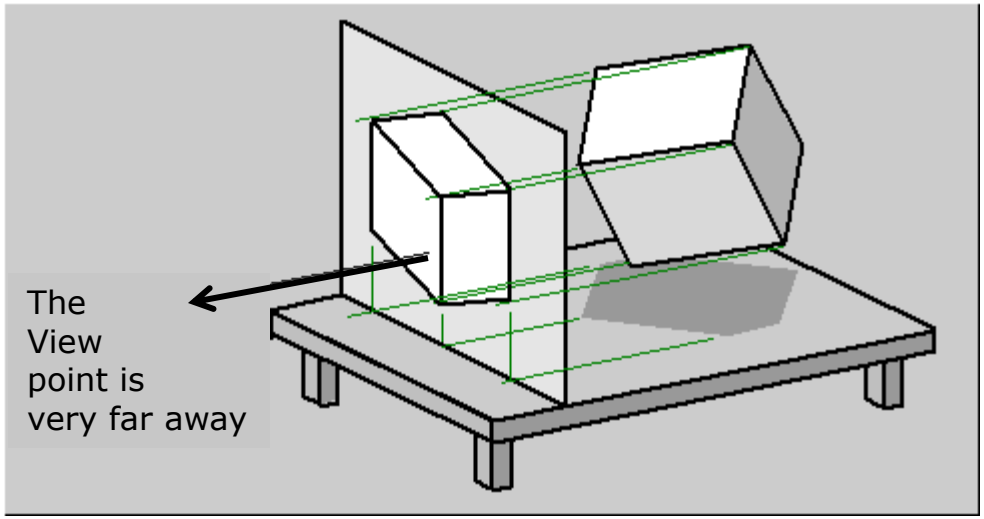
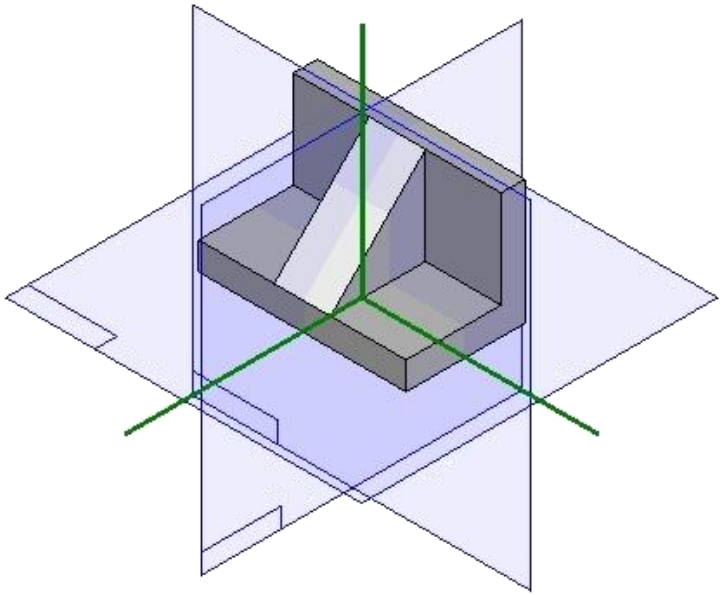
Technical Drawing in Engineering

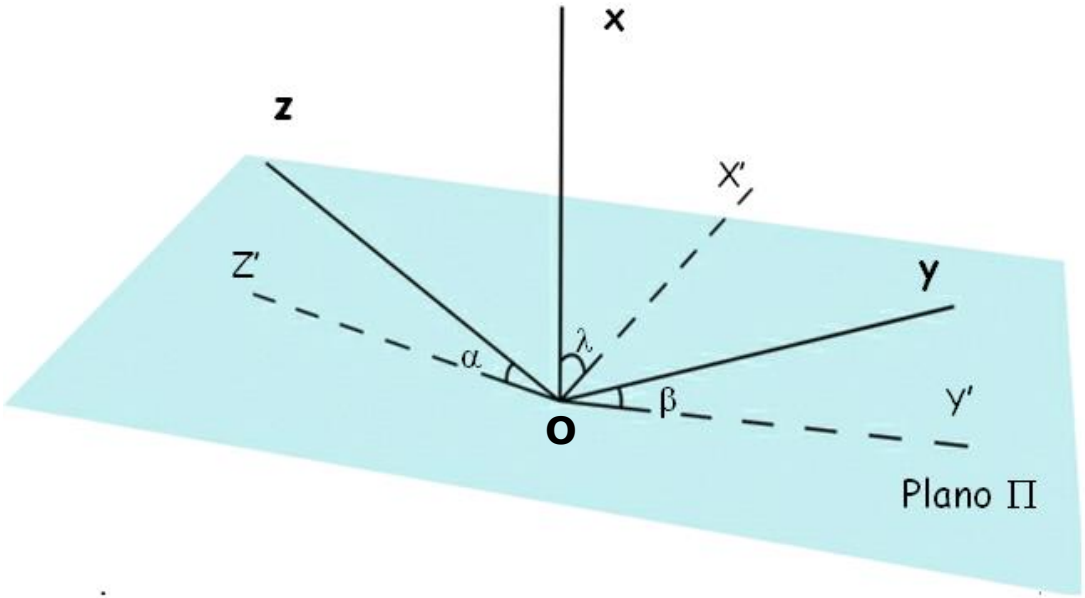
Lecture 6. Axonometric projection system

