



Computer Aided Engineering Drawing

BCEDK103/203

All modules concepts + questions

COMPUTER AIDED ENGINEERING DRAWING

A drawing is graphical representation of objects and structures and is done using free hand, mechanical or computer methods.

Plane of Projection

A plane of projection is an imaginary flat plane upon which the image created by the line of sight is projected. The paper or computer screen on which a drawing is created is a plane of projection.

Orthographic Projection

Orthographic projection is a parallel projection technique in which the plane of projection is perpendicular to the parallel line of sight.

Vertical plane of projection

Vertical plane of projection is the plane onto which the Front View (FV) of the multi-view drawing is projected.

Horizontal plane of projection

Horizontal plane of projection is the plane onto which the Top View of the multi-view drawing is projected. The Top view of an object shows the width and depth dimensions of the object.

Profile plane of projection

Profile plane is the plane onto which the Side View of the multi-view drawing is projected. The side view of an object shows the depth and the height dimensions.

Projection Methods

Universally either the 1st angle projection or the third angle projection methods is followed for obtaining engineering drawings.

First Angle Projection

In this the object is assumed to be positioned in the first quadrant. The object is assumed to be positioned in between the projection planes and the observer. The views are obtained by projecting the images on the respective planes.

Third Angle Projection

In the third angle projection method, the object is assumed to be in the third quadrant. i.e. the object behind vertical plane and below the horizontal plane. In this projection technique, placing the object in the third quadrant puts the projection planes between the viewer and the object

Orthographic Projections

Lines are used to construct a drawing. Various type of lines are used to construct meaningful drawings. Each line in a drawing is used to convey some specific information.

Conventions used for lines

In orthographic projections, many times different types of lines may fall at the same regions. In such cases, the following rules for precedence of lines are to be followed:

Visible lines take precedence over all other lines

Hidden lines take precedence over center lines

Center lines have lowest precedence

When a visible line and a hidden line are to be drawn at the same area, It will be shown by the visible line only and no hidden line will be shown. Similarly, in case of hidden line and centre line, only hidden line will be shown. In such case, the centre line will be shown only if it is extending beyond the length of the hidden line.

Projection of Points

A POINT -The position of a point in engineering drawing is defined with respect to its distance from the three principle planes i.e., with respect to the VP, HP, & PP.

Conventions used while drawing the projections of points with respect to the 1st angle projection of point “P”

Top views are represented by only small letters eg. p .

Their front views are conventionally represented by small letters with dashes eg. p'

Profile or side views are represented by small letters with double dashes eg. p ''

Projectors are shown as thin lines.

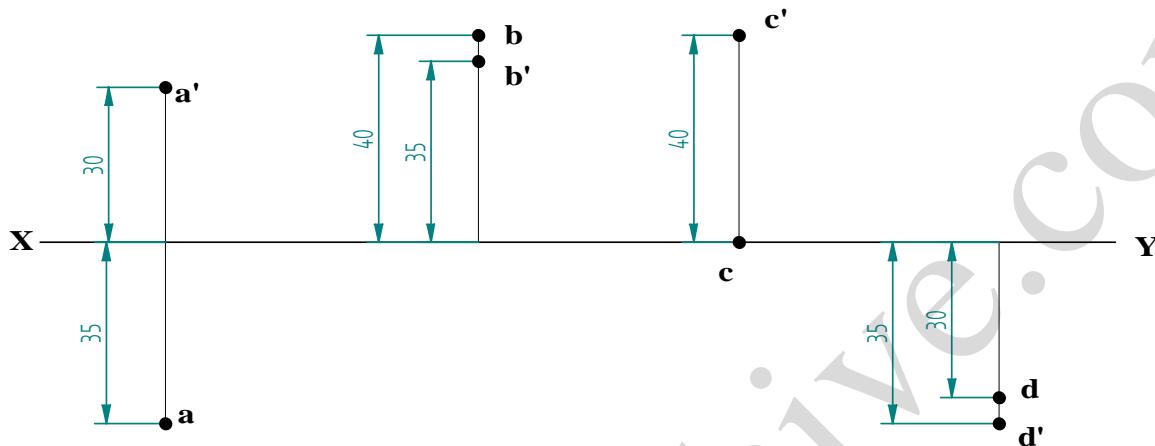
The line of intersection of HP and VP is denoted as X-Y.

The line of intersection of VP and PP is denoted as X1-Y1

Projections of Points

- 1 Draw the projections of the following Points on the same XY line. Keeping convenient distance between each projector. Name the Quadrant in which they lie.

- A. 30mm above HP & 35mm in front of VP.
- B. 35mm above HP & 40mm behind VP
- C. 40mm above HP& on VP
- D. 35mm below HP & 30mm in front of VP



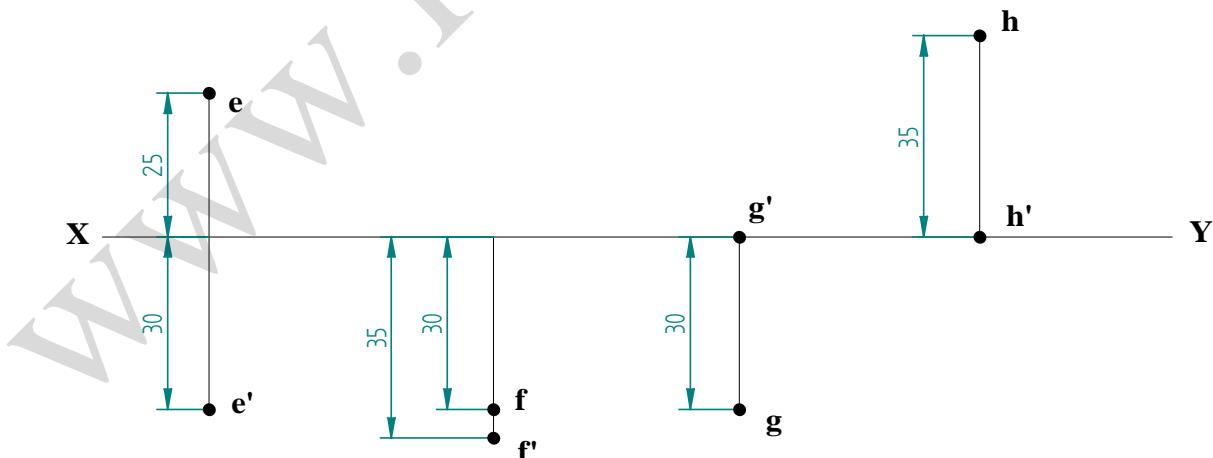
Solution:

A I Quadrant
B II Quadrant

C I as well As II Quadrant
D IV Quadrant

2. Draw the projections of the following Points on the same XY line. Keeping convenient distance between each projector. Name the Quadrant in which they lie.

- F. 30mm below HP & 25mm behind VP
- F. 35mm below HP & 30mm in front of VP
- G. On HP & 30mm in front of VP.
- H. On HP & 35mm behind VP.



Solution:

E III Quadrant

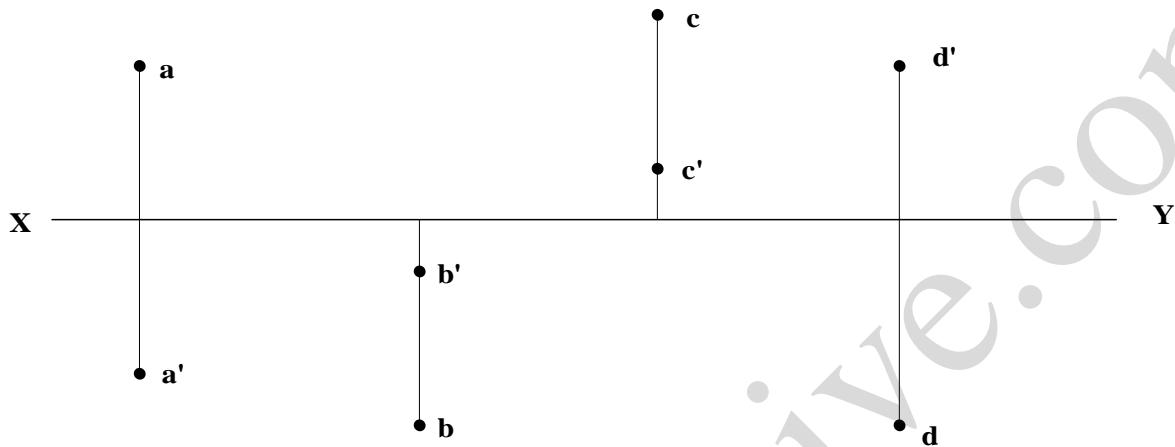
G I as well As IV Quadrant

F IV Quadrant

H II as well as III Quadrant

3 Draw and state the quadrants in which the following points located. Assume any distances

- A. Front view below XY line & top view above XY line.
- B. Front and Top views are below XY line
- C. Front & top views are above XY line.
- D. Front views above XY line & top view below XY line.



Solution:

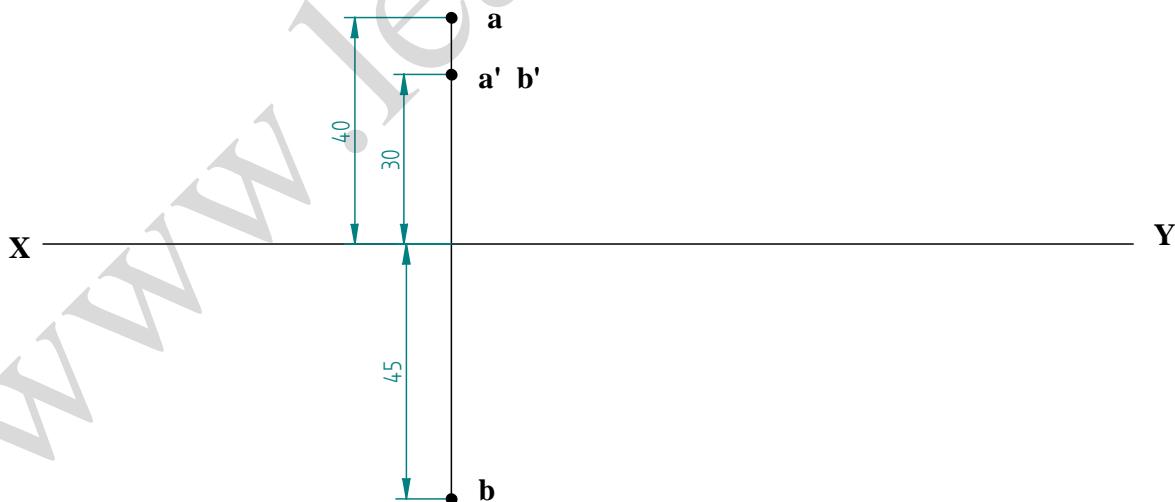
A III Quadrant

B IV Quadrant

C II Quadrant

D I Quadrant

4 A point 30mm above XY line is the front view of two points A&B. The top view of A is 40mm behind & the top view of B is 45mm in front of VP. Draw the projections of the Points & state the Quadrants in which points are situated.

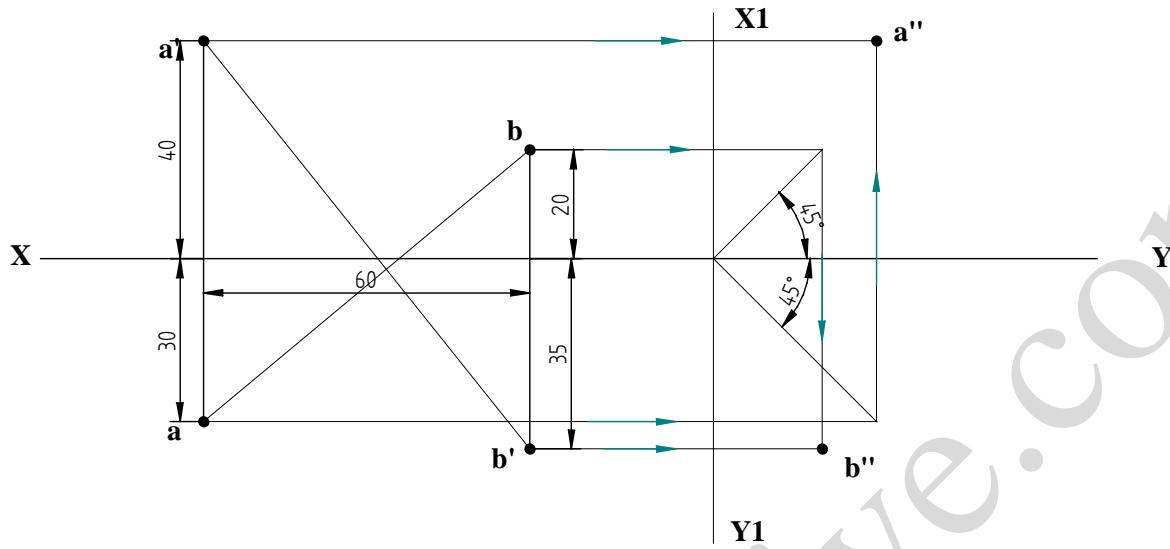


Solution:

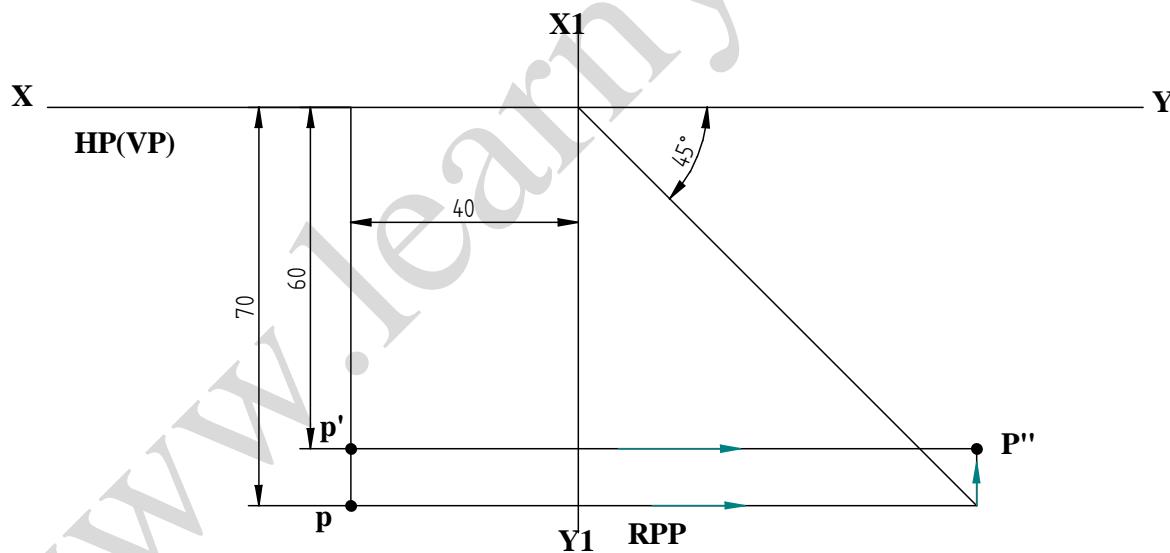
A I Quadrant

B I Quadrant

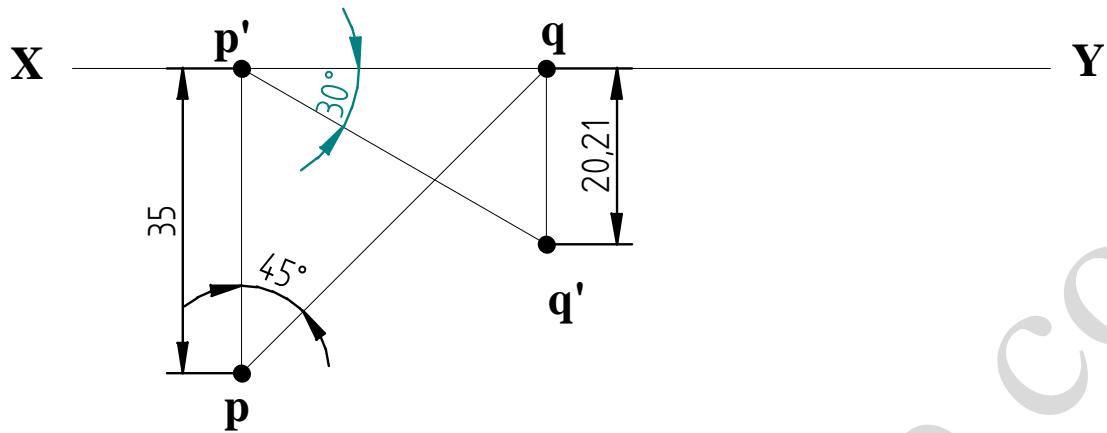
- 5 A point 'A' is 30mm in front of VP and 40mm above HP. Another point B is 20mm behind VP & 35mm below HP. The Horizontal distance between the points measured parallel to XY line is 60mm. Draw the three projections of the points. Join their front and top views.



- 6 Draw all the three views of a point P lying 60mm below HP, 70mm in front of VP and 40mm from the RPP. Also state the Quadrant in which it lies.

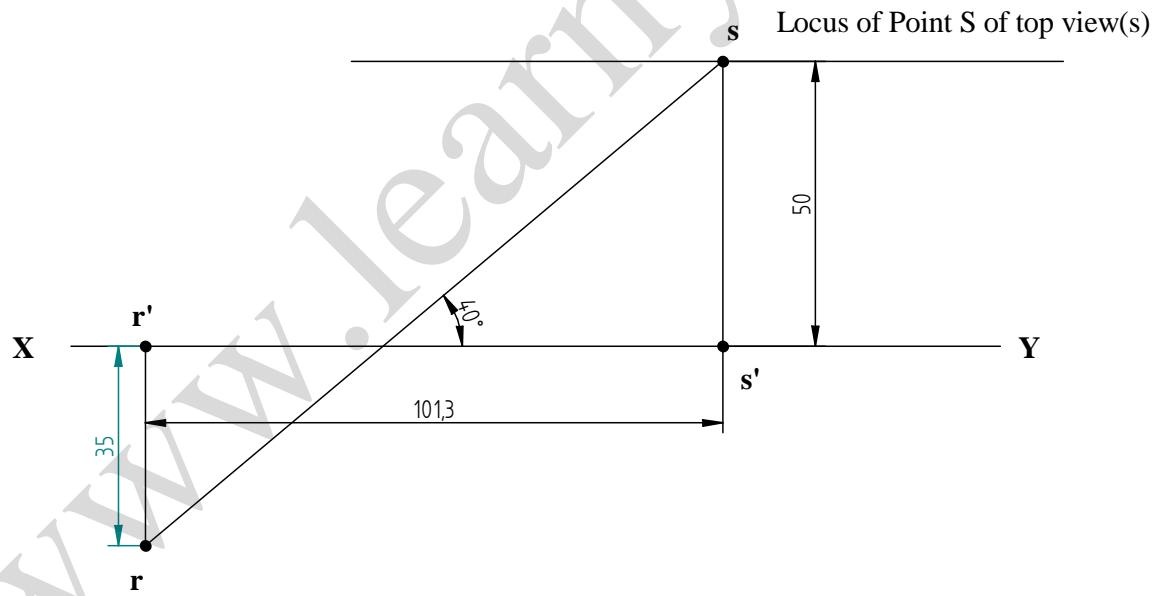


- A point P is on HP and 35mm in front of VP. Another Point Q is on VP and below HP. The line joining their front views makes an angle of 30deg to XY line, while the line joining their top views makes an angle of 45 deg with XY line. Find the distance of the points Q from HP.
- 7



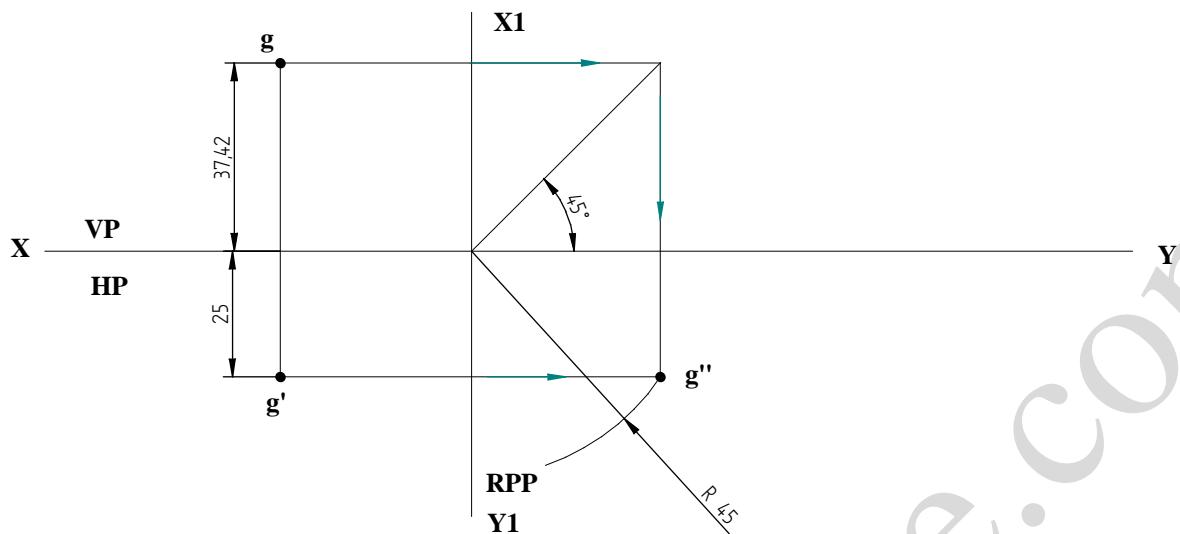
Ans: Point Q is **20.21 mm** Below HP

- Two points R and S are on HP. The Point R is 35mm in front of VP, while S is 50mm behind VP.
- 8 The line joining their top views makes an angle of 40deg with XY. Find the horizontal distance between the two projectors.



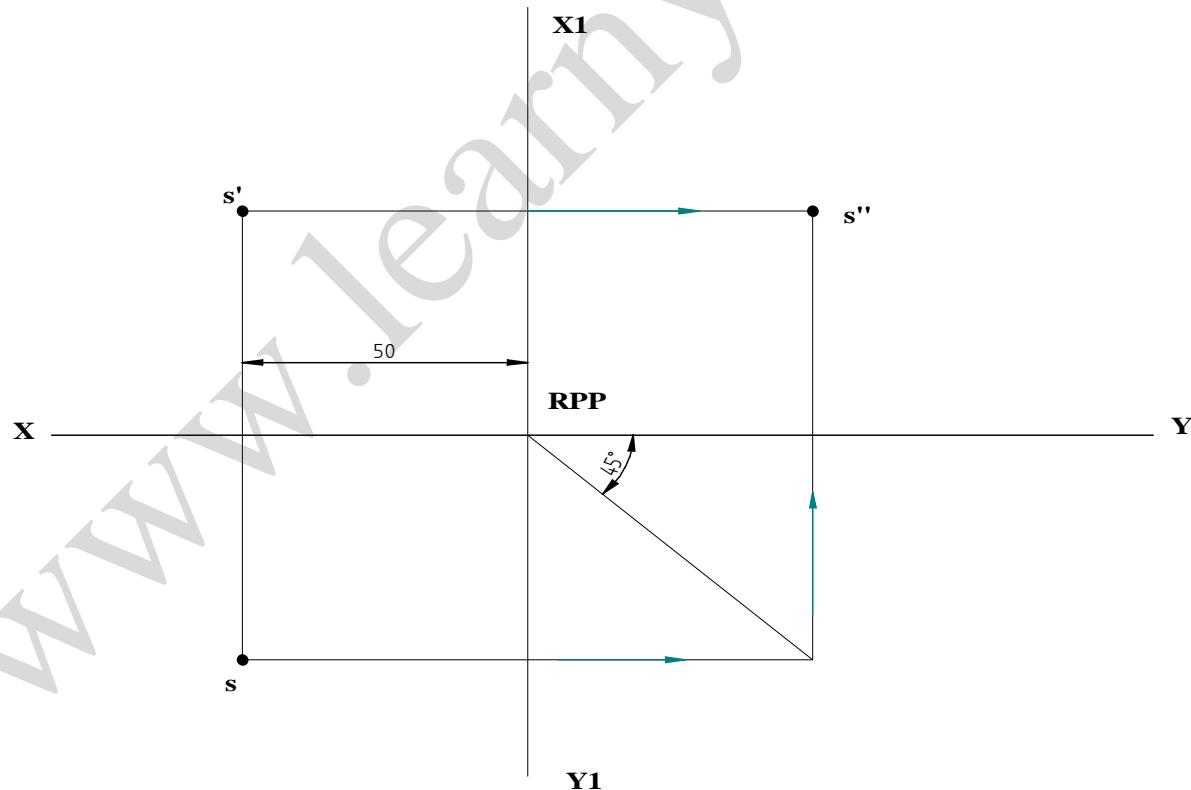
Ans: Distance Between Two Projectors is **101.3 mm**

- 9 A point G is 25mm below HP & is situated in the third quadrant, its shortest distance from XY line is 45mm Draw its projections and find its distance from VP.

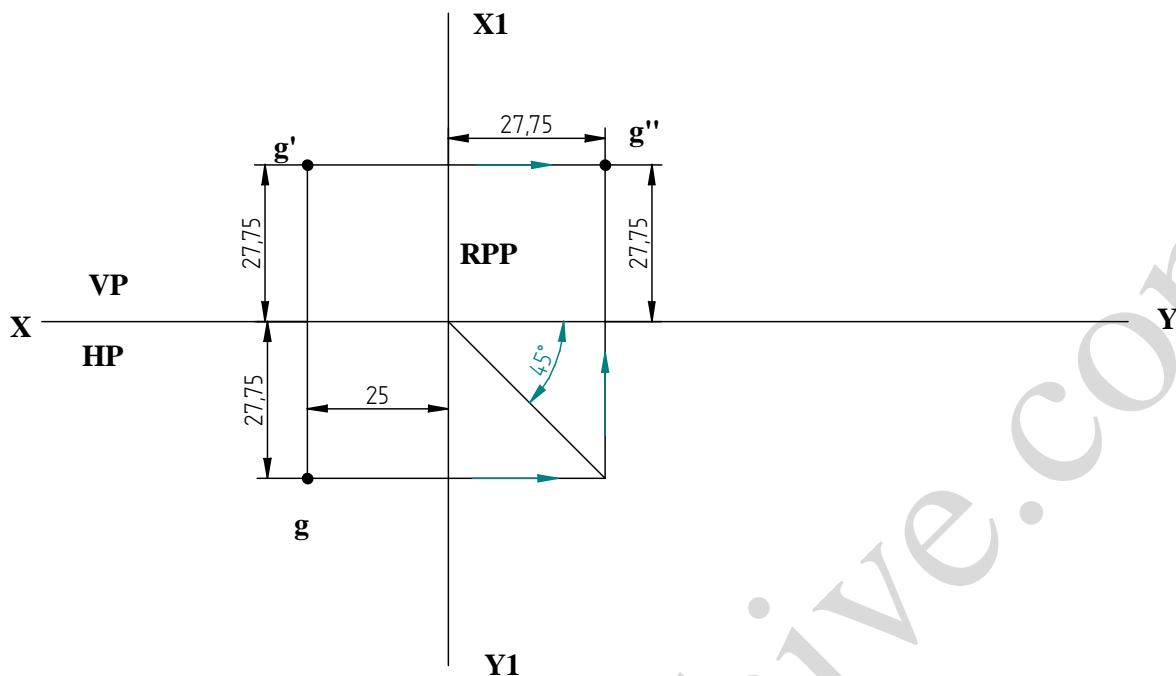


Point G is **37.42 mm** Behind VP

- 10 A point S is in the first quadrant and equidistant of 50mm form all the three principal Planes. Draw the projections of the points. Draw all three views of the point.

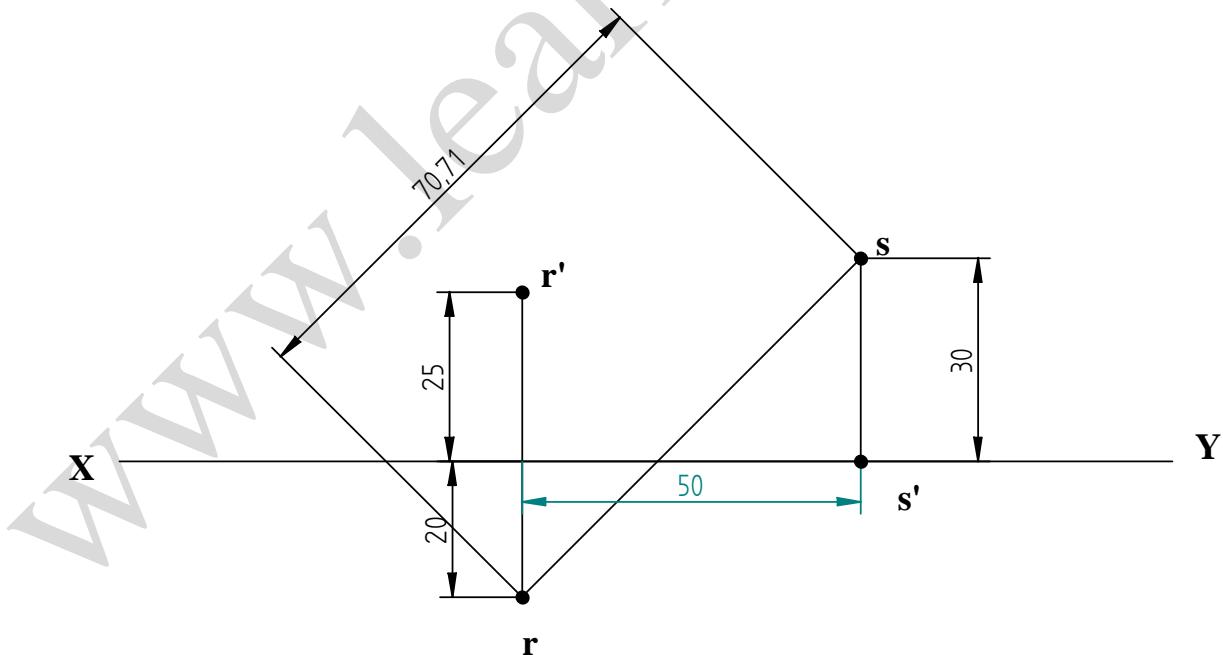


- 11 Draw the projections of point G which is in first quadrant such that it is equidistant from HP & VP. The point is 25mm from RPP. Determine its distance from VP, HP& PP.



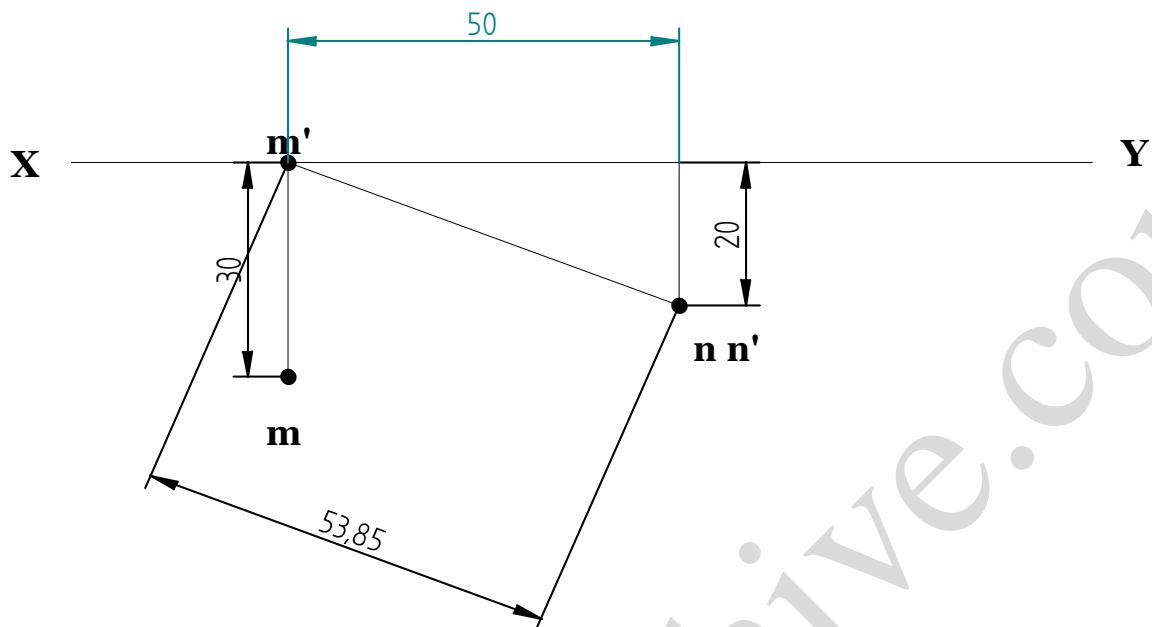
Ans: The Point is **27.75** mm from VP & HP

- 12 A point R is 25mm above HP & 20mm in front VP. Another point S is on HP and 30mm behind VP. The distance between their projectors measured parallel to the line of intersection of VP and HP is 50mm. Find the distance between top views of points R&S.



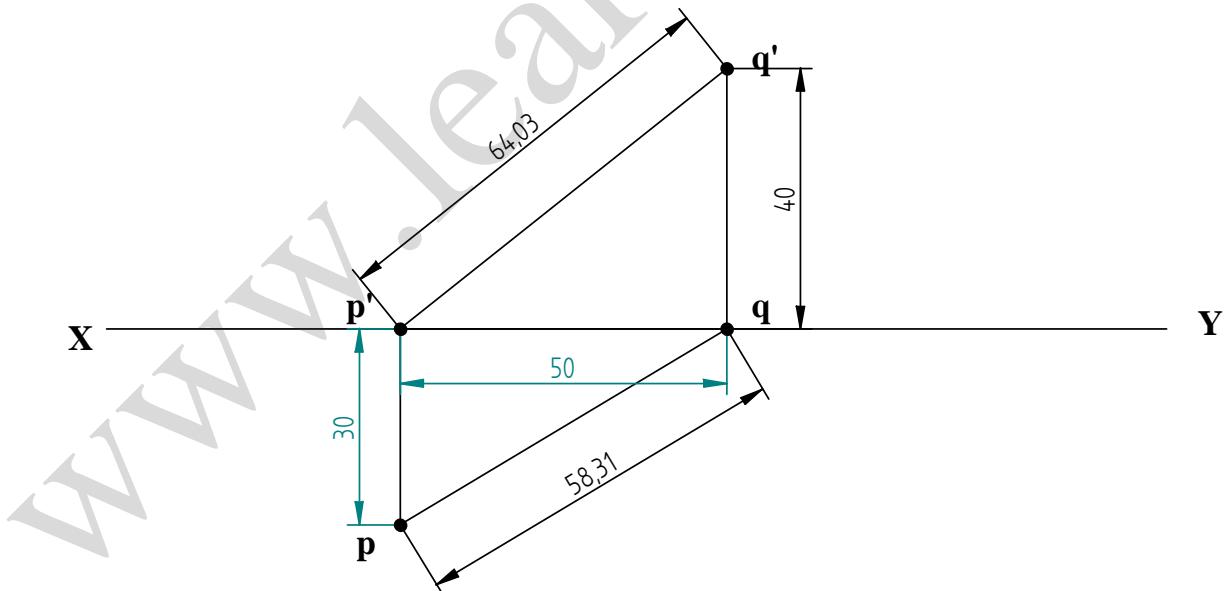
Ans: The Distance between Top views of R and S is **70.71mm**

- A point M is on HP & 30mm in front of VP. Another point N is 20mm below HP and 20mm in front of VP. The distance between their projectors measured parallel to XY line is 50mm. Find the distance between front views of the points M & N.



The distance between front views of M & N is **53.85mm**

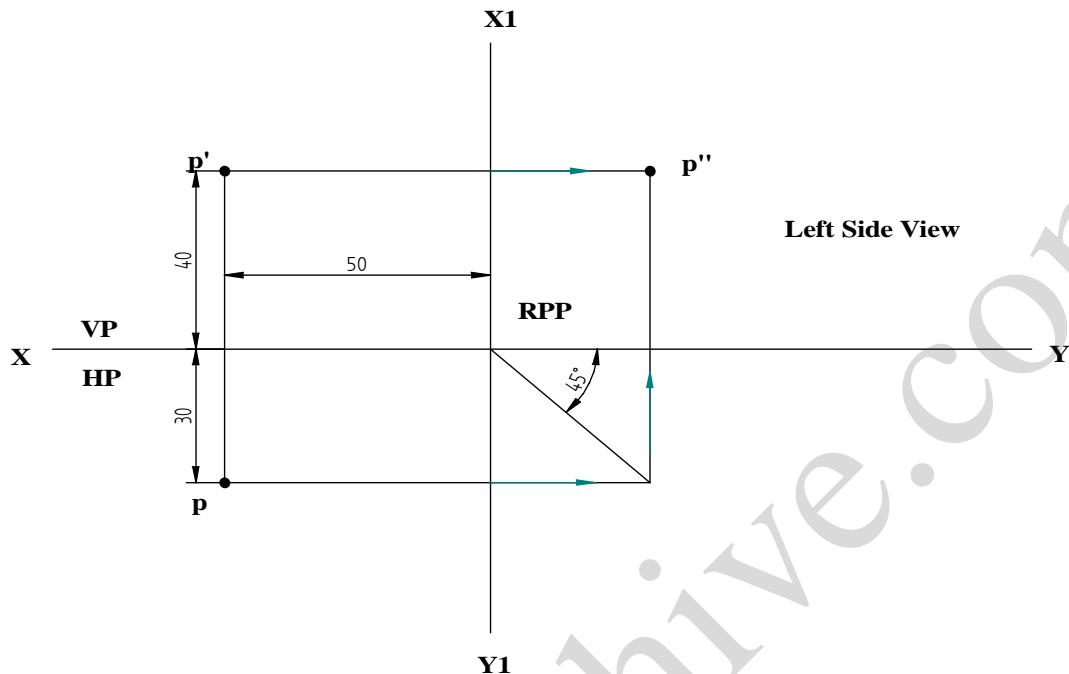
- A point P is on HP and 30mm in front VP. Another point Q is on VP and 40mm above Hp. The 14 distance between their projectors parallel to XY line is 50mm. Find the distance between their front and top views of the points P & Q.



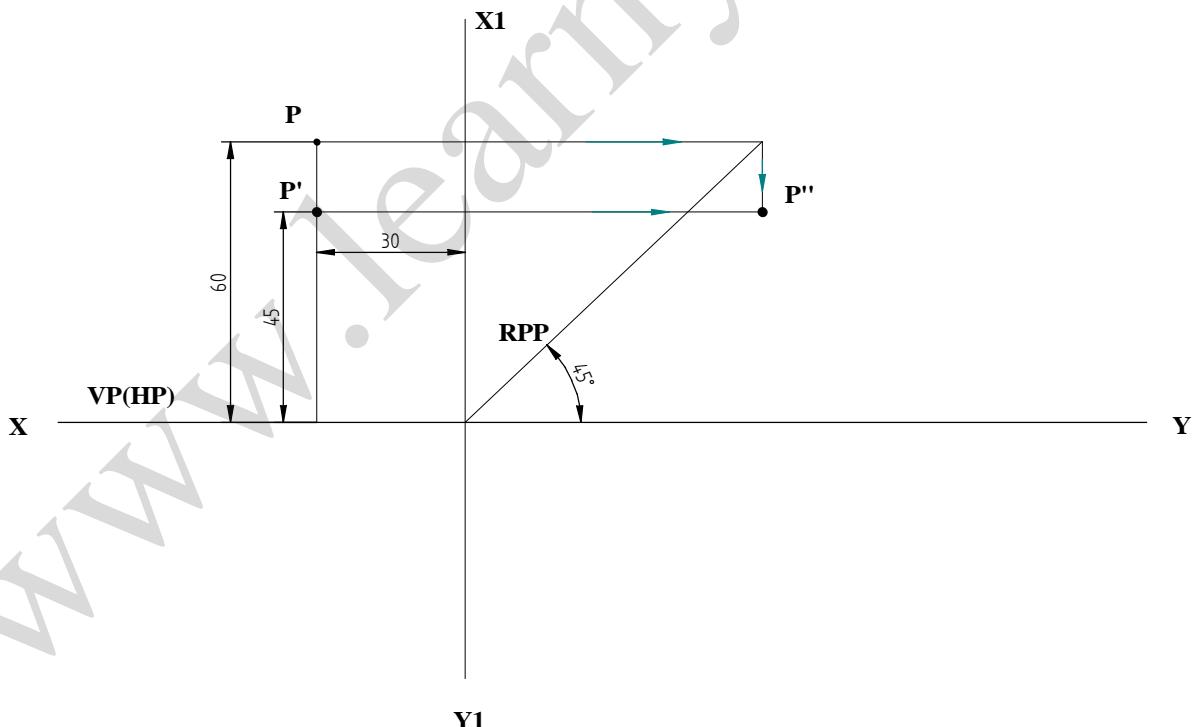
The distance between top views of P & Q is **58.31mm**

The distance between front views of P & Q is **64.03mm**

- 15 A point P is 30mm in front of VP, 40mm above HP and 50mm from RPP. Draw its projections

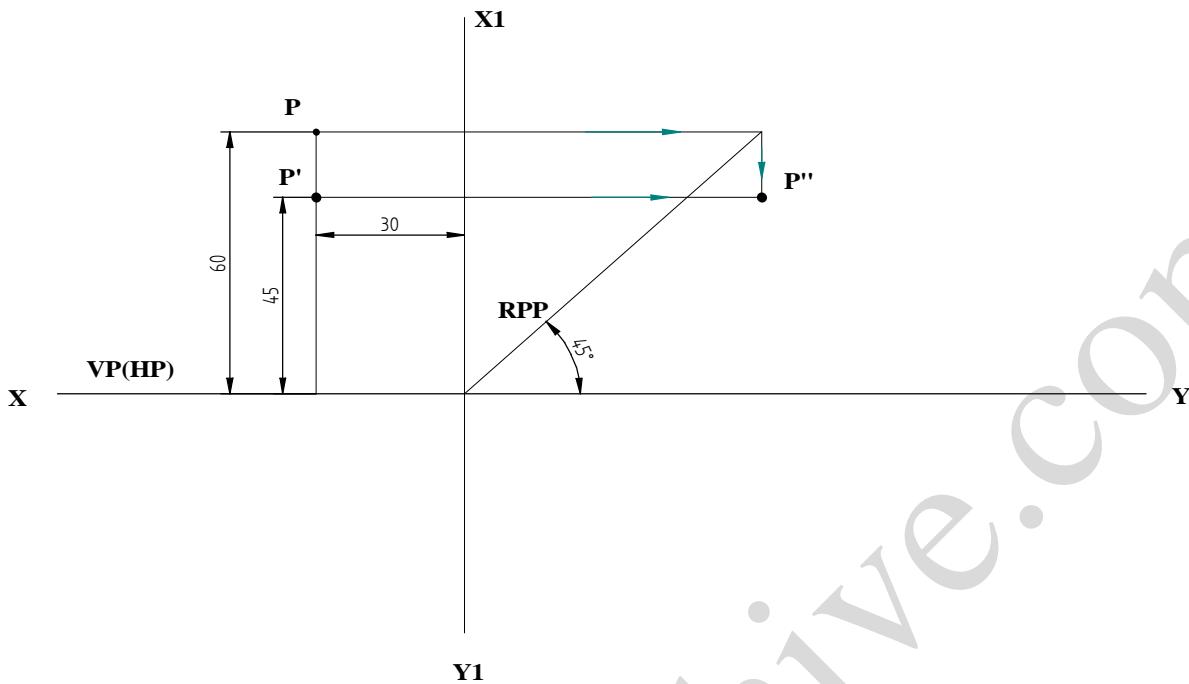


- 16 The point P is 45mm above HP, 60mm behind VP and 30mm from RPP. Draw the three principles view of the points. Also state the quadrant in which it lies.



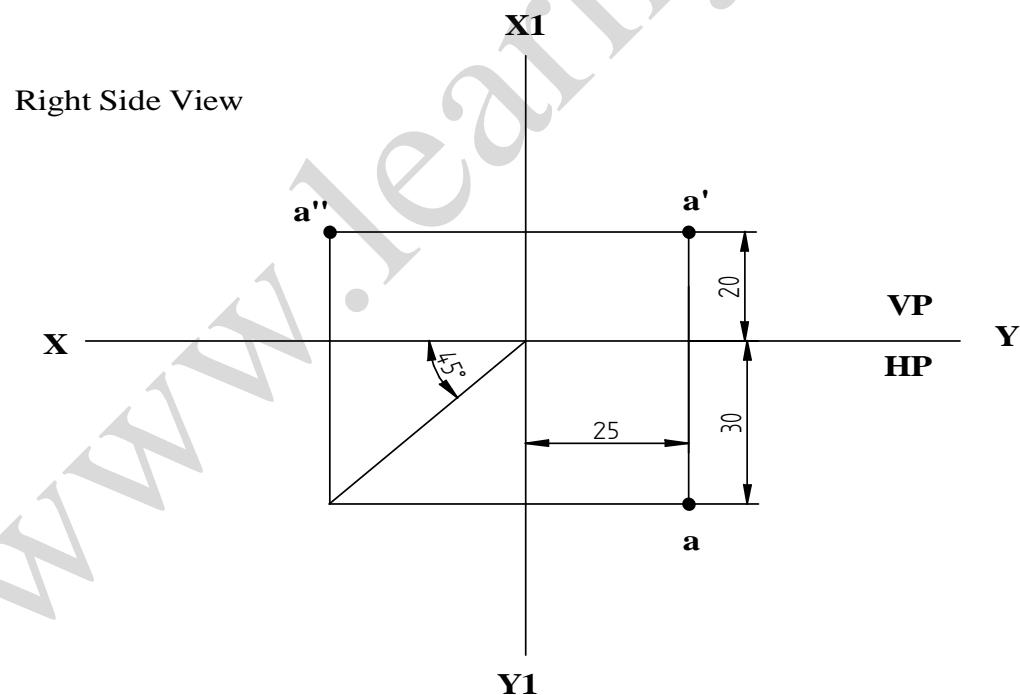
Ans: Point P lies in II Quadrant

- 17 Draw all the three views of a point P lying 60mm below HP, 70mm in front of VP and 40mm from the RPP. Also state the quadrant in which it lies

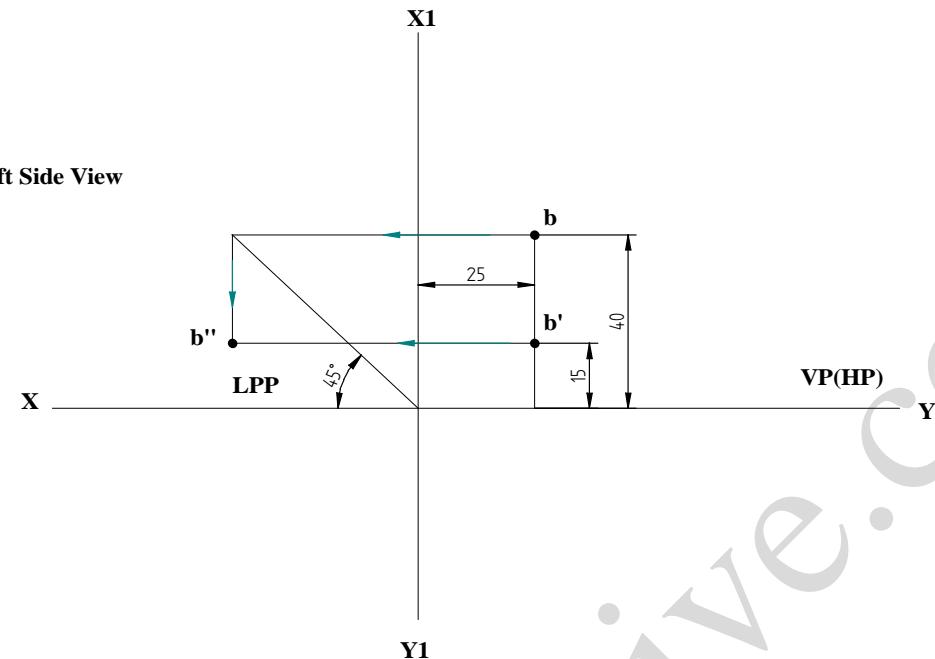


Ans: Point P in IV Quadrant

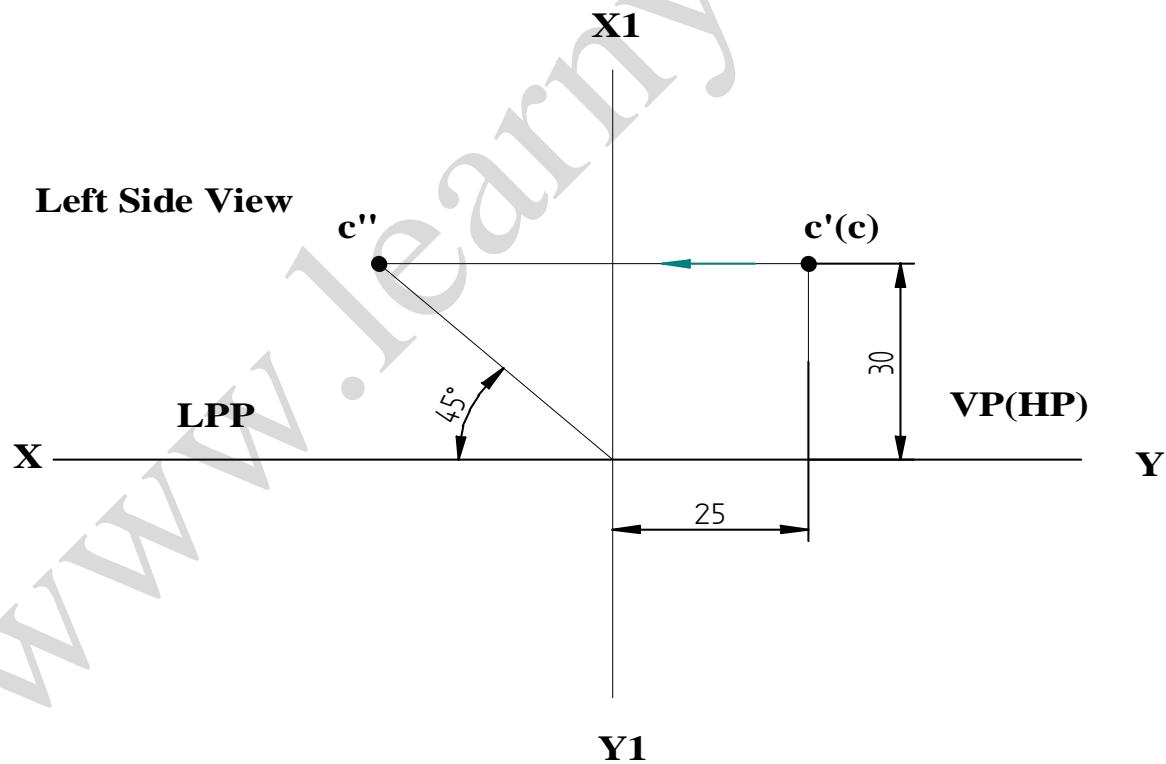
- 18 A point is 30mm in front of VP 20mm above HP & 25mm in front/behind/from LPP. Draw its Projections and name the side view.



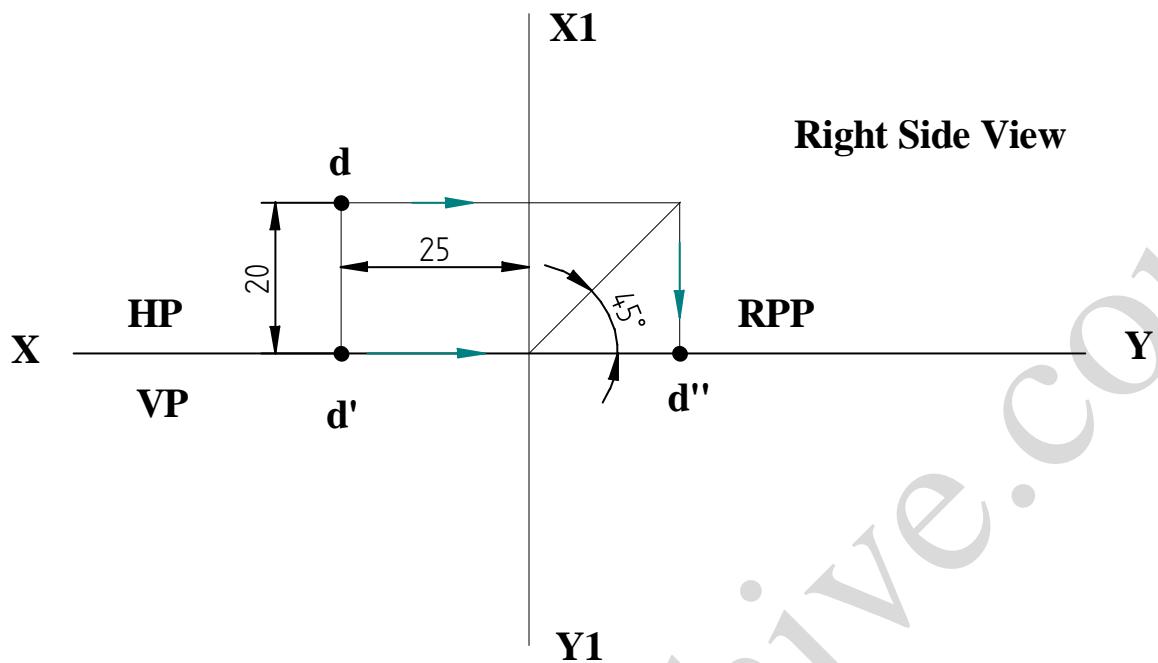
- 19 A point is 40mm behind VP, 15mm above HP and 25mm in front /behind/from LPP. Draw its projections and name the side view.



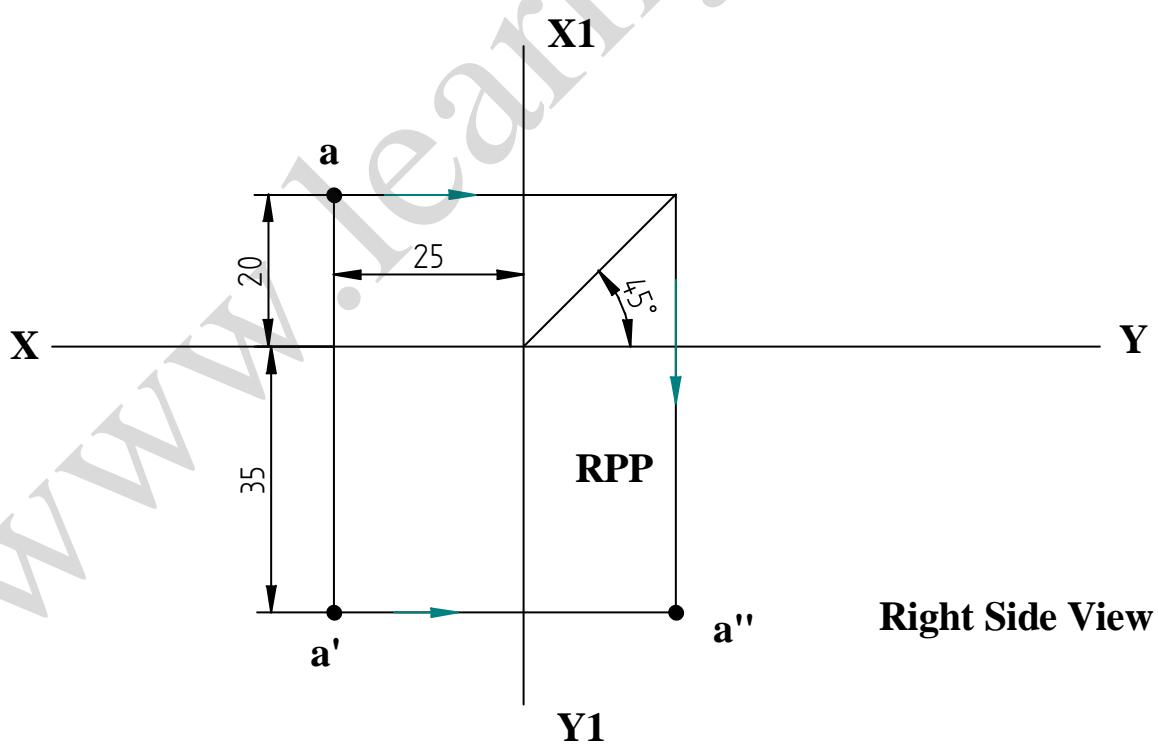
- 20 A point is 30mm behind Vp, 30mm above HP and 25 mm in front/behind/from LPP. Draw its projections and name the side view.



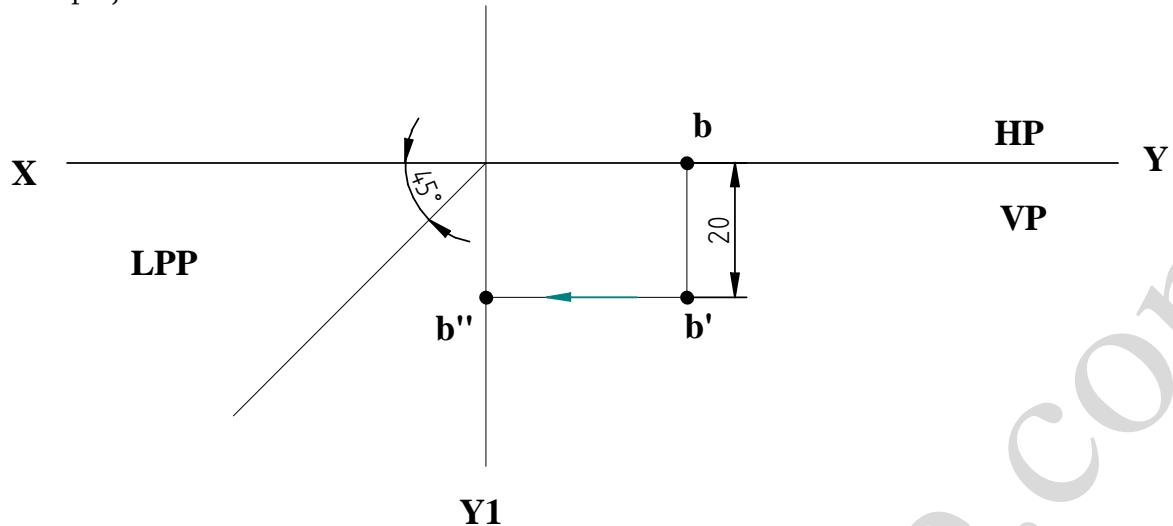
- 21 A point is lying on HP, 20mm behind VP & 25mm behind/in front/from RPP. Draw its projections and name the side view.



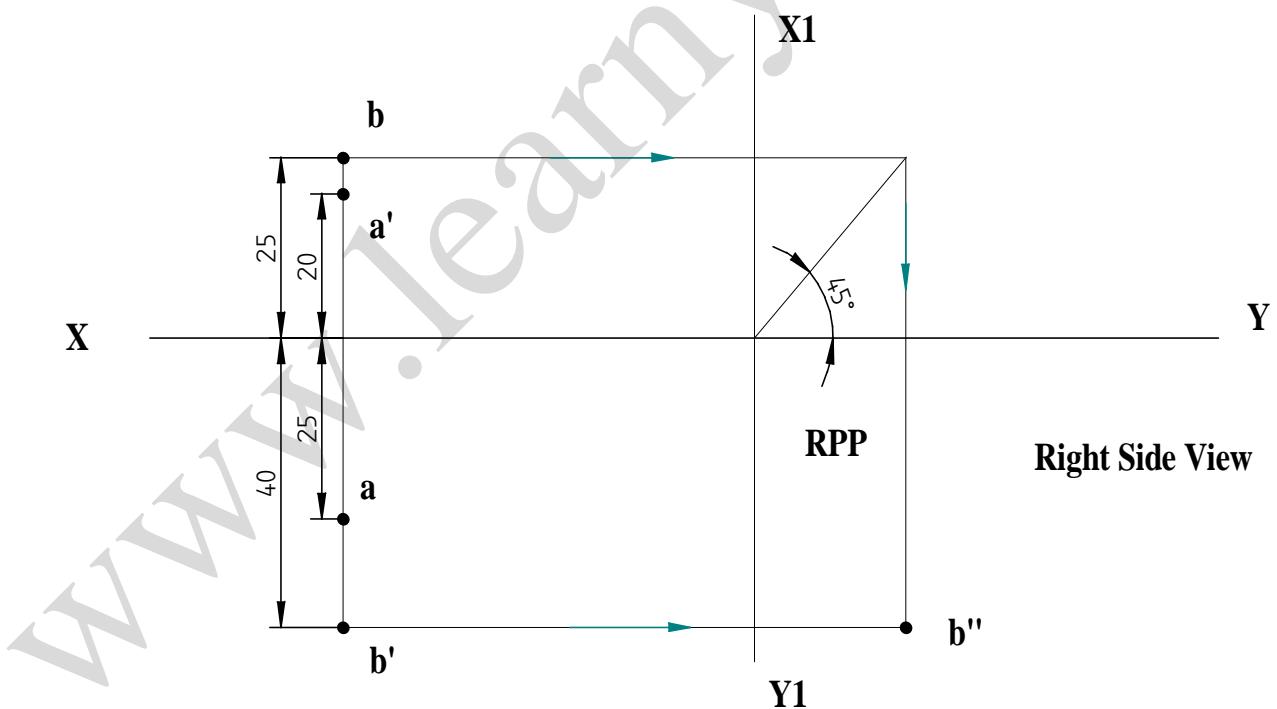
- 22 A Point is 35mm below HP, 20mm behind VP & 25mm behind/ in front from RPP. Draw its projections and name the side view.



- 23 A point is lying on VP, 20mm below HP & 30mm behind/in front/from LPP. Draw its projections and name the side view.

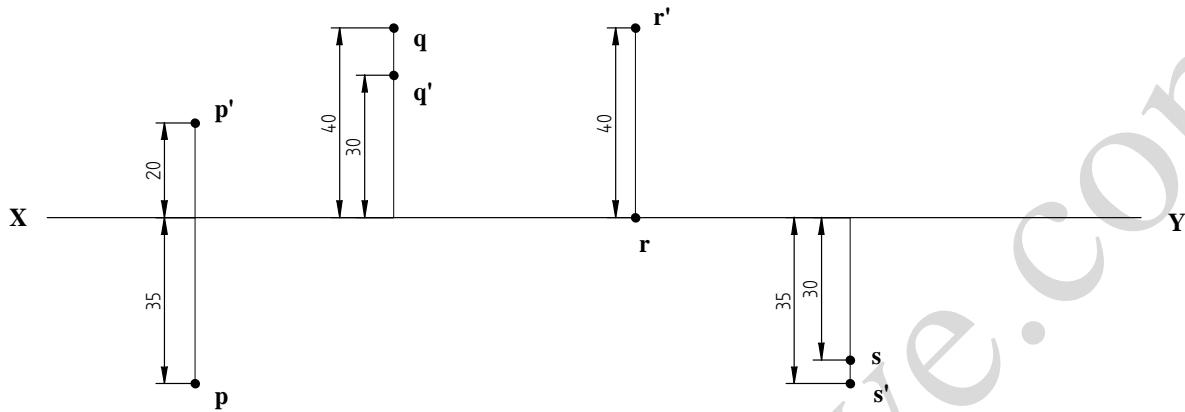


- 24 A point is 20mm above HP & 25mm in front of VP. Another Point B is 25mm behind VP and 40mm below HP. Draw their projections when the distance between their projectors parallel to XY line is 0 mm. Add the right side view only to point B.



25 Draw the projections of the following Points on the same XY line, keeping convenient distance between each projector. Name the Quadrants in which they lie.

- P 20mm above HP & 35mm in front VP.
- Q 30mm above HP & 40mm behind VP
- R 40mm above HP & VP.
- S 35mm below HP & 30mm in front of VP.

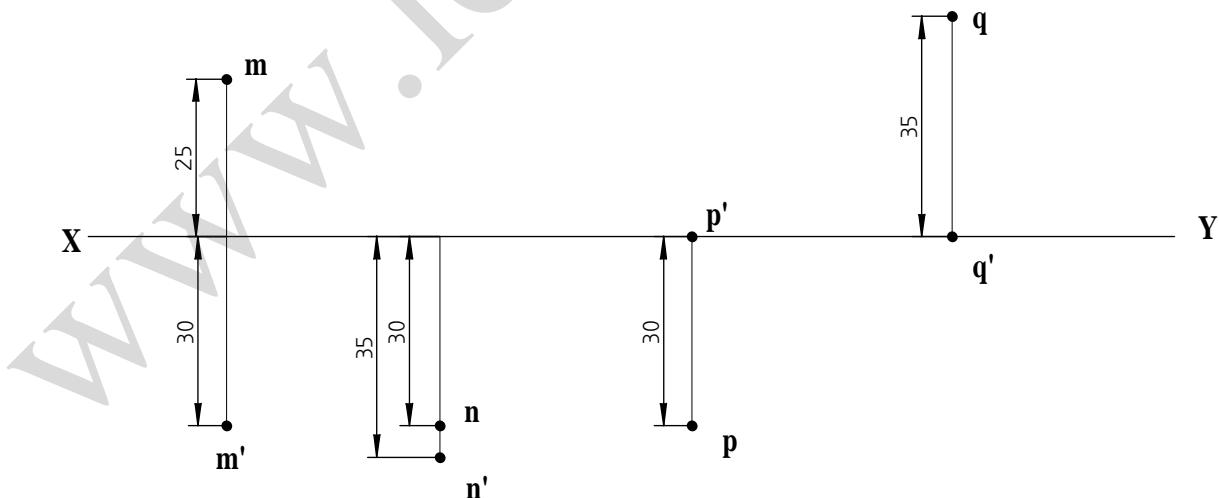


Solution:

- | | |
|---|--------------------------|
| P | I Quadrant |
| Q | II Quadrant |
| R | I as well as II Quadrant |
| S | IV Quadrant |

26 Draw the projections of the following Points on the same XY line, keeping convenient distance between each projector. Name the Quadrants in which they lie.

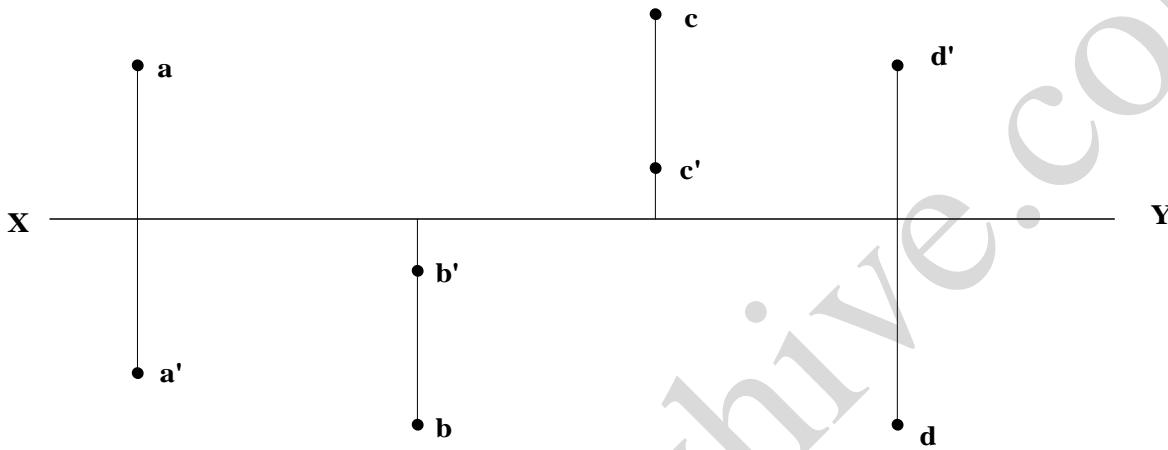
- M 30mm below HP & 25mm behind VP
- N 35mm below HP & 30mm in front VP.
- O On Hp & 30mm in front of VP.
- P On HP & 35mm behind of VP.



Solution:	M	I Quadrant	O	I as well as IV Quadrant
	N	IV Quadrant	P	I as well as III Quadrant

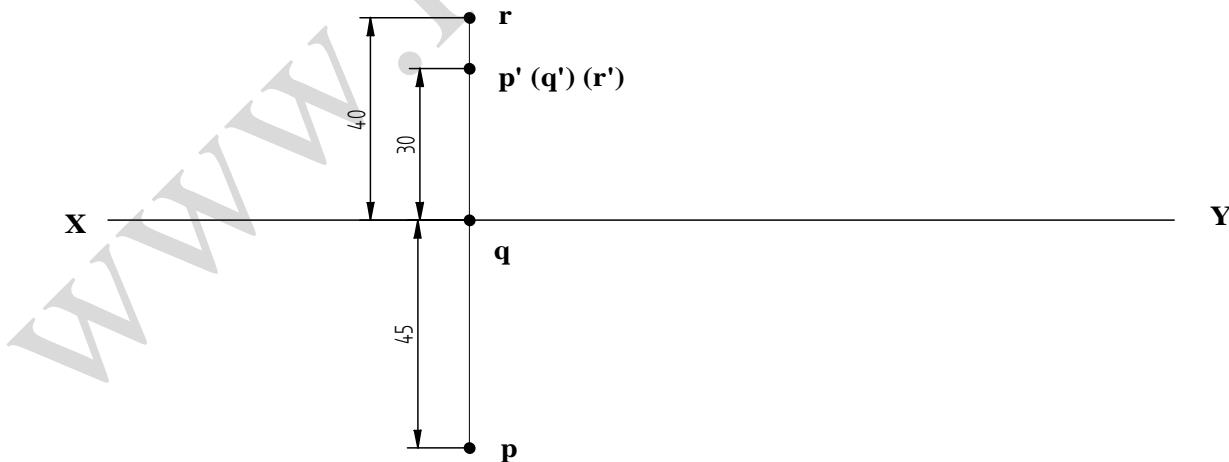
27 Draw and state the quadrants in which the following points located. Assume any distances

- A. Front view below XY line & top view above XY line.
- B. Front and Top views are below XY line
- C. Front & top views are above XY line.
- D. Front views above XY line & top view below XY line.

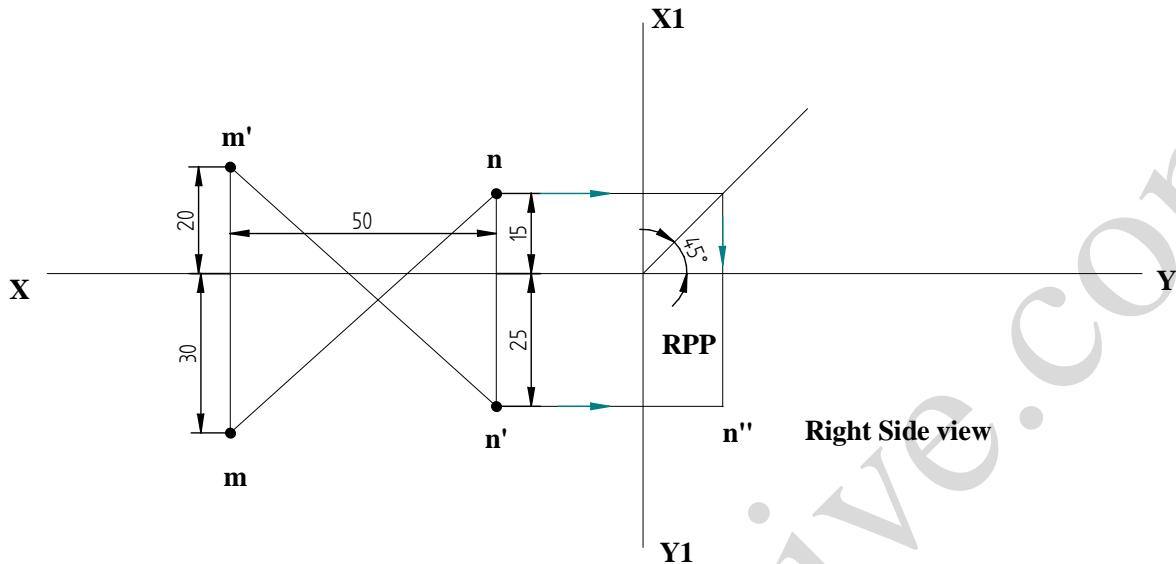


Solution:	A	III Quadrant	C	II Quadrant
	B	IV Quadrant	D	I Quadrant

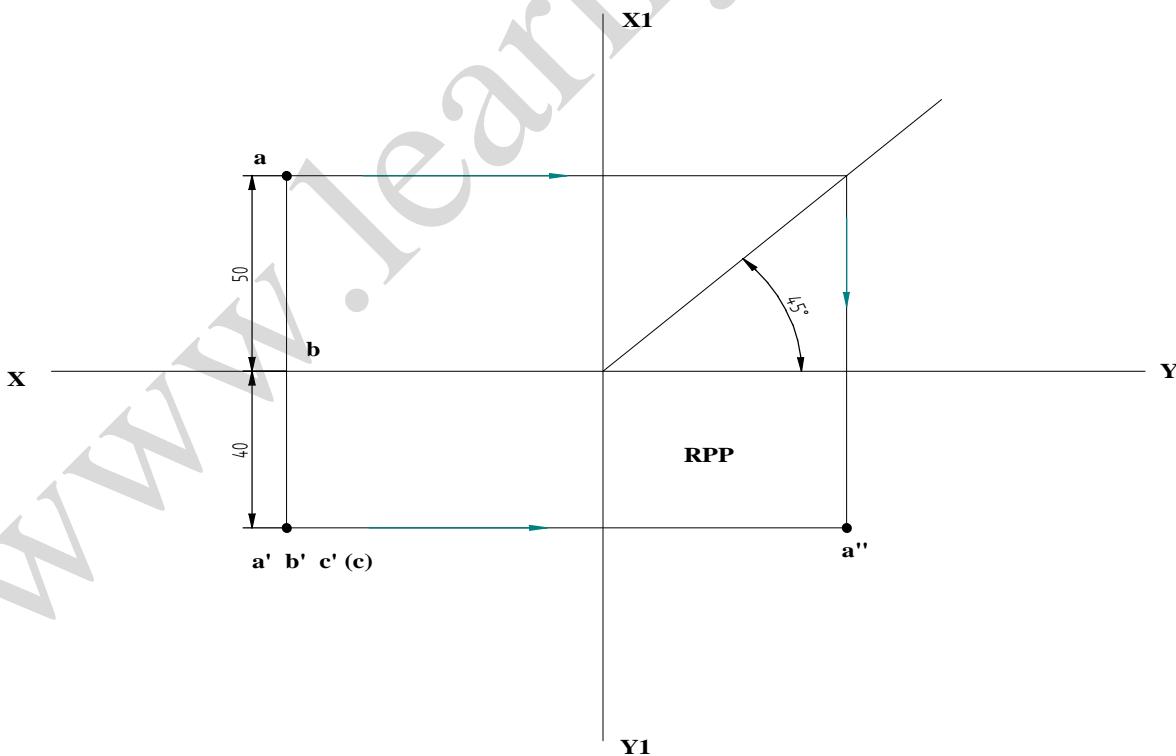
28 27. A point 30mm above XY line is the front View of the three P, Q and R. The Top View of R is 40mm behind VP, the top view of Q is on XY line and top view of point is 45mm in front of VP. Draw the projections of the points & state the quadrants in which the points are situated.



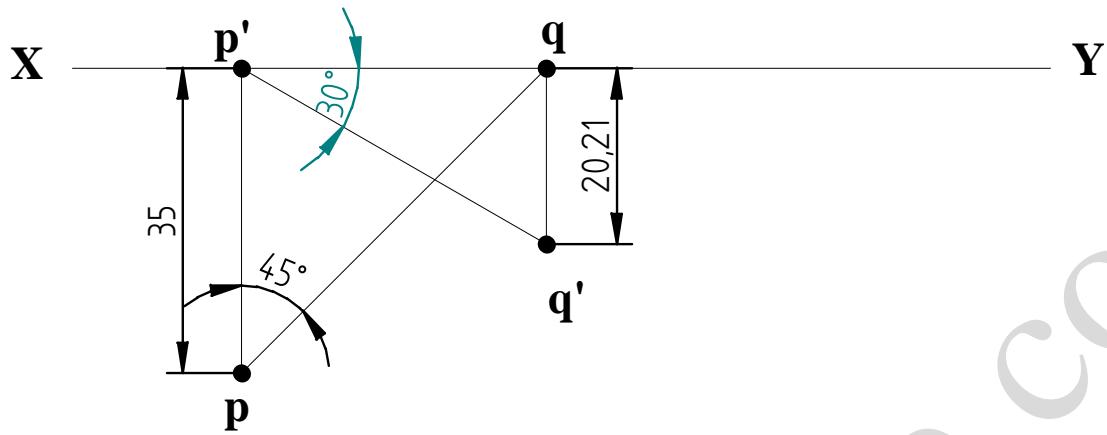
- 29 A point M is 30mm in front of VP and 20mm above HP, another point N in 15mm behind VP & 25mm below HP. The horizontal distance between the points parallel to XY line is 50mm. Draw the projections of the points M & N and join their front & top views. Draw the right side view for the point N only.



- 30 The common point 40mm below XY line represents not only the front views of three points A, B and C but also the top view of Point C. The top view of point B is lies on XY line and top view of point A lies 50mm above it. Draw the projections of the points and add the right side view to the point A only. Also state in which quadrants the points lie.

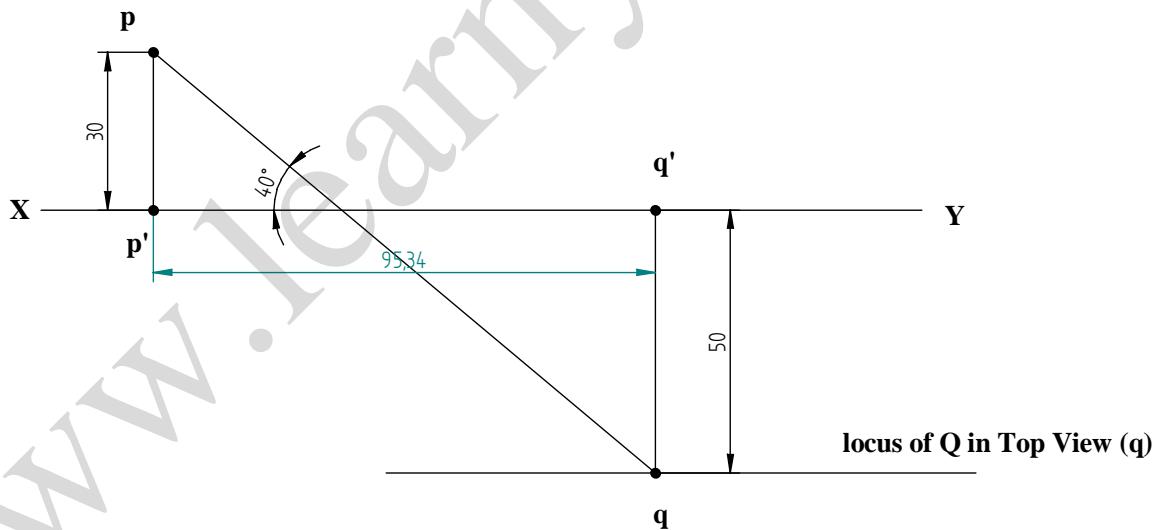


- 31 A point A is on HP and 35mm in front of VP. Another Point B is on VP and below HP, The line joining their front views makes an angle of 30deg. To XY line while the line joining their top views makes an angle 45deg with XY line. Find the distance of the point B from HP.



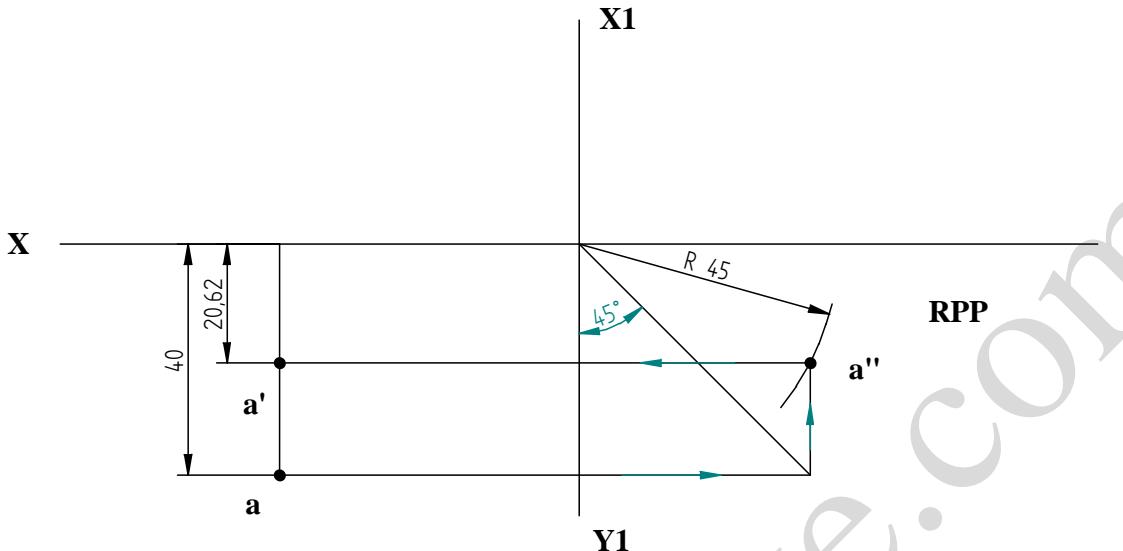
Ans: Point Q is 20.21 mm below HP

- 32 Two points P and Q are on Hp. The point P is 30mm behind VP, while Q is 50mm in front of VP. The line joining their top views makes an angle of 40deg with XY. Find the horizontal distance between their projectors parallel to XY line.



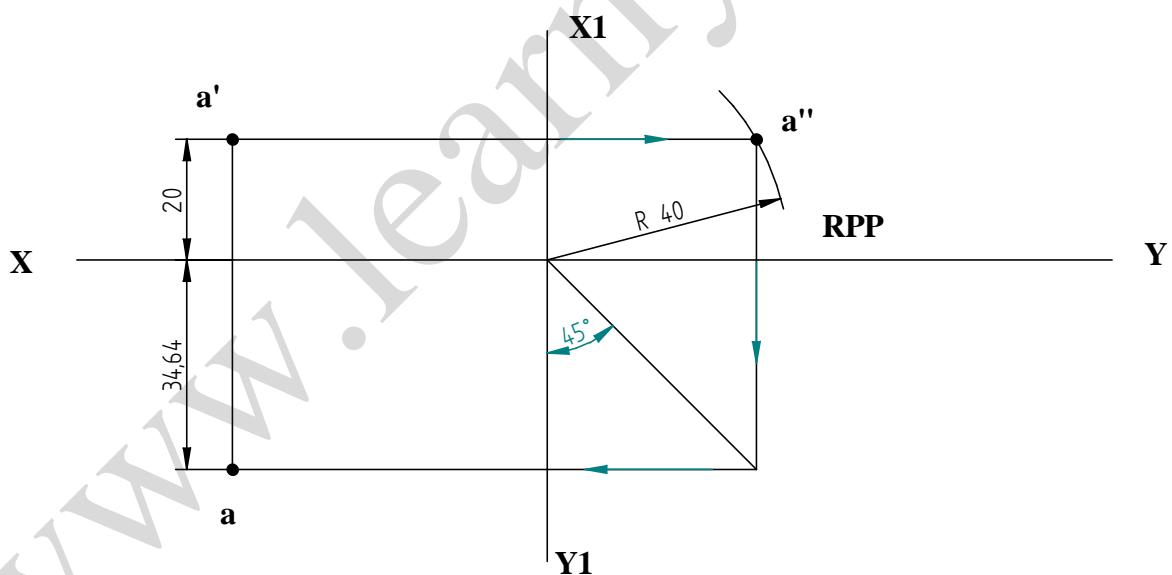
Distance between two projectors is 95.34mm

- 33 A point A is 40mm in front of VP and is situated in the fourth quadrant. Its shortest distance from the intersection of HP & VP is 45mm. Draw its projections. Also find its distance from HP.



Point A is 20.62 mm below HP

- 34 A point A is 20mm above HP and in the first quadrant. Its shortest distance from the XY line is 40mm. Draw the projections. Determine its distance from VP.



Distance of A from VP is 34.68mm

35

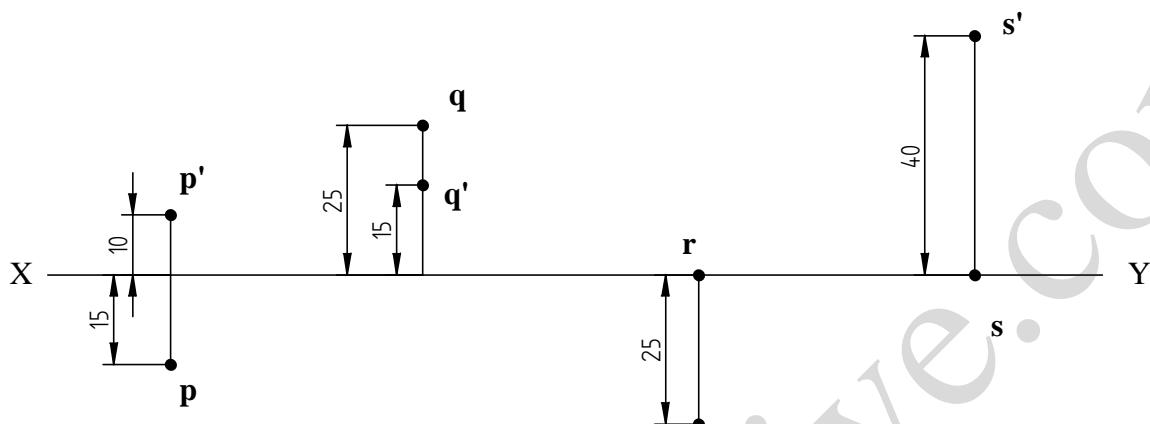
Draw the projections of the following Points on the same XY line, keeping convenient distance between each projector. Name the Quadrants in which they lie.

P P – 10mm above HP & 15mm in front of VP.

Q 15mm above HP & 25mm behind VP.

R 25mm below HP & in VP.

S 40mm above HP & in VP.

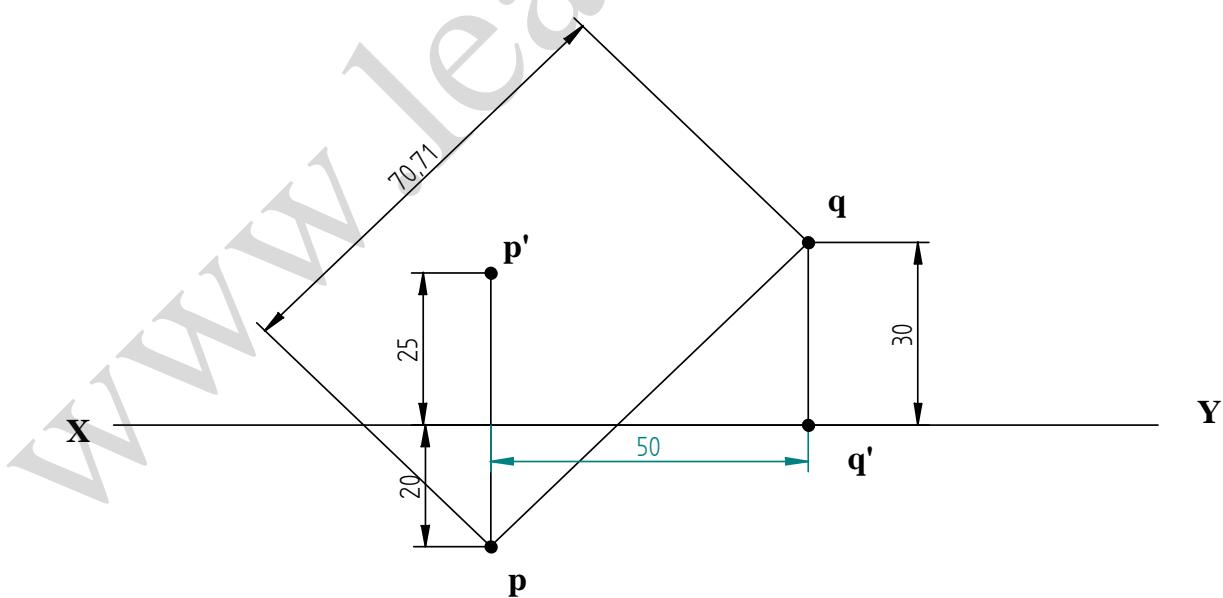


Solution:

P I Quadrant
Q II Quadrant

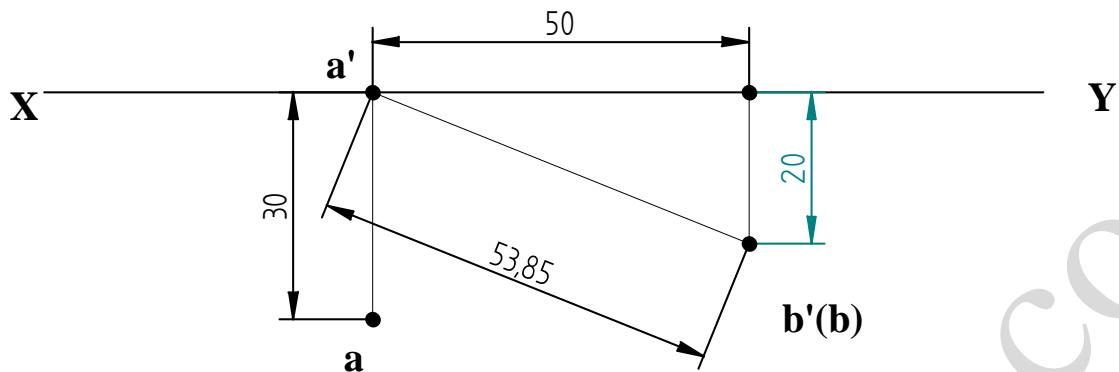
R III as well as IV Quadrant
S I as well as II Quadrant

- 36 A point P is 25mm above HP & 20mm in front of VP. Another point Q is on HP and 30mm behind VP. The distance between their projectors measured parallel to the line of intersection of VP and HP is 50mm. Find the distance between the top views of points P & Q.



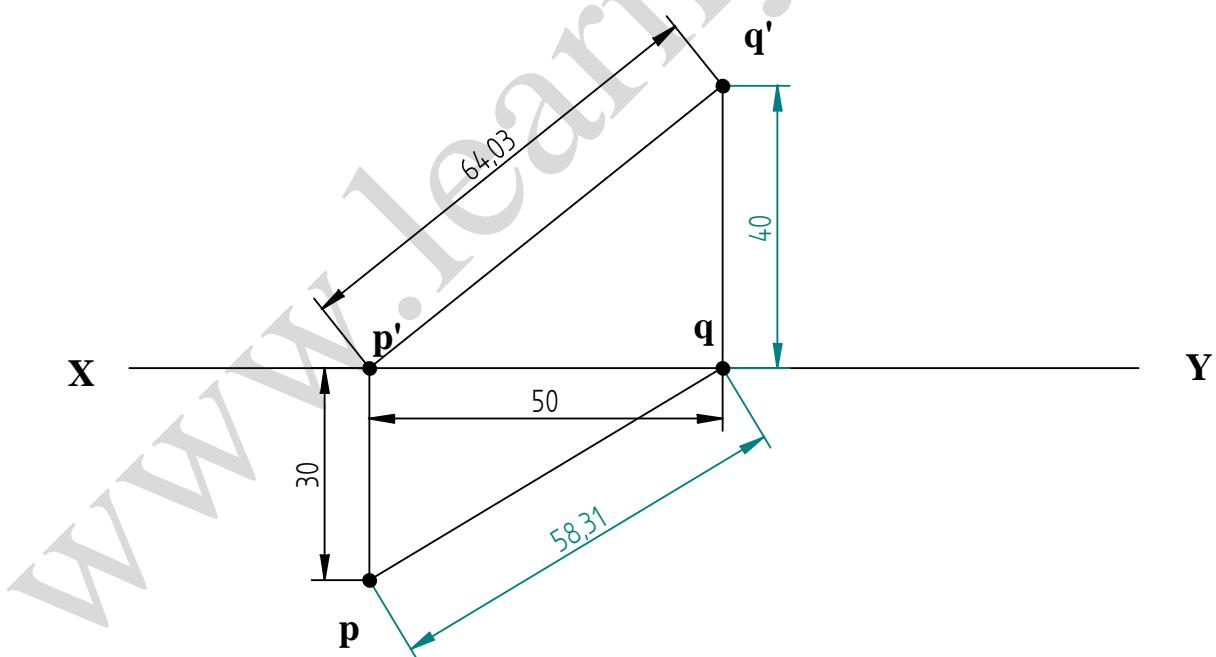
Ans: The Distance between Top views of P and Q is 70.71mm

- 37 A point A is on HP & 30mm in front of VP. Another point B is 20mm below HP and 20mm in front of VP. The distance between their projectors measured parallel to XY line is 50mm. Find the distance between the front views of the points A & B.



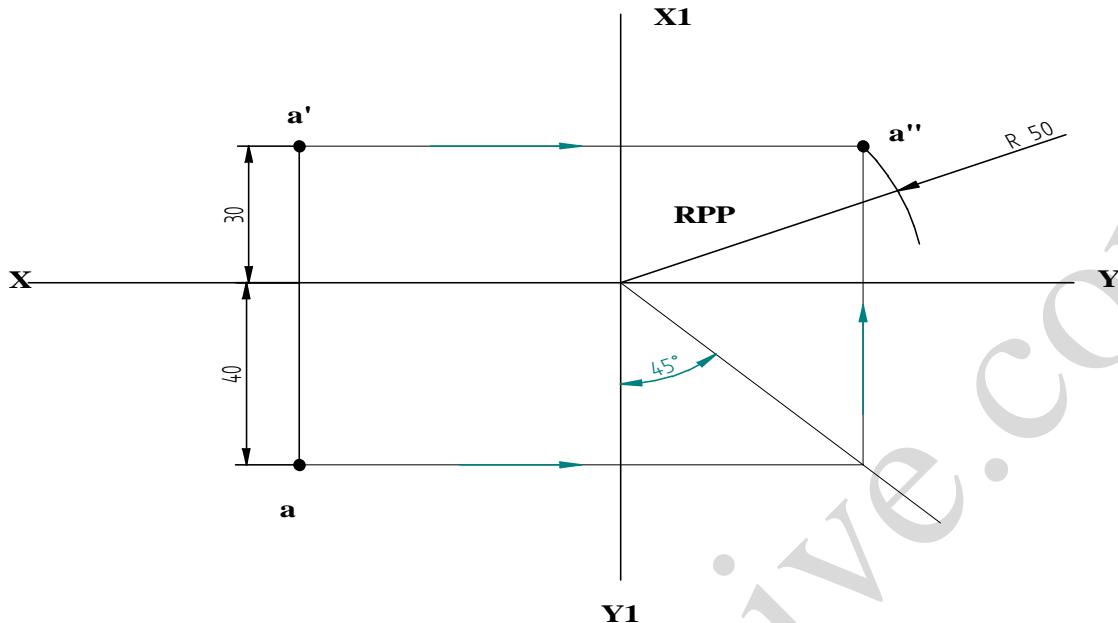
Distance between front views of A & B is **53.85** mm

- 38 A point P is on HP and 30mm in front of VP. Another Point Q is on VP and 40mm above HP. The distance between their projectors parallel to XY line is 50mm. Find the distance between their front and top views of the points P & Q.



Distance between front views of P & Q is **64.03** mm
 Distance between top views of P & Q is **58.31** mm

- 39 Draw the projections of a point A lying 30mm above HP and in first quadrant, if its shortest distance from the line of intersection of HP and VP is 50mm. Also find the distance of the point from VP.



Distance of A from VP is 40mm

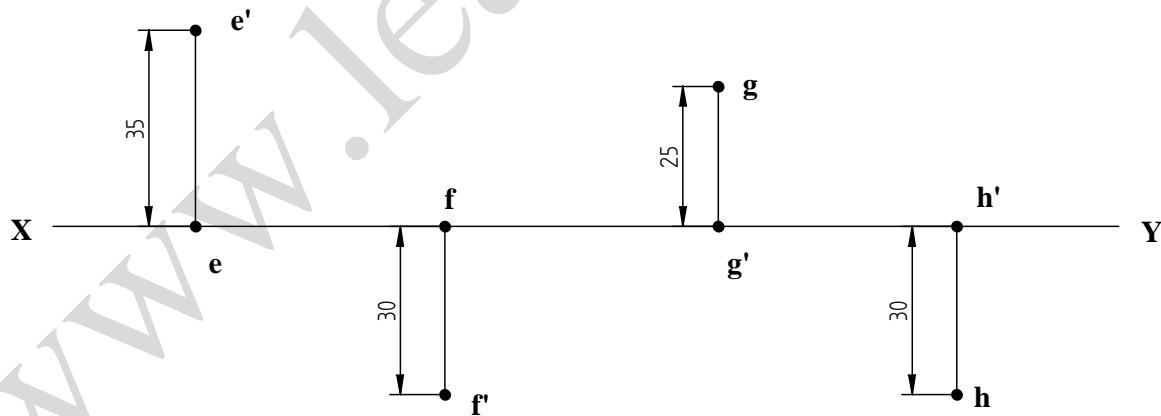
- 40 Draw the projections of the following points on the same reference XY line and state the quadrants in which they lie.

E 35mm above HP & VP

F 30mm below HP & on VP

G On HP & 25mm behind VP

H On HP & 30mm in front of VP



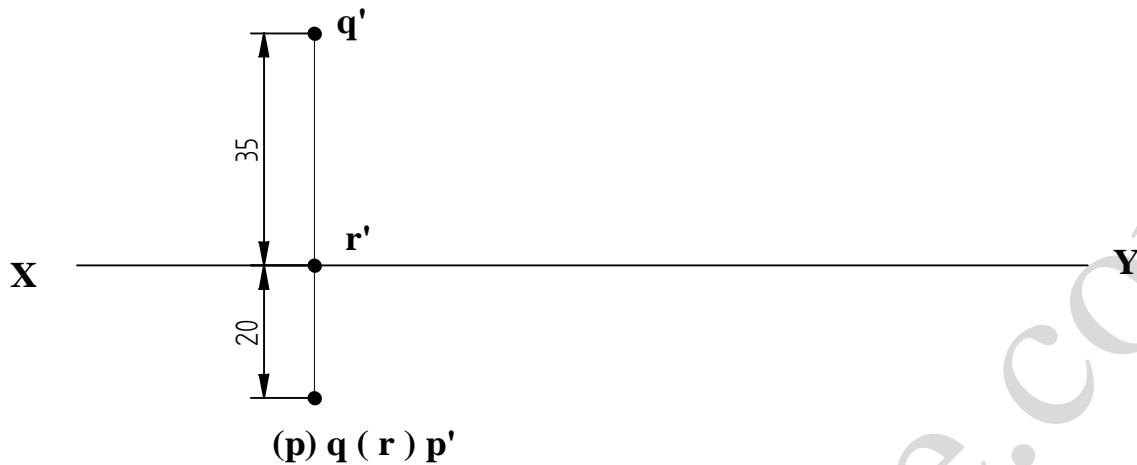
E I as well as II Quadrant

F - III as well as IV Quadrant

G G- II as well as III Quadrant

H H- I as well as IV Quadrant

- 41 A point 20mm below the reference XY line is the top view if three points P, Q & R. P is 20mm below HP, Q is 35mm above HP and R is on HP. Draw the projections of the three points and state their positions & quadrants in which they are situated.

