Rao Badhur Y Mahabaleshwarappa Engineering College (RYMEC)

(Formerly , Vijayanagara Engineering College (VEC), Ballari)

Welcome to RYMEC Family.

Rao Badhur Y Mahabaleshwarappa Engineering College (RYMEC), BALLARI.

Dr. CHITRIKI THOTAPPA (MECH – 1987-1991)

PROFESSOR & M.Tech Co-Ordinator, Dept. of Mech.

SECRETARY - RYMEC, Alumni Association

QUALIFICATION:

BE (Mech) 1991 - (Gulbarga University)

ME (PM) 1994 - (Karnataka University)

Ph.D (SCM) 2012 - (Sree Venkateshwara University)

EXPERIENCE : 26 yrs Teaching, 1 yr Industry, 8 yrs Research.

PRESENTATION

on

ENGINEERING GRAPHICS (EG) : (18EGDL15/25)

ENGINEERING GRAPHICS

Semester	**: I/II**	**CIE Marks**	**: 40**
Course Code	**: 18EGDL15/25**	**SEE Marks**	**: 60**
Teaching Hours/week (L:T:P)	**: 2:0:2**	**Exam Hours**	**: 03**
	Credits : 03		

Course Learning Objectives:

This course will enable students to

CLO1 To expose the students to standards and conventions followed in preparation of engineering drawings.

CLO2 To make them understand the concepts of orthographic and isometric projections.

CLO3 Develop the ability of conveying the engineering information through drawings.

CLO4 To make them understand the relevance of engineering drawing to different engineering domains.

CLO5 To develop the ability of producing engineering drawings using drawing instruments.

CLO6 To enable them to use computer aided drafting packages for the generation of drawings.

Question paper pattern:

- Module -1 is only for practice and CIE and not for examination.
- Question paper for each batch of students will be sent online by VTU and has to be downloaded before the commencement of Examination of each batch. The answer sheets will have to be jointly evaluated by the Internal & External examiners.
- A maximum of THREE questions will be set as per the following pattern (No mixing of questions from different Modules).

Textbooks:

1. **Engineering Drawing** – N.D. Bhatt & V.M. Panchal, 48th edition, 2005-Charotar Publishing House, Gujarat.
2. **Engineering Graphics** – K.R. Gopalakrishna, 32nd edition, 2005-Subash Publishers Bangalore.
3. **Computer Aided Engineering Drawing -** by Dr. M H Annaiah, Dr C N Chandrappa and Dr. B Sudheer Premkumar, Fifth edition, New Age International Publishers.

Reference Books:

1. **Computer Aided Engineering Drawing** – S. Trymbaka Murthy, – I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition-2006.
2. **Engineering Drawing-**by N.S.Parthasarathy & Vela Murali, Oxford University Press, 2015
3. **Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-** Luzadder Warren J., Duff John M., Eastern Economy Edition, 2005- Prentice-Hall of India Pvt. Ltd., New Delhi.
4. **A Primer on Computer Aided Engineering Drawing-**2006, Published by VTU, Belgaum.

MODULE-I

Introduction to Computer Aided Sketching:

Introduction, Drawing Instruments and their uses, relevant BIS conventions and standards. Lettering, line conventions, dimensioning, material conventions, and free hand practicing.

Computer screen, layout of the software, standard tool bar / menu and description of most commonly used tool bars, and navigational tools.

Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale.

Commands and creation of Lines, coordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz., tangency, parallelism, inclination and perpendicularity.

MODULE-II

Orthographic projections of points, straight lines and planes:

Introduction, Definitions - Planes of projection, reference line and conventions employed. First angle and Third angle projection.

Projections of straight lines (located in first quadrant/first angle only), true and apparent lengths, true and apparent inclinations to reference planes (No application problems and midpoint problems).

Orthographic projections of plane surfaces (First angle projection only):

Projections of regular plane surfaces–triangle, square, rectangle, pentagon, hexagon and circle-in simple positions inclined to both the planes; planes in different positions by change of position method only. (No problems on punched plates and composite plates).

MODULE – III

Projections of solids:

Introduction, definitions – projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, and cones with axis inclined to both the planes. (Solids resting on HP only and no problems on octahedrons, and freely suspended solids.)

MODULE IV

Development of Lateral Surfaces of Solids:

Introduction to section planes and sectional views.

Development of lateral surfaces of right regular prisms, cylinders, pyramids, and cones resting with base on HP only. Development of their frustums and truncations. (No problems on lateral surfaces of trays, tetrahedrons, spheres and transition pieces).

MODULE-V

Isometric Projection (using isometric scale only)

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron(cube), right regular prisms, pyramids, cylinders, cones, and spheres. Isometric projection of combination of two simple solids. Conversion of given isometric/ pictorial views to orthographic views of simple objects.

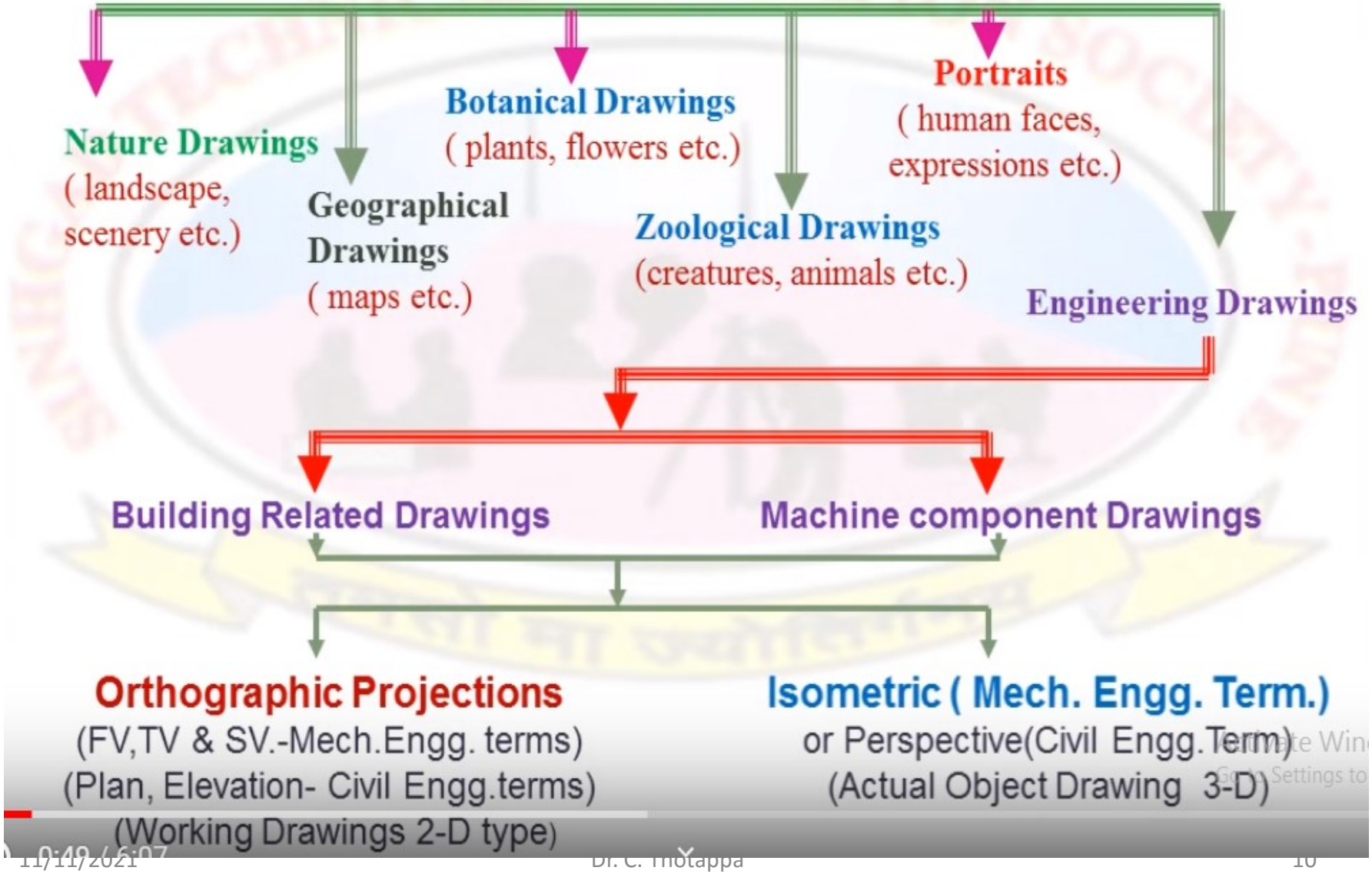
LIST OF ENGINEERING DRAWING MATERIALS

Following Engineering Graphic materials required for the class work.

(All materials should be of good quality).

1. **200 pages un-ruled long note book.**
2. **Soft rubber/Eraser .**
3. **2 No. Micro tip pencil 1 No. HB and 1 No. 2H .**
4. **Compass.**
5. **Protractor.**
6. **Long plastic scale.**
7. **Sketch book.**
8. **Engineering Drawing question bank with solutions by VTU.**

Types of Drawings



ENGINEERING GRAPHICS (EG) / ENGINEERING DRAWING (ED)

MODULE – II (ORTHOGRAPHIC PROJECTION)

INTRODUCTION:

- **To manufacture the Product/Object it is necessary to have its (Object) drawing in its true shape and true size.**
- **2-Dimensional objects like Planes (Triangle, Square, Rectangle, Pentagon, Hexagon, Circle etc.) Their true shape and true size drawings on a 2 – Dimensional drawing sheet can be drawn very easily.**
- **3 – Dimensional objects like Solids (Cube, Prisms, Pyramids, Cylinders, Cone, Sphere etc.) Their drawing in true shape and true size cannot be drawn easily on a 2 – Dimensional drawing sheet.**

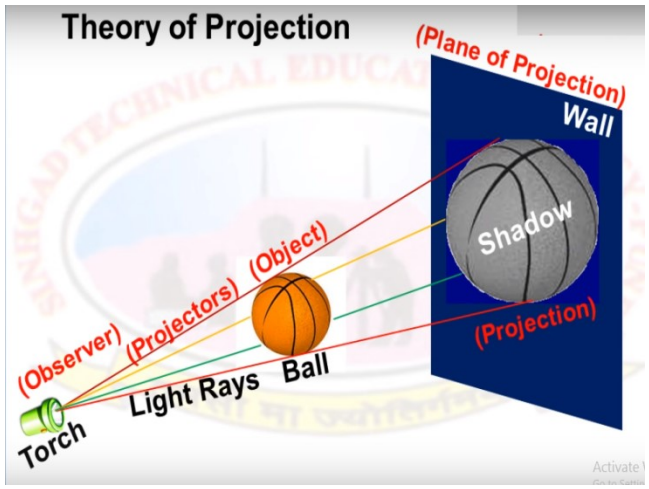
- However, Solid objects which are 3-Dimension can be drawn in 3-Dimensional drawing/view (Isometric View) on a drawing sheet (2-Dimensional), But its shape and size will not be true.
- 3-Dimensional drawing will only give the idea of object shape, So these drawings cannot be effectively used for Object/Product manufacturing.
- Therefore, to obtain true shape and true size drawings of 3-Dimensional (Solids) objects it is necessary to use Principles of Orthographic projection.
-

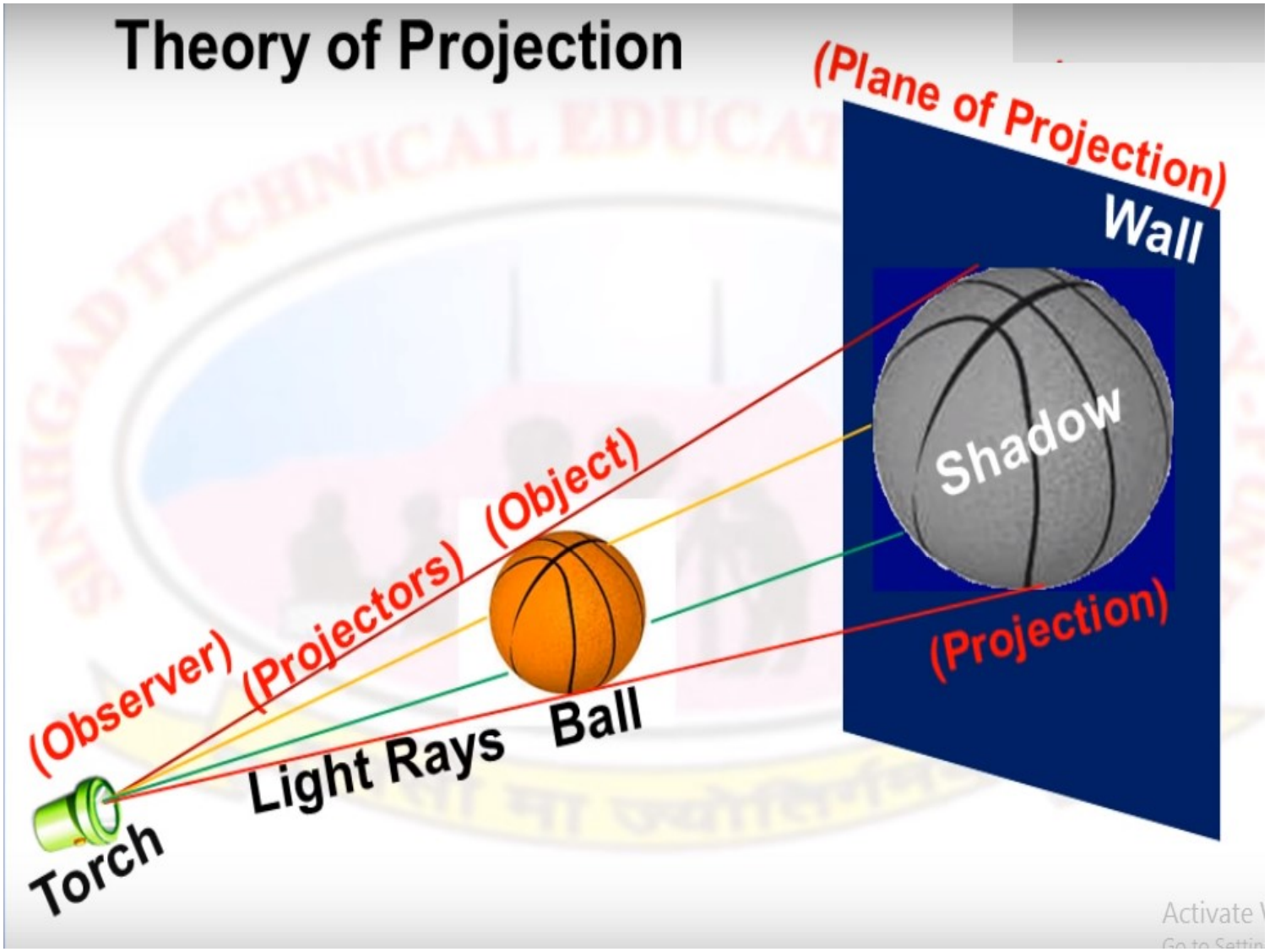
PRINCIPLES OF PROJECTION.

- The word PROJECTION is a Latin word means to throw forward.
- In Engineering drawing Projection means throwing forward the image / View of an object on to a Screen.
- PROJECTOR is a device which projects the image of an object on to a Screen/Wall.

To obtain the Image / View of an object the following 3 things are required.

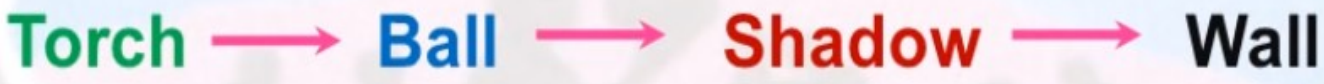
1. Light source / Observer
2. Object
3. Screen (Wall) / Plane of Projection (Reference Plane)




Theory of Projection
(Plane of Projection)
Wall
Shadow
(Object)
(Projectors)
(Observer)
(Projection)
Light Rays
Ball
Torch

Projection means "To throw Forward".