Basics I





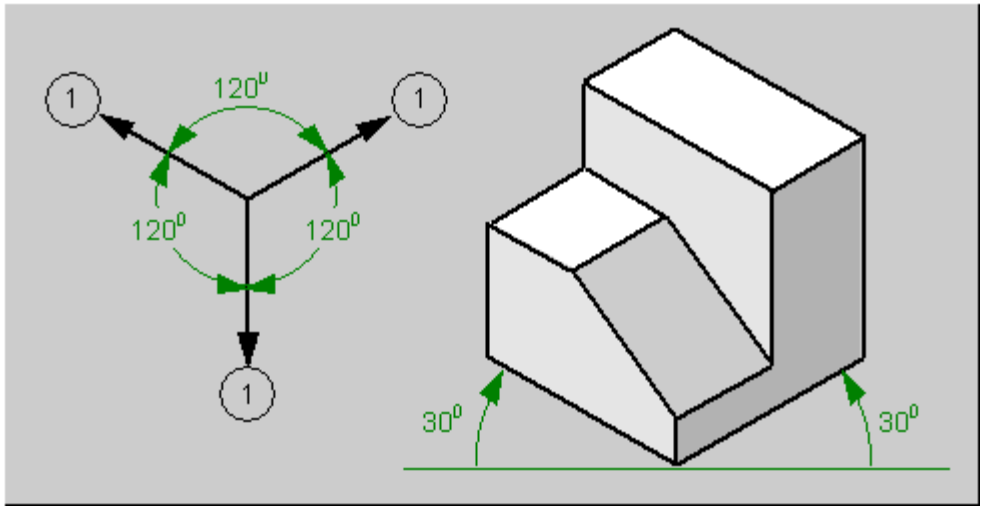
Basics II

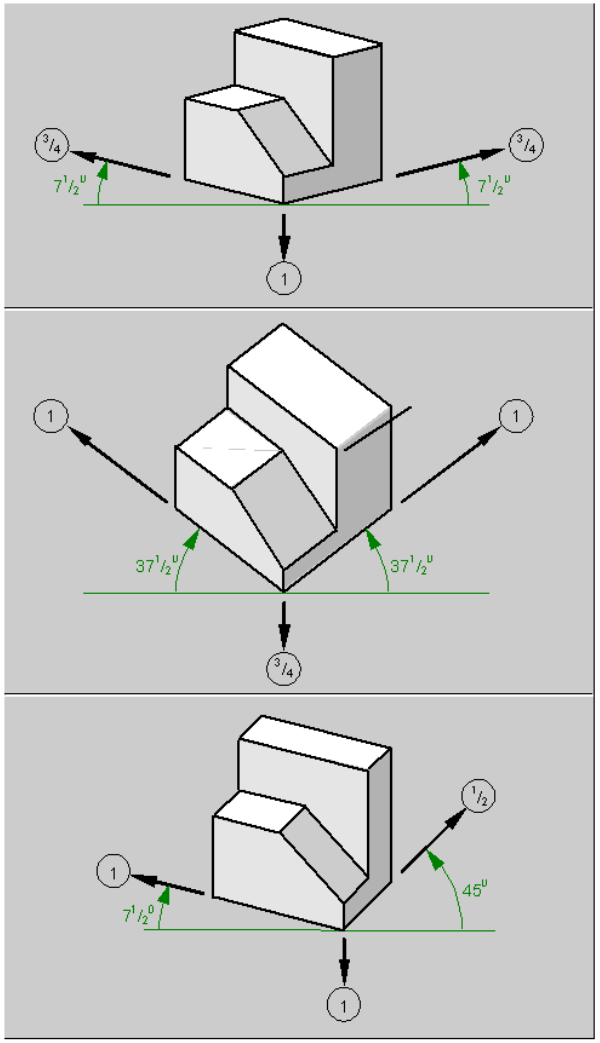


- Plane Π: Plane of the paper.
- The projection can be **orthogonal** or oblique.
- Coordinate axes (XYZ): Origin in O and perpendicular between them.
- Axonometric axes (X'Y'Z').

Axonometric orthogonal projection

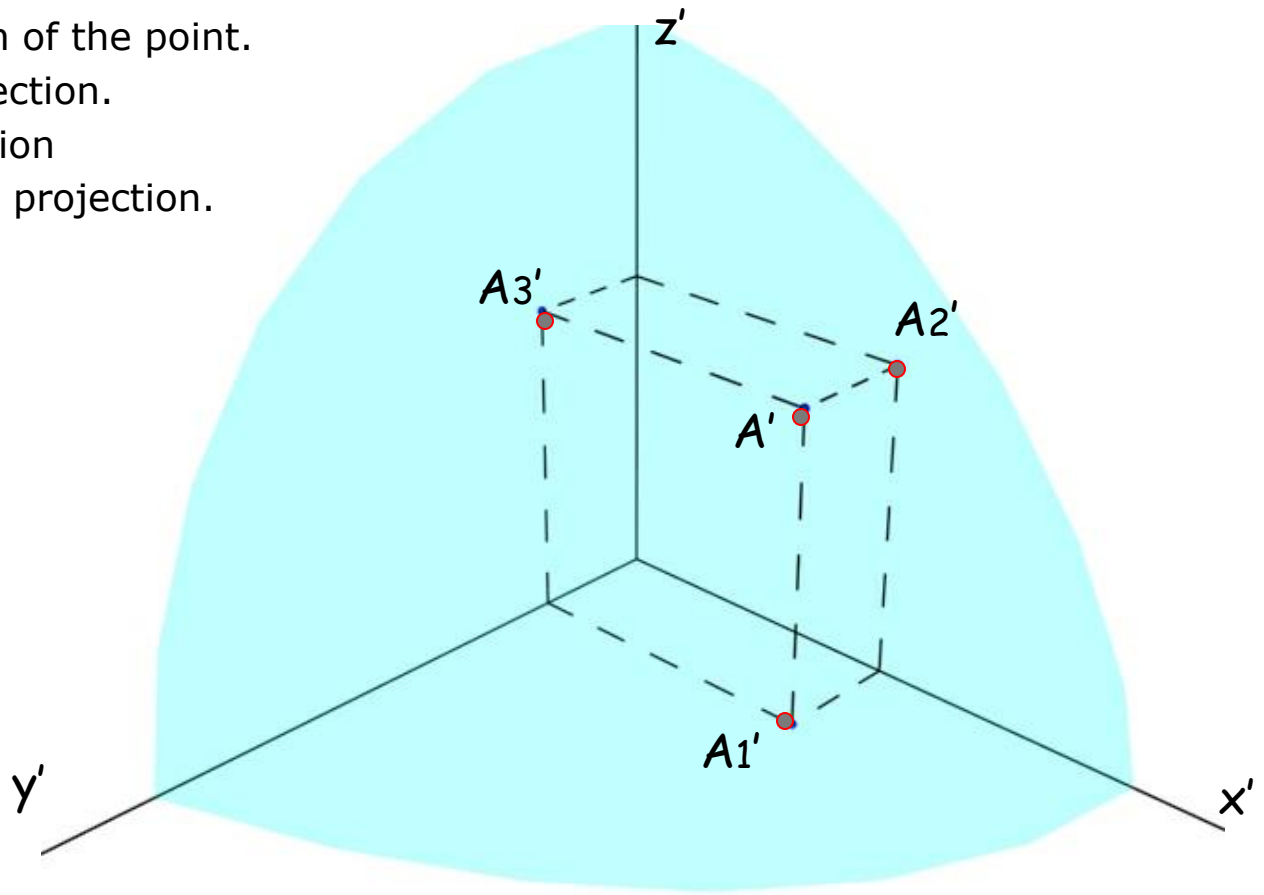
- Trimetric system:
  $\alpha \neq \beta \neq \lambda$
- Dimetric system:
  $\alpha = \beta \neq \lambda$ / $\alpha \neq \beta = \lambda$ / $\alpha = \lambda \neq \beta$
- Isometric system:
  $\alpha = \beta = \lambda$





