21MES102L
Engineering Graphics and Design
School of Mechanical Engineering

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21MES102L
Engineering Graphics and Design

E10
Isometric Projection
of Solids and
Perspective Projection
of Solids

Topics Covered

- Principles of Pictorial Projection, Isometric Projection and Isometric View
- Draw the Isometric view from Orthographic views of simple objects
- Define the Significance of Perspective projection

Pictorial Projections

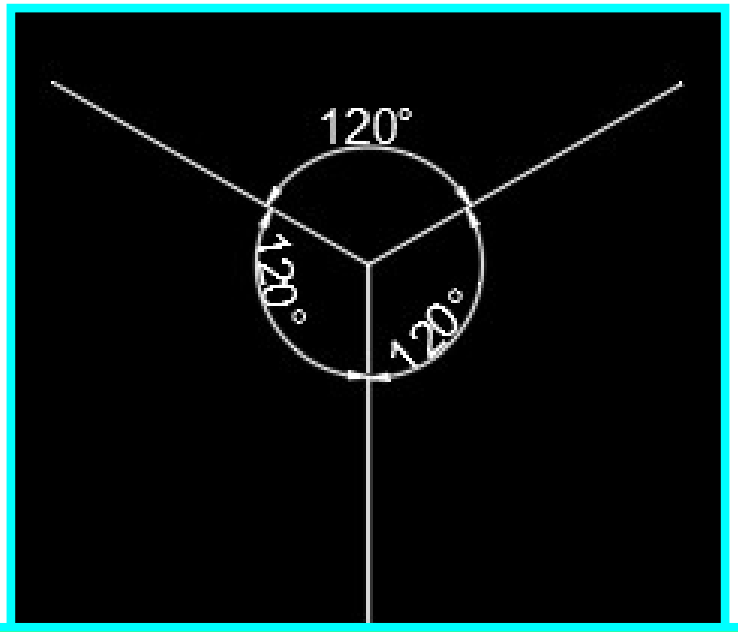
- Pictorial views shows all the three dimensions of an object which are useful to understand about an Object.
- The commonly used Pictorial Projections in Engineering practices are
- Isometric projection
- Oblique projection
- Perspective projection

Isometric Projection

- The **Isometric Projections** are commonly used to prepare the pictorial views of the **SMALLER objects** & they are commonly used in Mechanical , Automobile , Aerospace & Chemical Engineering to expose the details of the machine components.

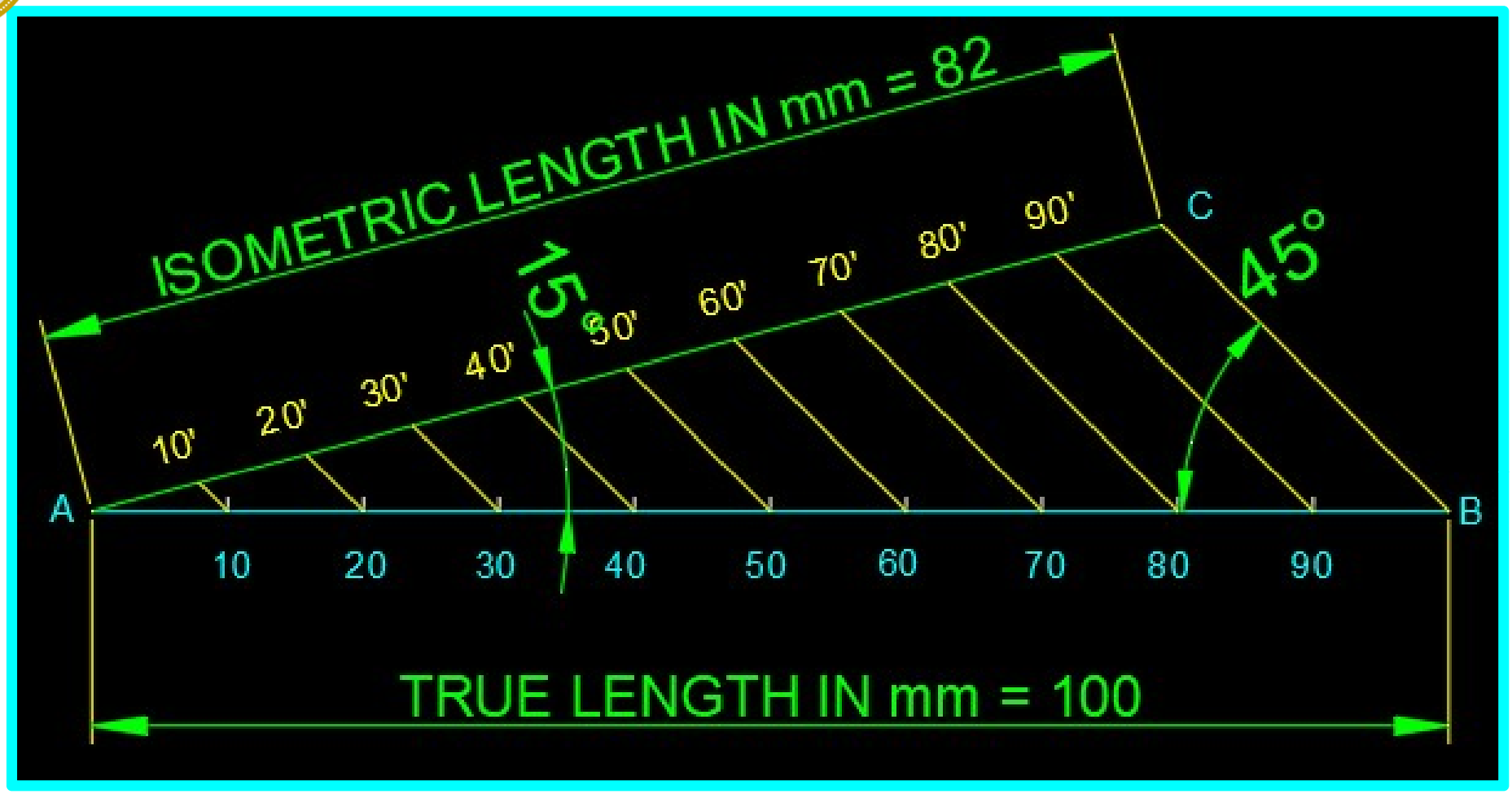
Isometric View & Isometric Projection

- The Picture drawn with **True lengths** is called **Isometric drawing** or **Isometric View**
- The Picture drawn with **Isometric dimensions** (**0.82** times of the **True length**) is called **Isometric Projection** & it is more time consuming process

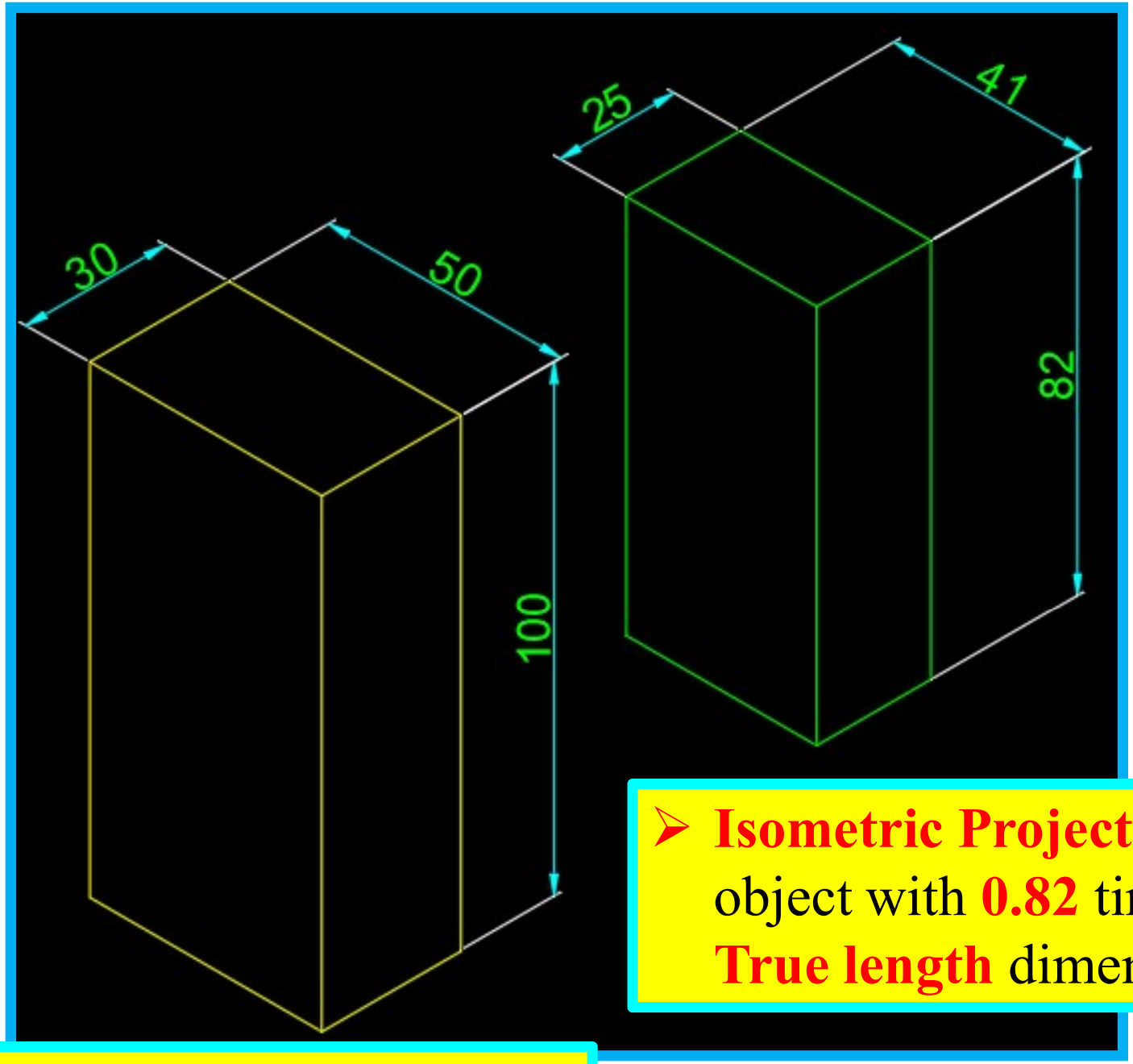


- Included angle between the **Isometric Axis**

Isometric Scale



- An **Isometric Scale** used for converting **True dimensions** into **Isometric dimensions** is shown in the above figure.

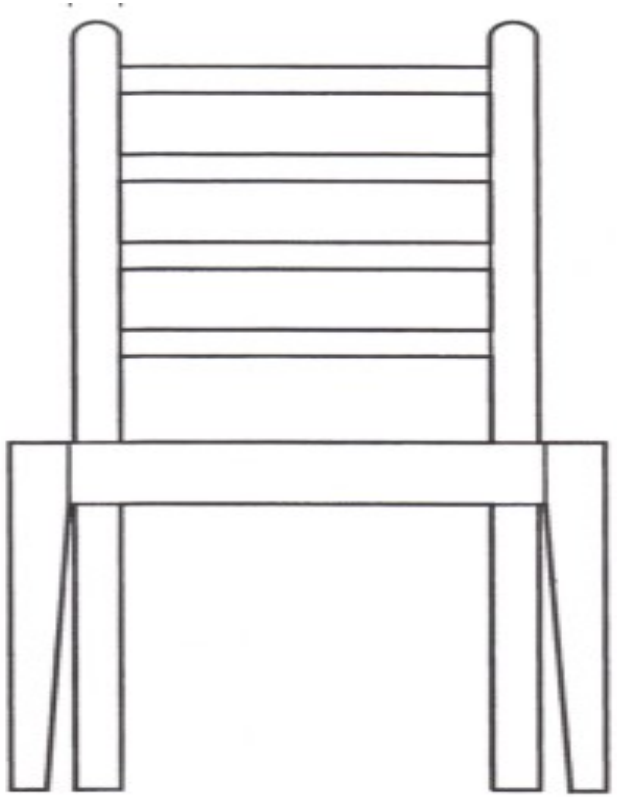


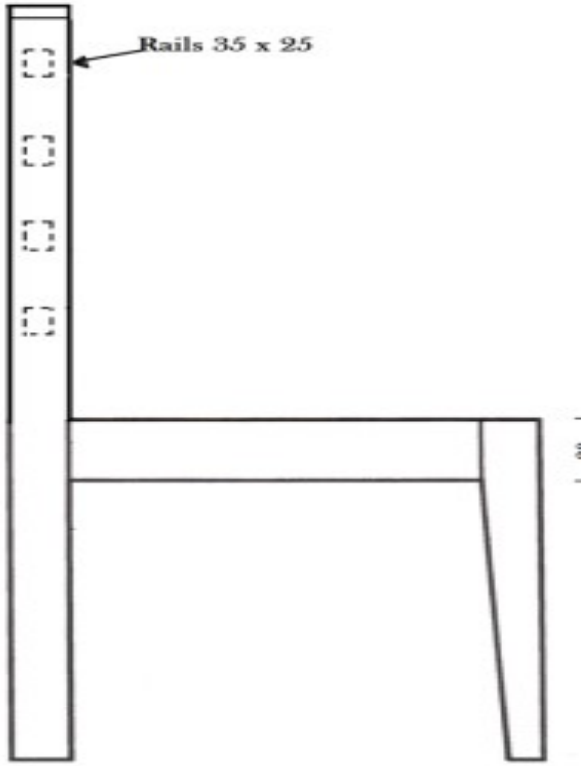
- **Isometric Projection** of an object with **0.82** times of the **True length** dimensions

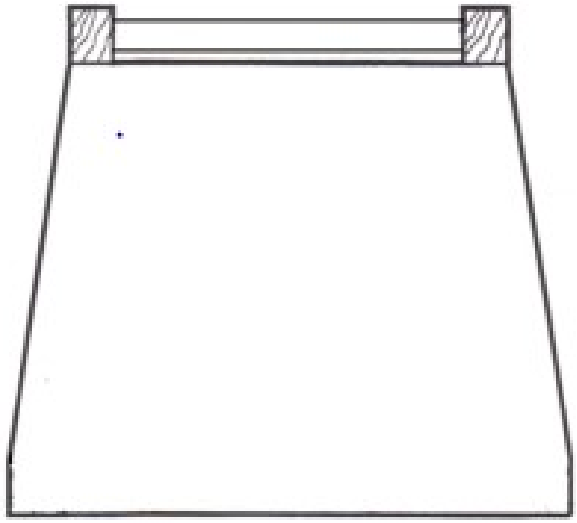
- **Isometric View** of an object with **True length** dimensions

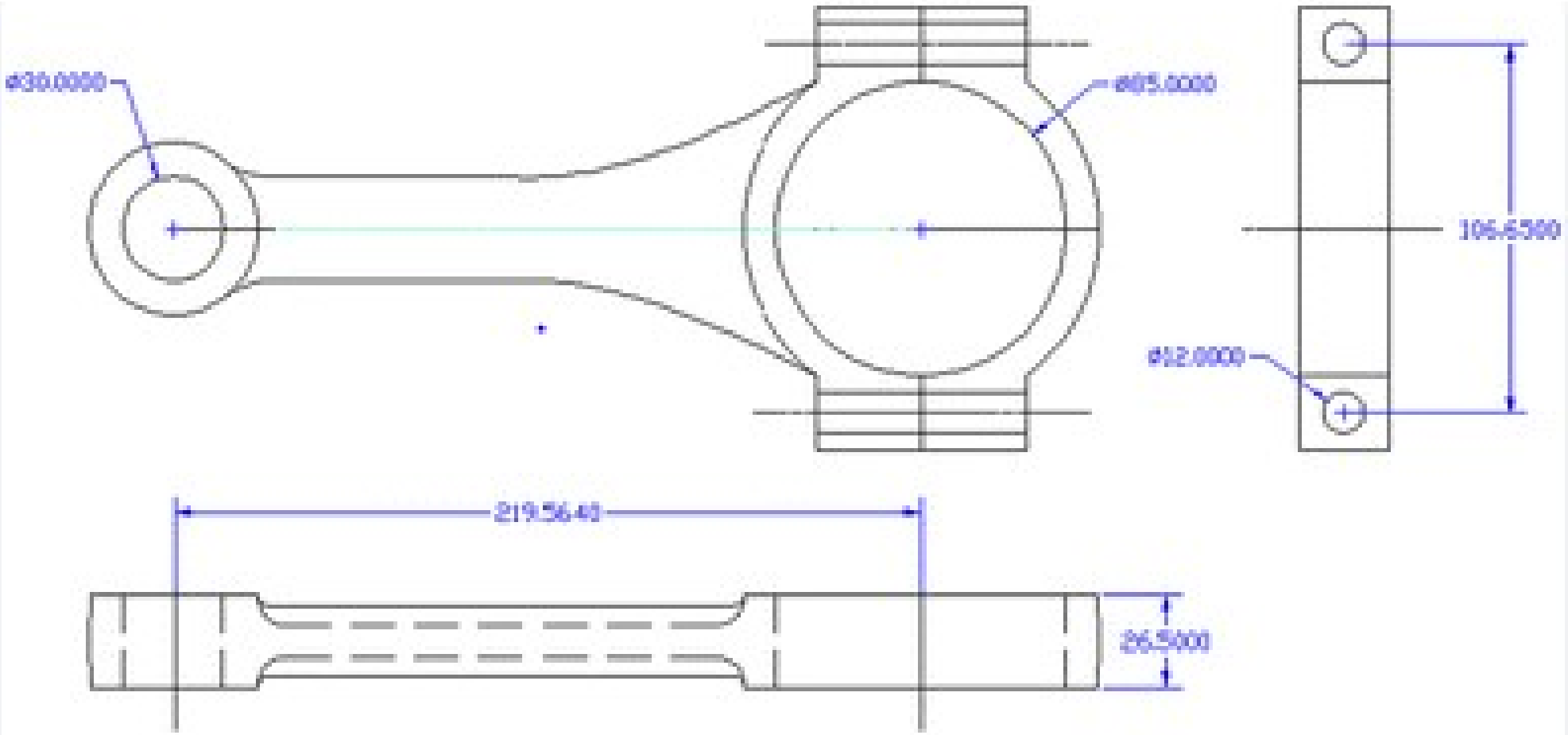
- The **Isometric view** of a **chair** which gives an **Aesthetic pleasure** and an **Ergonomics in design** provided in it.

- **Orthographic views** of a **Chair** where the **Reality on comfort** is difficult to be Assumed or visualized



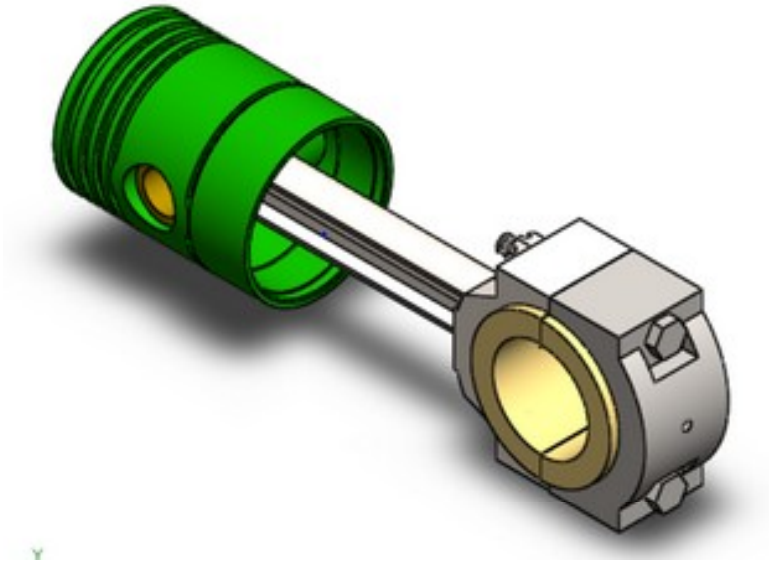


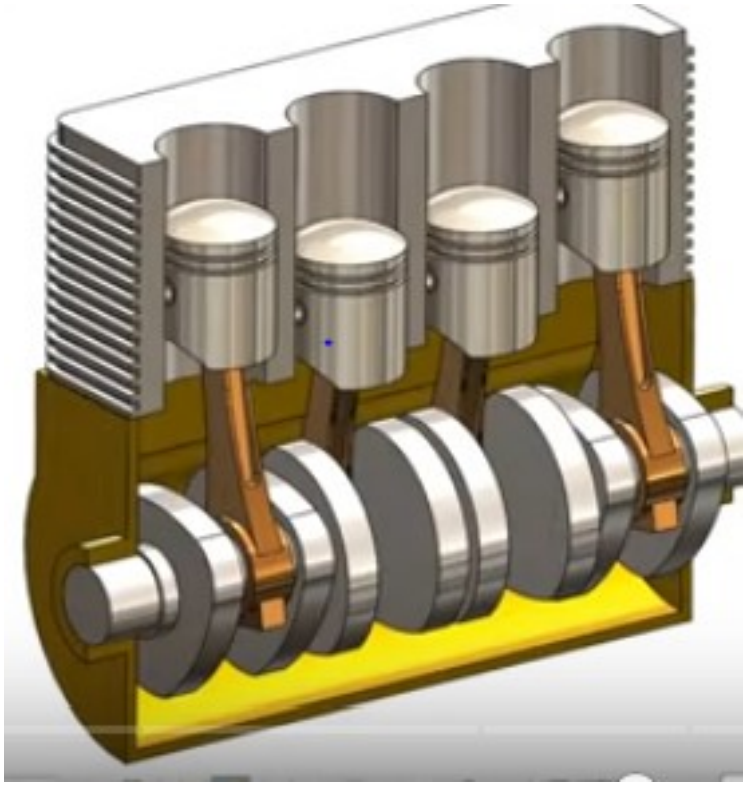




- **Orthographic views of a Connecting Rod** which is quite **uneasy** to visualize the component

Isometric View

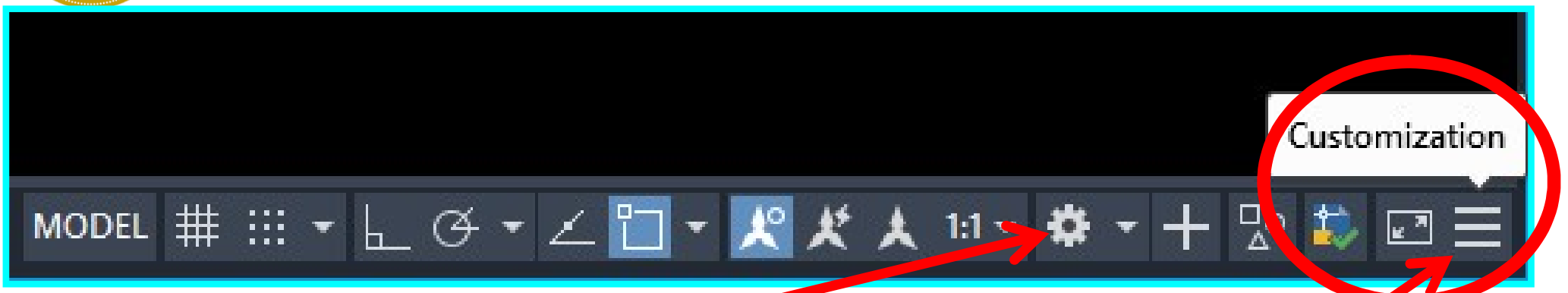




- **PISTON & CONNECTING ROD**

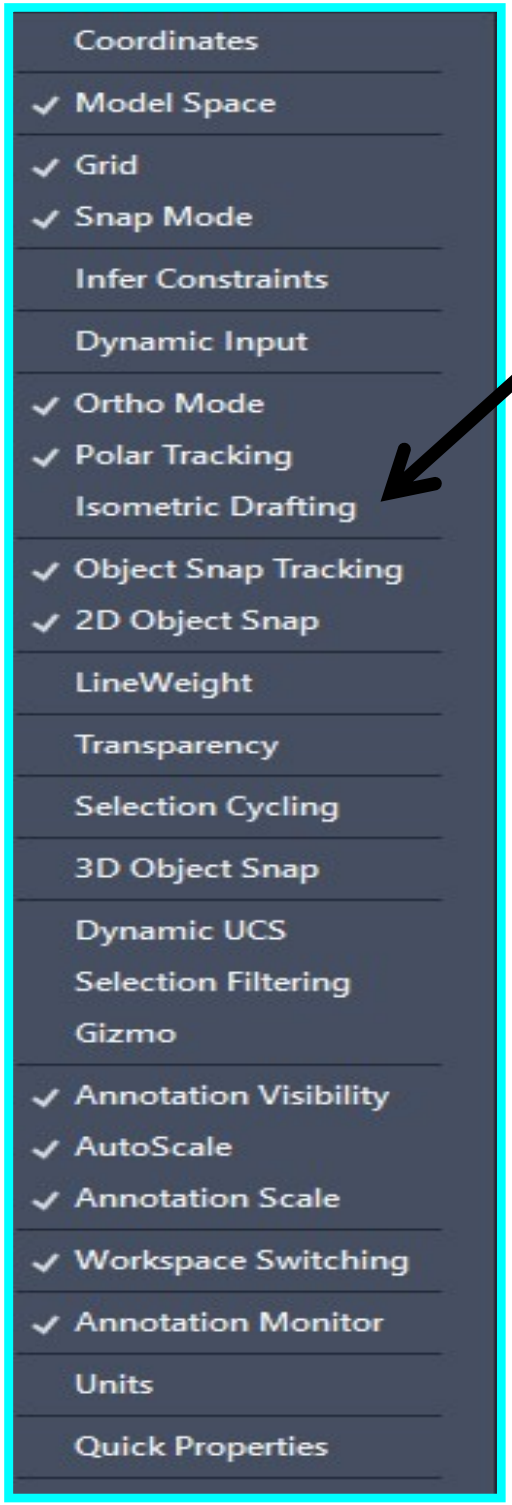
- The **Isometric view** has the distinct advantage of conveying the Real shape of the object in such a way that even those who are not familiar with the art of reading a drawing can easily visualize its form and Shape