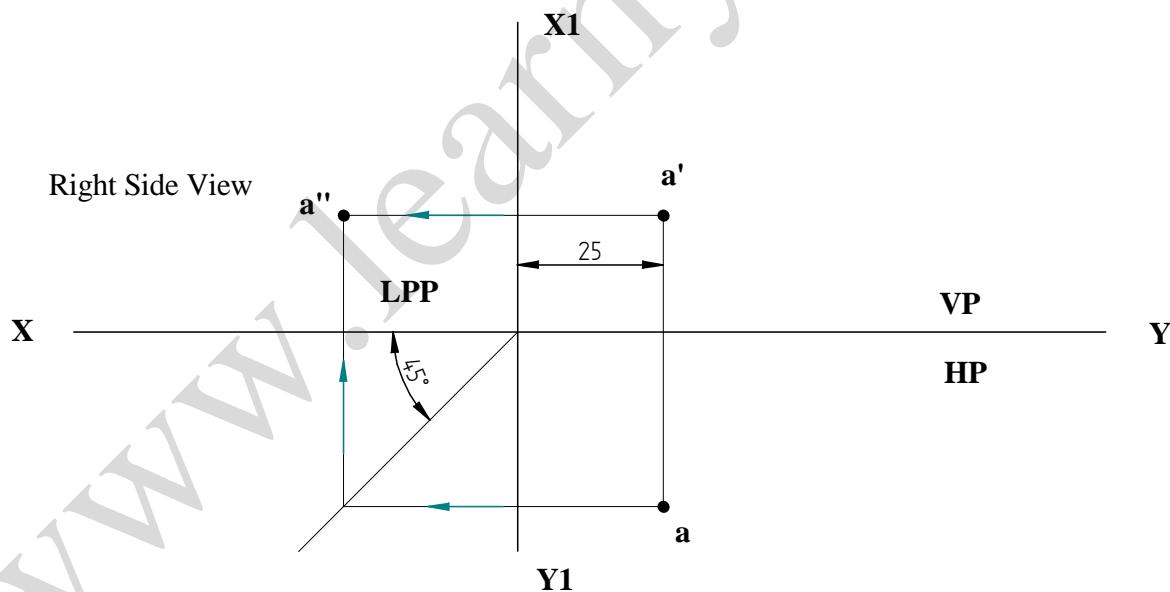


P-20mm below HP and 20mm infront of VP,IV Quadrant

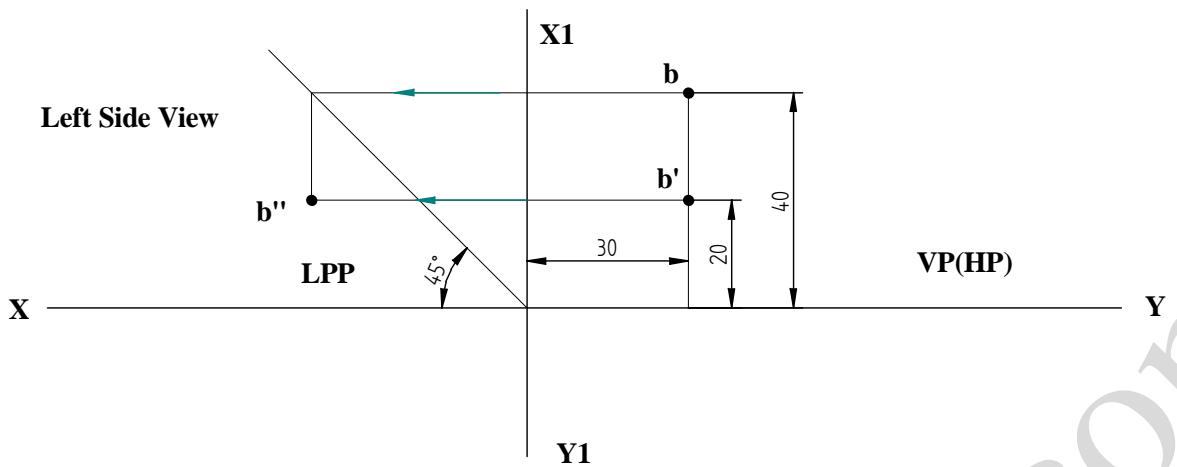
Q-35 mm below HP and 20mm infront of VP,I Quadrant

R-on HP and 20mm infront of VP,I as well as IV Quadrant

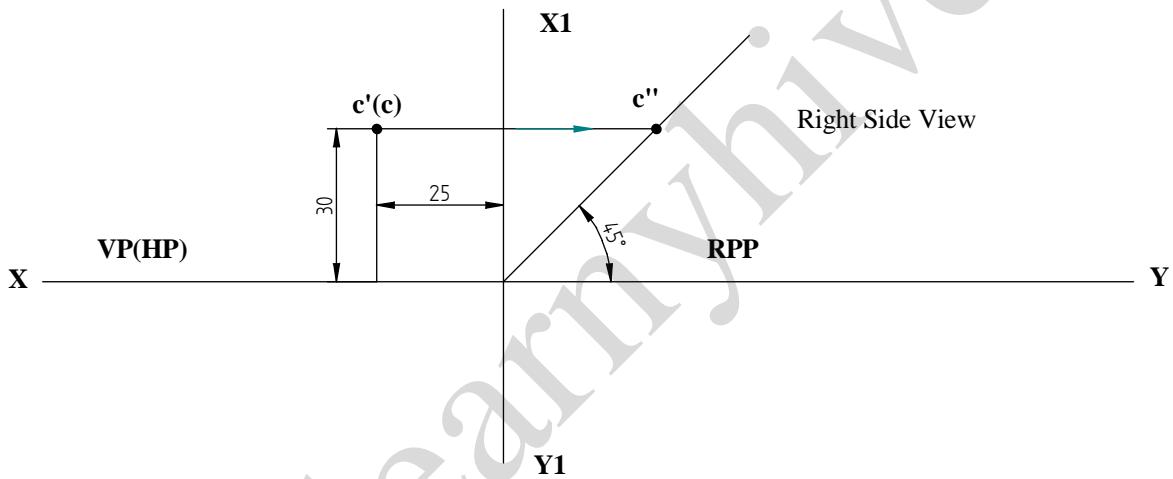
- 42 A point is 30mm in front of VP, 20mm above HP & 25mm in front /behind / from LPP. Draw its Projections and name the side view



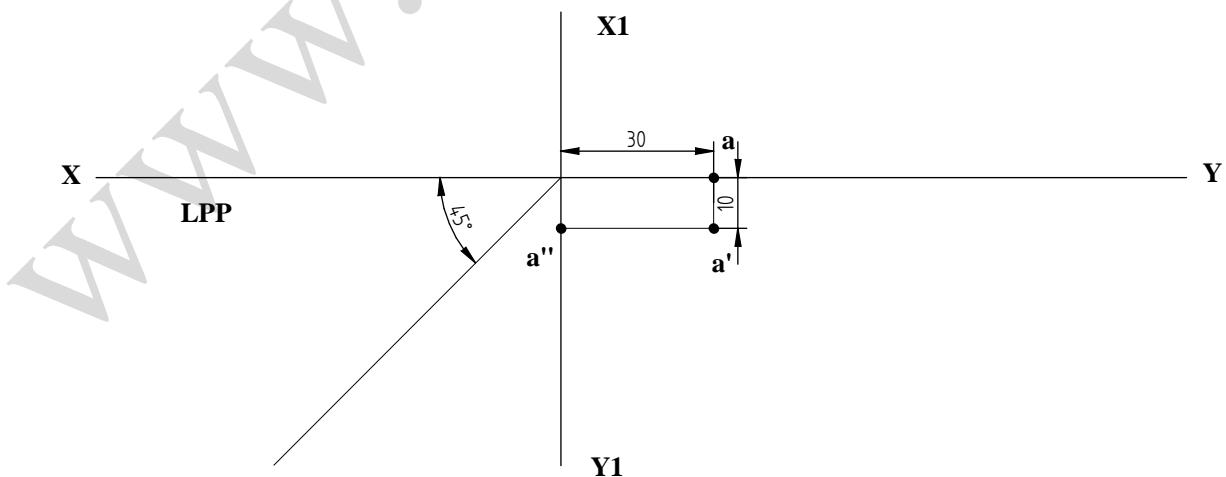
- 43 A point is 40mm behind VP, 20mm above HP and 30mm in front / behind / from LPP. Draw its projections and name the side view.



- 44 A point is 30mm behind VP, 30mm above HP and 25mm in front /behind / from RPP. Draw its projections and name the side views.



- 45 A point is lying on VP, 10mm below HP & 30mm behind/ in front / from LPP. Draw its projections and name the side view.

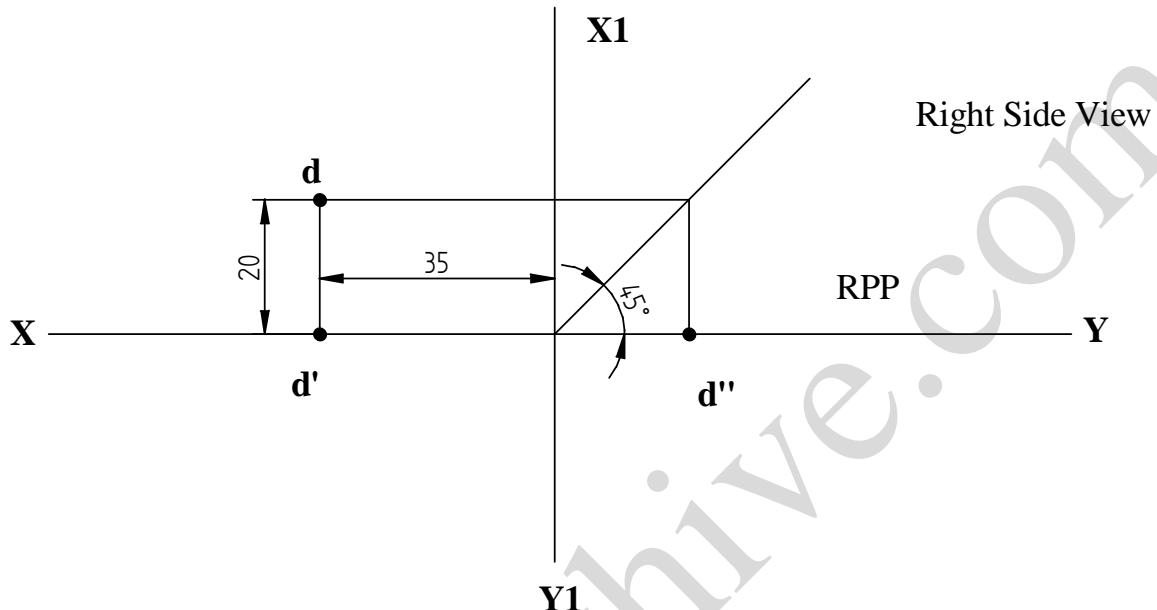


Choices

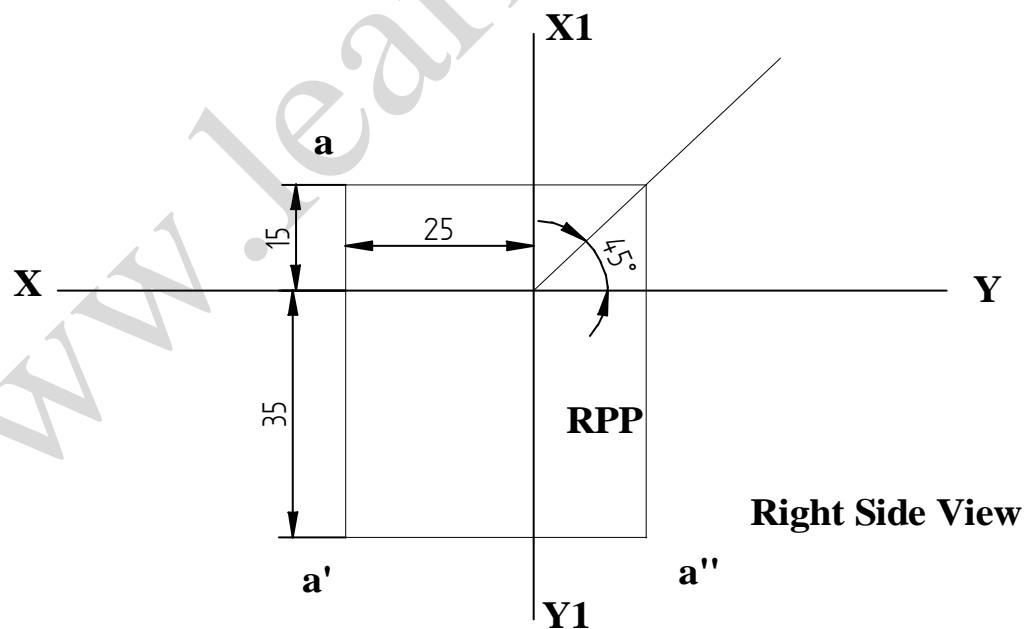
Treating the point is in III Quadrant, it is left side view

Treating the point is in IV Quadrant, it is Right side view

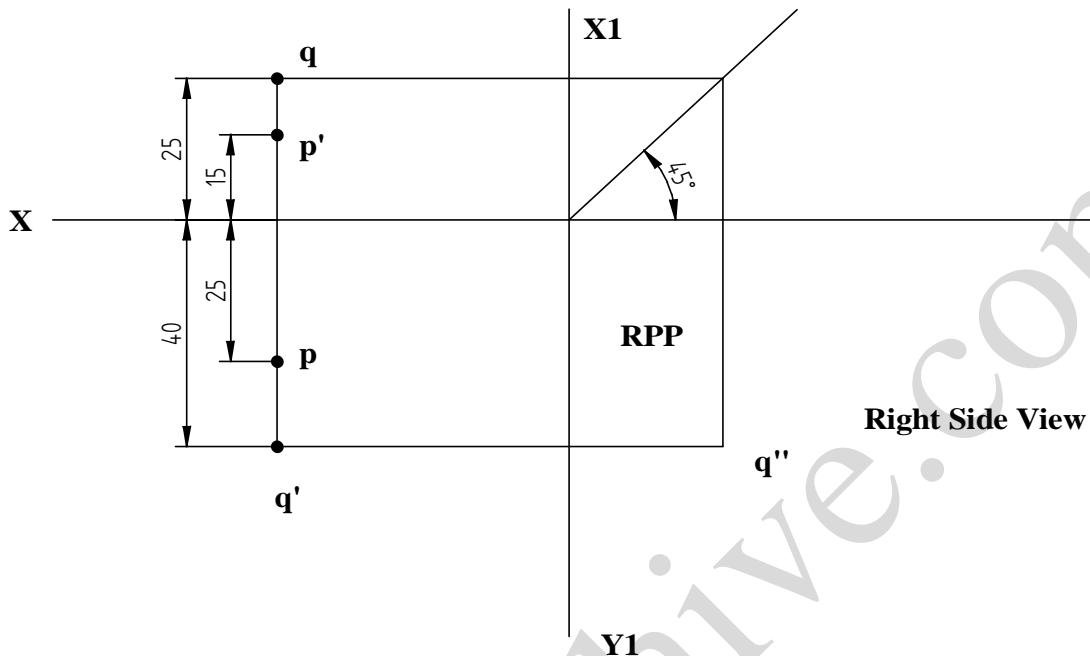
- 46 A point is lying on HP, 20mm behind VP & 35mm behind/ in front /from RPP. Draw its projections and name the side view.



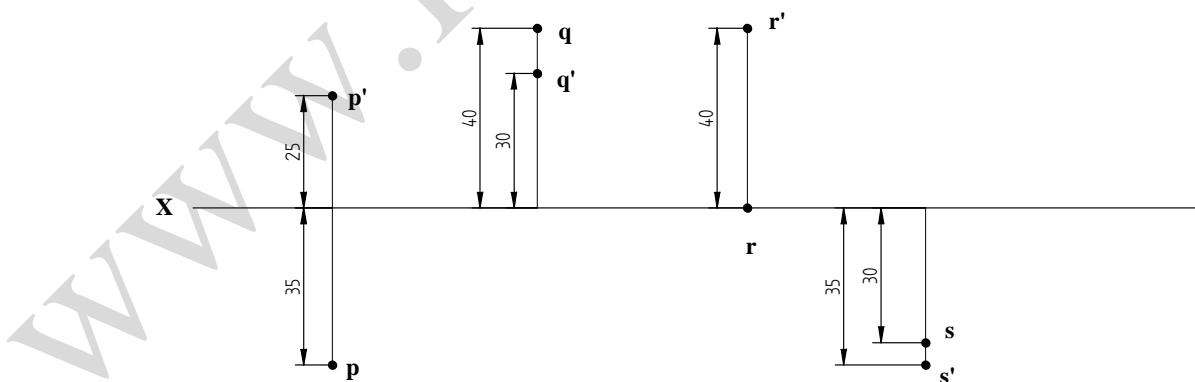
- 47 A point is 35mm below HP, 15mm behind VP & 25mm behind / in front / from RPP. Draw its projections and name the side view



- 48 A point P is 15mm above HP & 25mm in front of VP. Another Point Q is 25mm behind VP and 40mm below HP. Draw their projections when the distance between their projectors parallel to XY line is 0mm. Add the right side view only to point Q



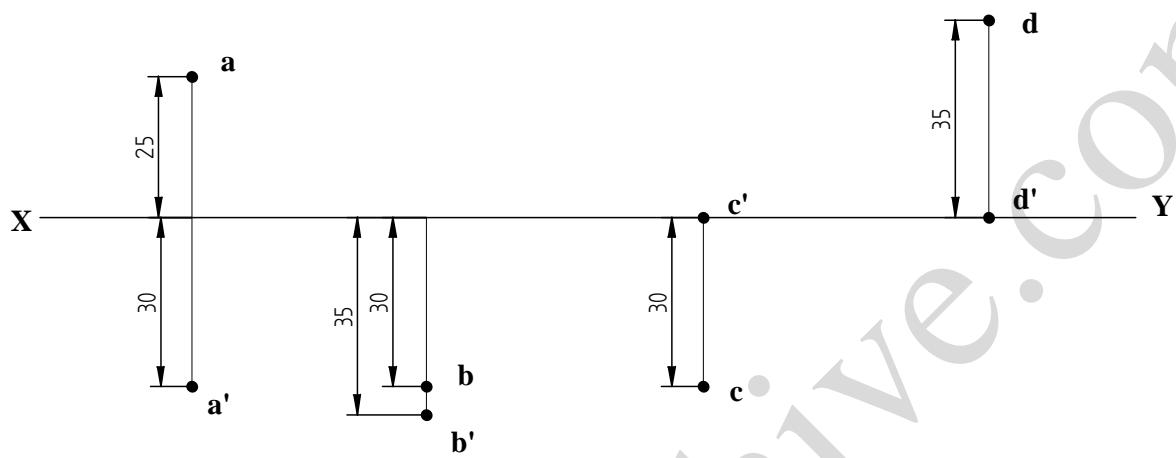
- 49 Draw the projections of the following points in the same XY line, keeping convenient distance between each projector. Also state the Quadrant in which they lie.
 P 25mm above HP & 35mm in front of VP.
 Q 35mm above HP & 40mm behind VP.
 R 40mm above HP & on VP.
 S 35mm below HP & 30mm in front of VP.



P I Quadrant
 Q II Quadrant

R I as well as II Quadrant
 S IV Quadrant

- 50 Draw the projections of the following points in the same XY line, keeping convenient distance between each projector. Also state the Quadrant in which they lie.
- A 30mm above HP & 25mm in front of VP.
 - B 35mm above HP & 30mm in front of VP.
 - C On HP & 30 mm in front of VP
 - D on HP & 35mm behind of VP.



- A I Quadrant
- B IV Quadrant
- C I as well as IV Quadrant
- D II as well as III Quadrant

Projections of lines

Straight line

A Straight line is the Locus of a point, which moves linearly. Straight line is also the shortest distance between any two given points.

The location of a line in projection quadrants is described by specifying the distances of its end points from the VP, HP and PP. A line may be:

- Parallel to both the planes.
- Parallel to one plane and perpendicular to the other.
- Parallel to one plane and inclined to the other.
- Inclined to both the planes.

Projection of a line

The projection of a line can be obtained by projecting its end points on planes of projections and then connecting the points of projections. The projected length and inclination of a line, can be different compared to its true length and inclination.

To Find True length and true inclinations of a line

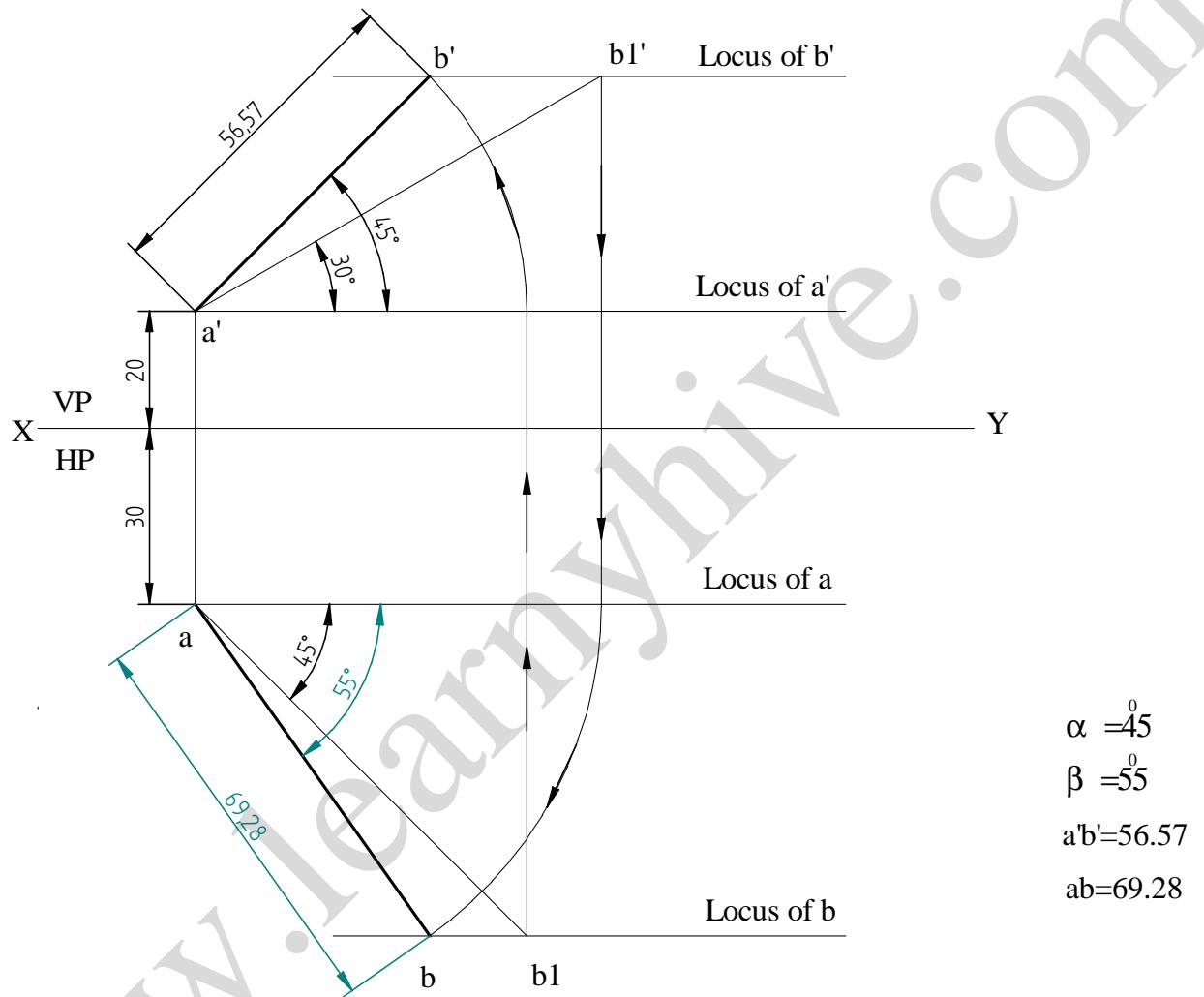
Many times if the top and front views of a line are given, the true length and true inclinations of a line is required to be determined.

The top and front views of the object can be drawn from if any of the following data are available:

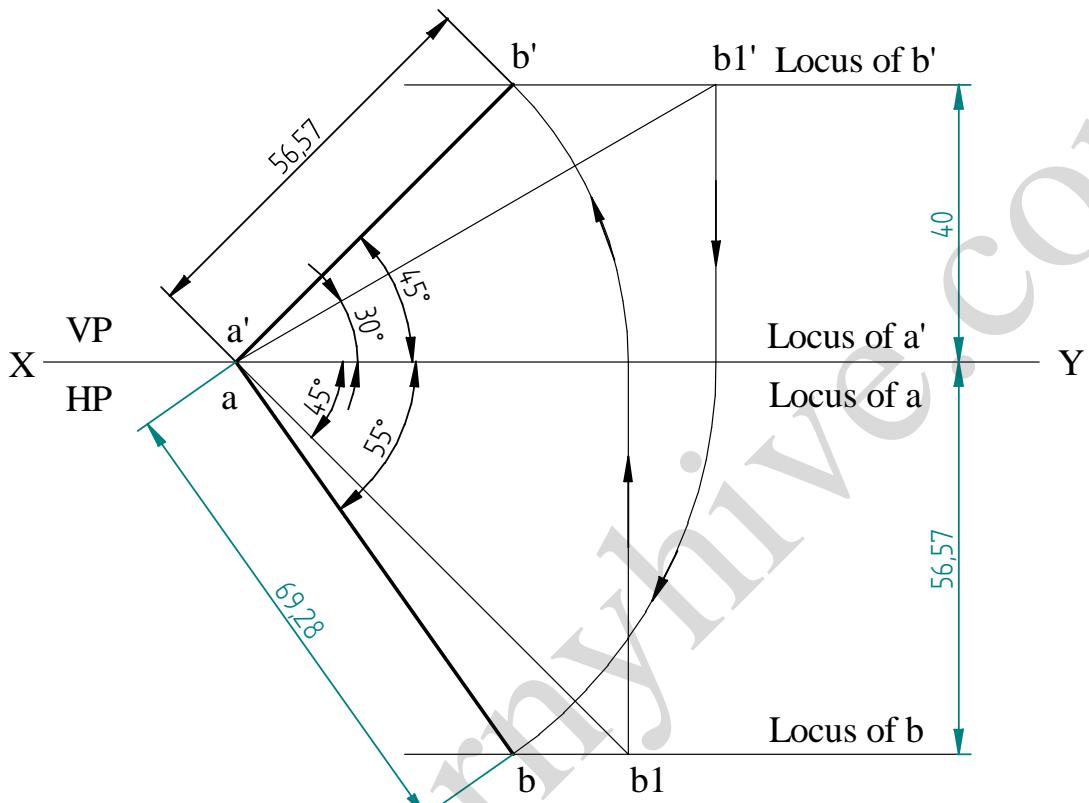
- (a) Distance between the end projectors,
- (b) Distance of one or both the end points from HP and VP and
- (c) Apparent inclinations of the line.

Projections of Straight Lines

1. A line AB 80mm long has its end A 20mm above the HP and 30mm in front of VP. It is inclined at 30° to HP and 45° to VP. Draw the projections of the line and find apparent lengths and apparent inclinations.



2. A line AB 80mm long has its end A on XY line and is inclined to HP at 30° and inclined to VP at 45° . Draw front and top views of line and determine their lengths. Also measure the perpendicular distance of end B from both HP and VP.



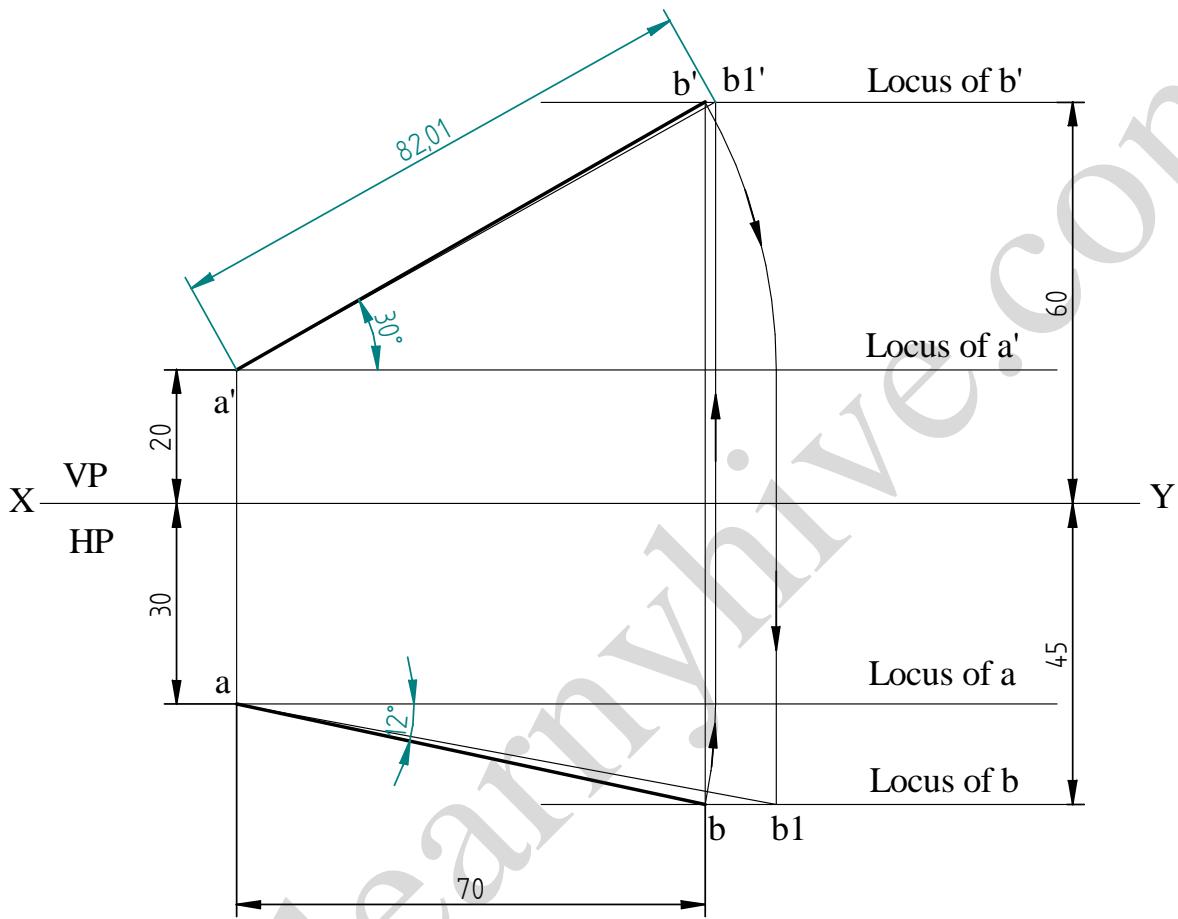
$$a'b' = 56.57$$

$$ab = 69.28$$

Distance of B from HP = 40

Distance of B from VP = 56.57

3. A line AB has its end A 20mm above the HP and 30mm in front of VP. The other end B is 60mm above the HP and 45mm in front of VP. The distance between end projectors is 70mm. Draw its projections. Determine the true length and apparent inclinations.

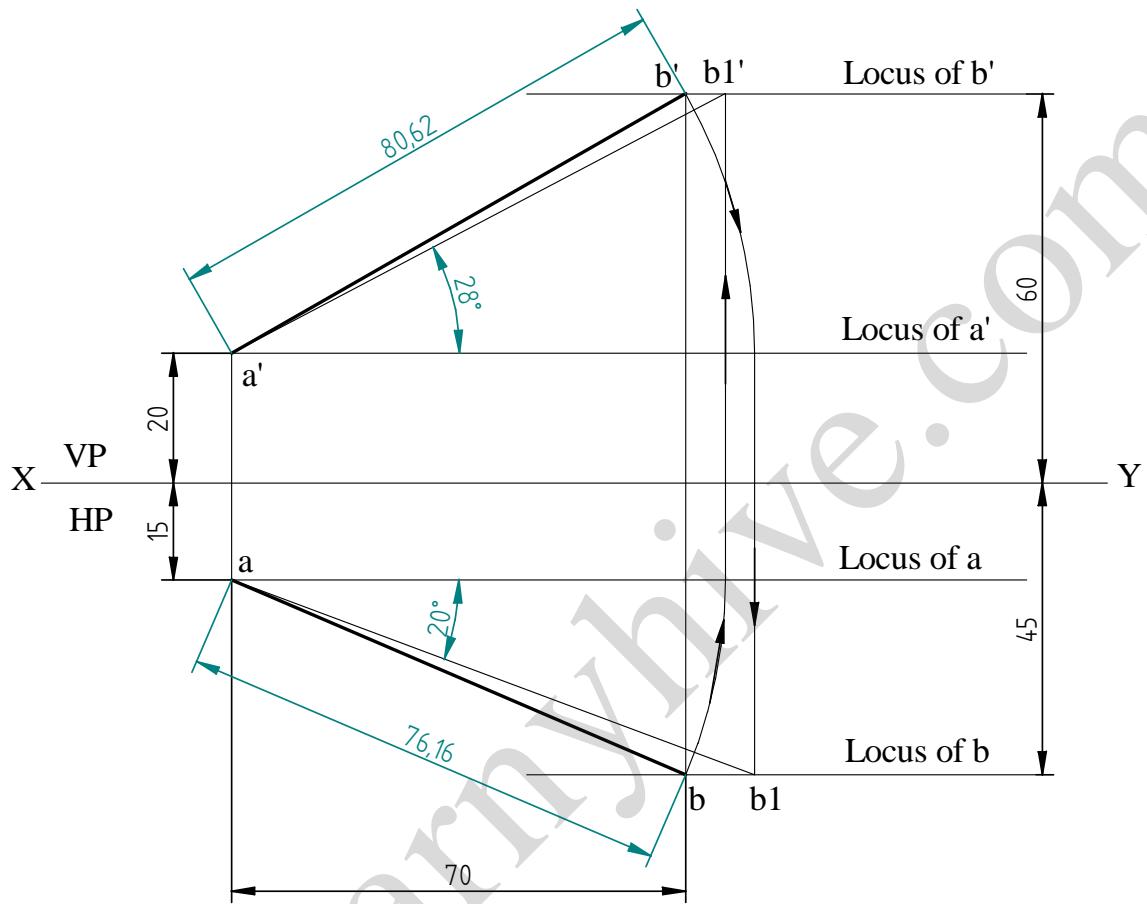


$$AB = 82.01$$

$$\alpha = 30^\circ$$

$$\beta = 12^\circ$$

4. A line AB has its end A 20mm above the HP and 15mm in front of the VP. The other end B is 60mm above the HP. The distance between end projectors is 70mm. Draw its projections. Determine the apparent lengths and true inclinations.



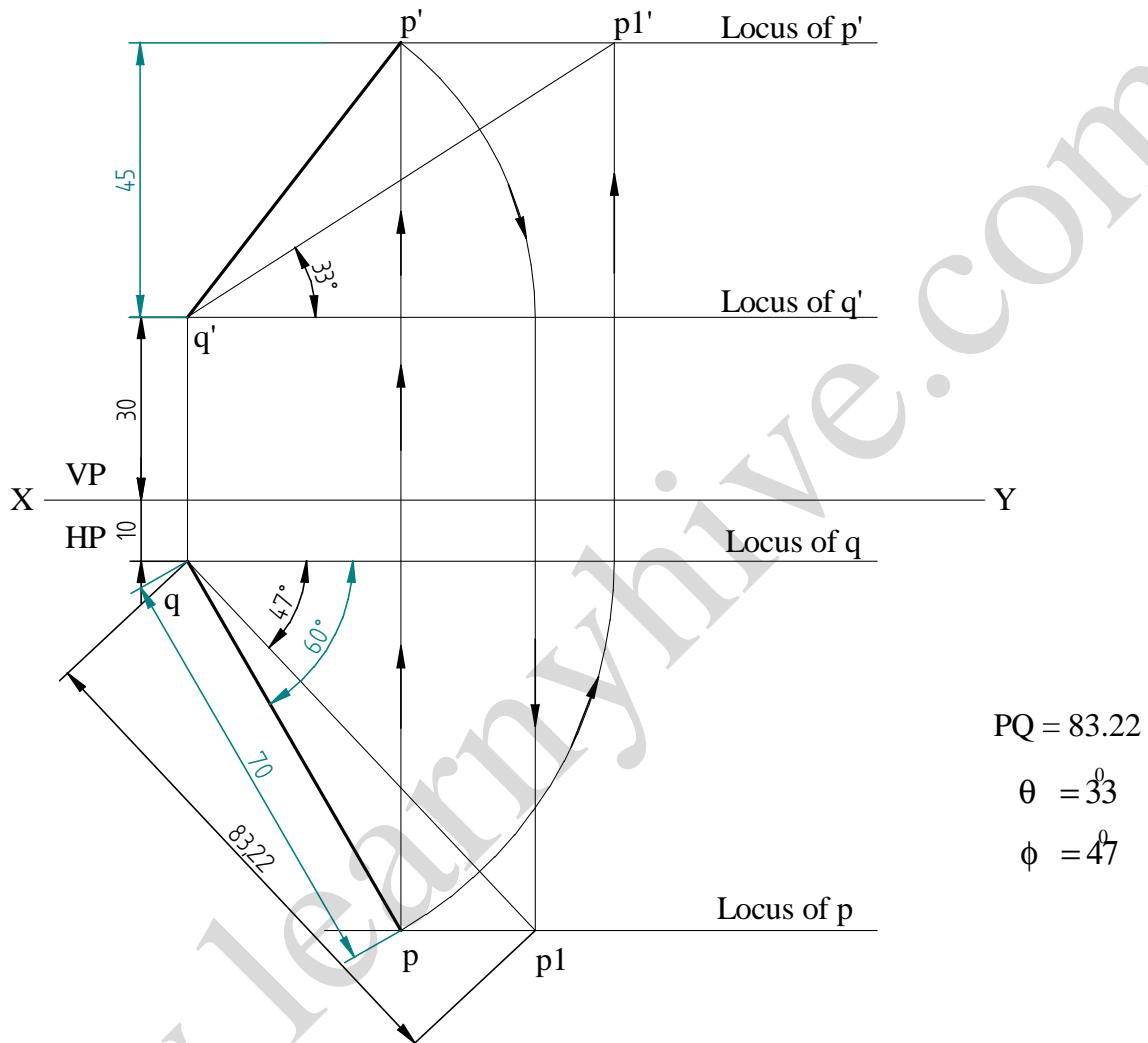
$$a'b' = 80.62$$

$$ab = 76.16$$

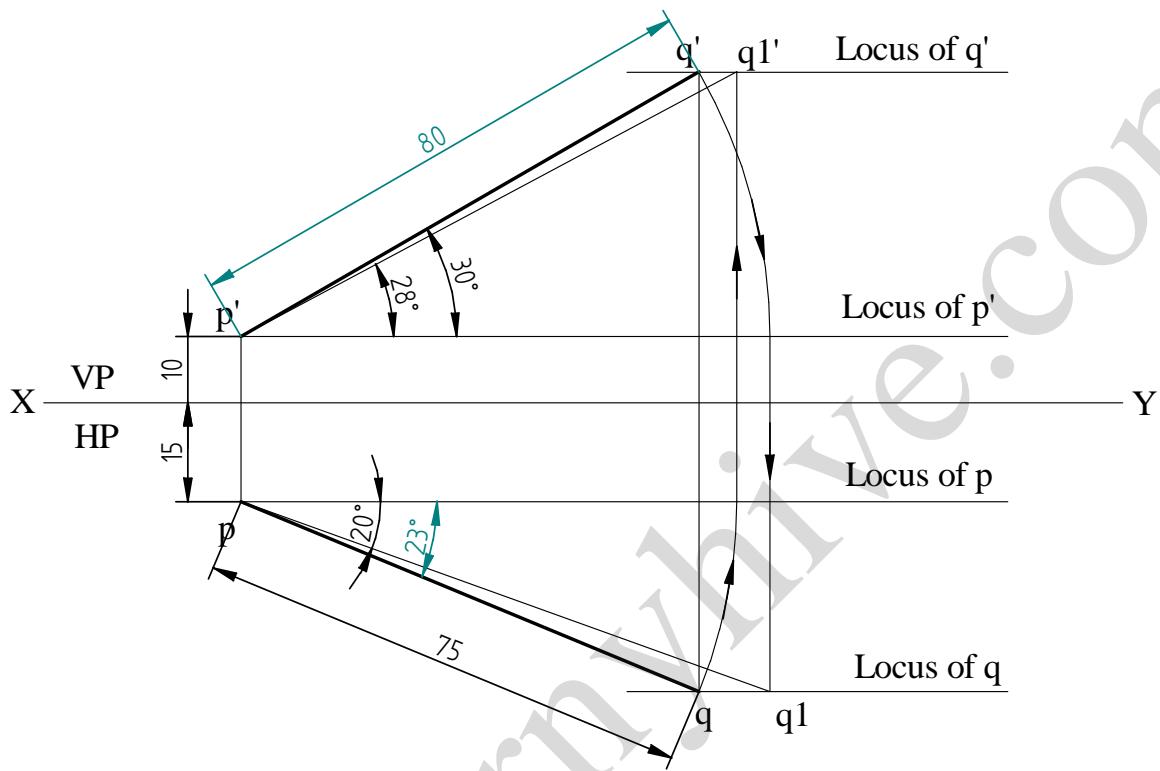
$$\theta = 28^\circ$$

$$\phi = 20^\circ$$

5. The top view PQ of a straight line is 70mm and makes an angle of 60° with the XY line. The end Q is 10mm in front of VP and 30mm above the HP. The difference between the distances of P and Q above the HP is 45mm. Draw the projections. Determine the true length and true inclinations with HP and VP.



6. A line PQ 85mm long has its ends P 10mm above the HP and 15mm in front of the VP. The top view and front view of line PQ are 75mm and 80mm respectively. Draw its projections. Also determine the true and apparent inclinations of the line.



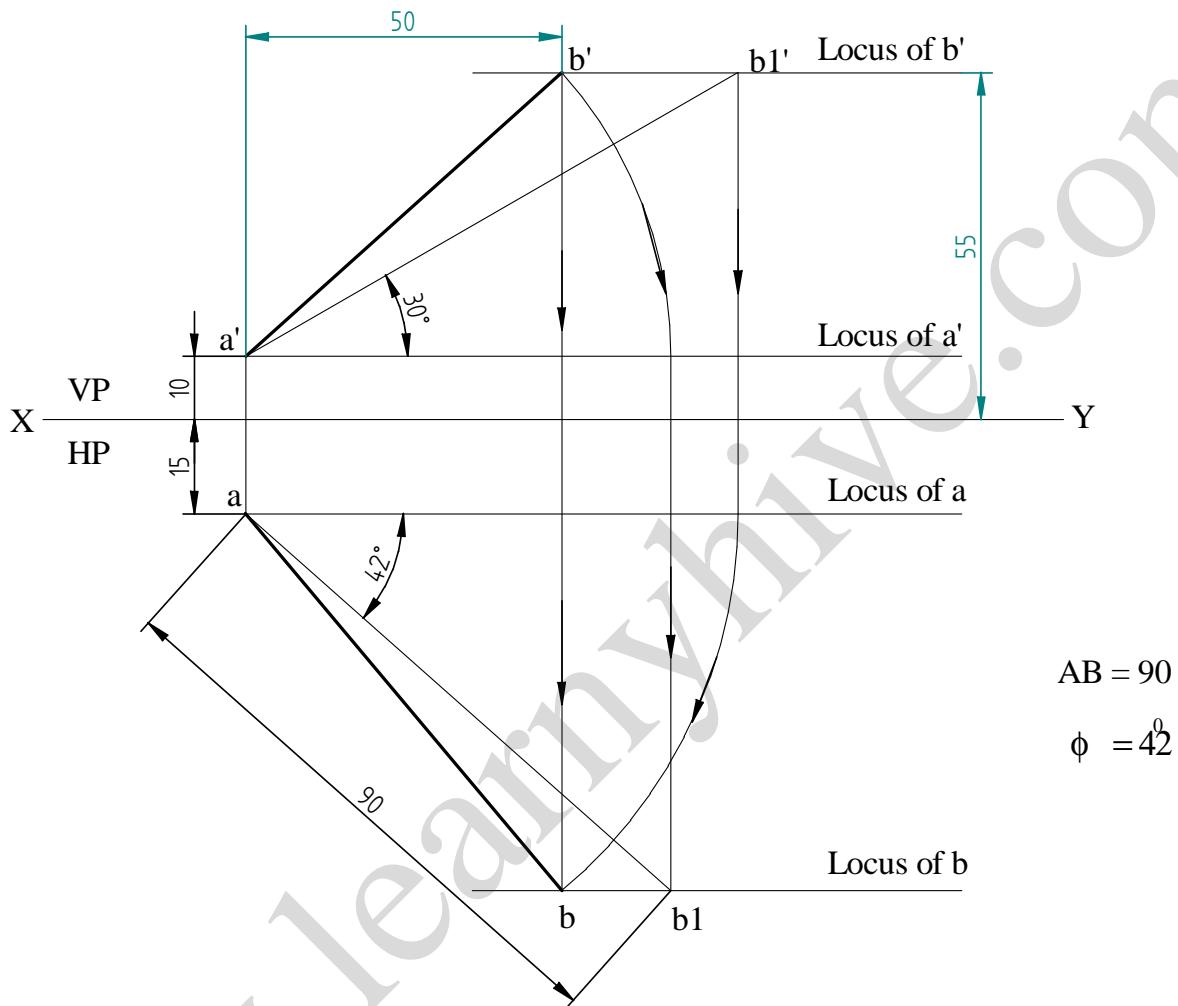
$$\theta = 28^\circ$$

$$\alpha = 30^\circ$$

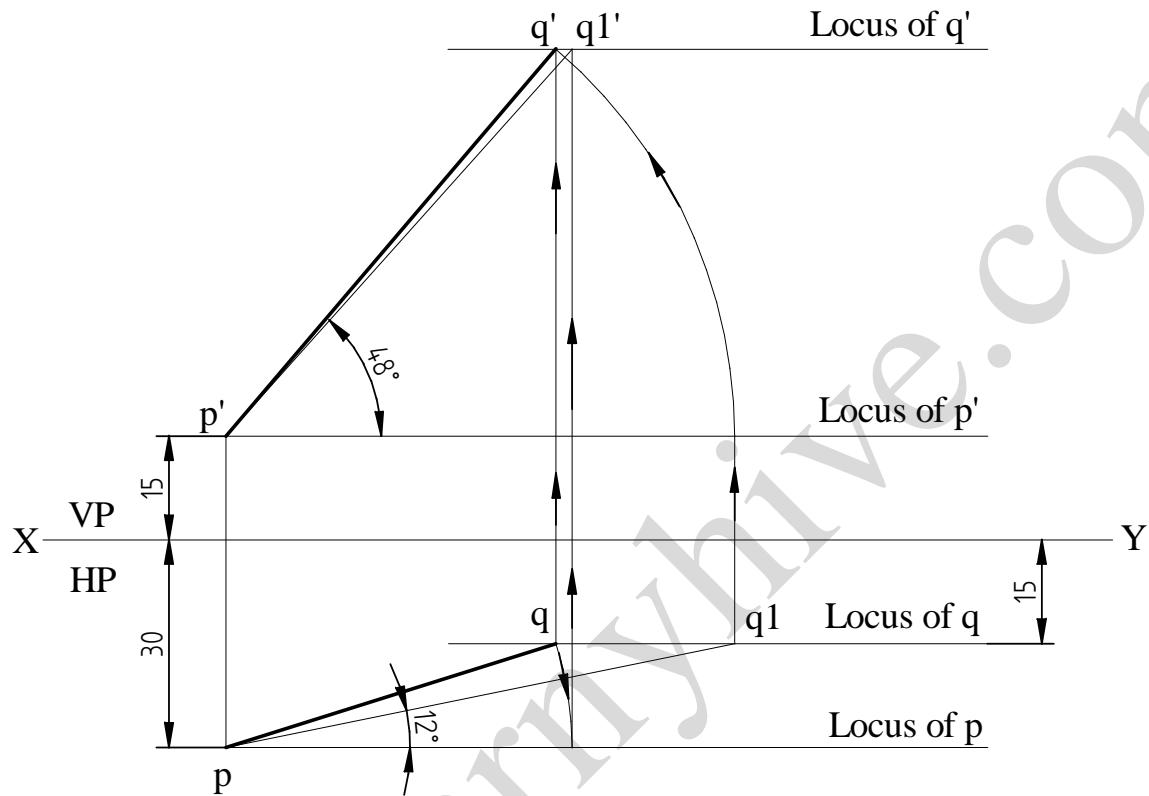
$$\phi = 20^\circ$$

$$\beta = 23^\circ$$

7. A line has its end A 10mm above HP and 15mm in front of VP. The end B is 55mm above HP and line is inclined at 30° to HP. The distance between the end projectors is 50mm. Draw the projections of the line. Determine the true length of the line and its inclination with VP.



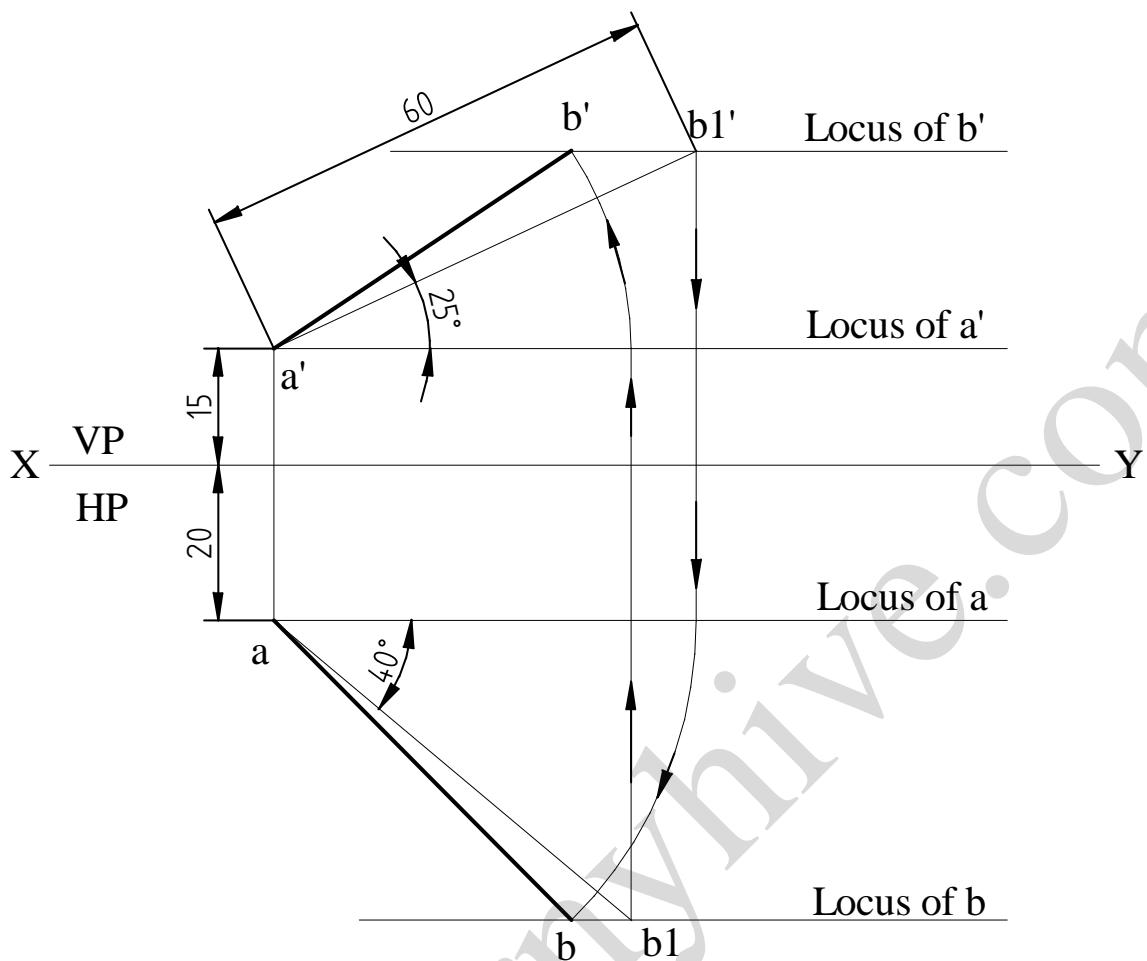
8. The top view of a line 75mm long measures 50mm. The end P is 30mm in front of VP and 15mm above HP. The end Q is 15mm in front of VP and above HP. Draw the projections of the line and finds its true inclinations with HP and VP.



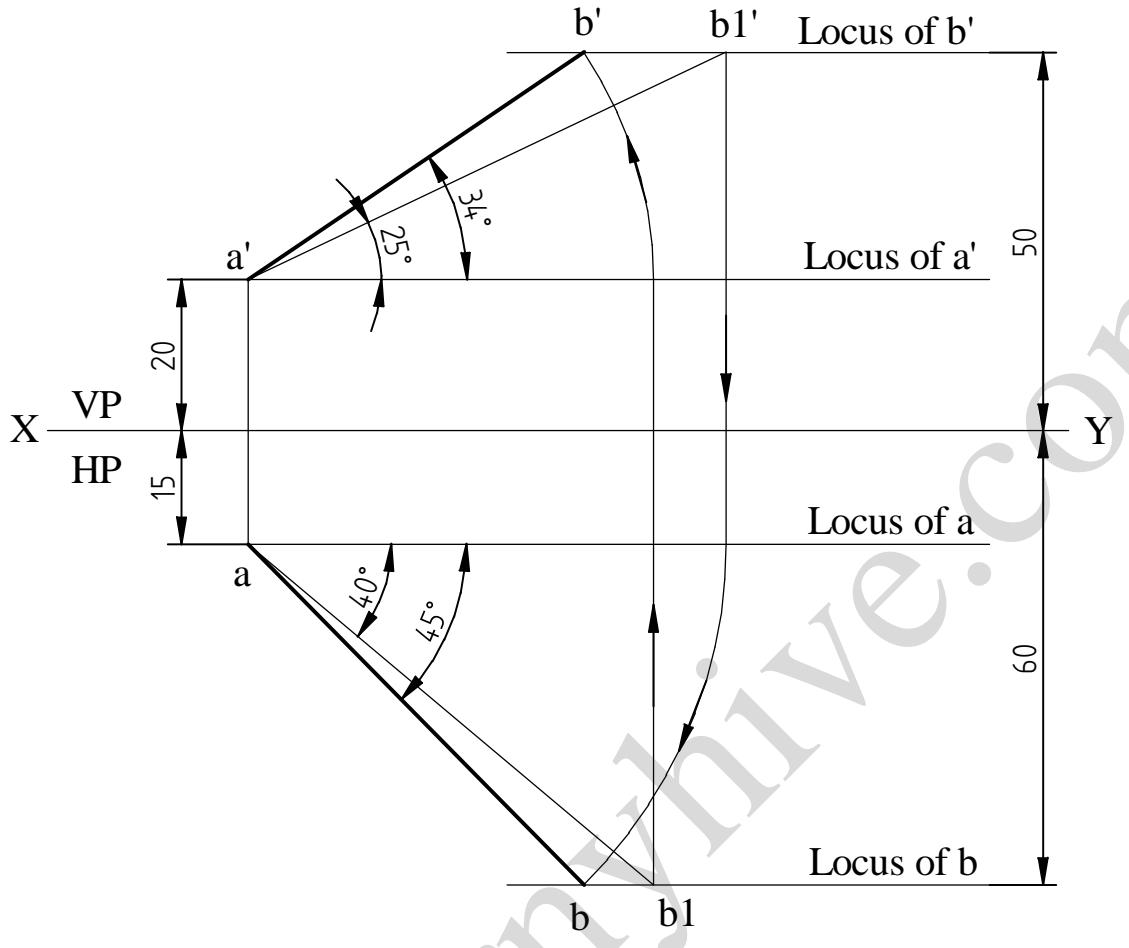
$$\theta = 48^\circ$$

$$\phi = 12^\circ$$

9. A line AB 60mm long has one of its extremities 20mm infront of VP and 15mm above HP. The line is inclined at 25° to HP and 40° to VP. Draw its top and front views.



10. A line AB measuring 70mm has its end A 15mm infront of VP and 20mm above HP and the other end B is 60mm infront of VP and 50mm above HP. Draw the projections of the line and find the inclinations of the line with both the reference planes of projection.



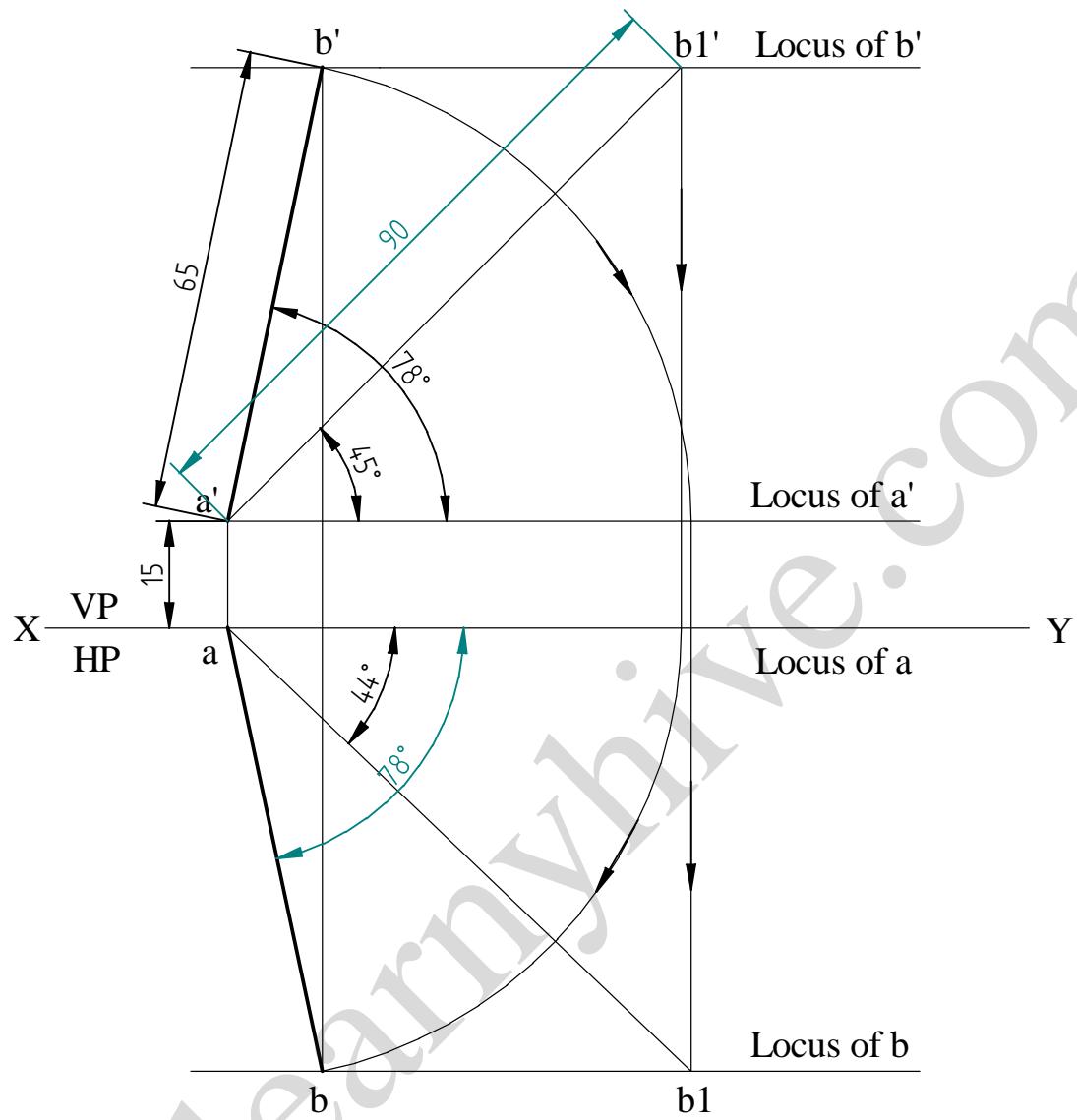
$$\theta = 25^\circ$$

$$\alpha = 34^\circ$$

$$\phi = 40^\circ$$

$$\beta = 45^\circ$$

11. The front view of a 90mm long line which is inclined at 45° to the XY line, measures 65mm. End A is 15mm above the XY line and is in VP. Draw the projections of the line and find its inclinations with HP and VP.



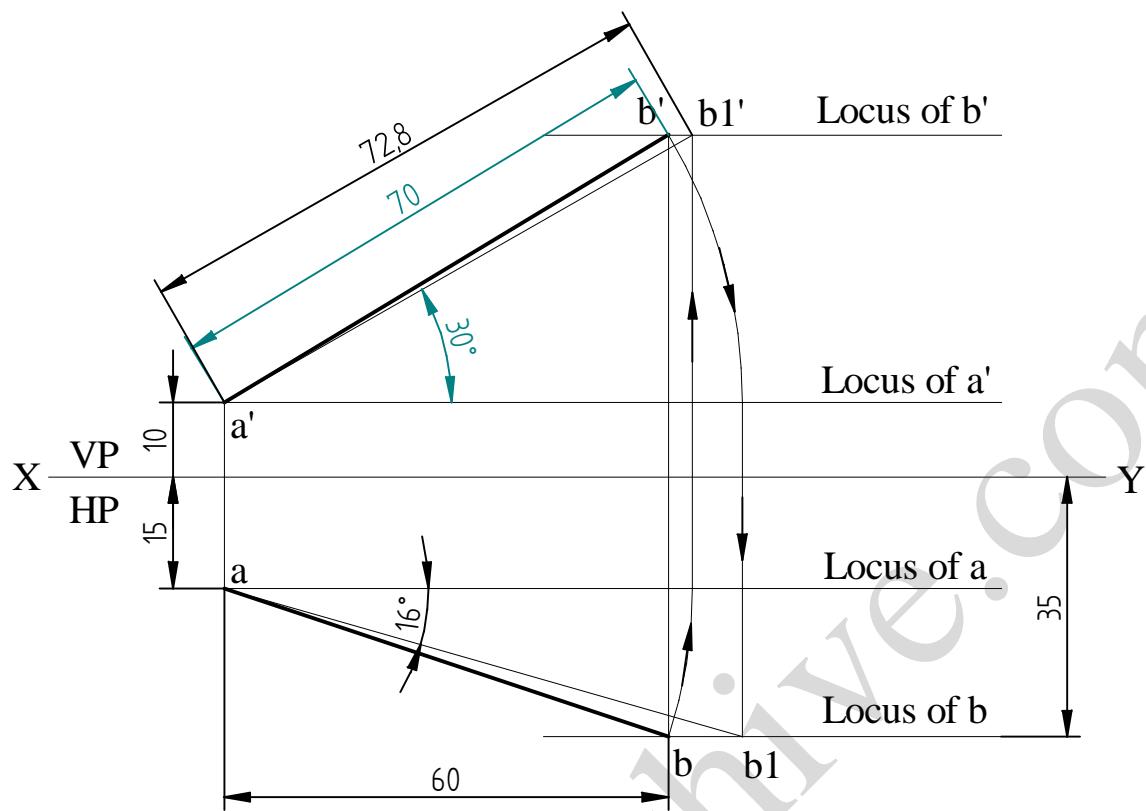
$$\theta = 45^\circ$$

$$\alpha = 78^\circ$$

$$\phi = 44^\circ$$

$$\beta = 78^\circ$$

12. The distance between the end projectors through the end points of a line AB is 60mm. The end A is 10mm above HP and 15mm in front of VP. The end B is 35mm in front of VP. The line AB appears 70mm long in the front view. Complete the projections. Find the true length of the line and its inclinations with HP and VP.

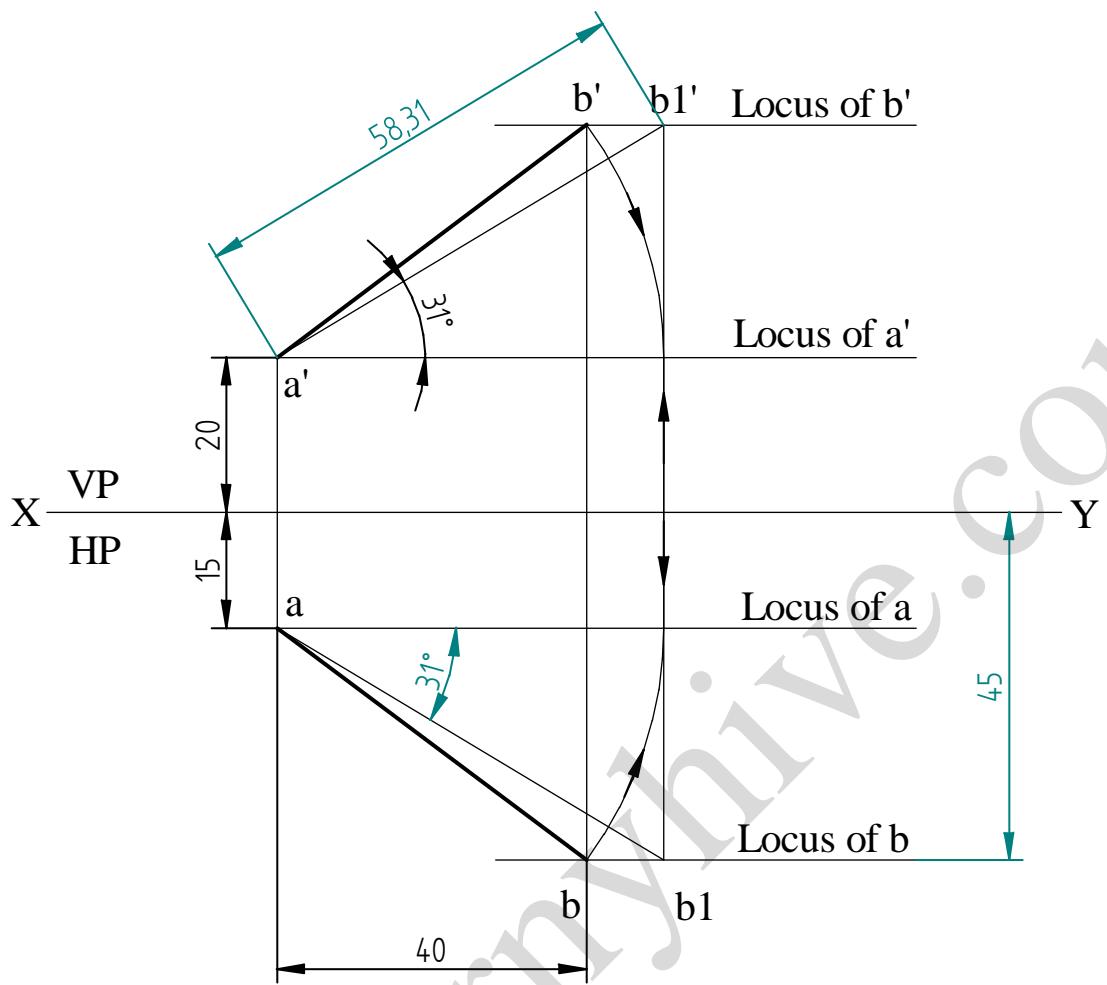


$$AB = 72.8$$

$$\theta = 30^\circ$$

$$\phi = 16^\circ$$

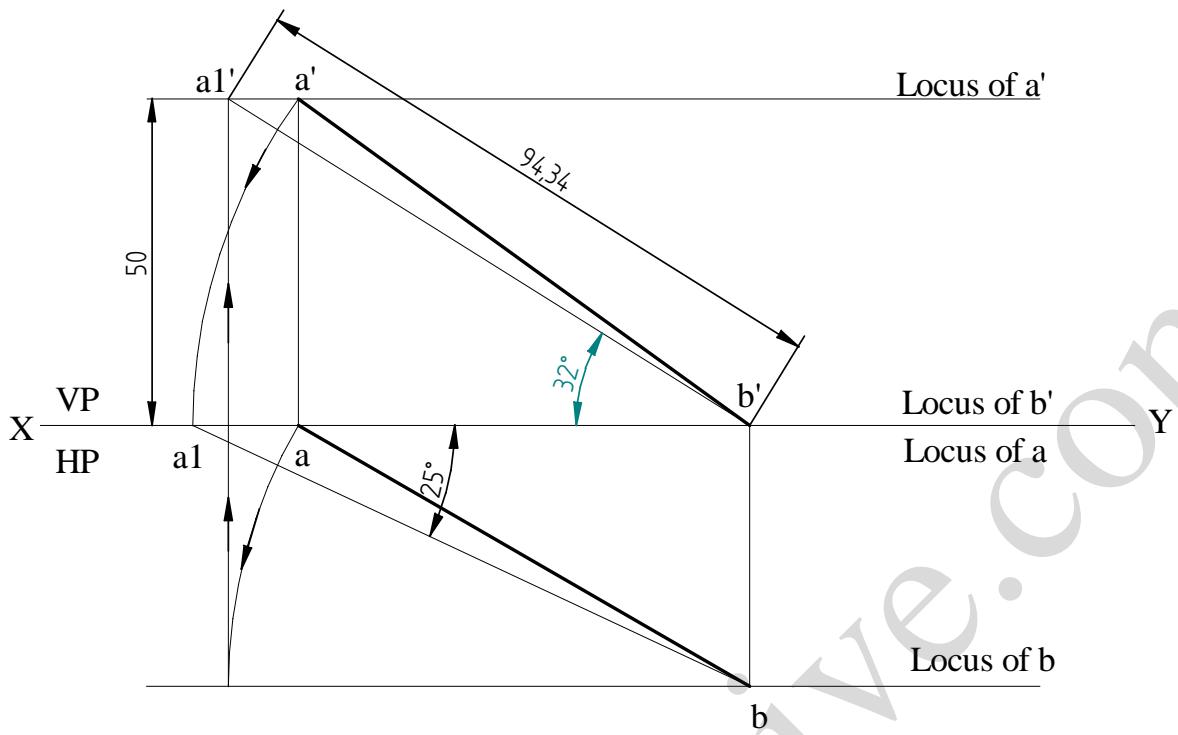
13. The distance between the end projectors through the end points of a line AB is 40mm. The end A is 20mm above HP and 15mm in front of VP. The end B is 45mm in front of VP. The line AB appears 50mm long in the front view. Complete the projections. Find the true length of the line and its inclinations with HP and VP.



$$AB = 58.31$$

$$\theta = \phi = 31^\circ$$

14. The point B of a line AB is on the horizontal plane, the top view of the line makes an angle of 30° with XY line, being 80mm. The point A is on the vertical plane and 50mm above the horizontal plane. Draw the top and front views of the line and obtain the true length of the line. Also find the inclinations of the line with the two planes.

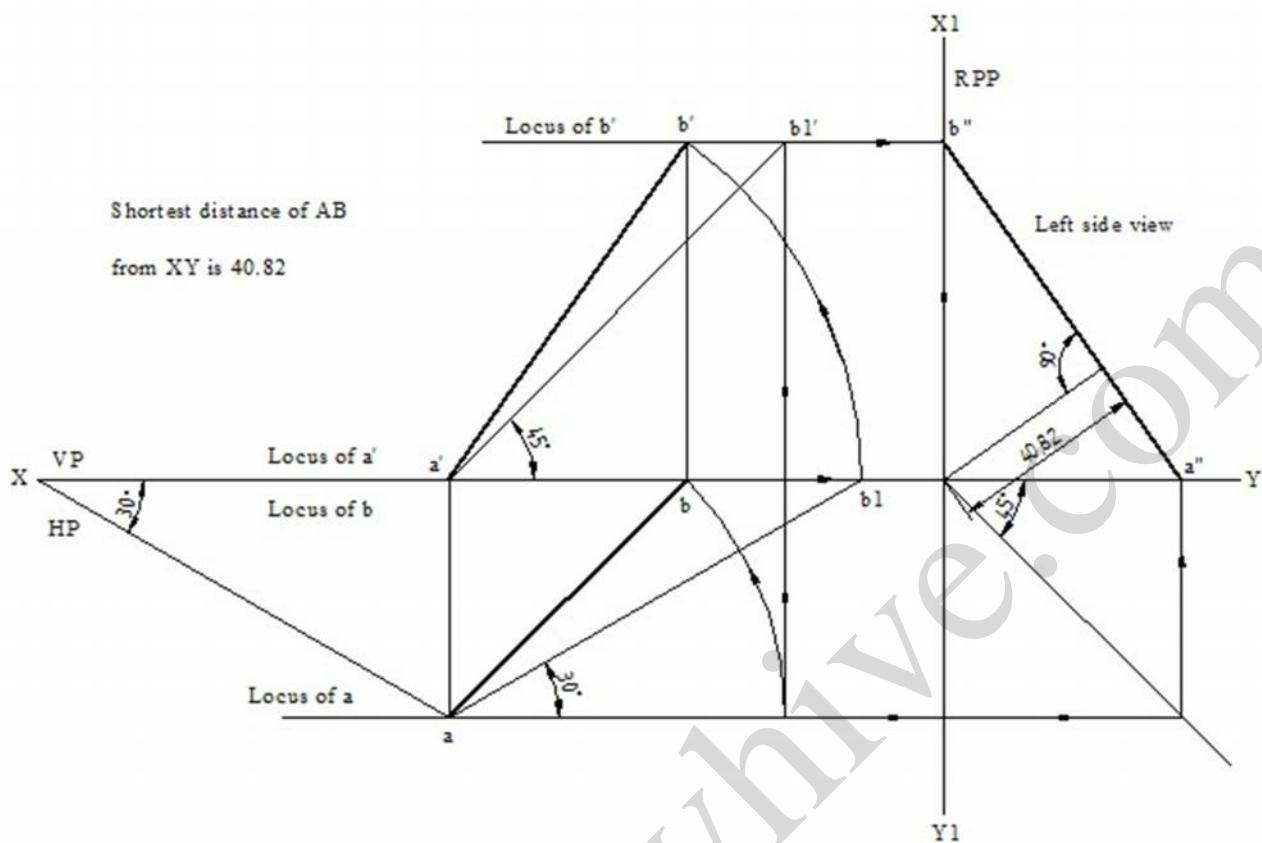


$$AB = 94.34$$

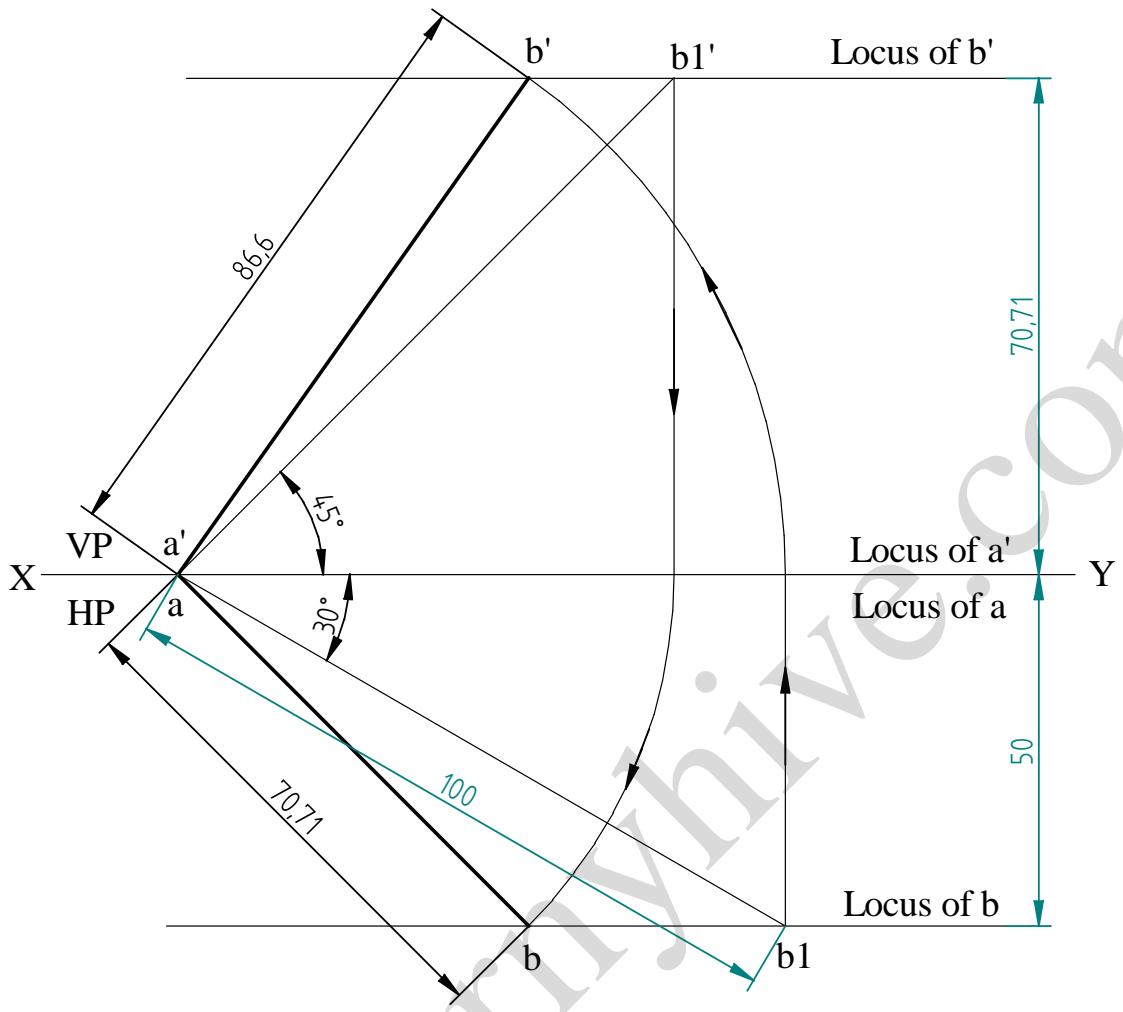
$$\theta = 32^\circ$$

$$\phi = 25^\circ$$

15. Draw the projections of a straight line AB, 100mm long, inclined at 45° to HP and 30° to VP. The end A is in HP and the end B is in VP. Find the shortest distance between the straight line AB and the line of intersection of planes of projection.



16. A line AB 100mm long is inclined to HP at 45° and inclined to VP at 30° . Draw front and top views of line and determine their lengths. Also determine the perpendicular distance of end B from both HP and VP.



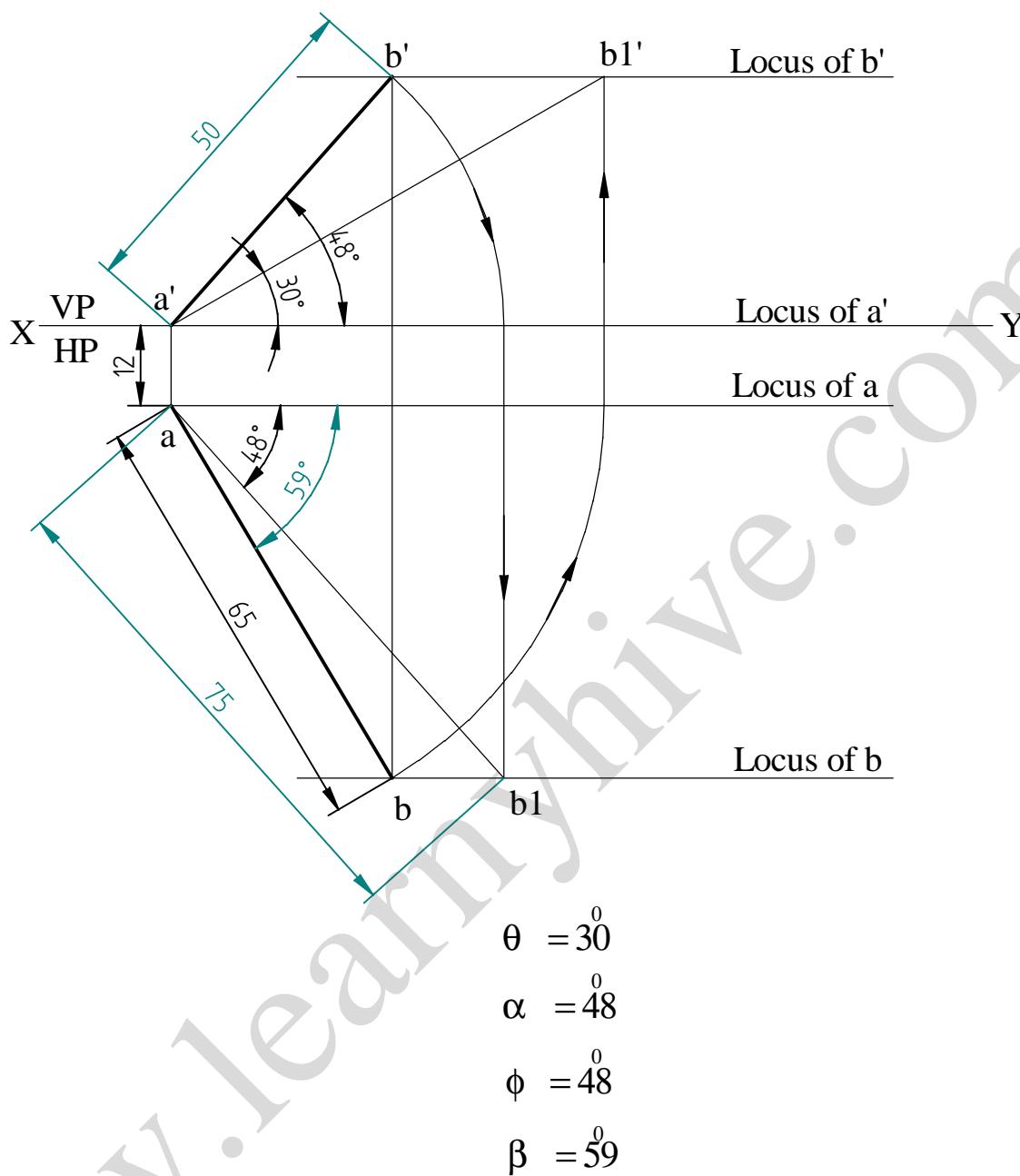
Perpendicular distance of B from HP is 70.71

Perpendicular distance of B from VP is 50

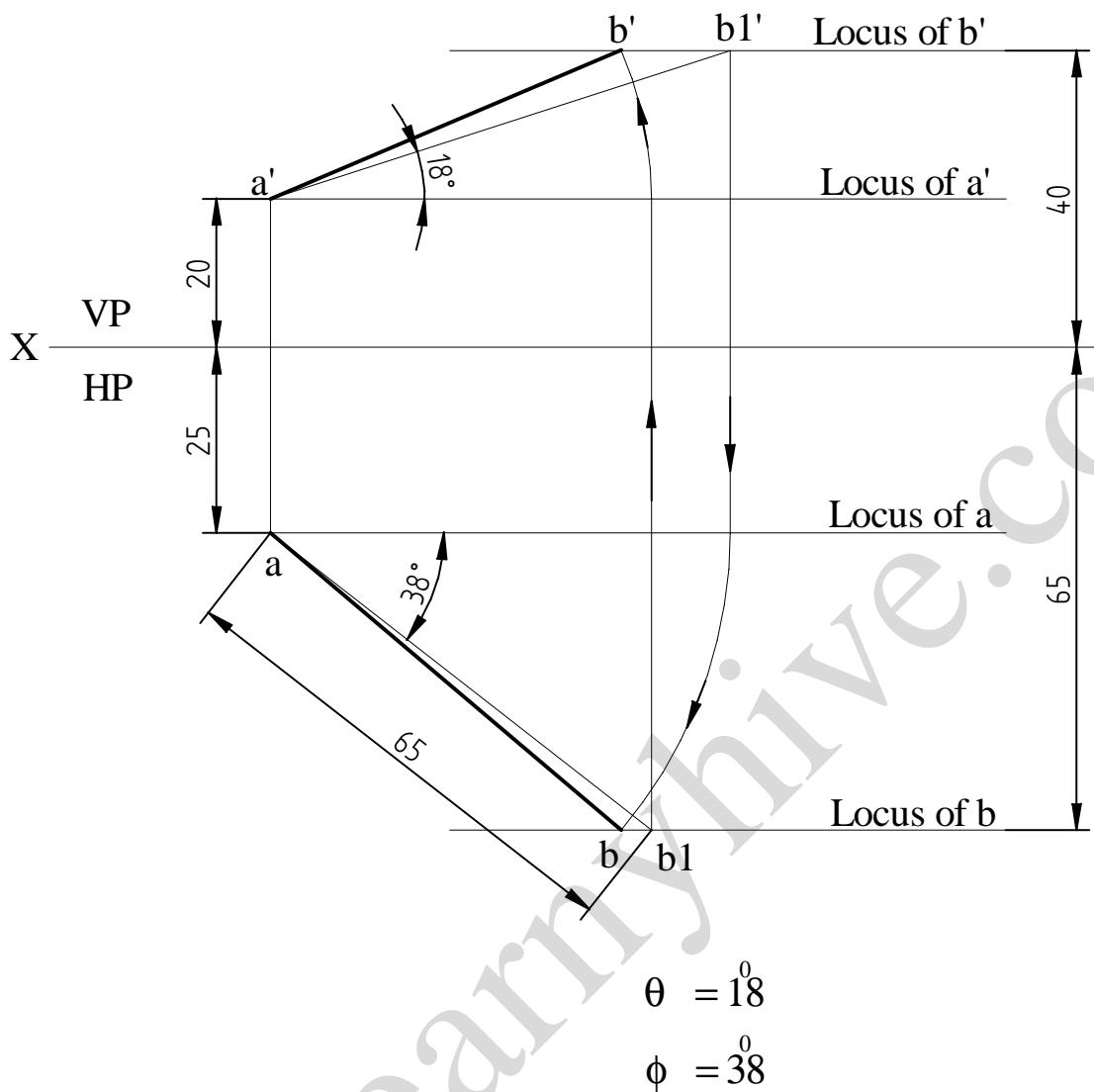
$$a'b' = 86.6$$

$$ab = 70.71$$

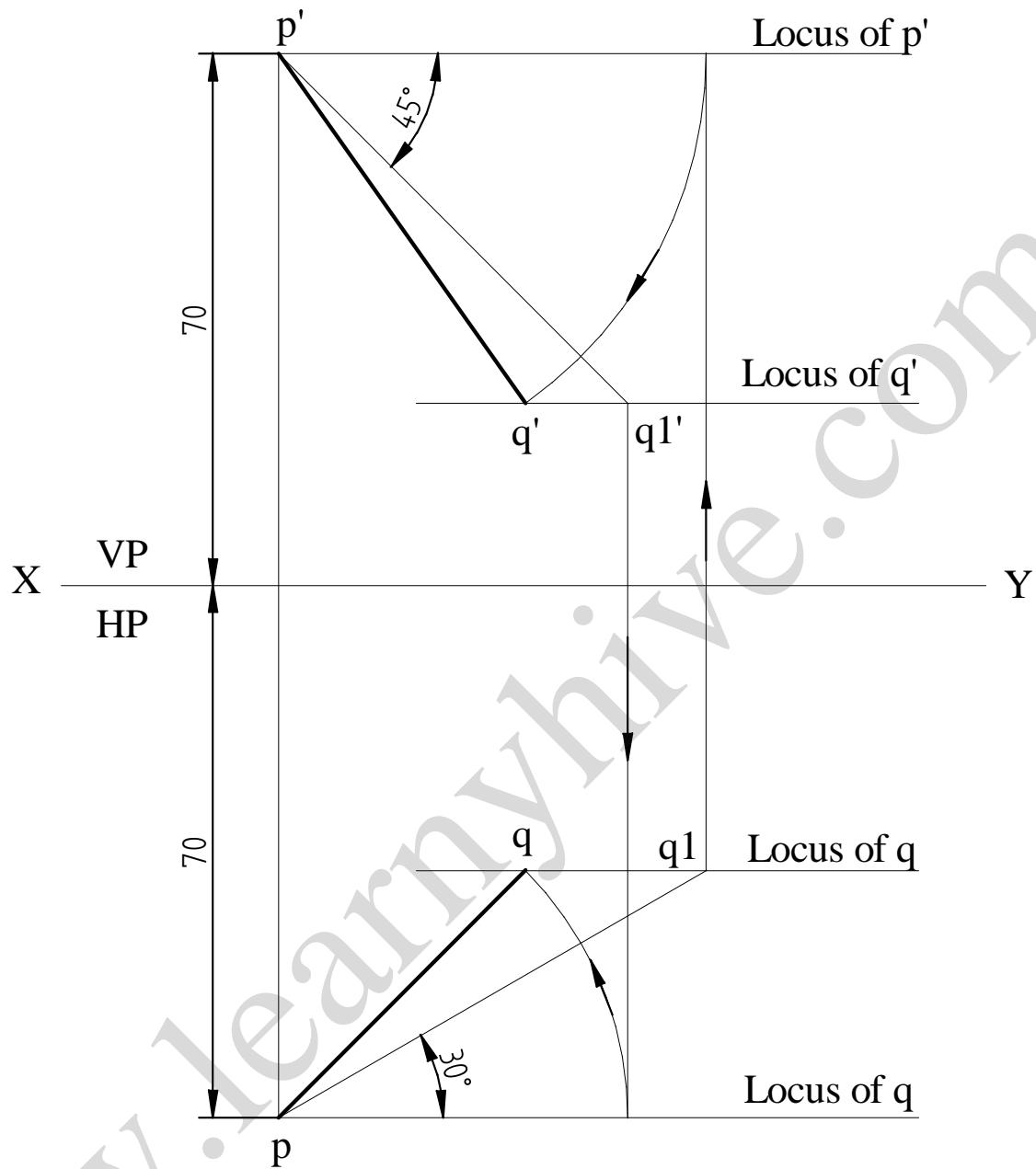
17. The top view of a 75mm long line AB measures 65mm, while the front view is 50mm. Its one end A is in HP and 12mm in front of the VP. Draw the projections of AB and determine its inclination with the HP and the VP.



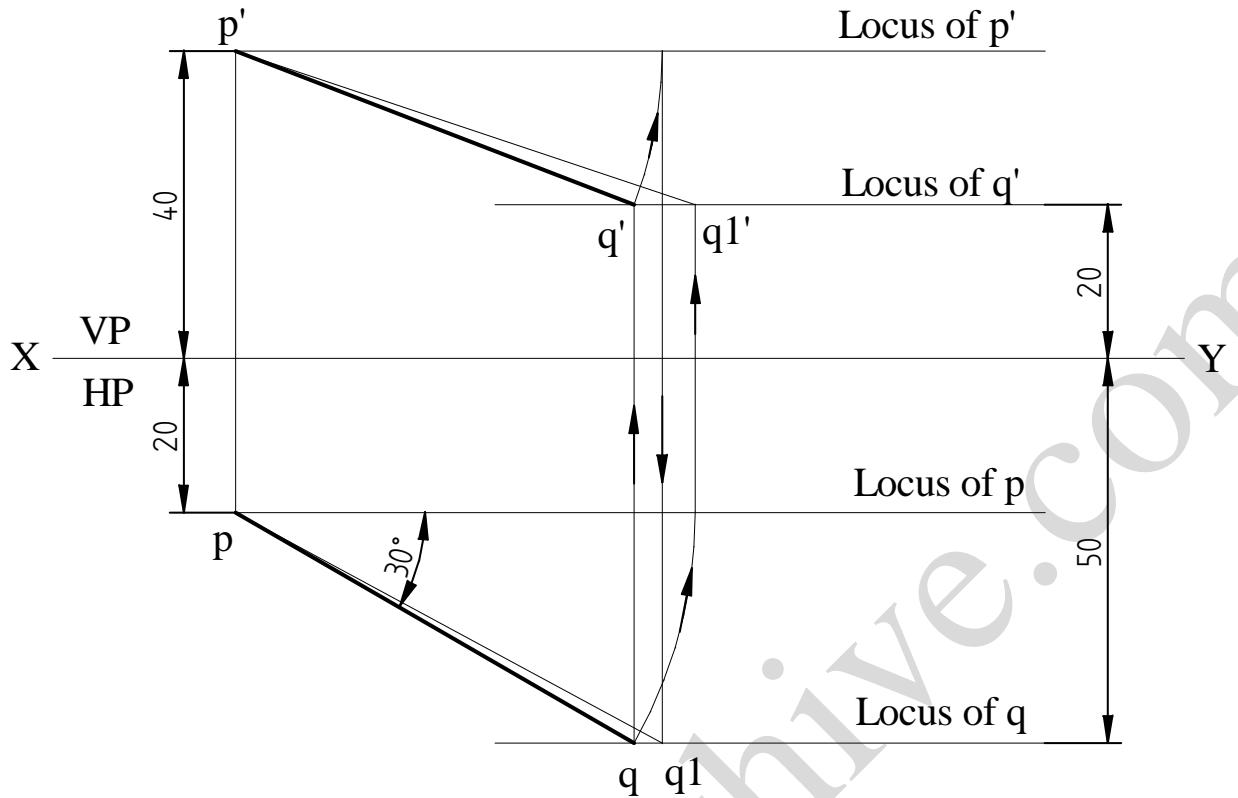
18. A line AB, 65mm long, has its end A 20mm above the HP and 25mm in front of the VP. The end B is 40mm above the HP and 65mm in front of the VP. Draw the projections of AB and show its inclinations with the HP and the VP.



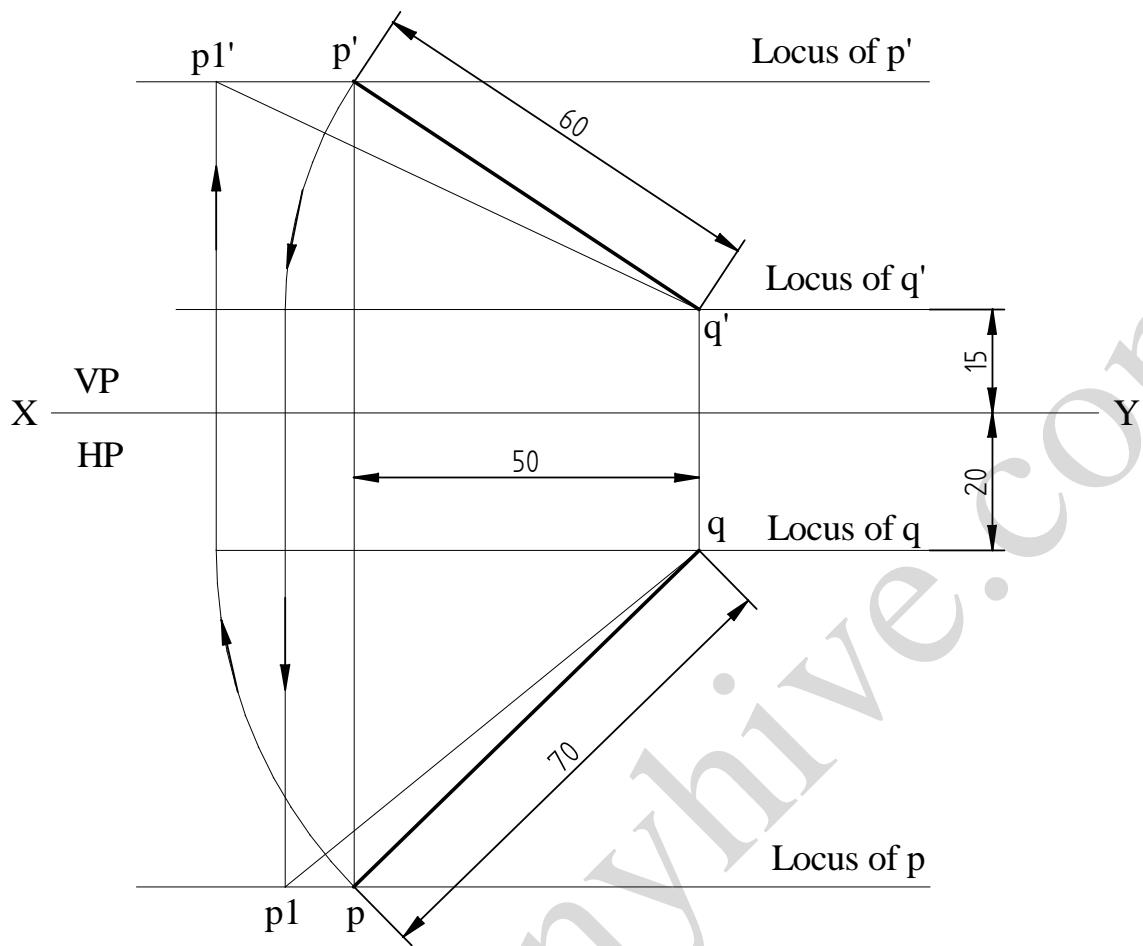
19. A straight line PQ, 65mm long, is inclined at 45° to HP and 30° VP. The point P is 70mm from both the reference planes and the point Q is towards the reference planes. Draw the projections.



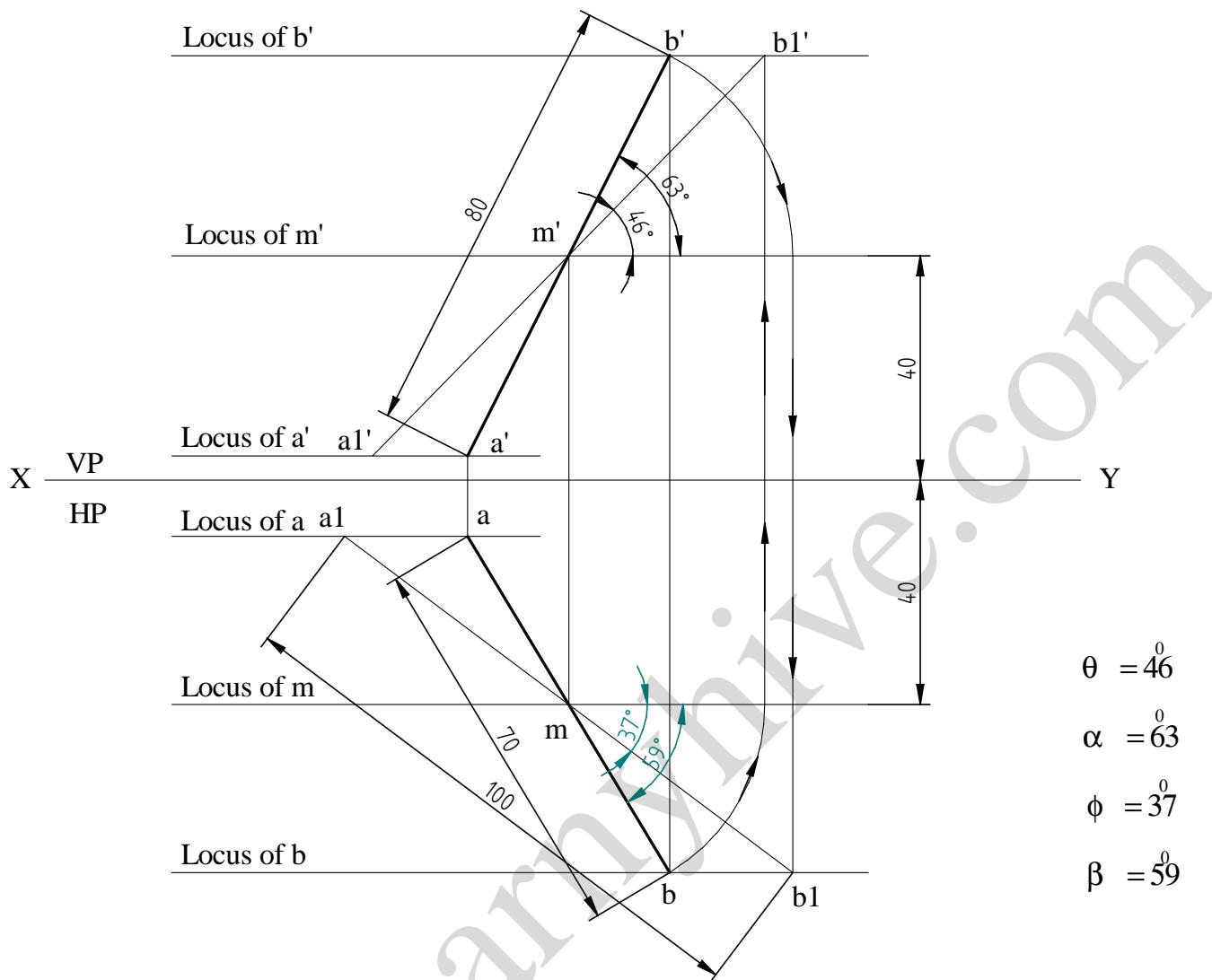
20. A point P is 40mm above HP and 20mm in front of VP. Another point Q is 20mm above HP and 50mm in front of VP. The top view of line PQ is inclined at 30° to XY. Draw the projections.