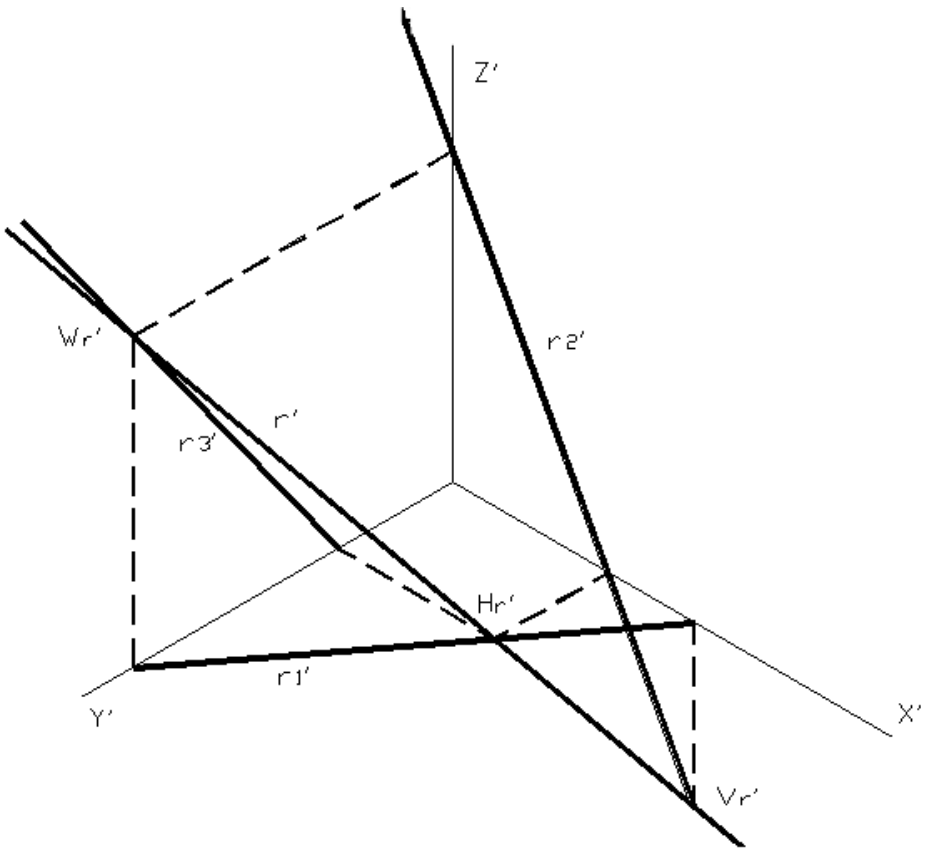
Representation of a point

- To define the position of a point only 2 of its 4 projections are required.
  - A′ Direct projection of the point.
  - A'_1 Horizontal projection.
  - A'_2 Vertical projection
  - A'_3 Second vertical projection.



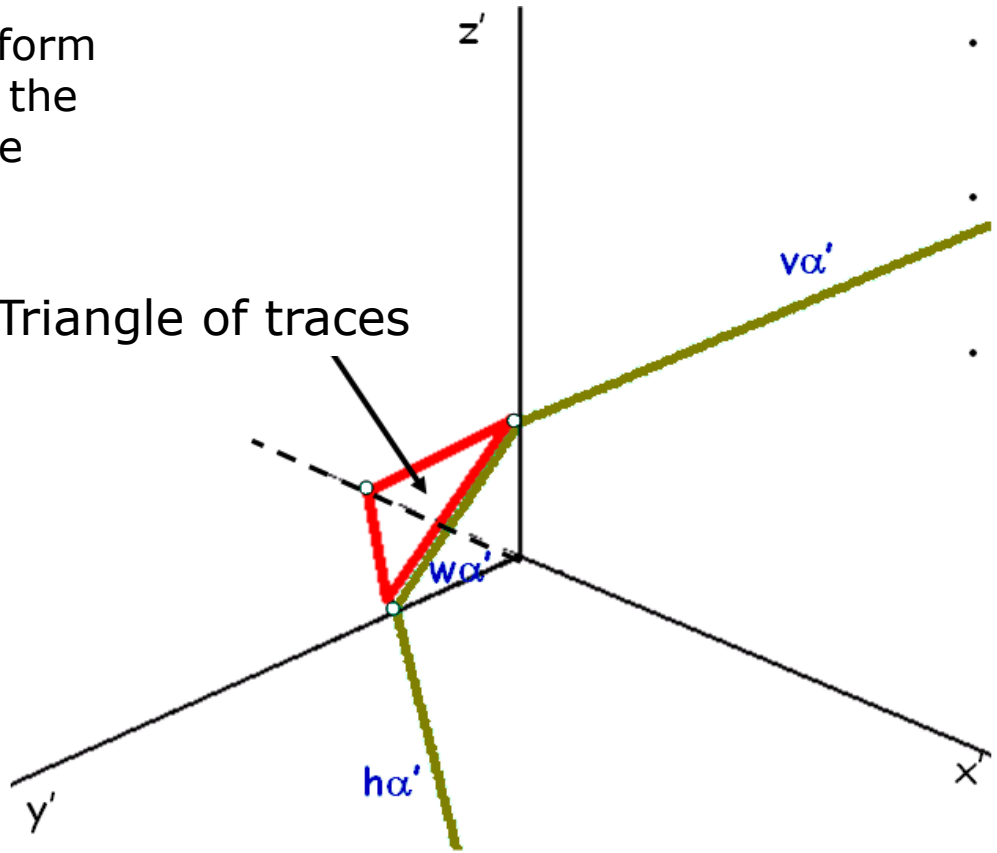
Representation of a line

- Line r’ is defined by 2 of its projections, the other 2 can be obtained from these.
  - Data: r’ y r’1.
  - Find r’2 and r’3.
- The traces are the intersections of the direct projection (r’) and the horizontal (H), vertical (V) and second vertical (W).
  - Hr’ intersection of lines r’ and r’1.
  - Vr’ intersection of r’ and r’2.
  - Wr’ intersection of r’ and r’3.



