

Technical Drawing in Engineering



Lecture 2. Orthographic Projection: Basic concepts

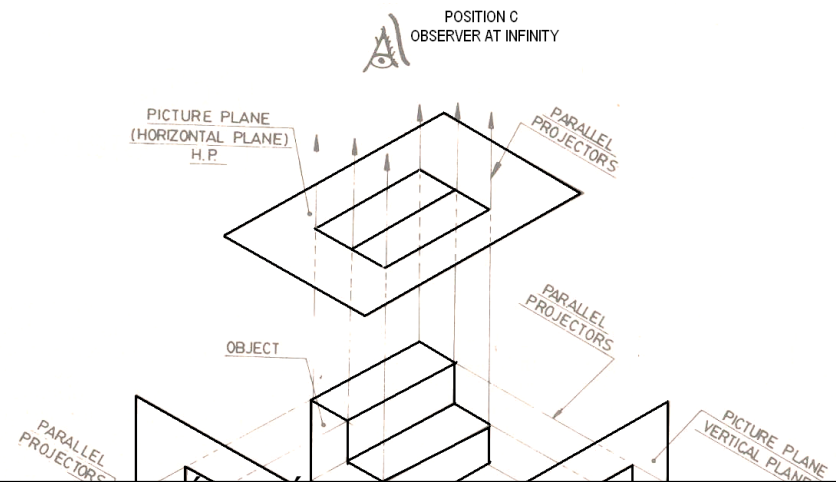
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What is Orthographic Projection

- Orthographic means straight projection.
- It stands for the projection of the shadow of the object on a plane.



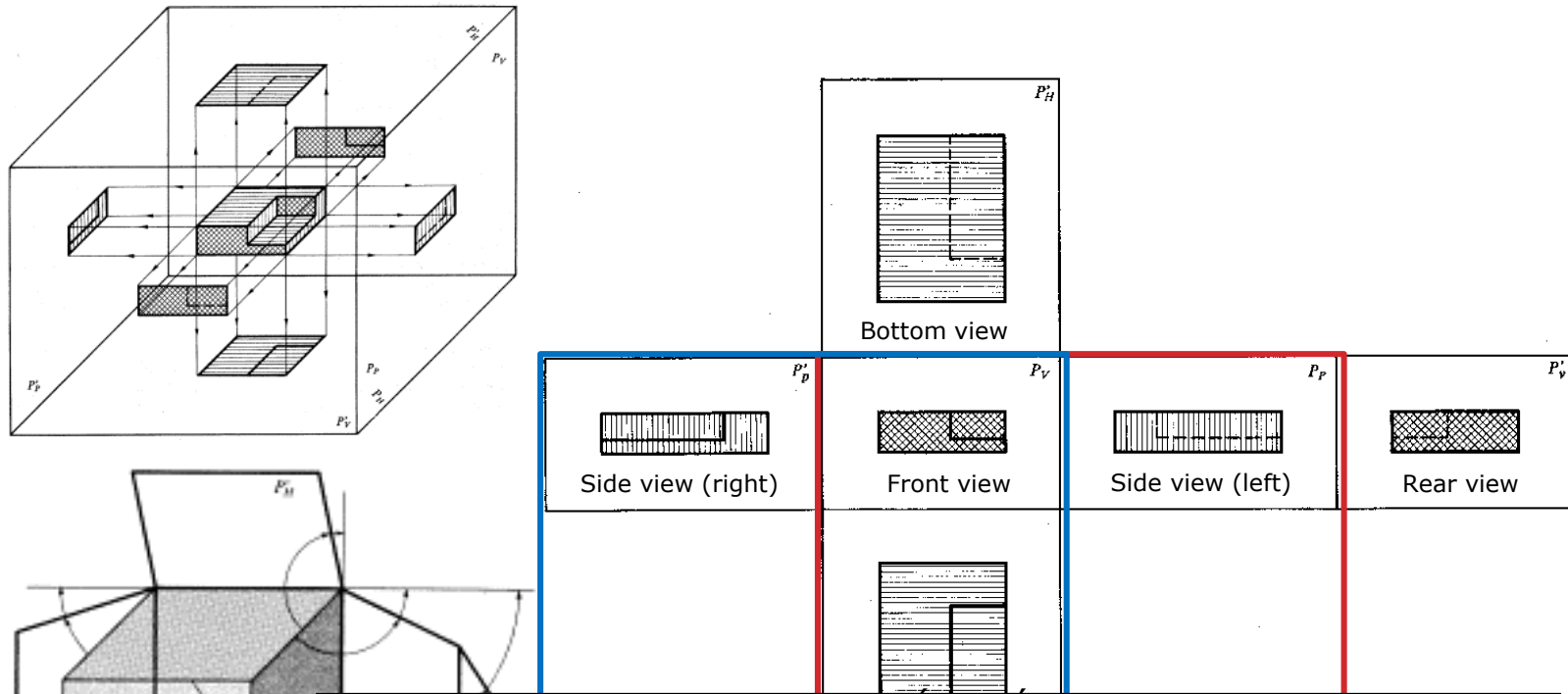
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Basic concepts I

□ European system



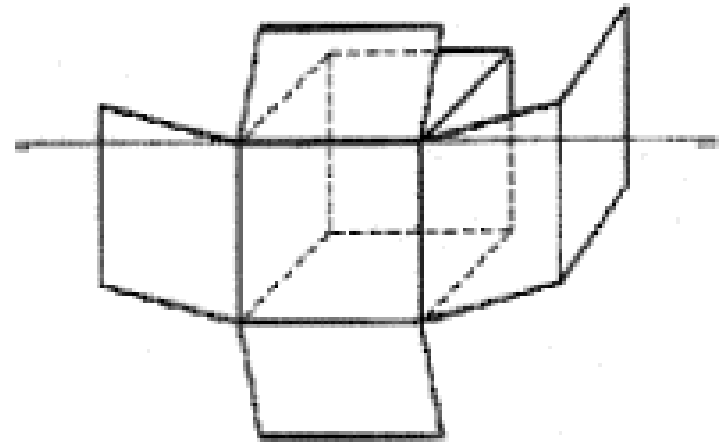
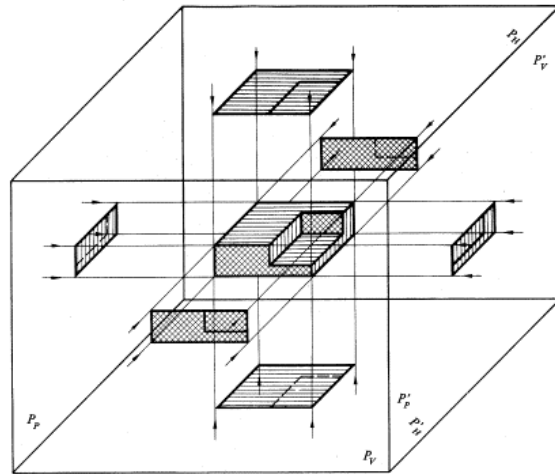
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Basic concepts II

□ American system



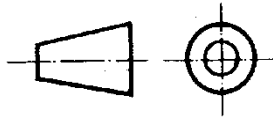
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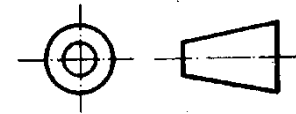
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Basic concepts III

□ **European system**



□ **American system**



Solids in O.P.



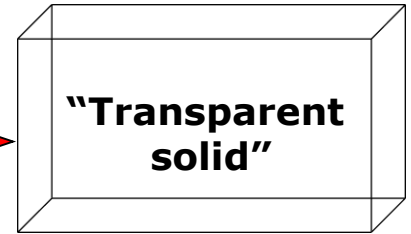
Edges



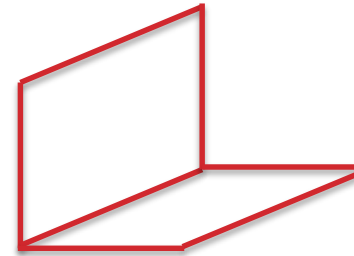
Visible and hidden lines



"Transparent solid"



□ **To represent simple objects:**
2 projection planes



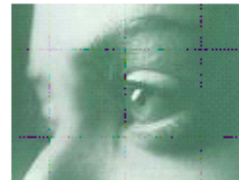
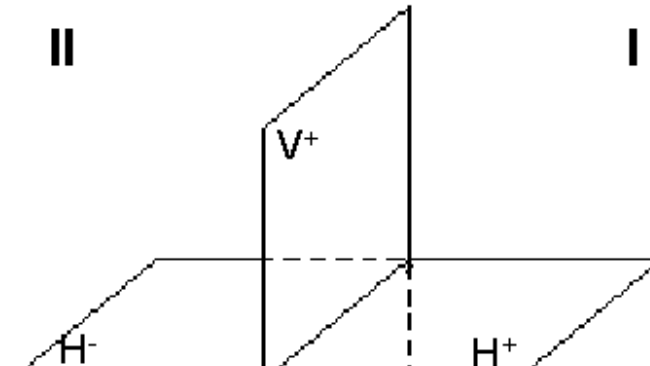
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Basic concepts IV

- Double orthogonal projection in two perpendicular planes called **vertical** and **horizontal projection planes**.
- Division by quadrants:
 - 4 quadrants with the following projection planes:
 - 1st quadrant: V+ H+
 - 2nd quadrant: V+ H-
 - 3rd quadrant: V- H-
 - 4th quadrant: V- H+



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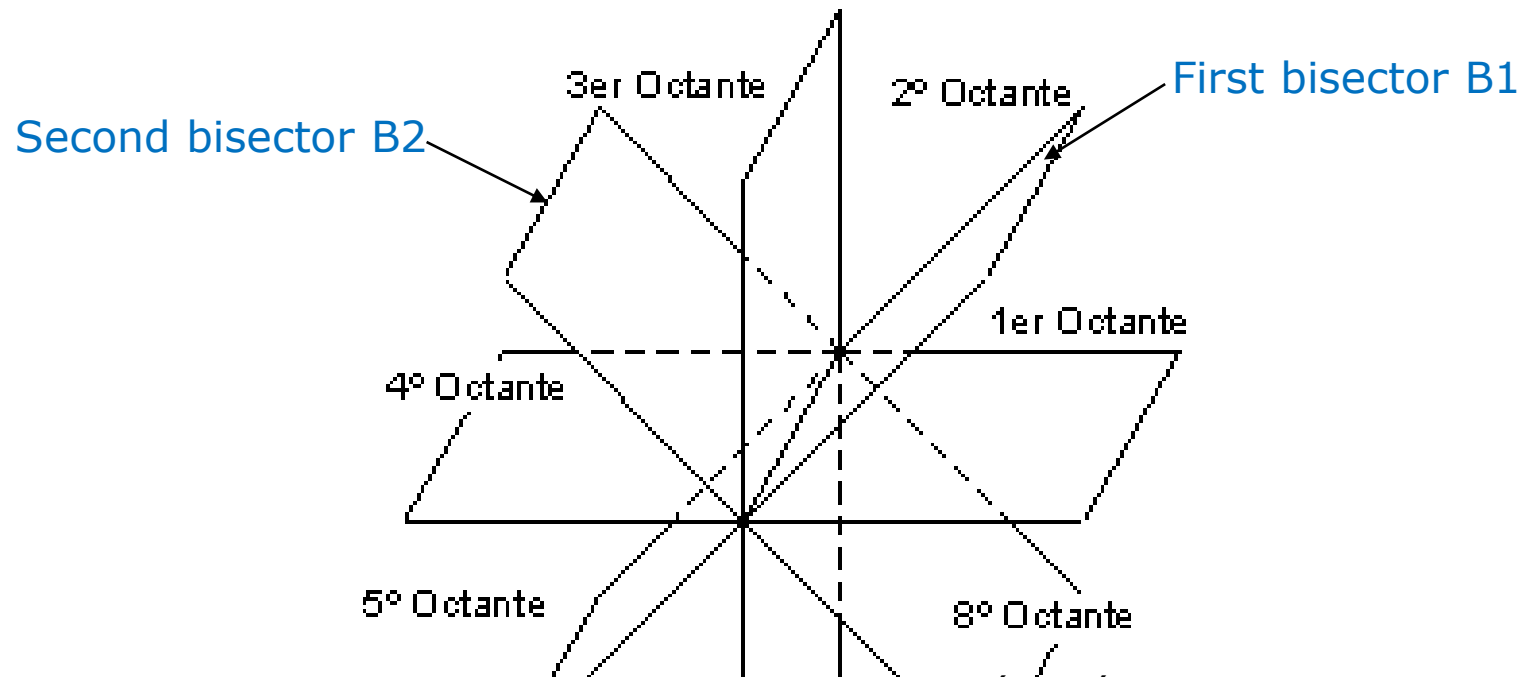
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III