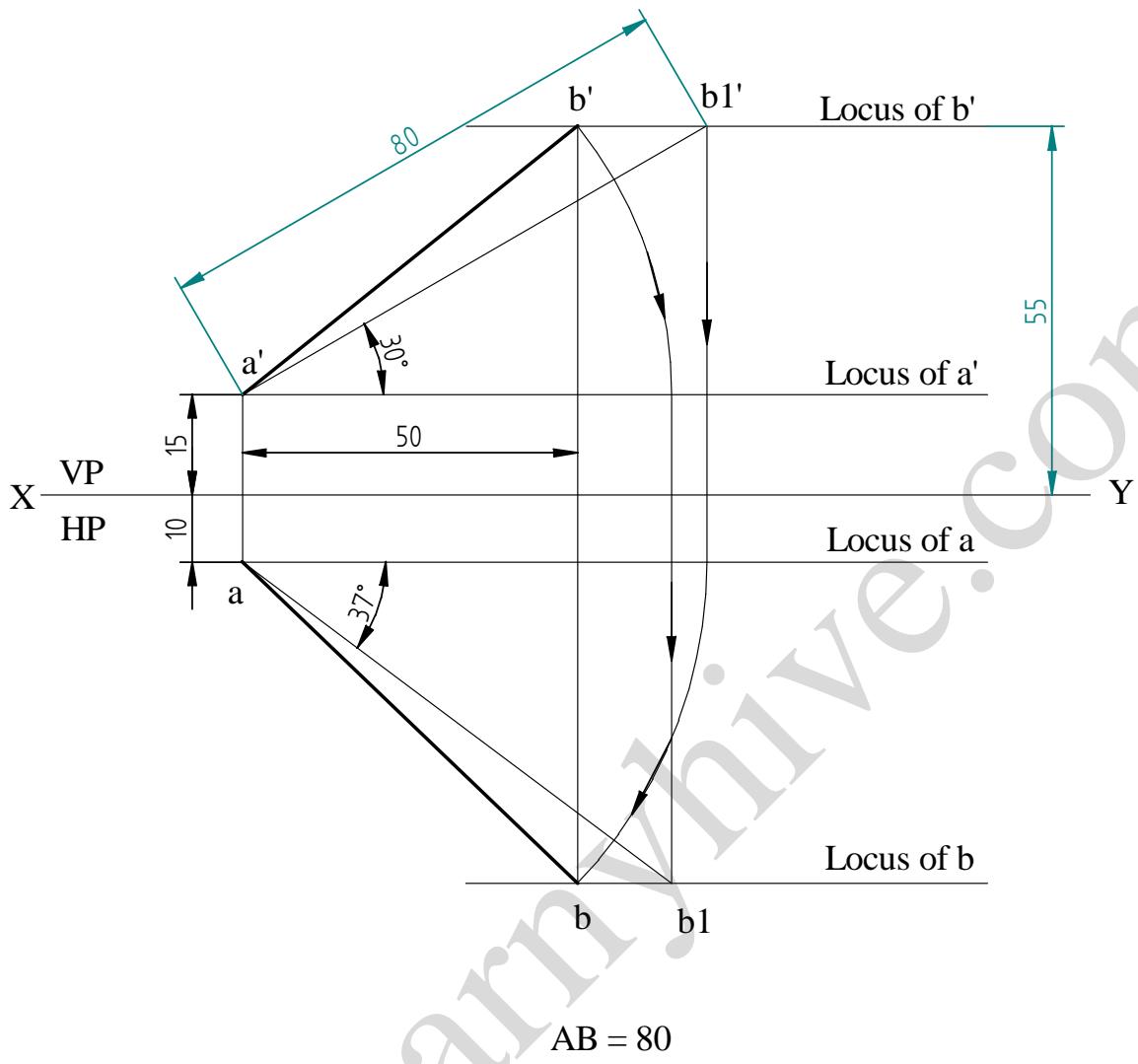
21. The top view of a line PQ is 70mm and front view is 60mm long. The end Q is nearer to both HP and VP than the end P and is 15mm above HP and 20mm infront of VP. Draw the projections of the line if the distance between their projectors is 50mm.



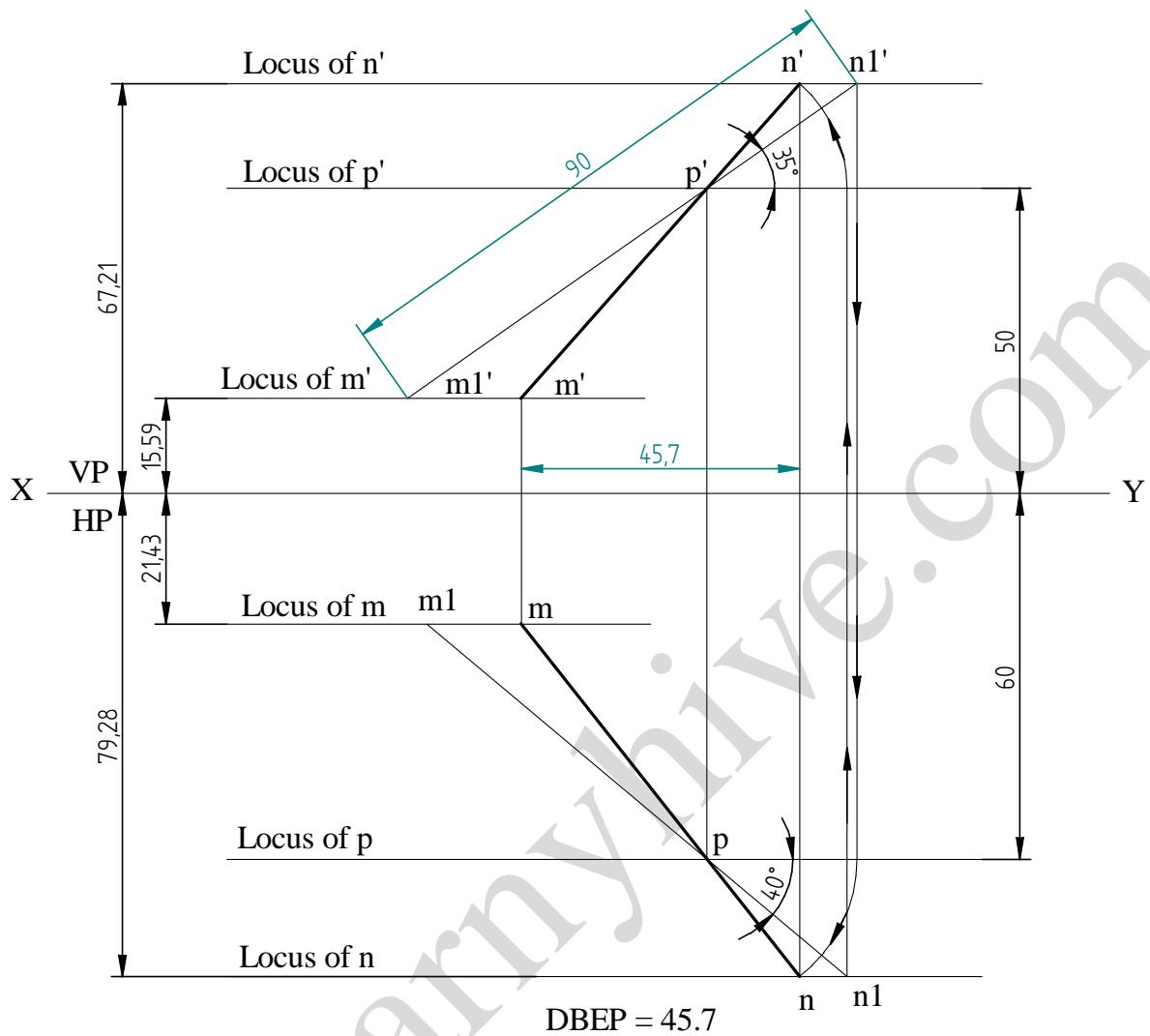
22. A line AB 100mm long measures 80mm in front view and 70mm in top view. The mid-point M of the line is 40mm from both HP and VP. Draw its projections. Find its inclinations.



23. A line has its end A 15mm above HP and 10mm in front of VP. The end B is 55mm above HP and the line is inclined at 30° to HP. The distance between the end projectors is 50mm. Draw the projections of the line and determine the true length of the line and its inclination with VP.

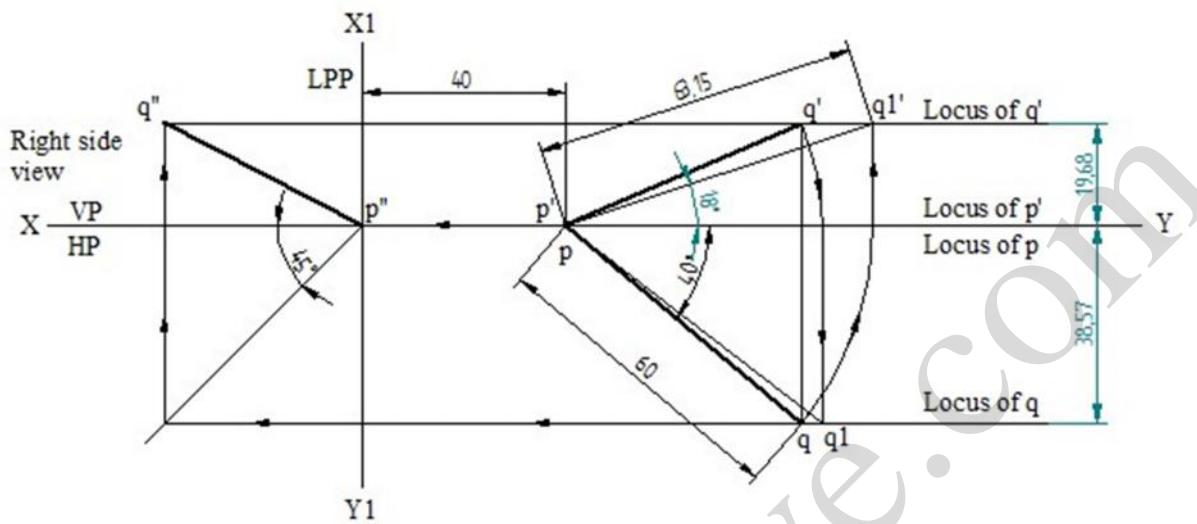


24. A line MN 90mm long has a point P on it which divides the line in the ratio 2:1, i.e MP:PN=2:1. This point P is 50mm above HP and 60mm in front of VP. The line is inclined at 35° to HP and 40° to VP. Draw the projection of the line. Find the distance between end projectors and the position of the ends of the line with HP and VP.



25. A straight line PQ inclined at 40° to VP has $pq=60\text{mm}$ and $p'q'=50\text{mm}$. The end P is both in HP and VP, and 40mm to the right of left profile plane.

- Draw the projections of the straight line PQ.
- Find the true length and true inclination with HP.
- Draw the profile view of the straight line.
- Find the position of the end Q with HP and VP.



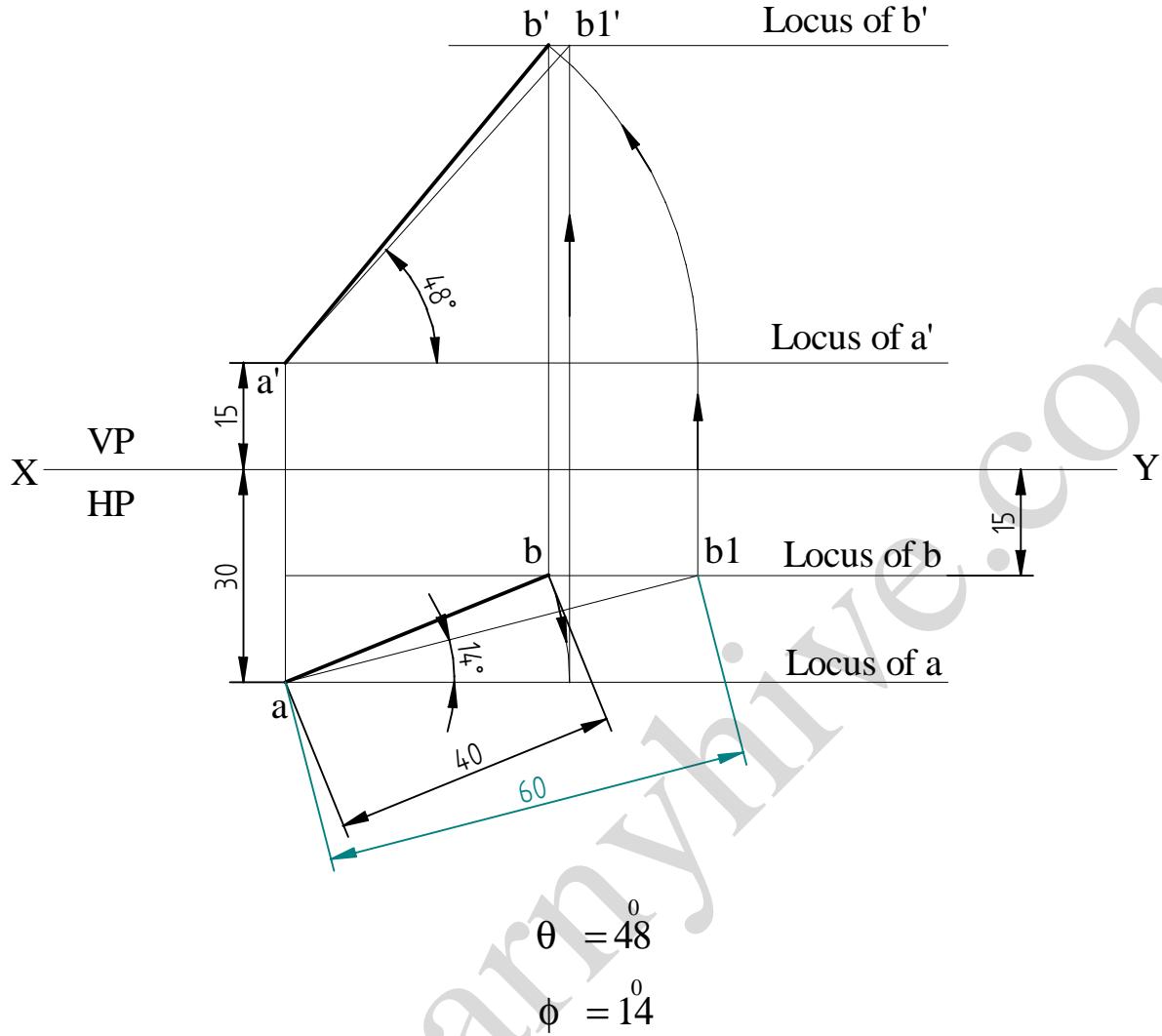
$$PQ = 63.15$$

$$\theta = 18^\circ$$

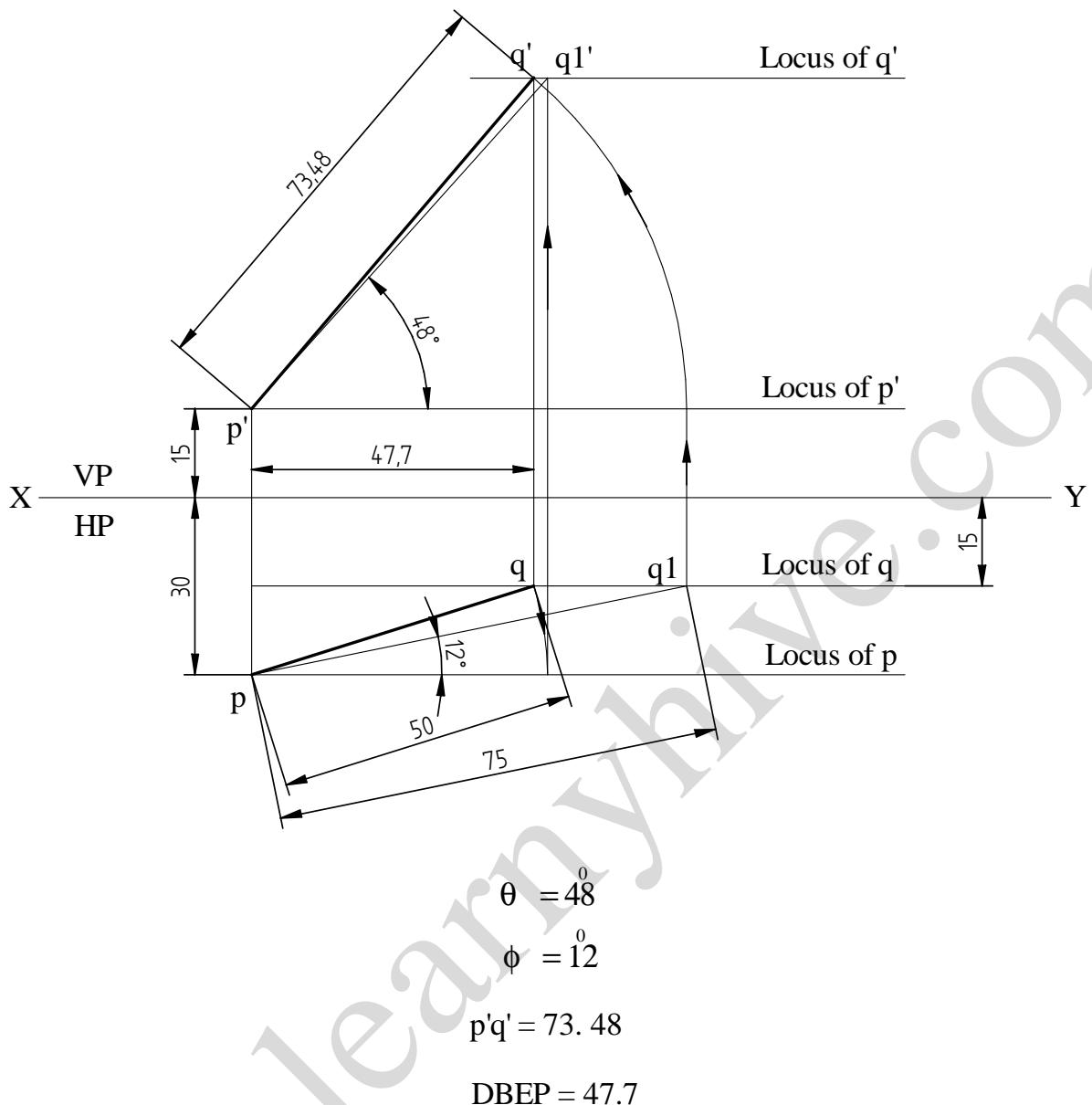
Distance of Q from HP is 19.68

Distance of Q from VP is 38.57

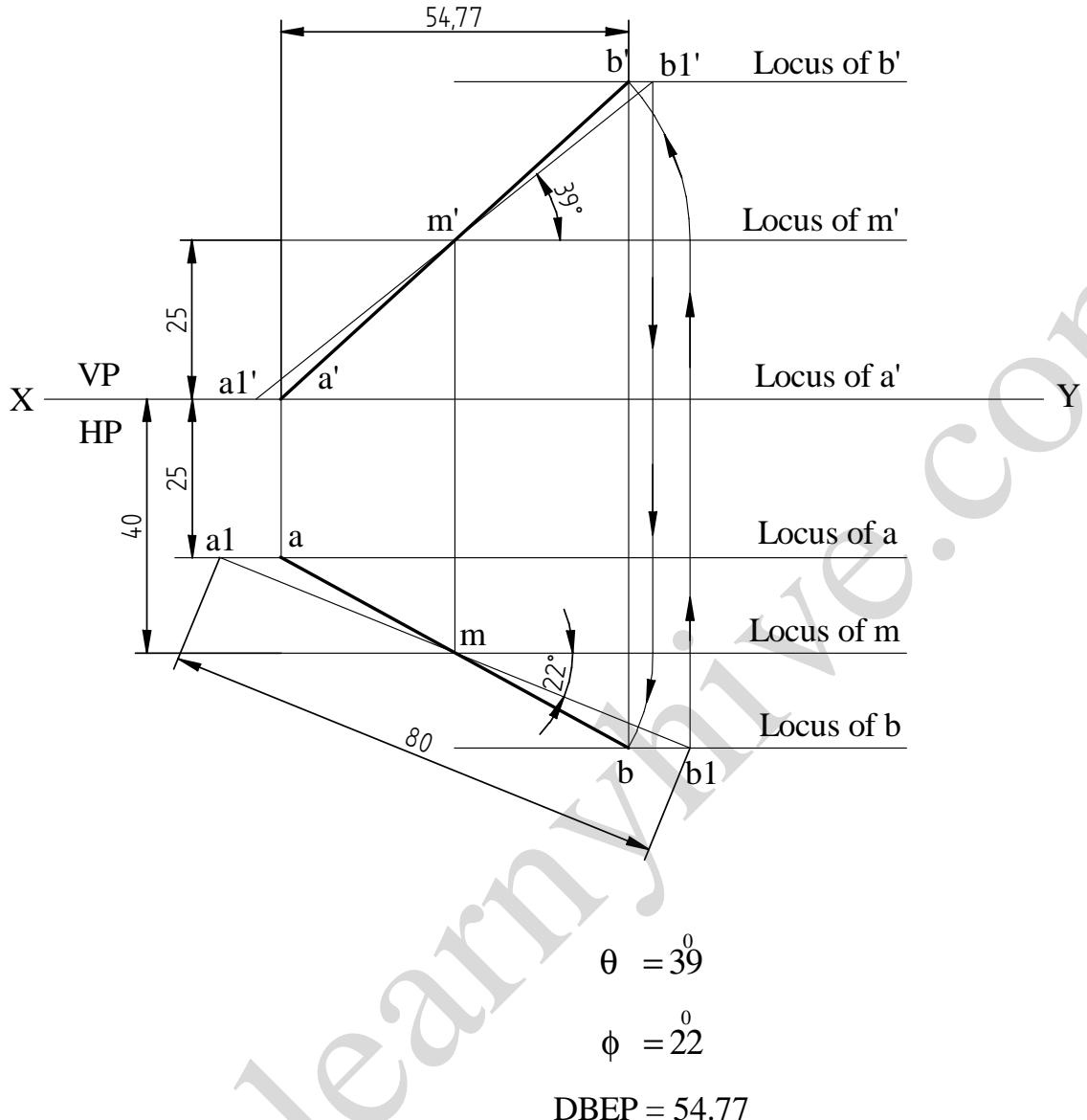
26. A line has one end 30mm infront of VP and 15mm above HP and the other end is 15mm infront of VP and is above HP. Length of the line is 60mm. Top view of the line is 40mm long. Draw the two views of the line and obtain the inclination of the line with HP and VP.



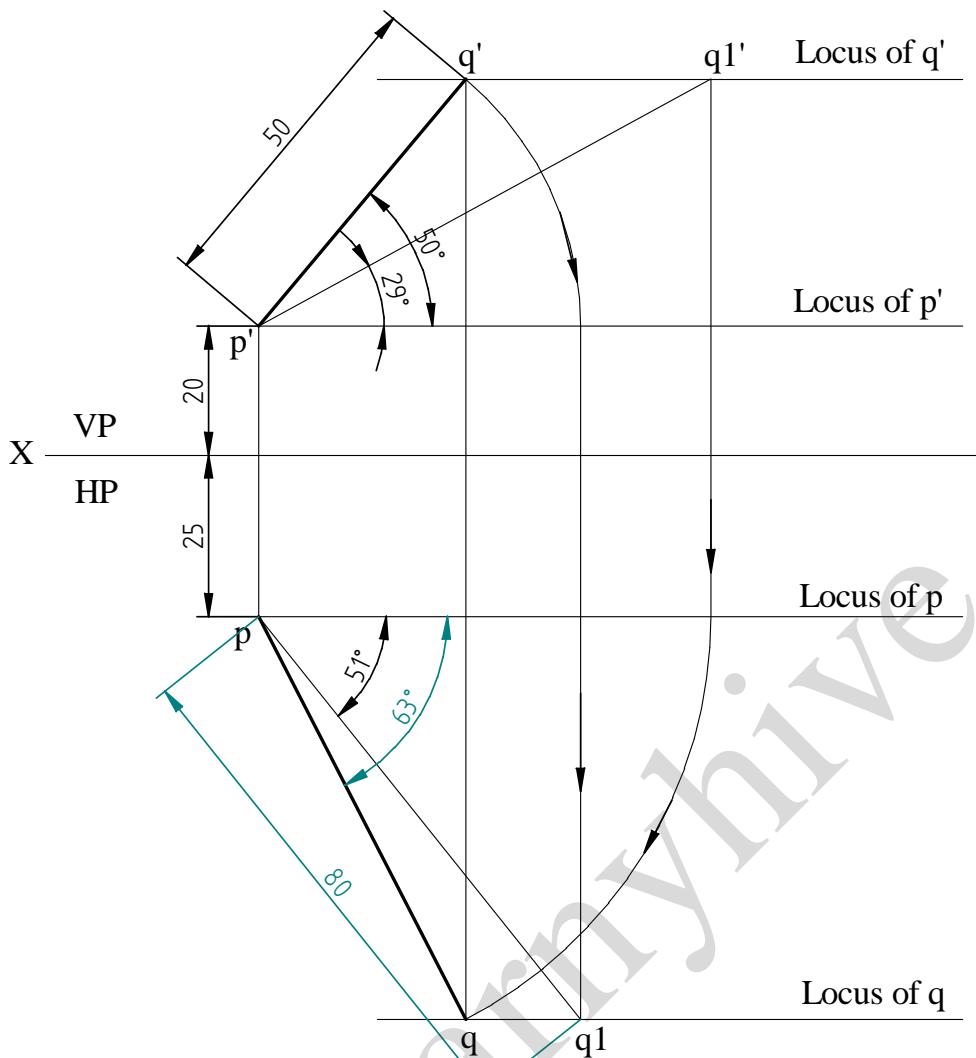
27. The top view of line PQ 75mm long measures 50mm. The end P is 30mm in front of VP and 15mm above HP. The end Q is 15mm in front of VP and above HP. Draw the projections of the line and finds its true inclinations with HP and VP. Find the length of front view and distance between the end projectors.



28. A straight line AB measuring 80mm long has the end A in the HP and 25mm infront of the VP. Its mid-point M is 25mm above the HP and 40mm infront of the VP. Draw the projections of the line and determine the inclination of the line with HP and VP and also find distance between end projectors.

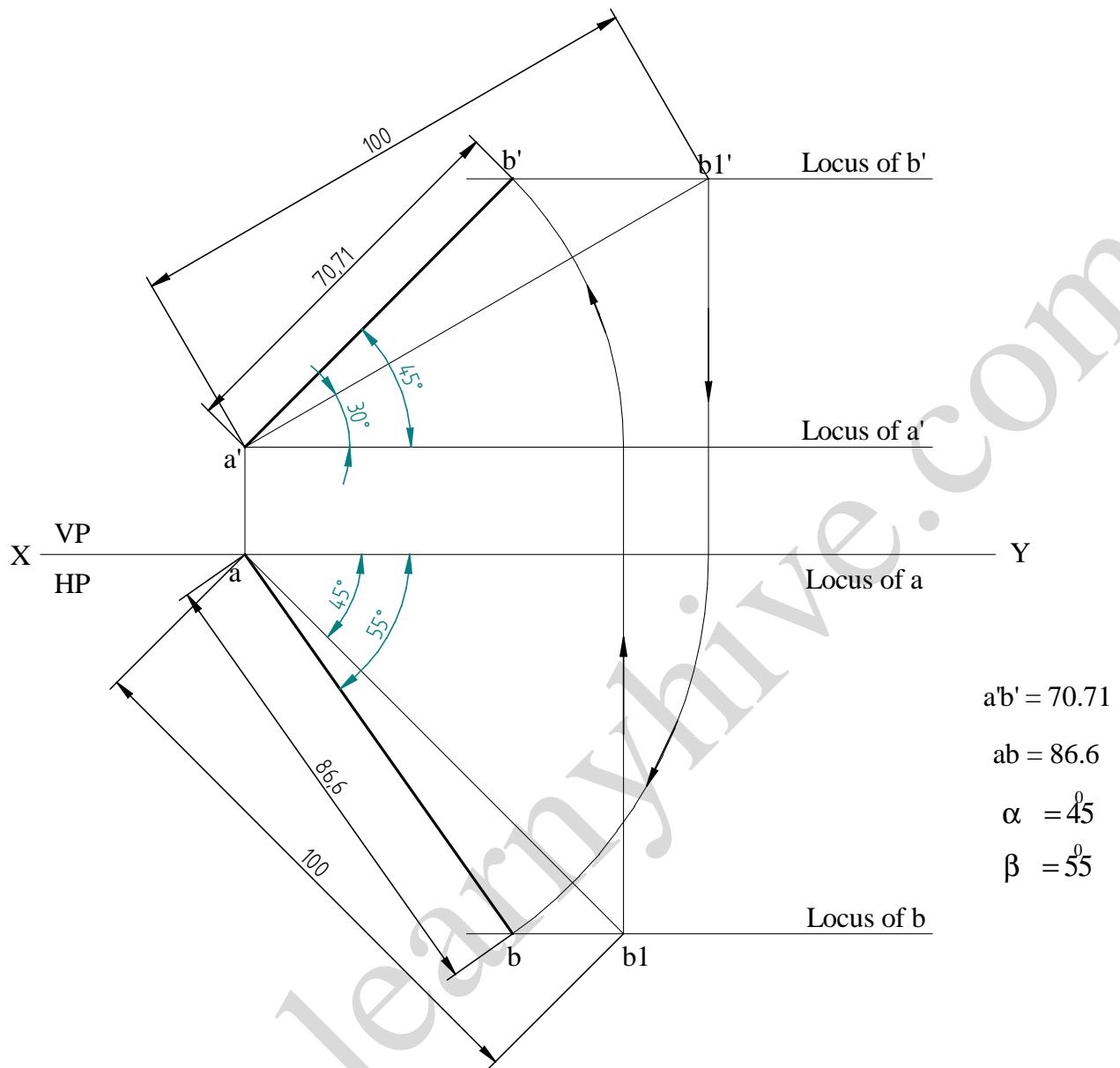


29. The front view of the line PQ 80mm long measures 50mm and is inclined to XY (reference line) at 50° . One end of the line P is 20mm above the HP and 25mm infront of the VP. Draw the front view and top view of the line and find the inclinations of the line with HP and VP.

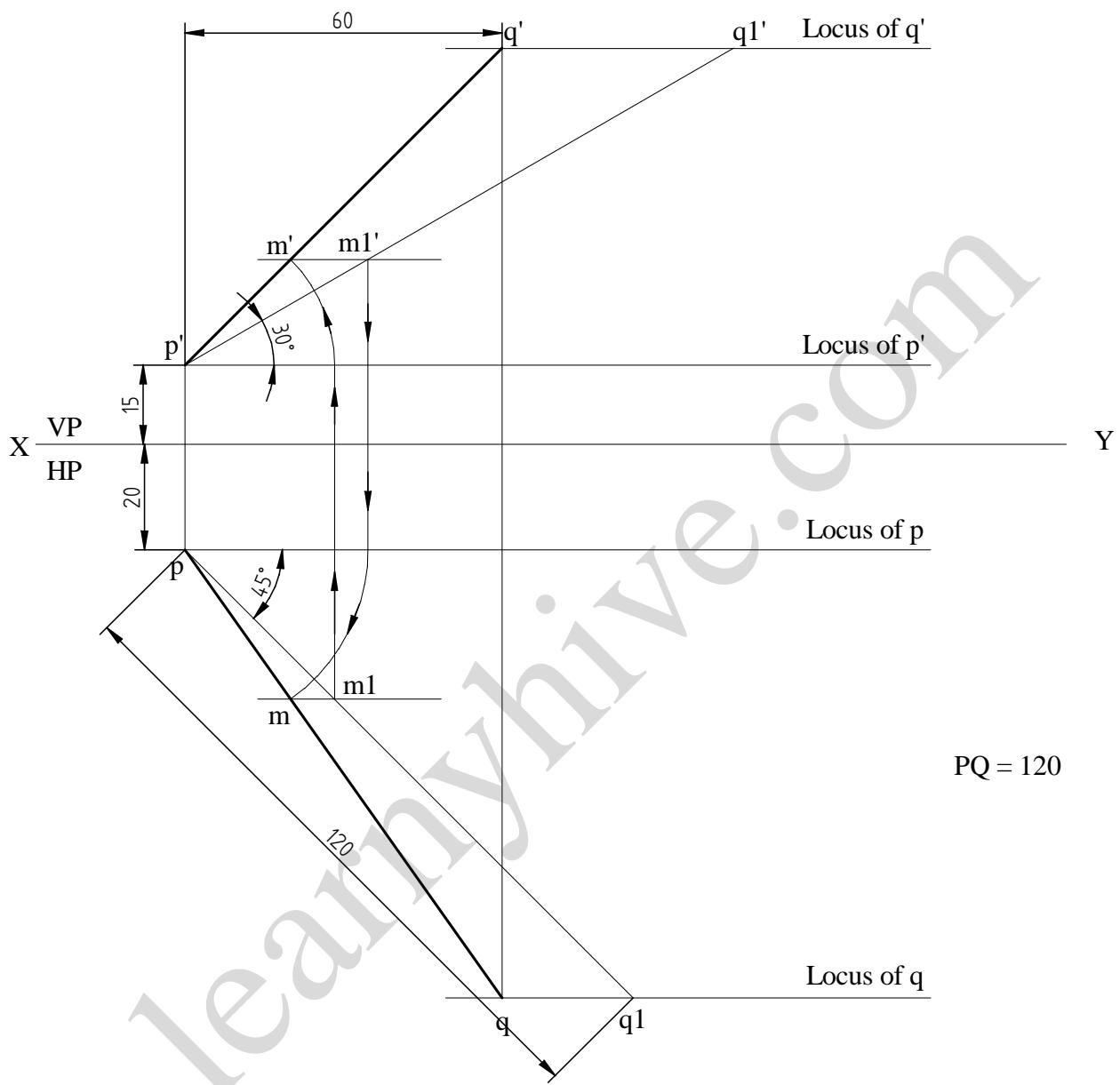


$$\begin{aligned}
 \theta &= 29^\circ \\
 \alpha &= 50^\circ \\
 \phi &= 51^\circ \\
 \beta &= 63^\circ
 \end{aligned}$$

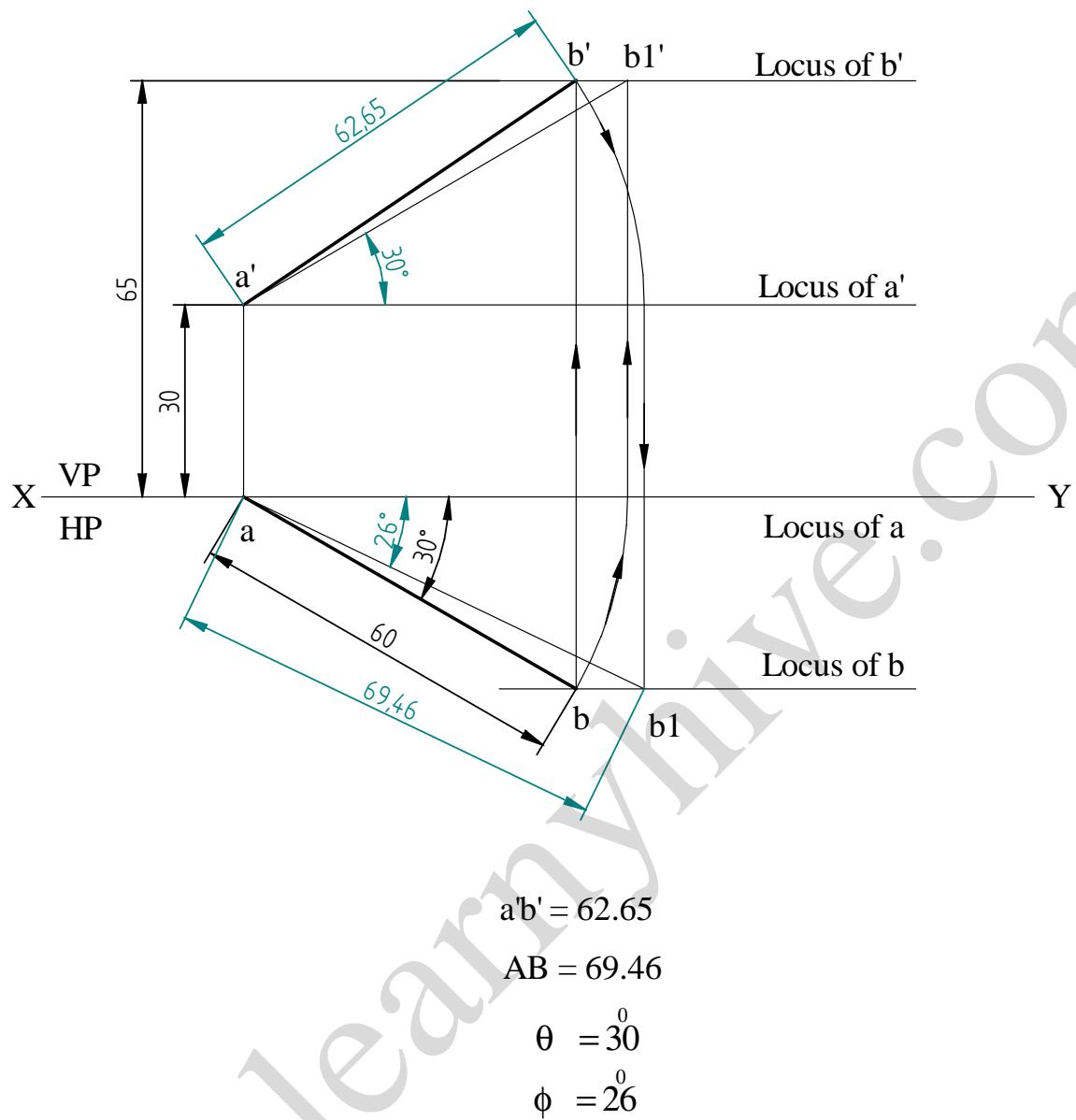
30. Draw the projections of a line AB 100mm long inclined at 45° to VP and 30° to HP. One end of the line is 20mm above the HP and in the VP. Also determine the apparent length and inclinations.



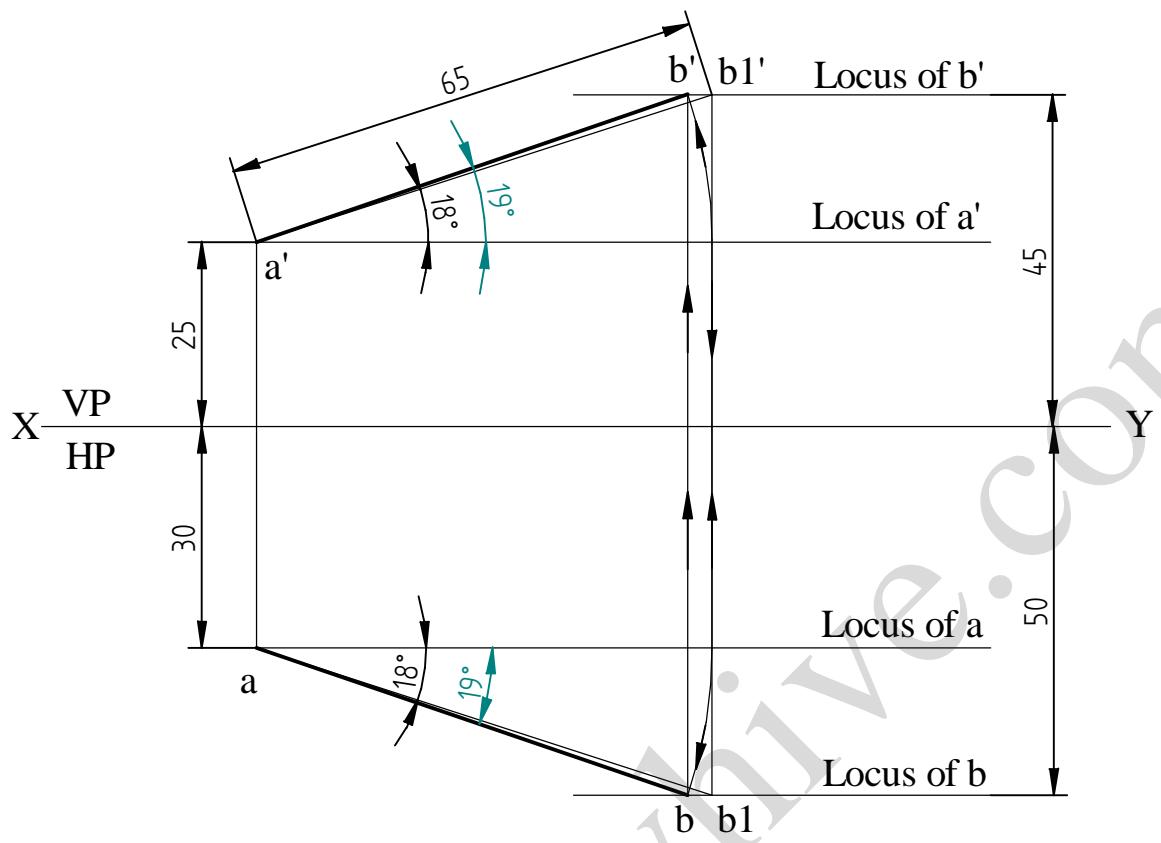
31. Draw the projections of a line PQ and find its true length and inclinations when the line is inclined at 30° to the HP and 45° to the VP. The line is having one of its ends 15mm above HP and 20mm in front of VP. The distance between the end projectors on the XY line is 60mm.



32. The top view ab of a straight line AB is 60mm long and makes an angle of 30° with the XY line. The end A is in VP and 30mm above HP. The end B is 65mm above HP. Draw the projections of the line AB and determine i) length of the front view ii) its true length and true inclinations with the reference planes.



33. A line AB 65mm long, has its end A 25mm above HP and 30mm in front of VP. The other end is 45mm above HP and 50mm in front of VP. Draw the projections and determine its inclinations.



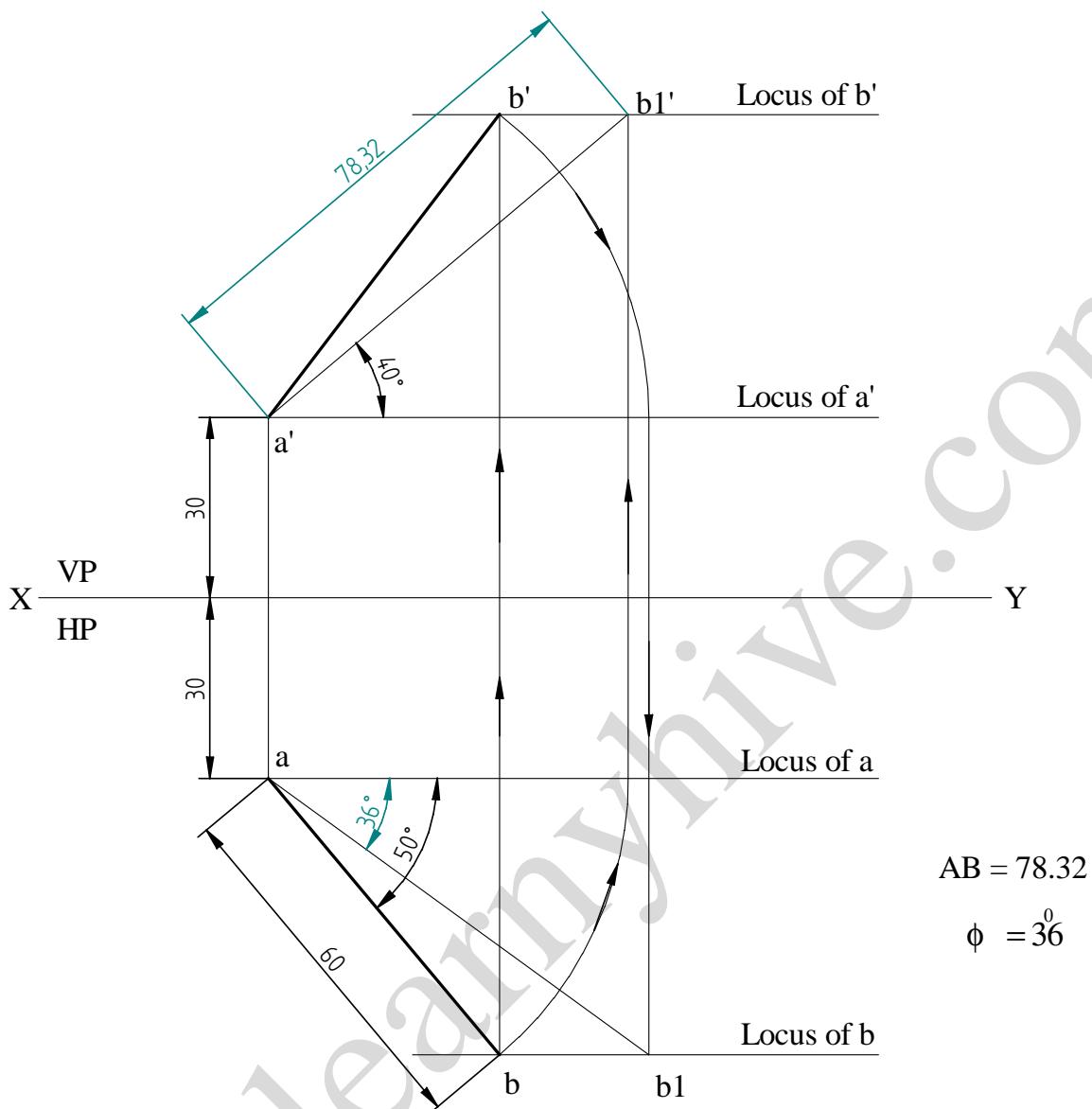
$$\theta = 18^\circ$$

$$\alpha = 19^\circ$$

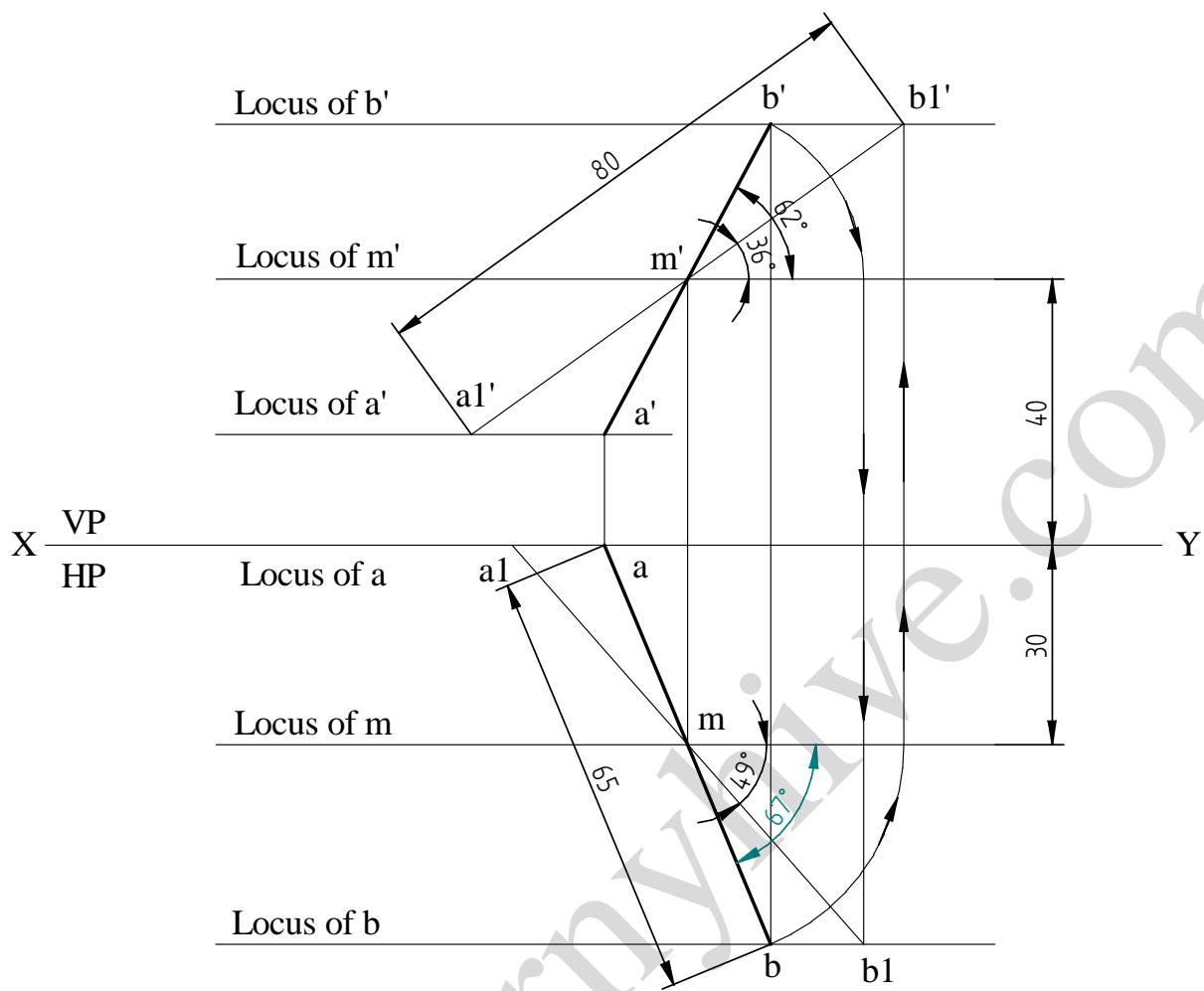
$$\phi = 18^\circ$$

$$\beta = 19^\circ$$

34. One end of a line is 30mm in front of VP and 30mm above HP. The line is inclined at 40° to HP and its top view measuring 60mm, is inclined at 50° to XY. Draw the projections of the line and determine true length and inclination with HP.



35. The top view of the line AB 80mm long, measures 65mm. The mid-point of the line is 30mm in front of VP and 40mm above HP. The point A is in the VP. Draw its projections and find its inclinations.



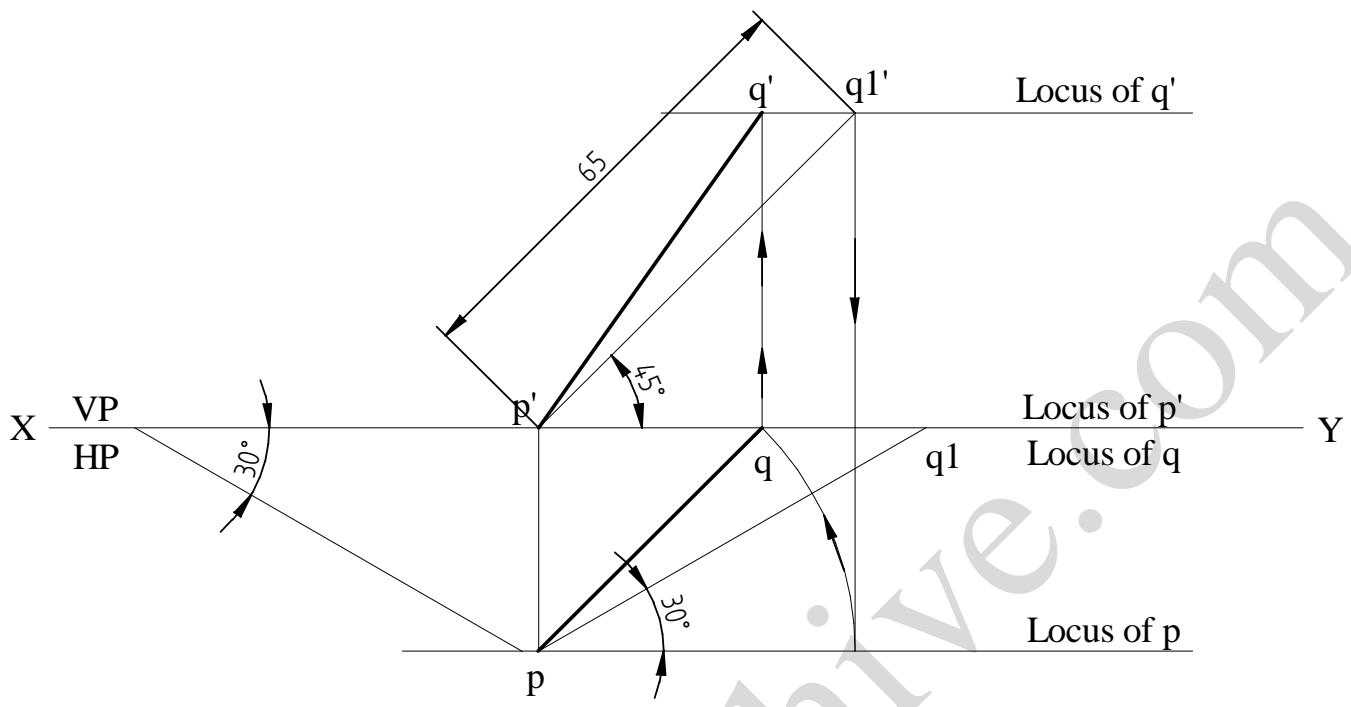
$$\theta = 36^\circ$$

$$\alpha = 62^\circ$$

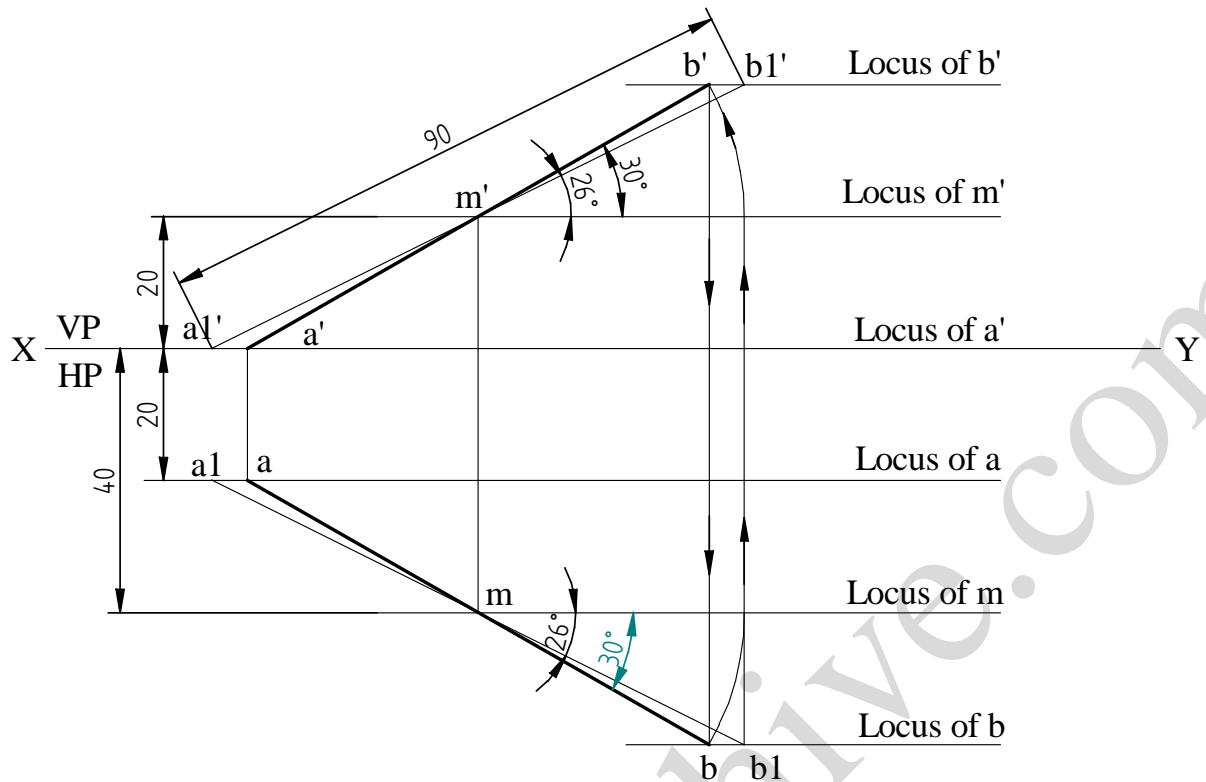
$$\phi = 49^\circ$$

$$\beta = 67^\circ$$

36. A straight line PQ is inclined at 45° to HP and 30° to VP. The point P is in HP and the point Q is in VP. The length of the straight line is 65mm. Draw the projections of the straight line AB.



37. Draw the projections of a line AB 90mm long and find its true and apparent inclinations with HP and VP when its end A is on HP and 20mm infront of VP. Its mid-point M is 20mm above the HP and 40mm infront of the VP.



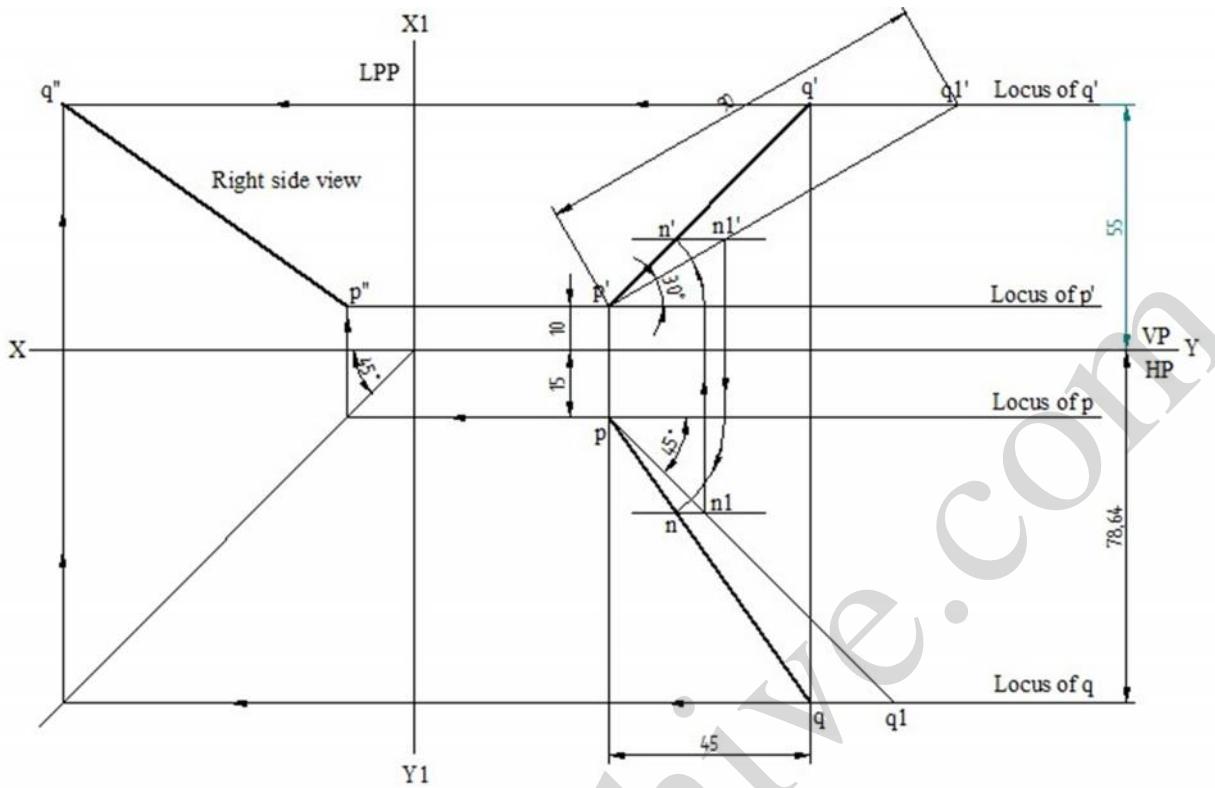
$$\theta = 26^\circ$$

$$\alpha = 30^\circ$$

$$\phi = 26^\circ$$

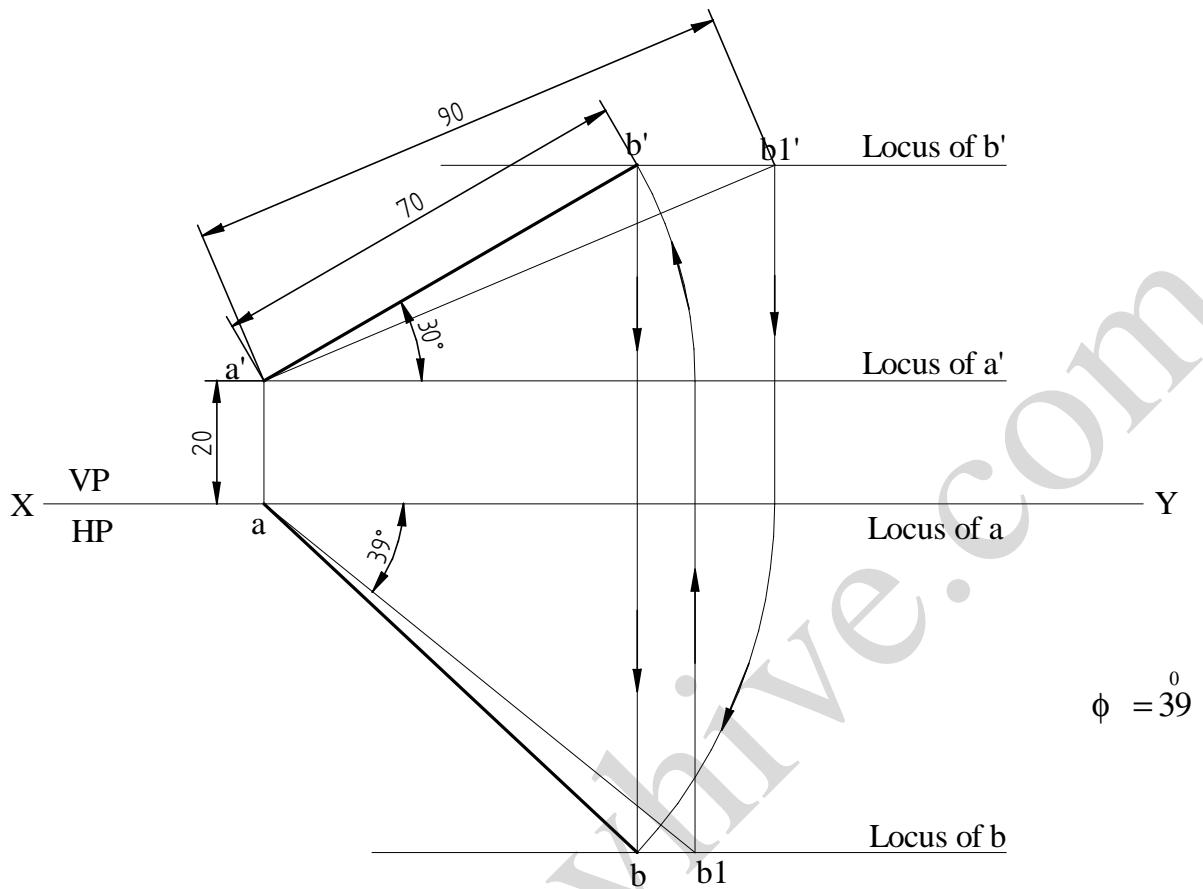
$$\beta = 30^\circ$$

38. A line PQ is inclined to both HP and VP by 30° and 45° respectively. One of its ends P is at a distance of 10mm from HP and 15mm from VP. The distance between the end projectors is 45mm. Draw the top, front and right side views of the line. Determine the true length of the line and the distances of the end Q from VP and HP.

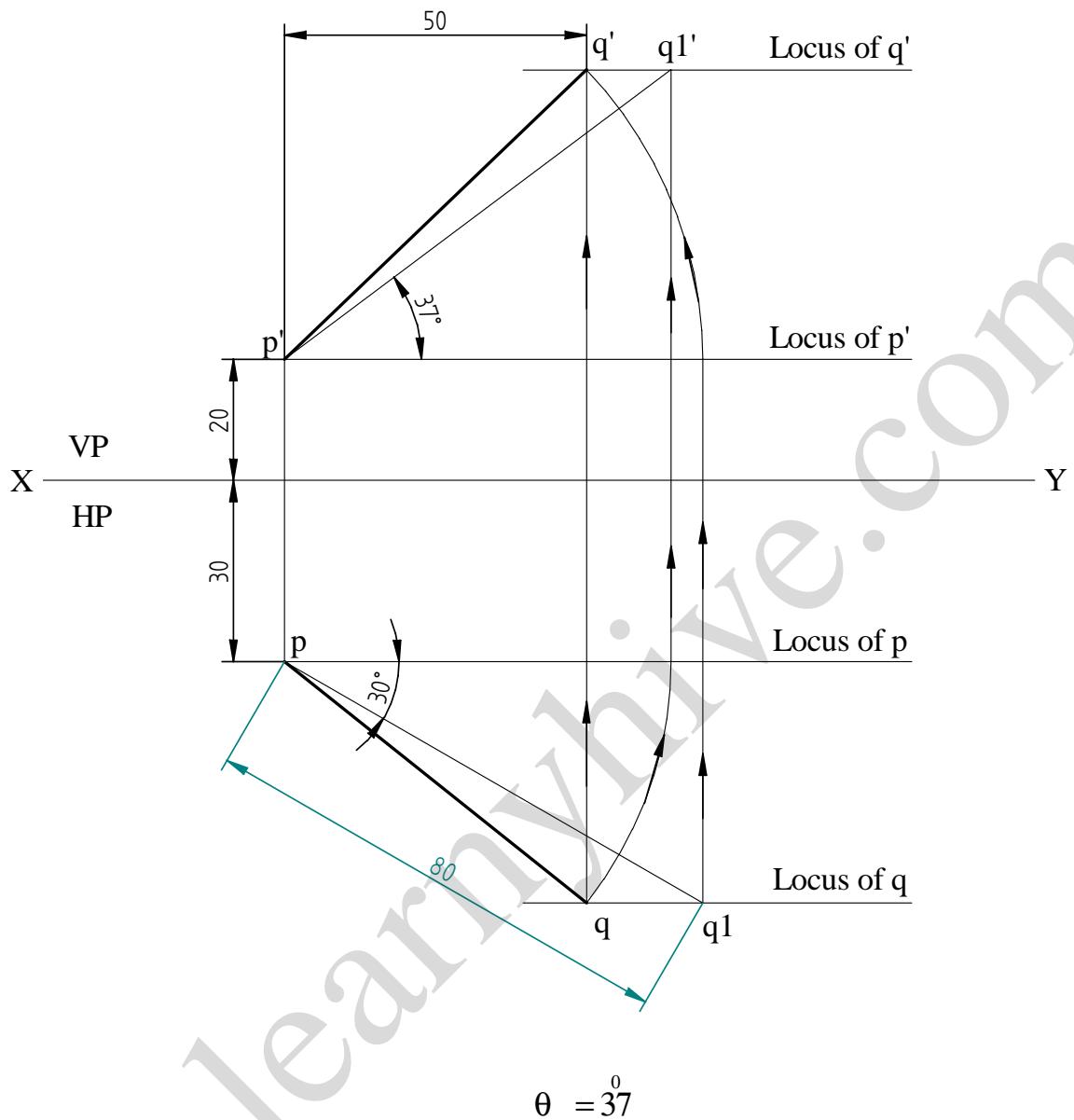


$PQ = 90$
 Distance of Q from HP is 55
 Distance of Q from VP is 78.64

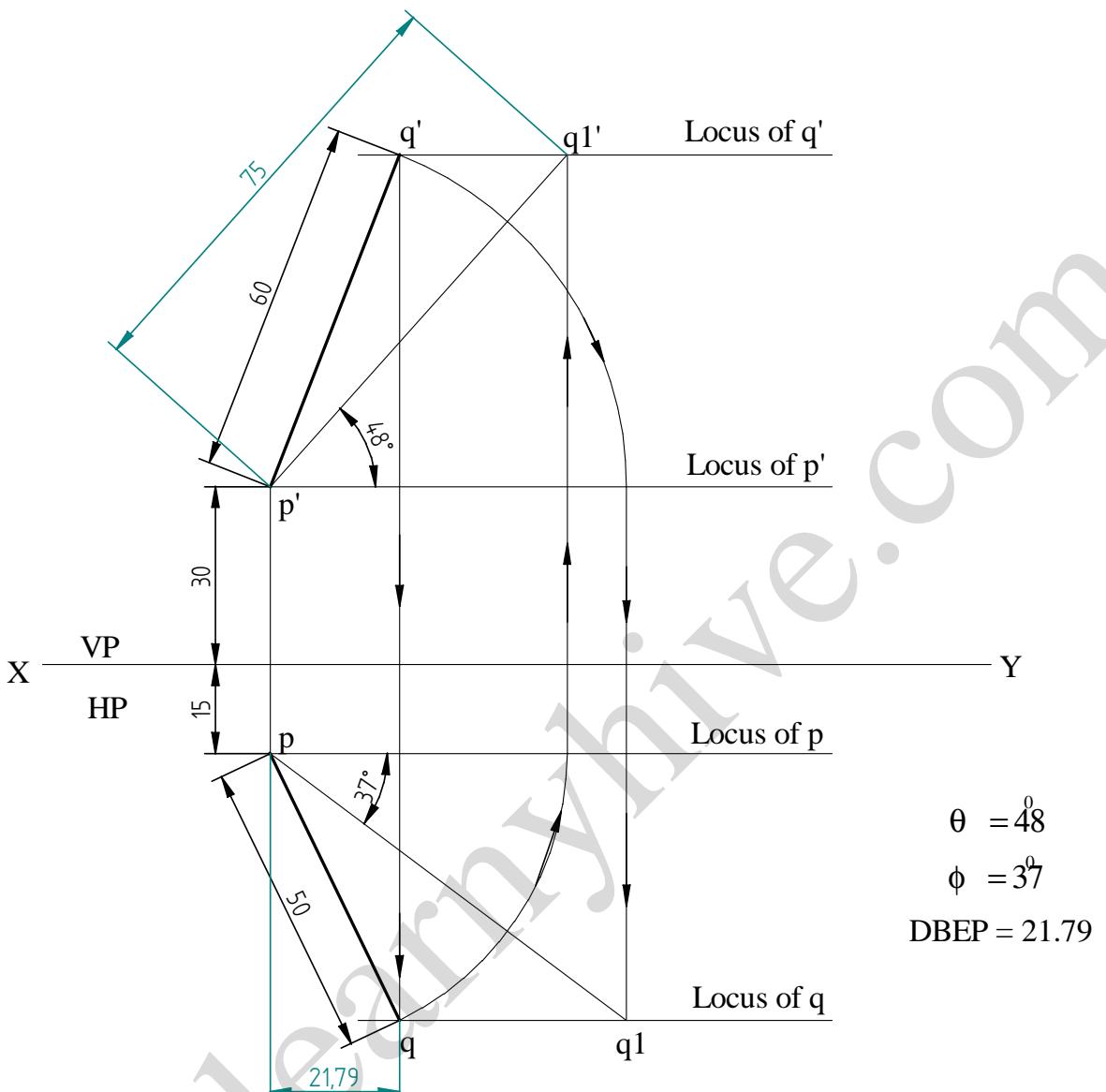
39. The elevation of the line AB 90mm long, is inclined at 30° to HP and measures 70mm. The end A is 20mm above HP and is in VP. Draw the projections of the line and find its inclination with VP.



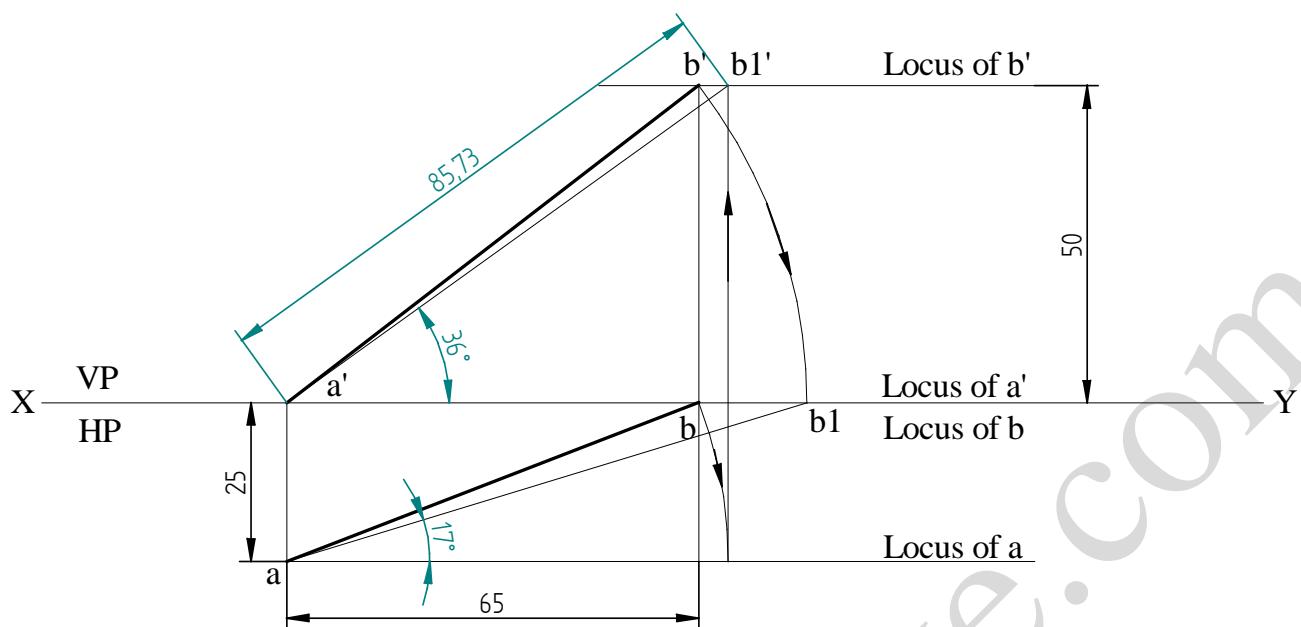
40. A line PQ measures 80mm in length. The point P is above HP and in front of VP by 20mm and 30mm respectively. The distance between the end projectors is 50mm. The line is inclined to VP by 30° . Draw the projections of the line and find its true inclination with HP.



41. The top view of a line PQ is 75mm long measures 50mm and the front view measures 60mm. The end P is 30mm above HP and 15mm in front of VP. Draw the projections of the line and find its true inclinations with HP and VP. Find length of front view and distance between the end projectors.



42. The end A of a line AB is in HP and 25mm in front of VP. The end B is in VP and 50mm above HP. The distance between the end projectors when measured parallel to the line of intersection of HP and VP is 65mm. Draw the projections of the line AB and determine its true length and true inclinations with HP and VP.

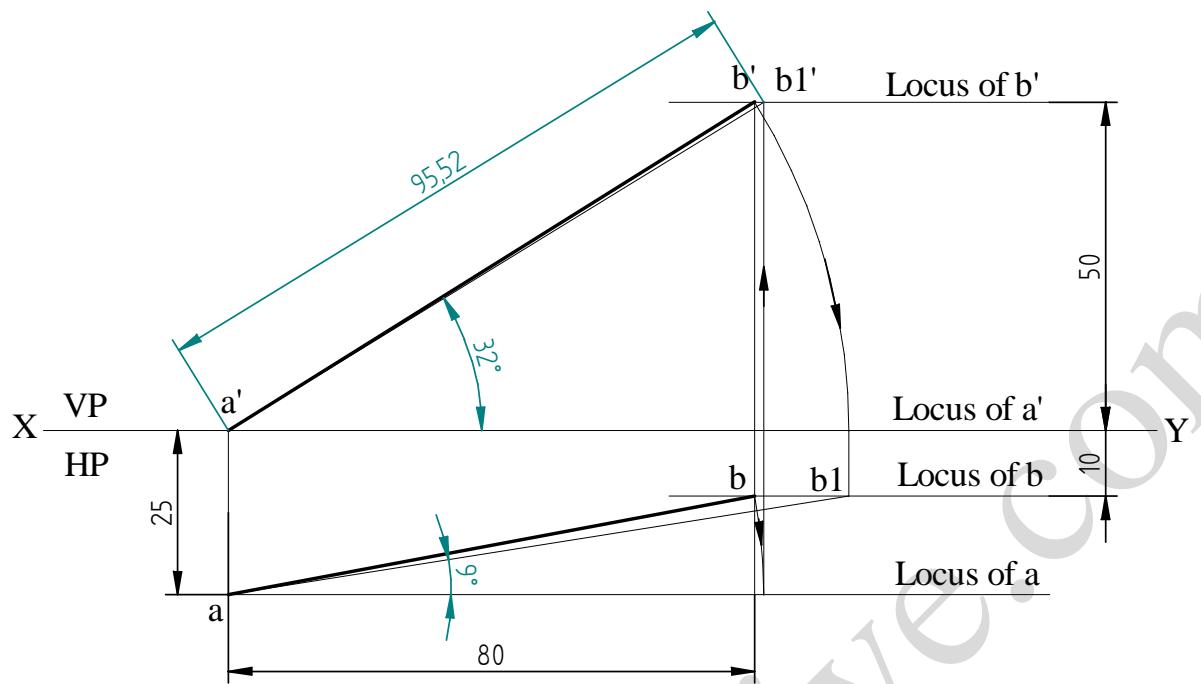


$$AB = 85.73$$

$$\theta = 36^\circ$$

$$\phi = 17^\circ$$

43. The end A of a line is in HP and 25mm in front of VP. The end B is 10mm in front of VP and 50mm above HP. The distance between the end projectors when measured parallel to the line of intersection of HP and VP is 80mm. Draw the projections of the line AB and determine its true length and true inclinations with HP and VP.

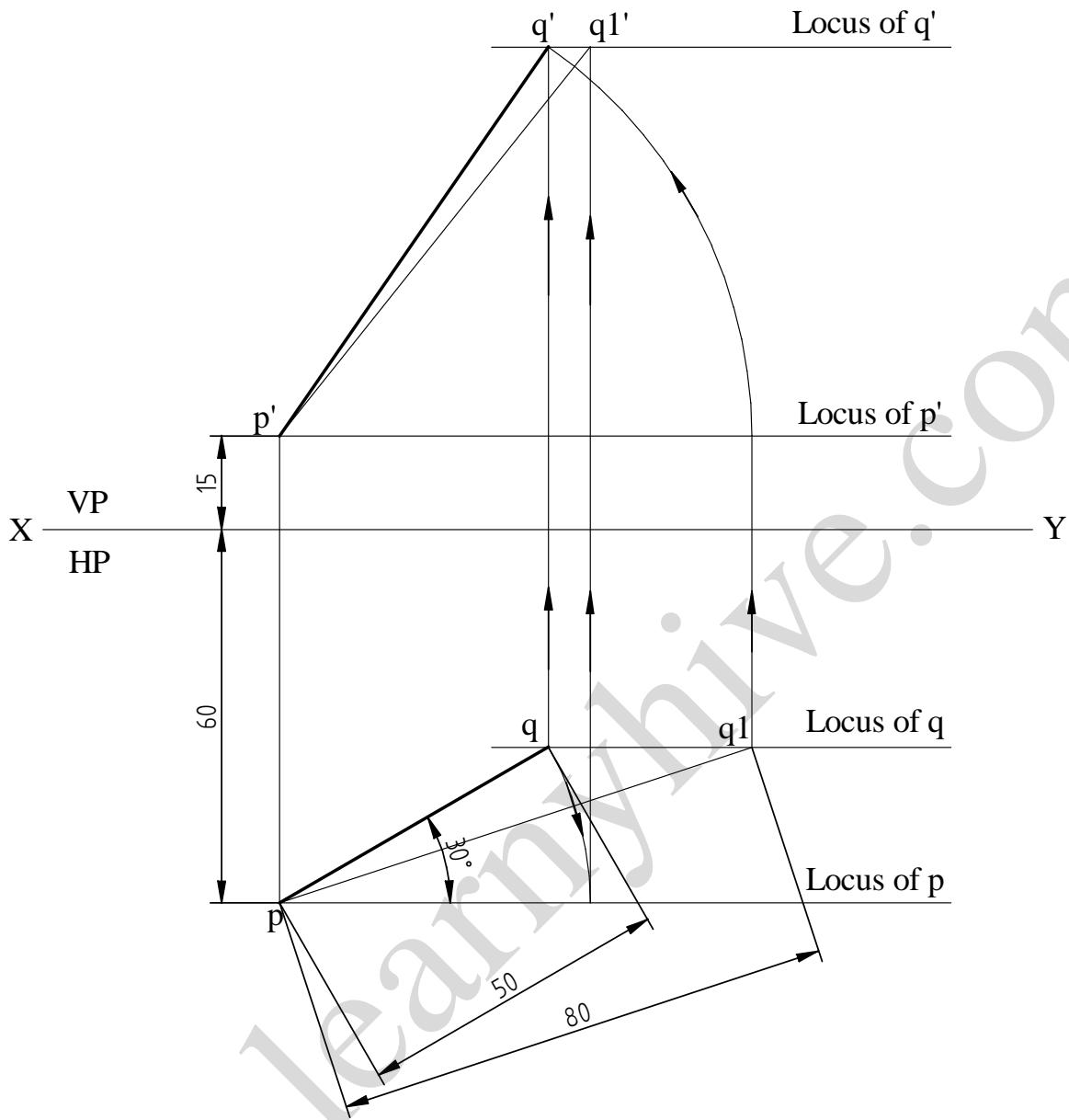


$$AB = 95.52$$

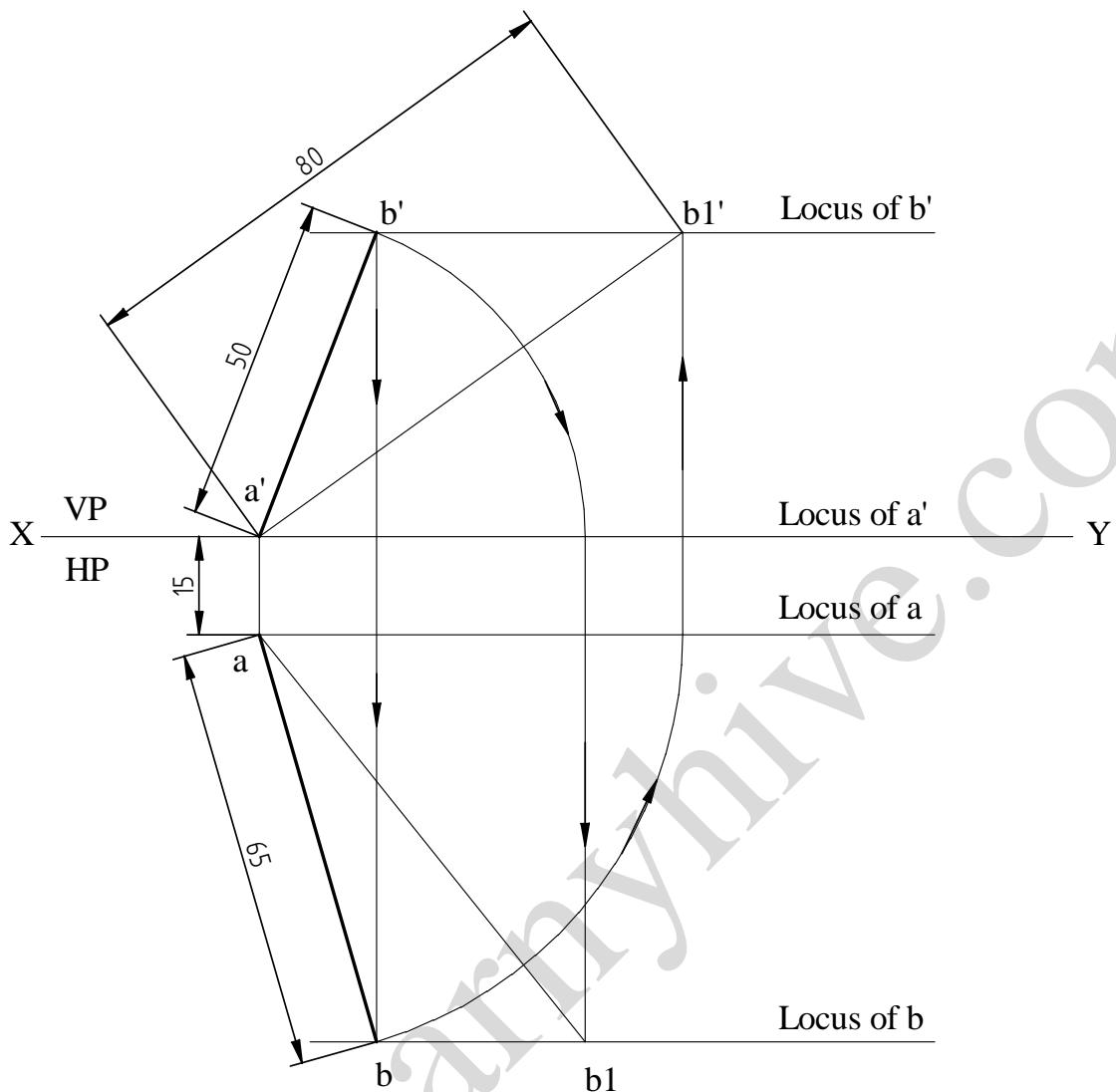
$$\theta = 32^\circ$$

$$\phi = 9^\circ$$

44. A straight line PQ 80mm long appears to a length of 50mm and inclined at 30° to XY line in its top view. Draw its projections when its end point P is 15mm above HP and 60mm in front of VP. Point Q is nearer to VP than P.

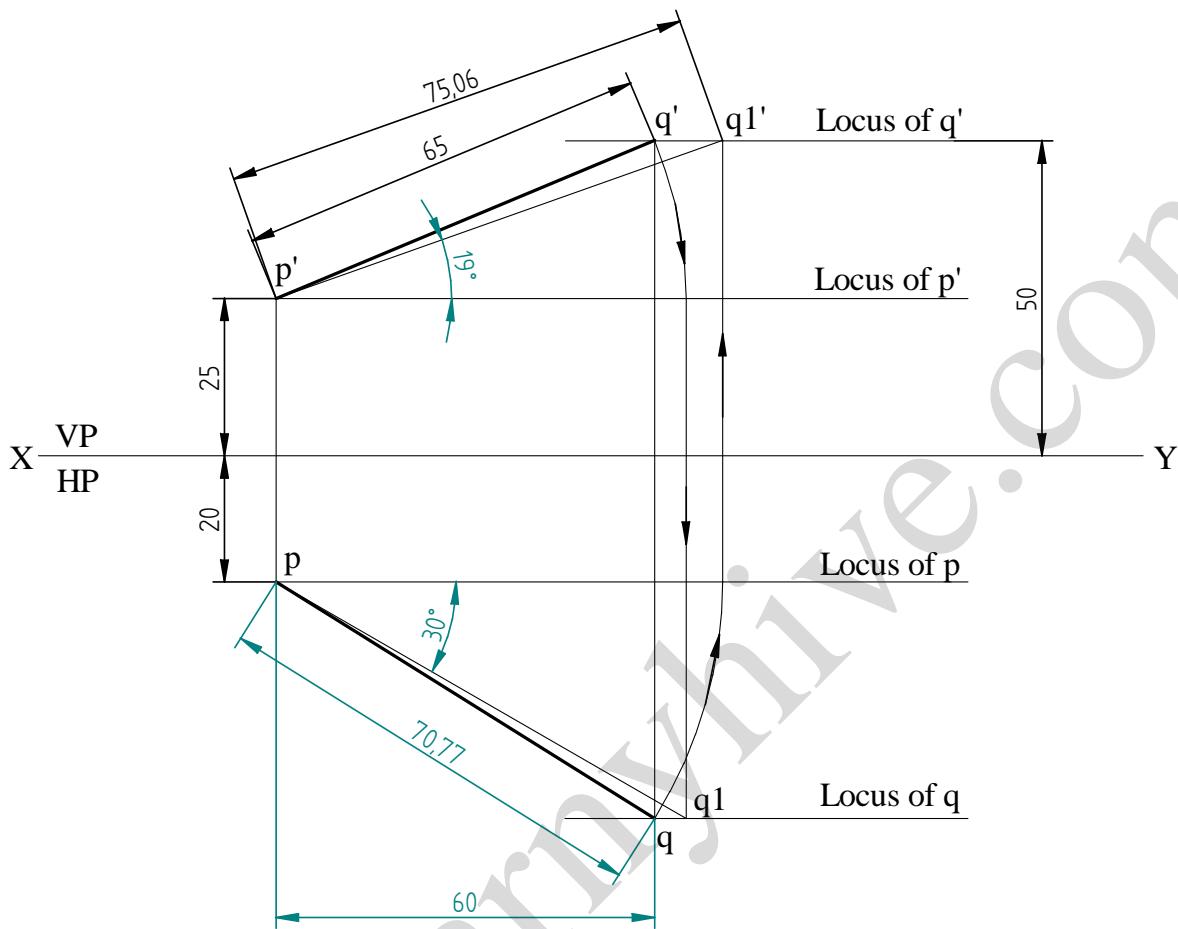


45. The top view of a line AB, 80mm long measures 65mm and the length of the front view is 50mm. The end A is on HP and 15mm infront of VP. Draw the projections.



46. Draw the projections of a line PQ and find its apparent lengths, true length and true inclination with HP when the line PQ has its end P 25mm above HP and 20mm in front of VP. The distance between the end projectors of the line when measured parallel to the line of

intersection of the HP and VP is 60mm. The end Q is 50mm above the HP and the line is inclined at 30° to the VP.



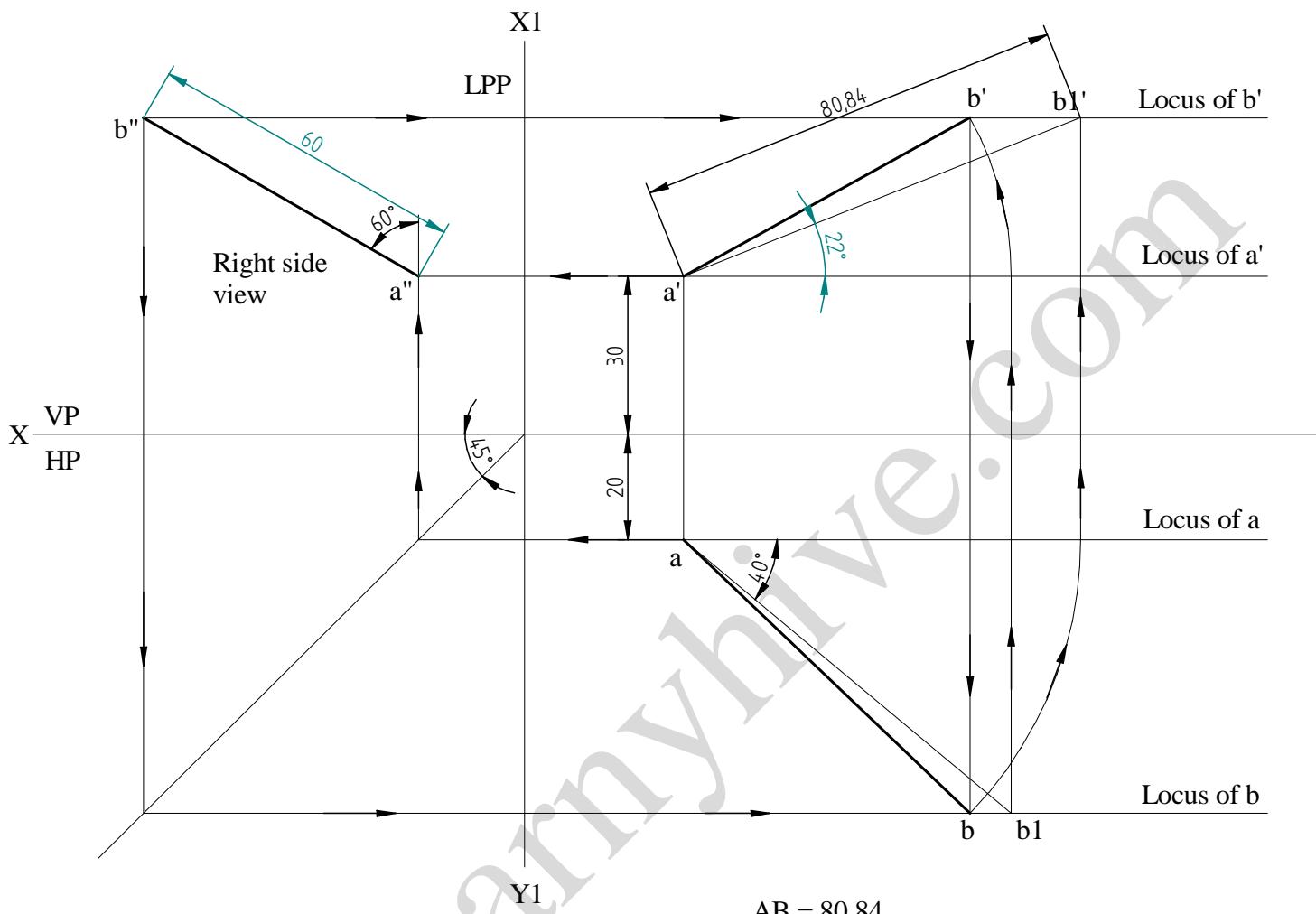
$$PQ = 75.06$$

$$p'q' = 65$$

$$pq = 70.77$$

$$\theta = 19^\circ$$

47. Find the true length and true inclination of a line AB with HP having one of its end 20mm infront of VP and 30mm above the HP. The line is inclined at 40° to VP and the right side view of the line is 60mm long and inclined at 60° to the X₁Y₁ line. Draw all the three views of the line.



$$AB = 80.84$$

$$\theta = 22^\circ$$

Projections of Planes

Plane surface (plane/lamina/plate)

A plane is a two dimensional surface having length and breadth with negligible thickness. They are formed when any three non-collinear points are joined. Planes are bounded by straight/curved lines and may be either regular or an irregular. Regular plane surface are those in which all the sides are equal. Irregular plane surface are those in which the lengths of the sides are unequal.

Positioning of a Plane surface

A plane surface may be positioned in space with reference to the three principal planes of projection in any of the following positions:

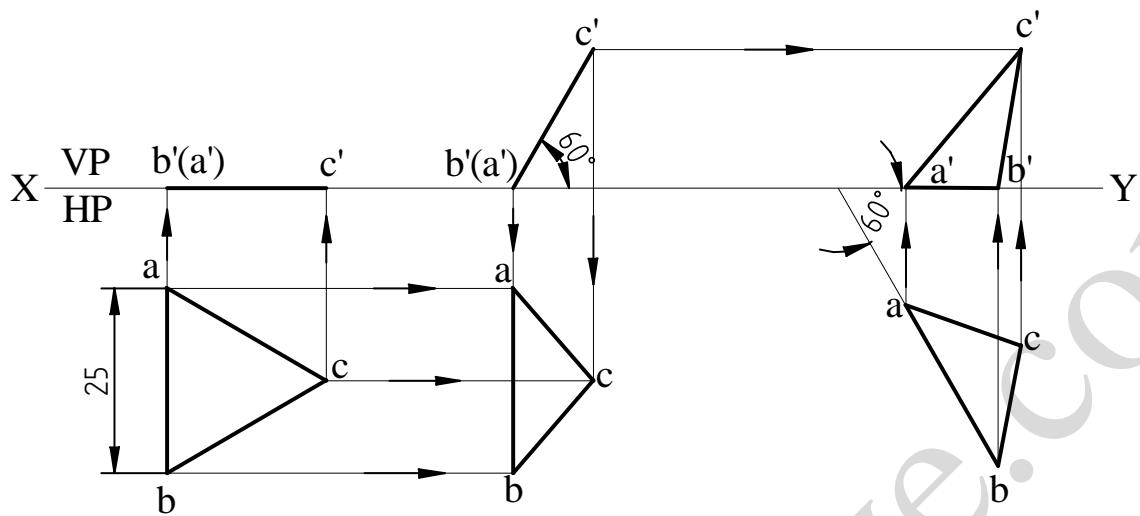
- Parallel to one of the principal planes and perpendicular to the other two.
- Perpendicular to one of the principal planes and inclined to the other two.
- Inclined to all the three principal planes.

Projections of a Plane surface

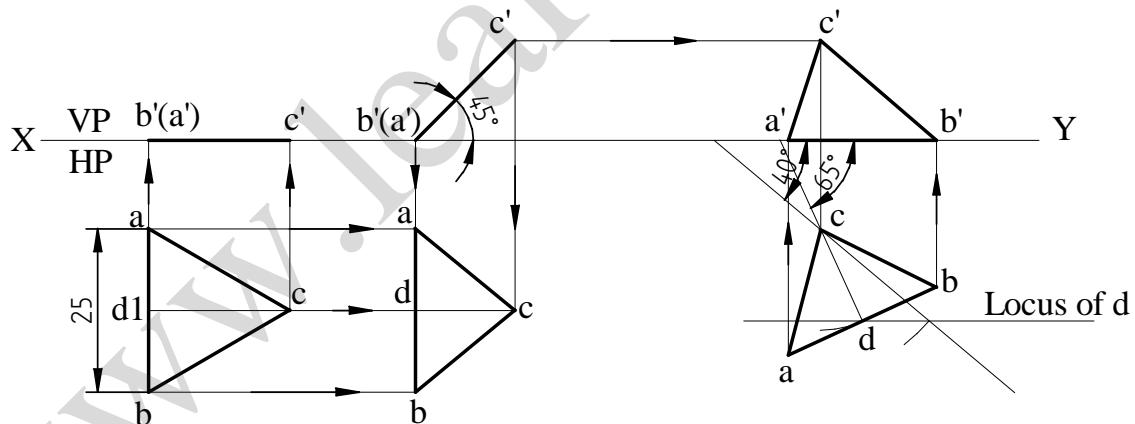
A plane surface when held parallel to a plane of projection, it will be perpendicular to the other two planes of projection. The view of the plane surface projected on the plane of projection to which it will be perpendicular will be a line, called the line view of a plane surface. When the plane surface is held with its surface parallel to one of the planes of projection, the view of the plane surface projected on it will be in true shape because all the sides or the edges of the plane surface will be parallel to the plane of projection on which the plane surface is projected. When a plane surface is inclined to any plane of projection, the view of the plane surface projected on it will be its apparent shape.

Projections of Planes

1. An equilateral triangular lamina of 25mm side lies with one of its edges on HP such that the surface of the lamina is inclined to HP at 60° . The edge on which it rests is inclined to VP at 60° . Draw the projections.

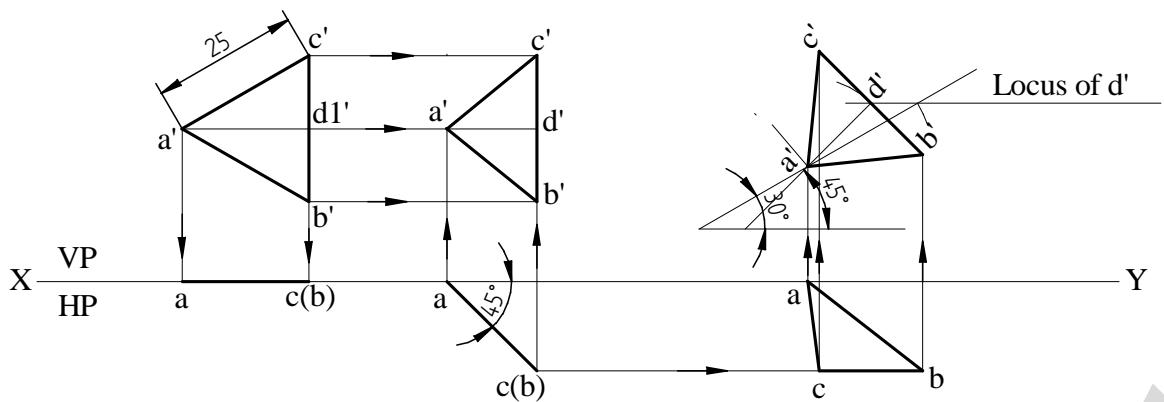


2. An equilateral triangular lamina of 25mm side lies on one of its sides on HP. The lamina makes 45° with HP and one of its medians is inclined at 40° to VP. Draw the projections.