In this *Object* are being thrown (projected) forward in the form of *Projection*/Image/View



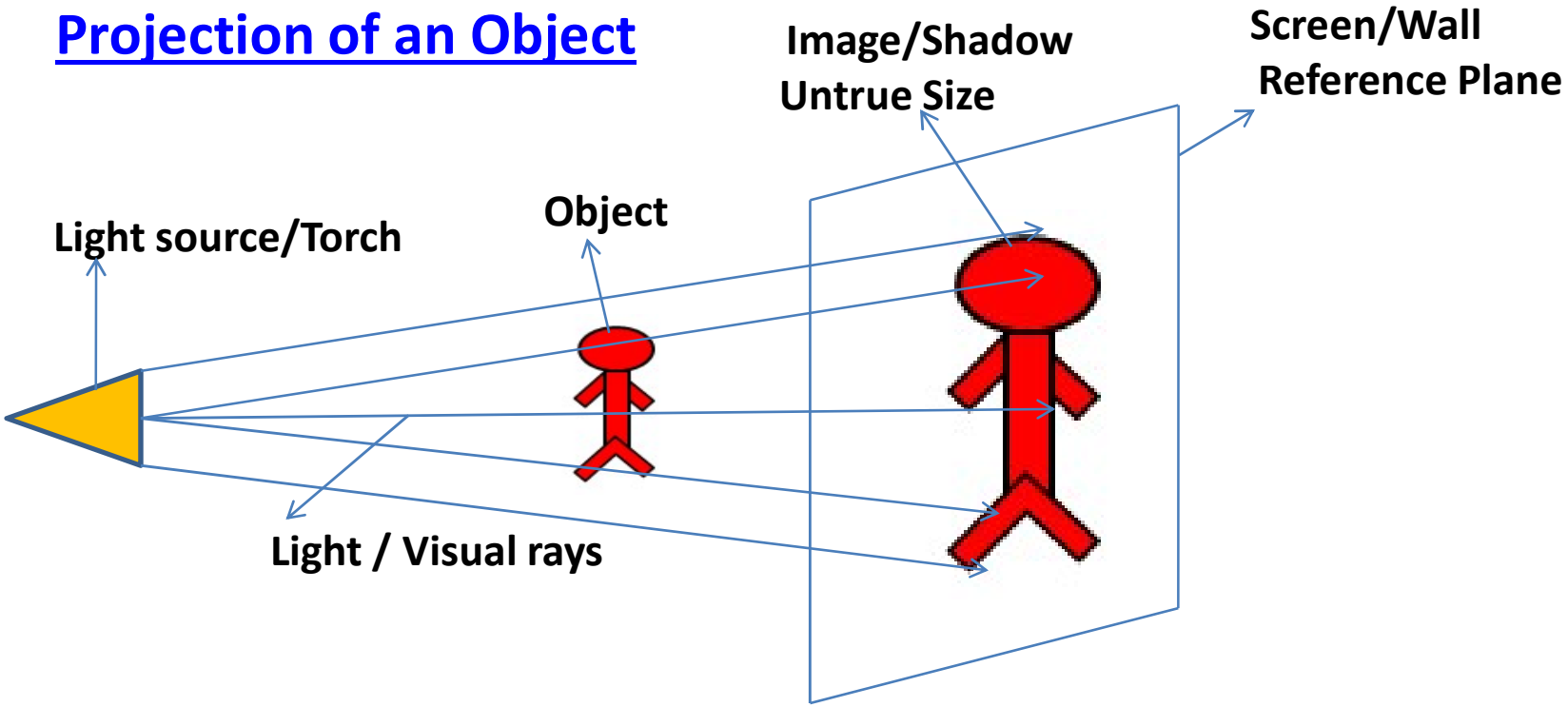
Light Source/Torch → Observer

Ball → Object

Shadow → Projection/ View/Image

Wall → Plane of Projection (POP) /Reference Planes/Screen

Projection of an Object

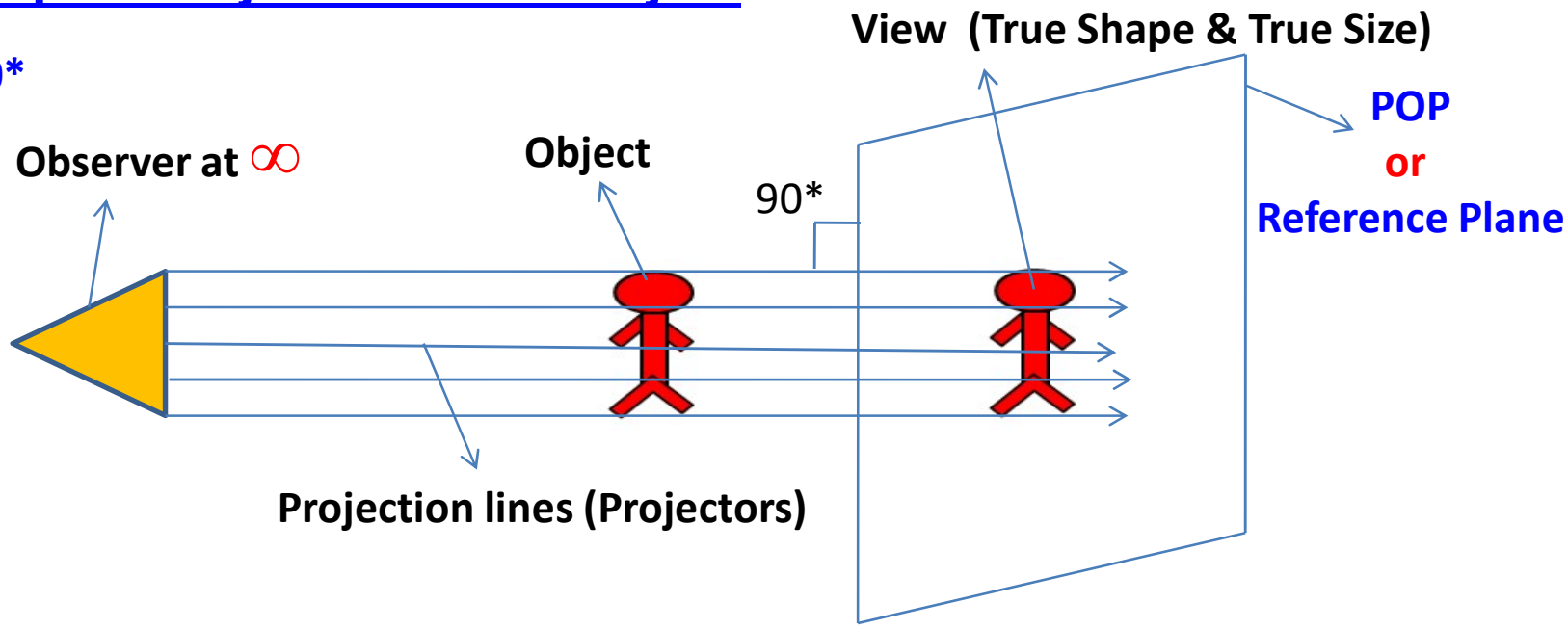


Note:

- **Observer/Light source is at definite place.**
- **Light rays / Projections lines are diverging and Inclined to POP.**
- **Image / View is always true shape, but un-true size, as the position of the POP, Object & Observer changes Image / View size also changes.**

Orthographic Projection of an Object

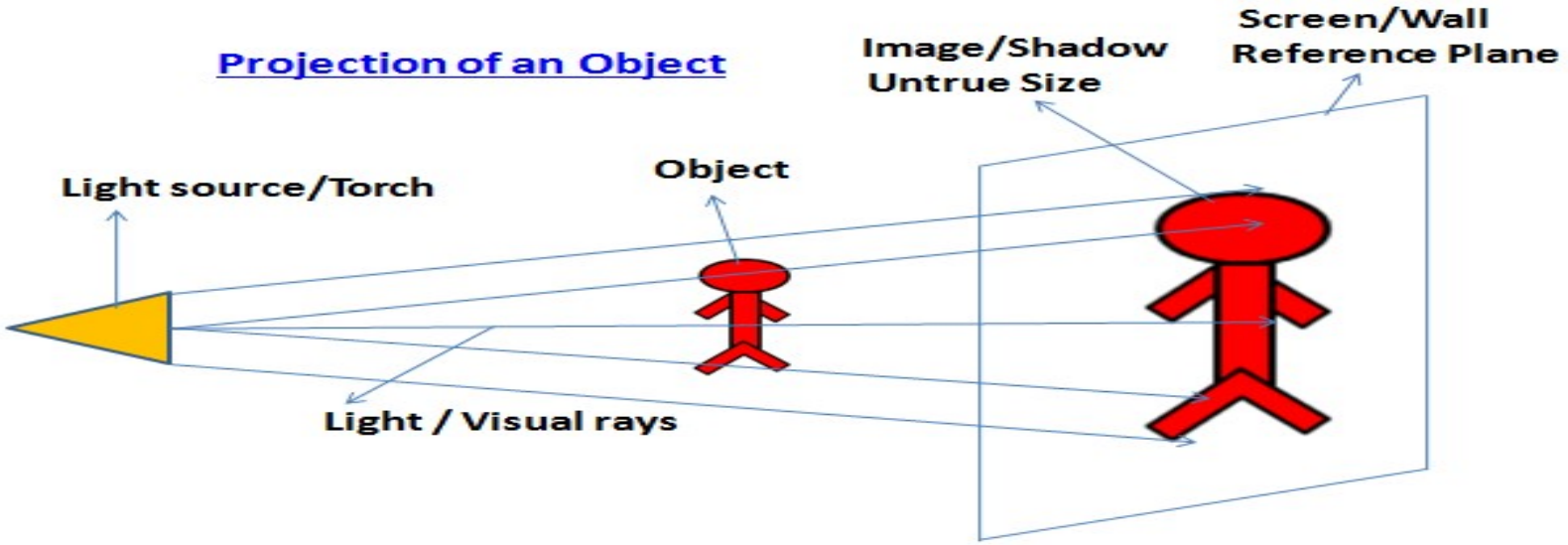
Ortho – 90*



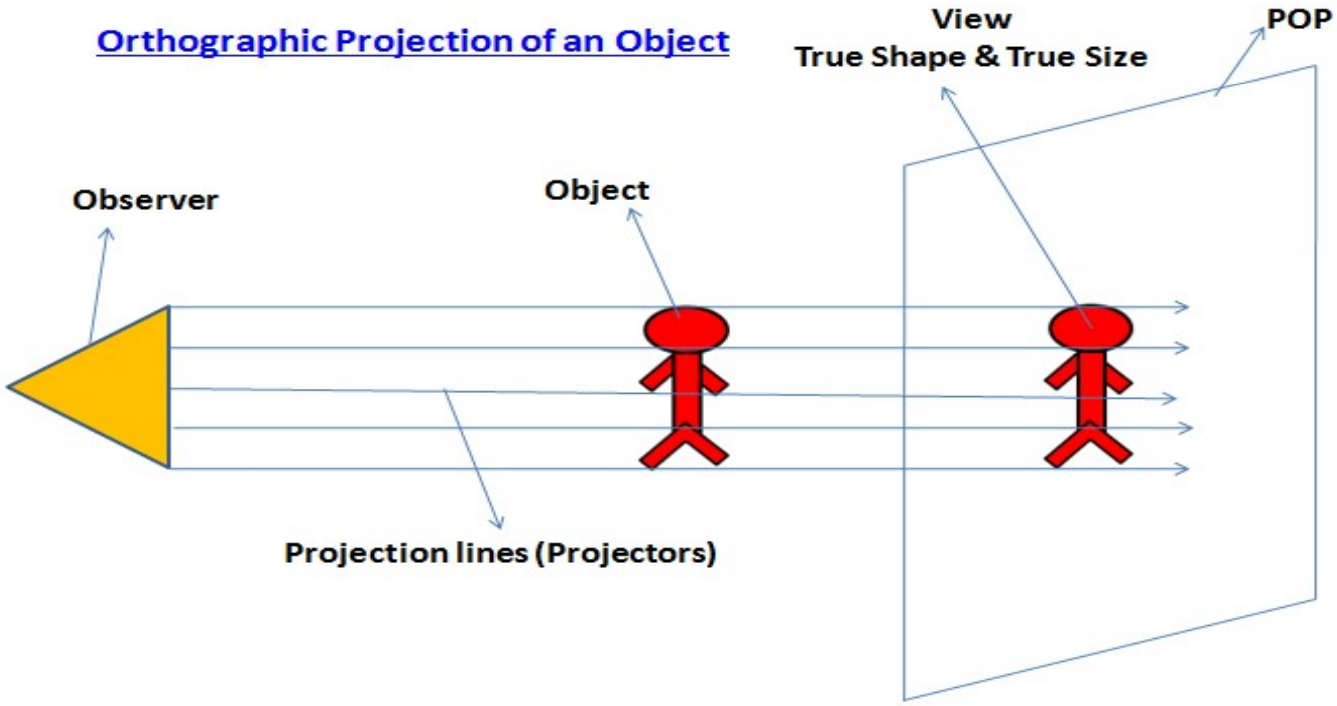
Note: **POP – Plane Of Projection**

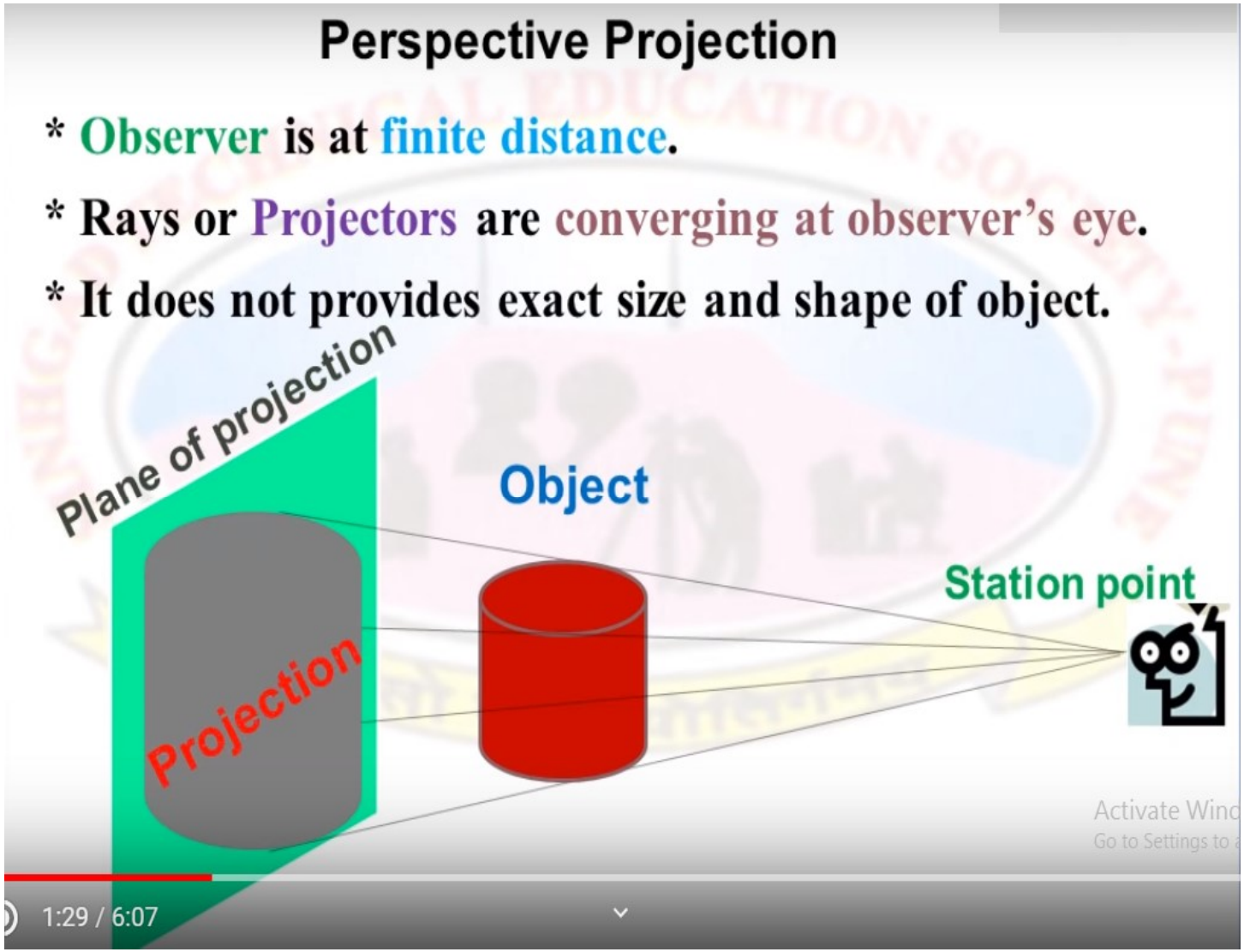
- **Observer is at Infinity ∞.**
- **Projections lines are parallel to each other and Perpendicular/Normal/90* to POP.**
- **View is always true shape and true size, irrespective of the position of the POP, Object & Observer (i.e., Size and Shape of the View will not change).**

Projection of an Object



Orthographic Projection of an Object




Perspective Projection
* Observer is at finite distance.
* Rays or Projectors are converging at observer's eye.
* It does not provides exact size and shape of object.
Plane of projection
Object
Station point
Projection
1:29 / 6:07

Orthographic Projection

Latin Origin

* ORTHO means Perpendicular.