Isometric Drafting Setting in Auto Cad 2023



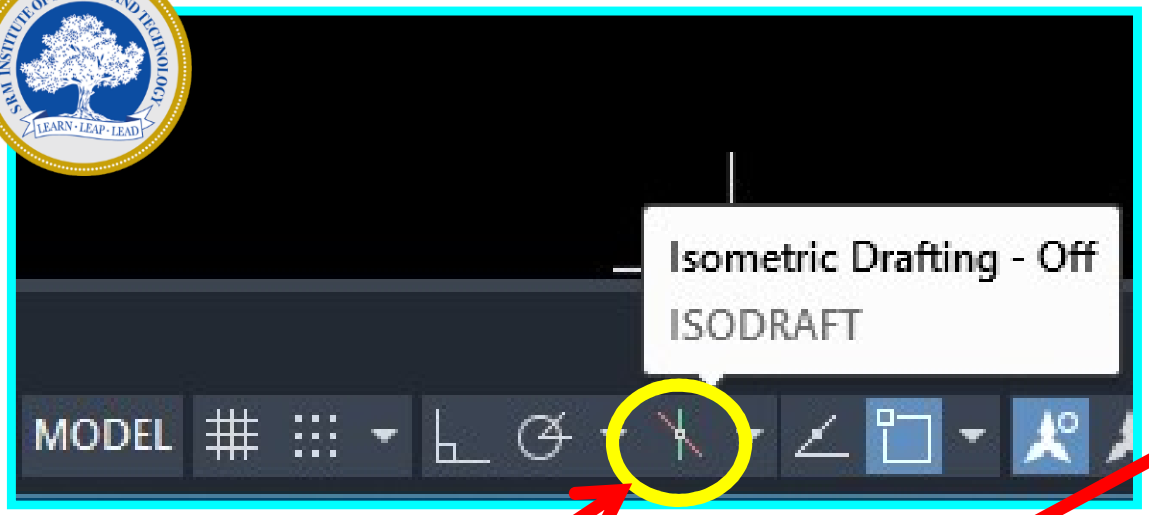
➢ Change the Workspace to **Drafting & Annotation**

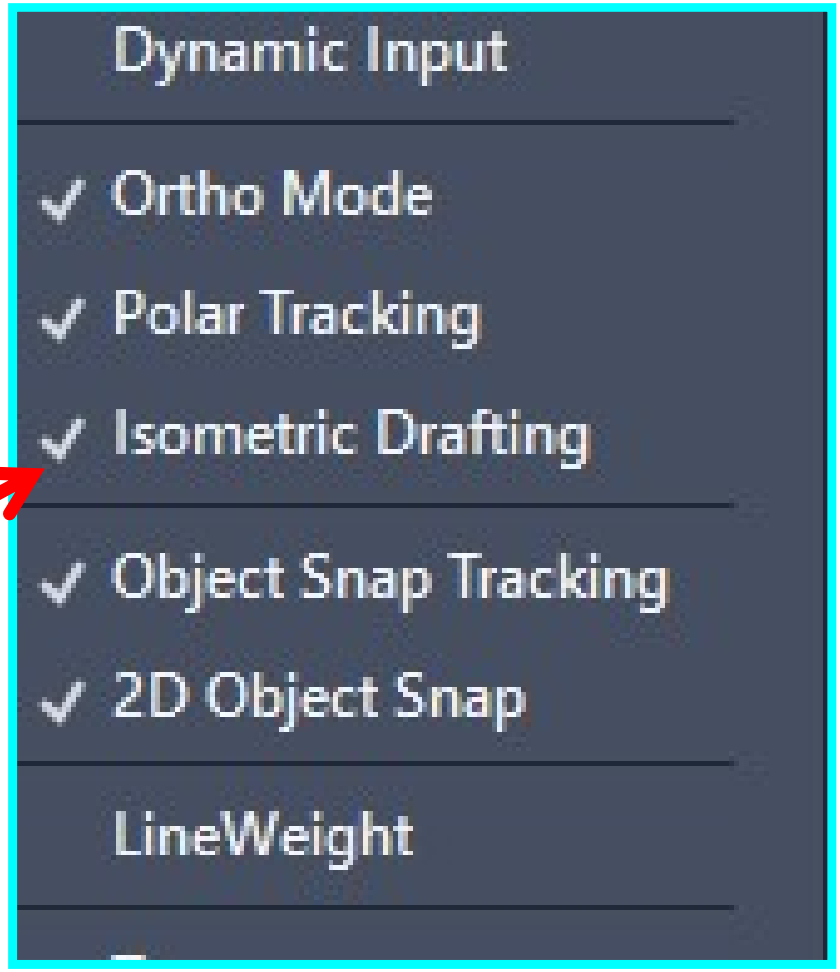
➢ **Click** on the **Customization** at the Right bottom of the Auto cad window for **Enabling** the **ISOMETRIC DRAFTING.**



Click on **Isometric Drafting**

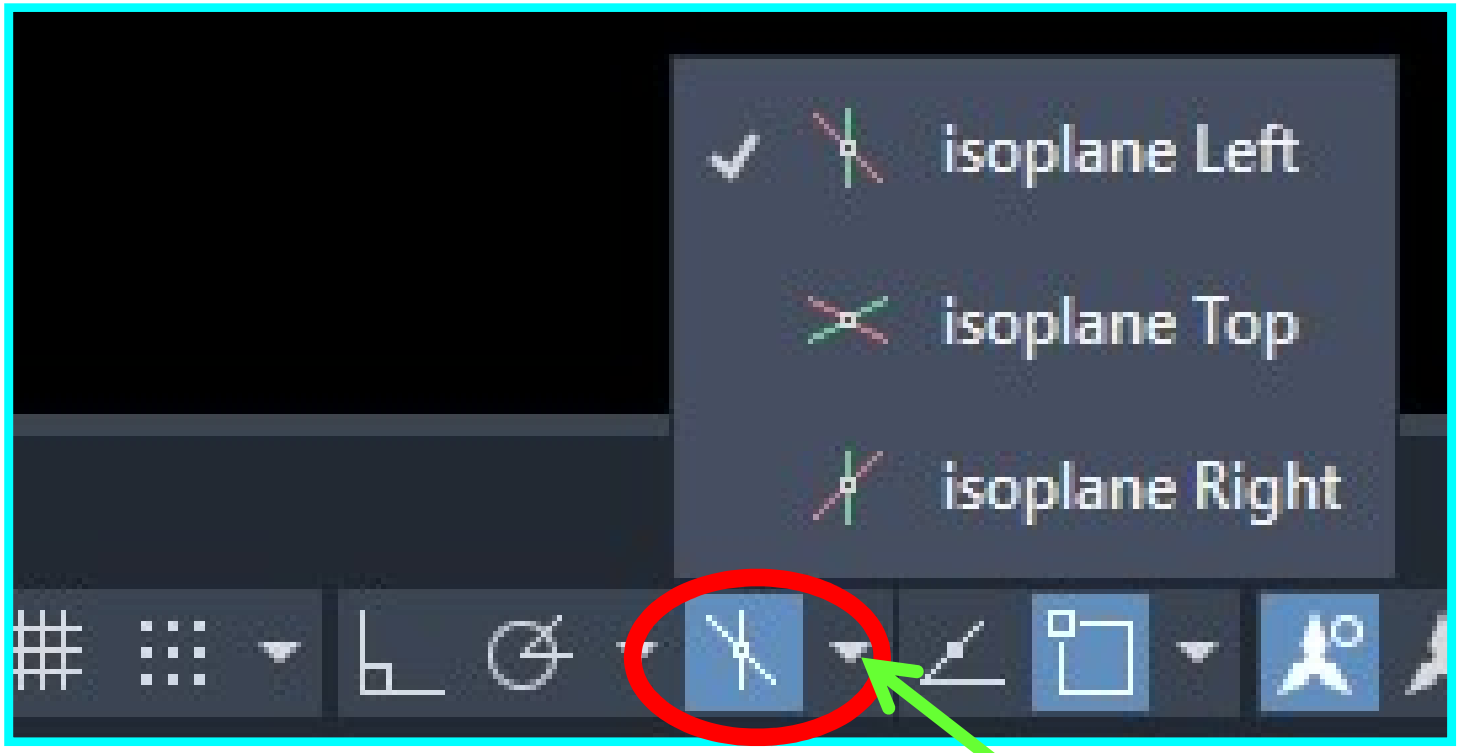
- After enabling the **Isometric Drafting** the **ISODRAFT** tool will be visible in the Bottom Pane
- Enable the **ISODRAFT** tool for setting the ISO Plane as per the requirement to draw the **Isometric View / Projection**
- The list of Isoplanes are
  - **Isoplane Left**
  - **Isoplane Top**
  - **Isoplane Right**





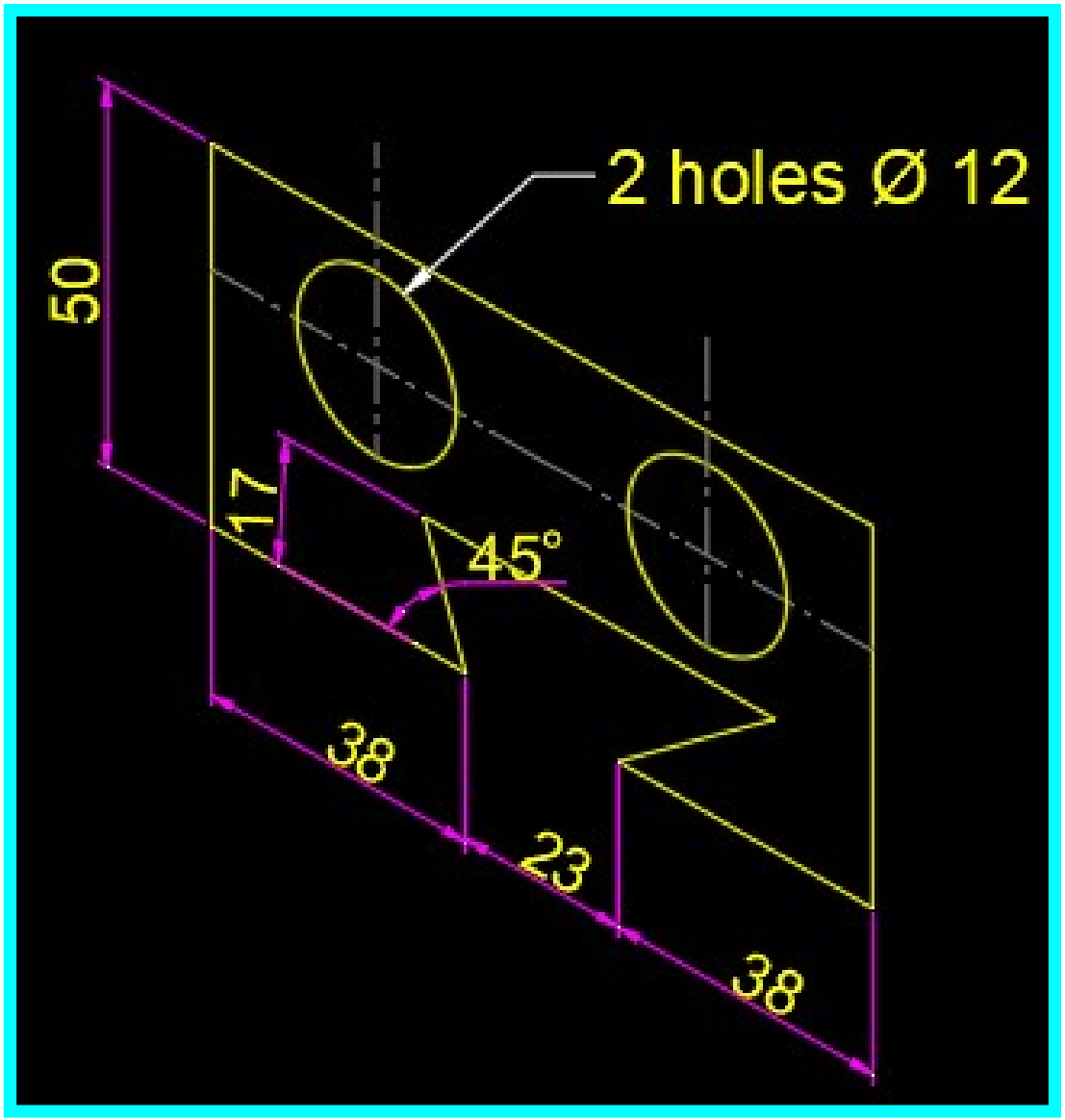
- The **ISODRAFT** icon is visible only after enabling the **Isometric Drafting** in the **Customization** Tool Bar

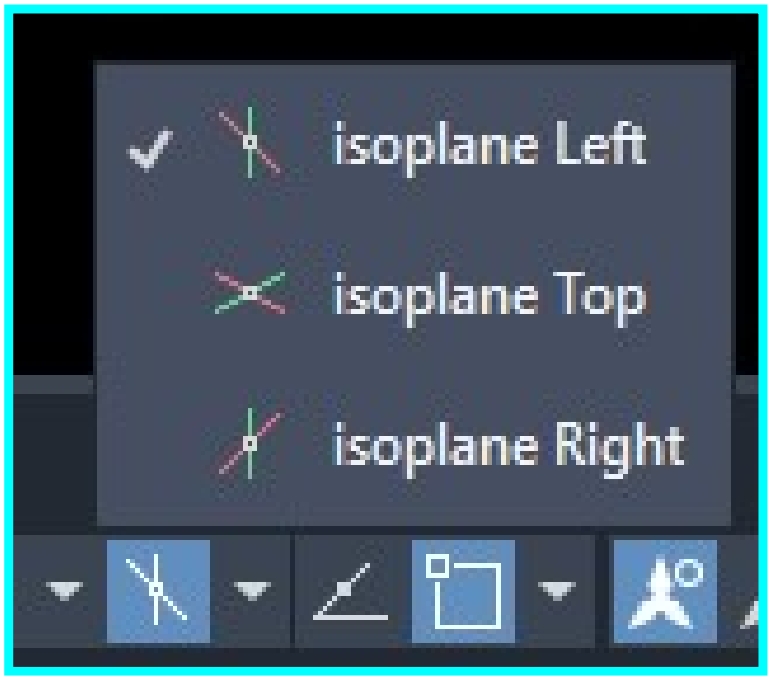
➢ Selection of **Isoplane**



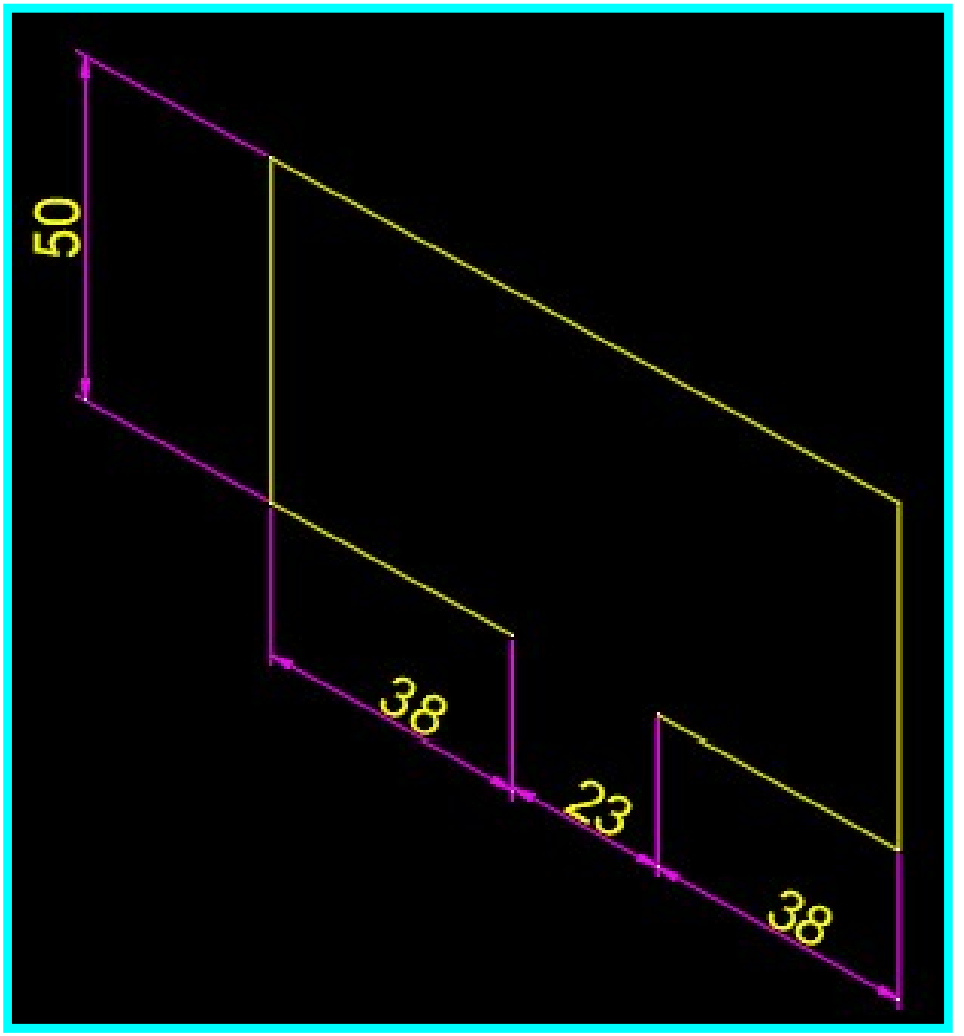
➢ Click on the pull down to set the required **isoplane**

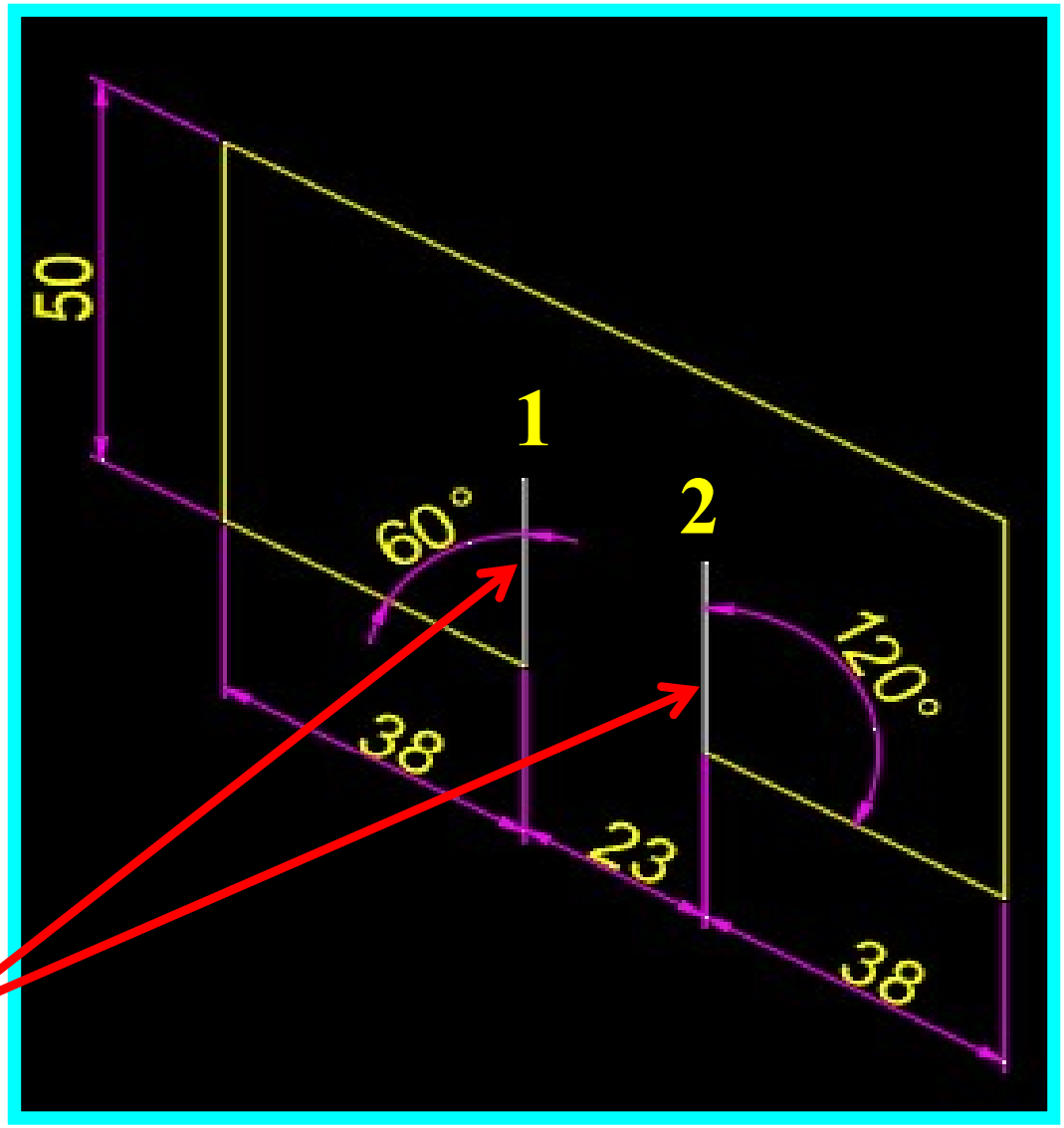
- Guidelines for Drawing **Dove Tail Shape , Circle** & **Dimensioning** in a Iso Plane





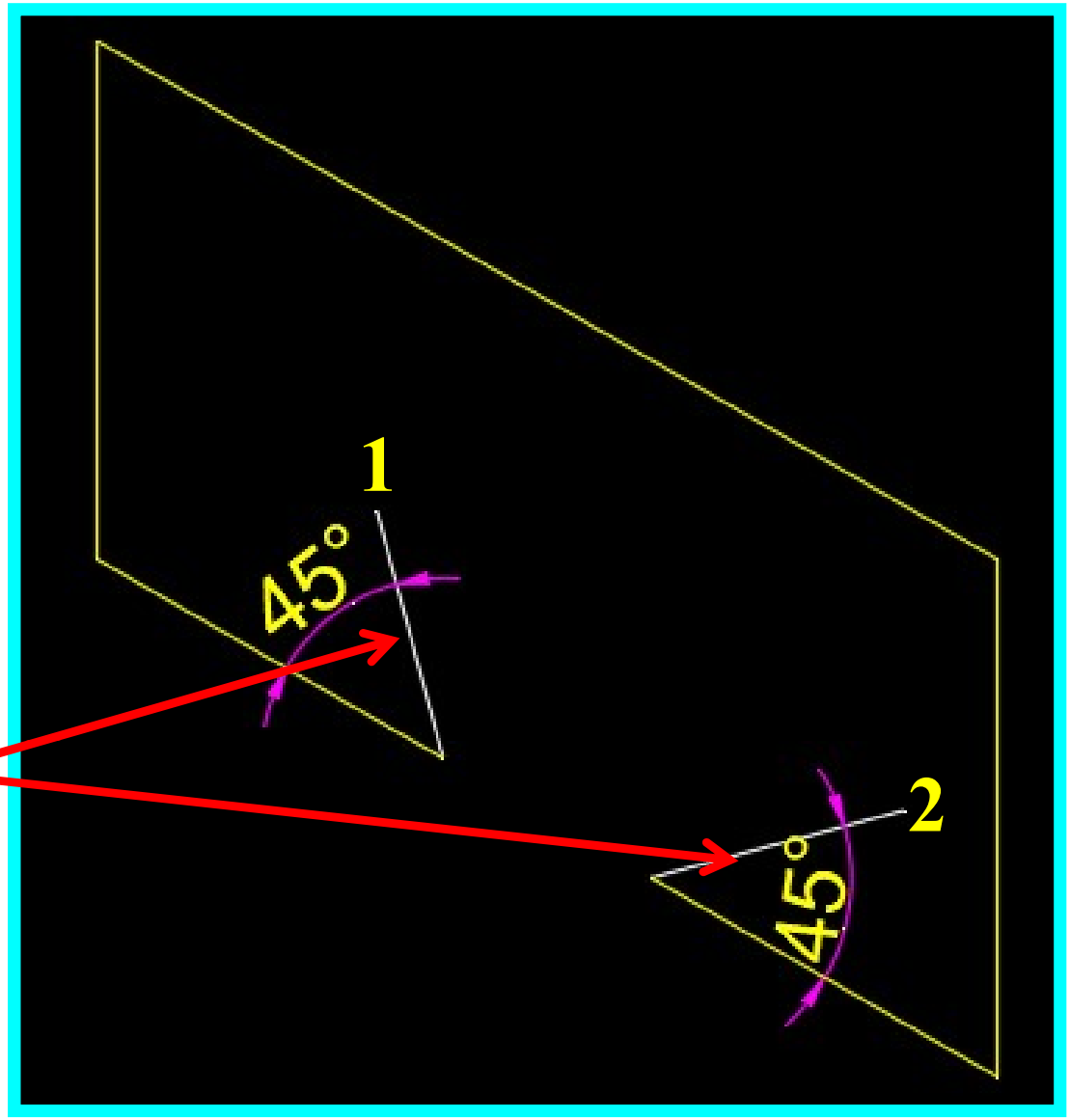
- Select IsoPlane **Left** Ortho on draw the sketch as per dimensions.

