

# UNIT III

## Projection of Solids

# Solids

1. A solid is a three dimensional object, having length, breath and thickness.
2. It is bounded by plane faces or curved surfaces or combination of plane and curved areas.

# Solids

## 1. Types of solids

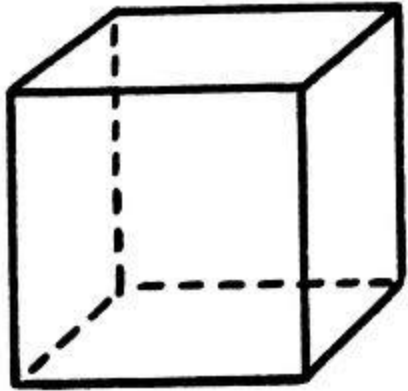
a) Polyhedra

b) Solids of revolution

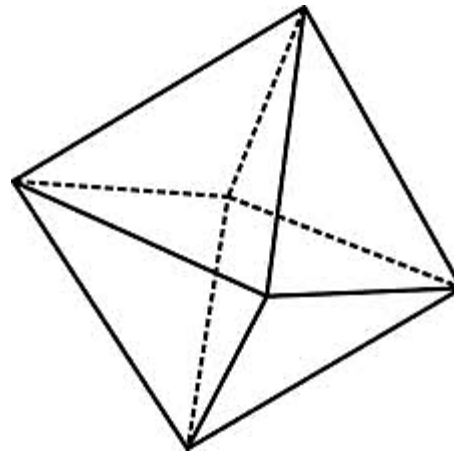
# Polyhedra

1. A polyhedron is a many sided solid figure bounded by only plane surfaces or faces.
2. If all the faces of a polyhedron are having the same size and shape, it is said to be a regular polyhedron.

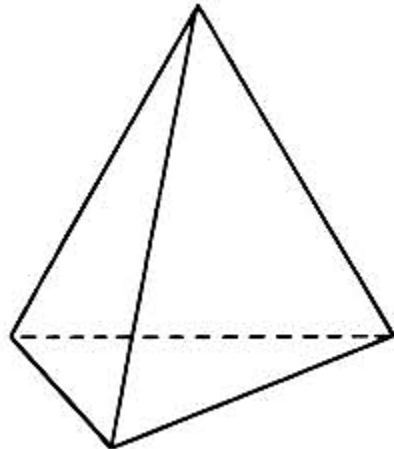
# Polyhedra Examples



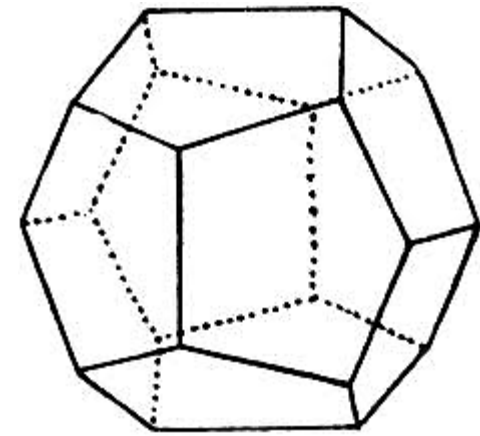
Cube



Octahedron



Tetrahedron



Dodecahedron

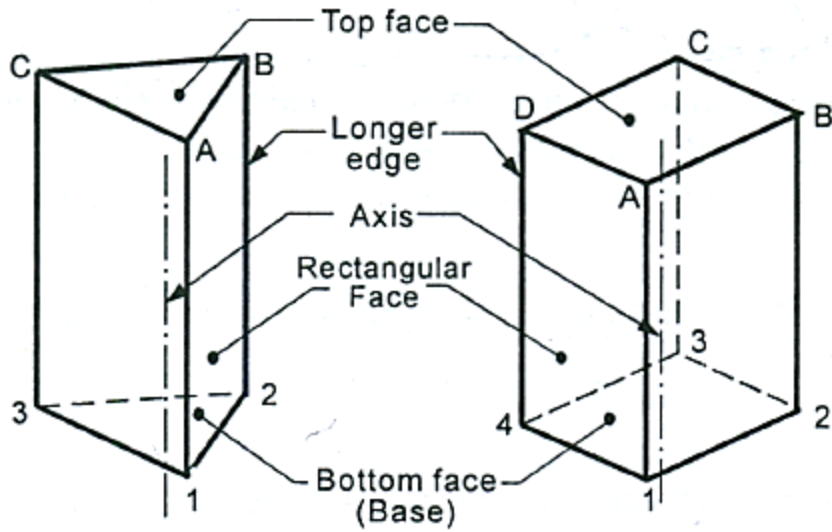
# Polyhedra

There are polyhedra other than regular ones which are called prisms and pyramids.

## 1. Prism

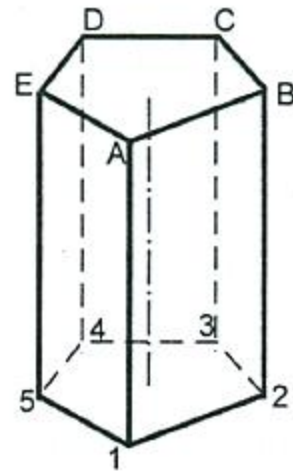
- a) A prism is a polyhedron having two equal and similar end faces called top face and bottom face joined by other faces which may be rectangles or parallelograms.
- b) The imaginary line joining the centres of the faces is called the Axis.

# Prisms Examples

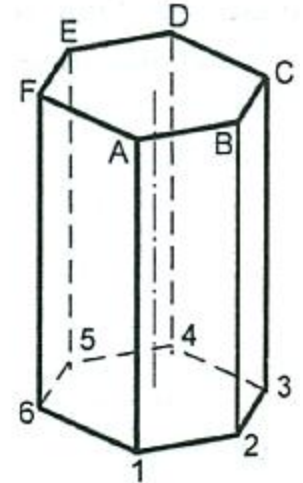


(a) TRIANGULAR

(b) SQUARE



(c) PENTAGONAL



(d) HEXAGONAL

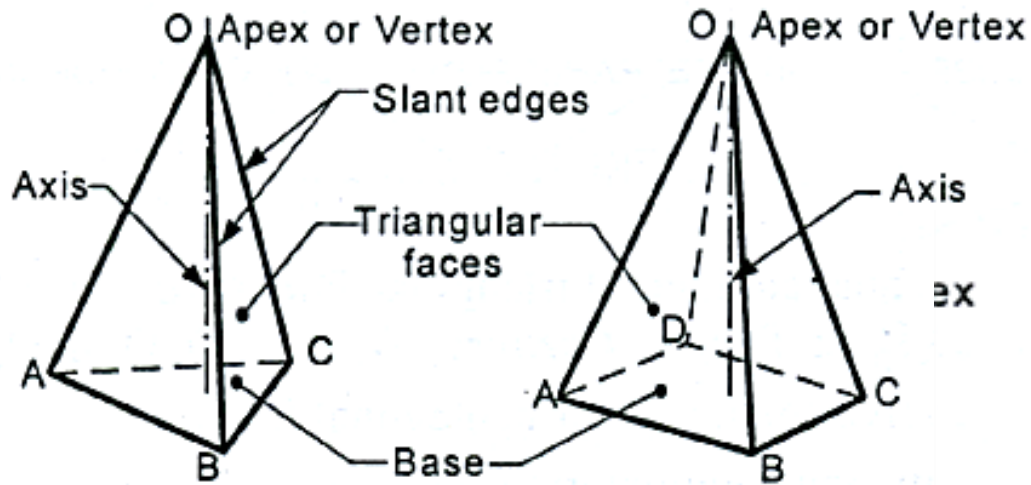
# Polyhedra

## 1. Pyramids

- a) A pyramid is a polyhedron having a plane figure for its base and equal number of isosceles triangular faces meeting at a point called vertex or apex.

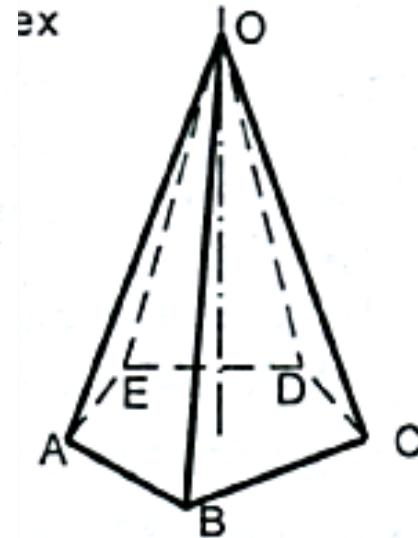


# Pyramids Examples

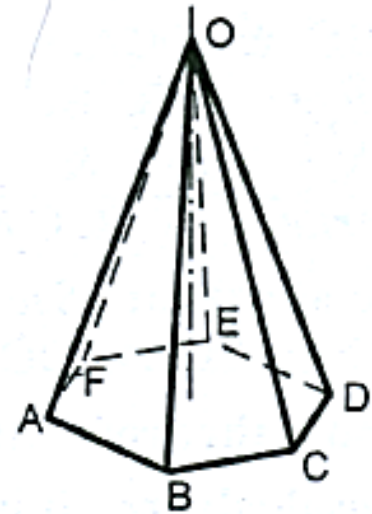


(a) TRIANGULAR

(b) SQUARE



(c) PENTAGONAL



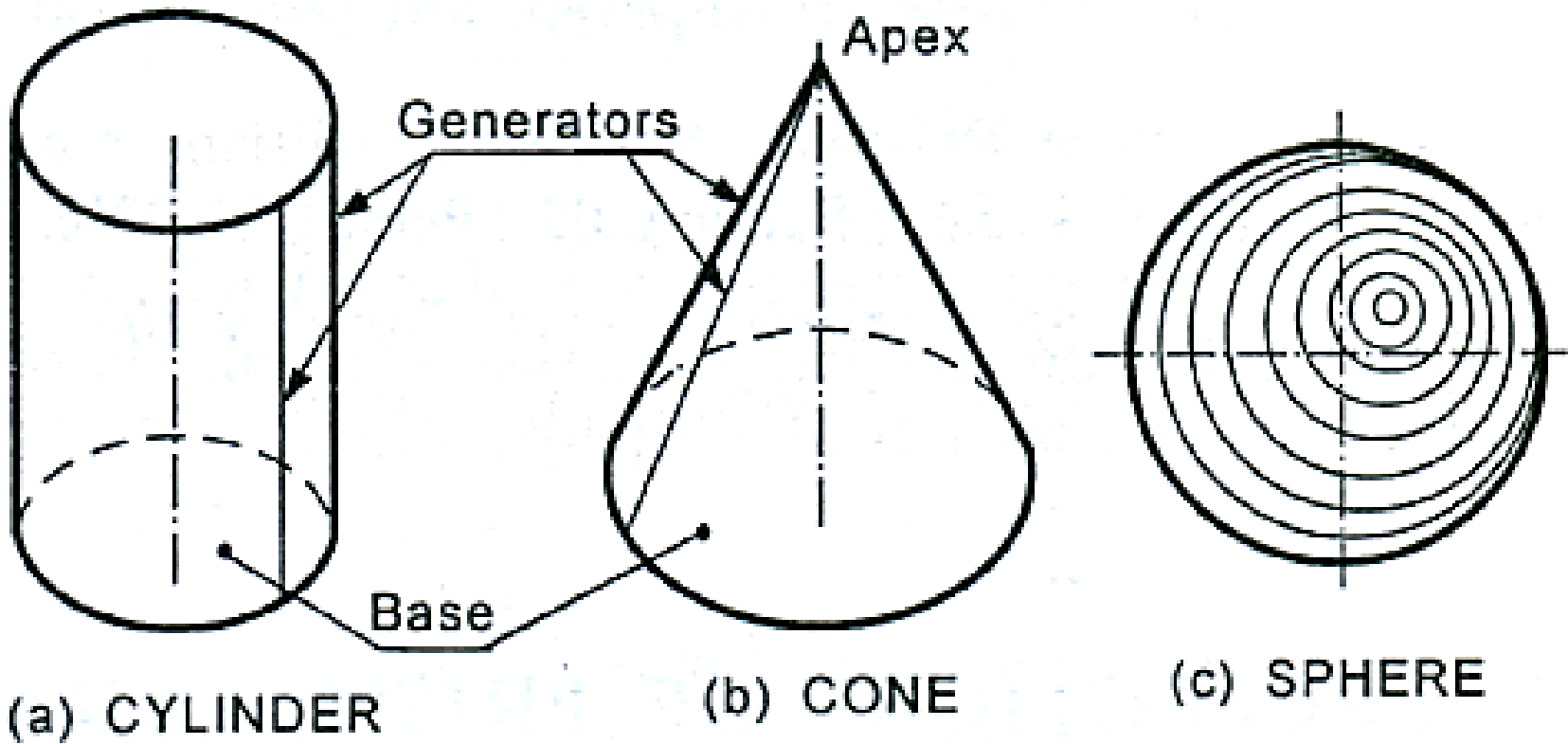
(d) HEXAGONAL

# Polyhedra

## 2. Solids of revolution

If a plane surface is revolved about one of its edges, the solid generated is called a solid of revolution.