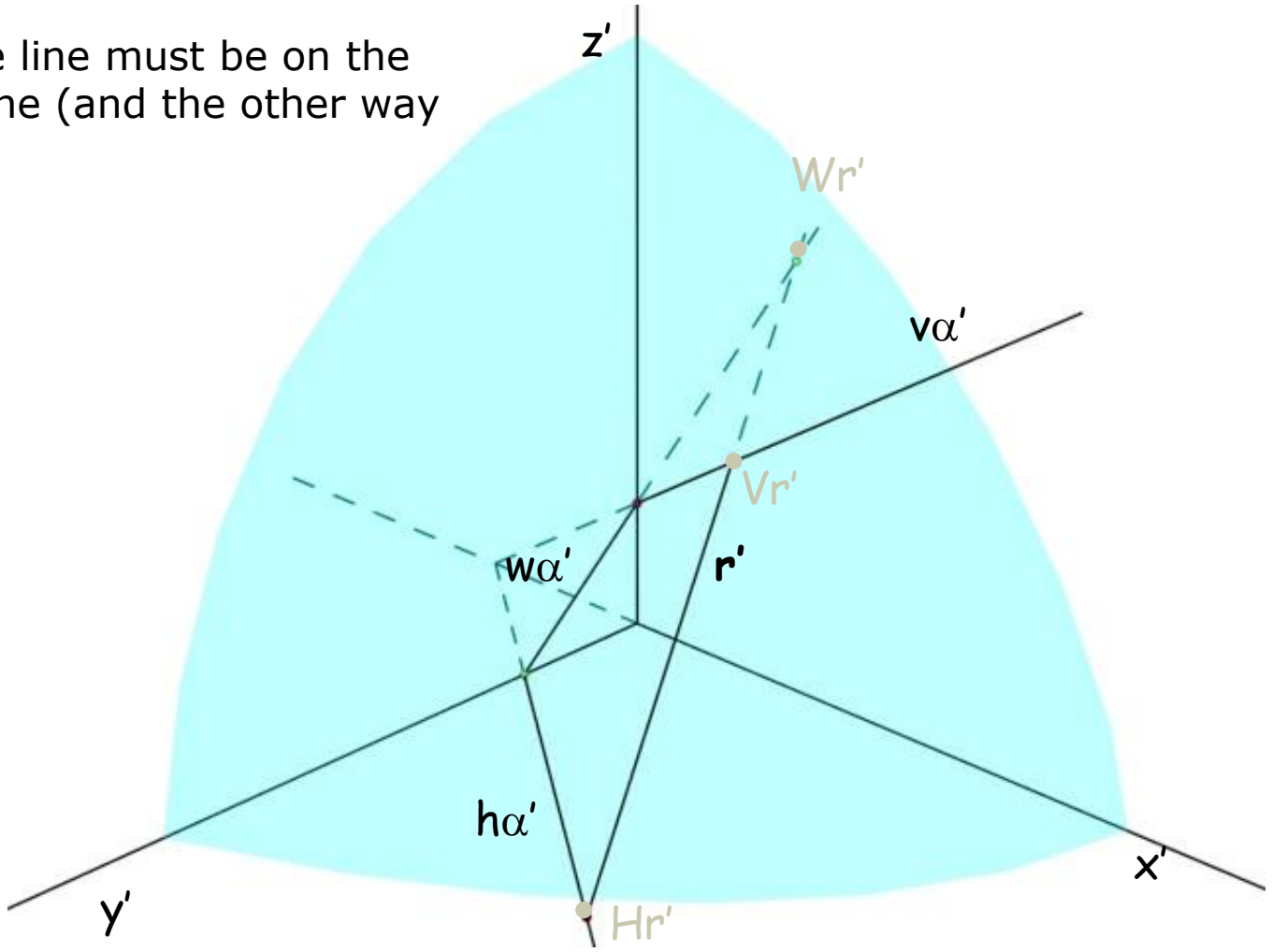
Representation of a plane

- It is represented by its traces.
- The 3 traces cut in the axes in pairs.
- These traces, when enlarged, form the Triangle of traces. Each of the vertex of the triangle are in the axes.

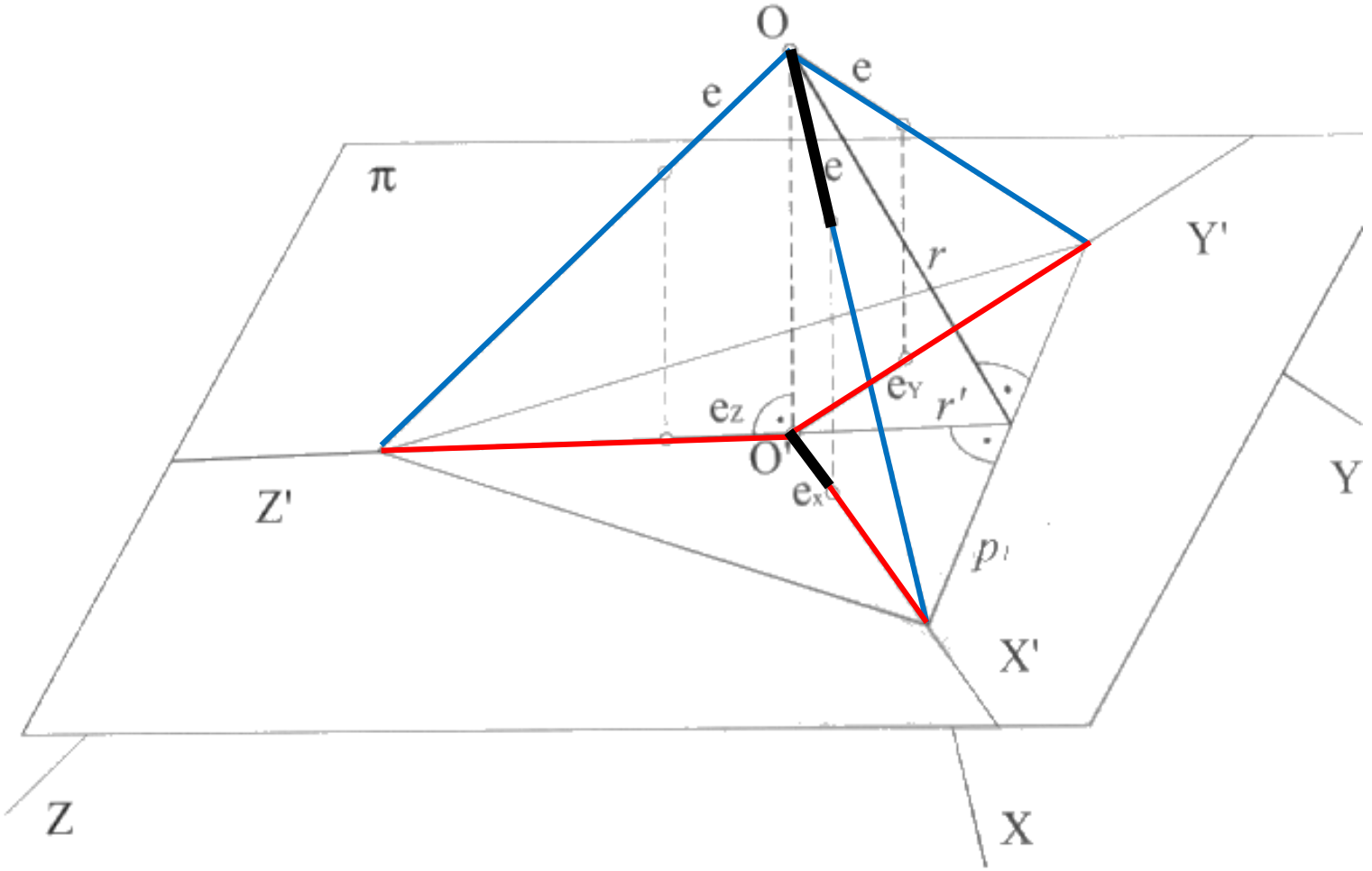


Membership: Line and plane

- The traces of the line must be on the traces of the plane (and the other way round):
  - Vr′ over vα′
  - Hr′ over hα′
  - Wr′ over wα′