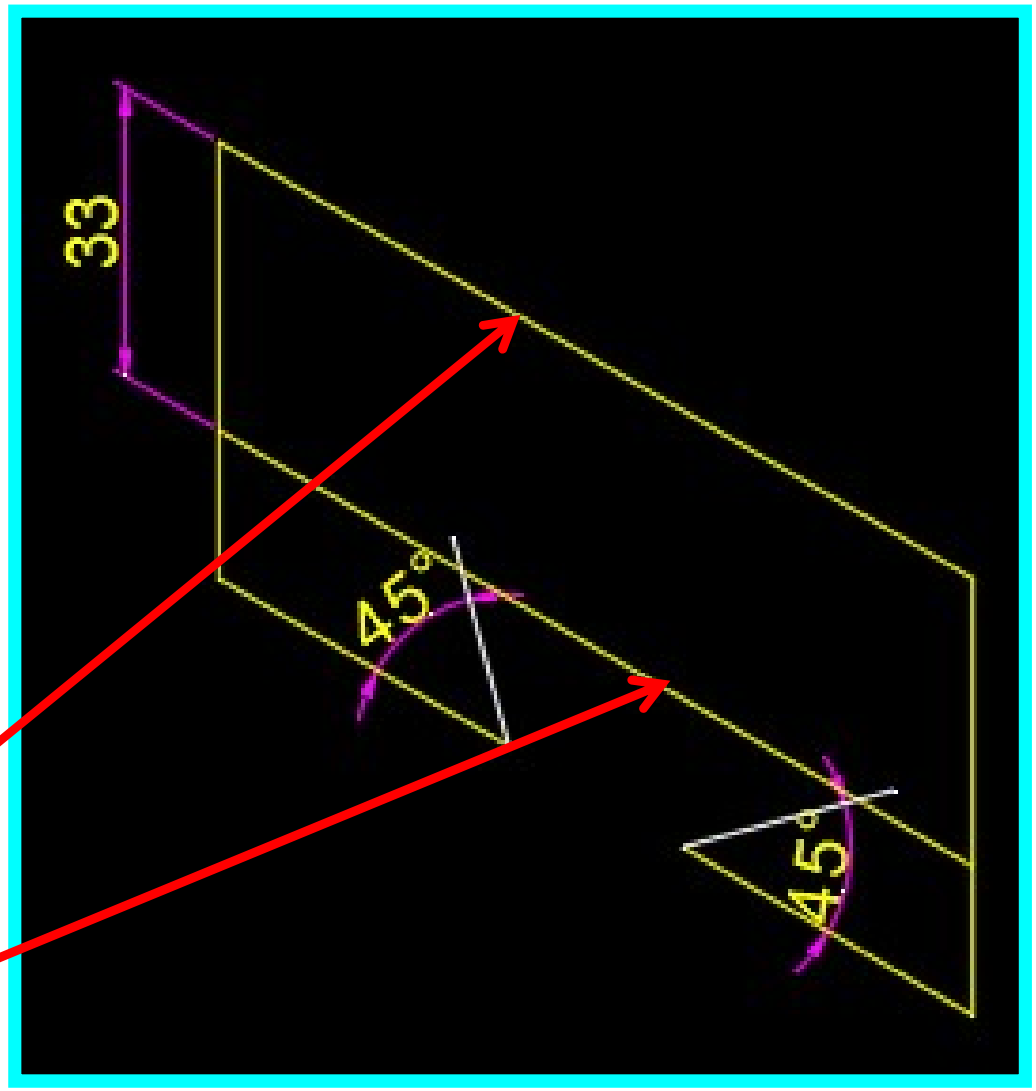




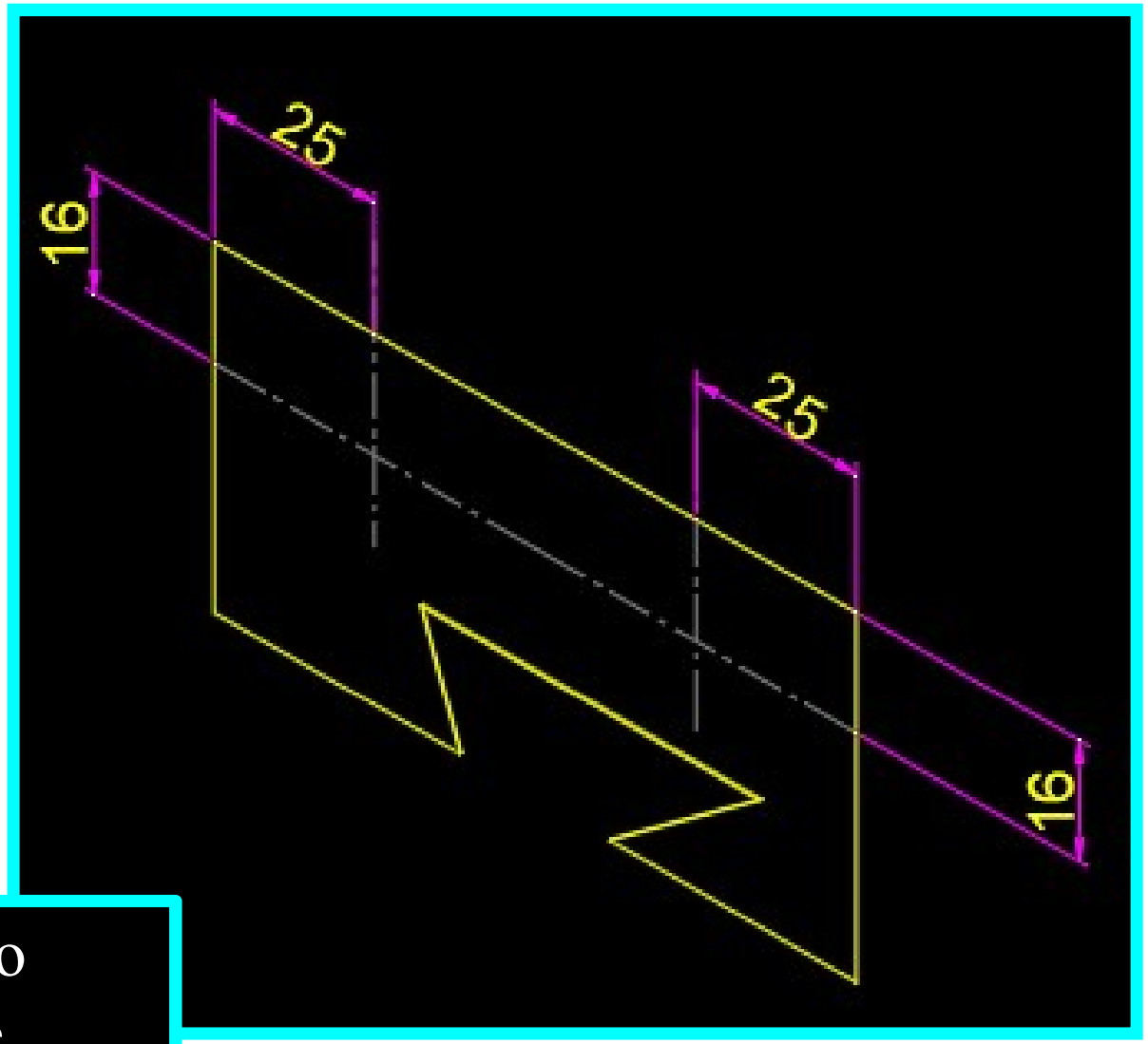
- Draw two **Vertical** line at the required ends & measure the angle as shown in the figure

- Use **ROTATE** command & Rotate the vertical line **1** for **15º** & vertical line **2** for **-75º**





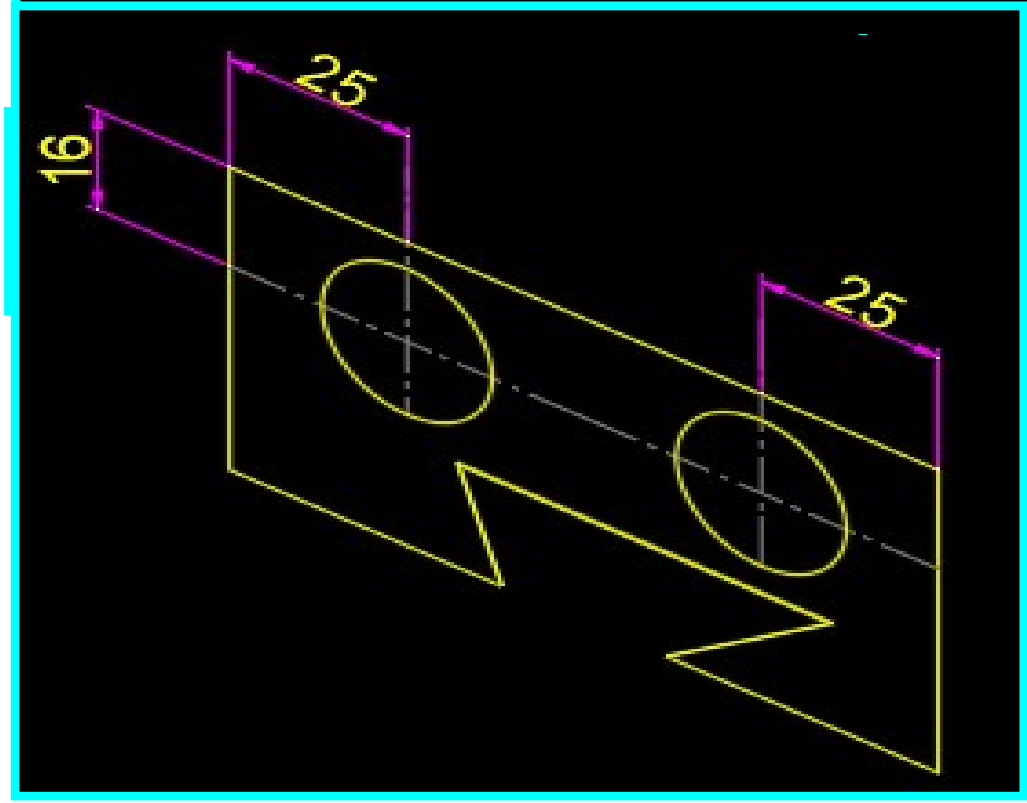
- Use **COPY** command **Copy** the Top side line & Drag down (Ortho on) for **33** mm
- Use **Trim** Command to remove the unwanted lines.

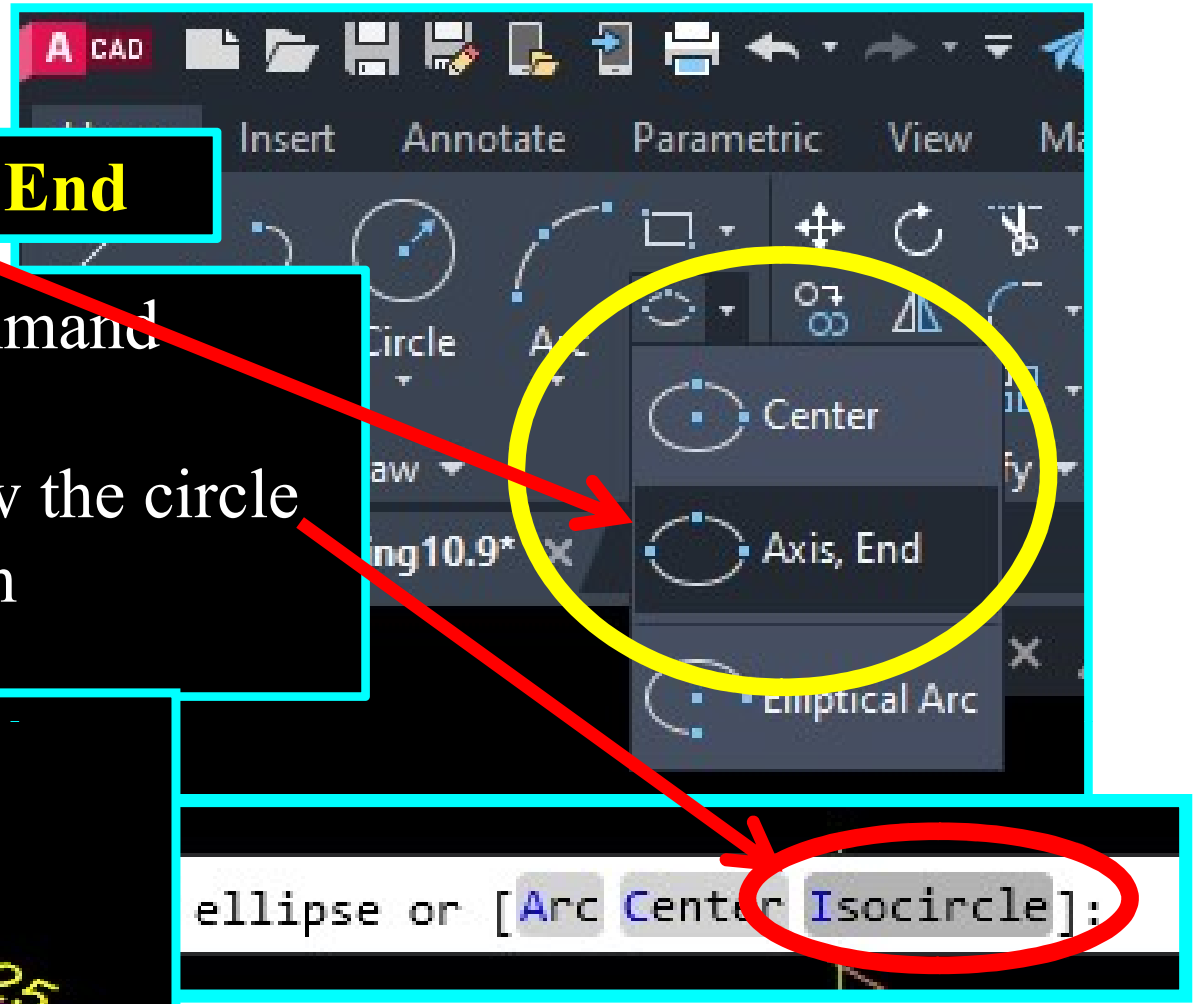


- Use **COPY** command to locate the centers of the circles as per dimensions

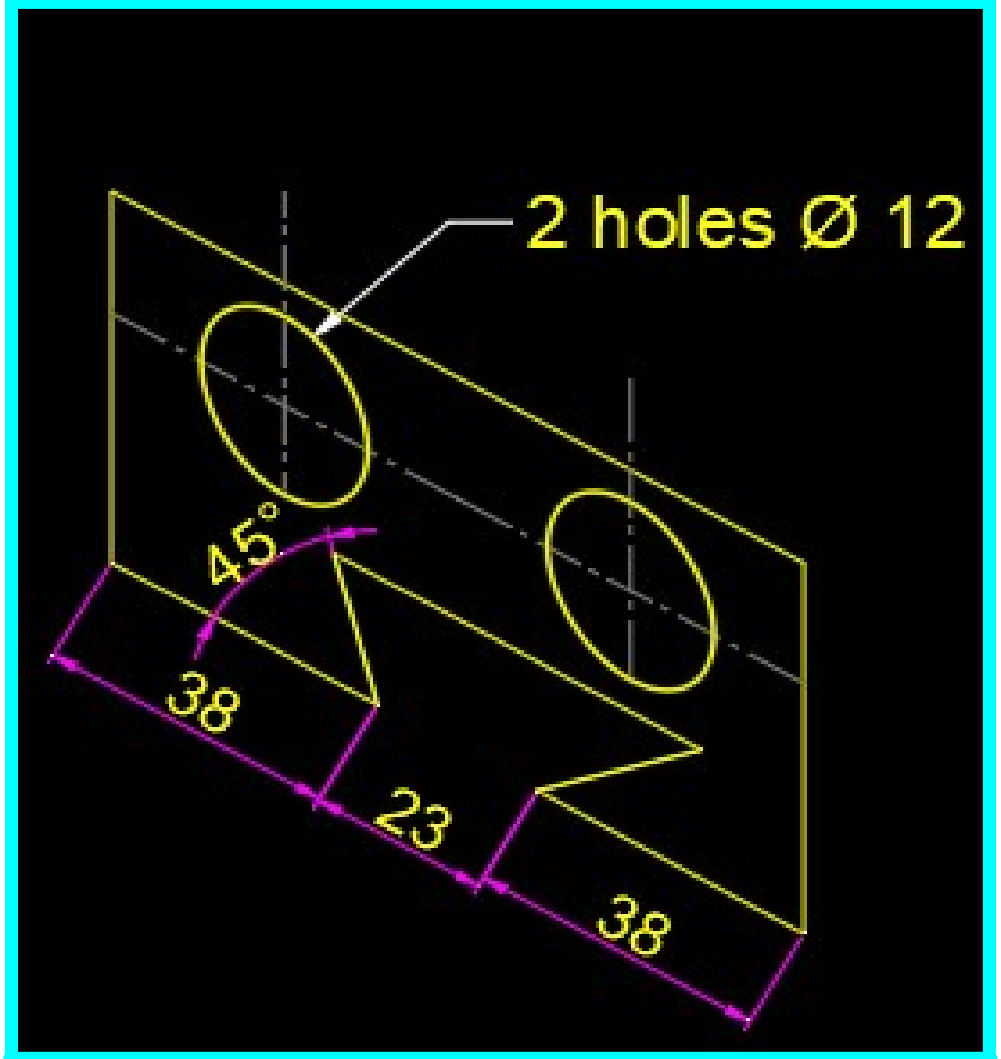
- Select Ellipse **Axis, End**

- Select **Isocircle** from command prompt window
- Specify the **center** & draw the circle for the required dimension