# Solids of revolution

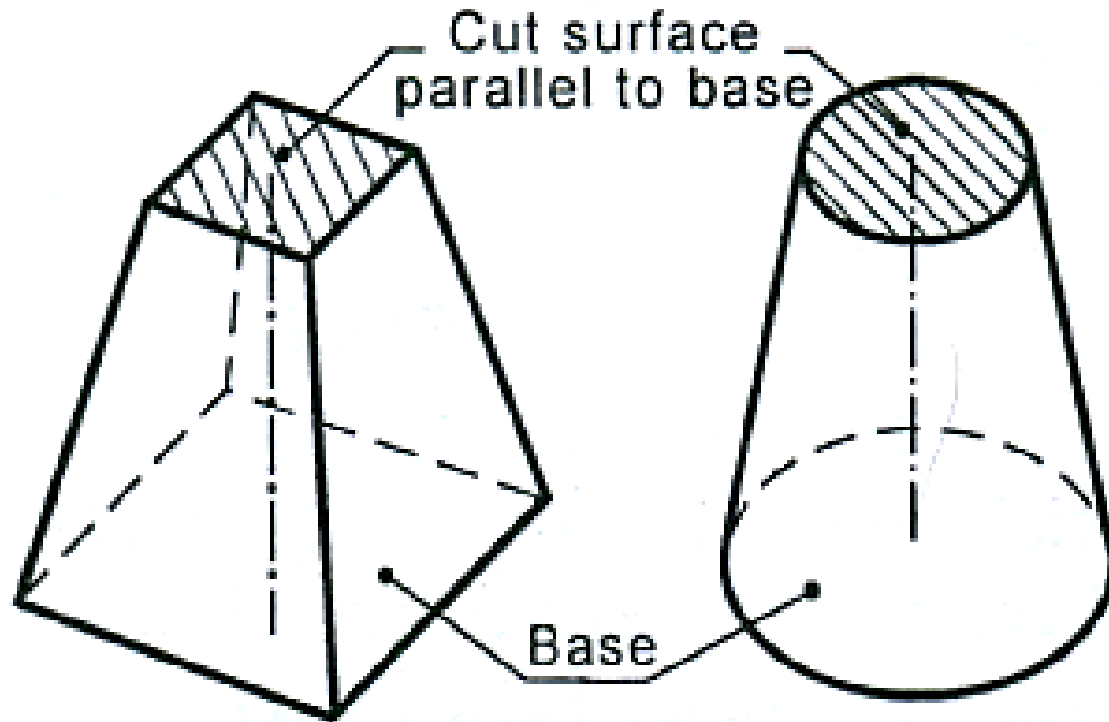


# Other forms of solids

## Frustum

When a pyramid of a cone is cut by a cutting plane parallel to its base, the remaining portion thus obtained after removing the top portion is called the Frustum.

# Frustum



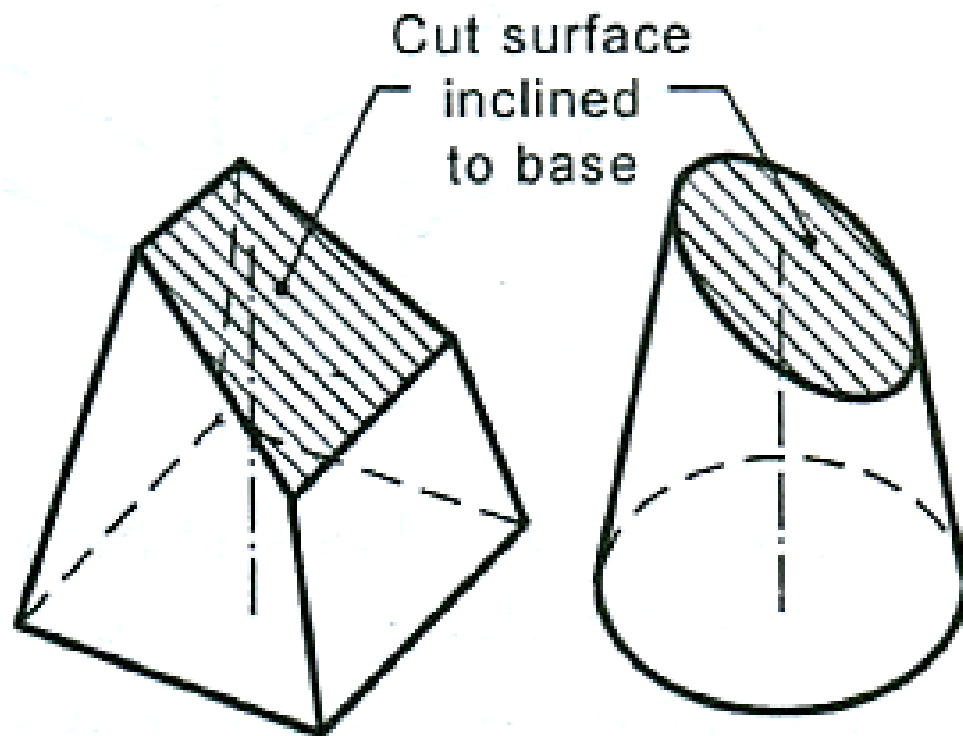
Frustum of Pyramid and Cone

# Other forms of solids

## Truncated

When a solid(prism/cylinder/pyramid/cone) is cut by a cutting plane inclined to its base (not parallel) the remaining portion thus obtained after removing the top portion is called the truncated solid.

# Truncated



Truncated Pyramid and Cone

# Solids with Axis inclined to the VP and parallel to the HP

1. In first stage, it is assumed to be kept such that the **axis is perpendicular to the VP.**
2. In this simple position, the **front view is drawn first** and the top view projected from it.
3. In the second stage, the projections are obtained by any one of the method
  - a) **Change of position method**
  - b) Change of reference line or Auxiliary projection method



# Solids with Axis inclined to the HP and parallel to the VP

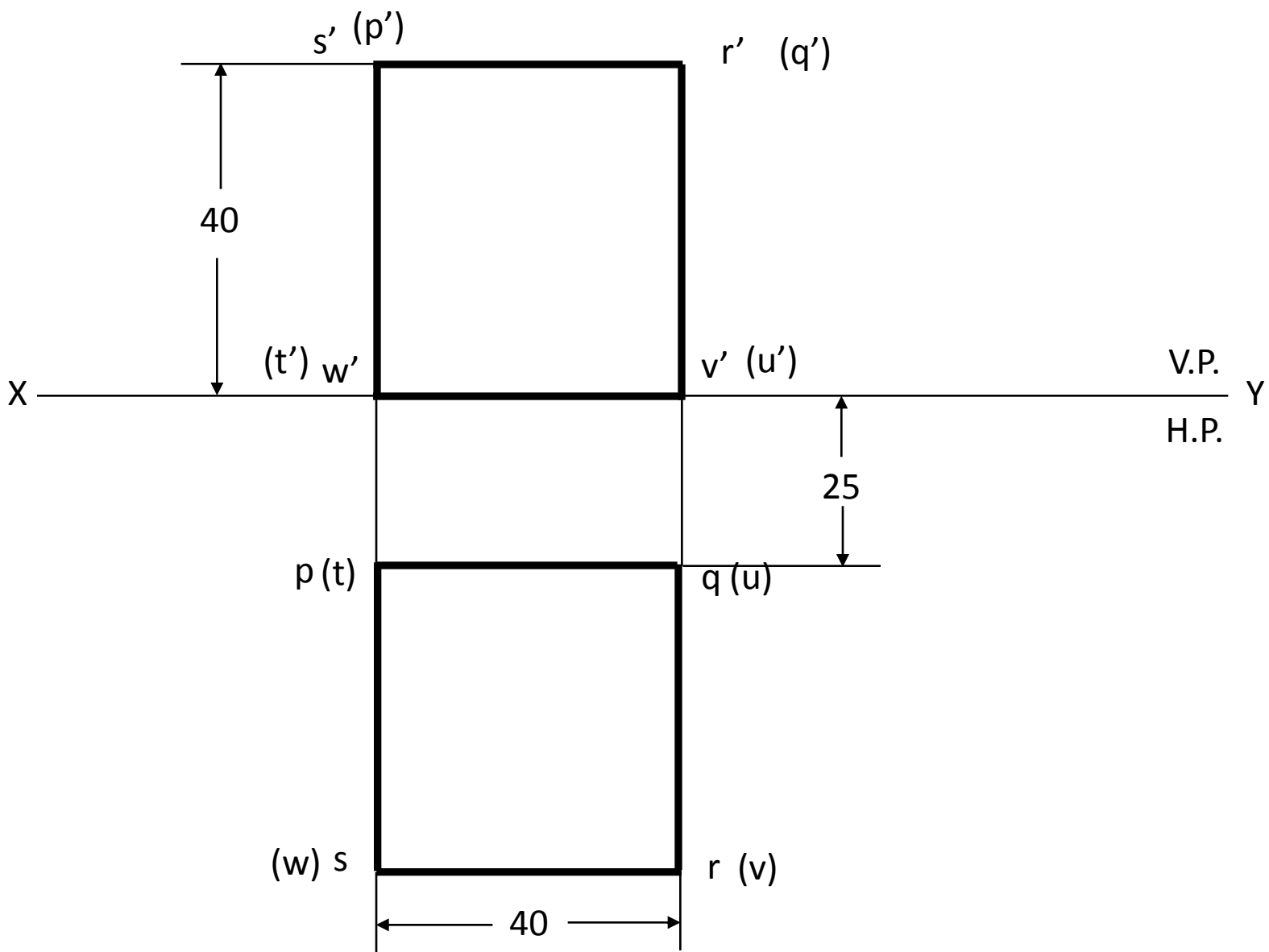
1. In first stage, it is assumed to be kept such that the **axis is perpendicular to the HP.**
2. In this simple position, the **top view is drawn first** and the front view projected from it.
3. In the second stage, the projections are obtained by any one of the method
  - a) Change of position method
  - b) Change of reference line or Auxiliary projection method

Change of position method

# Problem 1

A cube of side 40 mm rests on the ground with a face parallel to VP and 25 mm in front of VP. Draw the top and front views of the cube.

Problem 1

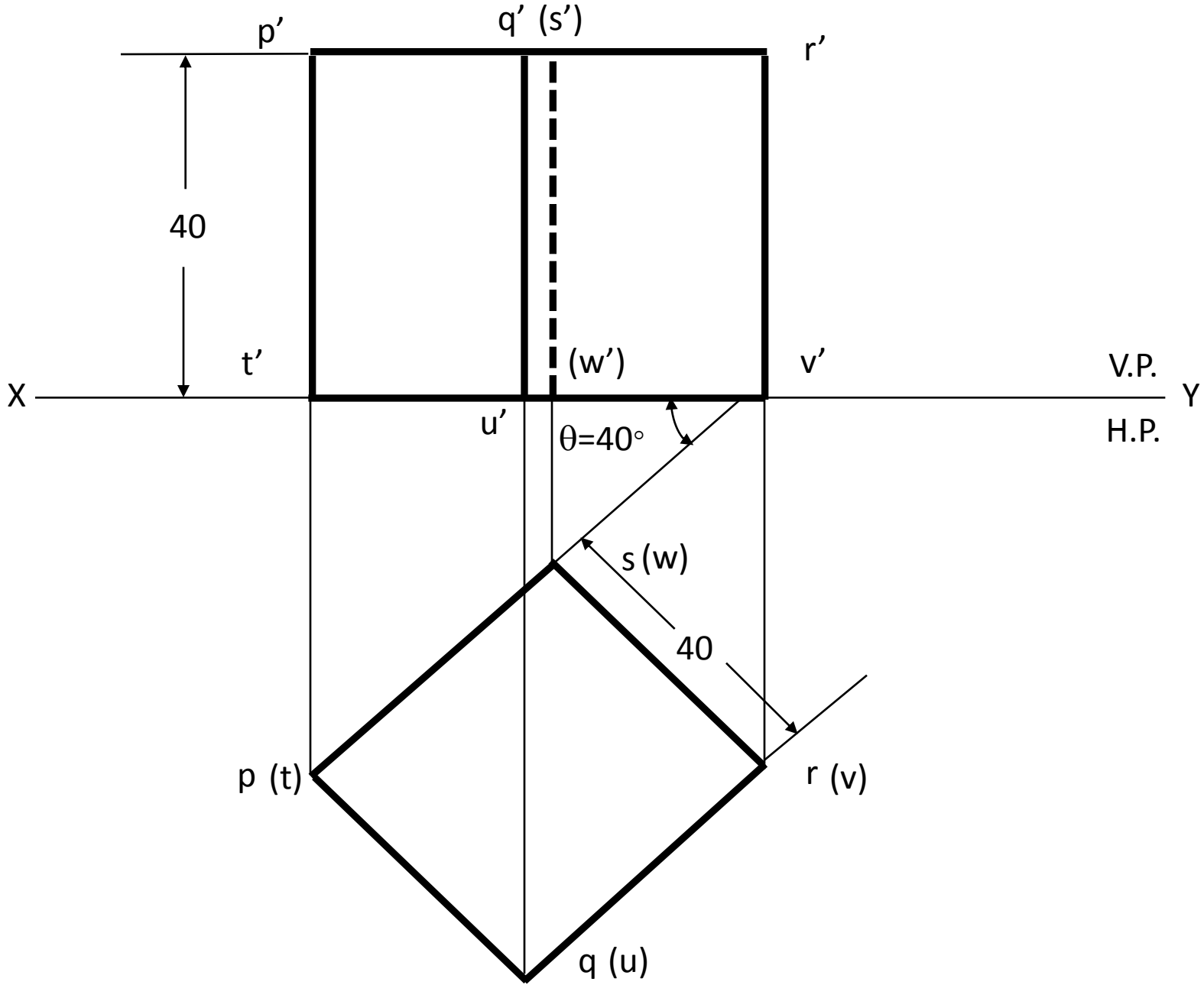


## Problem 2

A cube of side 40 mm rests on the HP on one of its ends with a vertical face inclined at  $40^\circ$  to the VP. Draw its projections.

