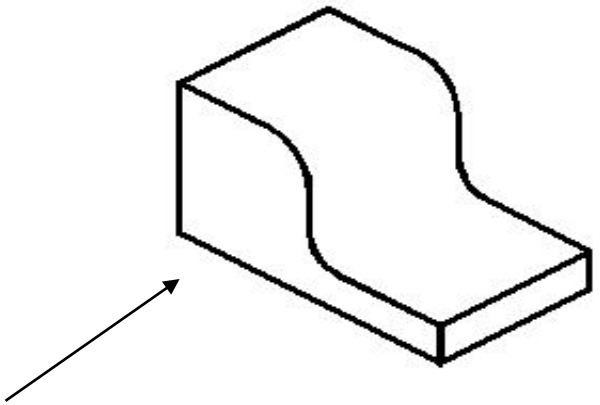
Intersections & Tangencies

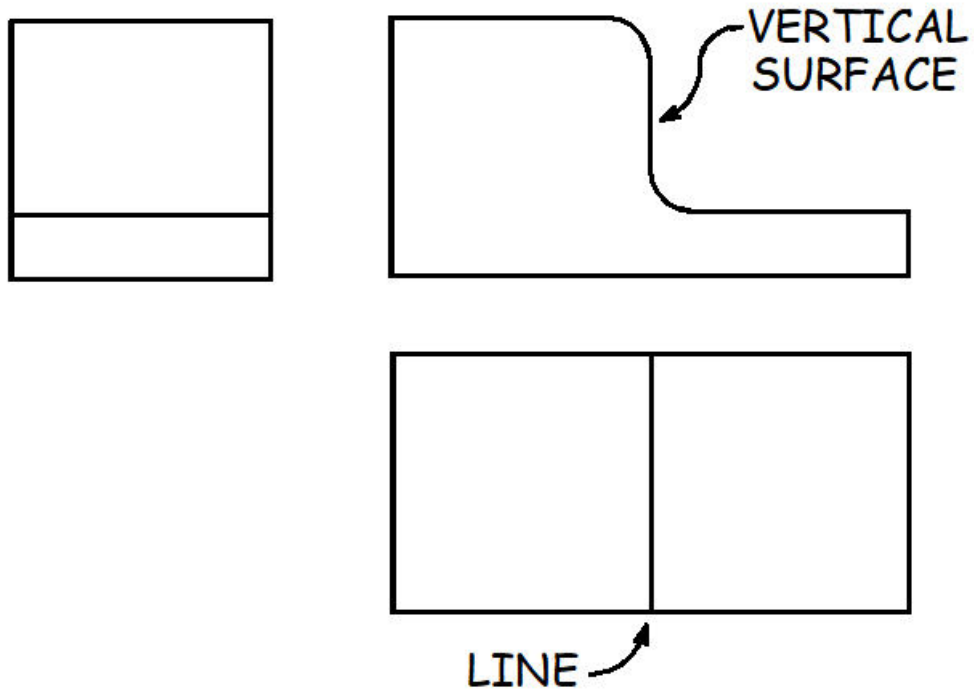
- Where a plane surface intersects a curved surface, an edge is formed



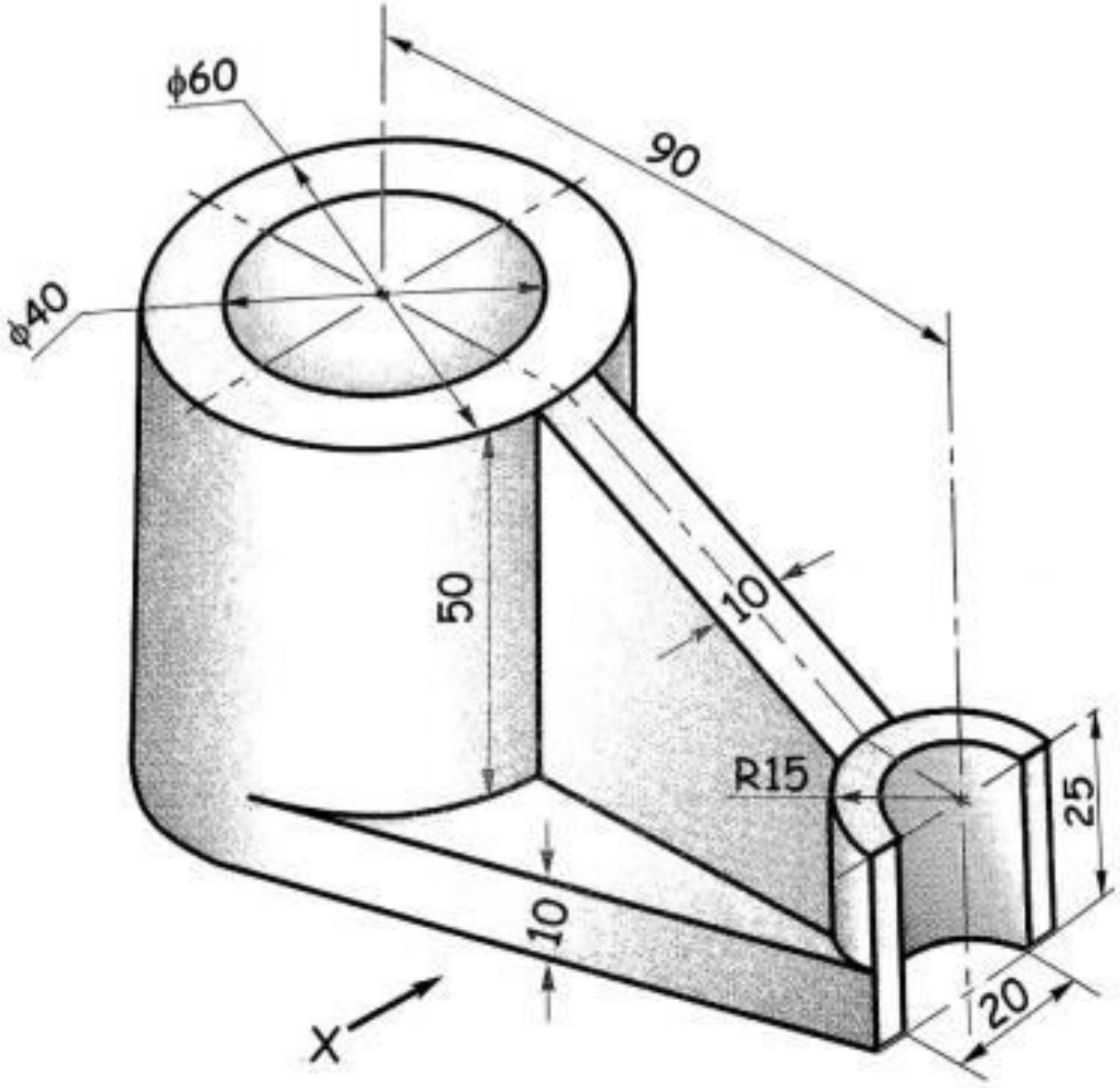
Intersections & Tangencies

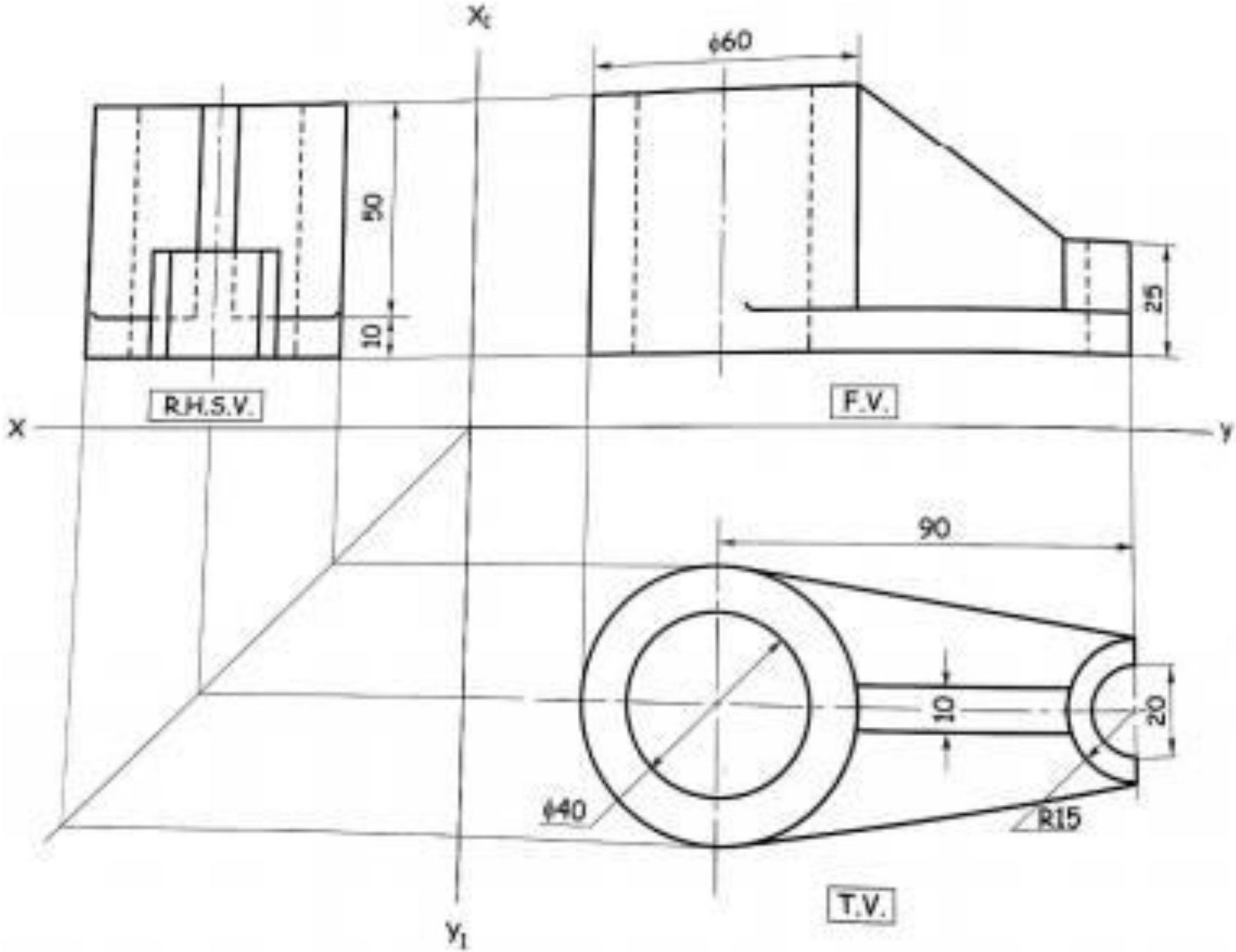
- Where the plane surface is horizontal or vertical, exceptions to these rules may occur





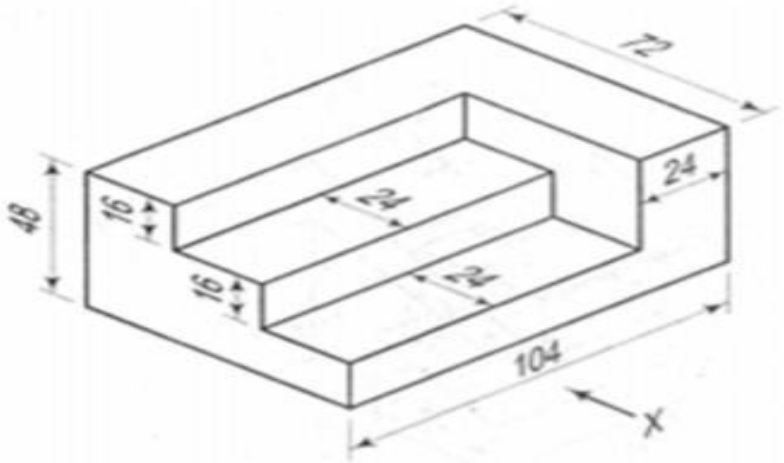
ion



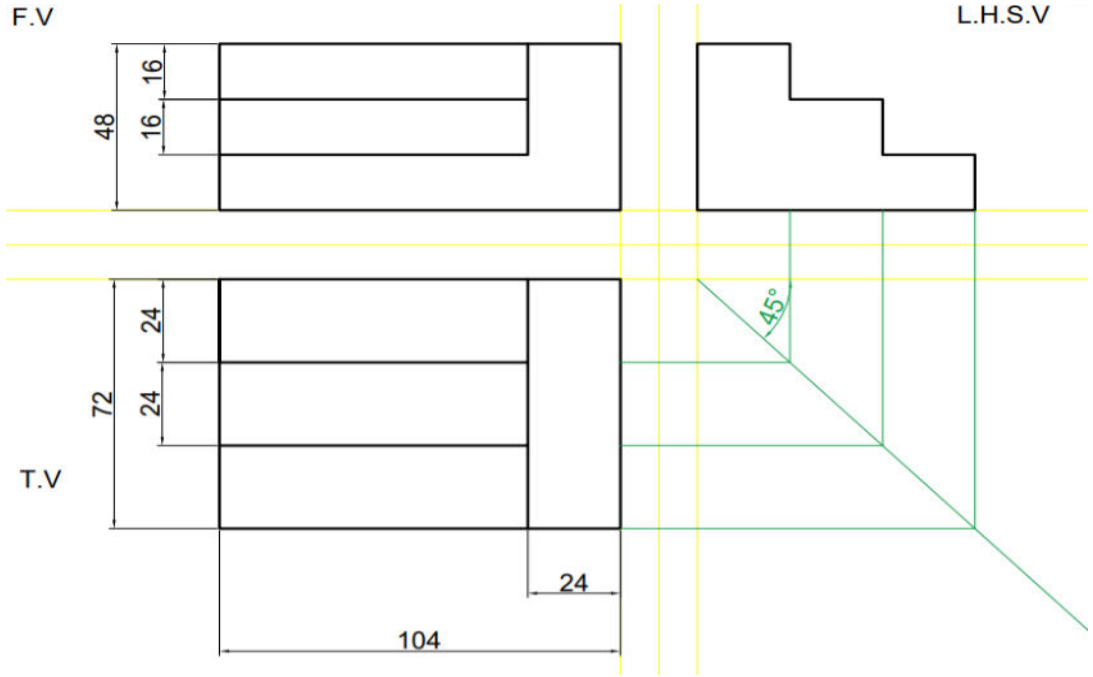

X1
ϕ60
50
10
25
R.H.S.V.
F.V.
X
Y
90
10
20
ϕ40
R15
T.V.
Y1

Practice Problem

Figure below show pictorial views. Draw the T.V, F.V and LHSV views using first angle method of projections.

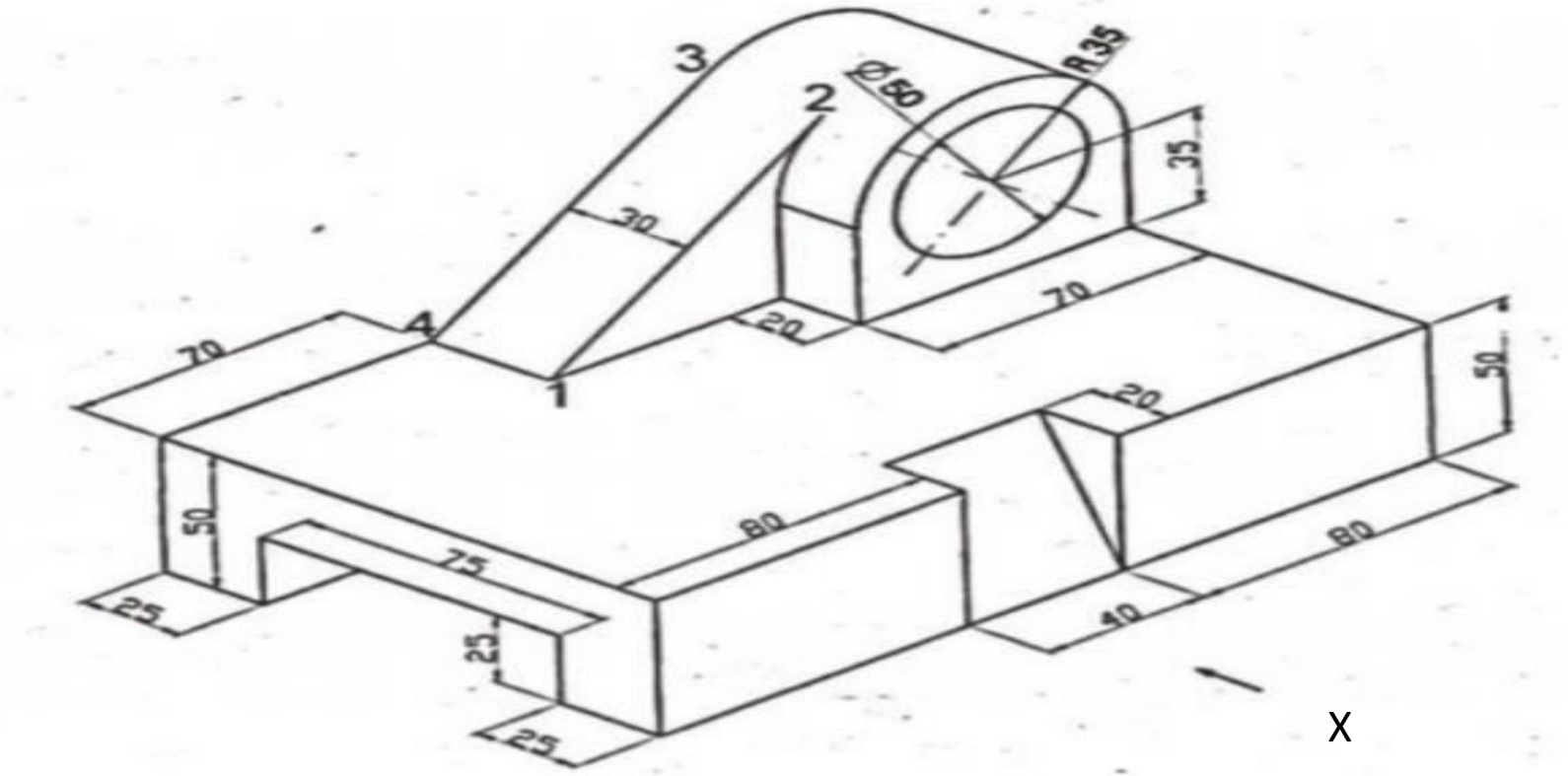


Draw: (i) F.V.
(ii) T.V.
(iii) L.H.S.V.

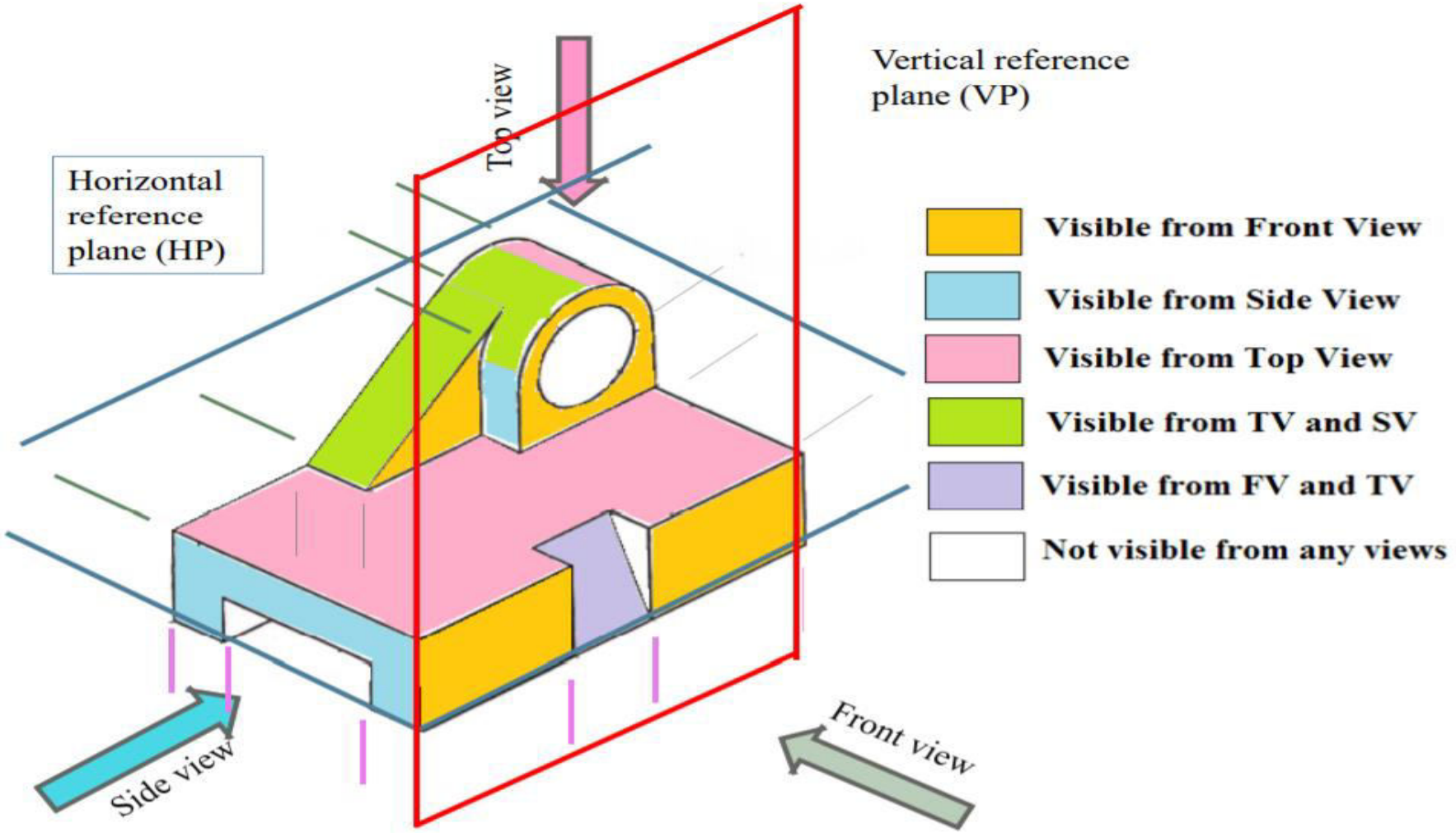


Practice Problem

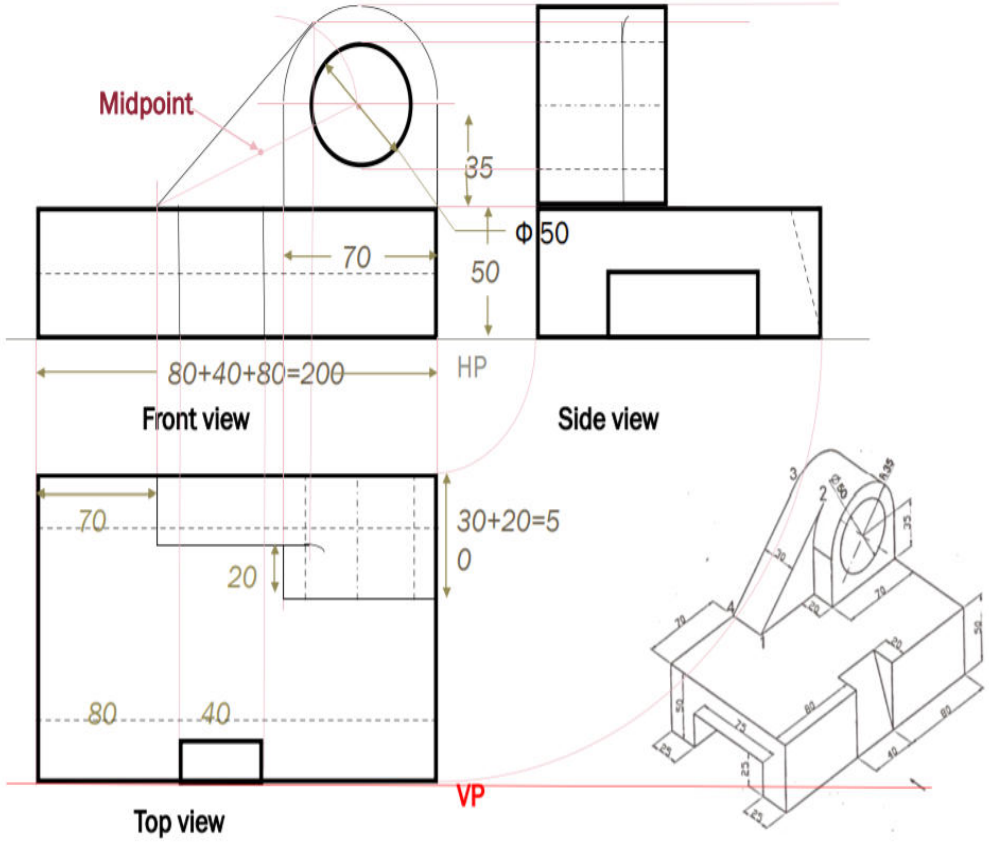
Figure below show pictorial views. Draw the T.V, F.V and LHSV views using first angle method of projections.