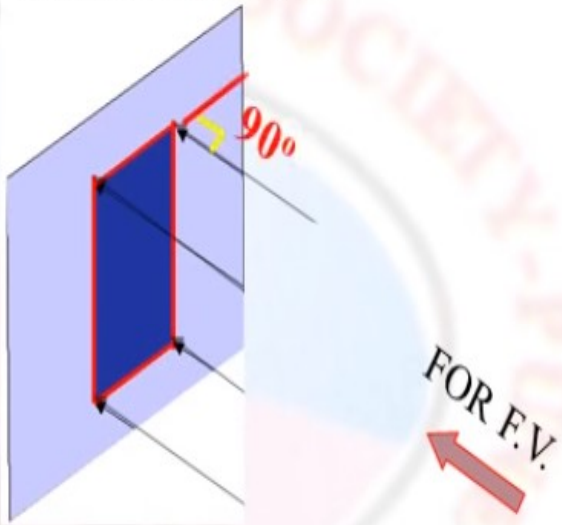
* Assume that observer is at infinite distance and rays or Projection lines are Parallel to each other and Perpendicular to the Plane of Projection.

* Since the projectors are perpendicular to the plane of projection, the view is called Orthographic View and the projection method is called Orthographic projection.

Orthographic Projection

* Orthographic projection is a two dimensional projection method.

* FV : Length and height of Object



* As projectors are Parallel to each other, the size of Orthographic View of an object is equal to the actual size of an object.

Isometric Projection

* Observer is at infinite distance.
* Rays or Projectors are parallel to each other & perpendicular to the plane of projection.
* All faces of the object are equally inclined to the planes of projection.
* All faces of the object are visible in a single view.

1:51 / 6:07

PRINCIPAL VIEWS & PRINCIPAL PLANES OF PROJECTION (POP)

PRINCIPAL VIEWS

Complete details of the object like all the sizes and shape of the object cannot be obtained in a single view, they are obtained in more than one view of an object.

For any Object Max. of 6 views can be obtained/drawn they are:

- **Front View (FV), Top View (TV), Right Side View (RSV), Left Side View (LSV), Rear View (RV) and Bottom View (BV).**

But, all views of the object may not be required to know the complete details of the object.

-Simple shape object may require only 2 views and

- complex shape objects may require 3-4 Views.

PRINCIPAL VIEWS & PRINCIPAL PLANES OF PROJECTION (POP)

4- Principal Views of an Object are :

1. Front View (FV)
2. Top View (TV)
3. Right Side/Profile View (RSV / RPV) &
4. Left Side/Profile View (LSV / LPV).

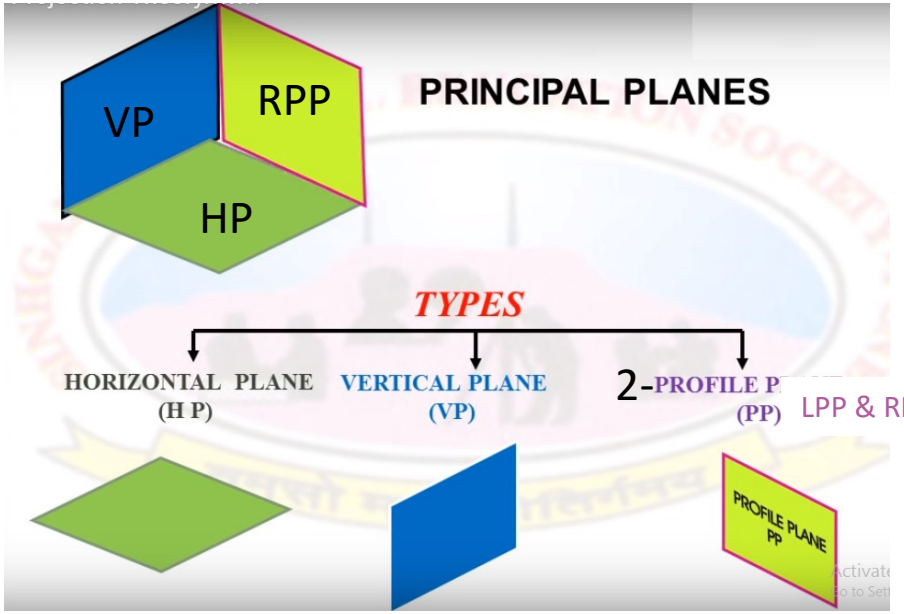
PRINCIPAL VIEWS & PRINCIPAL PLANES OF PROJECTION (POP)

PRINCIPAL PLANES OF PROJECTION (POP):

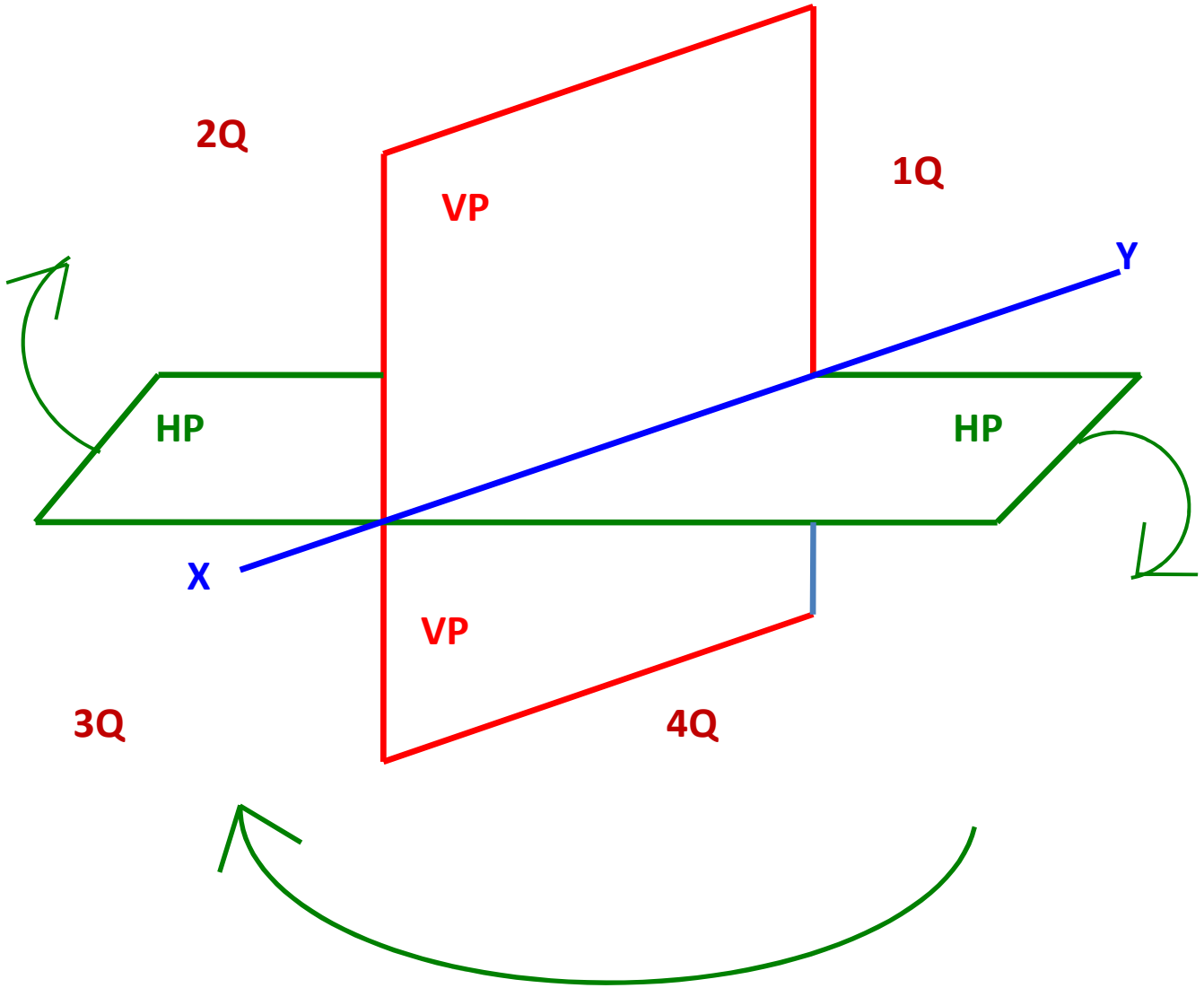
These are also called reference planes, where views of the object are drawn/obtained.

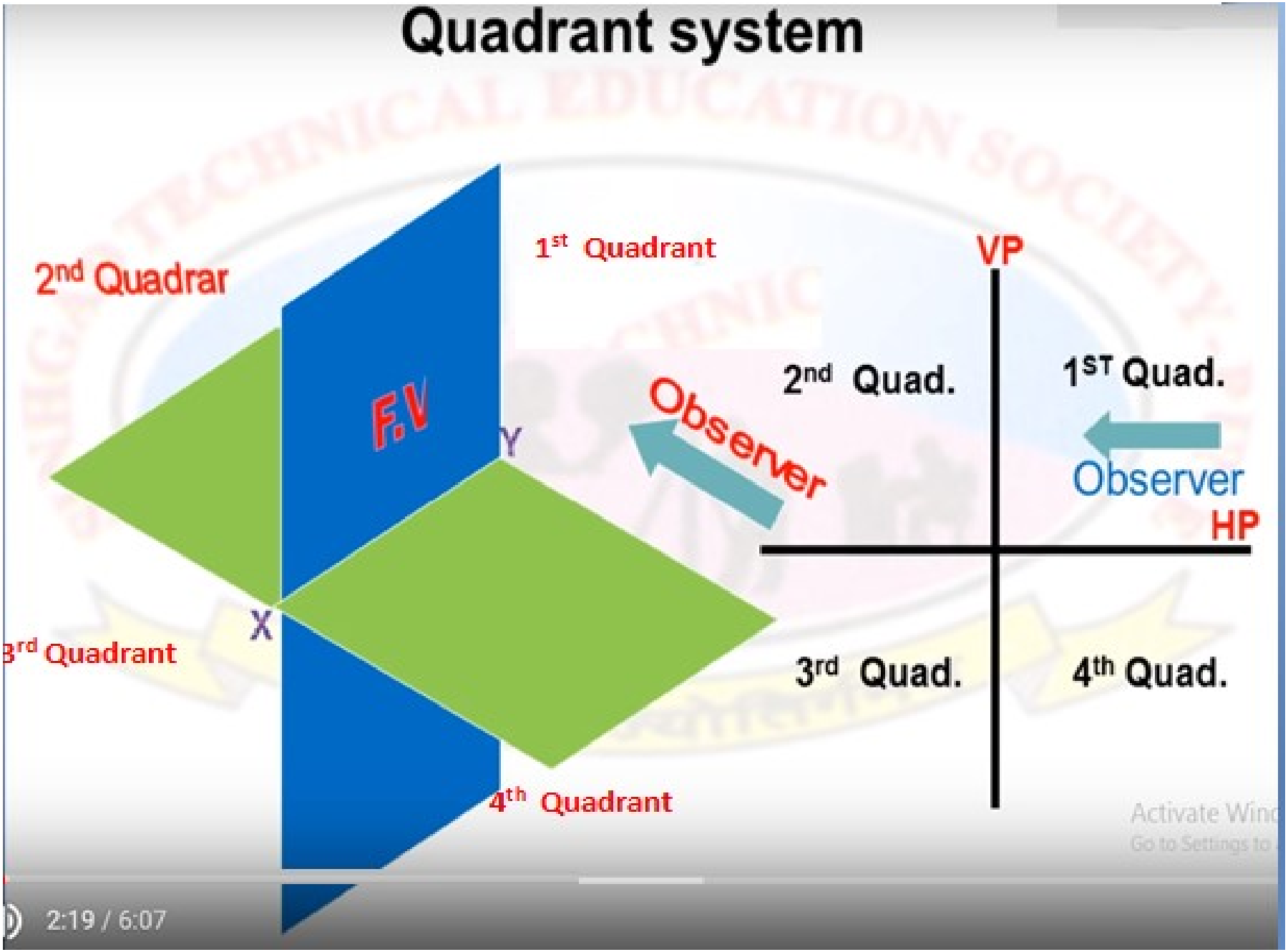
Four (4) Principal Planes of Projections : 4 Principal views are obtained on 4 Principal Planes of Projections (POP) they are:

1. **Horizontal Plane (HP)**
2. **Vertical Plane (VP)**
3. **Right Side/Profile Plane (RPP)**
4. **Left Side/Profile Plane (LPP)**

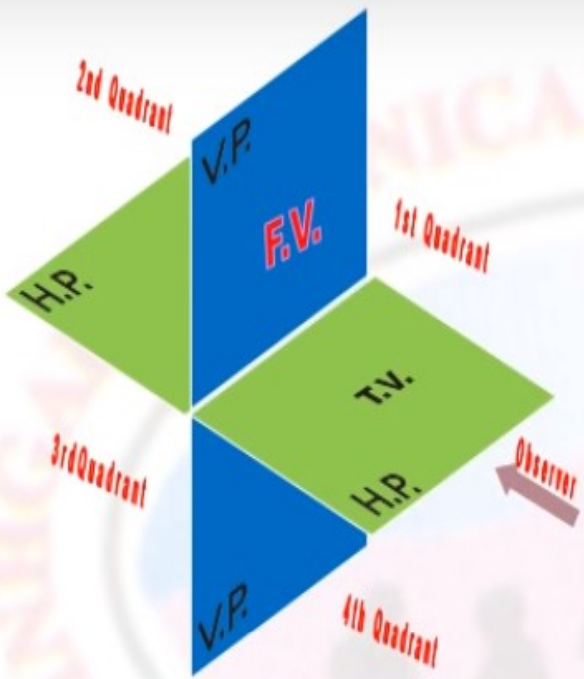


4 – Quadrant System



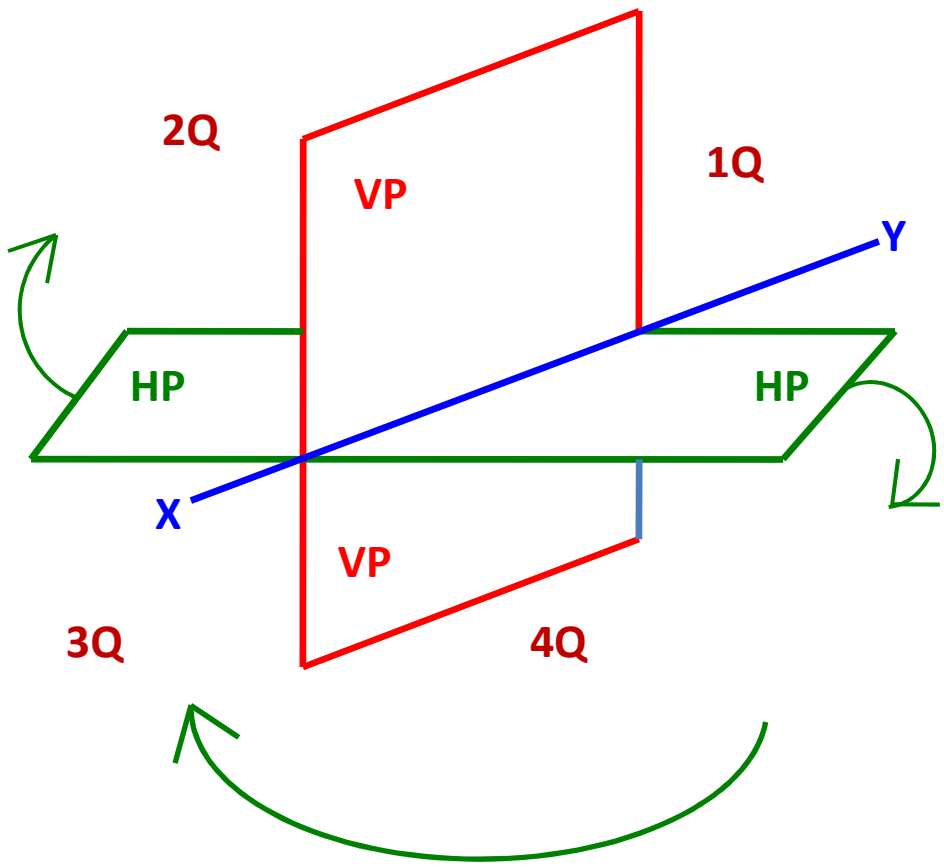

Quadrant system
2nd Quadrar
1st Quadrant
F.V
Y
X
3rd Quadrant
4th Quadrant
Observer
VP
2nd Quad.
1ST Quad.
Observer
HP
3rd Quad.
4th Quad.
2:19 / 6:07