Reduction coefficients I



$$c_x = \frac{e_x}{e}$$

$$c_y = \frac{e_y}{e}$$

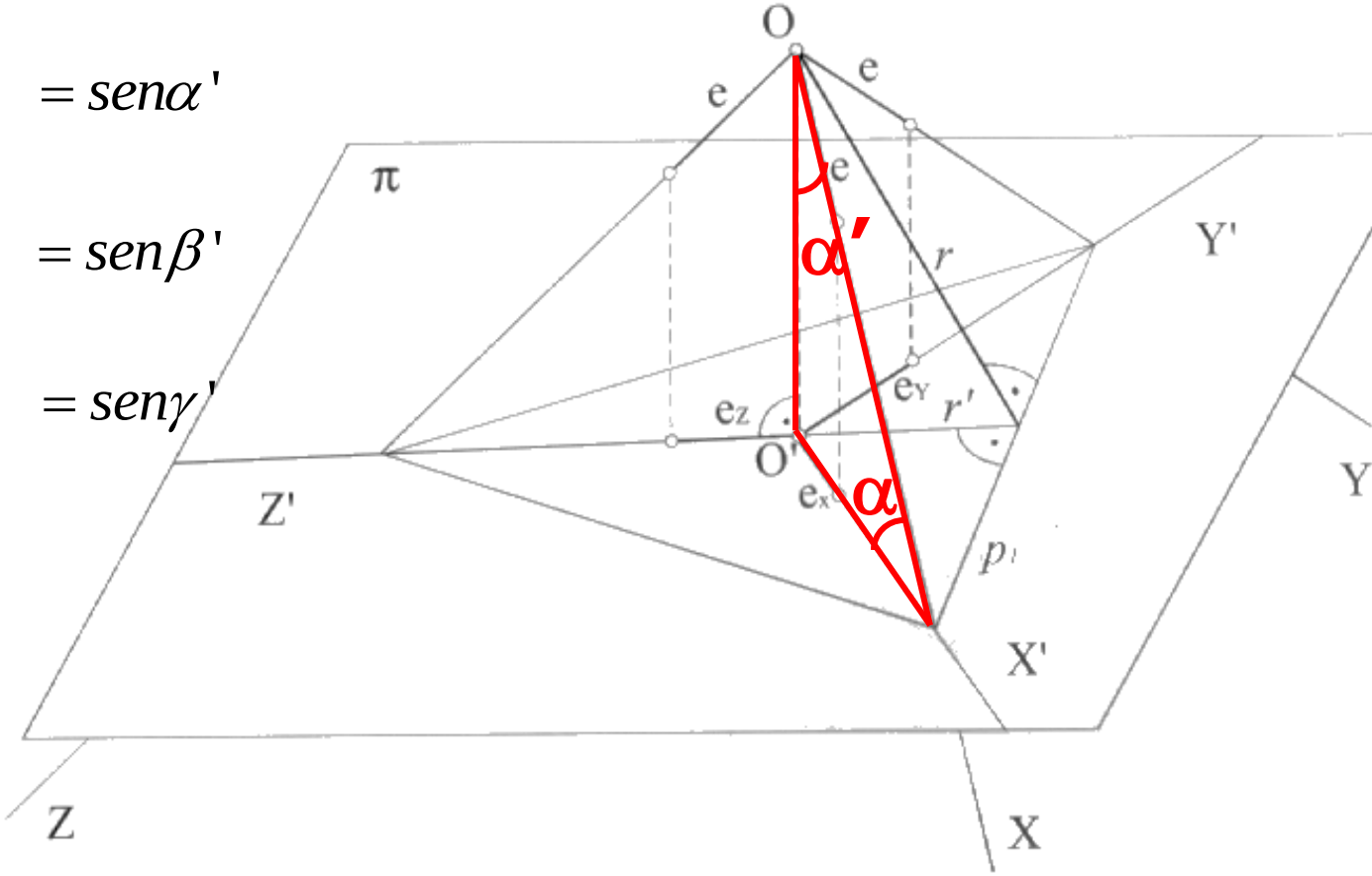
$$c_z = \frac{e_z}{e}$$

Reduction coefficients II

$$c_x = \frac{e_x}{e} = \cos\alpha = sen\alpha'$$

$$c_y = \frac{e_y}{e} = \cos\beta = sen\beta'$$

$$c_z = \frac{e_z}{e} = \cos\gamma = sen\gamma'$$



Reduction coefficients III

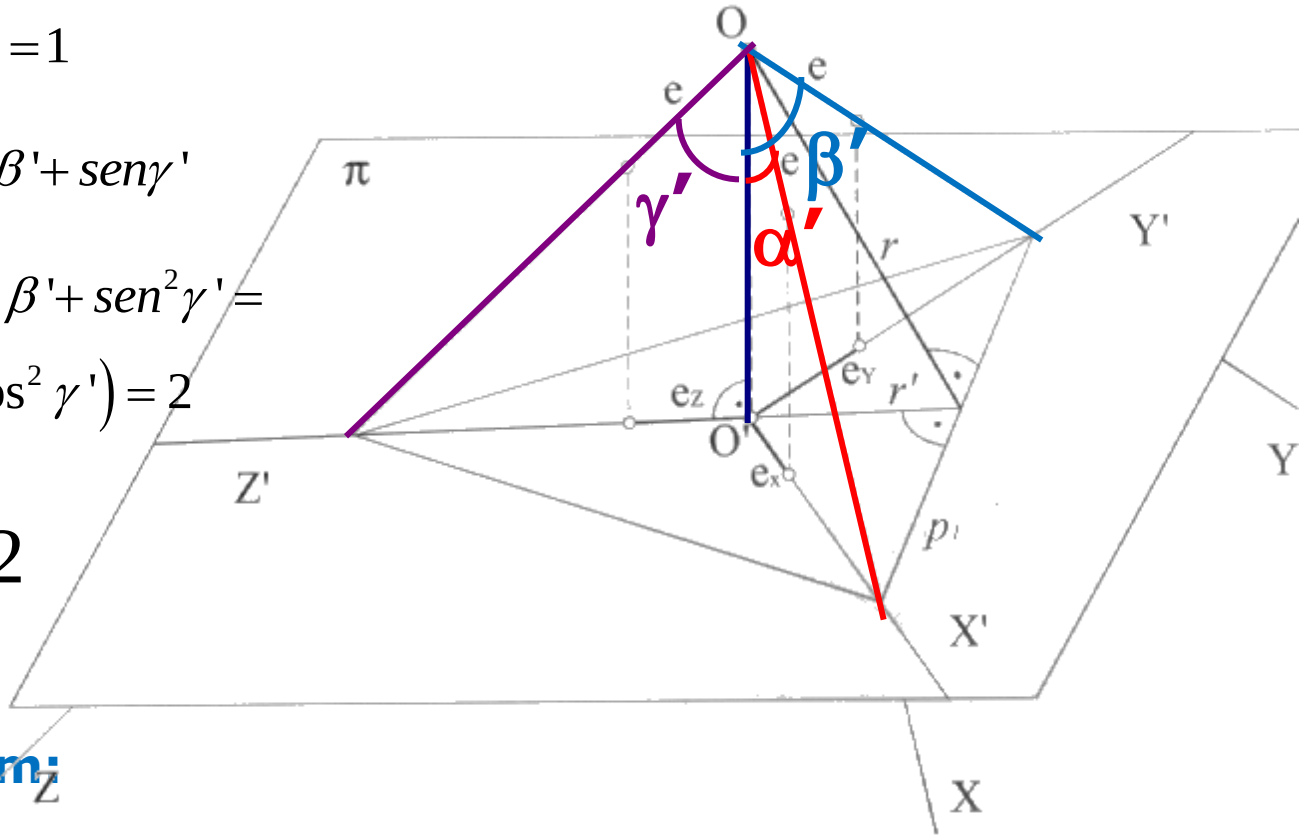
$$\cos^2\alpha' + \cos^2\beta' + \cos^2\gamma' = 1$$