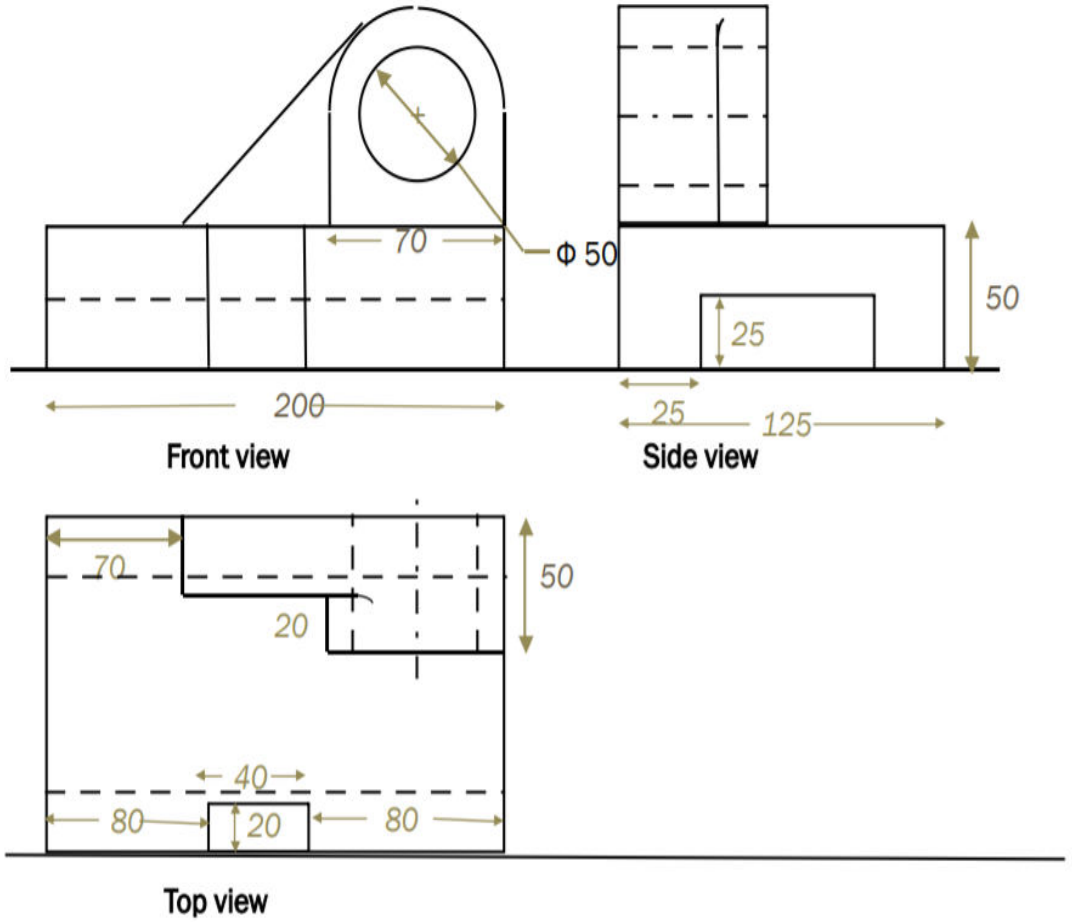


Practice Problem



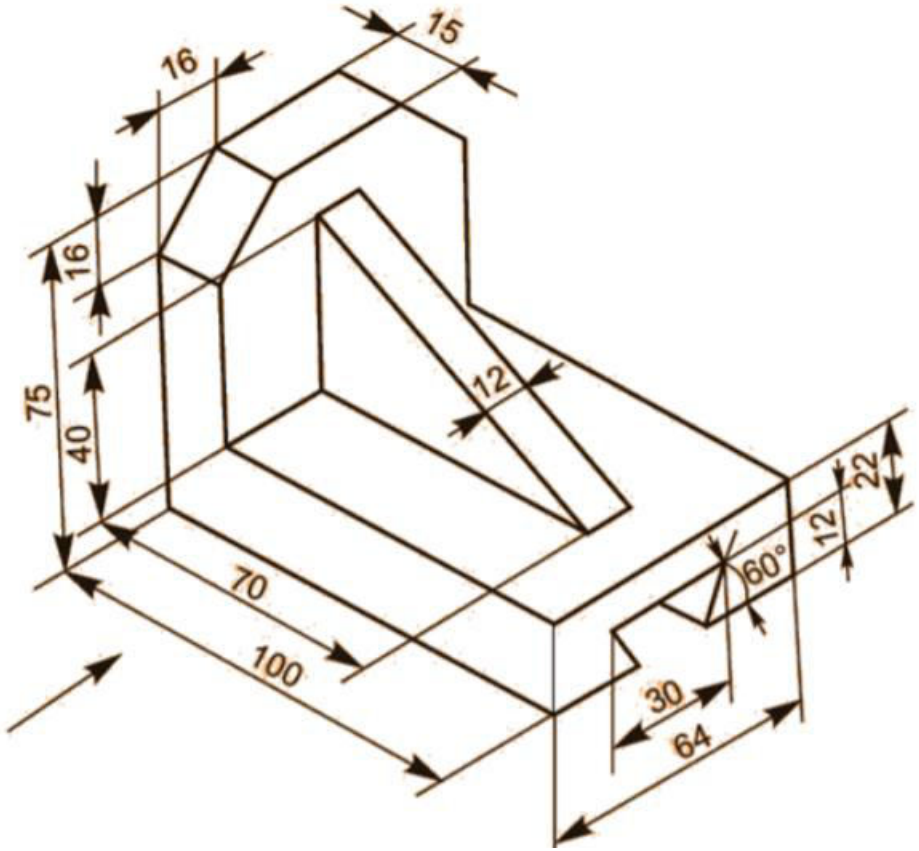
Practice Problem - solution

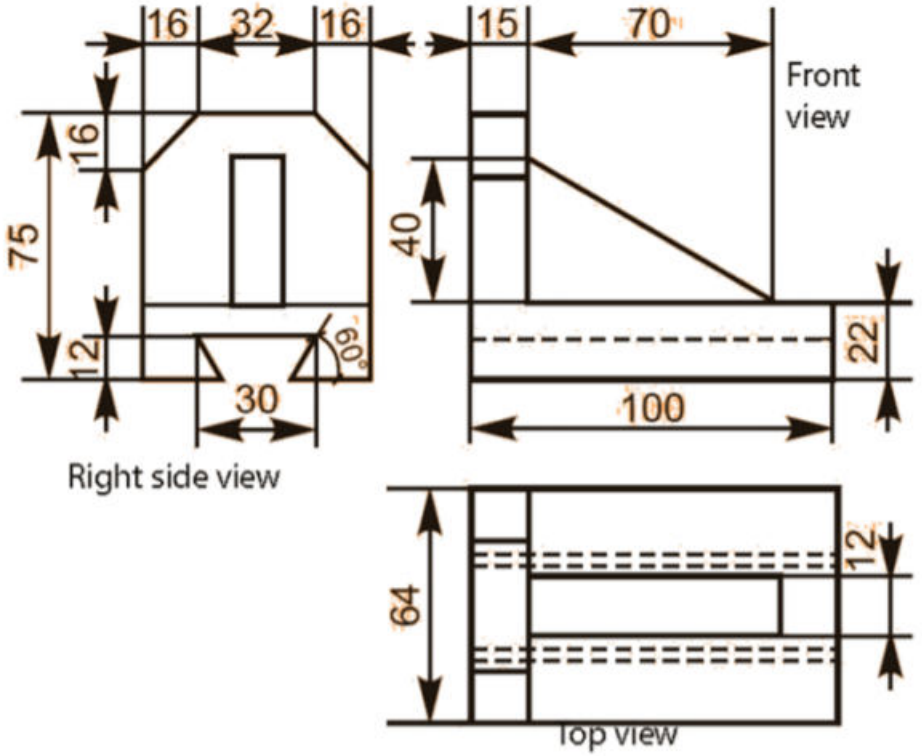




Practice Problem

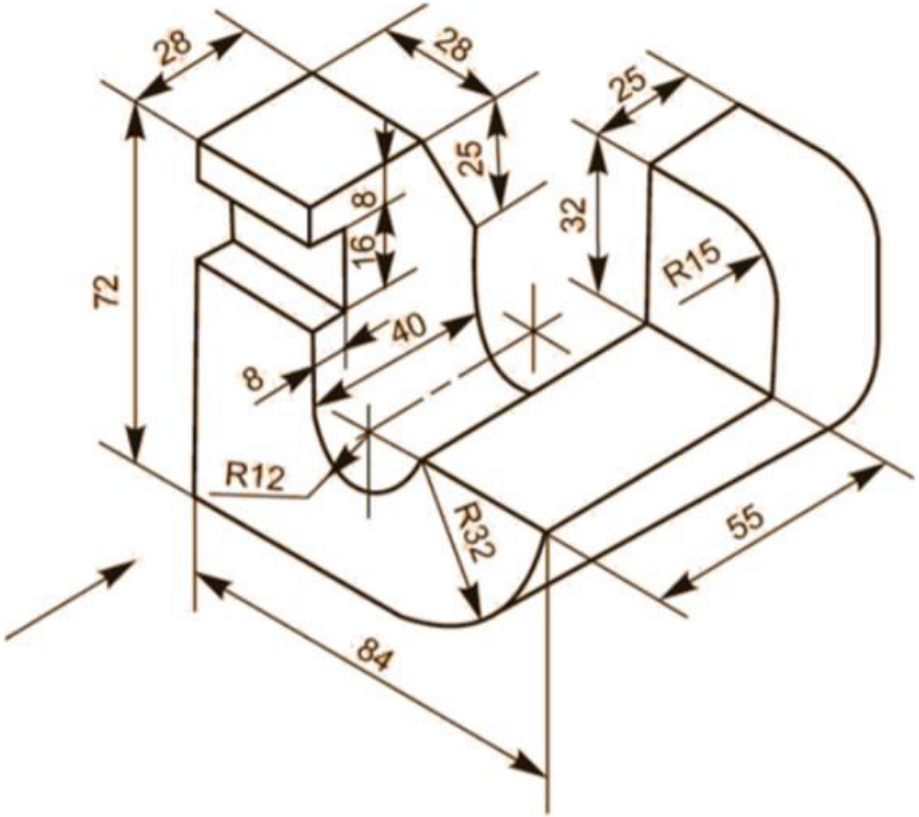
Figure below show pictorial views. Draw the T.V, F.V and RHSV views using first angle method of projections.

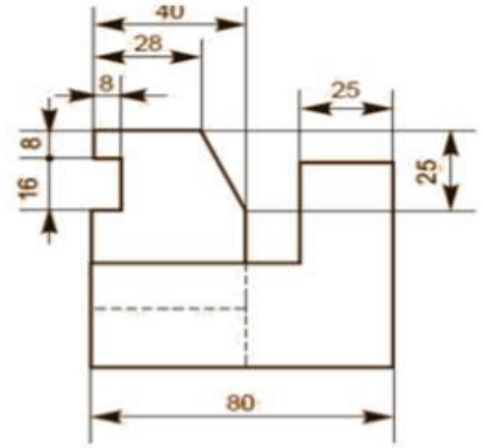




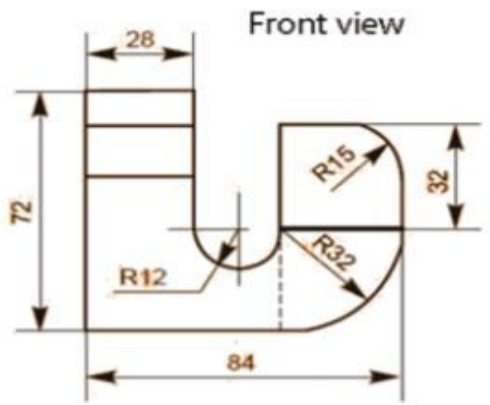
4-Practice Problem

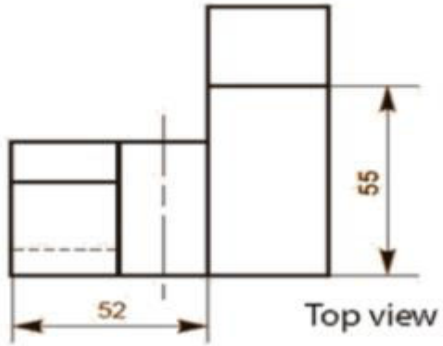
Figure below show pictorial views. Draw the T.V, F.V and RHSV views using first angle method of projections.





right side view

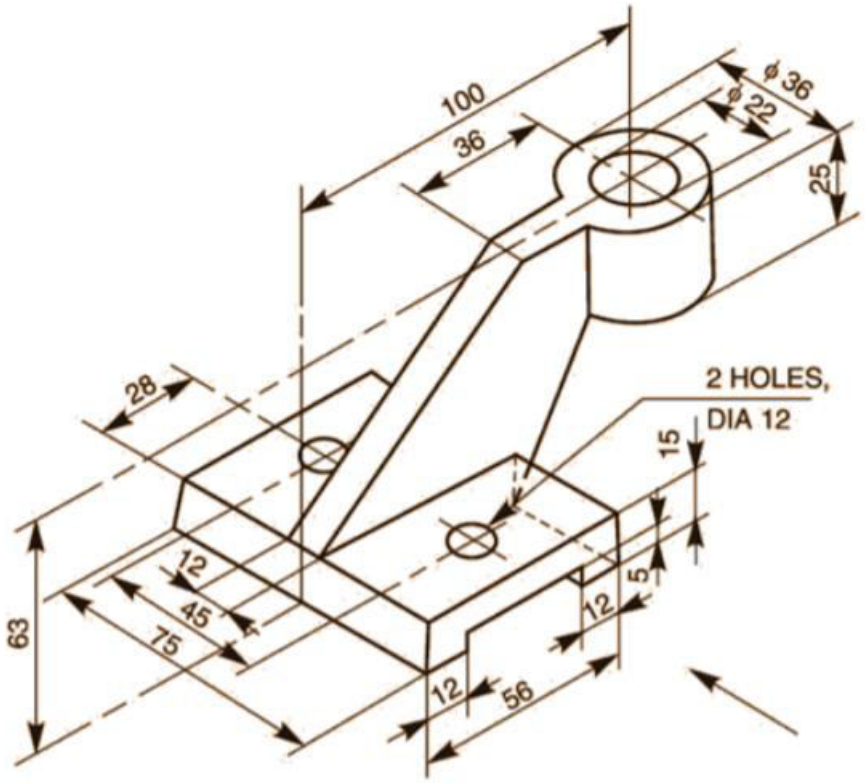


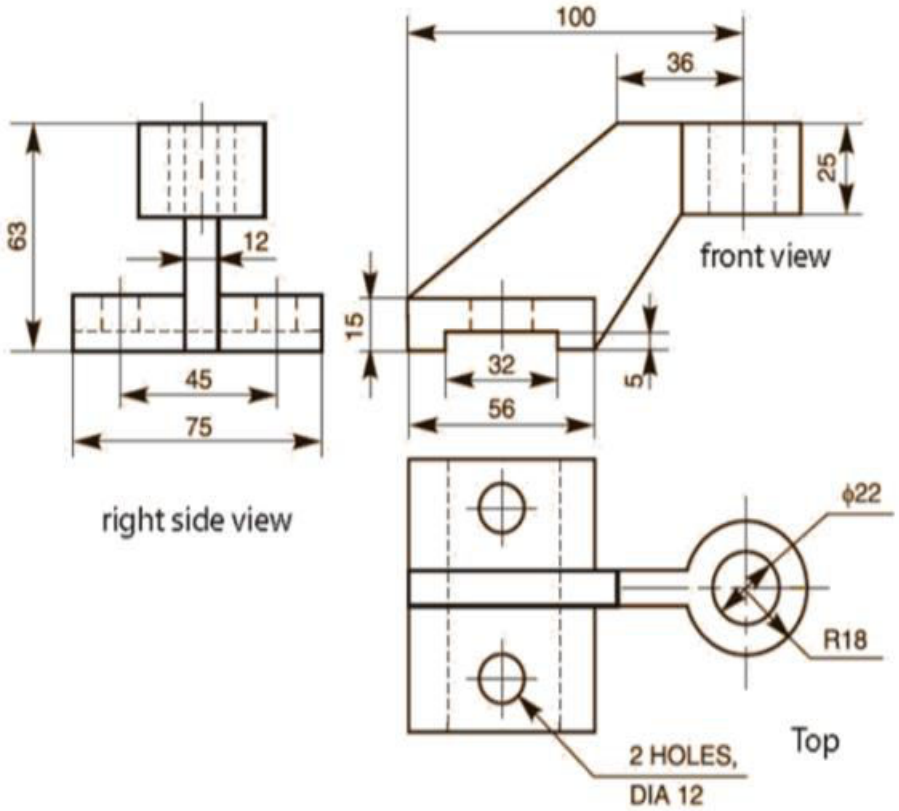


Top view

Practice Problem

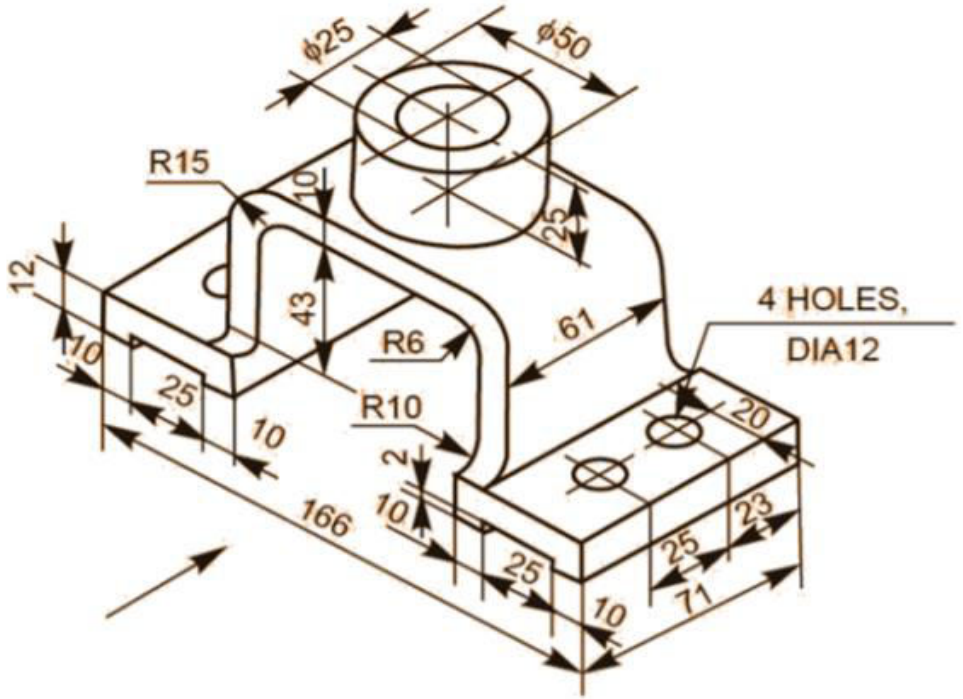
Figure below show pictorial views. Draw the T.V, F.V and RHSV views using first angle method of projections.

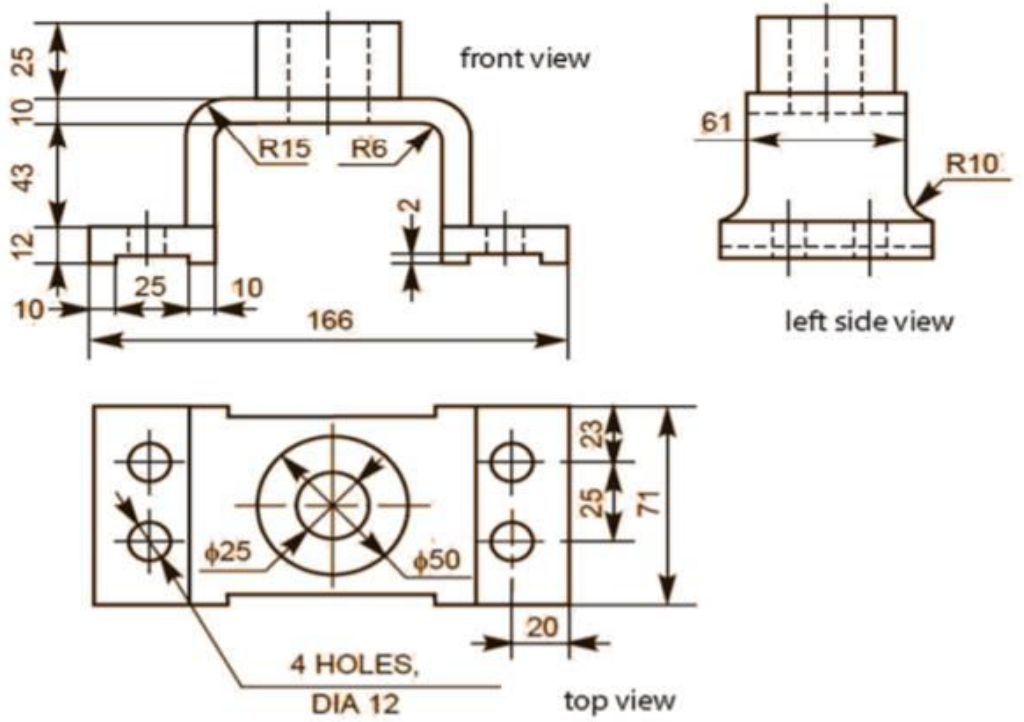




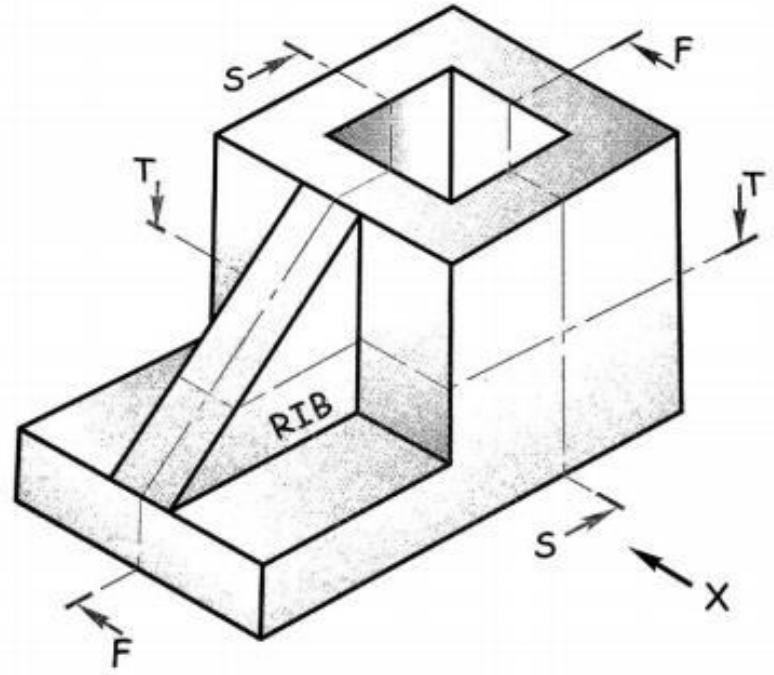
Practice Problem

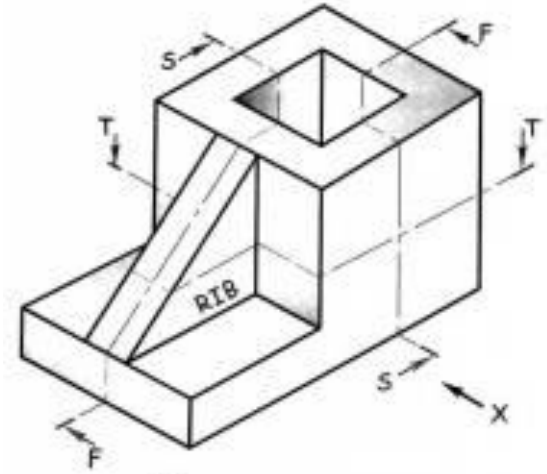
Figure below show pictorial views. Draw the T.V, F.V and LHSV views using first angle method of projections.



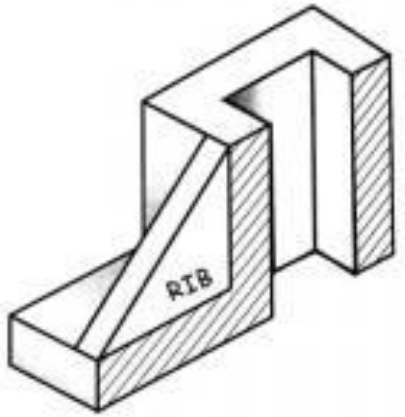


5-Sectional Orthographic Projection

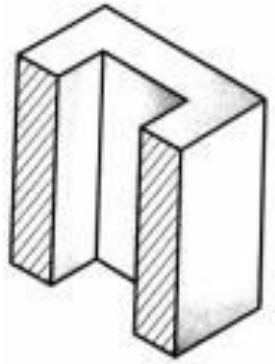


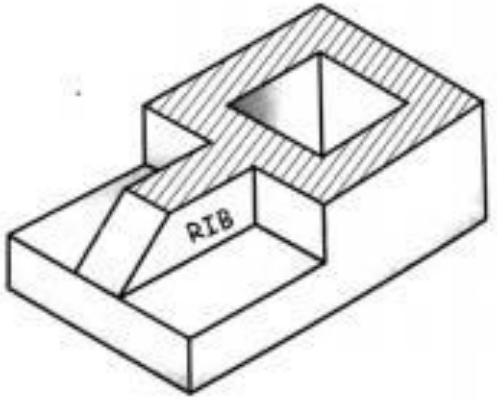


(a)

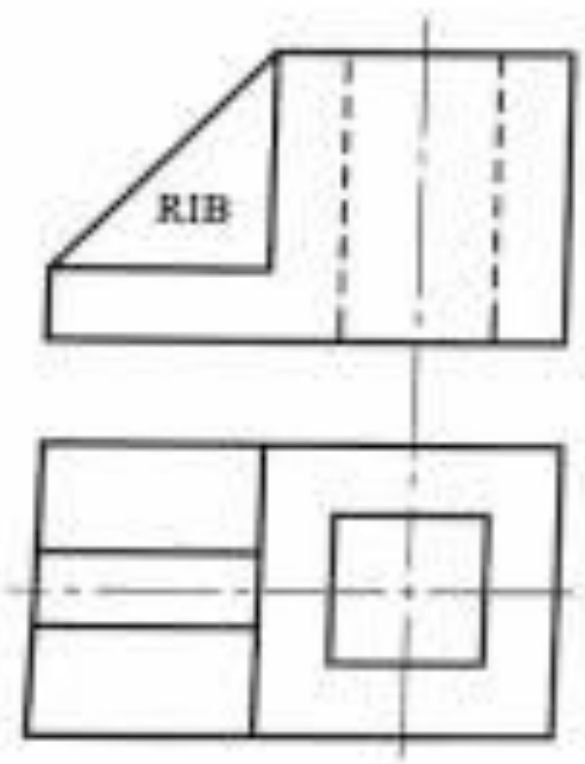


(b)

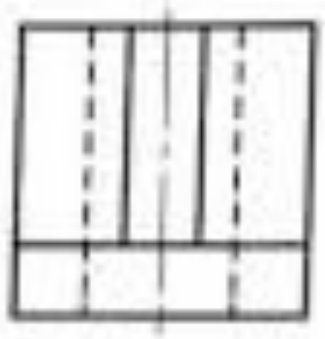

(c)

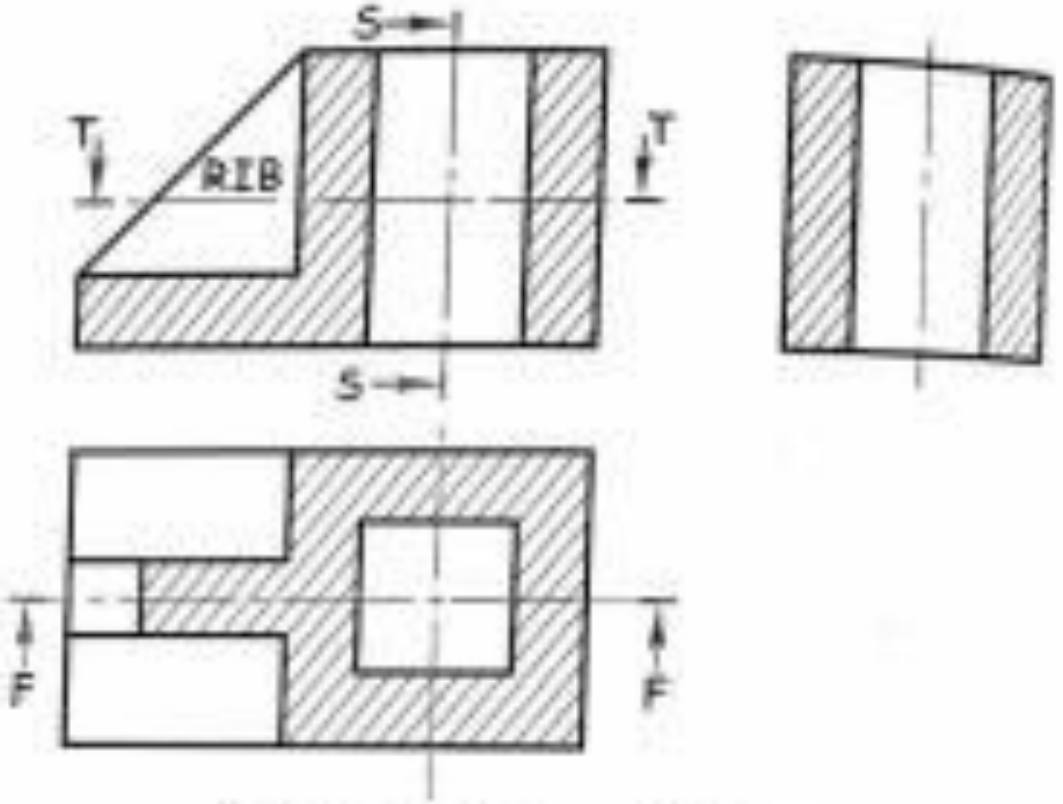


(d)