Quadrant system



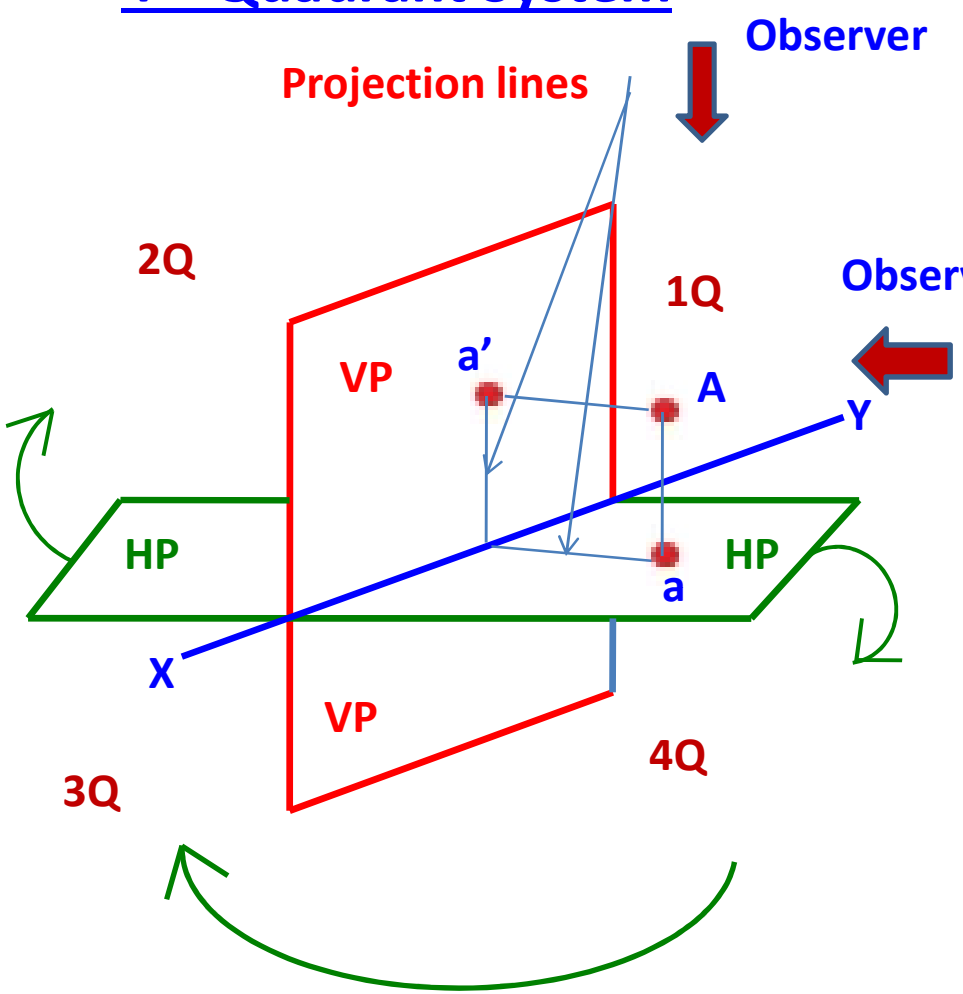
Quadrant	Observer; Object; Plane positions	Position of object w.r.t. planes of projection
First	Observer – Object – Plane	Above HP, In Front of VP
Second	Observer – Plane – Object	Above HP, Behind VP
Third	Observer – Plane – Object	Below HP, Behind VP
Fourth	Observer – Object – Plane	Below HP, In Front of VP

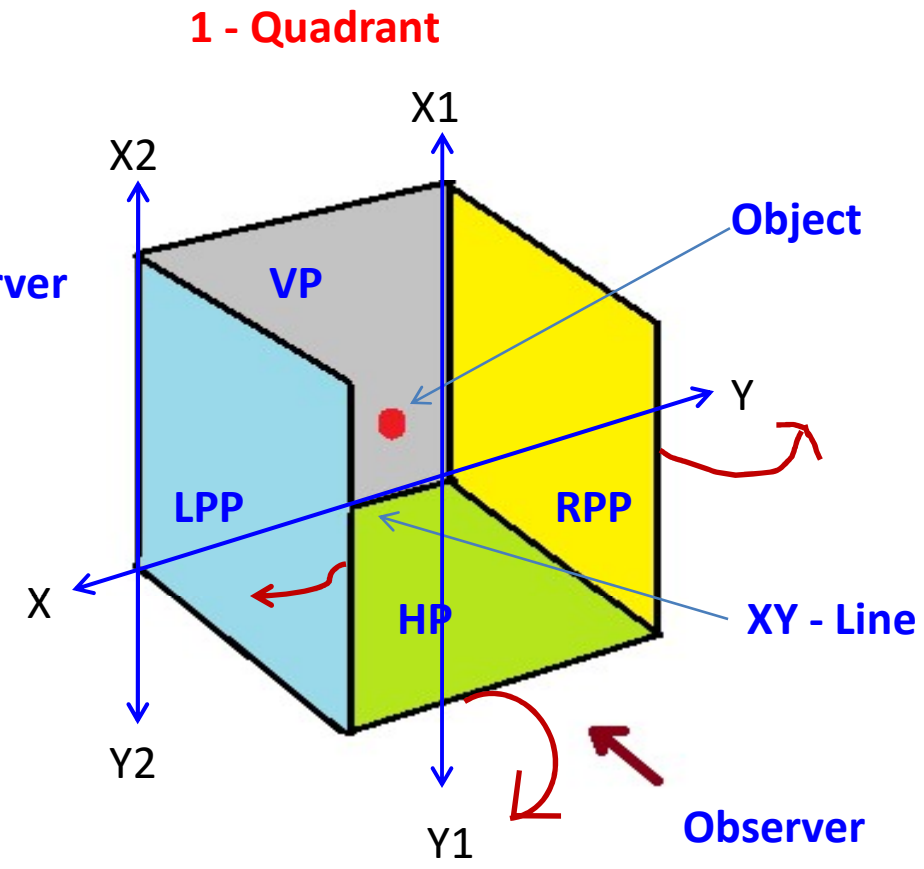
4 – Quadrant System



- **4-Quadrant system is formed in the space when the Horizontal plane (HP) and Vertical Plane (VP) bisect each other or assumed to extend beyond the line of intersection (XY).**
- **Intersection of VP & HP is called Line of intersection (XY line) or Reference line.**
- **POP's are perpendicular to each other and they are transparent in nature.**

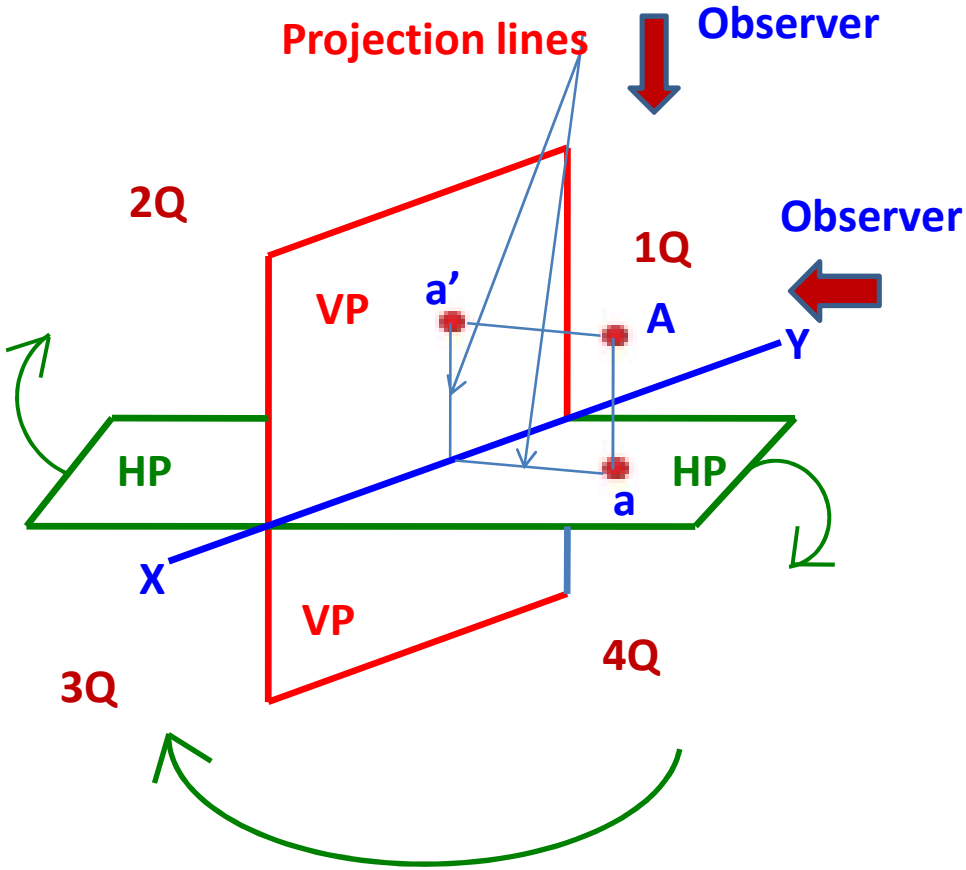
4 – Quadrant System





DIFFERENT ANGLES OF ORTHOGRAPHIC PROJECTION

(Based on the object location with reference to Quadrant)



4 – Quadrant System

Depending upon the position or location of the object in different quadrants, there are four angles of Projection.

- 1st Angle Projection.
- 2nd Angle Projection.
- 3rd Angle Projection.
- 4th Angle Projection.

First Angle Projection: If the Object is in the 1st Quadrant and views are taken, then it is called as First Angle Projection

DIFFERENT ANGLES OF ORTHOGRAPHIC PROJECTION
(Based on the object location with reference to Quadrant)

- **First Angle Projection: If the Object is in the 1st Quadrant and views are taken, then it is called as First Angle Projection.**

- **Second Angle Projection: : If the Object is in the 2nd Quadrant and views are taken, then it is called as Second Angle Projection.**

- **Third Angle Projection: If the Object is in the 3rd Quadrant and views are taken, then it is called as Third Angle Projection.**

- **Fourth Angle Projection: : If the Object is in the 4th Quadrant and views are taken, then it is called as Fourth Angle Projection.**

DIFFERENT ANGLES OF ORTHOGRAPHIC PROJECTION
(Based on object location with reference to POP's (HP&VP)

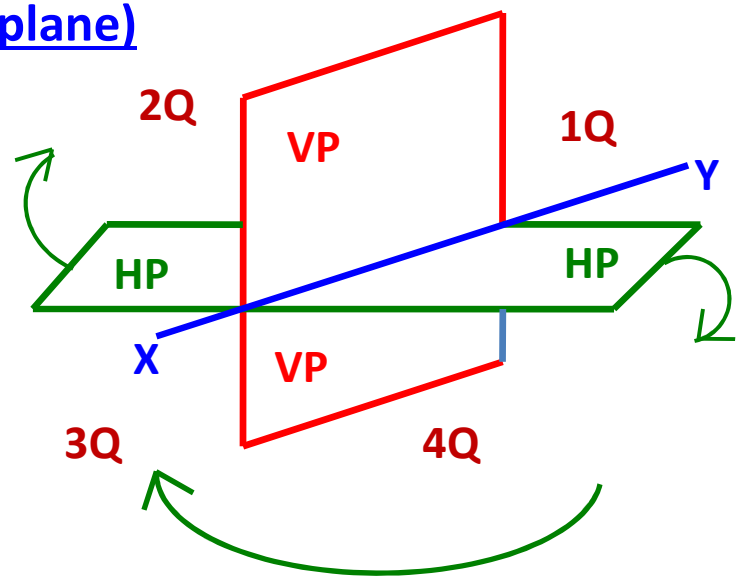
NOTE:

- **Assuming that POP's transparent, POP's Perpendicular/Normal to each other.**
- **Position of the observer will not change, irrespective of the object located in any Quadrant.**

- **First Angle Projection (In 1Q) : Object will be Above HP / On HP and In-front of VP/On VP.**
- **Second Angle Projection (In 2Q) : Object will be Above HP/ On HP and Behind VP/On VP.**
- **Third Angle Projection (In 3Q) : Object will be Below HP/ On HP and Behind VP/On VP.**
- **Fourth Angle Projection(In 4Q) : Object will be Below HP / On HP and In-front of VP/On VP.**

ROTATION OF PLANES OF PROJECTIONS (POP'S)

(To get all POP's on a single plane)

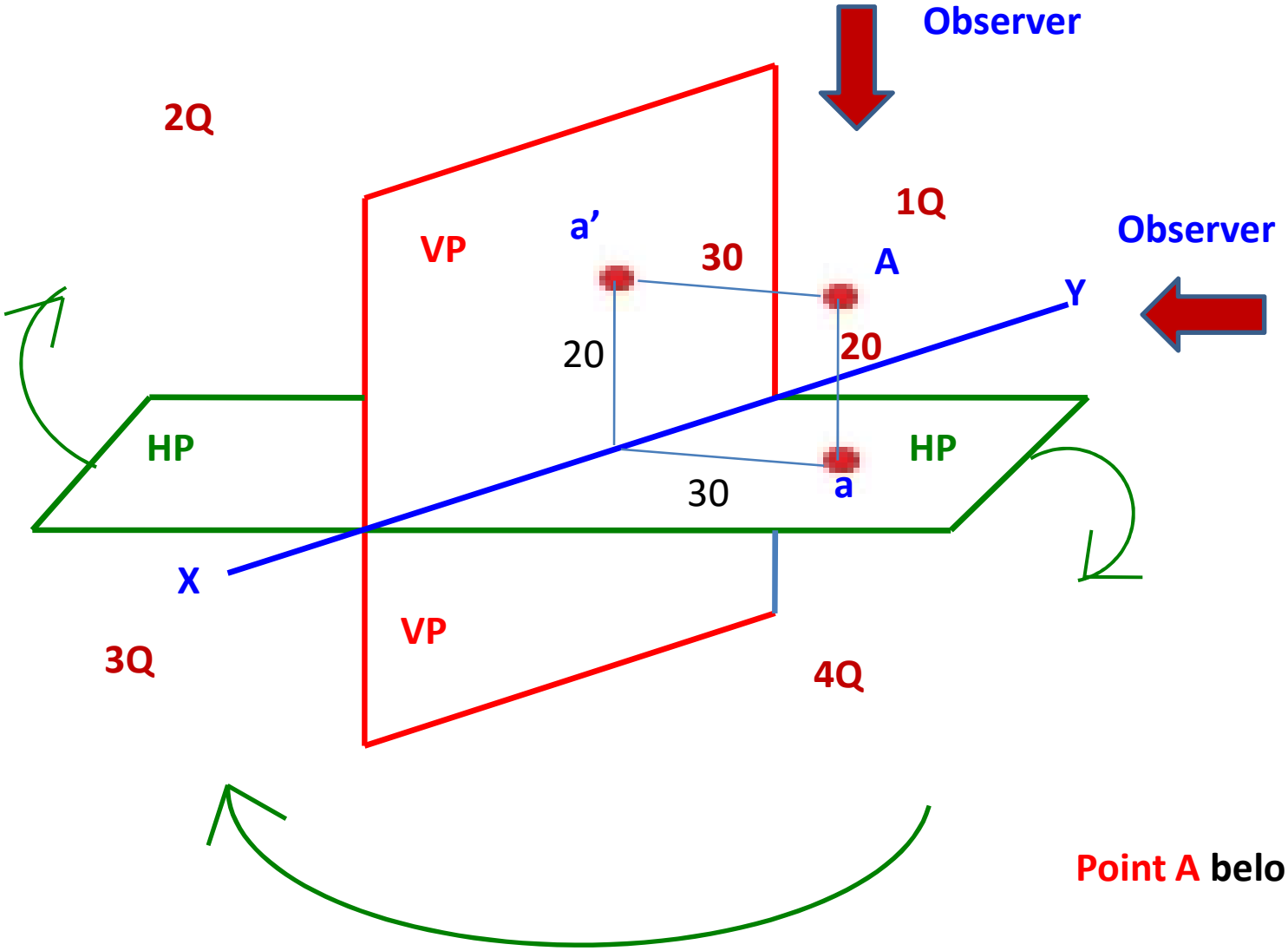


In order to obtain all POP's on a single plane:

- **Vertical Plane (VP)** - **Always kept stationary.**
- **Horizontal planes (HP)** - **Are rotated about line of intersection (i.e. XY line) through 90* in Clockwise direction.**
- **Side/Profile planes (RPP & LPP) - Are rotated against VP through 90* about line of intersection (X1 Y1 & X2 Y2).**

