Concordia University
Engineering and Computer Science

MECH 211 – Mechanical Engineering Drawing

François Tardy

Credits: 3.5

Lecture 5

Université Concordia University

Objectives of the Lecture

To continue to acquire knowledge in the Descriptive Geometry, point and line concepts:

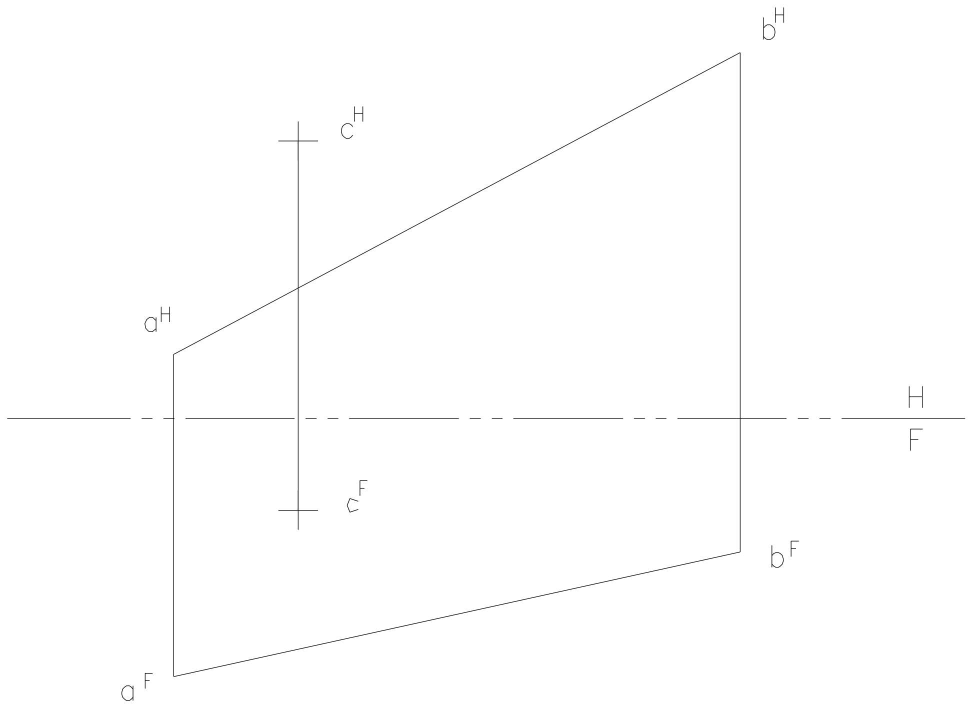
- Distance form a point to a line,
- Location of a perpendicular line at a give location on a line,
- Non-intersecting lines – skew lines,
- Shortest distance between skew lines,
- Location of a line through a given point and intersecting two skew lines.

Objectives of the Lecture

To continue to acquire knowledge in the Descriptive Geometry – point and line and plane concepts:

- Representation of a plane surface,
- Relative position of a line versus a plane,
- Location of a line on a plane,
- Location of a point on a plane,
- True-length lines in a plane,
- Strike of a plane – bearing of the horizontal line in a plane,
- Edge view of a plane – planes that appear as edge view in the principal views,
- Slope of a plane – the angle the plane is doing with the horizontal plane from T.E.V.).

Point to Line Distance



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A perpendicular from point C to line AB is the shortest distance between the objects.

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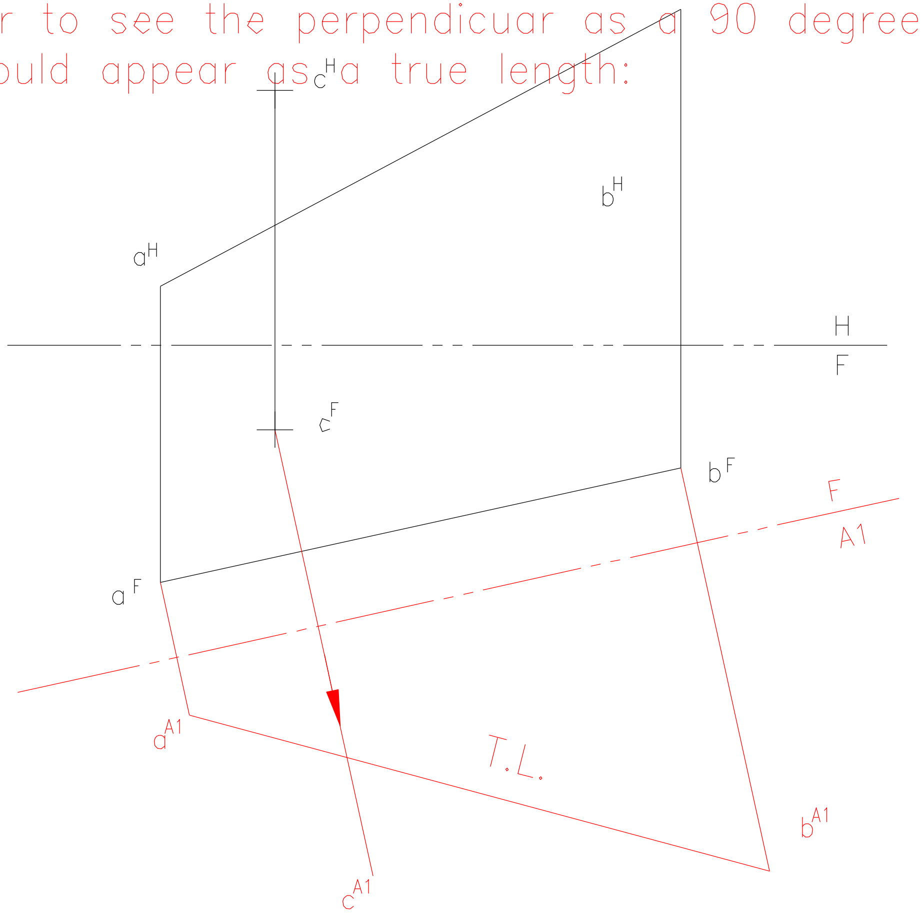

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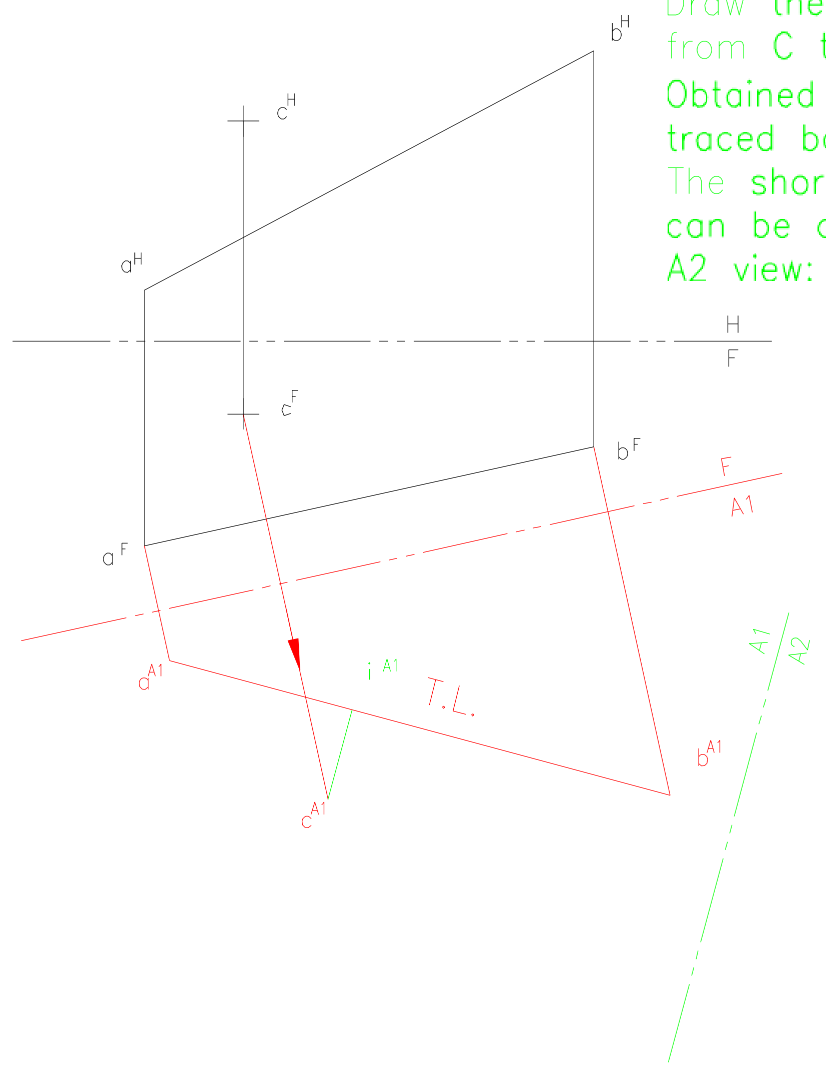

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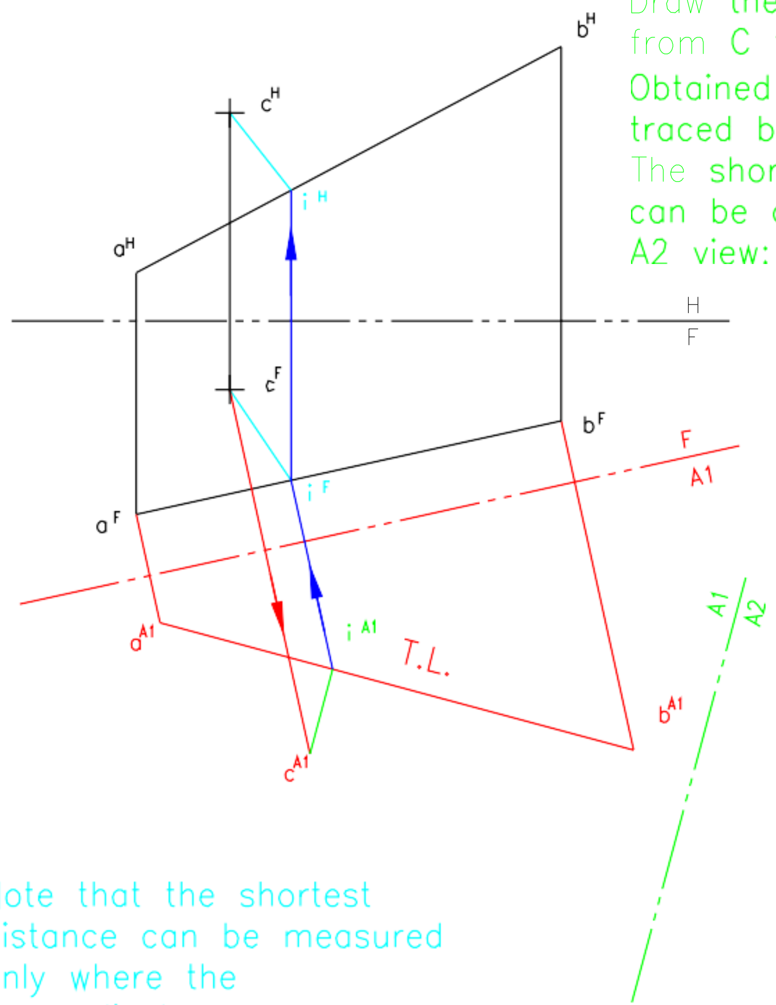

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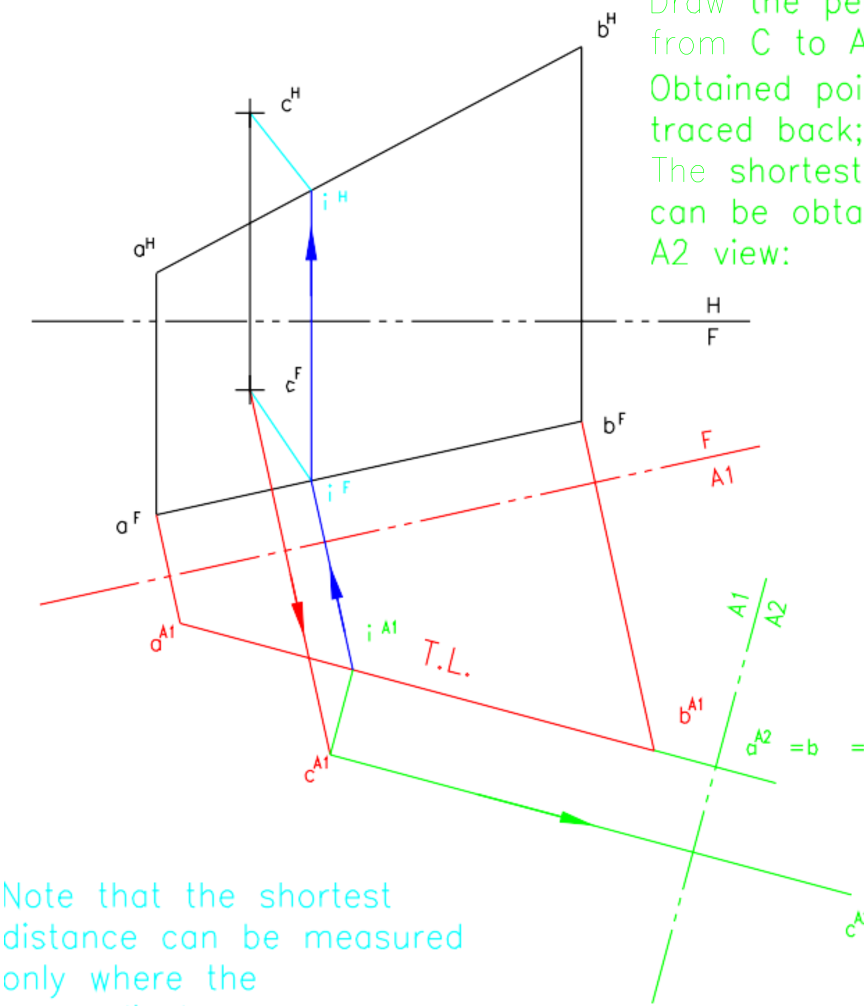

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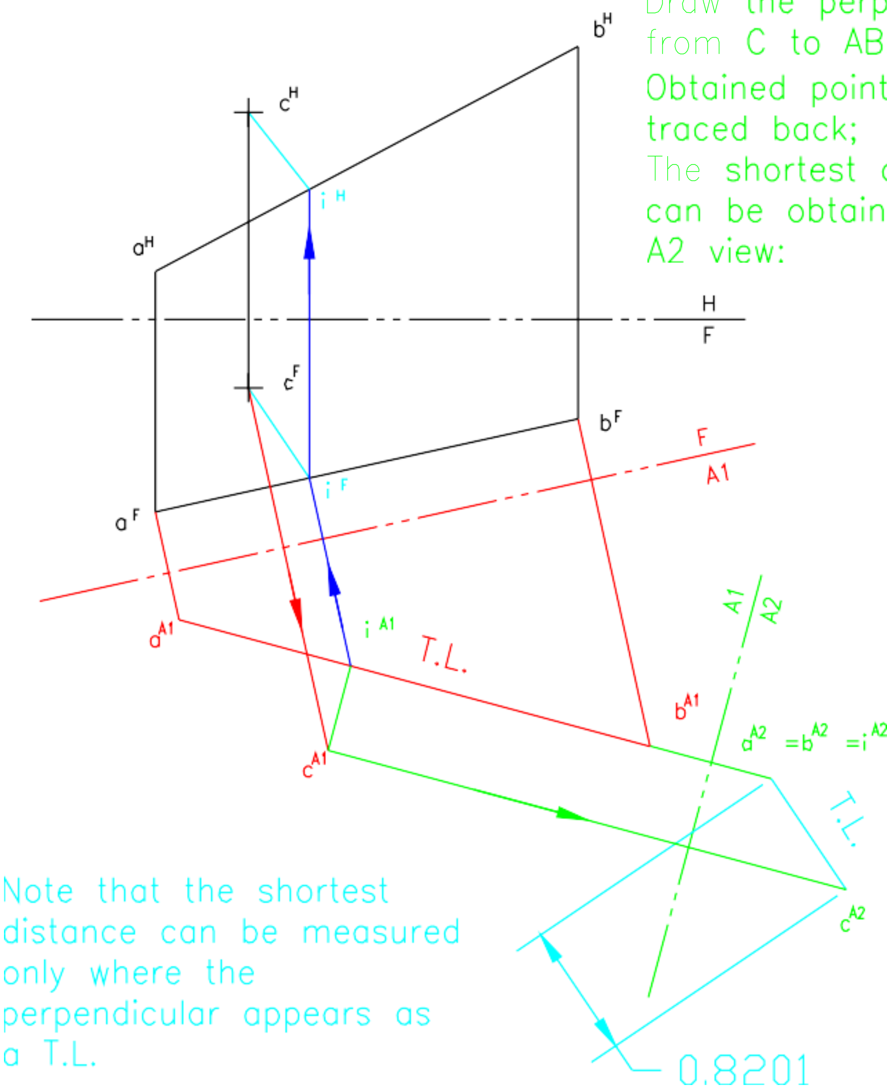