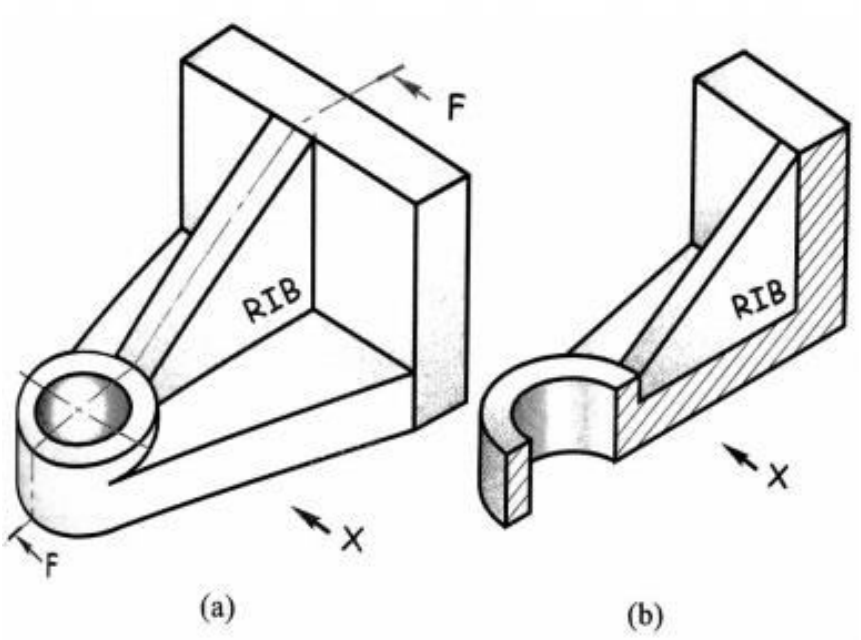


(e) Orthographic View

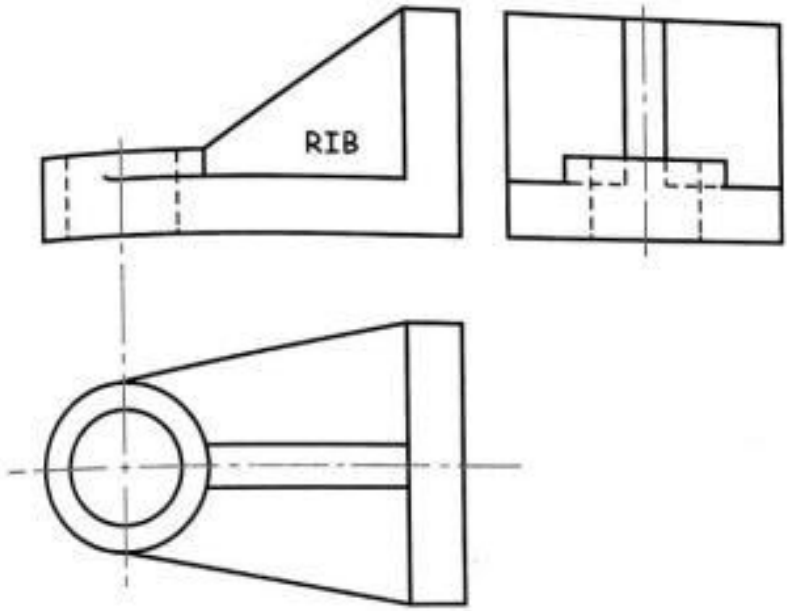




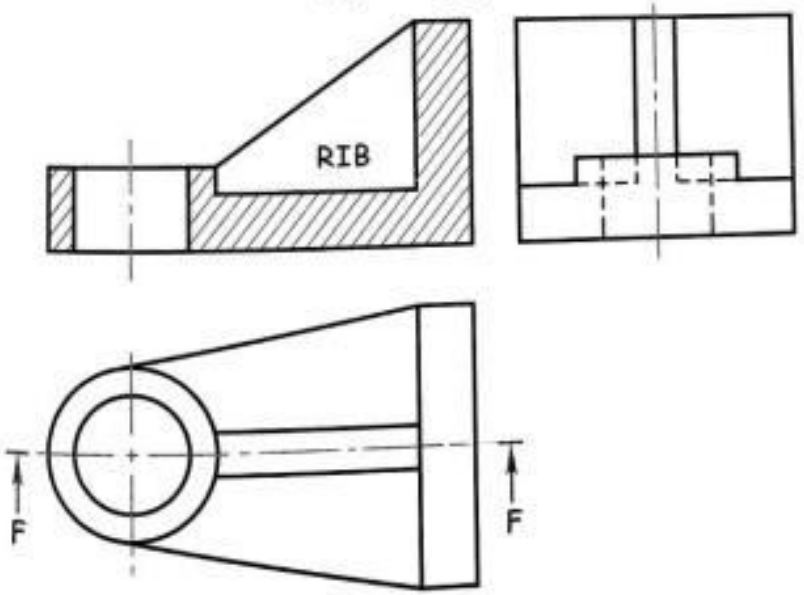
(f) Sectional Orthographic View

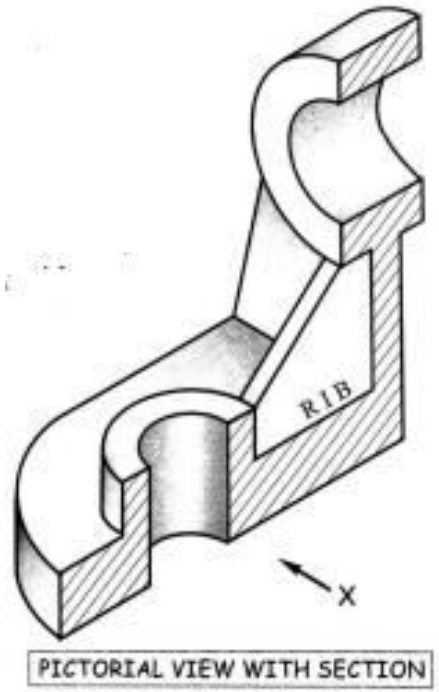


(a) (b)