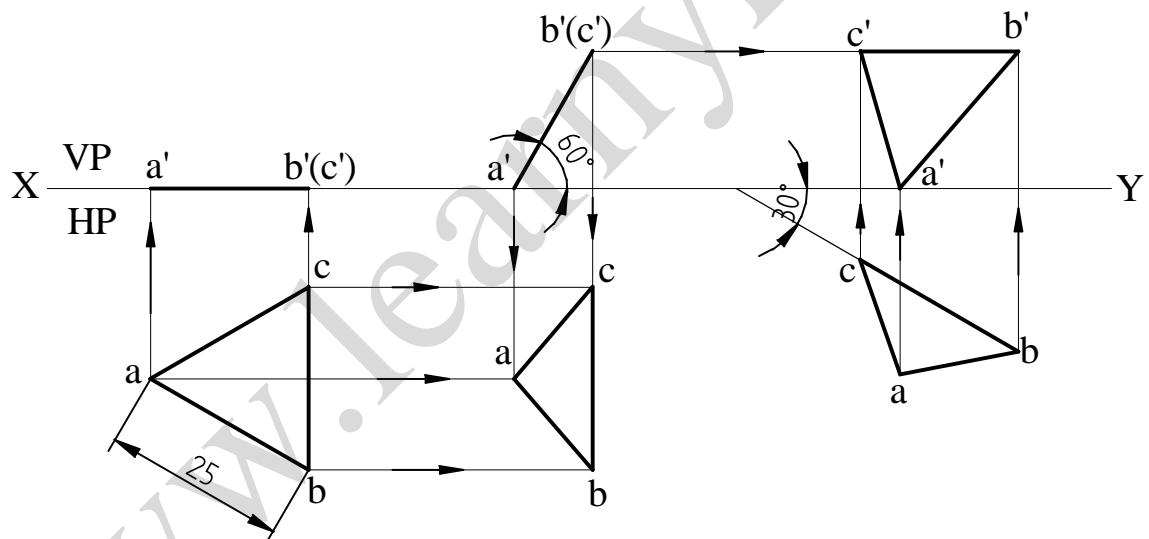
$$\beta = 40^\circ$$

3. A triangular lamina of 25mm sides rests on one of its corners on VP such that the median passing through the corner on which it rests is inclined at 30° to HP and 45° to VP. Draw the projections.

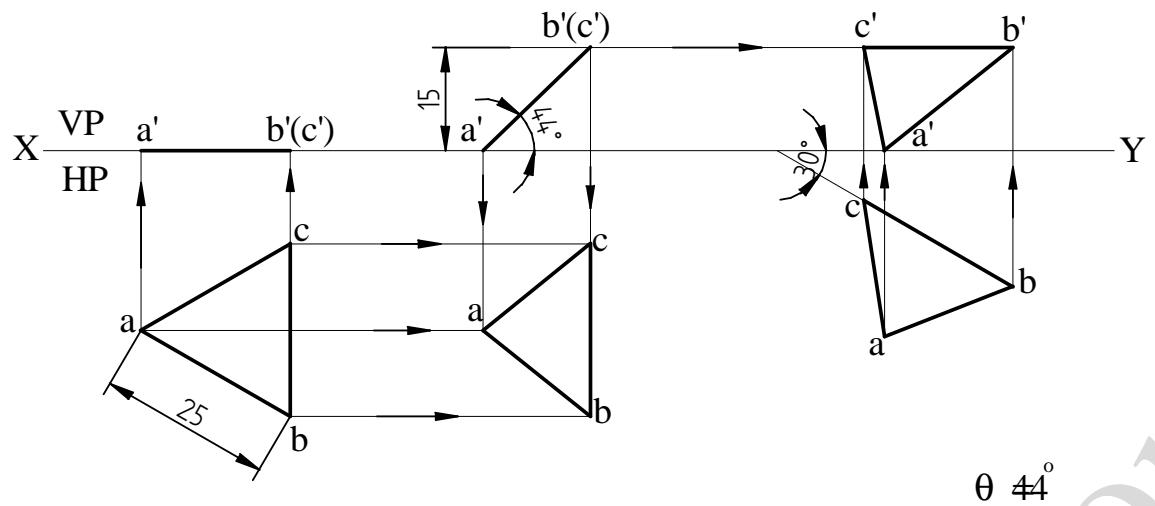


$$\alpha = 45^\circ$$

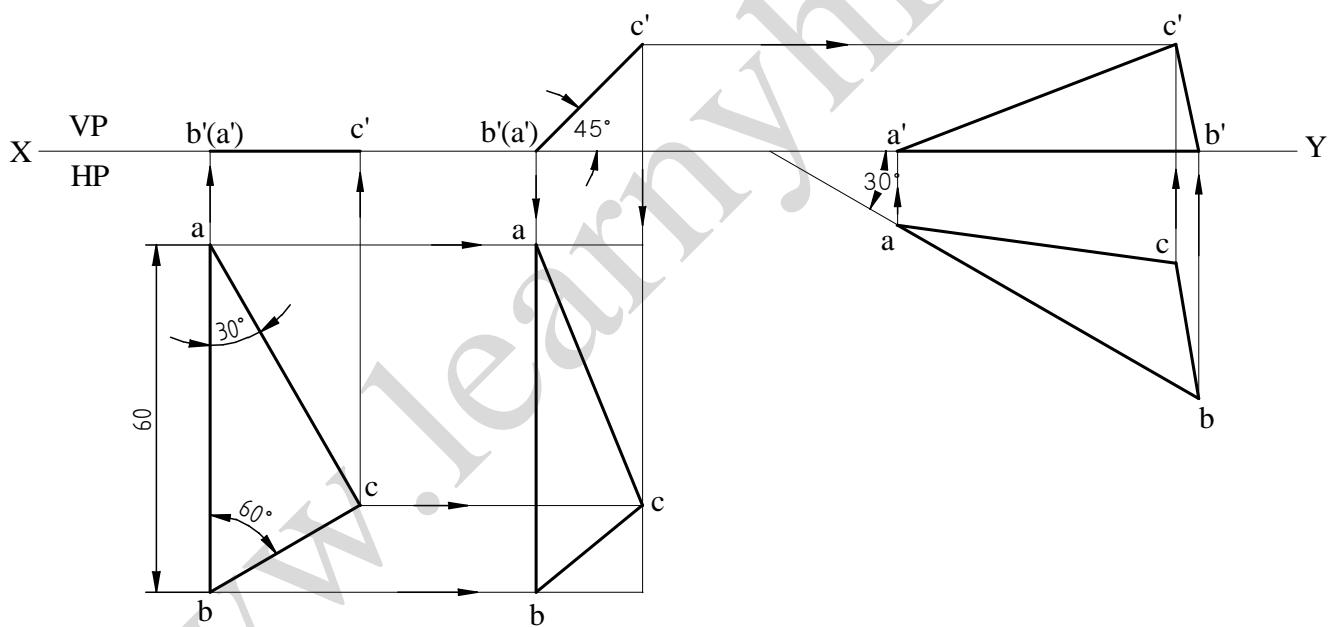
4. A triangular plane figure of sides 25 mm is resting on HP with one of its corner such that the surface of the lamina makes an angle of 60° with HP. If the side opposite to the corner on which the lamina rests makes an angle of 30° with VP. Draw the top and front views in this position.



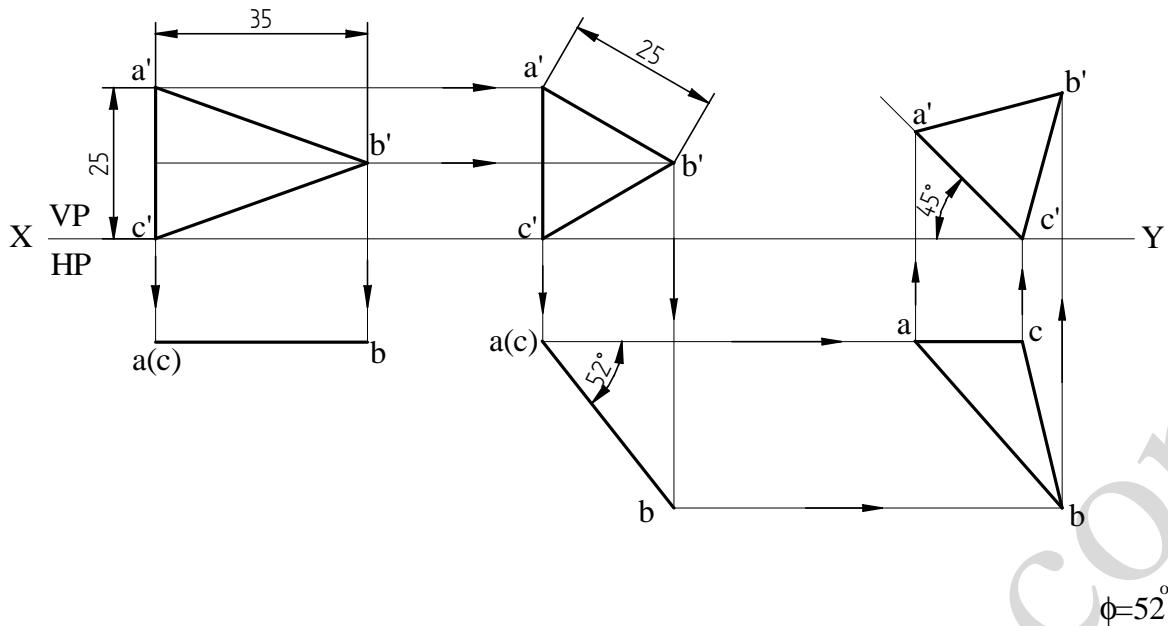
5. A triangular plane lamina of sides 25mm is resting on HP with one of its corners touching it, such that the side opposite to the corner on which it rests is 15mm above HP and makes an angle of 30° with VP. Draw the top and front views in this position. Also determine the inclination of the lamina to the reference plane.



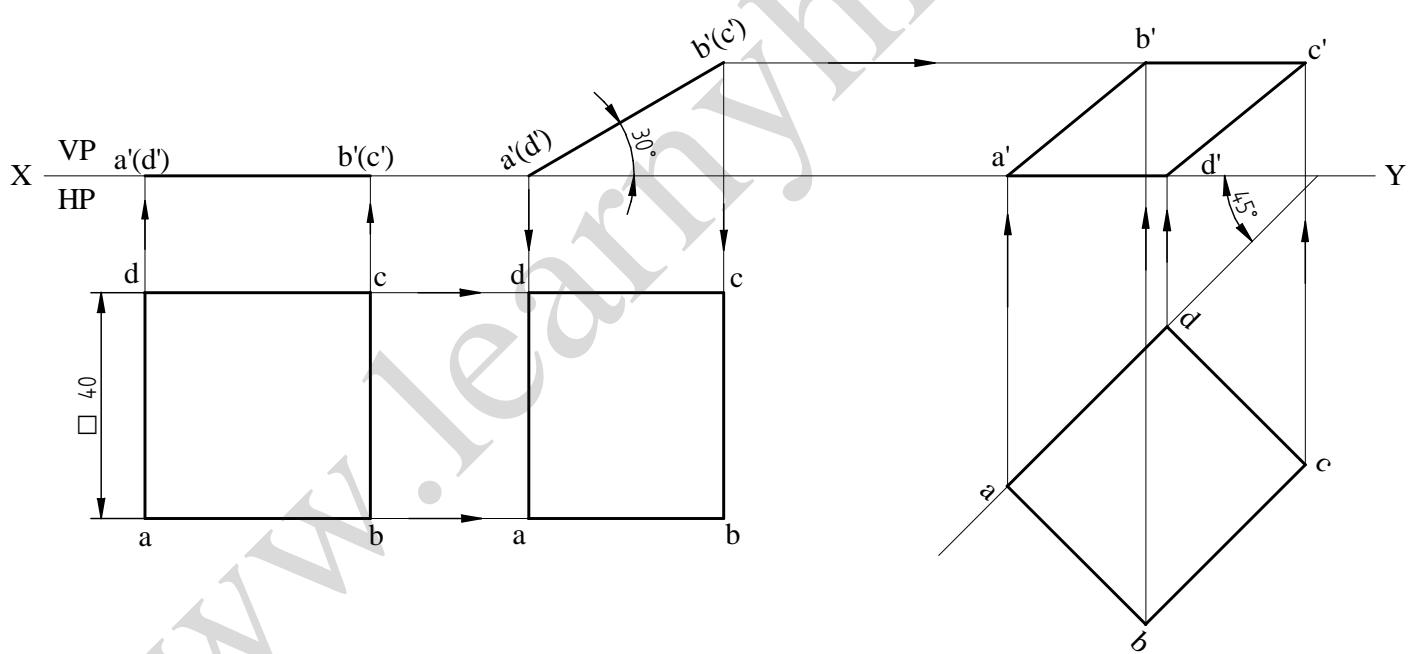
6. A 30° - 60° setsquare of 60mm longest side is so kept such that the longest side is in HP, making an angle of 30° with VP. The setsquare itself is inclined at 45° to HP. Draw the projections of the setsquare.



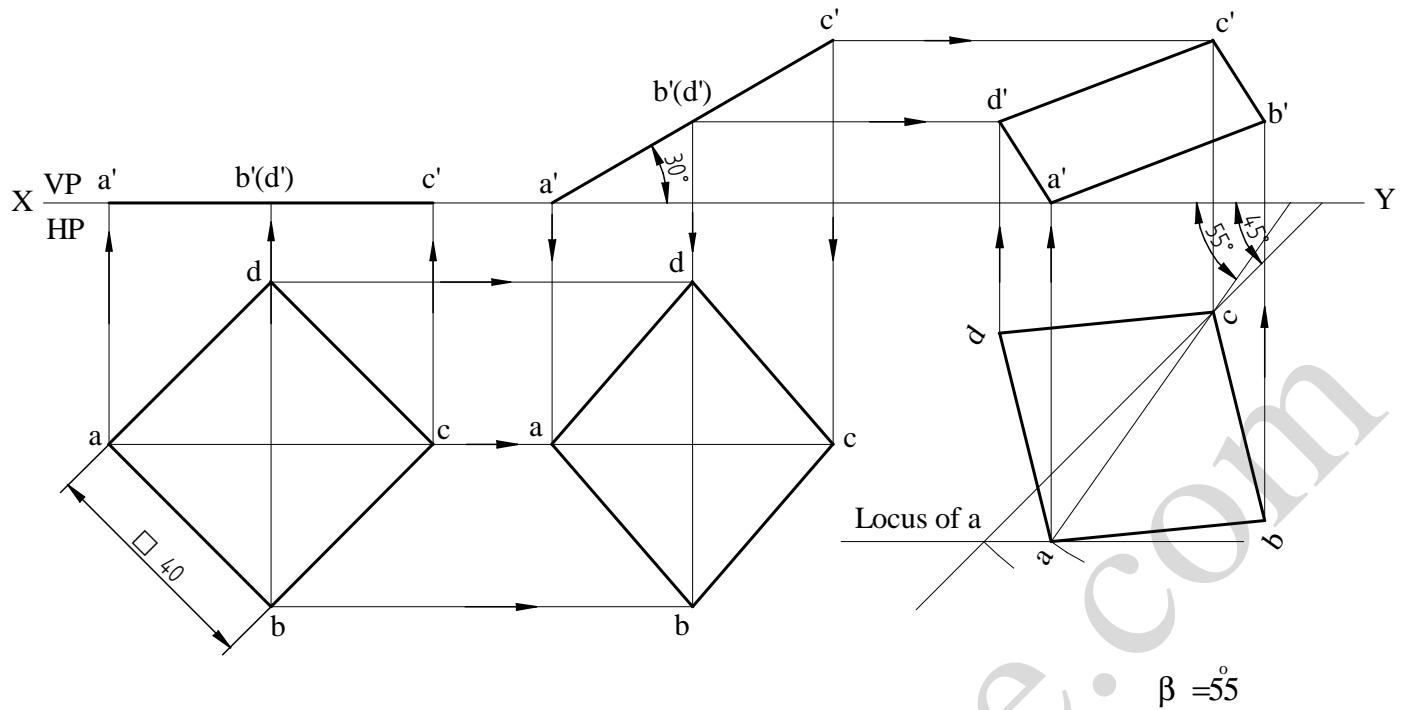
7. An isosceles triangular plate of negligible thickness has base 25mm long and altitude 35mm. It is so placed on HP such that in the front view it is seen as an equilateral triangle of 25mm sides with the side that is parallel to VP is inclined at 45° to HP. Draw its top and front views. Also determine the inclination of the plate with the reference plane.



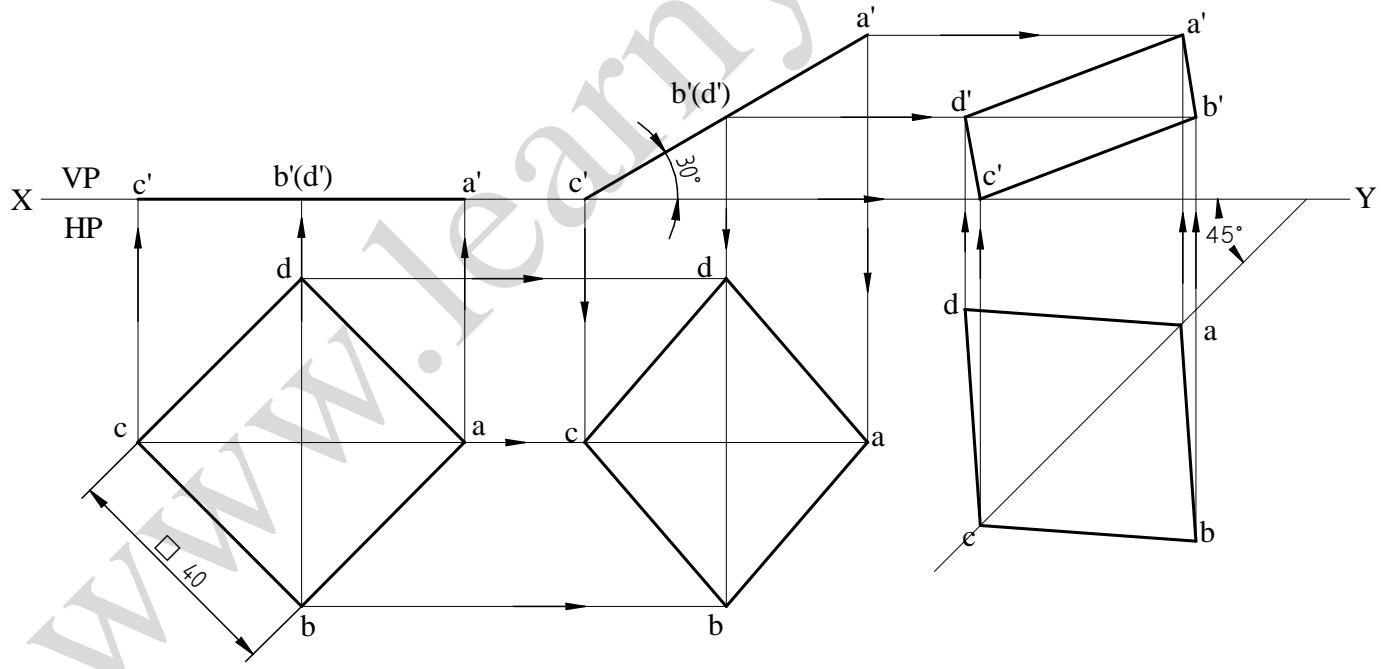
8. A square lamina of 40mm side rests on one of its sides on HP. The lamina makes 30° to HP and the side on which it rests makes 45° to VP. Draw its projections.



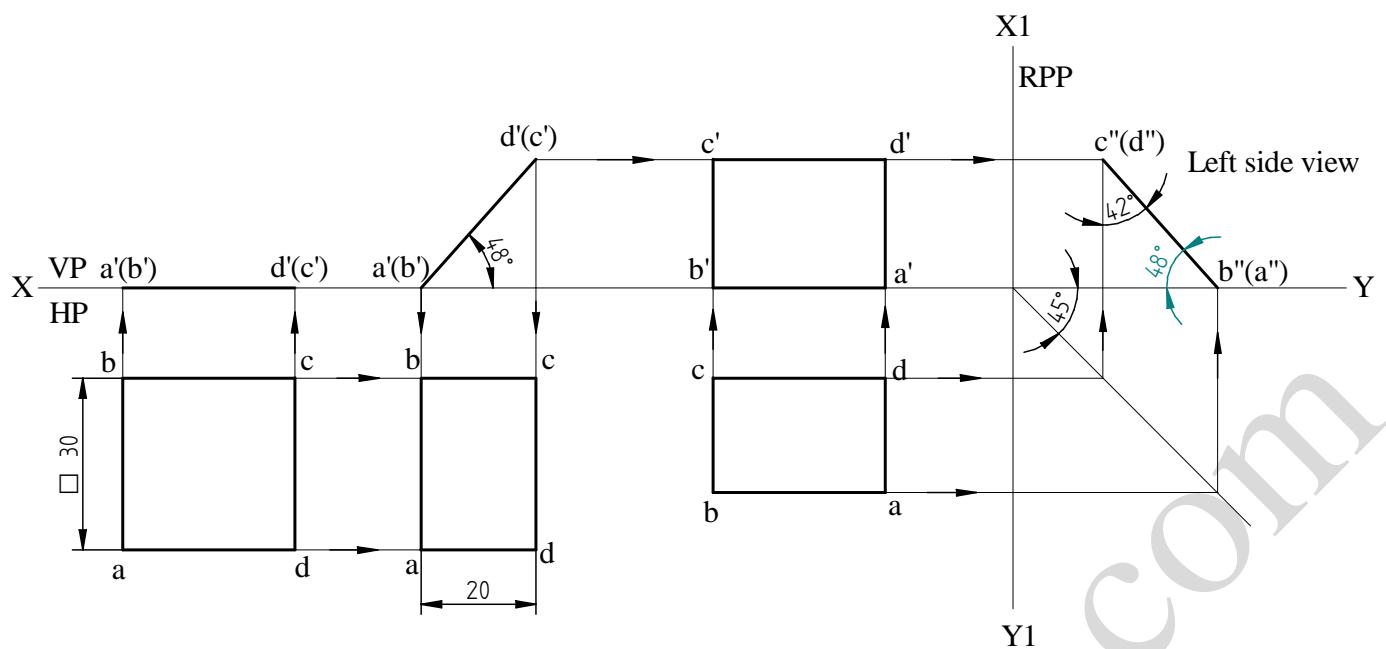
9. A square plate of 30mm sides rests on HP such that one of the diagonals is inclined at 30° to HP and 45° to VP. Draw its projections.



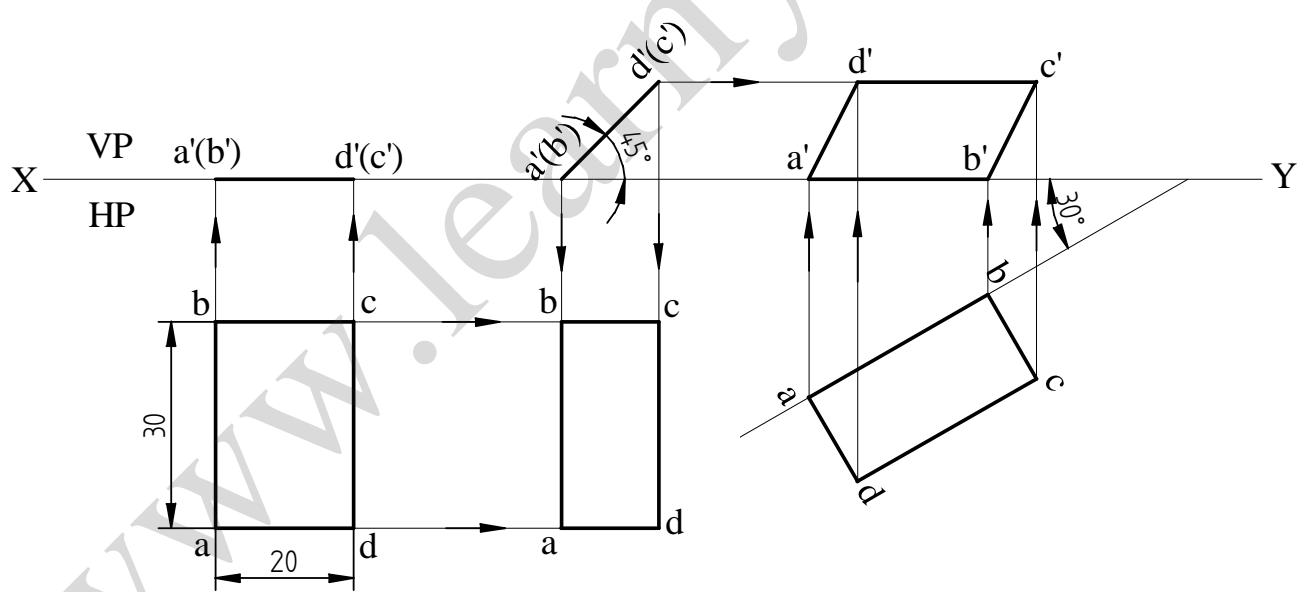
10. A square lamina ABCD of 40mm side rests on corner C such that the diagonal AC appears to be at 45° to VP. The two sides BC and CD containing the corner C make equal inclinations with HP. The surface of the lamina makes 30° with HP. Draw its top and front views.



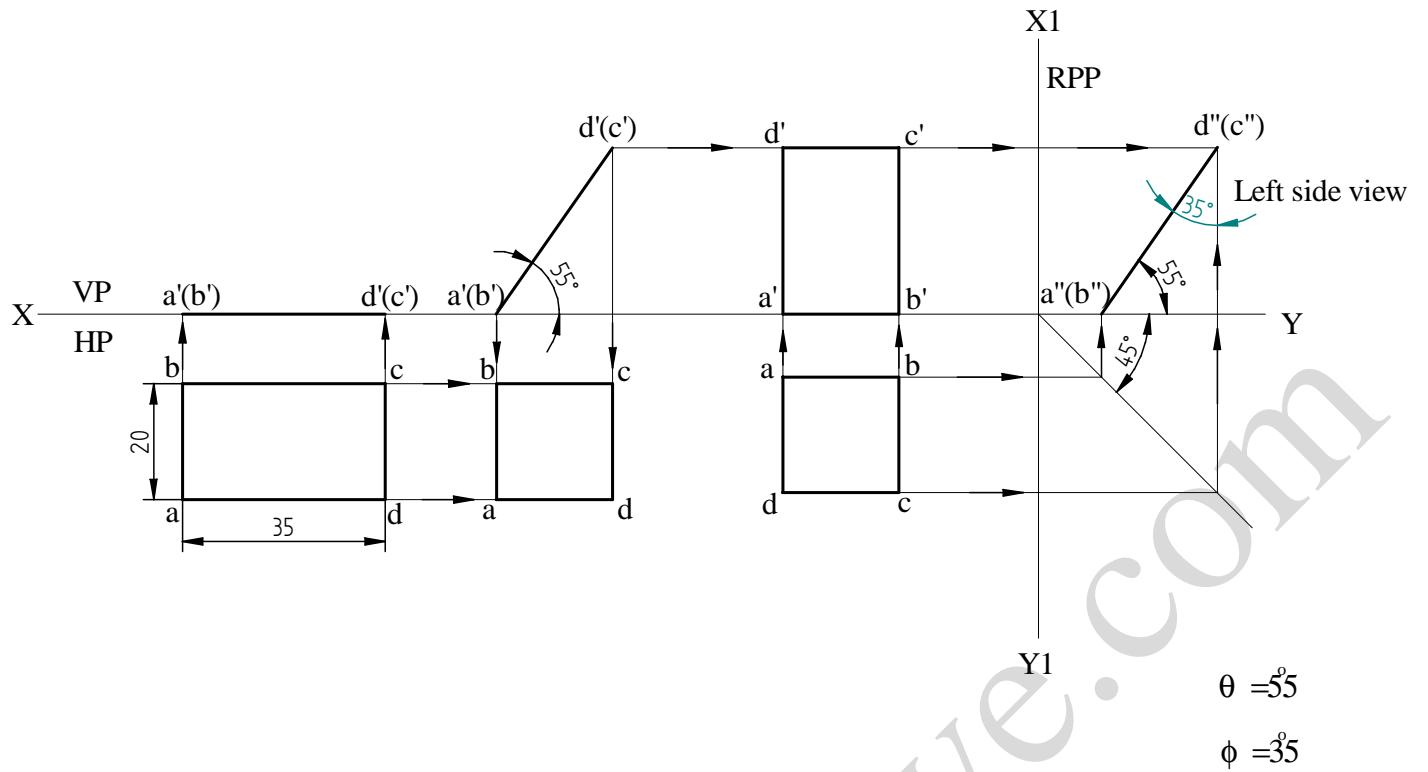
11. The top view of a square lamina of side 30mm is a rectangle of sides 30mm×20mm with the longer side of the rectangle being parallel to both HP and VP. Draw the top and front views of the square lamina. What is the inclination of the surface of the lamina with HP and VP?



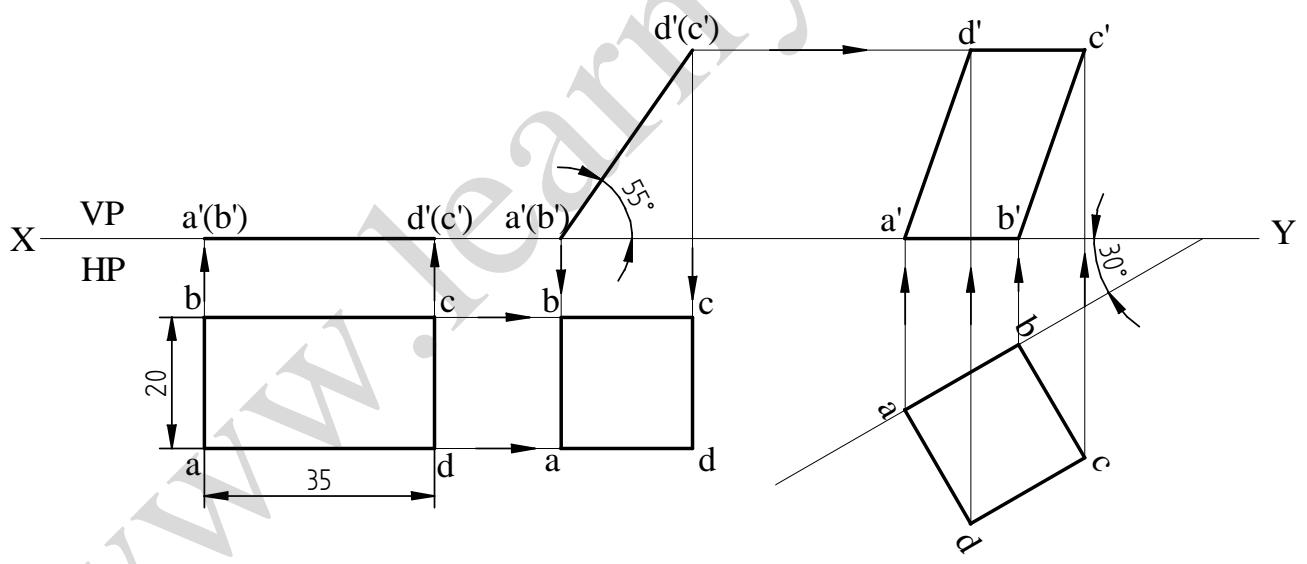
12. A rectangular lamina of sides 20mm×30mm rests on HP on one of its longer edges. The lamina is tilted about the edge on which it rests till its plane surface is inclined to HP at 45° . The edge on which it rests is inclined at 30° to VP. Draw the projections of the lamina.



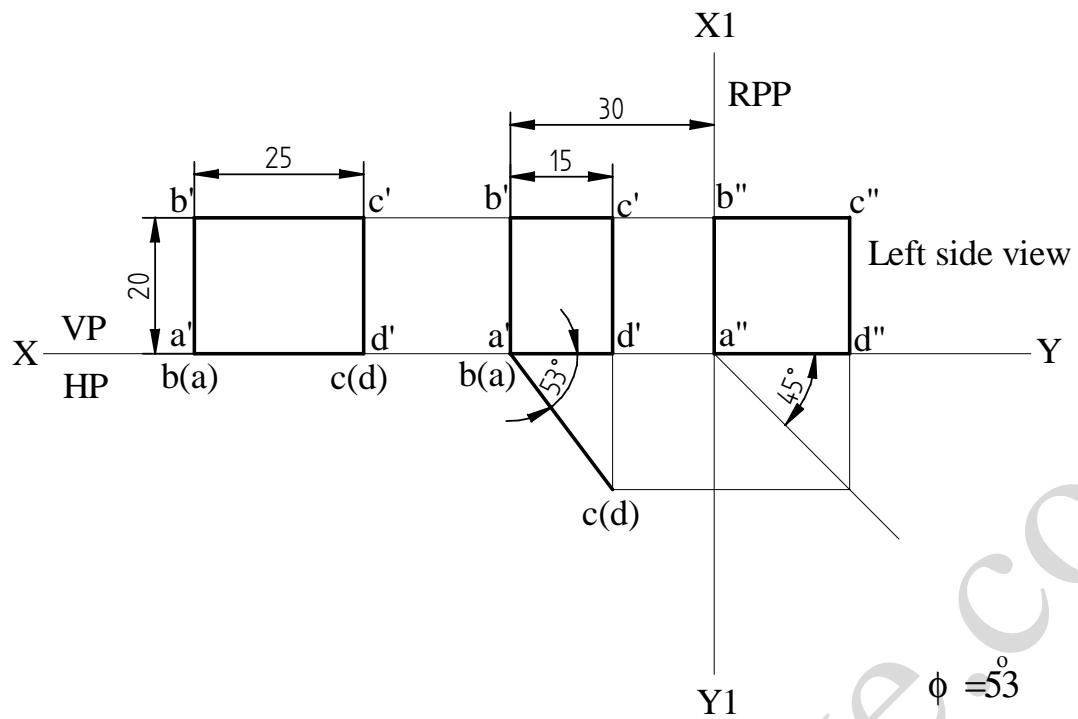
13. A rectangular lamina of 35mm×20mm rests on HP on one of its shorter edges. The lamina is rotated about the edge on which it rests till it appears as a square in the top view. The edge on which the lamina rests being parallel to both HP and VP. Draw the projections and find its inclinations to HP and VP.



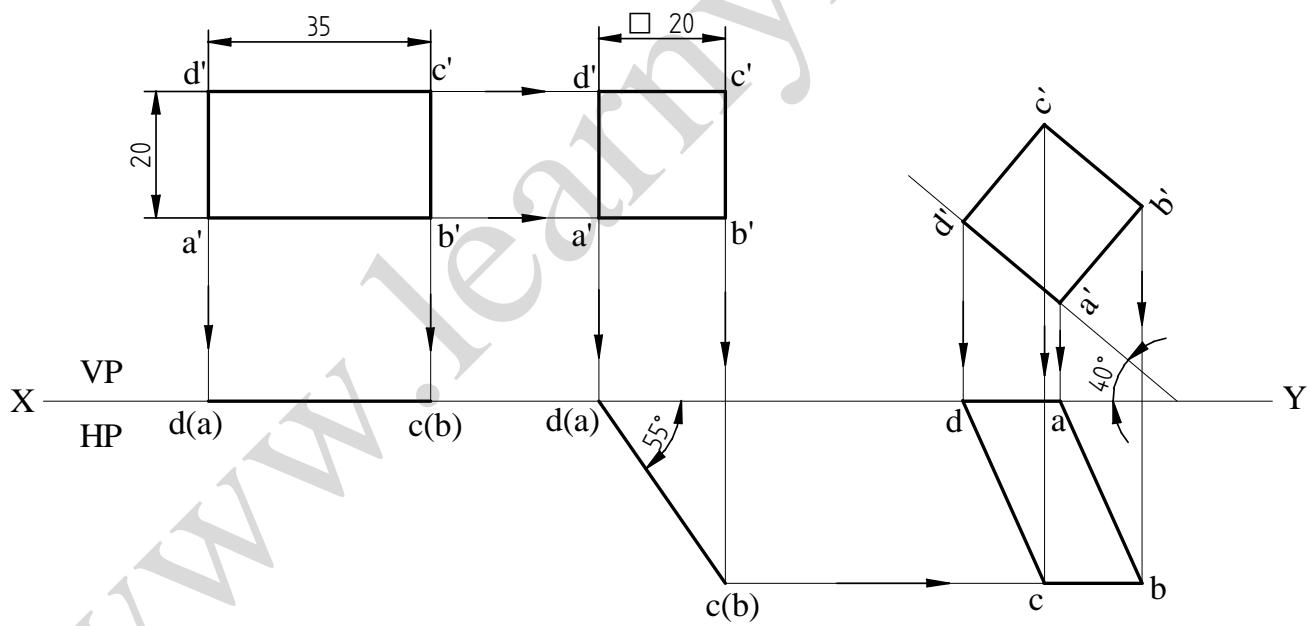
14. A rectangular lamina of $35\text{mm} \times 20\text{mm}$ rests on HP on one of its shorter edges. The lamina is rotated about the edge on which it rests till it appears as a square in the top view. The edge on which the lamina rests is inclined at 30° to VP. Draw its projections and find its inclination to HP.



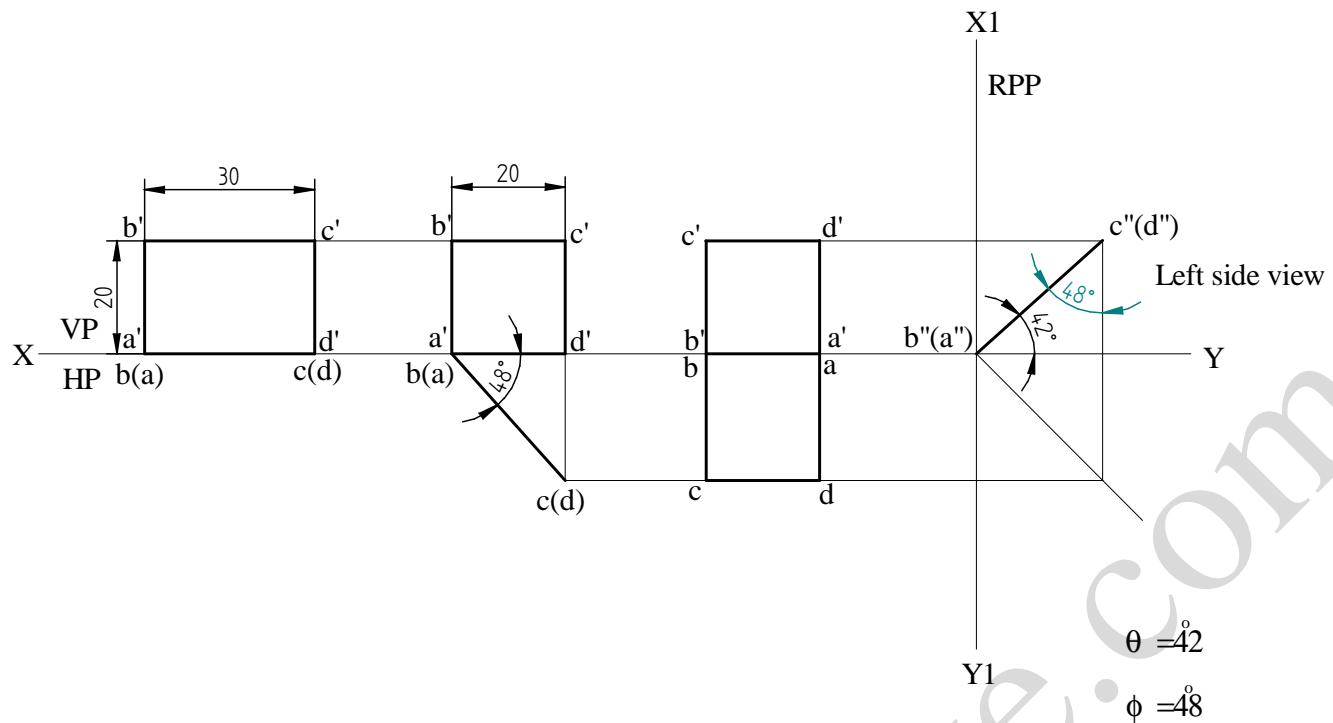
15. A rectangular lamina of sides $20\text{mm} \times 25\text{mm}$ has an edge in HP and adjoining edge in VP, is tilted such that the front view appears as a rectangle of $20\text{mm} \times 15\text{mm}$. The edge, which is in VP, is 30mm from the right profile plane. (a) Draw the top view, front view and the left profile view in this position (b) Find its inclinations with the corresponding principal planes.



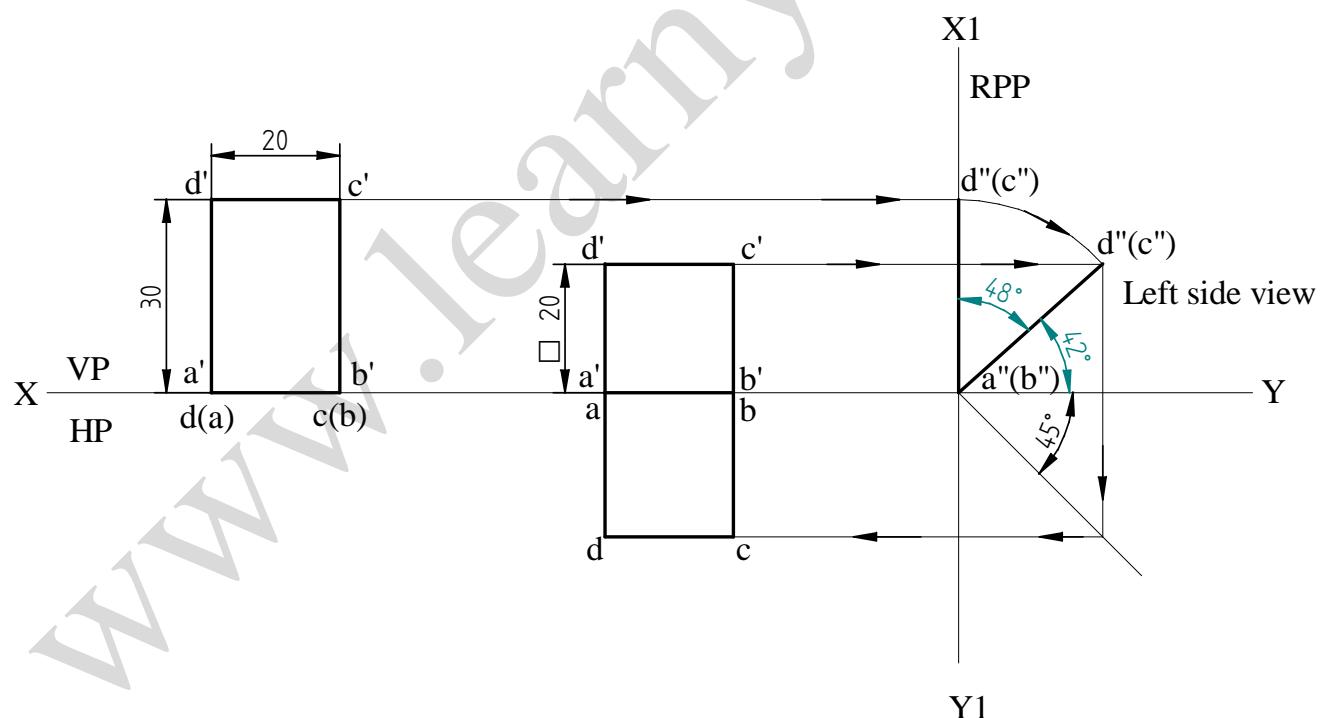
16. A rectangular plate of negligible thickness of size 35mm×20mm has one of its shorter edges in VP with that edge inclined at 40° to HP. Draw the top view if its front view is a square of side 20mm.



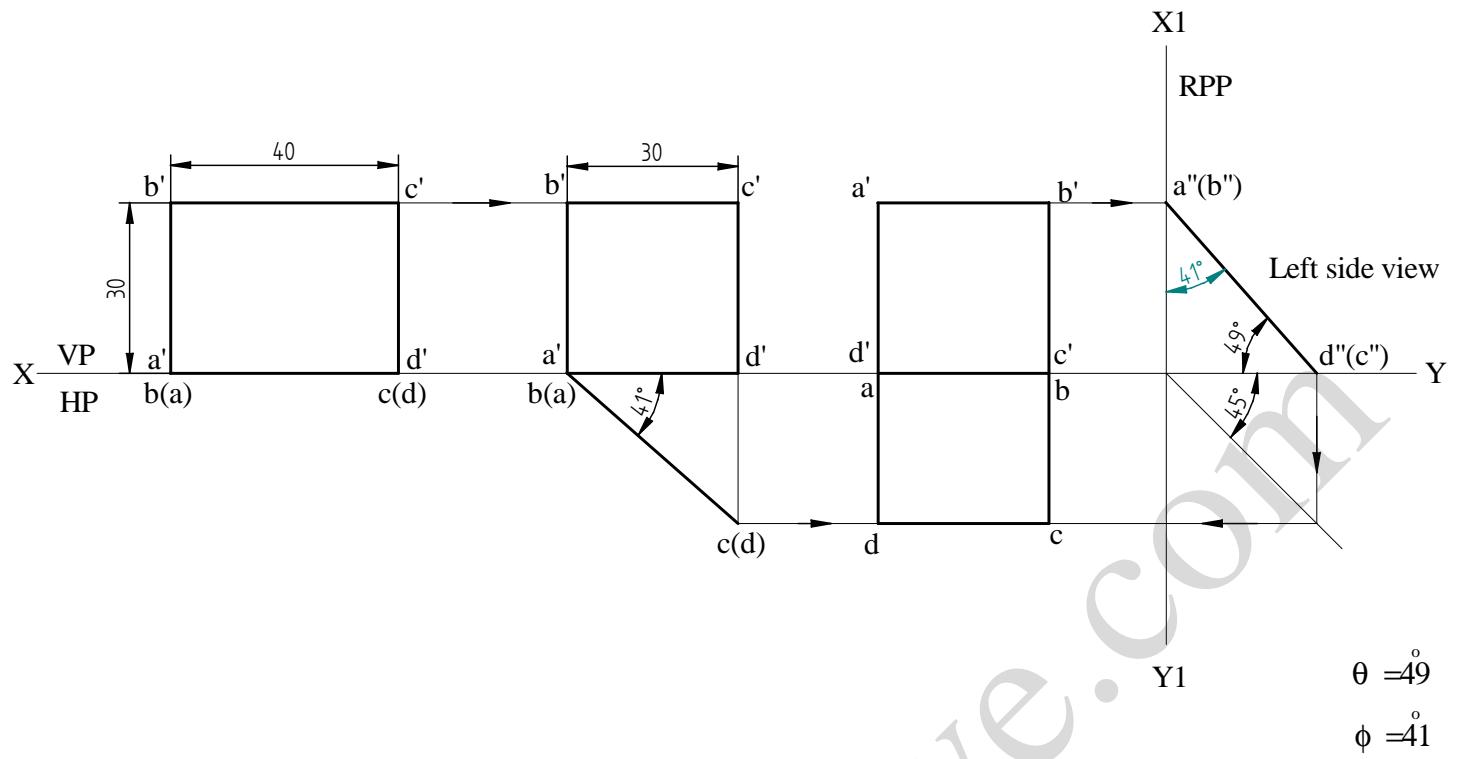
17. The front view of a rectangular lamina of sides 30mm×20mm is a square of 20mm sides. Draw the projections and determine the inclinations of the lamina with HP and VP.



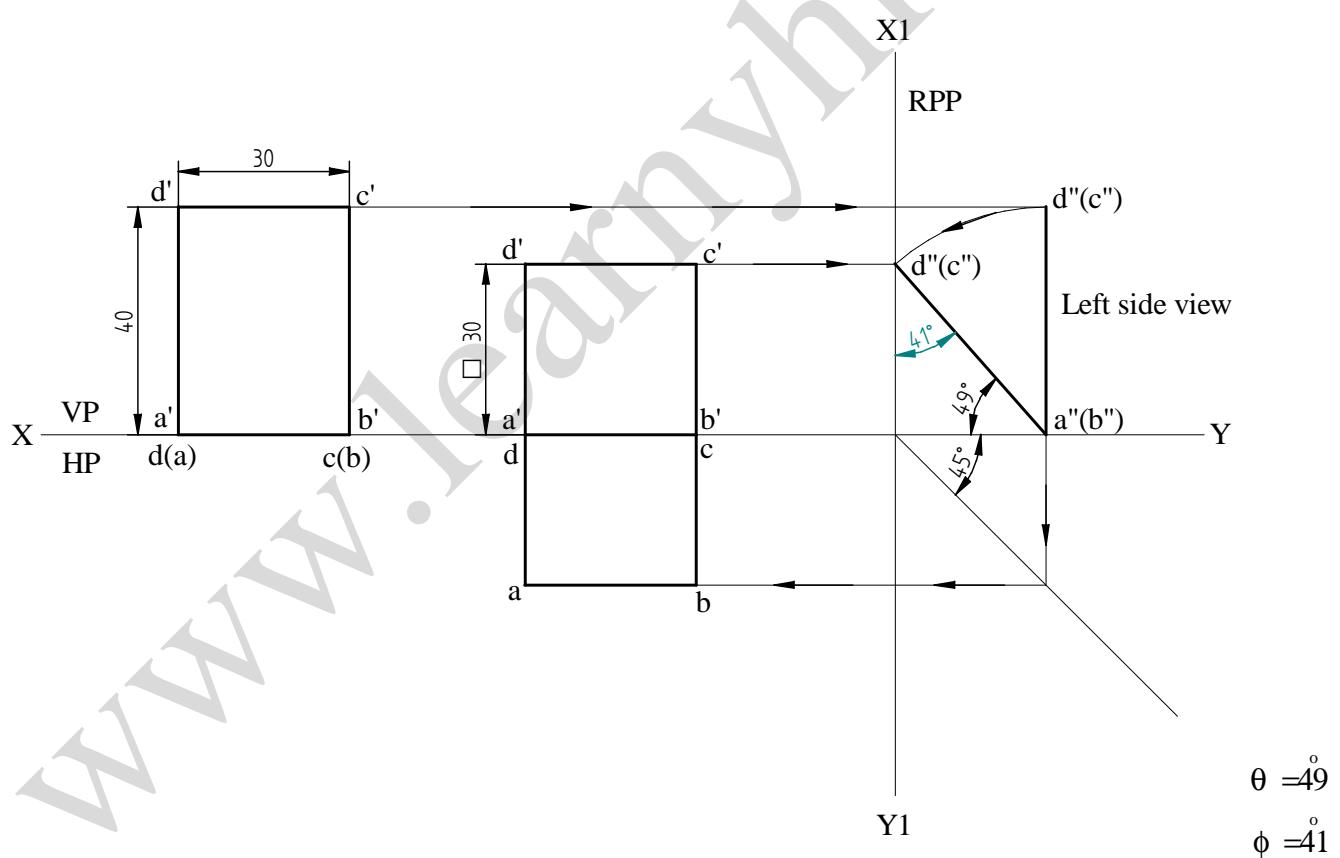
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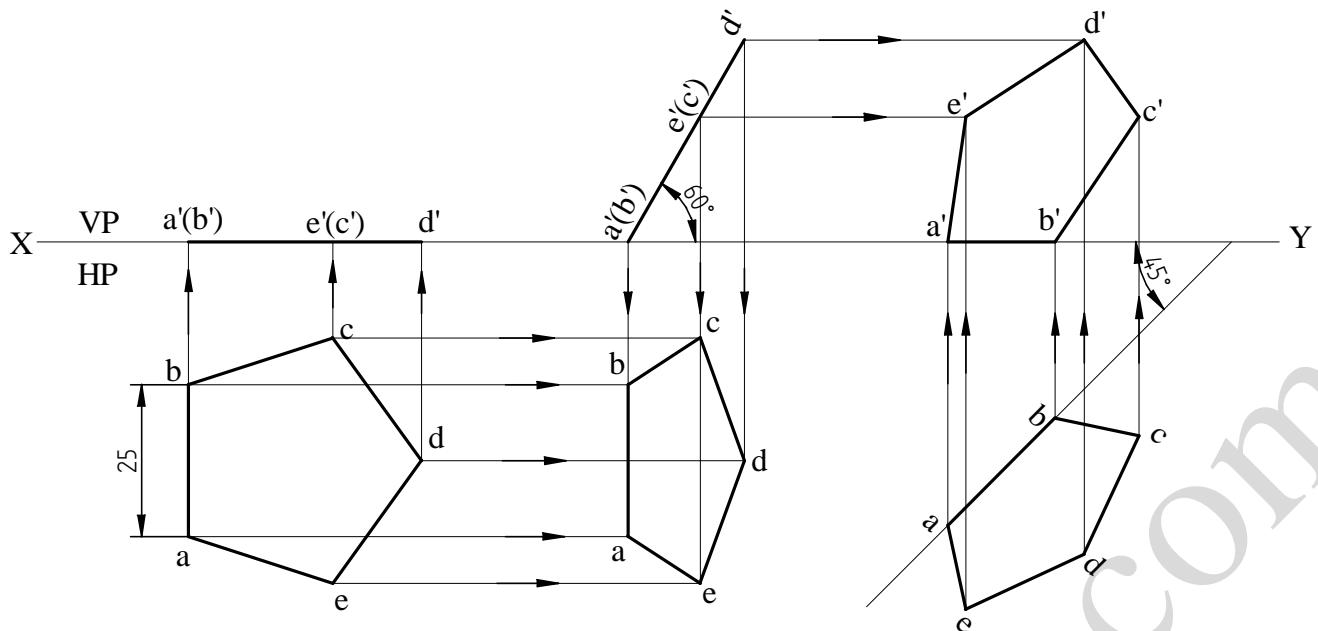
18. A mirror 30mm×40mm is inclined to the wall such that its front view is a square of 30mm side. The longer sides of the mirror appear perpendicular to both HP and VP. Find the inclination of the mirror with the wall.



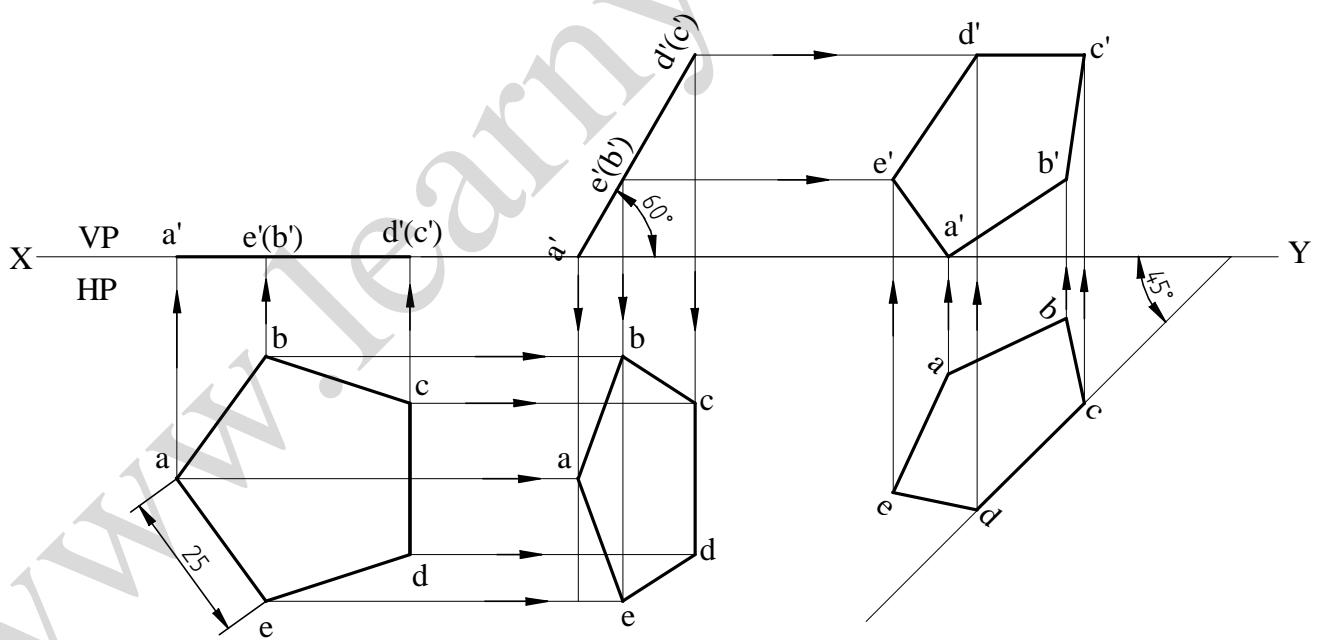
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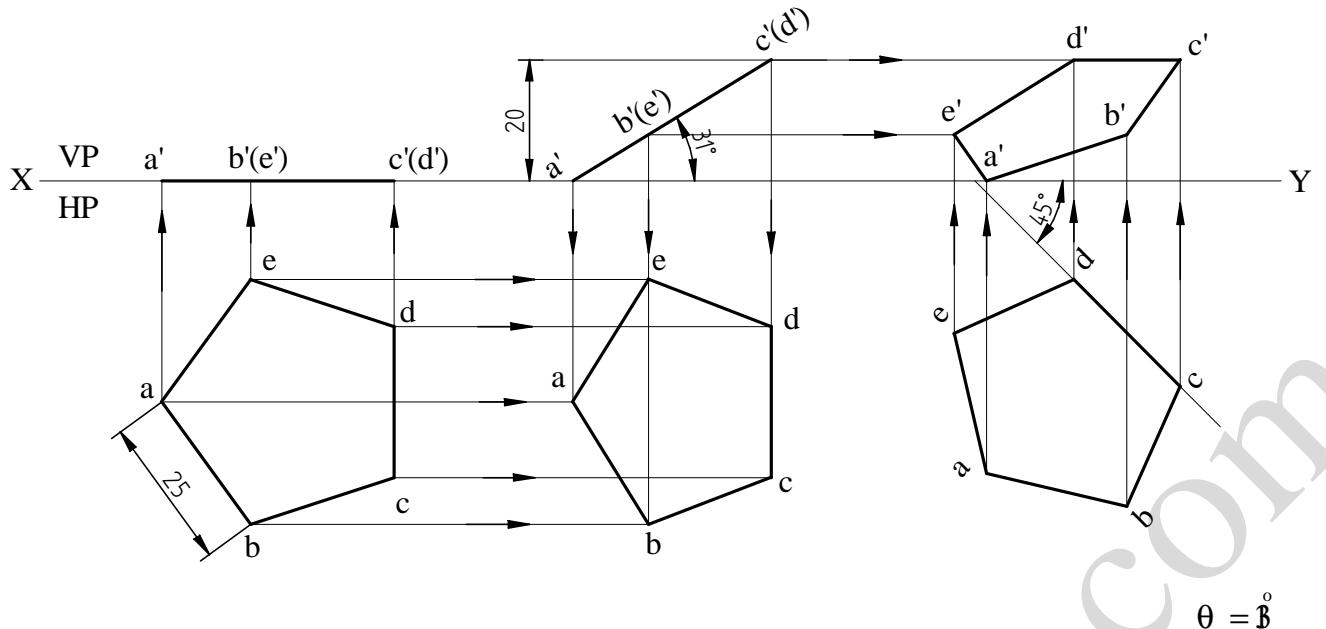
19. A pentagonal lamina of edges 25mm is resting on HP with one of its sides such that the surface makes an angle of 60° with HP. The edge in which it rests is inclined at 45° to VP. Draw its projections.



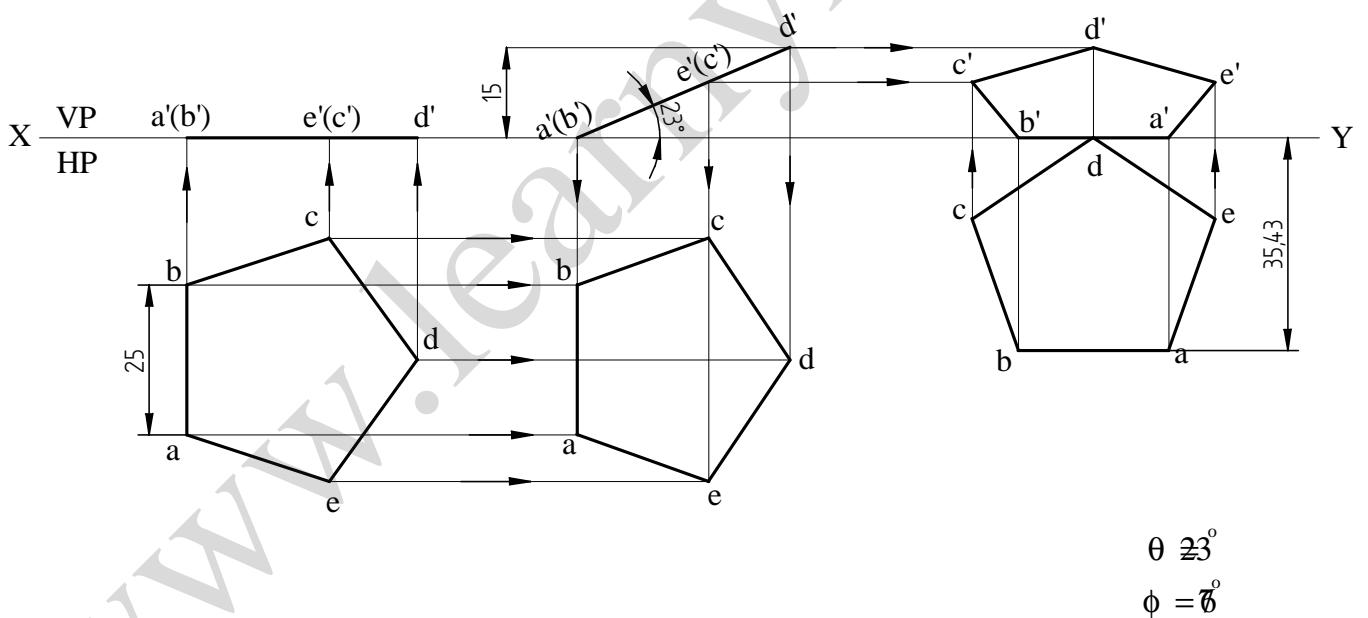
20. A pentagonal lamina of edges 25mm is resting on HP with one of its corners such that the plane surface makes an angle of 60° with HP. Two of the edges containing the corner on which the lamina rests make equal inclinations with HP. When the edge opposite to this corner make an angle of 45° with VP and nearer to the observer. Draw the top and front views of the lamina in this position.



21. A pentagonal lamina of edges 25mm is resting on HP with one of its corner such that the edge opposite to this corner is 20mm above HP and makes an angle of 45° with VP. Draw the top and front views of the plane lamina in this position. Determine the inclination of the lamina with HP.

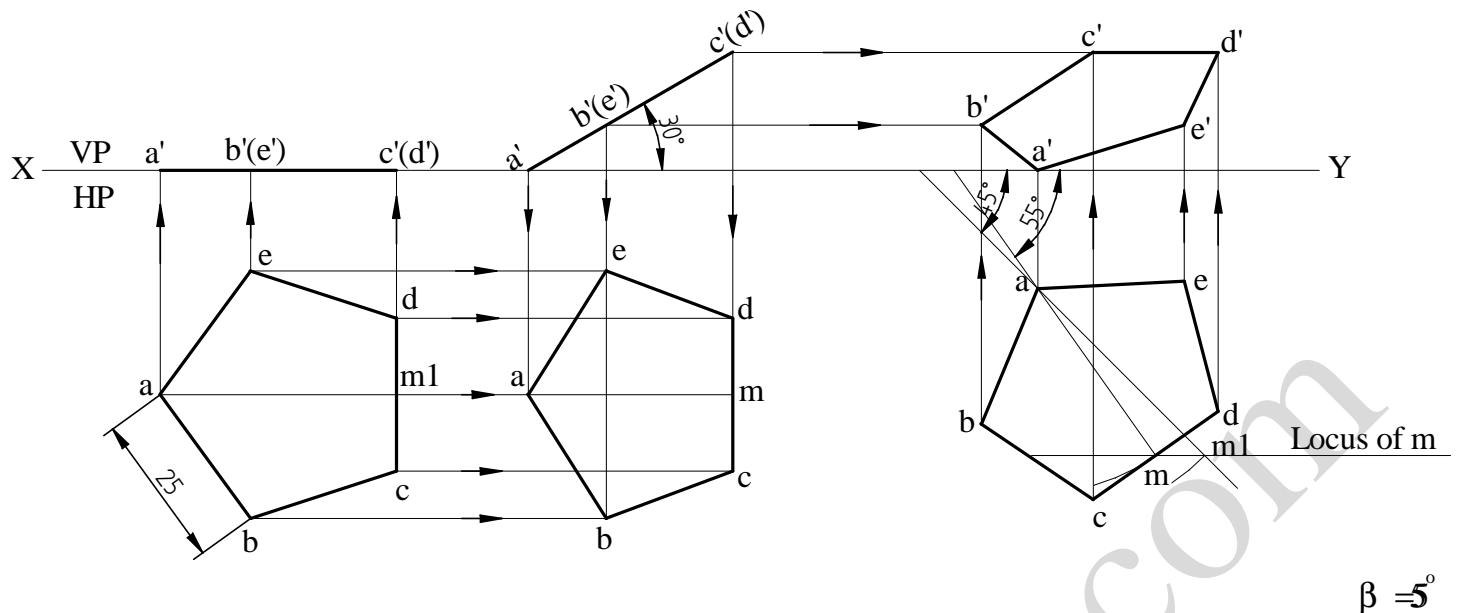


22. A pentagonal lamina of sides 25mm is resting on one of its edges on HP with the corner opposite to that edge touching VP. This edge is parallel to VP and the corner, which touches VP is at a height of 15mm above HP. Draw the projections of the lamina and determine the inclinations of the lamina with HP and VP and the distance at which the parallel edge lies from VP.

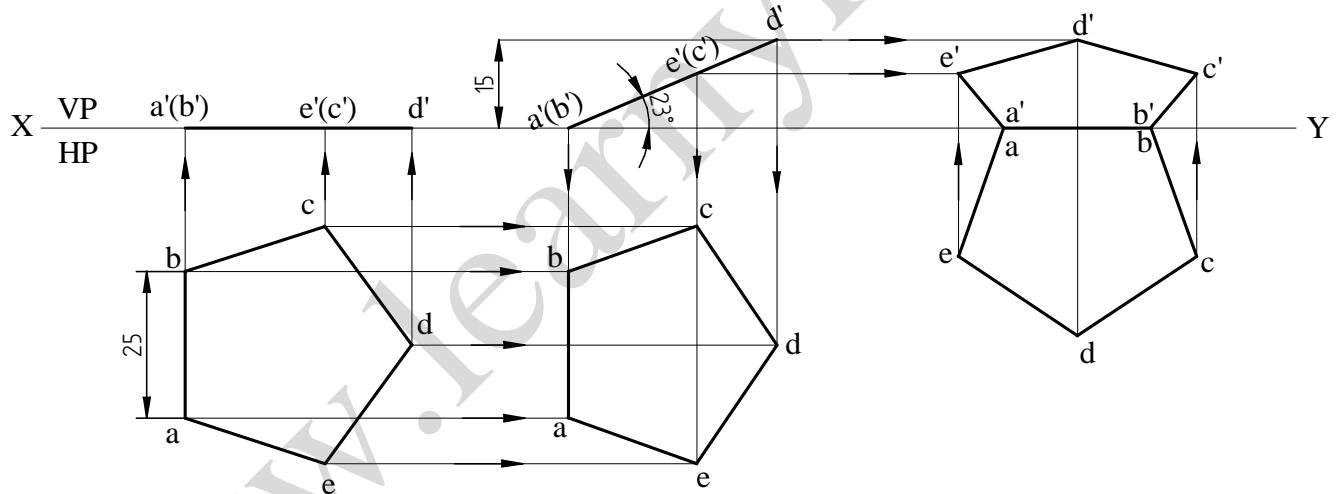


Distance of parallel edge ab from VP is 35.43 mm

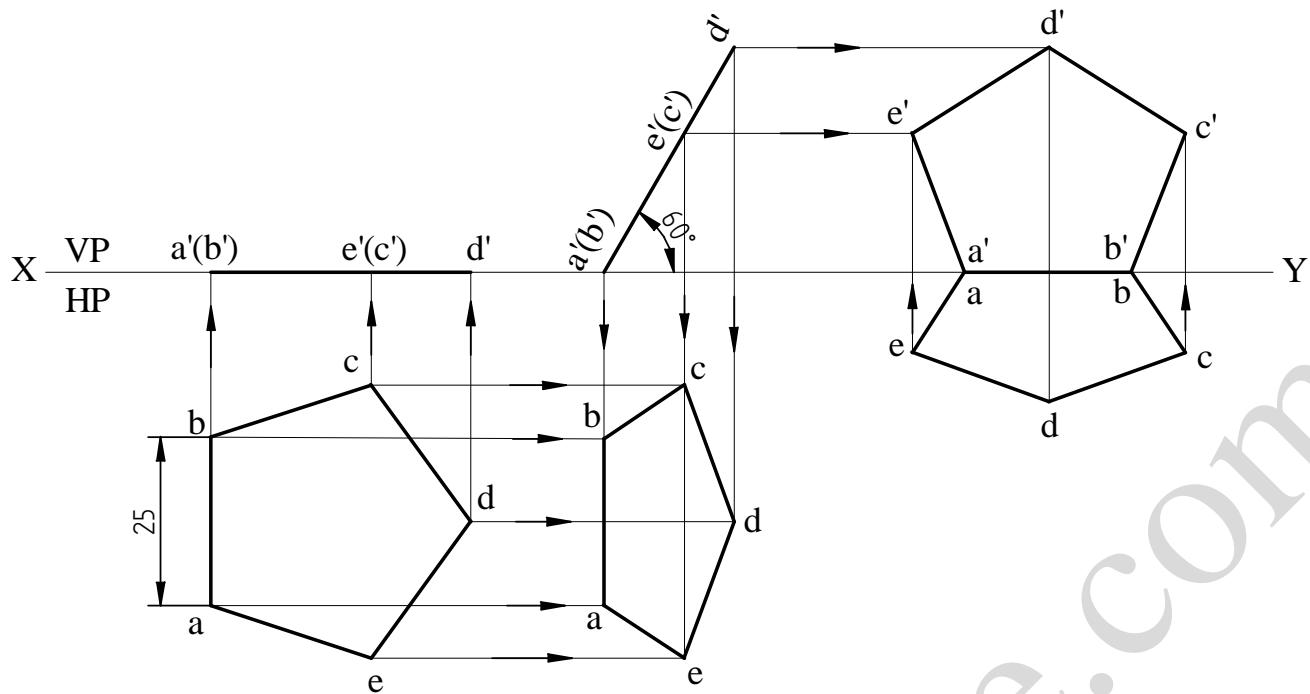
23. A pentagonal lamina having edges 25mm is placed on one of its corner on HP such that the perpendicular bisector of the edge passing through the corner on which the lamina rests is inclined at 30° to HP and 45° to VP. Draw the top and front views of the lamina.



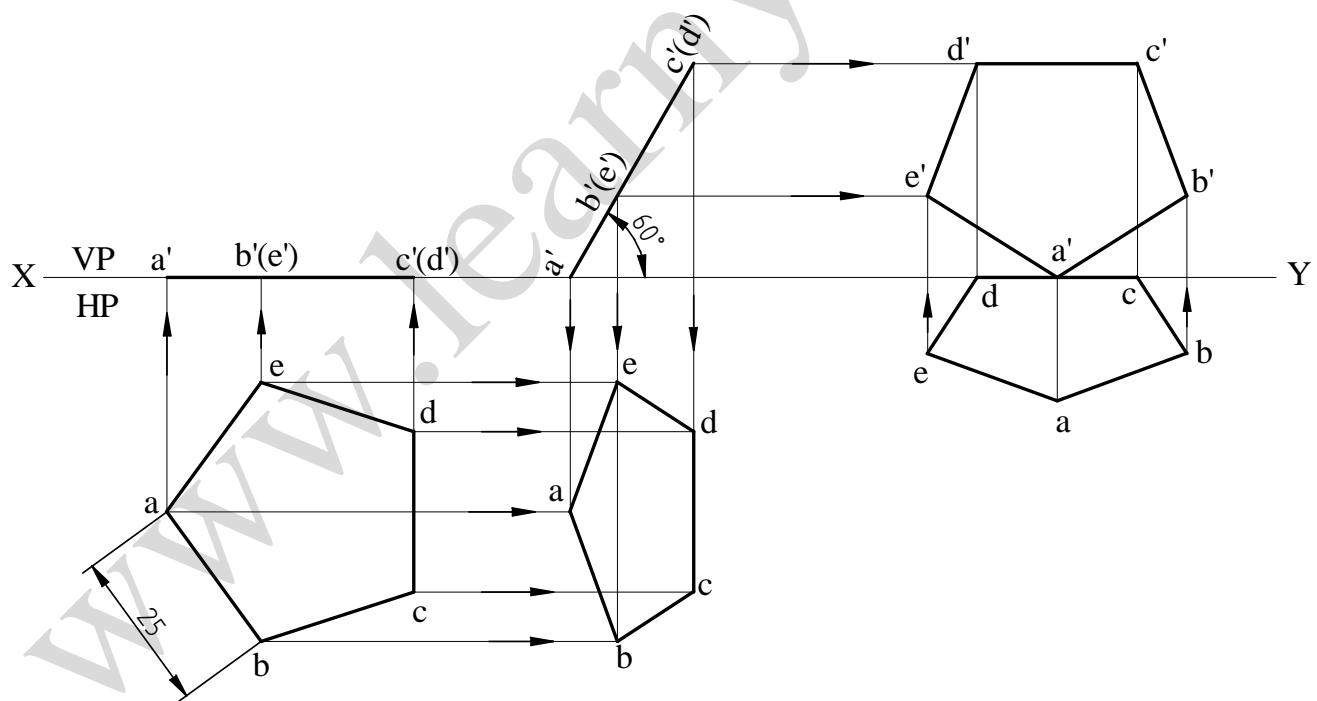
24. A pentagonal lamina of sides 25mm is having a side both on HP and VP. The corner opposite to the side on which it rests is 15mm above HP. Draw the top and front views of the lamina.



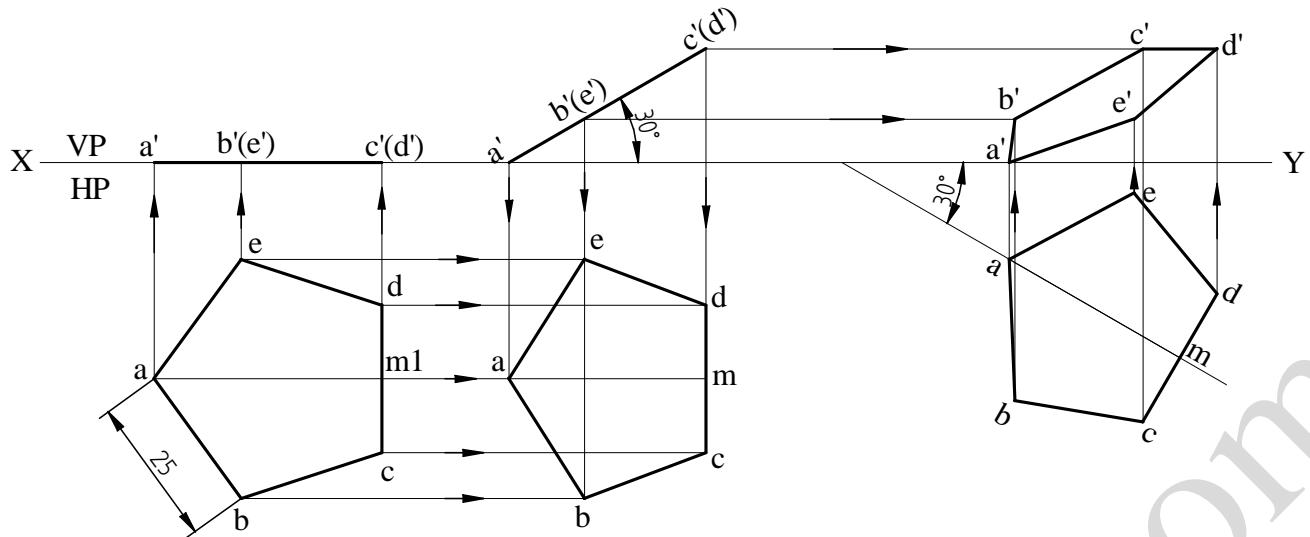
25. A pentagonal lamina of sides 25mm is having a side both on HP and VP. The surface of the lamina is inclined at an angle of 60° with HP. Draw the top and front views of the lamina.



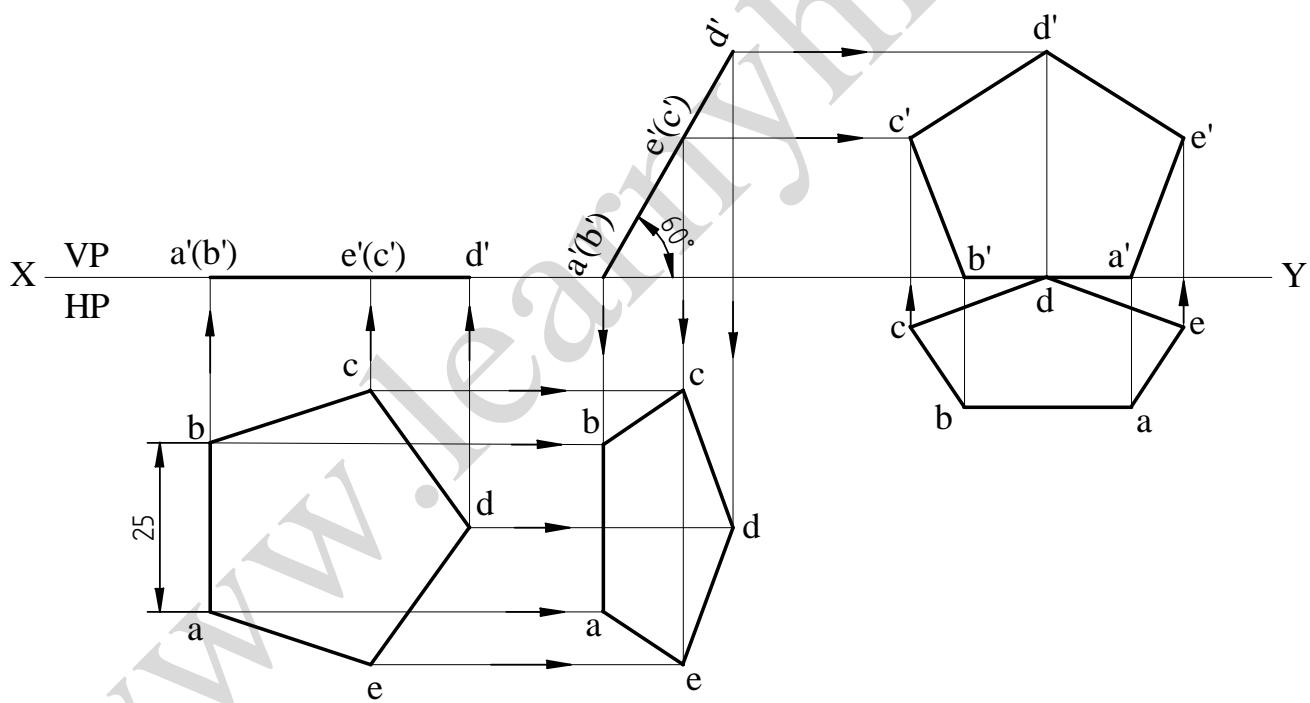
26. A regular pentagonal lamina of 25mm side is resting on one of its corner on HP while the side opposite to this corner touches VP. If the lamina makes an angle of 60° with HP and 30° with VP. Draw the projections of the lamina.



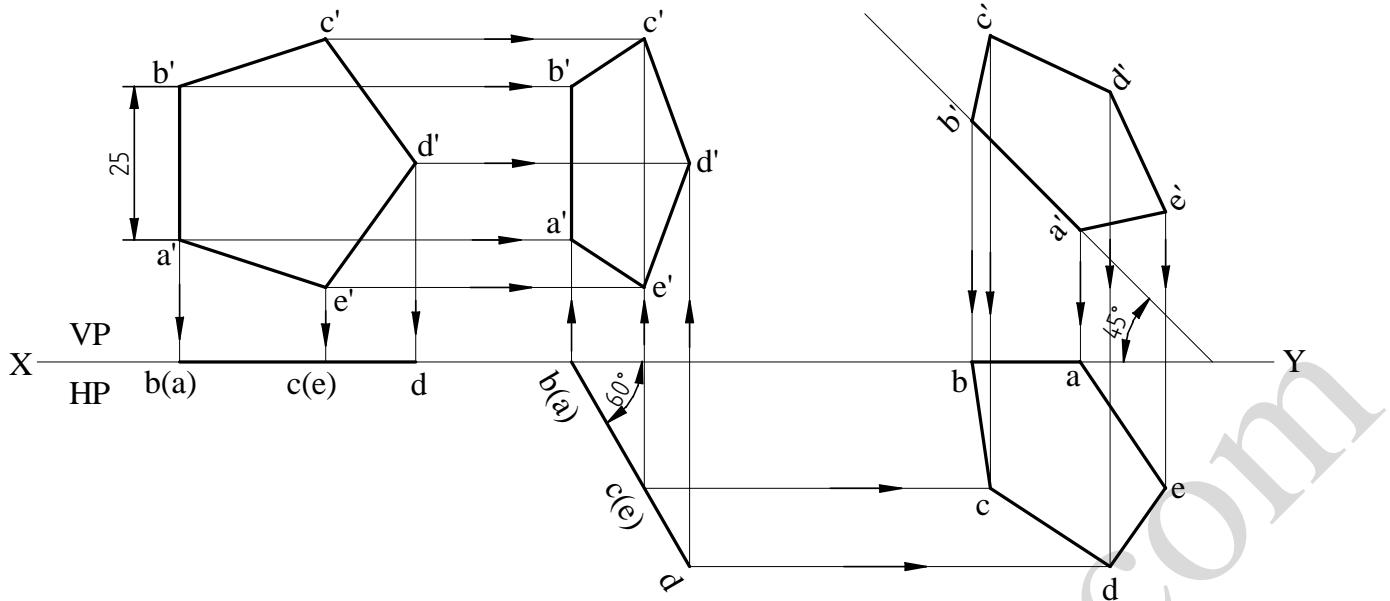
27. A pentagonal lamina having edges 25mm is placed on one of its corner on HP such that the surface makes an angle of 30° with HP and perpendicular bisector of the edge passing through the corner on which the lamina rests appears to be inclined at 30° to VP. Draw the top and front views of the lamina.



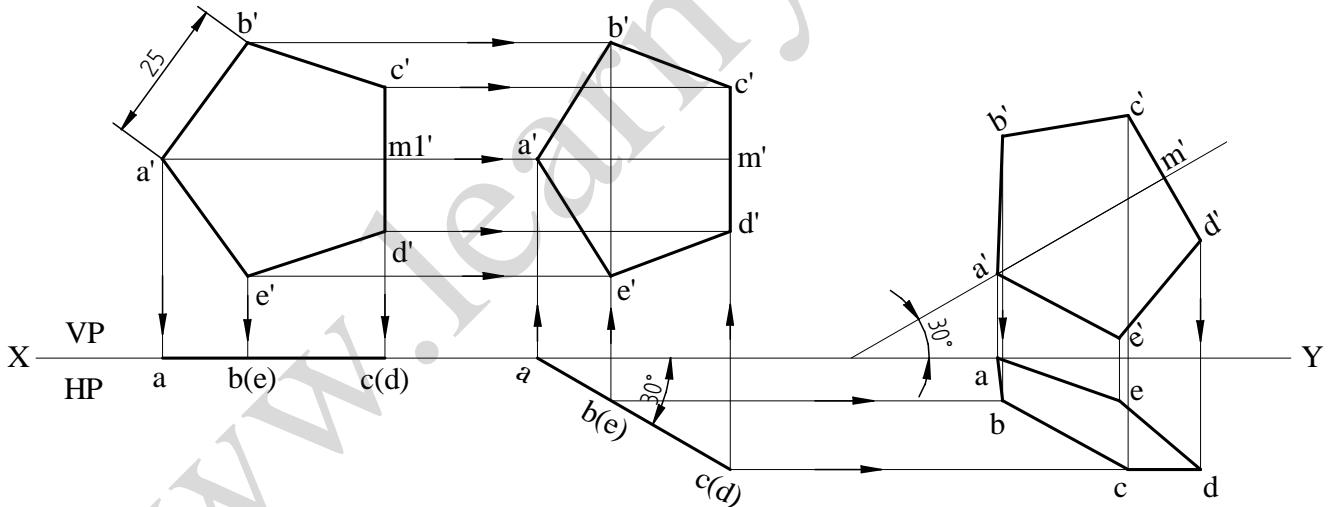
28. A regular pentagonal lamina of 25mm side is resting on one of its sides on HP while the corner opposite to this side touches VP. If the lamina makes an angle of 60° with HP and 30° with VP. Draw the projections of the lamina.



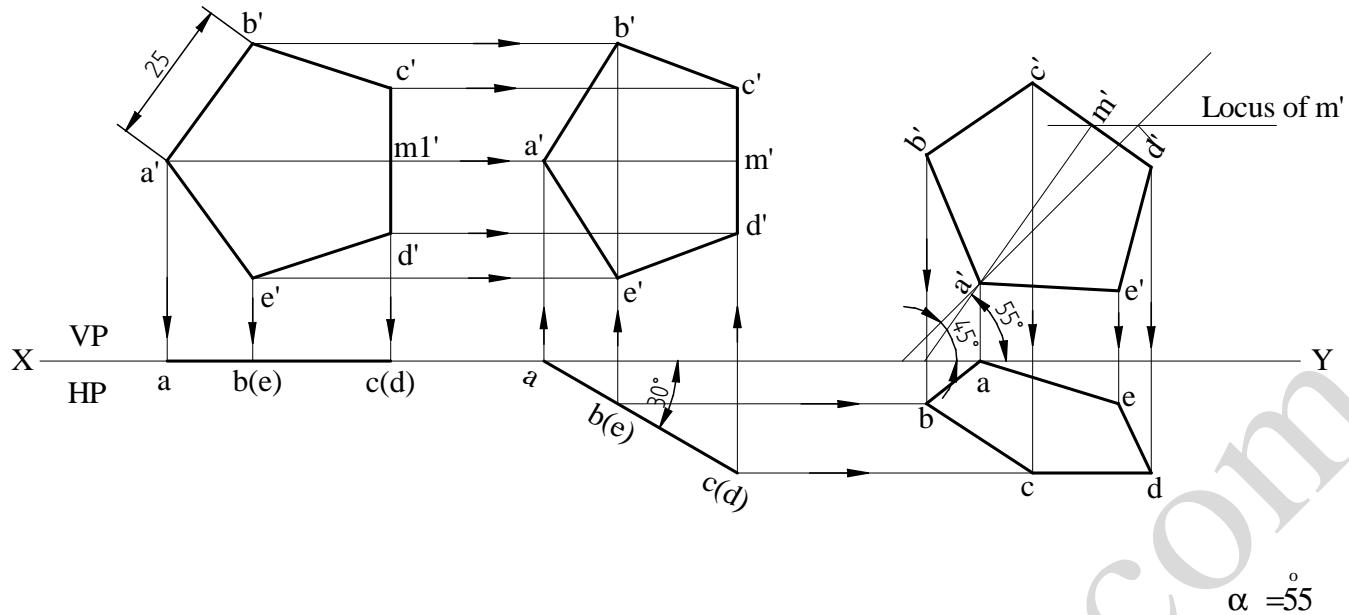
29. A pentagonal lamina of edges 25mm is resting on VP with one of its sides such that the surface makes an angle of 60° with VP. The edge on which it rests is inclined at 45° to HP. Draw its projections.



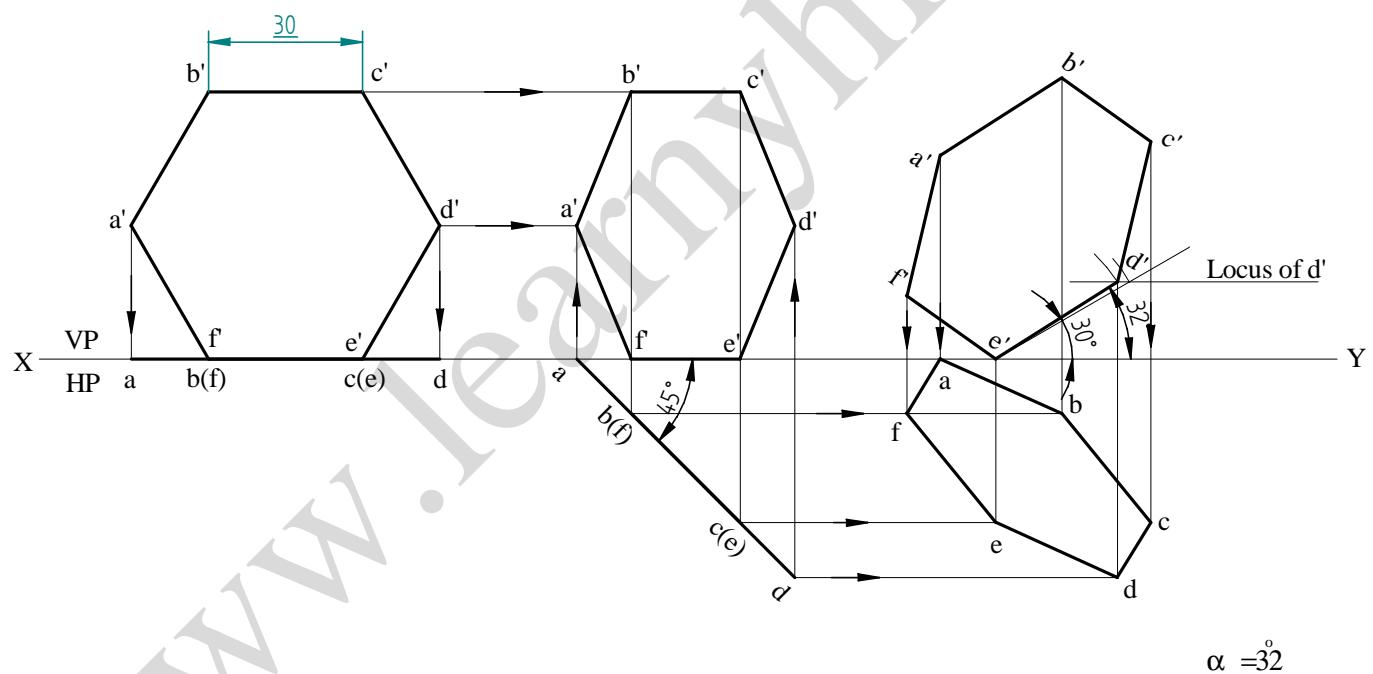
30. A pentagonal lamina having edges 25mm is placed on one of its corner on VP such that the surface makes an angle of 30° with VP and perpendicular bisector of the edge passing through the corner on which the lamina rests appears to be inclined at 30° to HP. Draw the top and front views of the lamina.



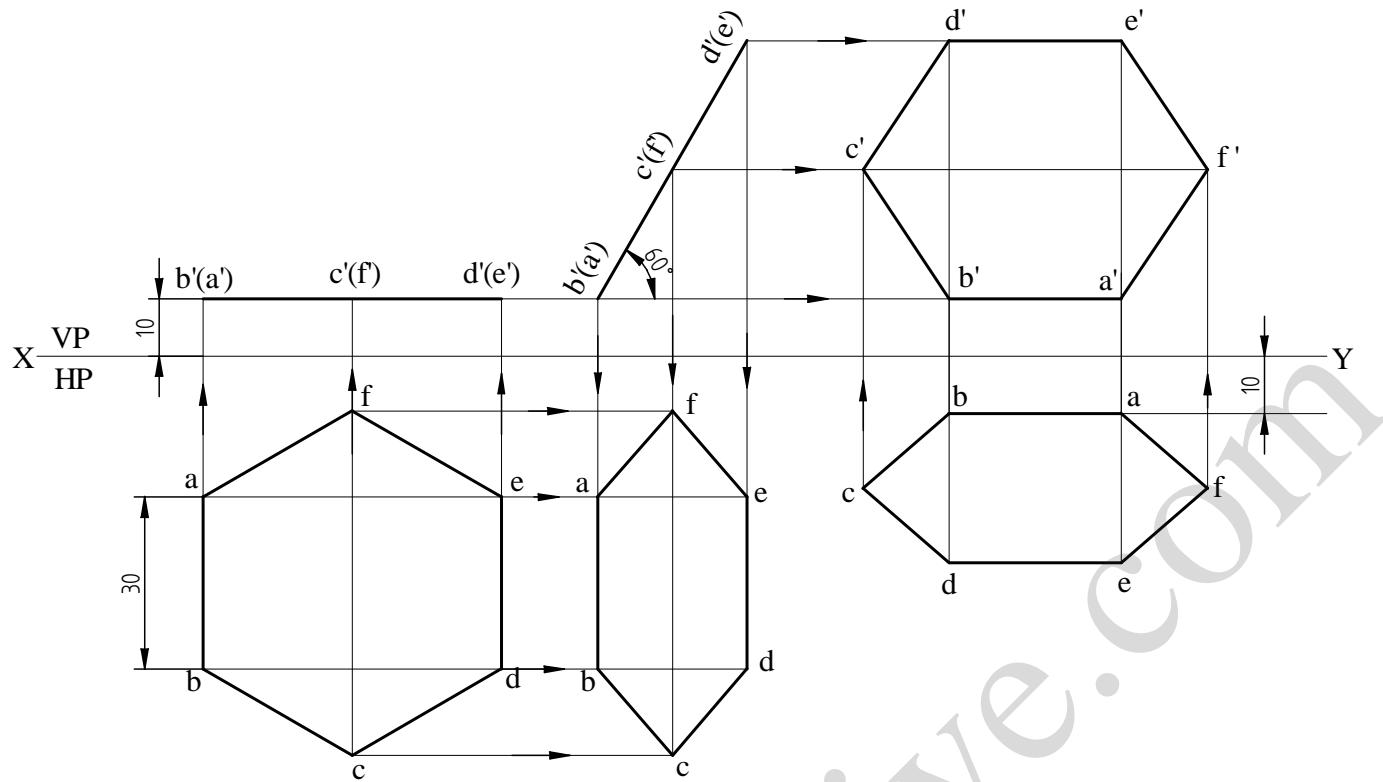
31. A pentagonal lamina having edges 25mm is placed on one of its corner on VP such that the surface makes an angle of 30° with VP and perpendicular bisector of the edge passing through the corner on which the lamina rests is inclined at 45° to HP. Draw the top and front views of the lamina.



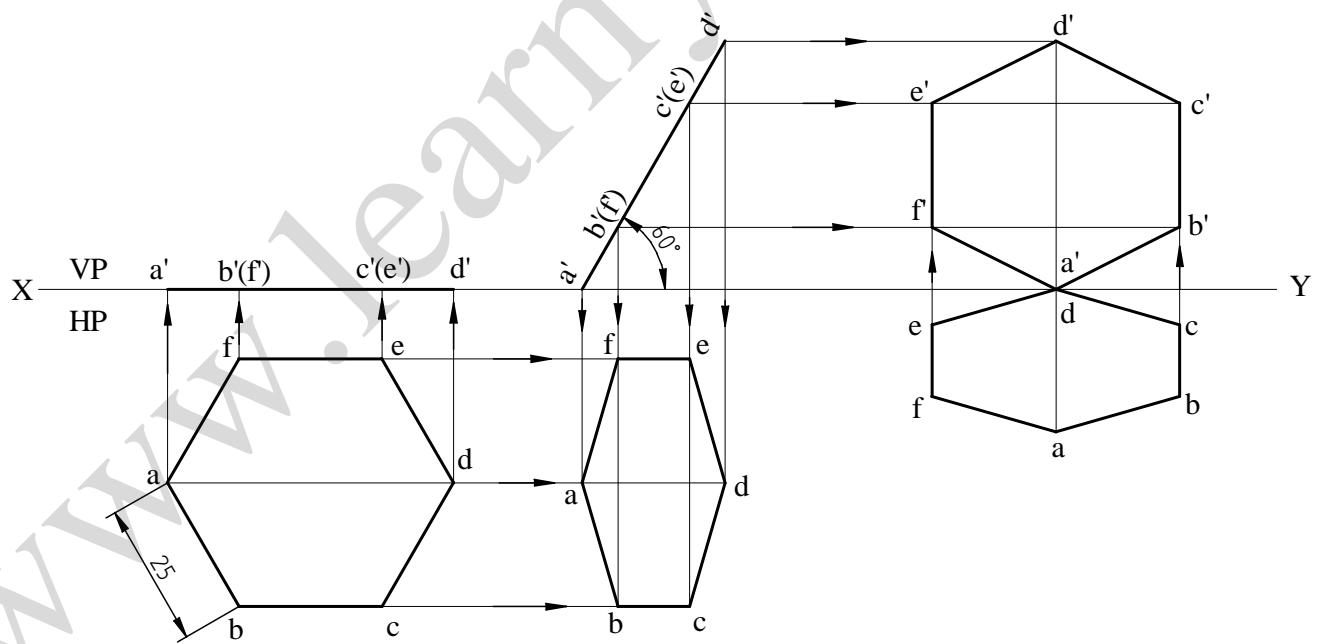
32. A hexagonal lamina of 30mm sides rests on HP with one of its corner touching VP and surface inclined at 45° to it. One of its edges is inclined to HP at 30° . Draw the front and top views of the lamina in its final position.



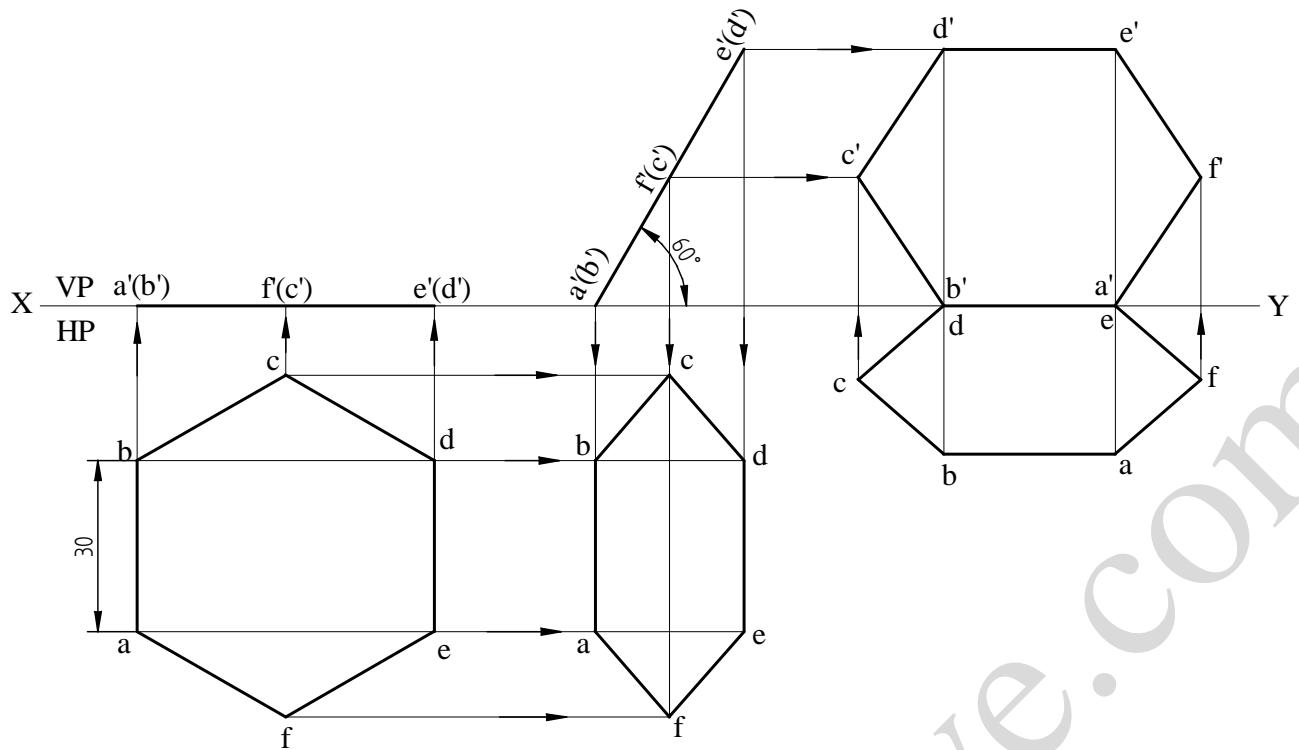
33. Draw the top and front views of a hexagonal lamina of 30mm sides having two of its edges parallel to both vertical and horizontal planes and one of its edges is 10mm from each of the planes of projection. The surface of the lamina is inclined at an angle of 60° to the HP.