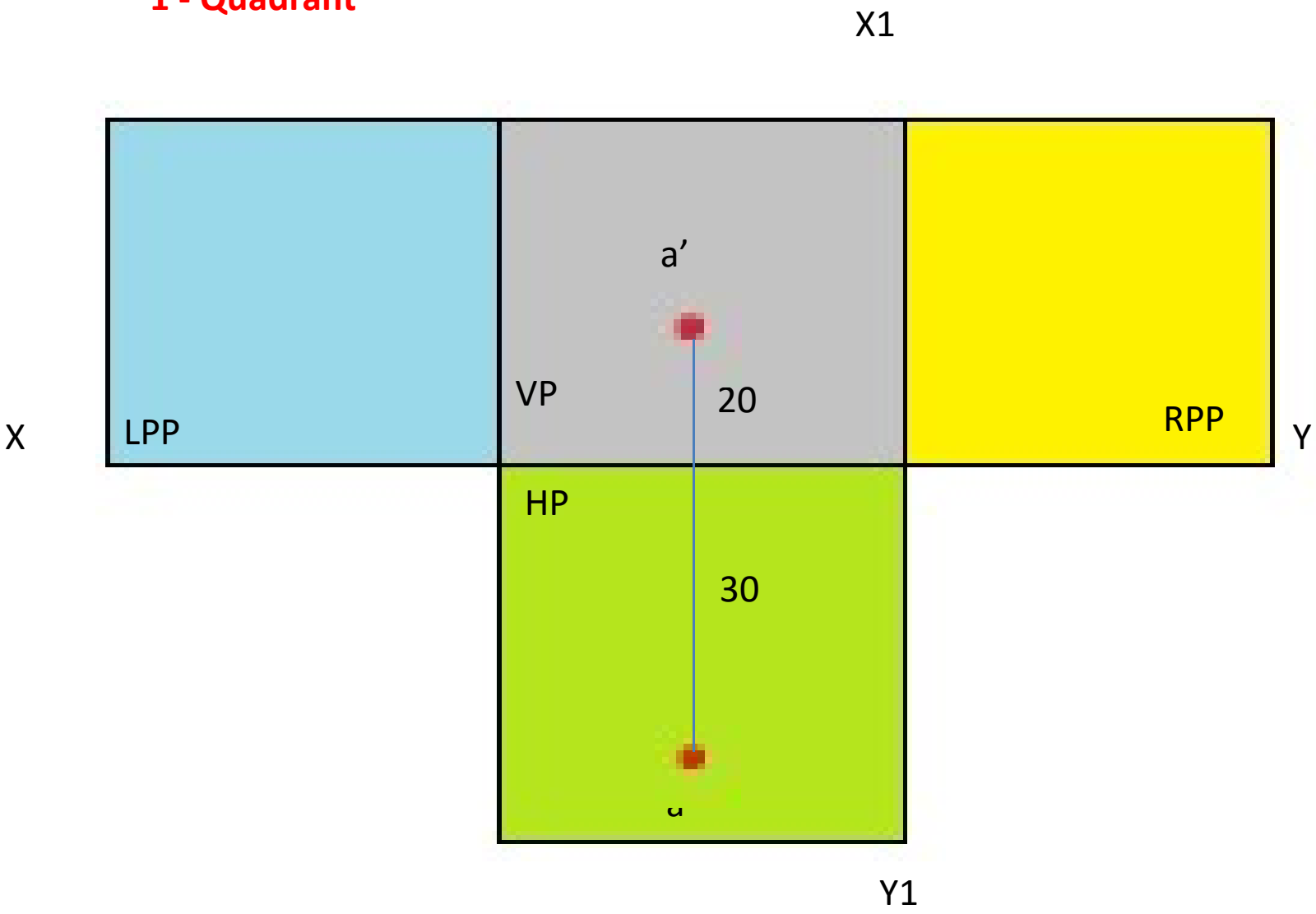
So that all POP's comes on a single plane.

Point (Object) A is 20 mm above HP and 30 in-front of VP, Draw the Projections of point A (i.e. Draw its FV & TV) and state in which Quadrant it Belongs to.



Point A belongs to 1 Q

1 - Quadrant



NOTE:

- **All above / Below HP dimensions are seen in VP.**
- **All in-front / Behind VP dimensions are seen in HP.**
- **Always RPP & LPP are attached to VP (Right side to VP is RPP & left side to VP is LPP)**

NOTE:

1. **If Point B lies on HP, then its front view (FV=b') lies on XY line.**
2. **If Point B lies on VP, then its (TV = b) lies on XY line.**
3. **If Point C lies on both HP and VP, then both (FV & TV) i.e., c' & c lies on XY line. Then the location of Point C may be considered in any Quadrant, but consider it in a 1st Q.**

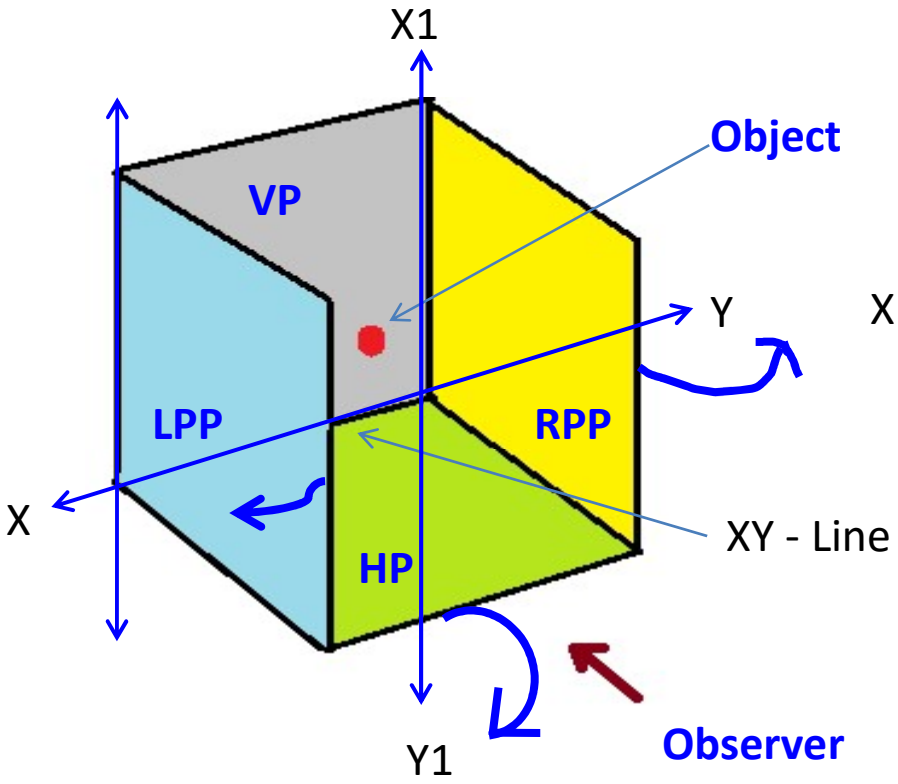
STANDARD NOTATION / REPRESENTATION OF VIEWS

To avoid confusion and to have uniformity always Views are represented by lower/small case letters only and Object is named / represented by Capital letters.

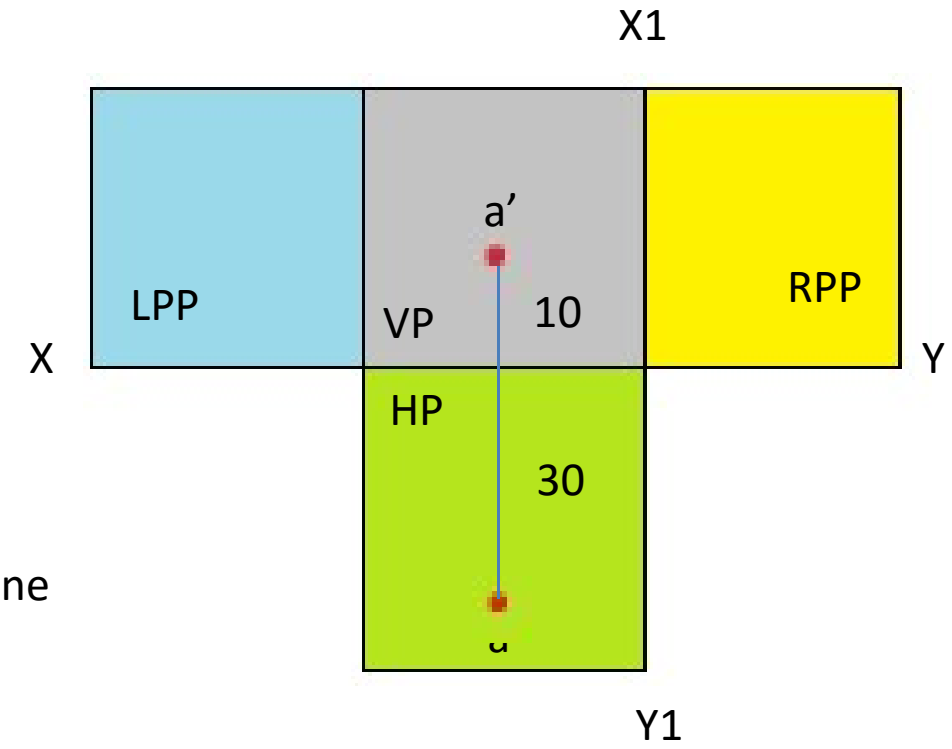
And to differentiate between different views they are represented as follows.

- **Top View (a) – Only small letter (i.e. a, b ….)**
- **Front View (a’) (– small letter with single dash (i.e. a’, b’ ….)**
- **Side View (a”) – Small letter with double dash (i.e. a”, b” …)**