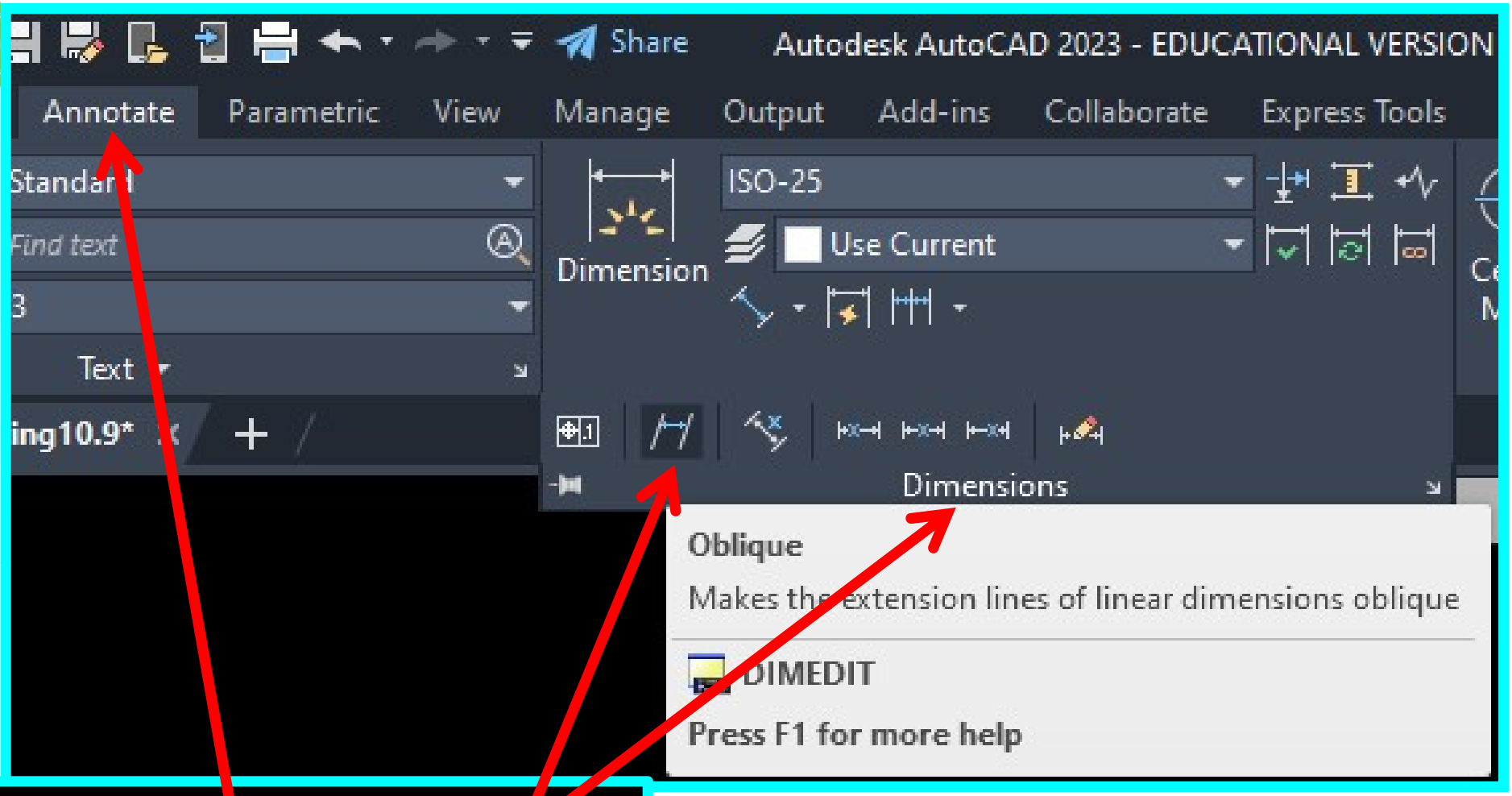




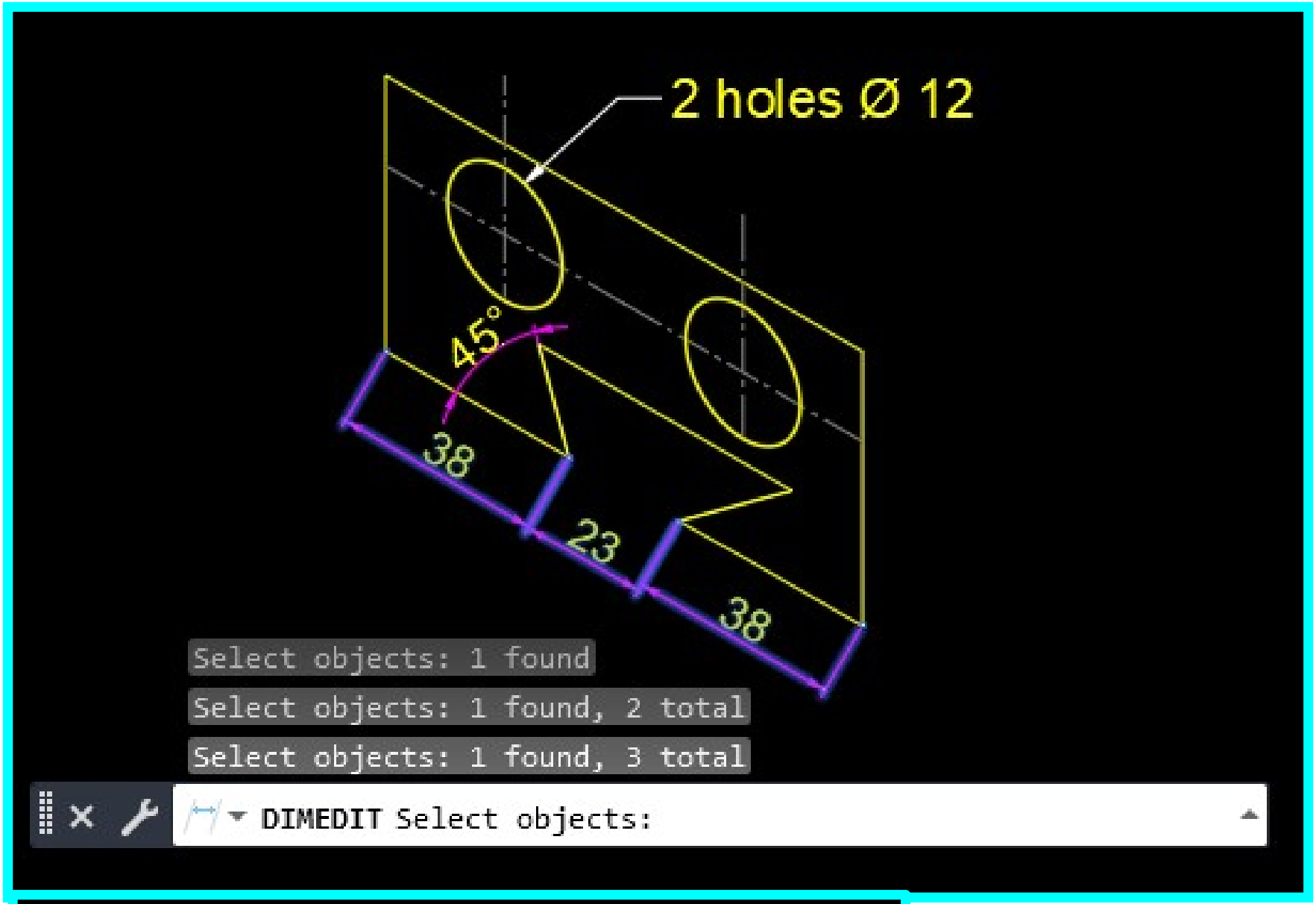
➢ Dimensioning in Isoplane



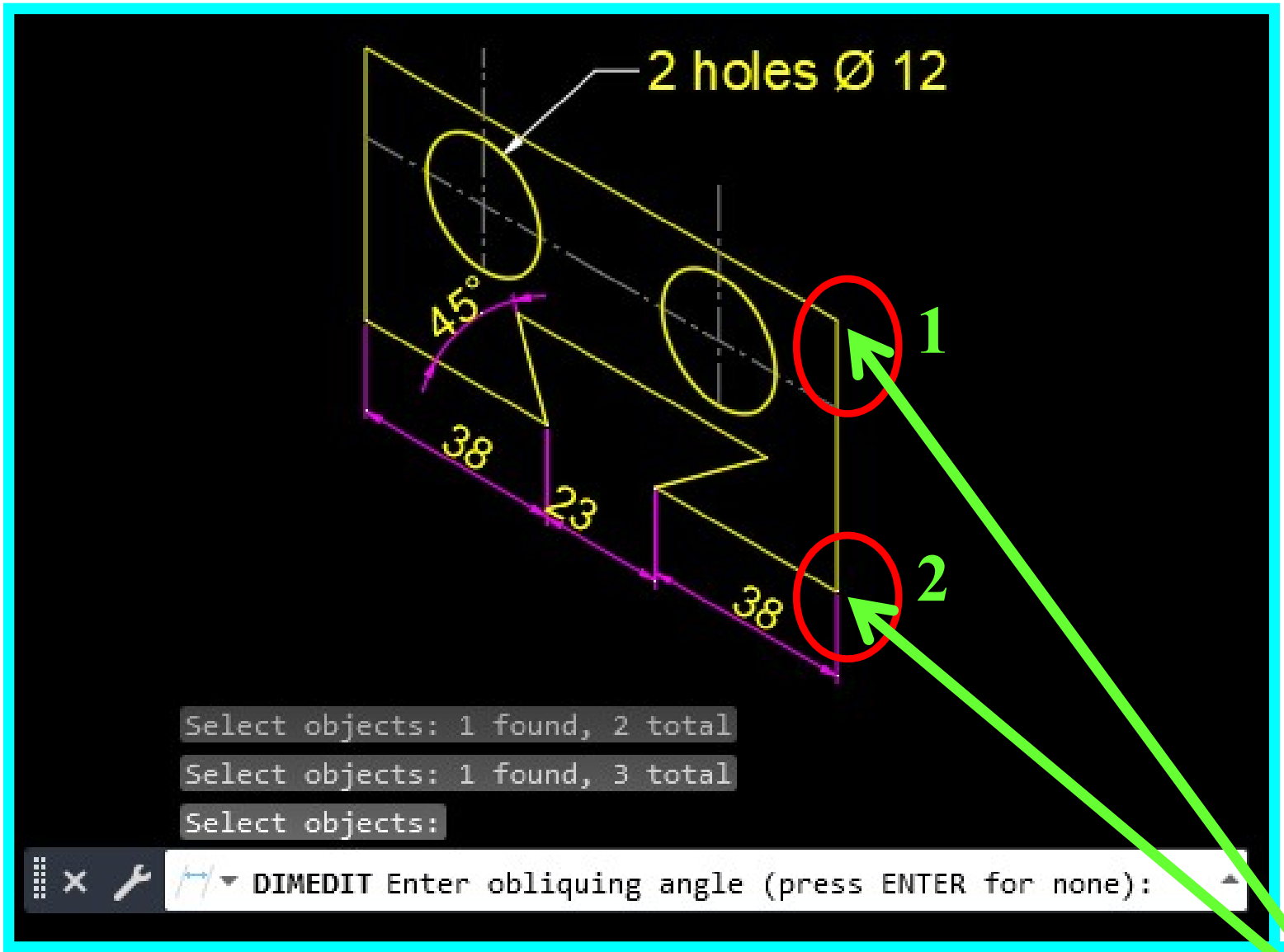
➢ Use **ALIGNED** Dimension & mark all the dimensions



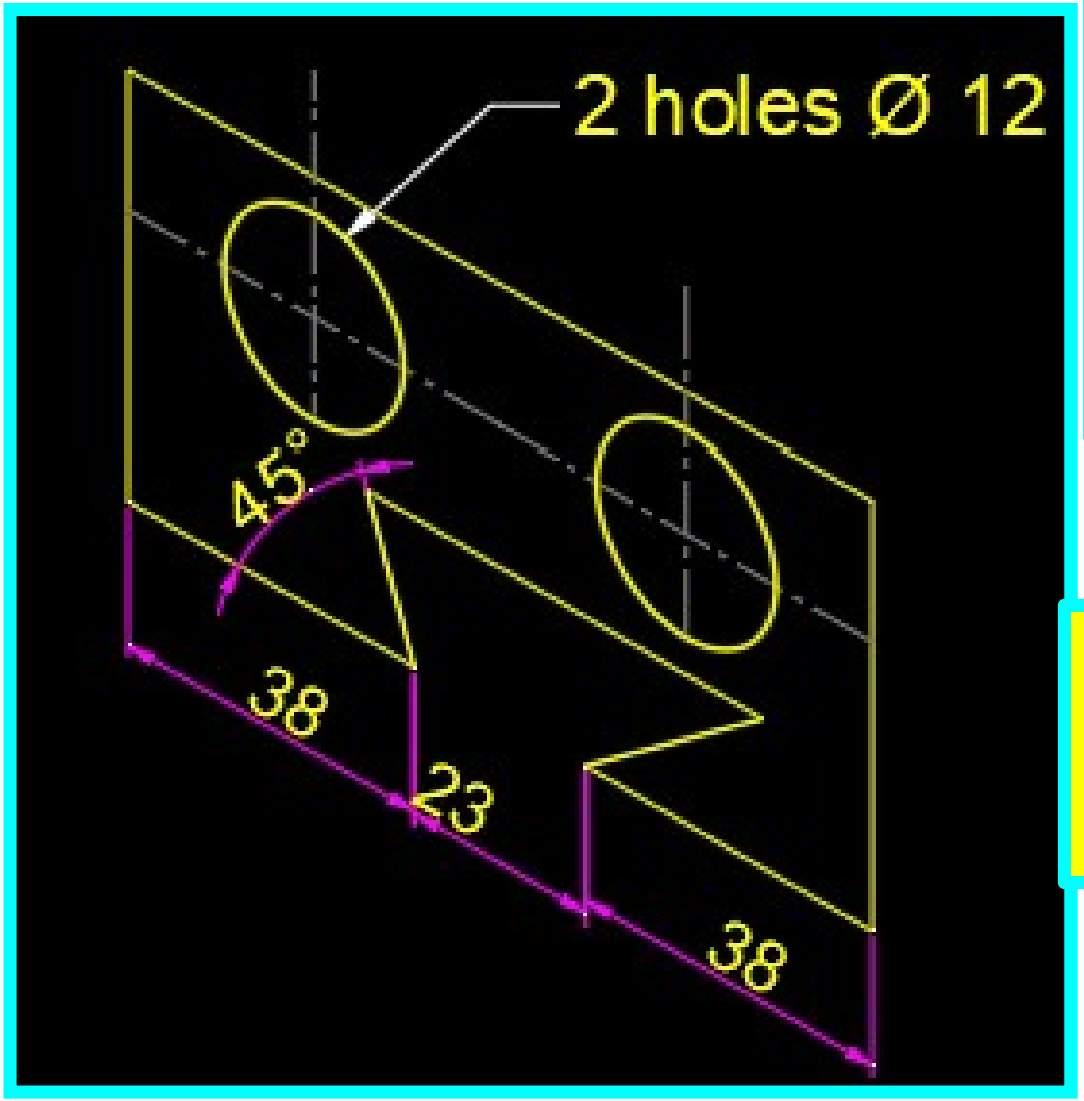
- Select **Annotate,**
  Click on **Dimensions**
  Click on **Oblique**

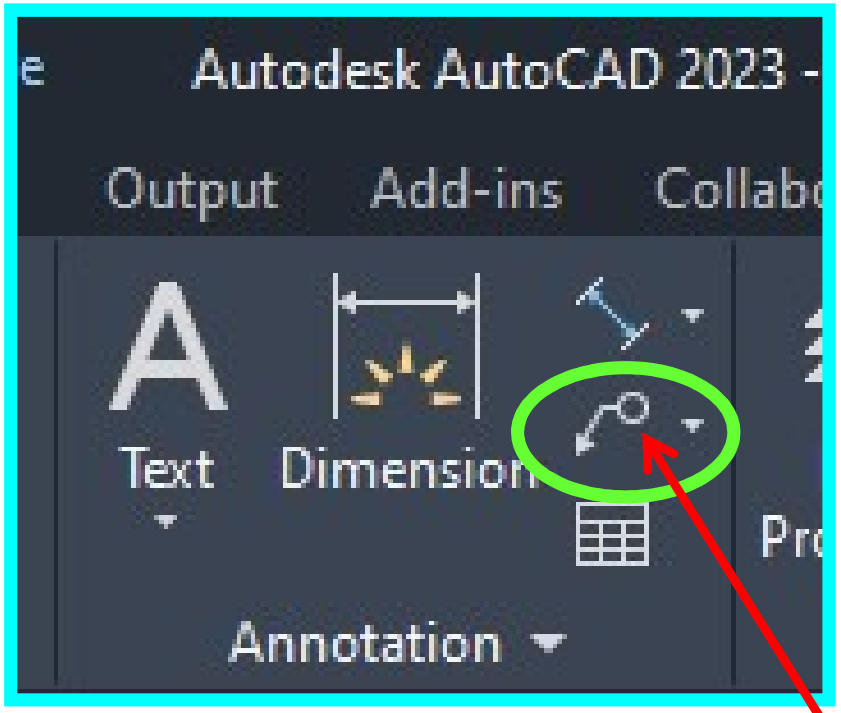


➢ Select the **3** dimensions & press Enter

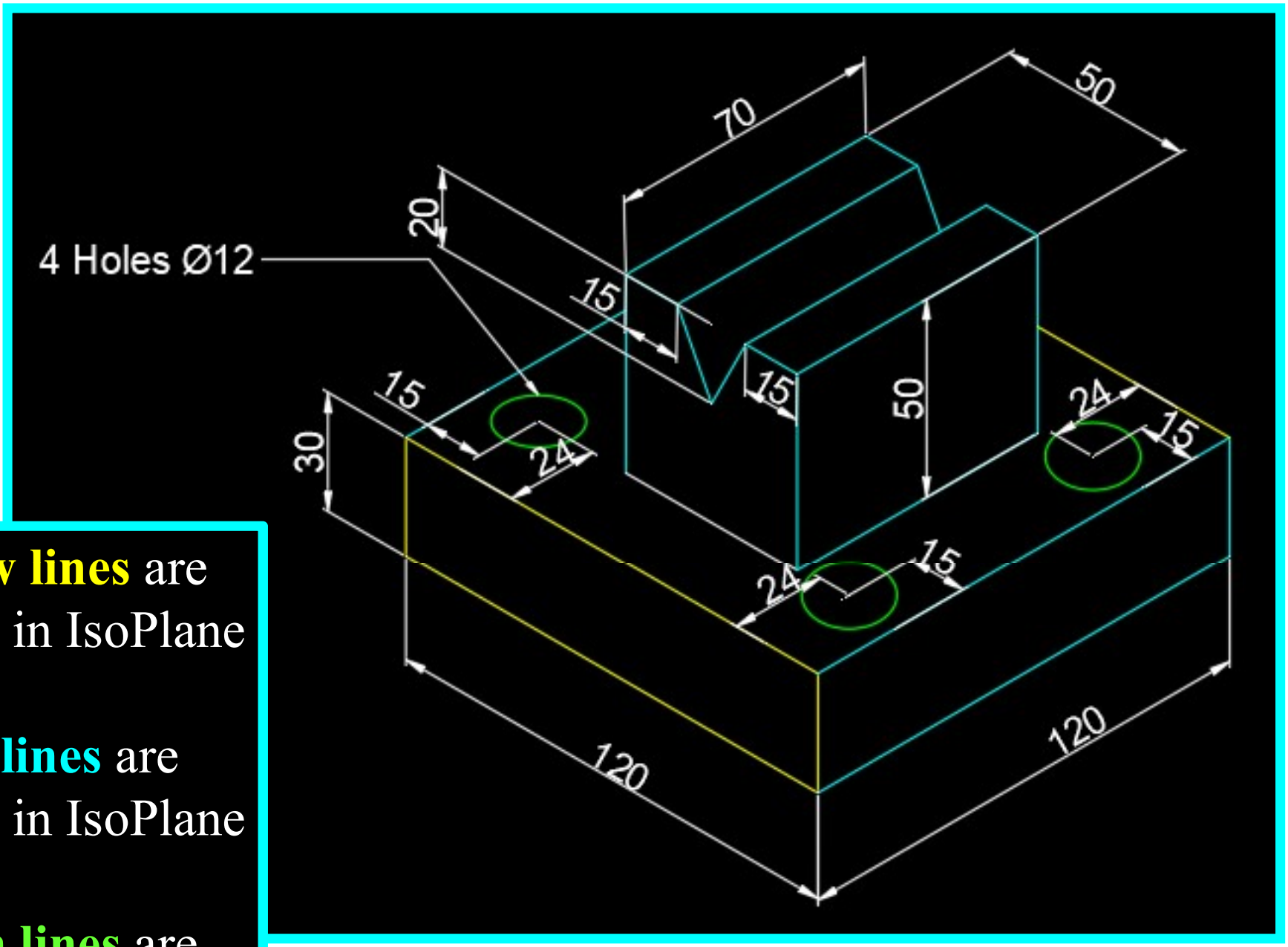


➢ Instead of defining the **Oblique angle**
show the Reference of the vertical line in order

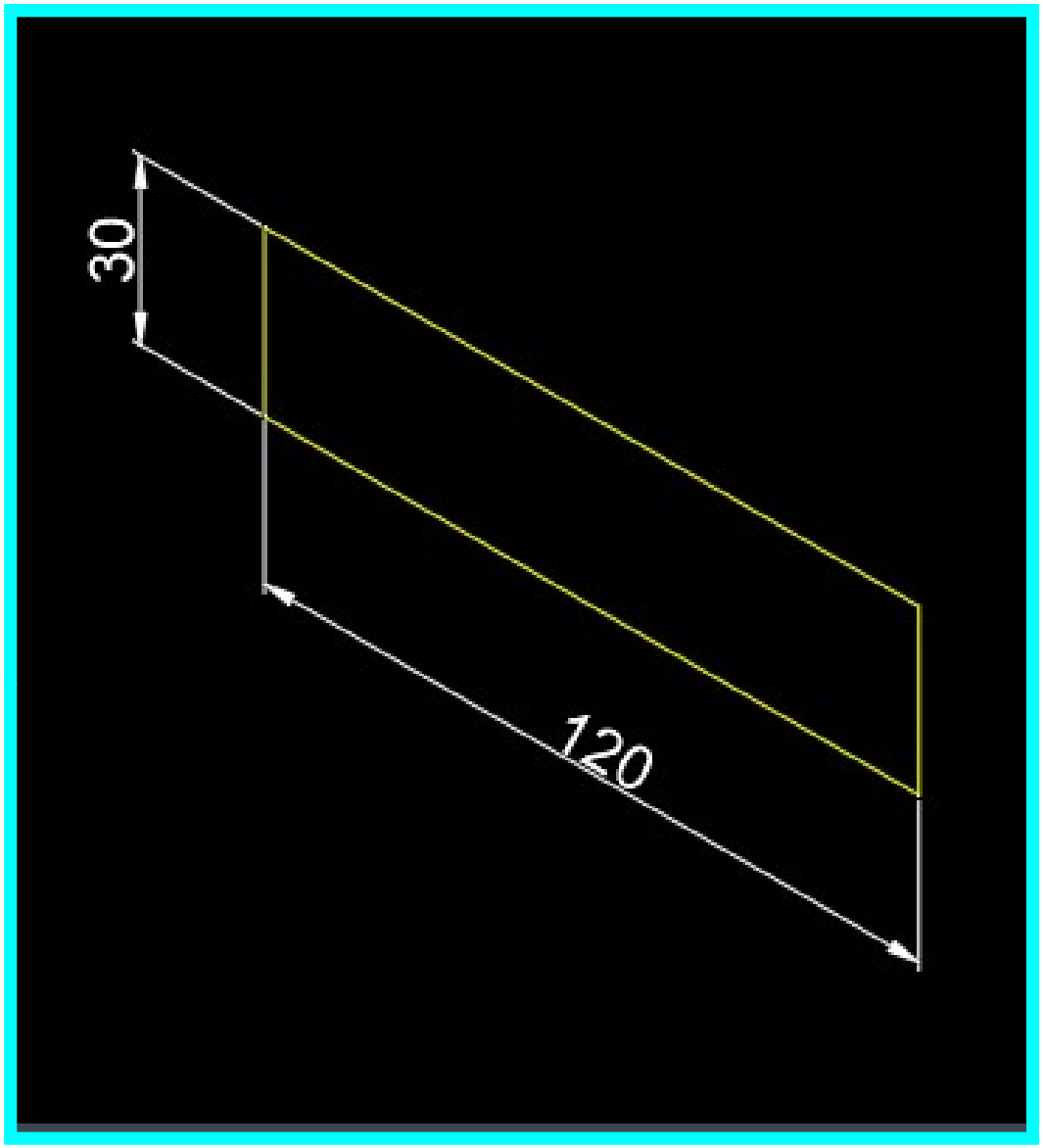




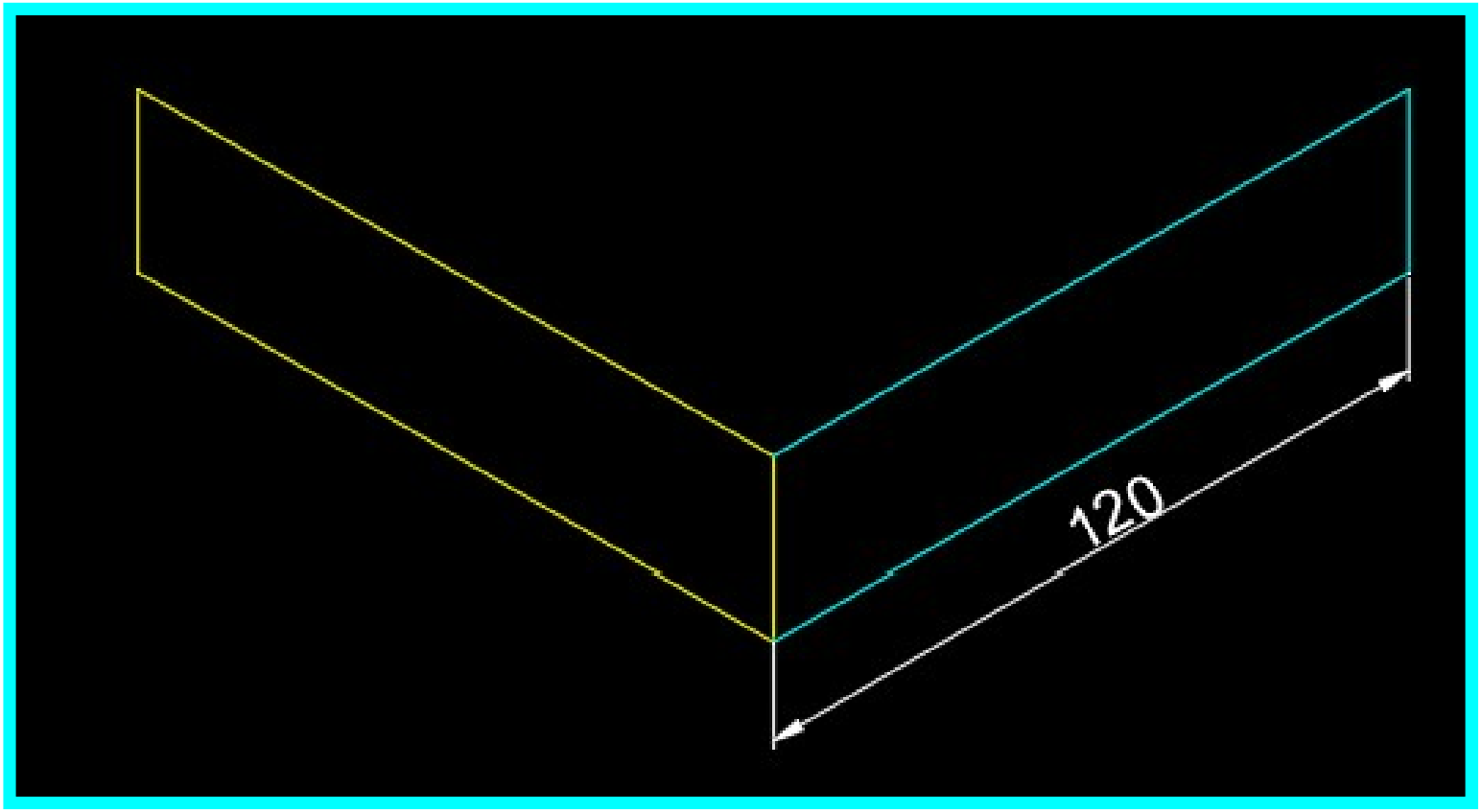
- Select **Leader dimensions** to mark the dimensions for **circles** as shown