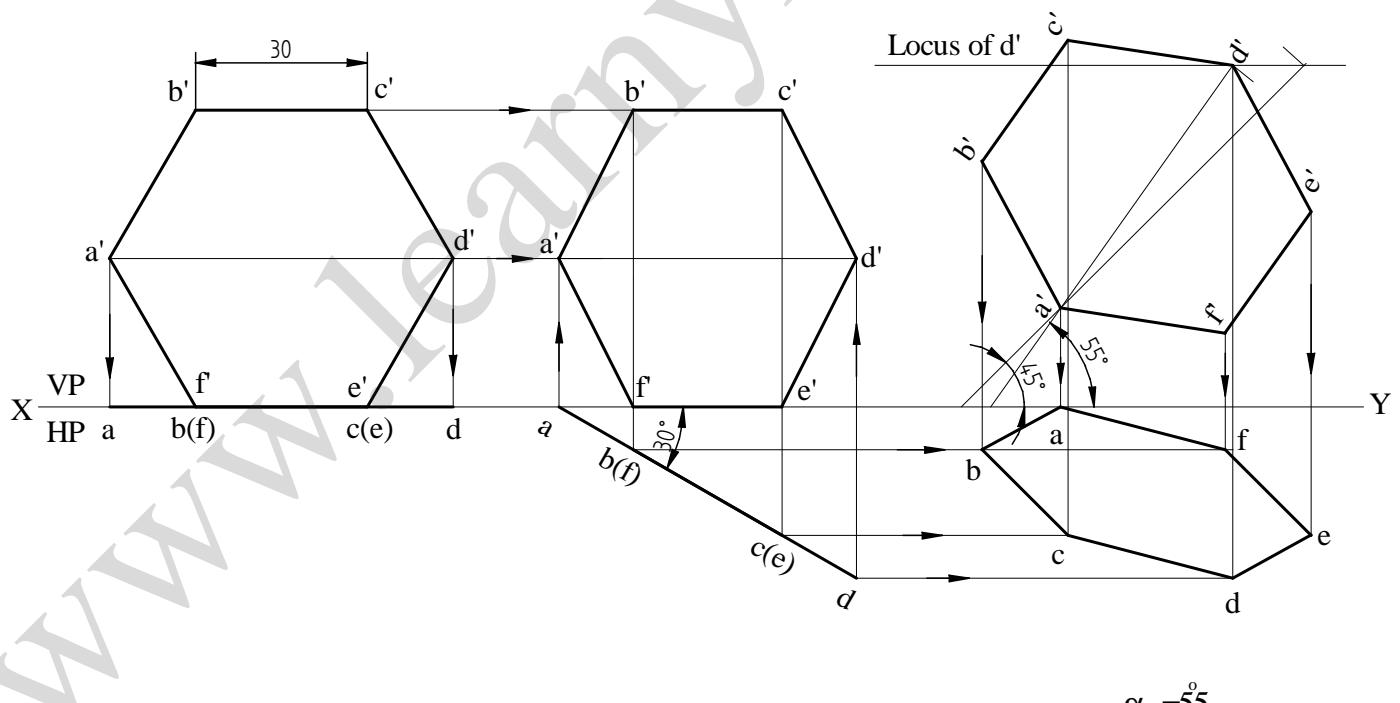
34. A regular hexagonal lamina of side 25mm is lying in such a way that one of its corner is on HP while the corner opposite to the corner on which it rests is on VP. The lamina makes 60° to HP. Draw the projections of the lamina.



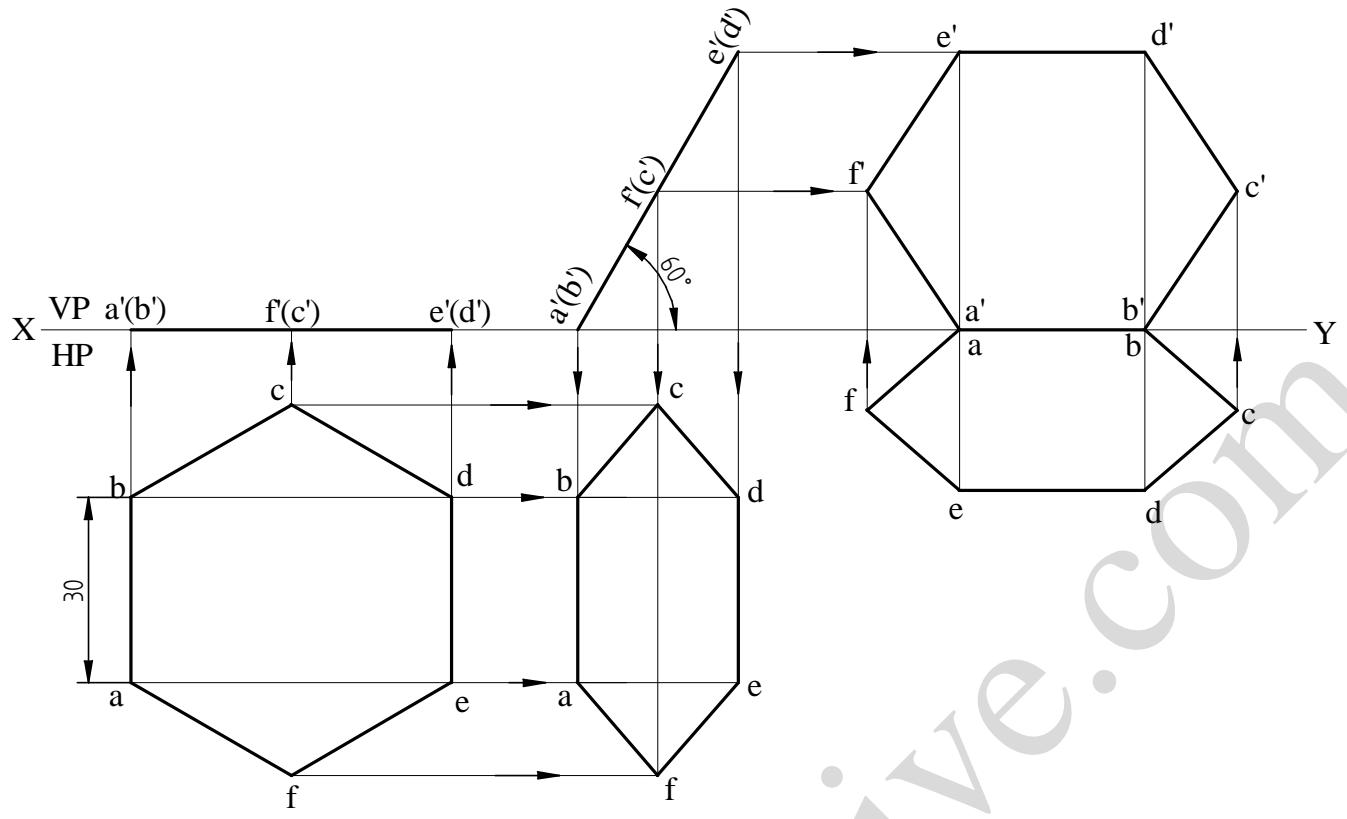
35. A regular hexagonal lamina of sides 30mm is lying in such a way that one of its sides is on HP while the side opposite to the side on which it rests is on VP. If the lamina makes 60° to HP. Draw the projections of the lamina.



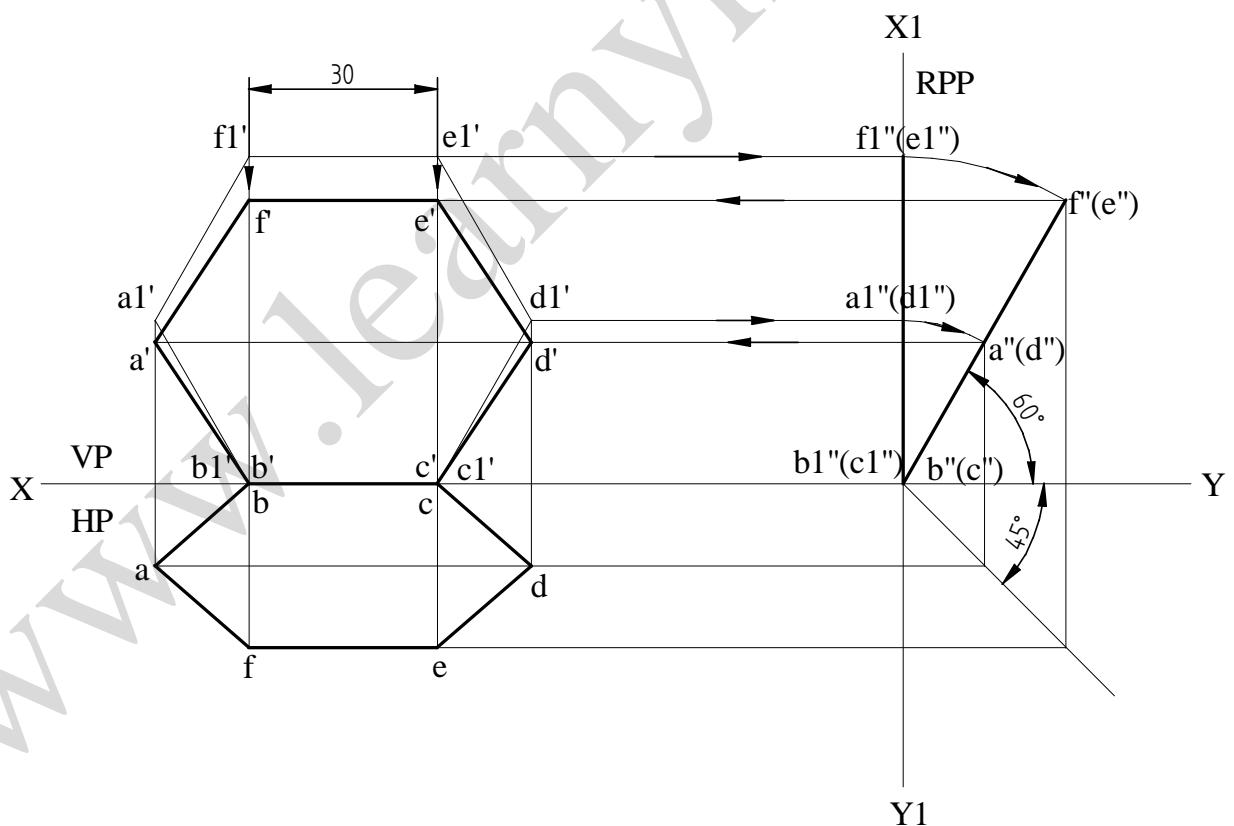
36. A hexagonal lamina of sides 30mm is resting on HP with one of its corners in VP and its surface inclined at an angle of 30° with VP. The diagonal passing through that corner which is in VP is inclined at 45° to HP. Draw the projections of the lamina.



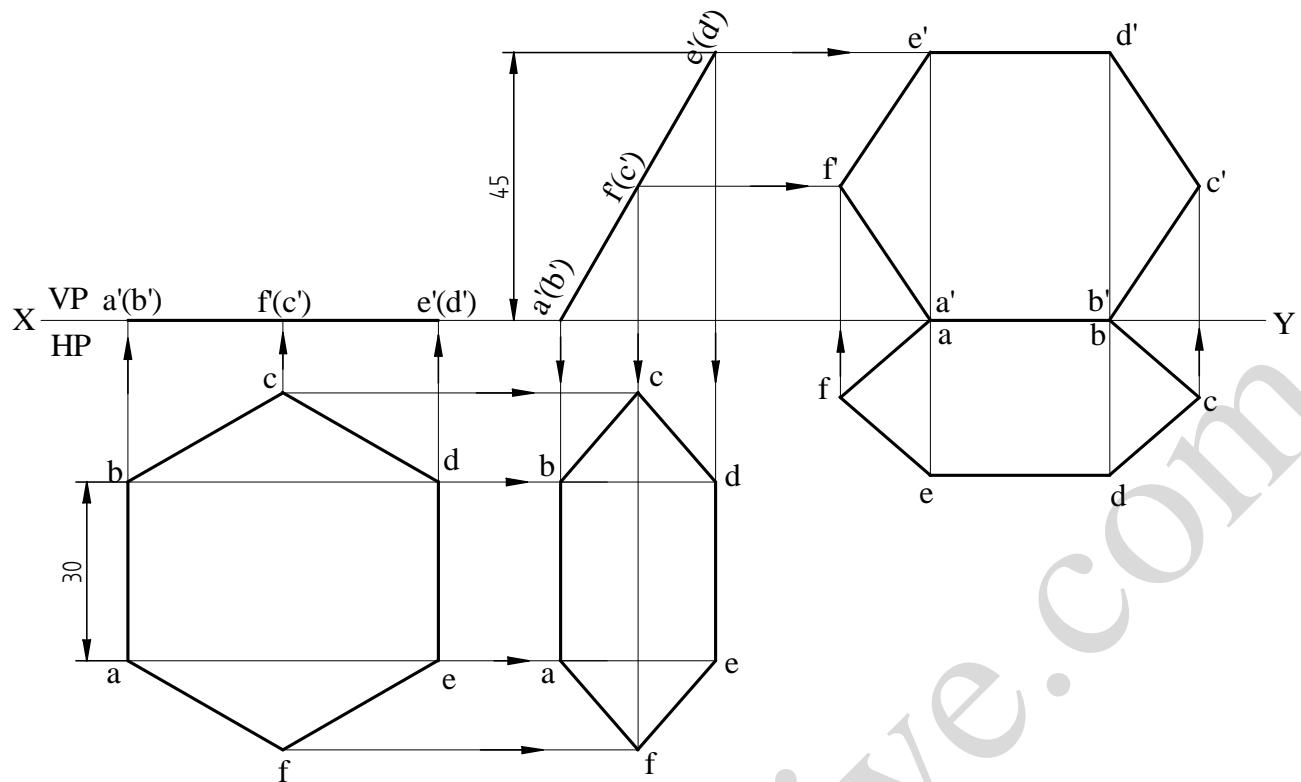
37. A regular hexagonal lamina of sides 30mm is lying in such a way that one of its sides touches both the reference planes. If the lamina makes 60° with HP. Draw the projections of the lamina.



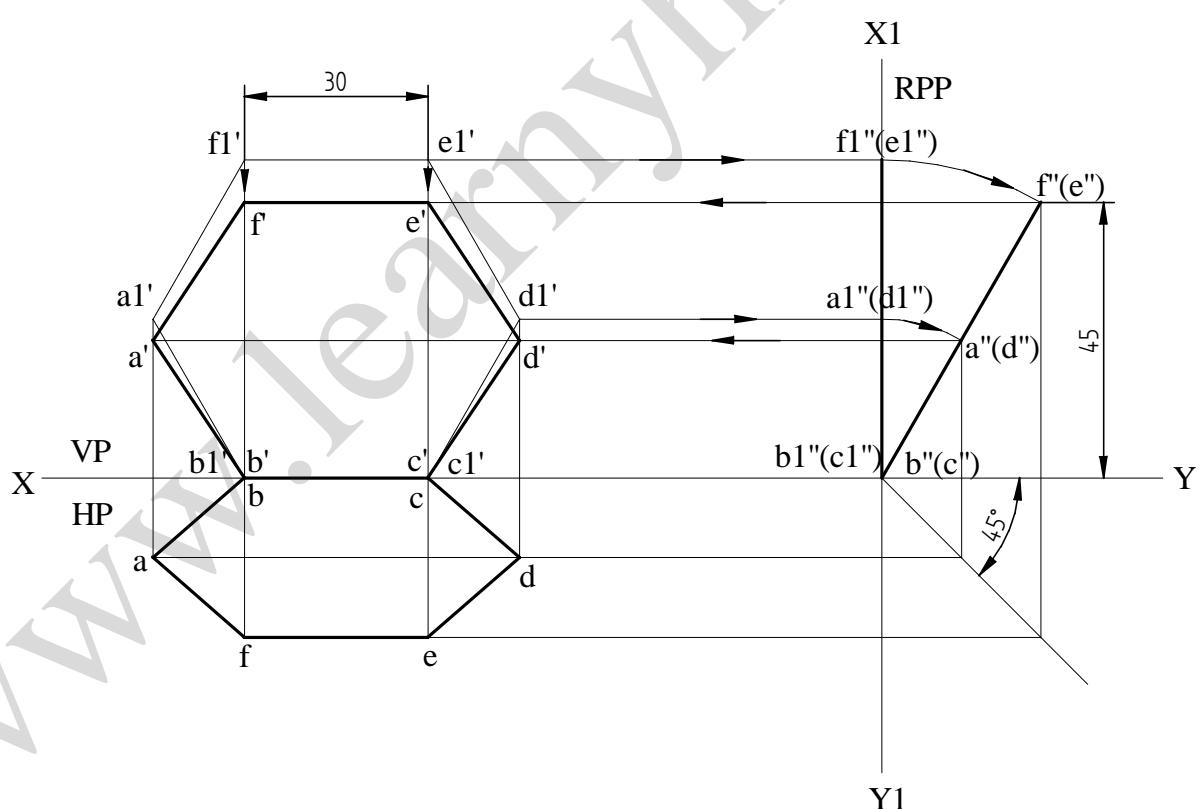
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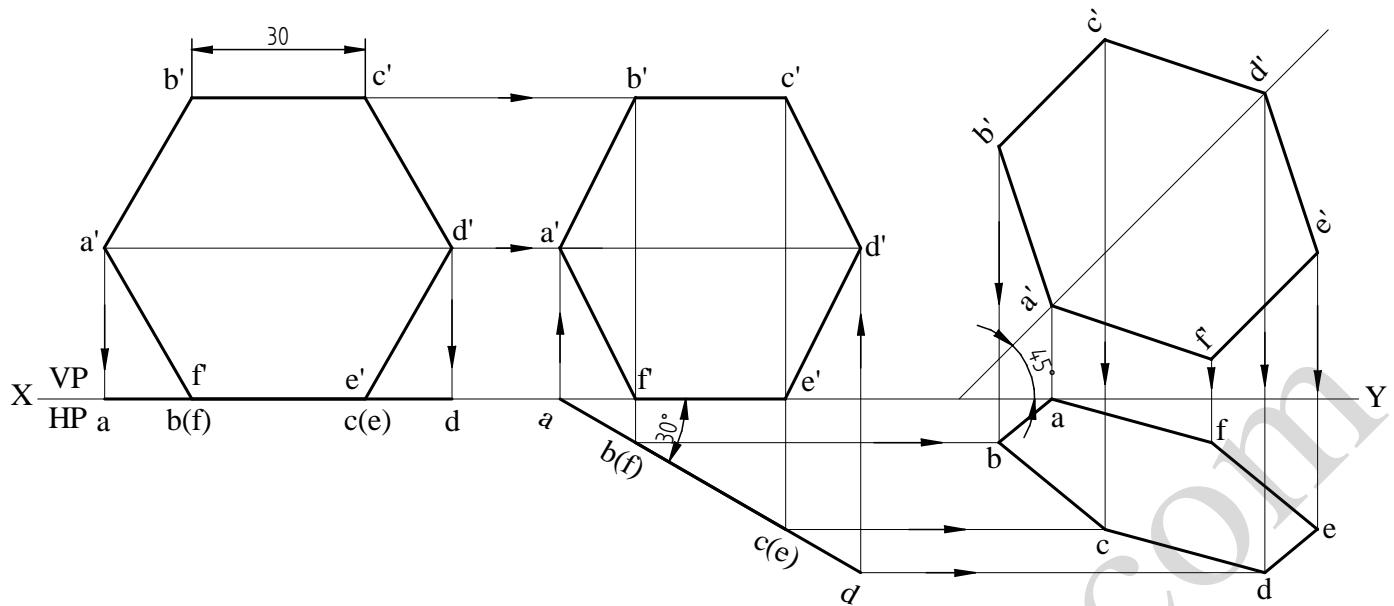
38. A regular hexagonal lamina of side 30mm is lying in such a way that one of its sides touches both the reference planes. If the side opposite to the side on which it rests is 45mm above HP, draw the projections of the lamina.



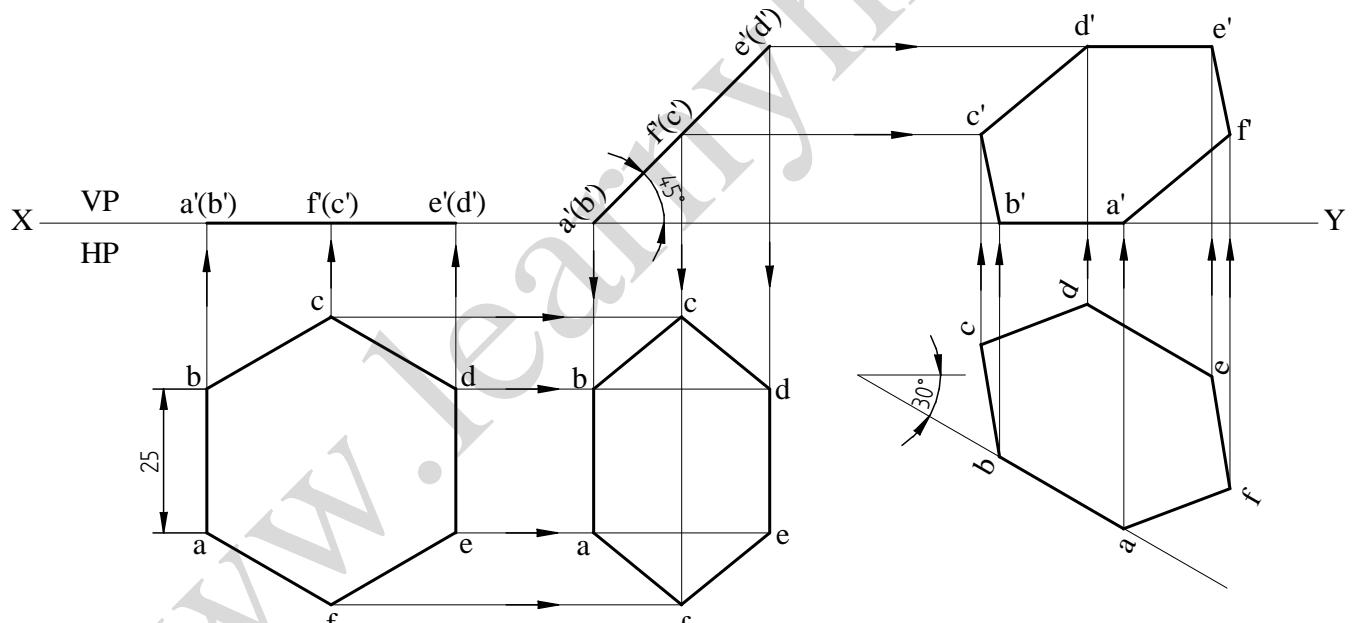
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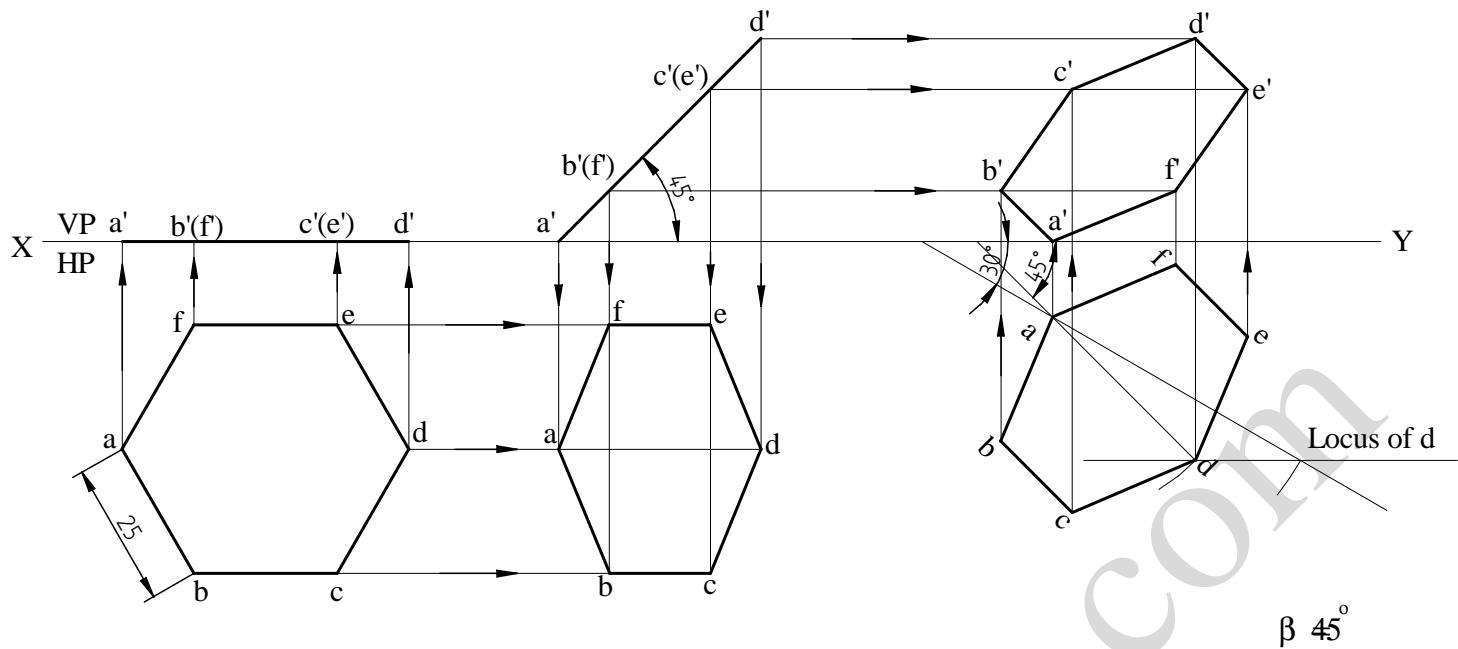
39. A hexagonal lamina of sides 30mm is resting on HP with one of its corners in VP and its surface inclined at an angle of 30° with VP. The diagonal passing through that corner which is in VP appears to be inclined at 45° to HP. Draw the projections of the lamina.



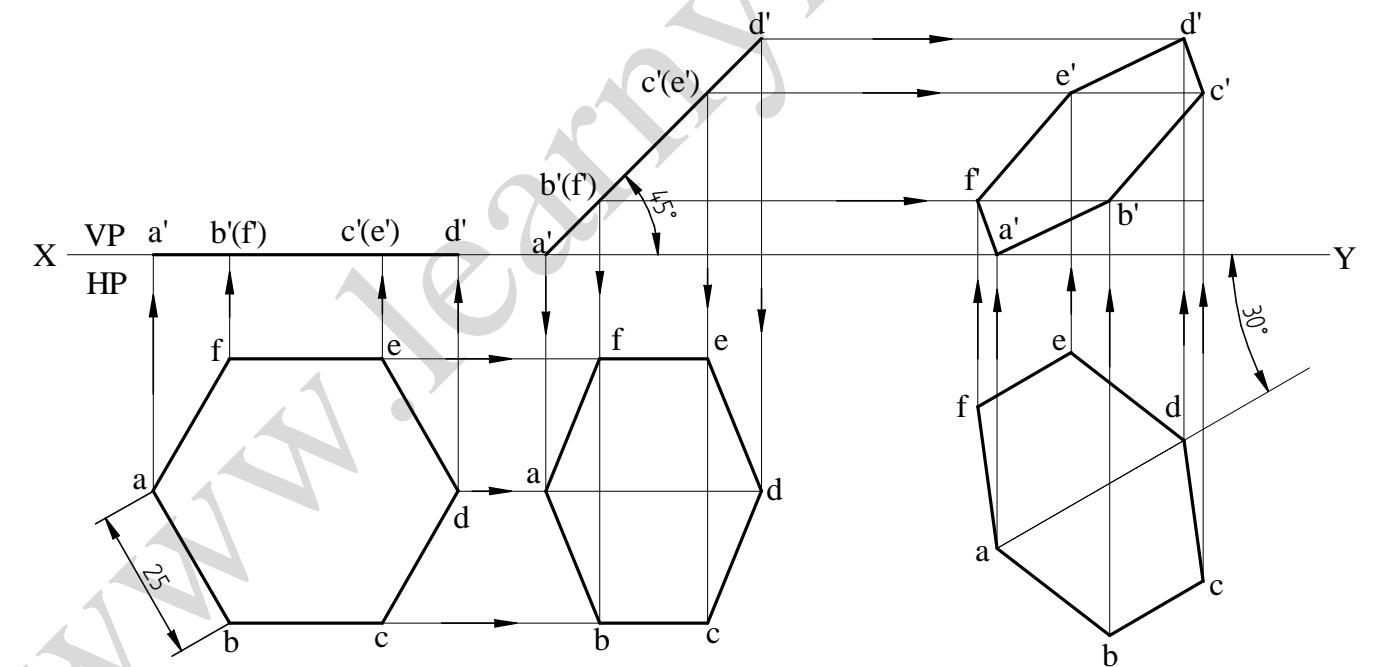
40. A hexagonal lamina of sides 25mm rests on one of its sides on HP. The lamina makes 45° to HP and the side on which it rests makes 30° to VP. Draw the projections.



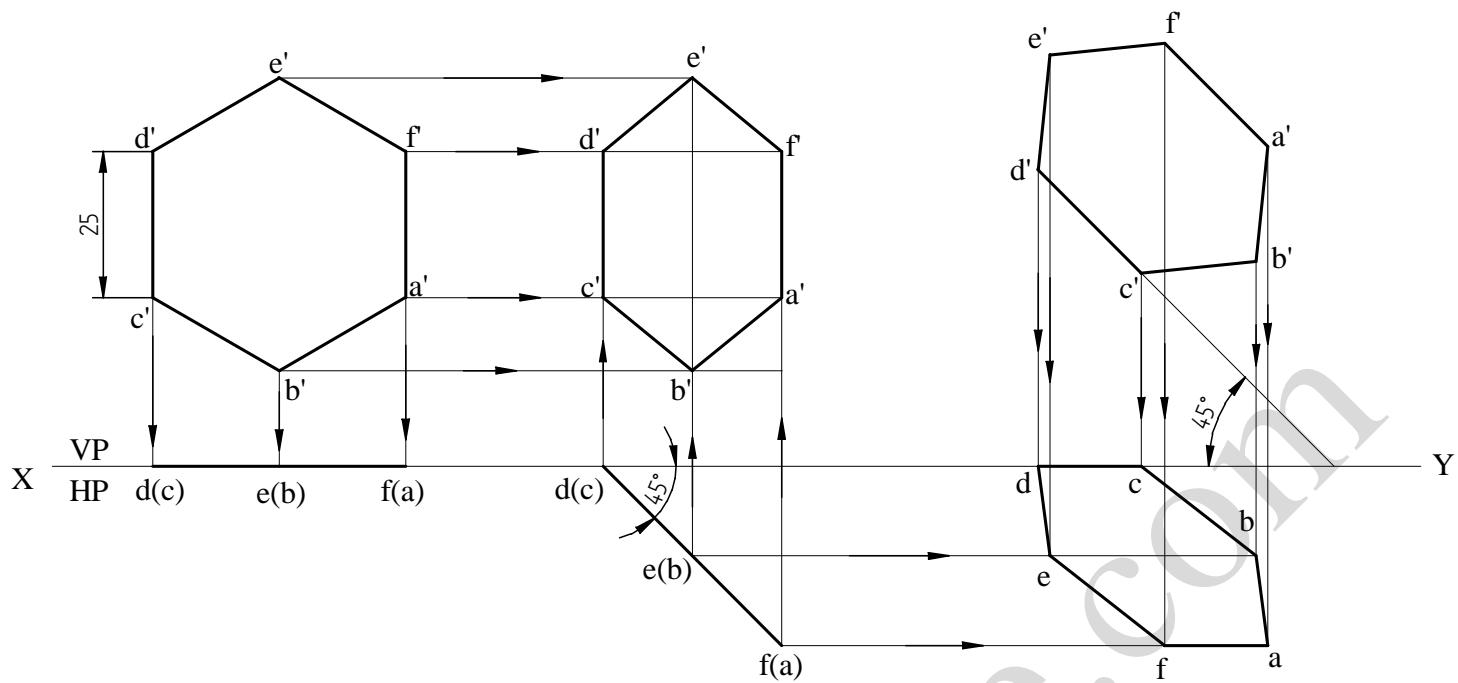
41. A hexagonal lamina of sides 25mm rests on one of its corner on HP. The lamina makes 45° to HP and the diagonal passing through the corner on which it rests is inclined at 30° to VP. Draw its projections.



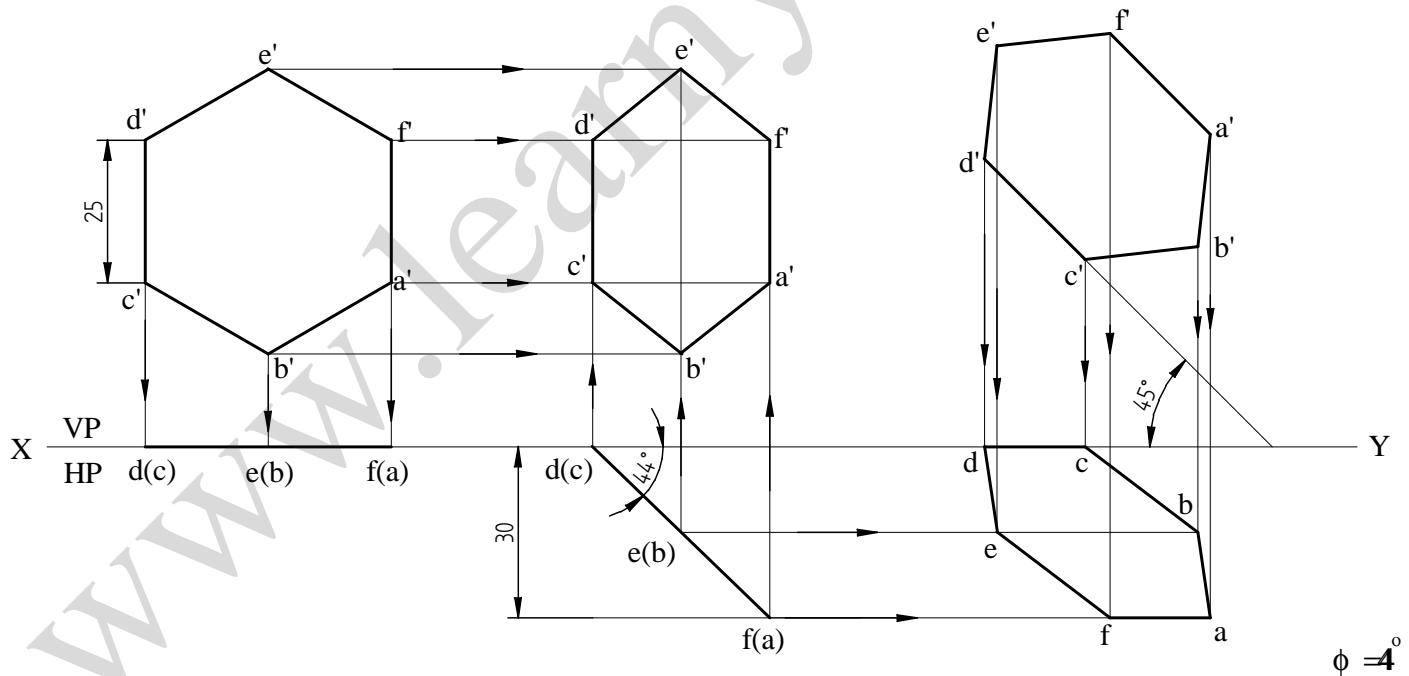
42. A hexagonal lamina of sides 25mm rests on one of its corners on HP. The lamina makes 45° to HP and the diagonal passing through the corner on which it rests appears to be inclined at 30° to VP. Draw its projections.



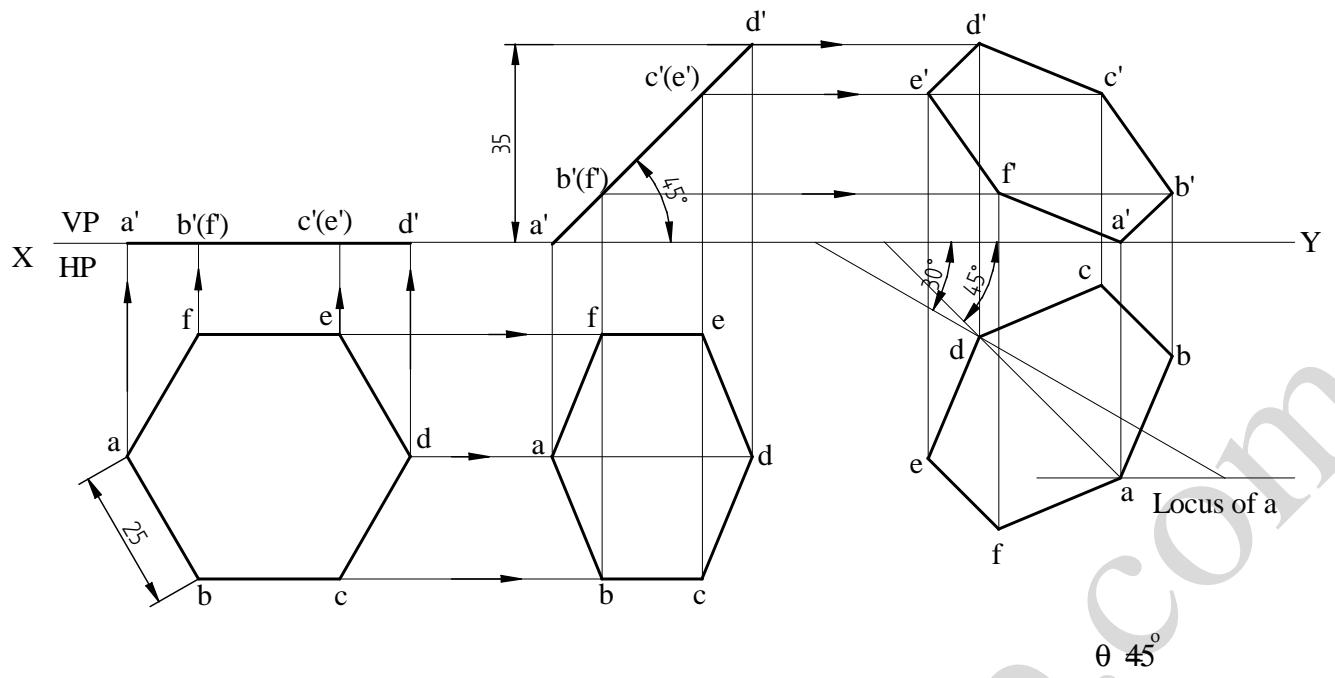
43. A hexagonal lamina of sides 25mm rests on one of its sides on VP. The lamina makes 45° to VP and the side on which it rests makes 45° to HP. Draw the projections.



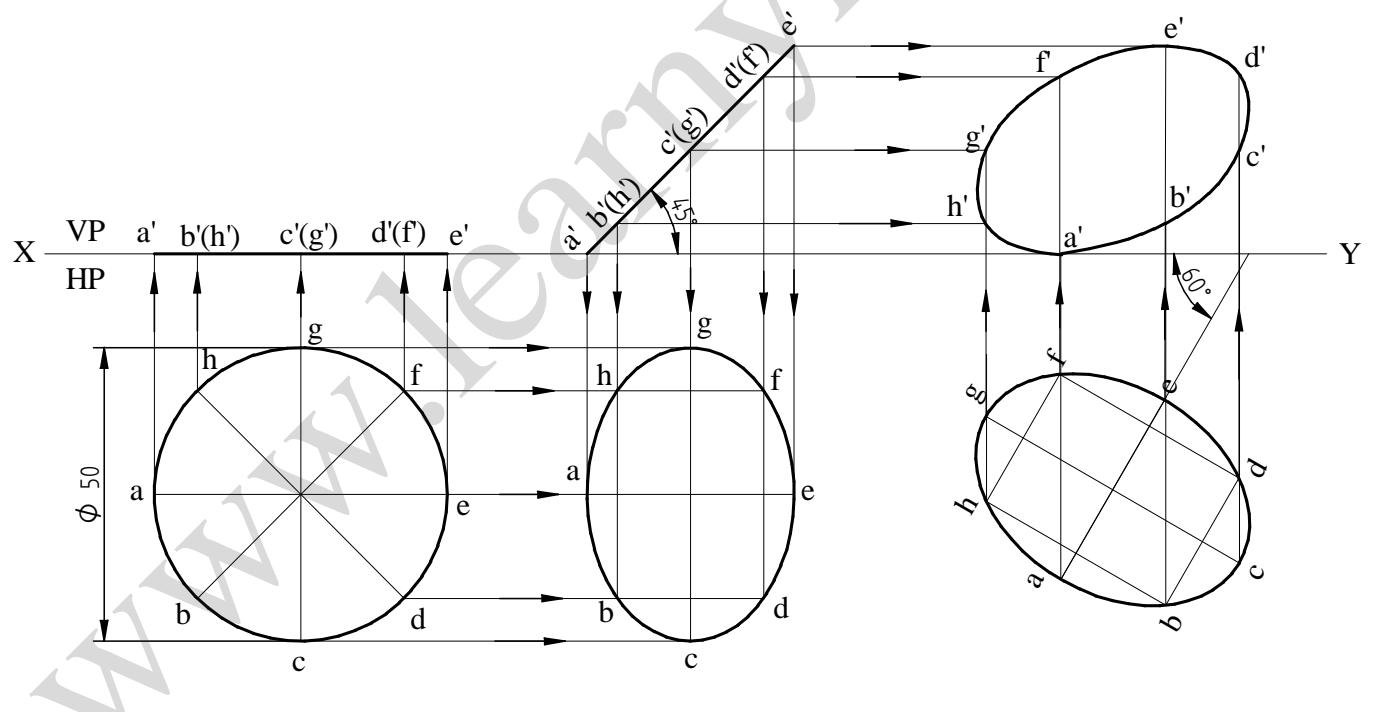
44. A hexagonal lamina of sides 25mm rests on one of its sides on VP. The side opposite to the side on which it rests is 30mm in front of VP and the side on which it rests makes 45° to HP. Draw the projections. Also determine the inclinations of the lamina with the reference planes.



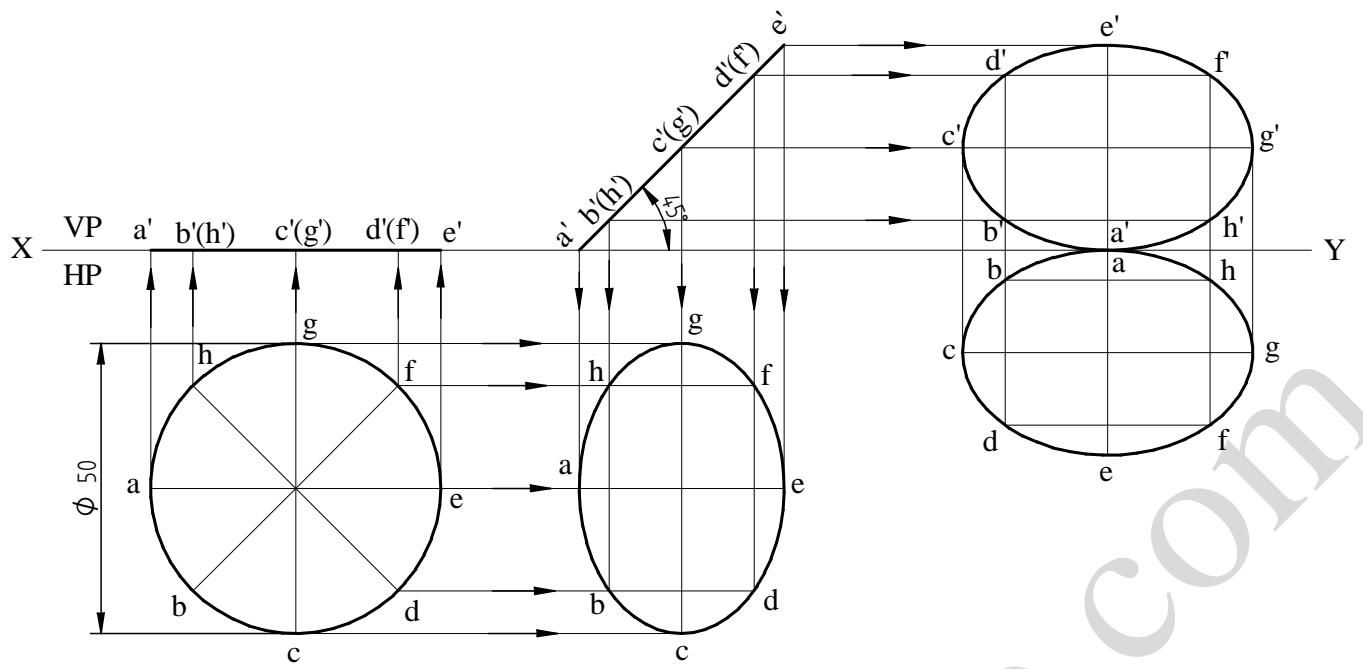
45. A hexagonal lamina of sides 25mm rests on one of its corner on HP. The corner opposite to the corner on which it rests is 35mm above HP and the diagonal passing through the corner on which it rests is inclined at 30° to VP. Draw its projections. Find the inclination of the surface with HP.



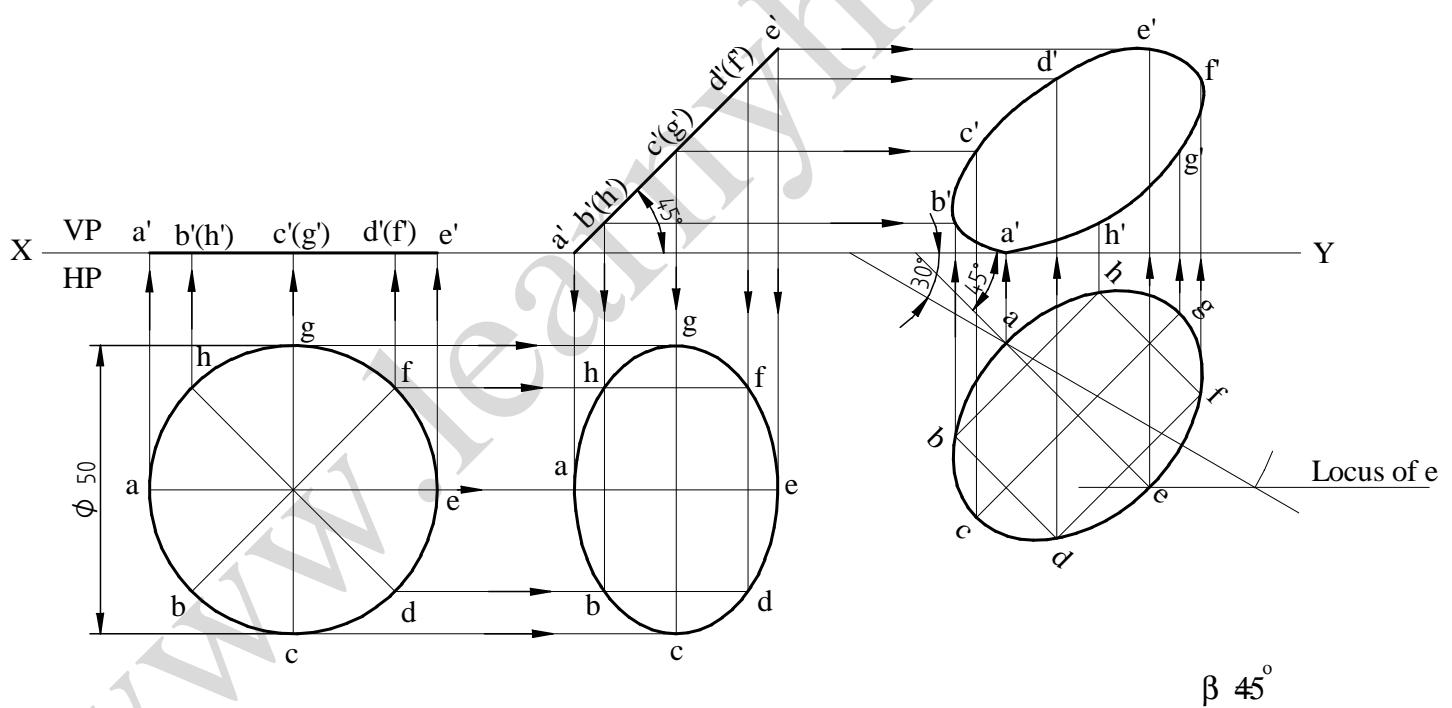
46. Draw the projections of a circular plate of negligible thickness of 50mm diameter resting on HP on a point A on the circumference, with its plane inclined at 45° to HP and the top view of the diameter passing through the resting point makes 60° with VP.



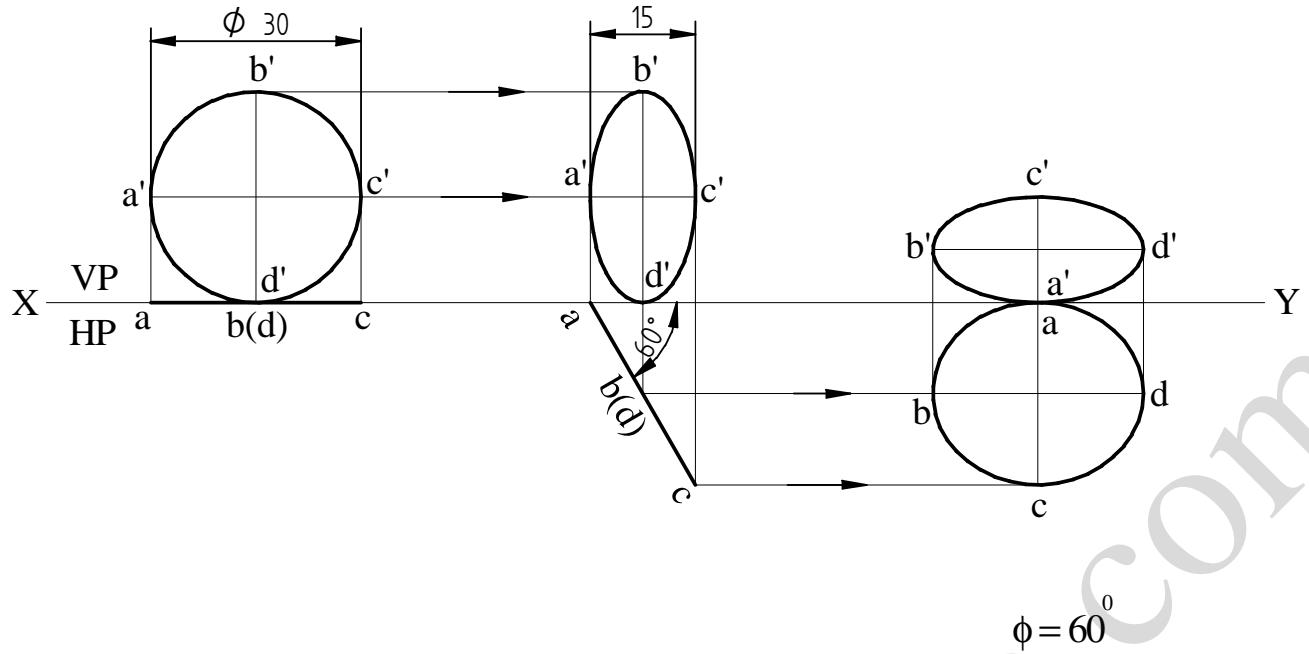
47. A circular lamina of 50mm diameter is standing with one of its points on the rim on HP and the lamina is inclined at 45° to HP. The diameter at right angles to the diameter which is passing through the point on which the lamina rests is parallel to VP. Draw its projections.



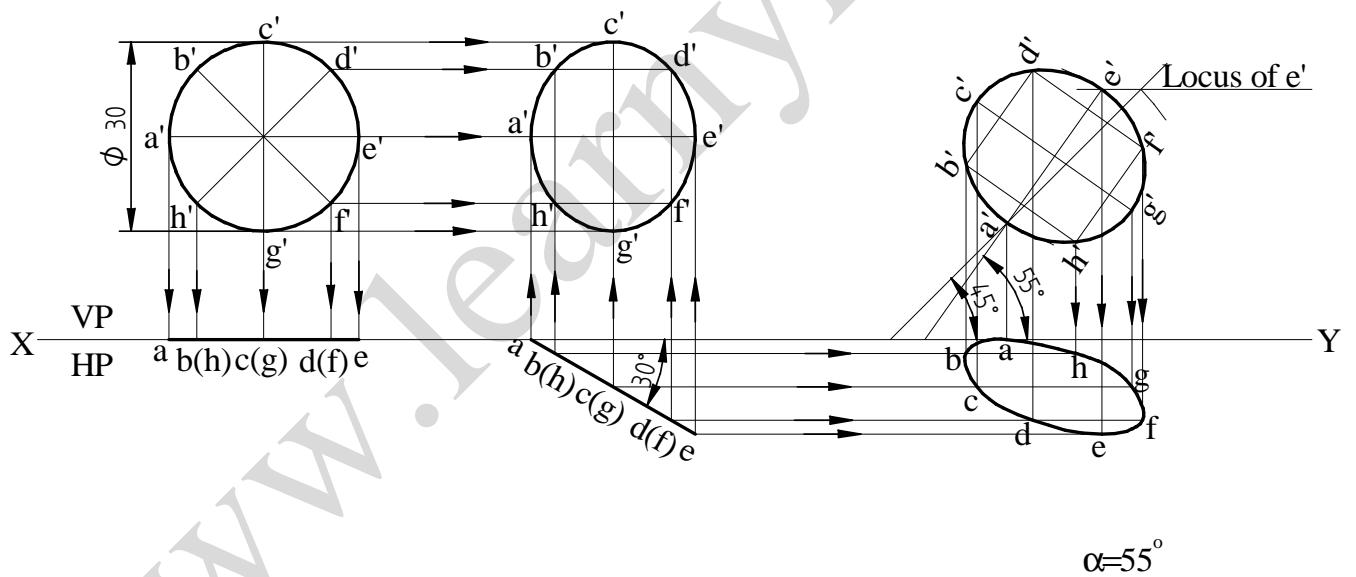
48. A circular lamina of 50mm diameter rests on HP such that one of its diameters is inclined at 30° to VP and 45° to HP. Draw its top and front views in this position.



49. A circular lamina inclined to the VP appears in the front view as an ellipse of major axis 30mm and minor axis 15mm. The major axis is parallel to both HP and VP. One end of the minor axis is in both the HP and VP. Draw the projections of the lamina and determine the inclination of the lamina with the VP.



50. A circular lamina of 30mm diameter rests on VP such that one of its diameters is inclined at 30° to VP and 45° to HP. Draw its top and front views in this position.



Projections of Solids

Solid

A solid is a 3-D object having length, breadth and thickness and bounded by surfaces which may be either plane or curved, or combination of the two. Solids are classified under two main headings

- Polyhedron
- Solids of revolution

A regular polyhedron is solid bounded only by plane surfaces (faces). Its faces are formed by regular polygons of same size and all dihedral angles are equal to one another. When faces of a polyhedron are not formed by equal identical faces, they may be classified into prisms and pyramids.

Prism

Prisms are polyhedron formed by two equal parallel regular polygon, end faces connected by side faces which are either rectangles or parallelograms.

Some definitions regarding prisms

Base and lateral faces: When the prism is placed vertically on one of its end faces, the end face on which the prism rests is called the base. The vertical side faces are the lateral faces.

Base edge/Shorter edge: These are the sides of the end faces.

Axis – It is the imaginary line connecting the end faces.

Longer edge/lateral edges: These are the edges connecting the respective corners of the two end faces.

Right prism – A prism whose axis is perpendicular to its end face is called as a right prism. Prisms are named according to the shape of their end faces, i.e, if end faces are triangular, prism is called a triangular prism.

Oblique prism: It is the prism in which the axis is inclined to its base.

Pyramids

Pyramid is a polyhedron formed by a plane surface as its base and a number of triangles as its side faces, all meeting at a point, called vertex or apex.

Axis – the imaginary line connecting the apex and the center of the base.

Inclined/slant faces – inclined triangular side faces.

Inclined/slant/longer edges – the edges which connect the apex and the base corners.

Right pyramid – when the axis of the pyramid is perpendicular to its base.

Oblique pyramid – when the axis of the pyramid is inclined to its base.

Solids of revolution

When some of the plane figures are revolved about one of their sides – solids of revolution are generated some of the solids of revolution are:

Cylinder: when a rectangle is revolved about one of its sides, the other parallel side generates a cylinder.

Cone: when a right triangle is revolved about one of its sides, the hypotenuse of the right triangle generates a cone.

Sphere: when a semi-circle is revolved about one of its diameter, a sphere is generated.

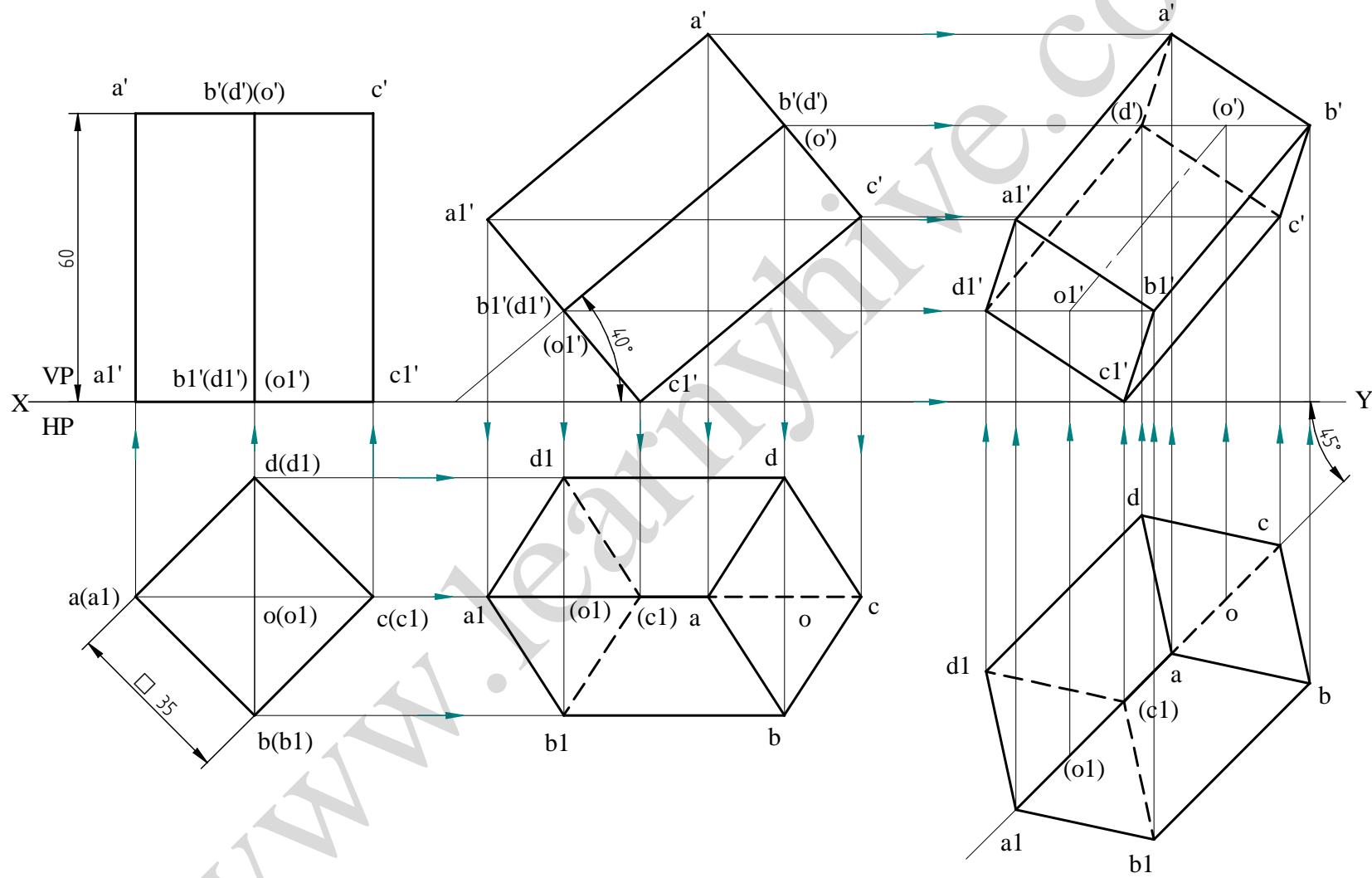
Visibility

When drawing the orthographic views of an object, it will be required to show some of the hidden details as invisible. To distinguish the invisible portions from the visible ones, the invisible edges of the object are shown on the orthographic views by dashed lines. However, in practice, these lines of dashes conveniently and colloquially, but wrongly called as dotted lines. To identify the invisible portions of the object, a careful imaginative thinking is essential.

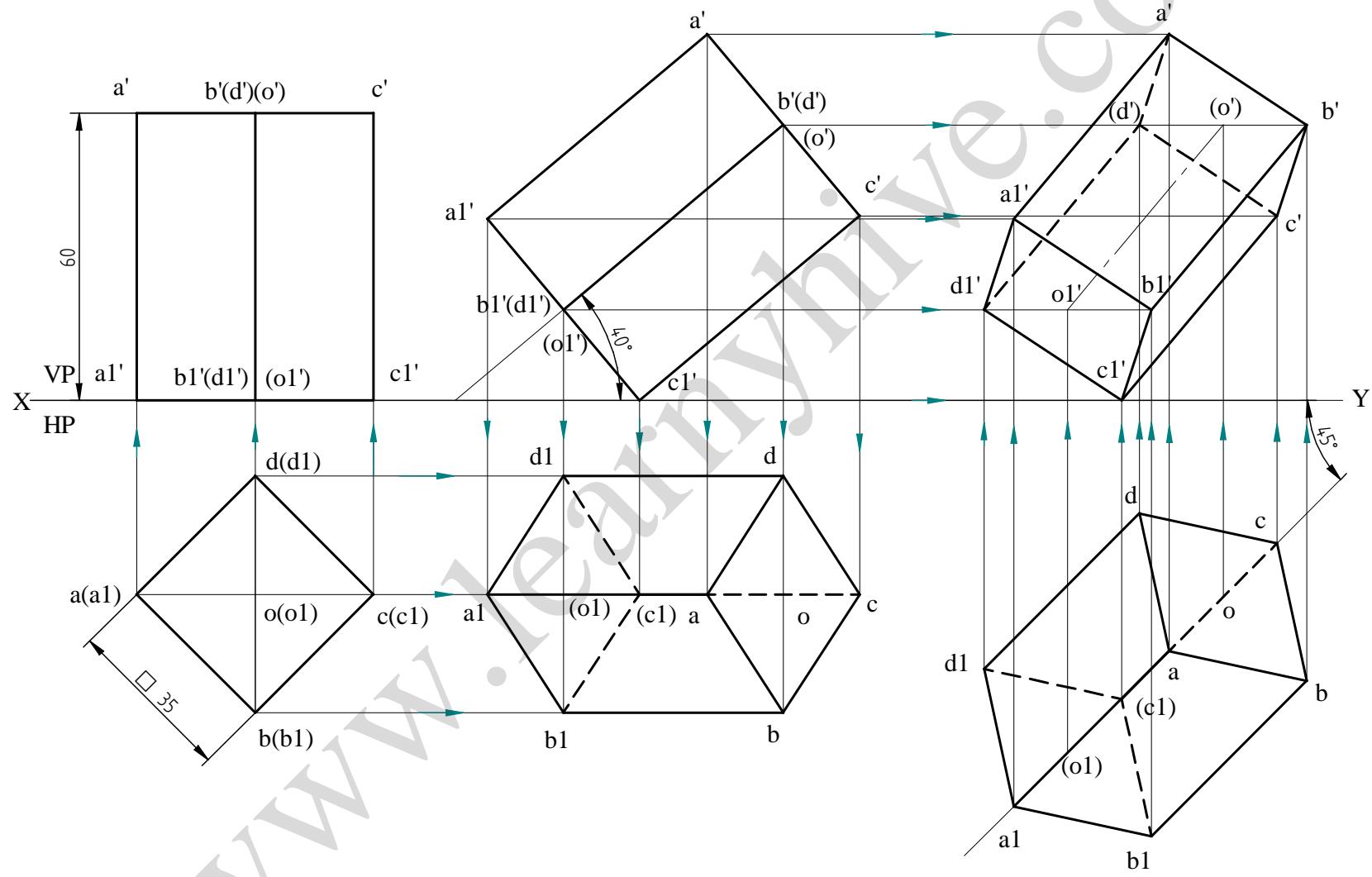
- Projections of solids placed in different positions
- The solids may be placed on HP in various positions
- The way the axis of the solid is held with respect to HP or VP or both -
 - Perpendicular to HP or VP
 - Parallel to either HP or VP and inclined to the other
 - Inclined to both HP and VP

Projections of Solids

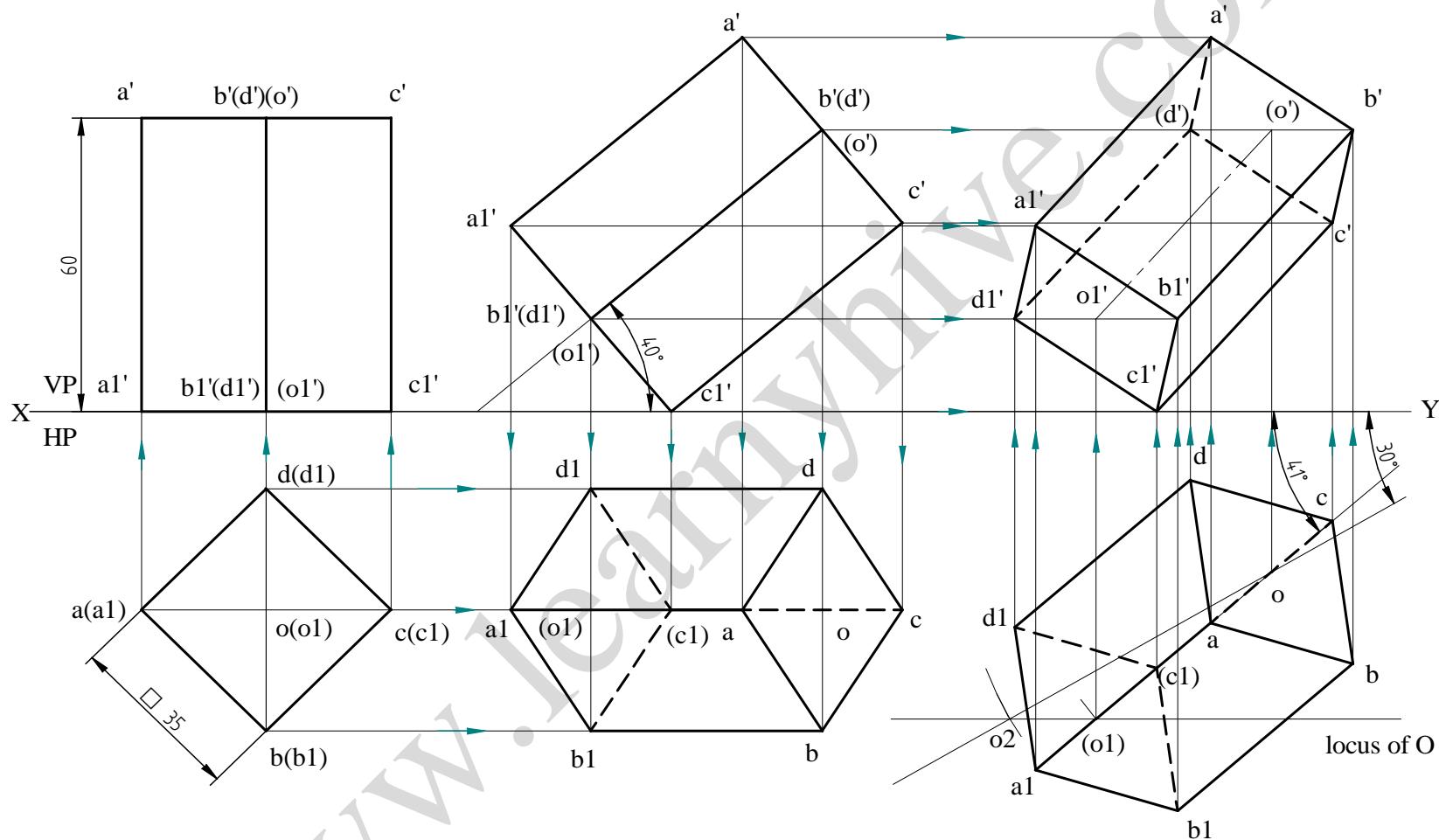
1. A square prism 35mm side of base & 60mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30deg. Draw the projections of the prism when the axis is inclined to HP at 45deg.



2. A square prism 35mm sides of base & 60mm axis length rests on HP on one of its corner of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections of the prism when the axis of the prism is inclined to HP at 40° and appears to be inclined to VP at 45°.

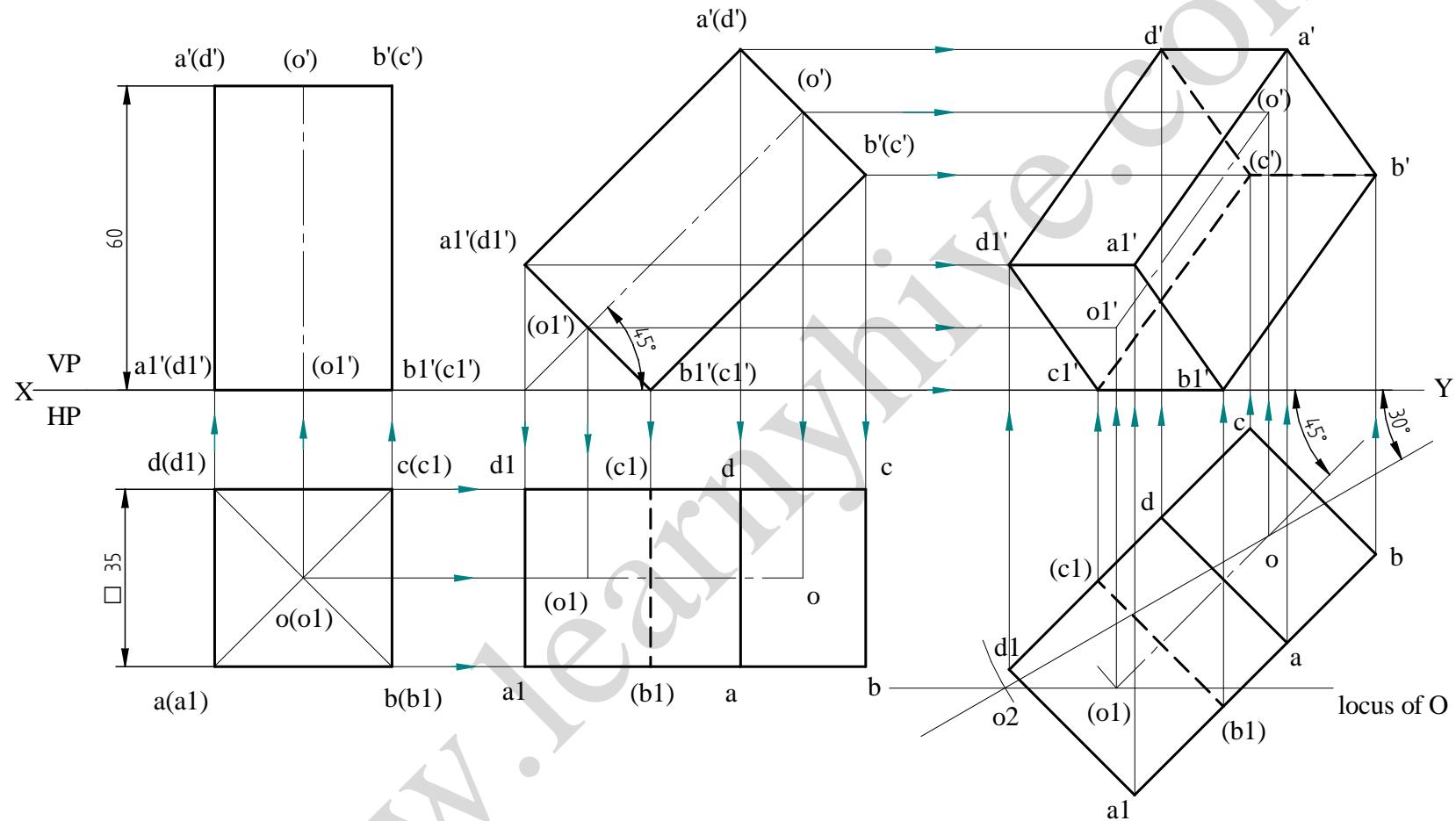


3. A square prism 35mm sides of base & 60mm axis length rests on HP on one of its corner of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections of the prism when the axis of the prism is inclined to HP at 40deg and to VP at 30deg.

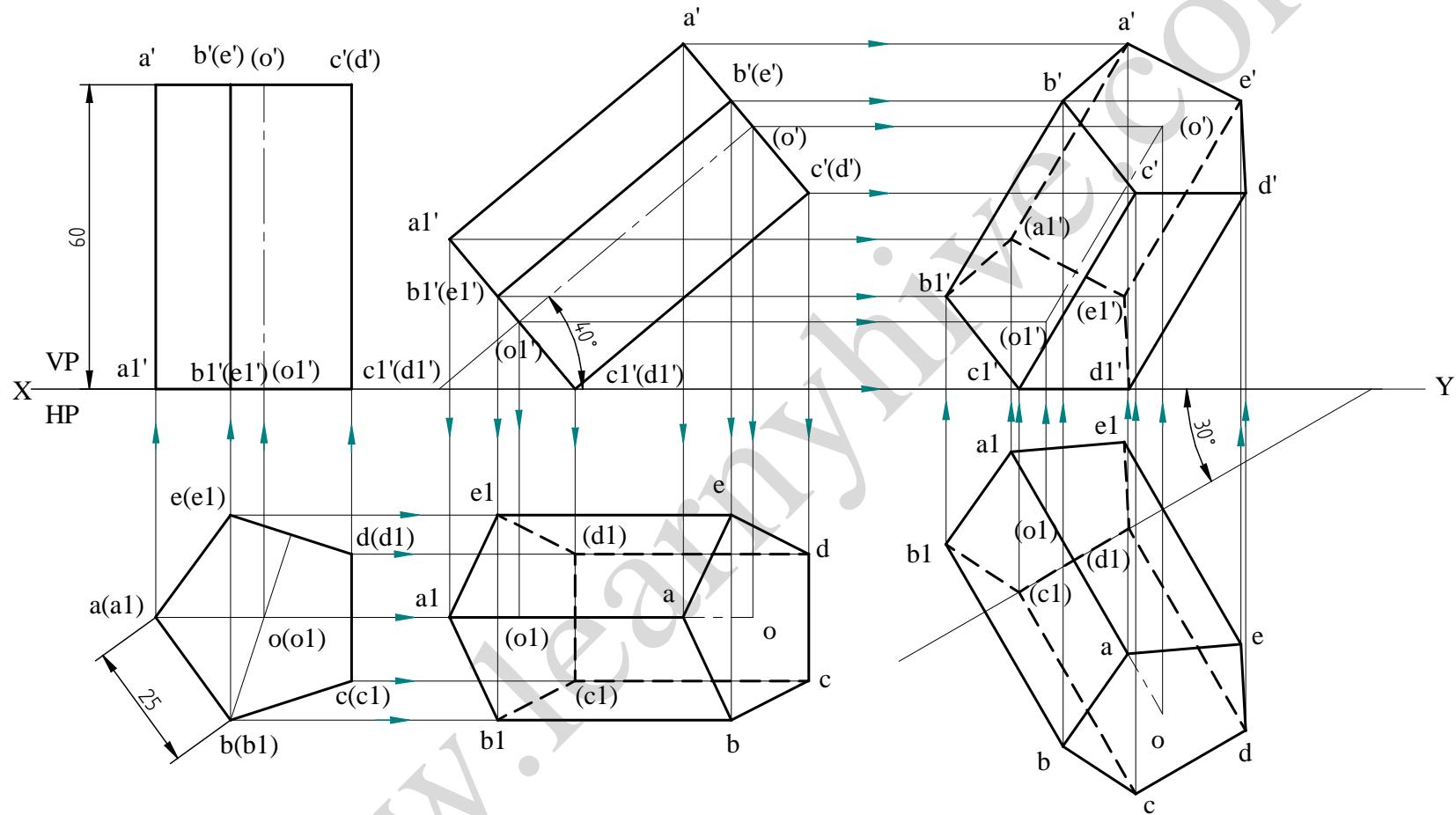


$$\beta = 41 \text{ degree}$$

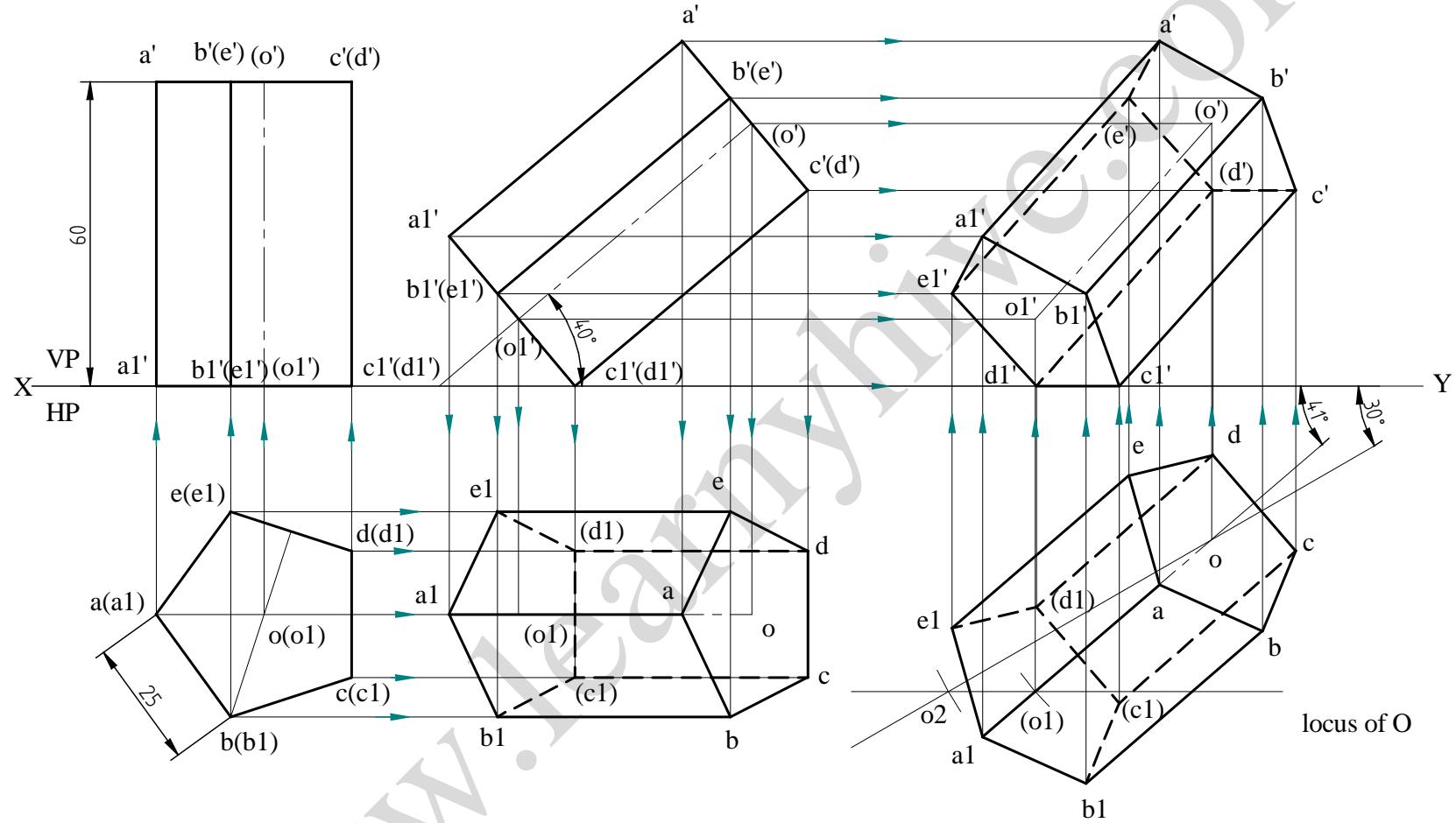
3. A square prism 35mm sides of base & 60mm axis length rests on HP on one of its edges of the base. Draw the projections of the prism when the axis is inclined to Hp at 45deg & VP at 30deg.



05. A pentagonal prism 25mm sides of base & 60mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30deg. Draw the projections of the prism when the axis is inclined to HP at 40deg.

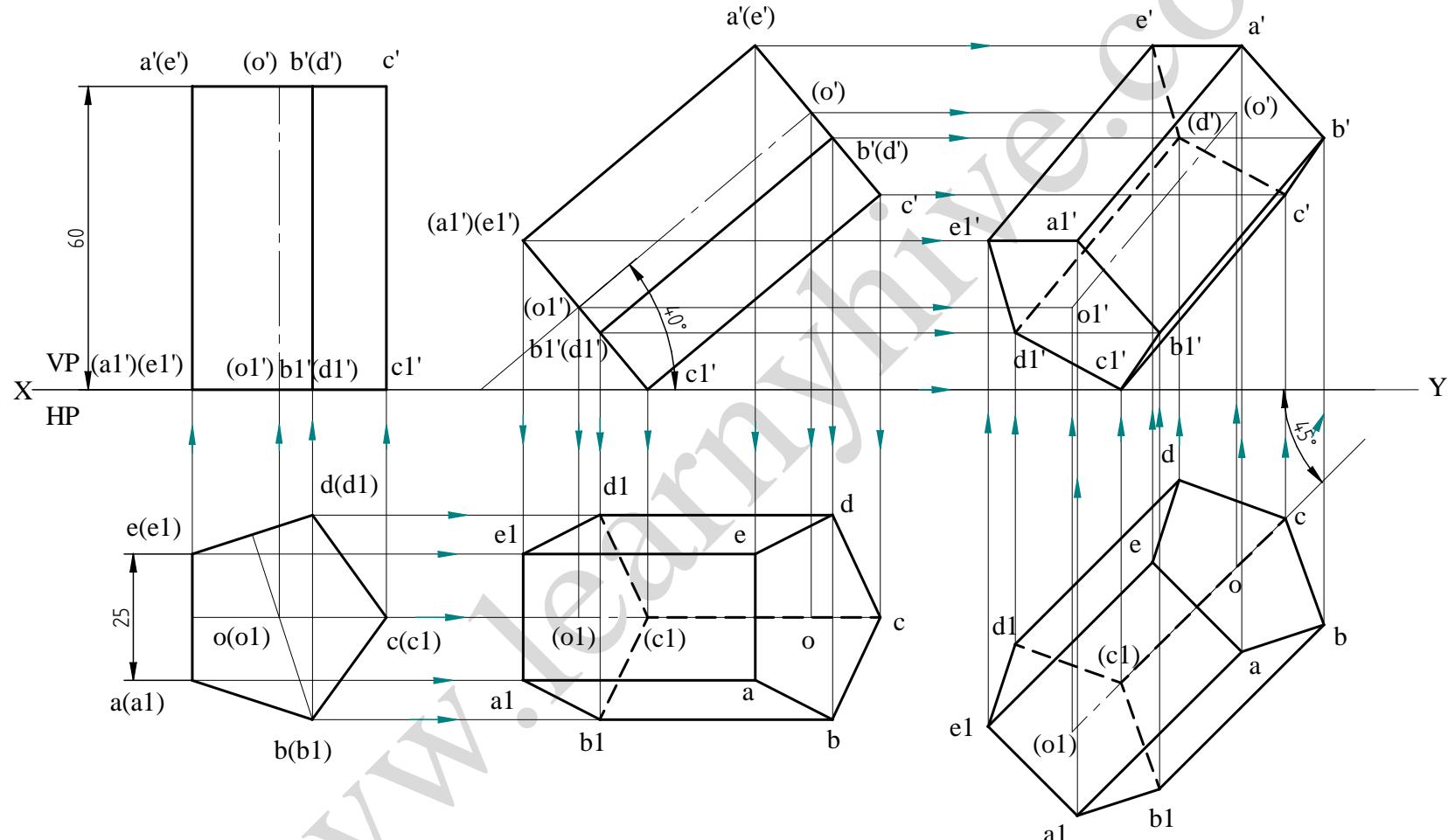


06. A pentagonal prism 25mm sides of base & 60mm axis length rests on HP on one of its edges of the base. Draw the projections of the prism when the axis is inclined to HP at 40deg & VP at 30deg.

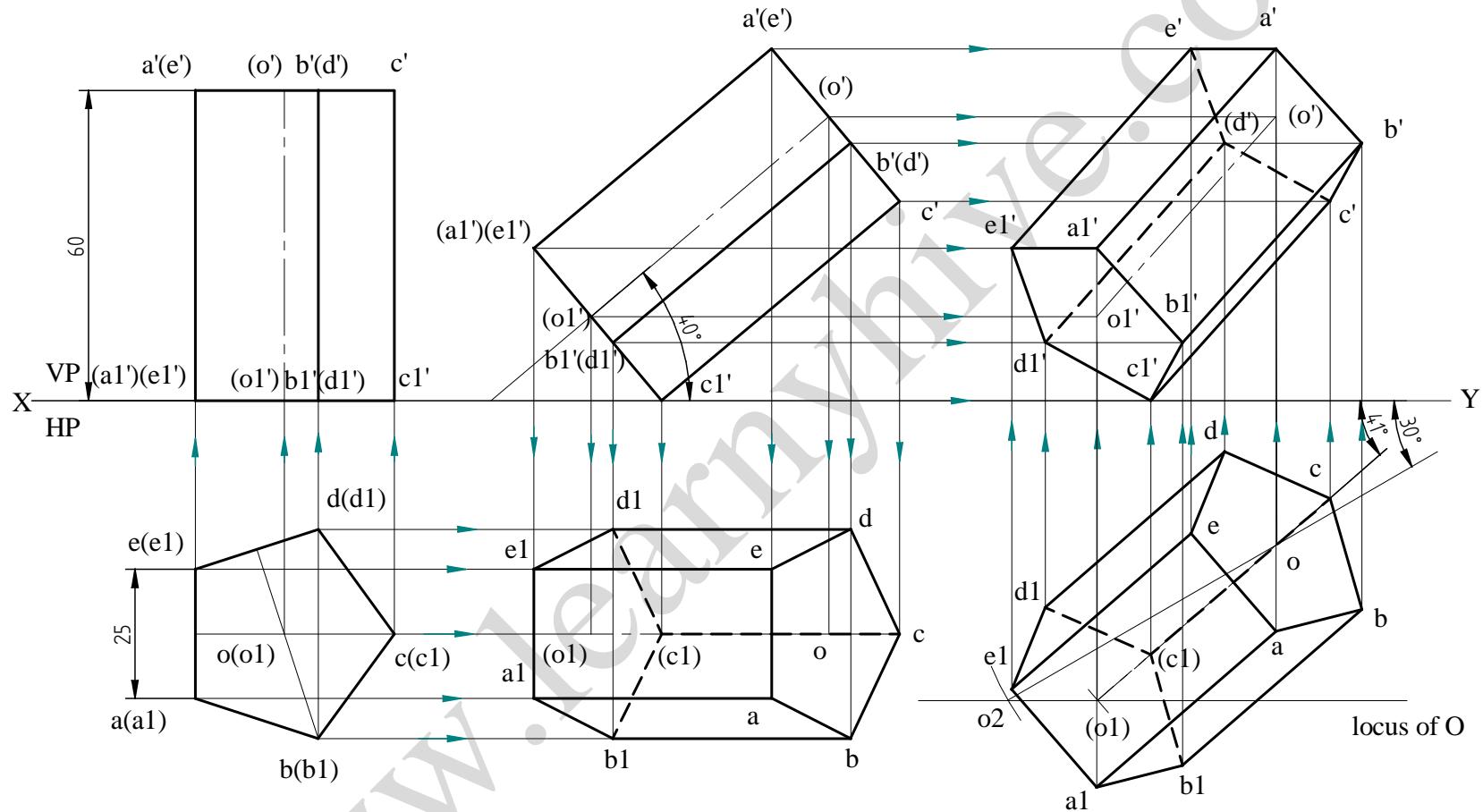


b 41 degree

07. A pentagonal prism 25mm sides of base & 60mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections of the prism when the axis of the prism is inclined to HP at 40° & appears to be inclined to VP at 45°.

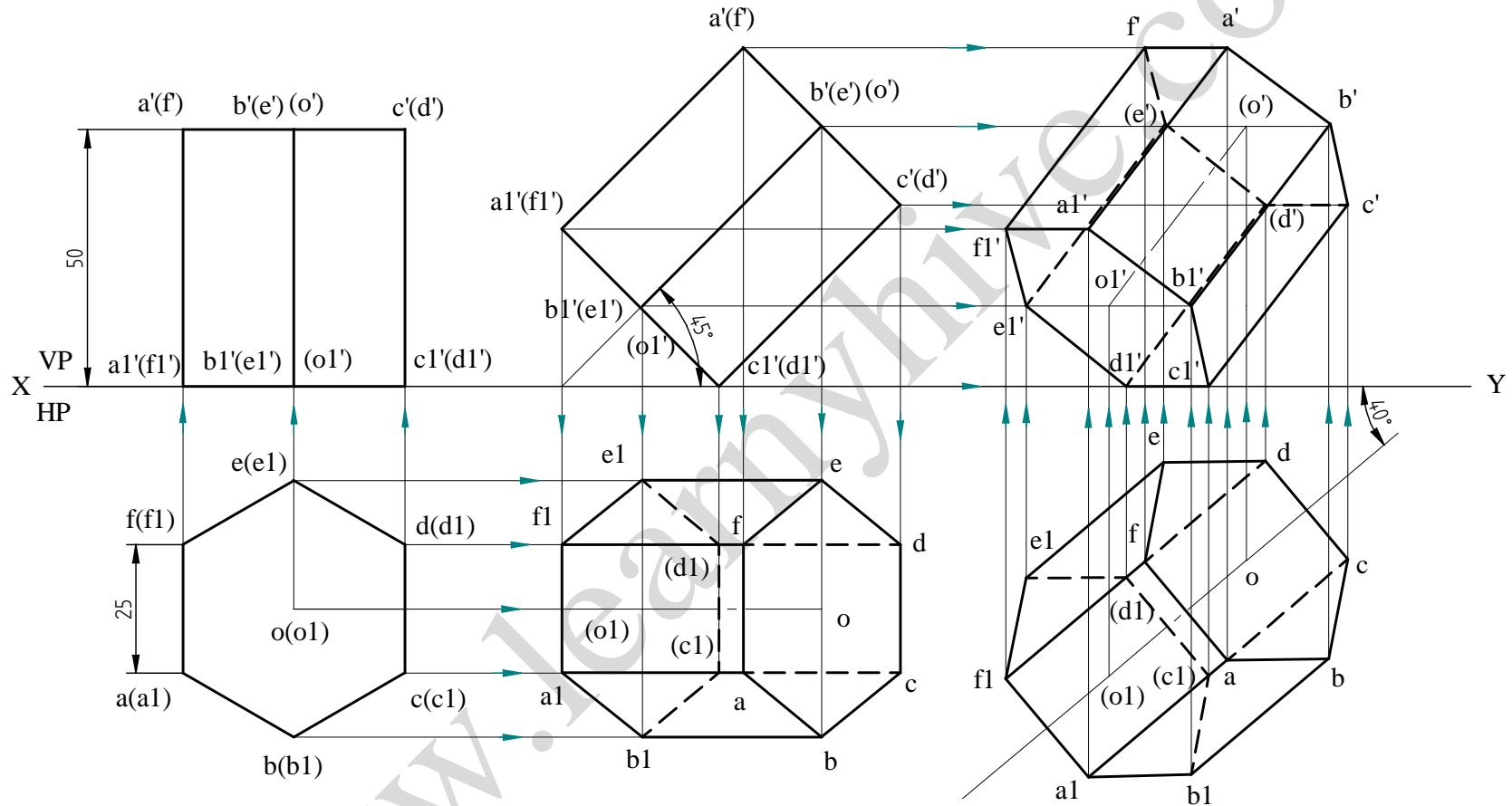


08. A pentagonal prism 25mm sides of base & 60mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections of the prism when the axis of the prism is inclined to HP at 40deg & to VP at 30deg.

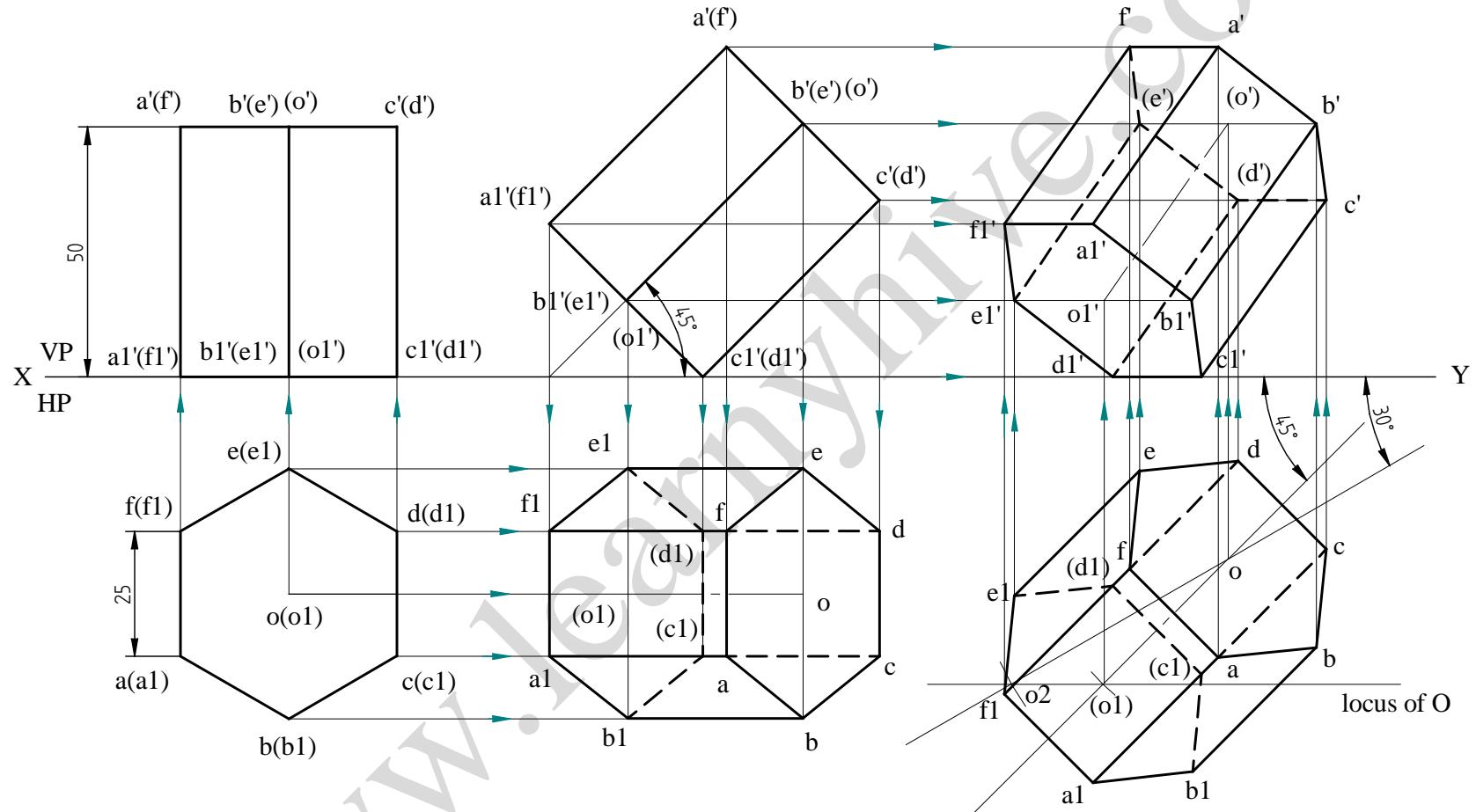


$$\beta = 41 \text{ degree}$$

09. A hexagonal prism 25mm sides of base and 50mm axis length rests on HP on one of its edges. Draw the projections of the prism when the axis is inclined to HP at 45deg & appears to be inclined to VP 40deg.

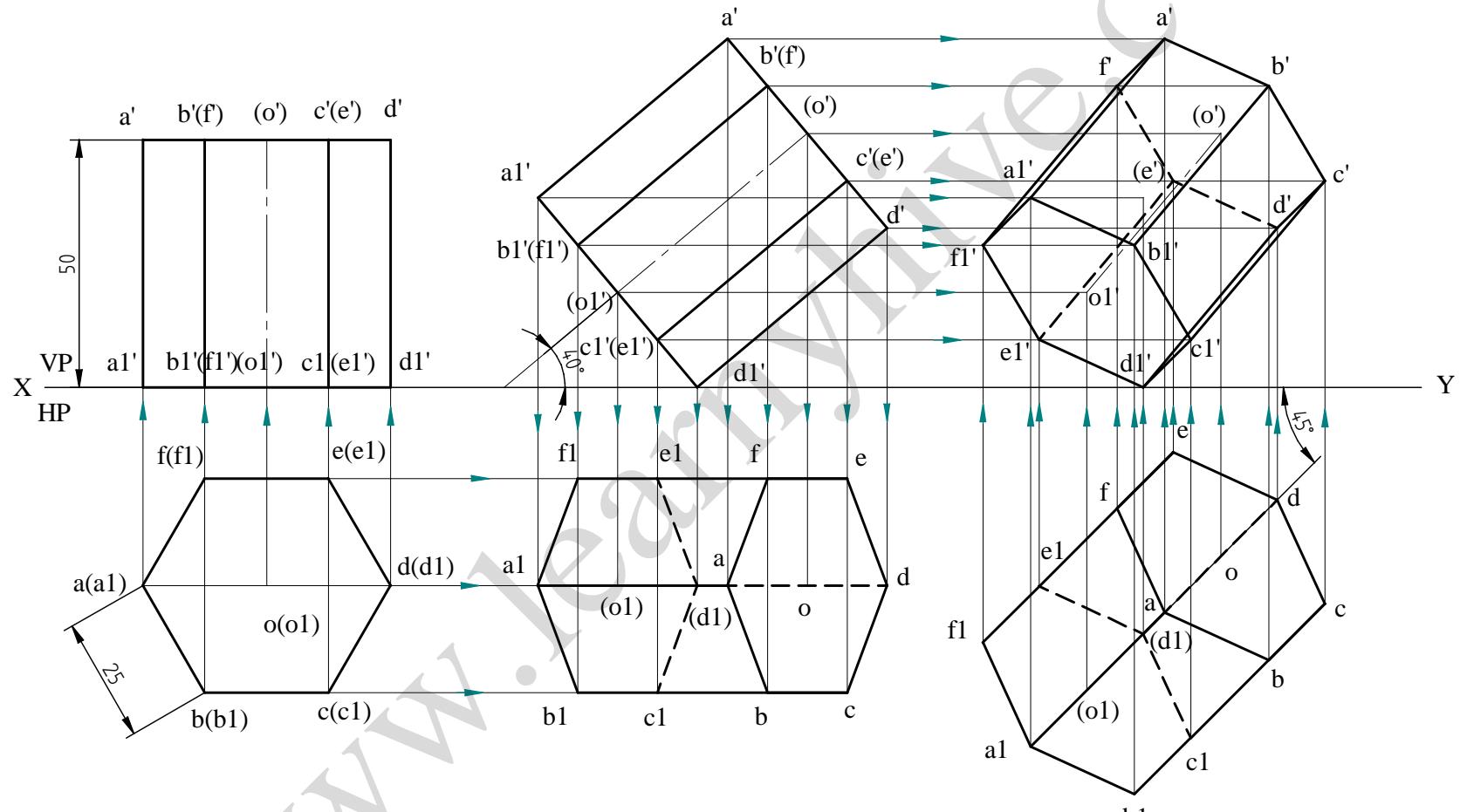


10. A hexagonal prism 25mm sides of base and 50mm axis length rests on HP on one of its edges of the base. Draw the projections of the prism when the axis is inclined to HP at 45deg & VP at 30deg.