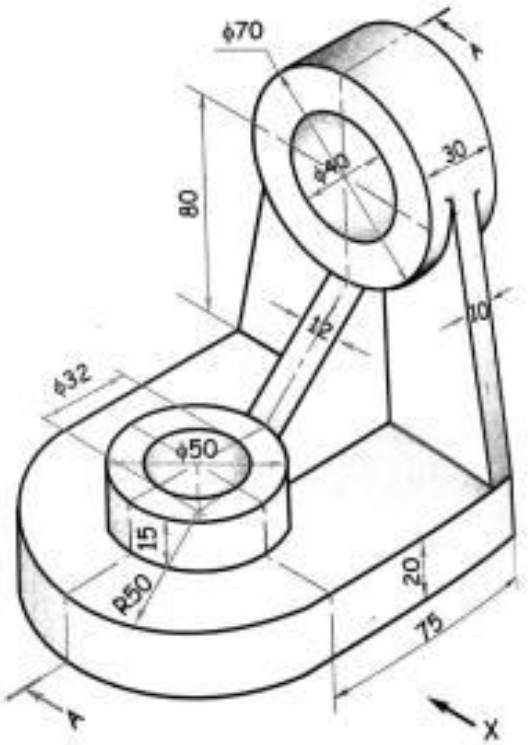


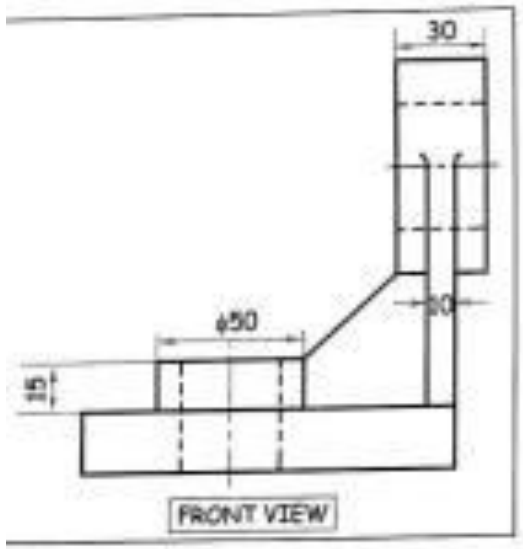
(c) Orthographic View



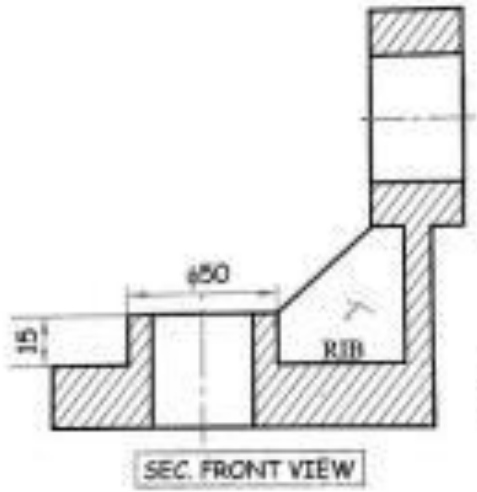


PICTORIAL VIEW WITH SECTION

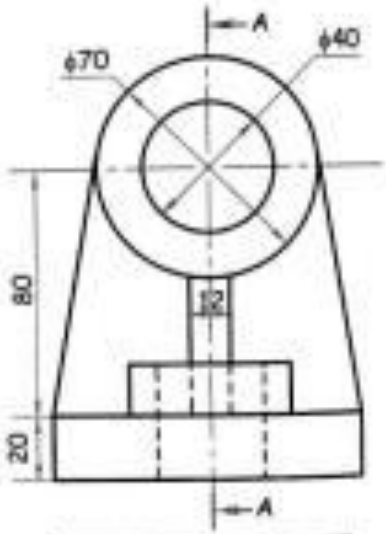




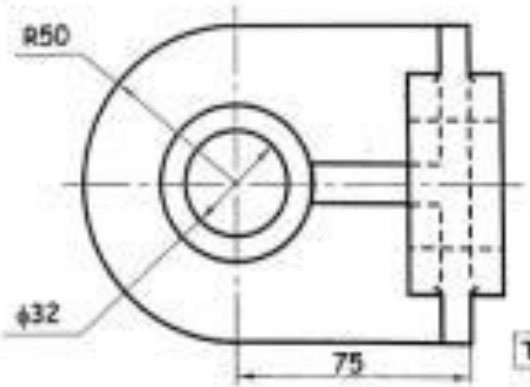
FRONT VIEW



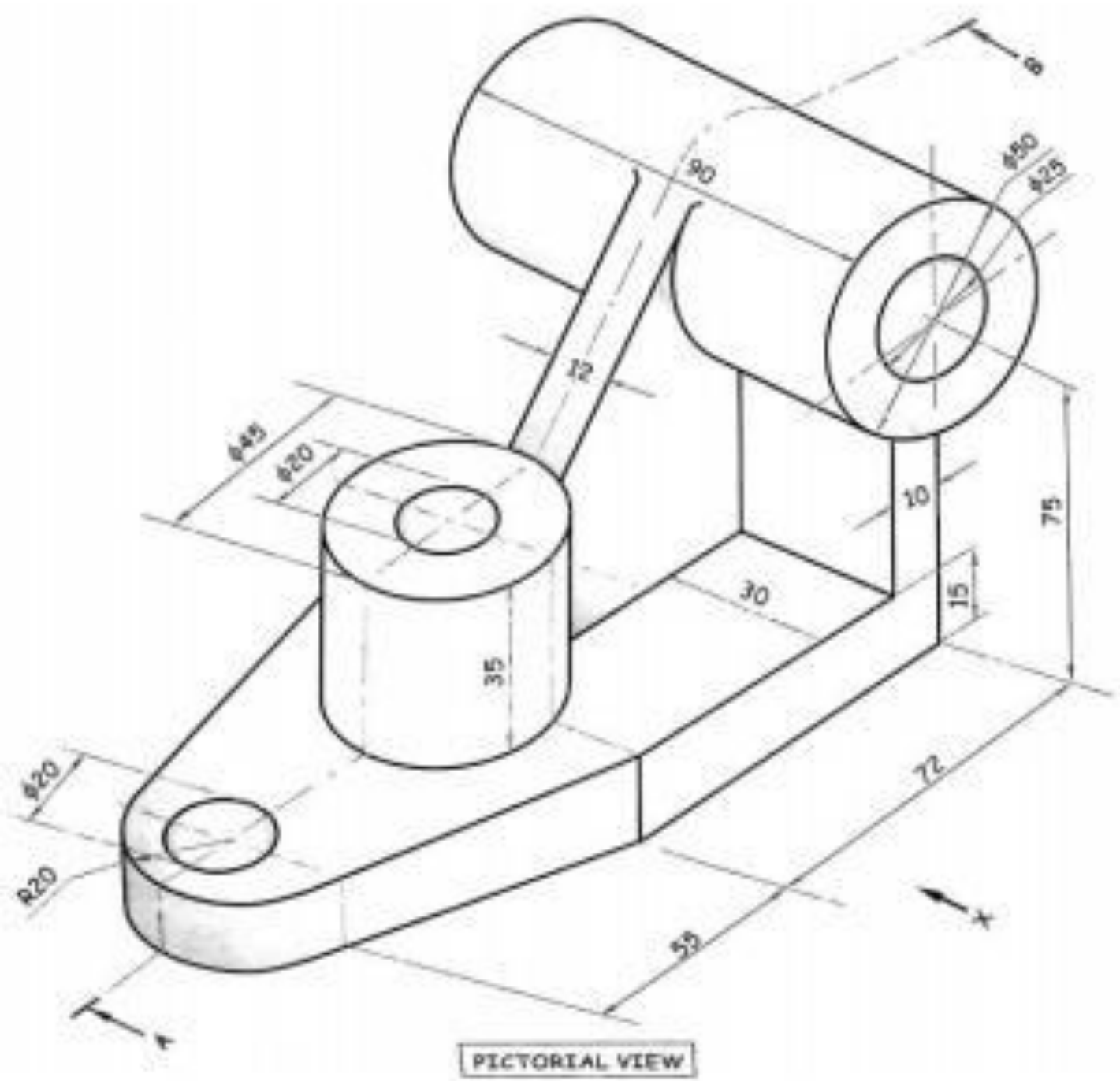
SEC. FRONT VIEW



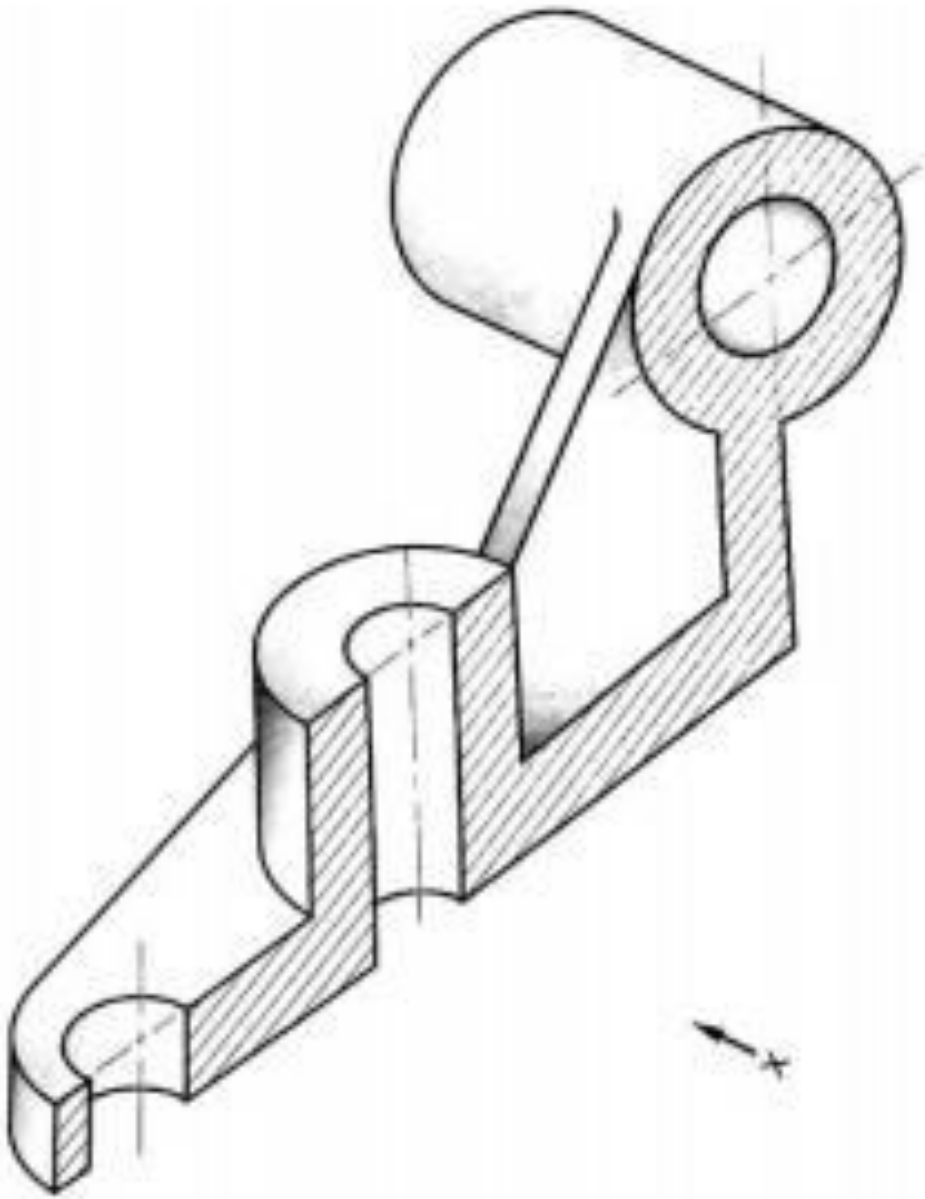
LEFT HAND SIDE VIEW



TOP VIEW

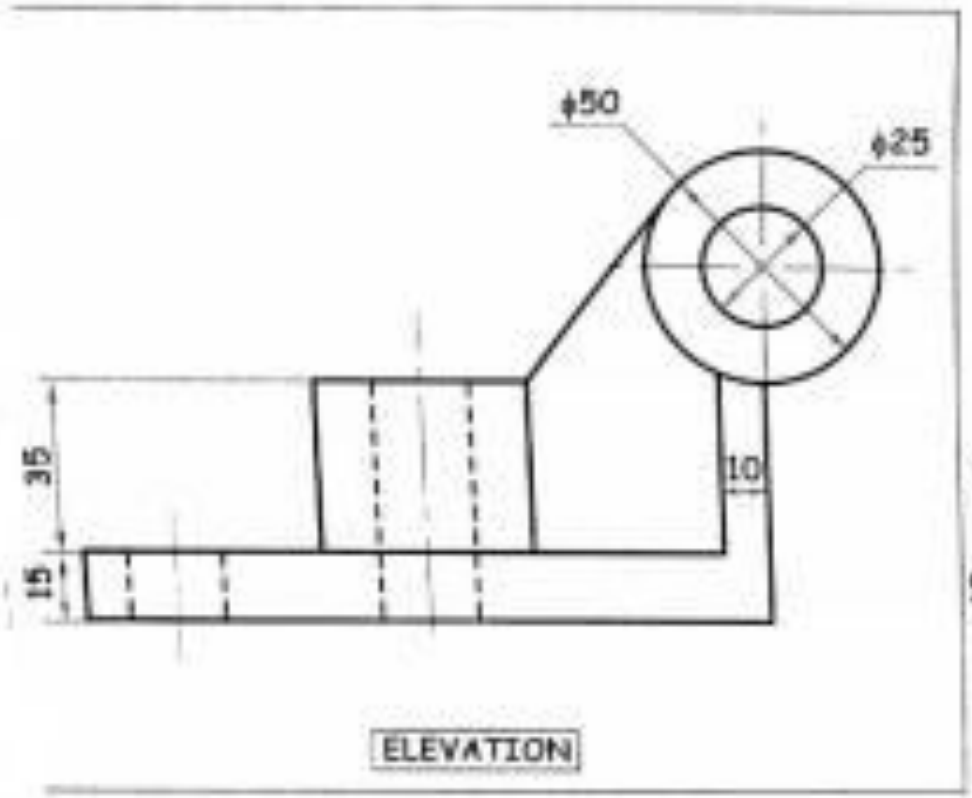


PICTORIAL VIEW

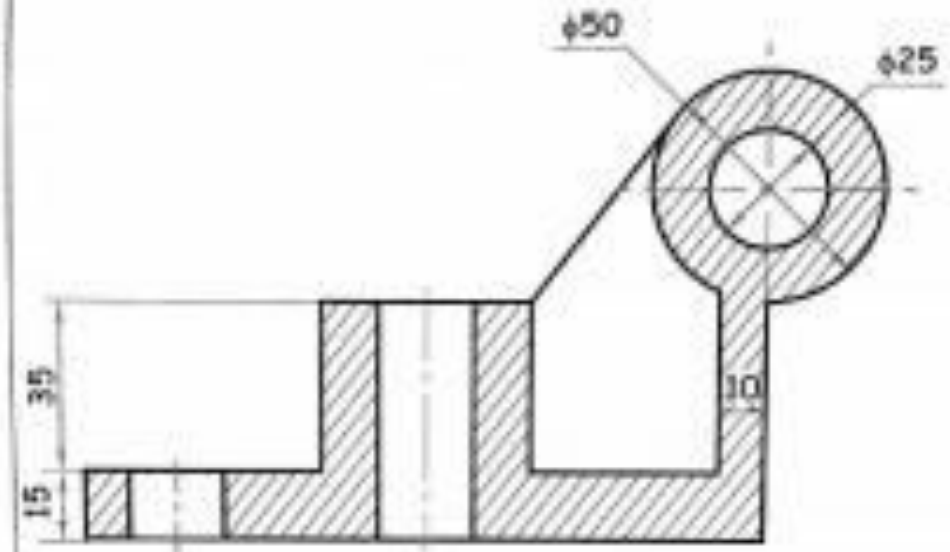


PICTORIAL VIEW WITH SECTION

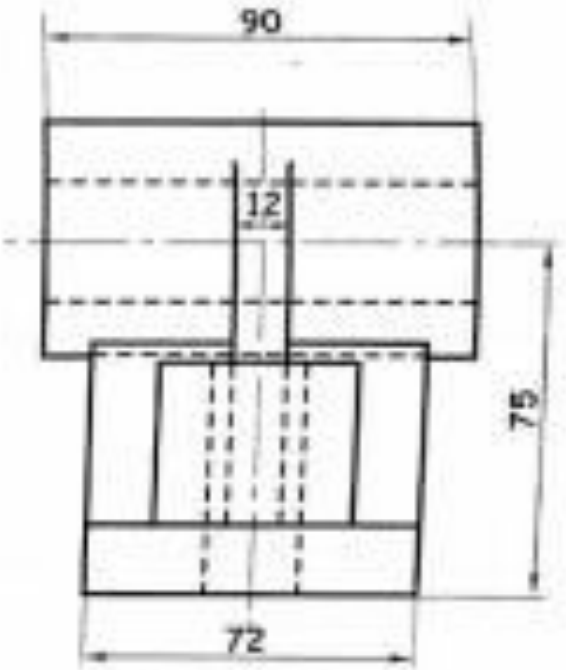
6-



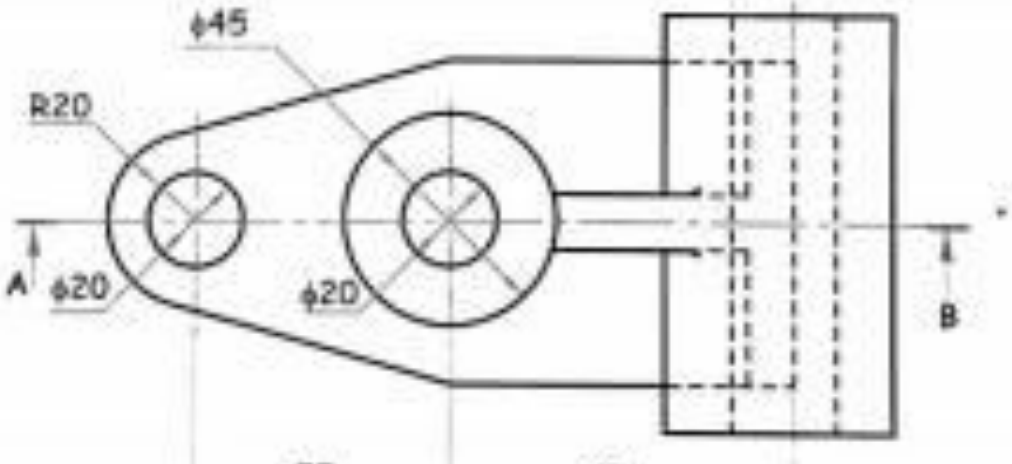
ELEVATION

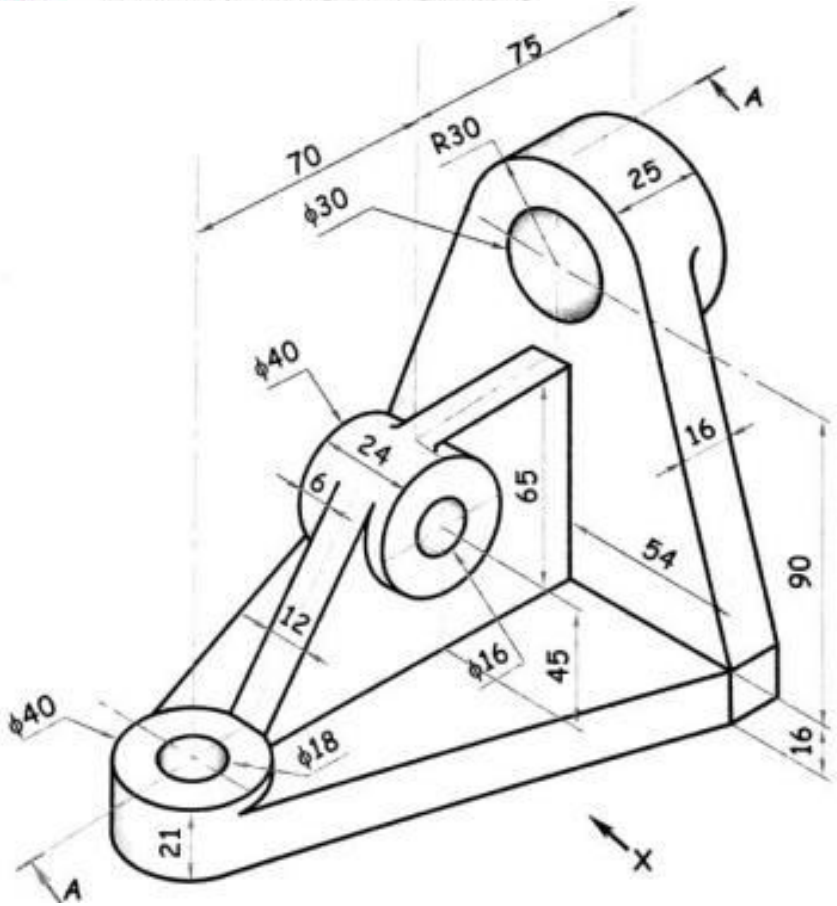


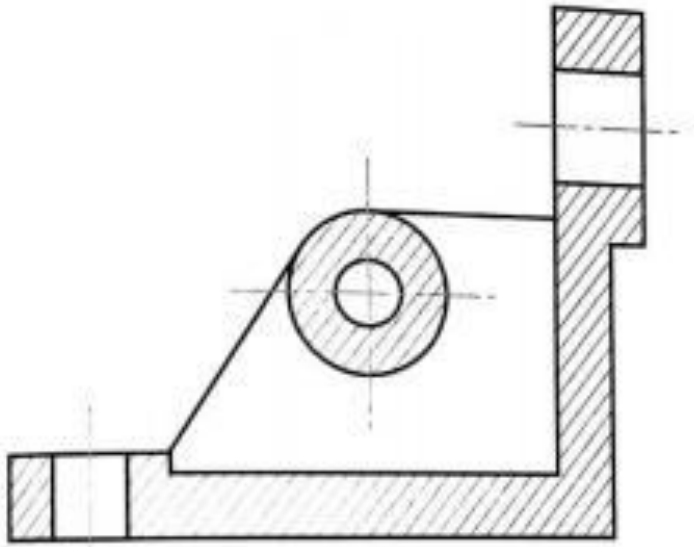
SECTIONAL ELEVATION



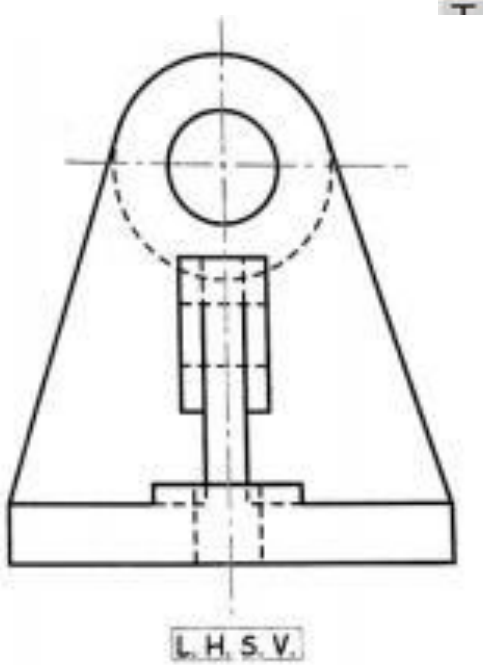
END VIEW



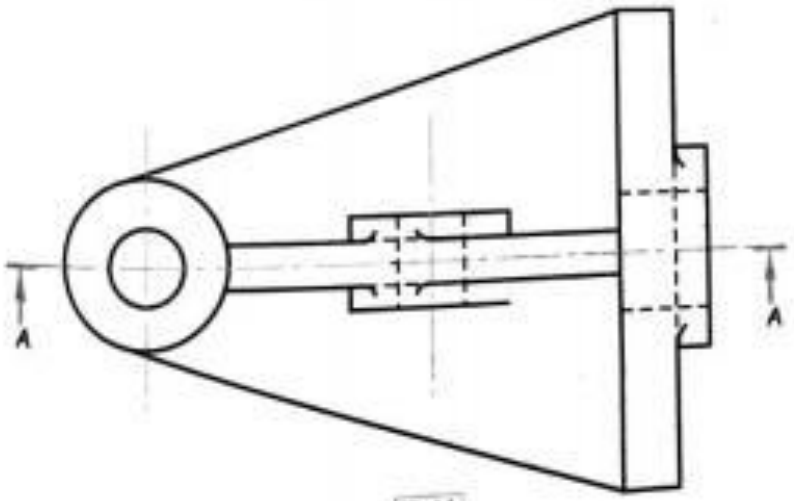




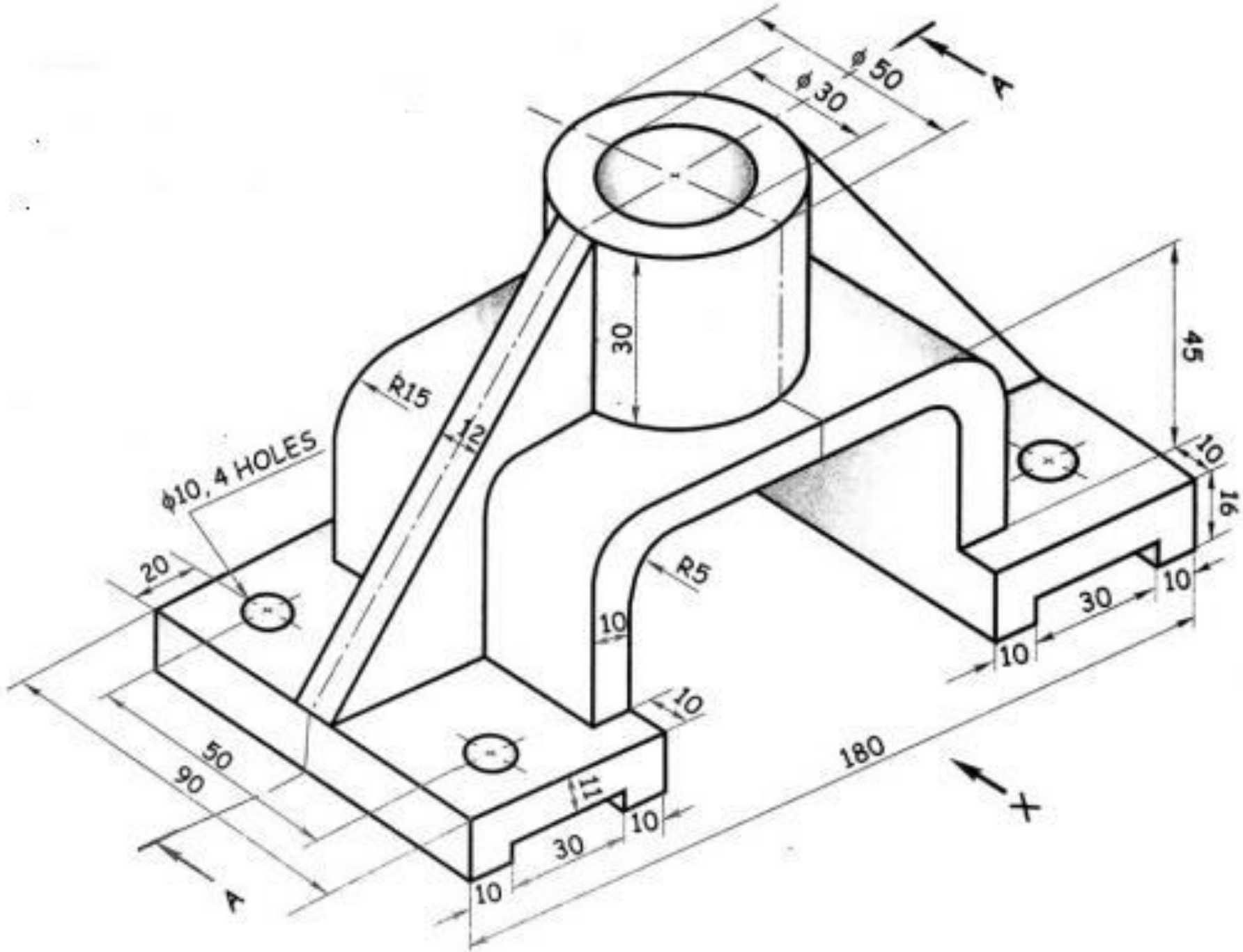
SECTIONAL F. V.

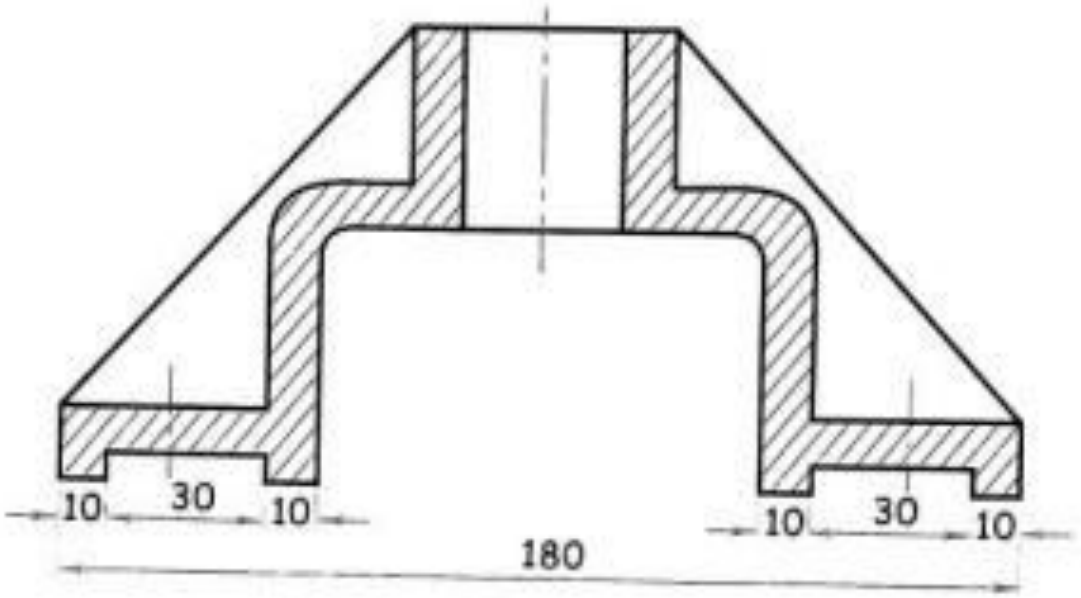


L. H. S. V.

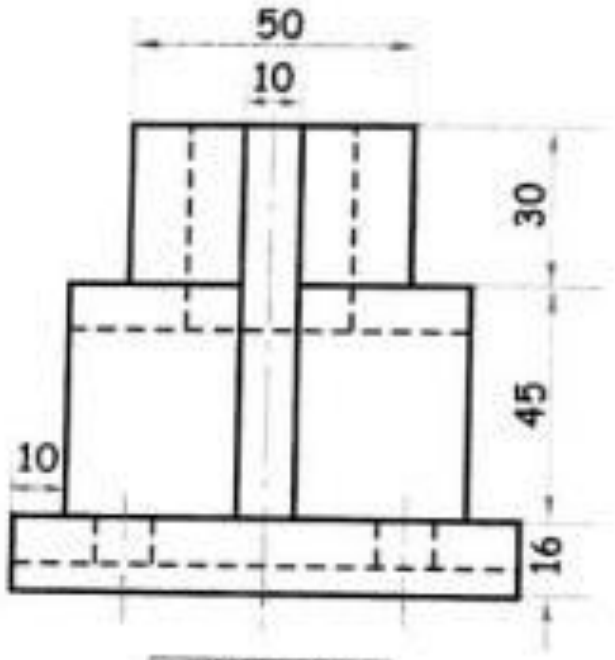


T. V.

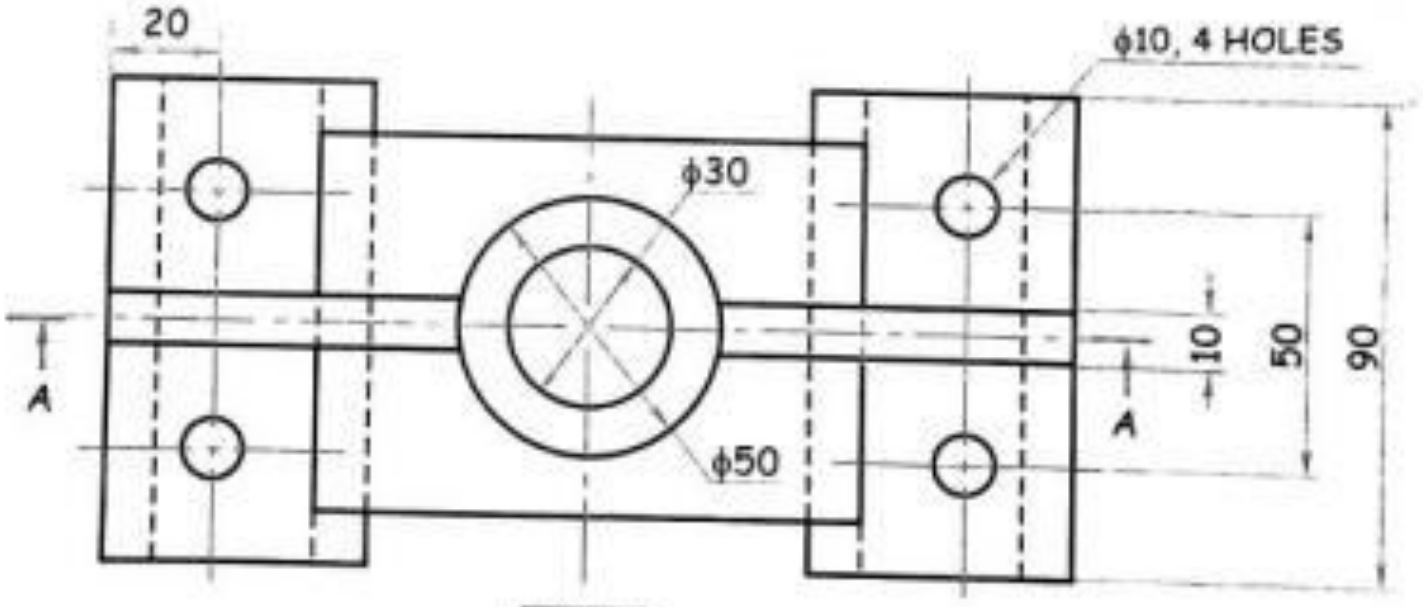

φ50
φ30
A
30
45
R15
φ10, 4 HOLES
20
10
16
R5
10
30
10
10
10
50
90
11
10
30
10
180
X
A



SECTIONAL ELEVATION



END VIEW



PPT on Projection of planes

Presented by :-
Kavita Thakur

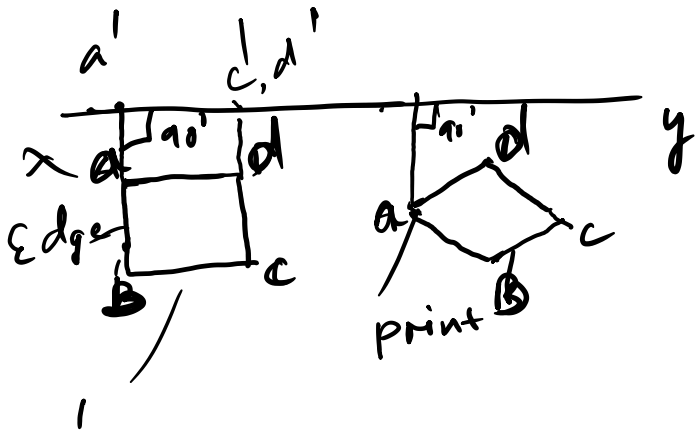
Projection of planes

thickness is negligible

Step1:- Assume initial position

Step2:- Consider surface inclination (from HP/VP)

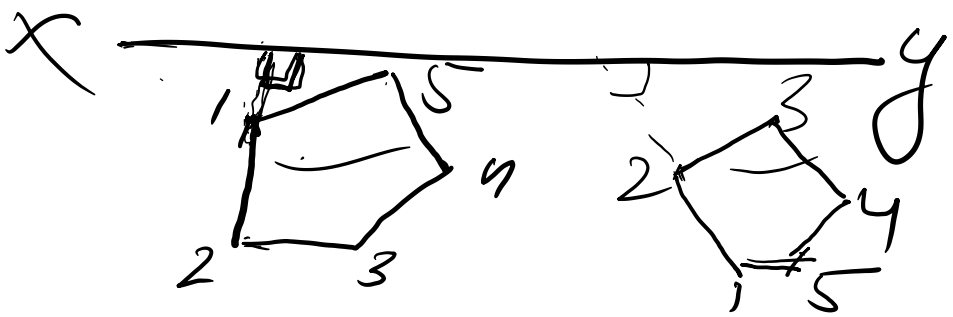
Step3:- Consider Edge inclination


a'
c', d'
x
a
d
Edge
b
c
y
a
d
c
b
print
1

* Surface inclined to HP → Assume plane is lying in HP.

True shape will be visible from TV

* Surface inclined to HP + Edge inclined to VP

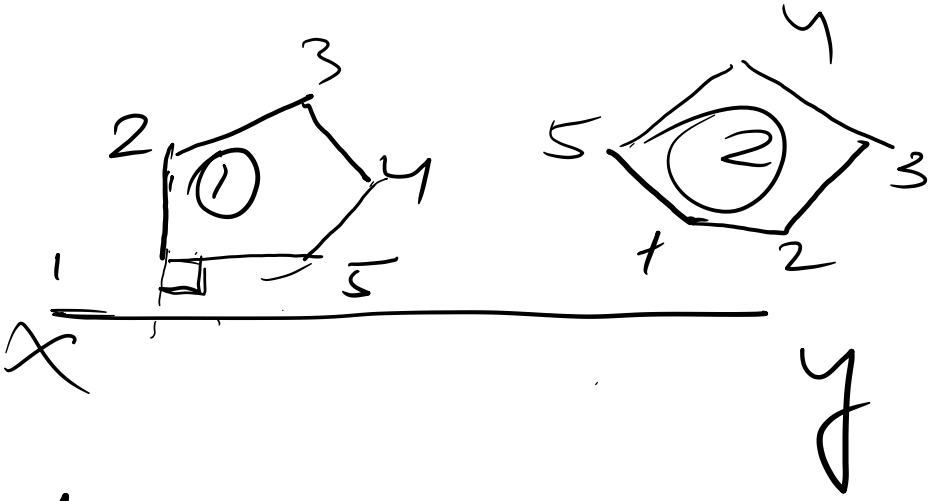


* Surface inclined to VP

② F.V ③ Os F.V

① T.V ④ T.V

Stage 1 Stage 2



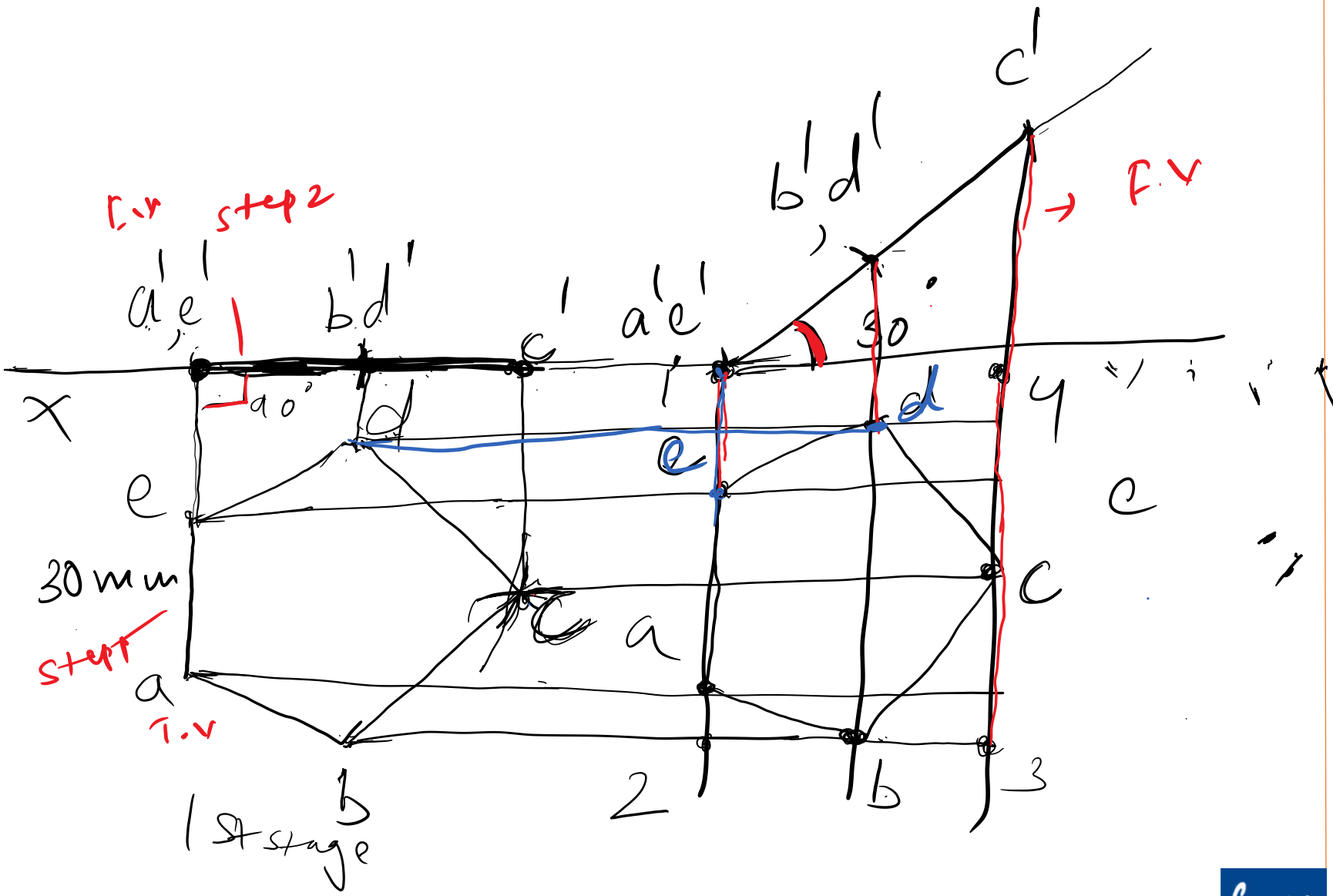
* Surface inclined to VP & Edge inclined to HP

Que> Draw the projection of a regular Pentagon of 30 mm side having its surface inclination at 30° to the HP and a side parallel to HP and inclined at an angle of 60° to the VP.

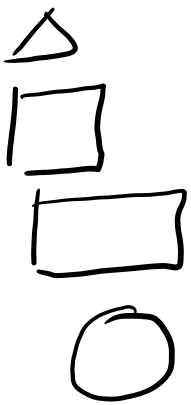
Given data :- side = 30 mm

$\theta_{surface} = 30°$ (Angle made with HP)

$\phi_{edge} = 60°$ (Angle made with VP)


T.V step 2
a'e'
b'd'
c'
a'e'
b'd'
c'
F.V
30°
X
Y
a
e
d
e
d
e
c
30 mm
step
c
a
c
a
T.V
b
1
2
b
3
1st stage

Planes



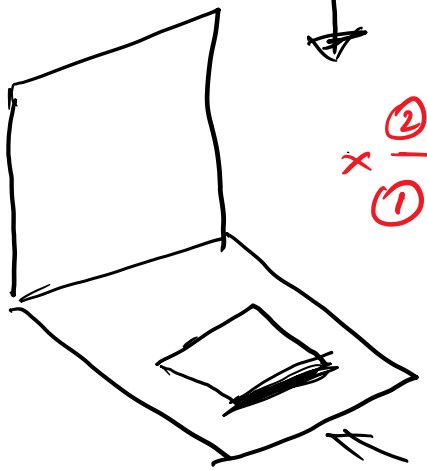
pentagon

hexagon

(1)

Planes lies in/on HP

VP

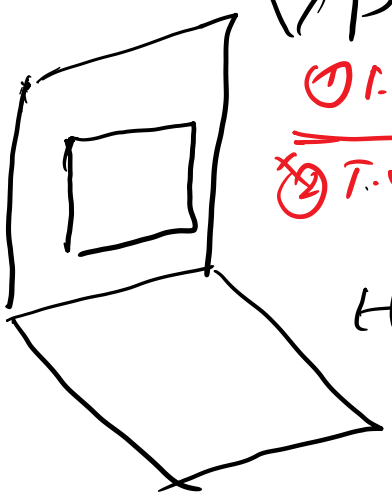


HP

* True shape of geometry will be visible from TV

(2)