IV

Basic concepts V

- 2 bisectors + 8 octants

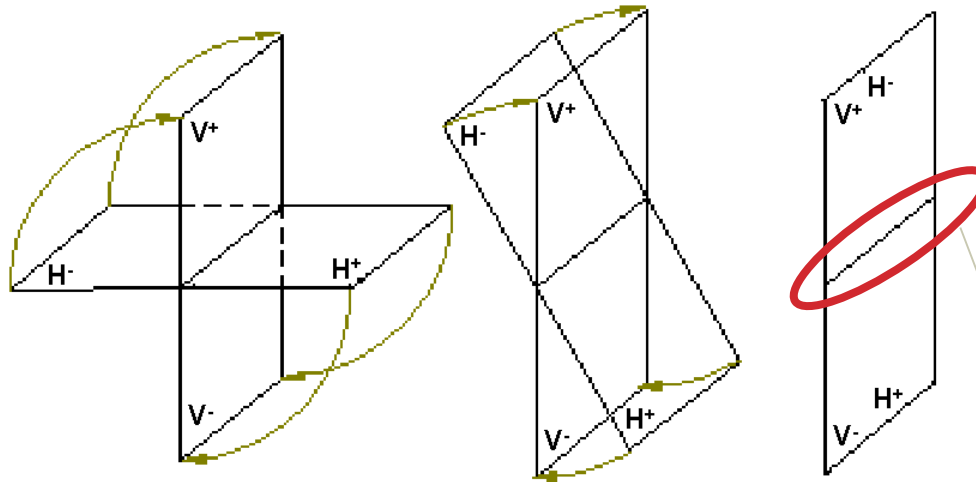


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Basic concepts VI



V+ H-

Reference line

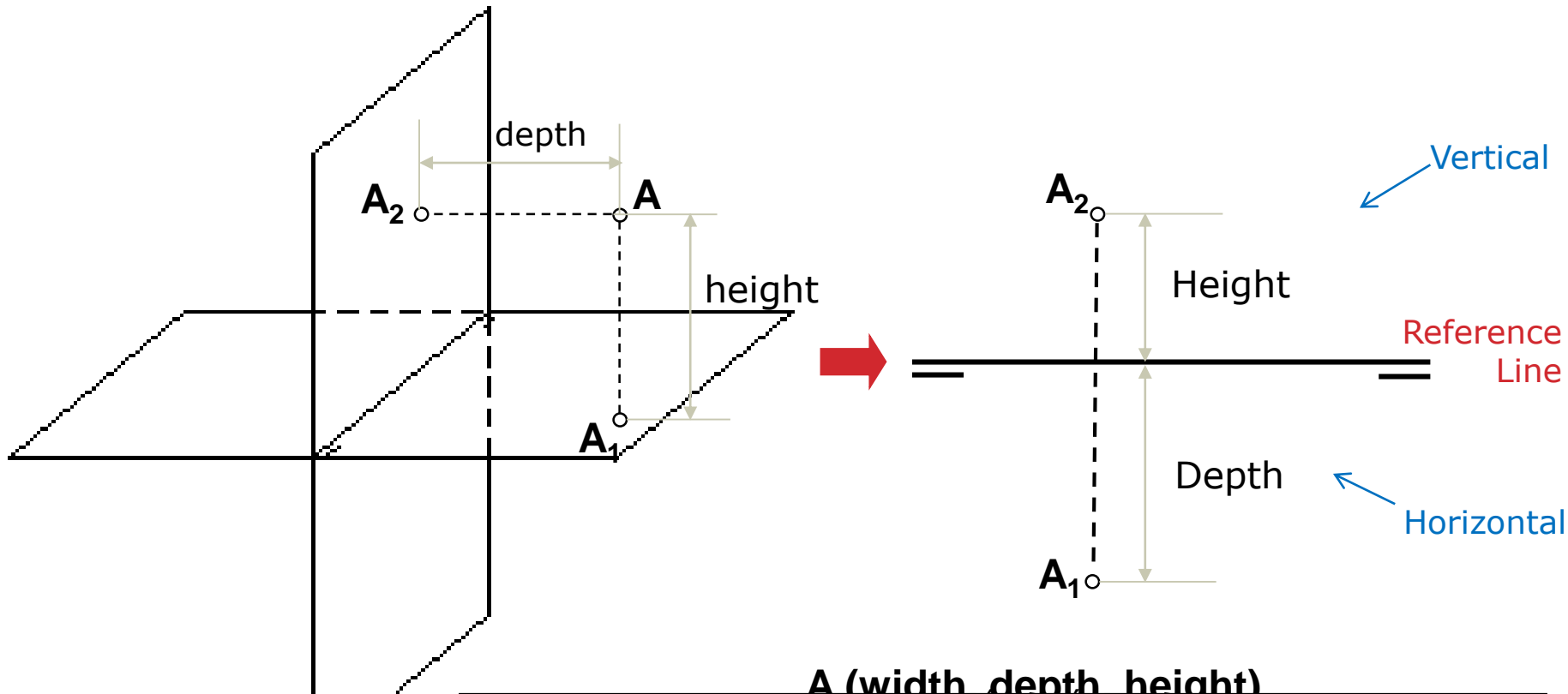
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V- H+

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Representation of a point I



A (width depth height)

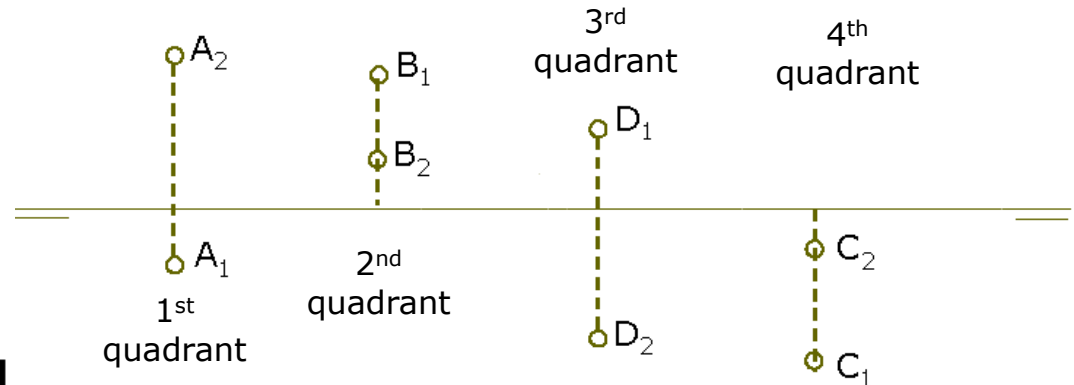
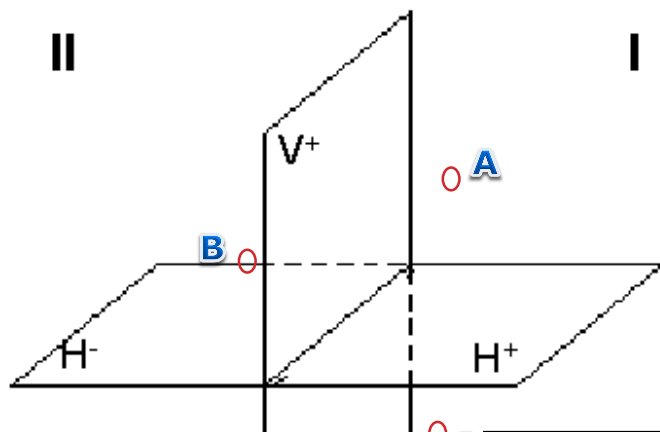
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Representation of a point II

Positions of the points



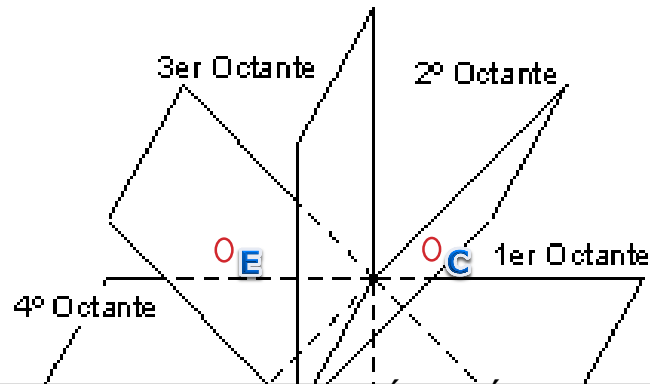
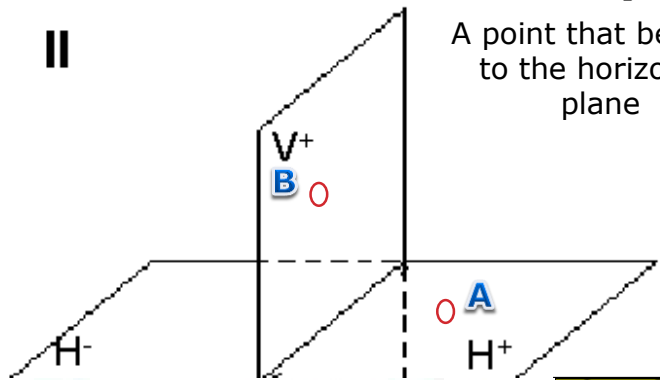
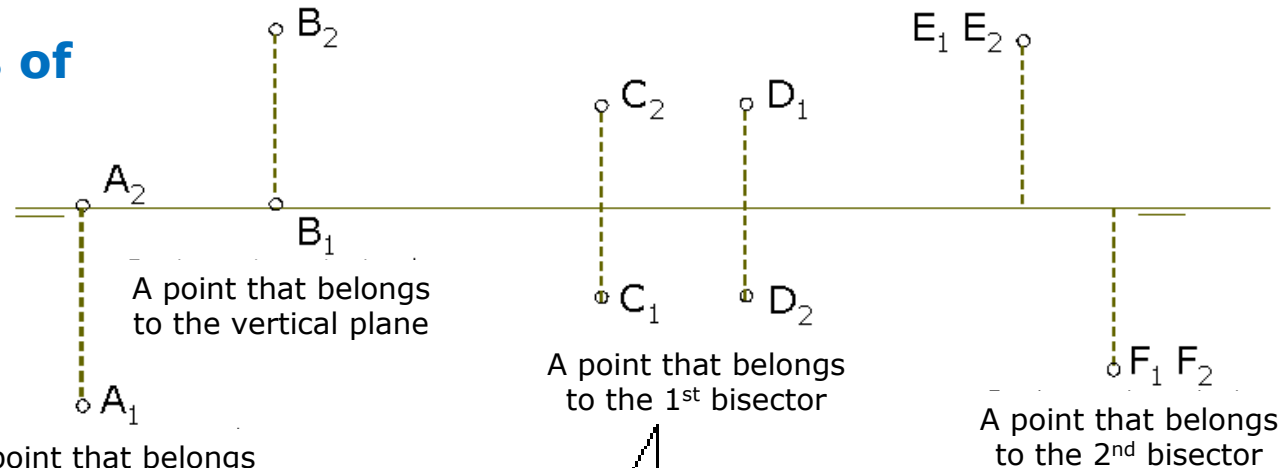
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Representation of a point II

Special positions of the points



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III

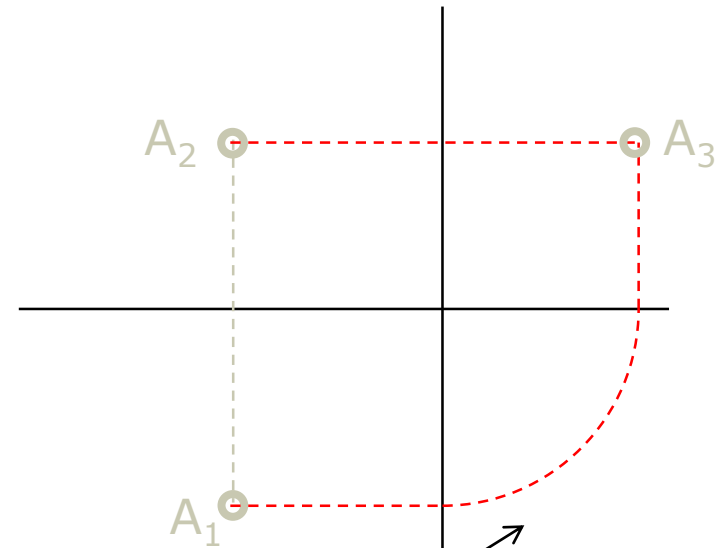
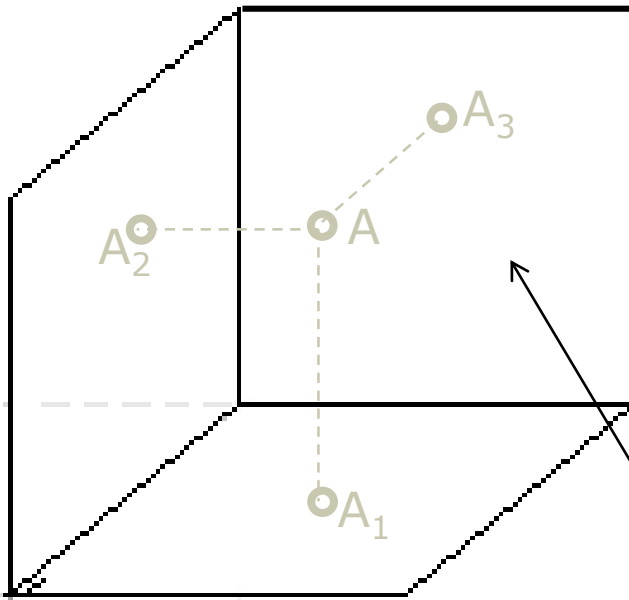
IV