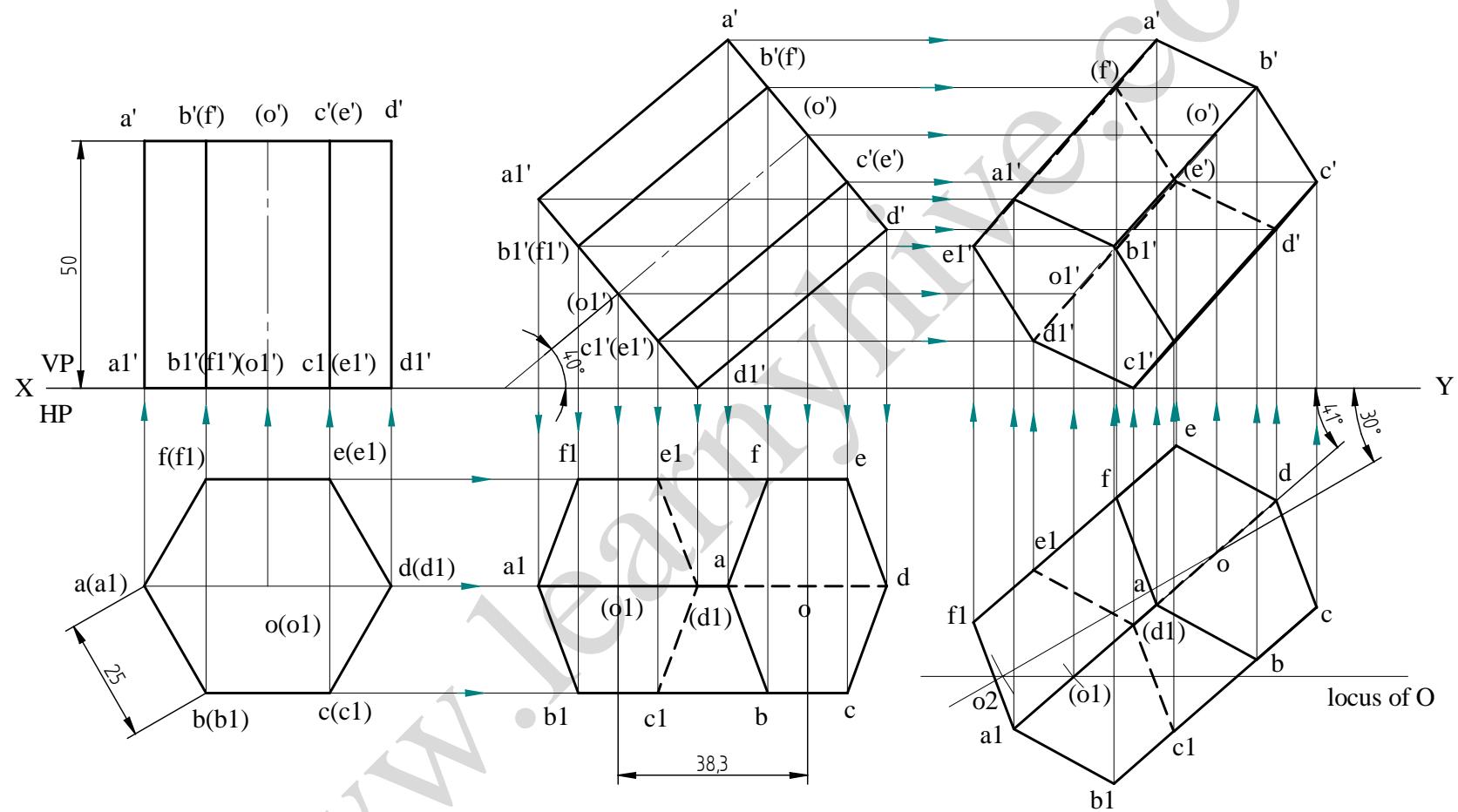


$$\beta = 41 \text{ degree}$$

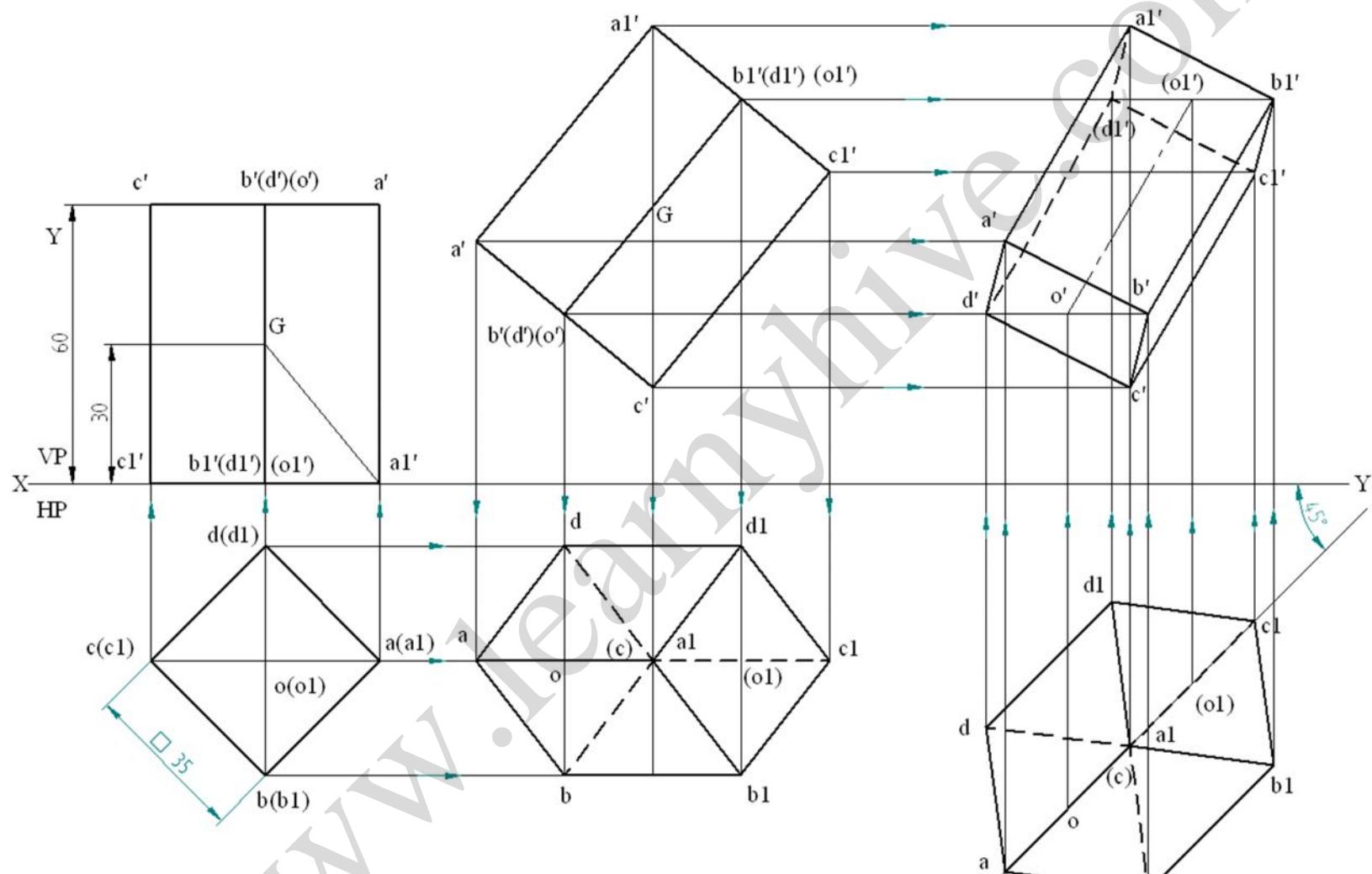
11. A hexagonal prism 25mm sides of base and 50mm axis length rests on HP on one of its edges of the base such that the two base edges containing the corner on which its rests make equal inclinations with HP. Draw the projections of the prism when the axis if the prism is inclined to HP at 40 deg & appears to be inclined to VP at 45deg.



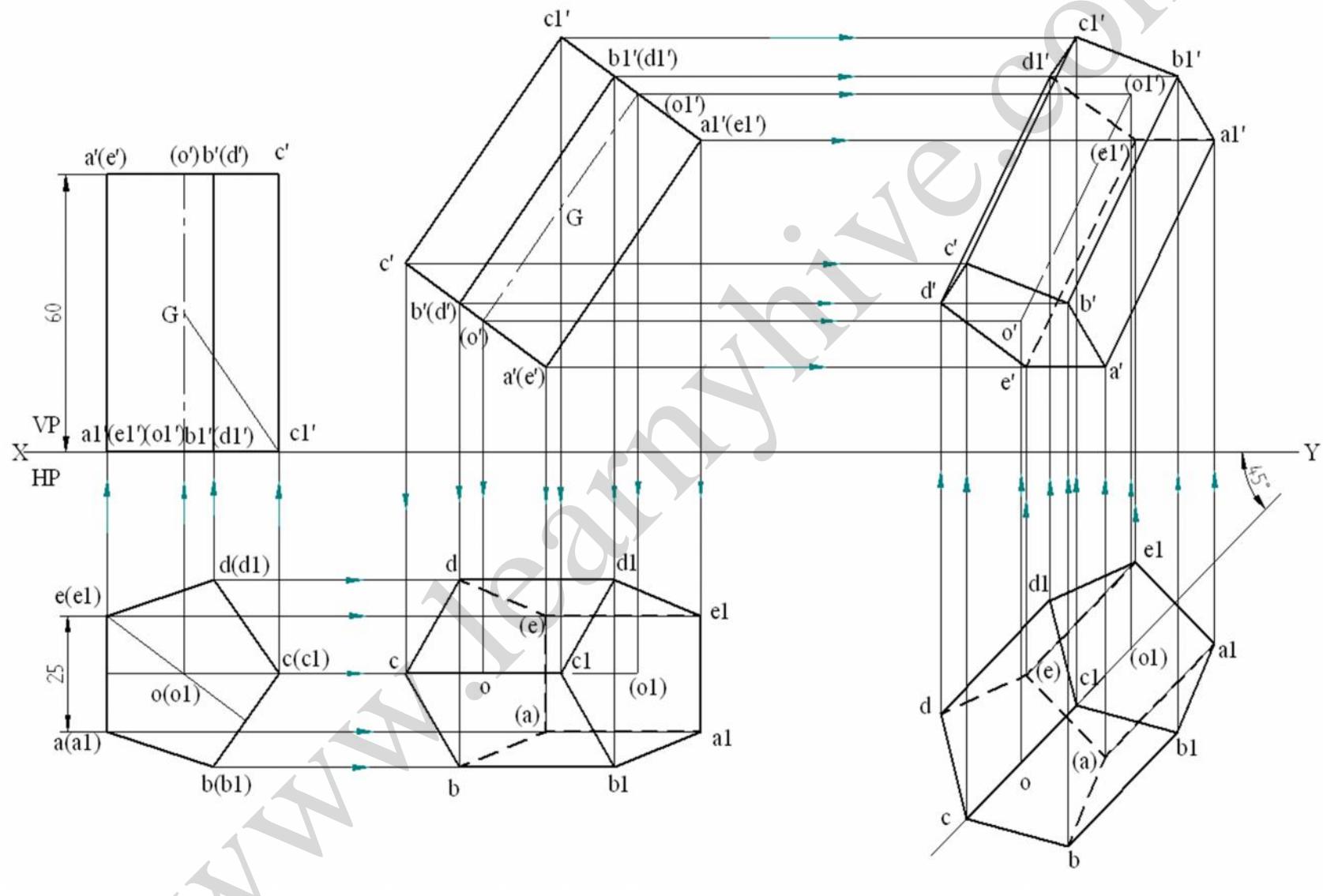
12. A hexagonal prism 25mm sides of base and 50mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which its rests make equal inclinations with HP. Draw the projections of the prism when the axis is inclined to HP at 40 deg & VP at 30deg.



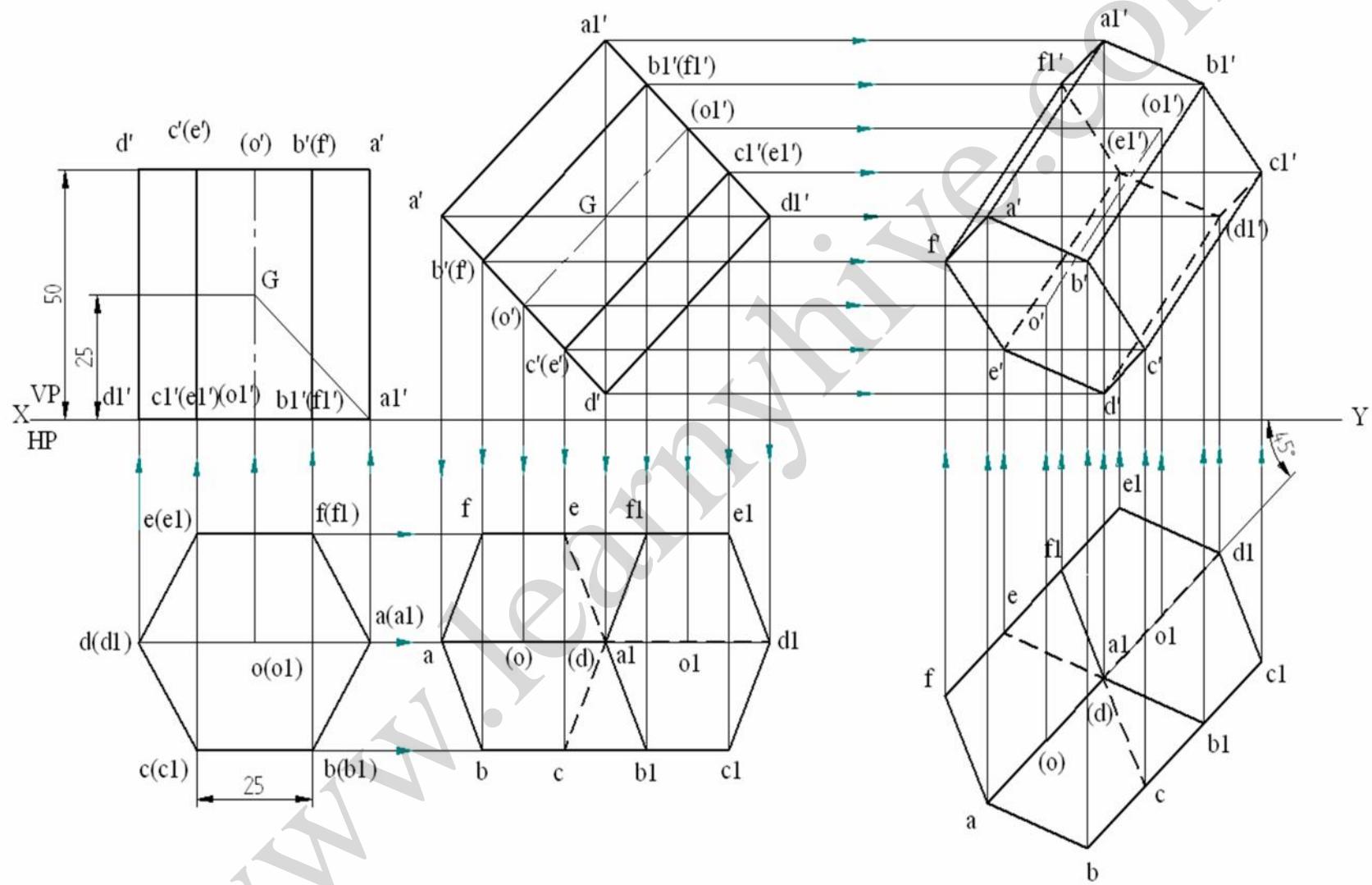
13. A square prism 35mm side of base & 60mm axis length is suspended freely from one of its corners. Draw the projections of the prism when the axis appears to be inclined to VP at 45deg.



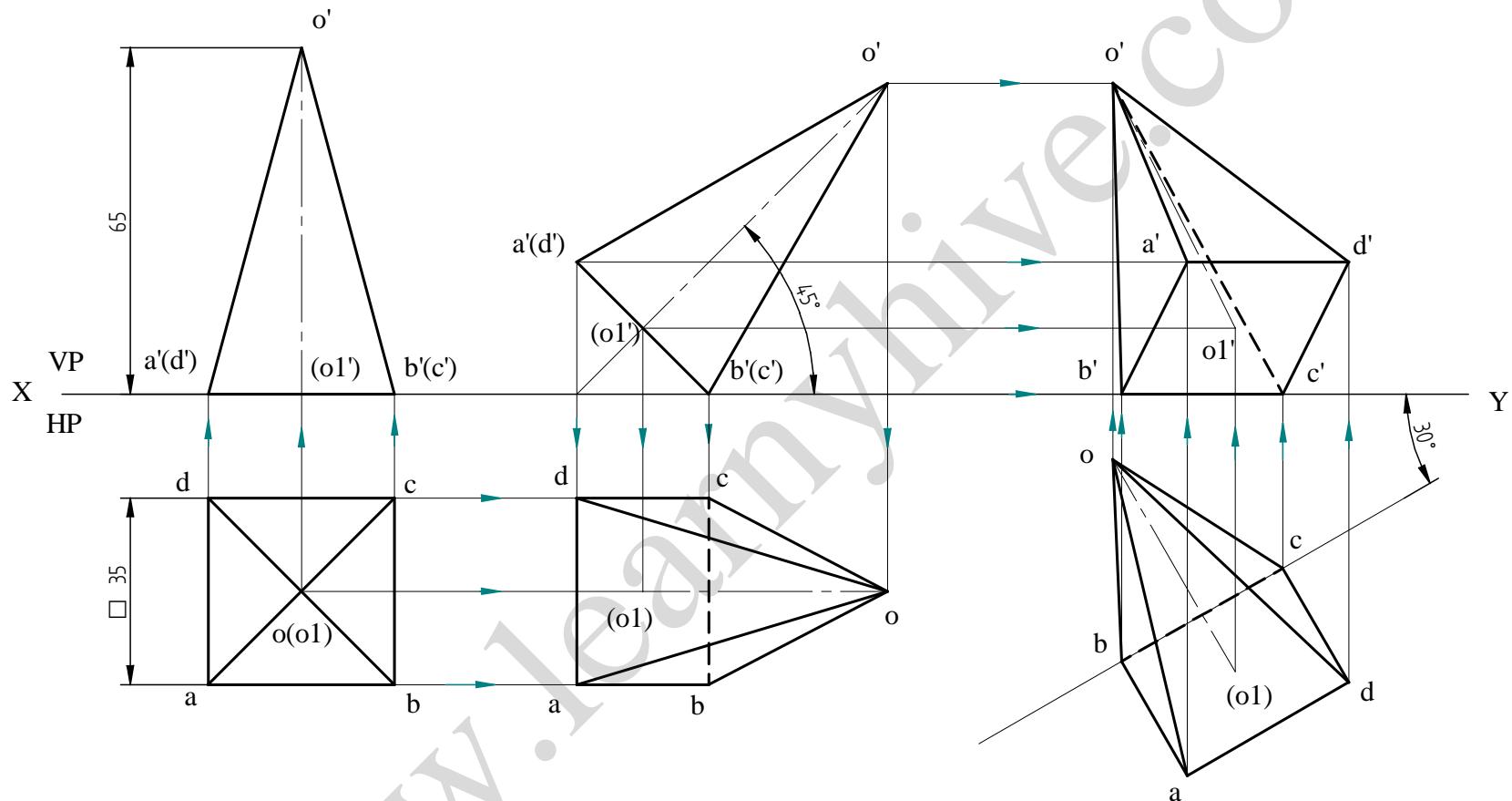
14. A pentagonal prism 25mm sides of base & 60mm axis length is suspended freely from one of its a corners. Draw the projections of the prism when the axis appears to be inclined to VP at 45deg.



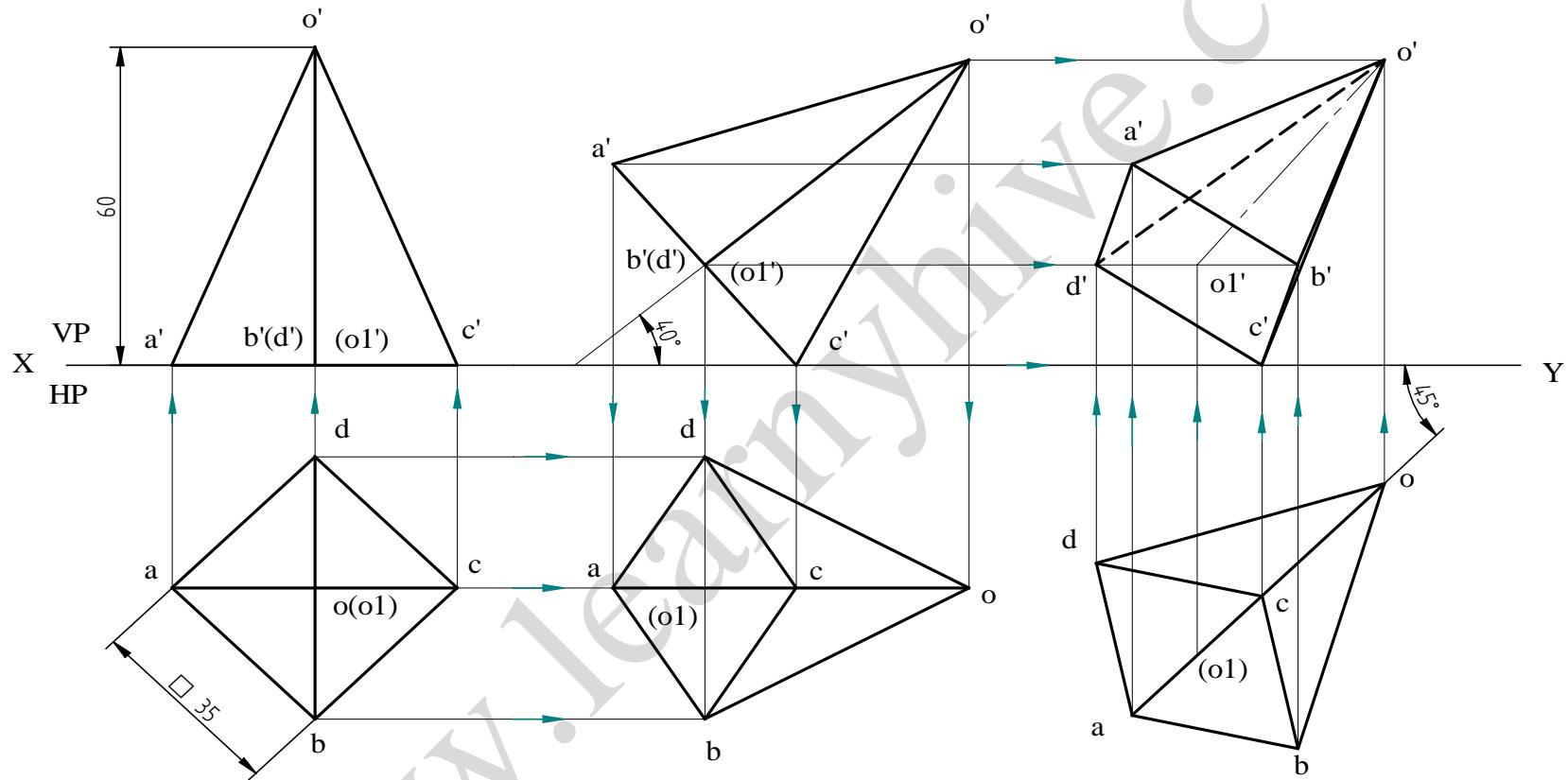
15. A hexagonal prism 25mm sides of base & 50mm axis length is suspended freely from one of its corners. Draw the projections of the prism when the axis appears to be inclined to VP at 45deg.



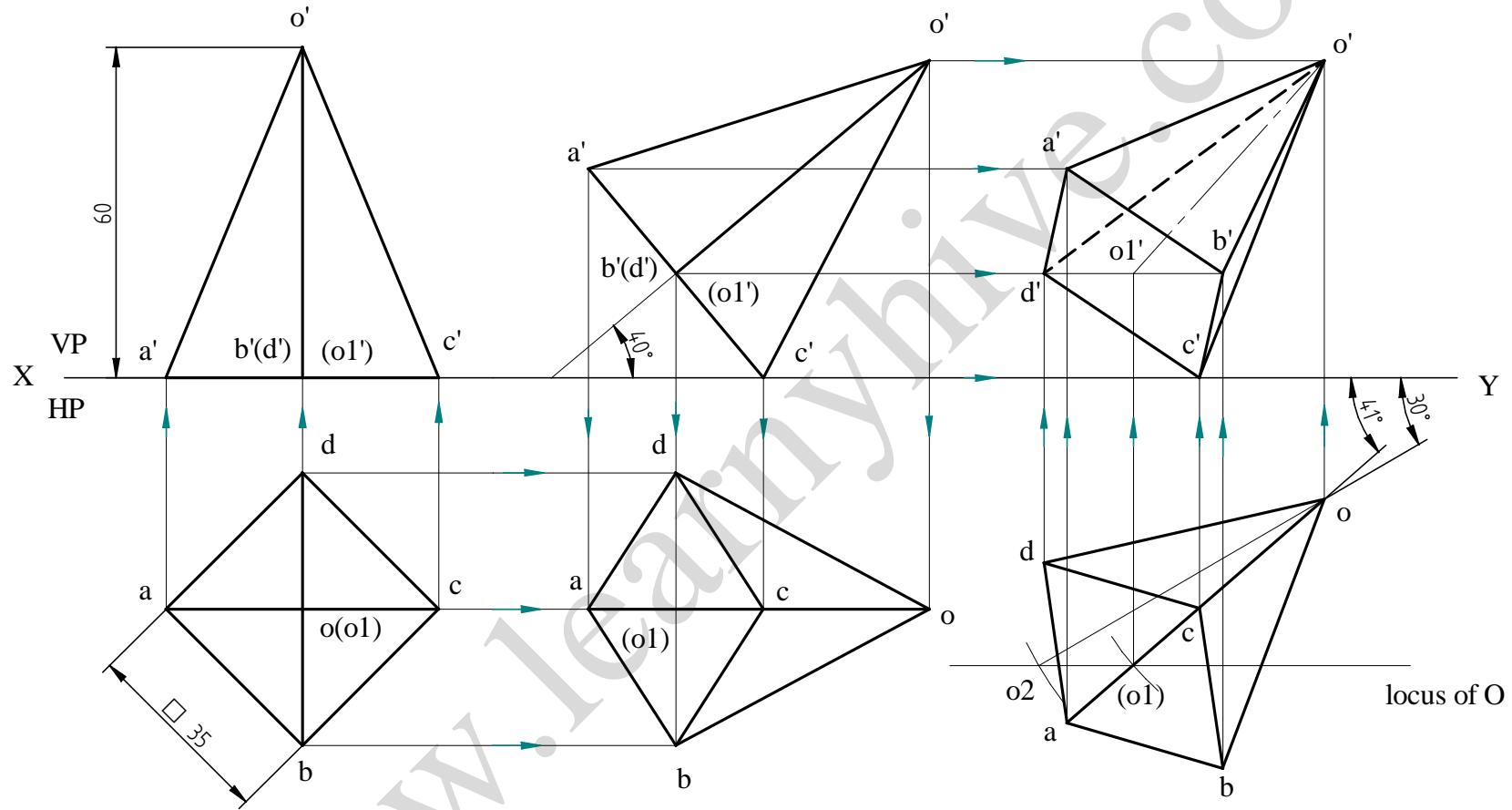
16. A square pyramid 35mm of sides of base and 65mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30deg. Draw the projections of the pyramid when the axis is inclined to HP at 45deg.



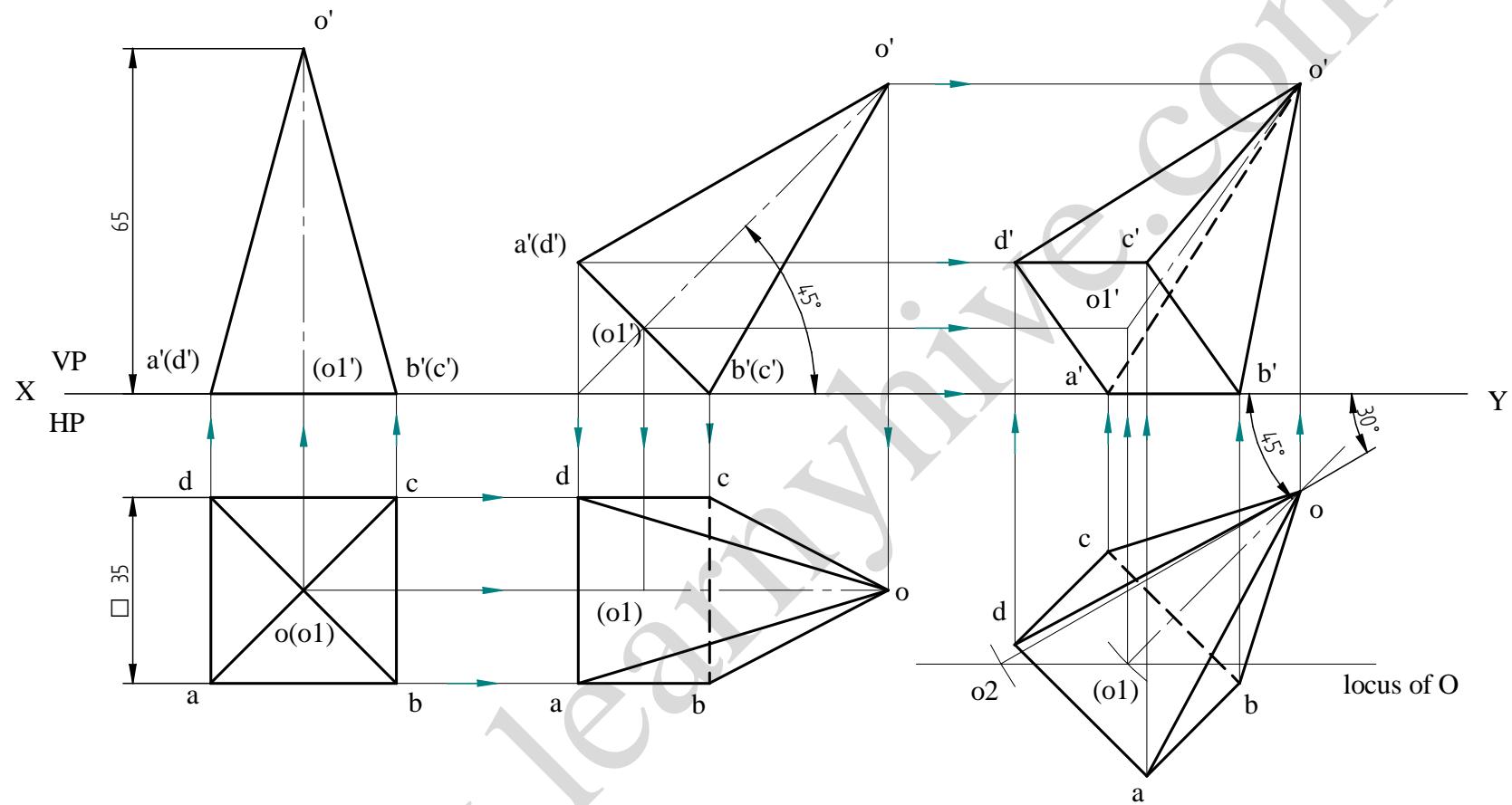
17. A square pyramid 35mm sides of base & 60mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections of the pyramid when the axis of the pyramid is inclined to HP 40° & appears to be inclined to VP at 45°.



18. A square pyramid 35mm sides of base & 60mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections of the pyramid when the axis of the pyramid is inclined to HP 40° deg & appears to be inclined to VP at 45° deg.

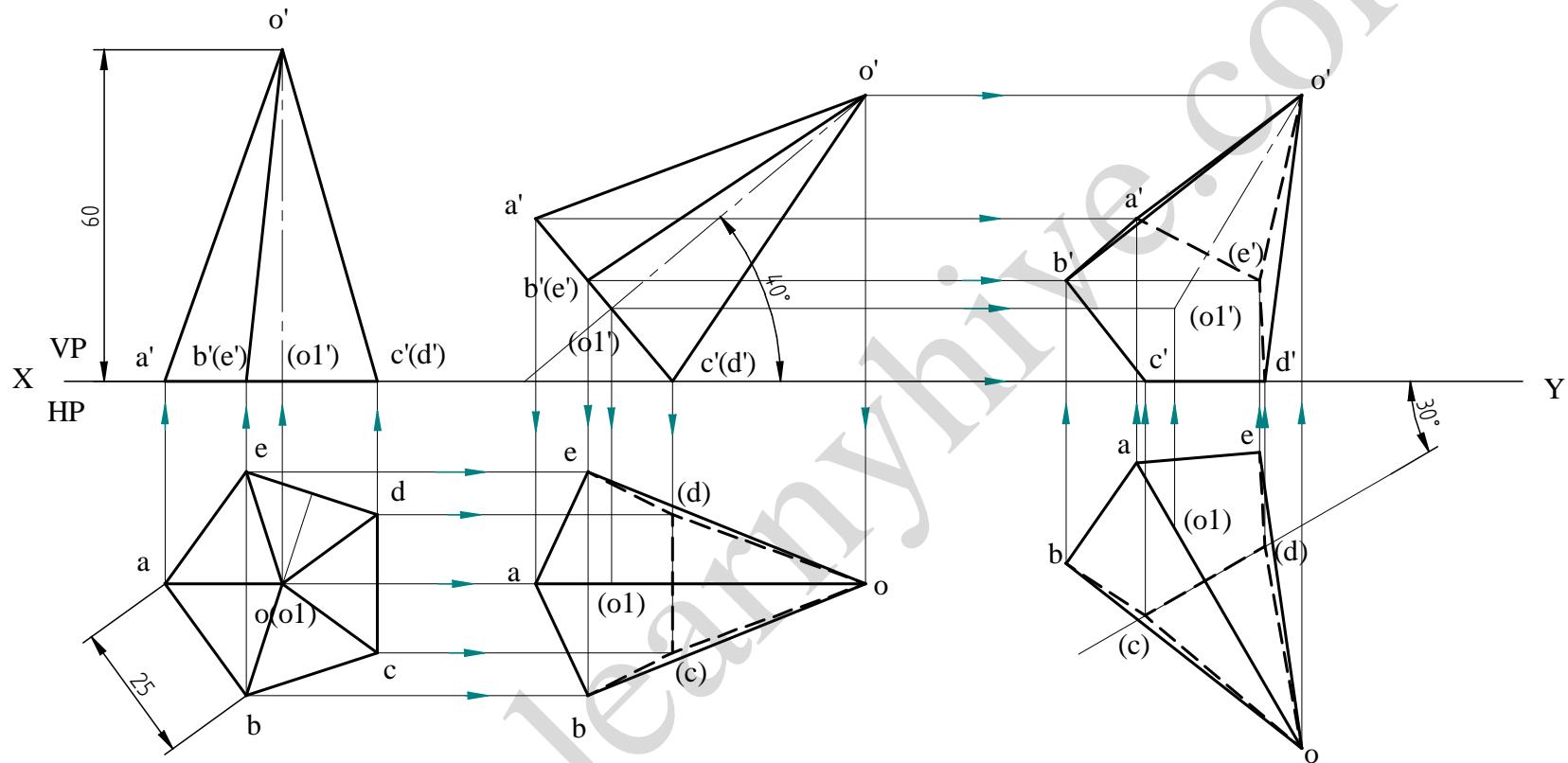


19. A square pyramid 35mm sides of base & 65mm axis length rests on HP on one of its edges of the base. Draw the projections of the pyramid when the axis is inclined to HP at 45deg & VP at 30deg.

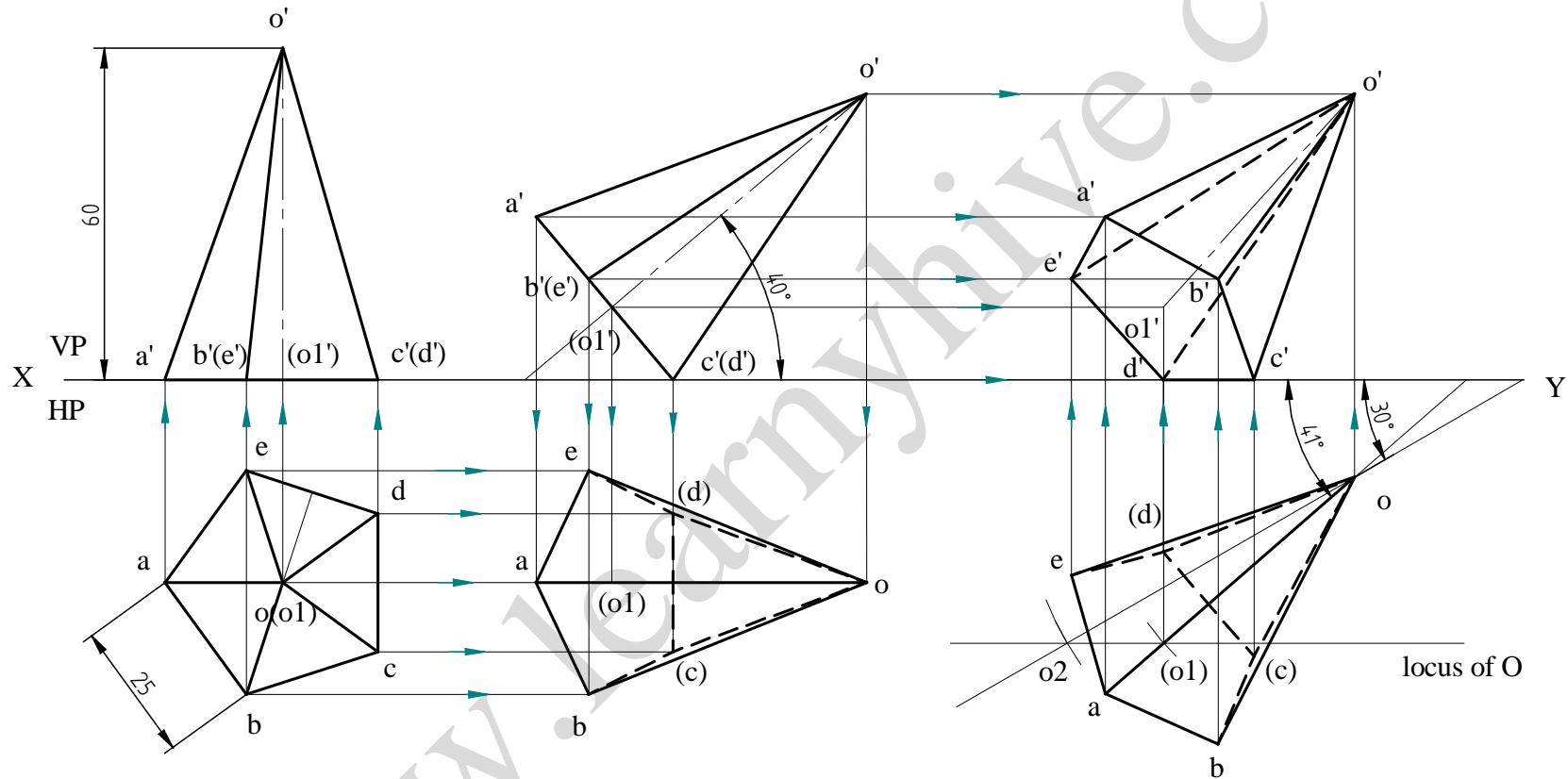


$$\beta = 45 \text{ degree}$$

20. A pentagonal pyramid 25mm side if base & 60mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30deg. draw the projections of the pyramid when the axis is inclined to HP at 40deg.

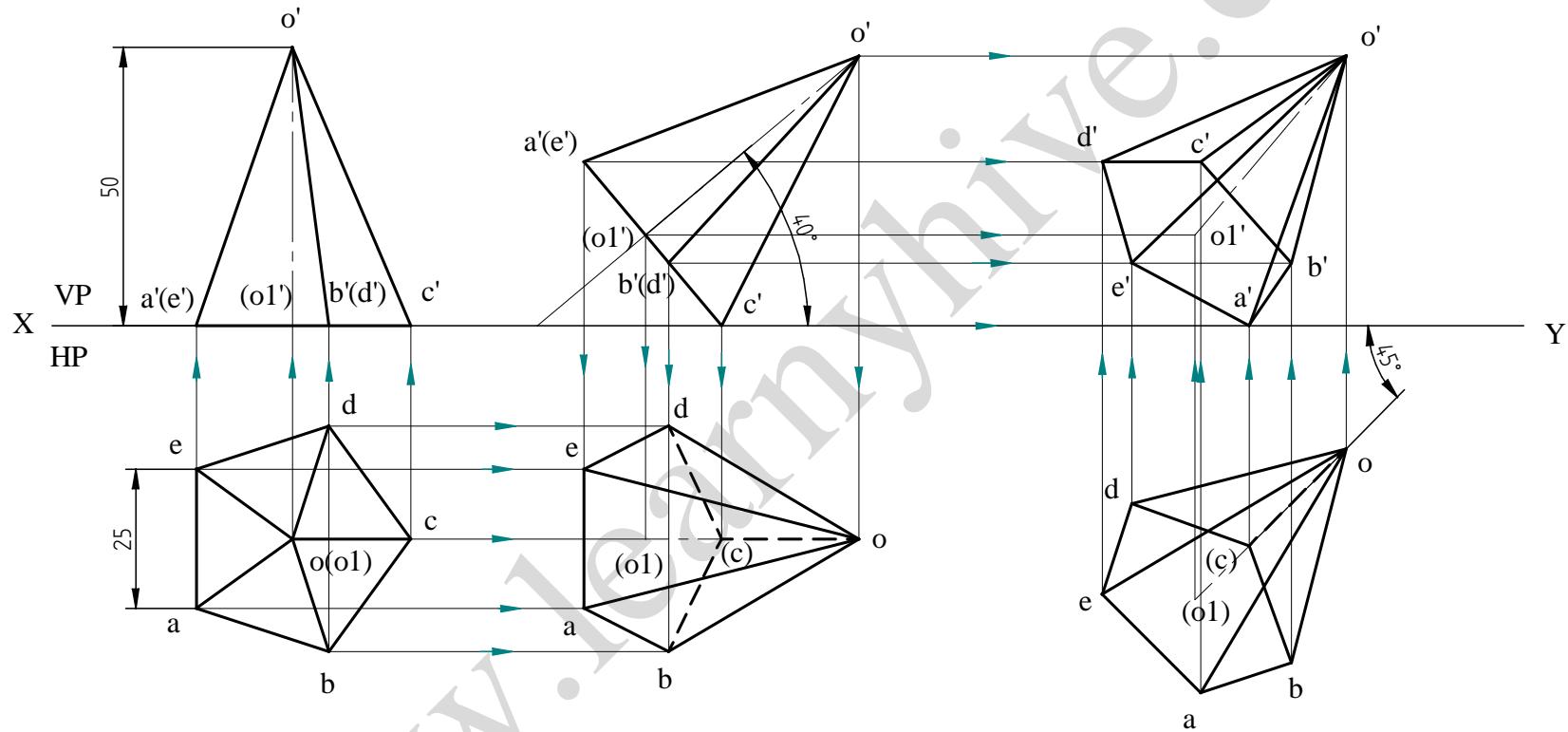


21. A pentagonal pyramid 25mm sides of base 60mm axis length rests on HP on one of its edges of the base. Draw the projections of the pyramid when the axis is inclined to HP at 40deg & VP at 30deg.

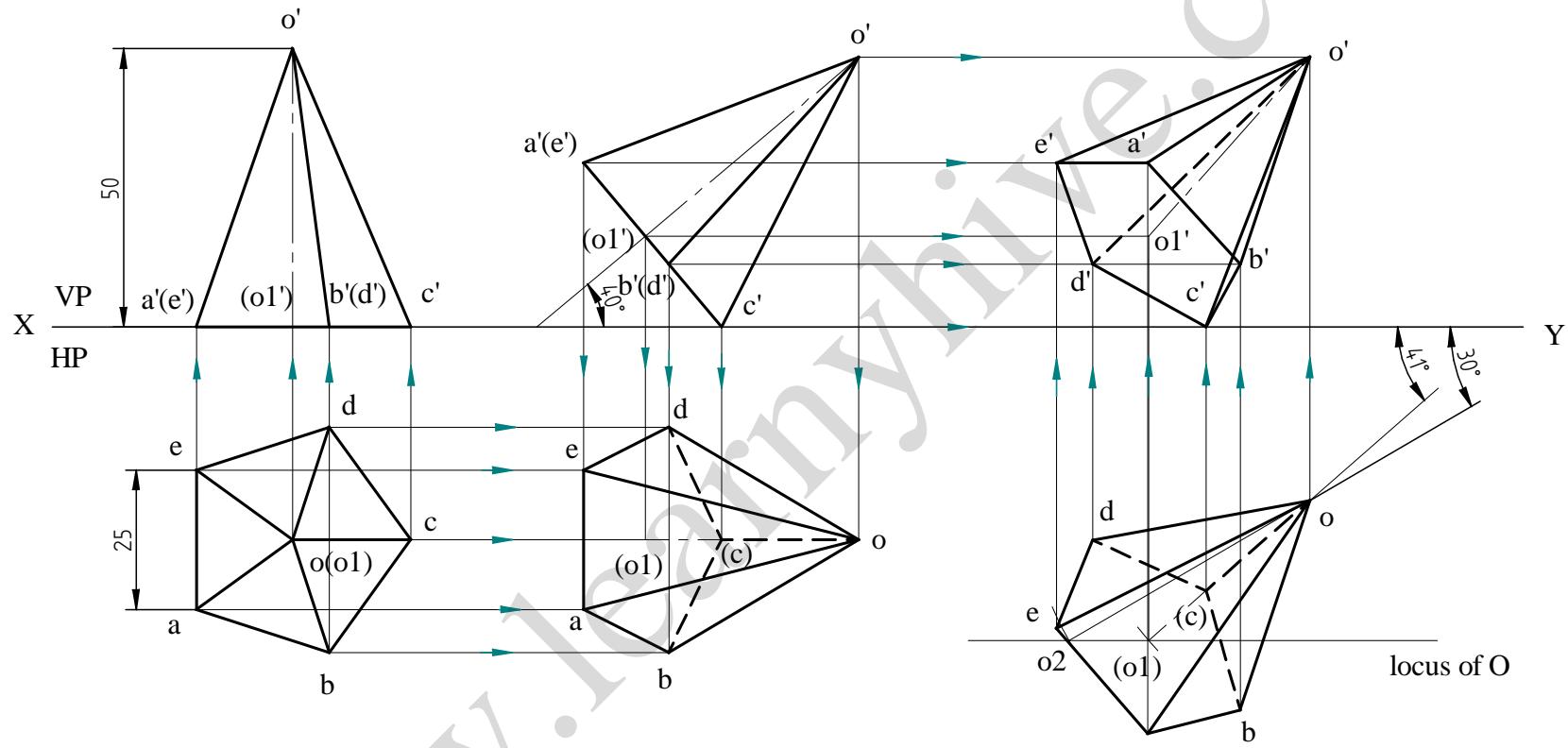


$$\beta = 41 \text{ degree}$$

22. A pentagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections of the pyramid when the axis if the pyramid is inclined to HP at 40deg. & appears to be inclined at VP at 45deg.

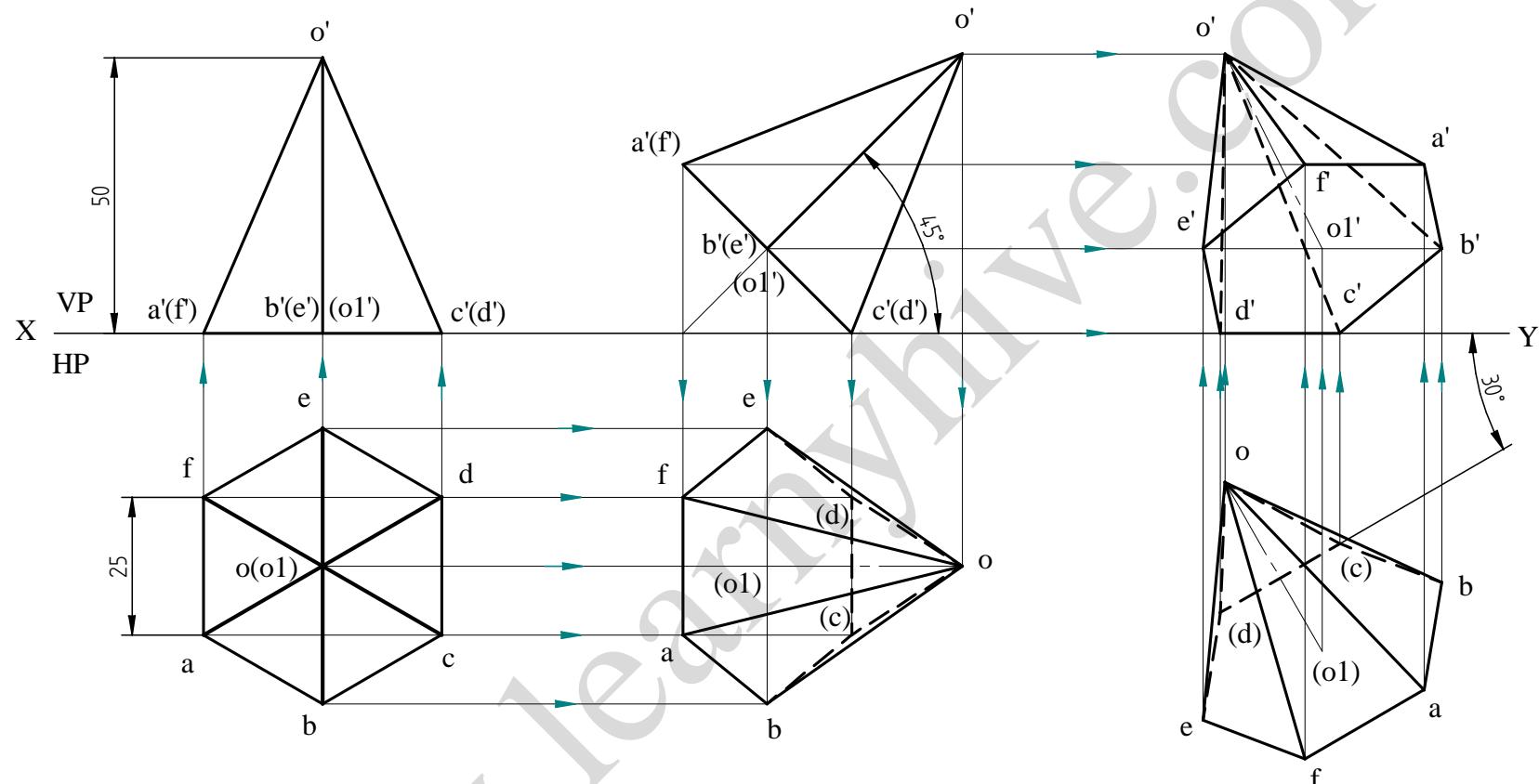


23. A pentagonal pyramid 25mm sides if base and 50mm axis length rests on HP on one of its corner of the base such that the two base edges containing the corner on which it makes equal inclinations with HP. Draw the projections of the pyramid when the axis of the pyramid is inclined to 40deg & VP at 30deg

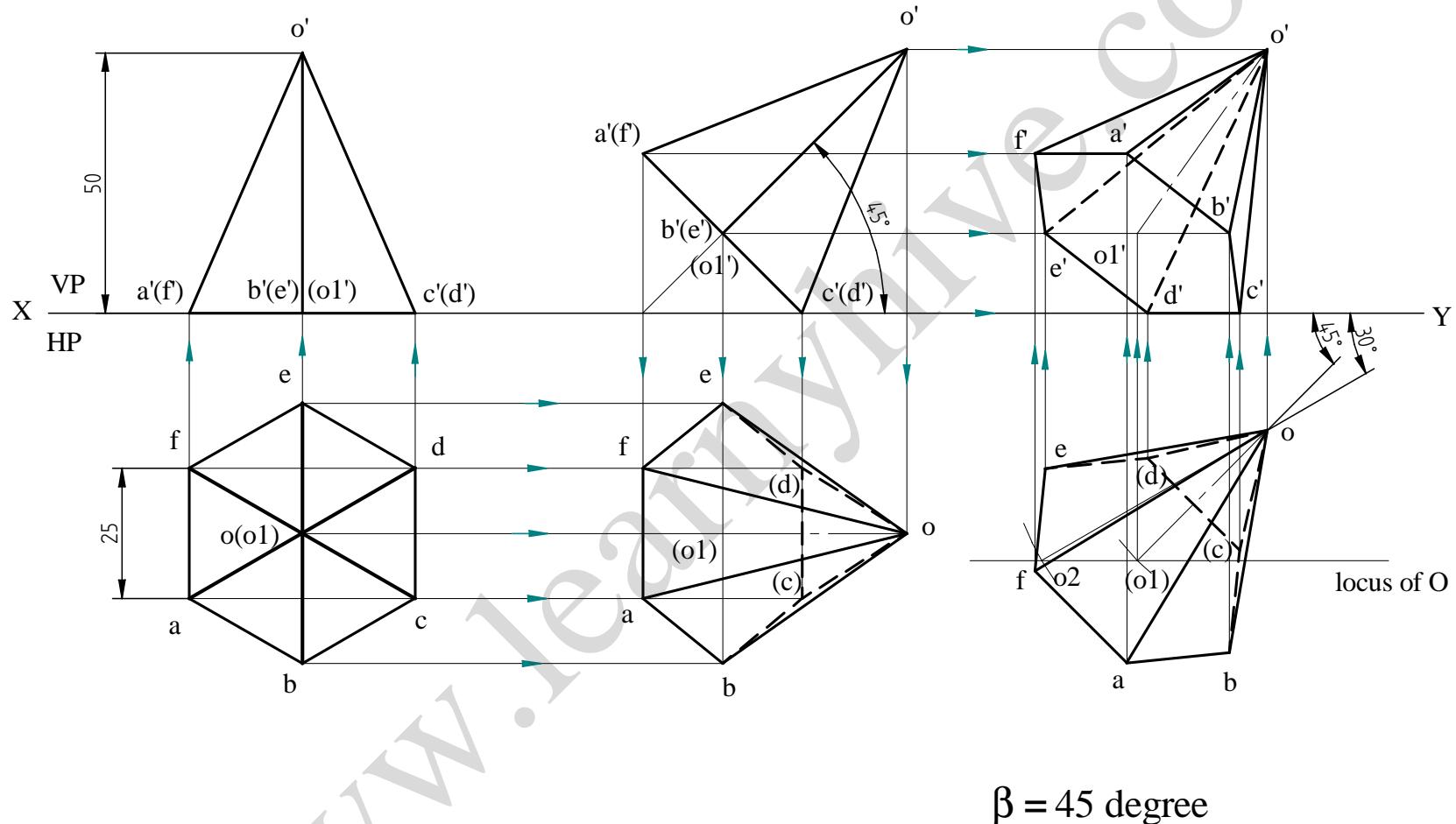


$$\beta = 41 \text{ degree}$$

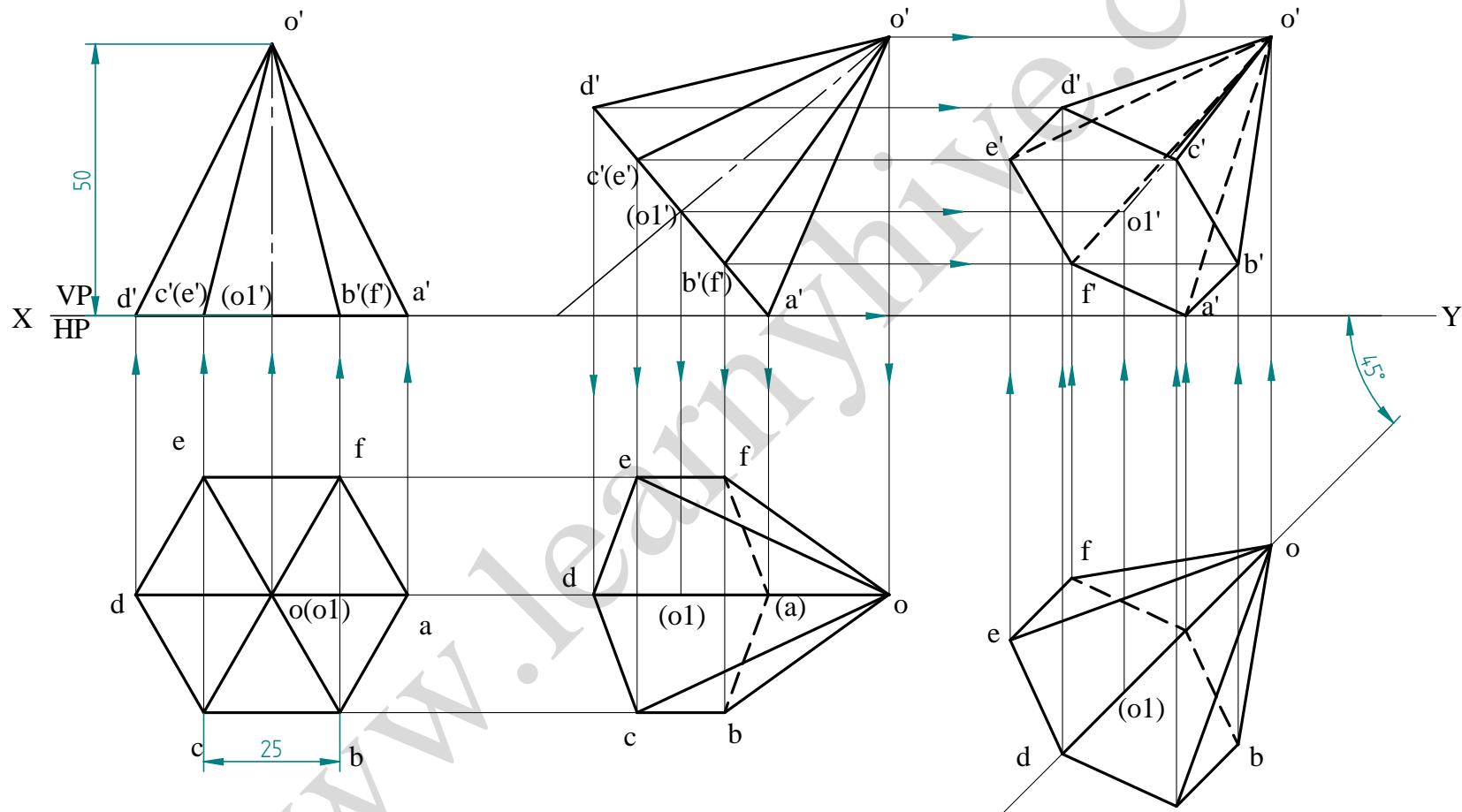
24. A hexagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its edges of the base which is inclined at VP at 30deg. Draw the projections of the pyramid when the axis is inclined to HP at 45deg.



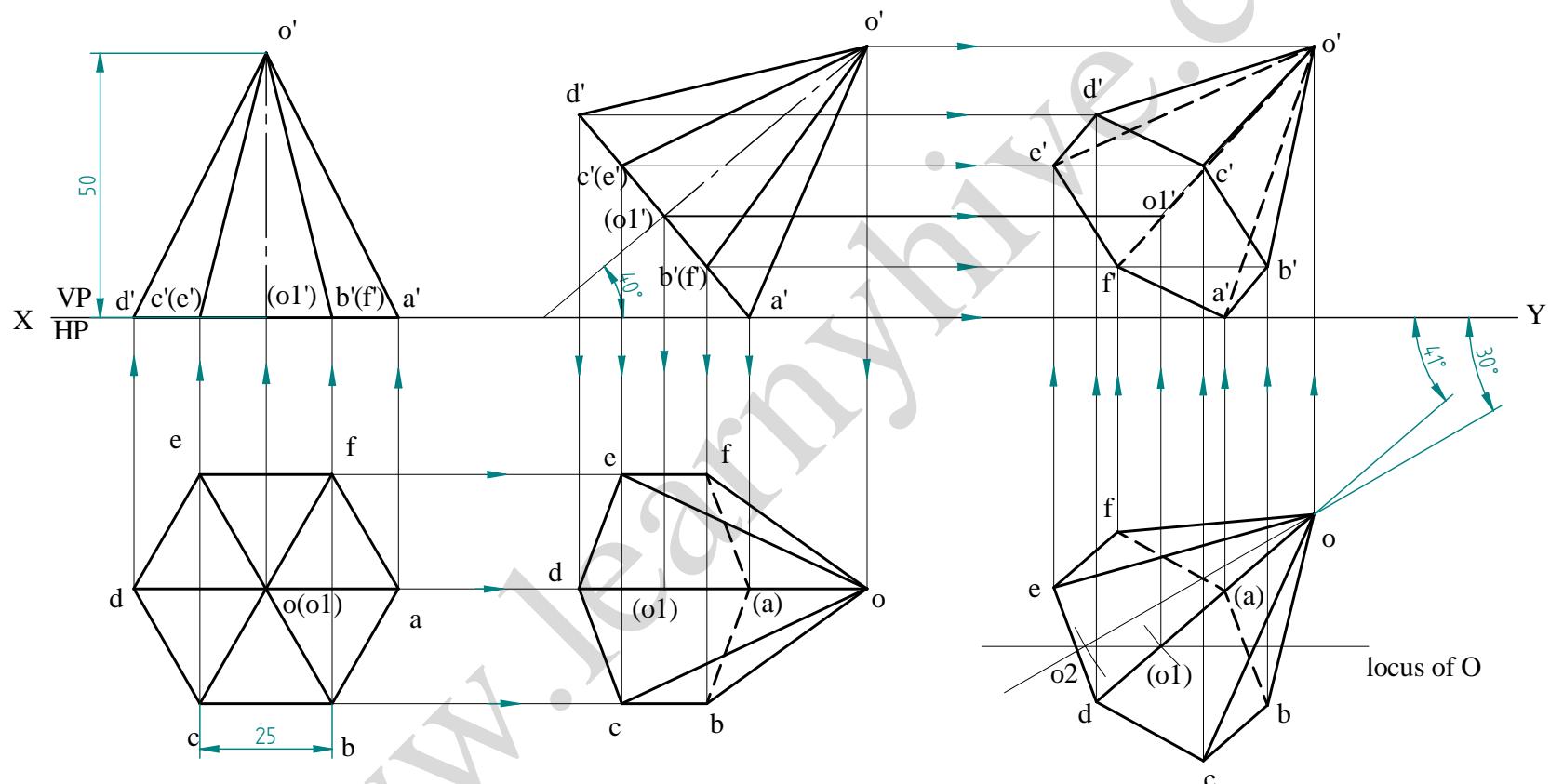
25. A hexagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its edges of the base. Draw the projections of the pyramid when the axis is inclined to HP at 45deg & VP at 30deg.



26. A hexagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its corners of the base such that the two base edges contain in the corner on which it rests make equal inclinations with HP. Draw the projections of the pyramid when the axis of the axis of the pyramid is inclined to HP at 40deg & appears to be inclined to VP at 45deg.

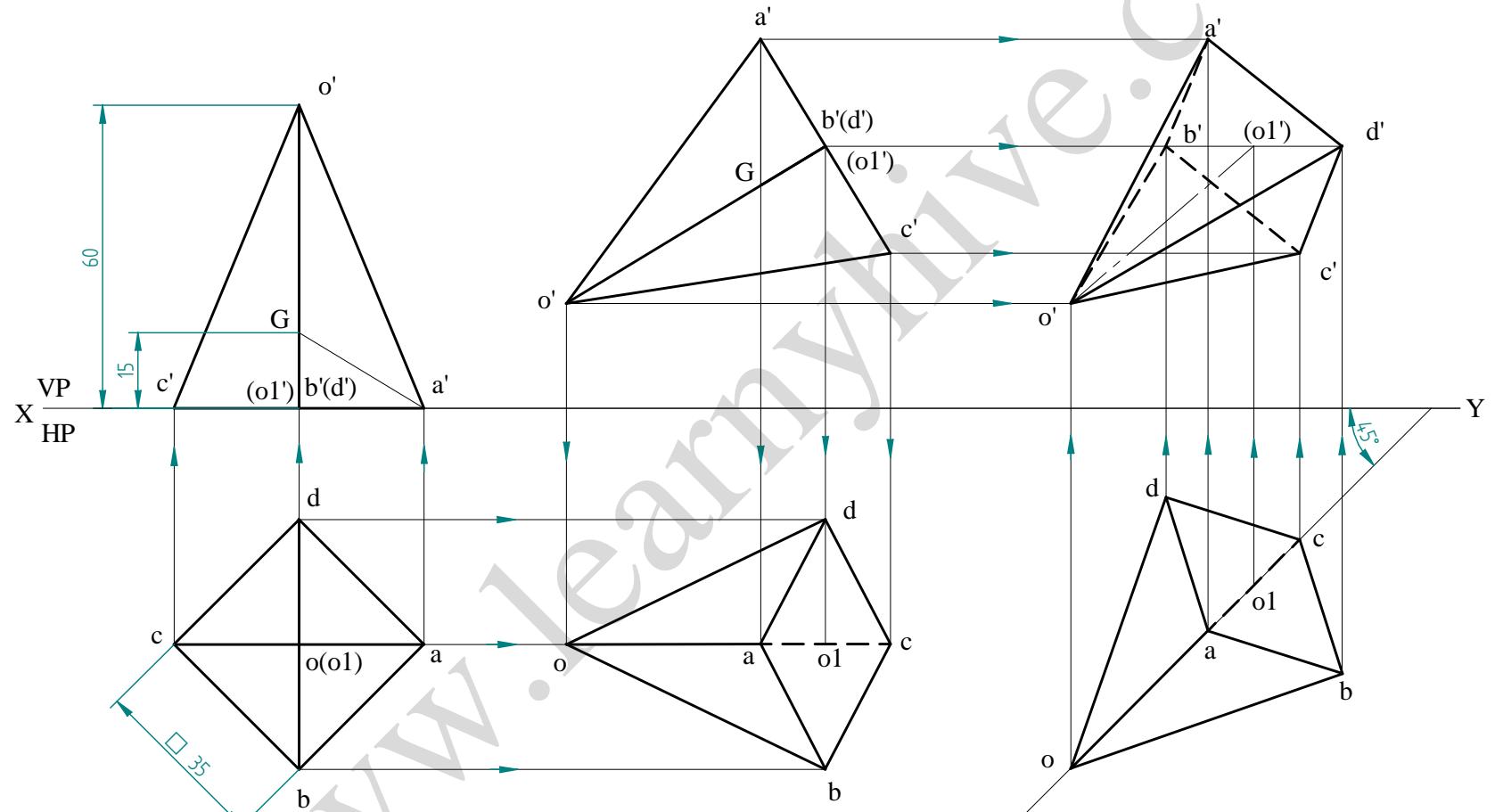


27. A hexagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its corner of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections of the pyramid when the axis of the pyramid is inclined to HP at 40deg & to VP at 30deg.

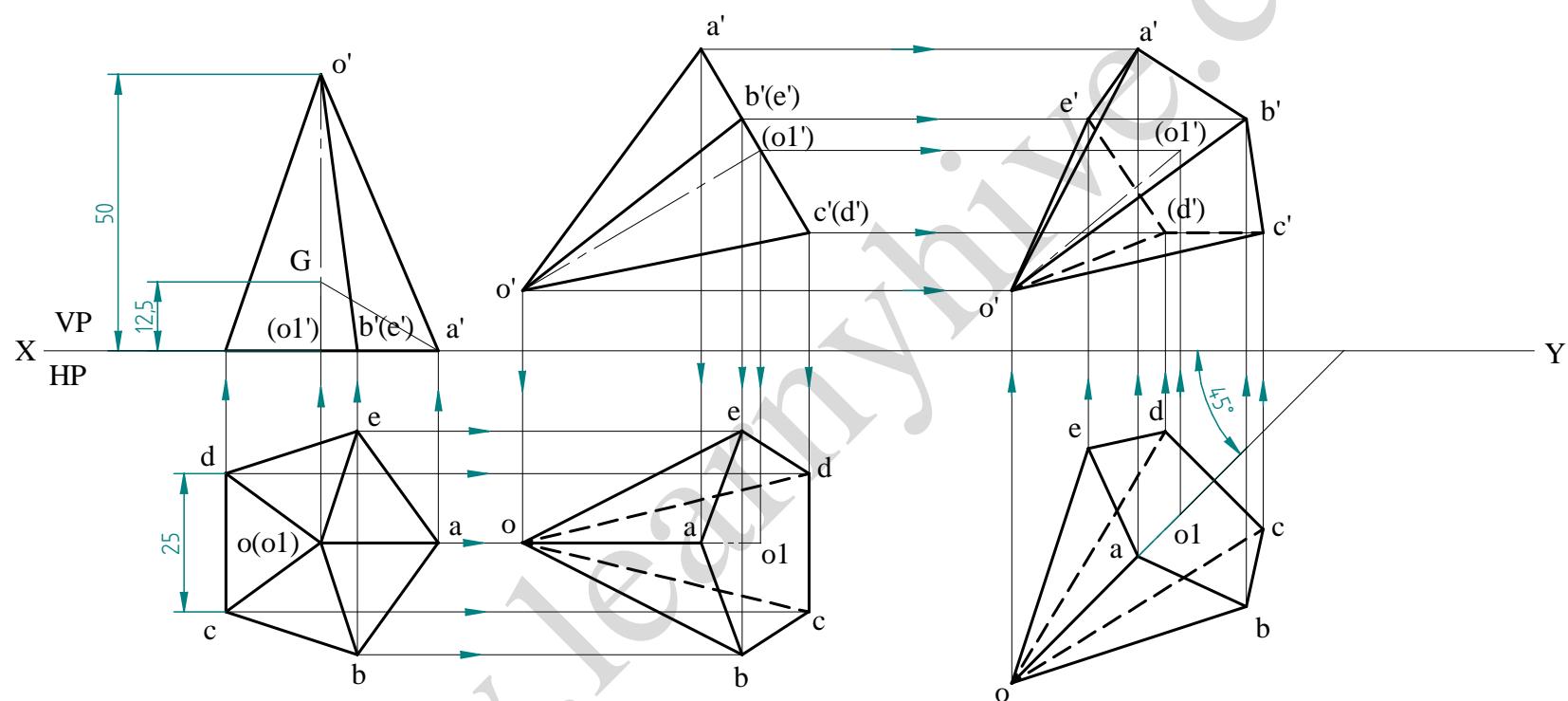


b 41 degree

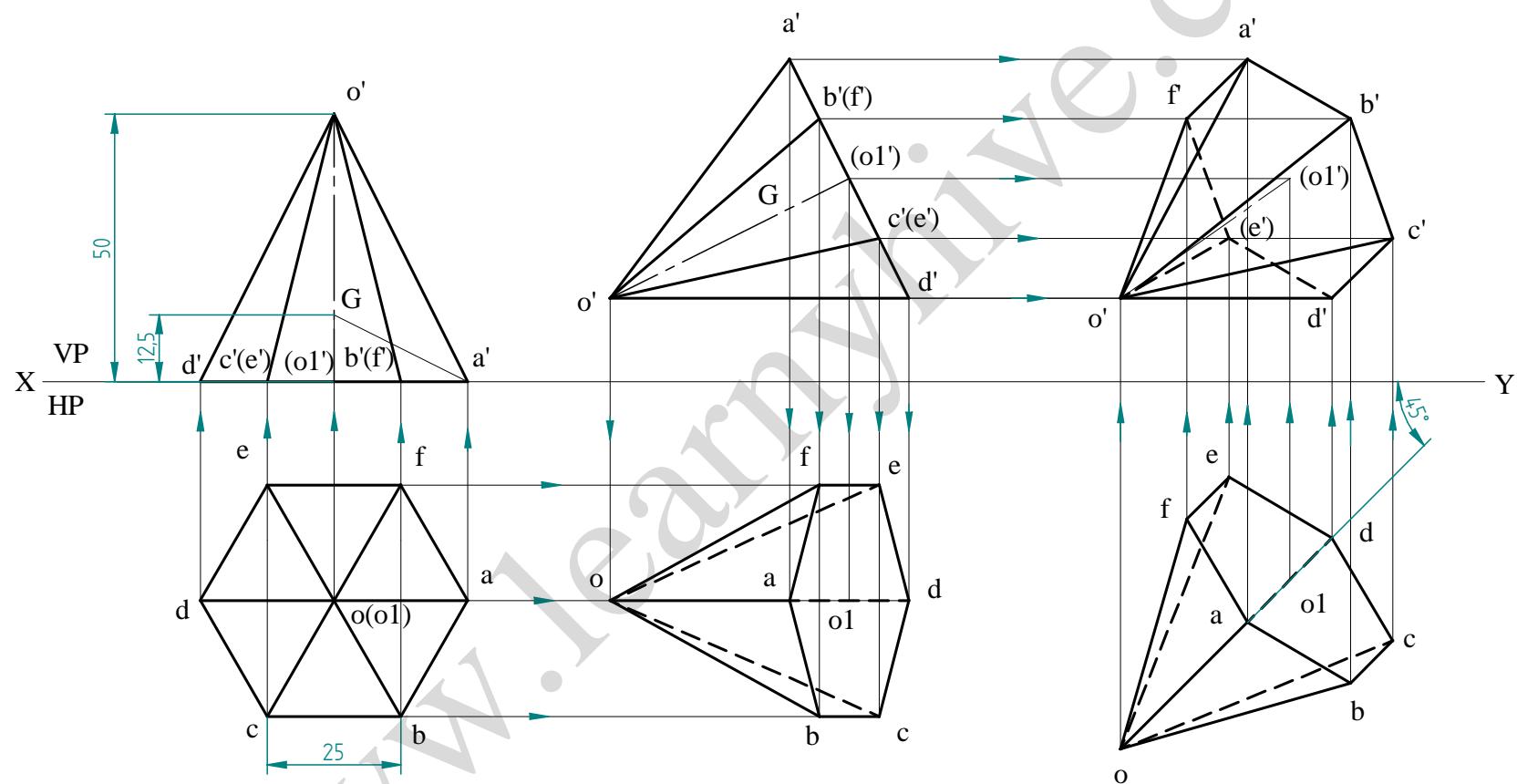
28. A square pyramid 35mm sides of base & 60mm axis length is suspended freely from the corner of its base. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg.



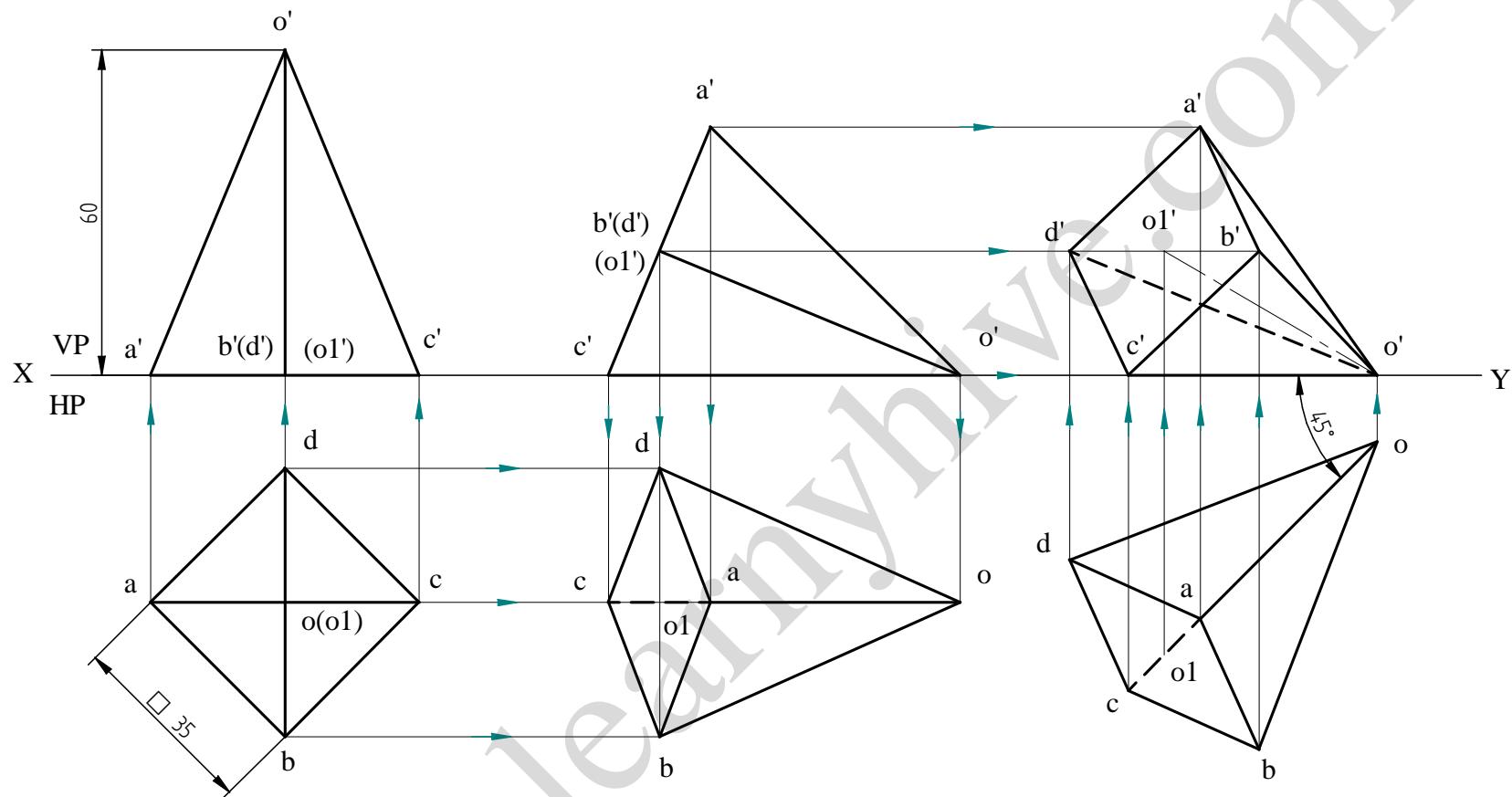
29. A pentagonal pyramid 25mm sides of base & 50mm axis length is suspended freely from a corner of its base. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg.



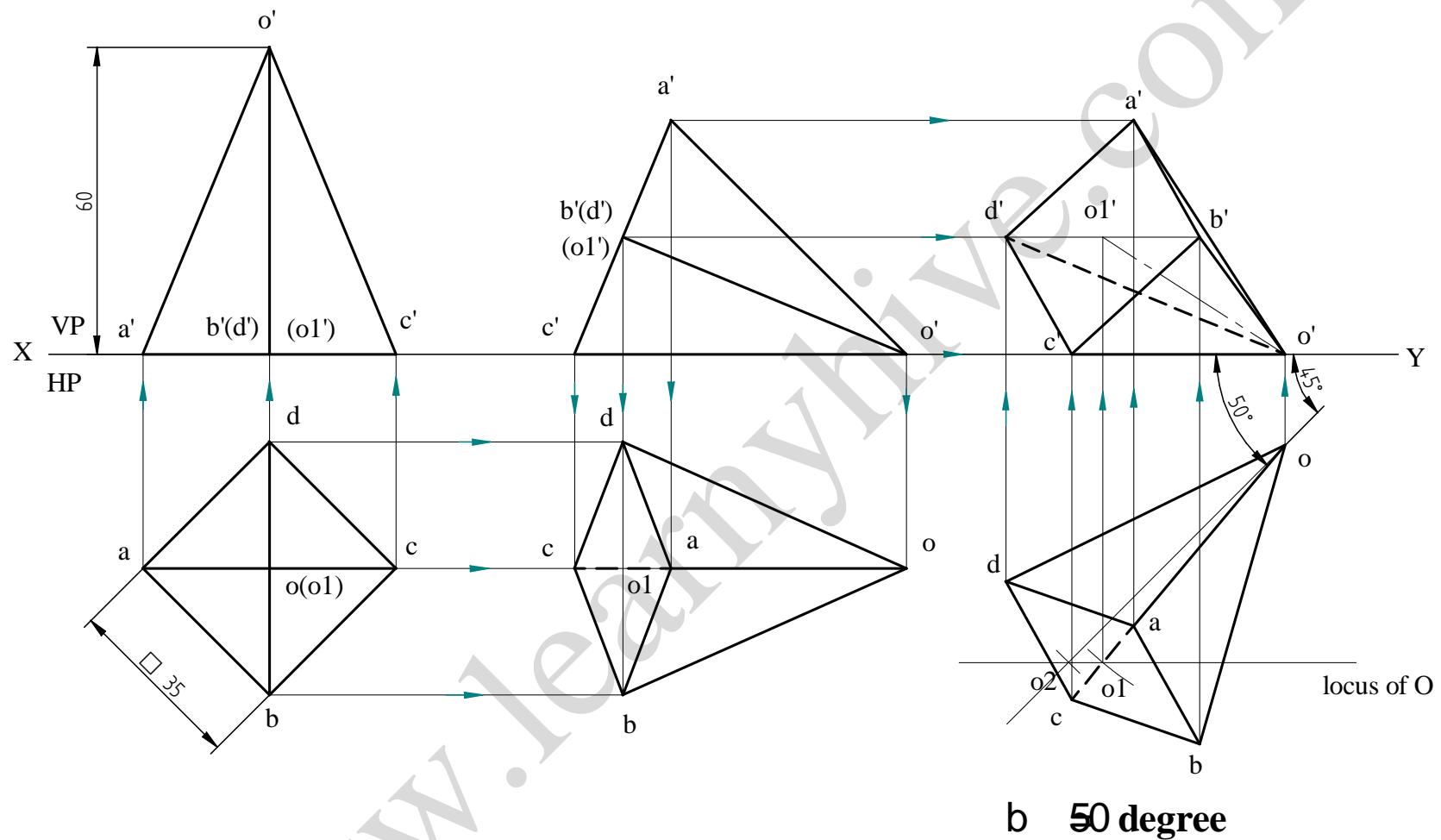
30. A hexagonal pyramid 25mm sides of base & 50mm axis length is suspended freely from a corner of its base. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg.



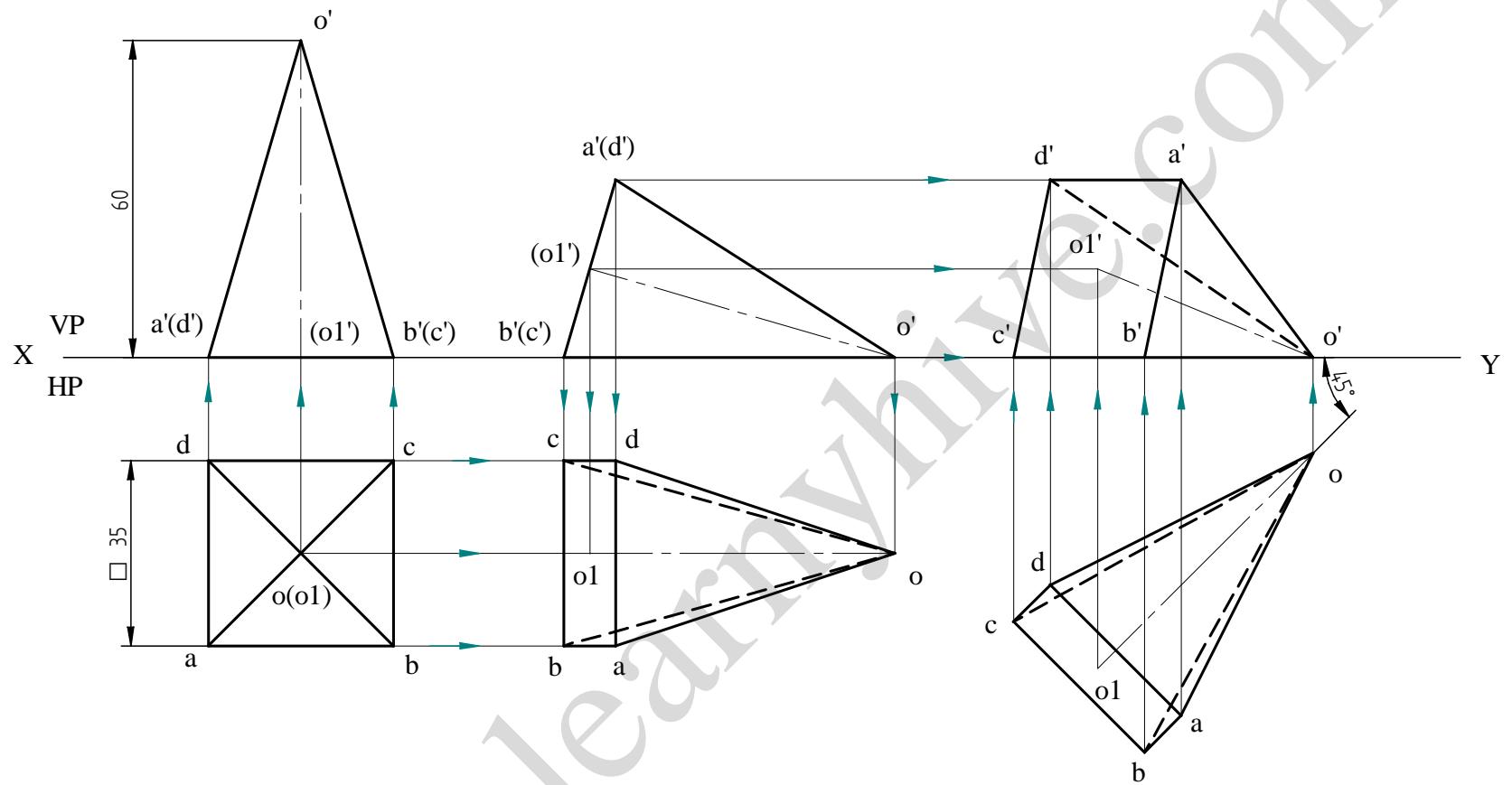
31. A square pyramid 35mm sides of base & 60mm axis length rests on HP on one of its slant edges. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg.



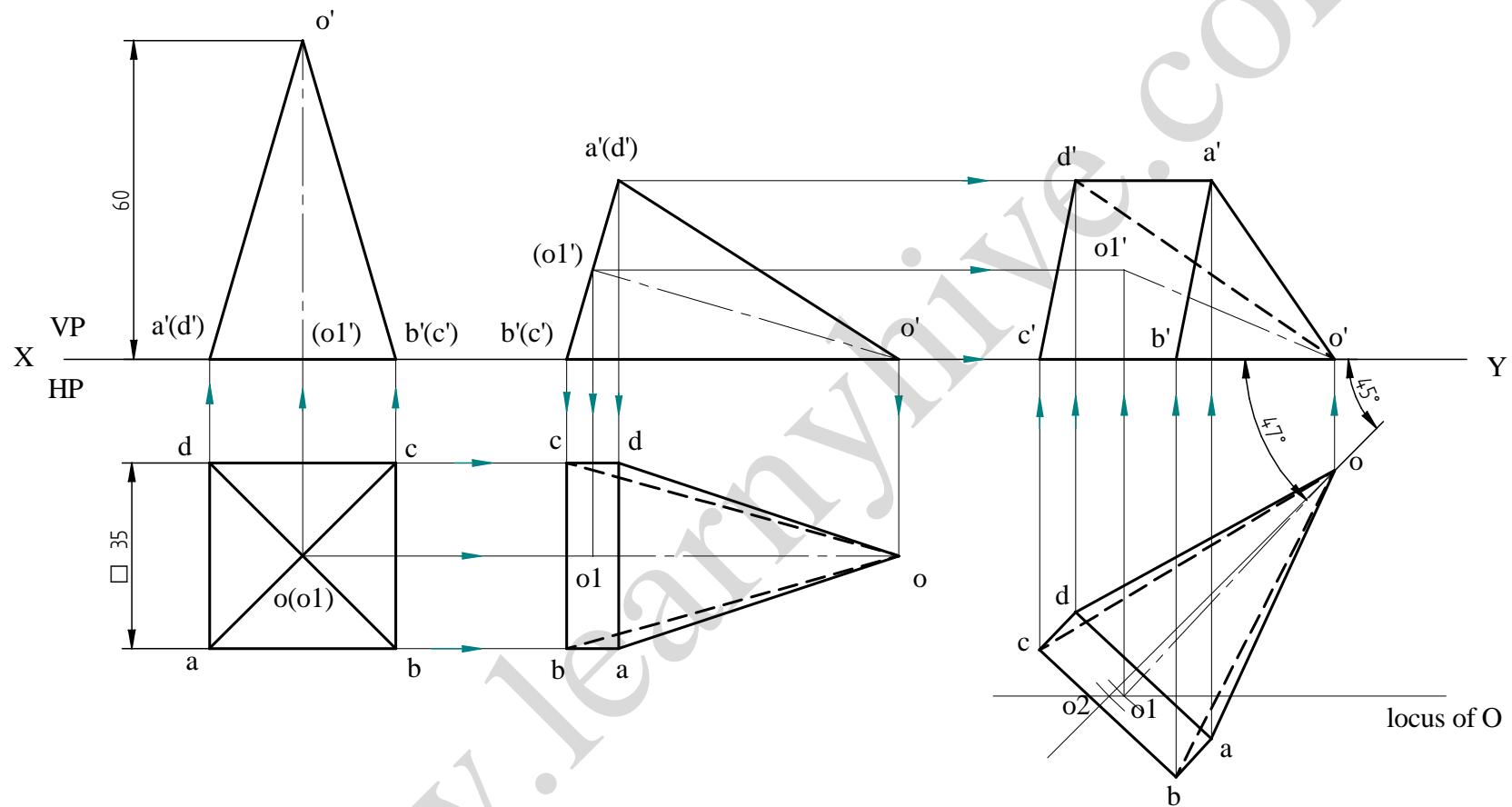
32. A square pyramid 35mm sides of base & 60mm axis length rests on HP on one of its slant edges. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg.



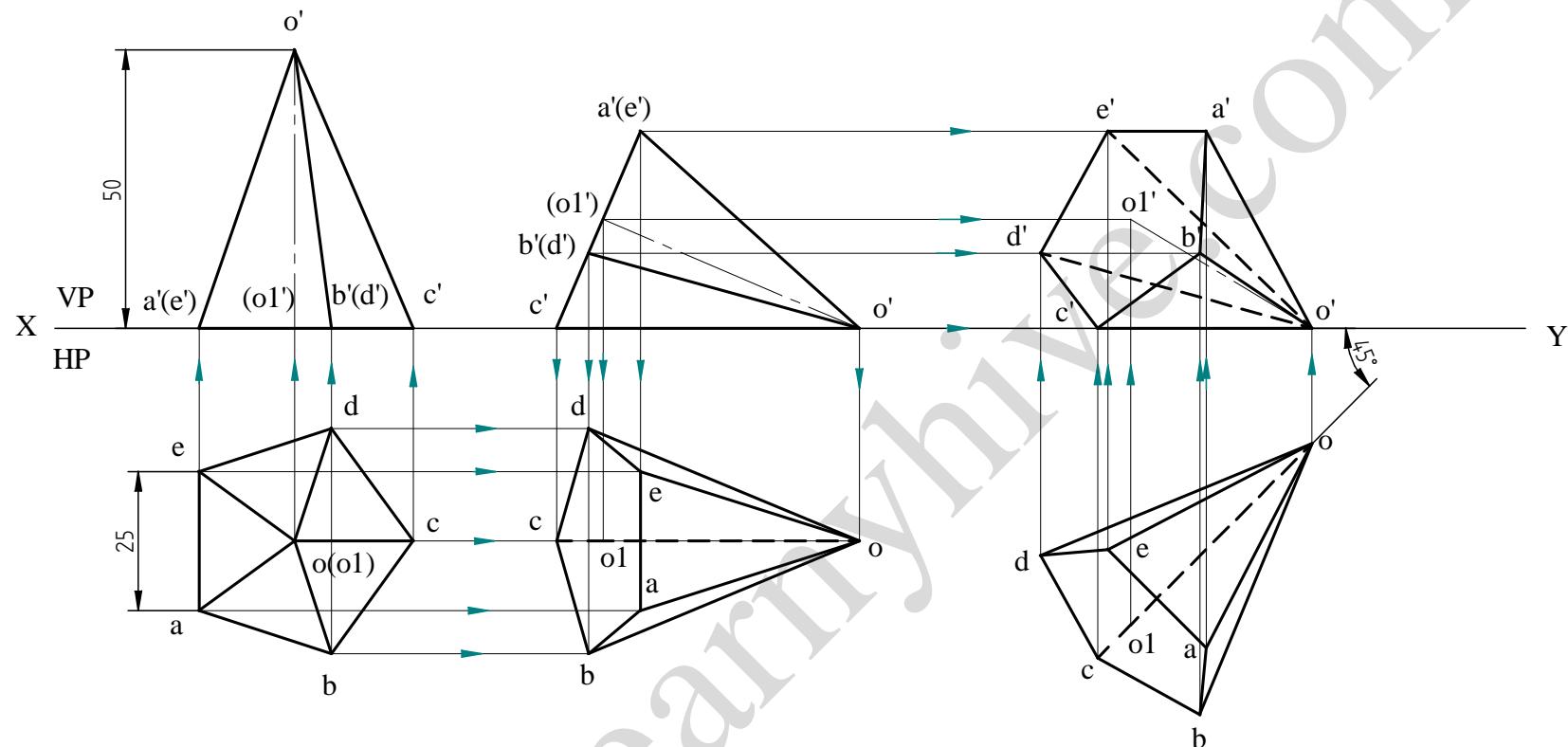
33. A square pyramid 35mm sides of base & 60mm axis length rests on HP on one of its slant triangular faces. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg.



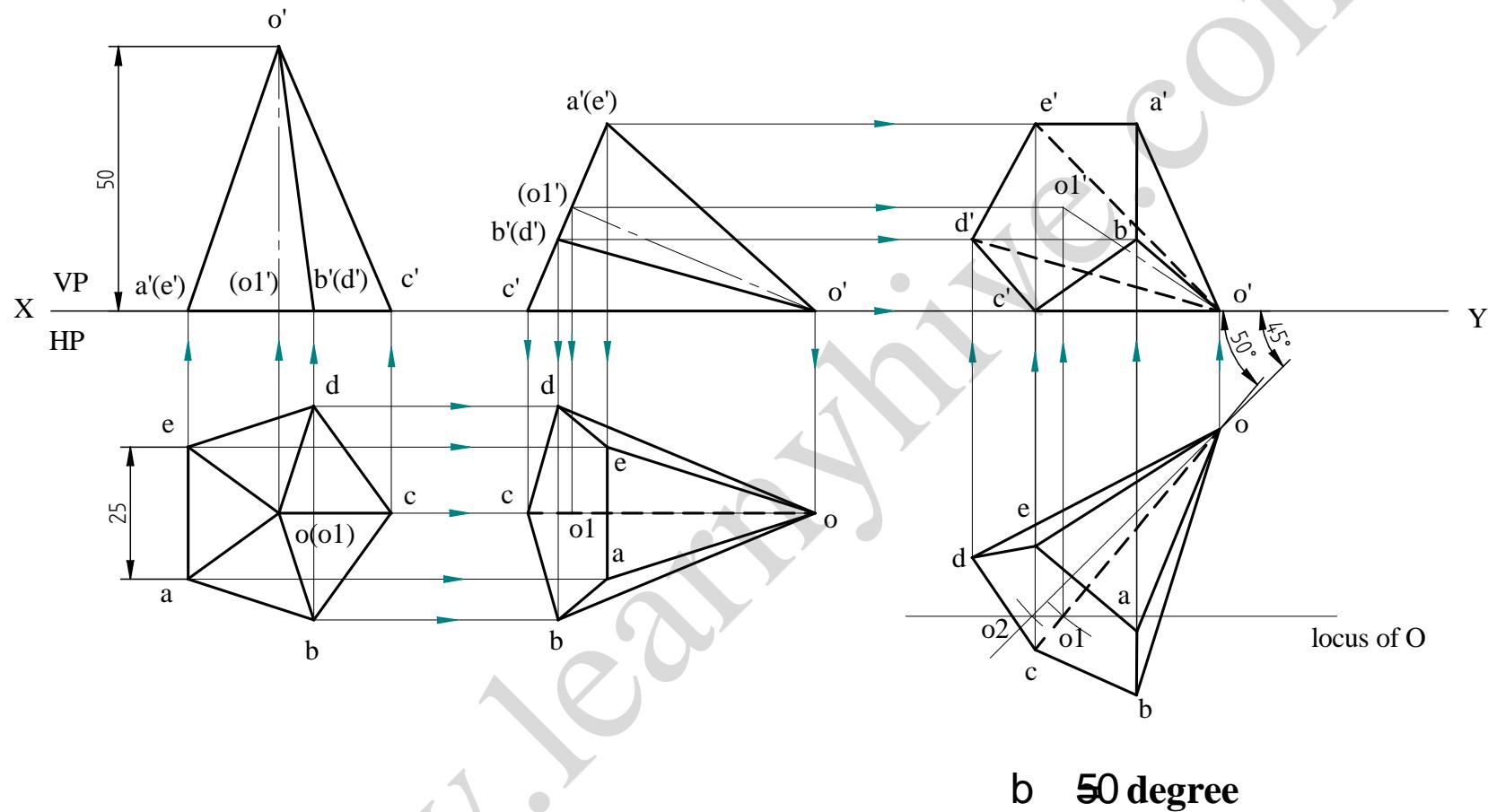
34. A square pyramid 35mm sides of base and 60mm axis length rests on HP on one of its slant triangular faces. Draw the projections of the pyramid when the axis is inclined to VP at 45deg.



35. A pentagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its slant edges. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg.