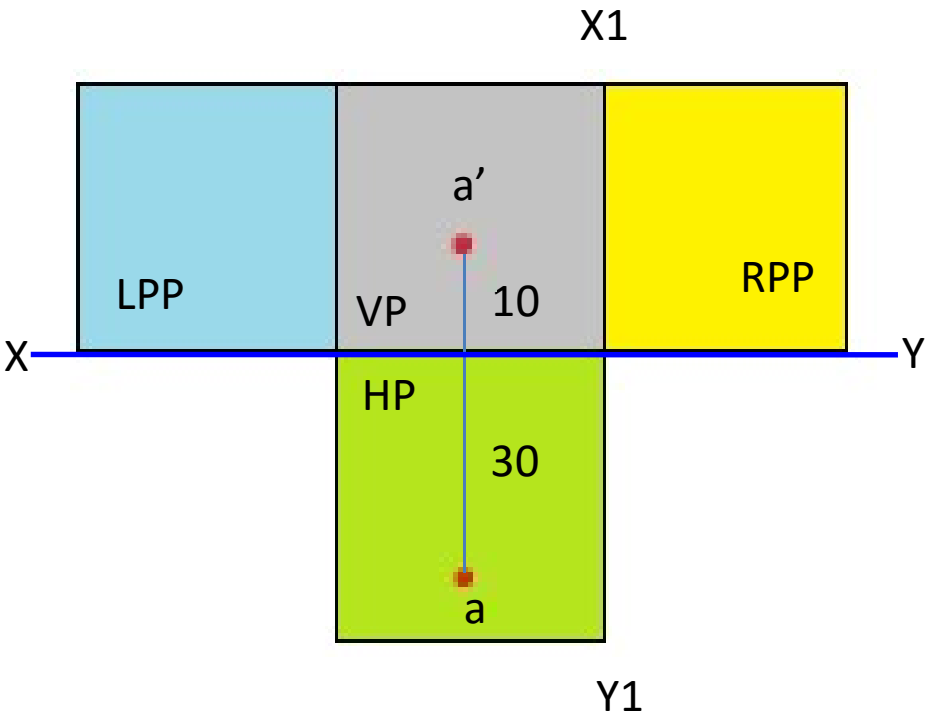
1 - Quadrant



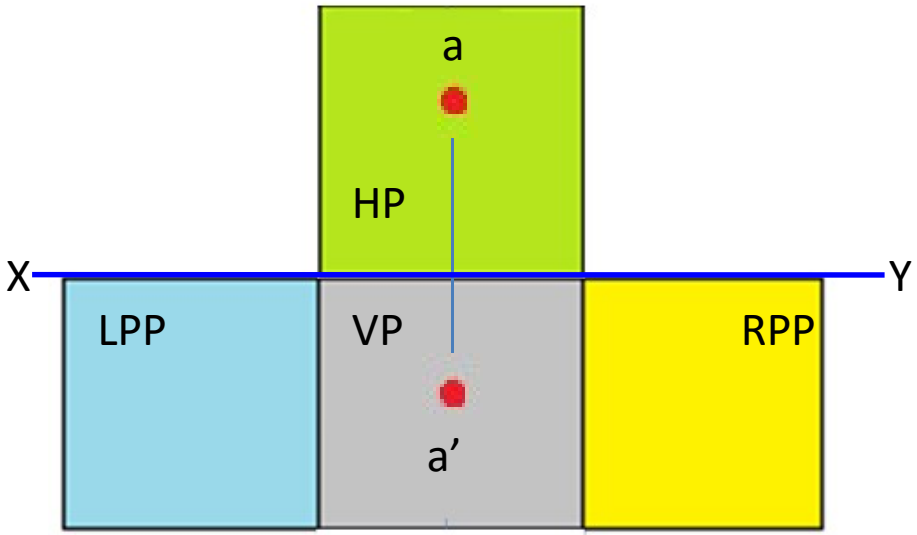
1 - Quadrant



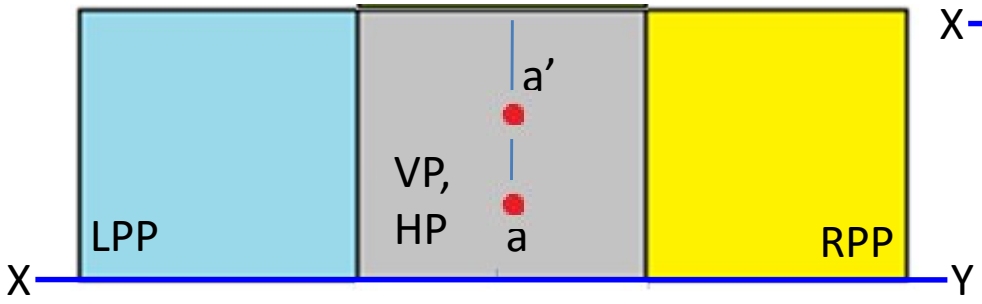
1 - Quadrant



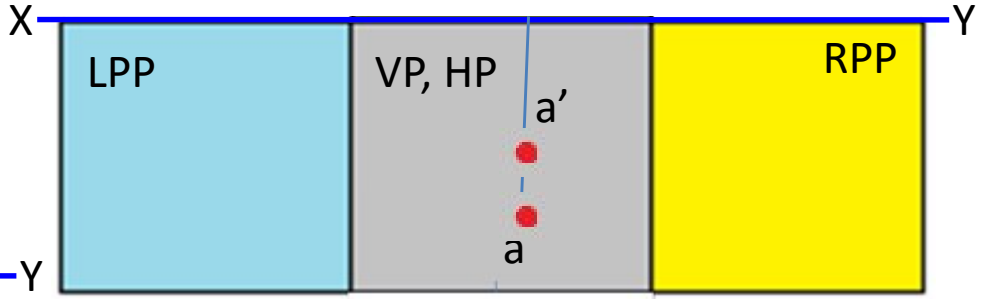
3- Quadrant



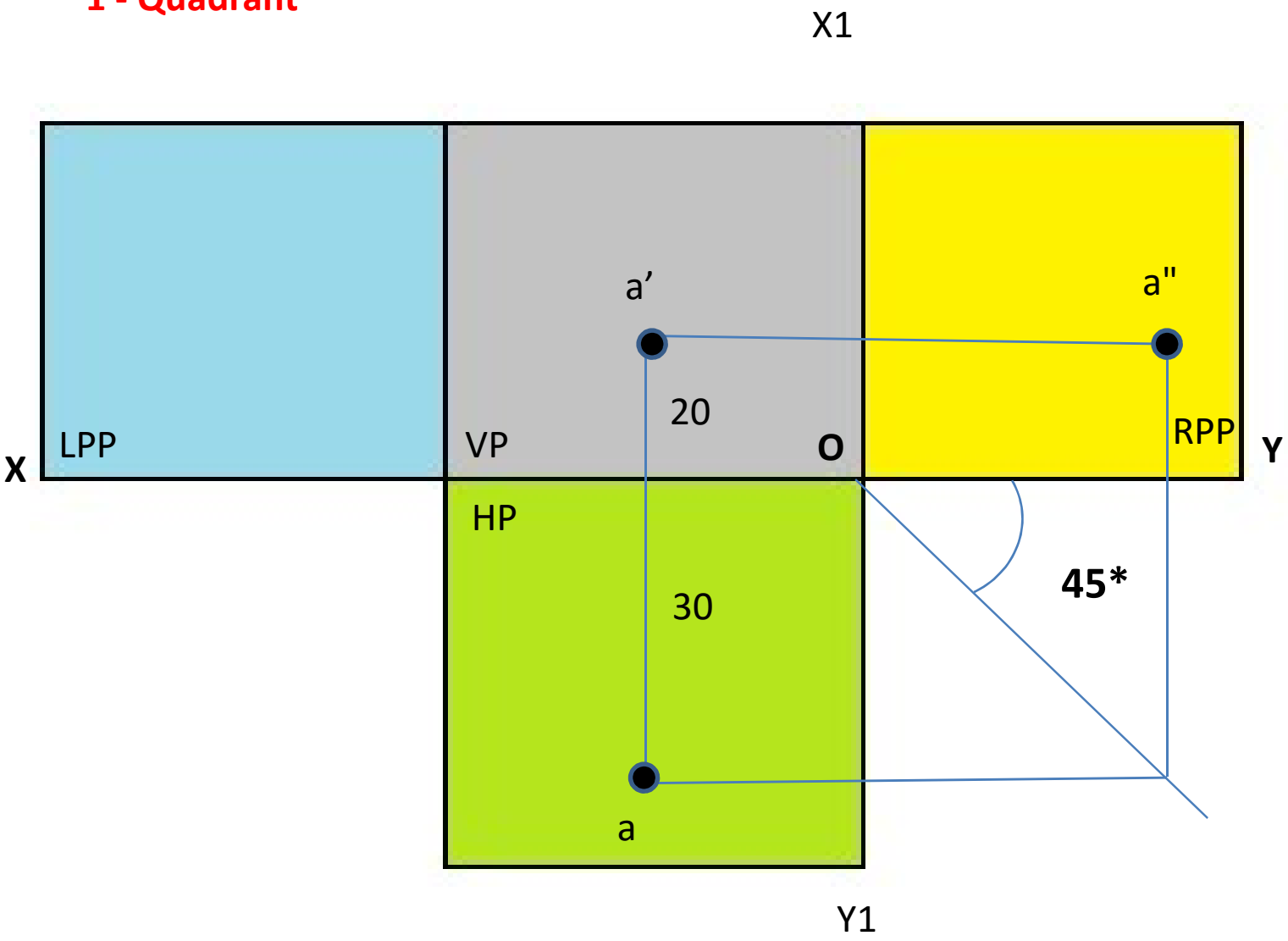
2 - Quadrant

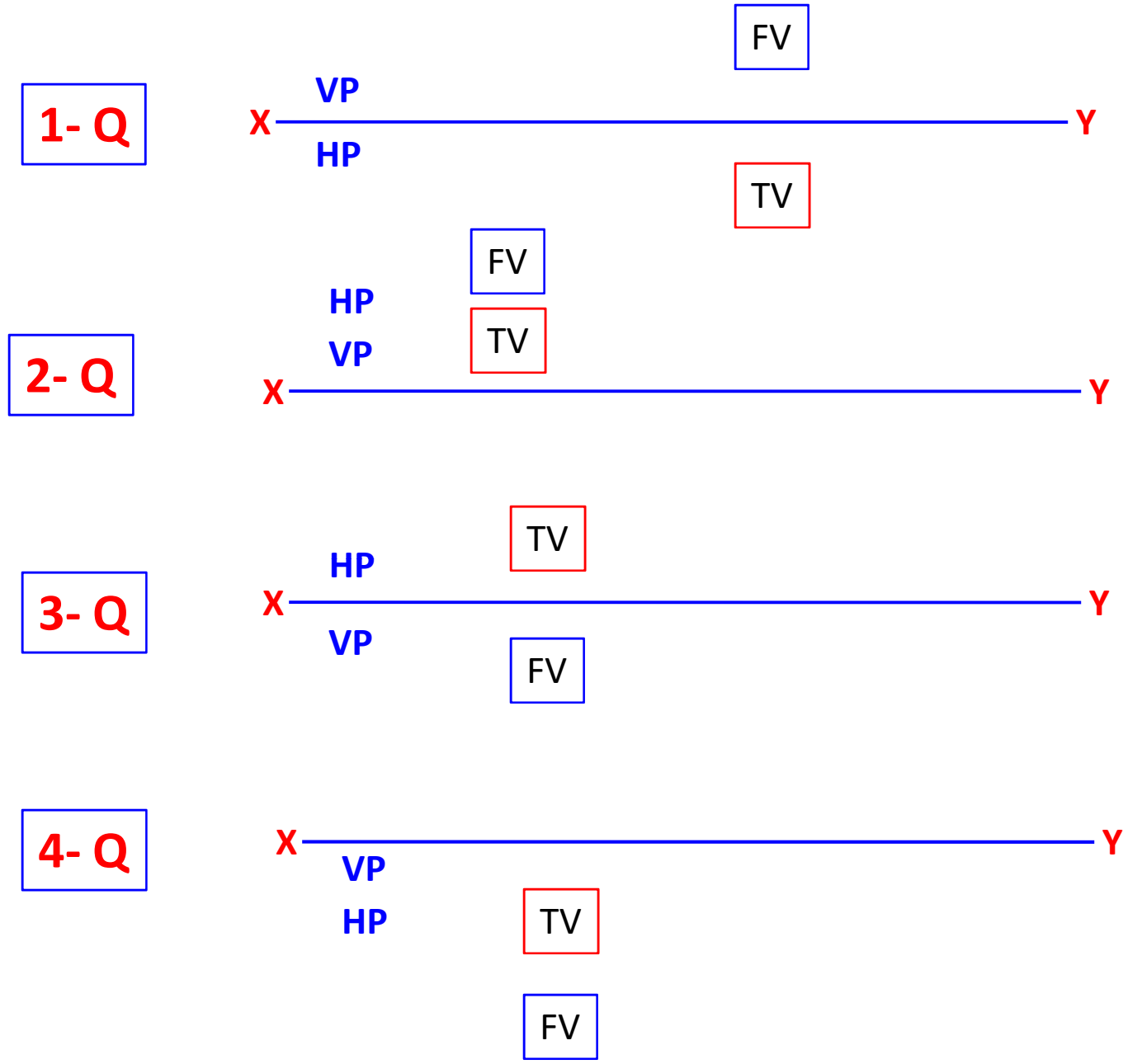


4 - Quadrant

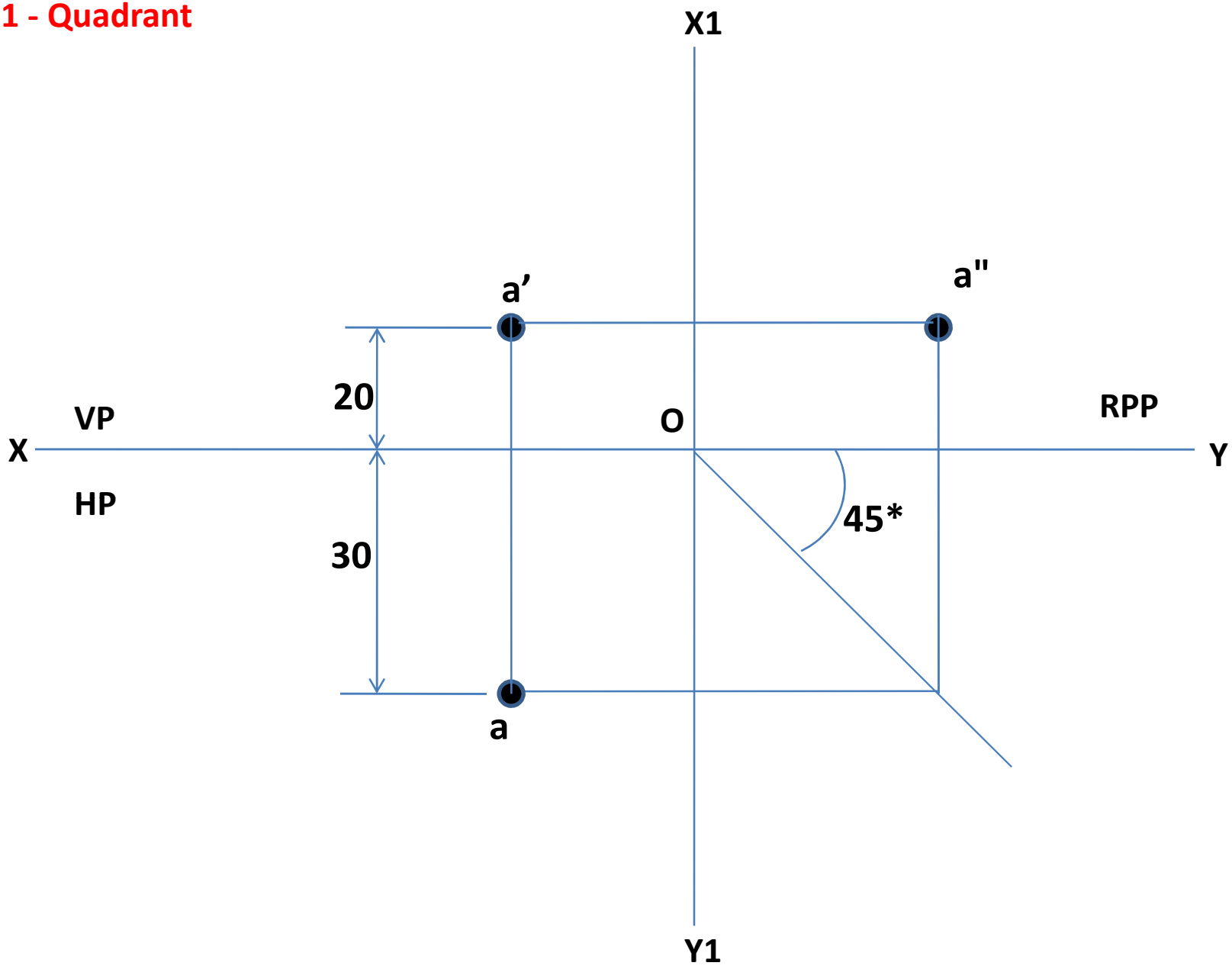


1 - Quadrant

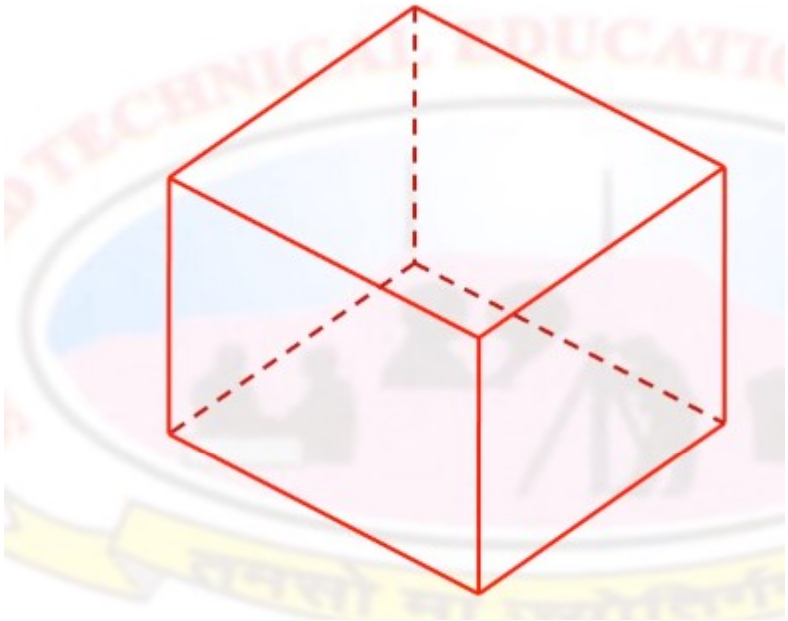



1- Q
FV
VP
X
Y
HP
TV
2- Q
FV
HP
TV
VP
X
Y
3- Q
TV
HP
X
Y
VP
FV
4- Q
X
Y
VP
HP
TV
FV

1 - Quadrant



Glass box concept



Projections (Orthographic Projection) of Points (Object)

In Orthographic projection of Points (Point is considered as an Object) .

Point is a dimensionless object (It has no size) i.e. no width, no length and no depth. A point in geometry just shows the location.

A point is shown (denoted) by a dark dot (.)

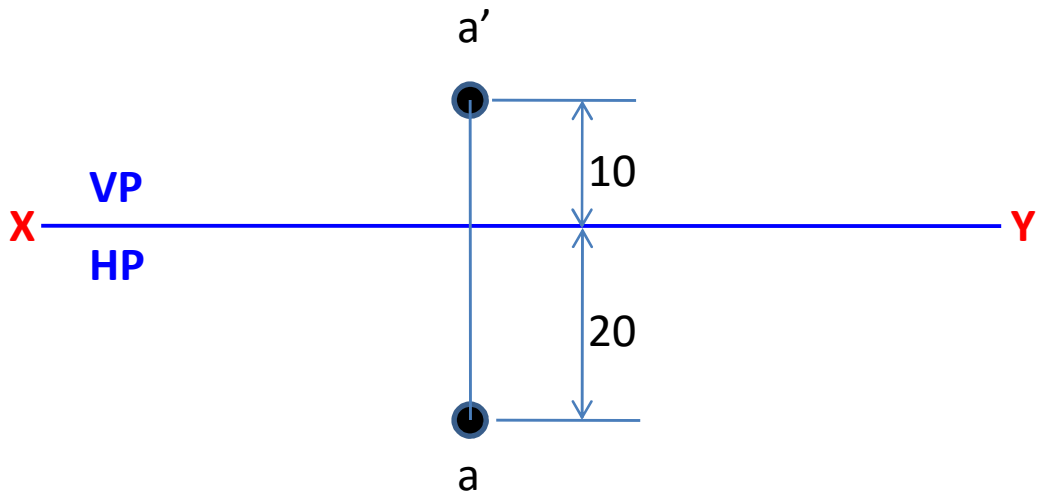
Orthographic projection of a Point is defined as obtaining the views of an Point (Object) on Different POP's using principles of orthographic projection.

PROBLEMS ON PROJECTION OF POINTS

Let us draw the projections of Point (Views of Points) considering it in a Different Quadrants Or Different angles of Projection.

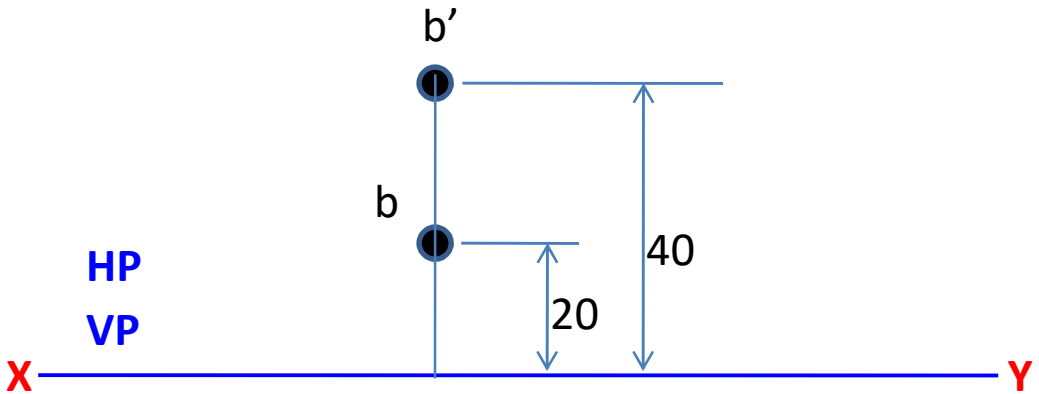
P1. **Point A is 10 mm above HP and 20 mm in-front of VP, Draw the Projection of Point A.**

1- Q



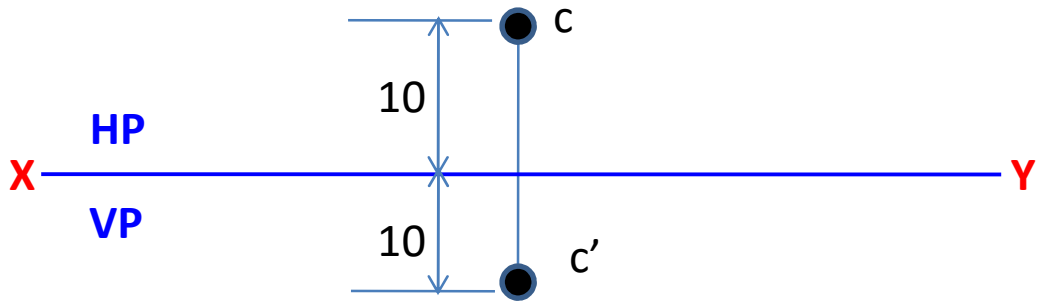
P2. **Point B is 40 mm above HP and 20 mm behind VP, Draw its FV and TV.**

2- Q



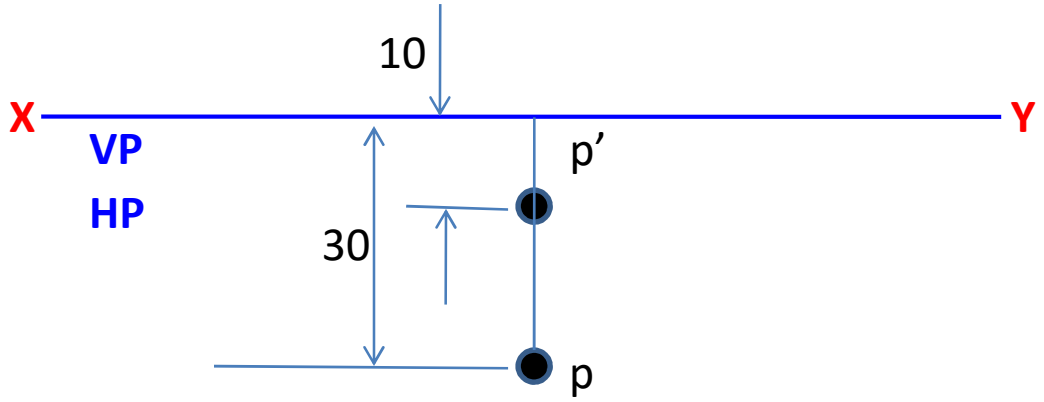
P3. Point C is 10 mm below HP and 10 mm behind VP, Draw the Projection of Point C.