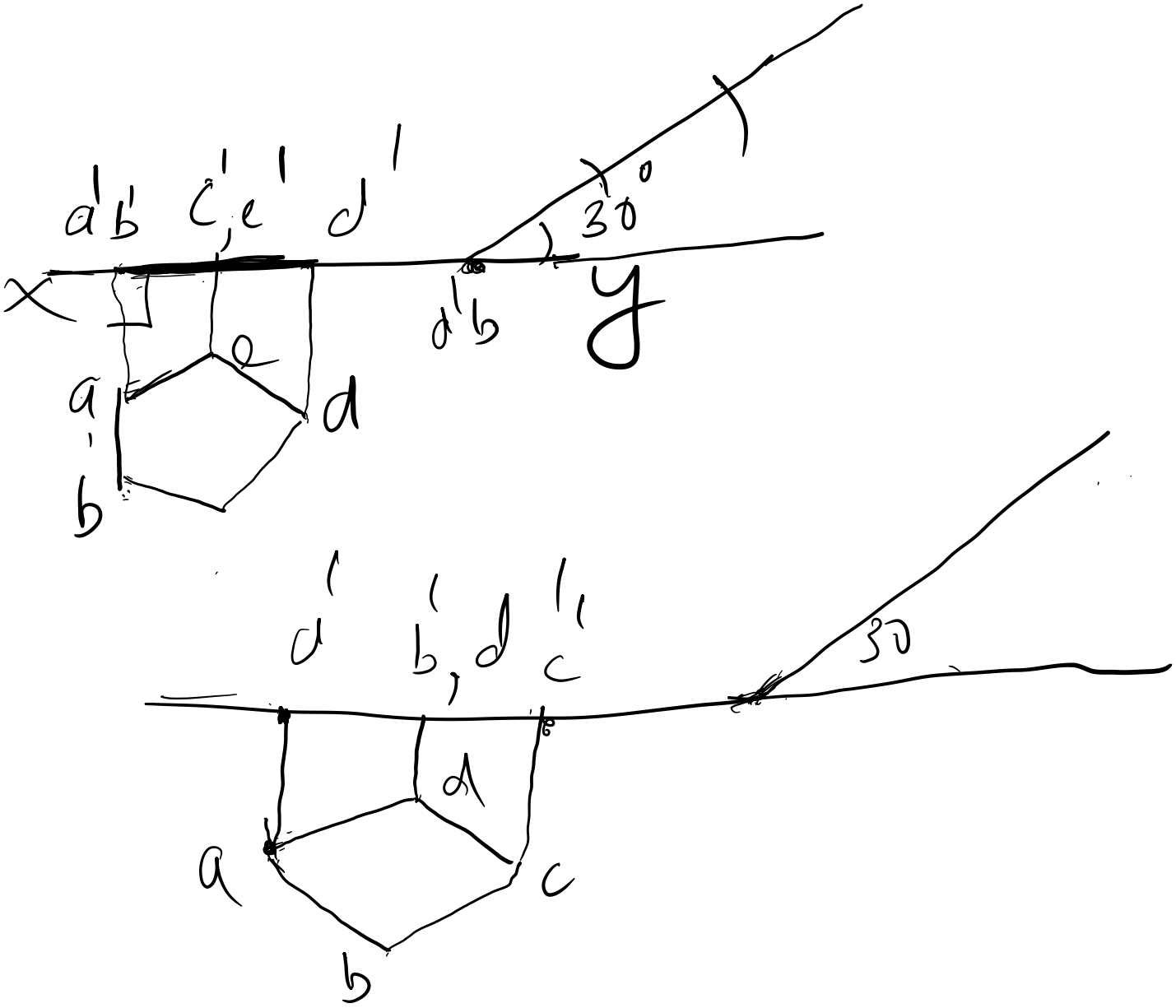
Planes lies in/ on VP



HP

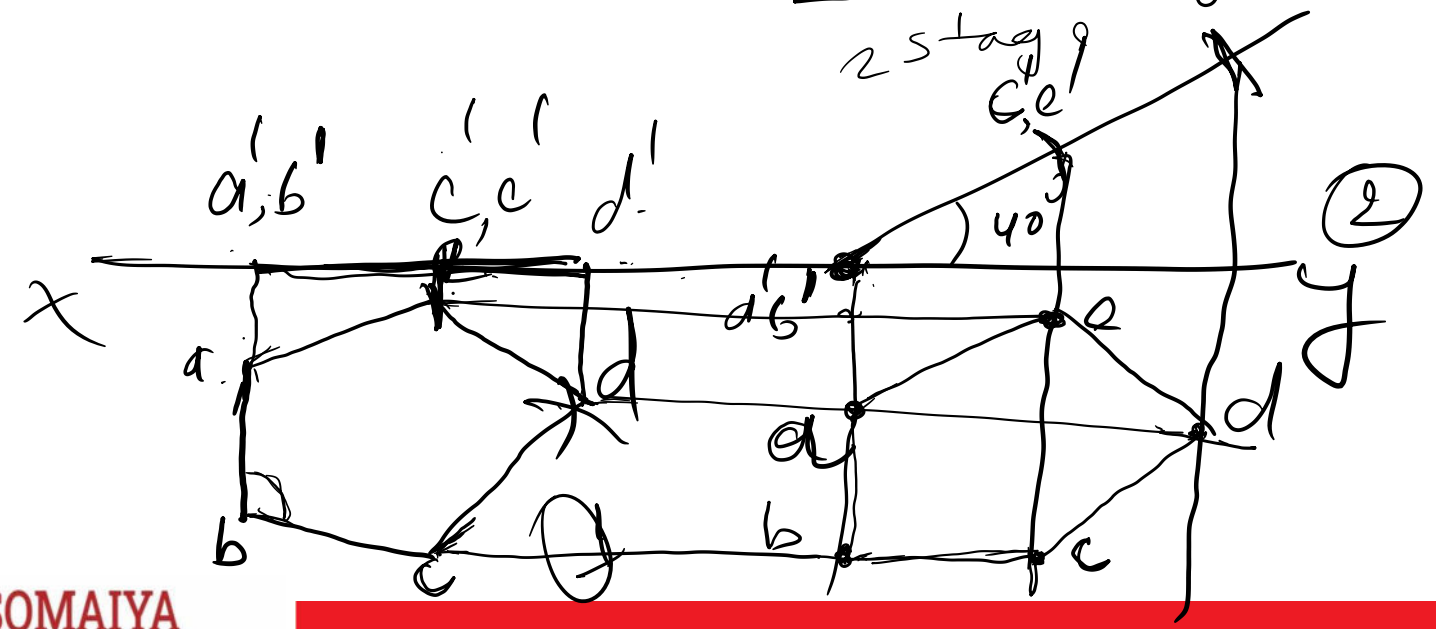
* True shape of geometry will be visible from FV

Plane lies on/in HP	plane lies on/in VP
Geometry is resting on one of its corner on/in HP * Always draw given condition on left side	Geometry is resting on one of its corner on/in VP * Always draw given condition on left side


a'b' c',e' d'
30°
x
y
a'b
e
a
d
b
d' b',d' c'
30
d
a
c
b

One Pentagonal plane side of 30mm is resting on one of its side on HP. The plane is inclined at 40° to HP.

Given :- Geometry :- Pentagon
side = 30mm



Given Data

Shape → pentagon

side = 30 mm

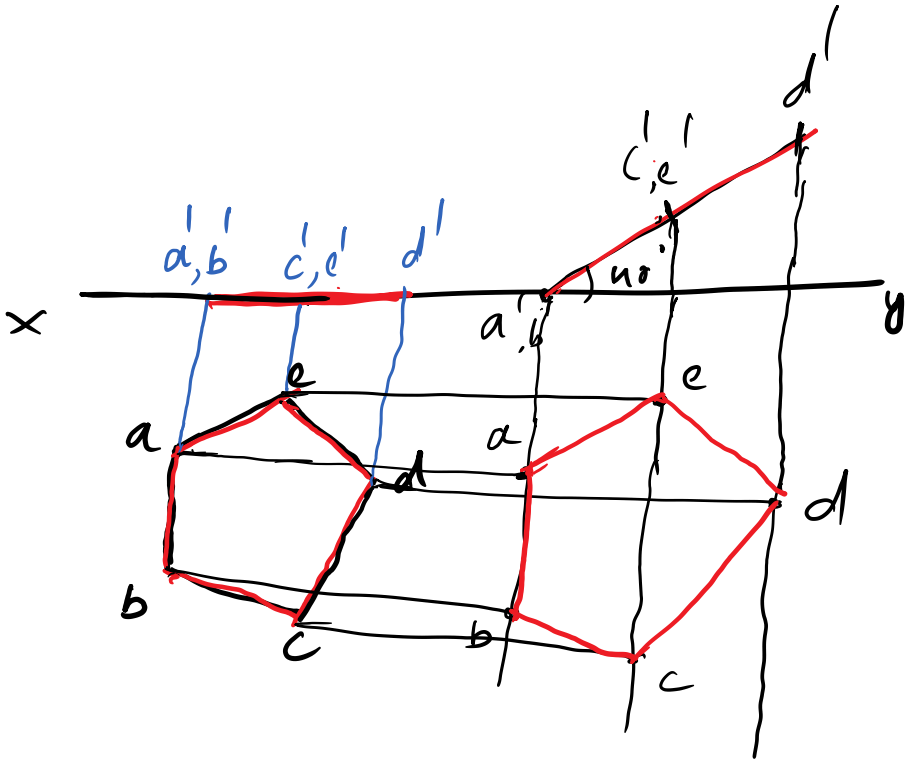
$\theta_5 = 40^\circ$

Edge inclination in/on H.P

② F.V ③ θ F.V

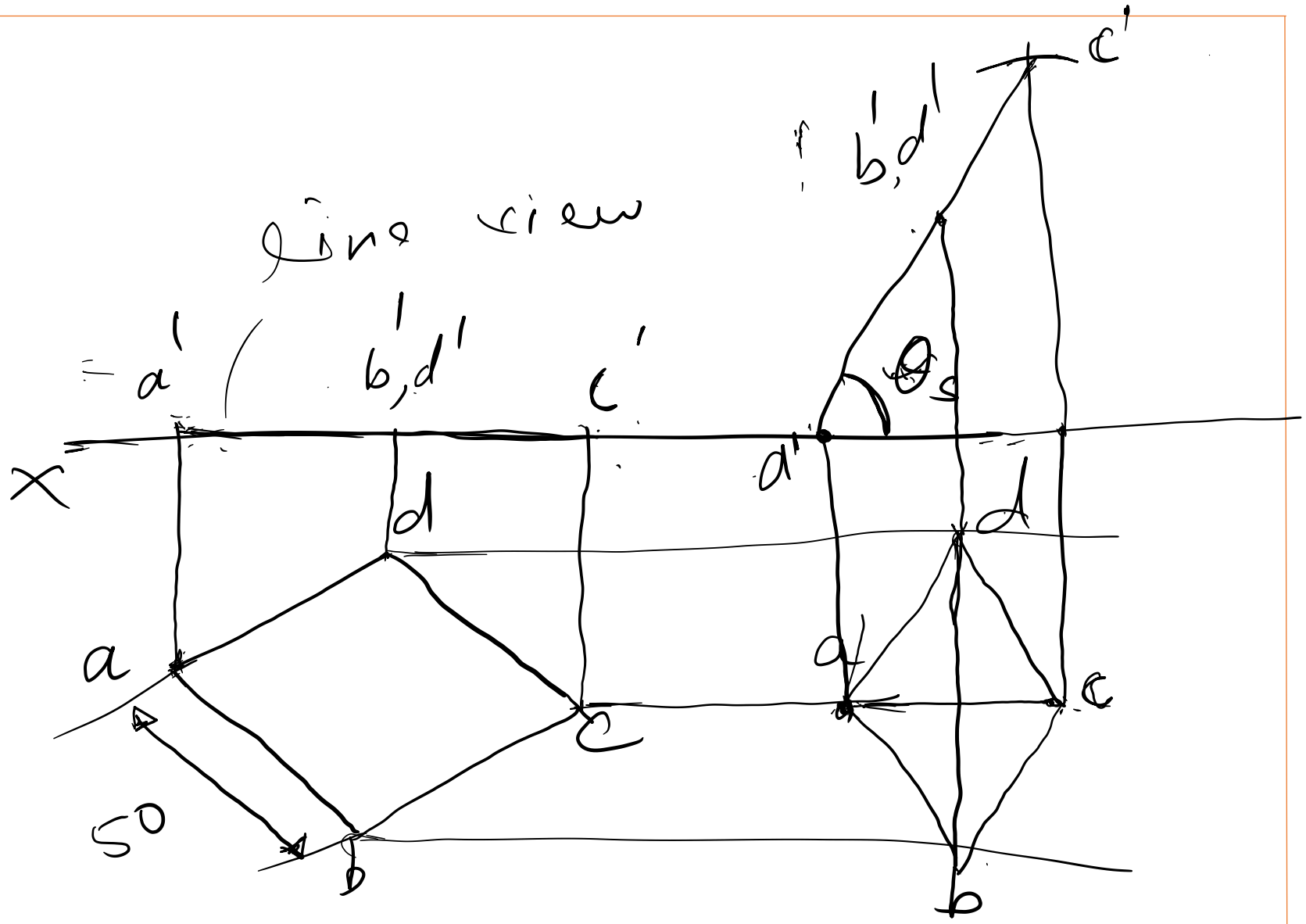
x ——— y

① T.V ④ T.V



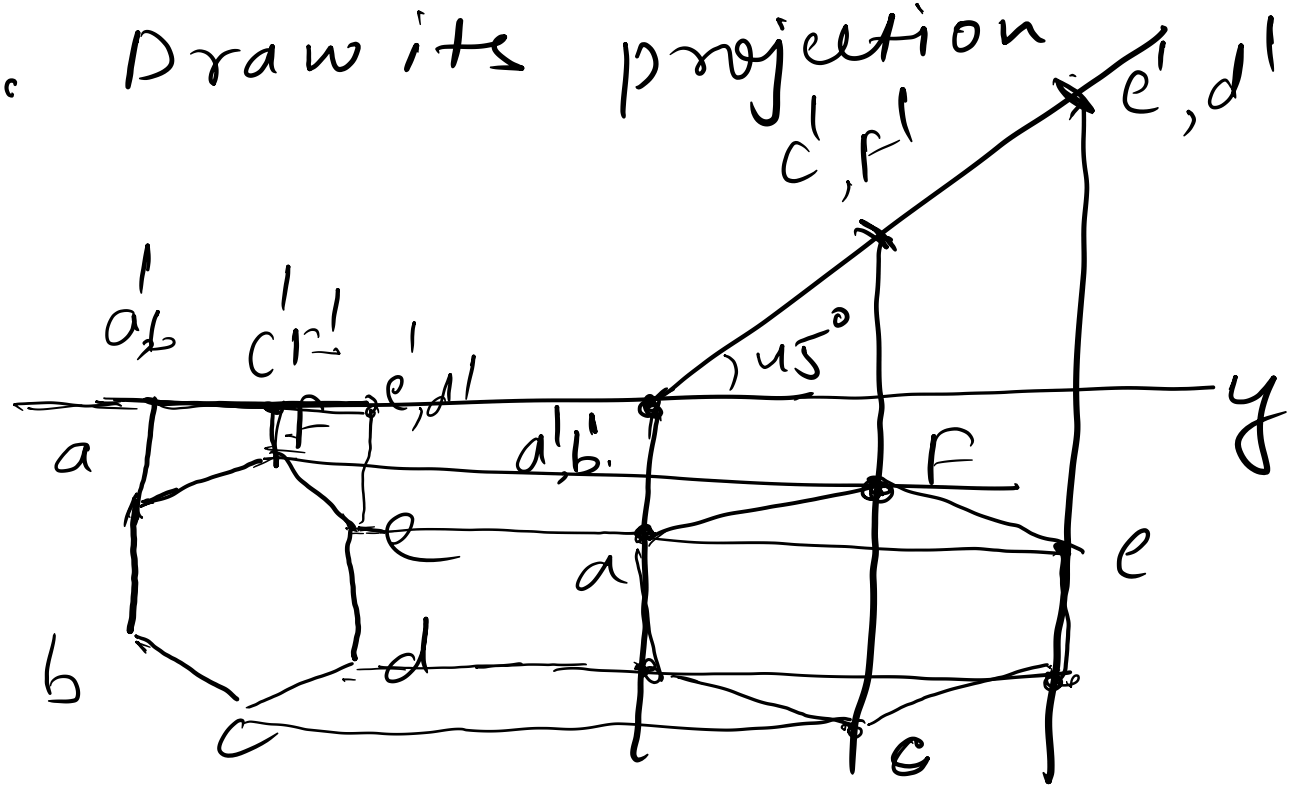
A square lamina ABCD of 50mm side rest on the corner A in the H.P such that the plane is seen as a rhombus in the top view with diagonal contained by corner A measuring 25 mm. Draw its projection and determine surface inclination of the plane with the HP

Sol:- Geometry :- Square

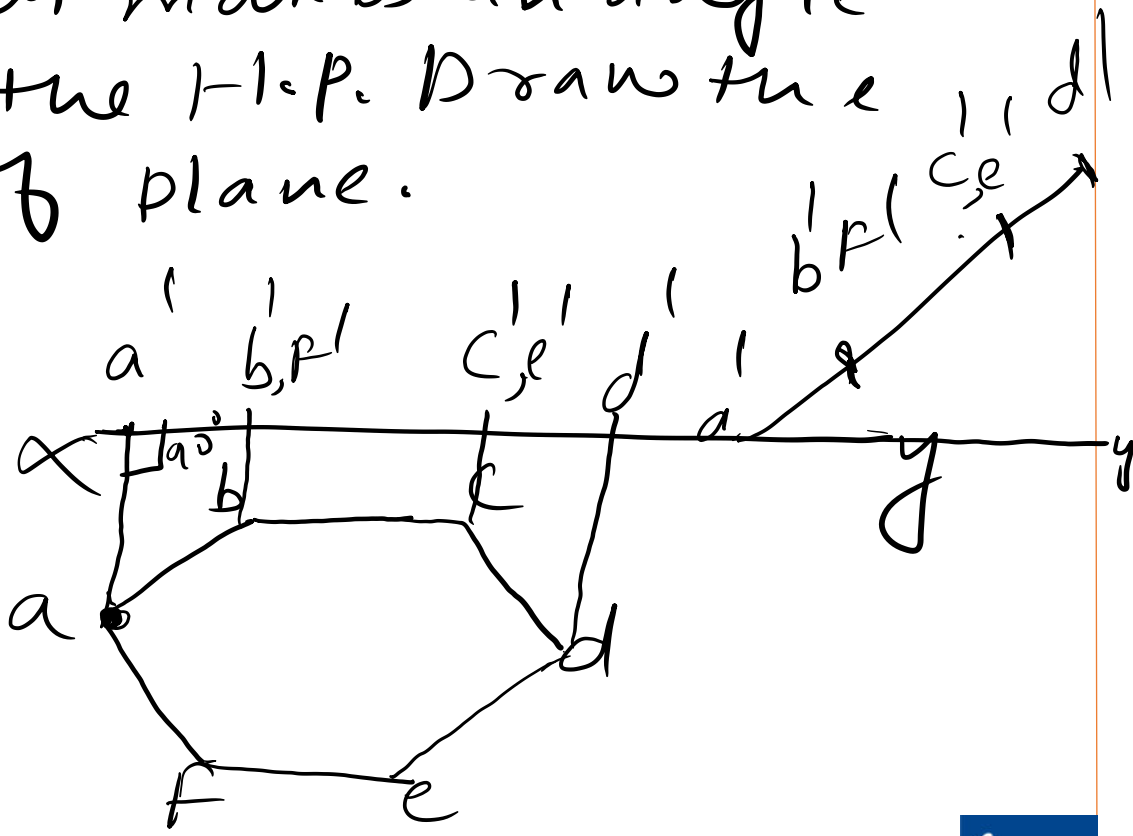

Fine view
a'
b',d'
c'
θ
x
d
a'
d'
a
c
50
b

A hexagonal plane of 25 mm side has one of its side in the H.P. The surface of a plane is inclined at 45° to H.P. Draw its projection

Sol:-

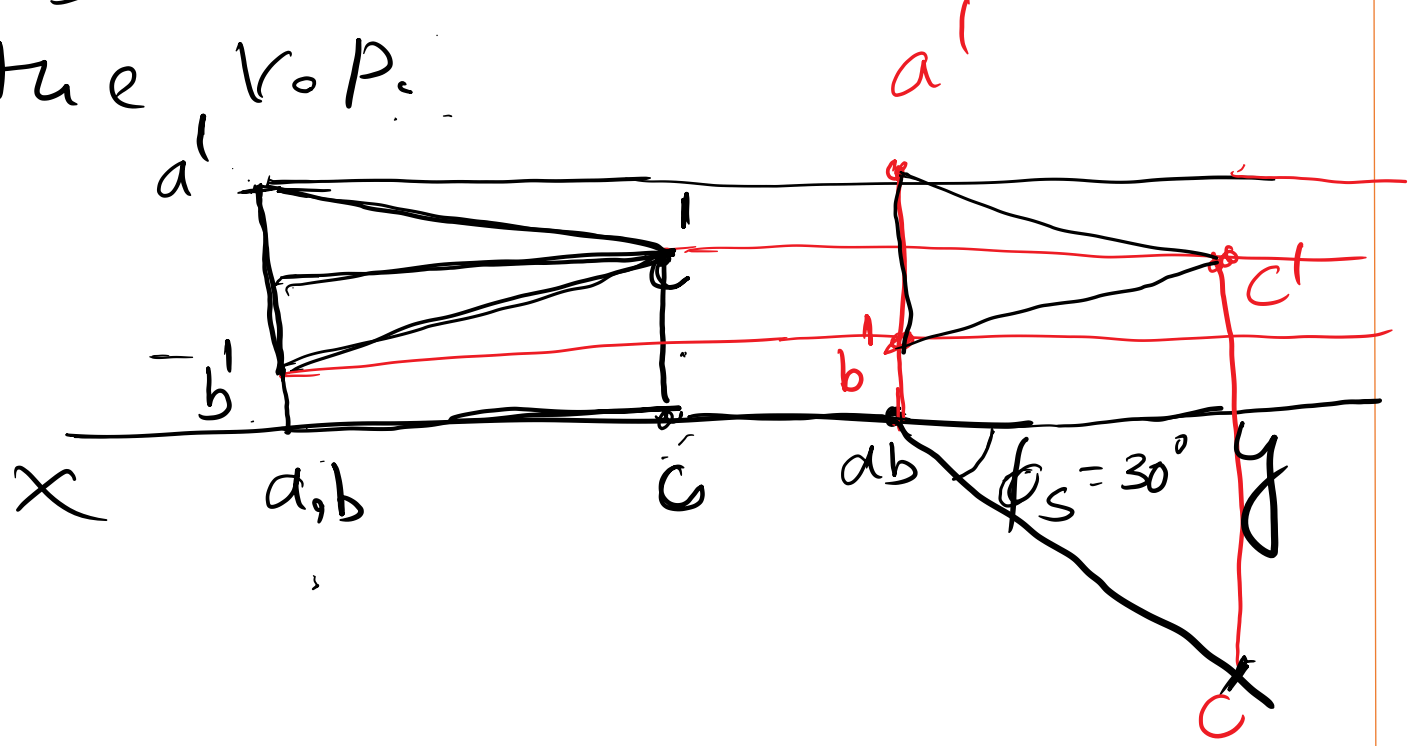


A hexagonal lamina of side 30 mm is resting in the H.P. on one of its corner. The diagonal through that corner makes an angle 45° with the V.P. Draw the projection of plane.



Que> An isosceles triangular plate with base 45 mm and altitude 60 mm has its base in V.P. Draw its projections if its surface is inclined at 30° to the V.P.

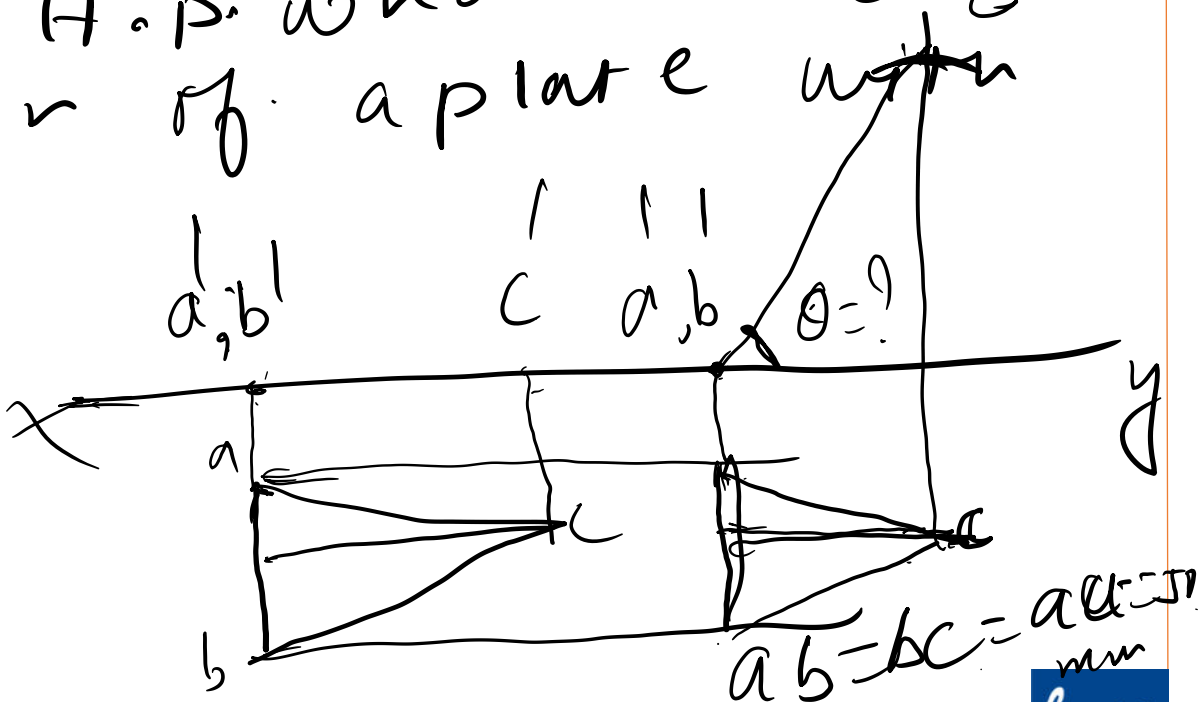
Sol:-



An isosceles triangular plate of 50mm base and 75mm altitude appears as an equilateral triangle of 50mm in top view. Draw the projection of a plate if its 50mm edge is on the H.P. what is the inclination of a plate with H.P.?

Ans:-

Equilateral



12

Given Data

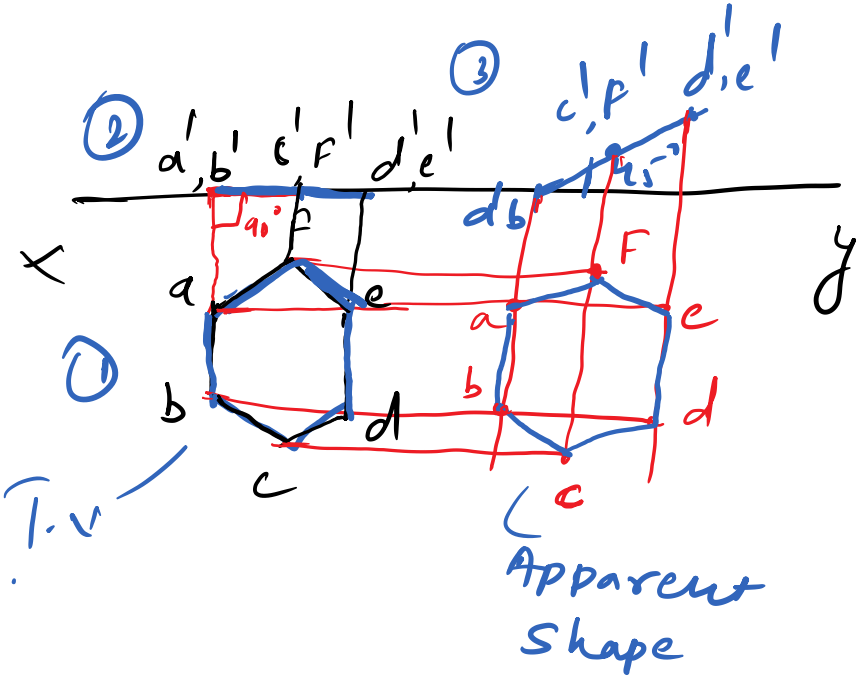
Plane – hexagon

side length = 25 mm

side is in the H.P

True shape will be visible from T.V

$\theta_s = 45°$



(14) A hexagonal lamina of side 25 mm is resting in the V.P. on one of its corner. Draw the three view, if the diagonal passing through that corner makes an angle 30° the the V.P. Draw using first angle method of projection :-

Given Data :-

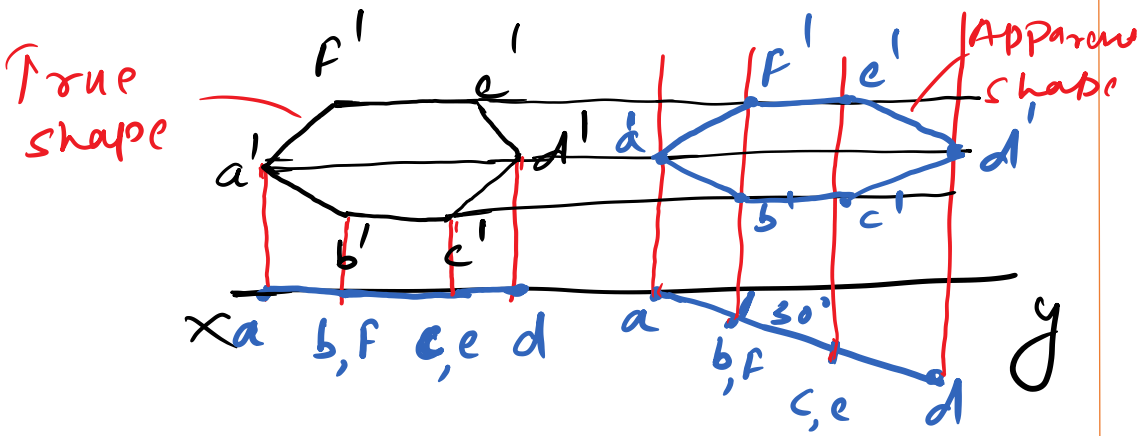
hexagonal

Side length = 25 mm

True shape = F.V

Corner

$\phi_s = 30°$



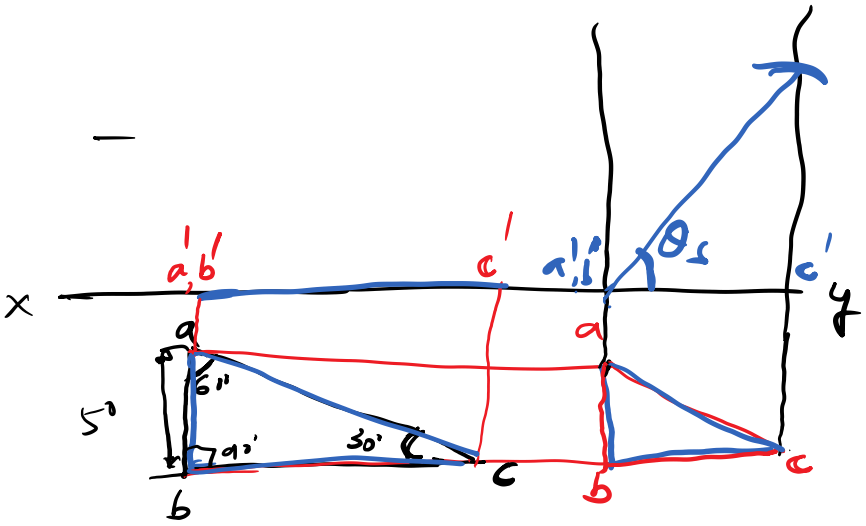
15) A 30°-60°-90° set square has its shortest edge 50mm long and is in the H.P. The T.V. of the set square is an isosceles triangle. Draw the projections. Measure the inclination of a plane with the H.P.