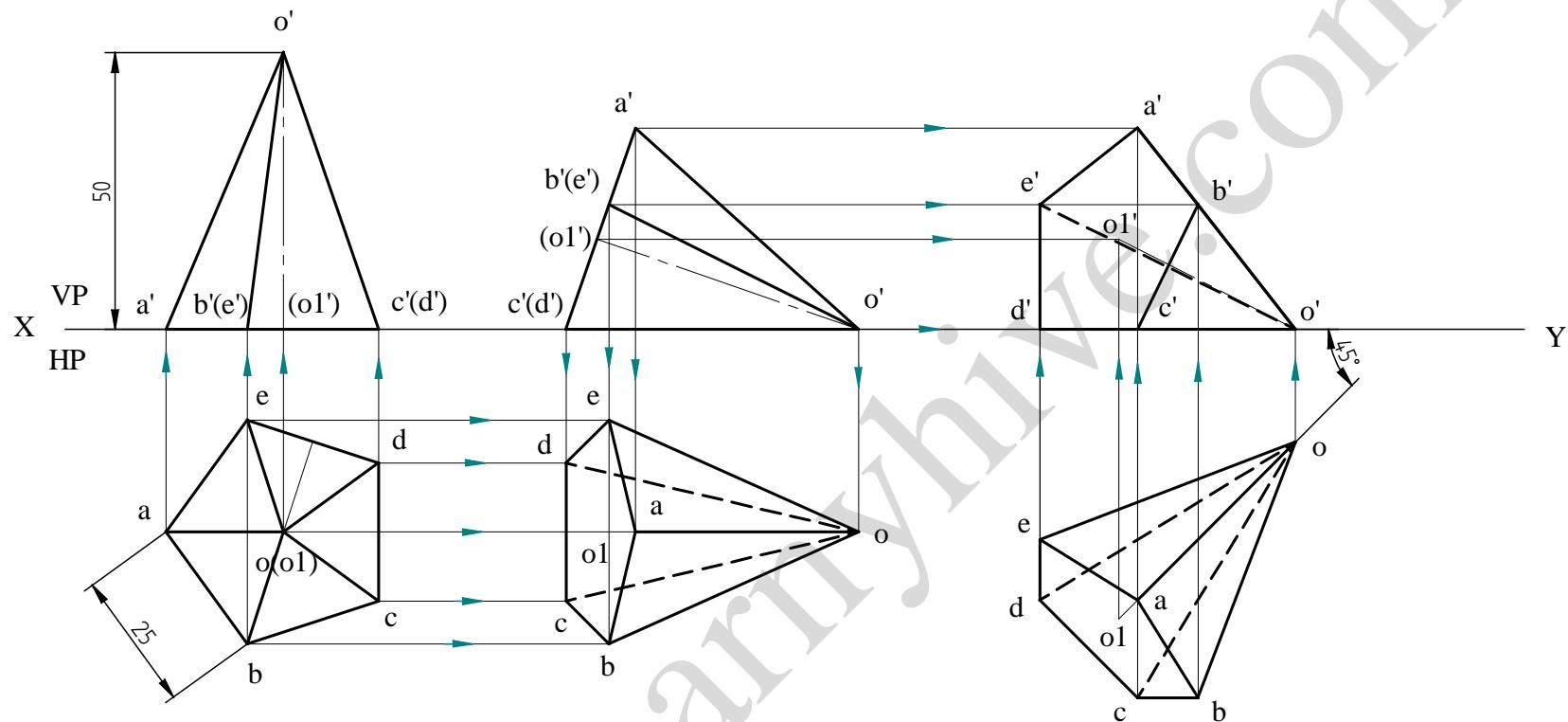


36. A pentagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its slant edges. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg

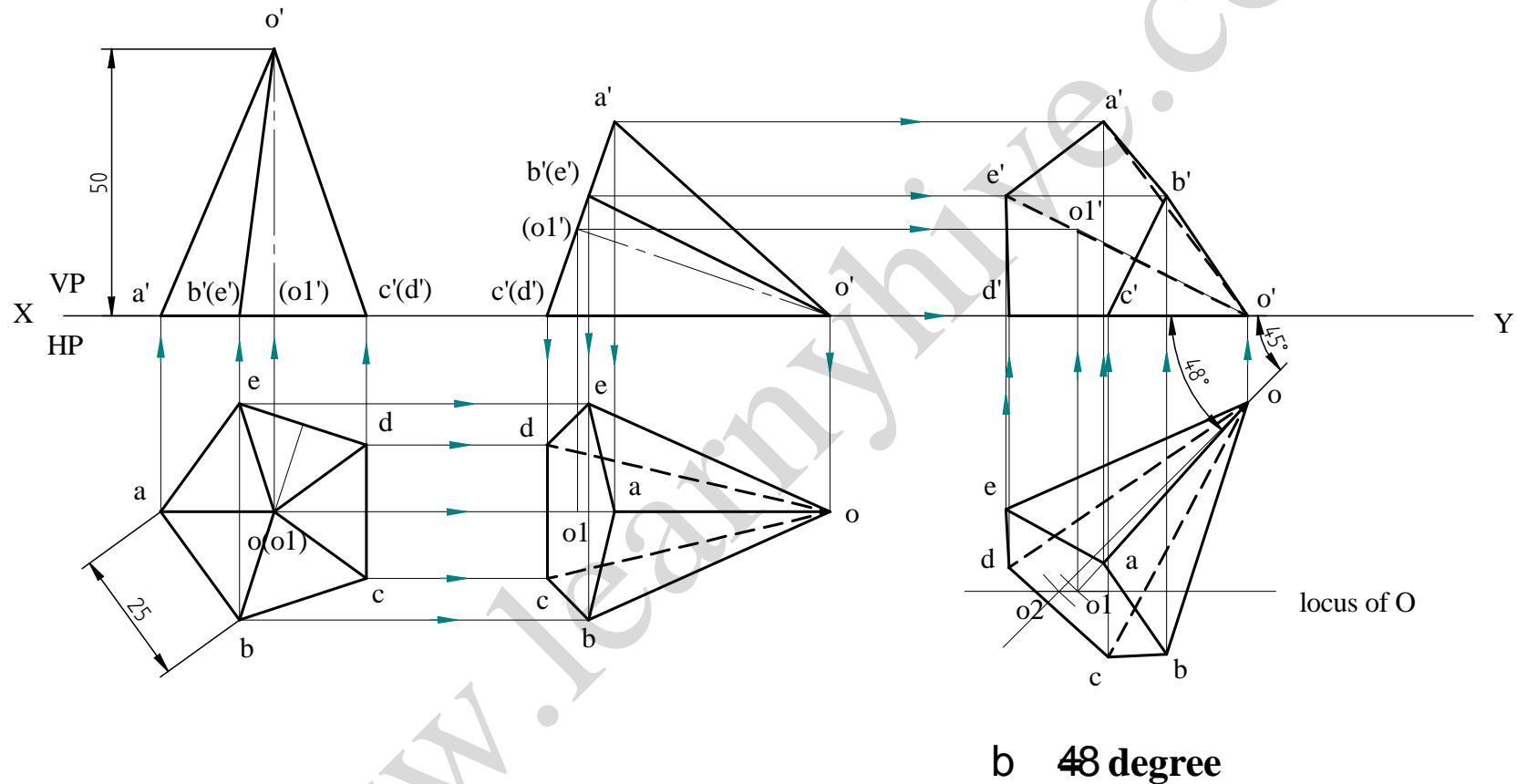


b 50 degree

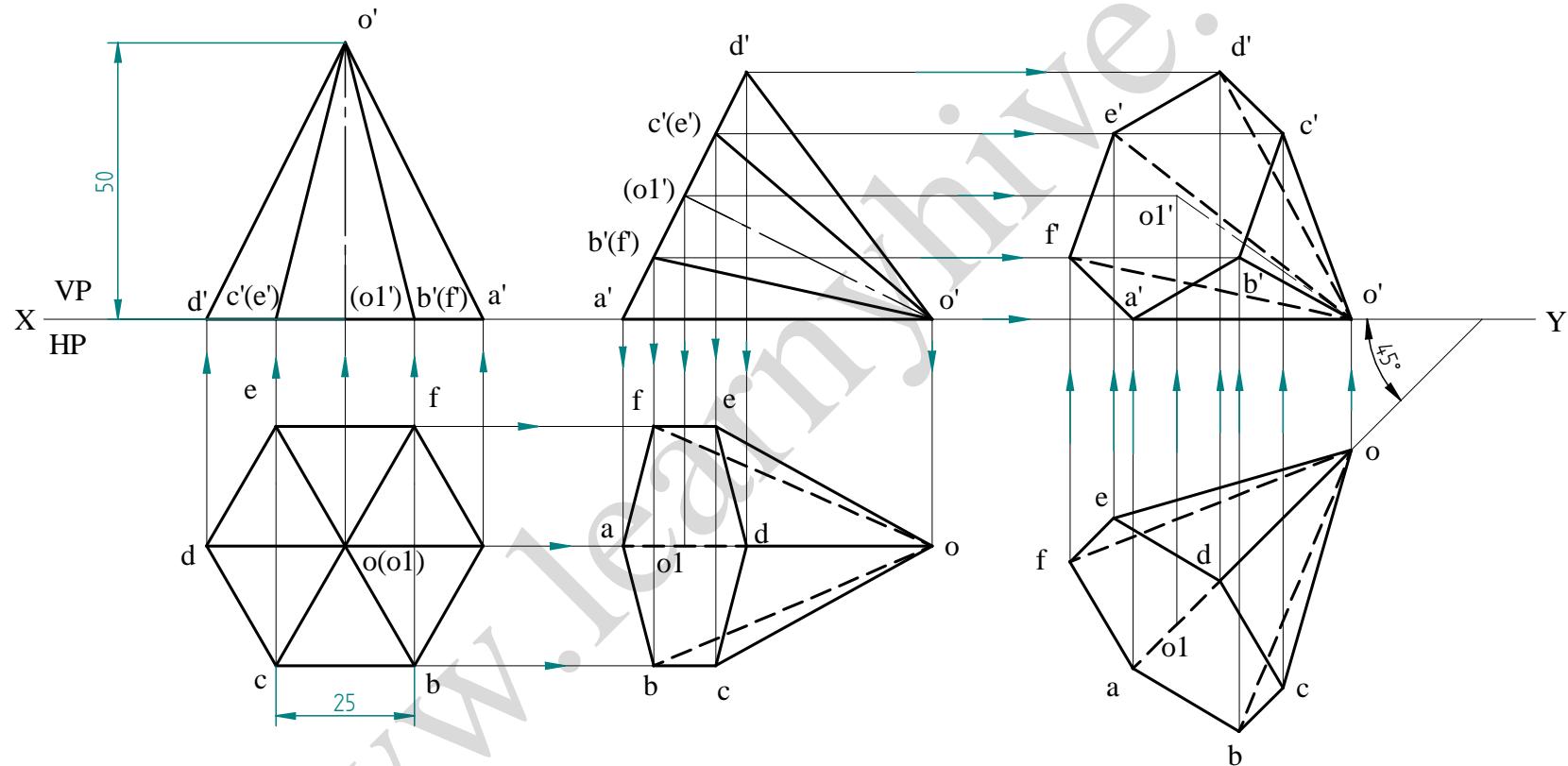
37. A pentagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its slant triangular faces. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg.



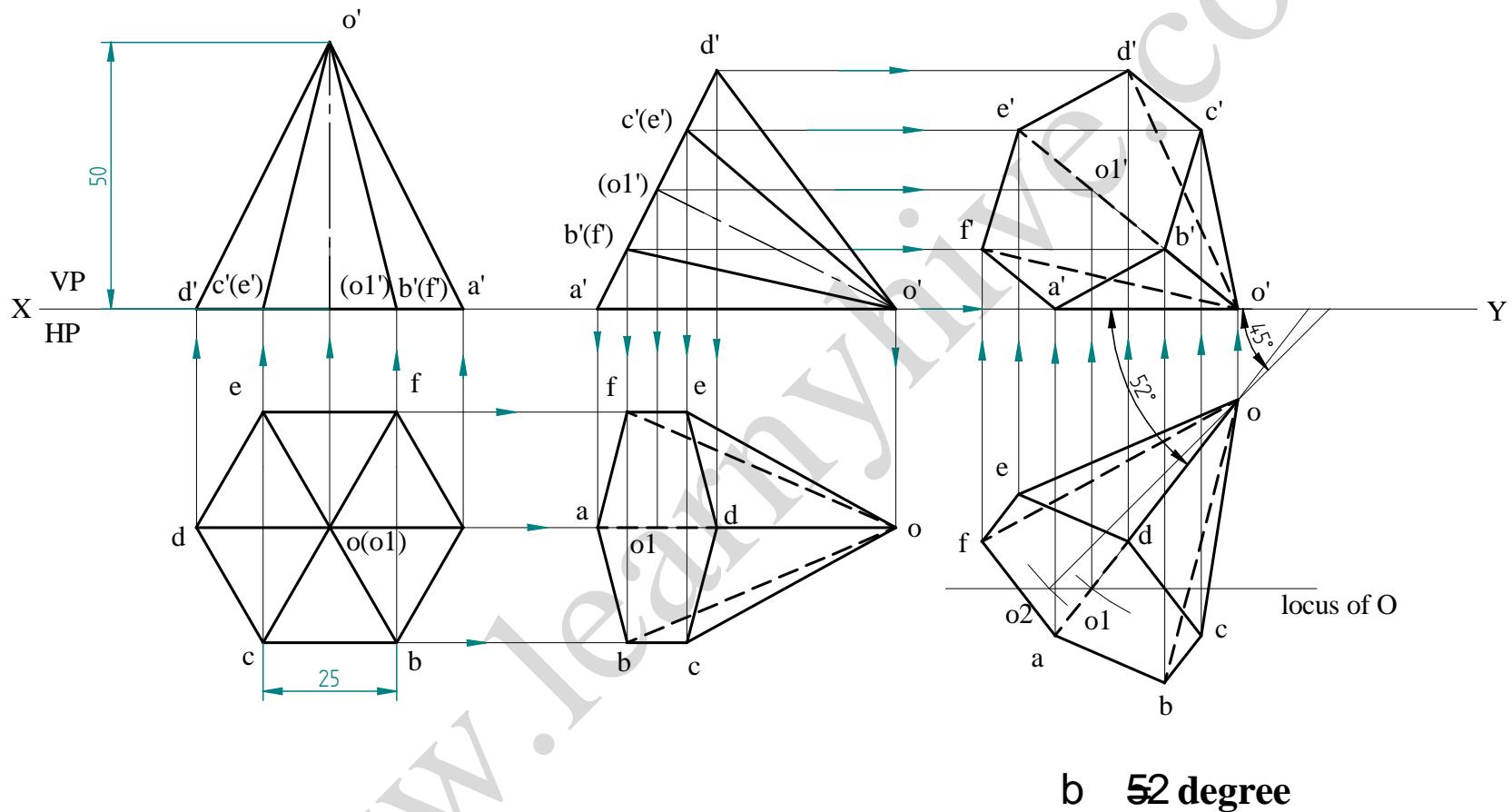
38. A pentagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its slant triangular faces. Draw the projections of the pyramid when the axis is inclined to VP at 45deg



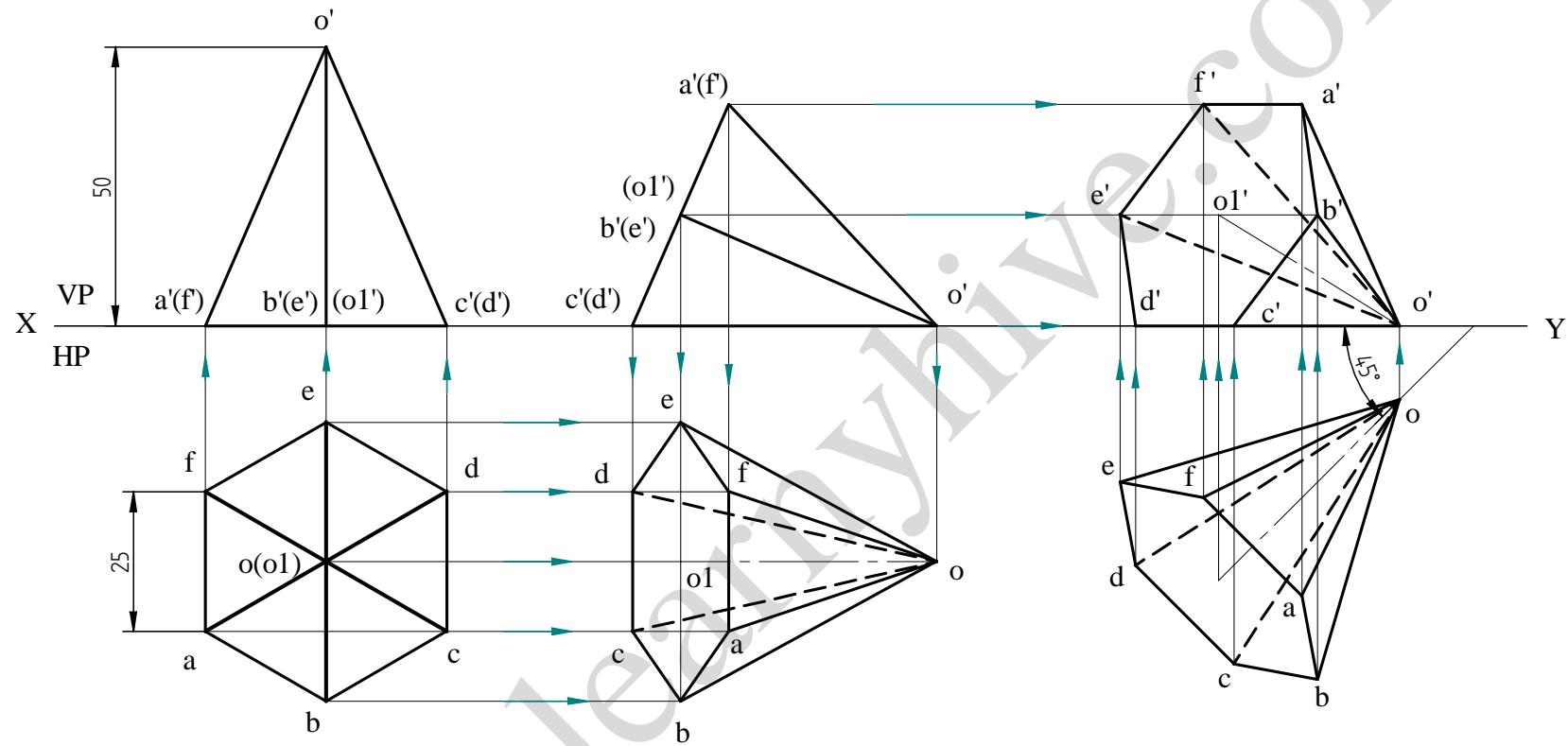
39. A hexagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its slant edges. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg.



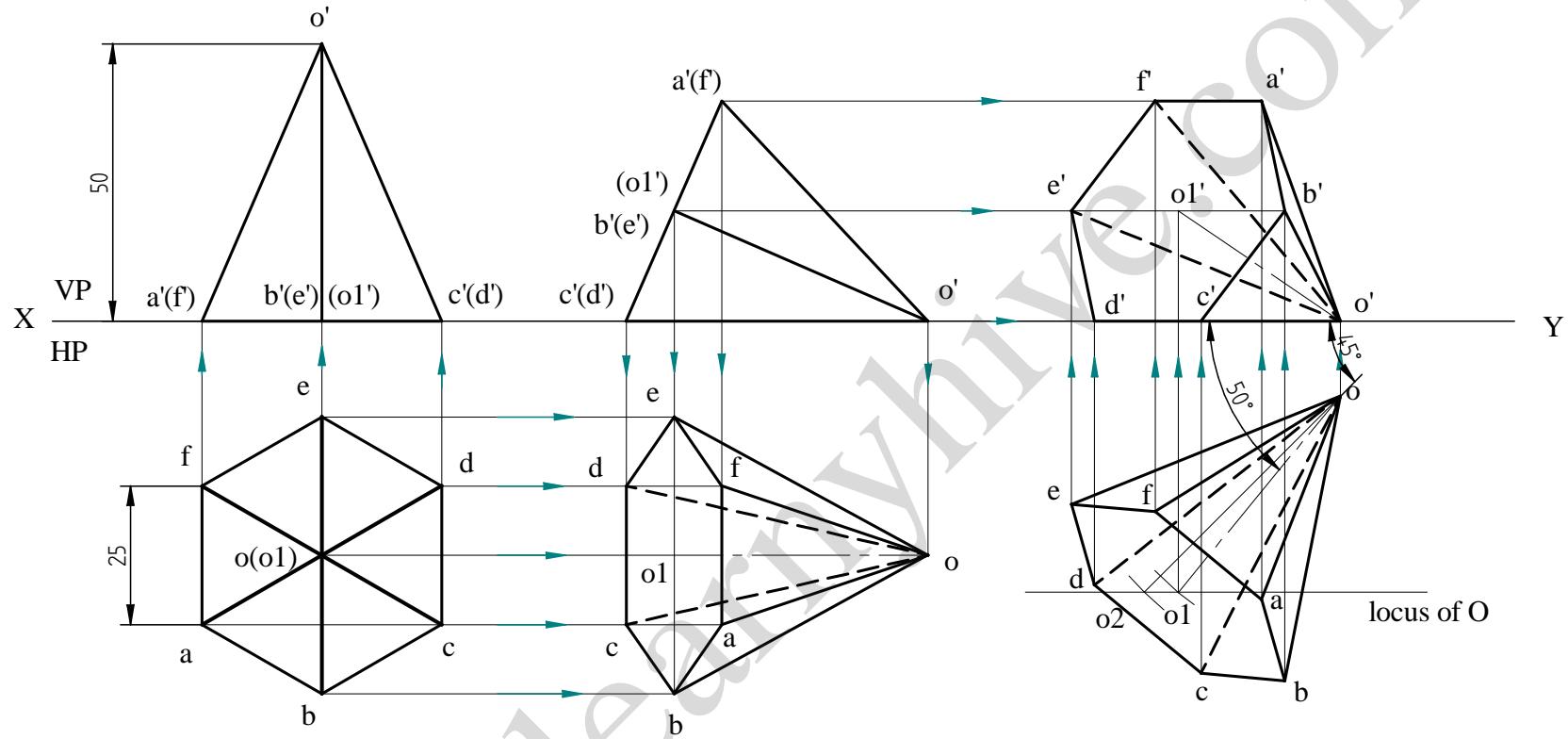
40. A hexagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its slant edges. Draw the projections of the pyramid when the axis is inclined to VP at 45deg



41. A hexagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its triangular faces. Draw the projections of the pyramid when the axis appears to be inclined to VP at 45deg.

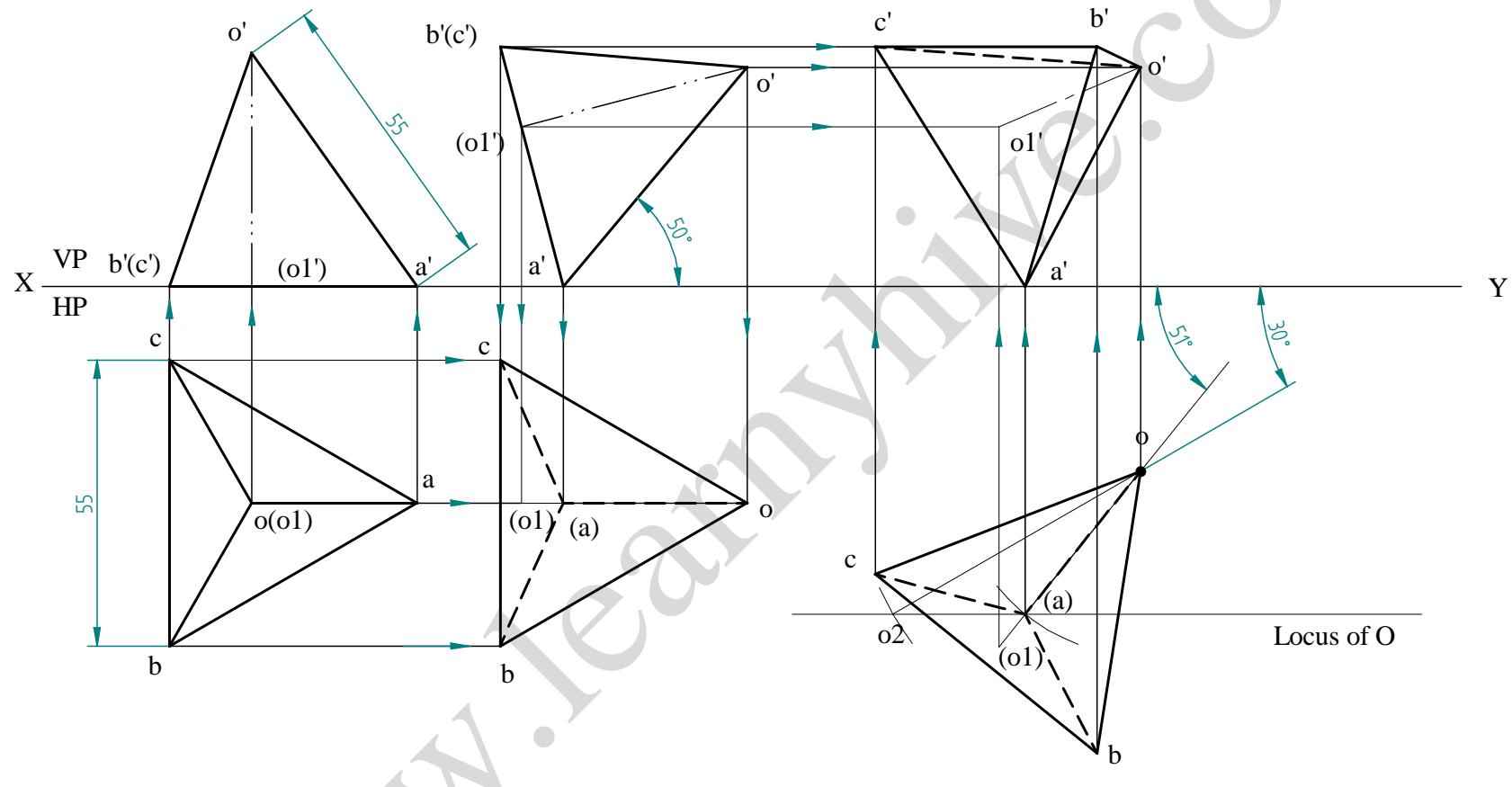


42. A hexagonal pyramid 25mm sides of base & 50mm axis length rests on HP on one of its triangular faces. Draw the projections of the pyramid when the axis is inclined to VP at 45deg.



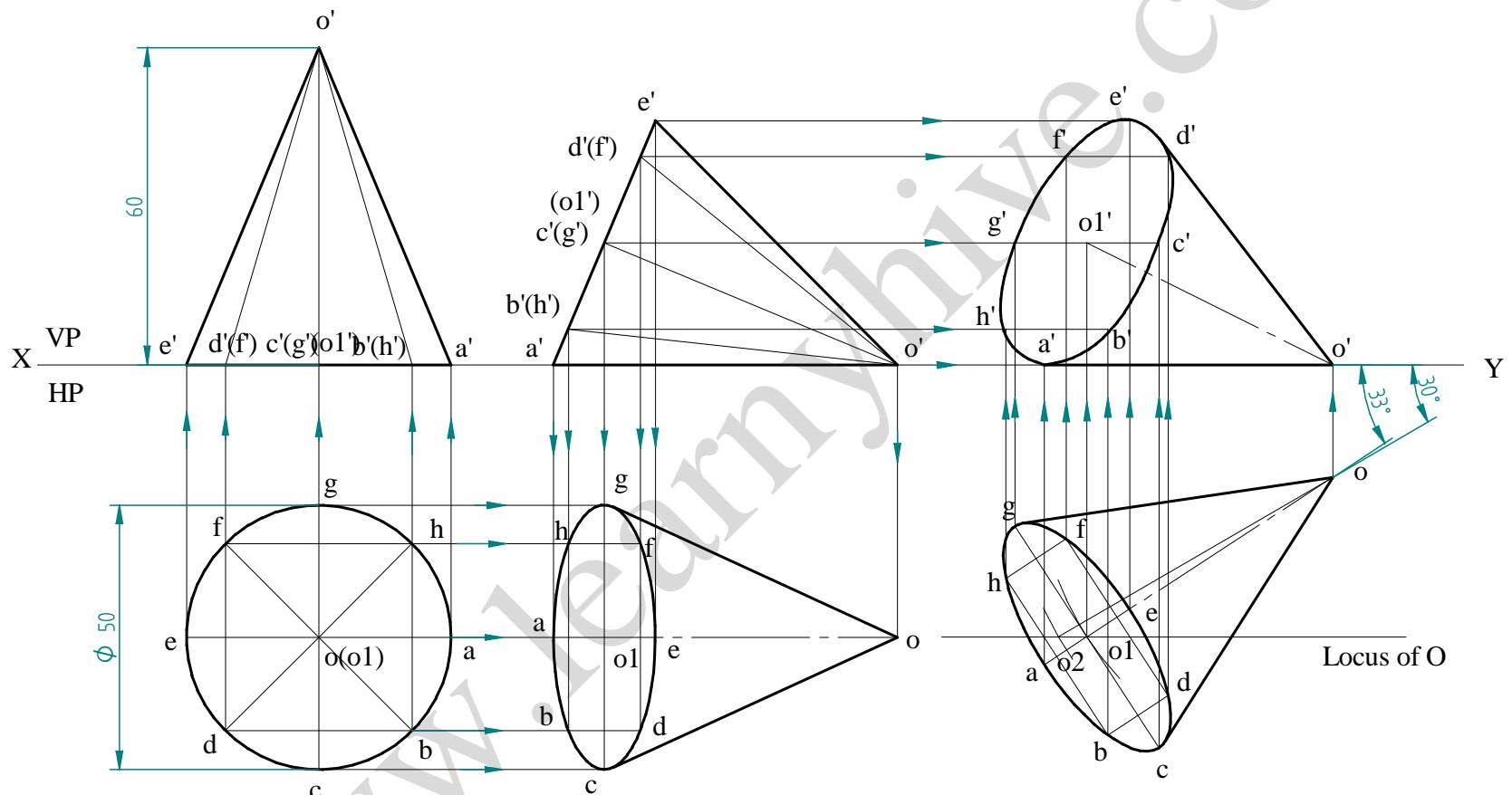
b 50 degree

44. A tetrahedron of 55mm sides rests on one of its corners such that an edge containing that corner is inclined to HP at 50deg. & VP at 30deg. Draw its projections



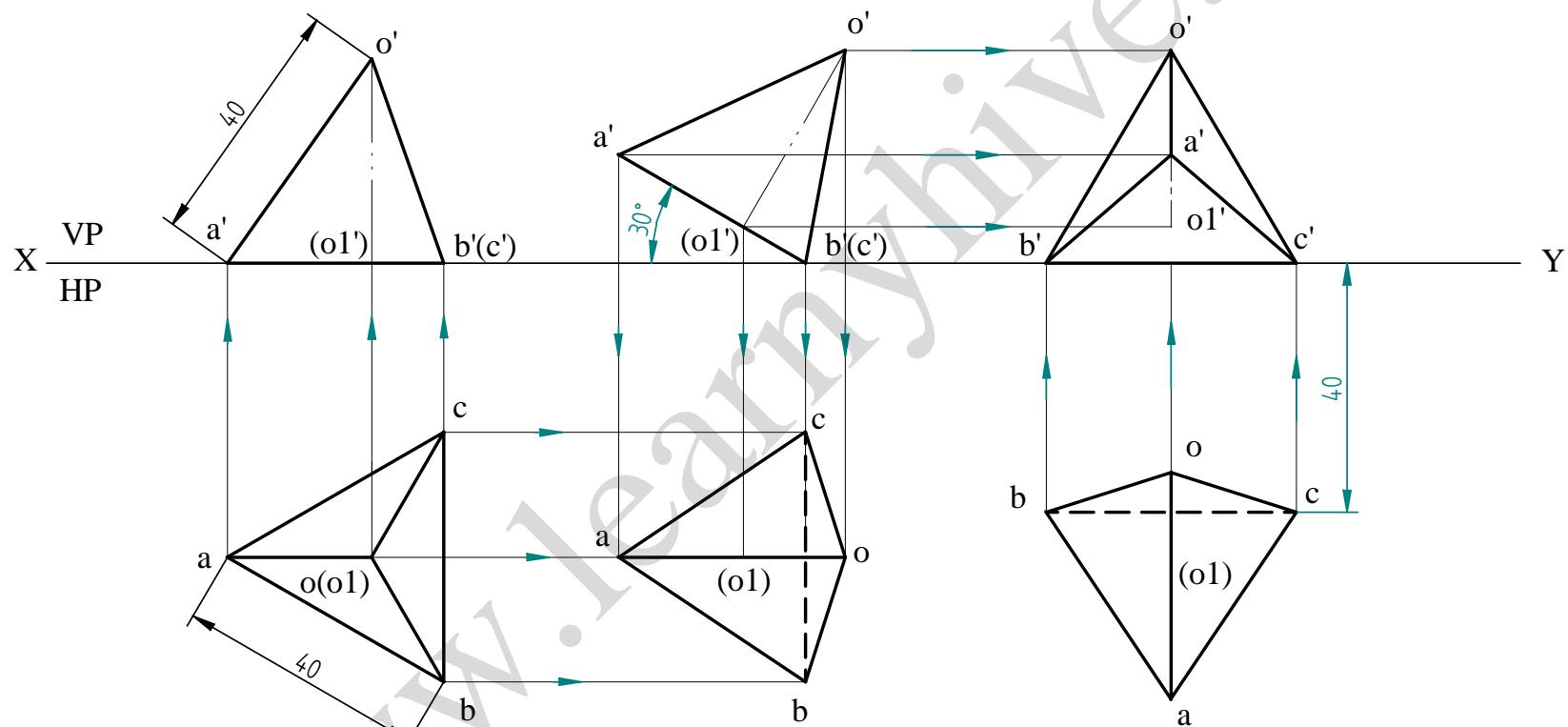
b 51 degree

45. A cone of 50mm base diameter & 60mm axis length rests on HP on one of its generators. Draw its projections when the axis is inclined to VP at 30deg.

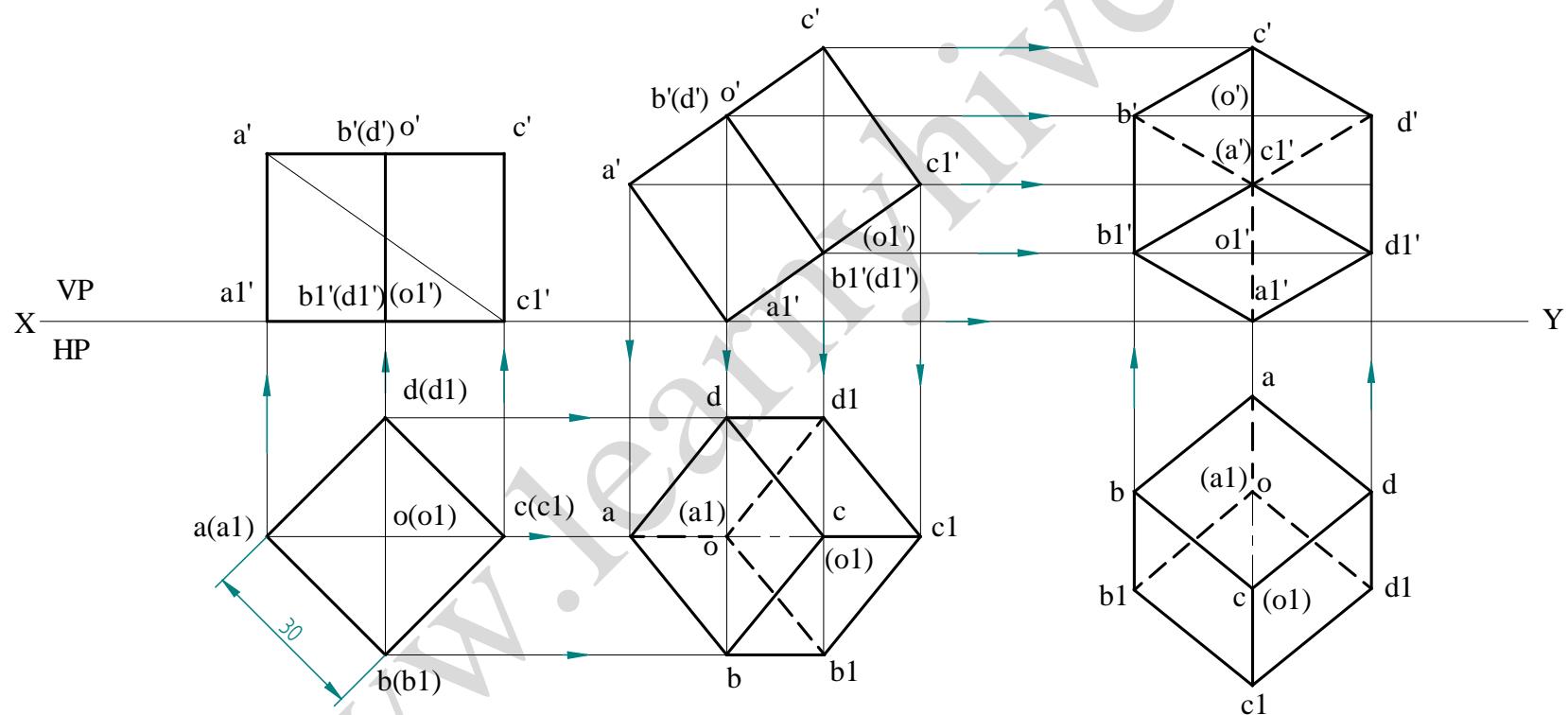


b 33 degree

46. A tetrahedron of sides 40mm is resting on one of its sides on HP. This is parallel to VP& 40mm away from it. It is tilted about resting side such that the base containing this edge is inclined at 30deg to HP. Draw the projections of the solids.



47. A hexahedron of 30mm sides is resting on one of its corners on HP such that one of its solid diagonals is perpendicular to VP. Draw the projections of the solid.



Isometric Projections

Axonometric projection:

Axonometric projection is a parallel projection technique used to create a pictorial drawing of an object by rotating the object along one or more of its axes relative to the plane of projection (or the picture plane). Axonometric projection is one of the four principal projection techniques: multiview, axonometric, oblique and perspective projection. In multi view, axonometric, and oblique projections, the observer is theoretically infinitely far away from the projection plane. In addition, the lines of sight are parallel to each other and perpendicular to the plane of projection. The main difference between a multiview drawing and an axonometric drawing are that, in a multiview, only two dimensions of an object are visible in each view and hence more than one view is required to define the object. In an axonometric drawing, the object is rotated about an axis to show all three dimensions, and only one view is required.

Isometric projection is a type of pictorial projection in which the dimensions along the three axes of the solid are shown in one view. It is one of the three types of axonometric projection

In axonometric drawing, one axis of space is shown vertical and depending on the exact angle at which the view deviates from the orthogonal, axonometric projections are generally three types: (a) trimetric projection, (b) dimetric projection, and (c) isometric projection

In trimetric projection, the direction of viewing is such that all of the three axes of space appear unequally foreshortened. The scale along each of the three axes and the angles among them are determined separately as dictated by the angle of viewing. Trimetric perspective is seldom used

In dimetric projection, the direction of viewing is such that two of the three axes of space appear equally shortened, of which the attendant scale and angles of presentation are determined according to the angle of viewing; the scale of the third direction (vertical) is determined separately. When two of the three angles are equal, the drawing is classified as a dimetric projection. Dimetric drawings are less pleasing to the eye, but are easier to produce than trimetric drawings

In isometric projection, the most commonly used form of axonometric projection in engineering drawing. Here all three angles are equal. The

isometric is the least pleasing to the eye, but is the easiest to draw and dimension.

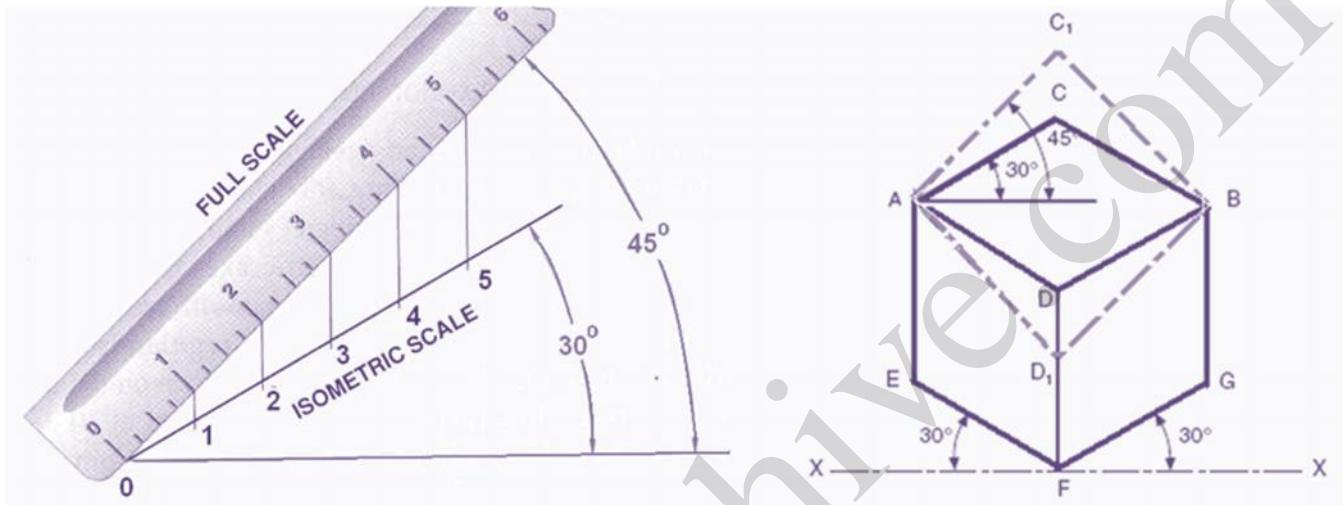


Figure 5. illustrates the construction of an isometric scale.

$$\text{Isometric scale} = \left(\frac{\text{Isometric length}}{\text{True length}} \right) = \frac{\cos 45^\circ}{\cos 30^\circ} = \frac{1}{\sqrt{2}} + \frac{\sqrt{3}}{2} = 0.8165$$

i.e. isometric length = 82% (approximately)

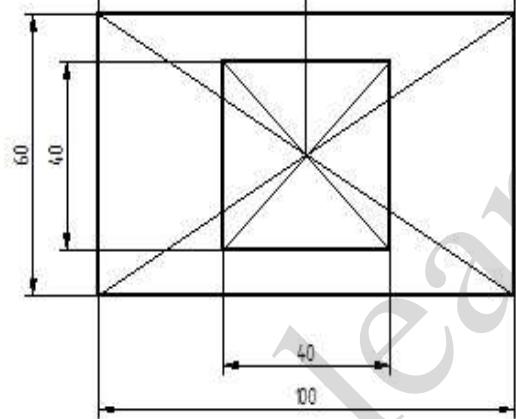
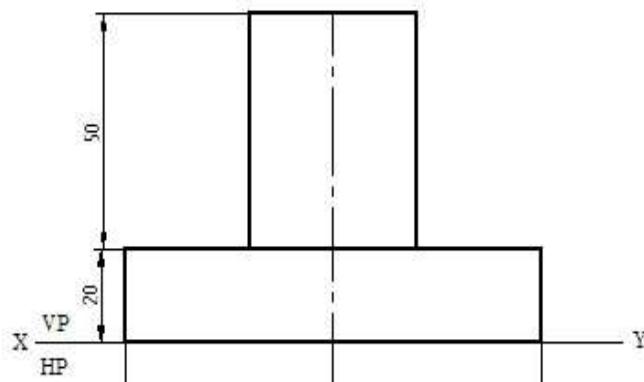
Isometric axes can be positioned in a number of ways to create different views of the same object. While drawing the Isometric view, first the view point will have to be decided for obtaining the maximum technical information.

Hidden Lines, Center Lines and Dimensions

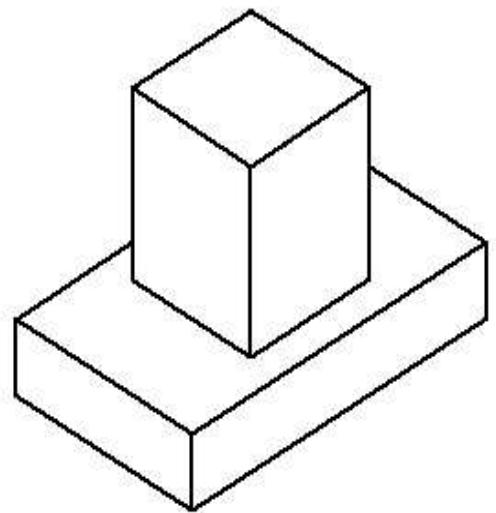
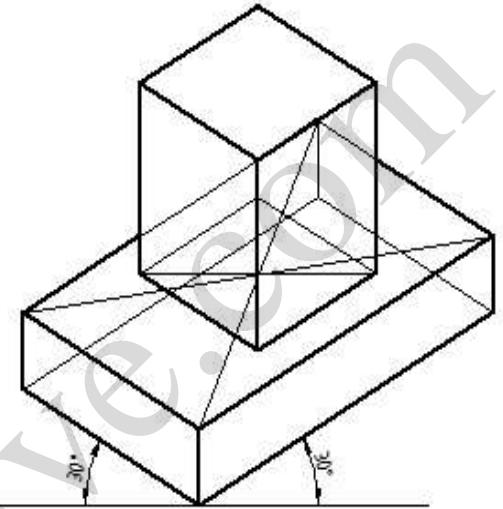
In isometric drawings, hidden lines are omitted unless they are absolutely necessary to completely describe the object. Most isometric drawings will not have hidden lines. To avoid using hidden lines, choose the most descriptive viewpoint. Centerlines are drawn only for showing symmetry or for dimensioning. Normally, centerlines are not shown, because many isometric drawings are used to communicate to non-technical people and not for engineering.

Isometric Projections

1. A square prism base side 40mm, height 50mm is placed centrally on a rectangular slab sides 100mm×60mm and thickness 20mm. Draw the isometric projection of the combination.

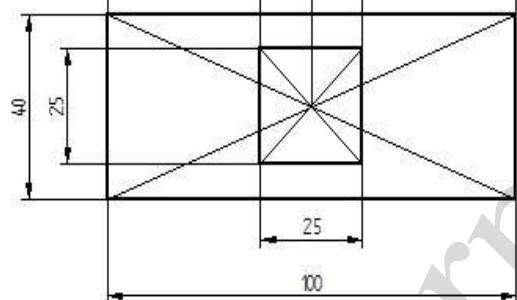
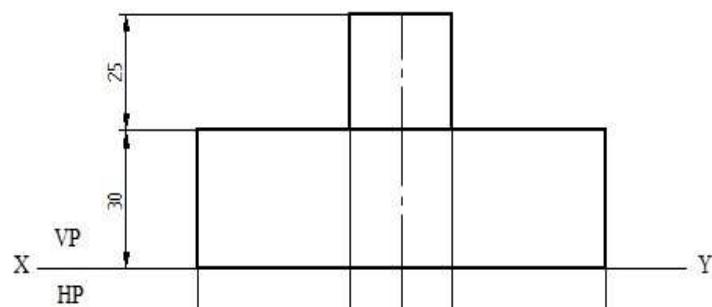


ORTHOGRAPHIC VIEW

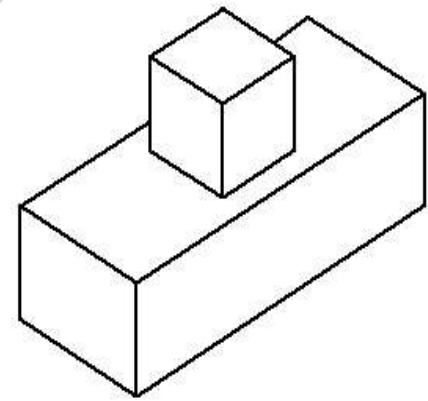
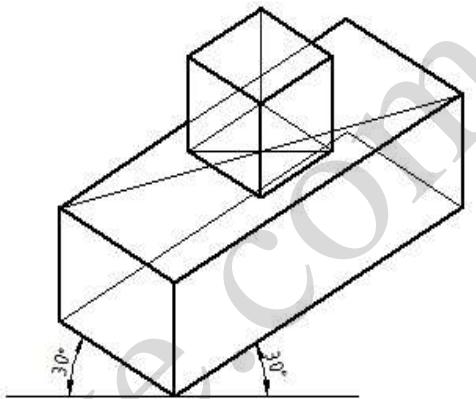


ISOMETRIC VIEW

2. A cube of side 25mm is resting centrally on a rectangular slab 100mm×40mm and 30mm thick. Draw the isometric projection of the combination.

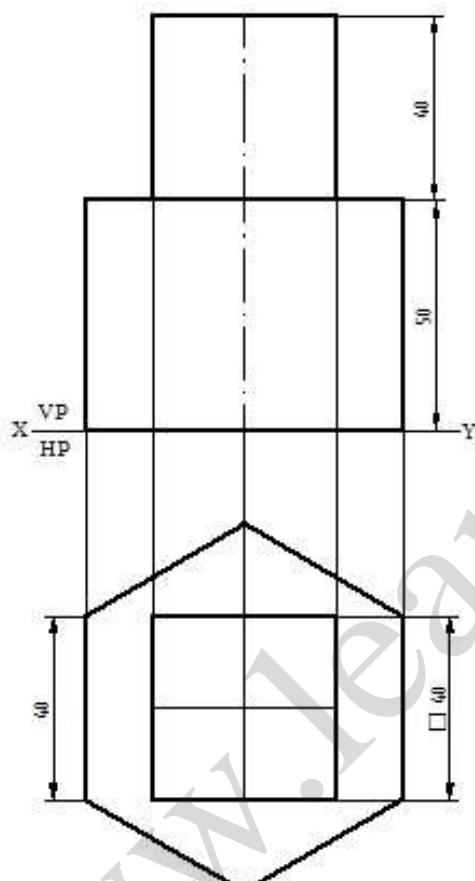


ORTHOGRAPHIC VIEW

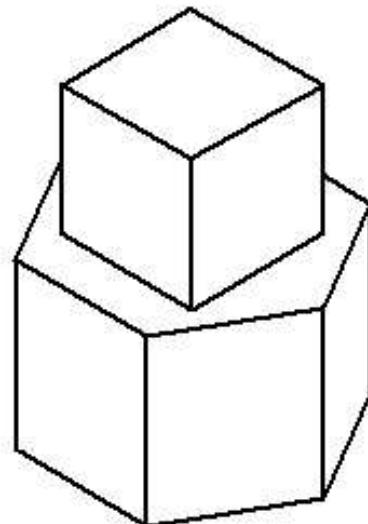
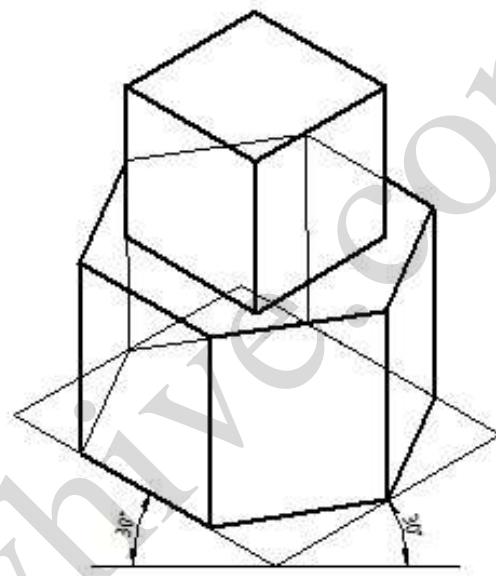


ISOMETRIC VIEW

3. A cube of side 40mm is resting centrally on a hexagonal prism base side 40mm and height 50mm, such that one of the base sides of the cube is parallel to one of the sides of the top face of the prism. Draw the isometric projection of the combination.

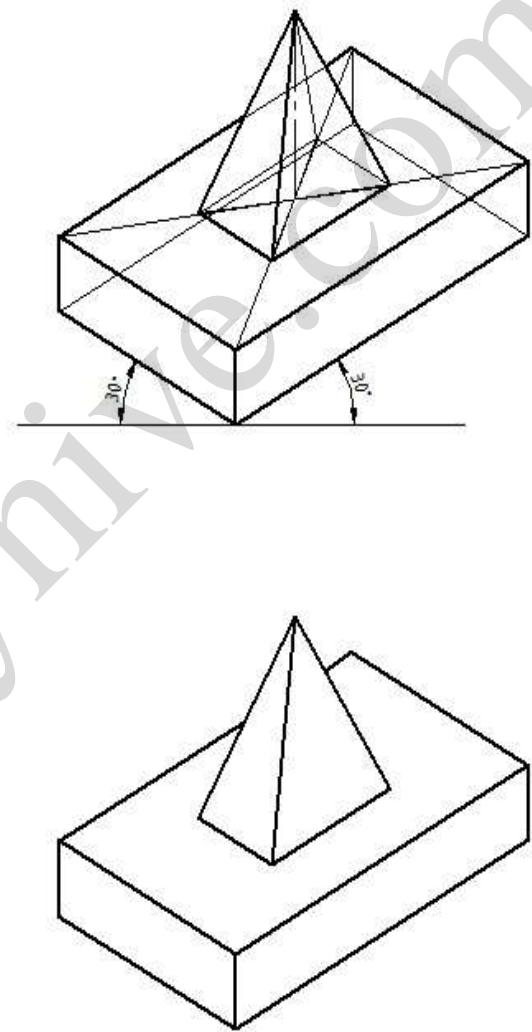
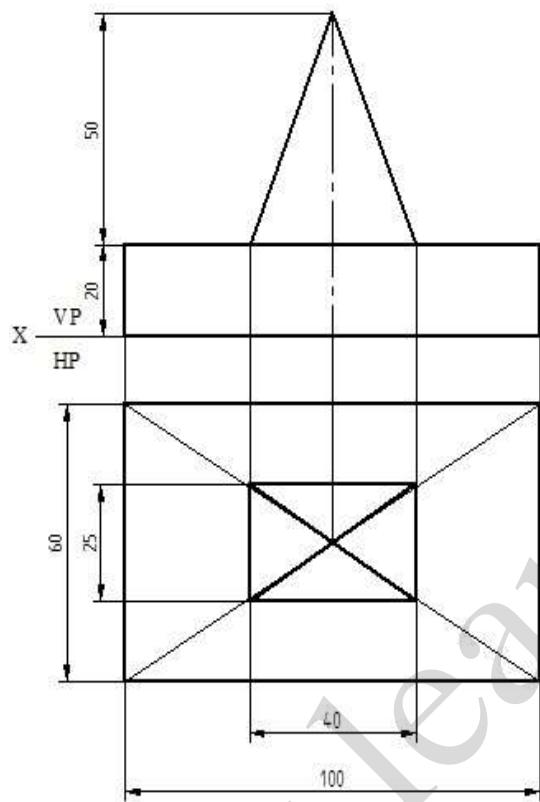


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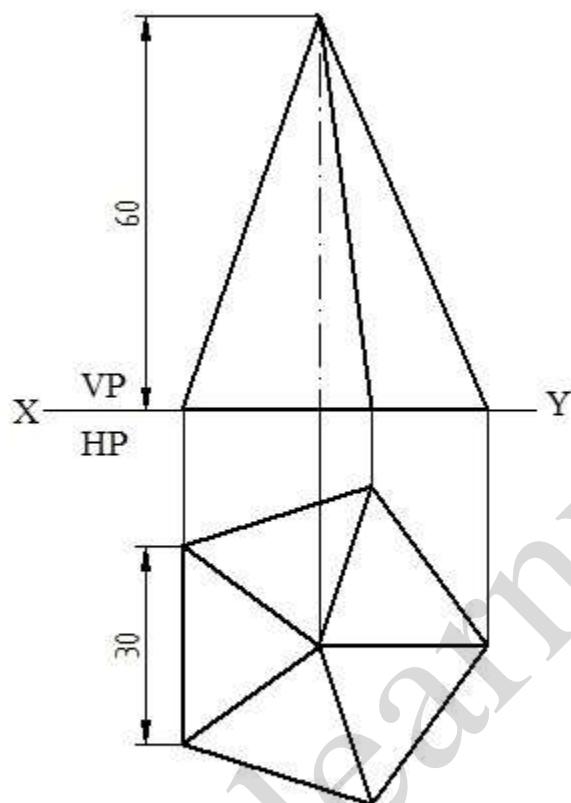


ISOMETRIC VIEW

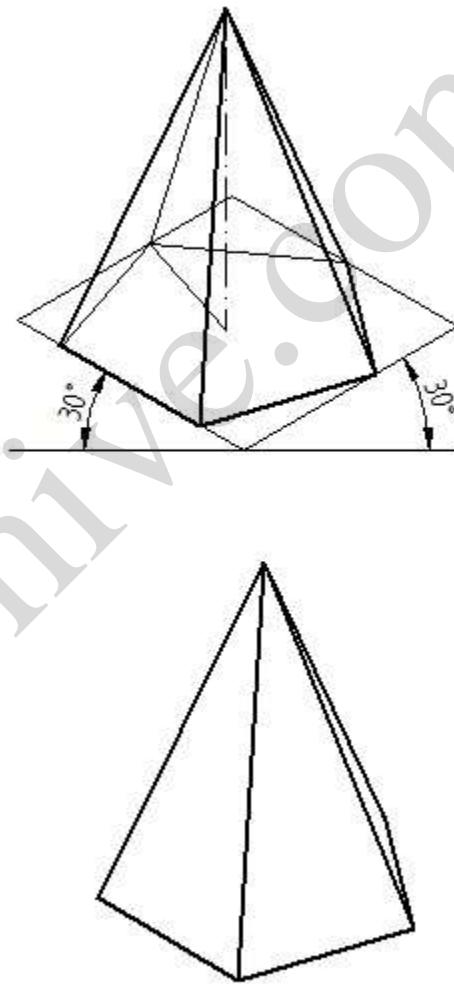
4. A rectangular pyramid of base $40\text{mm} \times 25\text{mm}$ and height 50mm is placed centrally on a rectangular slab sides $100\text{mm} \times 60\text{mm}$ and thickness 20mm. Draw the isometric projection of the combination.



5. A pentagonal pyramid of base side 30mm and axis length 60mm is resting on HP on its base with a side of base perpendicular to VP. Draw its isometric projections.

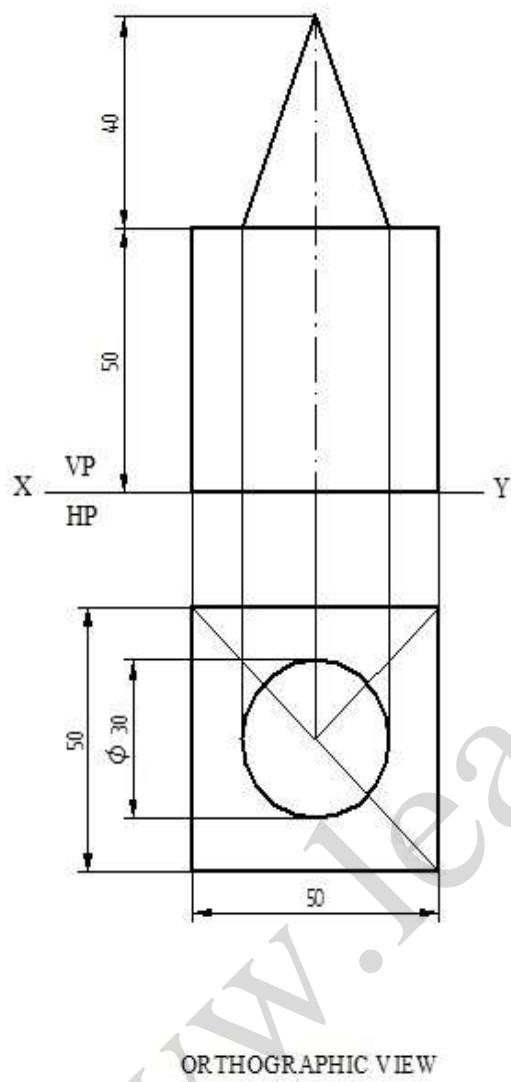


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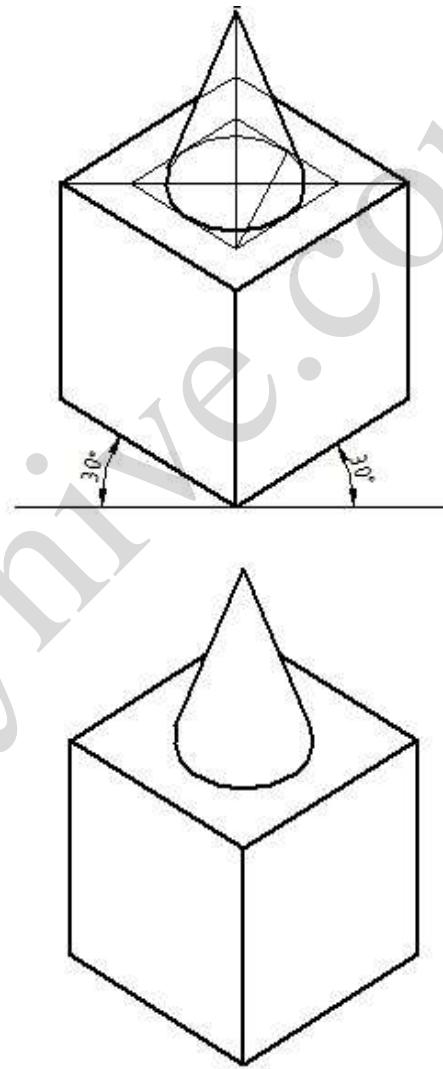


ISOMETRIC VIEW

6. A cone of base diameter 30mm and height 40mm rests centrally over a cube of side 50mm. Draw the isometric projection of the combination of solids.

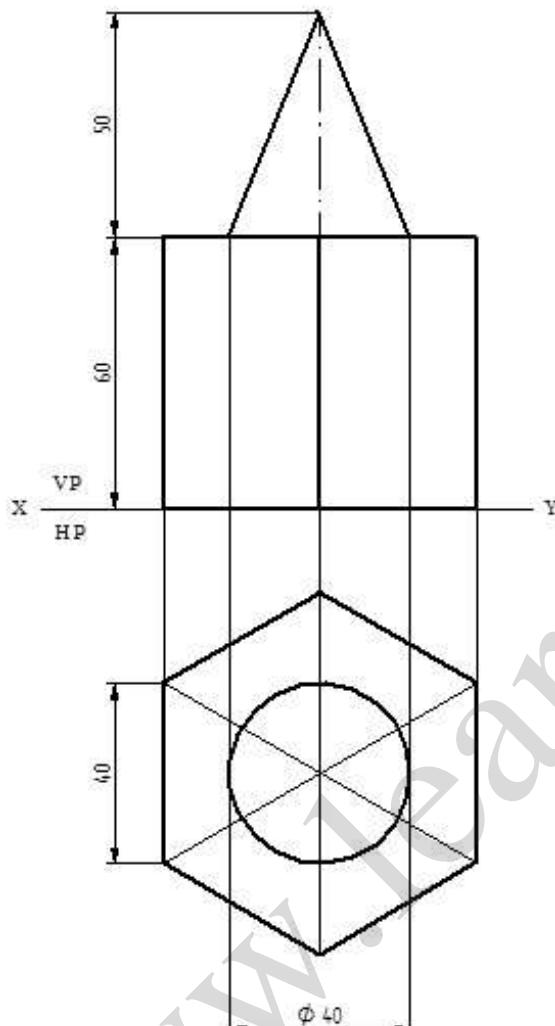


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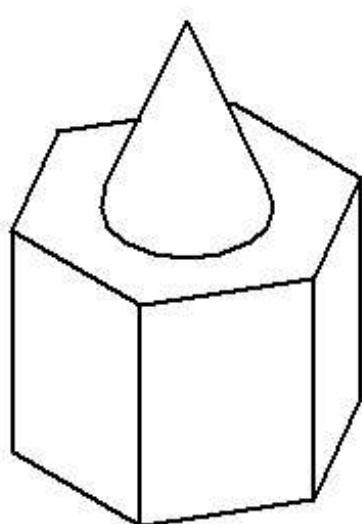
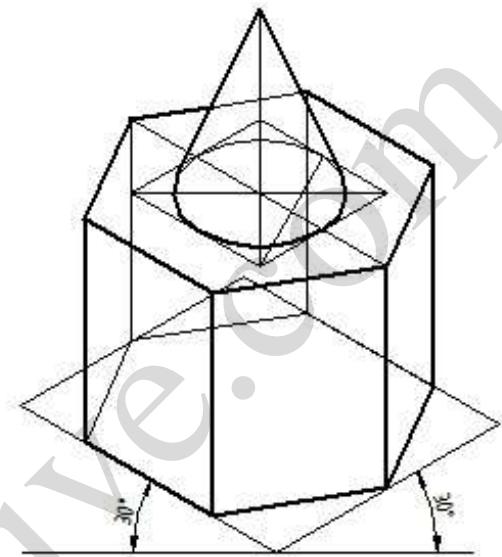


ISOMETRIC VIEW

7. Draw isometric projection of a hexagonal prism of side of base 40mm and height 60mm with a right circular cone of base 40mm as diameter and altitude 50mm, resting on its top such that the axes of both the solids are collinear.

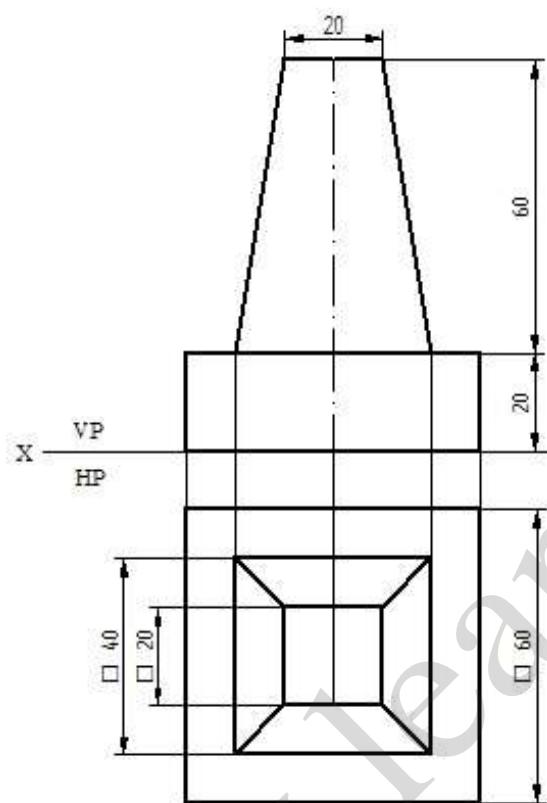


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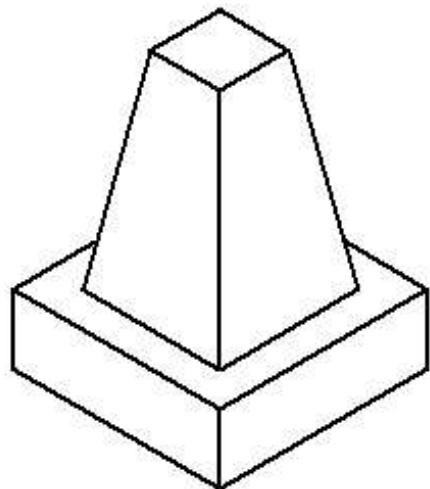
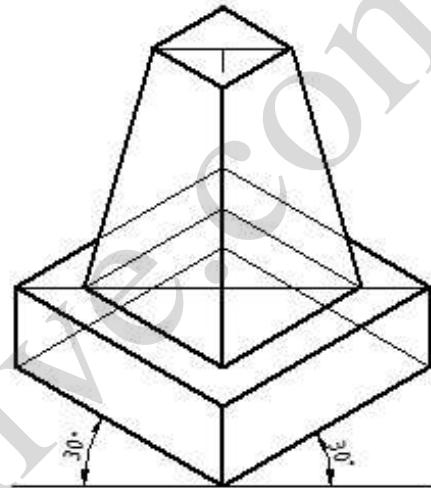


ISOMETRIC VIEW

8. The frustum of a square pyramid of sides 40mm and height 60mm rest on the centre of the top of a square block of side 60mm and height 20mm. The base edges of the pyramid are parallel to the top edges of the square block. Draw the isometric projection of the combination of the solids.

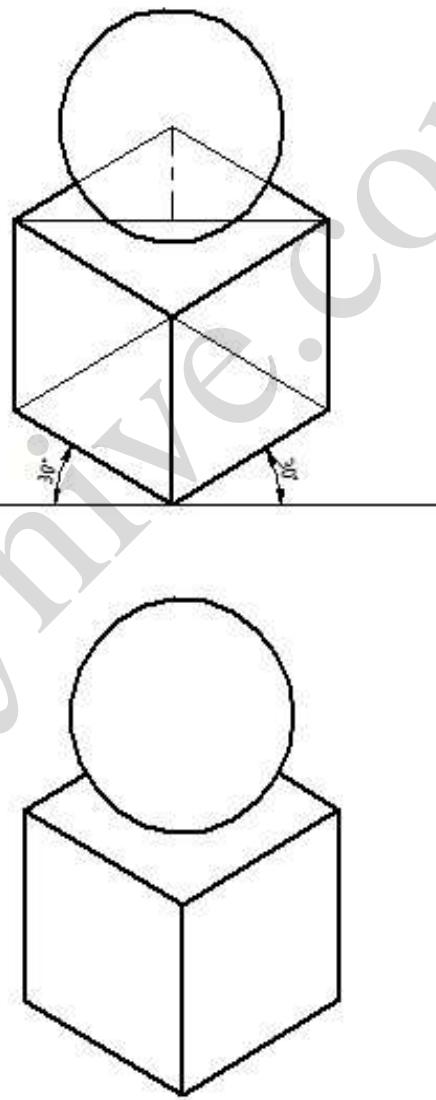
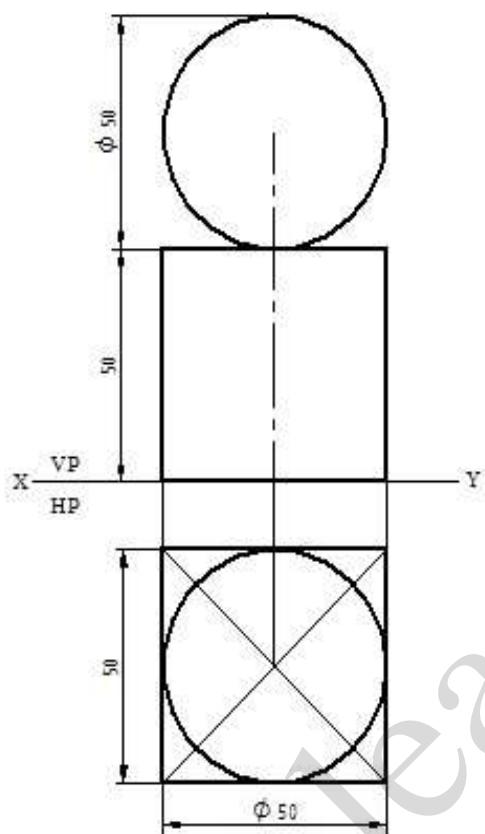


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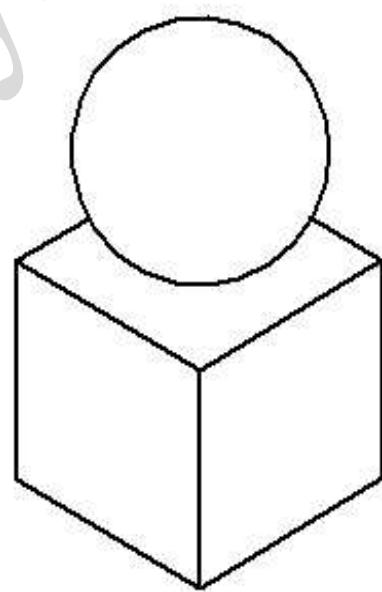
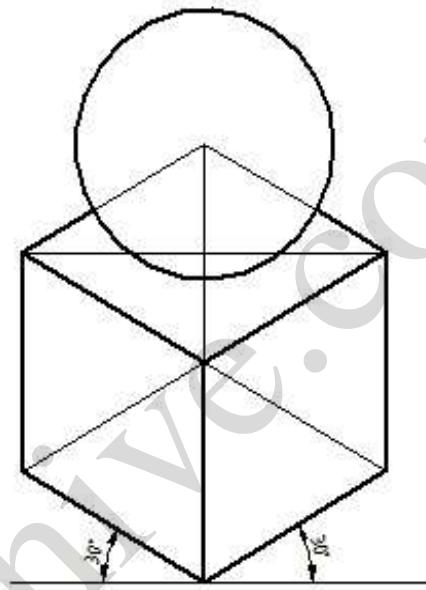
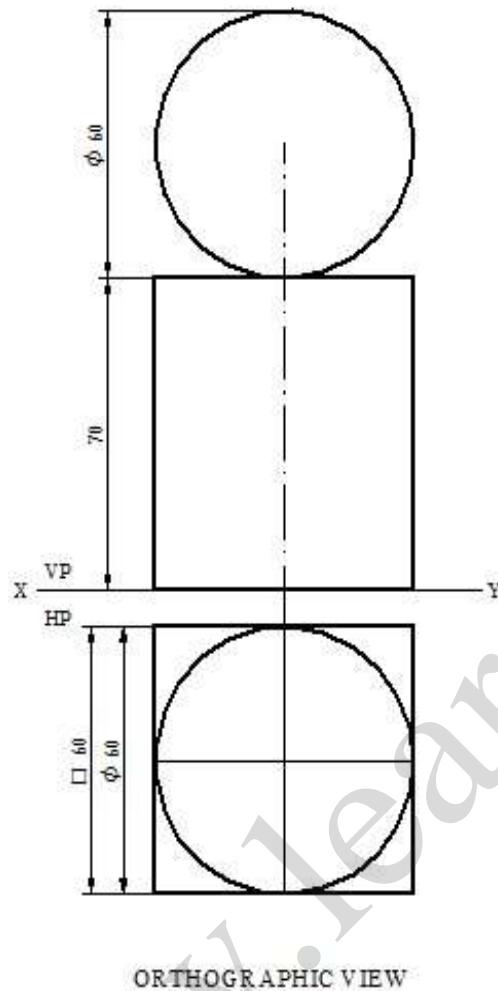


ISOMETRIC VIEW

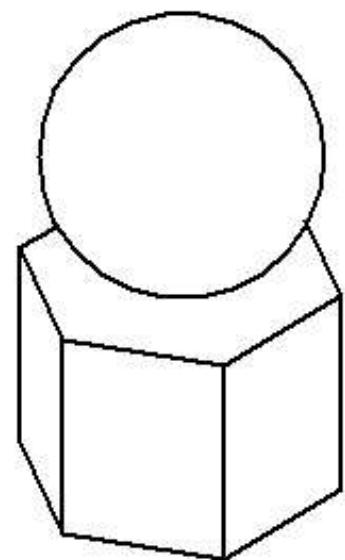
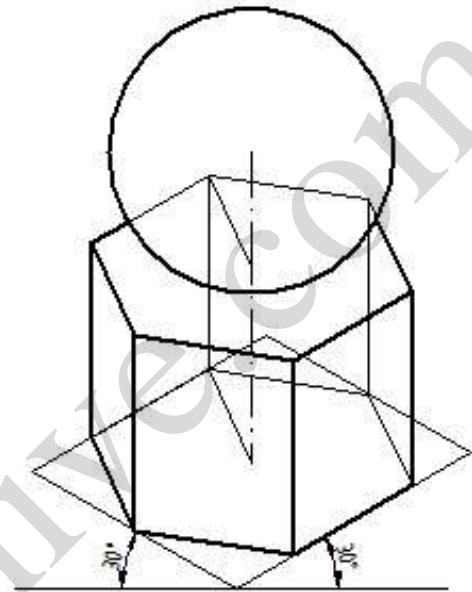
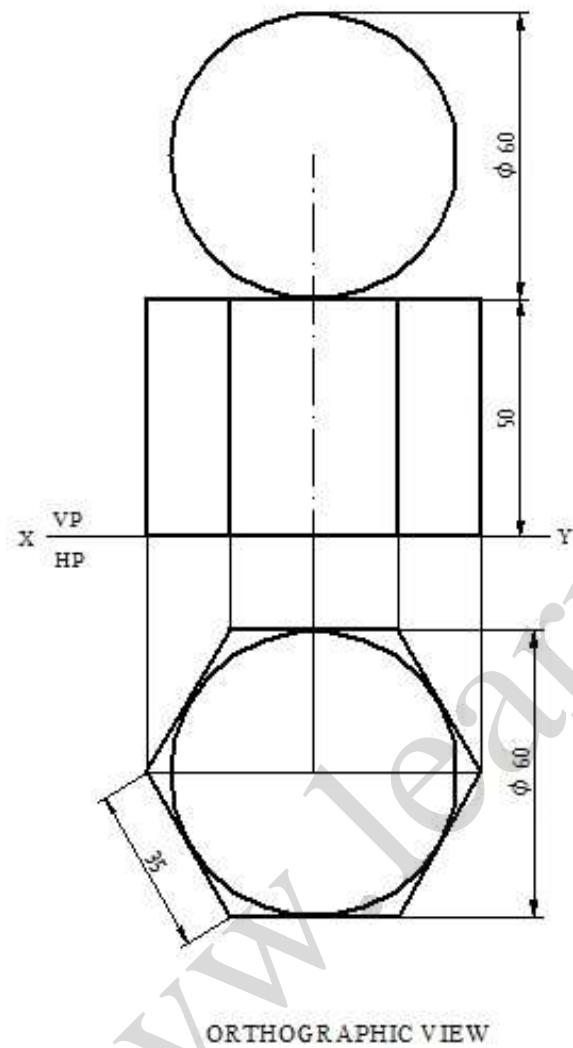
9. A sphere of diameter 50mm rests centrally on top of a cube of sides 50mm. Draw the isometric projections of the combination of the solids.



10. A sphere diameter 60mm is placed centrally on the top face of a square prism side 60mm and height 70mm. Draw the isometric projection of the combination.

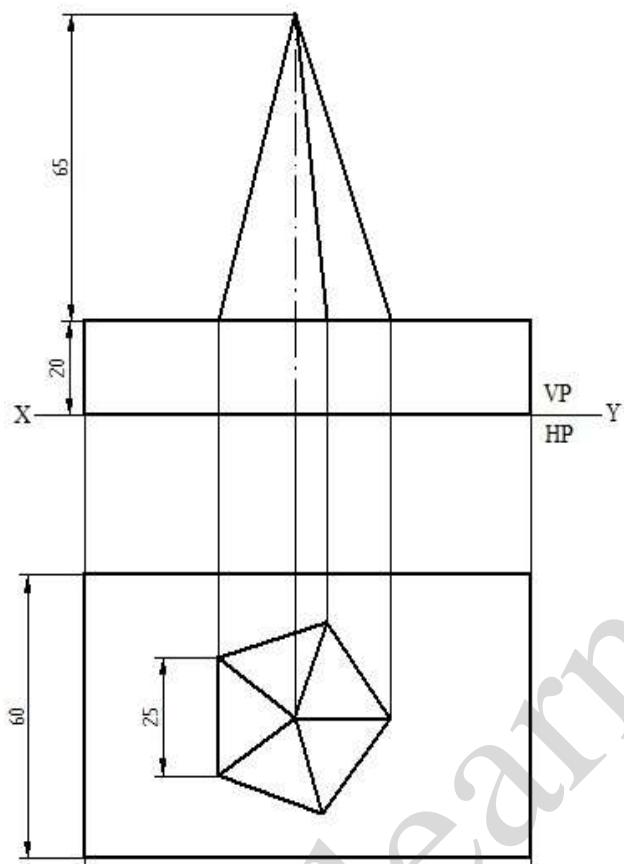


11. A sphere diameter 60mm is placed centrally on the top face of a hexagonal prism side 35mm and height 50mm. Draw the isometric projection of the combination.

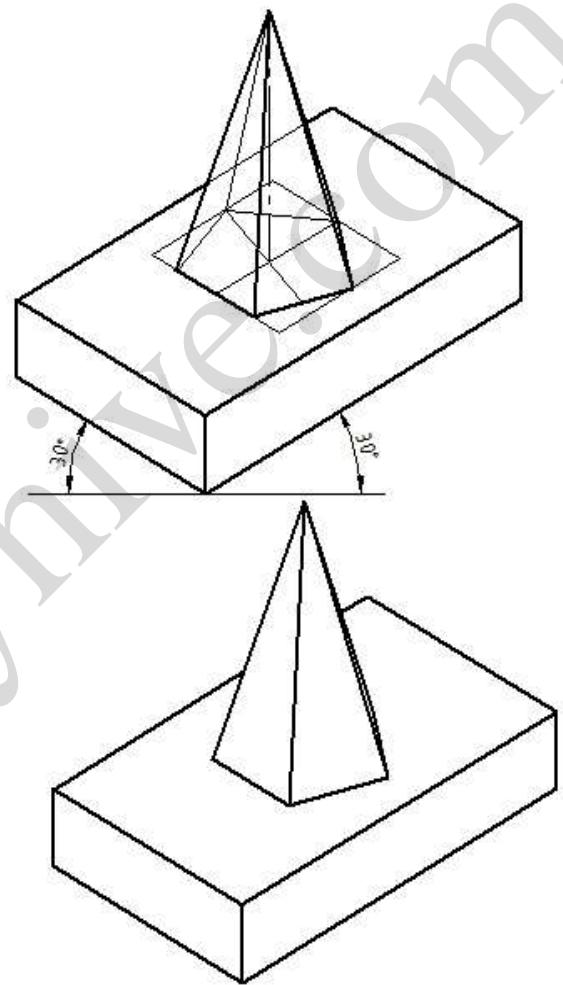


ISOMETRIC VIEW

12. A pentagonal pyramid base side 25mm and height 65mm is placed centrally on a rectangular slab 100mm×60mm and 20mm thick. Draw the isometric projection of the combination.

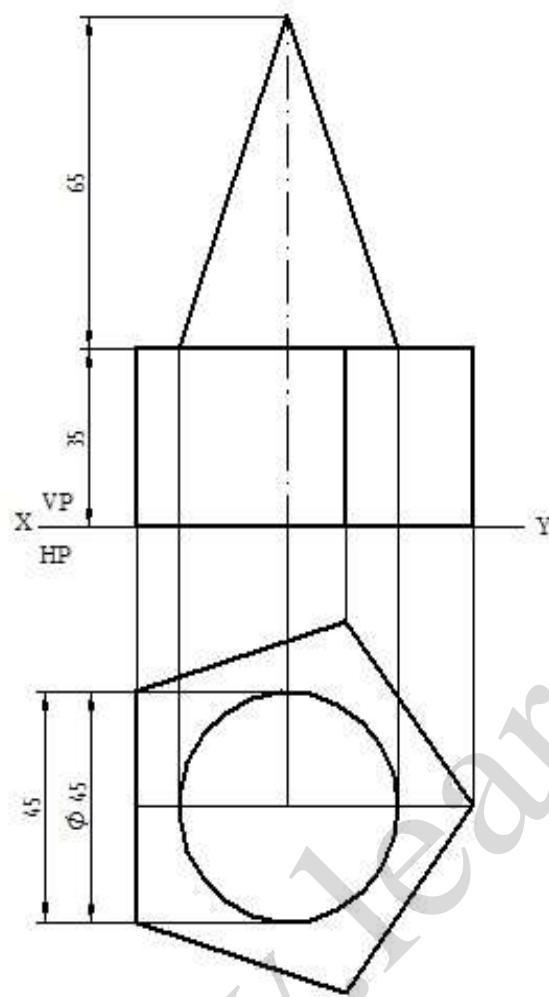


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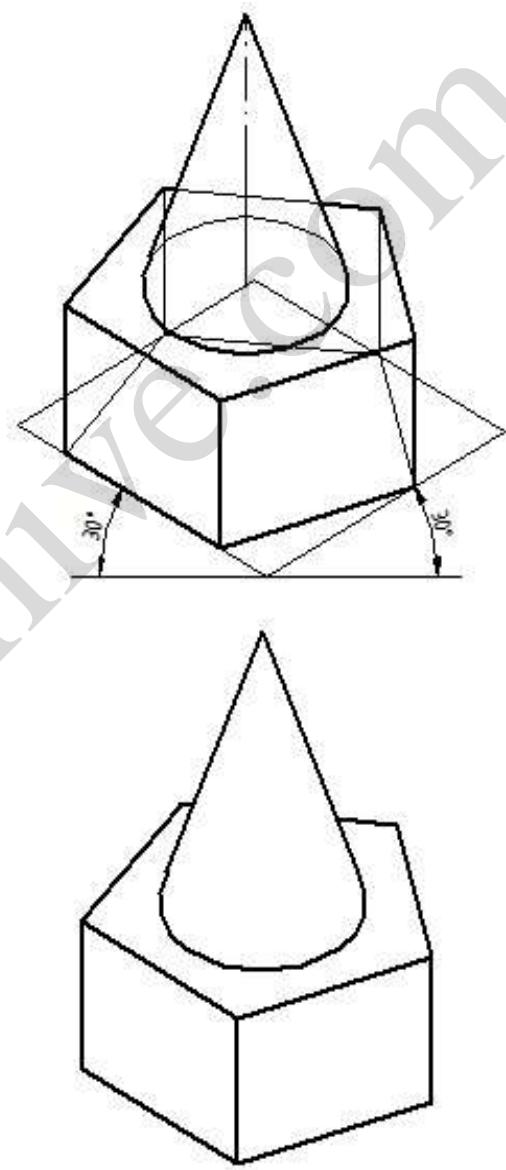


ISOMETRIC VIEW

13. A cone of base diameter 45mm and height 65mm is placed centrally on the top face of a pentagonal prism side 45mm and height 35mm. Draw the isometric projection of the combination.

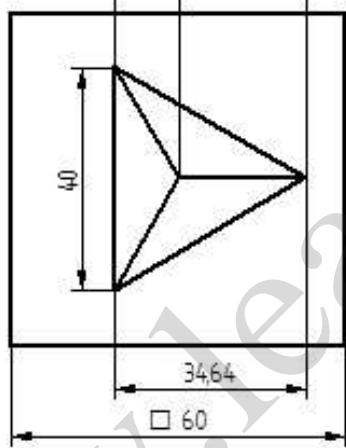
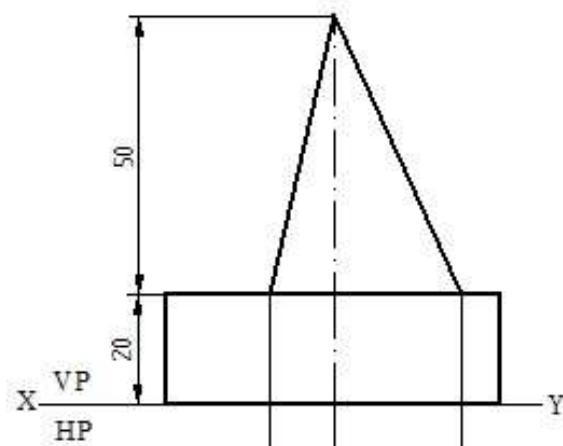


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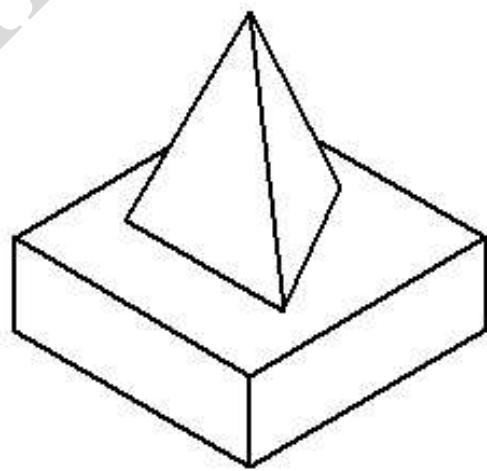
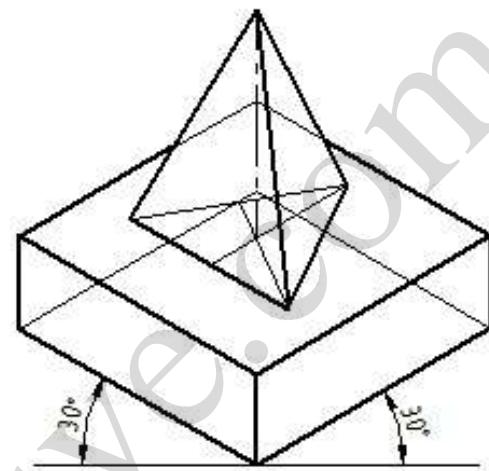


ISOMETRIC VIEW

14. A triangular pyramid base side 40mm and height 50mm is placed centrally on a square slab side 60mm and 20mm thick. Draw the isometric projection of the combination.

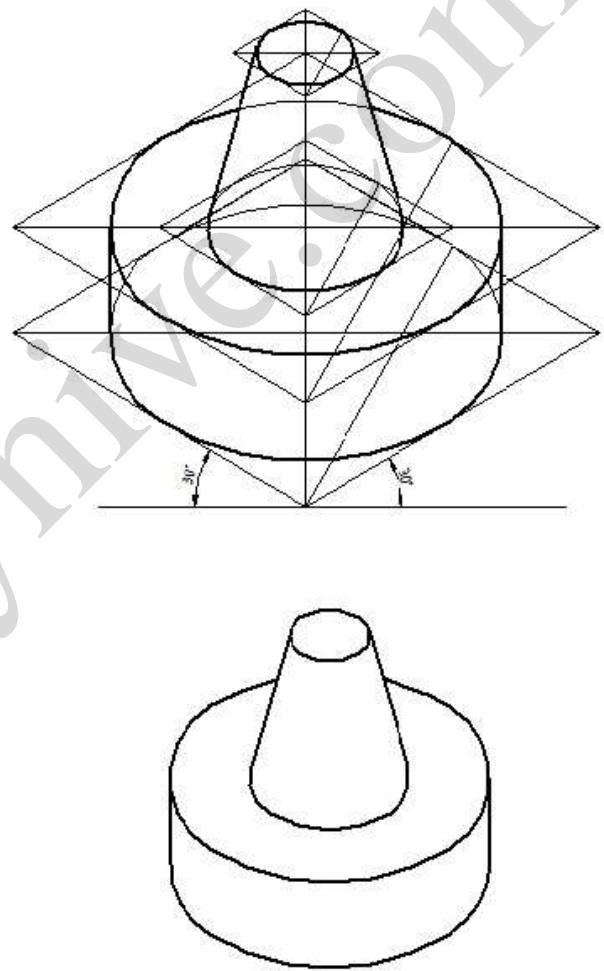
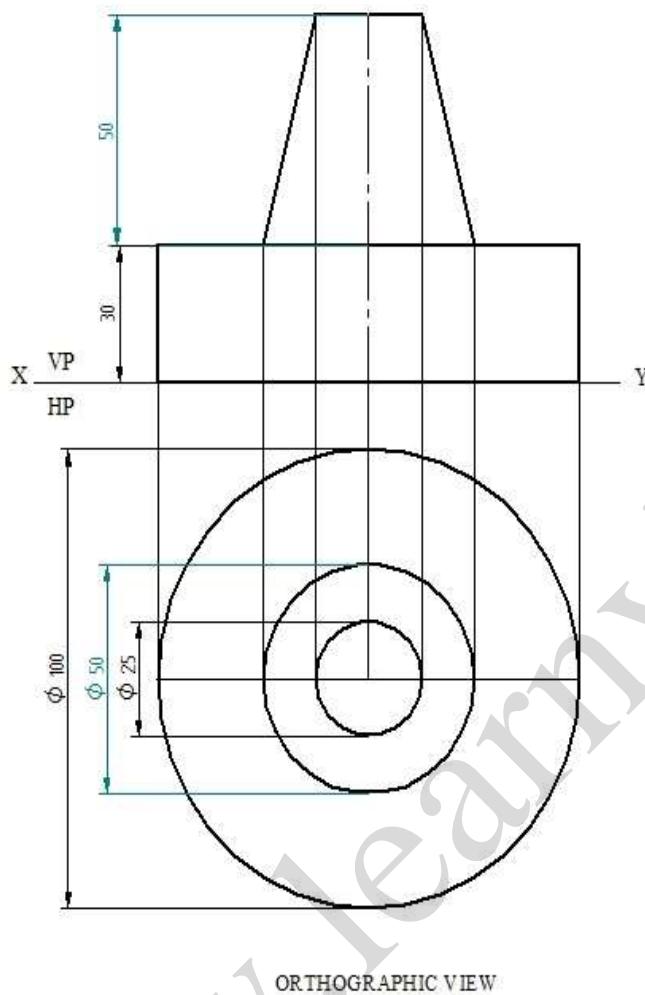


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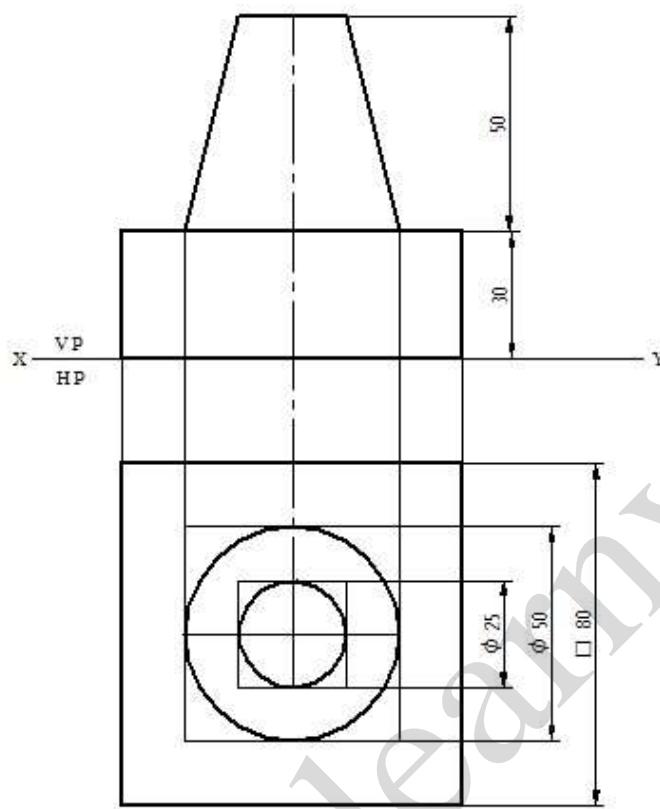


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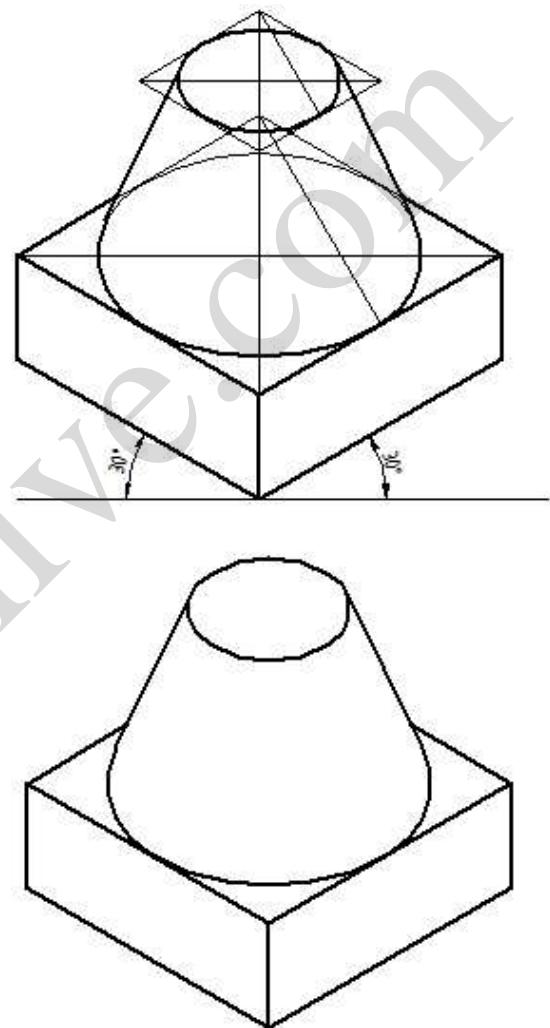
15. A frustum of cone base diameter 50mm, top diameter 25mm and height 50mm is placed centrally on a cylindrical slab of diameter 100mm and thickness 30mm. Draw the isometric projection of the combination.



16. A frustum of cone base diameter 50mm, top diameter 25mm and height 50mm is placed centrally on a square slab side 80mm and thickness 30mm. Draw the isometric projection of the combination.

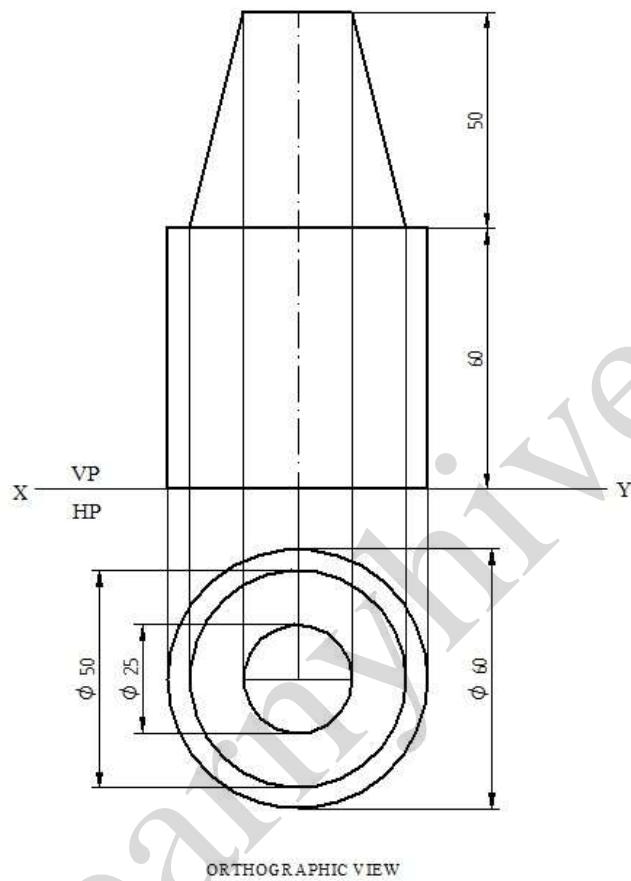


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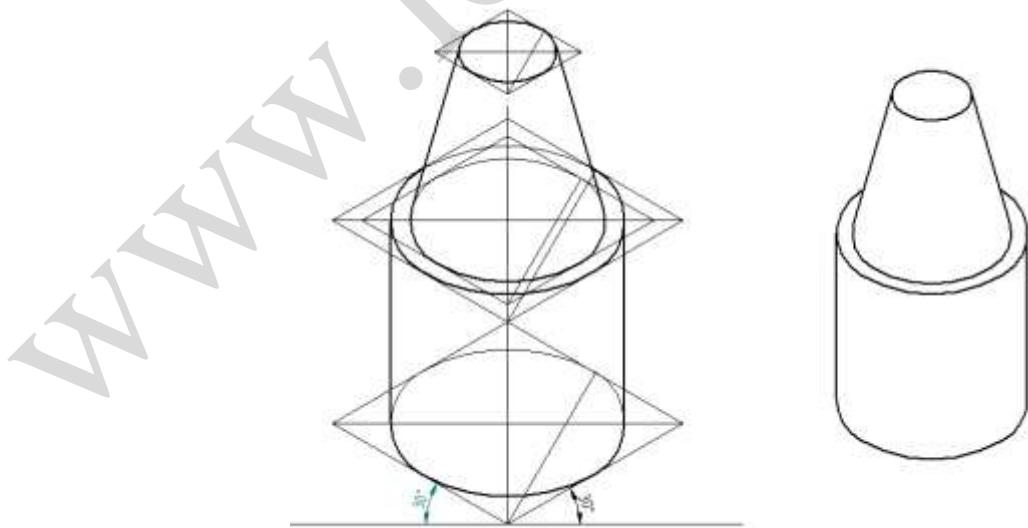


ISOMETRIC VIEW

17. A frustum of cone base diameter 50mm, top diameter 25mm and height 50mm is placed centrally on the top face of a cylinder diameter 60mm and height 60mm. Draw the isometric projection of the combination.