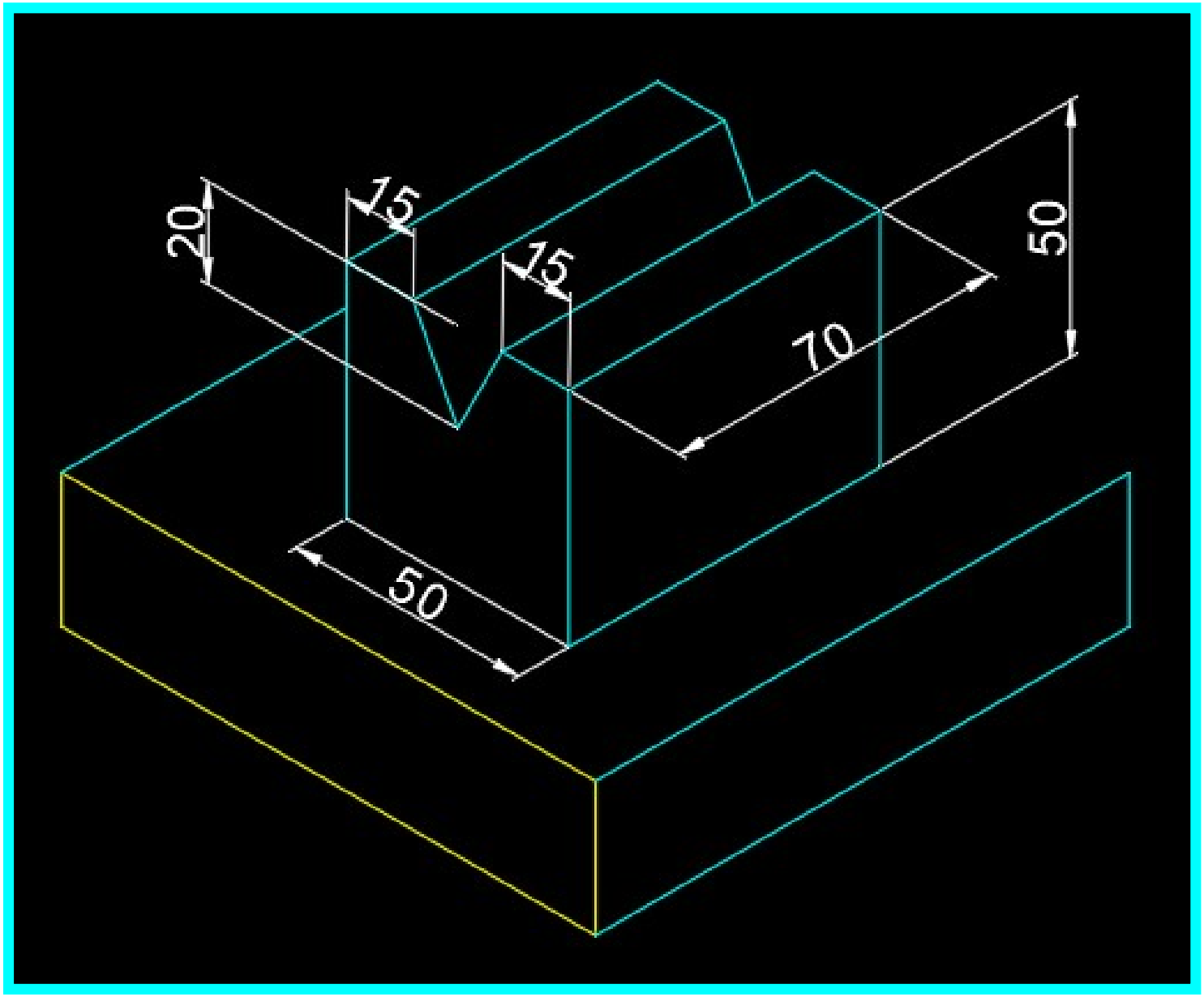
- **Yellow lines** are drawn in IsoPlane **Left**
- **Cyan lines** are drawn in IsoPlane **Right**
- **Green lines** are drawn in IsoPlane **Top**



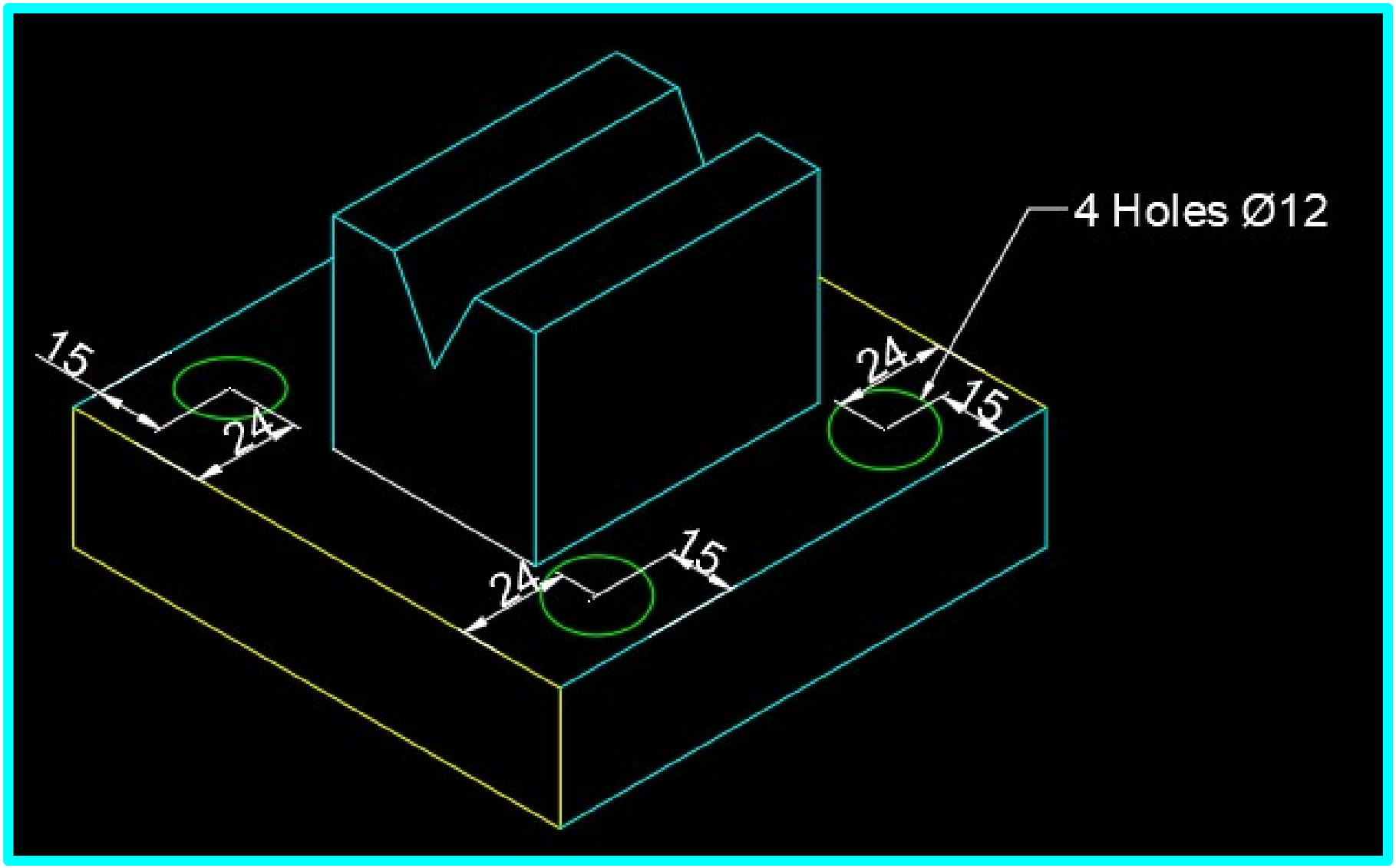
➢ Select IsoPlane **Left** & complete the sketch as per dimensions



➢ Select IsoPlane **Right** & complete the sketch as per dimensions

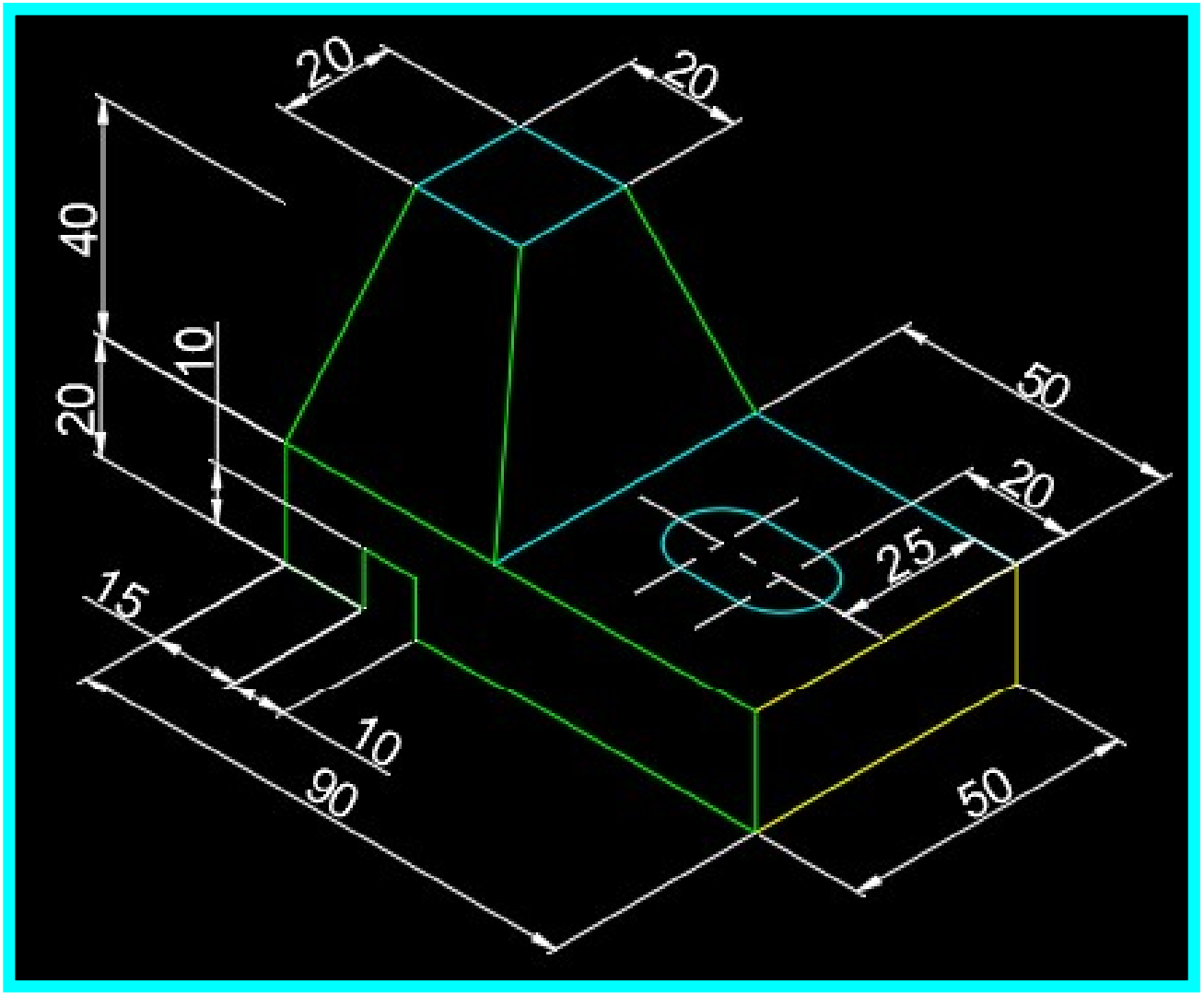


➢ Select IsoPlane **Right** & complete the sketch as per dimensions

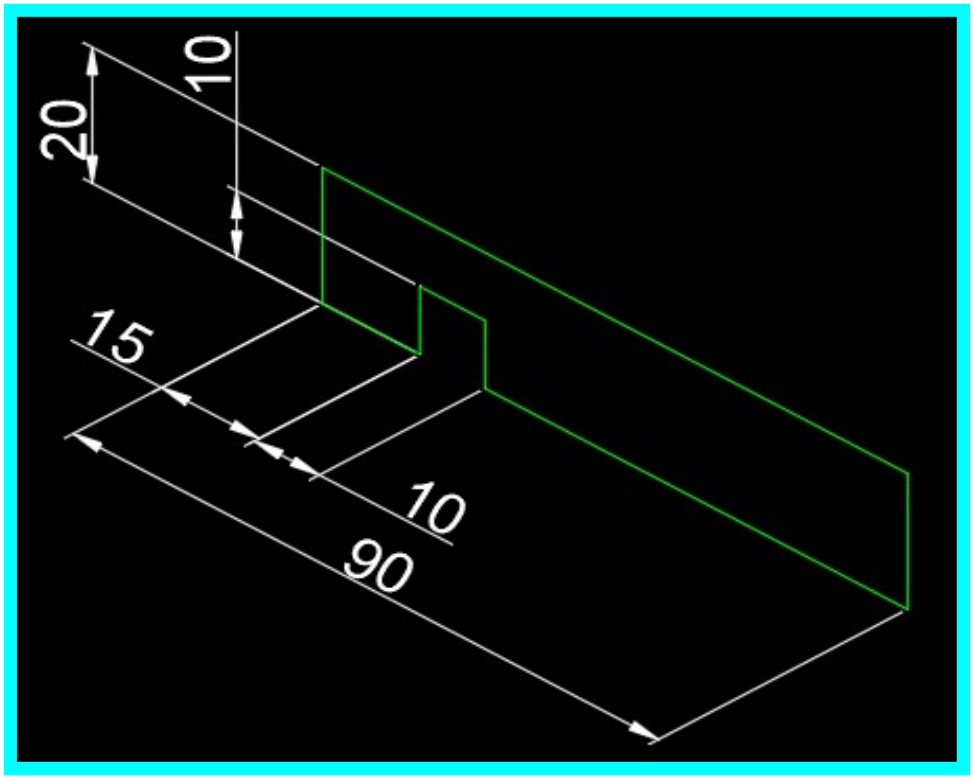


➢ Select IsoPlane **Top** & complete the sketch as per dimensions

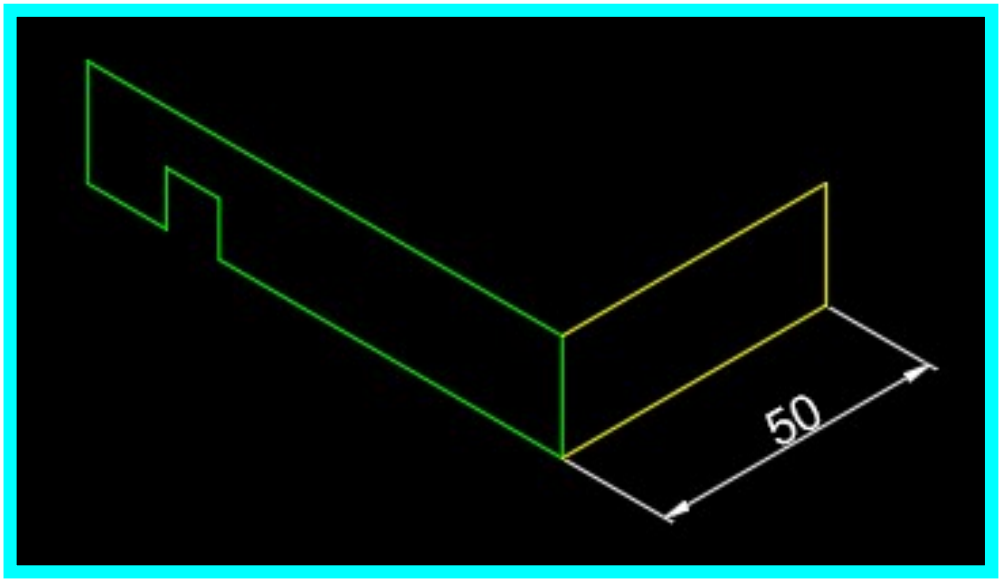
- **Green lines** are drawn in IsoPlane **Left**
- **Yellow lines** are drawn in IsoPlane **Right**
- **Cyan lines** are drawn in IsoPlane **Top**



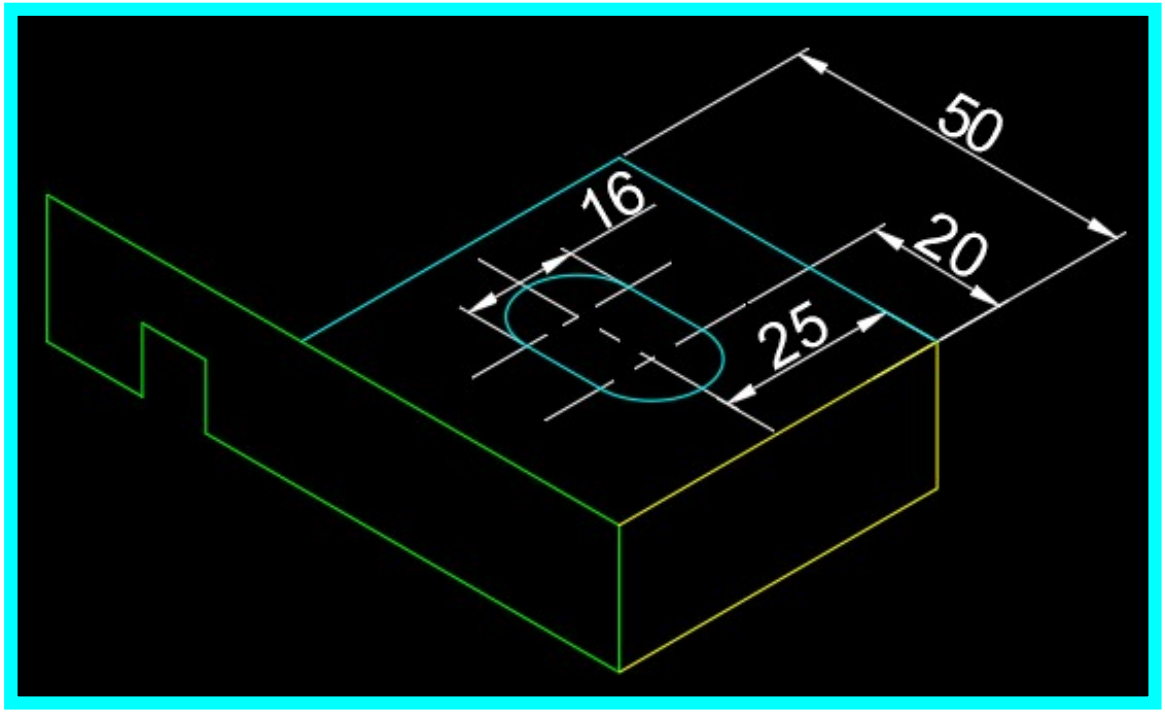
- Select IsoPlane **Left** & complete the sketch as per dimensions



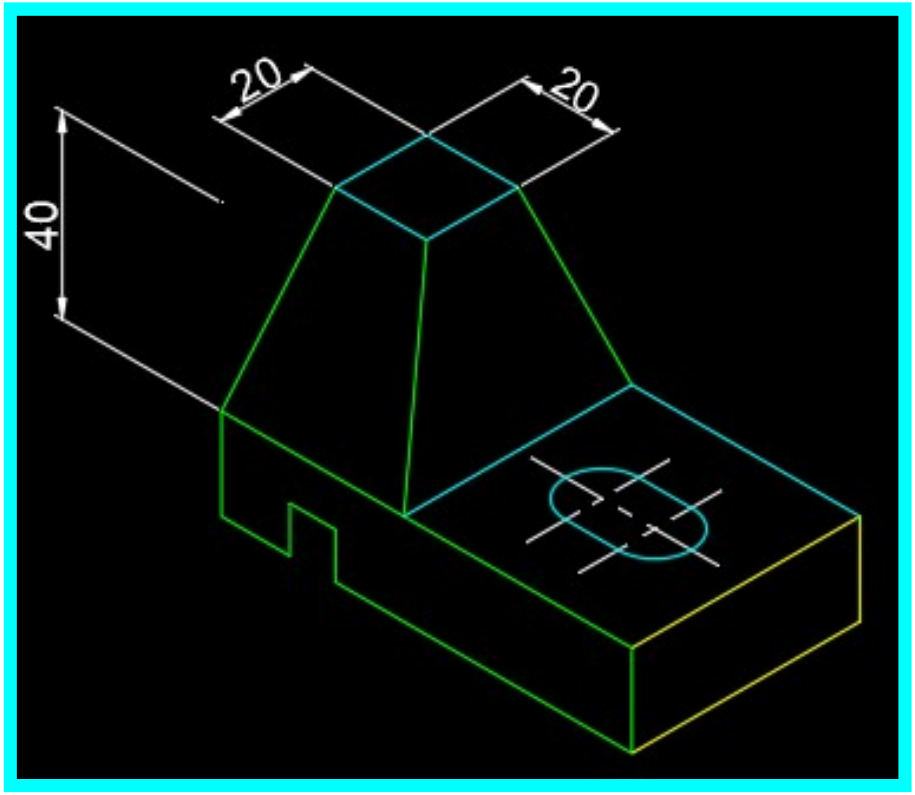
- Select IsoPlane **Right** & complete the sketch as per dimensions



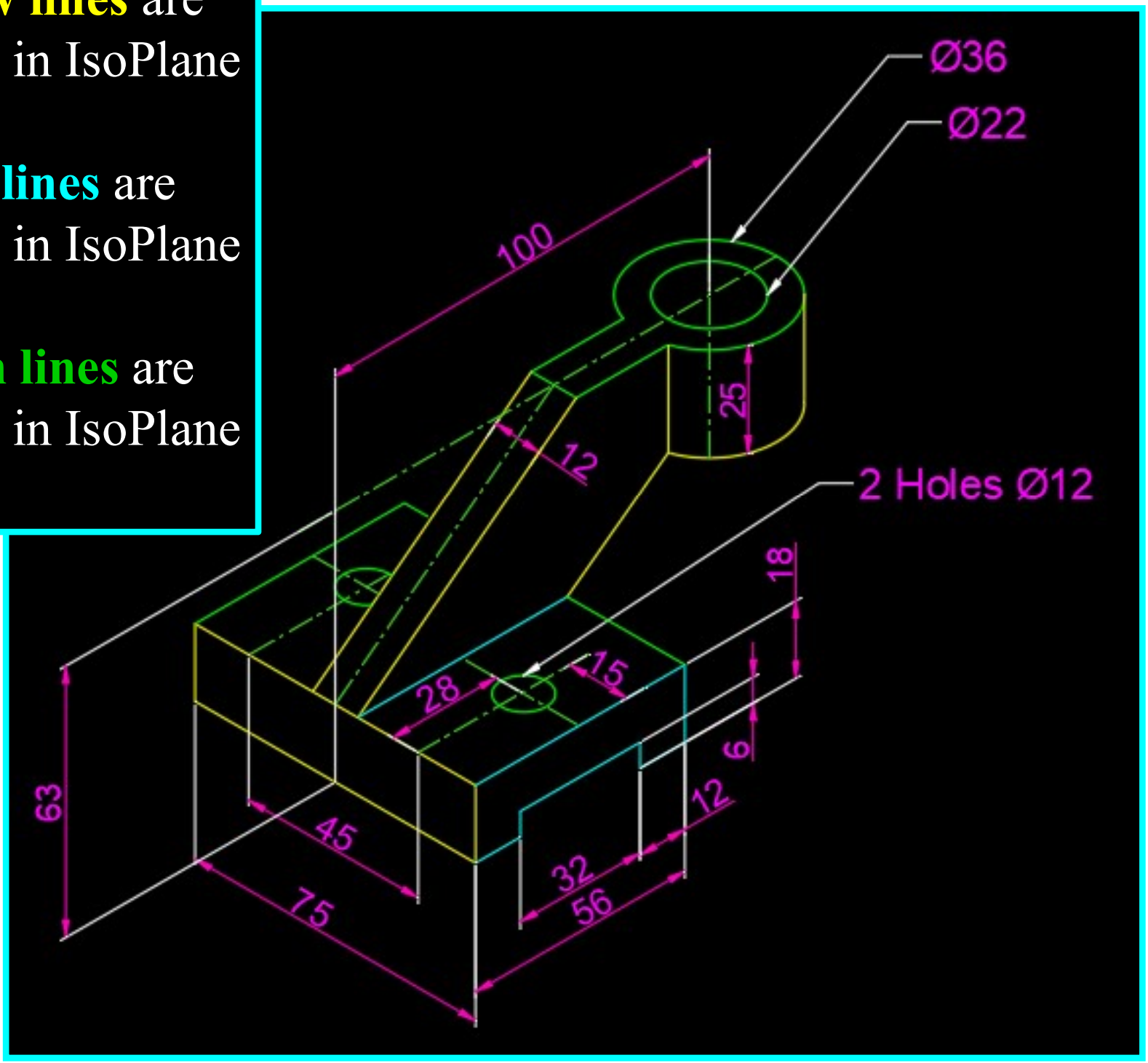
- Select IsoPlane **Top** & complete the sketch as per dimensions