$$c_x + c_y + c_z = sen\alpha' + sen\beta' + sen\gamma'$$

$$c_x^2 + c_y^2 + c_z^2 = sen^2\alpha' + sen^2\beta' + sen^2\gamma' =$$

$$= 3 - \left(\cos^2\alpha' + \cos^2\beta' + \cos^2\gamma'\right) = 2$$

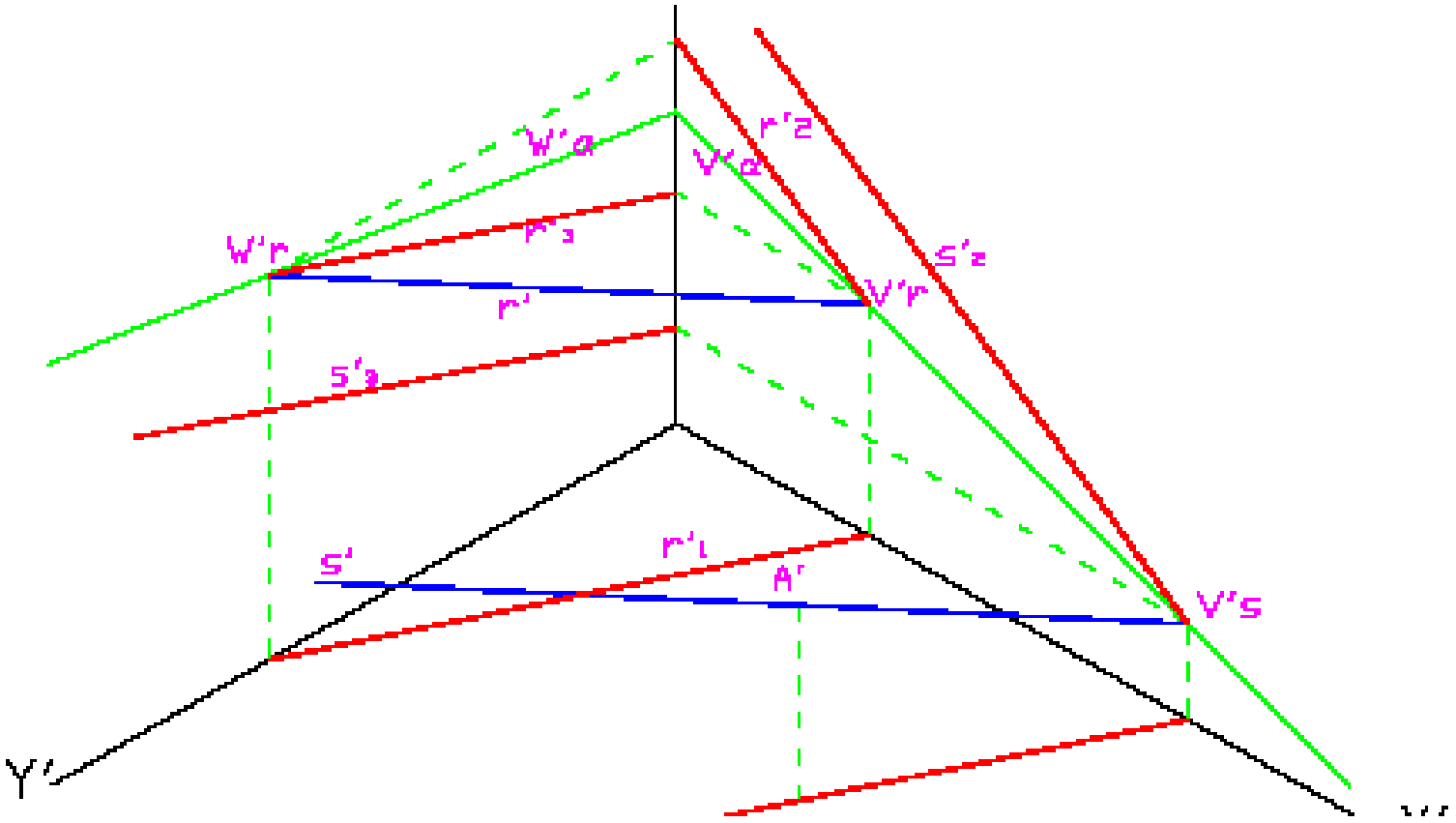
$$c_x^2 + c_y^2 + c_z^2 = 2$$



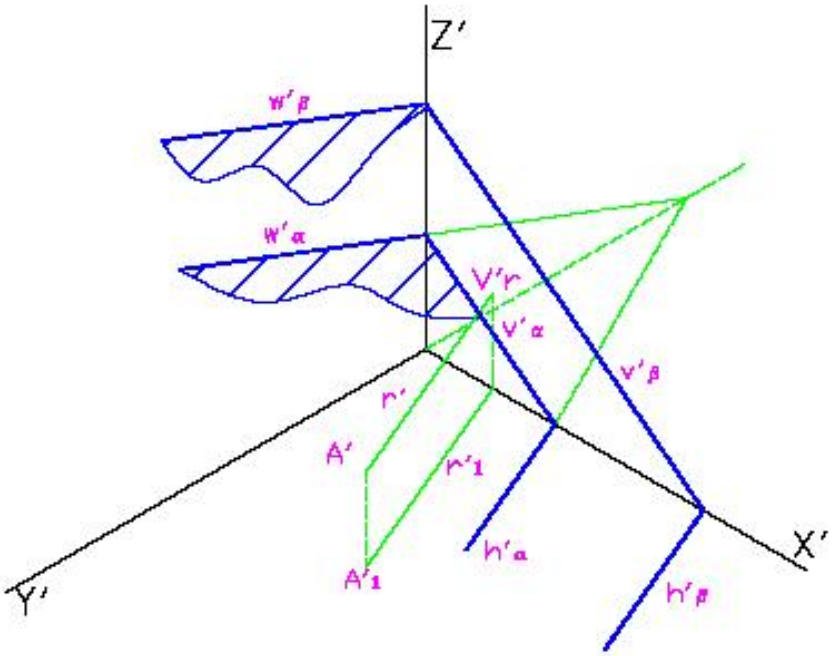
- **Isometric system:**

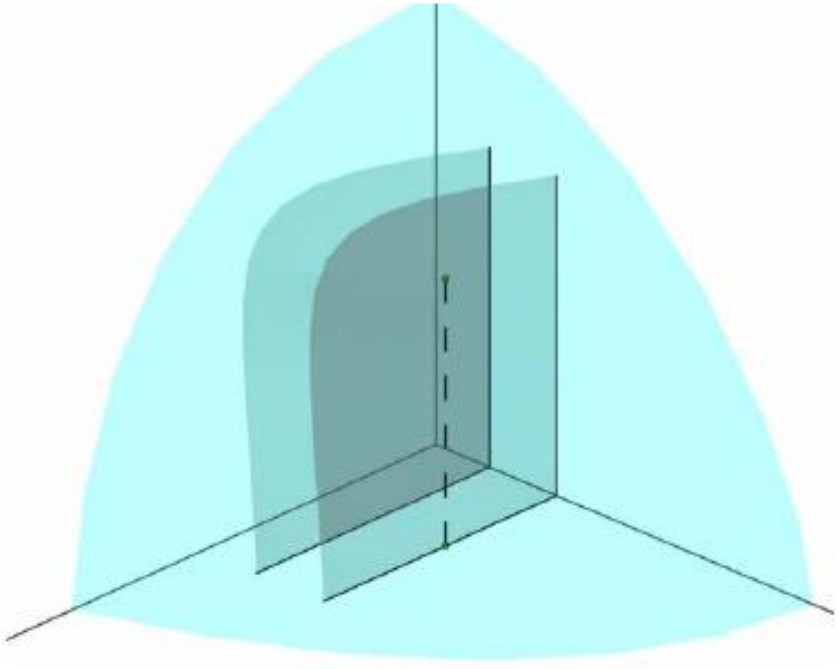
$$\left.\begin{array}{l} c_x^2 + c_y^2 + c_z^2 = 2 \\ c_x = c_y = c_z \end{array}\right\} \quad 3 \cdot c_x^2 = 2 \quad \Rightarrow \quad c_x = c_y = c_z = 0.816$$