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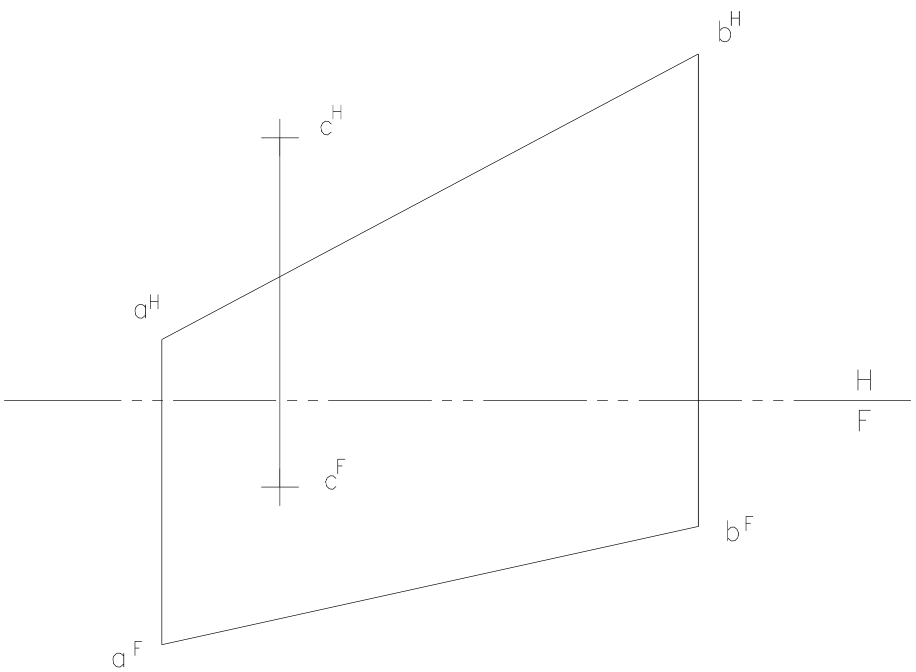
Location of a Perpendicular Line at a Given Location on a Line

(B) LOCATION OF A LINE PERPENDICULAR ON ANOTHER LINE PASSING THROUGH A GIVEN POINT

Given line AB and point I in the line, draw a perpendicular to the line that contains point I. How many solutions one could find?



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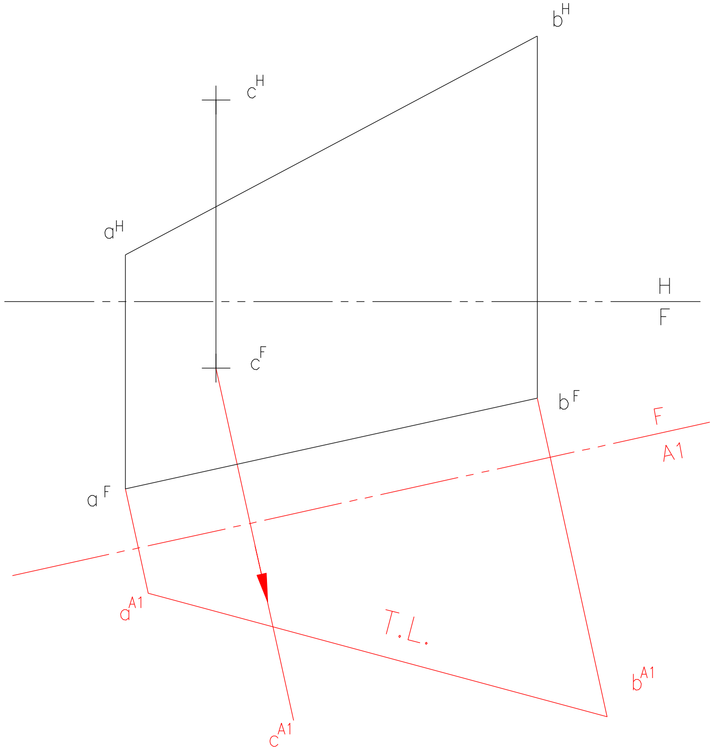

From the formulation it is obvious that one could find infinity of such lines.
Various methods will yield various solutions.
Draw TL of the line.

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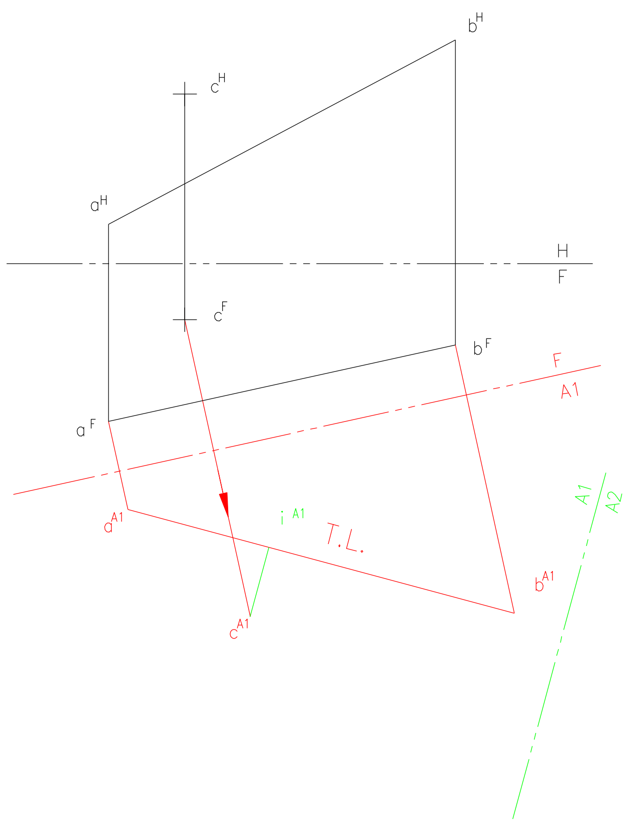

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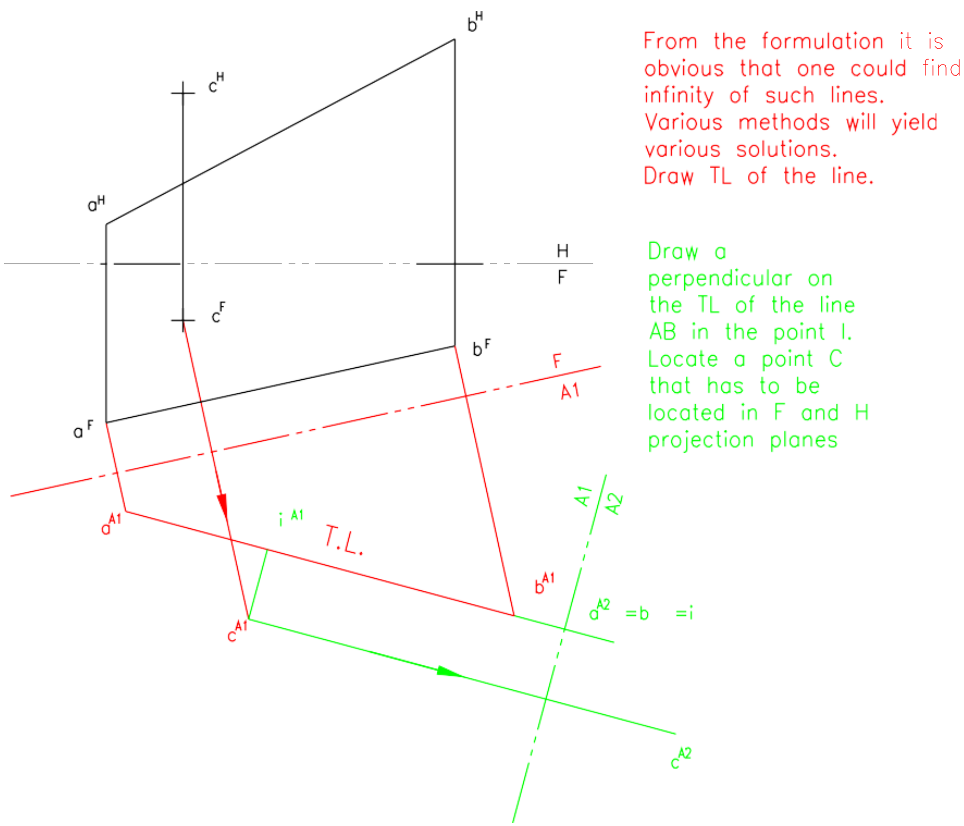

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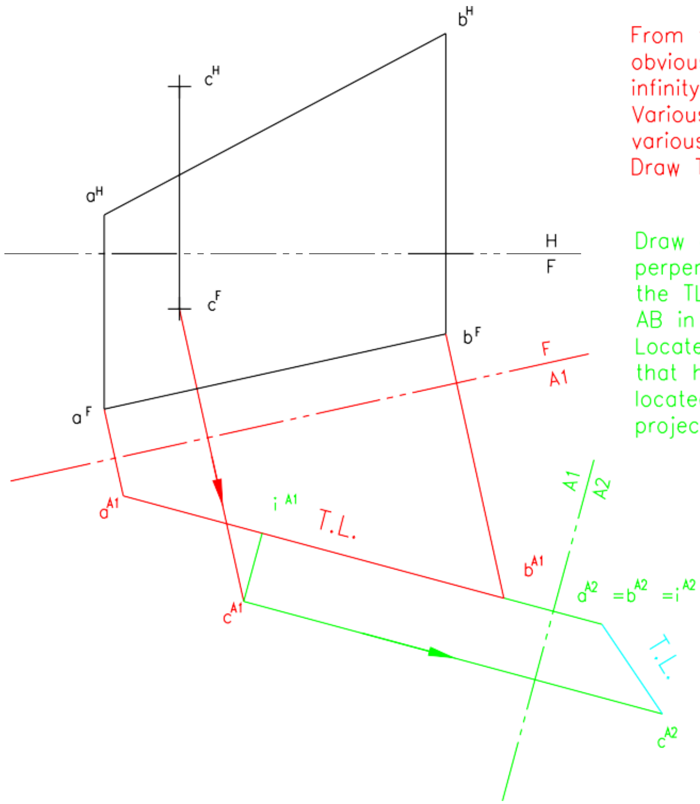

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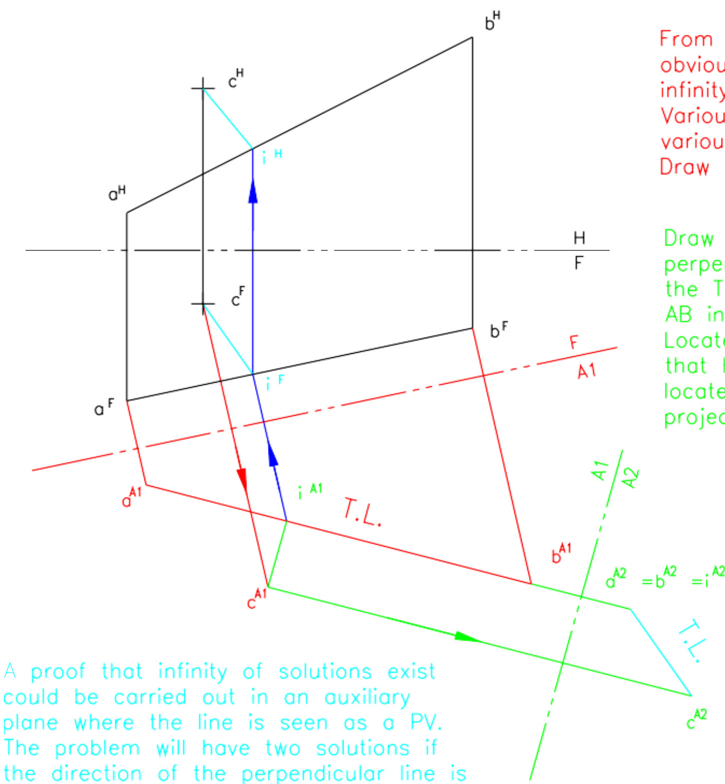

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Draw a perpendicular on the TL of the line AB in the point I. Locate a point C that has to be located in F and H projection planes

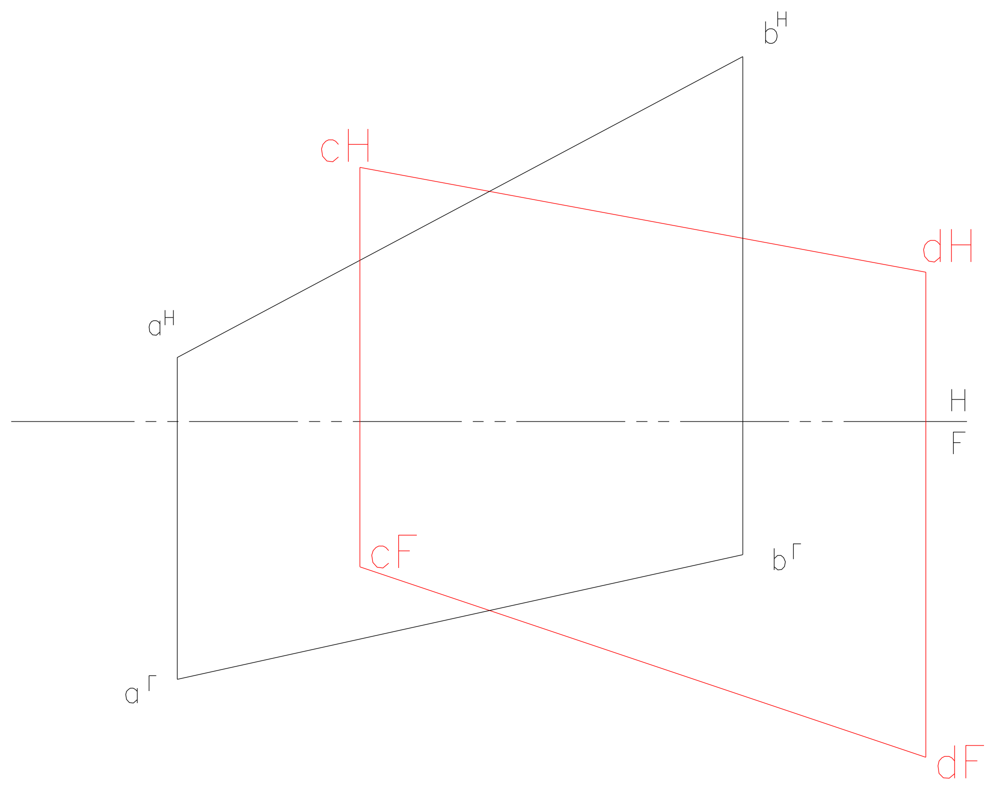
A proof that infinity of solutions exist could be carried out in an auxiliary plane where the line is seen as a PV. The problem will have two solutions if the direction of the perpendicular line is given.