Problem 2

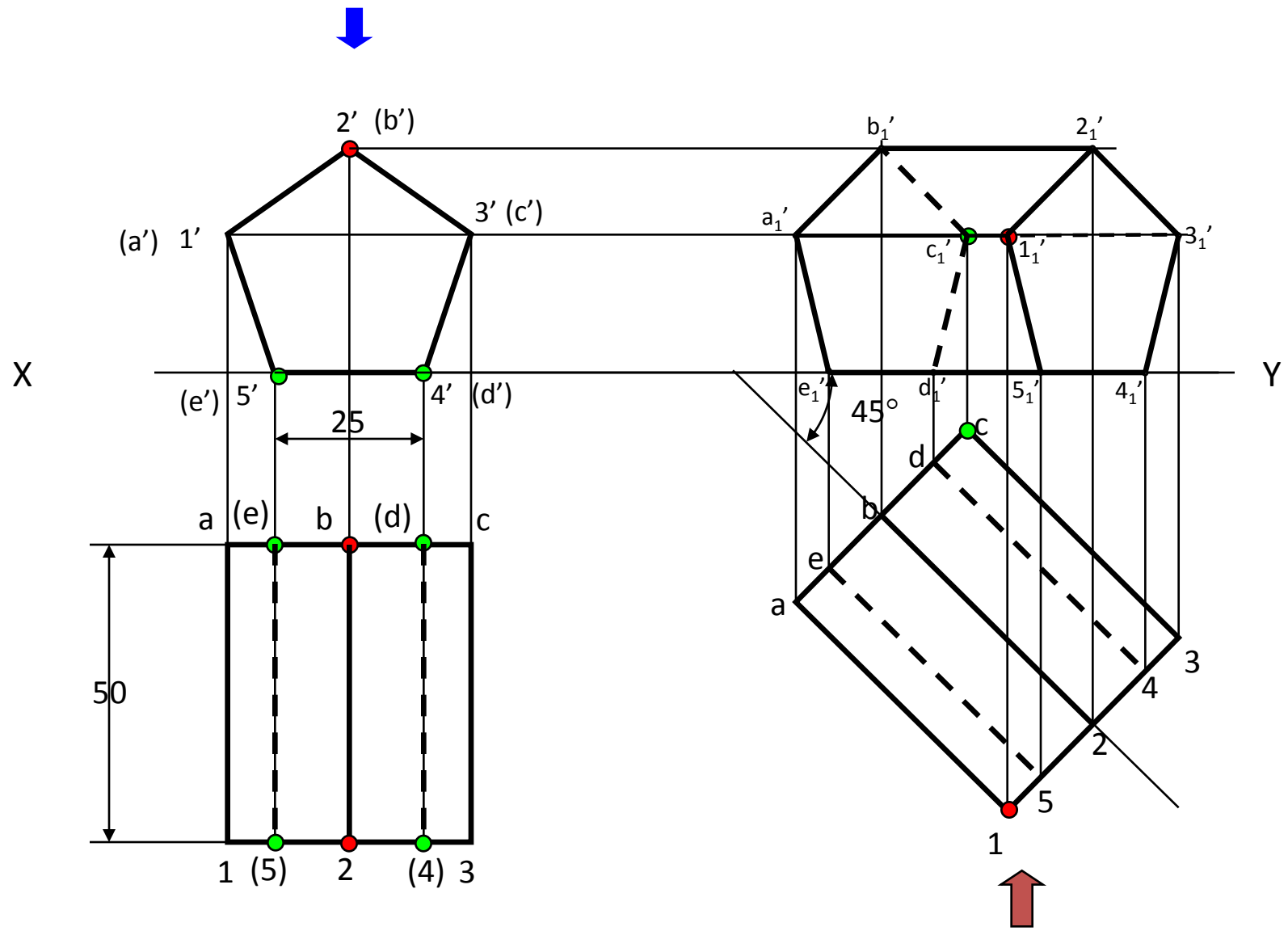
Draw the top view as a square of side 40 mm with one of its sides inclined at  $40^\circ$  to  $xy$ .



# Problem 3

Draw the projections of a **pentagonal prism** ,  
base 25 mm side and axis 50 mm long,  
resting on one of its rectangular faces on the  
H.P. with the axis inclined at  **$45^\circ$  to the V.P.**

# Problem 3

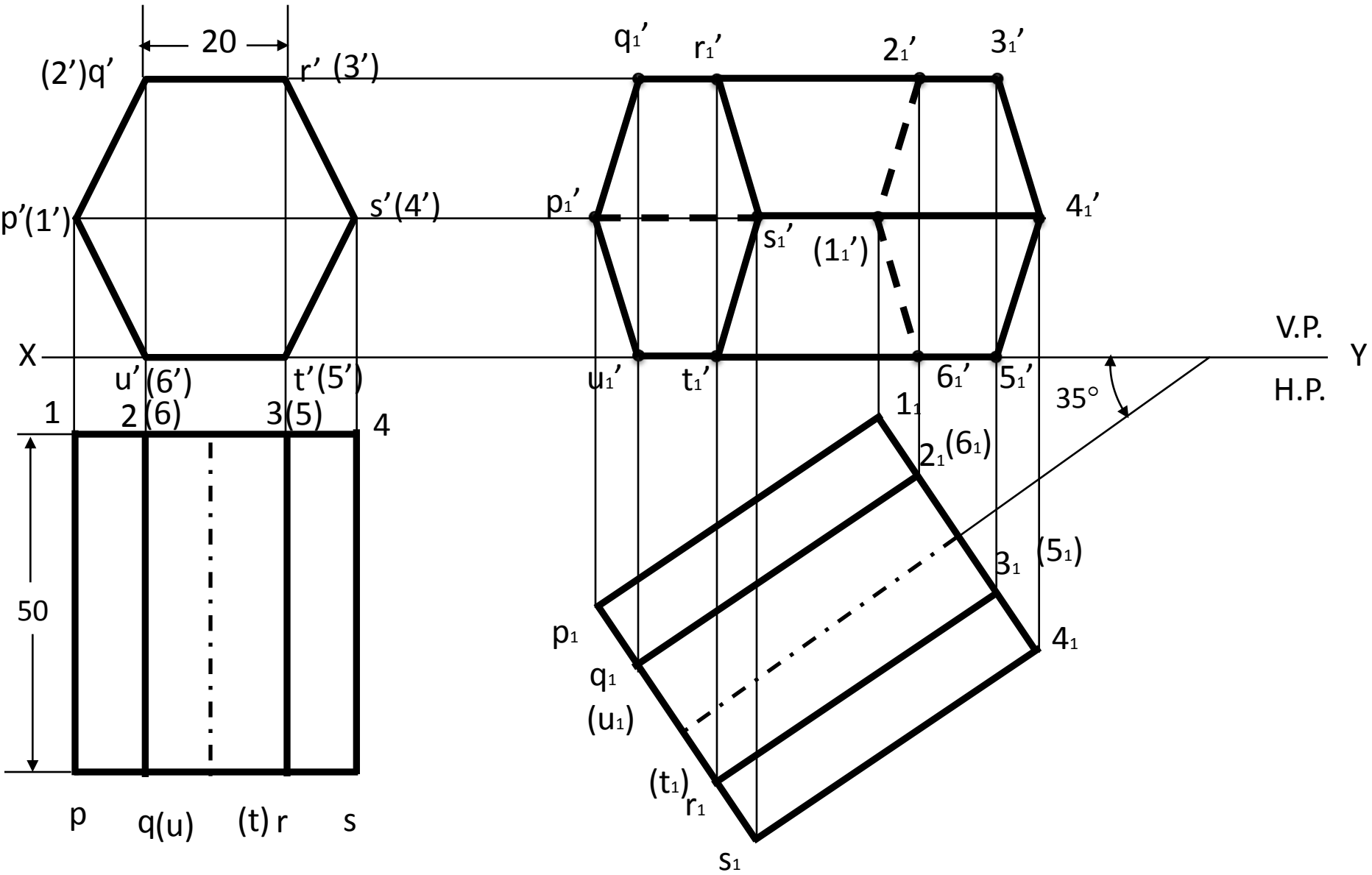




# Problem 4

Draw the projections of a **hexagonal prism** of base side 20 mm and axis length 50 mm when it is lying on the ground on one of its rectangular faces and the axis is inclined at **35° to the VP.**

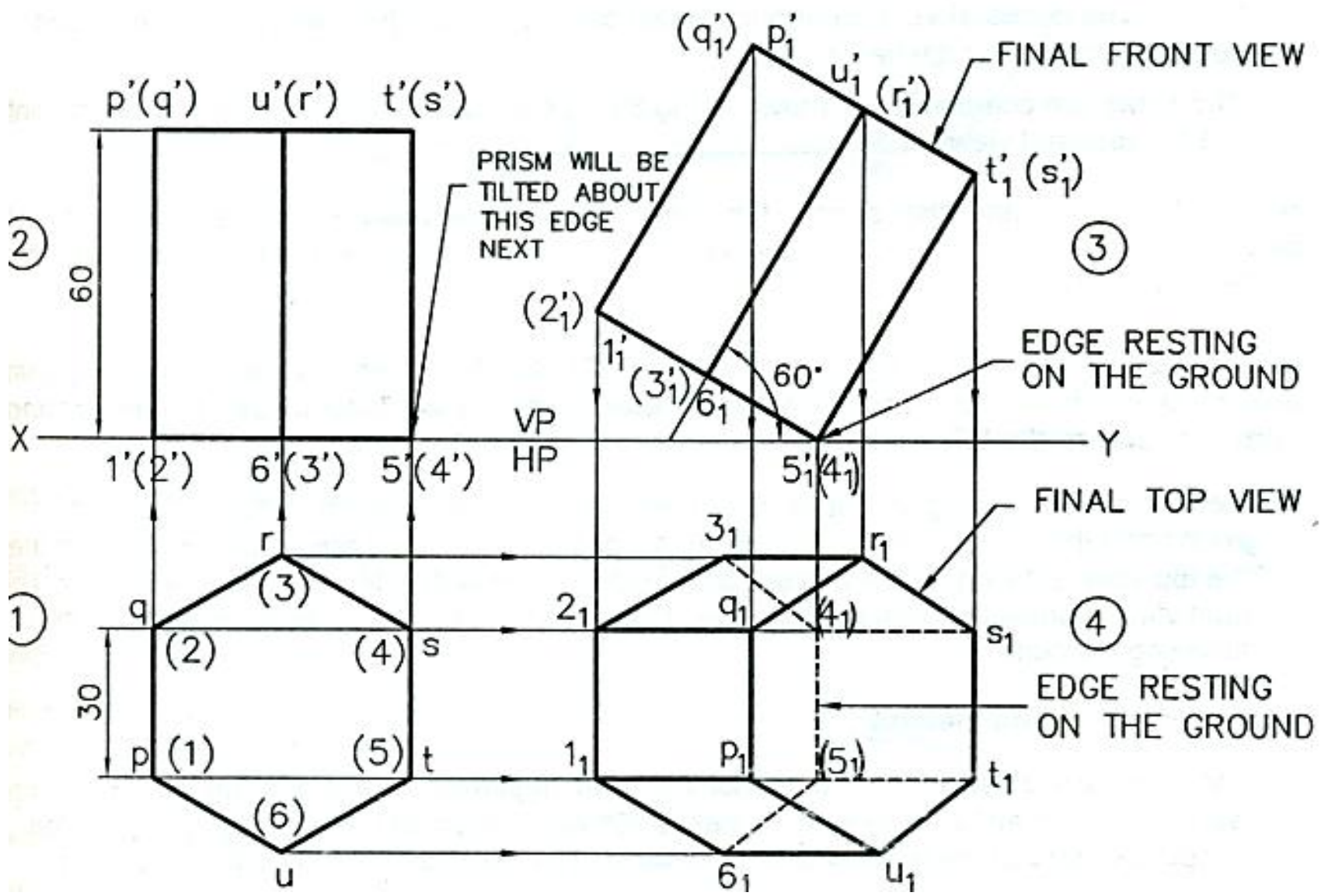
# Problem 4



# Problem 5

A **hexagonal prism** of base side 30 mm and axis length 60 mm rests on the HP on one of its base edges with its axis inclined at **60° to the HP** and parallel to the VP. Draw its top and front views.

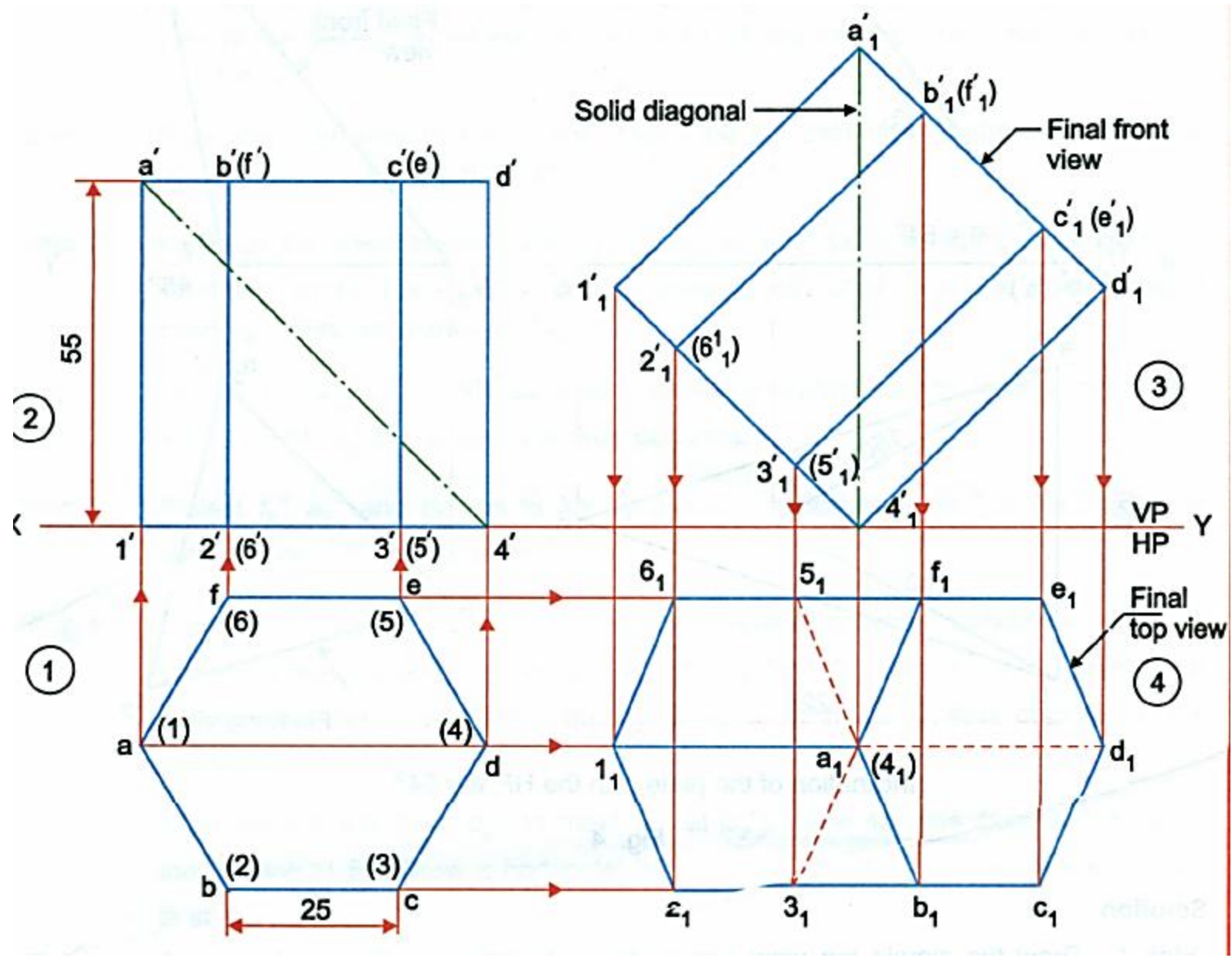
# Problem 5



# Problem 6

A **hexagonal prism** of base side 25 mm and axis length 55 mm rests on the HP on one of its base corners such that a solid diagonal passing through that corner is perpendicular to the HP. Draw its projections.