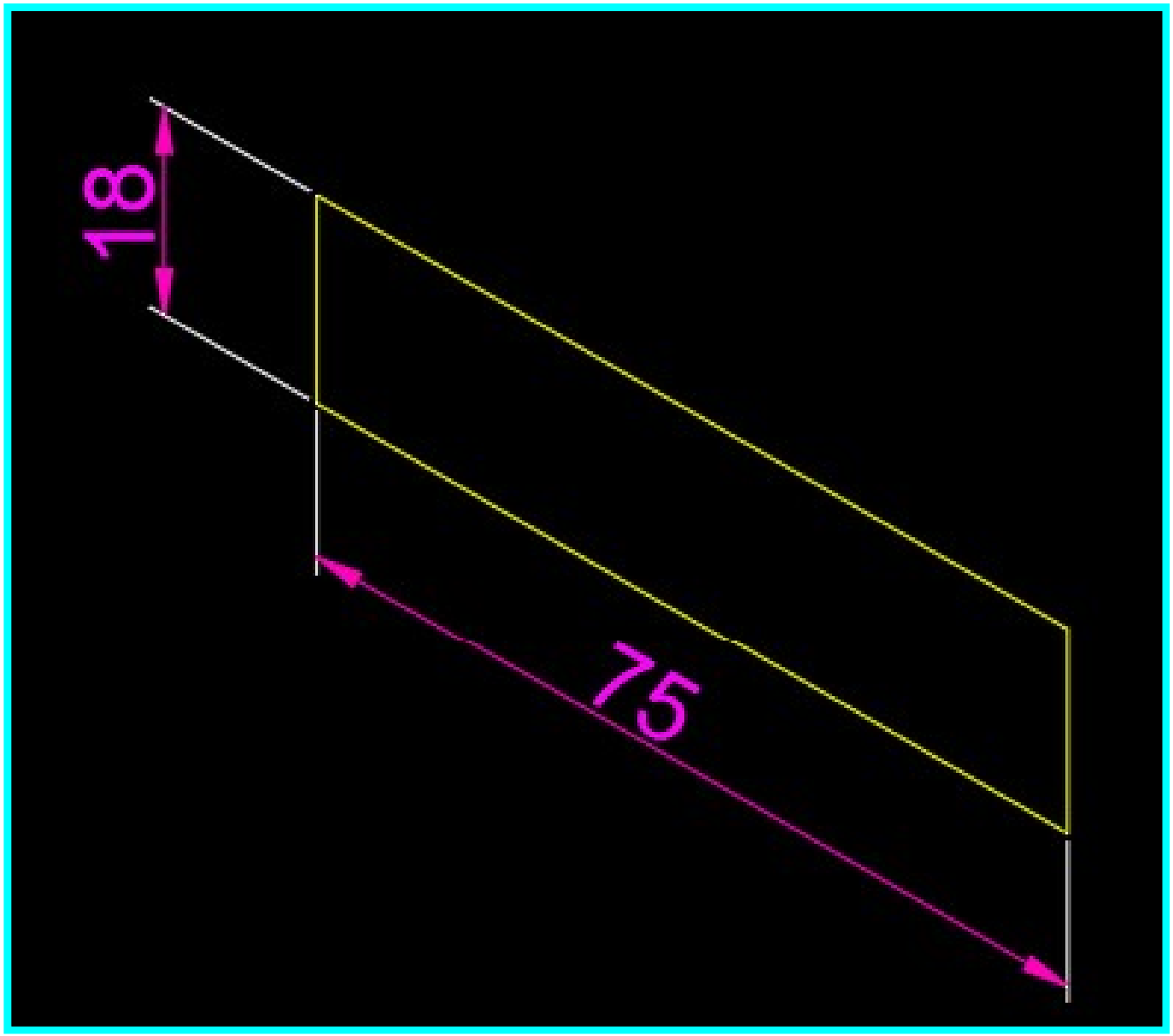


- Select IsoPlane **Top** & IsoPlane **Left** complete the sketch as per dimensions

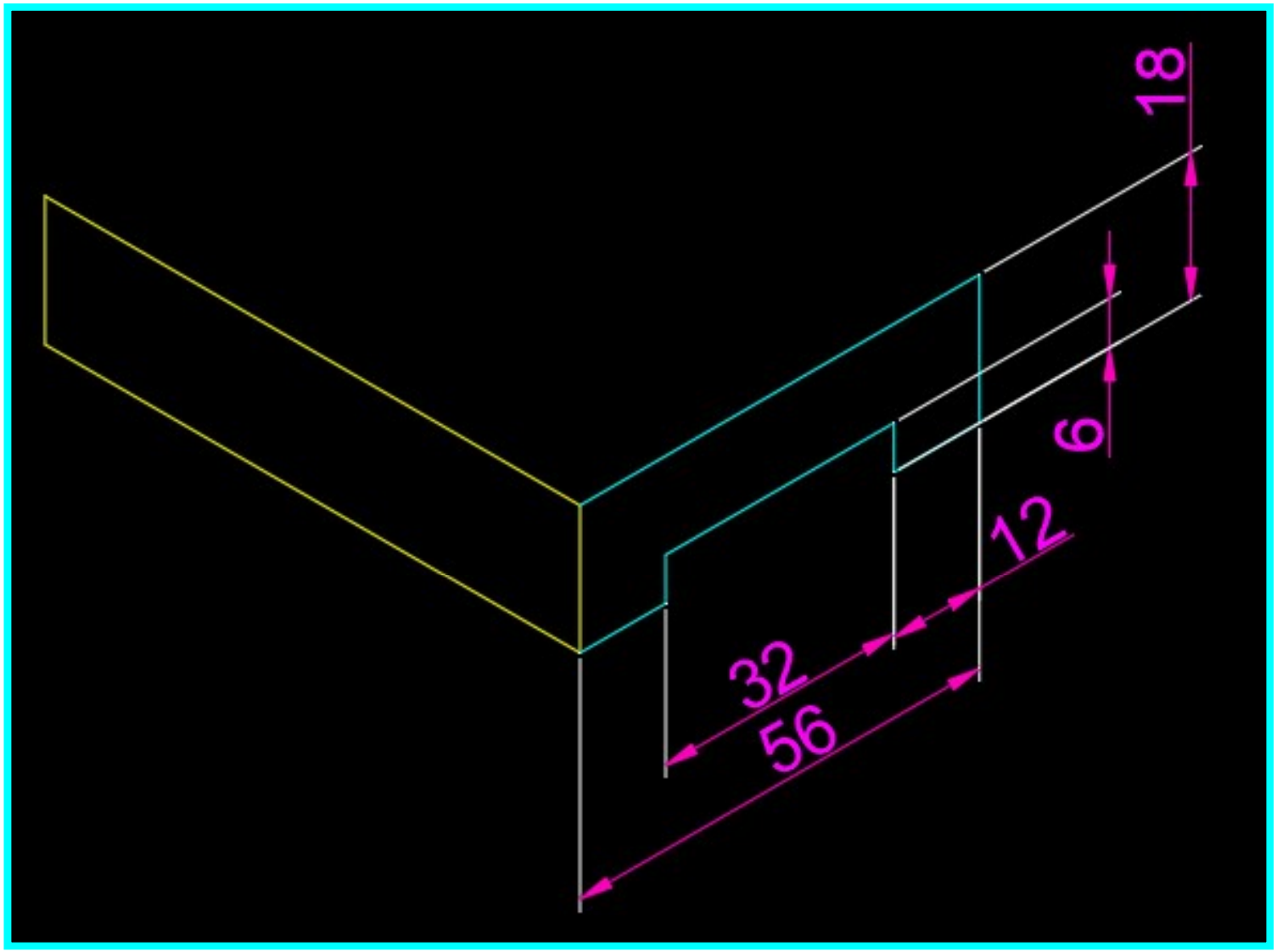


- **Yellow lines** are drawn in IsoPlane **Left**
- **Cyan lines** are drawn in IsoPlane **Right**
- **Green lines** are drawn in IsoPlane **Top**

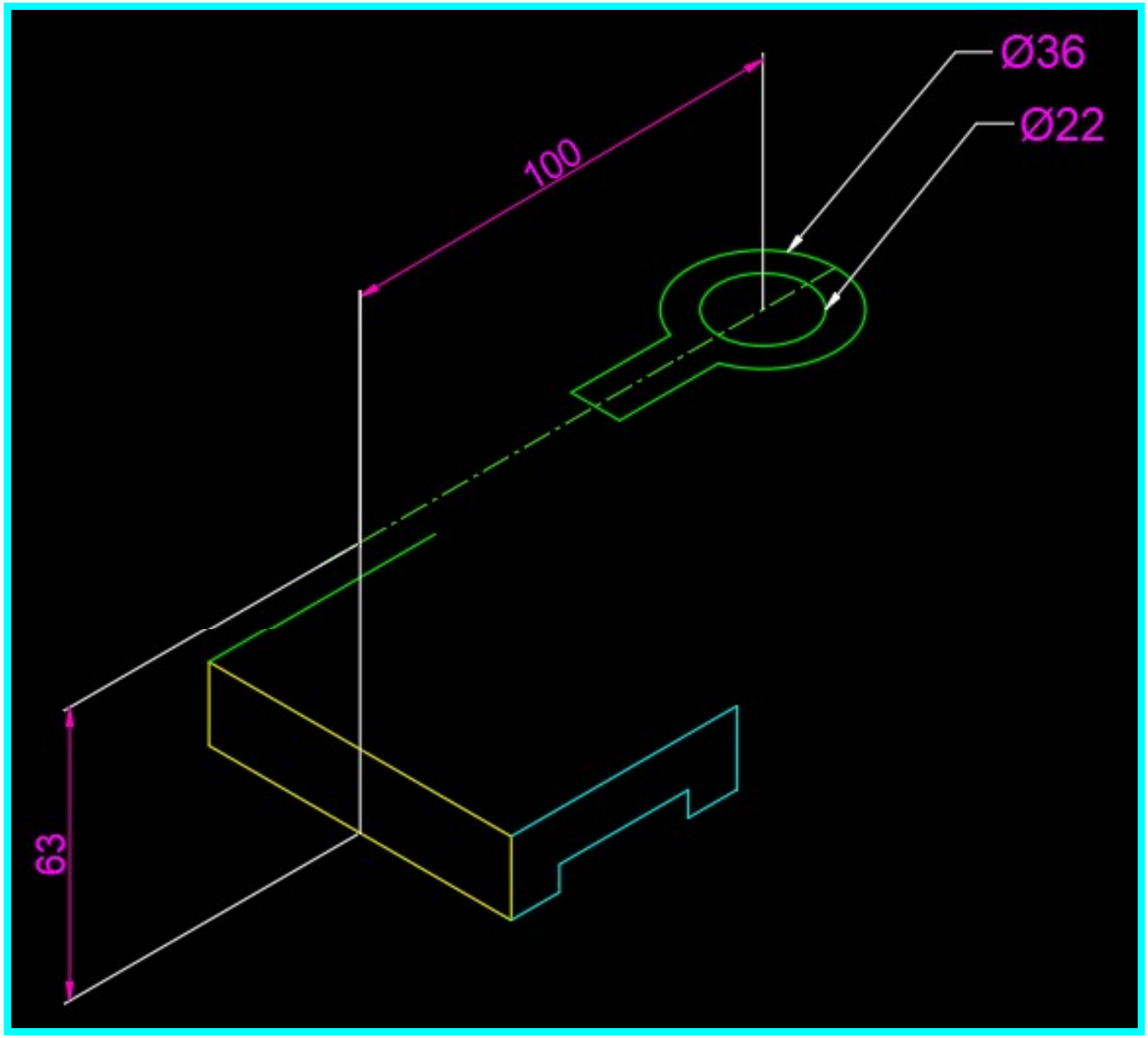




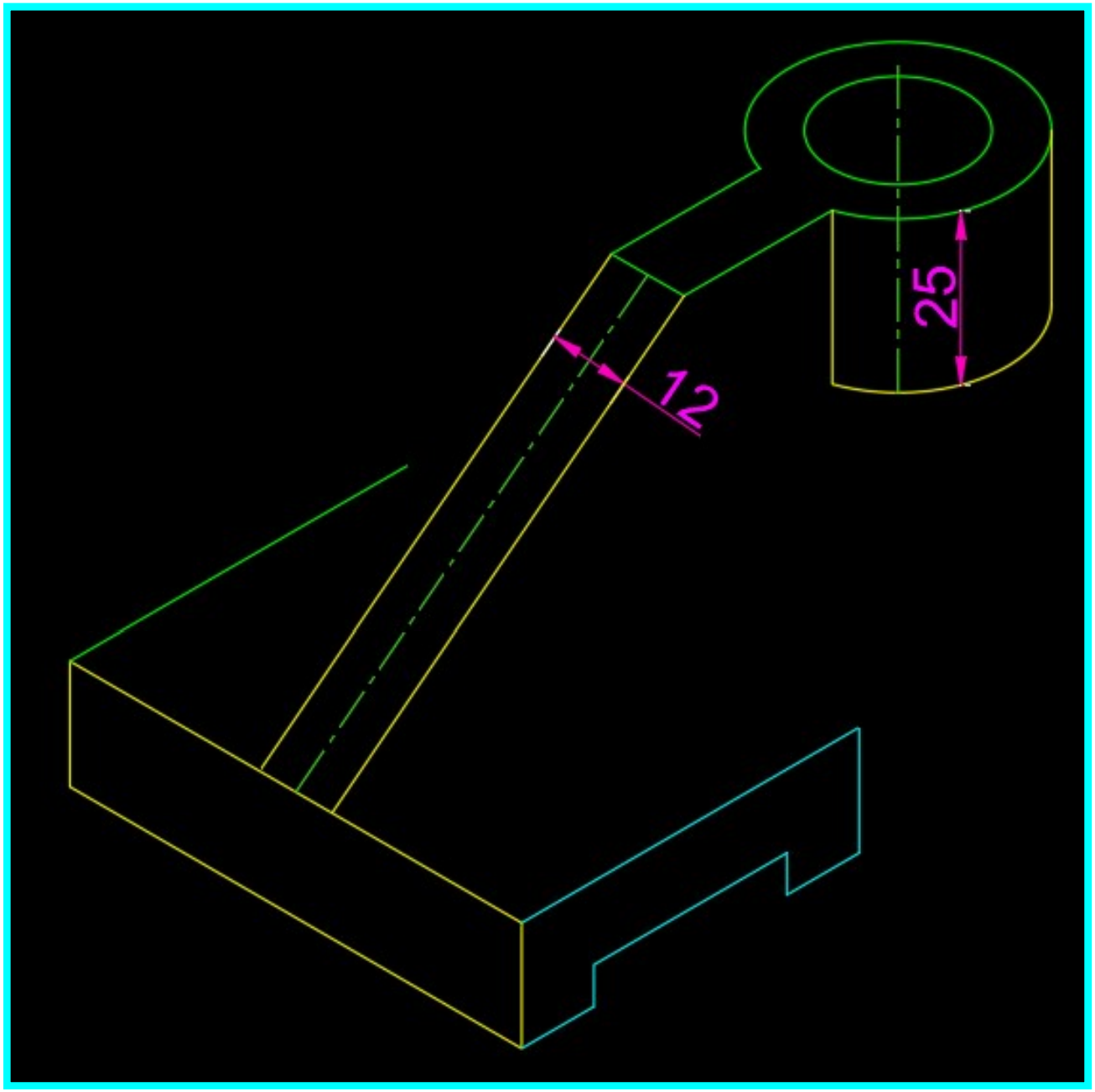
➢ Select IsoPlane **Left** & complete the sketch as per dimensions



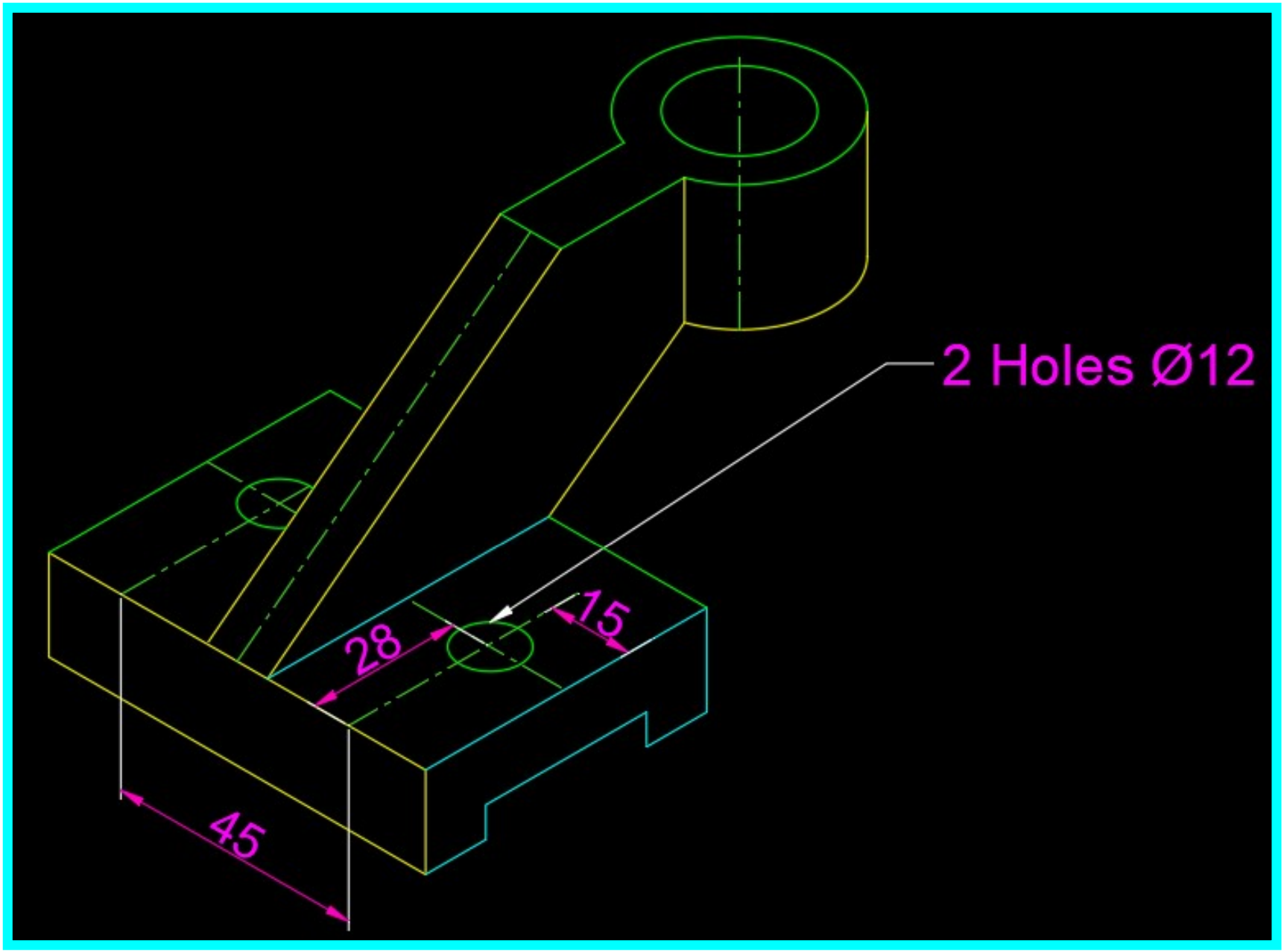
➢ Select IsoPlane **Right** & complete the sketch as per dimensions



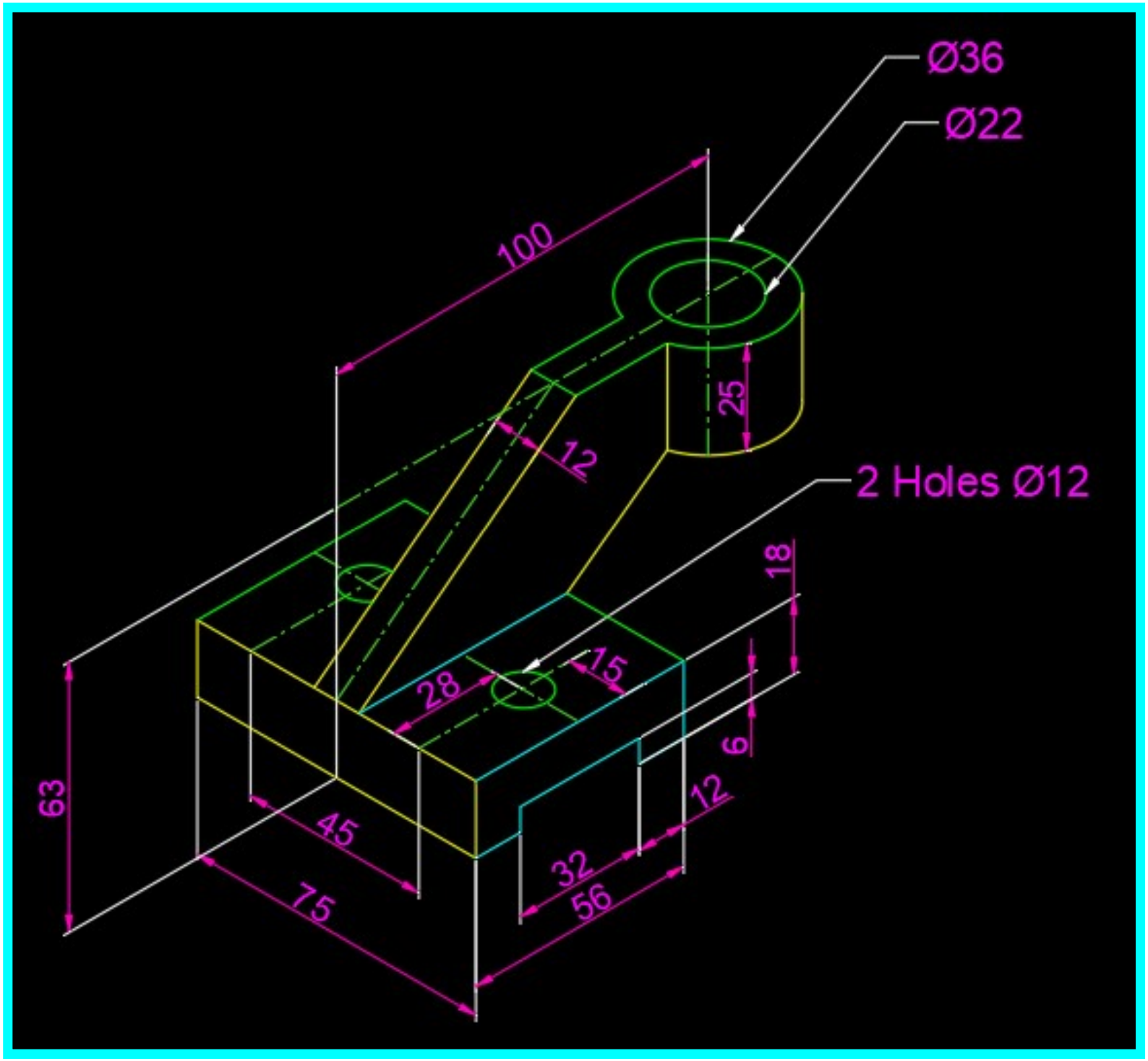
➢ Select IsoPlane **Top** & complete the sketch as per dimensions