Given Data

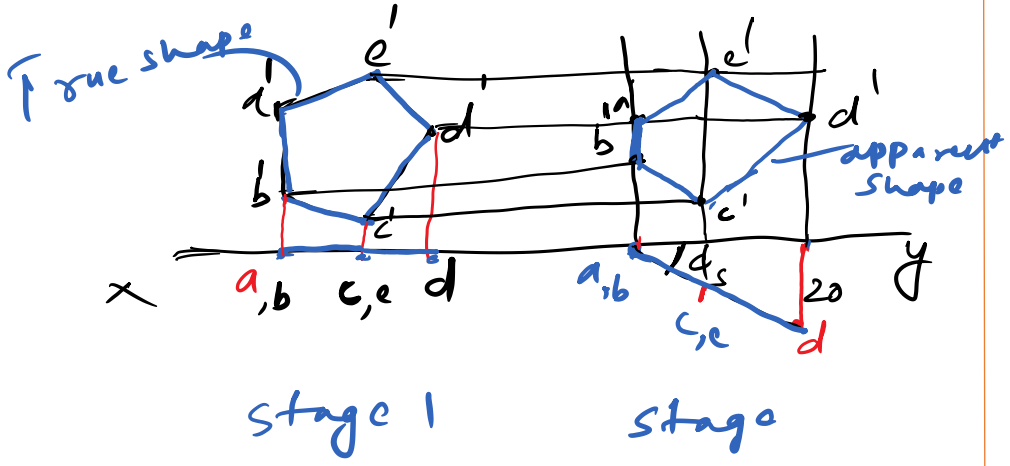
Shortest edge length = 50mm

T.V = Isosceles triangle

θ_s = ?



16) A pentagonal plate of 50 mm side has one its side in the V.P. The corner opposite to this side contained by the H.P. is 20 mm in front of the V.P. Draw the projections and find the inclination of a surface with the V.P.



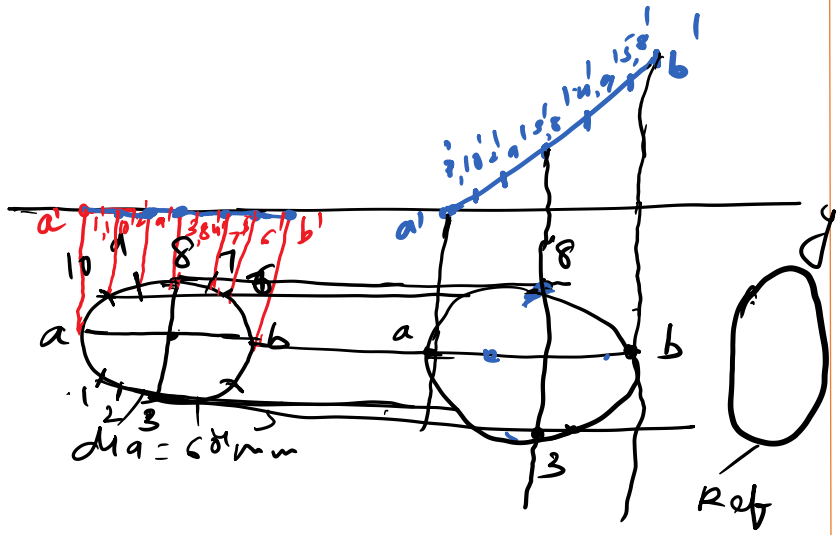
stage I stage

2) A circular plate of 60 mm dia. is resting on point A of its rim with its surface is inclined at 30° to the H.P. Draw the projections of the plate.

Given Data

circle

Tone shape :- T.V



A line AB, 70 mm long is inclined at angle 30° to the H.P. and 45° to the V.P. Its end point A is 10mm above the H.P. and 20 mm in front of the V.P. Draw the projections of line AB Assume complete line → be in 1st quad.

Given Data

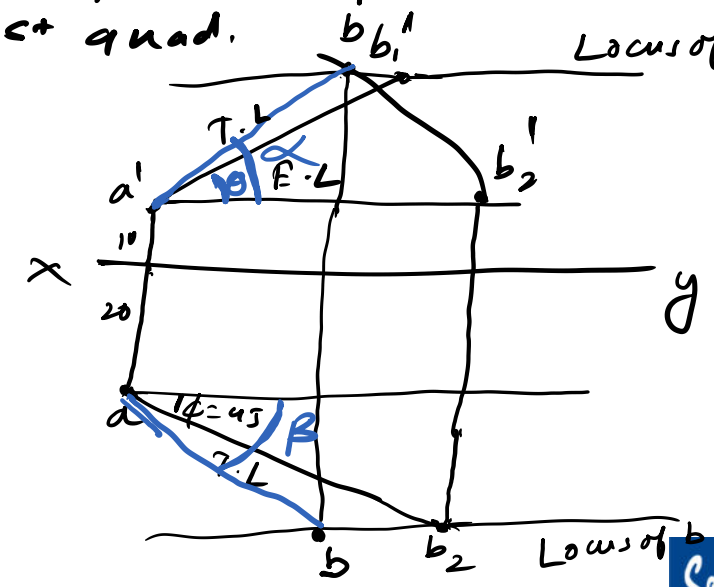
T.L = 70mm = $a'b_1' = ab_2$

$\theta = 30°$

$\phi = 45°$

a' = 10 mm above xy line

a = 20mm below xy line



111U06C105 – Engineering Drawing

Module
Section and Development of Solids

Introduction

When the surface of solid is considered to be completely opened out and laid on a plane, then surface is said to be developed and such a shape and size, which can be folded or formed to make the required object is called the ***Development of Surface****. It can also be stated as a process of unfolding all the surfaces of an object.*

Application of Development of Surfaces in Engineering Products

Sheet metal working is based on the knowledge of development of surfaces. Products like tanks, boiler's, funnels, hopper's, bins, airconditioning ducts, aeroplane parts, ship parts, chimneys etc. are made from flat sheets of metal. The metal sheets are cut as per the size required and is fabricated into the desired shapes.

Methods of development

Parallel line method

If stretch out lines principle is used in case of prism and cylinder, we get the development of surfaces by parallel line method because the vertical edges of prism and generators of cylinder are parallel to each other.

Radial line method

If stretch out lines principle is used in case of pyramid and cone, we get the development of surfaces by radial method because the slant edges of pyramid and generators of cone are uniform in true length and radiates from apex in each case.

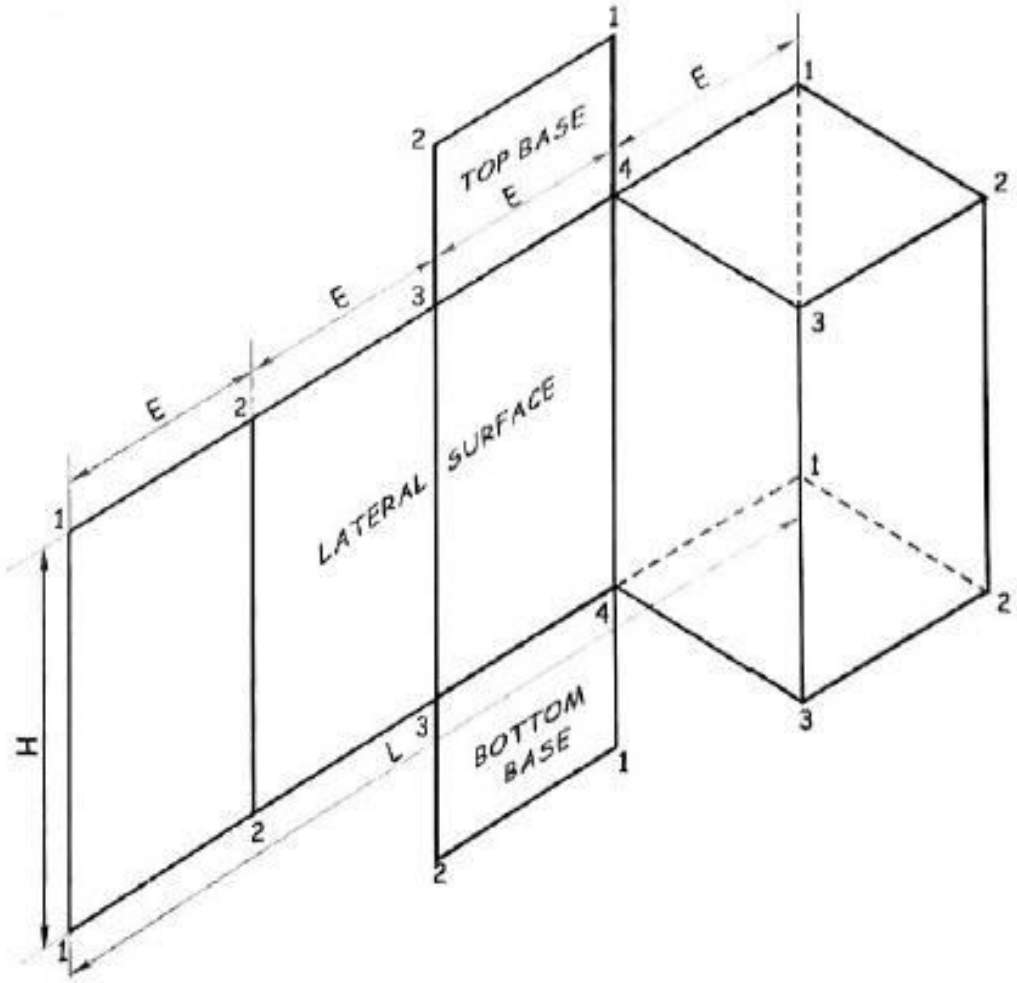
Introduction contd…

Development of Prism

development of lateral surface of a prism is obtained by placing a number of rectangular face one adjacent to the other, equal to the number of edges of base. Hence the development of lateral surface of prism is represented as

Rectangle of size = Height × Perimeter of base
= H × L
= H × n × E

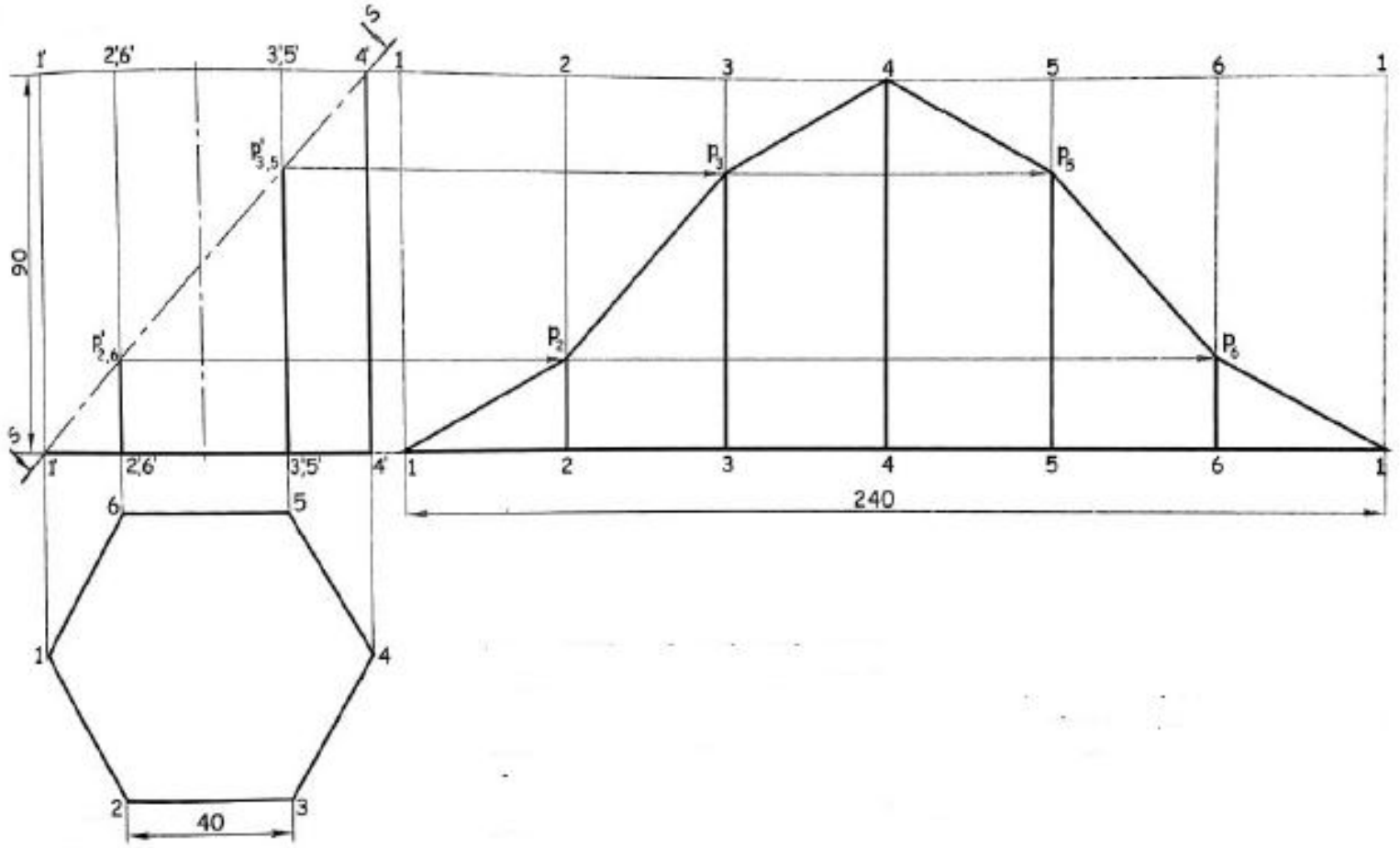
where H = Height of prism
n = Number of edges of base
L = Perimeter of base
E = Length of the edge of base



Introduction contd…

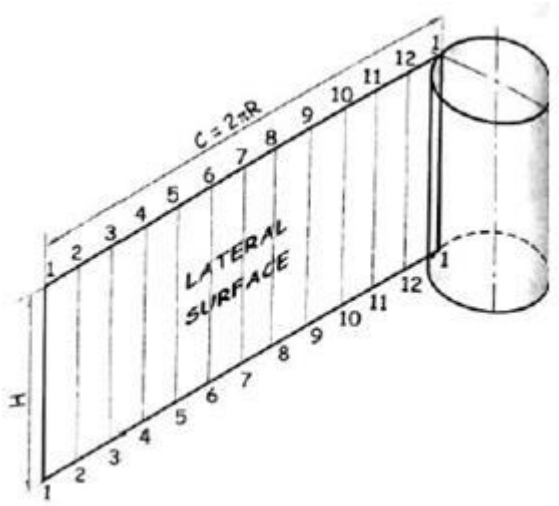
A hexagonal prism side of base 40 mm, axis height 90 mm has its two sides of base parallel to V.P. A section plane, cut the prism such that section plane passes through extreme left bottom corner to extreme right top corner of prism. Show the development of lateral surface of half cut prism.

Solution



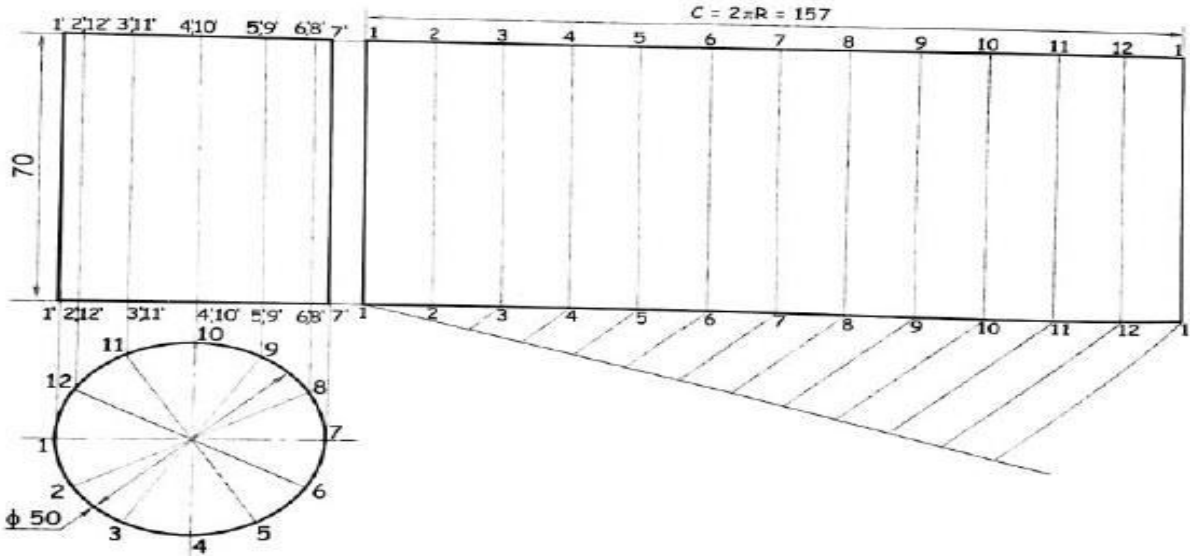
Development of Cylinder

If cylinder is rolled for one complete revolution on a plane then it moves the distance equal to circumference of its base circle. The area covered by it in one revolution will be equal to its Development of Lateral Surface (D.L.S.) which is a rectangle of sides equal to the circumference (C) of its base circle and the height (H) of the cylinder.



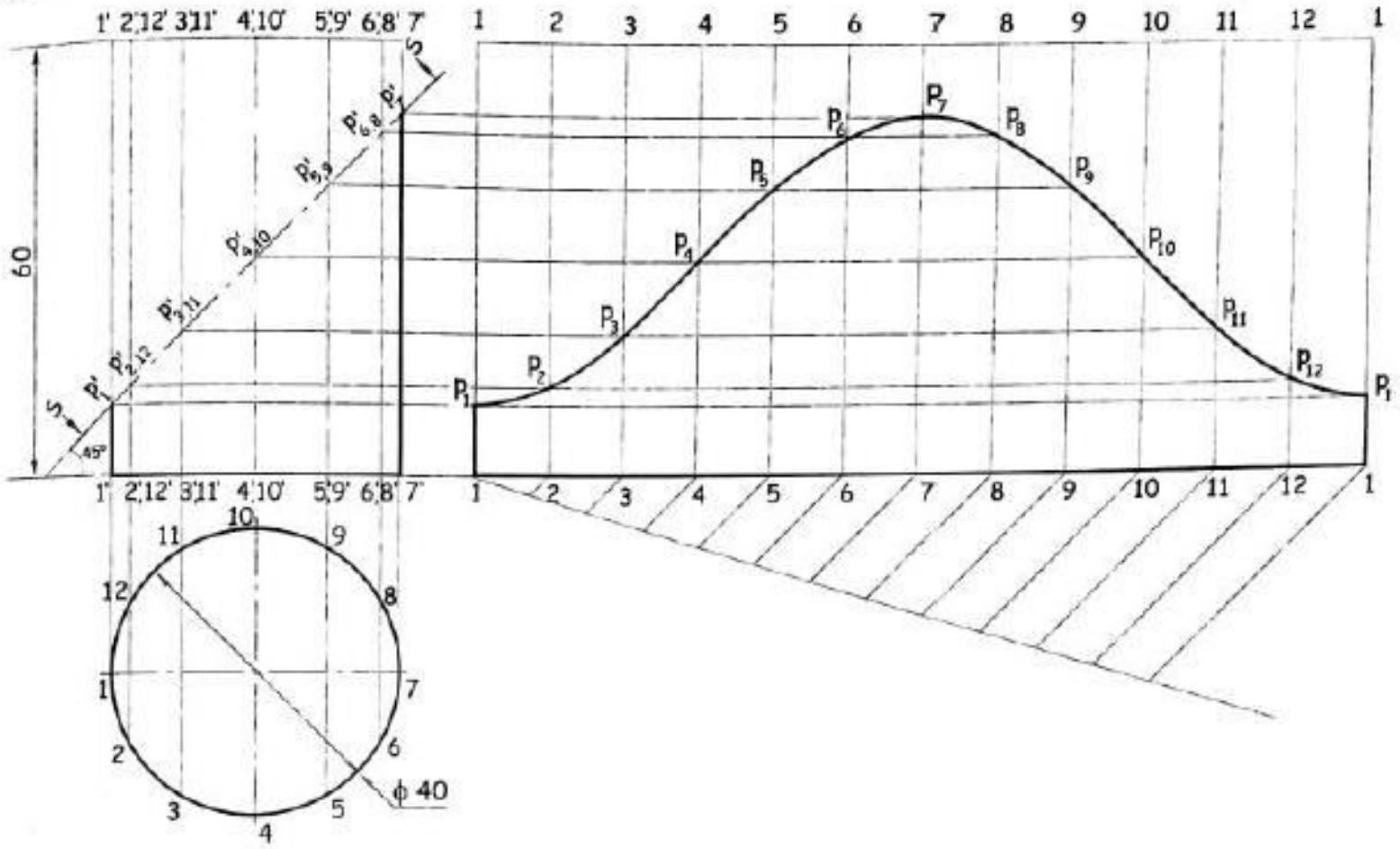
A right circular cylinder of base diameter 50 mm and axis height 70 mm is resting on it's base on H.P. Draw the development of lateral surface (D.L.S.) of cylinder.

Solution

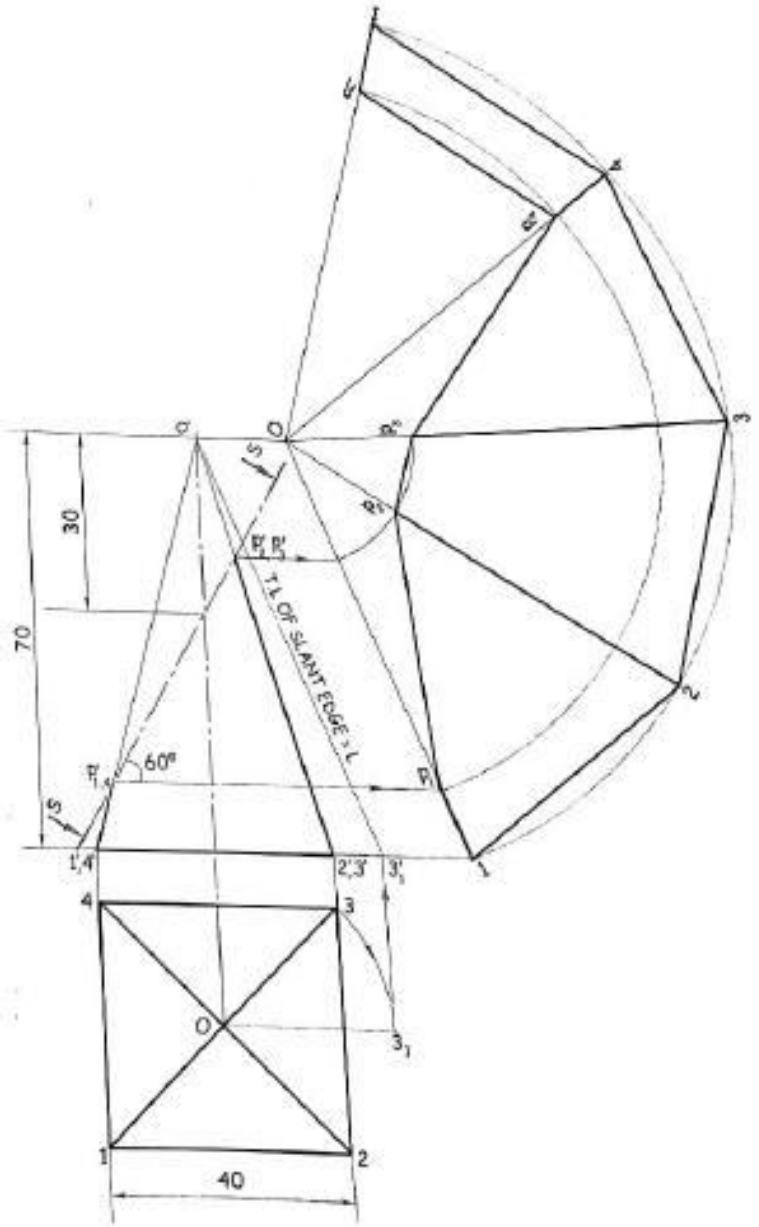


A cylinder of base diameter 40 mm and axis height 60 mm has it's axis perpendicular to H.P. and parallel to V.P. It is cut by a cutting plane perpendicular to V.P. inclined at 45° to H.P. and bisecting the axis of cylinder. Show the development of lateral surface (D.L.S.) of truncated cylinder.