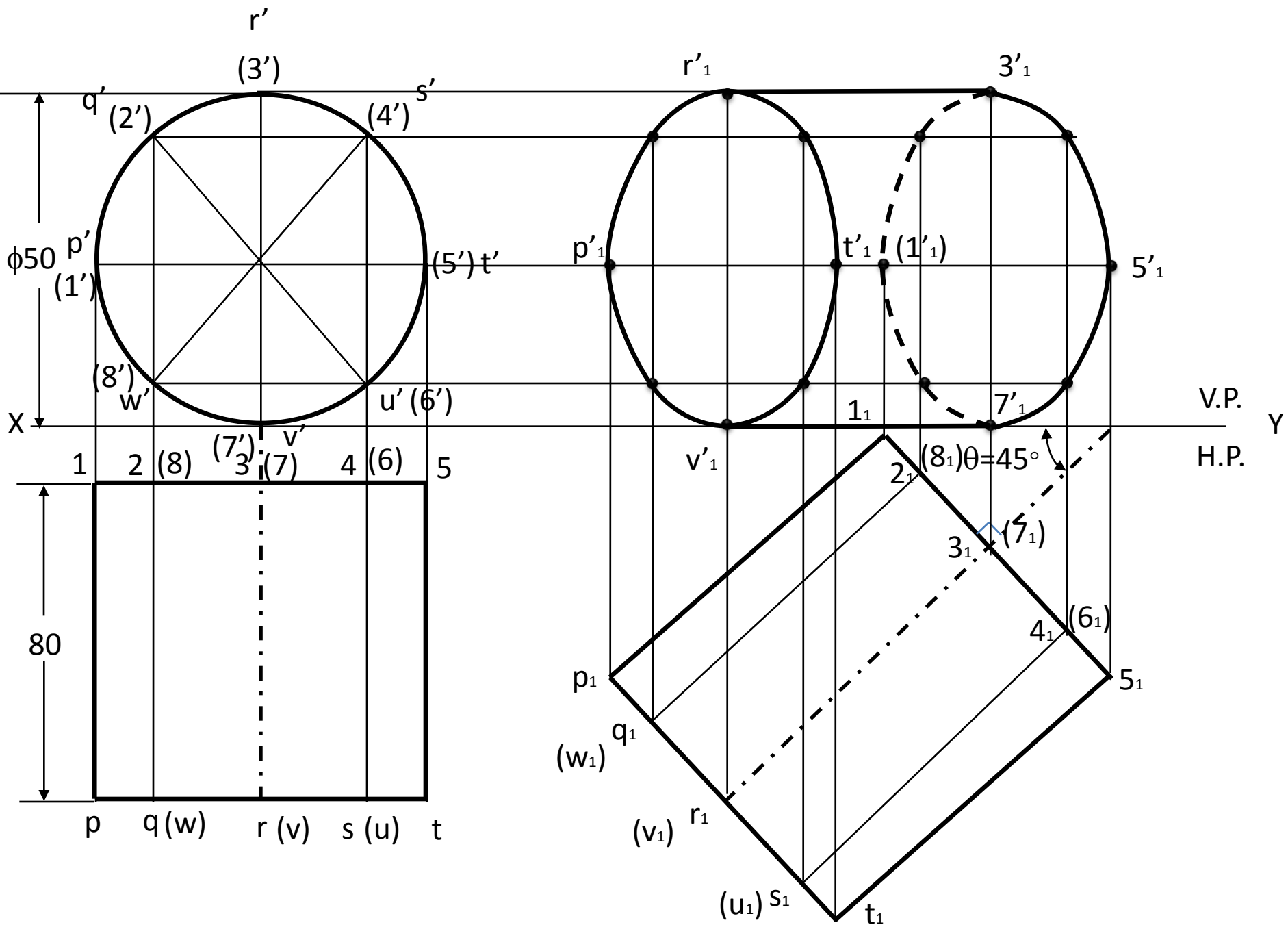
# Problem 6



# Problem 7

Draw the projections of a **cylinder** of diameter 50 mm and axis length 80 mm when it is lying on the ground with its axis inclined at  **$45^\circ$  to the VP** and parallel to the ground.

# Problem 7

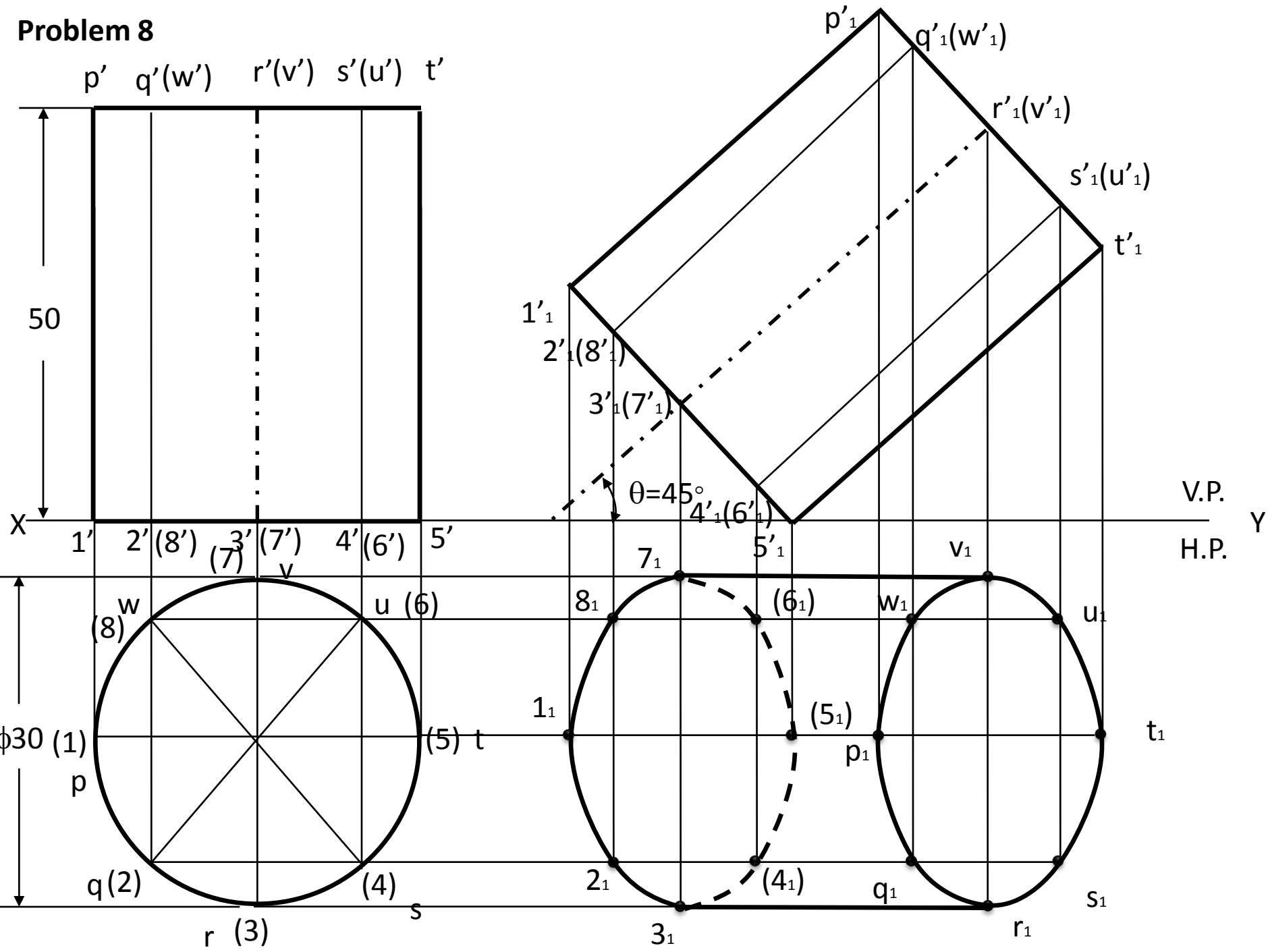




# Problem 8

A **cylinder** of diameter 30 mm and axis length 50 mm is resting on the HP on a point so that its axis is inclined at  **$45^\circ$  to the HP** and parallel to the VP. Draw its top and front views.

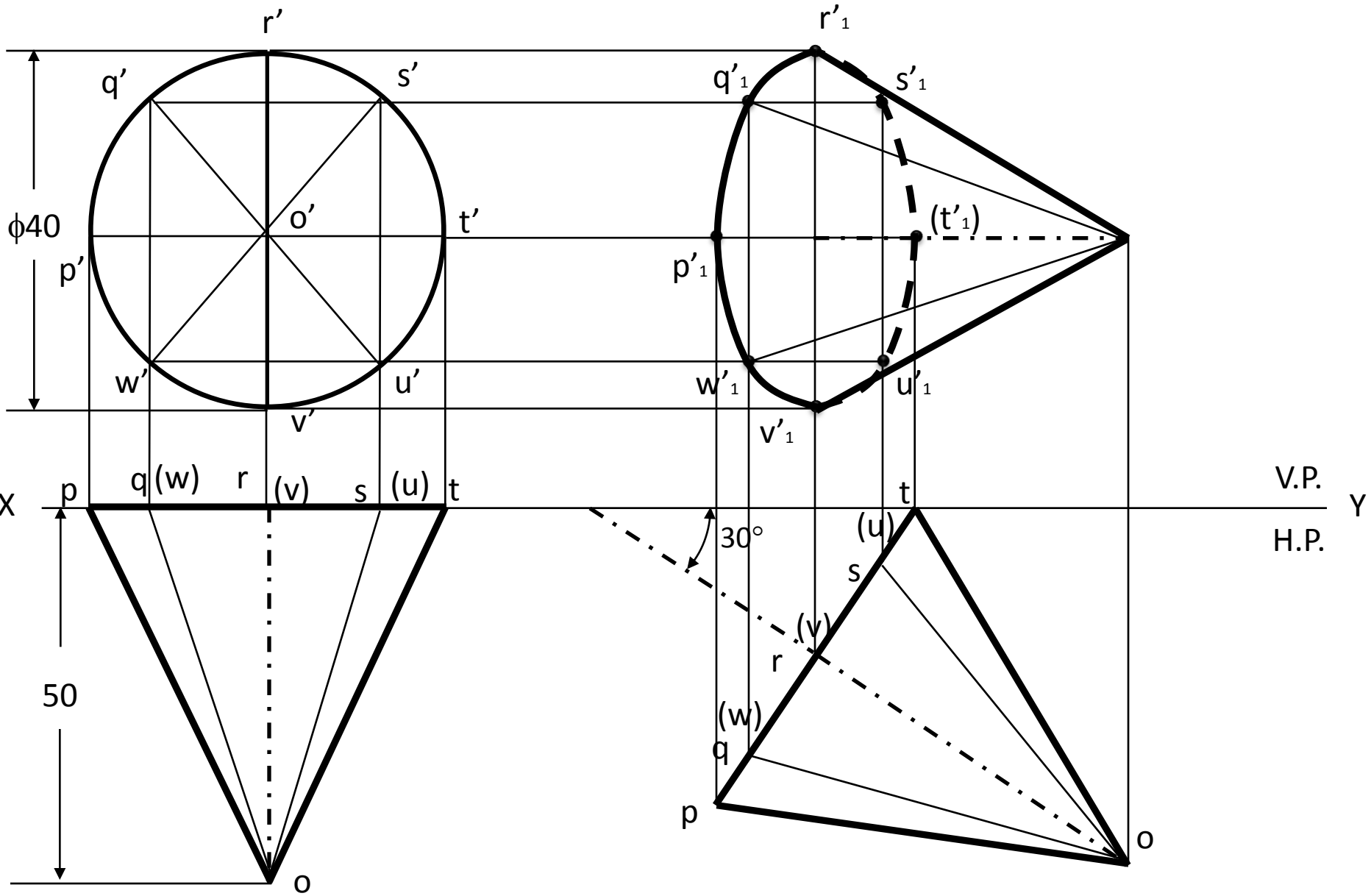
**Problem 8**



# Problem 9

A **cone** of base 40 mm diameter and axis 50 mm long touches VP on a point of its base circle. Its axis is inclined at **30° to VP** and parallel to HP. Draw its projections.