IV

6º Octante

7º Octante

Representation of a point III

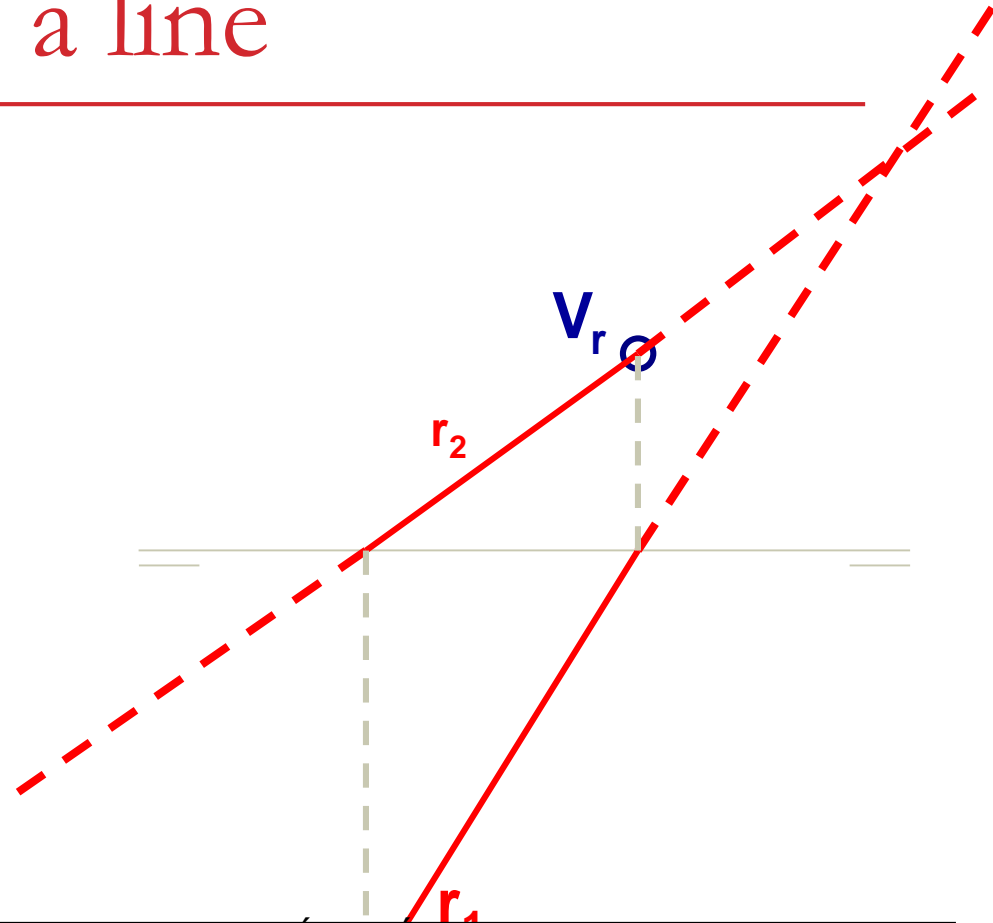
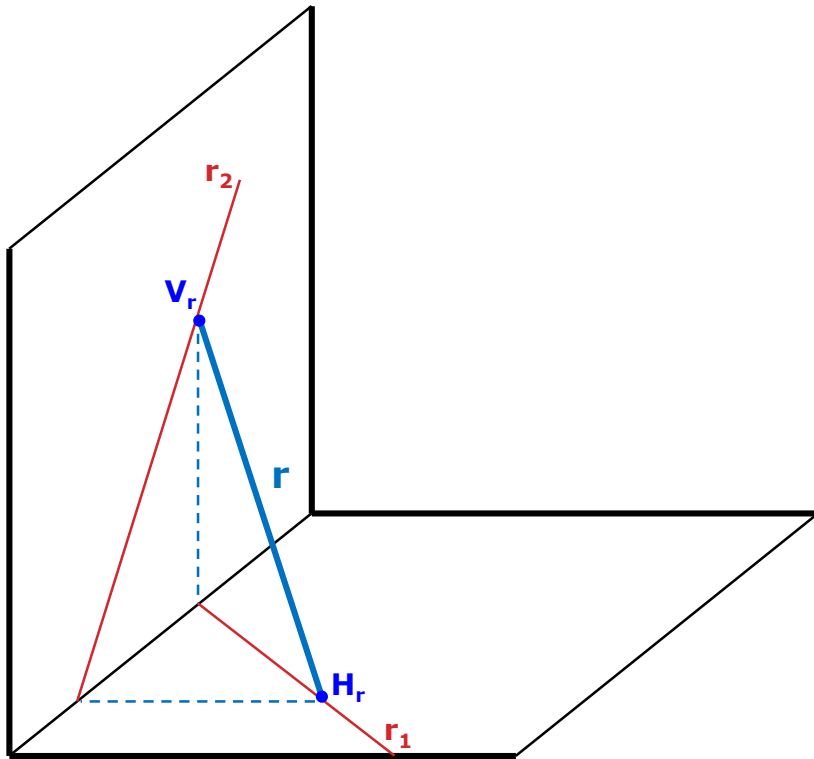


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Representation of a line



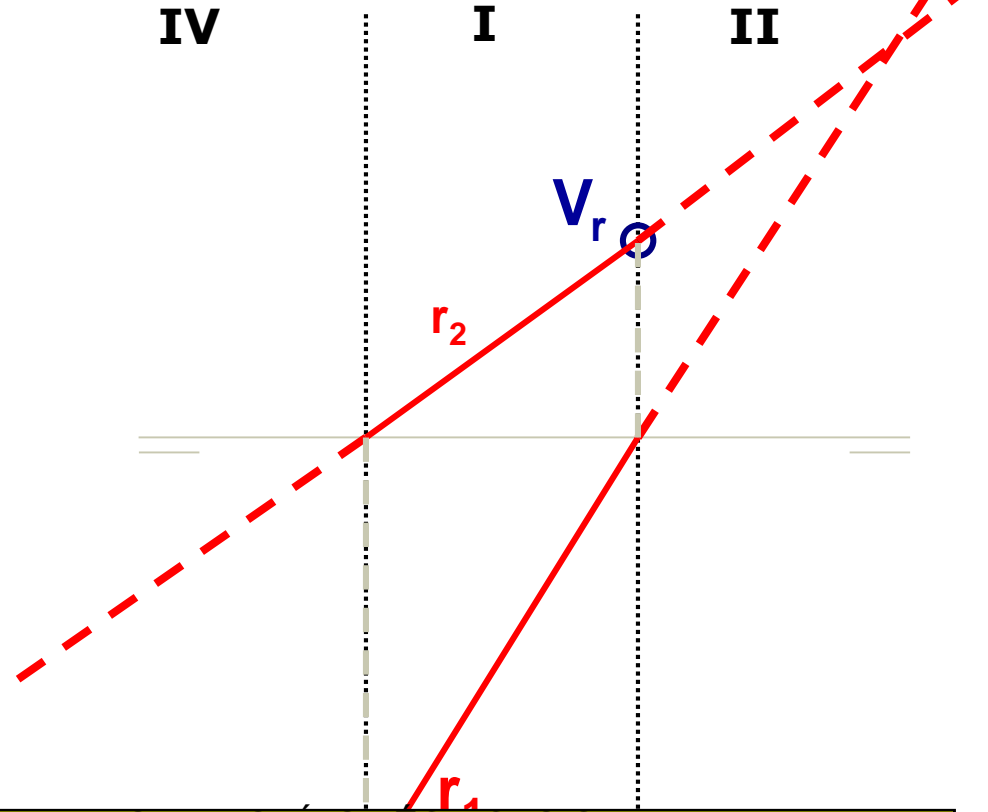
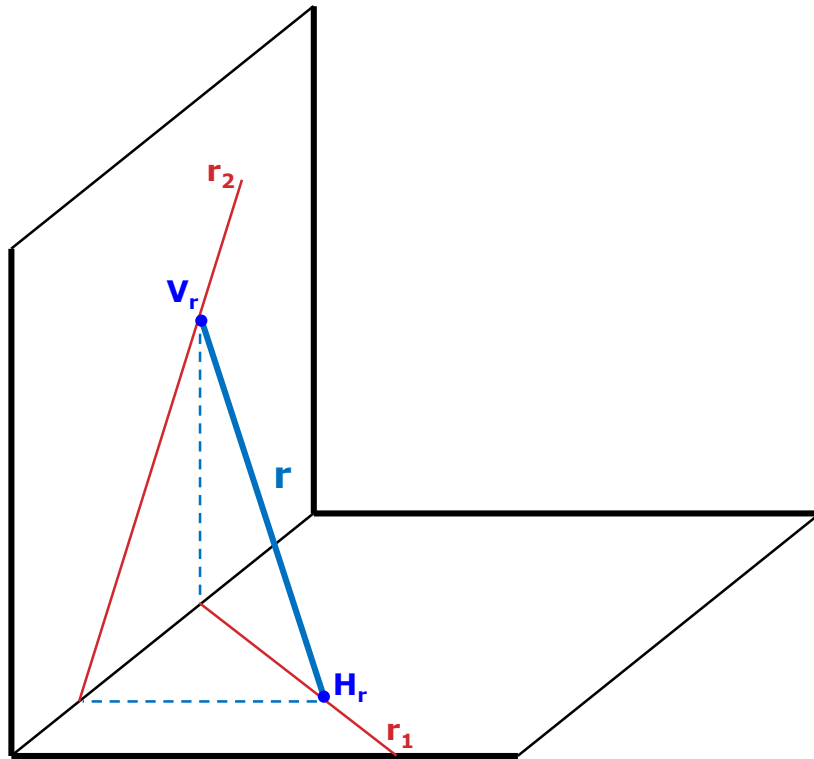
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first quadrant.

Representation of a line



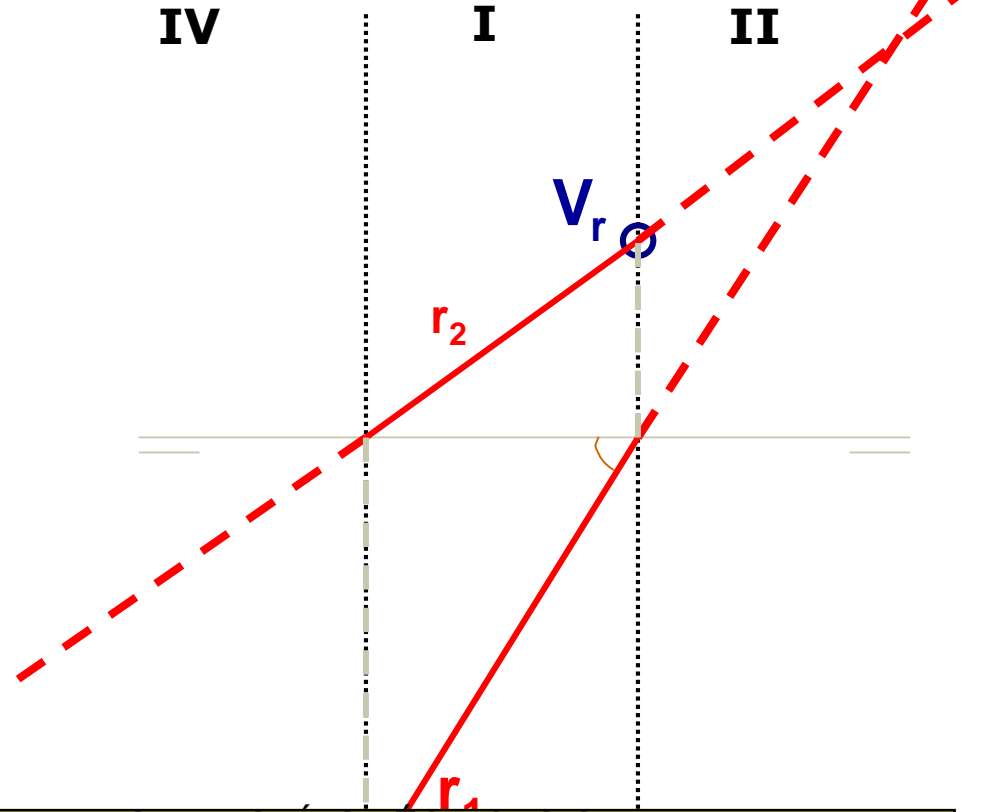
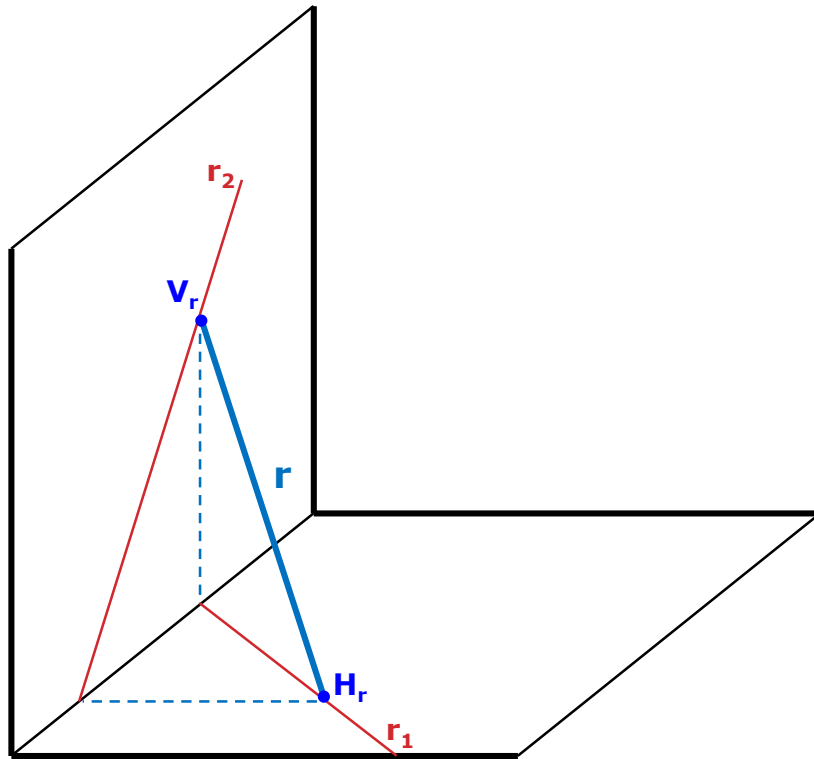
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first quadrant.