Non-intersecting Lines

Skew Lines

C THE TEST OF CHECKING INTERSECTION OF TWO LINES

SKEW LINES



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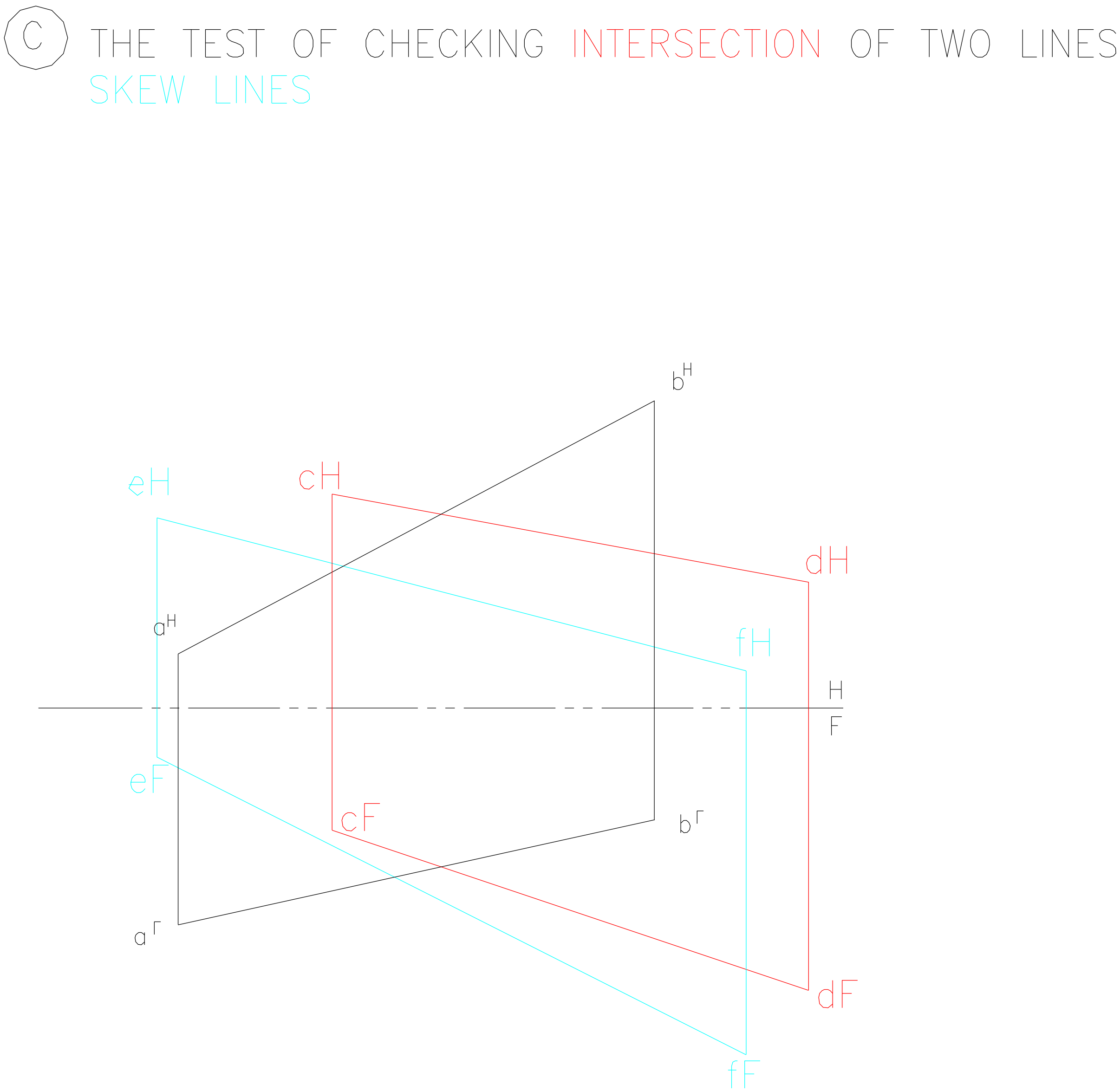

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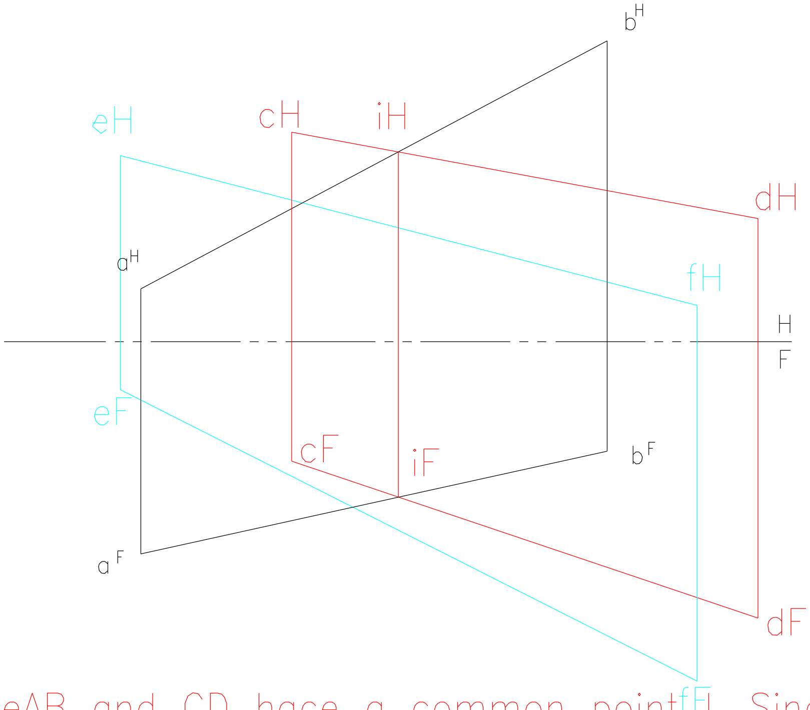

LineAB and CD hace a common point I. Since point I belongs to both lines and the lines are not laying on each other, I is the common point of intersection.

Non-intersecting Lines

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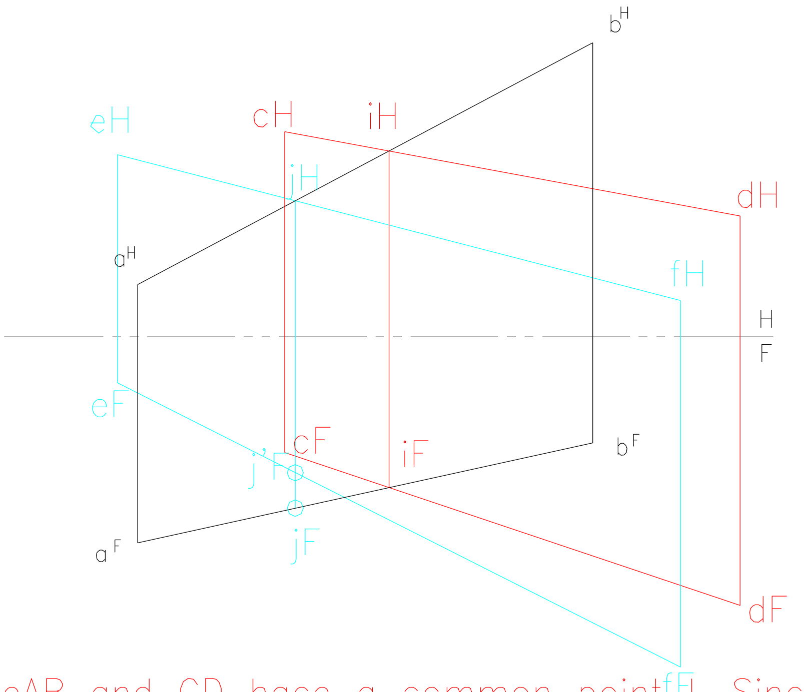

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Lines AB and EF are not intersecting. The point J that seems to be a common point of the two lines (horizontal view) proves to be located in two different locations, one od each of the two lines AB and EF.

Non-intersecting Lines

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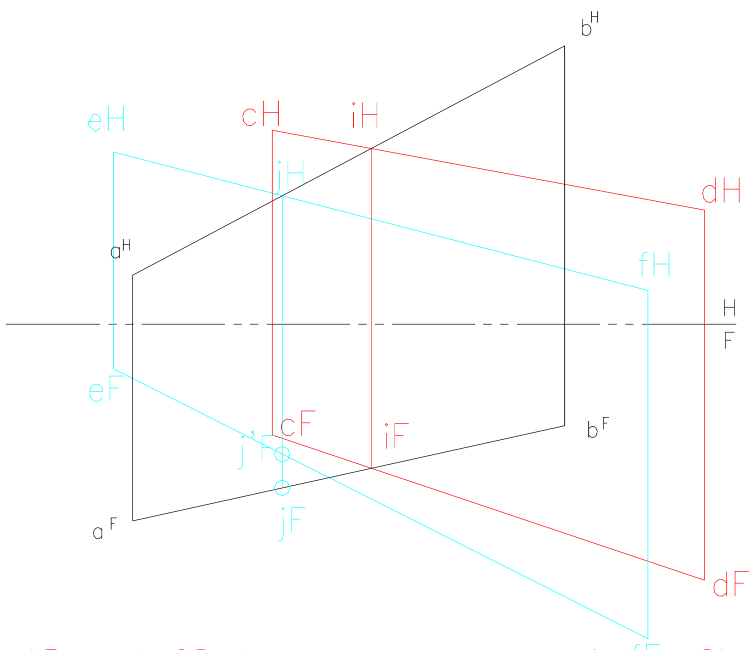
Lines AB and CD are intersecting since they have a common intersection point while lines AB and EF are not intersecting – they are skew lines.



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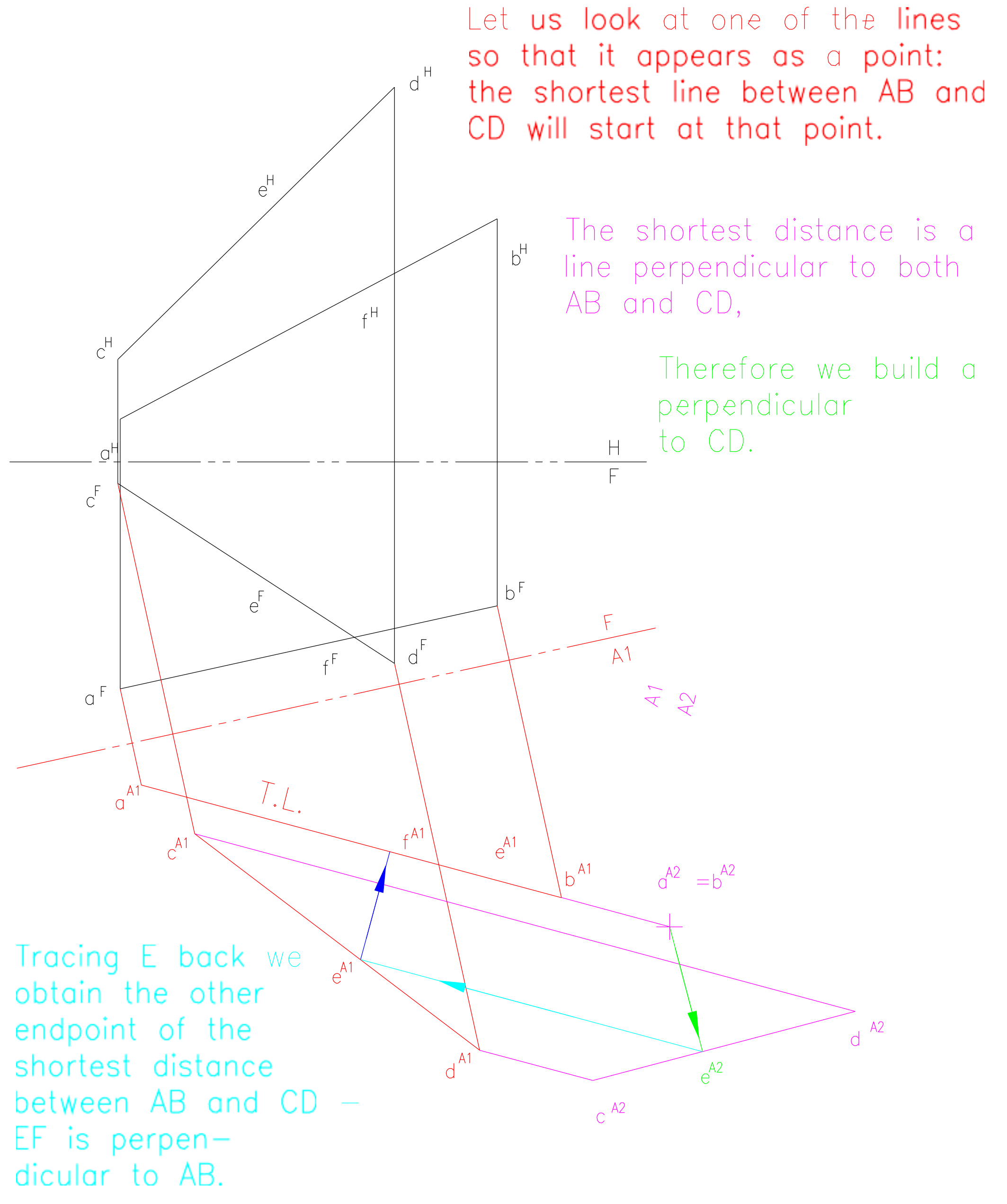
Determine the shortest distance between lines AB and CD



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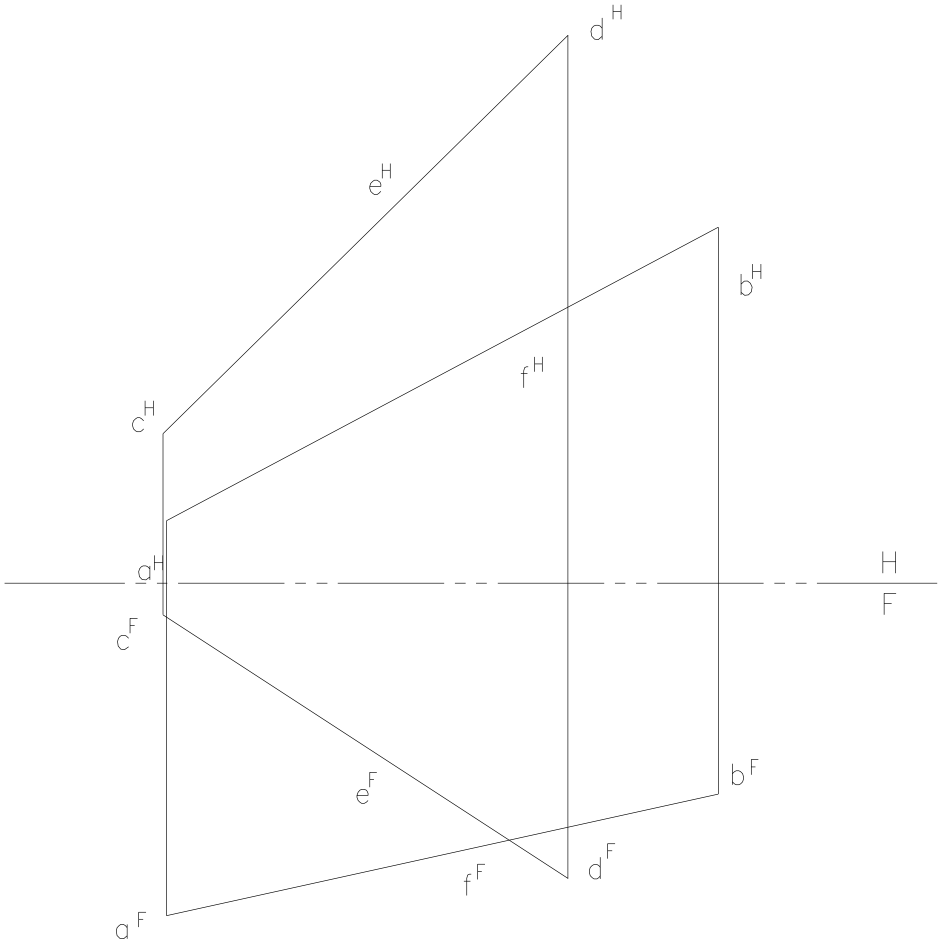