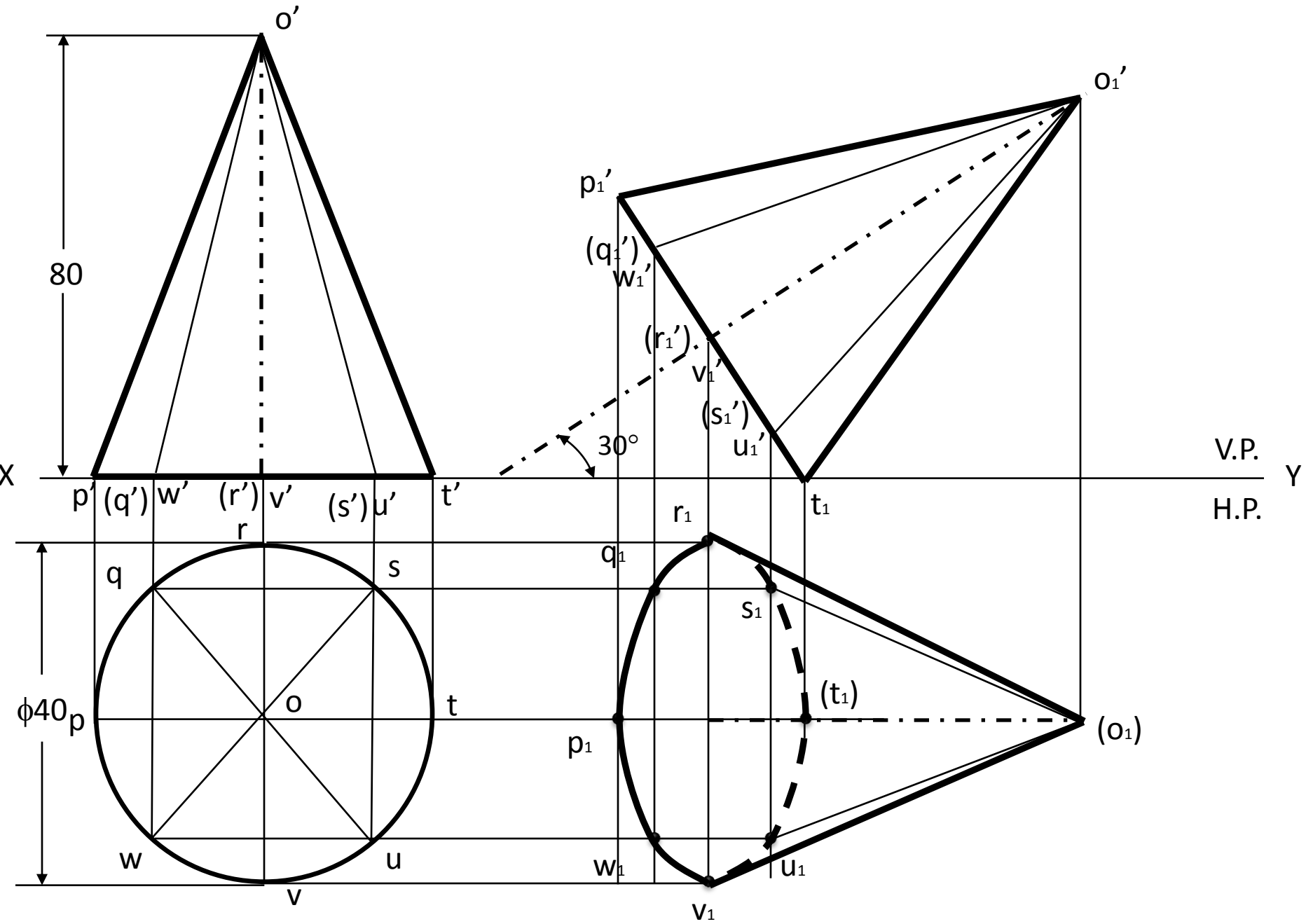
**Problem 9**



# Problem 10

A **cone** of base diameter 40 mm and altitude 80 mm rests on the HP with its axis inclined at **30° to the HP** and parallel to the VP. Draw its front and top views.

**Problem 10**



# Problem 11

A **cone** of base diameter 40 mm and height 56 mm is freely suspended from one of its base points such that its axis is parallel to the VP. Draw its projections.

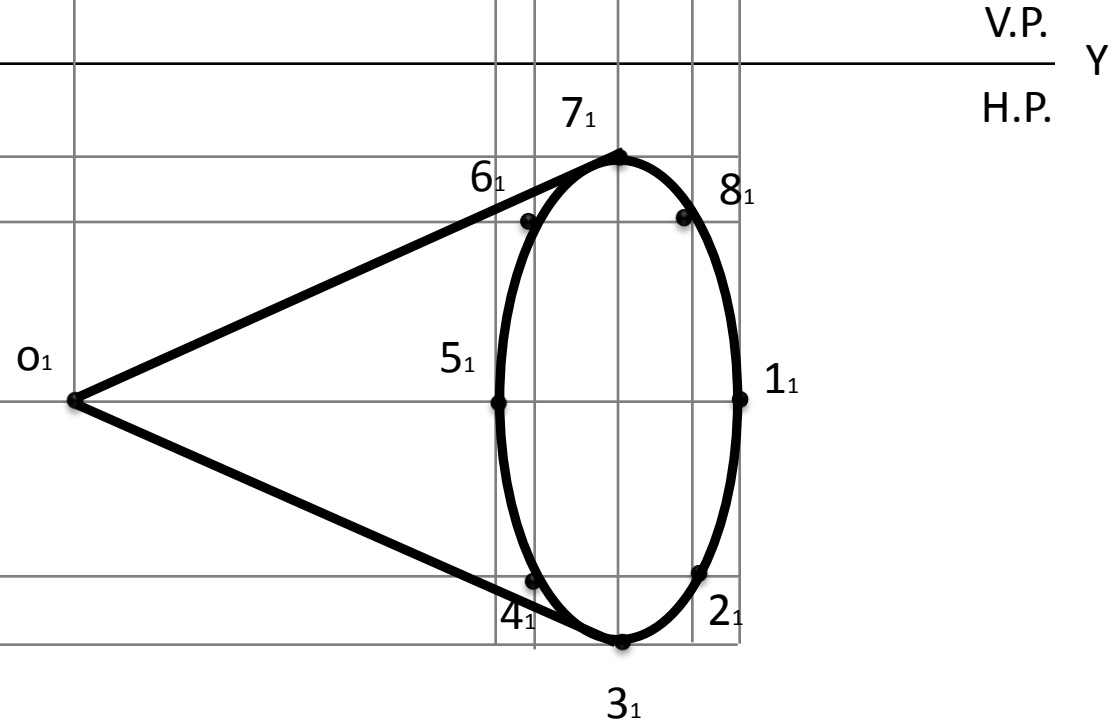
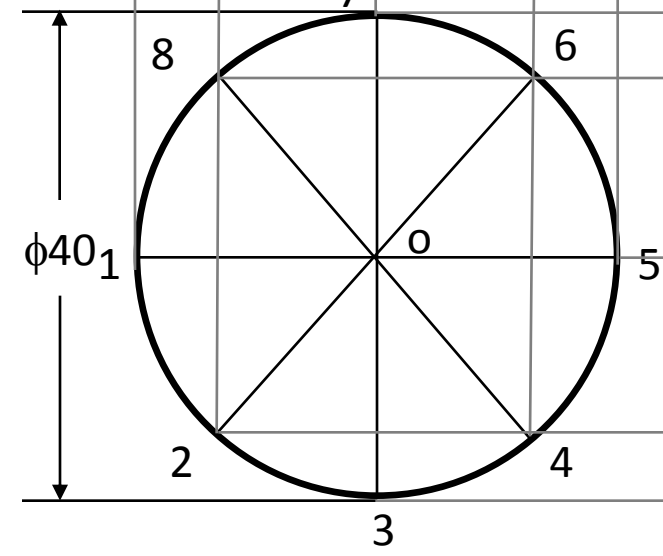
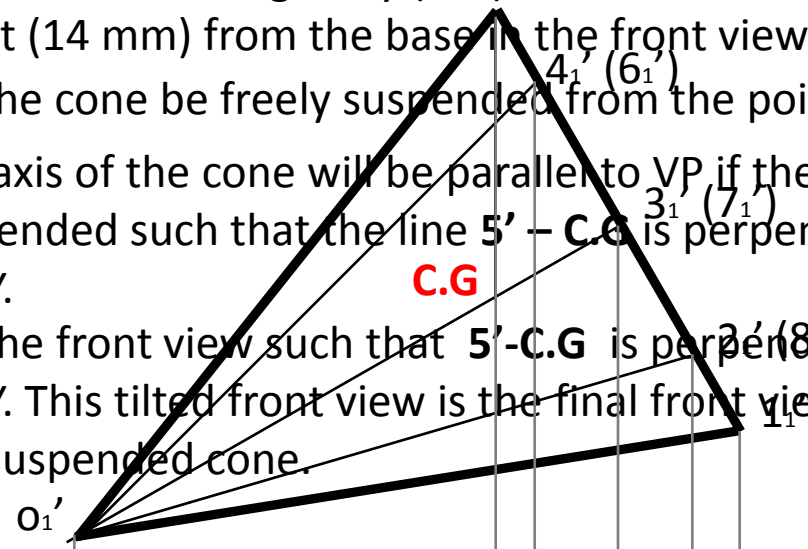
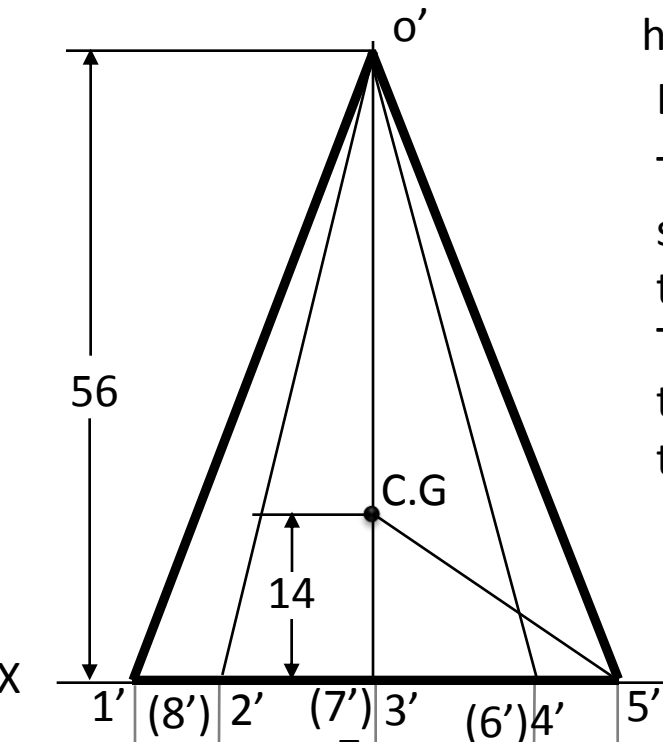
**Problem 11**

Mark the centre of gravity (C.G) of the cone at 1/4<sup>th</sup> height (14 mm) from the base in the front view.

Let the cone be freely suspended from the point 5.

The axis of the cone will be parallel to VP if the cone is suspended such that the line 5' - C.G is perpendicular to XY.

Tilt the front view such that 5'-C.G is perpendicular to XY. This tilted front view is the final front view of the suspended cone.





# Problem 12

A **cone** of base diameter 42 mm and axis length 65 mm rests on the HP on a point in the circumference of the base with one of its slant generators perpendicular to the HP and parallel to the VP. Draw its projections.