- Select IsoPlane **Left** & complete the sketch as per dimensions

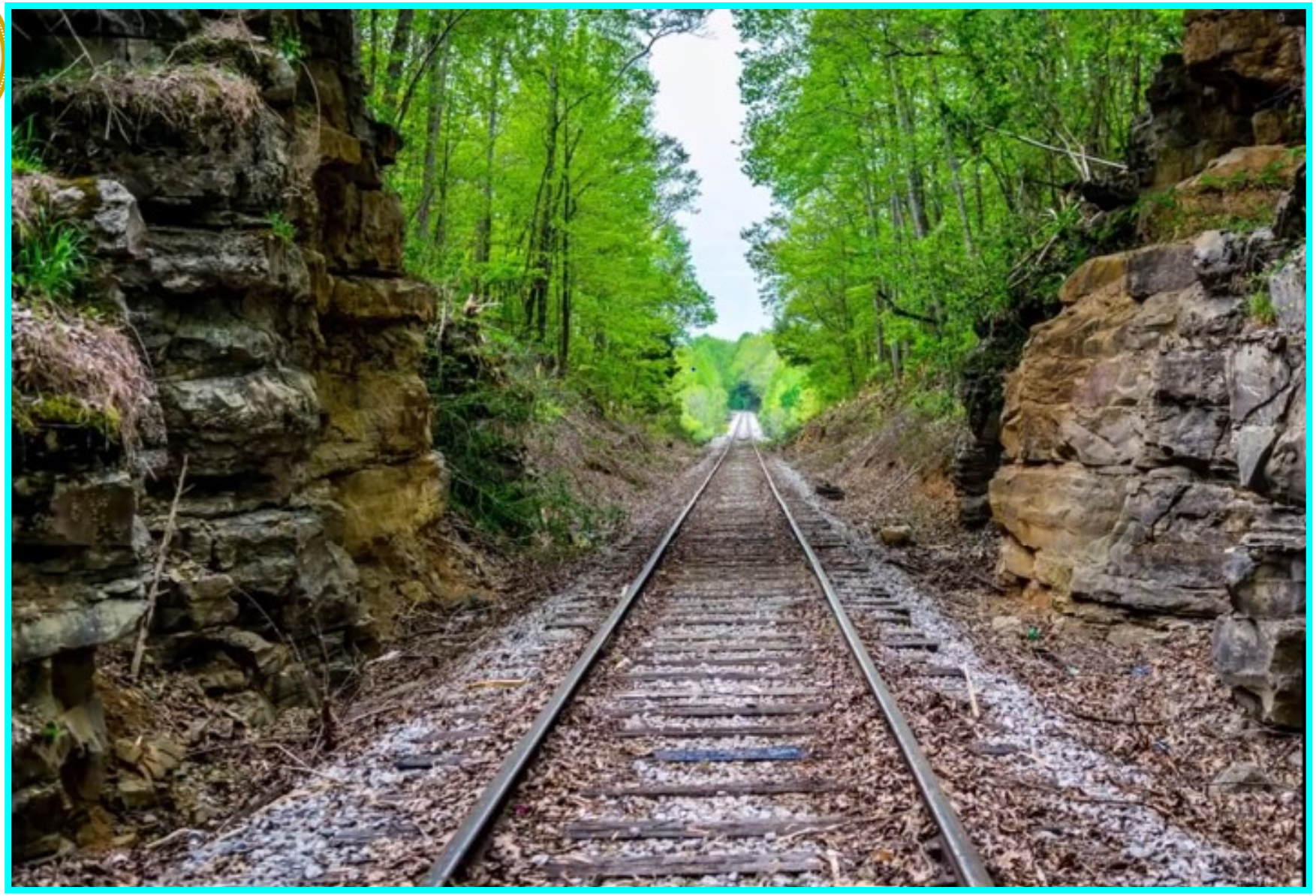


➢ Select IsoPlane **Top** & complete the sketch as per dimensions


Ø36
Ø22
100
25
12
2 Holes Ø12
18
15
28
6
12
63
45
32
75
56

Perspective Projections

- The Perspective Projections are used to define the **LARGER COMPONENTS** in most of the Civil & Architectural Engineering Fields.
- Visual rays from the eye to the object converge to a point.
- Sample photographic images are presented for better understanding about **Perspective Projections.**

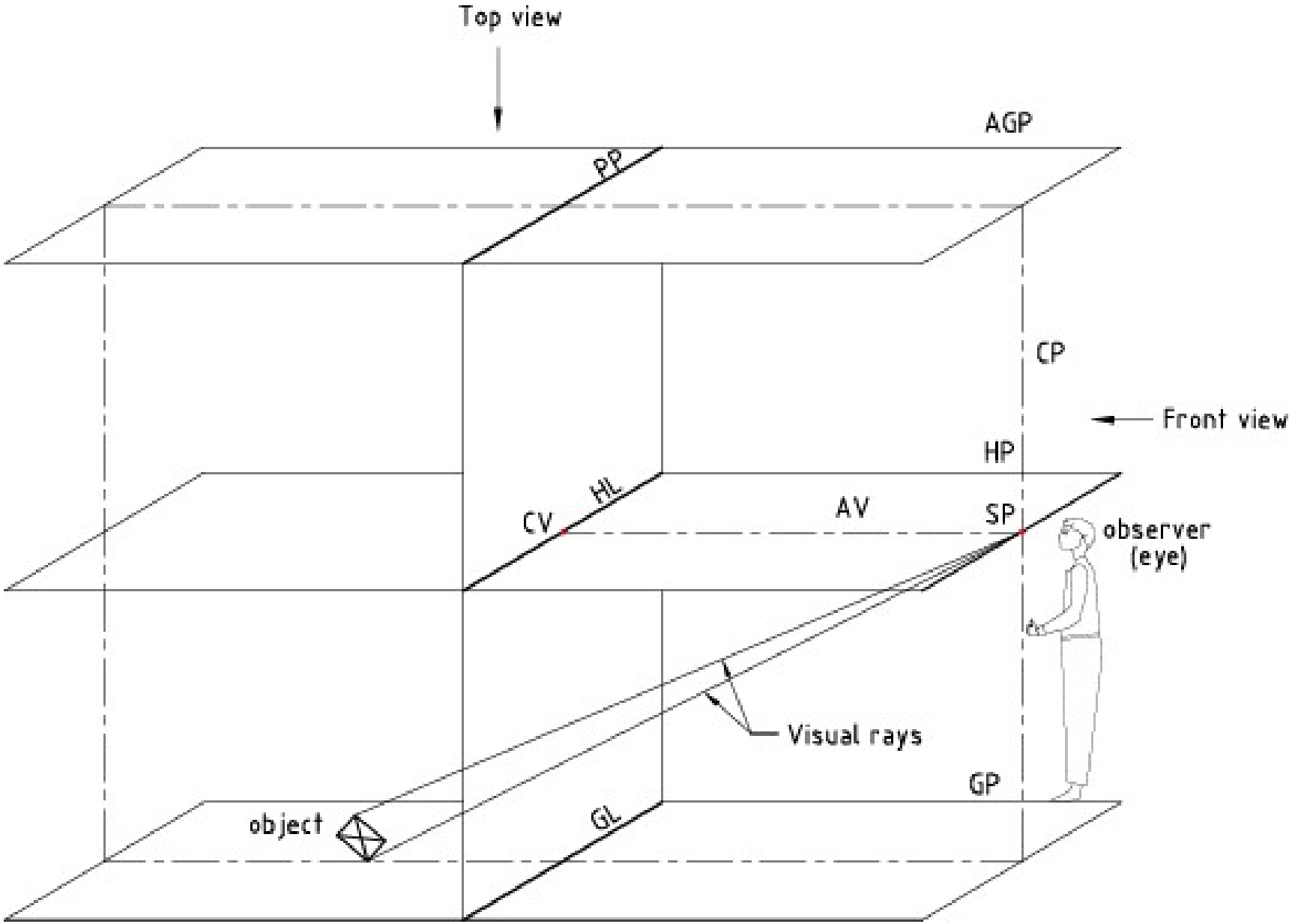


- A Photographic image of a Railway Track which is converging at a point

- A Photographic image of a Pathway with Canopy which is converging at a point

- A Photographic image of a corridor which is converging at a point

Perspective Projection



Perspective Nomenclature

- **Ground plane (GP)** is a horizontal reference plane on which the object will be resting or placed.
- **Station point (SP)** is the observer's eye.
- **Picture plane (PP)** is a vertical reference plane on which perspective view of the object is obtained when the object is viewed from the station point.
- **Ground line (GL)** is the intersection line of PP and GP.

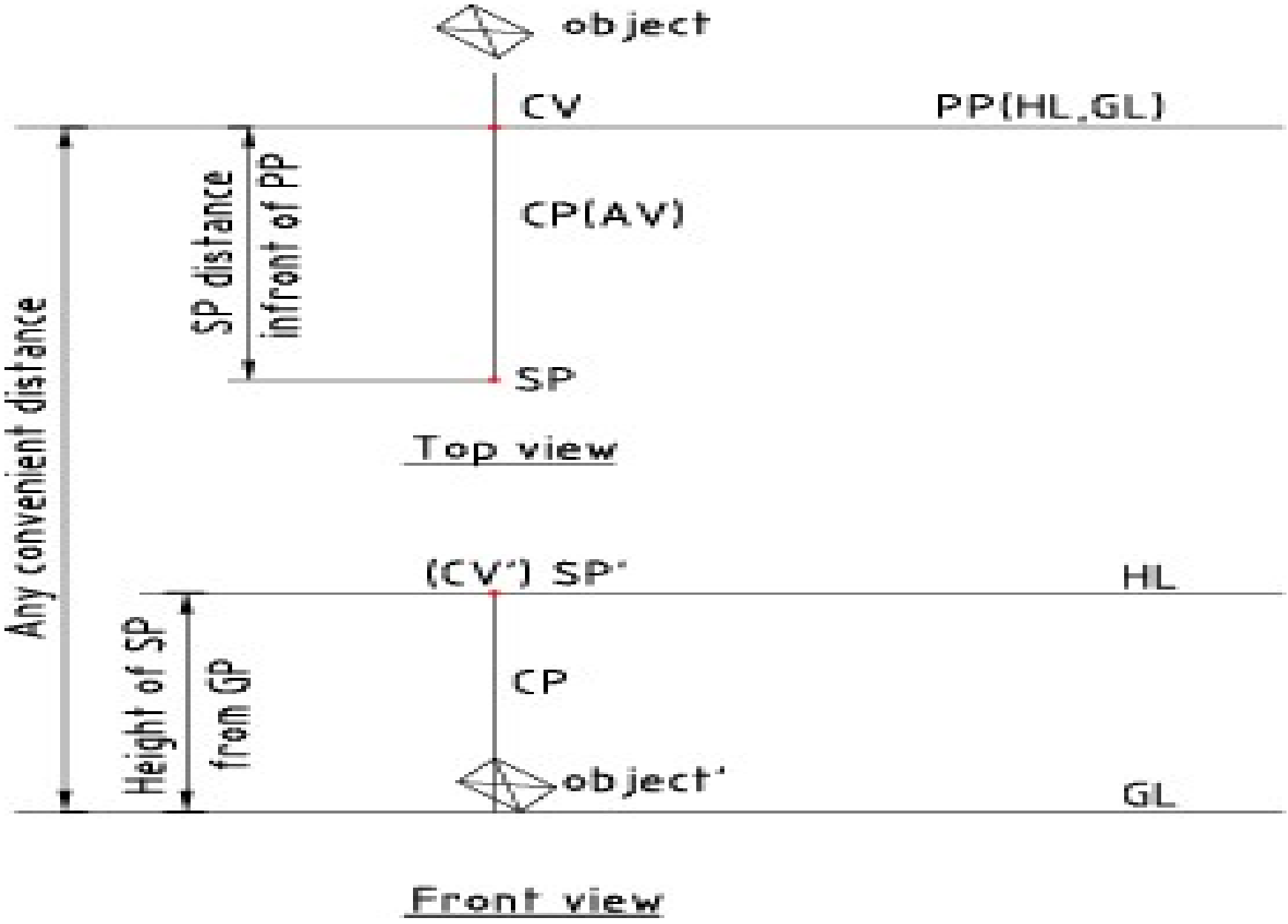
Perspective Nomenclature

- **Horizon plane (HP)** is also a horizontal reference plane which is parallel to **GP** and passing through the station point.
- **Horizon line (HL)** is the intersection line of **PP** and **HP**.
- **Visual rays** are imaginary lines drawn to join various corners of the object to the station point (**SP**) which pierce the picture plane. These piercing points are marked in top view and are projected to front view to get the perspective projection of an object.

Perspective Projection

- Consider the arrangement of the reference planes, position of the object and observer shown earlier.
- When viewed from the top, the line of intersection of the planes alone can be seen in top view.
- In this case, the object is placed behind **PP** and the observer (**station point**) stands in front of **PP** as shown in Fig.
- Also, consider the front view of the arrangement of the reference planes, object, observer and other elements seen as shown in Fig.

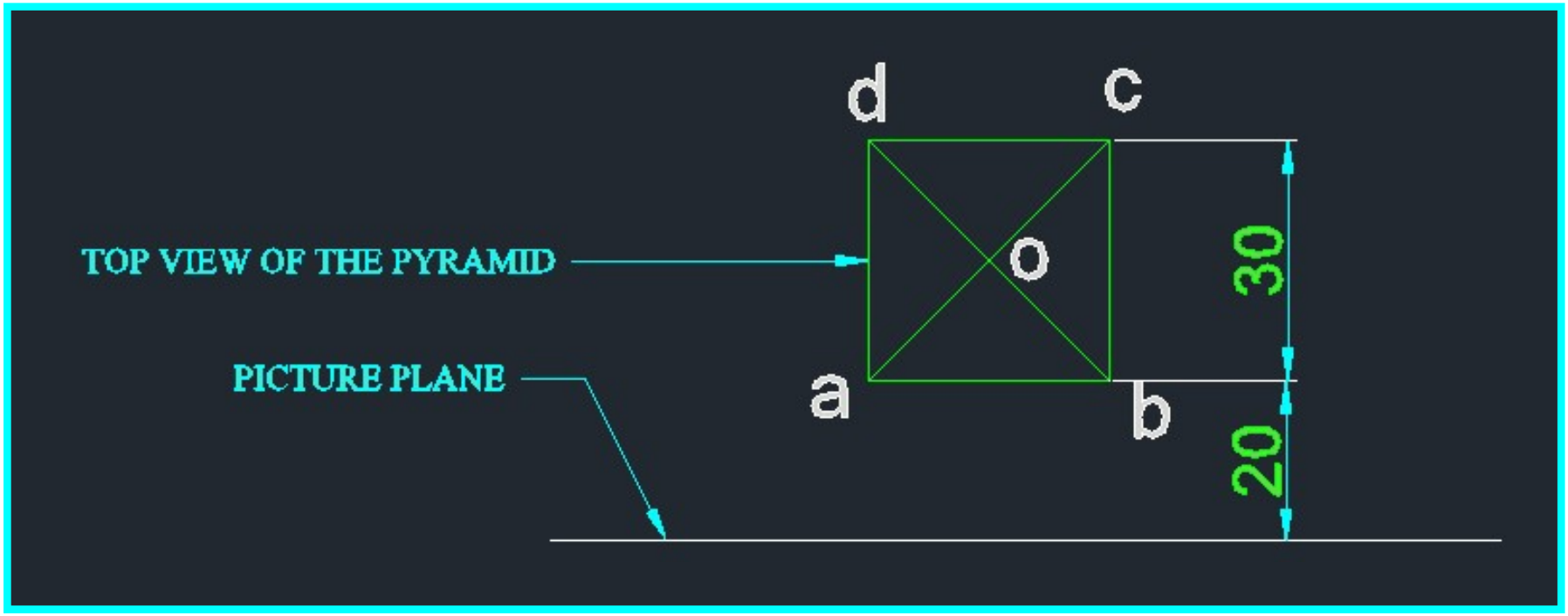
Perspective Projection



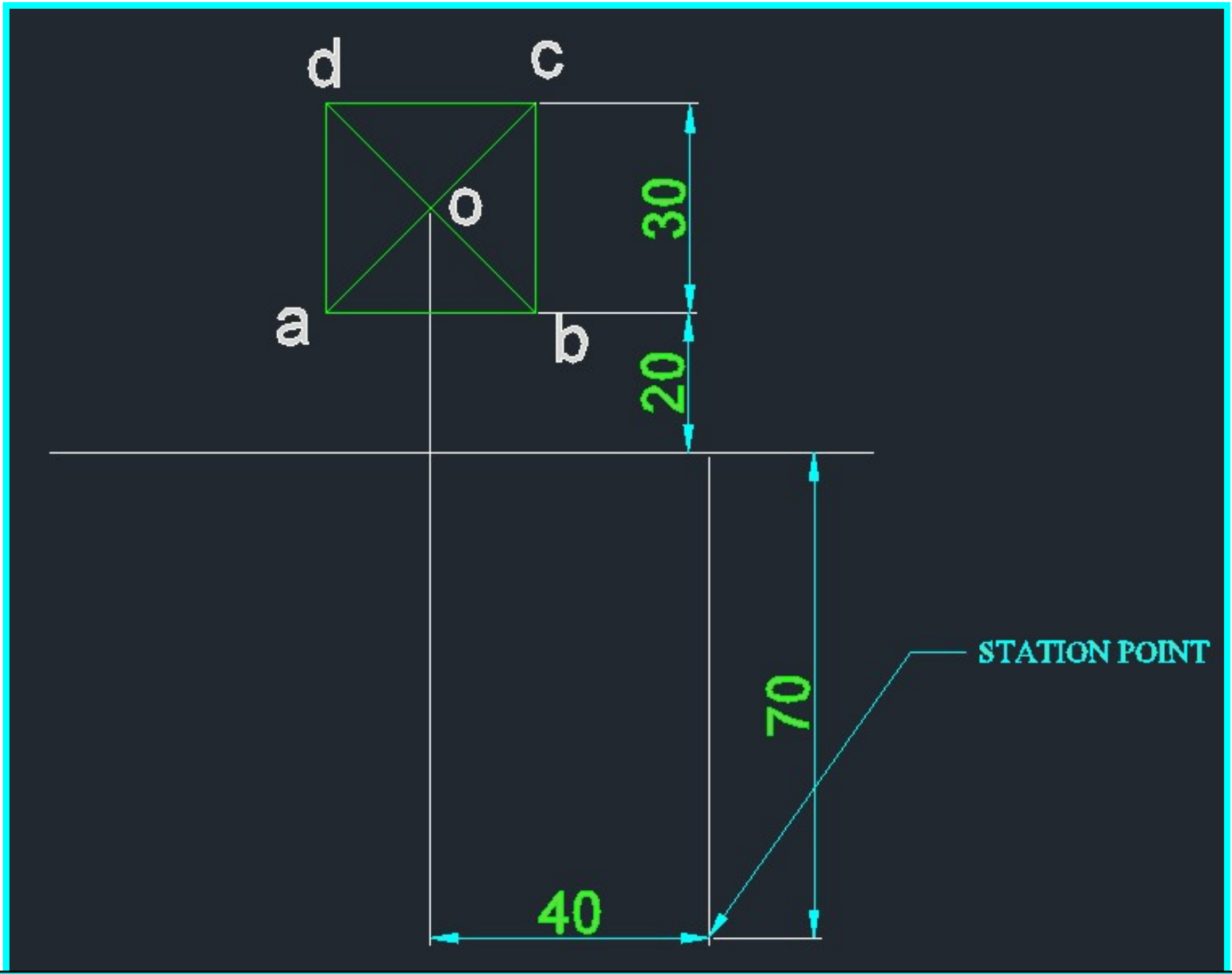
Visual ray method

- In **Visual ray method**, the **TV** and **FV** of the object and station point (**sp**) in both the views are located.
- Then visual rays from sp connecting various corners of the object in **TV** and **FV** are drawn.
- The piercing points of these rays with picture plane are marked in **TV** and projected to **FV** to get perspective projection of the object.

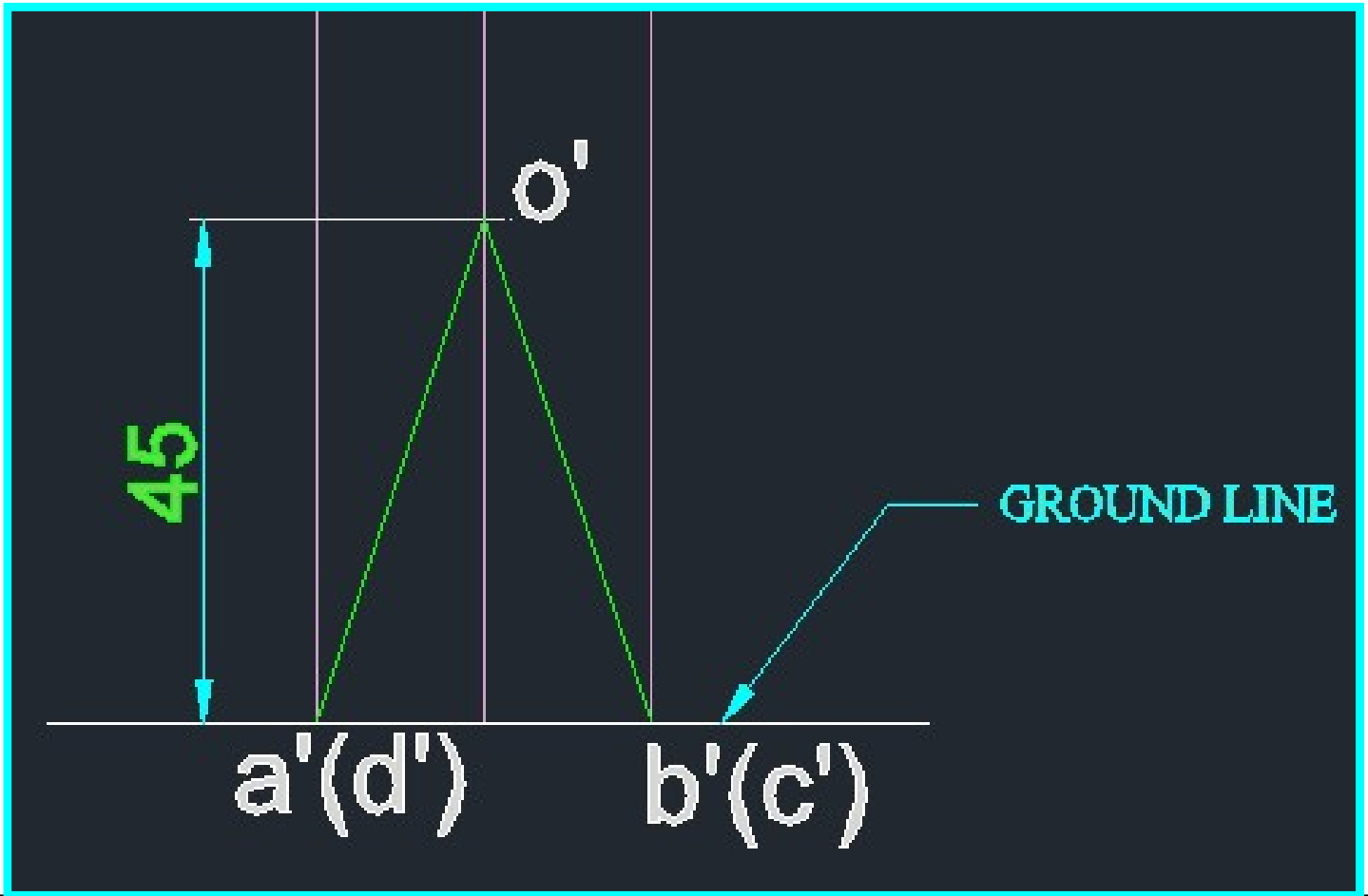
Draw the perspective view of a square pyramid of base **30** mm, side and height of apex **45** mm rests on GP. The nearest edge of the base is parallel to and **20** mm behind the picture plane. The station point is situated at a distance of **70** mm in front of the PP and **40** mm to the right of the axis of the pyramid and **60** mm above the ground.