Shortest Distance Between Skew Lines

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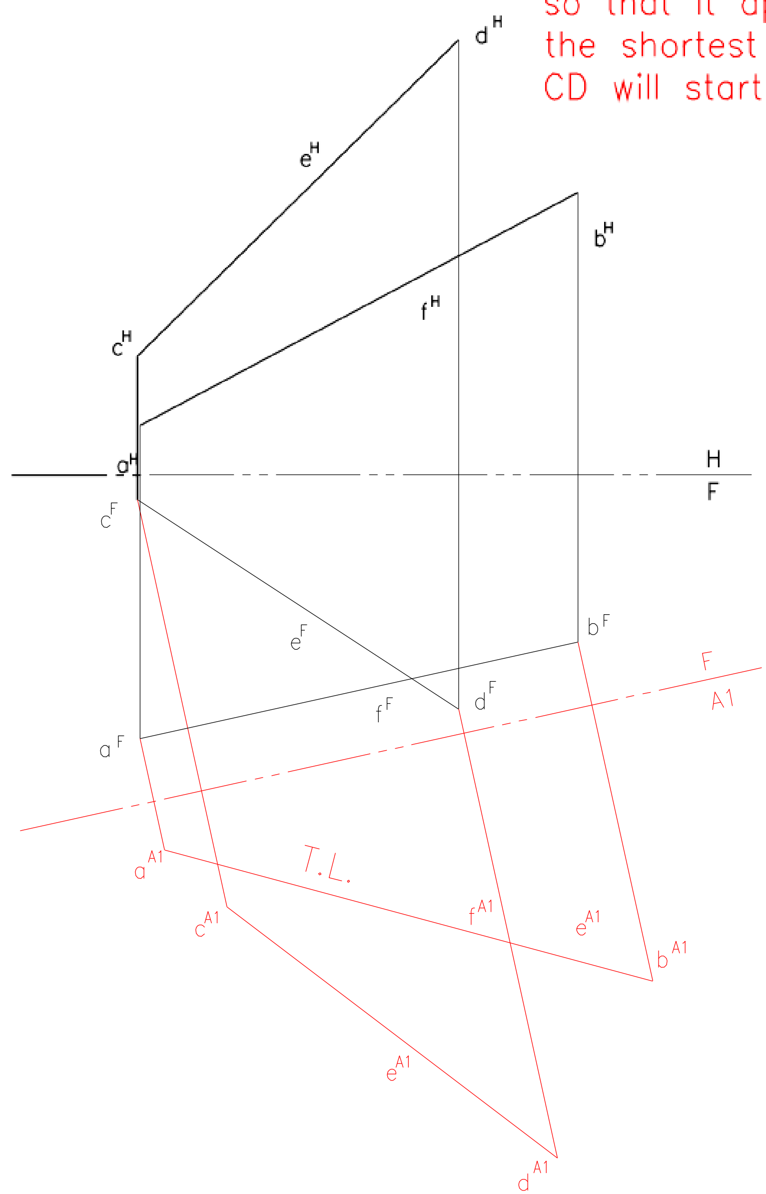
Determine the shortest distance between lines AB and CD

Let us look at one of the lines so that it appears as a point: the shortest line between AB and CD will start at that point.



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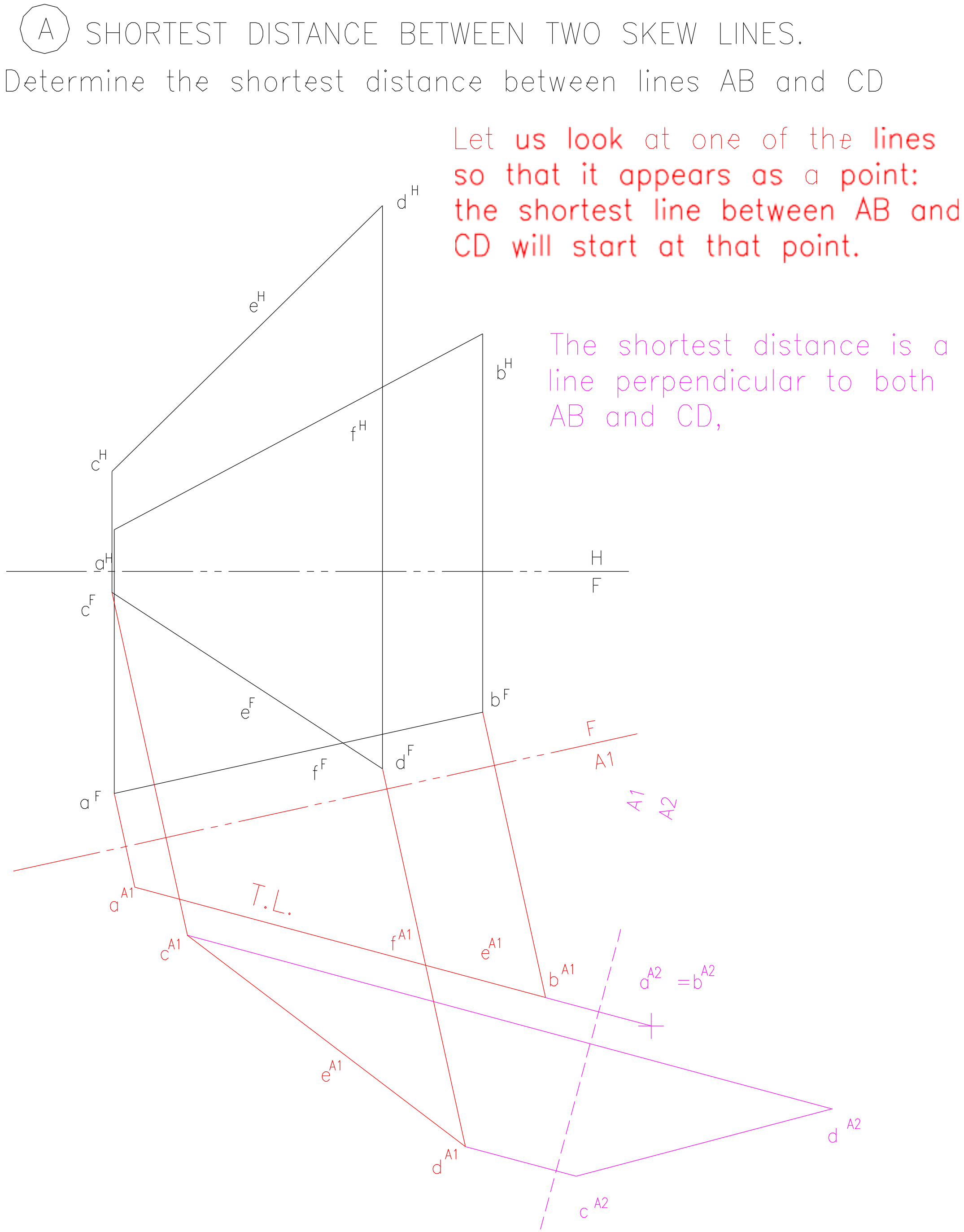

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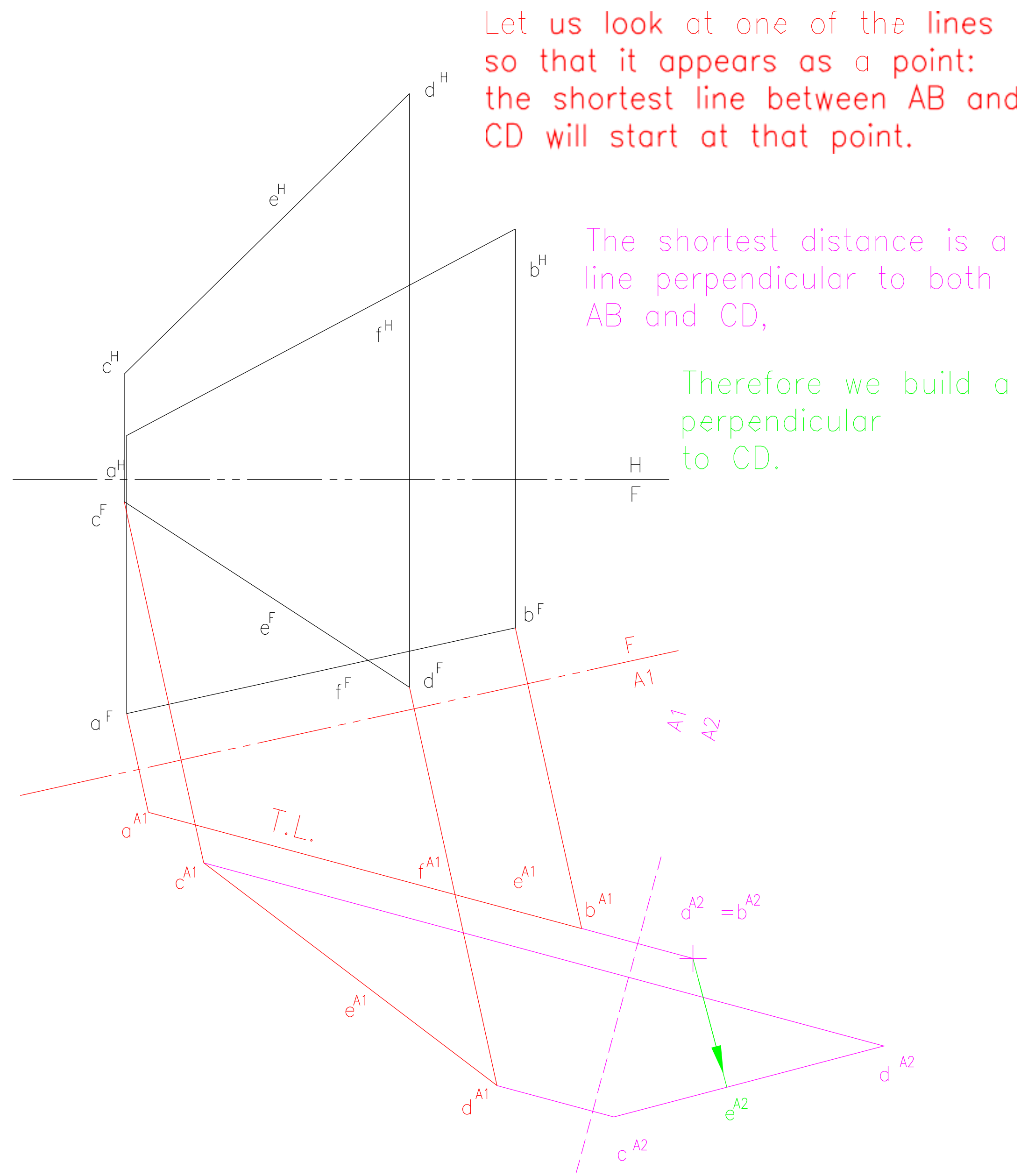

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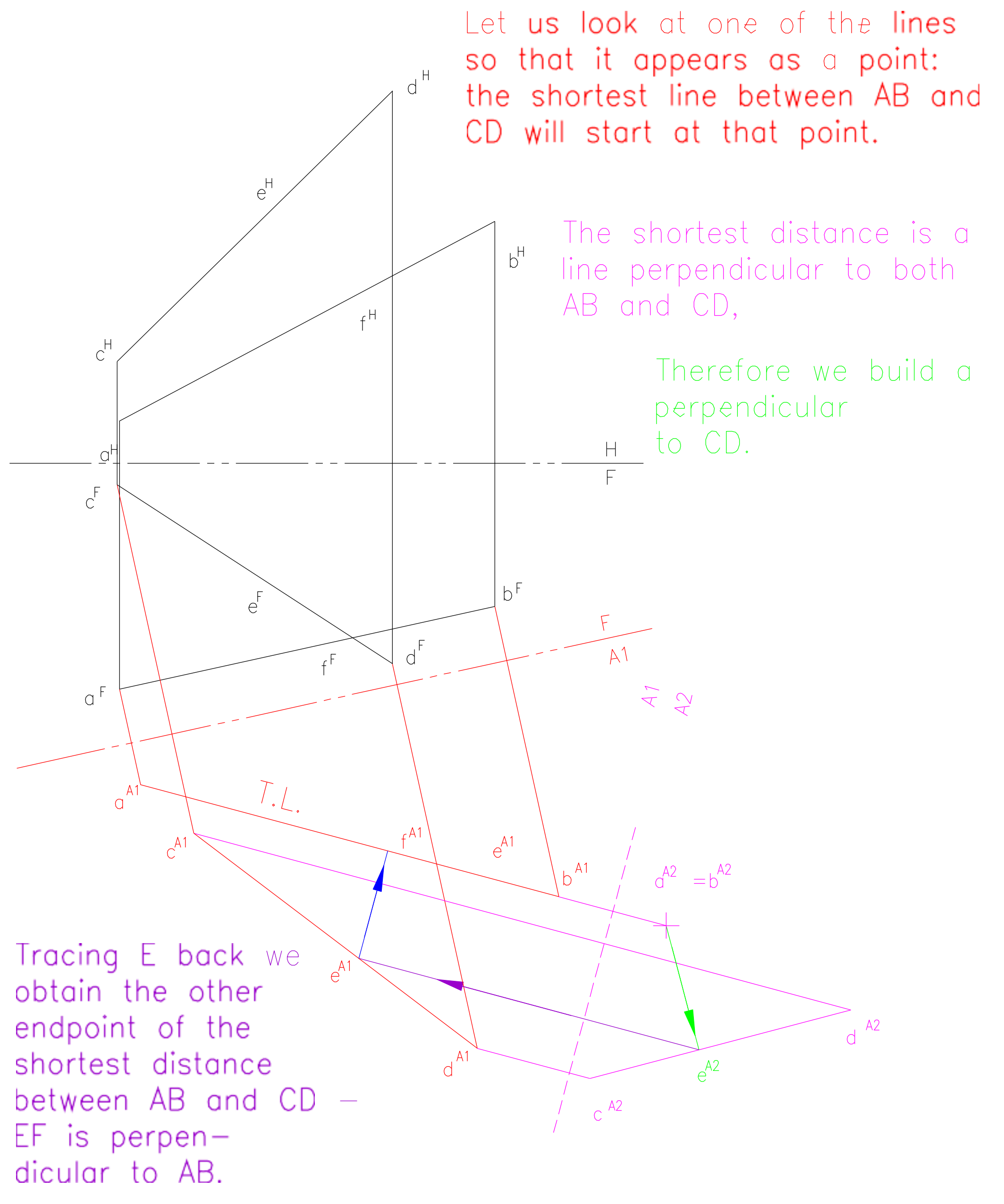