Representation of a line



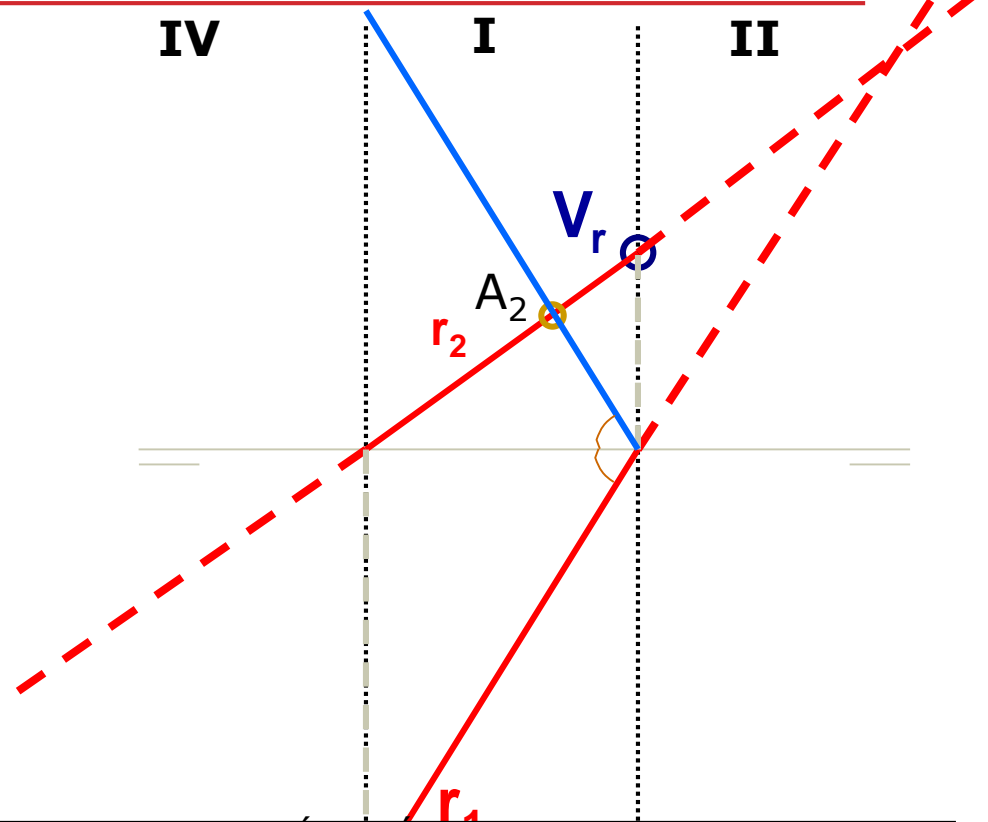
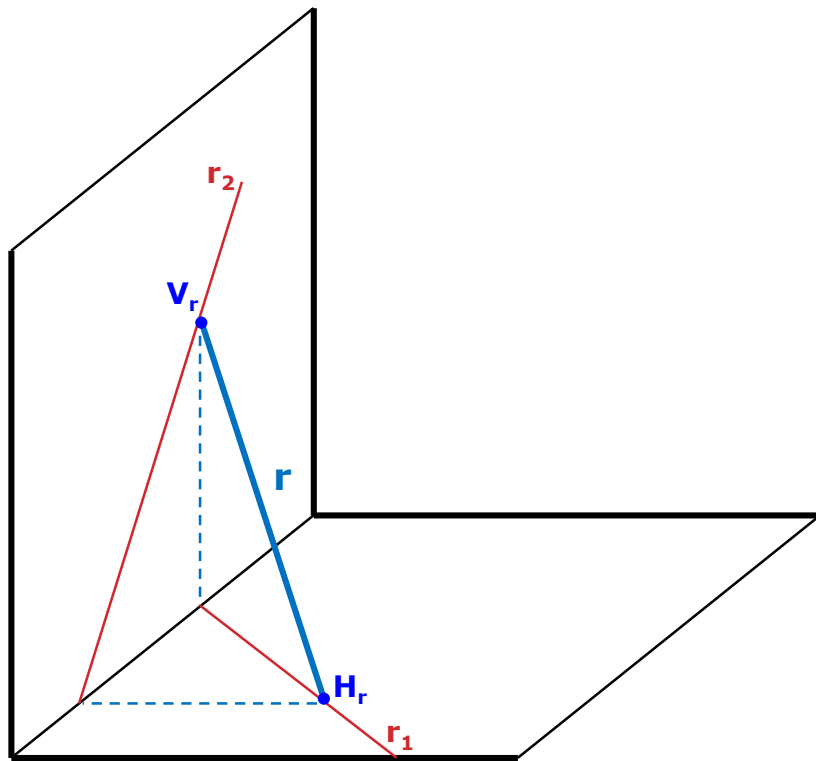
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first quadrant.

Representation of a line



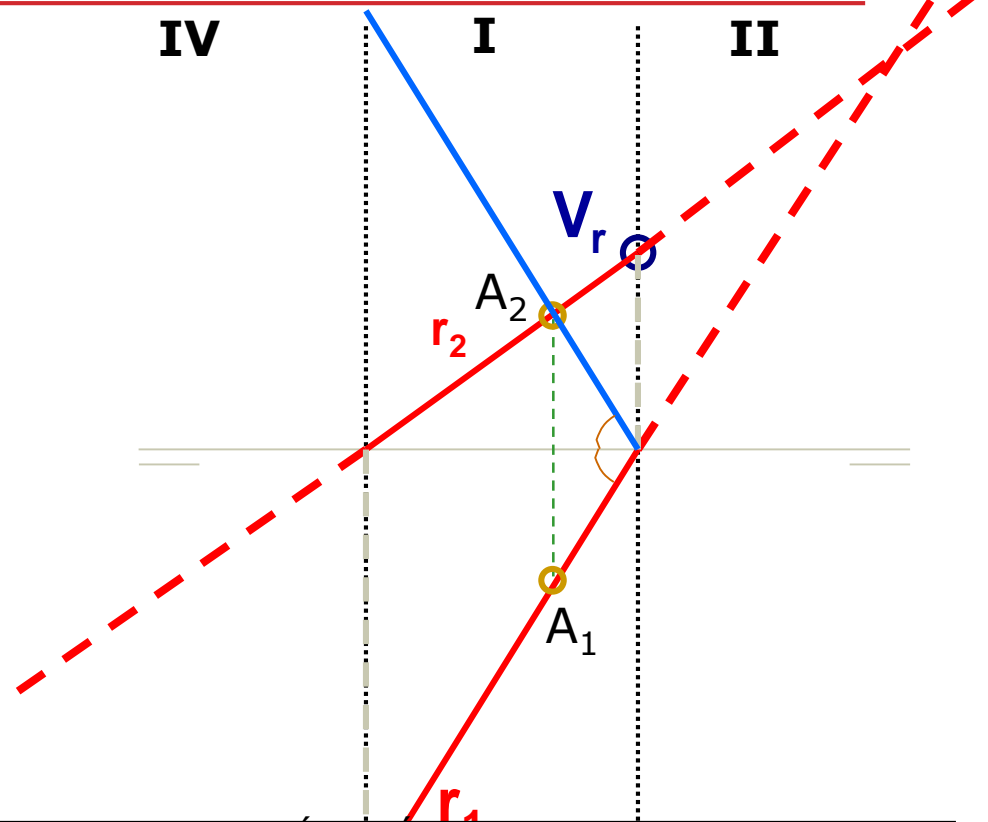
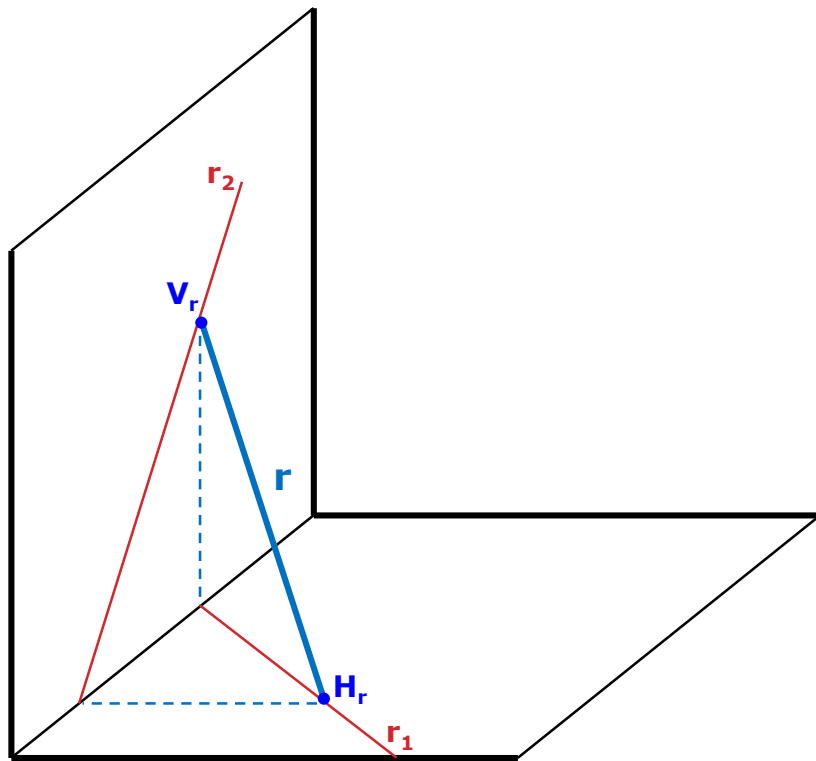
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first quadrant.

Representation of a line



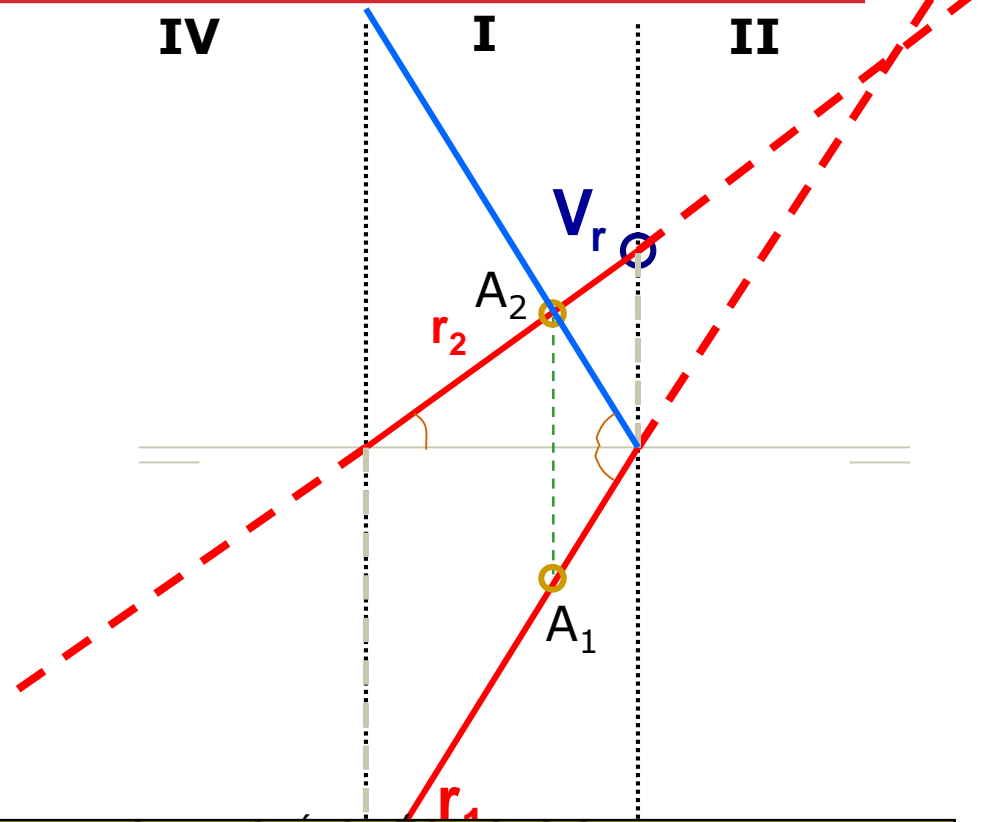
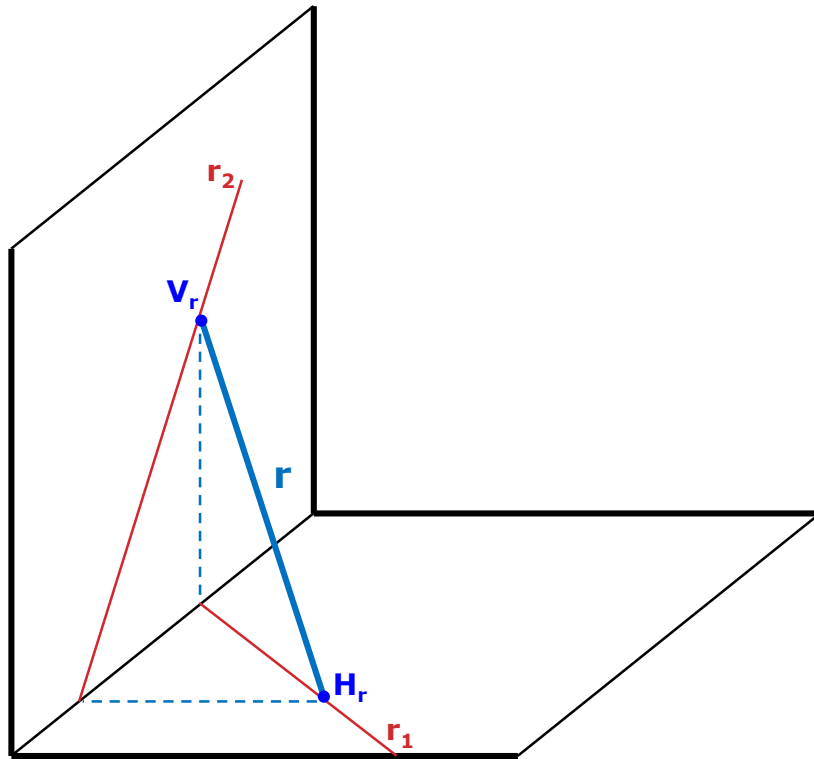
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first quadrant.