**Problem 12**

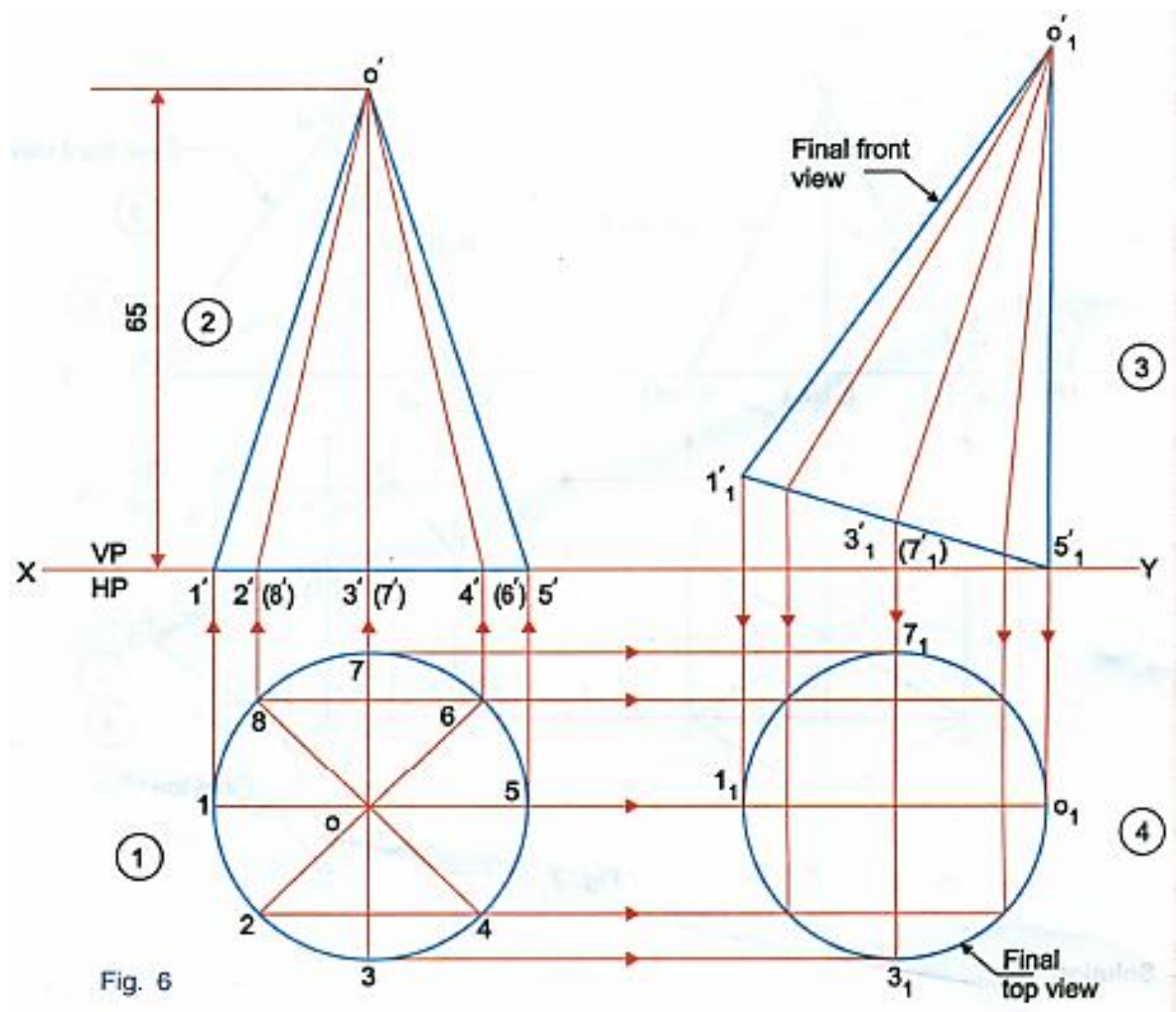
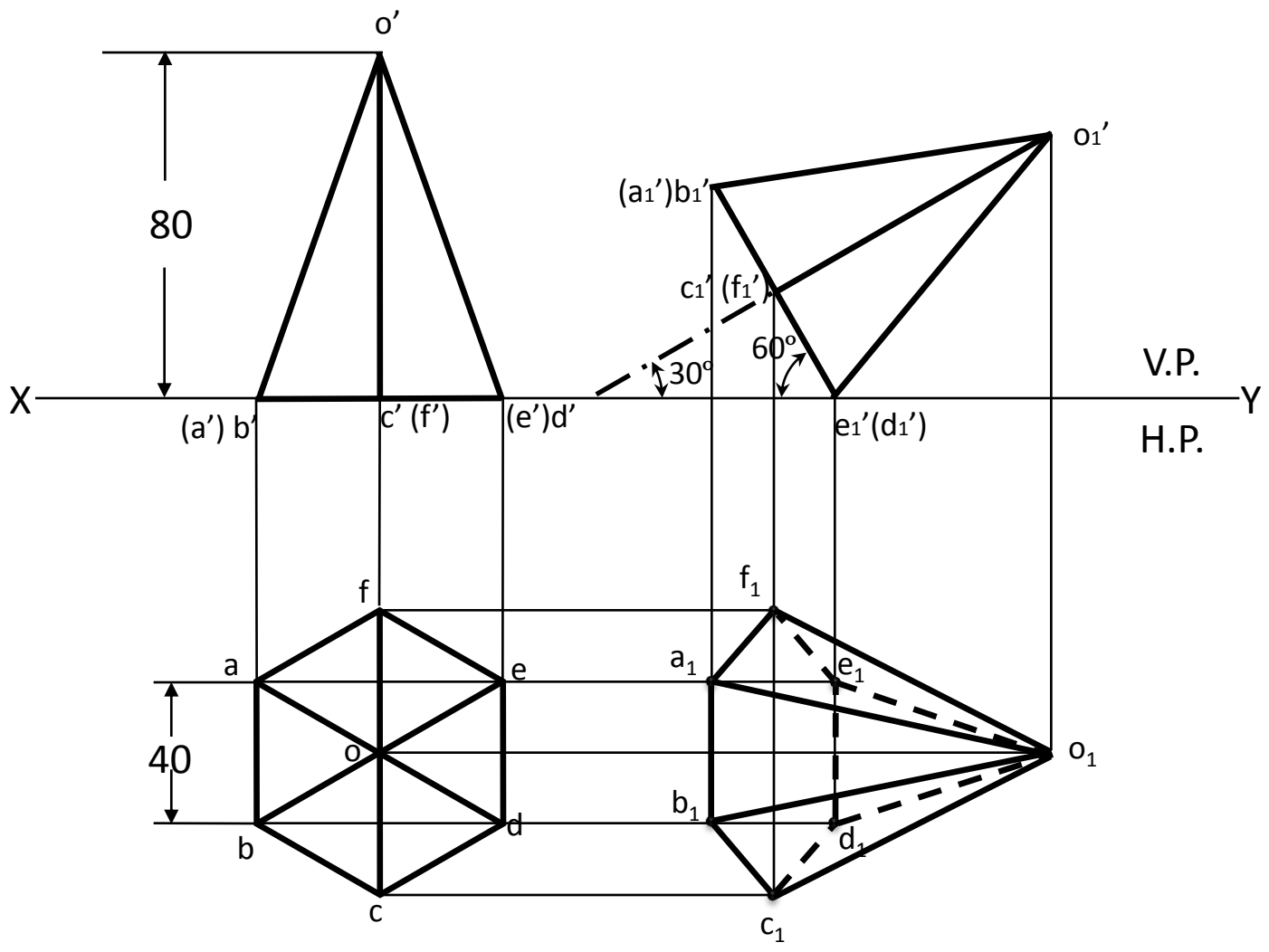


Fig. 6

# Problem 13

A **hexagonal pyramid** of base edge 40 mm and altitude 80 mm rests on one of its base edges on the HP with its axis inclined at  $30^\circ$  to the **HP** and parallel to the V.P. Draw its top and front views.

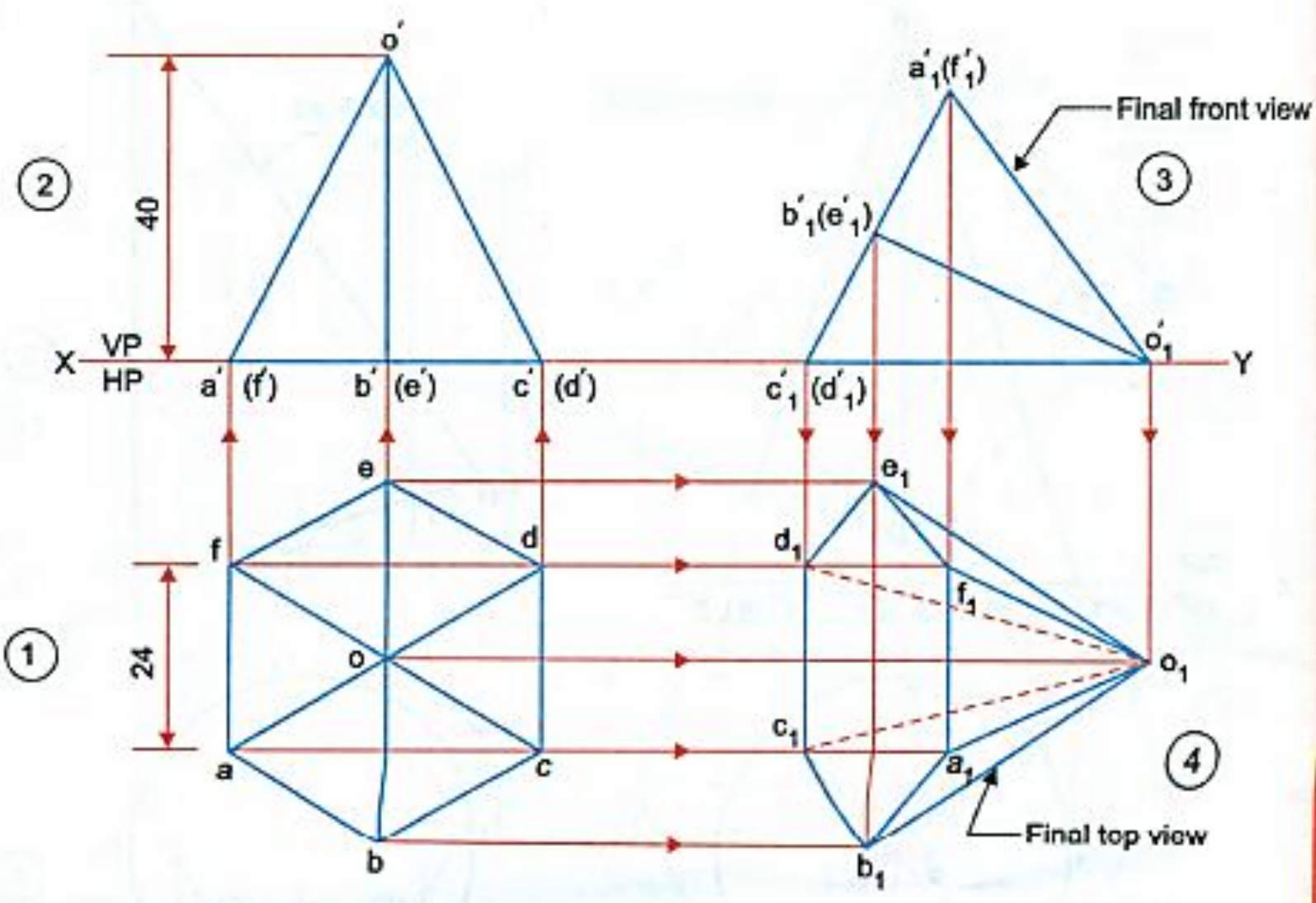
# Problem 13



# Problem 14

A hexagonal pyramid of base side 24 mm and axis length 40 mm is lying on the HP on one of its triangular faces with its axis parallel to the VP. Draw the top and front views of the pyramid.

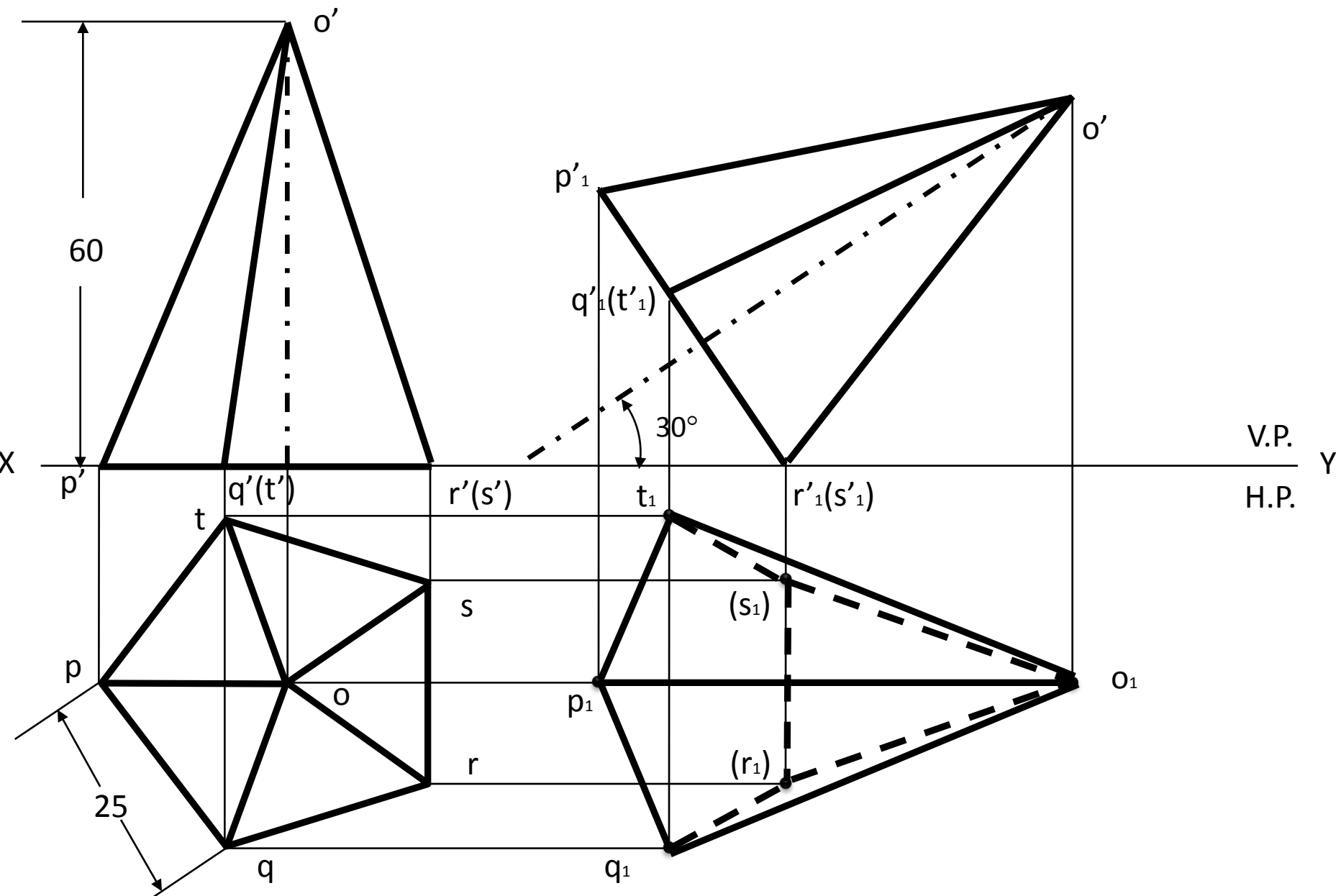
Problem 14



# Problem 15

Draw the projections of a **pentagonal pyramid** of base 25 mm side and axis 60 mm long when it is lying on the HP on one of its base edges, such that the axis is parallel to the VP and inclined at **30° to HP**.