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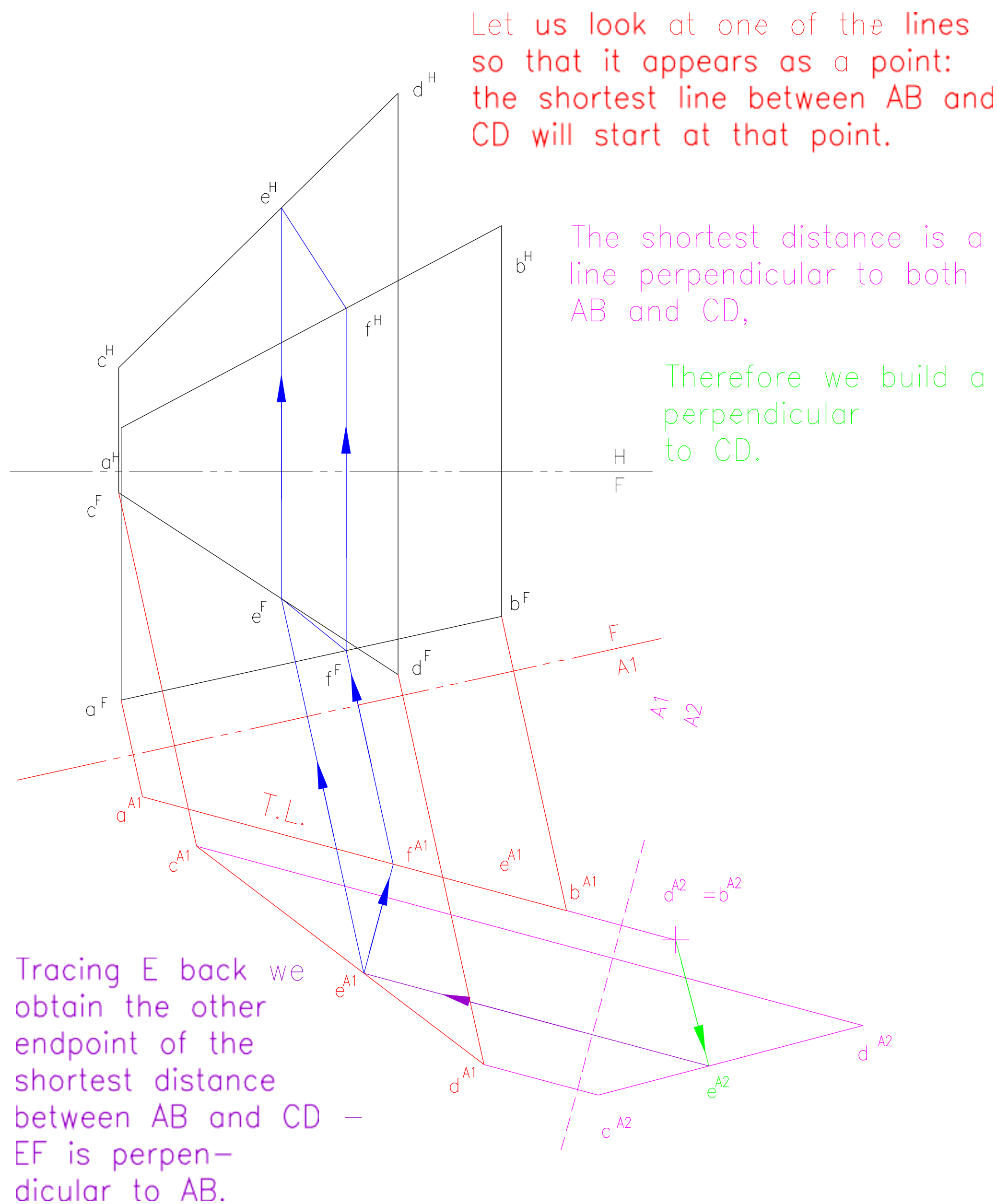
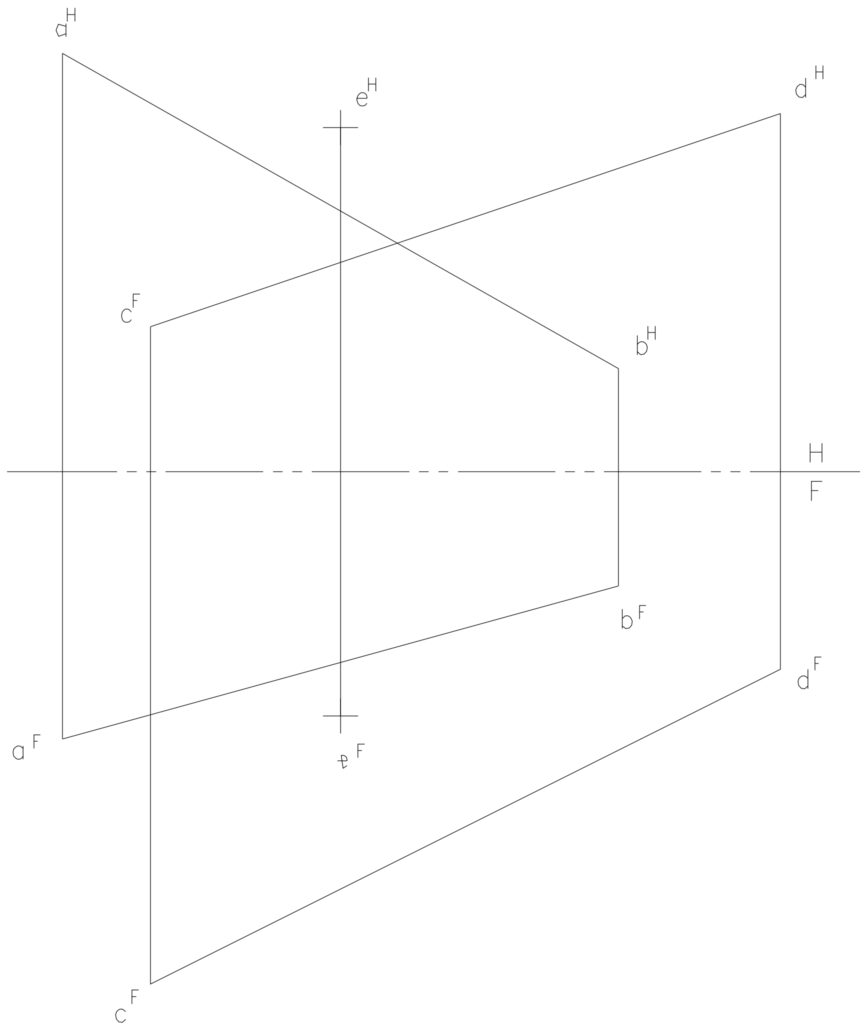


Location of a Line Through a Given Point and Two Intersecting Skew Lines

Ⓐ LOCATION OF A LINE THROUGH A GIVEN POINT AND INTERSECTING TWO SKEW LINES

Point E belongs to the intersection line of plane ABE and CDE.
That line is the one we want to find.
Let AB intersect CDE and proceed by cutting plane method



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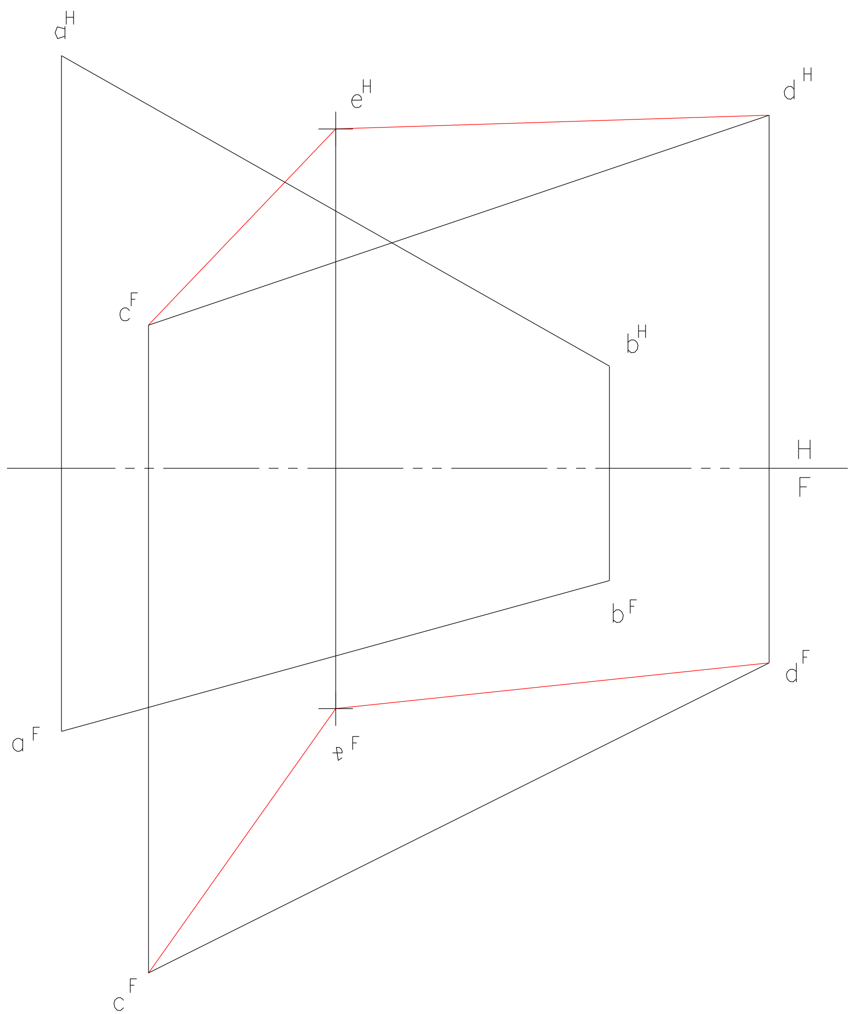

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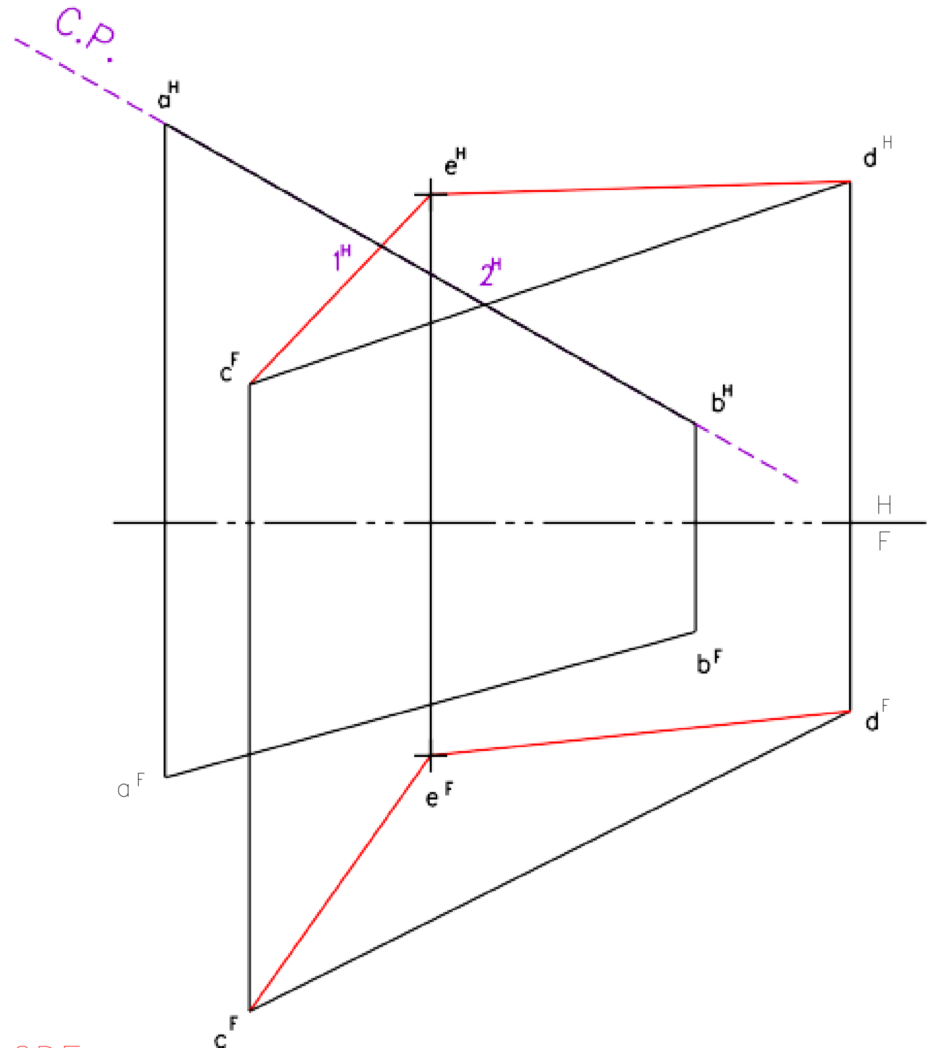

Define CDE.
Draw a frontal C.P. through AB.

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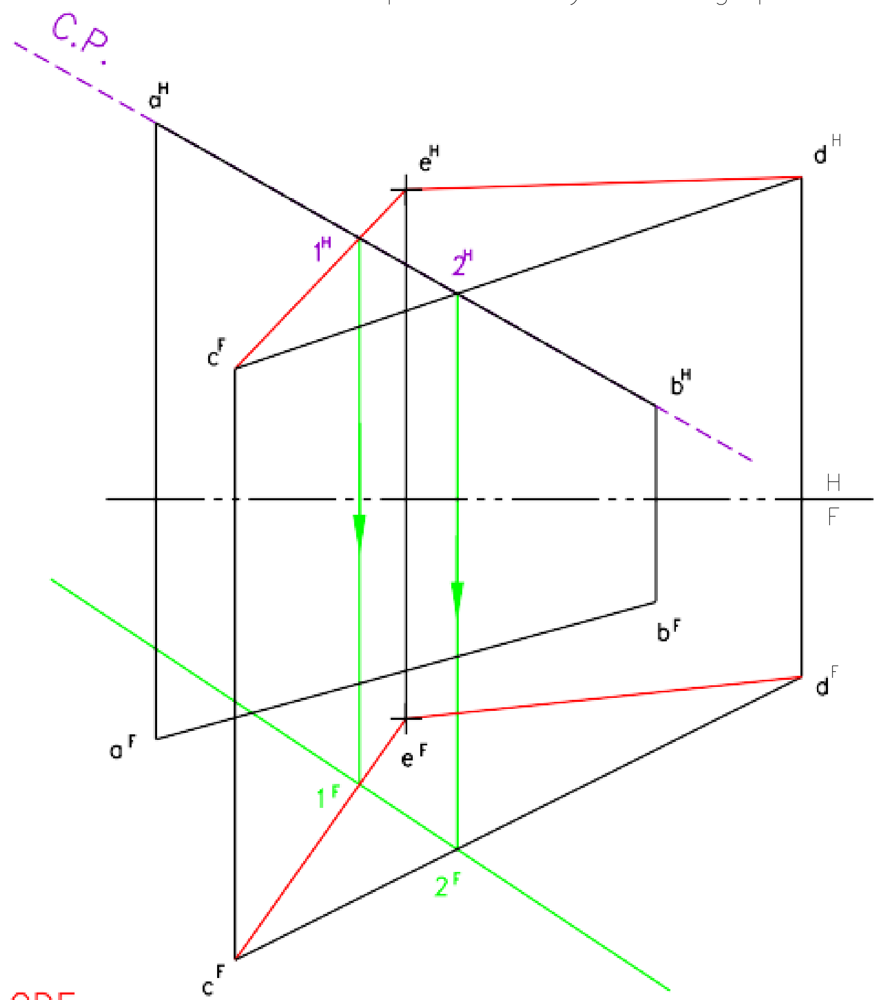

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Draw a frontal C.P. through AB.

Locate the intersection line of C.P. with CDE in the Frontal view.

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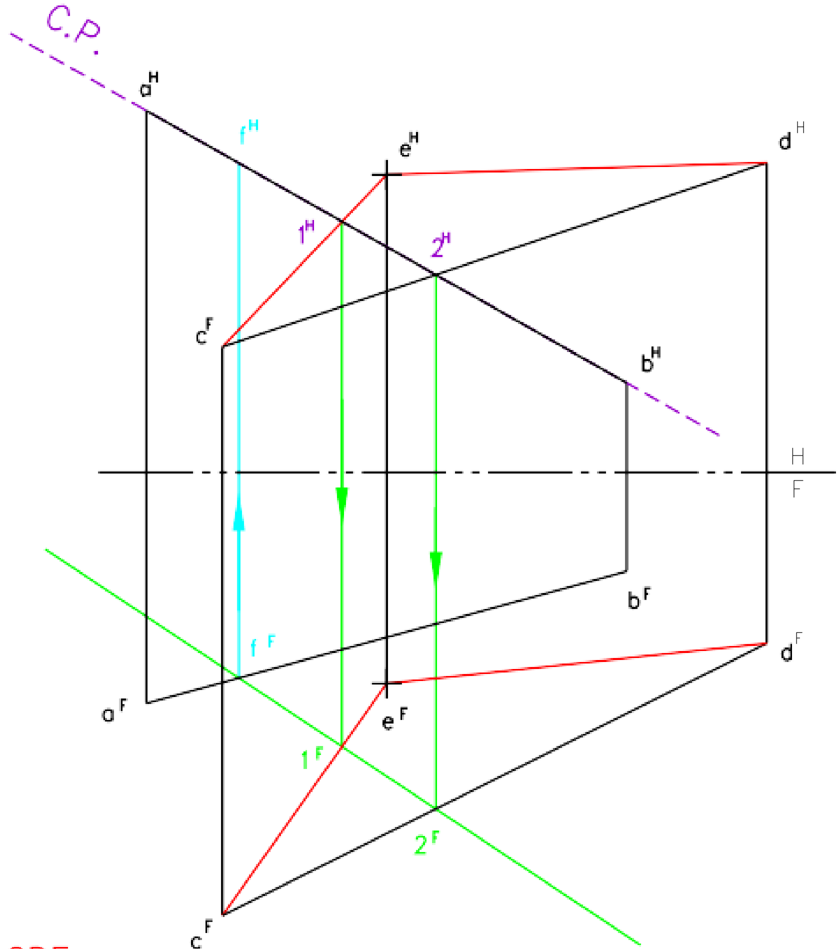

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Trace Point F back to the horizontal view.