3- Q



P4. Point P is 10 mm below HP and 30 mm in-front of VP, Draw FV & TV of Point P.

4- Q

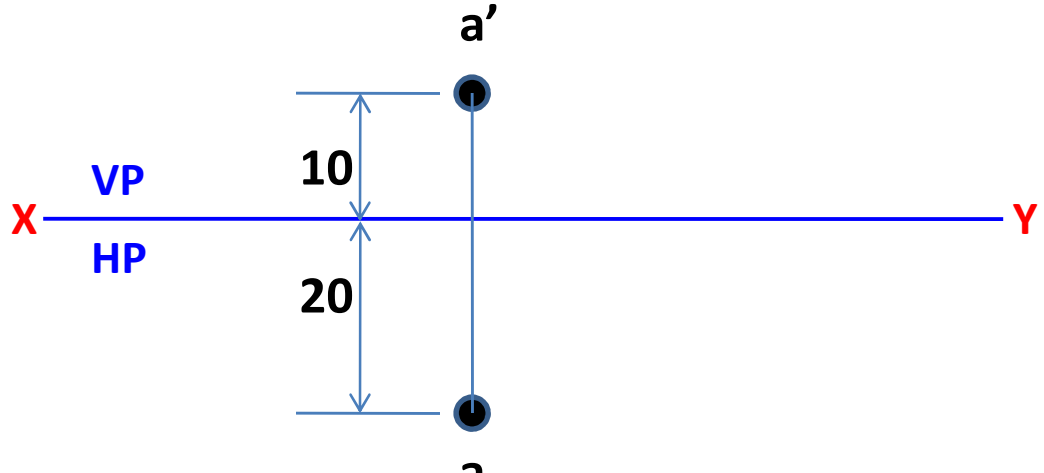


NOTE:

- XY line & X1Y1 lines should be light (2H pencil)
- Projection lines / Projectors should be v v light (2H Pencil)
- Point View should be dark (●) (HB Pencil)
- Naming of views a, a', a" should be dark (HB Pencil)
- All naming and Dimension Nos. should be dark (HB Pencil)
- Dimension lines, Extension lines should be light (2H Pencil)
- Arrow head dark should be dark W:L 1: 3 (HB Pencil)

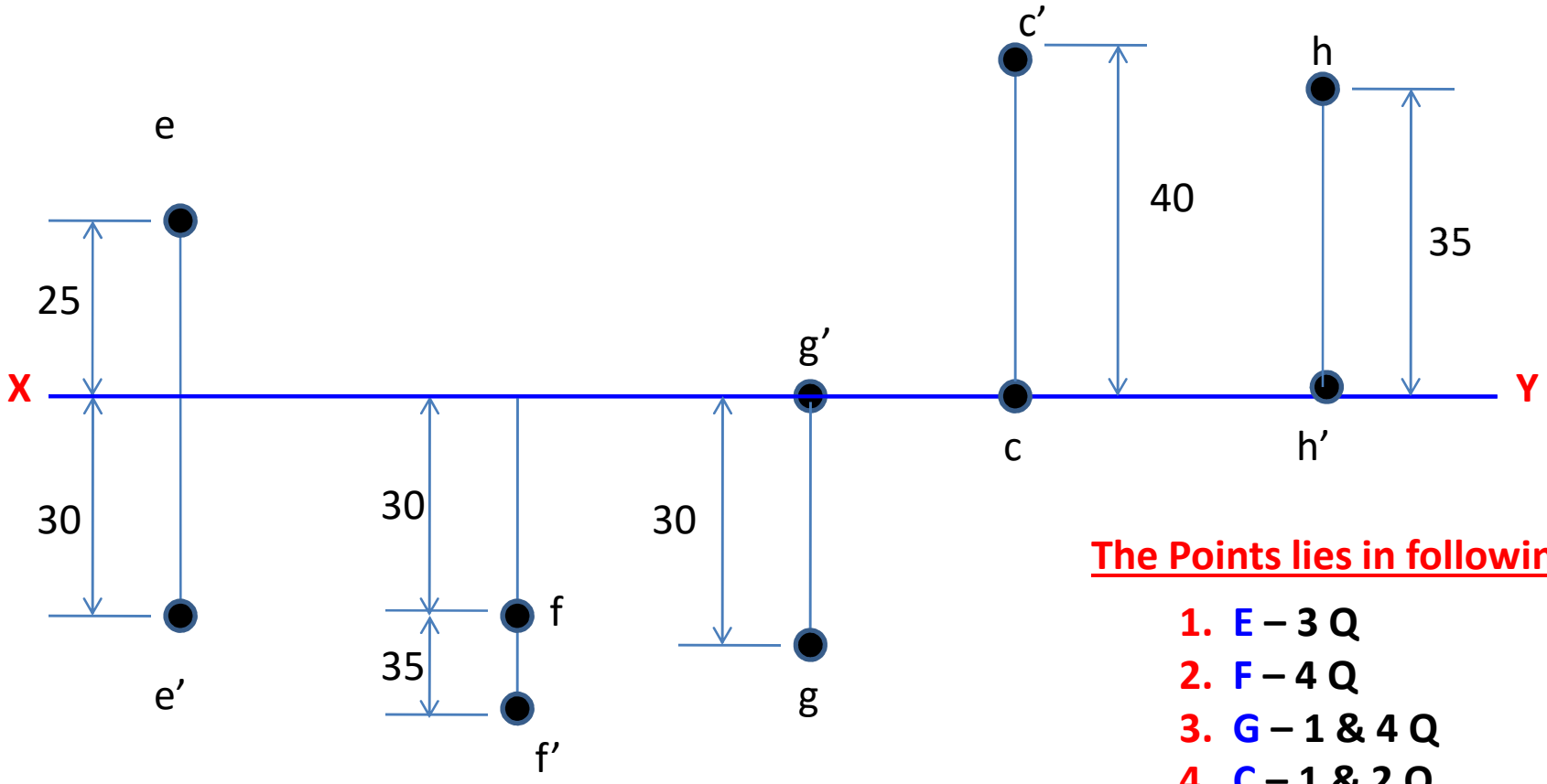
Q. Point A 10 mm above HP and 20 mm in-front of VP, Draw the projections.

1- Q



QBP2. **Draw the Projections of the following Points on the same XY line, keeping convenient distance between each projectors . Name the Quadrants in which they lie.**

1. **E – 30mm below HP & 25 mm behind VP.**
2. **F – 35mm below HP & 30mm in-front of VP.**
3. **G – On HP & 30 mm in-front of VP.**
4. **C – On VP & 40mm above HP.**
5. **H – On HP & 35mm behind VP.**

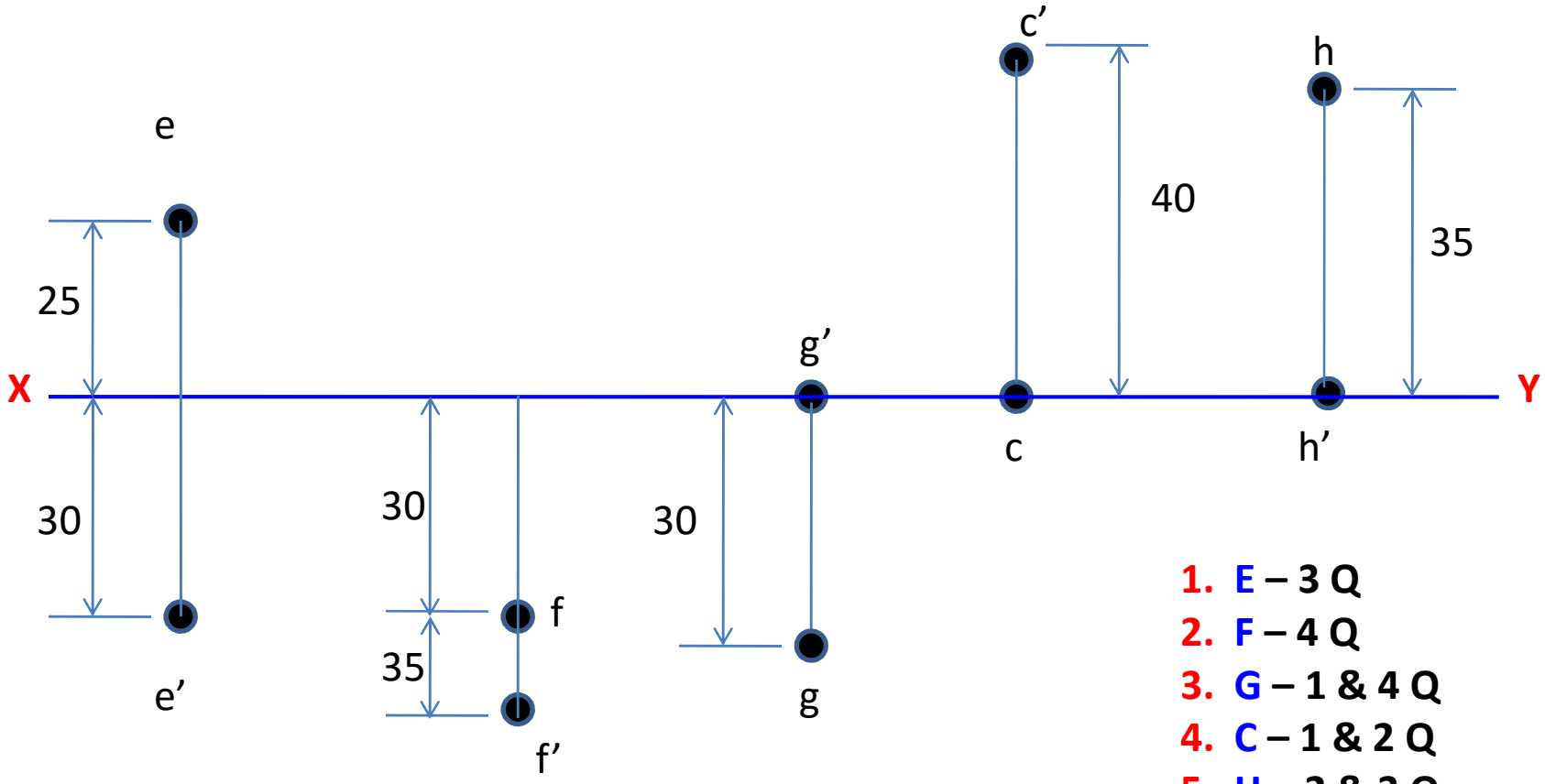


The Points lies in following Q

1. **E – 3 Q**
2. **F – 4 Q**
3. **G – 1 & 4 Q**
4. **C – 1 & 2 Q**
5. **H – 2 & 3 Q**

QBP2. **Draw the Projections of the following Points on the same XY line, keeping convenient distance between each projectors . Name the Quadrants in which they lie.**

1. **E – 30mm below HP & 25 mm behind VP.**
2. **F – 35mm below HP & 30mm in-front of VP.**
3. **G – On HP & 30 mm in-front of VP.**
4. **C – On VP & 40mm above HP.**
5. **H – On HP & 35mm behind VP.**



1. **E – 3 Q**
2. **F – 4 Q**
3. **G – 1 & 4 Q**
4. **C – 1 & 2 Q**
5. **H – 2 & 3 Q**

P10: A point S is in the first quadrant and equidistant of 50 mm from all the three principal planes (i.e. HP, VP & RPP). Draw the projections of the point. Draw all the three views of the point.

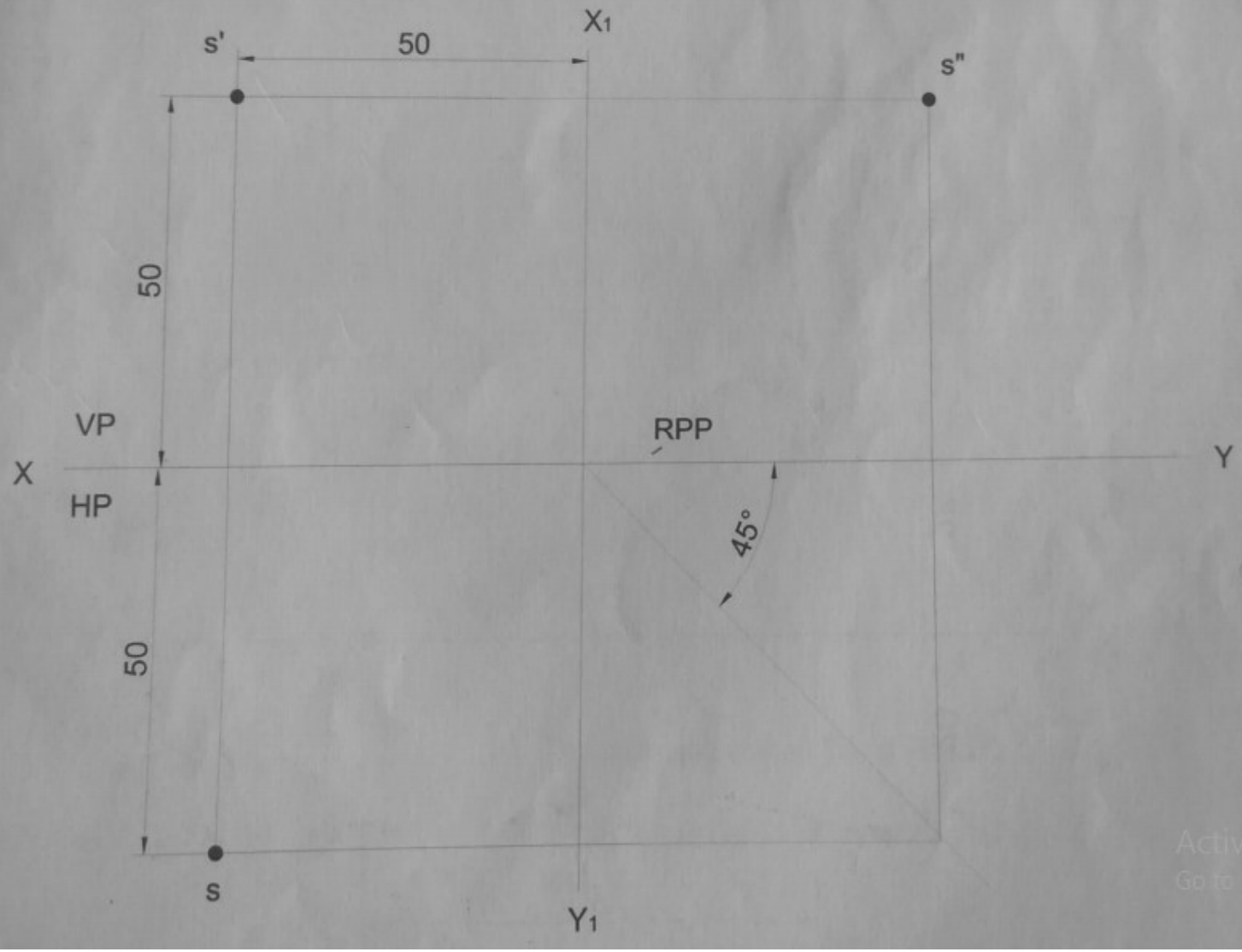
P10 Soln. Data given.