Representation of a line



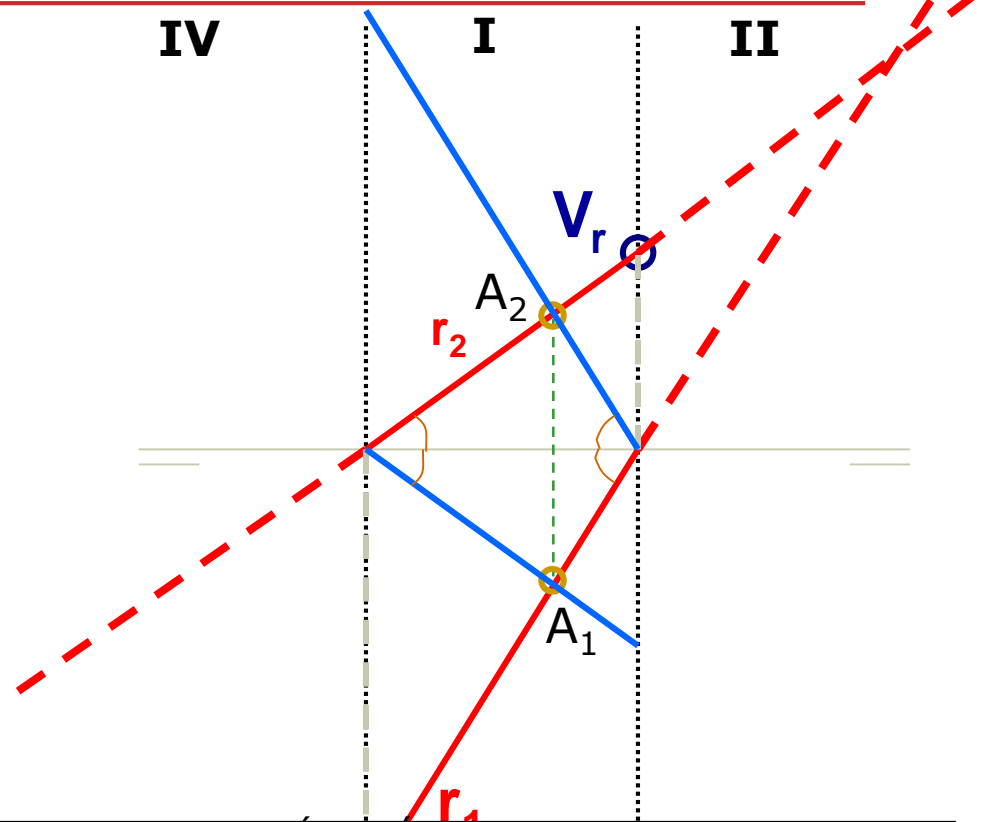
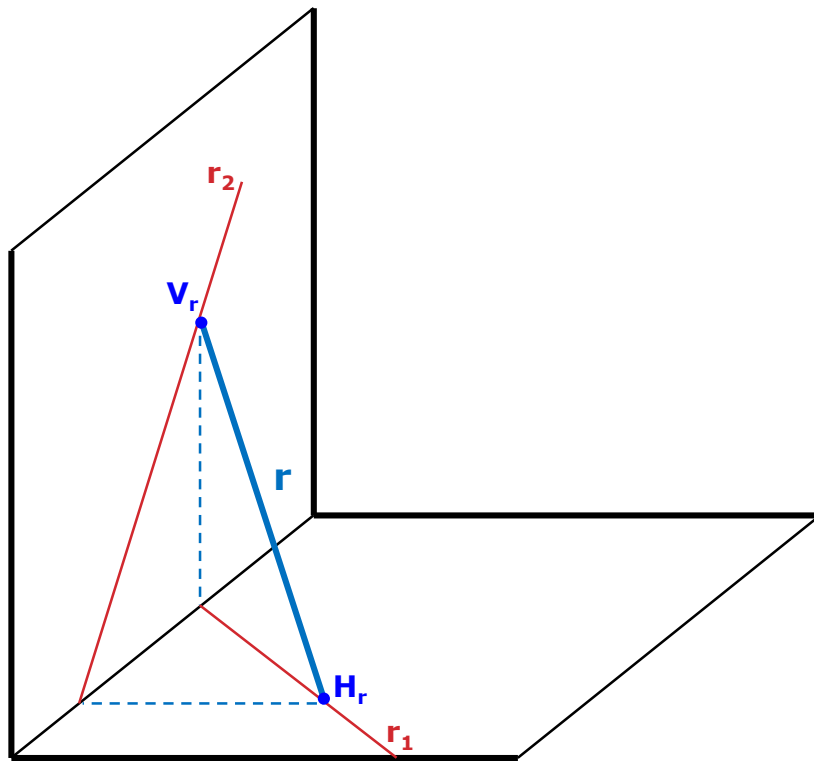
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first quadrant.

Representation of a line



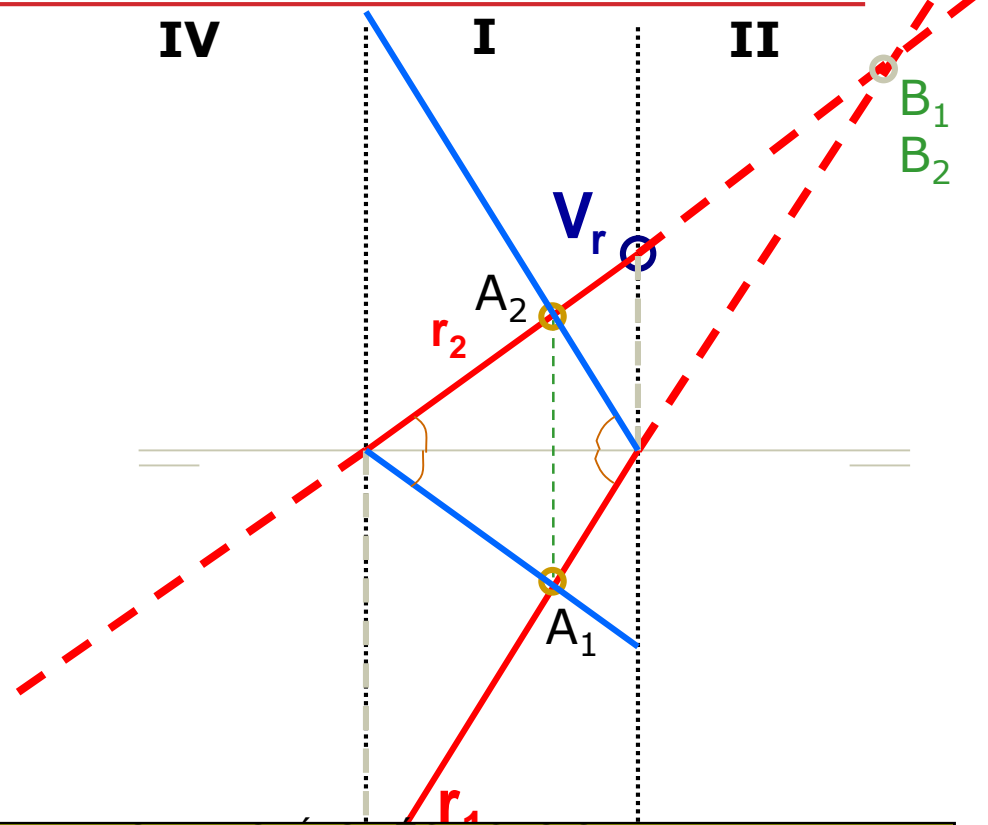
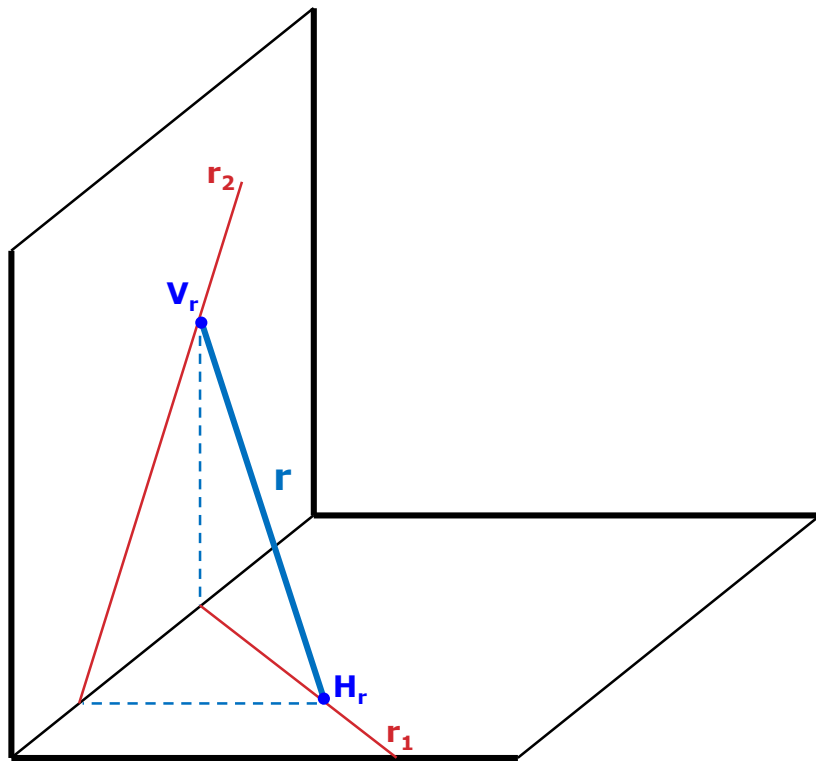
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first quadrant.

Representation of a line



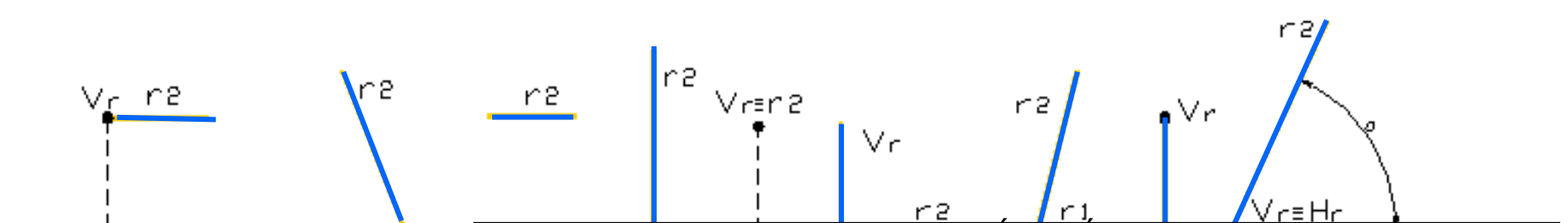
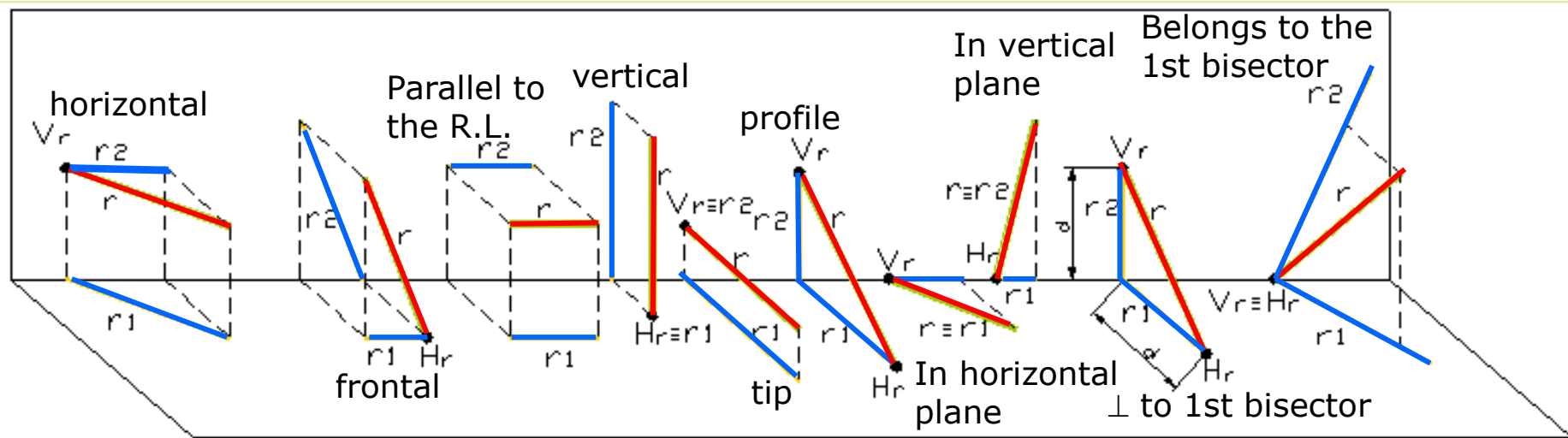
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first quadrant.

Particular positions of a line



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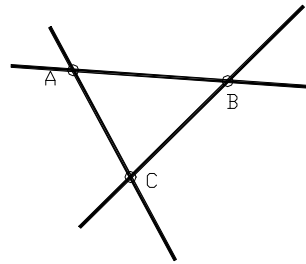
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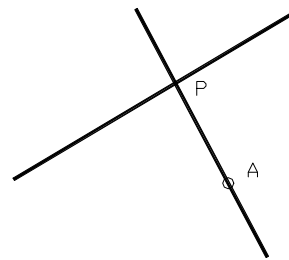
Representation of a plane

DEFINITION OF A PLANE

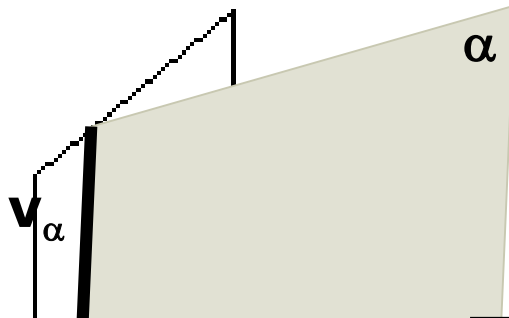
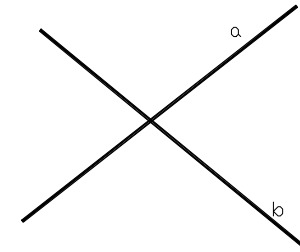
3 NON ALLIGNED POINTS



POINT AND LINE



TWO LINES THAT CUT EACH OTHER

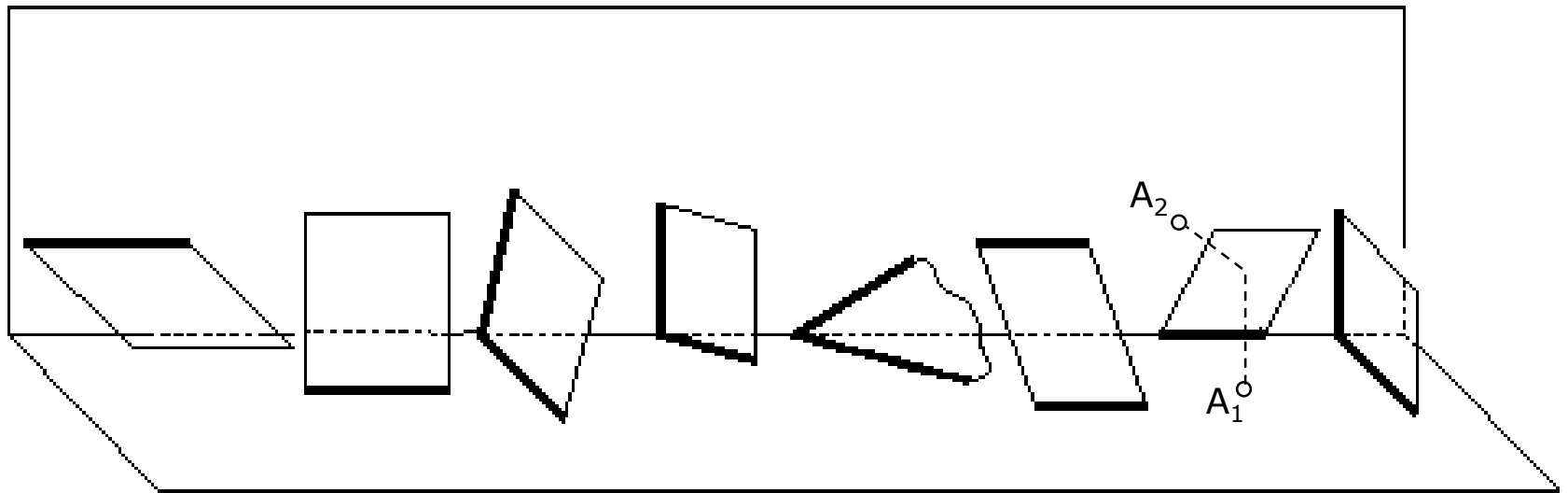


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Special positions of a plane



horizontal



frontal

edgewise



vertical



generic



// to the R.L.