**Problem 15**

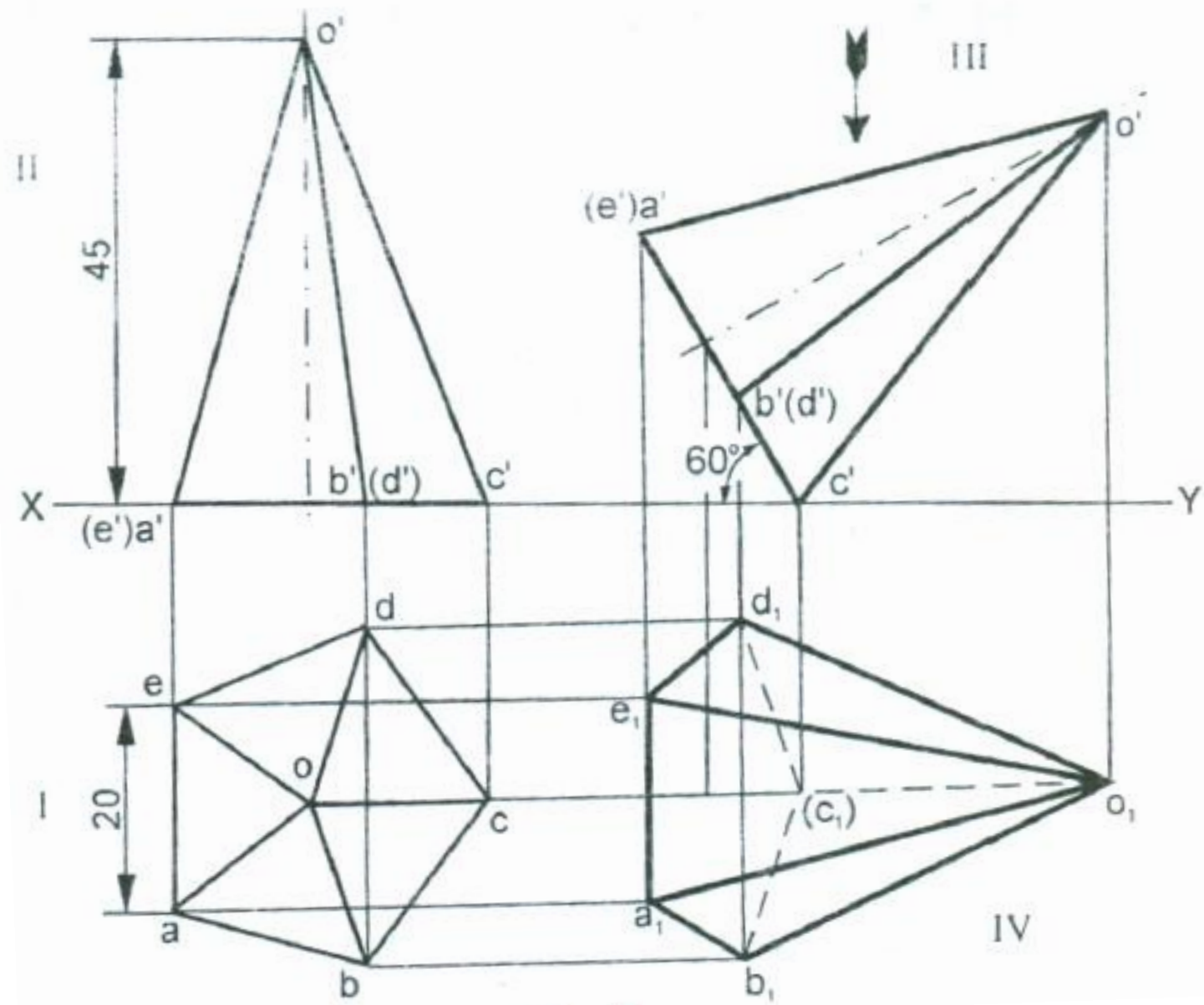




# Problem 15A

A **pentagonal pyramid** side of base 20 mm and axis 45 mm long rests with one of its corners on HP such that the base is inclined at an angle of **60° to HP** and one side of base is perpendicular to VP. Draw its projections.

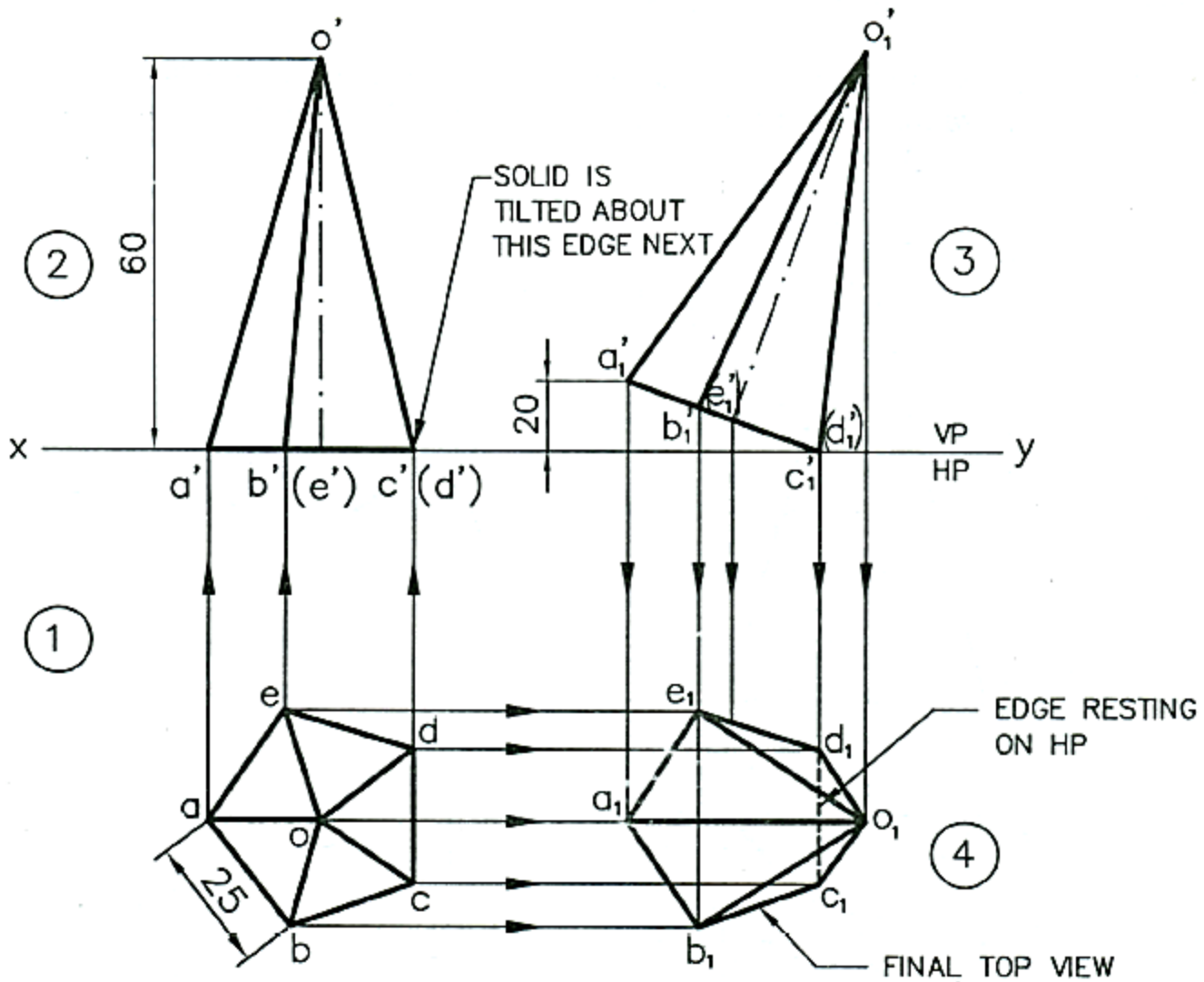
**Problem 15A**



# Problem 16

A **pentagonal pyramid** of base edge 25 mm and axis length 60 mm rests on one base side on HP such that the highest base corner is **20 mm above HP**. Its axis is parallel to the VP. Draw its top and front views.

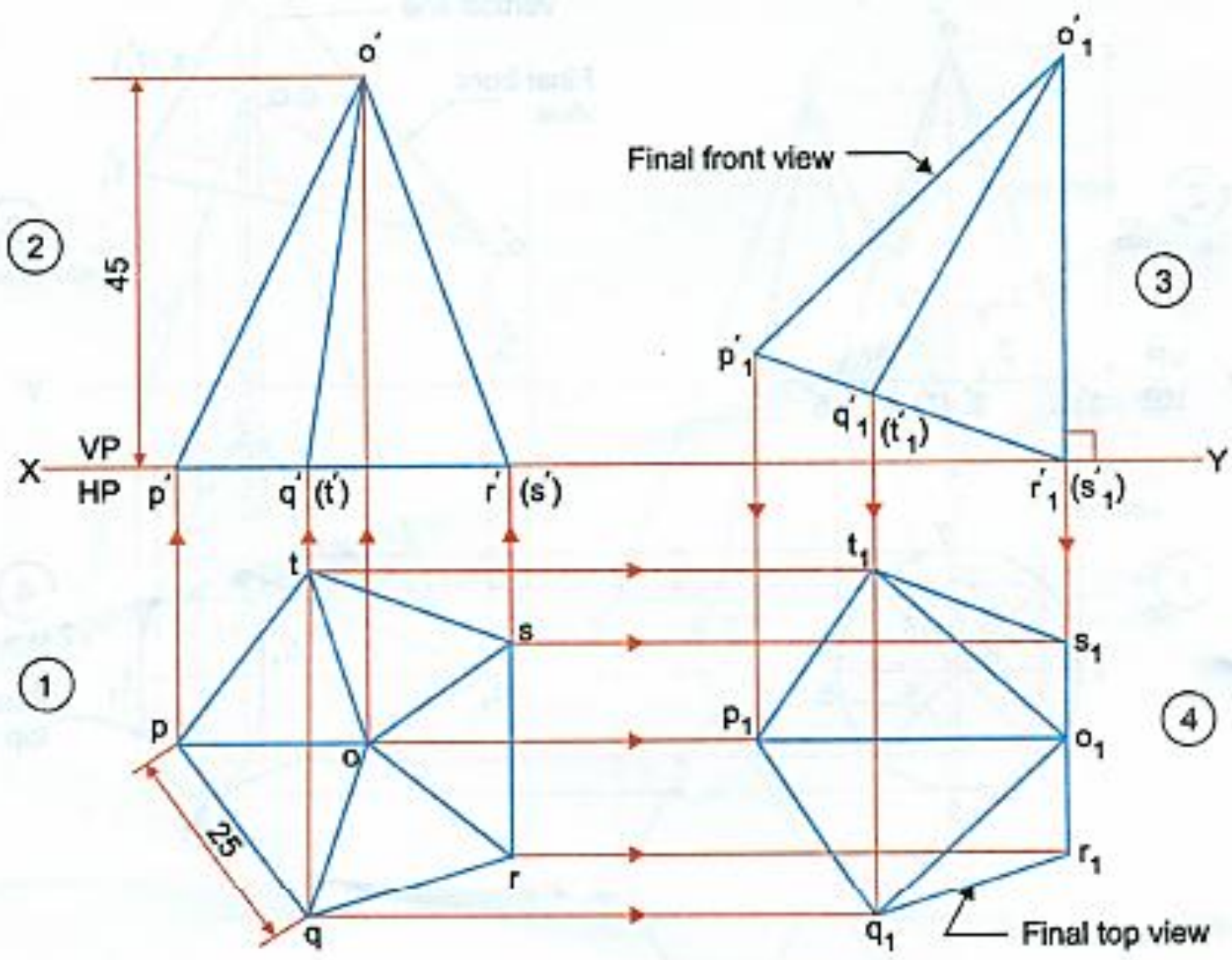
# Problem 16



# Problem 17

A **pentagonal pyramid** of base side 25 mm has an altitude of 45 mm. The pyramid rests on the HP on one of its base sides such that the triangular face containing that side is perpendicular to both the HP and the VP. Draw its projections.

**Problem 17**



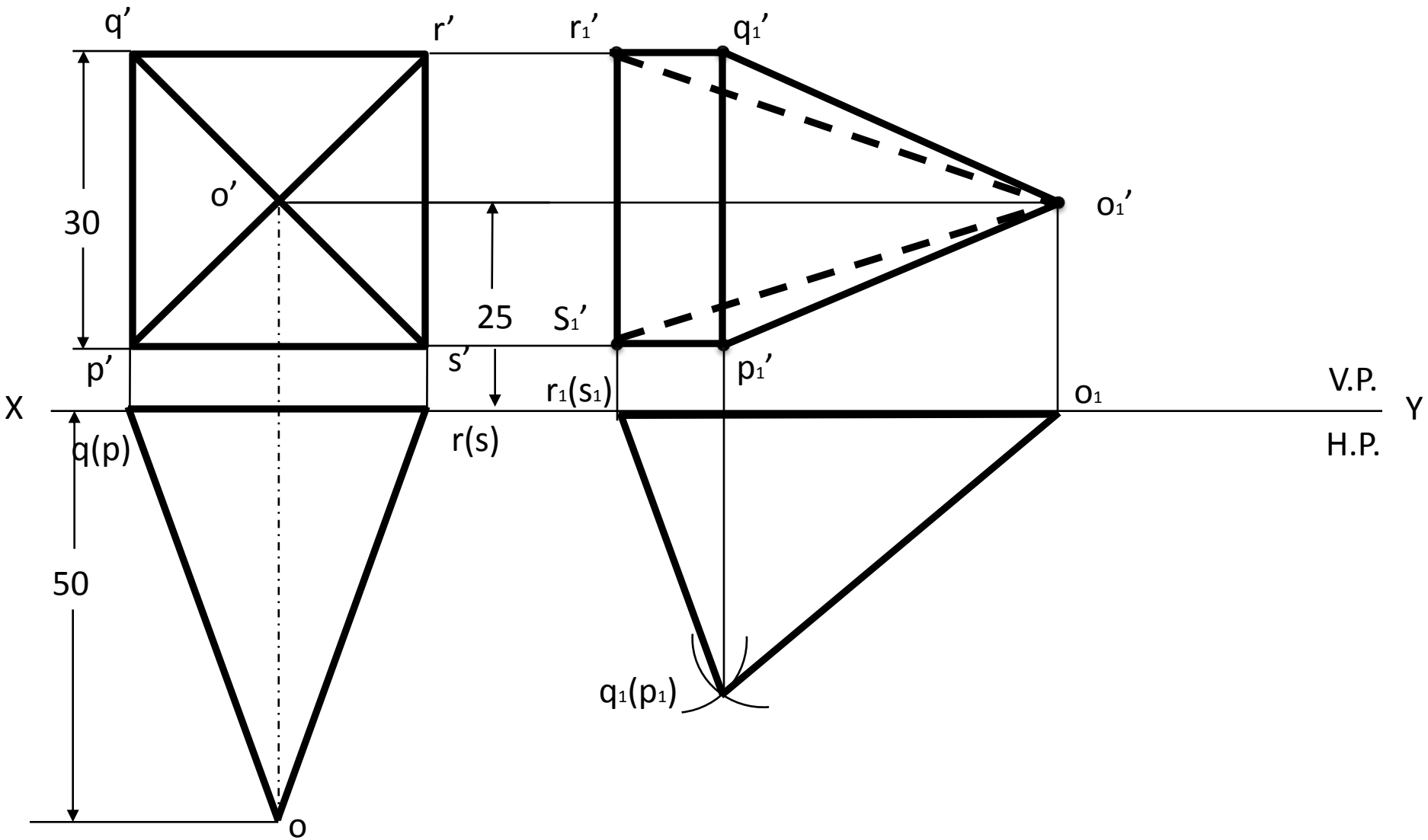
# Problem 18

A **square pyramid** of base side 30 mm axis length 50 mm has one of its triangular faces in the VP and the axis parallel to and 25 mm above the HP. Draw its projections.