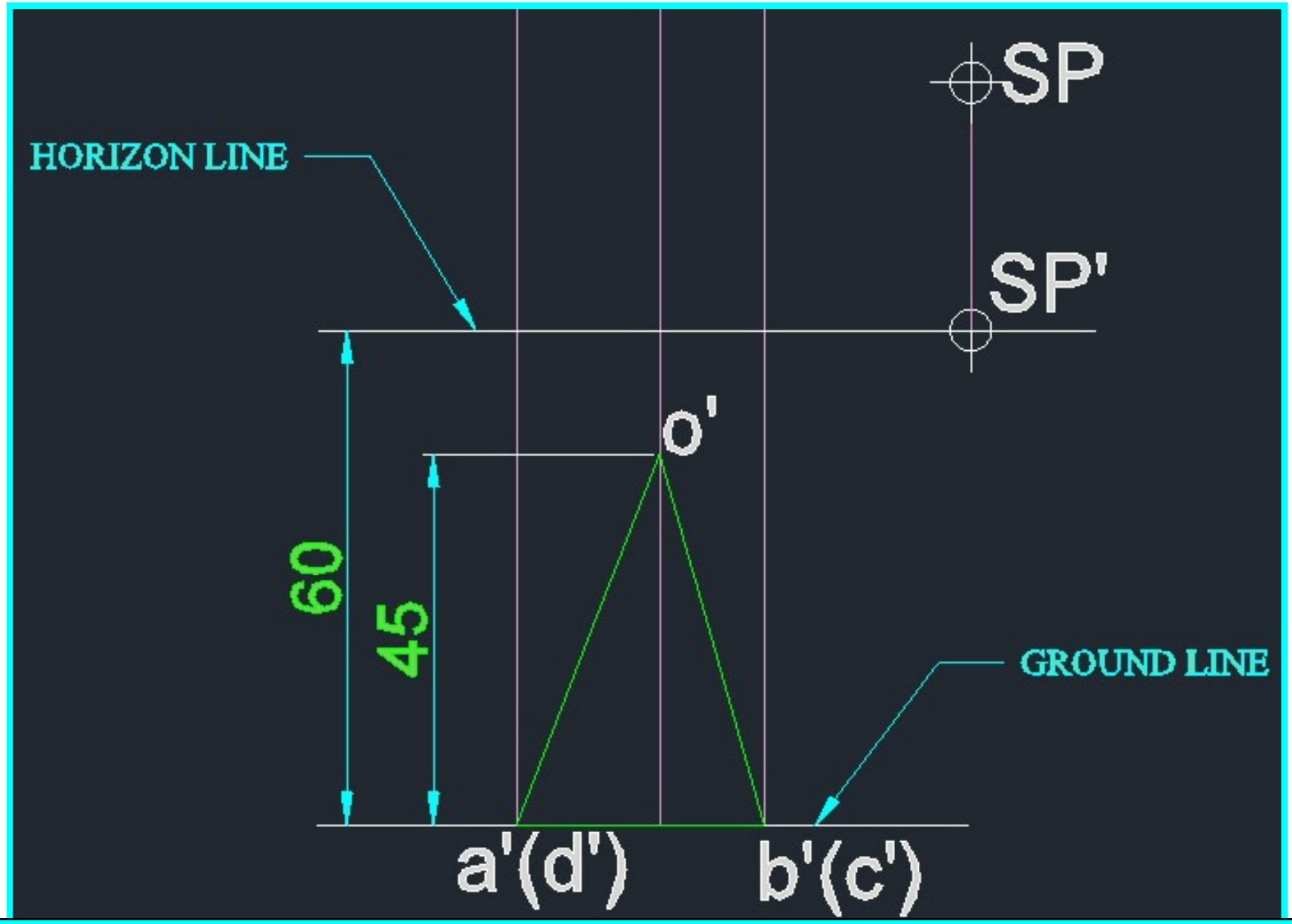
- Draw top view of the Picture plane (PP) as a horizontal line & the Pyramid as a Square of given side **30** mm above the PP **20** mm & give naming **a, b, c, d** & **o** for the Apex of the Pyramid.



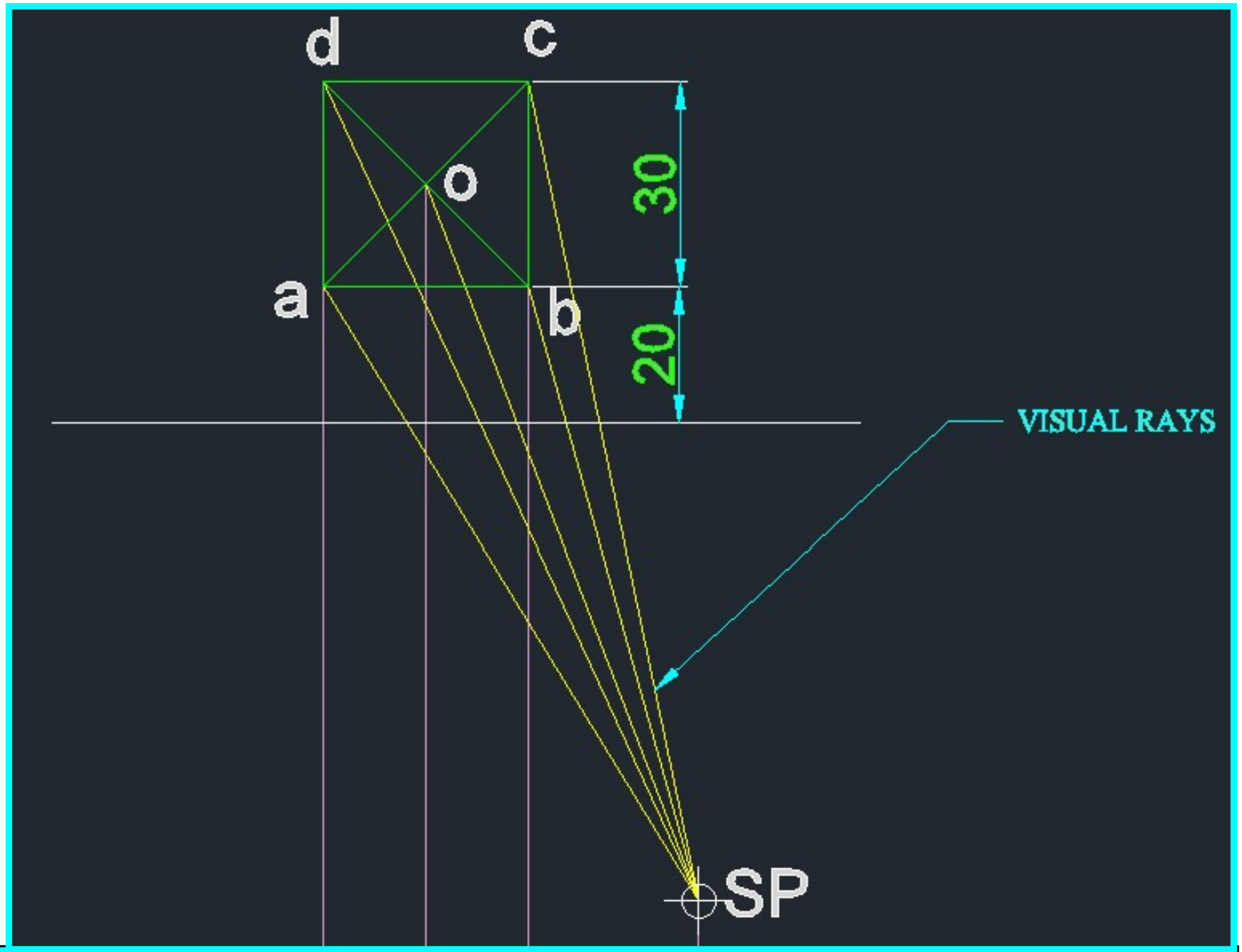
- Locate the Station Point (SP) **70** mm below the PP & **40** mm from the Apex



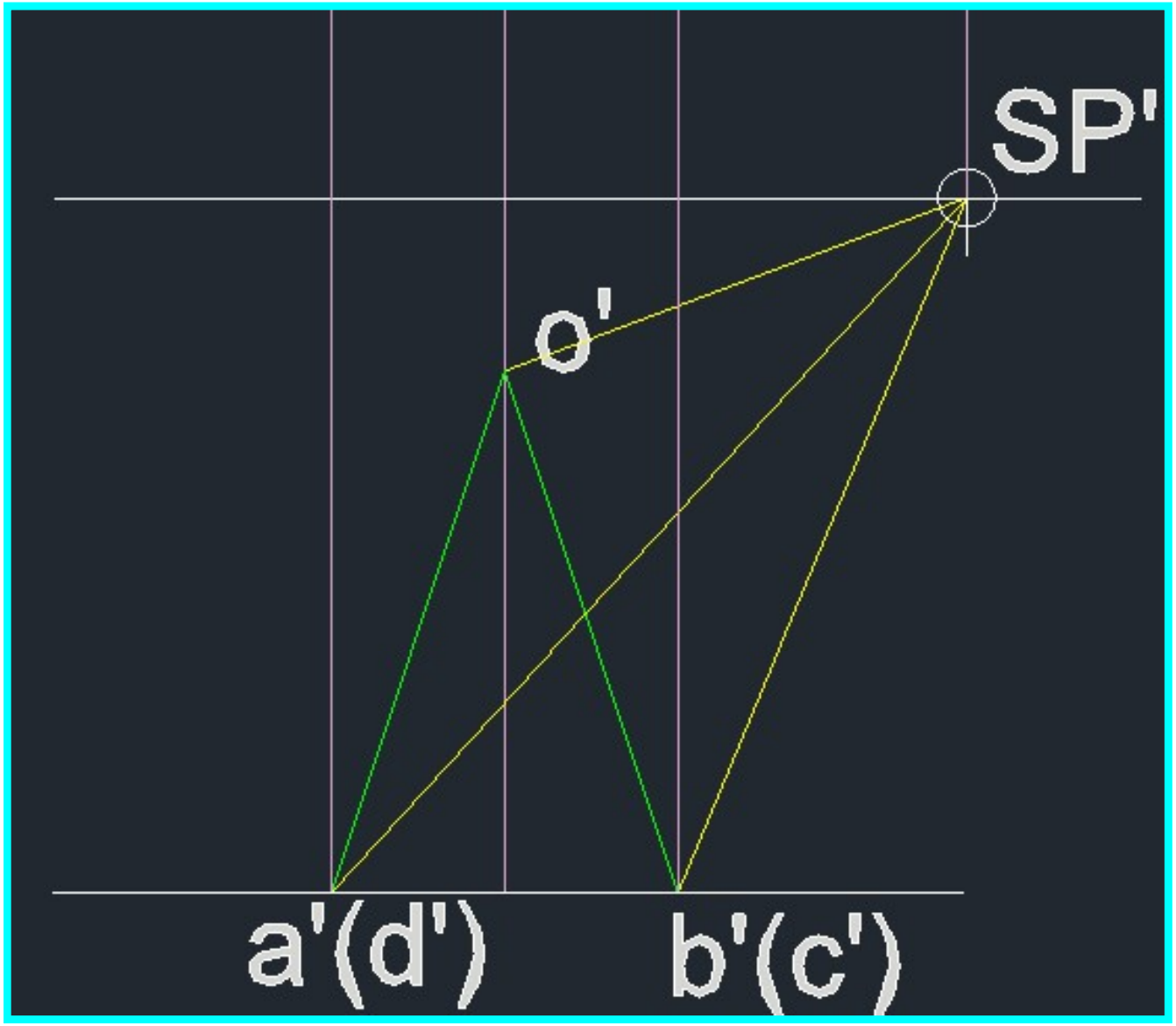
- Draw a horizontal line representing the **GROUND LINE (GL)** for a convenient distance below the Station point **SP**
- Project the lines from Top view & complete the Front view of the Square Pyramid & name the corners **a'(d'), b'(c')** & **o'** for the Apex point



- Draw a horizontal line representing the **HORIZON LINE (HL)** **60** mm distance above the **Ground line** GL & locate the station point **SP'** (front view of the Station point)

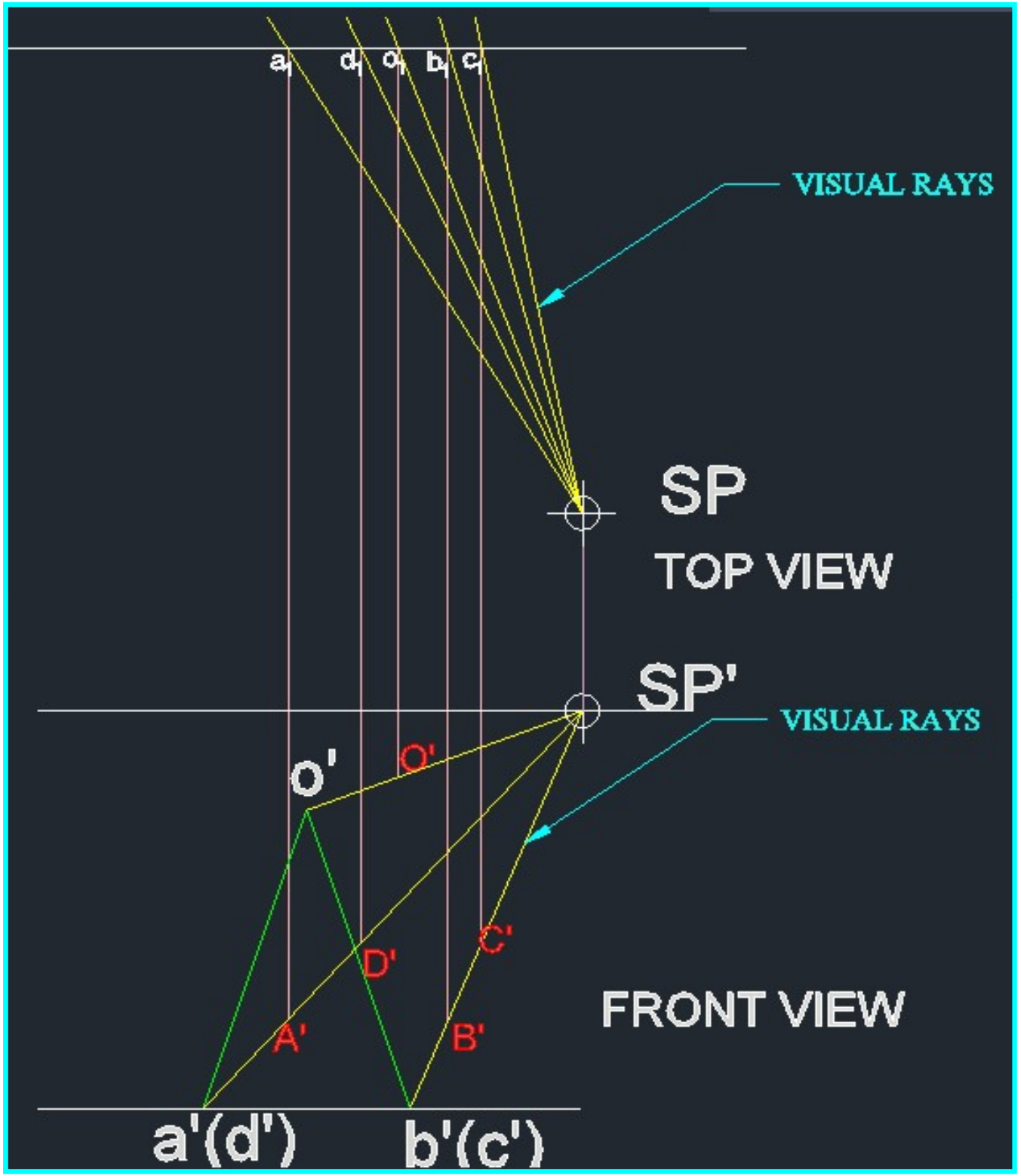


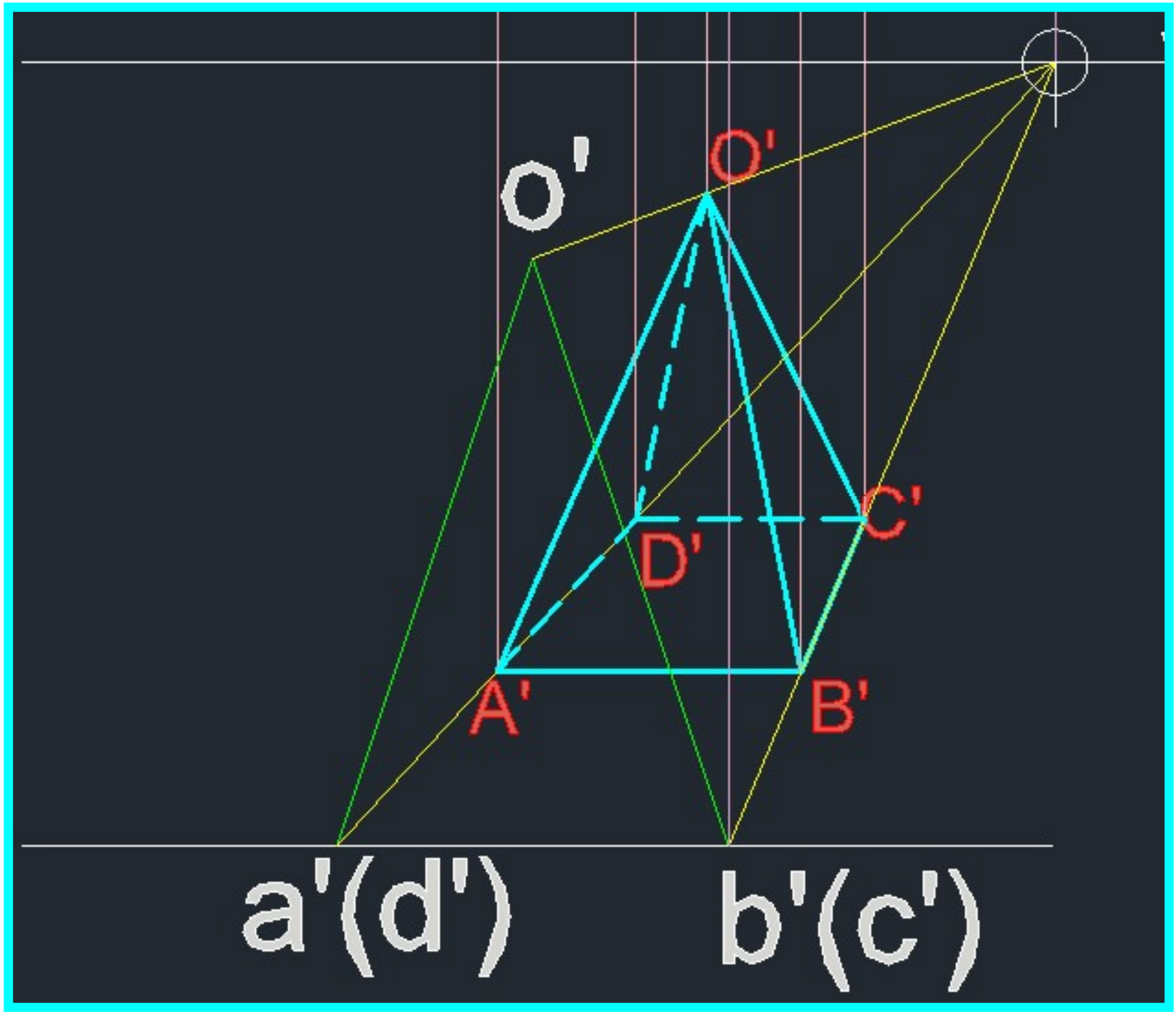
- Connect all the corners & the apex of the pyramid from Top view to the **SP** which is the representation of Visual rays

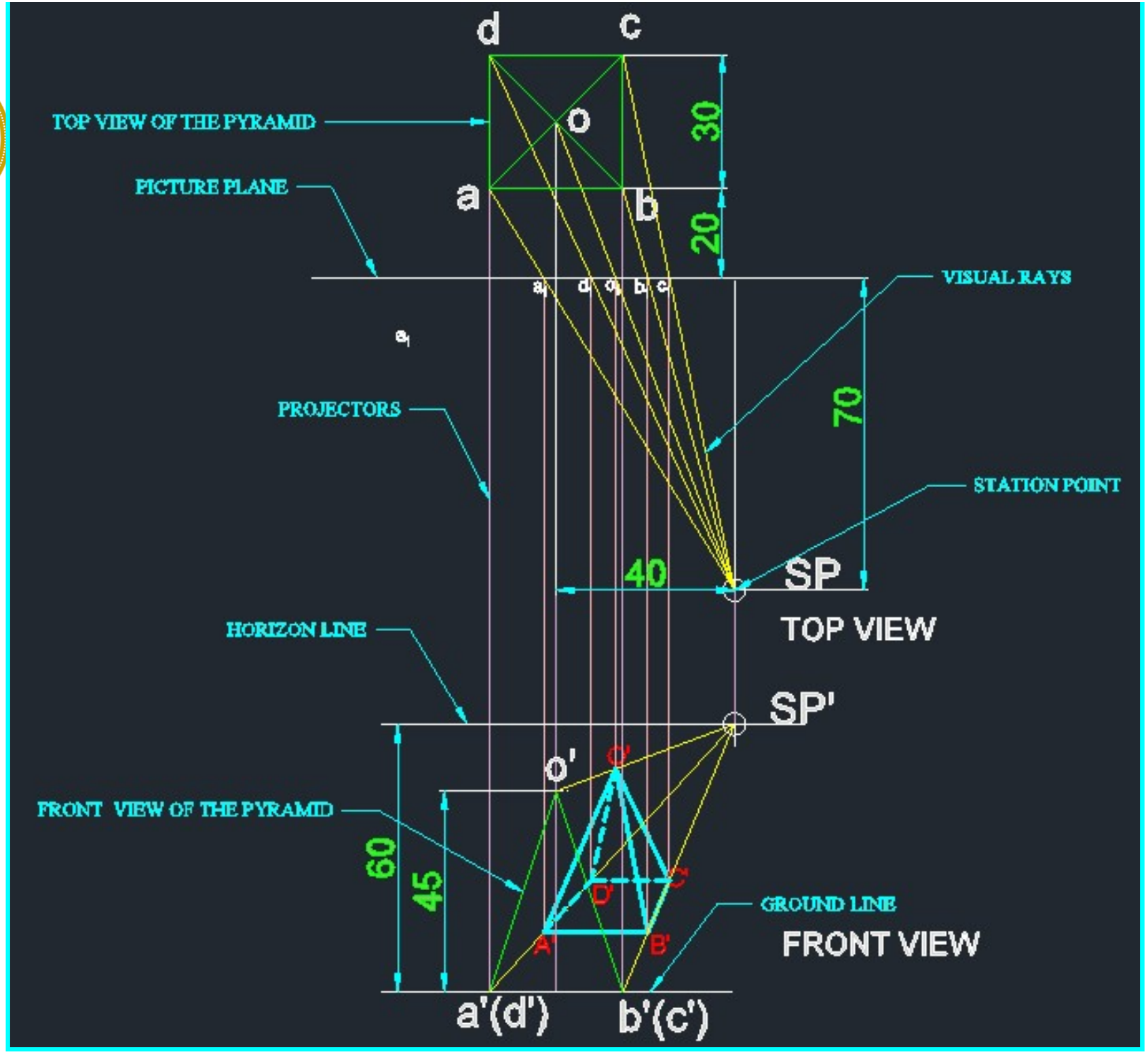


- Connect all the corners & the apex of the pyramid from front view to the **SP'** which is the representation of Visual rays

- Name the piercing points of the visual rays in the **PP** as a_1 d_1 o_1 b_1 & c_1
- Project all piercing points to front view & name it **as A' B'C'D'O'**




o'
O'
C'
D'
A'
B'
a'(d')
b'(c')


d
c
o
TOP VIEW OF THE PYRAMID
30
PICTURE PLANE
a
b
20
VISUAL RAYS
PROJECTORS
70
STATION POINT
40
SP
TOP VIEW
HORIZON LINE
SP'
o'
FRONT VIEW OF THE PYRAMID
60
45
GROUND LINE
FRONT VIEW
a'(d')
b'(c')

Tips to draw Perspective Projection

- The visible and invisible edges are usually identified through visualization.
- The visible edges are marked by considering the edges in the front portion of the solid which lie within the cone angle formed by the visual rays in top view with **SP**.
- The details printed in figure are neglected by the users while preparing the fair drawing of perspective.
- Complete the perspective projection by drawing dark lines for the visible portion of the object.

REFERENCE BOOKS

- JEYAPOOVAN T, “ENGINEERING GRAPHICS AND DESIGN”, 2023, Vikas Publishing House Pvt Ltd,
- K.V.NATARAJAN, “Engineering Graphics”, 2015, Dhanalakshmi Publishers.