profile



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and point A

Membership

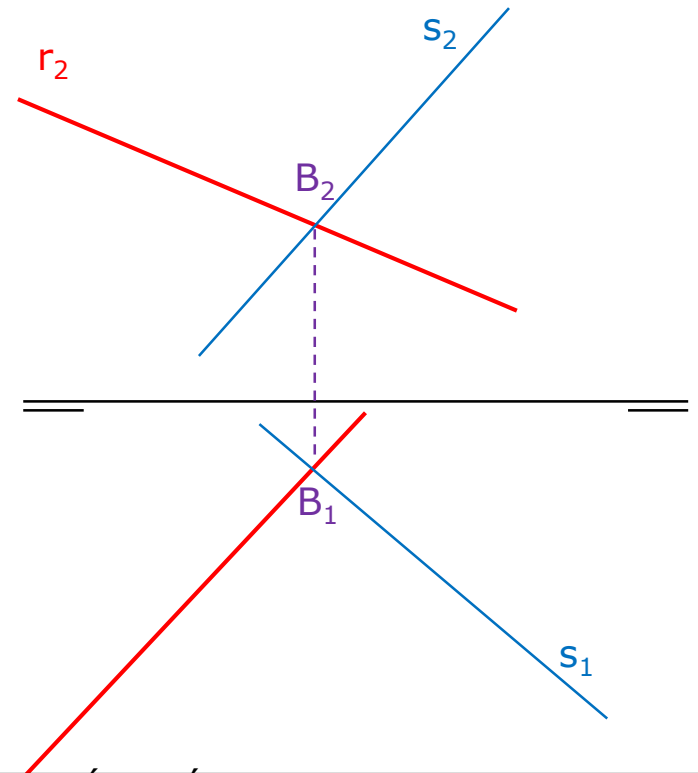
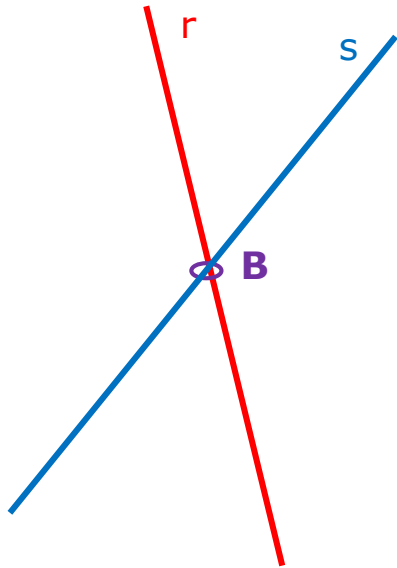
- A point *belongs* to a line if its **projections** are included in the line's **projections**.
- A line *belongs* to a plane if its **traces** are included in the **traces** of the plane.
- A point *belongs* to a plane, if it belongs to a line that is included in this plane.

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Intersection between lines



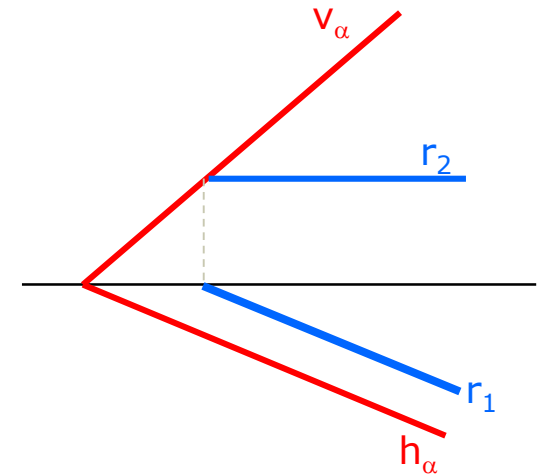
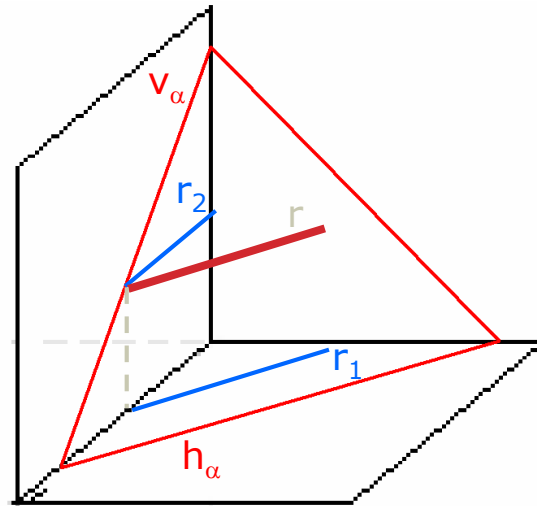
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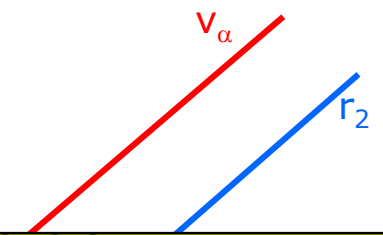
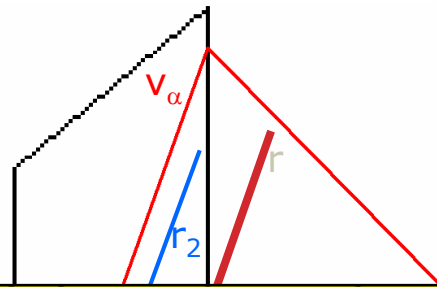
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Special lines of a plane I

□ Horizontal lines



□ Frontal lines



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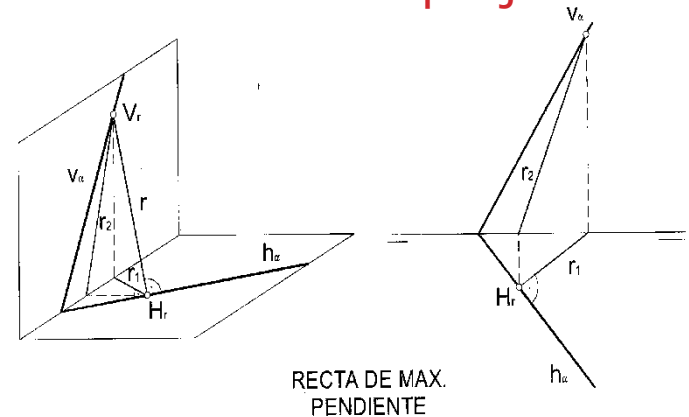
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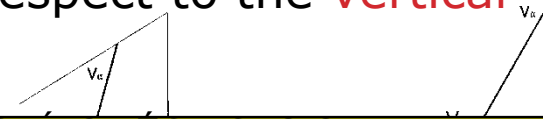
h_α

Special lines of a plane II

- Lines of maximum slope:** Is a line that belongs to the plane and has the **maximum angle** with respect to the **horizontal projection** of the plane.
 - Perpendicular to the horizontal projection of the plane.



- Lines of maximum inclination:** Is a line that belongs to the plane and has the **maximum angle** with respect to the **vertical projection** of the plane.
 - Perpendicular to the vertical projection of the plane.



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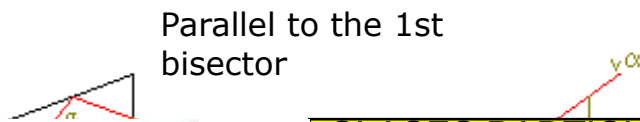
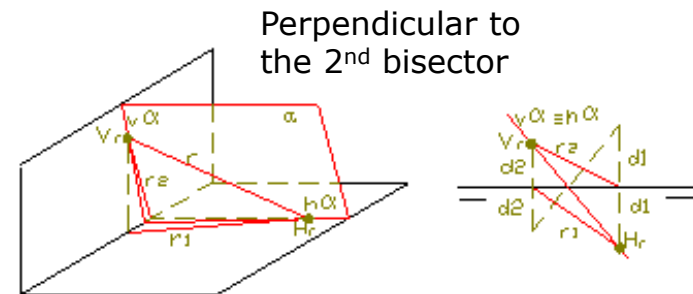
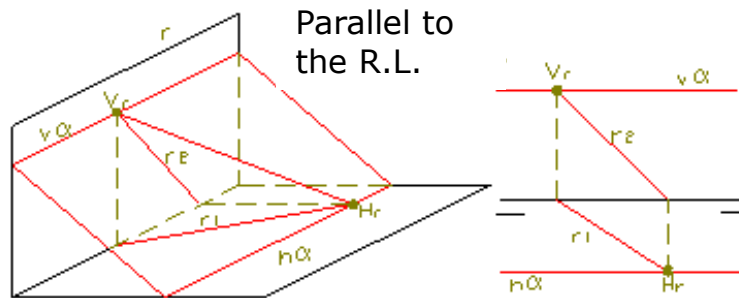
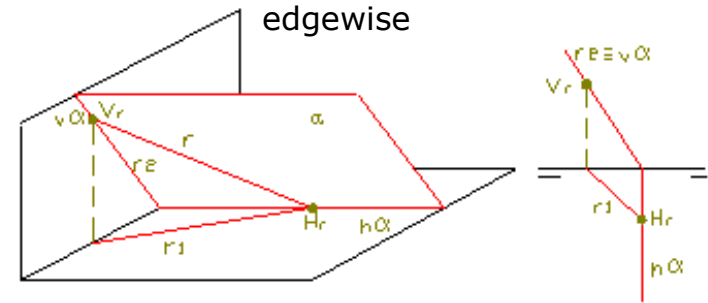
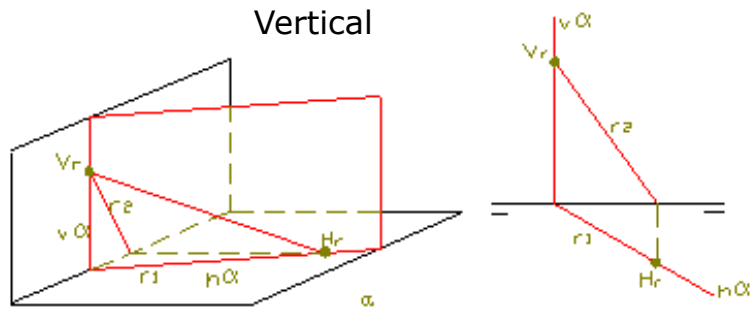
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INCLINACION

H_r h_a

Special planes and their lines

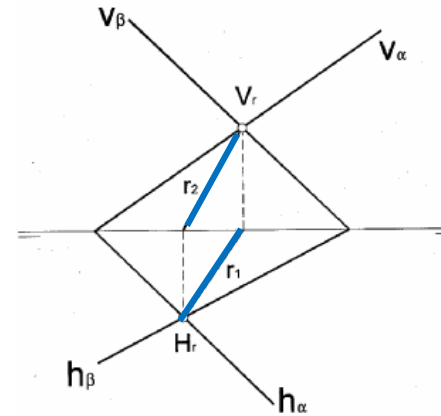
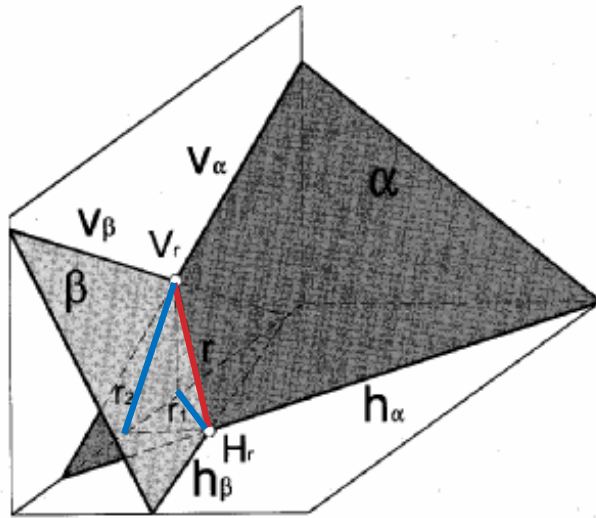


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Intersection of planes I



If the intersection of the projections of the planes is out of the paper

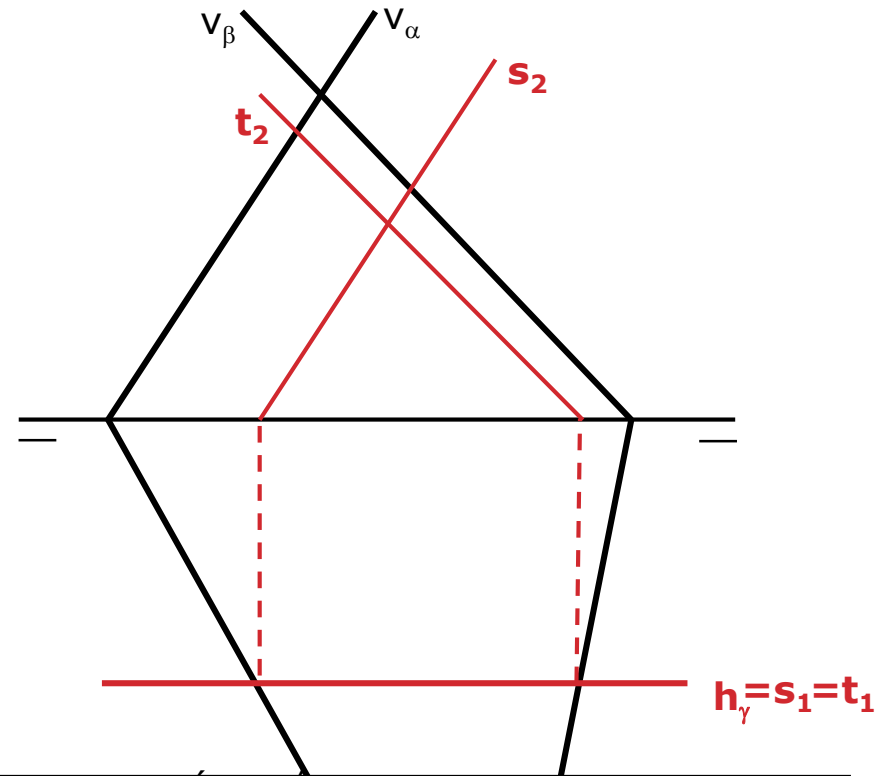
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Intersection of planes II