**Problem 18**

Make  $r_1$  as centre and cut an arc at a distance of  $rq$

Make  $o_1$  as centre and cut an arc at a distance of  $oq$

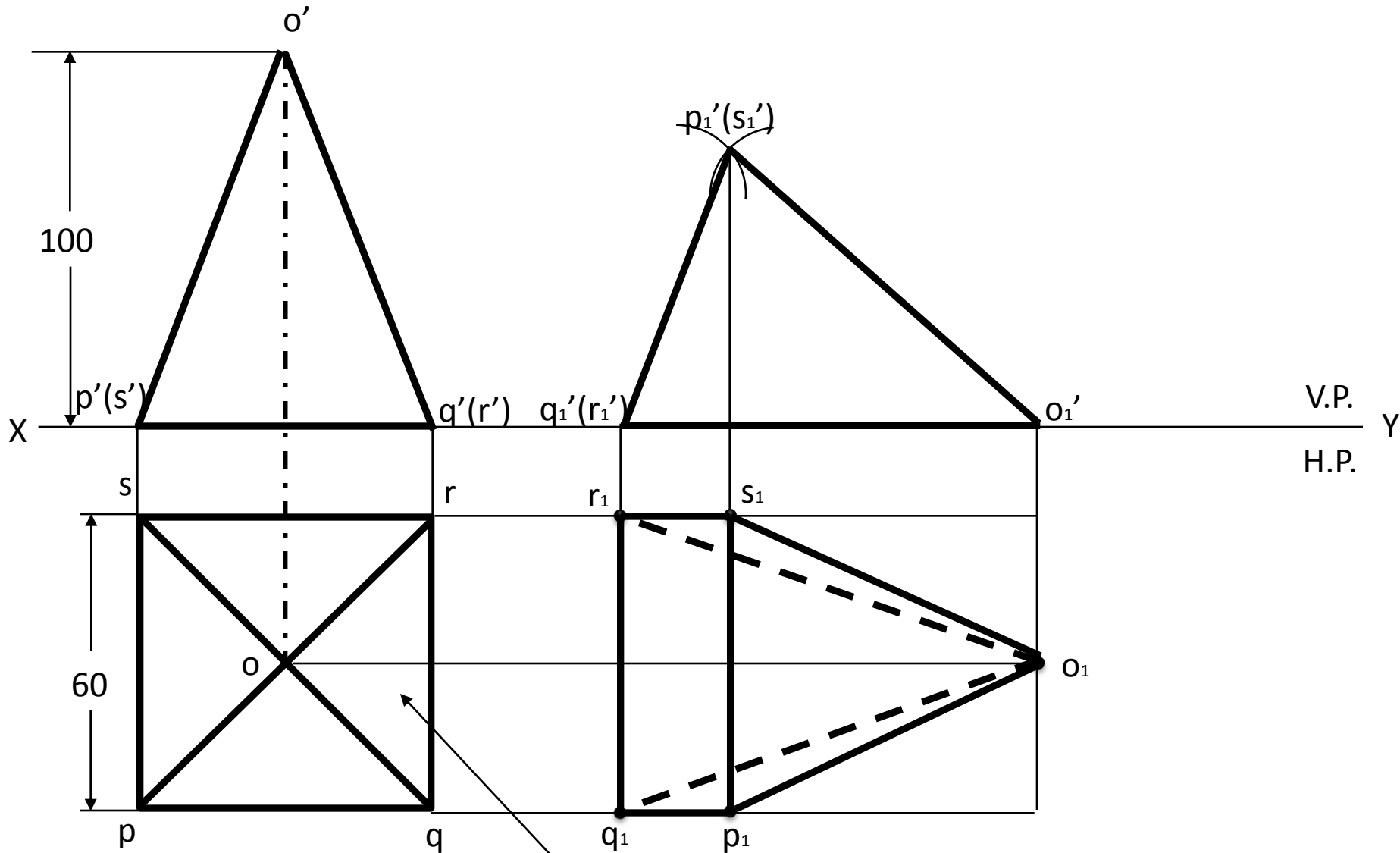




# Problem 19

A **square pyramid** of base side 60 mm and altitude 100 mm lies on the HP on one of its triangular faces with its axis parallel to the VP. Draw its projections. Page no 217

# Problem 19



This triangular face will be tilted to lie on the HP in the next stage

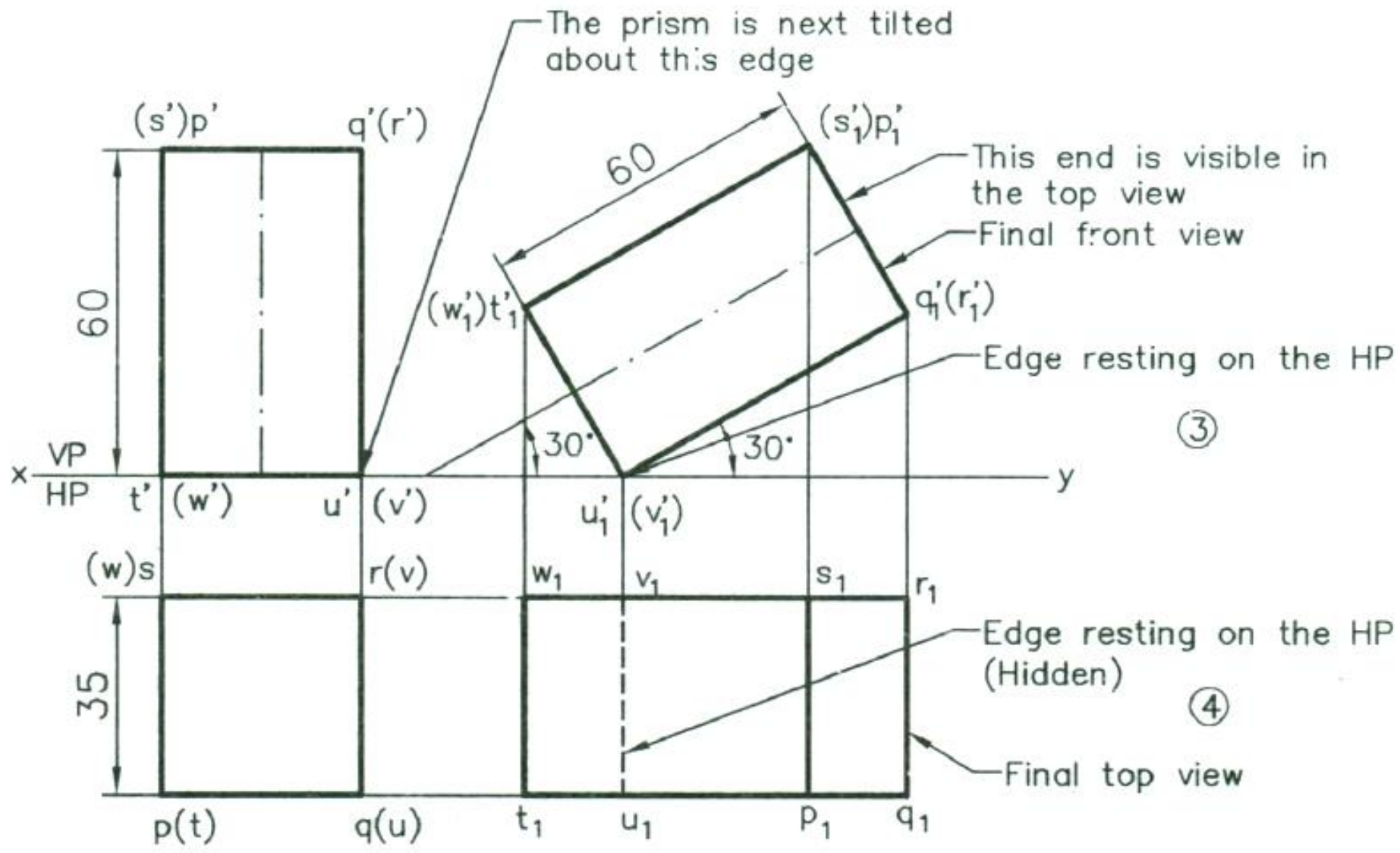
# Problem 20

A **square pyramid** of base side 30 mm and height 50 mm rests on the ground on one of its base edges such that its axis is inclined at **45° to the ground** and parallel to VP. Draw its projections.(univ Question)

# Problem 21

A **square prism** of base side 35 mm and axis length 60 mm rests on one of its base edges on the HP with its axis inclined at **30° to the HP** and parallel to the VP. Draw its top and front views.

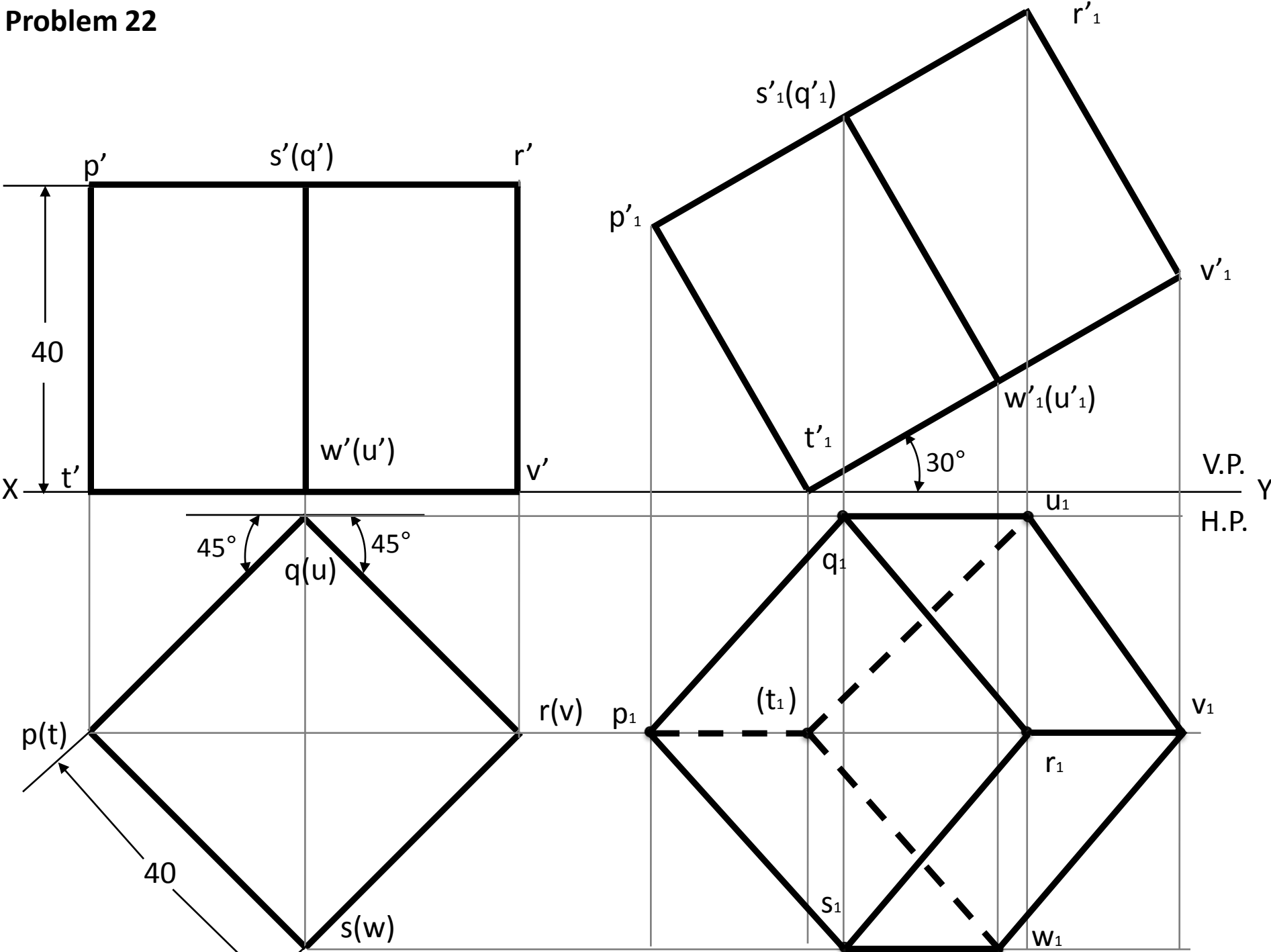
# Problem 21



# Problem 22

Draw the projections of a **cube of side 40 mm** when it rests on the ground on one of its corners and a face containing that corner is inclined at  **$30^\circ$  to the ground** and perpendicular to the VP.

**Problem 22**



# Problem 23

Draw the projections of a **cube of side 40 mm** when it rests on one of its corners with a diagonal of the solid vertical.



**Problem 23**