Parallelism and perpendicularity

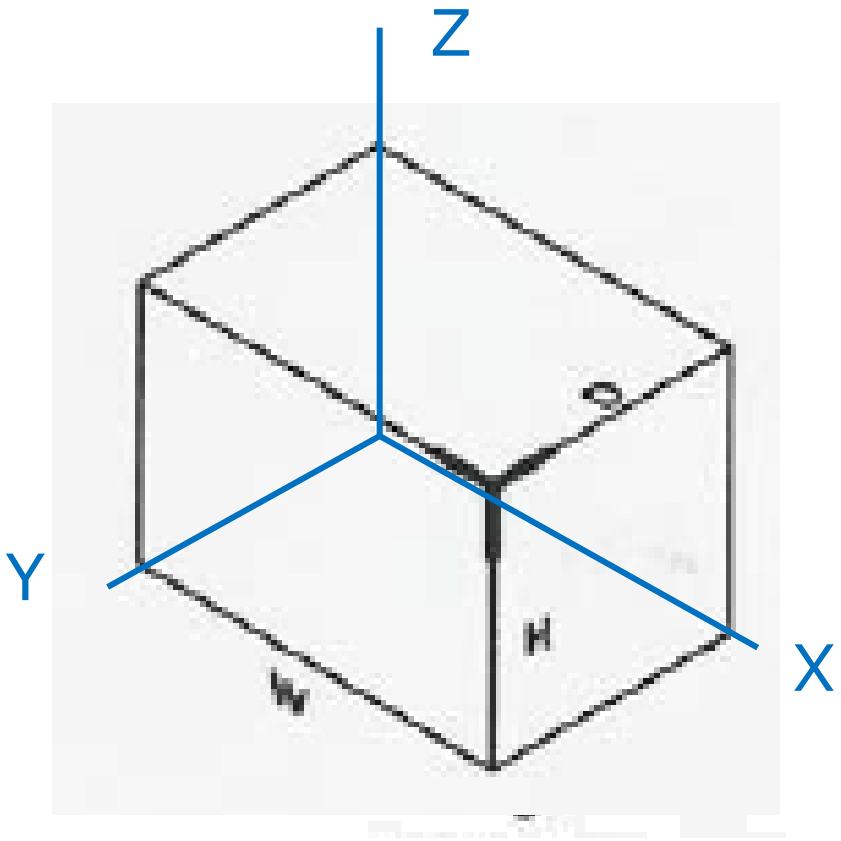


Parallelism and perpendicularity

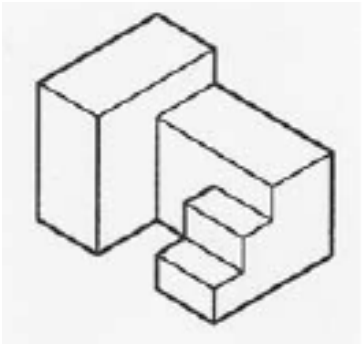




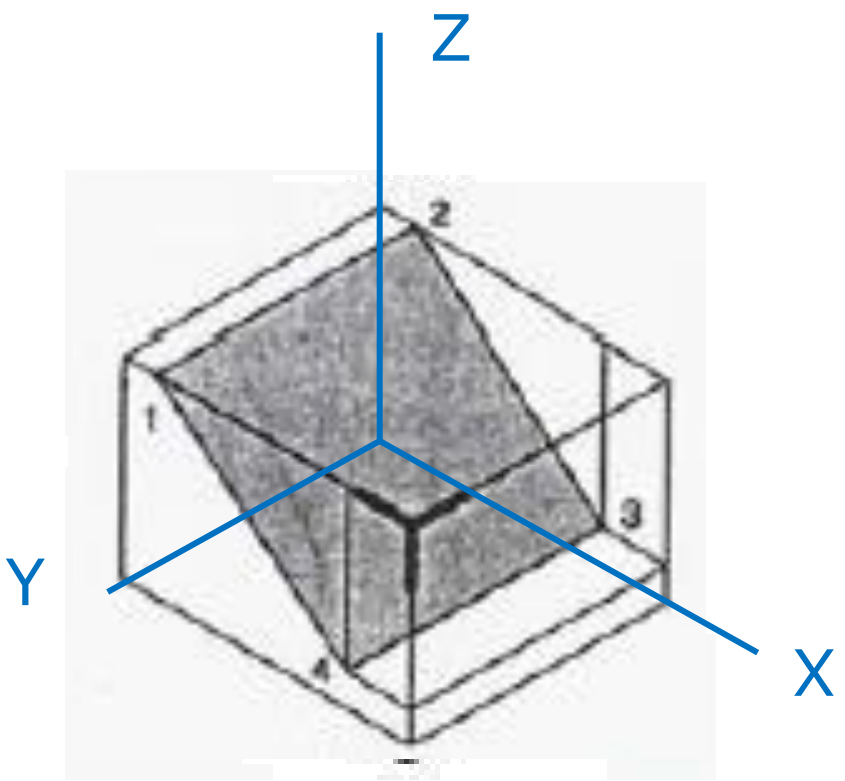
Construction of an isometric drawing I



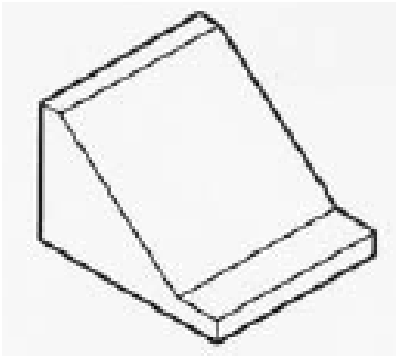
Draw in the axes direction



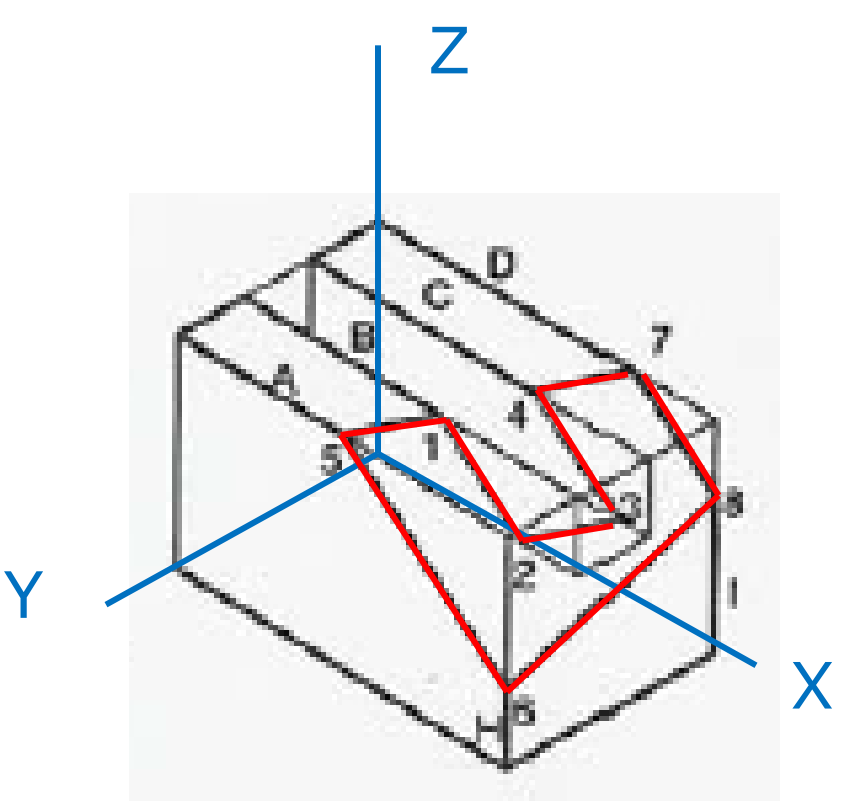