Solution :



A square pyramid of 40 mm side of base and 70 mm height stand with its base in the H.P. Its sides of base are parallel to V.P. An Auxillary Inclined Plane (A.I.P.) cuts the pyramid passing through a point on axis 30 mm from apex and inclined to H.P. at 60°. Draw the D.L.S. of pyramid assuming apex to be removed.



Development of Cone

If a cone is rolled for one complete rotation on a plane with apex of the cone hinged at a point then the area covered by the cone will be a sector of circle which represents the development of lateral surface of a cone.

The radius of the sector (R) will be equal to the true length of the generator of the cone and the length of the arc will be equal to the circumference of the base circle of the cone.

The angle θ subtended by the arc of length equal to the circumference of base circle can be calculated as follows :

$$\theta = \frac{\textit{Circumference of the base circle}}{\textit{Circumference of the circle of radius } R} \times 360^{\circ}$$

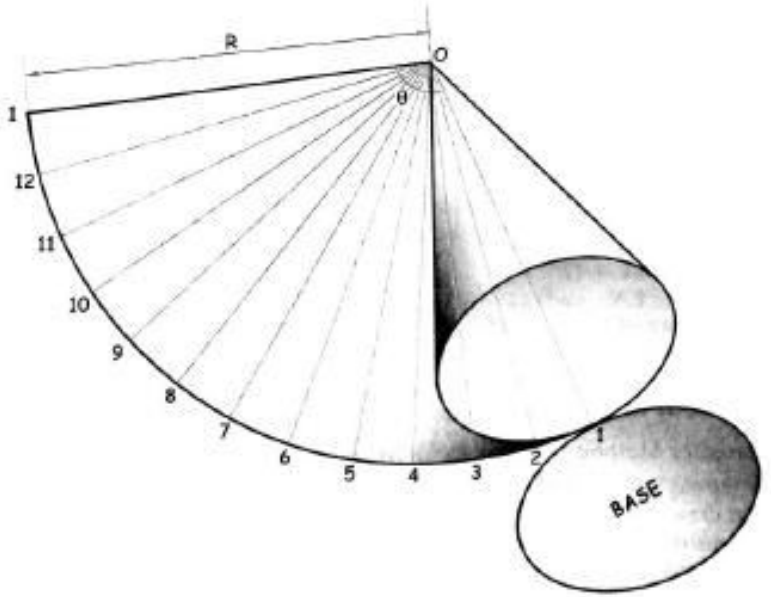
$$= \frac{2\pi r}{2\pi R} \times 360^{\circ}$$

$$\theta = \frac{r}{R} \times 360^{\circ}$$

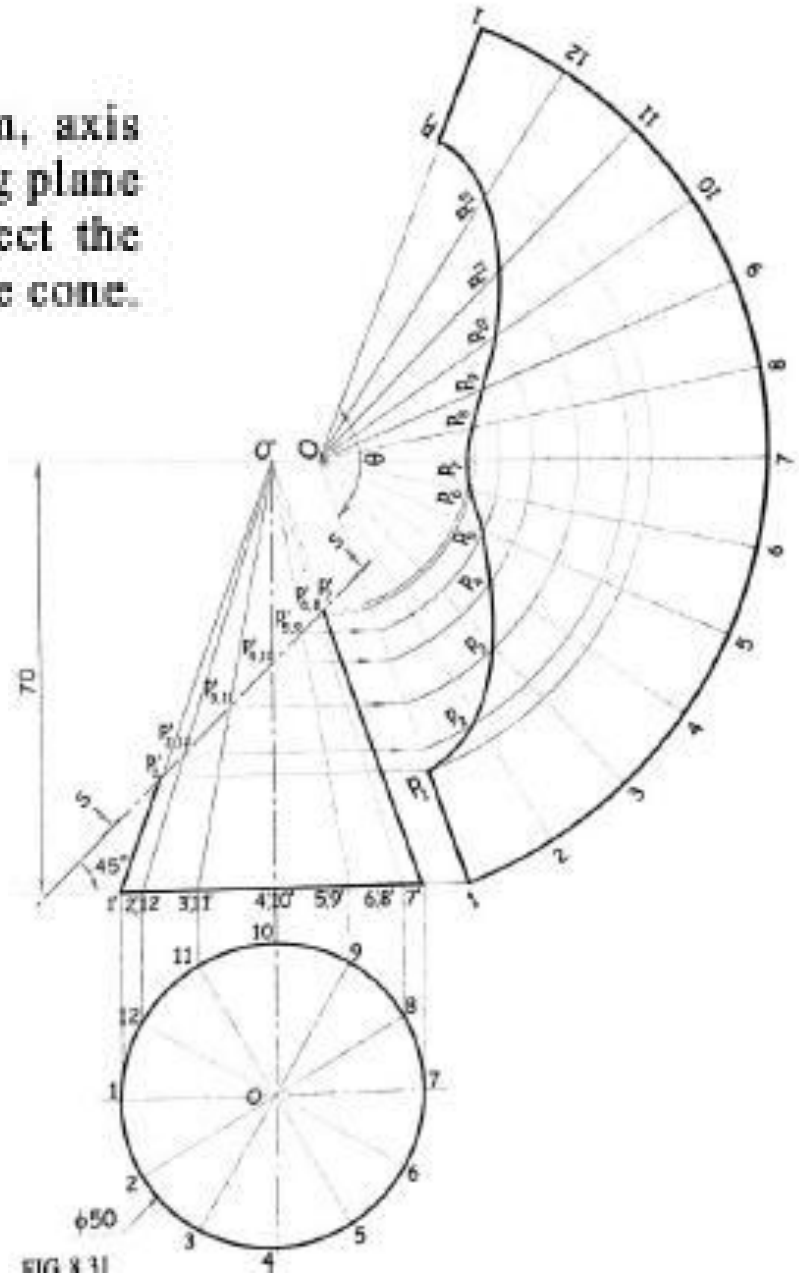
Where

r is the radius of the base circle.

R is the true length of generator.



A right circular cone having diameter at base 50 mm, axis length 70 mm resting on it's base in H.P. is cut by cutting plane perpendicular to V.P. and inclined to H.P. at 45°, bisect the axis. Draw the DLS of the lower remaining portion of the cone.



Problem 2(a)
A square prism side of base 30 mm, axis height 50 mm has its base in the H.P. with two sides of base parallel to the V.P. It is cut by an auxiliary inclined plane (A.I.P.). which bisects the axis and makes an angle 45° to the H.P. Draw the projection of F.V., sectional T.V., sectional S.V. and the true shape of a section. *(Use first angle method.)*

Solution (a)
Refer figure 11.9 (a) and (b).

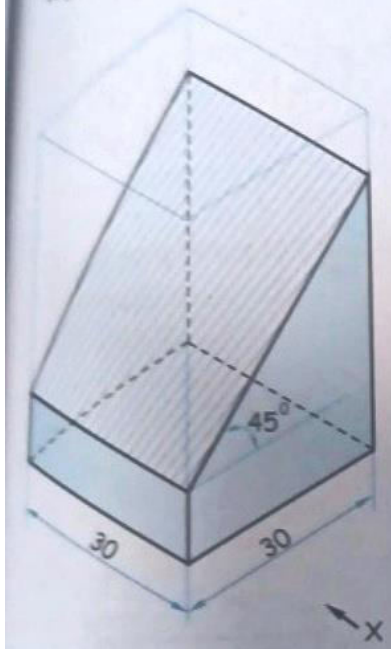


FIG.11.9 (a)

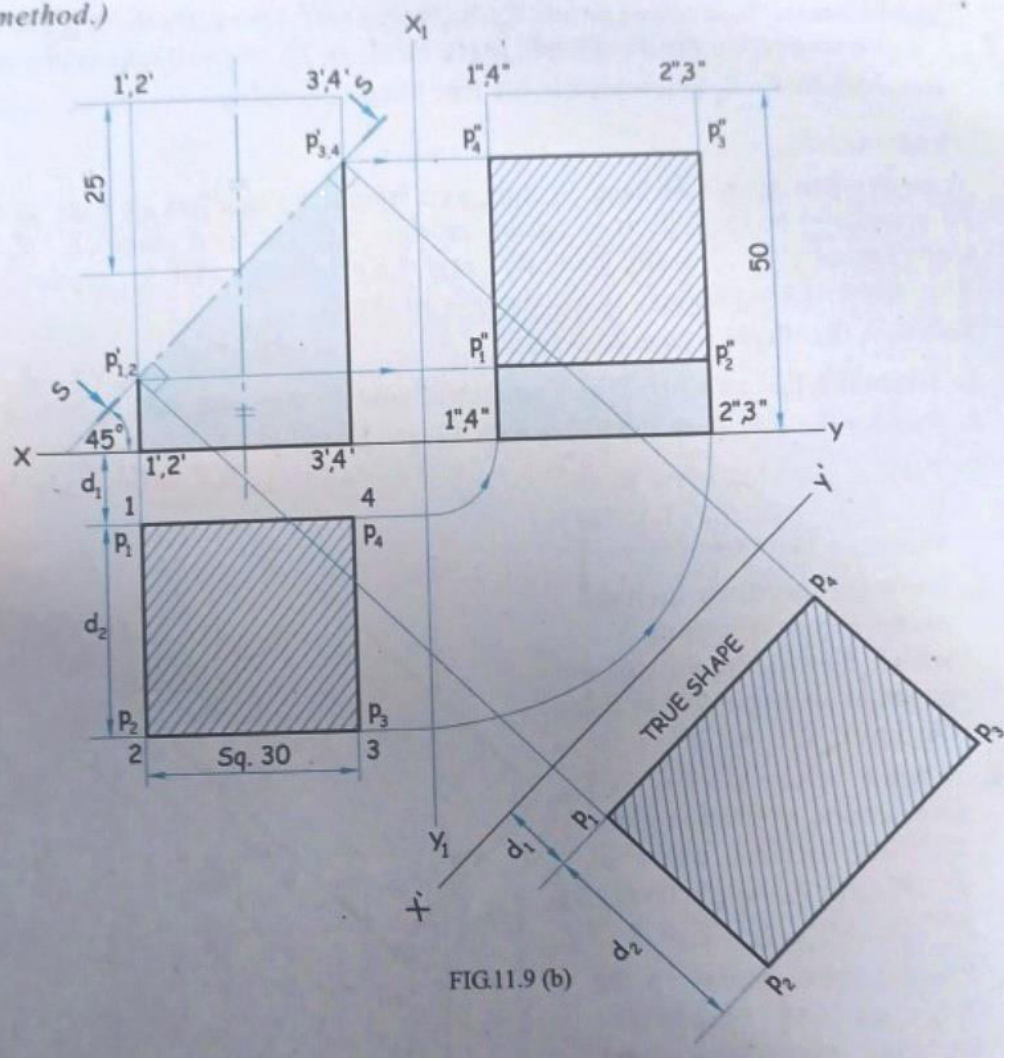
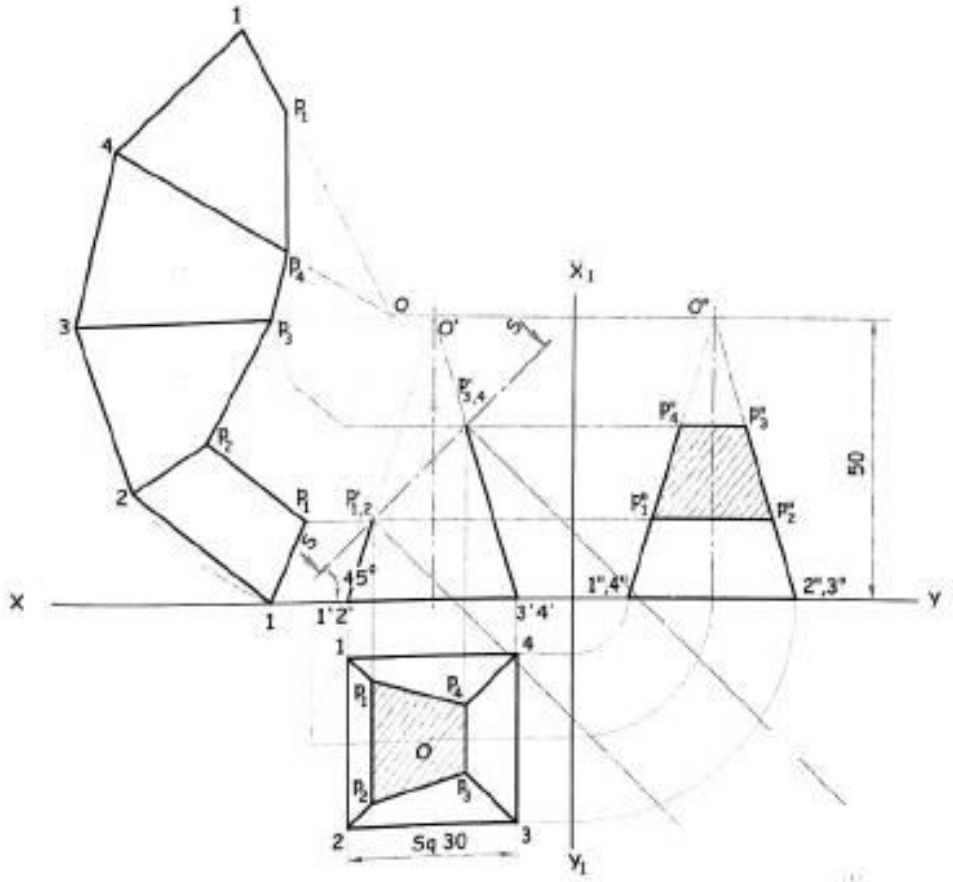
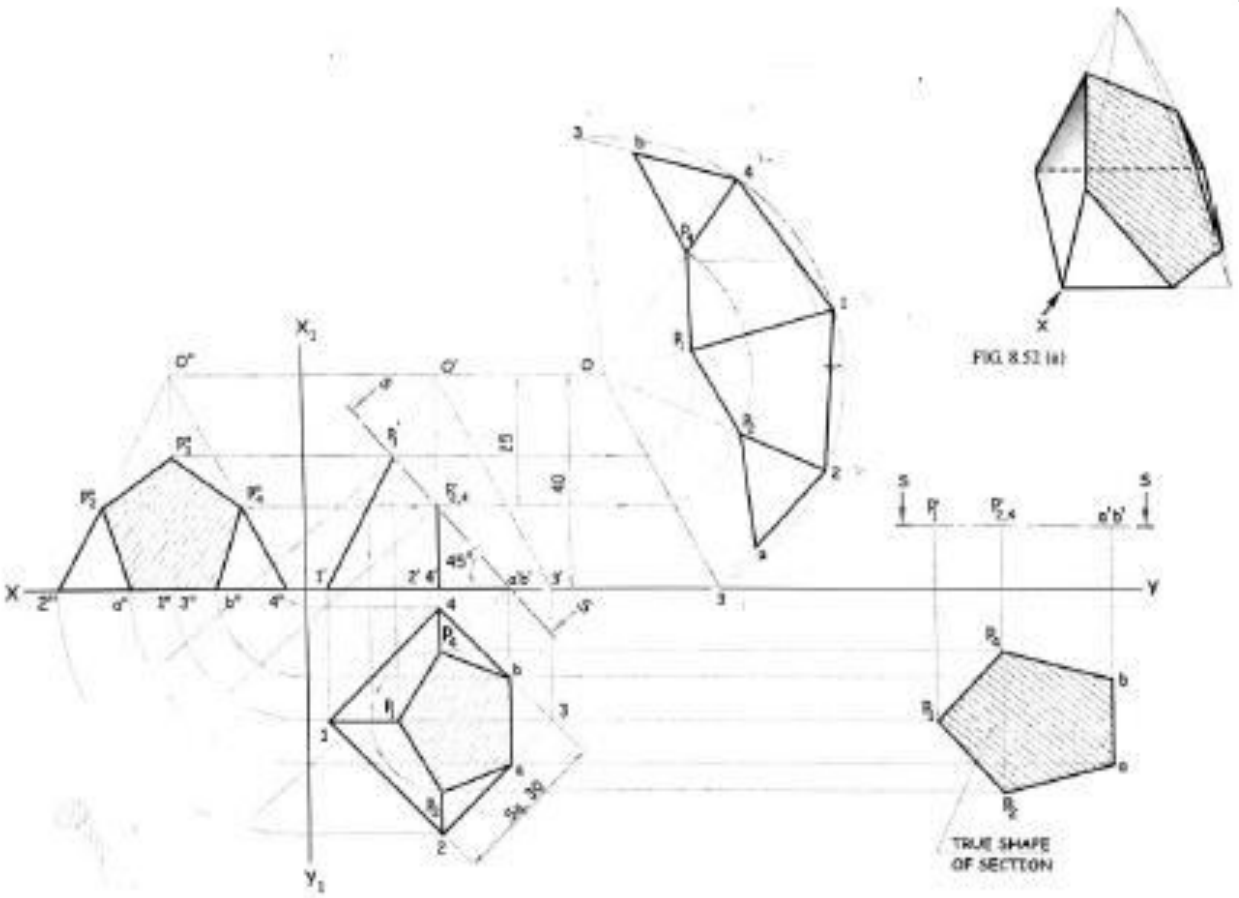


FIG.11.9 (b)

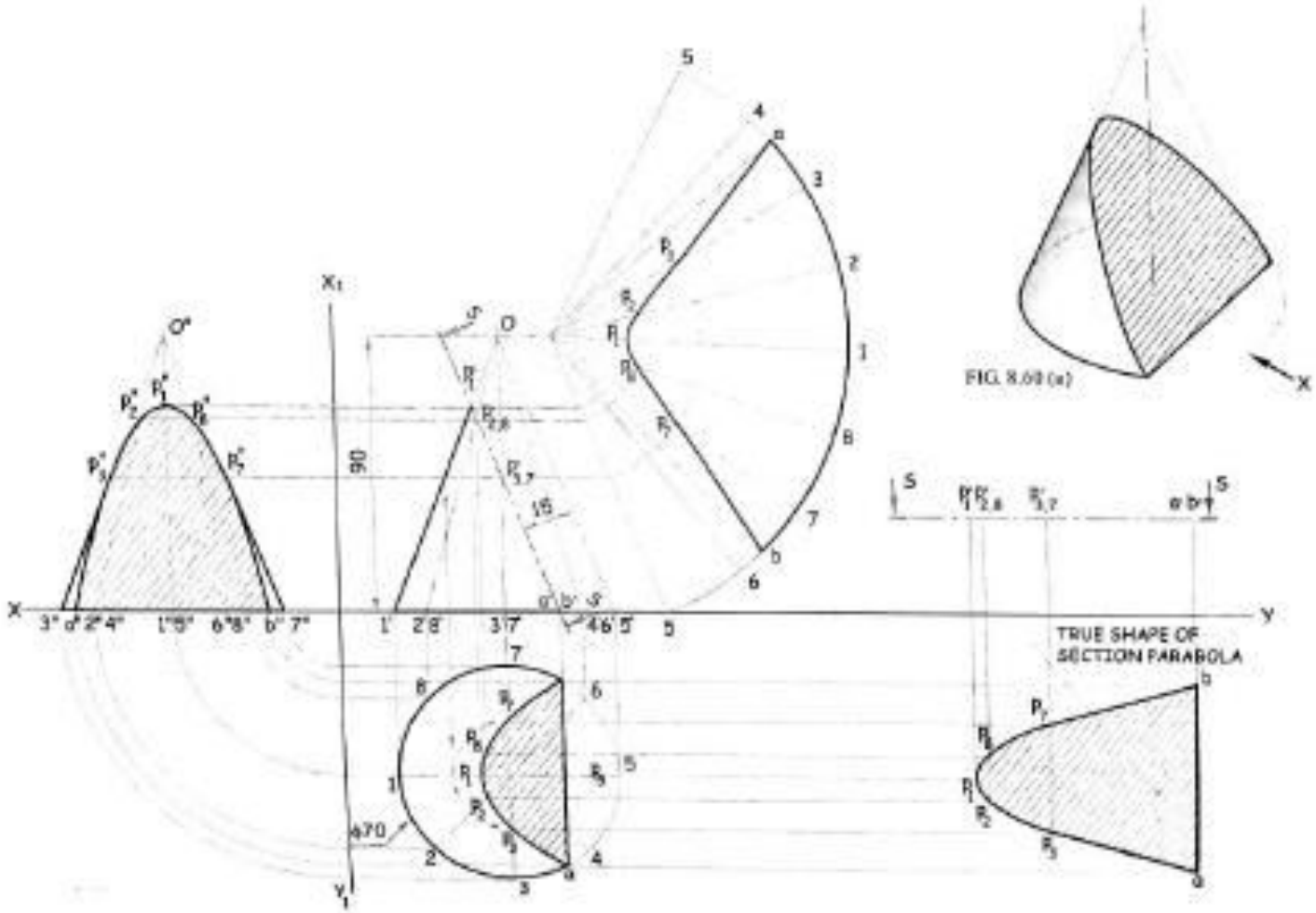
A square pyramid of 30 mm edges of base and 50 mm height is resting on its base with one of the edges of the base perpendicular to the V.P. It is cut by an A.I.P. in such a way that it bisects the axis and is inclined at 45° to the H.P. Draw elevation, sectional plan, sectional end view and the true shape of section. Also draw the development of lateral surface.



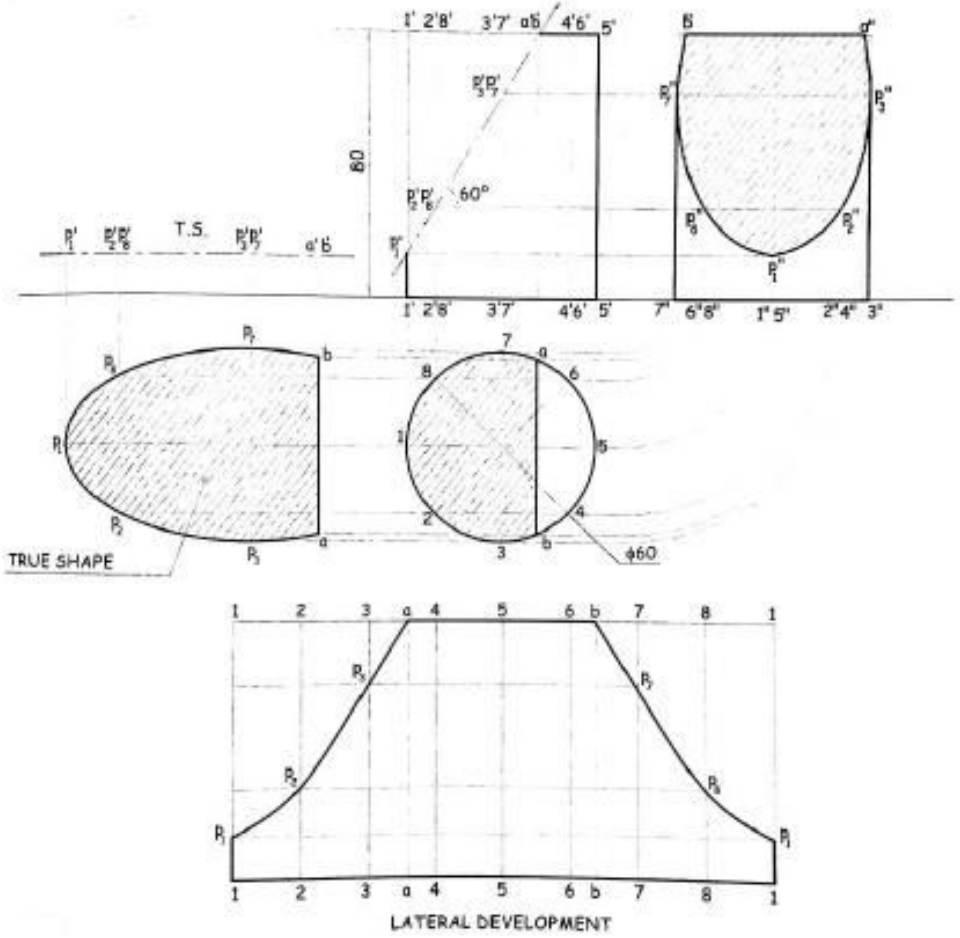
A square pyramid, base 30 mm and axis 40 mm long stands vertically on the H.P. with the edges of a base equally inclined to the V.P. It is cut by the section plane perpendicular to the V.P., inclined at 45° to the H.P. and passing through the point on the axis 25 mm from the apex. Draw the F.V., sectional T.V., sectional S.V. and the true shape of a section. Also draw the D.L.S. assuming apex part to be



A cone, of base 70 mm diameter and axis 90 mm long is resting on its base on H.P. It is cut by a section plane perpendicular to V.P. and parellel to and 15 mm away from one of its end generators. Draw the Sectional T.V., F.V., Sectional S.V. and the true shape of a section. Also draw the development of lateral surface.



A cylinder of 60 mm diameter and 80 mm long stands with its circular base on the H.P. A section plane perpendicular to V.P. and inclined at 60° to H.P. cuts the axis at a point 20 mm from its top end. Draw the sectional top view, front view, sectional side view and the true shape of section. Also draw its development of lateral surface.



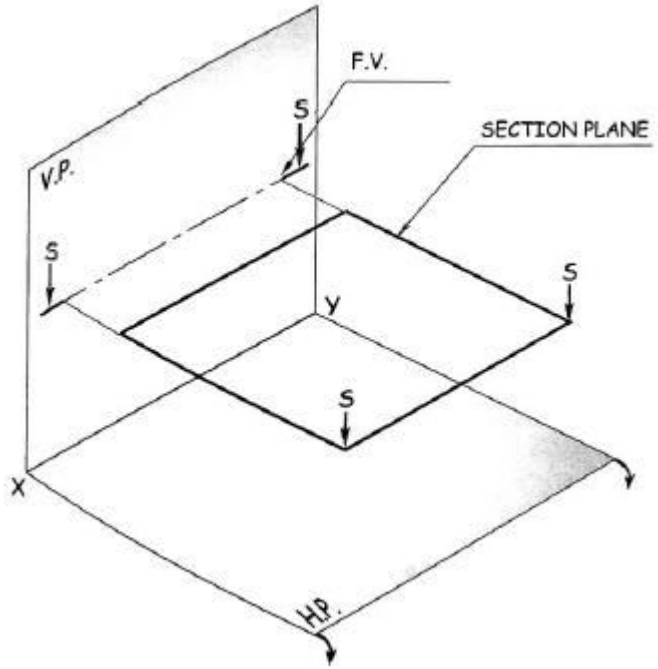
111U06C105 – Engineering Drawing

Module
Section of Solids

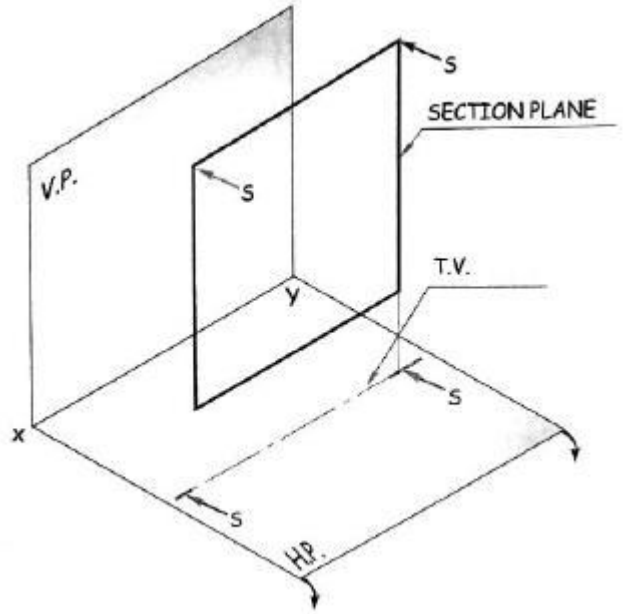
Introduction

Types of Section planes

Section Plane Perpendicular to V.P. and Parallel to H.P



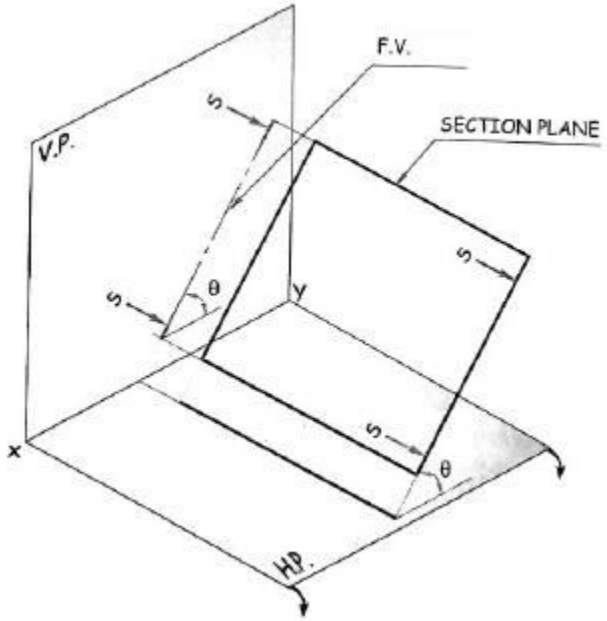
Section plane perpendicular to H.P. and Parallel to V.P.