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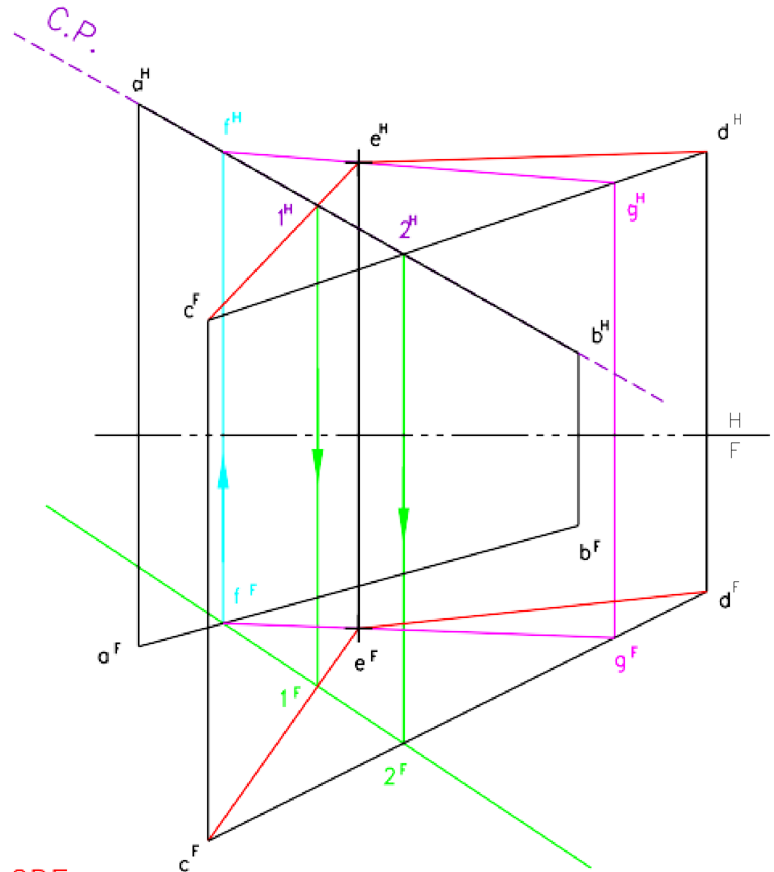
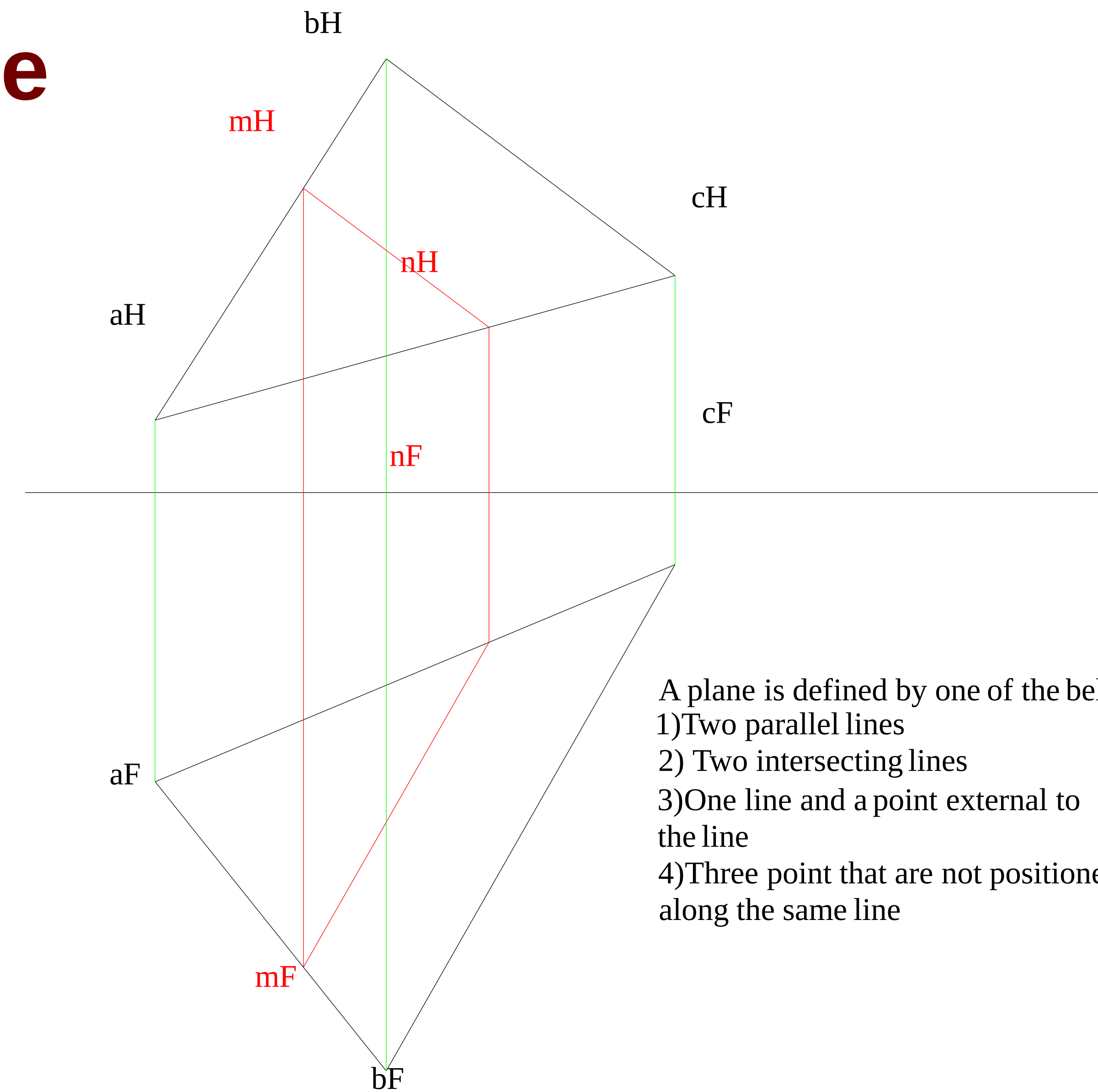


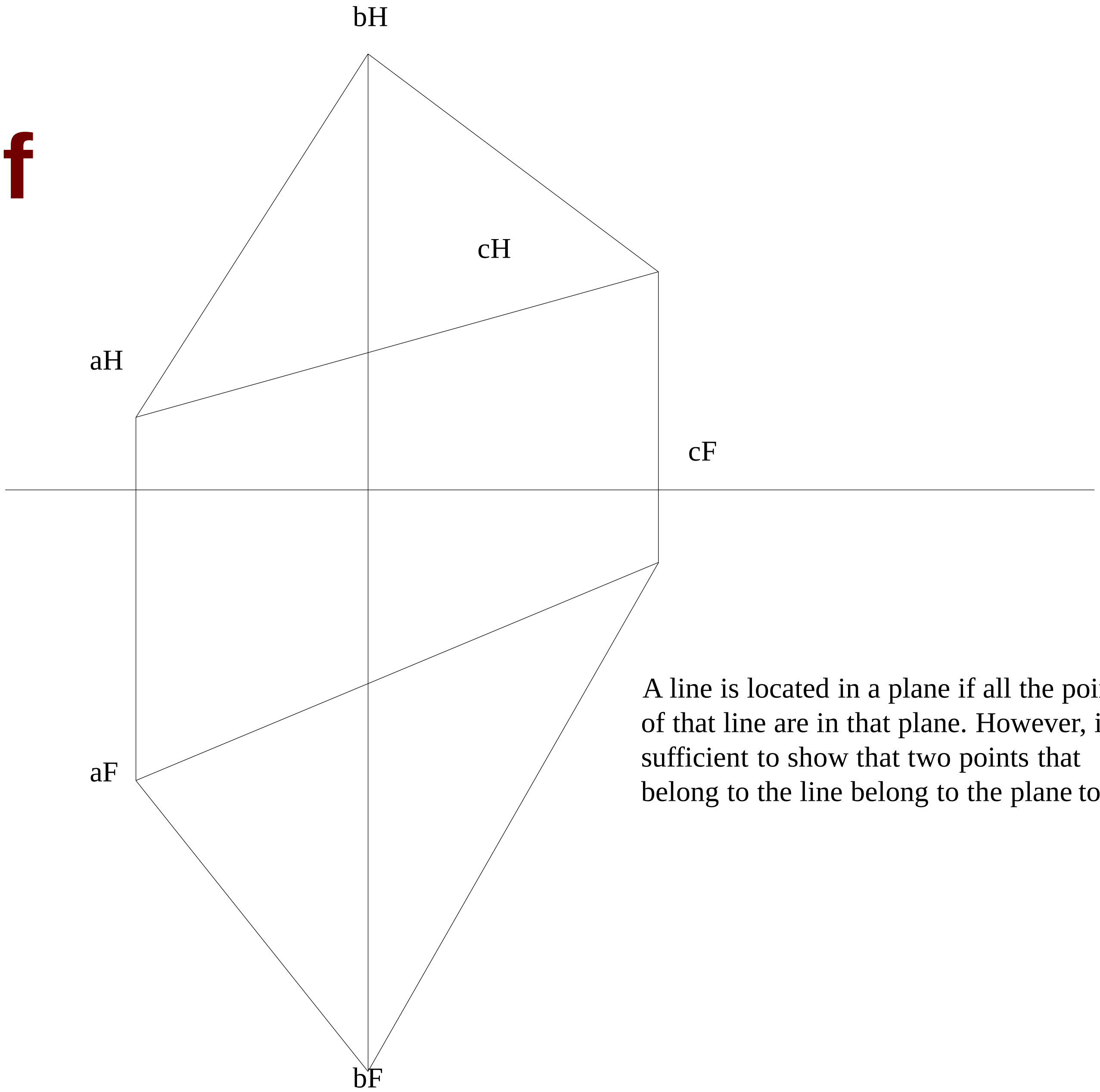
Define CDE.
Draw a frontal C.P. through AB.
Locate the intersection line of C.P. with CDE in the Frontal view.
Trace Point F back to the horizontal view.
There is a line through F, E, and a point belonging to CD, since F, E, and CD belong to CDE.
This line is FG.

Representation of a plane surface



A plane is defined by one of the below:
1)Two parallel lines
2) Two intersecting lines
3)One line and a point external to the line
4)Three point that are not positioned along the same line

Relative position of line vs. plane



A line is located in a plane if all the points of that line are in that plane. However, is sufficient to show that two points that belong to the line belong to the plane too.

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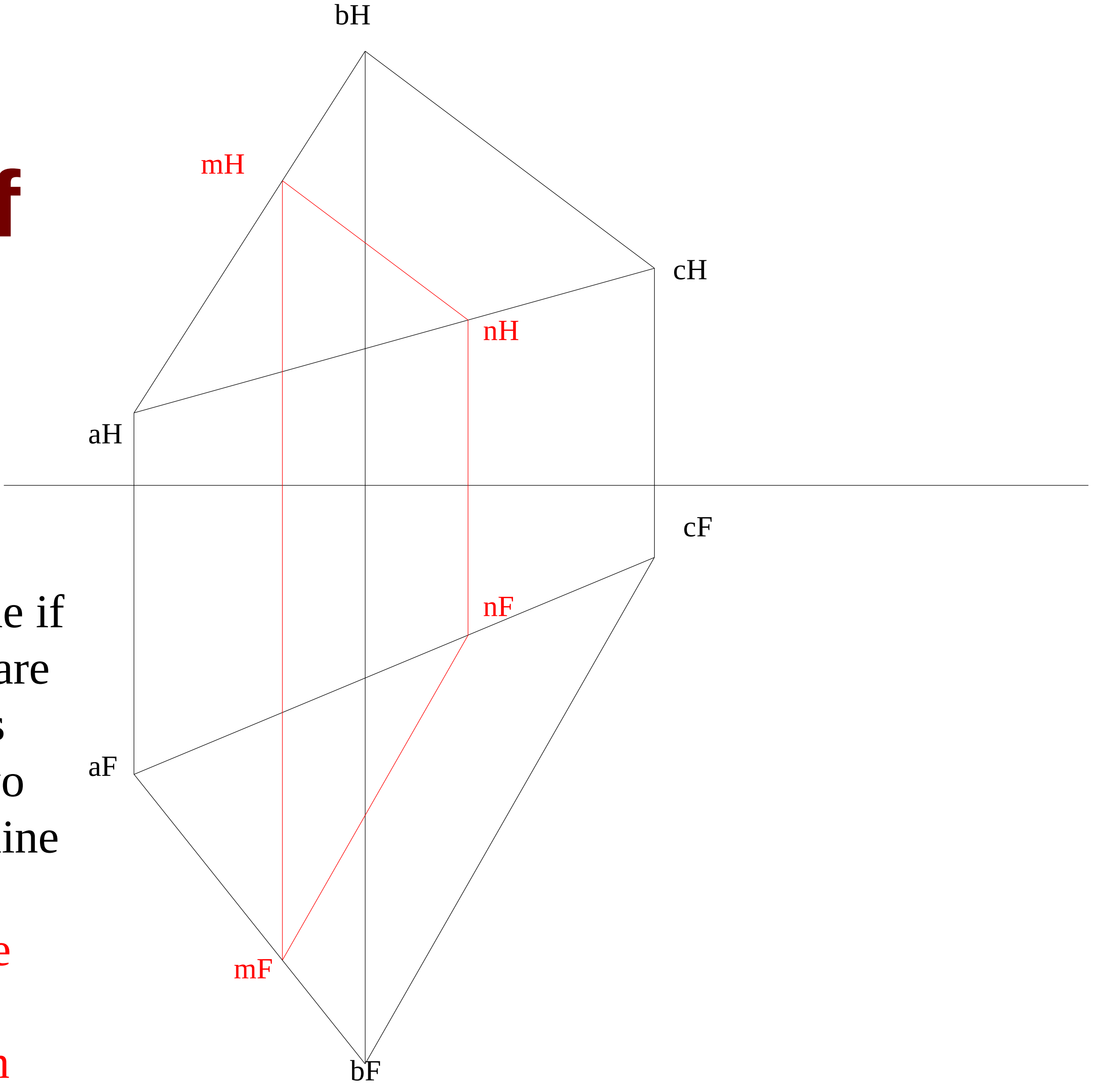

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Line MN is located in the plane ABC since M is simultaneously located in AB and MN and N on AC and MN.