Construction of an isometric drawing II



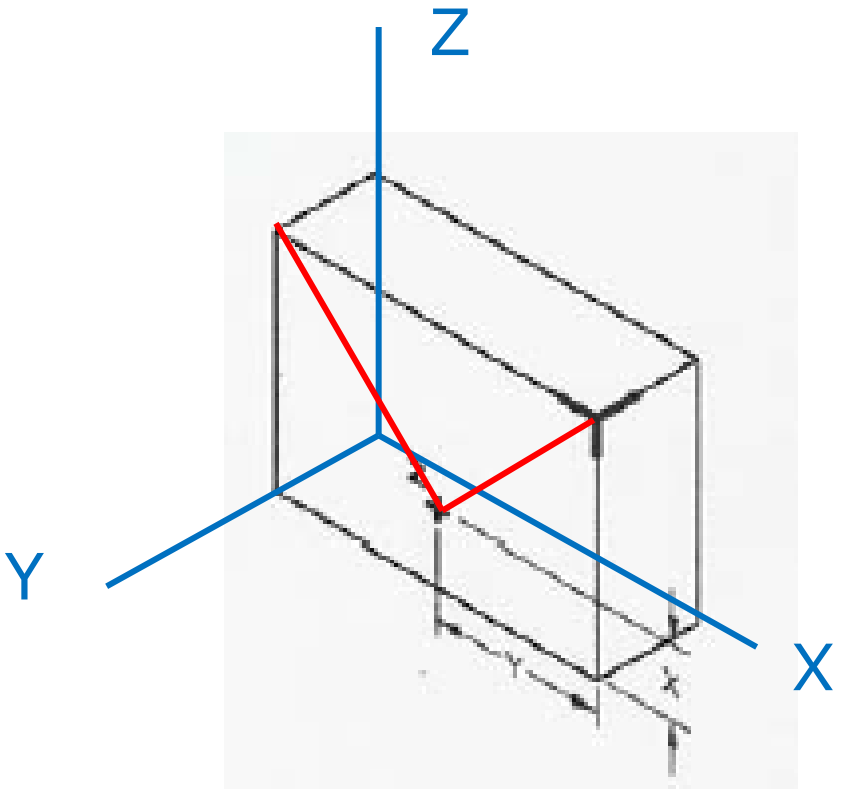
Non isometric lines



Construction of an isometric drawing II

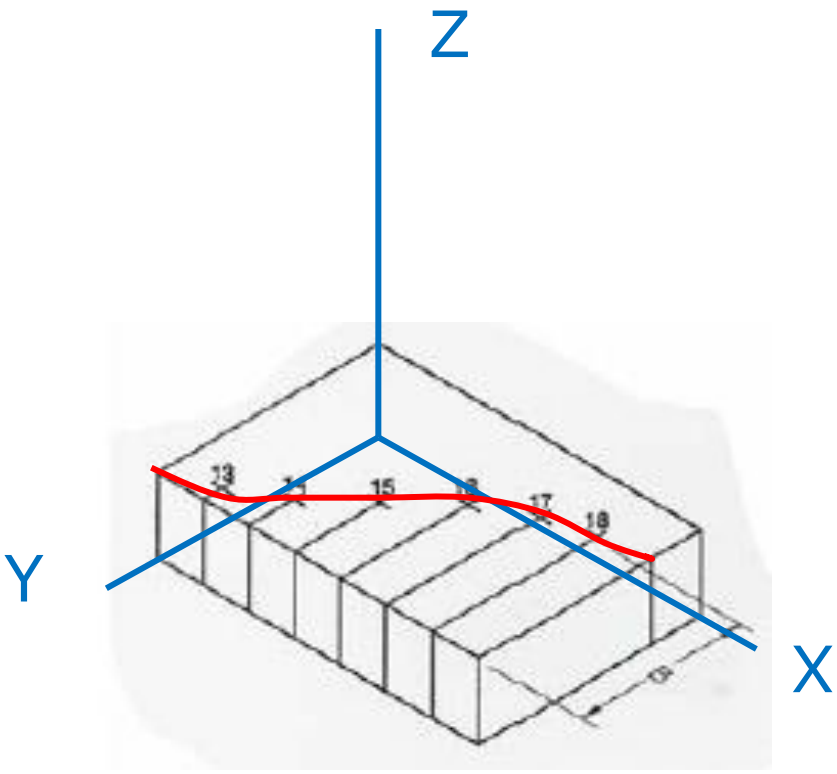


Inclined surfaces



Angles

Construction of an isometric drawing III



Irregular lines

Construction of an isometric drawing IV