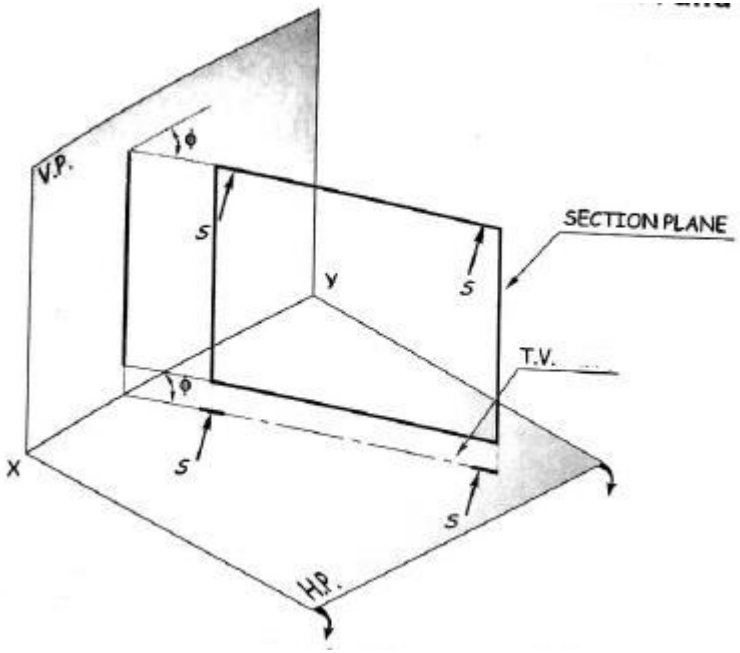
Introduction contd…

Types of Section planes

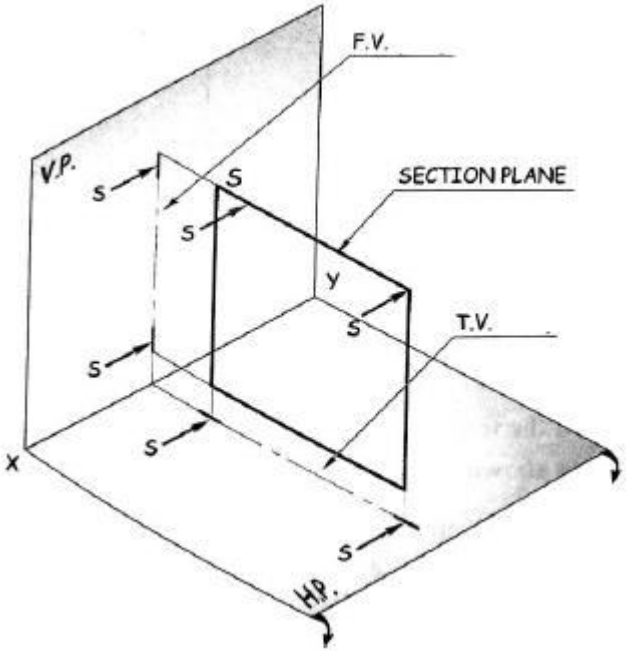
Section plane perpendicular to V.P. inclined to H.P.



Section plane perpendicular to H.P. inclined to V.P.

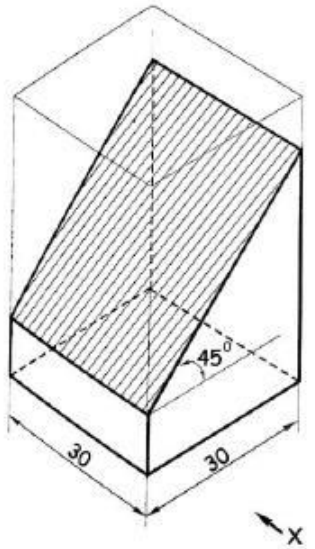


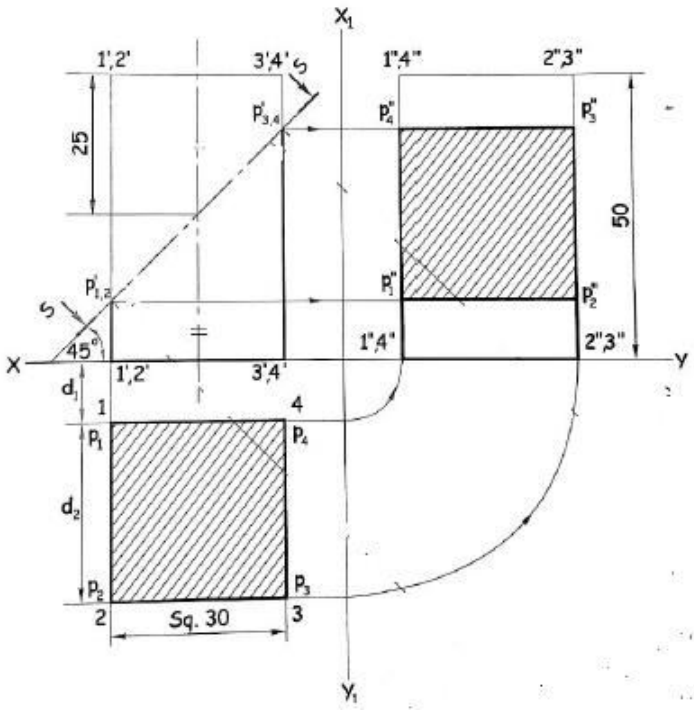
Section plane perpendicular to both H.P. and V.P.



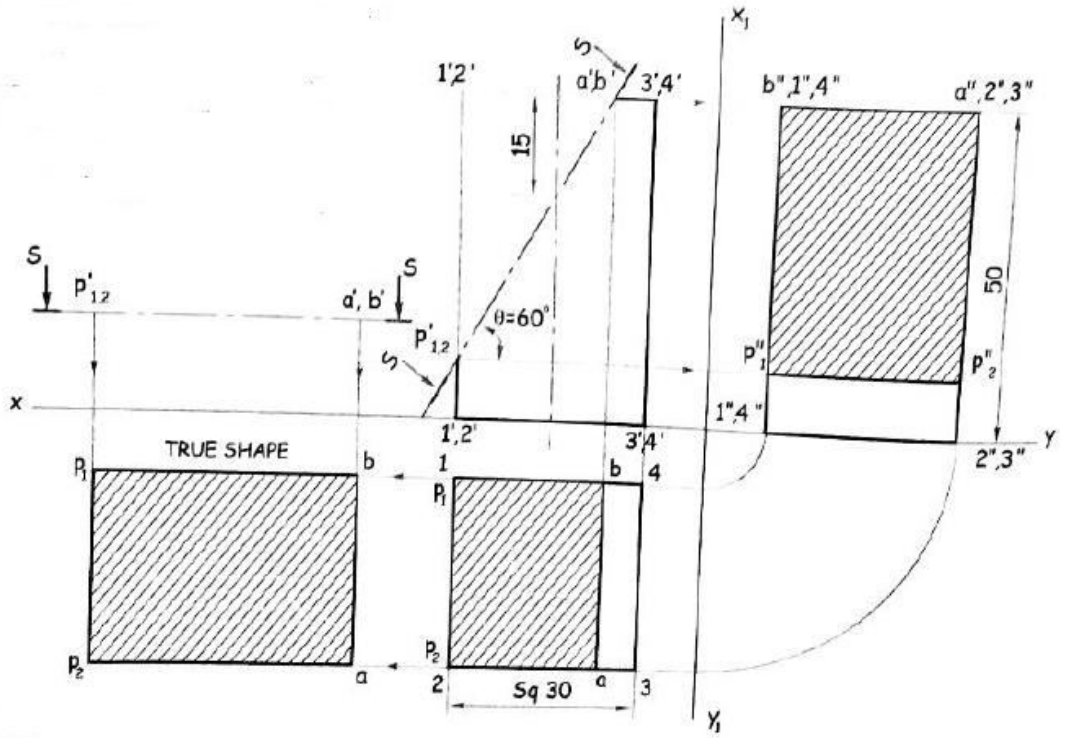
A square prism side of base 30 mm, axis height 50 mm has its base in the H.P. with two sides of base parallel to the V.P. It is cut by an auxiliary inclined plane (A.I.P.). which bisects the axis and makes an angle 45° to the H.P. Draw the projection of F.V., sectional T.V., sectional S.V. and the true shape of a section. *(Use first angle method.)*

Solution

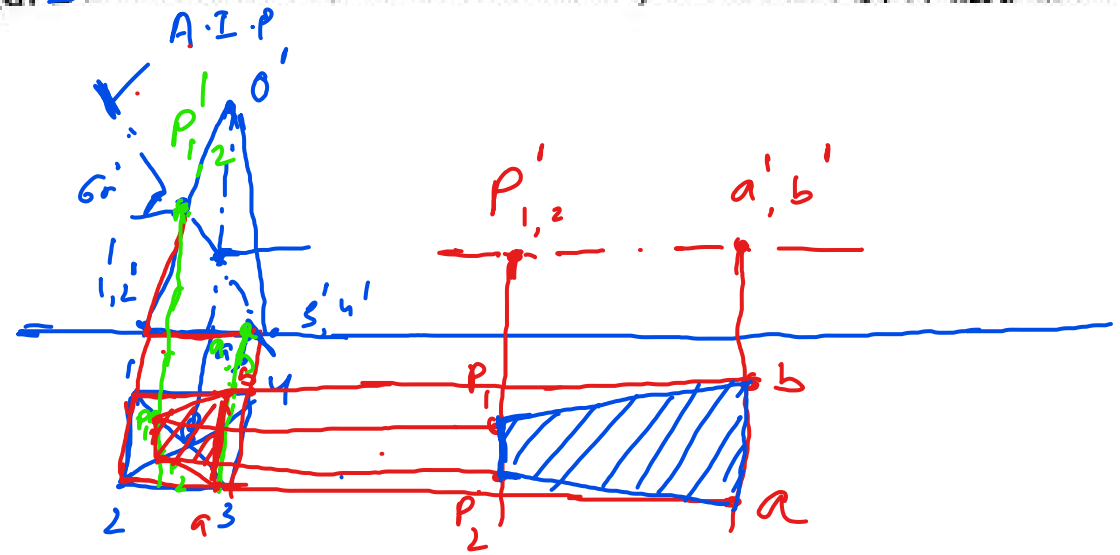




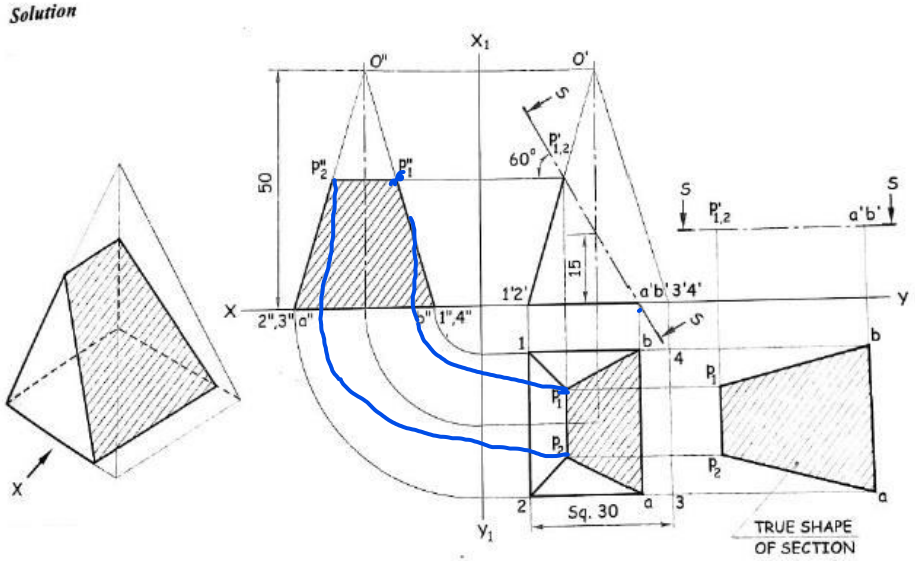
A square prism side of base 30 mm, axis height 50 mm stands vertical on the H P. with the sides of a base perpendicular to the V.P. A section plane perpendicular to the V.P. and inclined at 60° to the H.P. cuts the prism, which passes through the point on the axis at a distance of 15 mm from the top base. Draw the projection of F.V., sectional T.V., sectional S.V. and the true shape of a section.



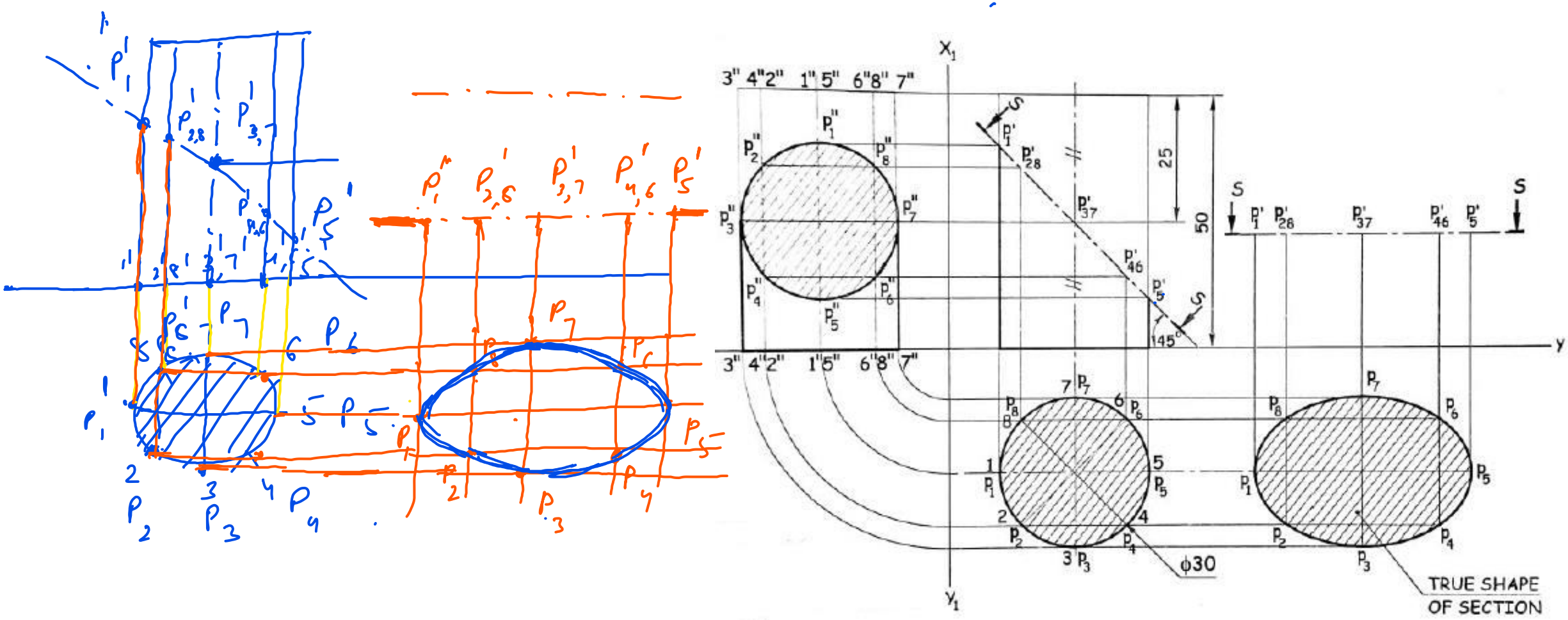
A square pyramid side of base 30 mm, axis length 50 mm has its base in the H.P. and two of its side of base perpendicular to the V.P. A section plane cuts the pyramid such that it is perpendicular to the V.P. and inclined at 60° to the H.P. and passes through the point on the axis 15 mm above the base of a pyramid. Draw the F.V., sectional T.V., sectional S.V. and the true shape of a section.



Solution

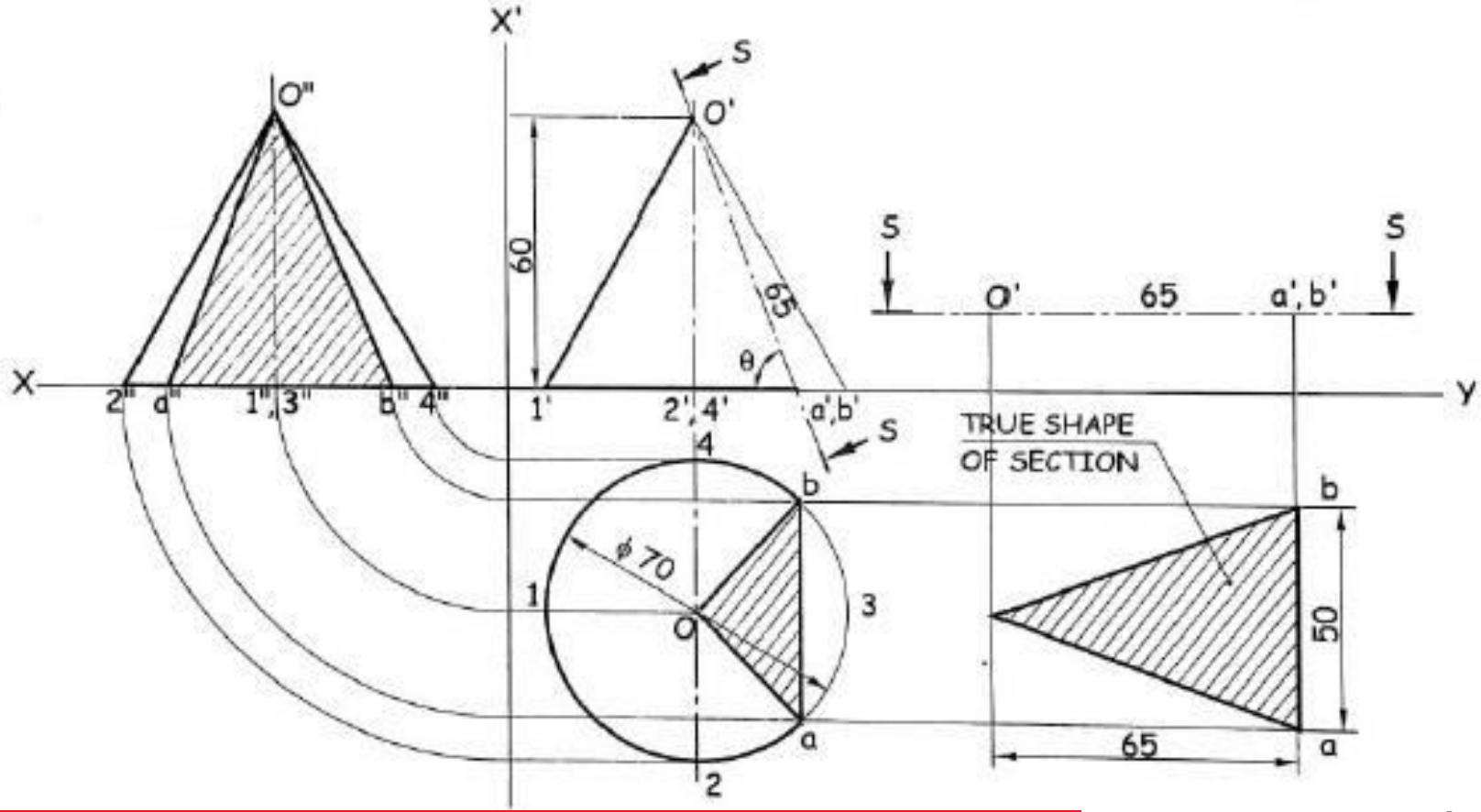


A cylinder of 30mm diameter and 50 mm long stands vertically on its circular base. It is cut by an A.I.P inclined at 45◦ to the H.P. which bisect a axis of a cylinder. Draw the sectional T.V. , F.V., sectional S.V. and true shape of the section.



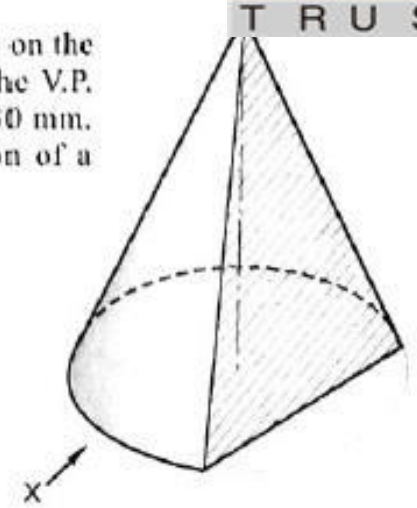
A cone, diameter of base 70 mm and axis 60 mm long is resting on its base on the ground. It is cut by a section plane perpendicular to V.P. and inclined to H.P. such that the true shape of the section is an isosceles triangle of height 65 mm. Draw the front view, sectional top view, sectional side view and true shape of the section. Also measure the base of the triangle and angle made by the cutting plane to H.P.

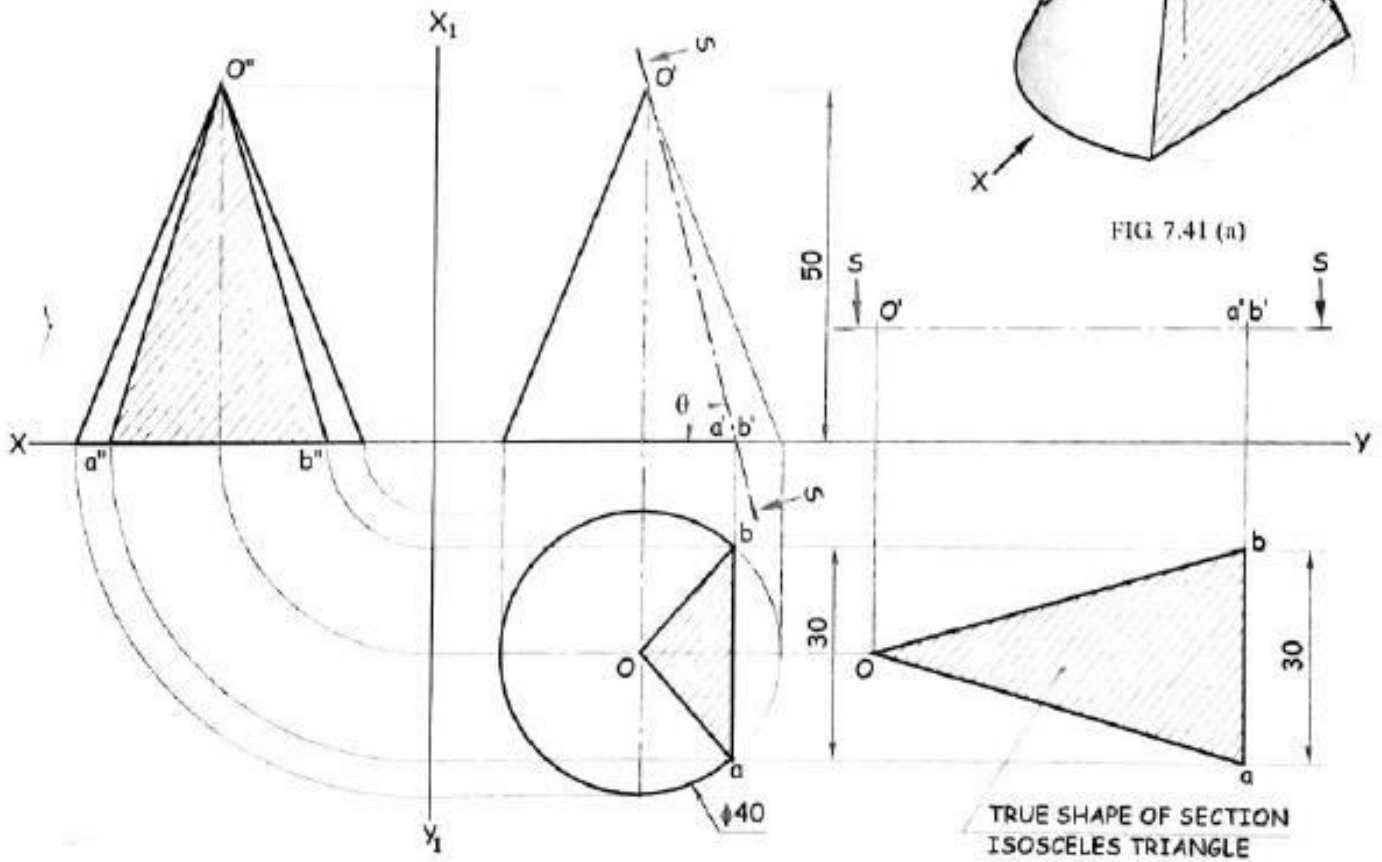
Solution



A cone, base diameter 40 mm and height 50 mm is resting on its base on the H.P. It is cut by a plane inclined to the H.P. and perpendicular to the V.P. such that the true shape of a section is an isosceles triangle of base 30 mm. Draw the F.V., sectional S.V., sectional T.V. Measure the inclination of a cutting plane with the H.P.

Solution





A hexagonal pyramid of 35 mm side of base and 65 mm axis length rest on its base on the H.P. with one of its side of a base perpendicular to the V.P. It is cut by the section plane whose H.T. makes an angle 30° with the XY and is 15 mm away from the axis of a pyramid. Draw the T.V., sectional F.V., sectional S.V. and the true shape of a section.

Solution