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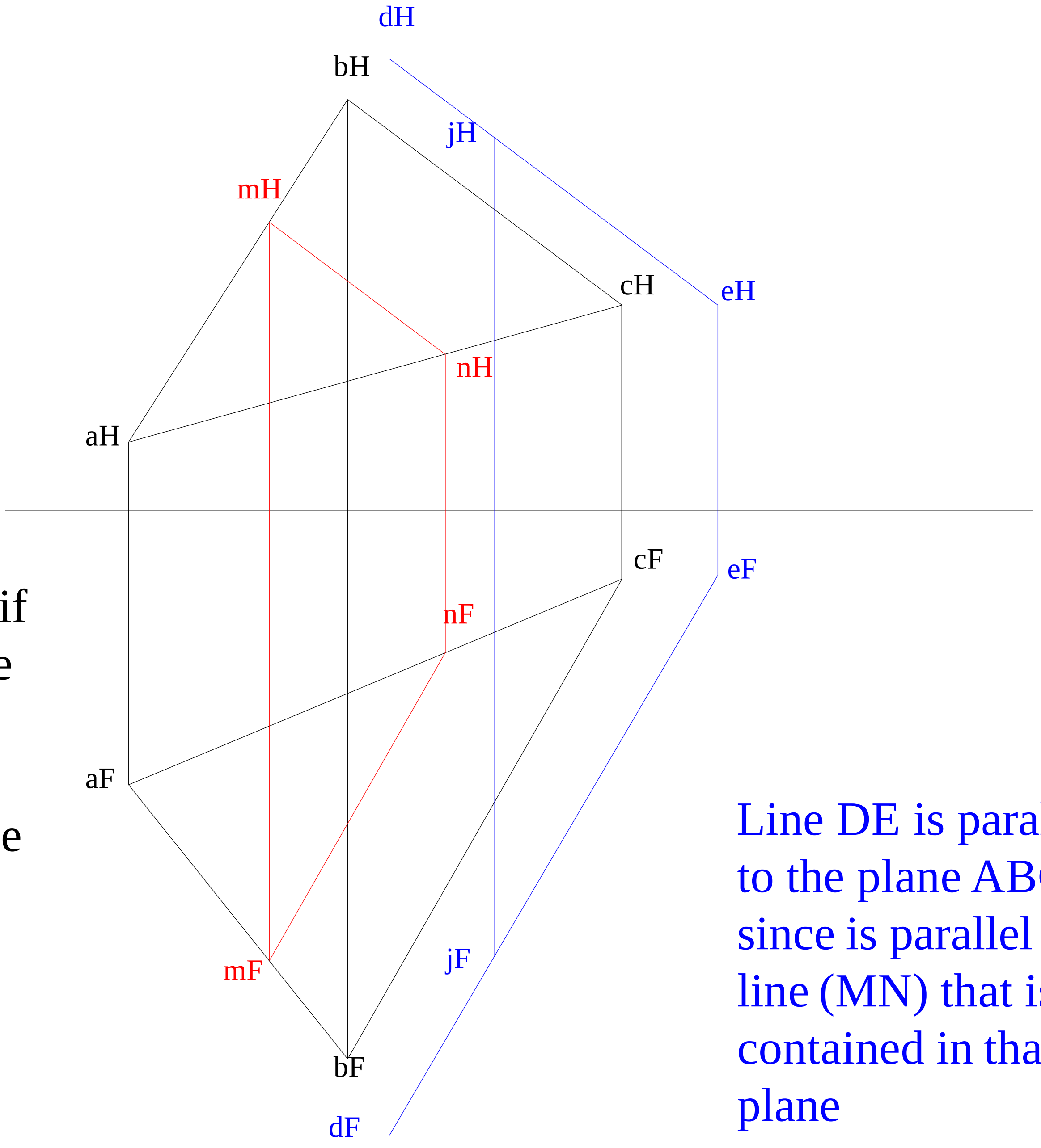

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Line DE is parallel to the plane ABC since is parallel to a line (MN) that is contained in that plane

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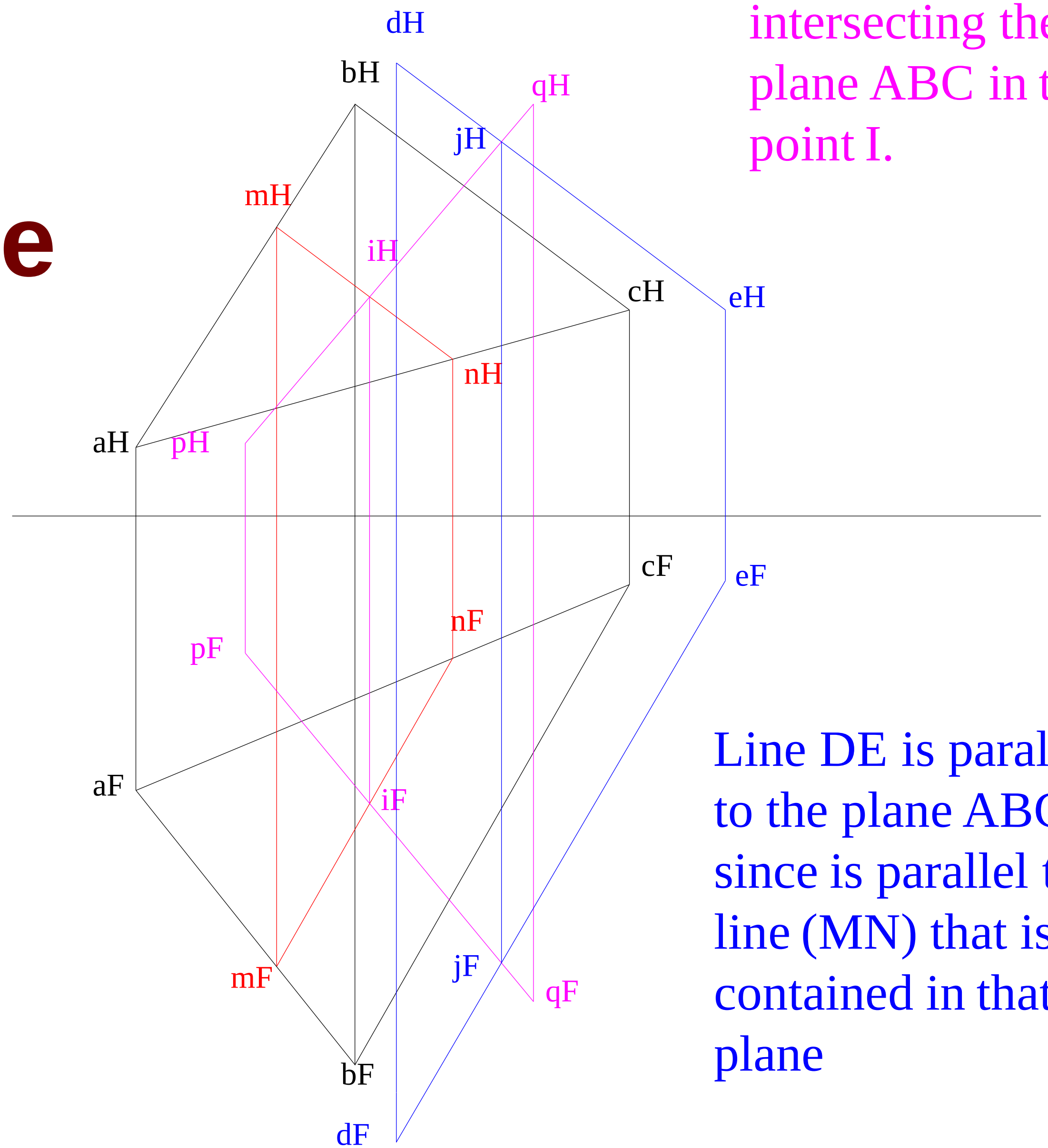

Line PQ is intersecting the plane ABC in the point I.

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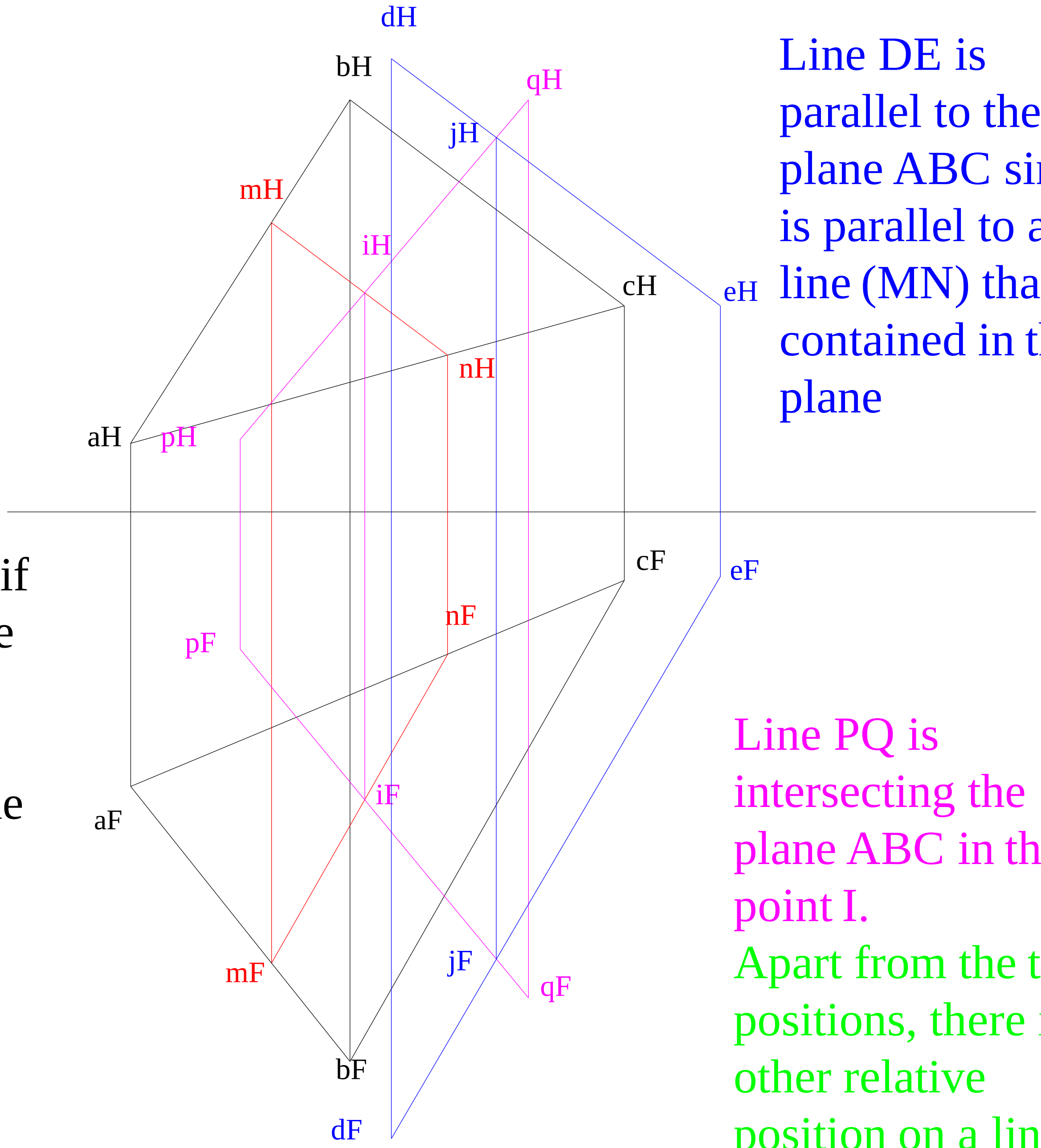

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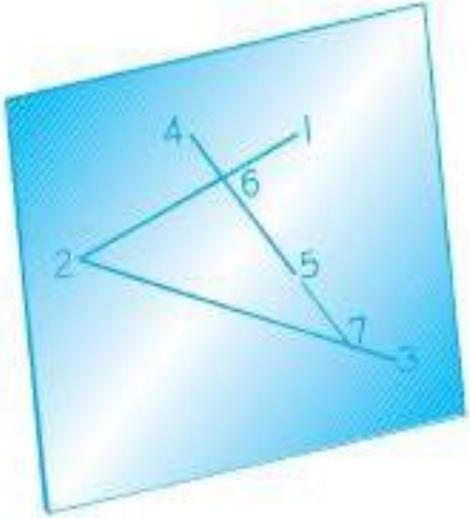
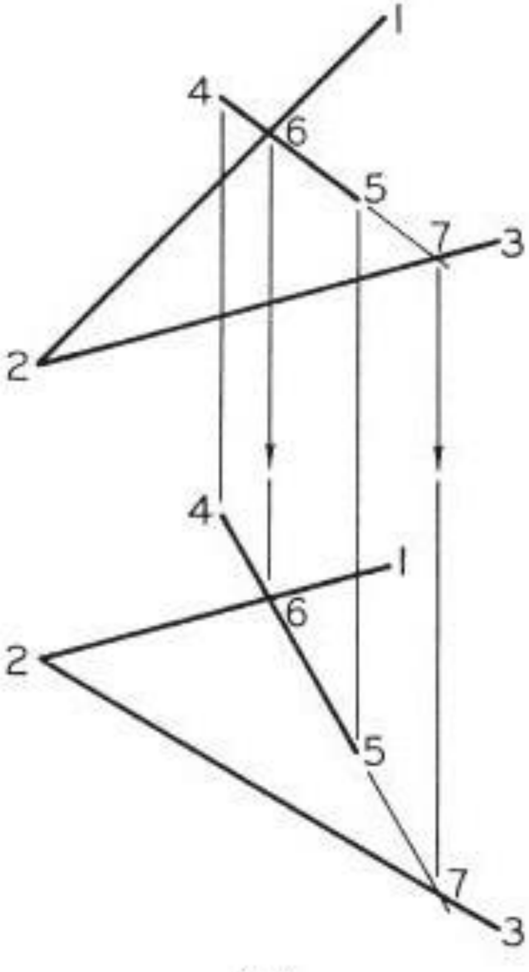
Apart from the three positions, there is no other relative position on a line with a plane.

Location of a line on a plane

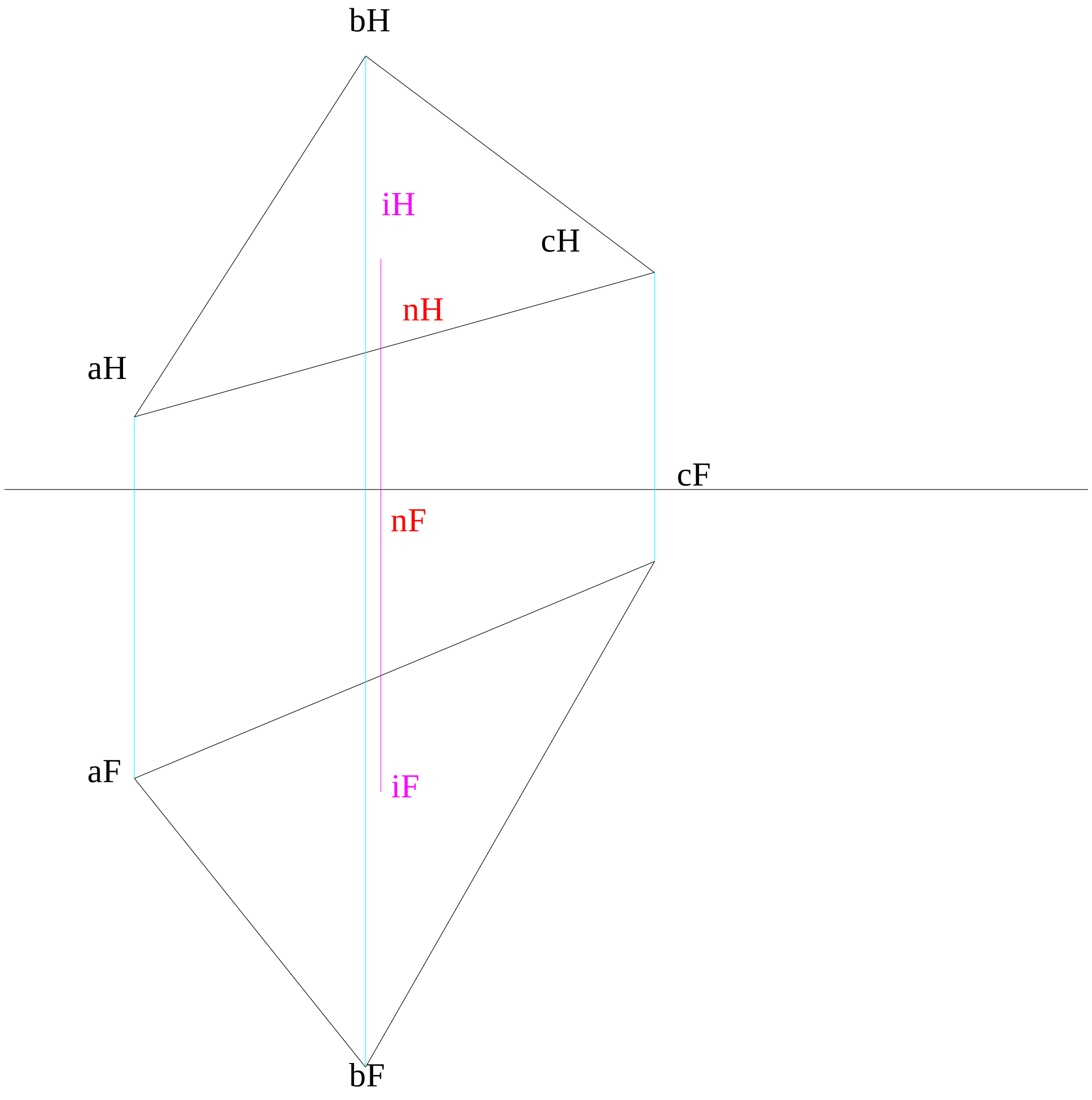
Locate line 4-5 in the plane 1-2-3.