- Draw a frontal plane γ
- Find the intersection of γ with α and β (s&t)



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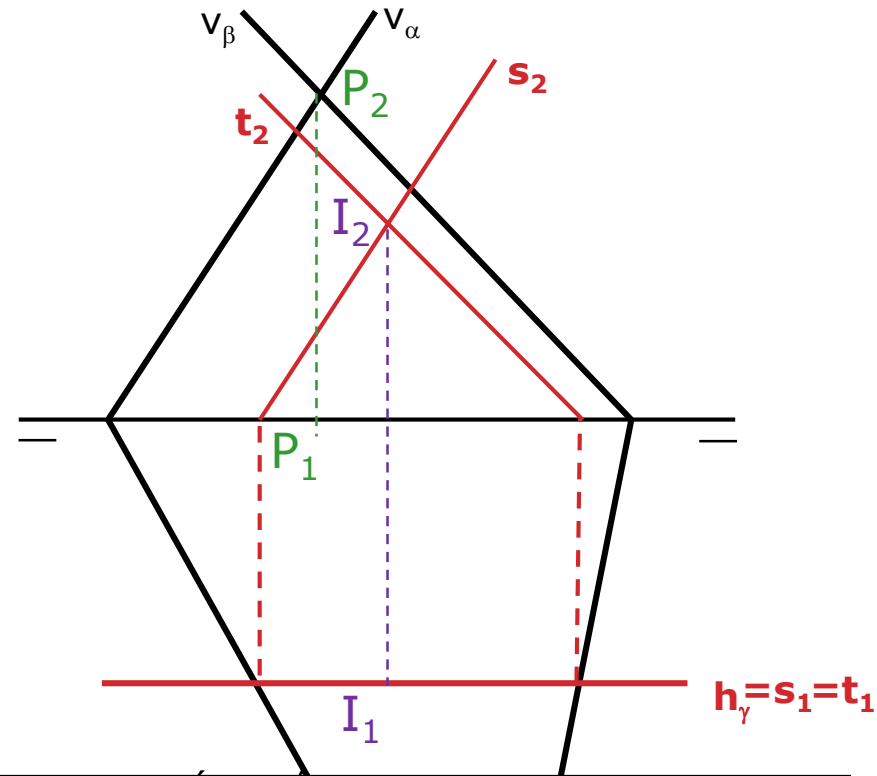
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<http://www.youtube.com/watch?v=9F-11W0uDXc>

Intersection of plans II

- Draw a frontal plane γ
- Find the intersection of γ with α and β (s & t)
- Projections of s & t would meet at point I
- And α & β at point P



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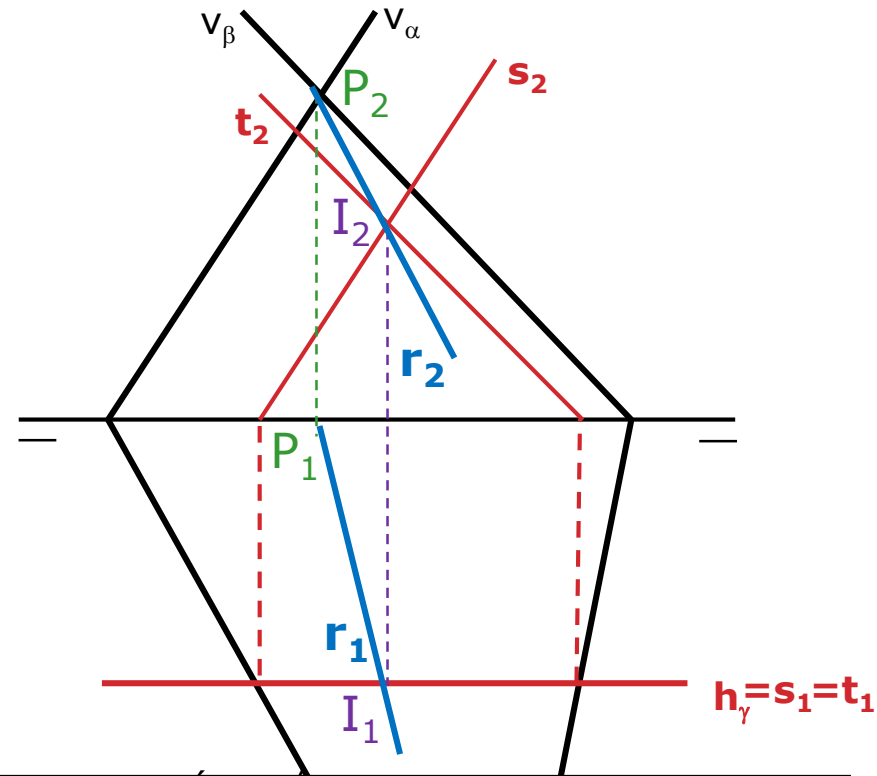
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Intersection of plans II

- Draw a frontal plane γ
- Find the intersection of γ with α and β (s & t)
- Projections of s & t would meet at point I
- And α & β at point P
- Joining I & P we get r (the line where both plans intersect)



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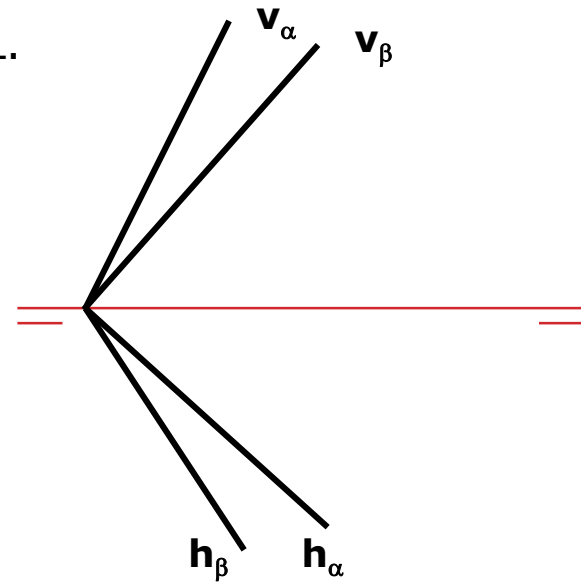
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Intersection of planes III

Coinciding planes in the same point on the R.L.



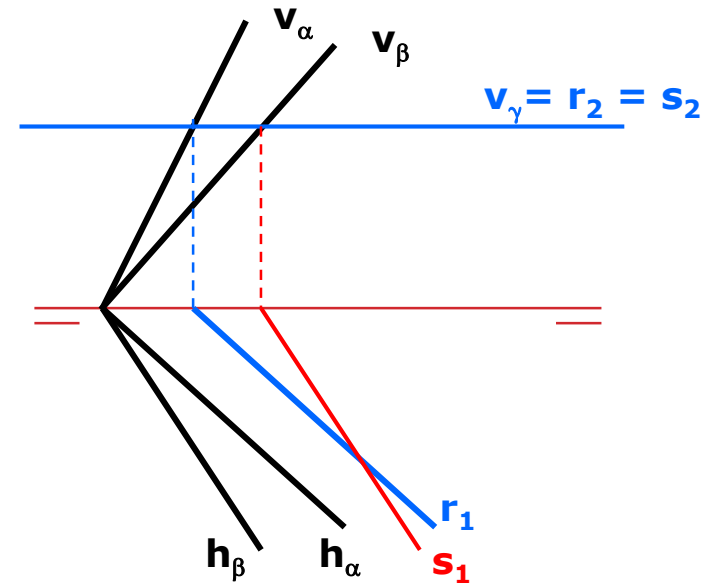
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Intersection of planes III

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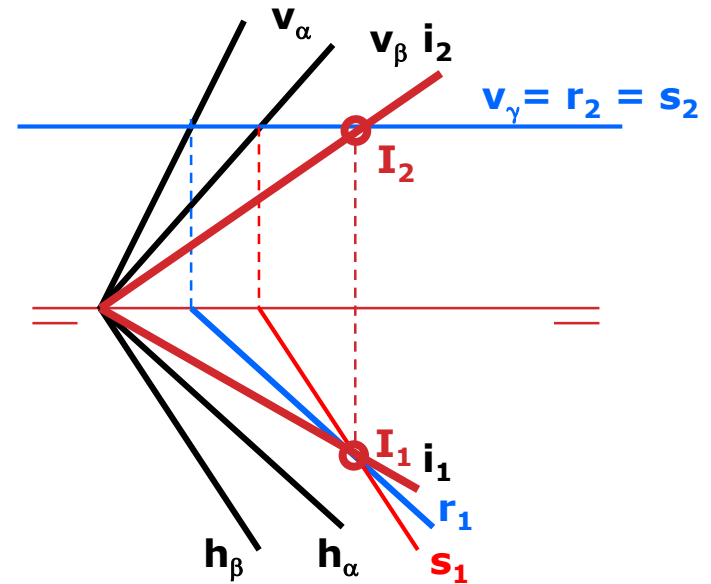
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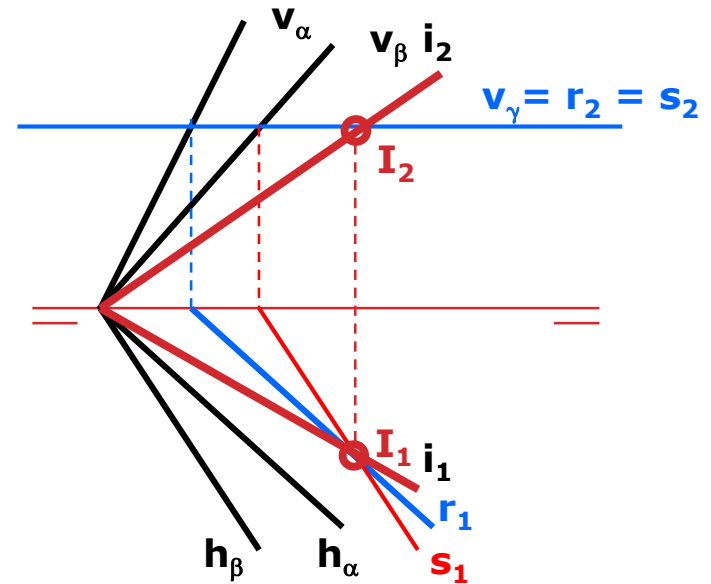
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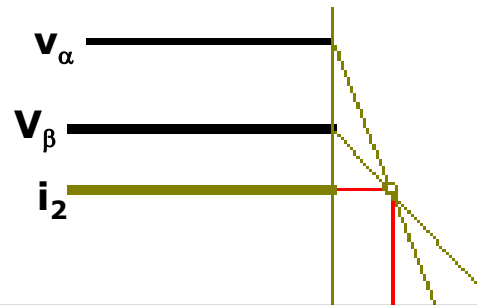
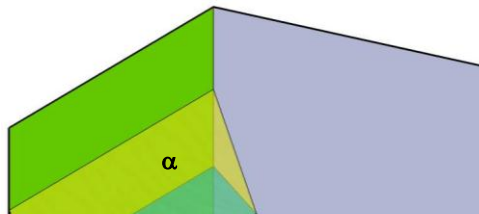
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Intersection of planes III

Coinciding planes in the same point on the R.L.



Planes parallel to the R.L.

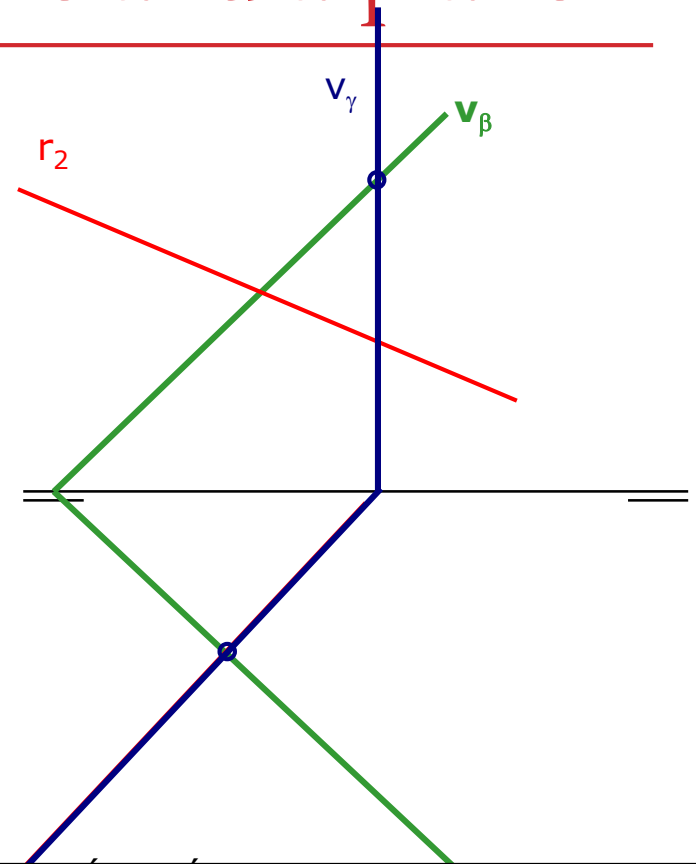
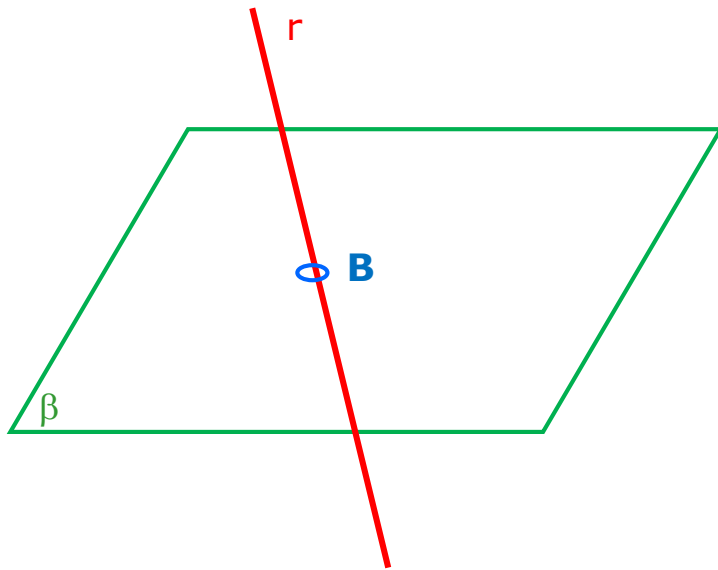