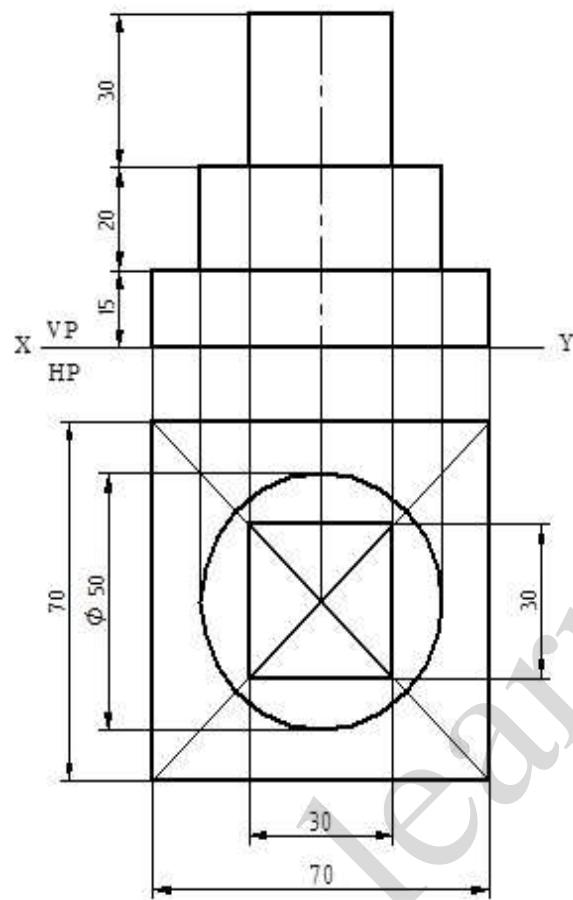


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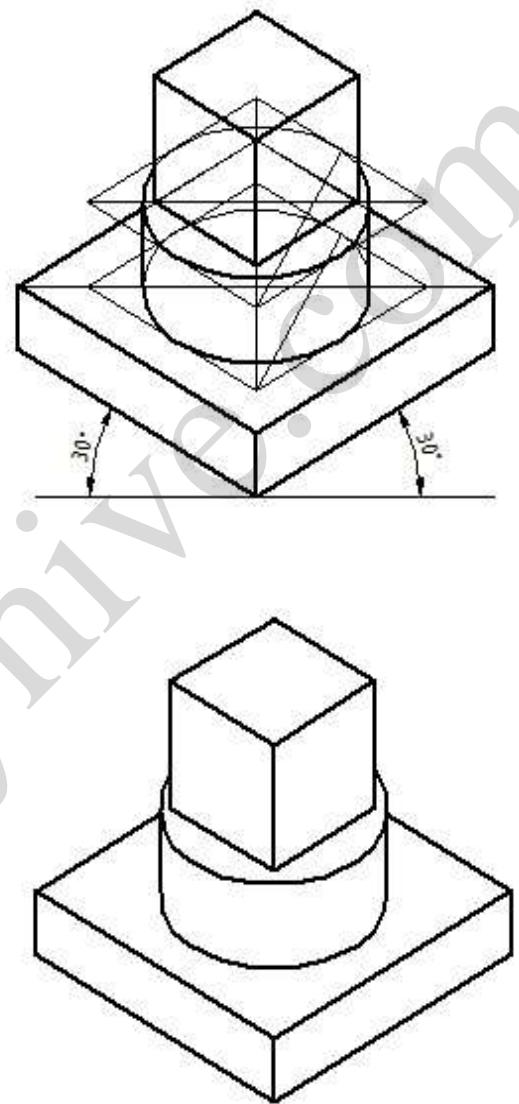


ISOMETRIC VIEW

18. Following figure shows the front and top views of solid. Draw the isometric projection of the solid.

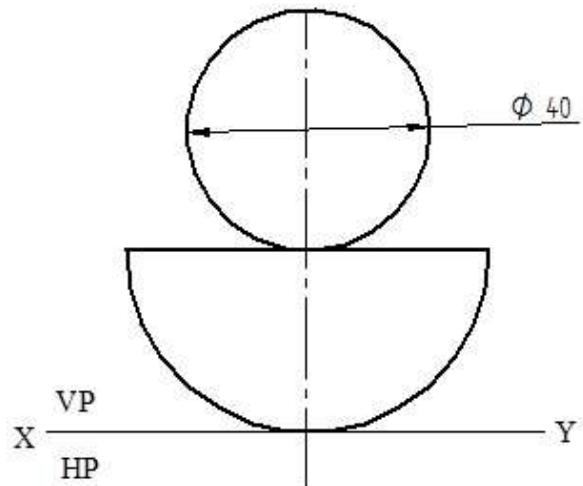


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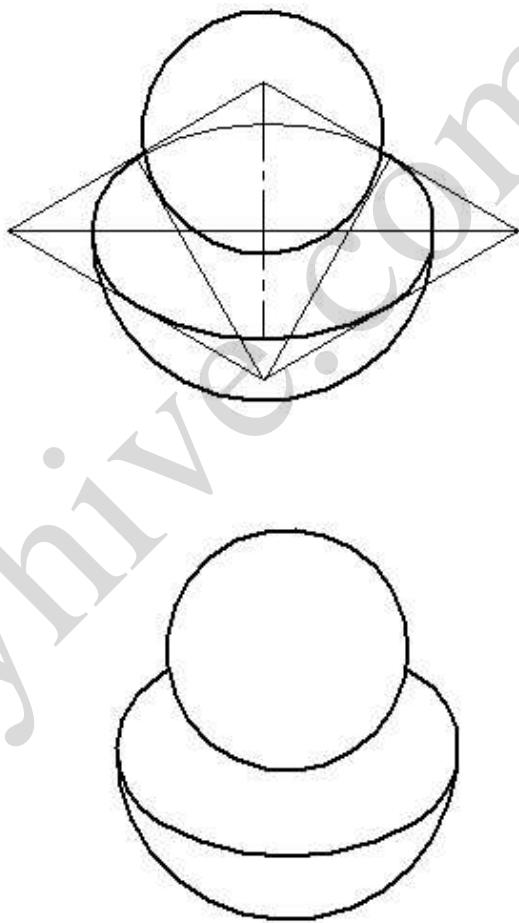


ISOMETRIC VIEW

19. A sphere of diameter 40mm is placed centrally on the flat face of a hemisphere of diameter 60mm. Draw the isometric projection of the combination.

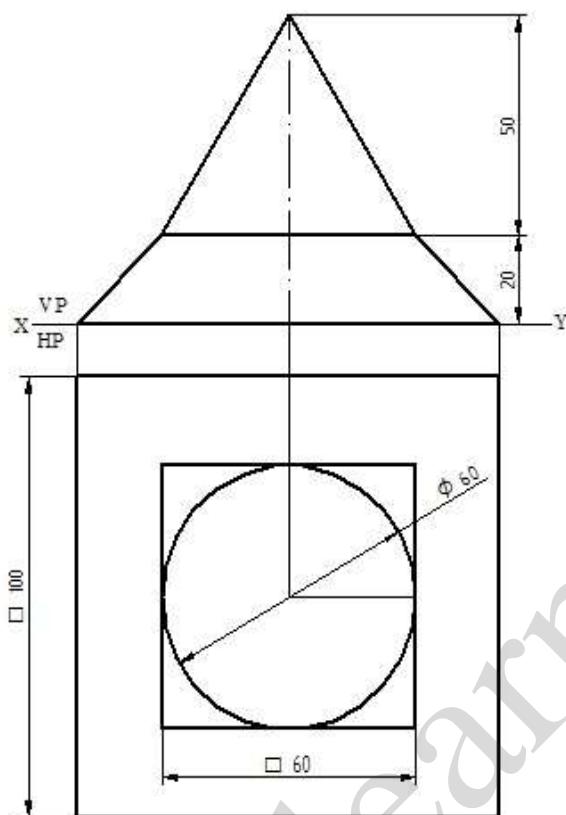


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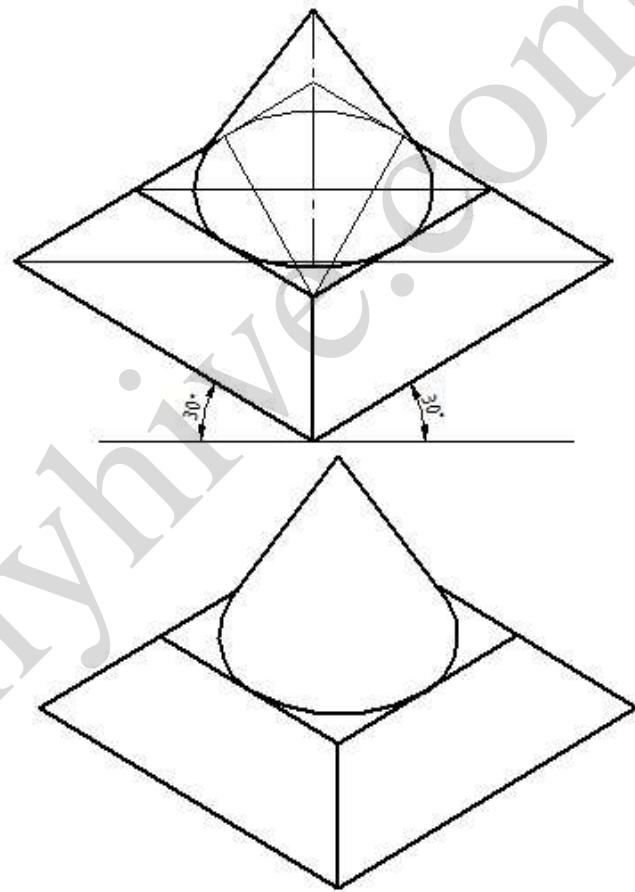


ISOMETRIC VIEW

20. A cone of base diameter 60mm, top diameter 40mm and height 50mm is placed centrally on frustum of a square pyramid base side 100mm, top face side 60mm and height 20mm. Draw the isometric projection of the combination.

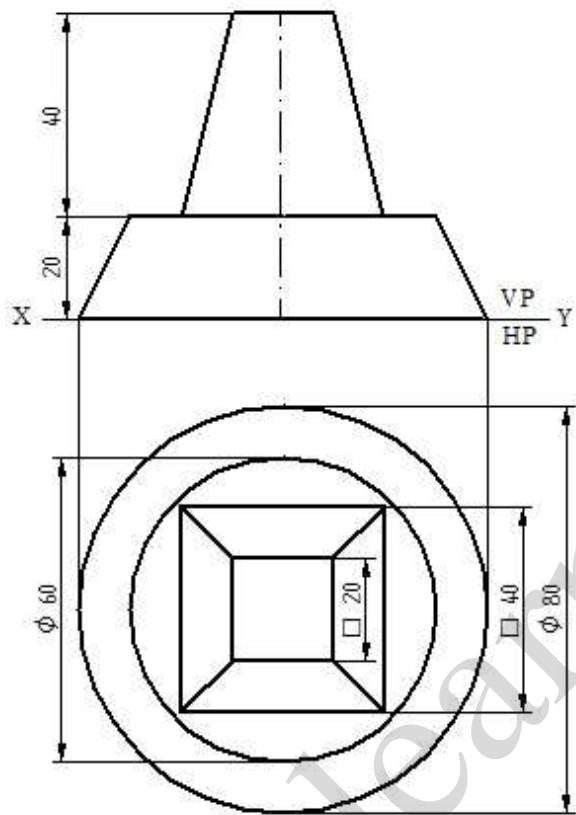


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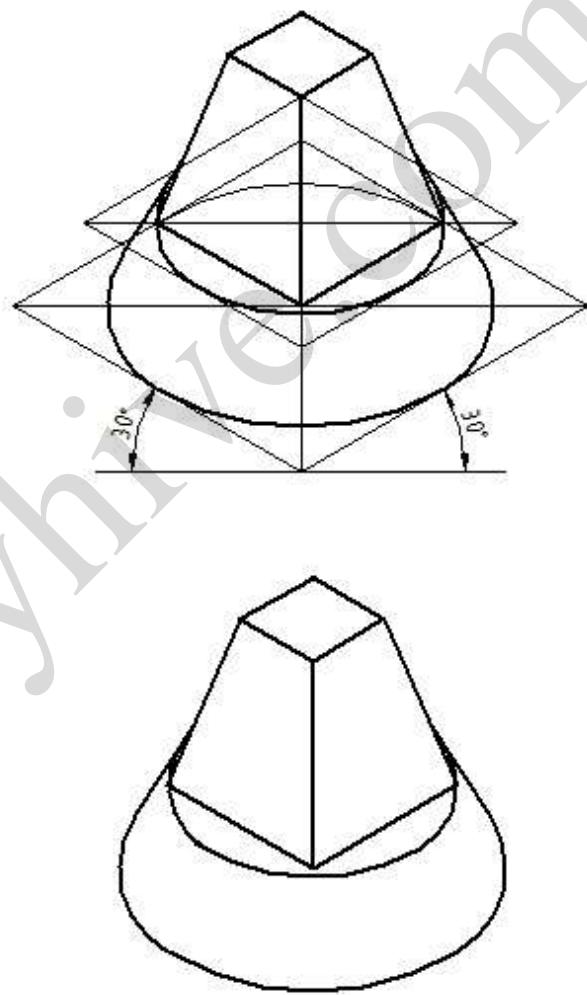


ISOMETRIC VIEW

21. A frustum of a square pyramid of base side 40mm, top face side 20mm and height 40mm is placed centrally on frustum of a cone of base diameter 80mm, top diameter 60mm and height 20mm. Draw the isometric projection of the combination.

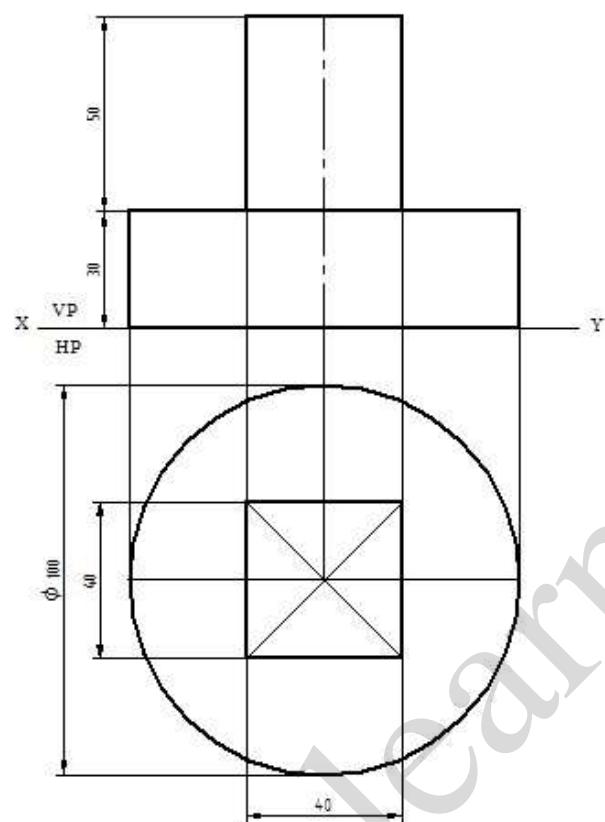


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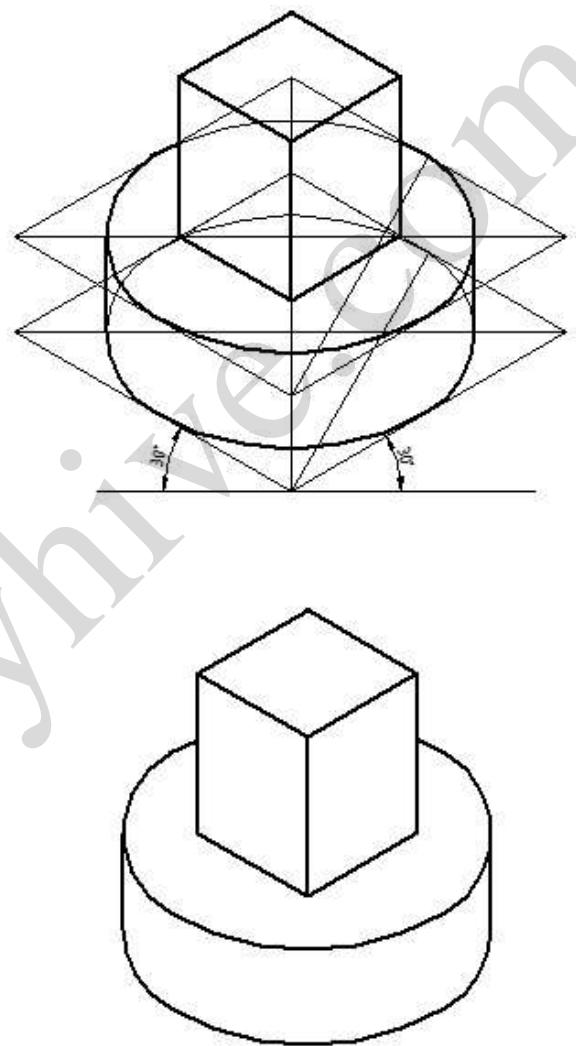


ISOMETRIC VIEW

22. A square prism base side 40mm, height 50mm is placed centrally on a cylindrical slab of diameter 100mm and thickness 30mm. Draw the isometric projection of the combination.

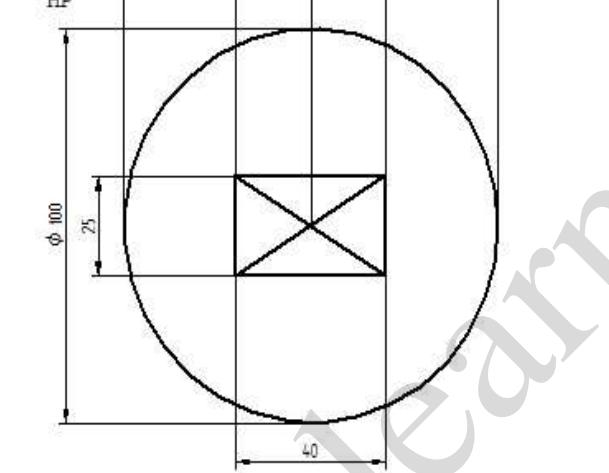
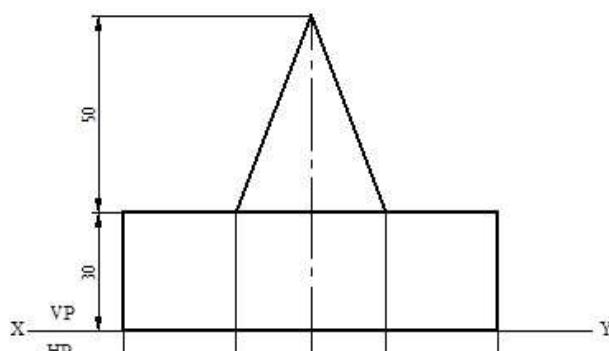


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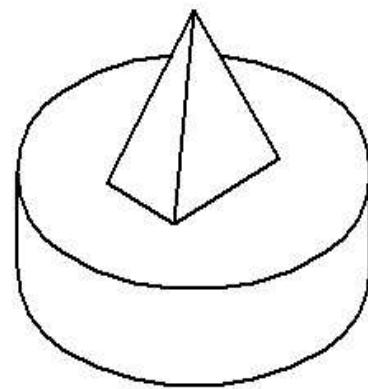
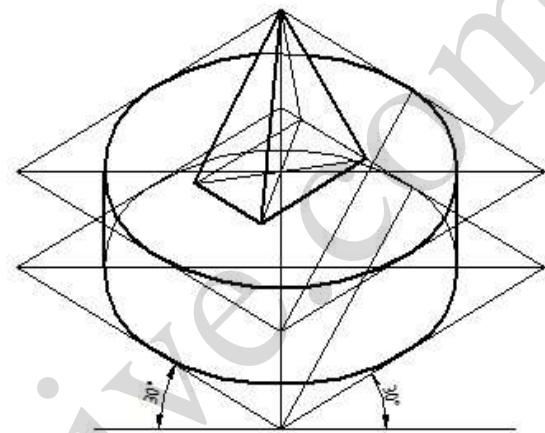


ISOMETRIC VIEW

23. A rectangular pyramid of base $40\text{mm} \times 25\text{mm}$ and height 50mm is placed centrally on a cylindrical slab of diameter 100mm and thickness 30mm. Draw the isometric projection of the combination.

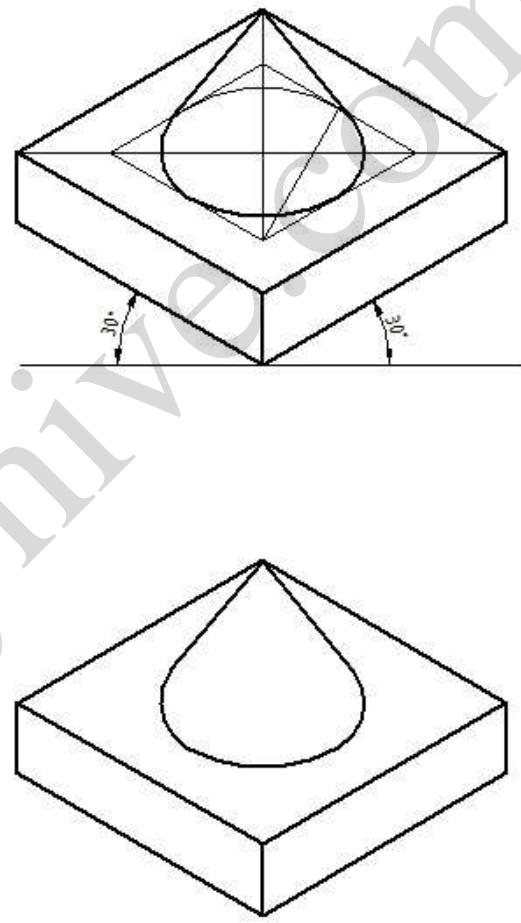
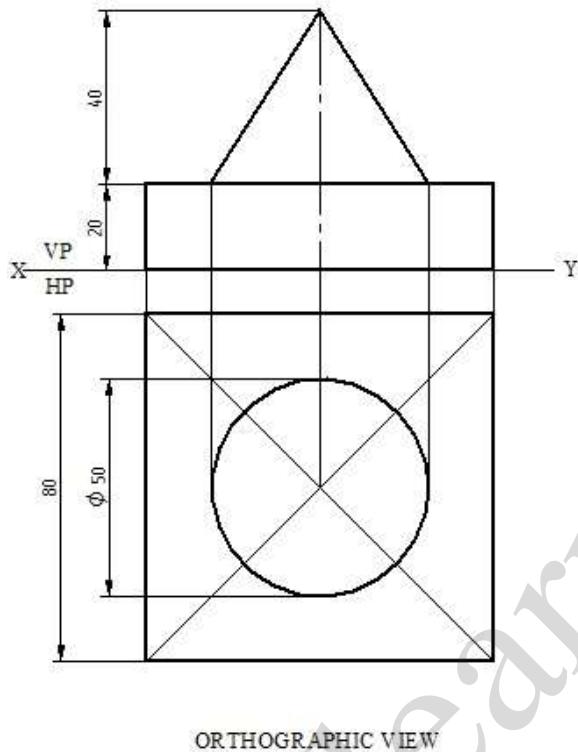


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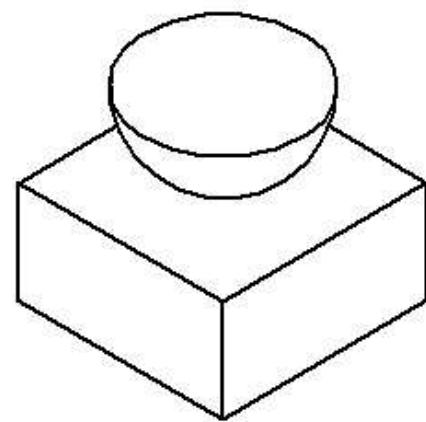
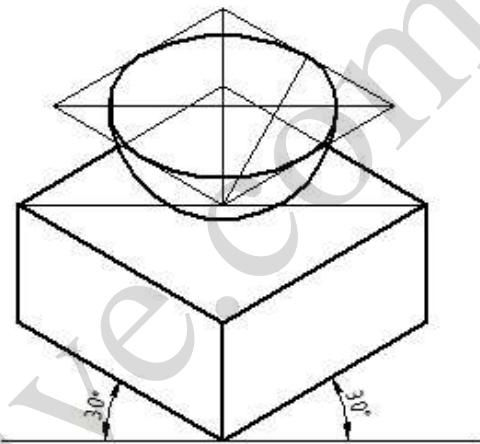
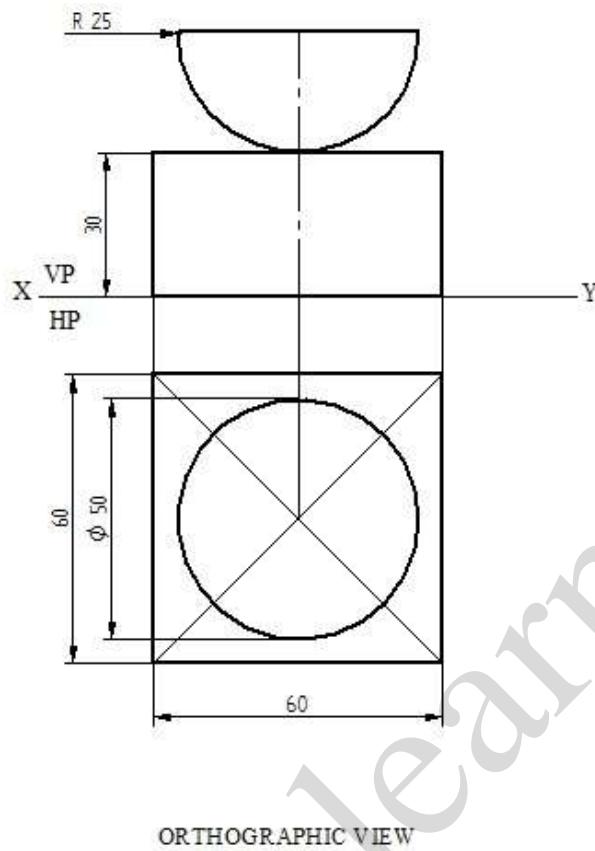


ISOMETRIC VIEW

24. A cone of base diameter 50mm and height 40mm is placed centrally on the top face of a square slab side 80mm and height 20mm. Draw the isometric projection of the combination.

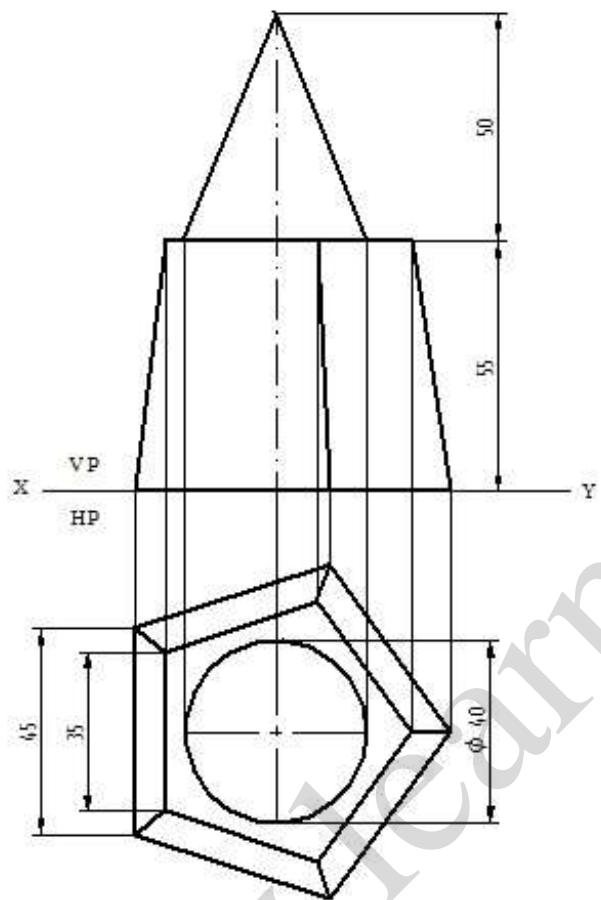


25. A hemisphere of diameter 50mm is centrally resting on top of a square prism of base side 60mm and height 30mm such that the curved surface of hemisphere is touching the top face of the prism. Draw its isometric projections.

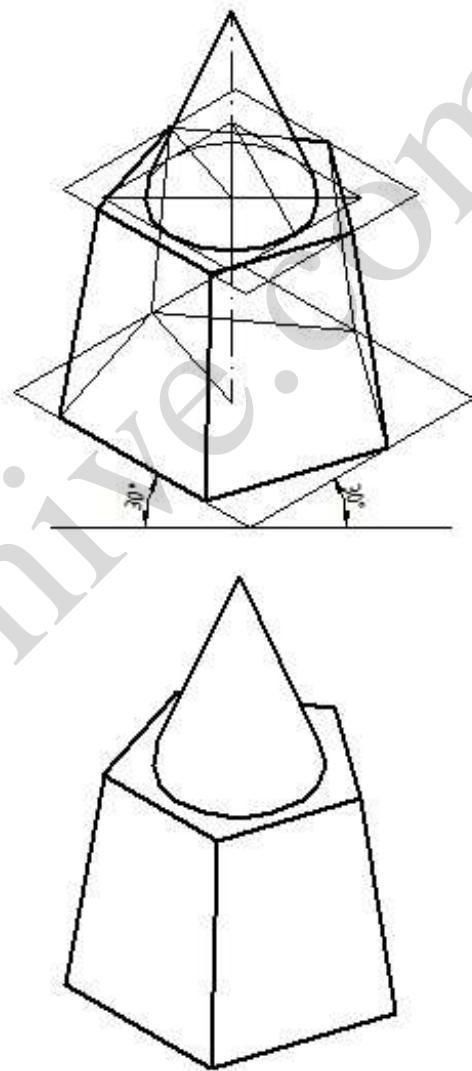


ISOMETRIC VIEW

26. A cone of base diameter 40mm and height 50mm rests centrally over a frustum of a pentagonal pyramid of base side 45mm and top side 35mm and height 55mm. Draw isometric projection of the solids.

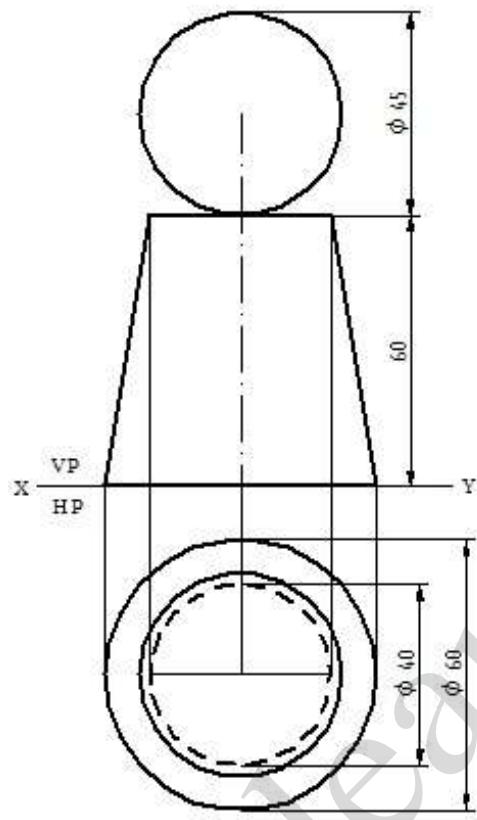


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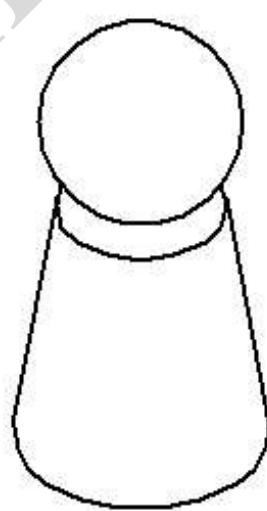
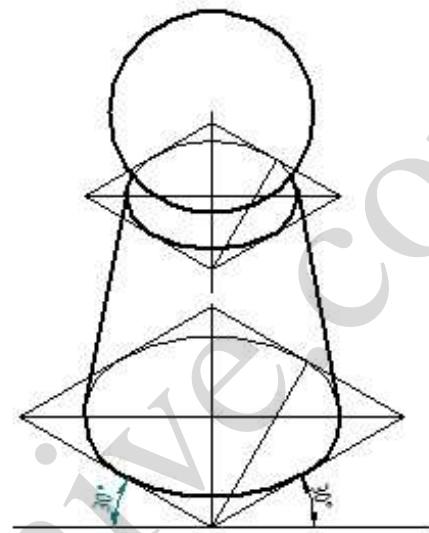


ISOMETRIC VIEW

27. A sphere of diameter 45mm rests centrally over a frustum of cone of base diameter 60mm, top diameter 40mm and height 60mm. Draw the isometric projections.

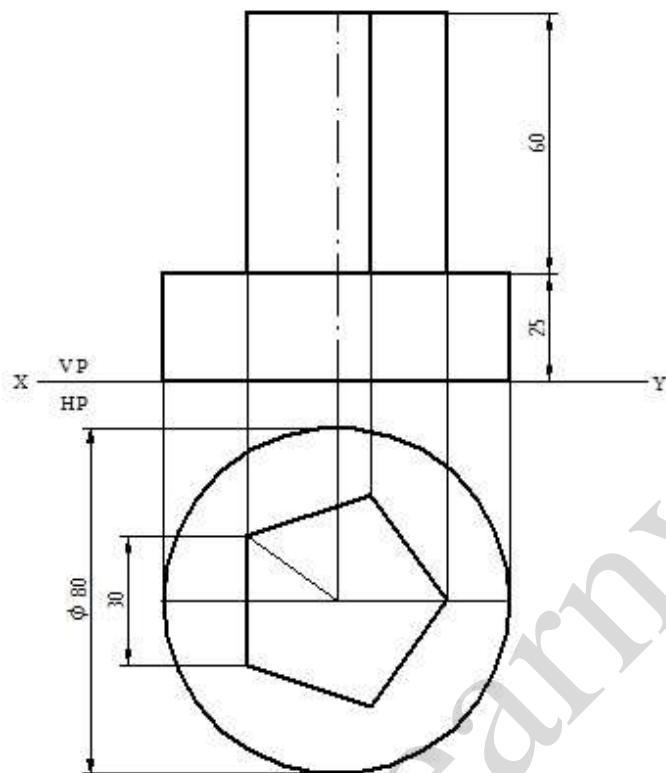


ORTHOGRAPHIC VIEW

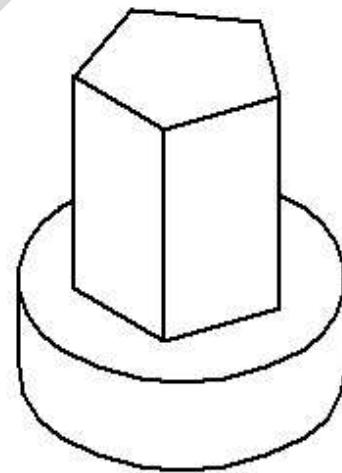
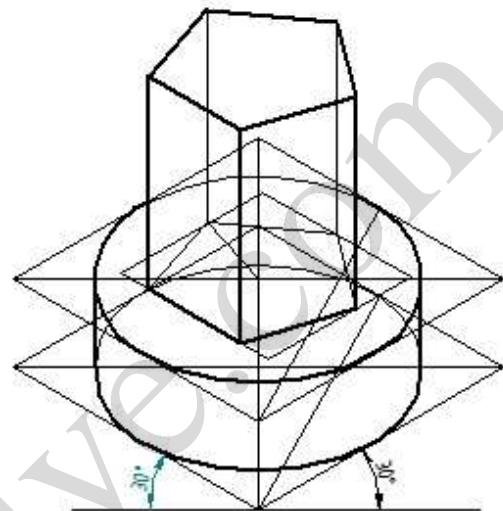


ISOMETRIC VIEW

28. A regular pentagonal prism of base edge 30mm and axis 60mm is mounted centrally over a cylindrical block of 80mm diameter and 25mm thick. Draw isometric projection of the combined solids.

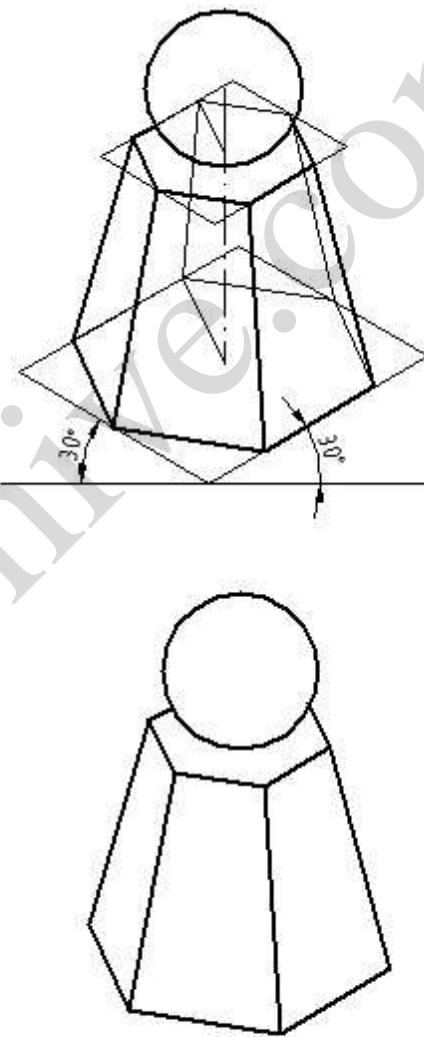
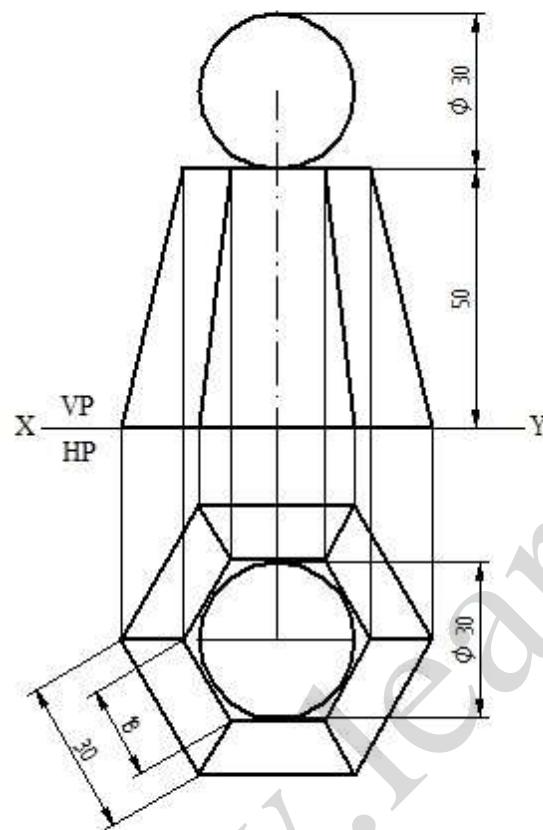


ORTHOGRAPHIC VIEW



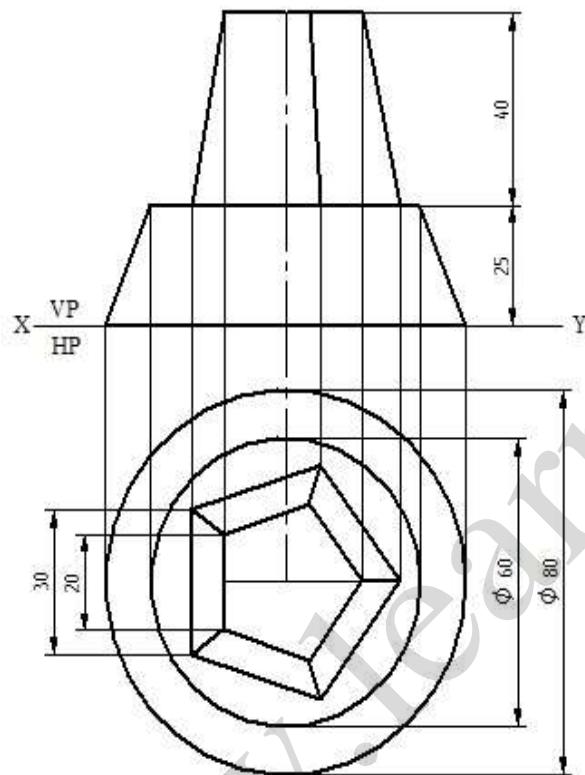
ISOMETRIC VIEW

29. A sphere of diameter 30mm rests on the frustum of a hexagonal pyramid base 30mm, top face 18mm side and height 50mm, such that their axes coincide. Draw the isometric projection of the combined solids.

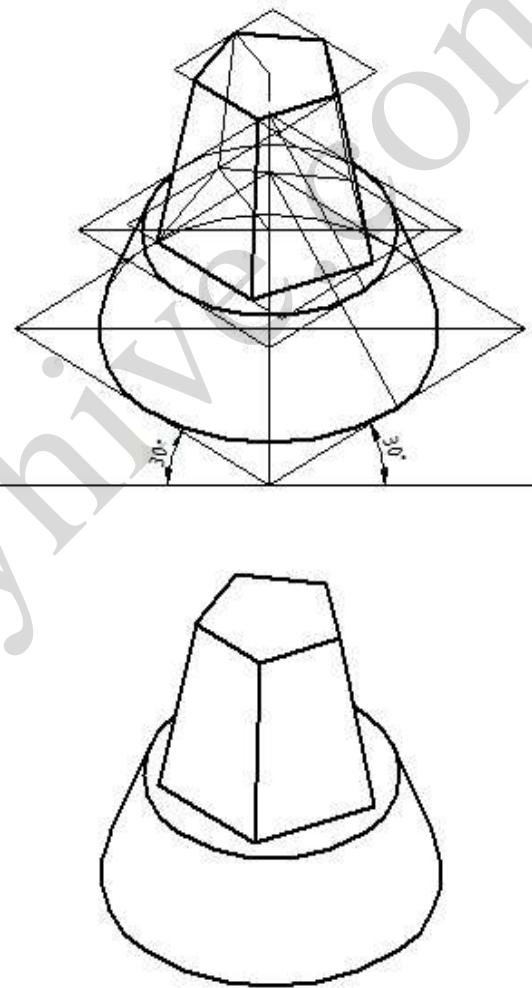


ISOMETRIC VIEW

30. Draw the isometric projection of the combination of solids formed by a frustum of cone and co-axial frustum of pentagonal pyramid. The lower frustum of cone is of 80mm base diameter, 60mm top diameter and height 25mm, the upper frustum of pyramid is of 30mm side of base, 20mm side of top face and height 40mm.

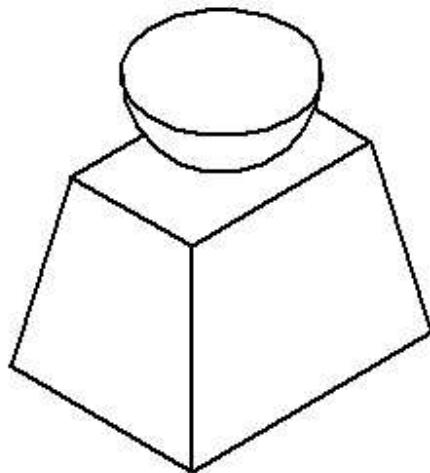
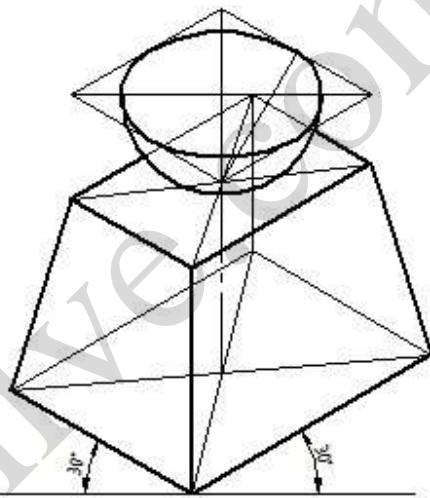
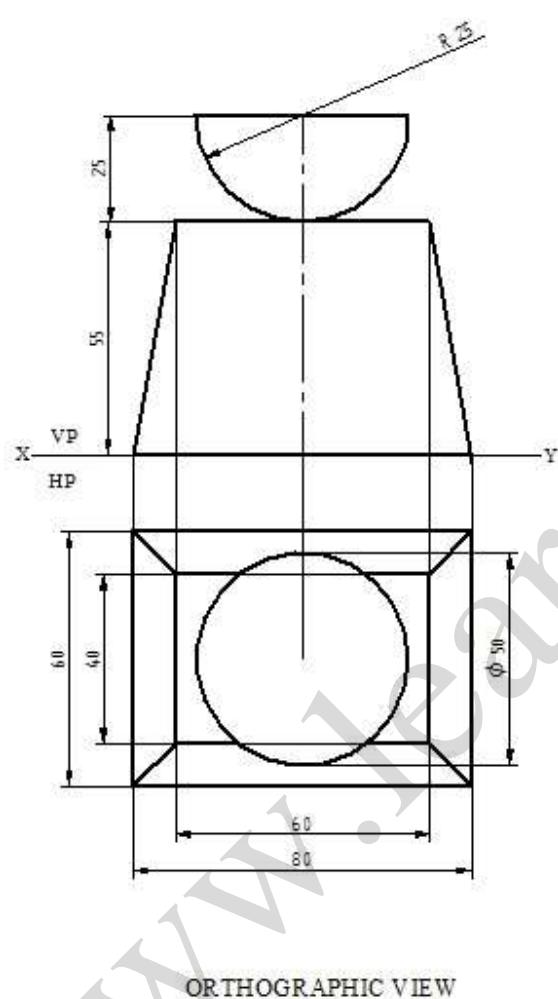


ORTHOGRAPHIC VIEW

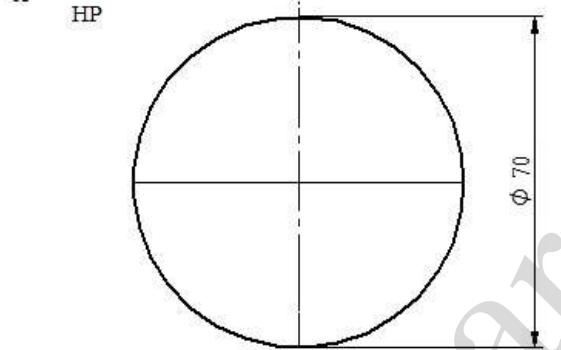
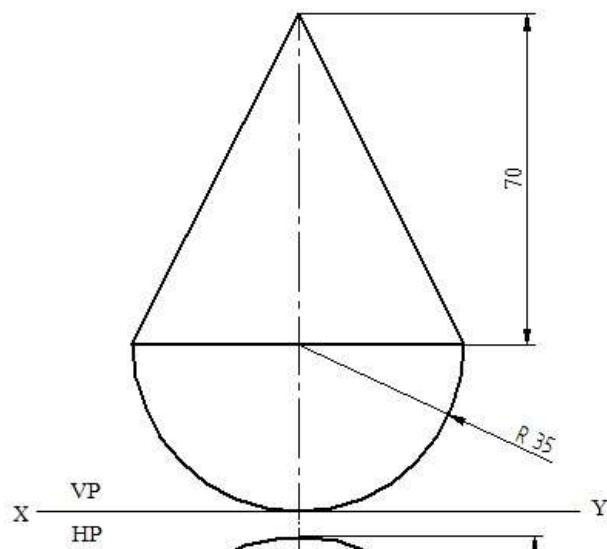


ISOMETRIC VIEW

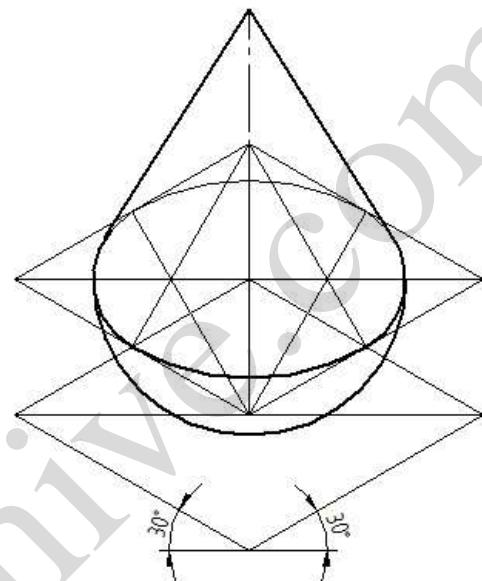
31. A hemisphere diameter 50mm is resting on its curved surface centrally on the top face of frustum of a rectangular pyramid base 80mm×60mm and top 60mm×40mm, height 55mm. Draw the isometric projection of the combination.



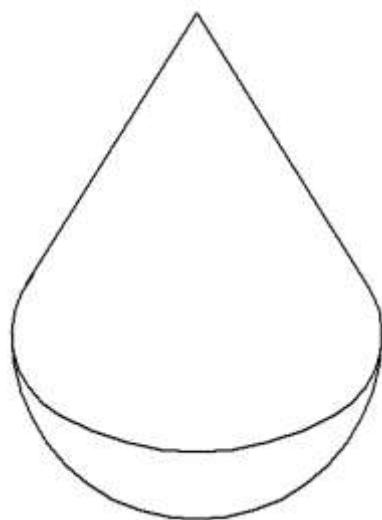
32. A hemisphere diameter 70mm is placed on the ground on its curved surface. A cone base diameter 70mm and height 70mm is placed centrally on it. Draw the isometric projection of the combination.



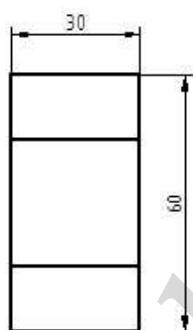
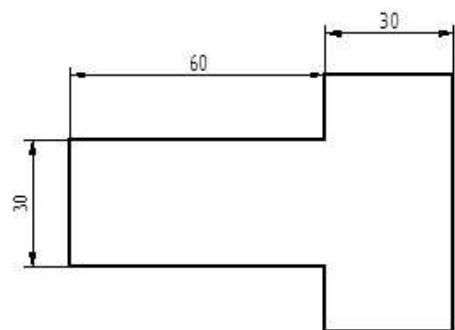
ORTHOGRAPHIC VIEW



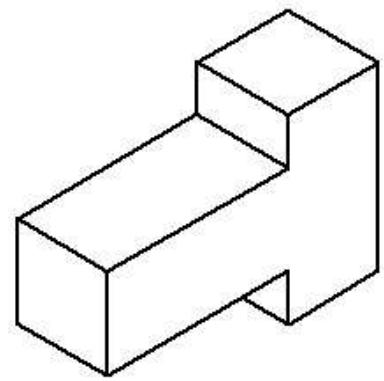
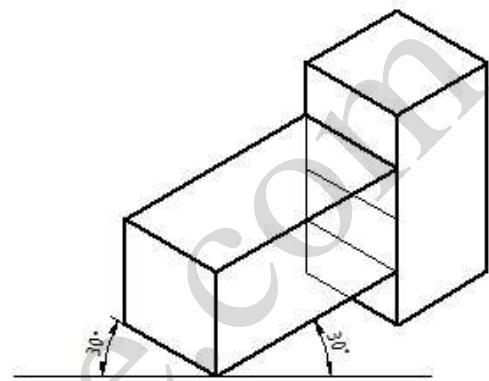
ISOMETRIC VIEW



33. Following figure shows the front and side views of solid. Draw the isometric projection of the solid.

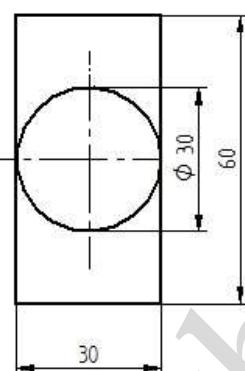
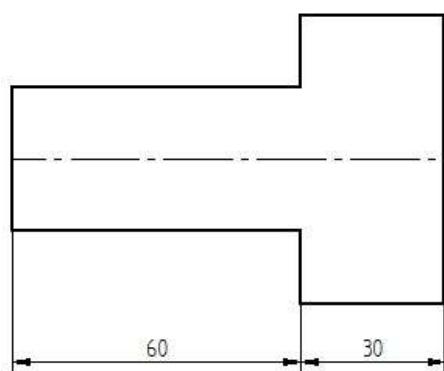


ORTHOGRAPHIC VIEW

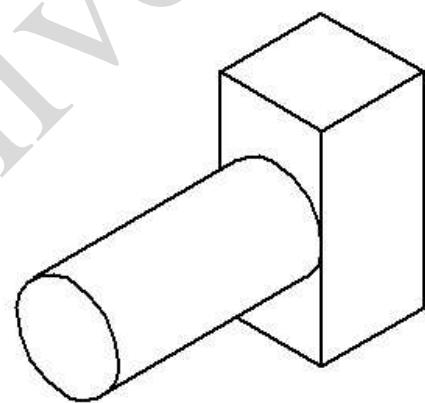
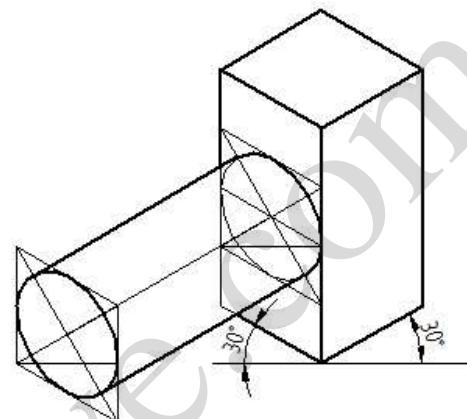


ISOMETRIC VIEW

34. Following figure shows the front and side views of solid. Draw the isometric projection of the solid.

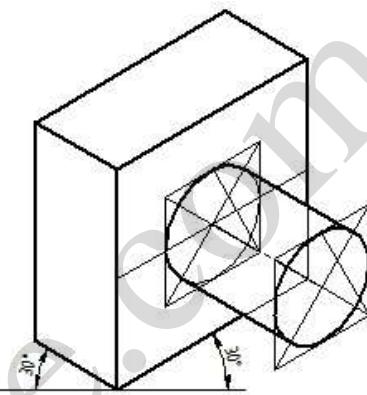
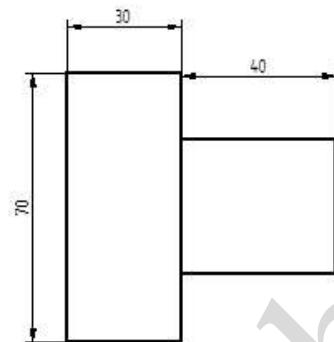
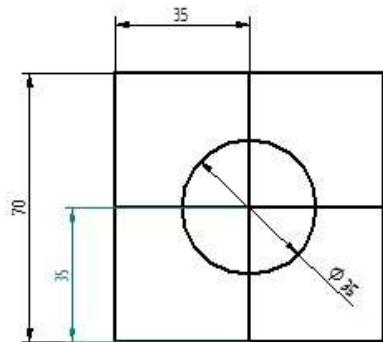


ORTHOGRAPHIC VIEW

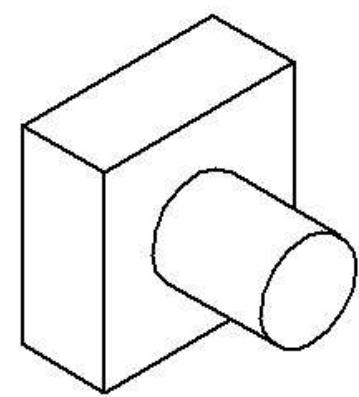


ISOMETRIC VIEW

35. Following figure shows the front and side views of solid. Draw the isometric projection of the solid.

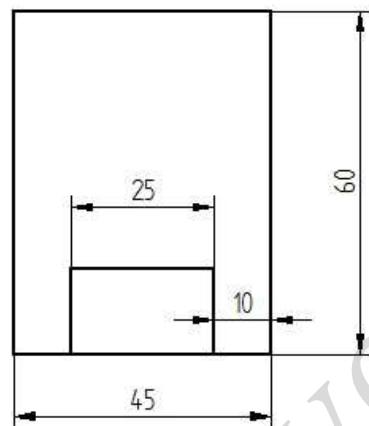
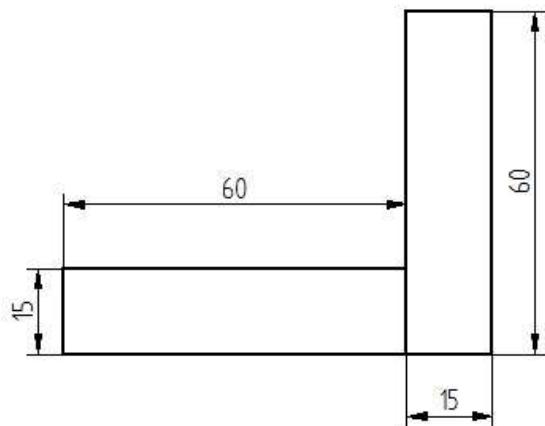


ORTHOGRAPHIC VIEW

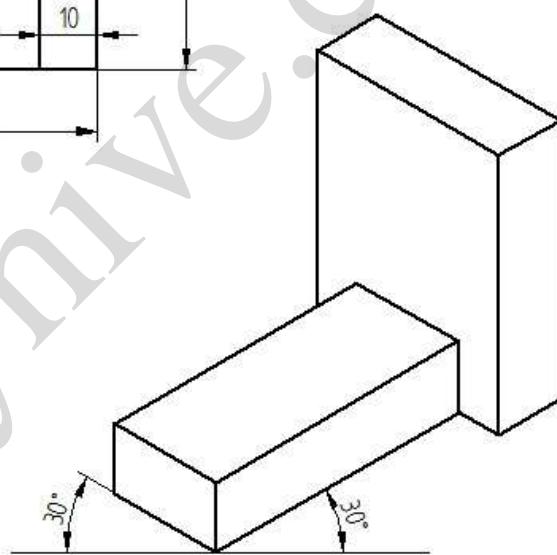


ISOMETRIC VIEW

36. Following figure shows the front and side views of solid. Draw the isometric projection of the solid.

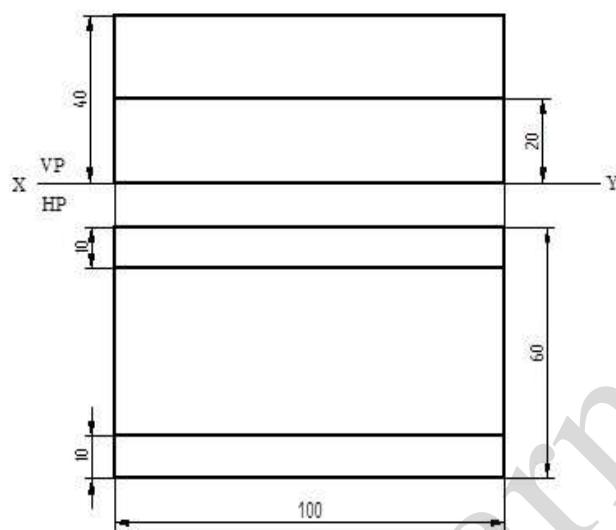


ORTHOGRAPHIC VIEW

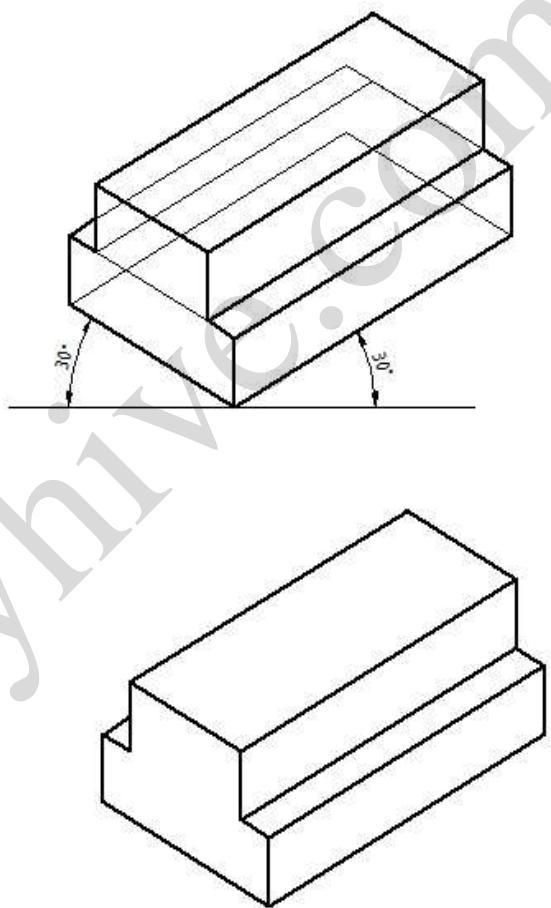


ISOMETRIC VIEW

37. Two rectangular plates are placed centrally with dimensions (l×b×h) 100mm×60mm×20mm and 100mm×40mm×20mm such that their longer edges are parallel. Draw the isometric projection of the combination.

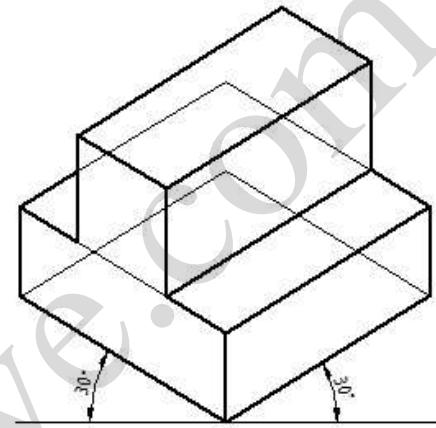
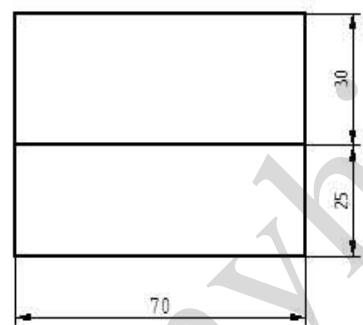
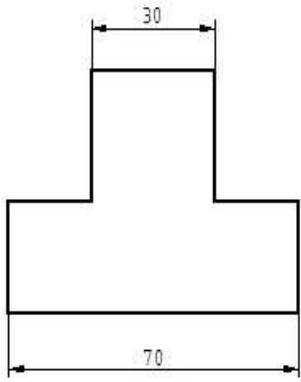


ORTHOGRAPHIC VIEW

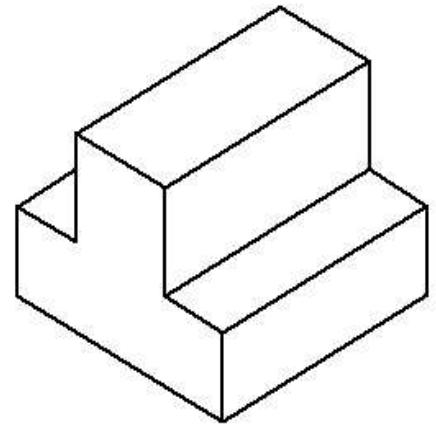


ISOMETRIC VIEW

38. A square prism of base side 30mm and length 70mm, is resting on its rectangular face on top of a square slab side 70mm and 25mm thick. Draw the isometric projection of the combination.



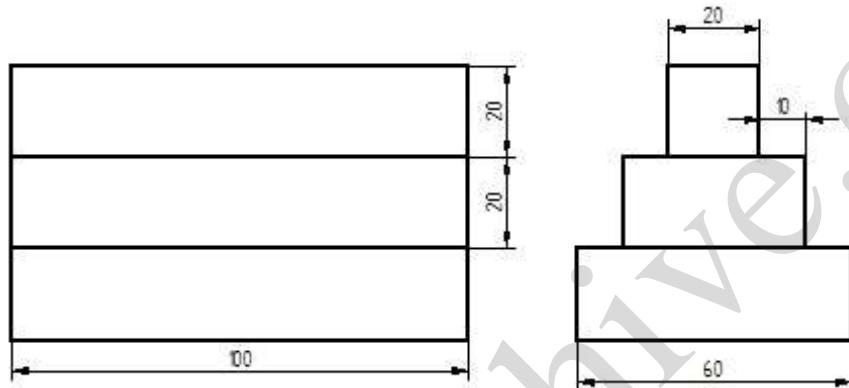
ORTHOGRAPHIC VIEW



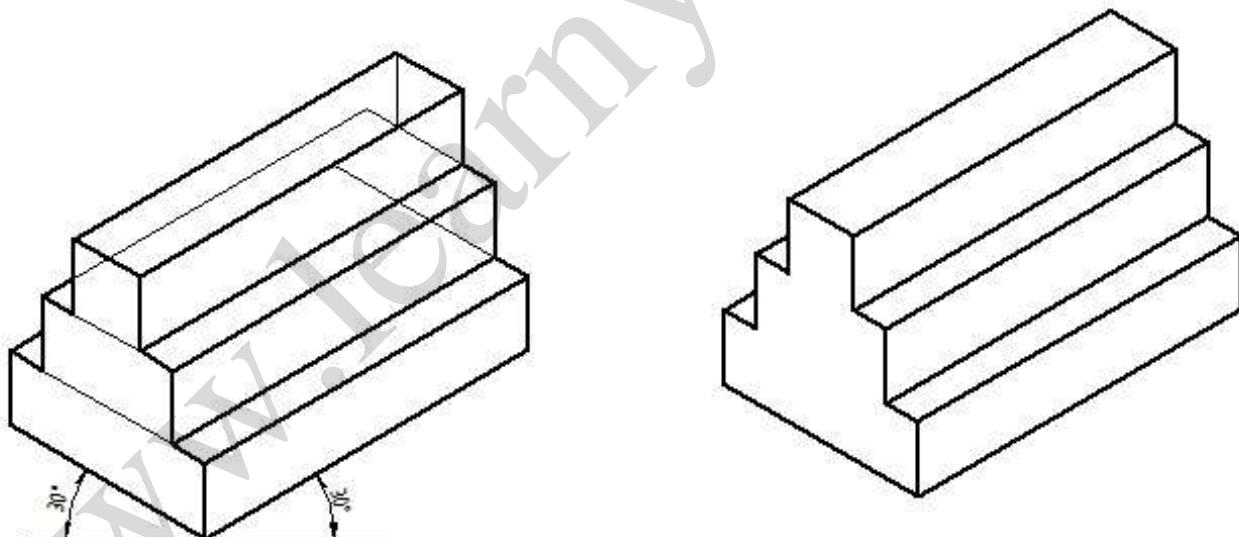
ISOMETRIC VIEW

39. Three rectangular slabs ($l \times b \times h$) $100\text{mm} \times 60\text{mm} \times 20\text{mm}$ and $100\text{mm} \times 40\text{mm} \times 20\text{mm}$ and $100\text{mm} \times 20\text{mm} \times 20\text{mm}$ are placed one above the other in the ascending order of their width (b), such that their longer axes are co-planar. Draw the isometric projection of the combination.

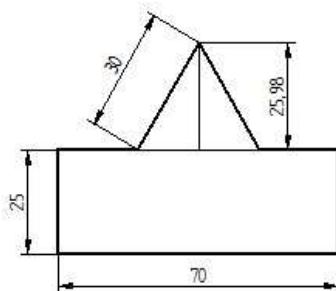
ORTHOGRAPHIC VIEW



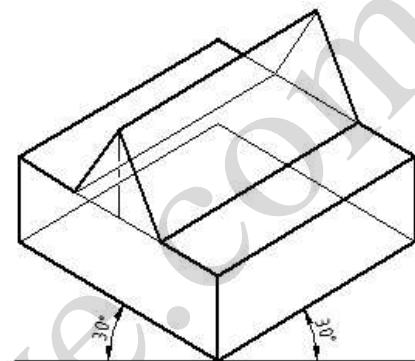
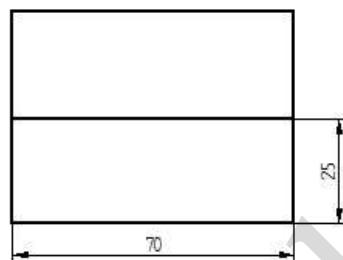
ISOMETRIC VIEW



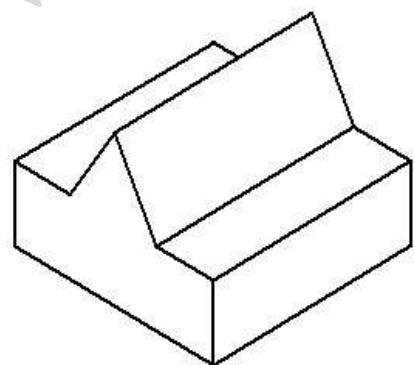
40. A triangular prism base side 30mm and length 70mm is resting on its rectangular face on top of a square slab side 70mm and 25mm thick. Draw the isometric projection of the combination.



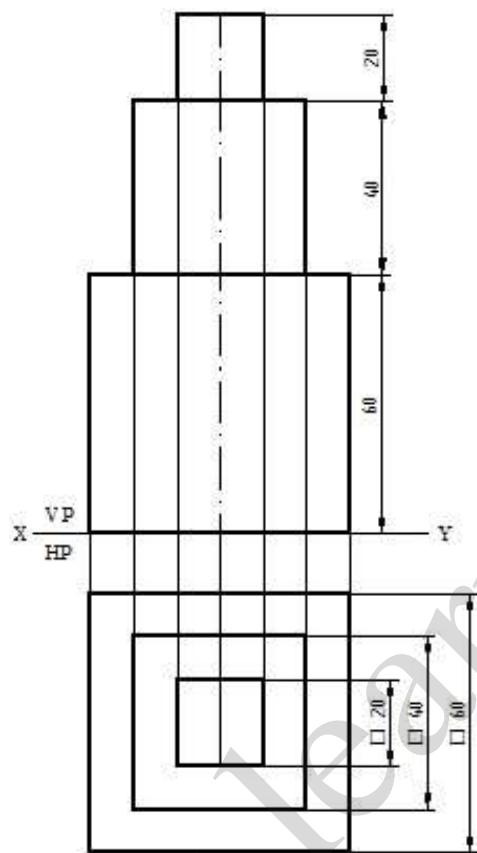
ORTHOGRAPHIC VIEW



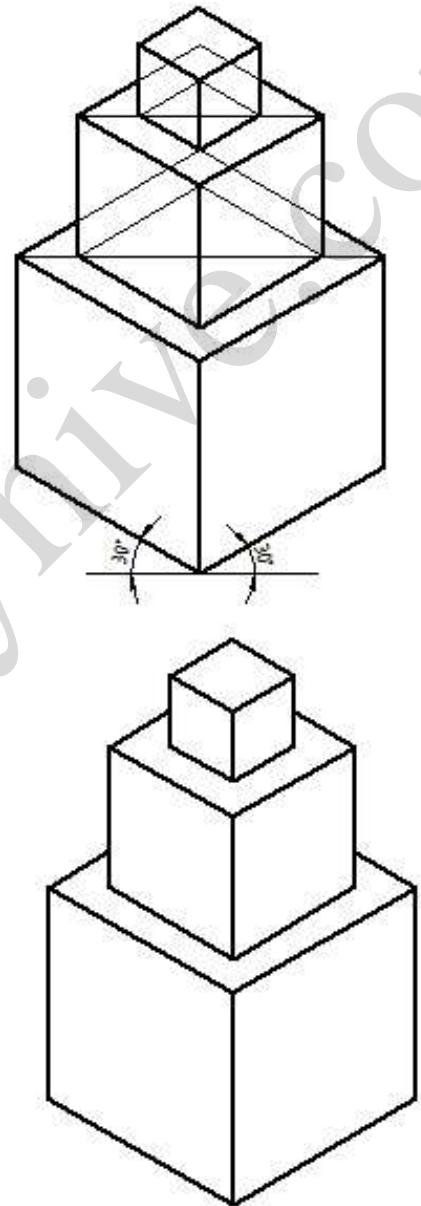
ISOMETRIC VIEW



41. Three cubes of sides 60mm, 40mm and 20mm are placed centrally one above the other in the ascending order of their side. Draw the isometric projection of the combination.

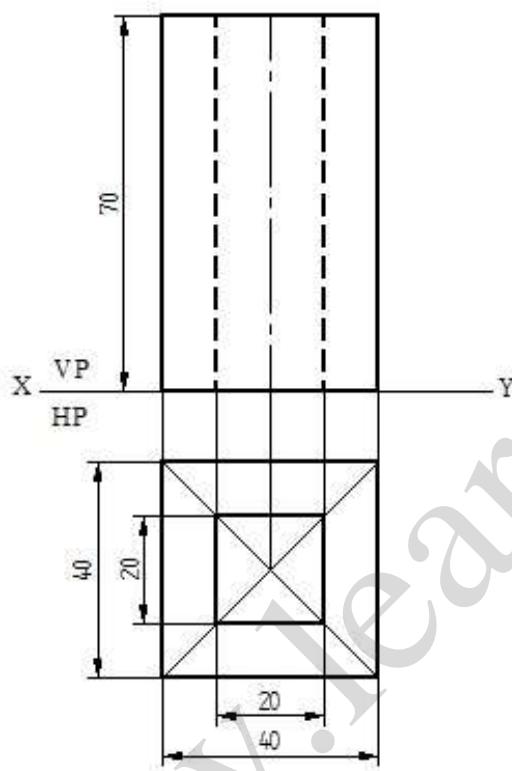


ORTHOGRAPHIC VIEW

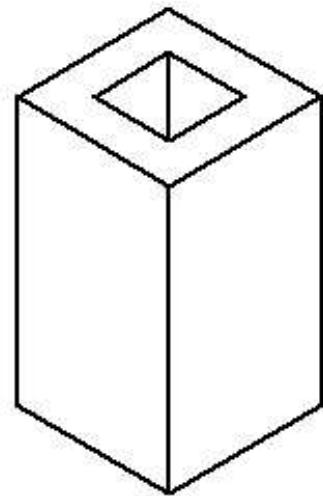
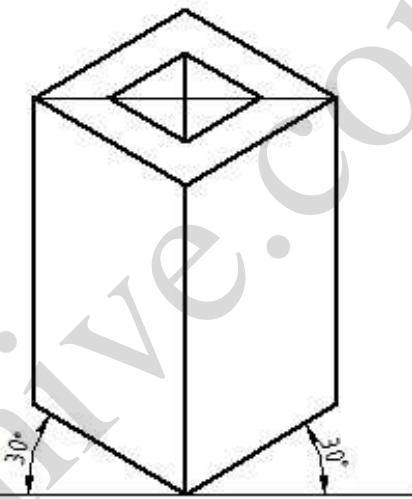


ISOMETRIC VIEW

42. A square prism of side 40mm and height 70mm has a full depth co-axial square hole side 20mm, such that edges of both the squares are parallel. Draw the isometric projection of the combination.

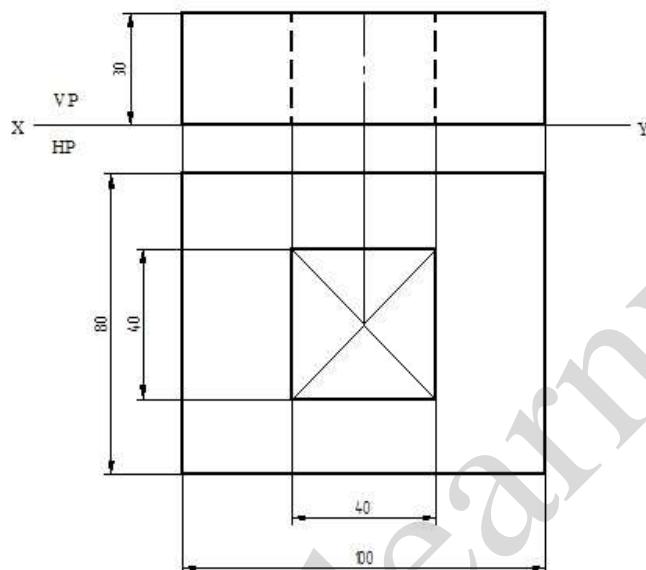


ORTHOGRAPHIC VIEW

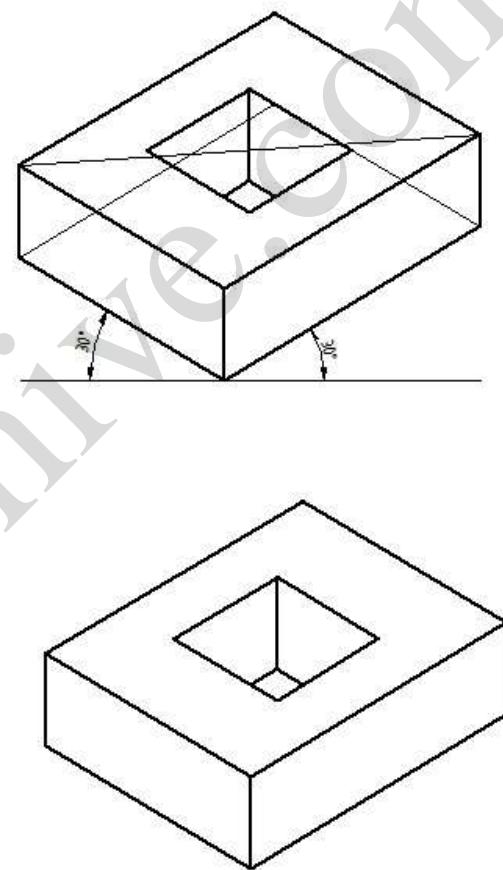


ISOMETRIC VIEW

43. A rectangular slab base 100mm×80mm and height 30mm has a full depth co-axial square hole side 40mm, such that one of the sides of the square is parallel to one of the sides of the rectangle. Draw the isometric projection of the combination.

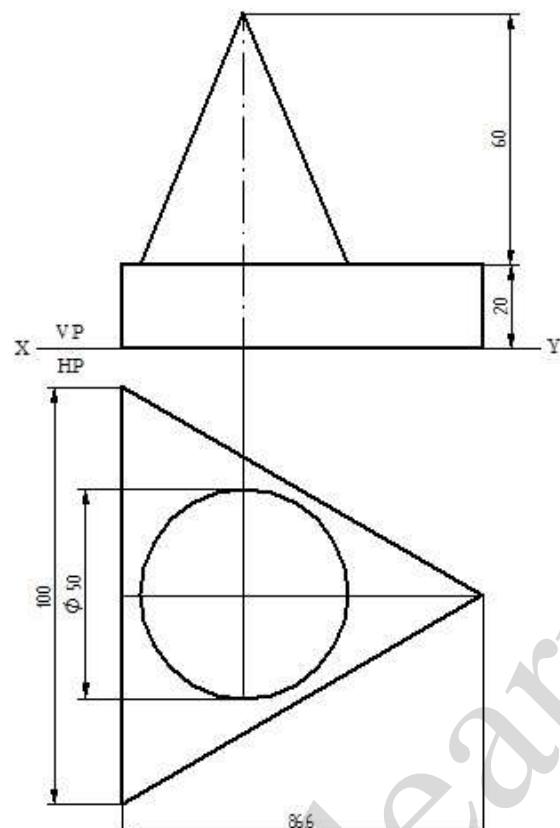


ORTHOGRAPHIC VIEW

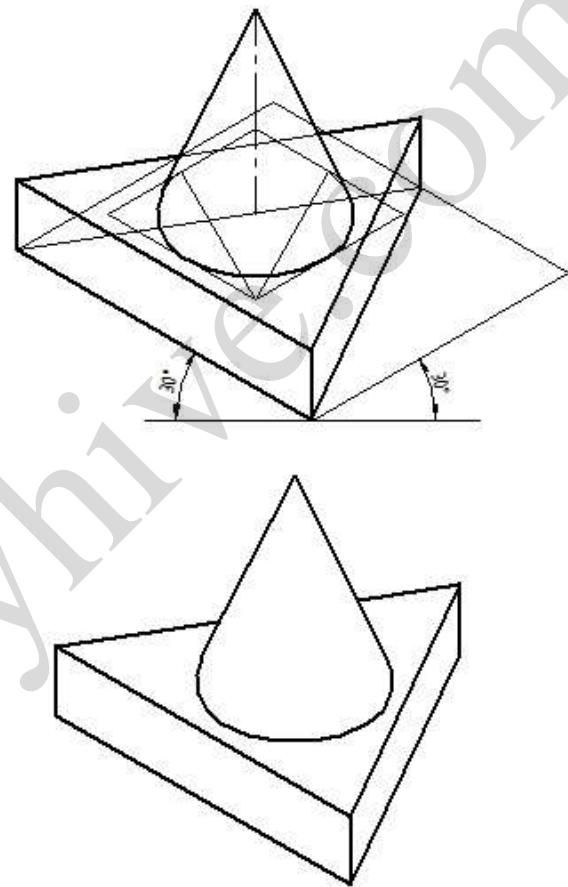


ISOMETRIC VIEW

44. A cone of base diameter 50mm and height 60mm is placed centrally on an equilateral triangular prism of side 100mm and 20mm thick. Draw the isometric projection of the combination.

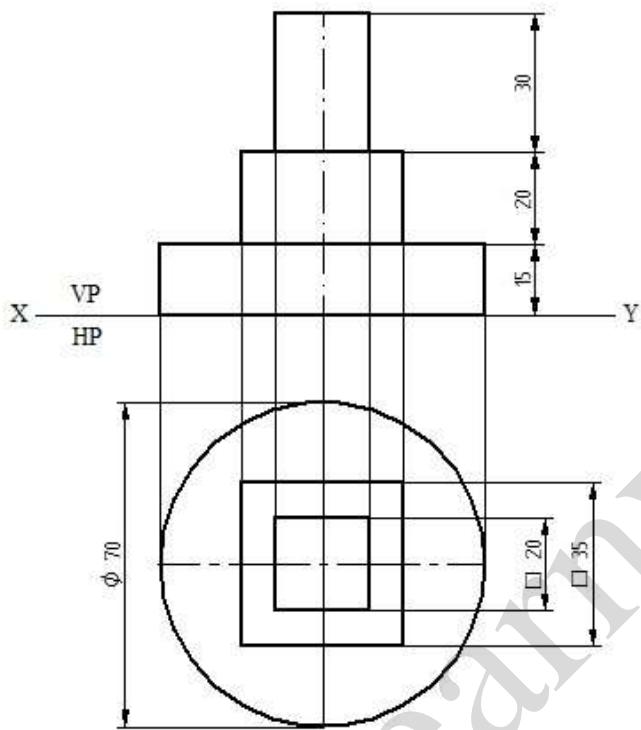


ORTHOGRAPHIC VIEW

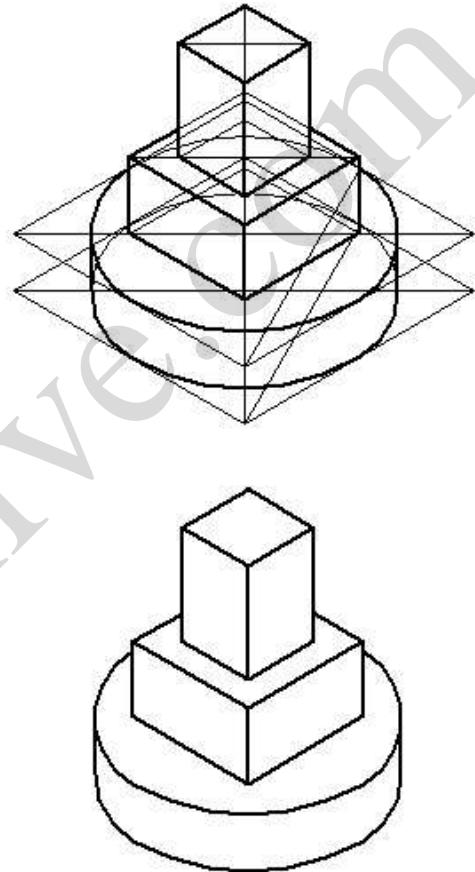


ISOMETRIC VIEW

45. Following figure shows the front and top views of solid. Draw the isometric projection of the solid.

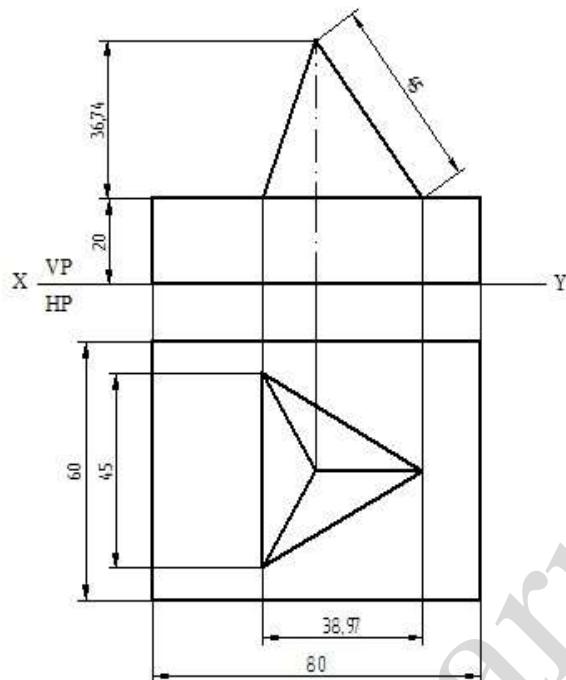


ORTHOGRAPHIC VIEW

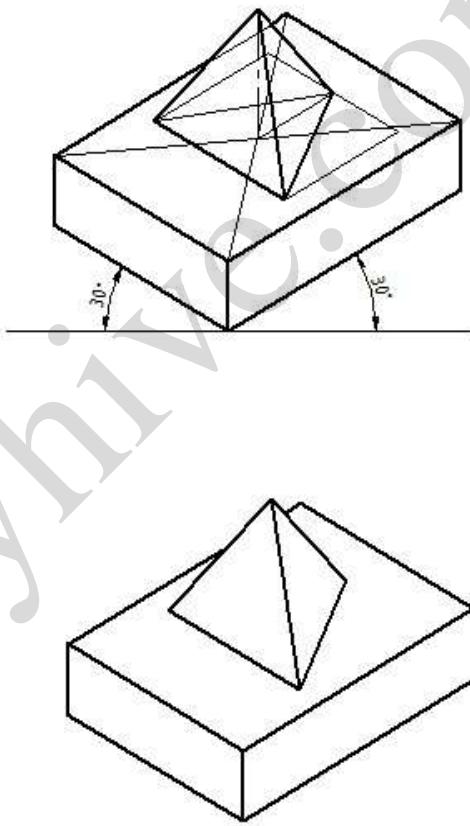


ISOMETRIC VIEW

46. Draw the isometric projection of a rectangular prism of $60 \times 80 \times 20mm thick surmounting a tetrahedron of sides 45mm such that the axes of the solids are collinear and at least one of the edges of both the solids are perpendicular to VP.$

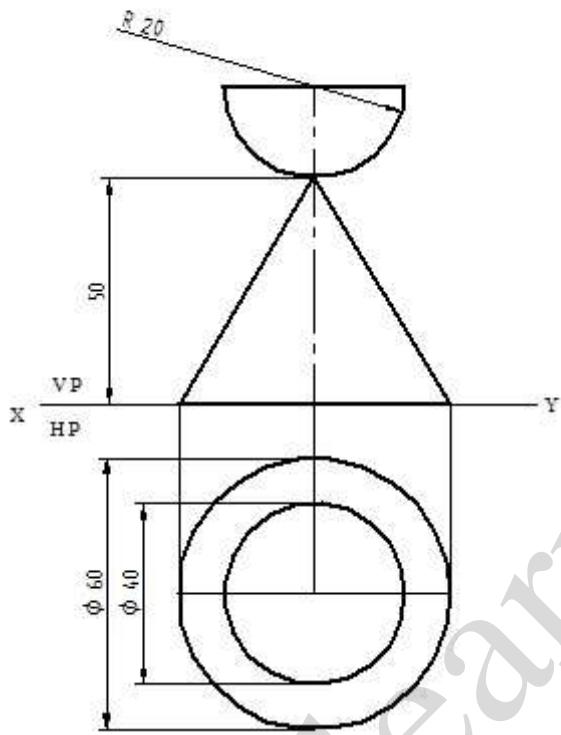


ORTHOGRAPHIC VIEW

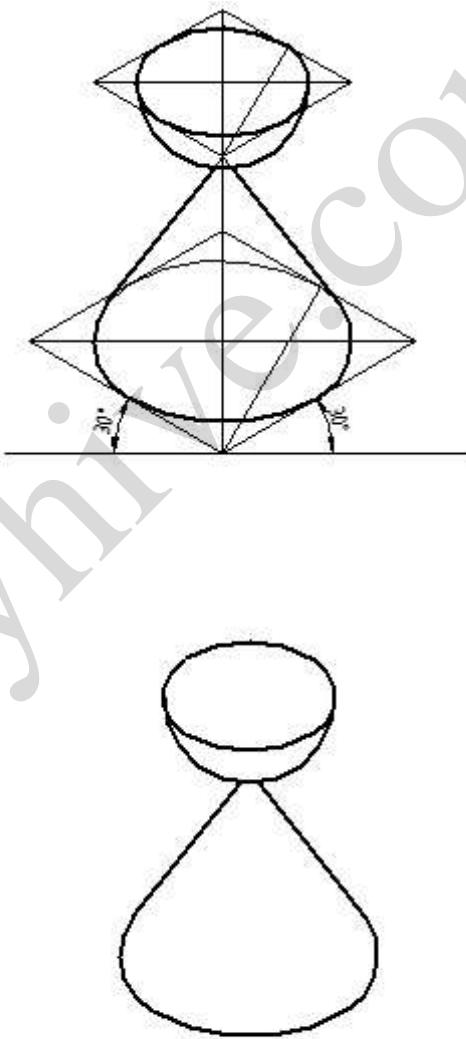


ISOMETRIC VIEW

47. A hemisphere of 40mm diameter is supported co-axially on the vertex of a cone of base diameter 60mm and axis length 50mm. The flat circular face of the hemisphere is facing upside. Draw the isometric projection of the combination of solids.

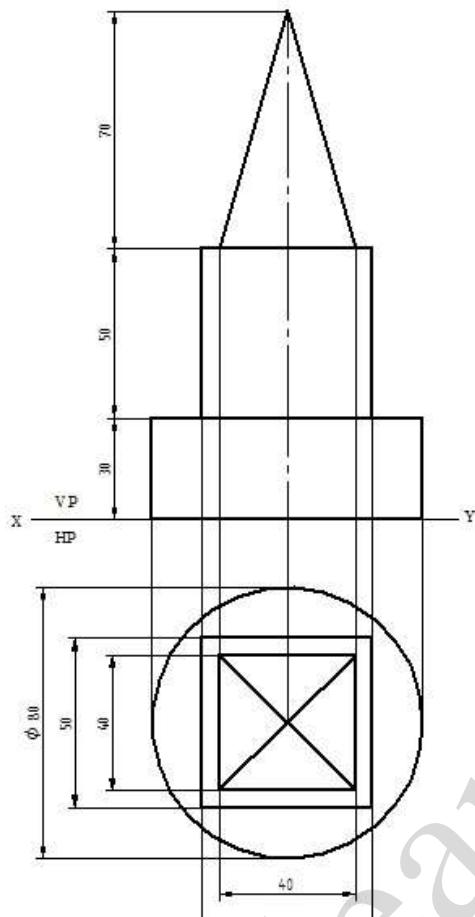


ORTHOGRAPHIC VIEW

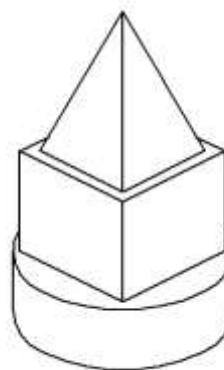
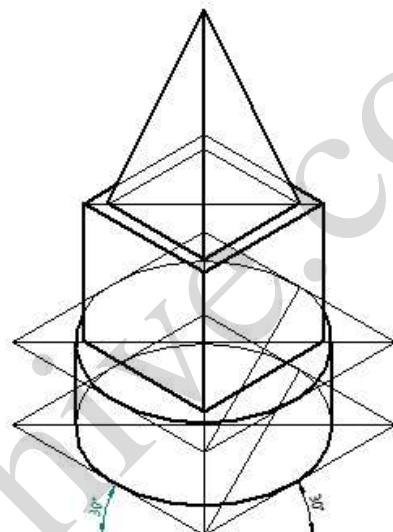


ISOMETRIC VIEW

48. A square pyramid of base side 40mm and height 70mm rests centrally on a cube of edge 50mm, which itself is placed on a cylinder of diameter 80mm and thickness 30mm. Draw the isometric projection of the solids, if the axes of the three solids are in common line.

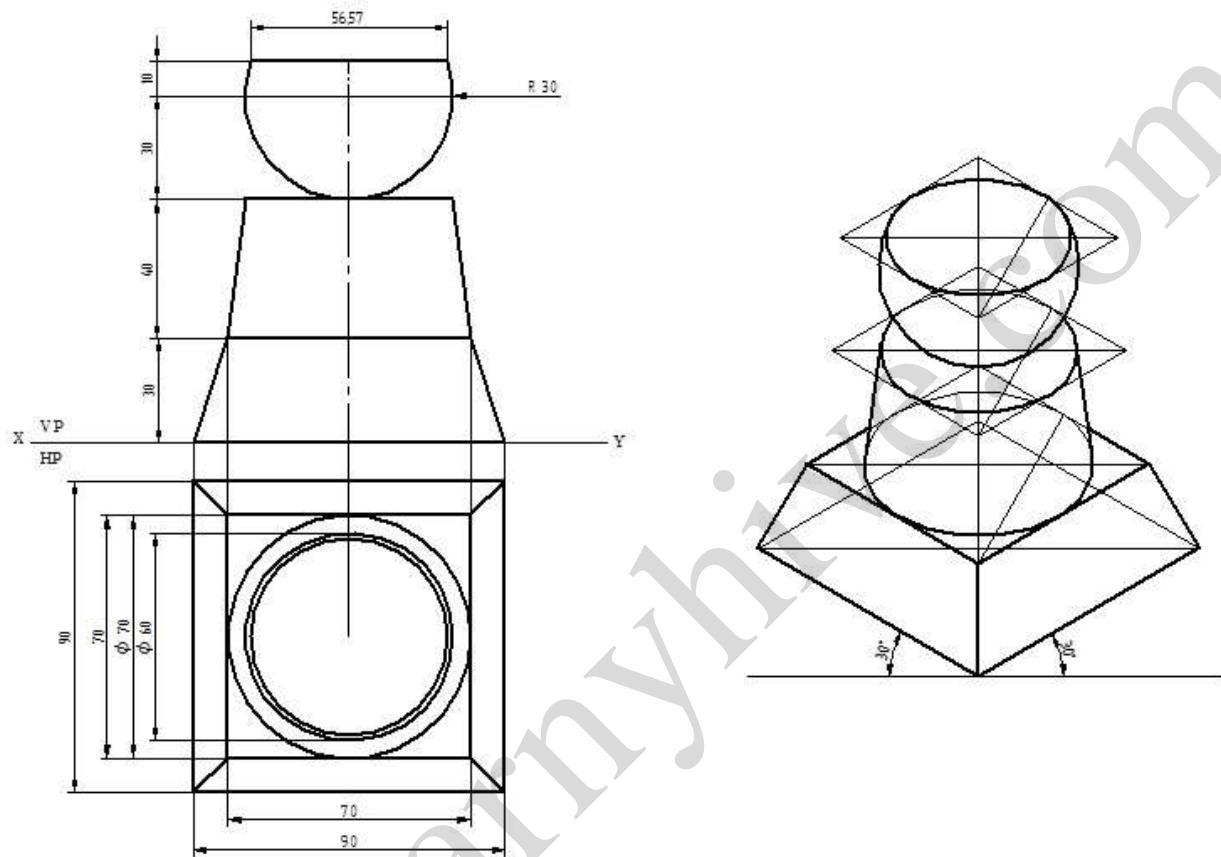


ORTHOGRAPHIC VIEW

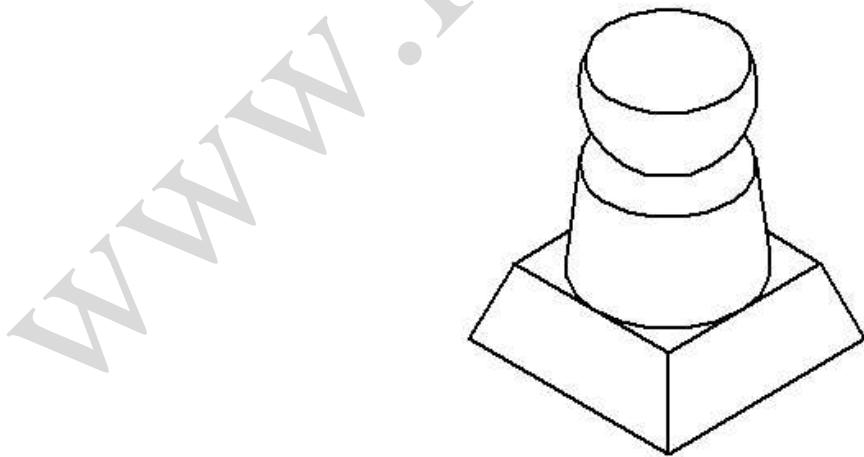
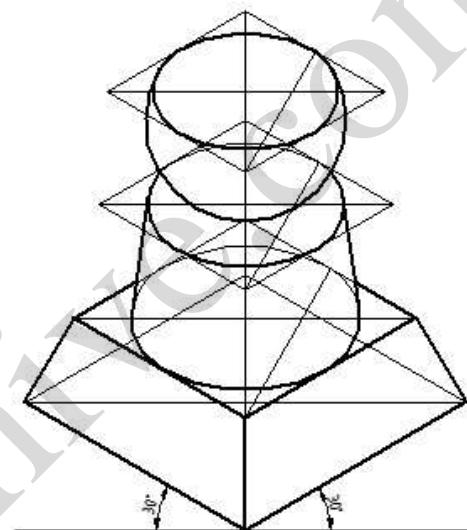


ISOMETRIC VIEW

49. Following figure shows the front view of combination of solids consisting a cut sphere and frustums of a cone and a square pyramid. Draw the isometric projection of the combination of solids.

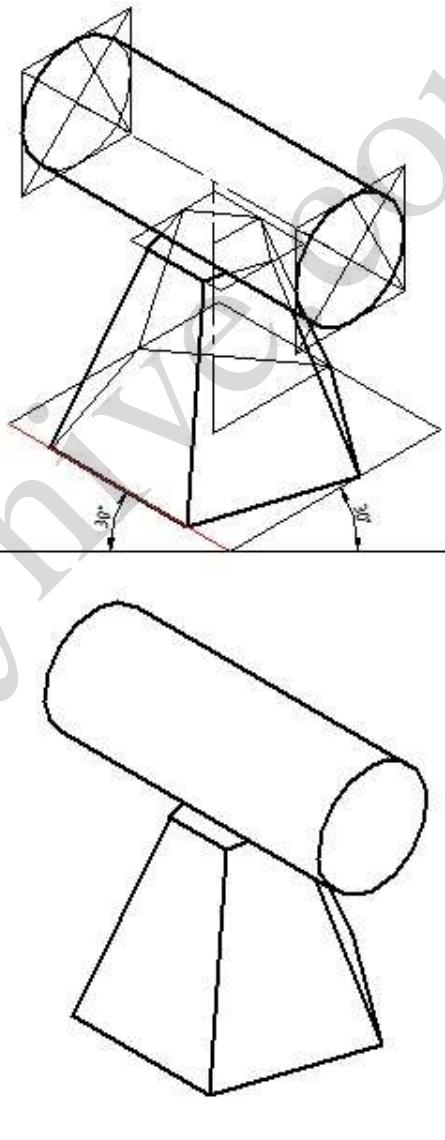
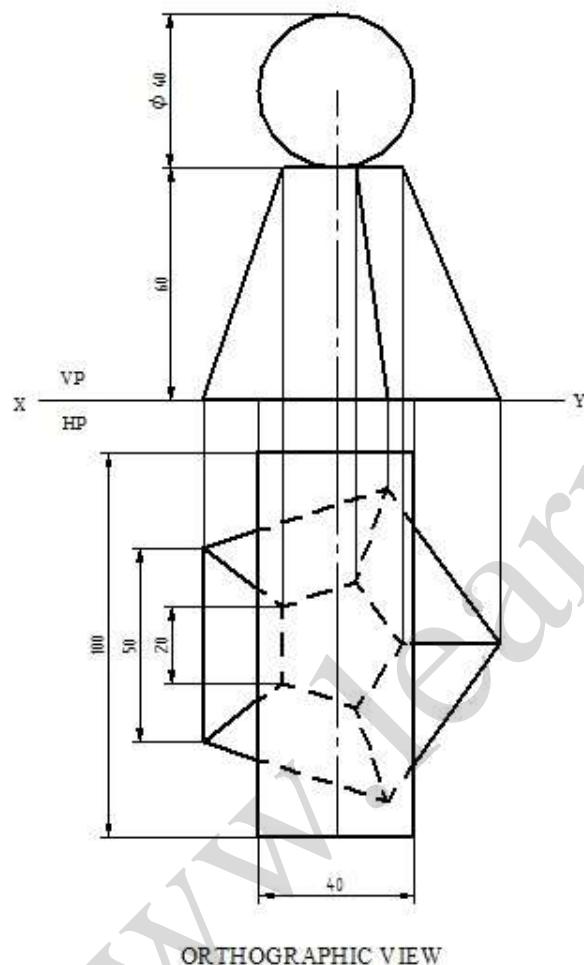


ORTHOGRAPHIC VIEW



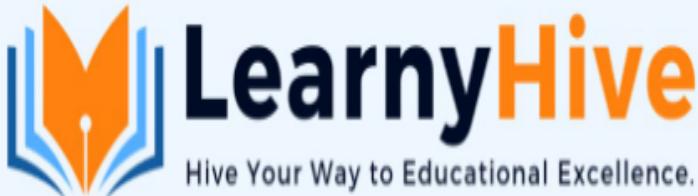
ISOMETRIC VIEW

50. Following figure shows the top view of a cylinder which is centrally mounted on a frustum of a pentagonal pyramid of 60mm height. Draw the isometric projection of the combination of solids.



ORTHOGRAPHIC VIEW

ISOMETRIC VIEW



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