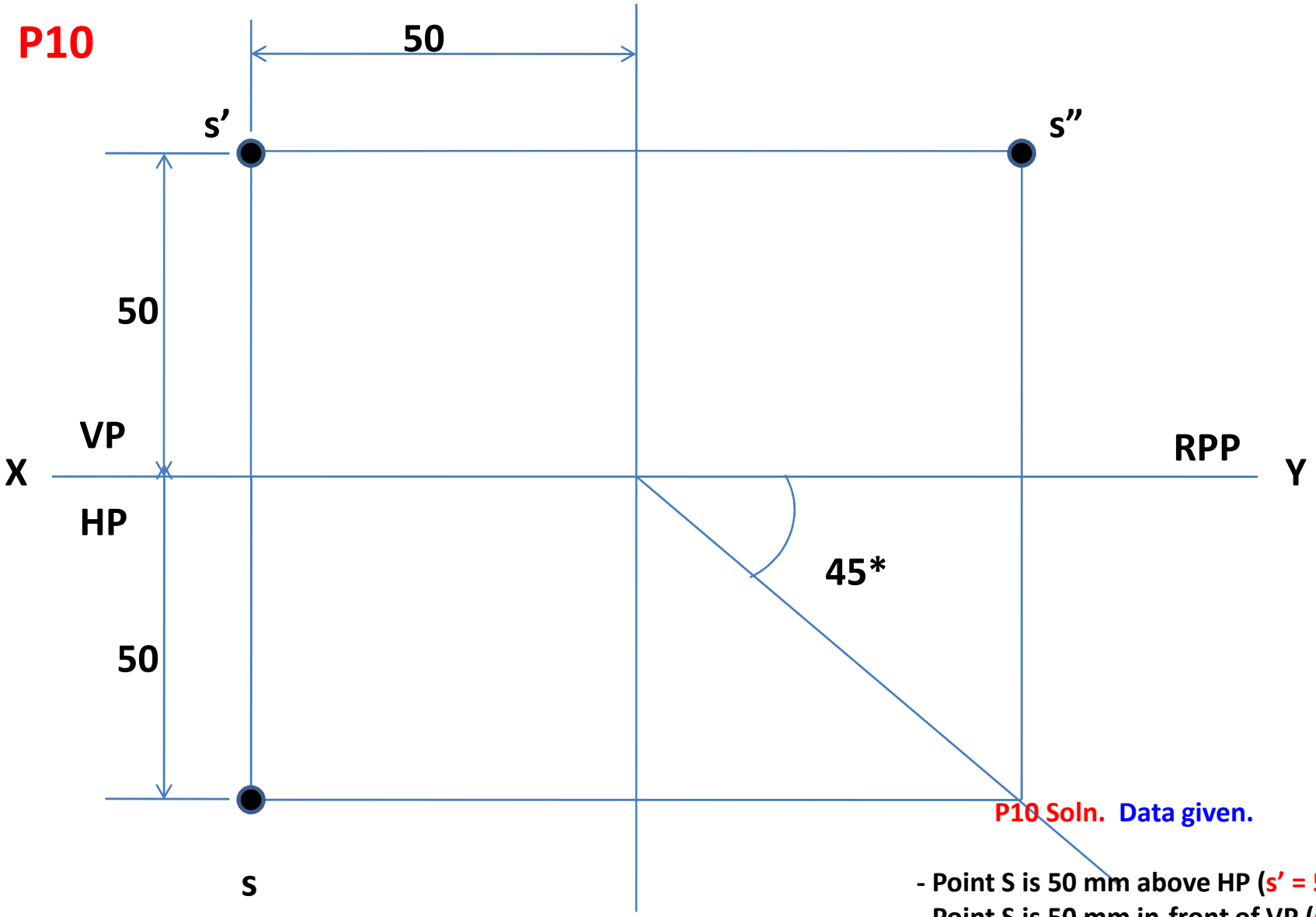
- **Point S is 50 mm above HP (s' = 50)**
- **Point S is 50 mm in-front of VP (s = 50)**
- **Point S is 50 mm in-front of RPP**

Draw: FV, TV & LPV in RPP

Problem 10 A point S is in the first quadrant and equidistant of 50 mm from all the three principal planes. Draw the projections of the point. Draw all the three views of the point.

Solution

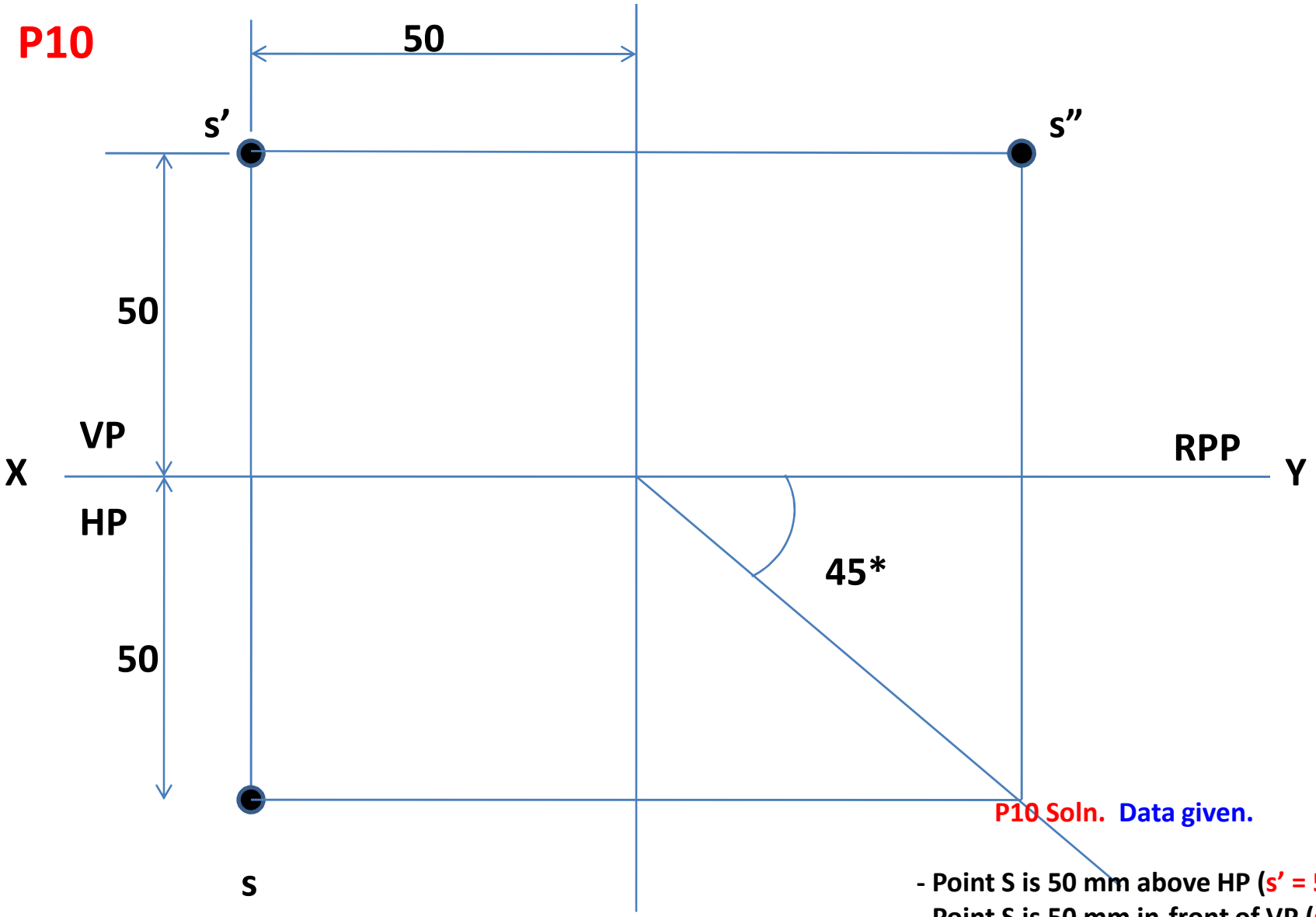




P10 Soln. Data given.

- Point S is 50 mm above HP (s' = 50)
- Point S is 50 mm in-front of VP (s = 50)
- Point S is 50 mm in-front of RPP

Draw: FV, TV & LPV in RPP



P10 Soln. Data given.

- Point S is 50 mm above HP (s' = 50)
- Point S is 50 mm in-front of VP (s = 50)
- Point S is 50 mm in-front of RPP

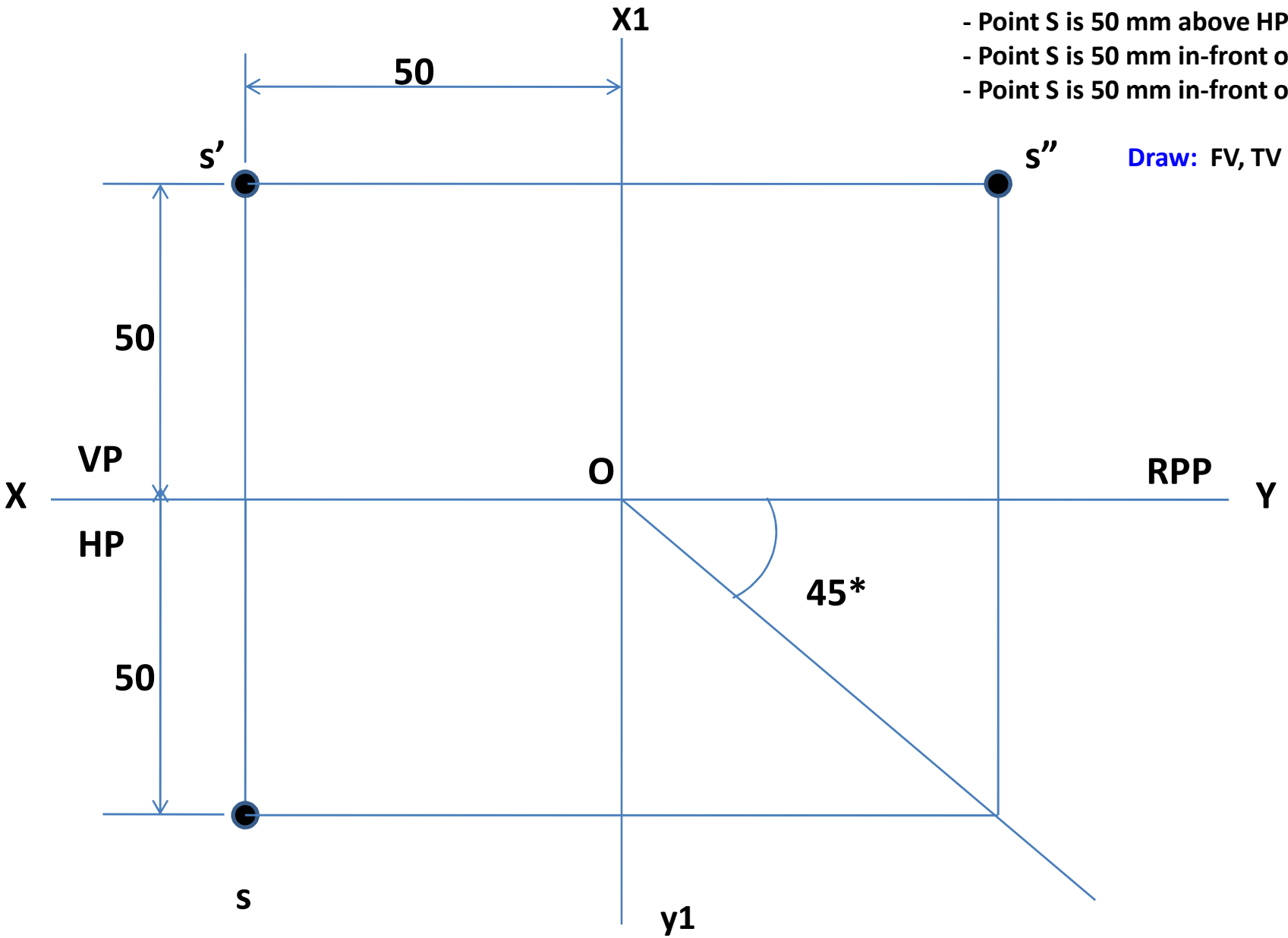
Draw: FV, TV & LPV in RPP

P10 Solution.

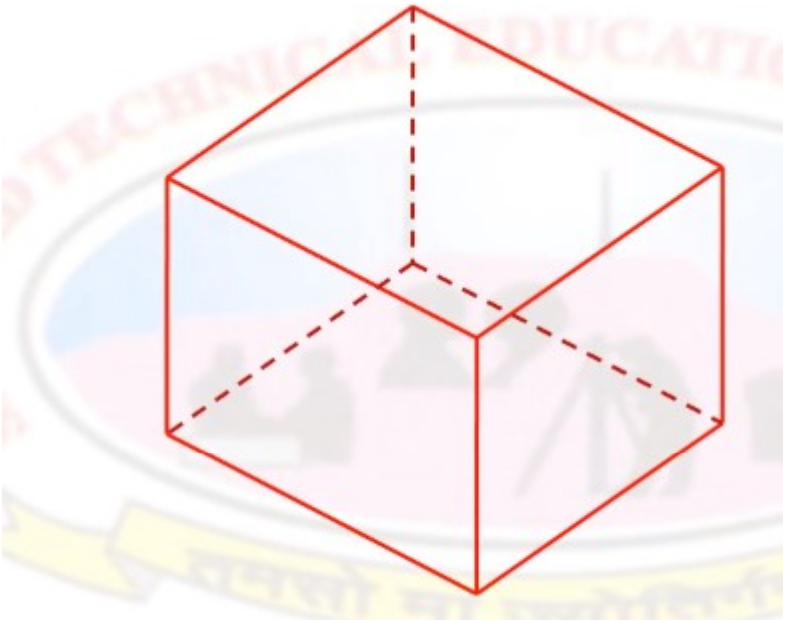
P10 Soln. Data given.

- Point S is 50 mm above HP (s' = 50)
- Point S is 50 mm in-front of VP (s = 50)
- Point S is 50 mm in-front of RPP

Draw: FV, TV & LPV in RPP



Glass box concept

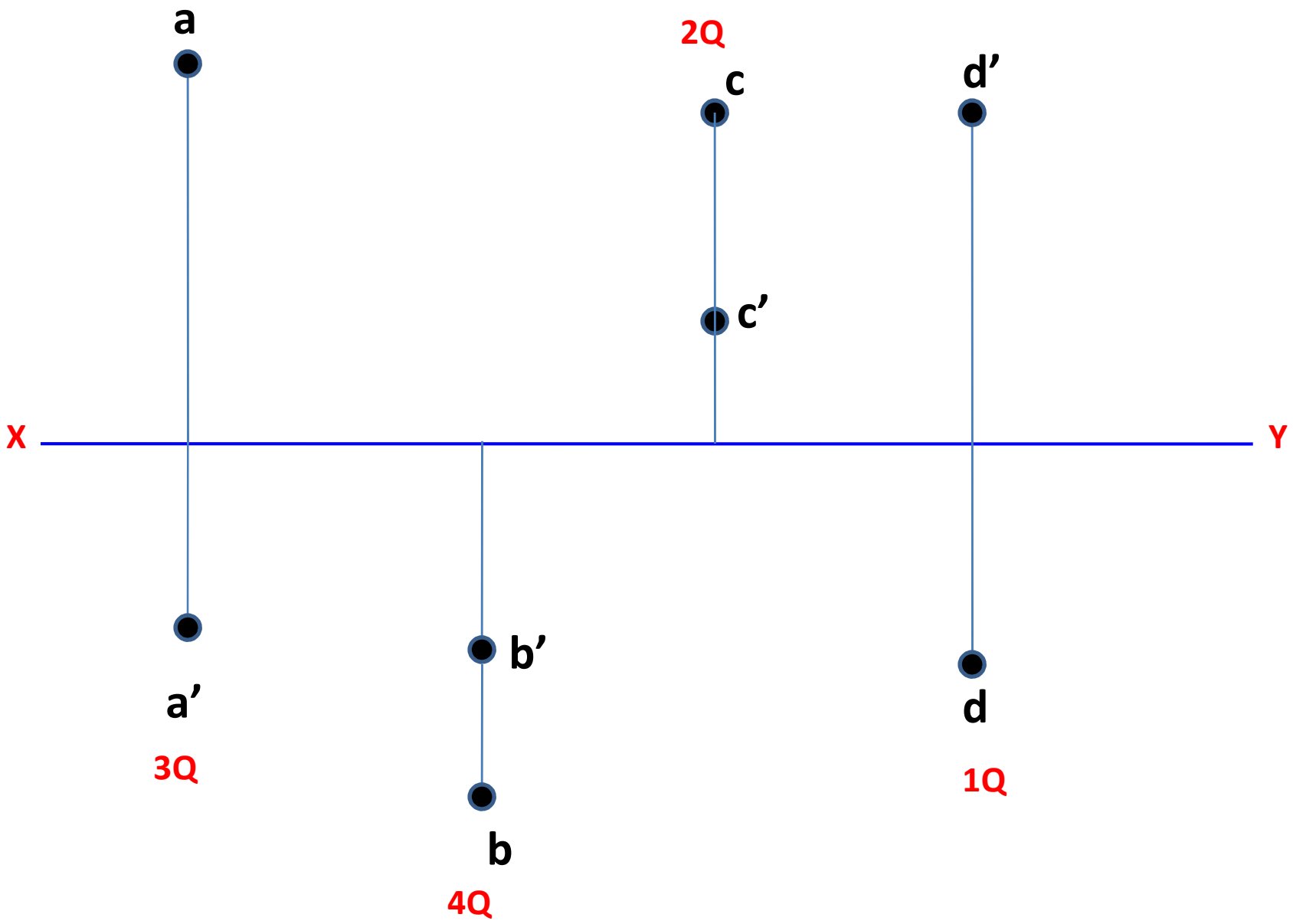


P03: Draw and state the Quadrants in which the following points are located. Assume any distances.

- **A – Front view is below XY line & Top view is above XY line.**
- **B – Front and Top Views are below XY line.**
- **C – Front and Top views are above XY line.**
- **D – Front view above XY line and Top View below XY line.**

A - is below HP & behind VP
B – is Below HP & in-front of VP
C – is Above HP & behind VP
D – is Above HP & in-front of VP

P 03 : Soln.



END