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Intersection between a line and a plane



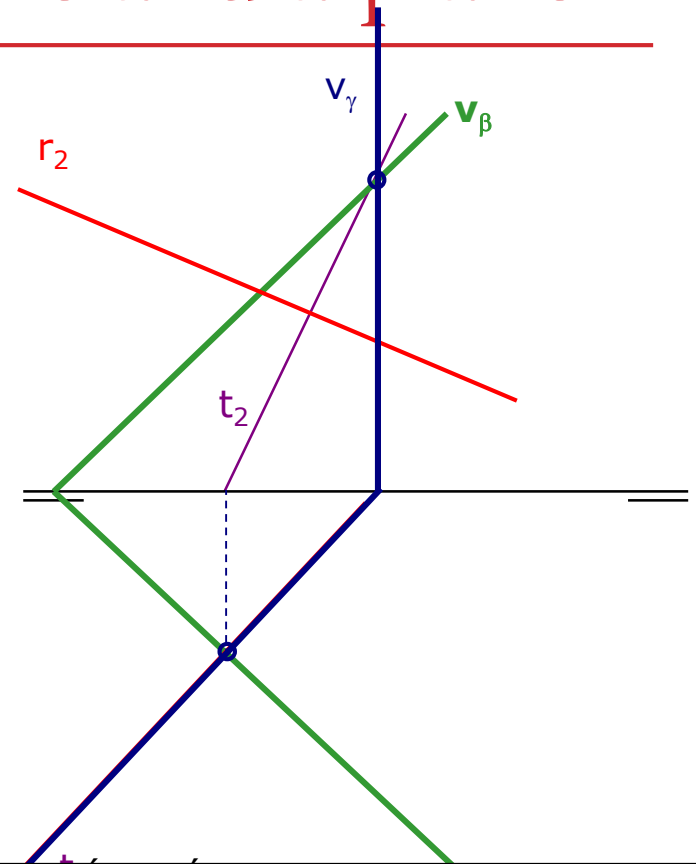
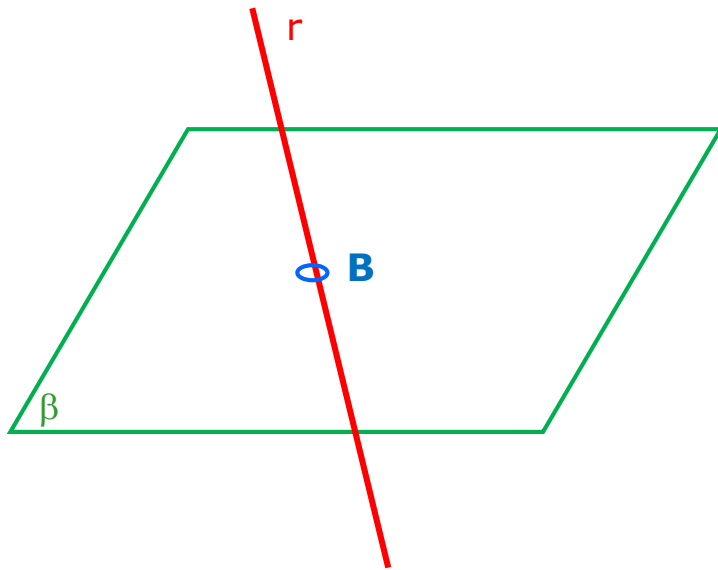
1. Create a plane γ that includes the line r .
(easiest option vertical plane)

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Intersection between a line and a plane



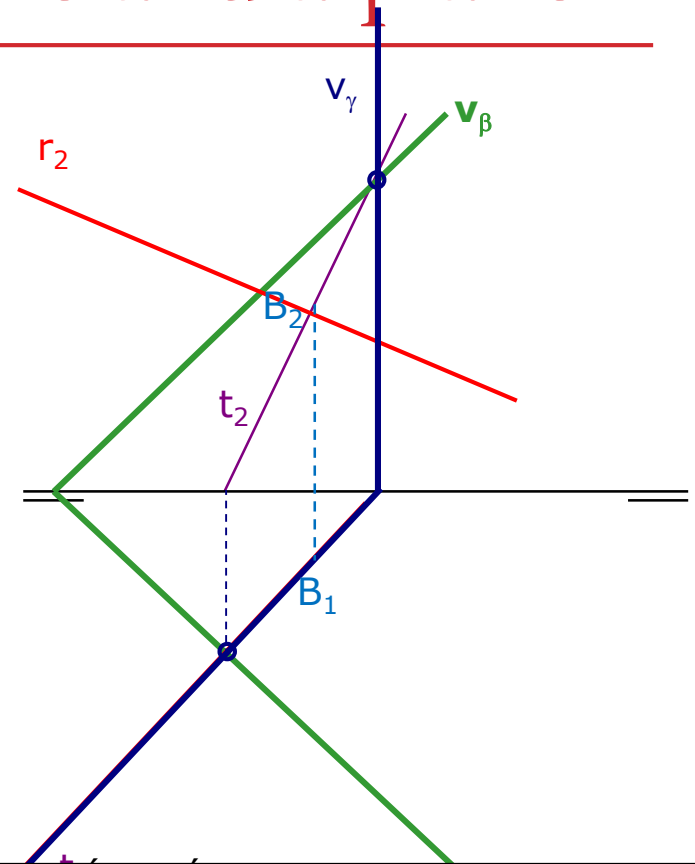
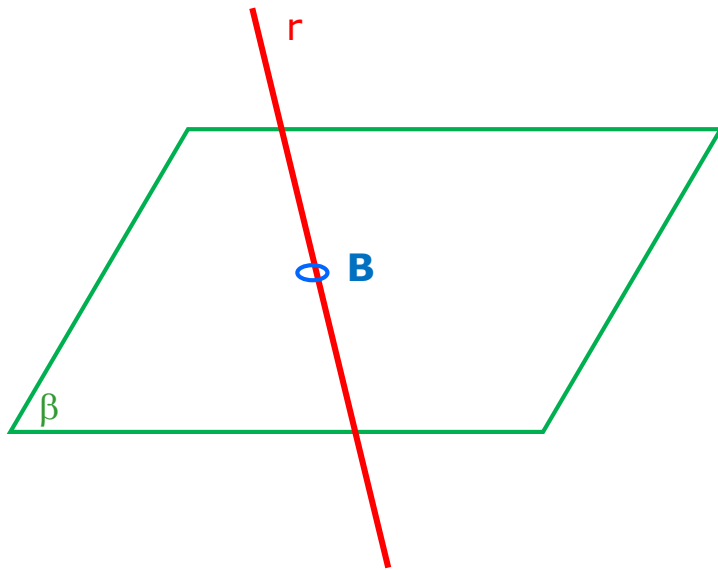
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Intersection between a line and a plane



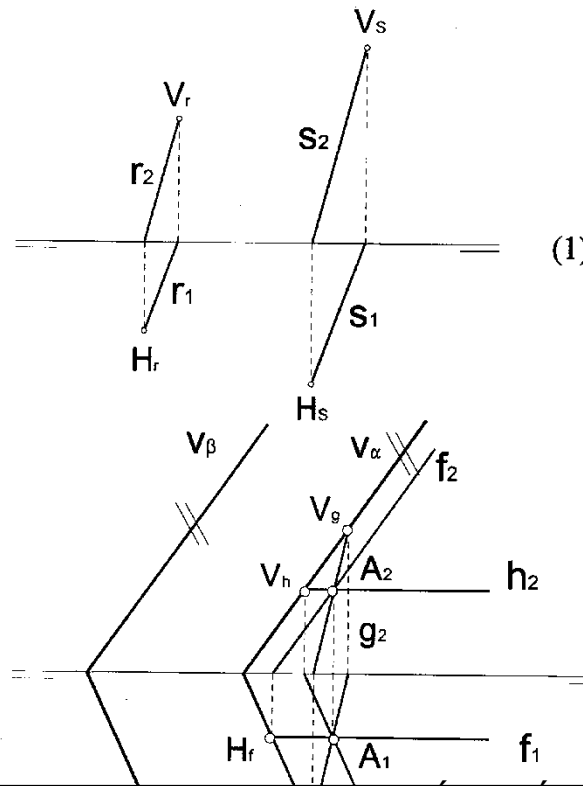
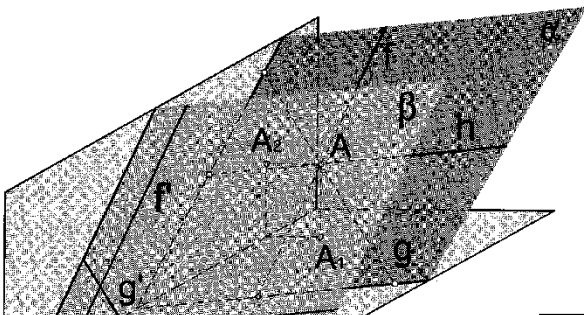
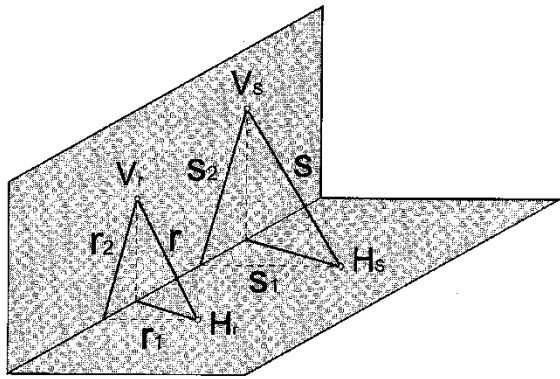
1. Create a plane γ that includes the line r .
(easiest option vertical plane)

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Relative positions: Parallelism I



LINE WITH LINE:

2 lines are parallel if their projections are also parallel

PLANE WITH PLANE:

their traces are

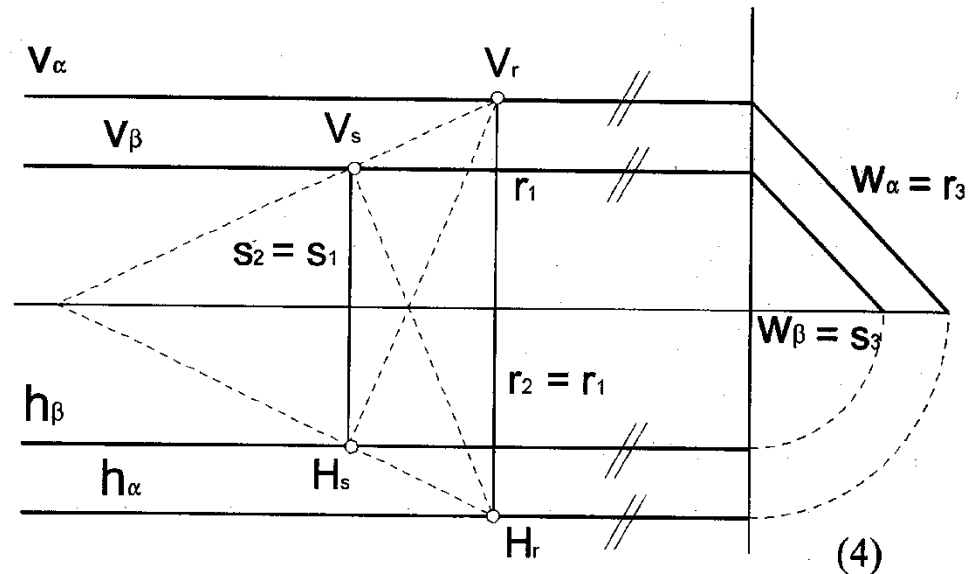
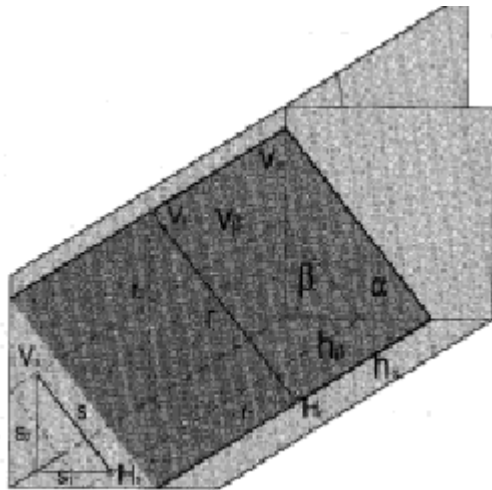
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Relative positions. Parallelism II

PLANES PARALLELS TO THE R.L.: their profile traces should be parallel as well

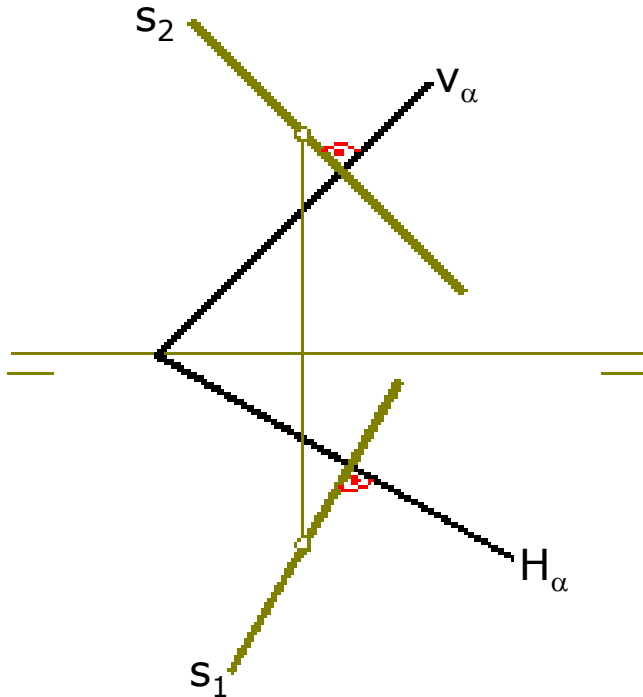


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Relative positions. Perpendicularity



□ A line and a plane are perpendicular when the projections of the line are perpendicular to the plane traces. The perpendicularity line-line and plane-plane **is not visible in the vertical or horizontal projection.**

□ If a line is perpendicular to a plane it is perpendicular to all the lines r , s , t , etc. that belong to the plane.

□ A plane is perpendicular to another plane if a line of one of the planes is perpendicular to the other plane.

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