(b)

Location of a point on a plane



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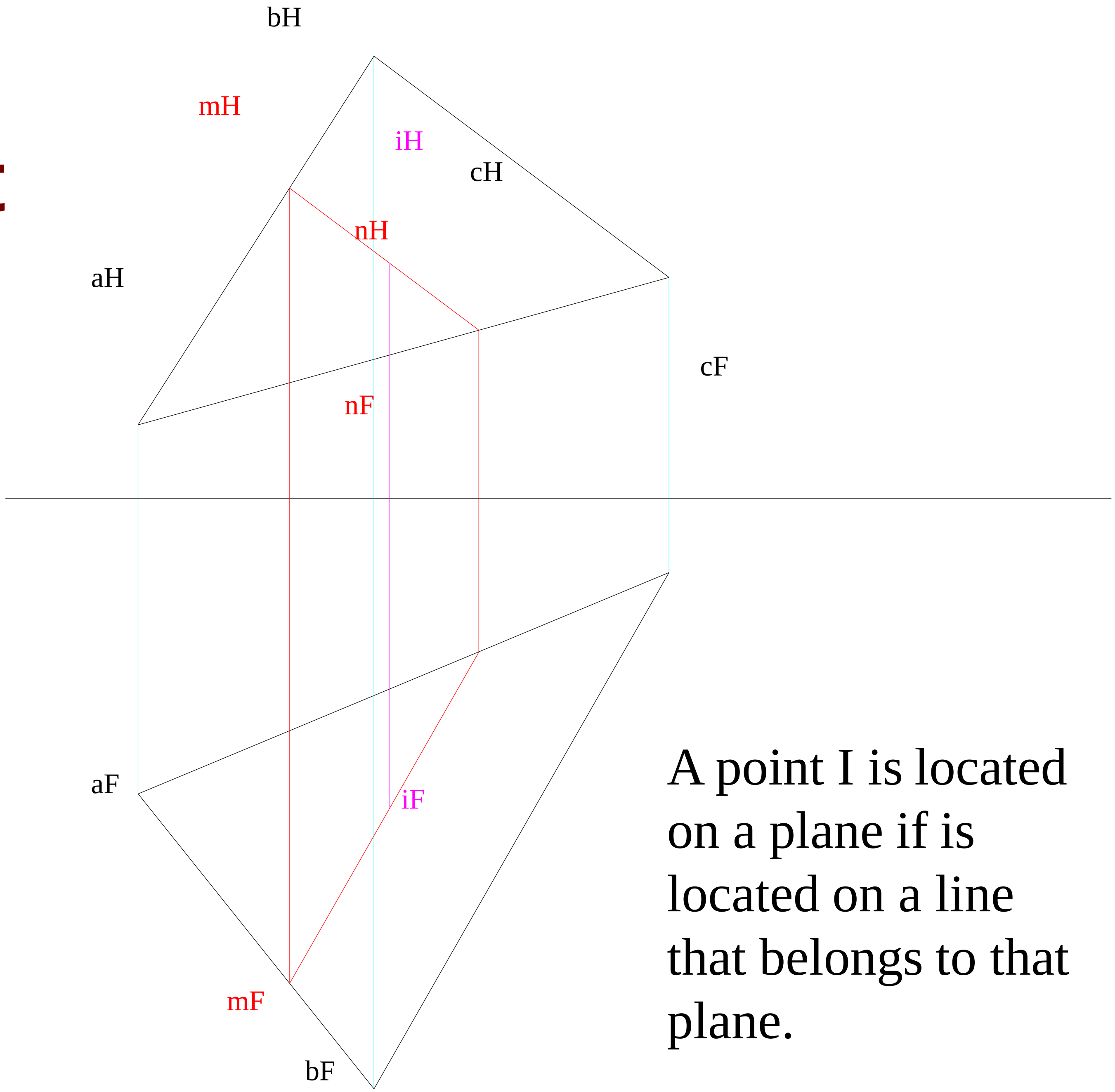
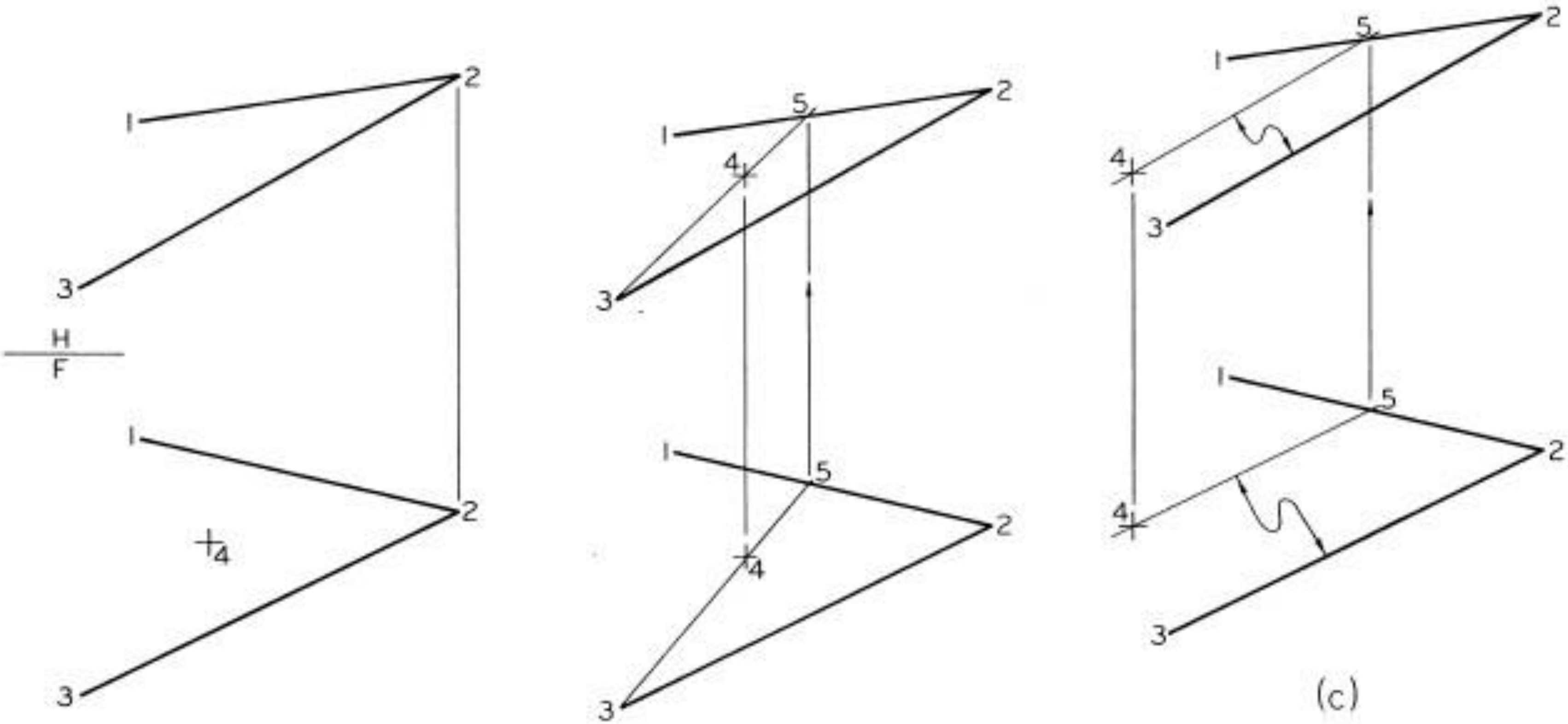


A point I is located on a plane if is located on a line that belongs to that plane.

Location of a point on a plane

Can you locate the point 4 in the plane 1-2-3?

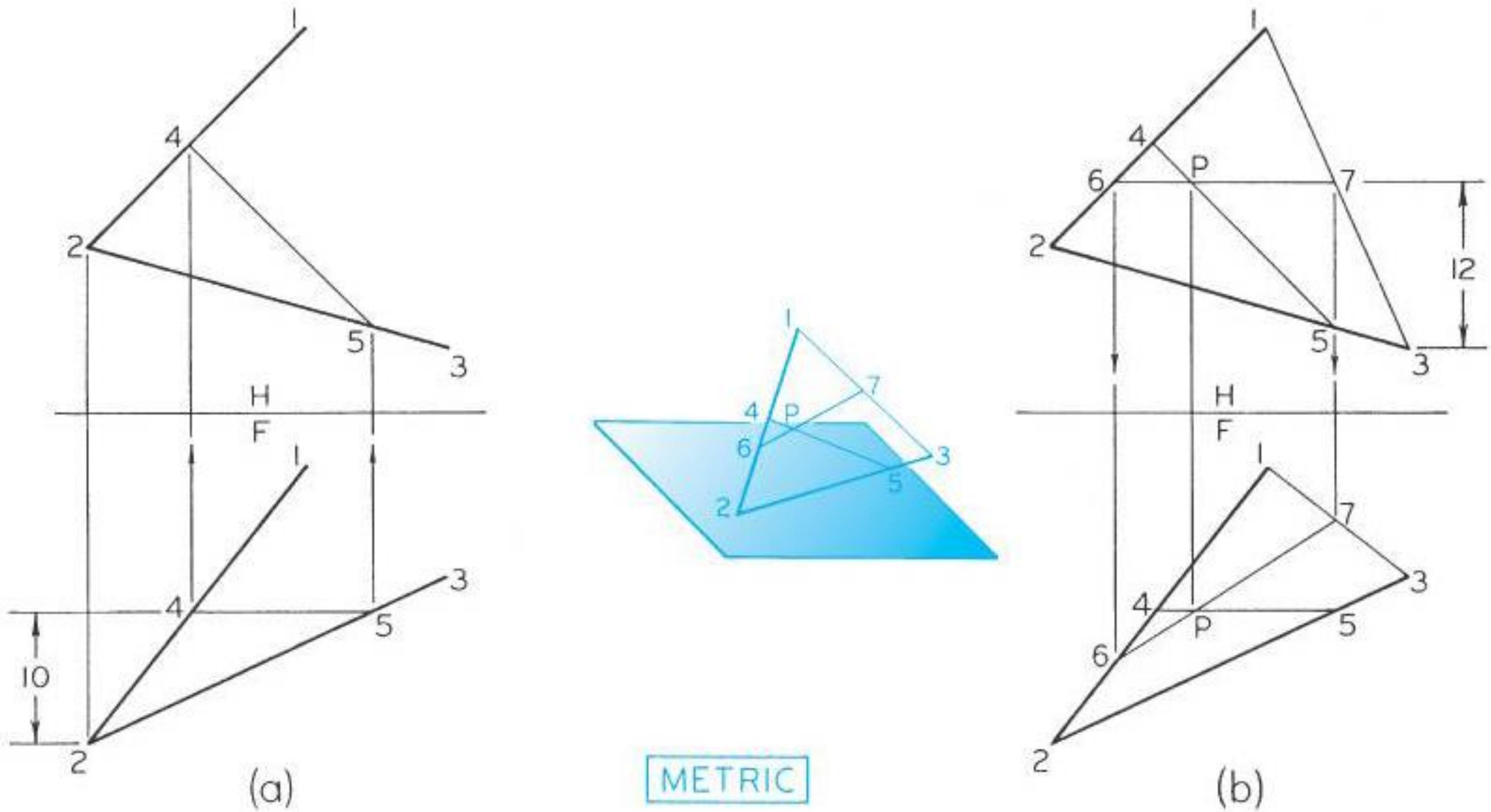


(a) (b) (c)

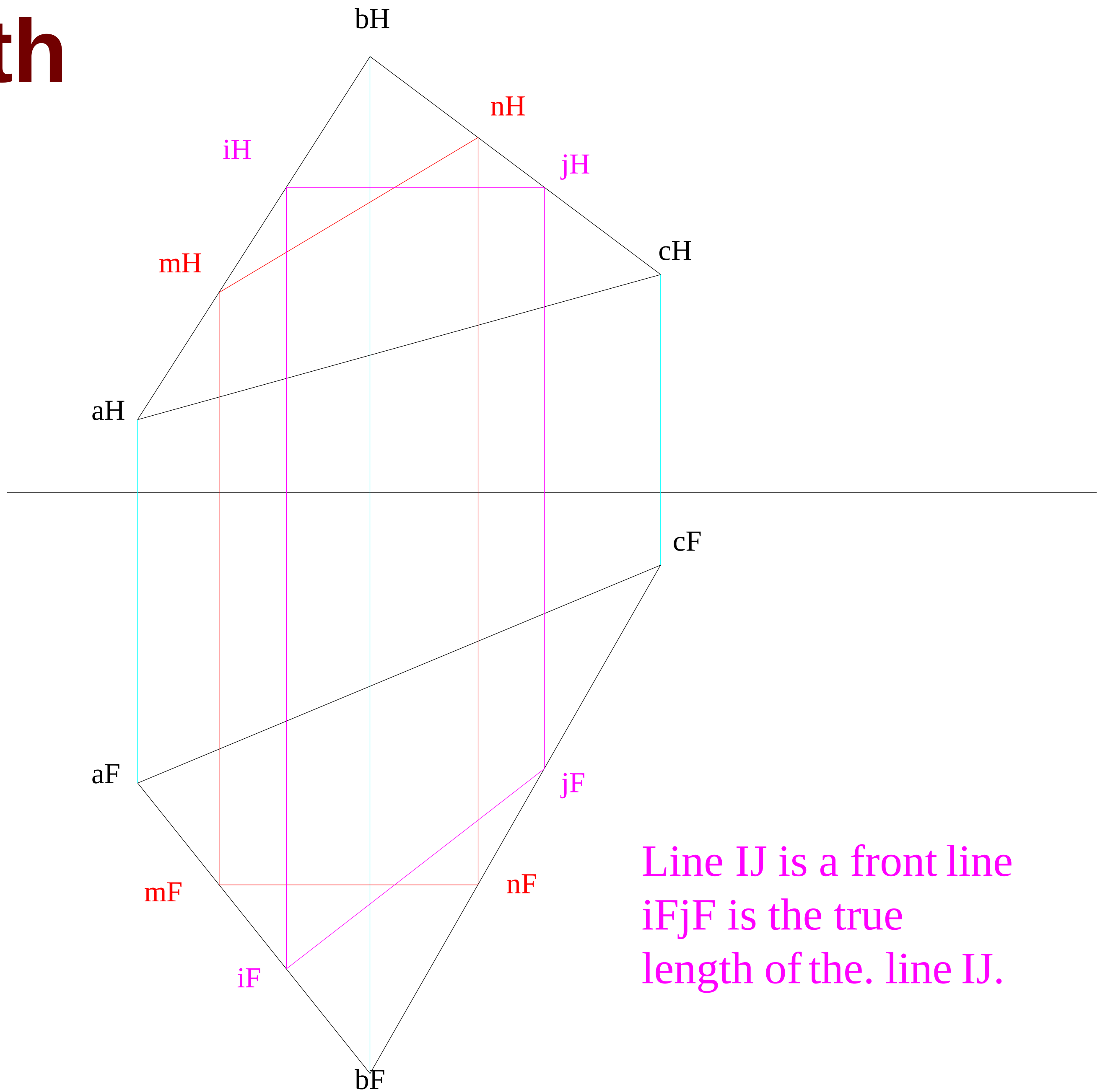
Using Parallelism

Location of a point on a plane

Locate a point which is 10 mm above point 2 and 12 mm behind point 3.



True Length Line Lies on the Plane



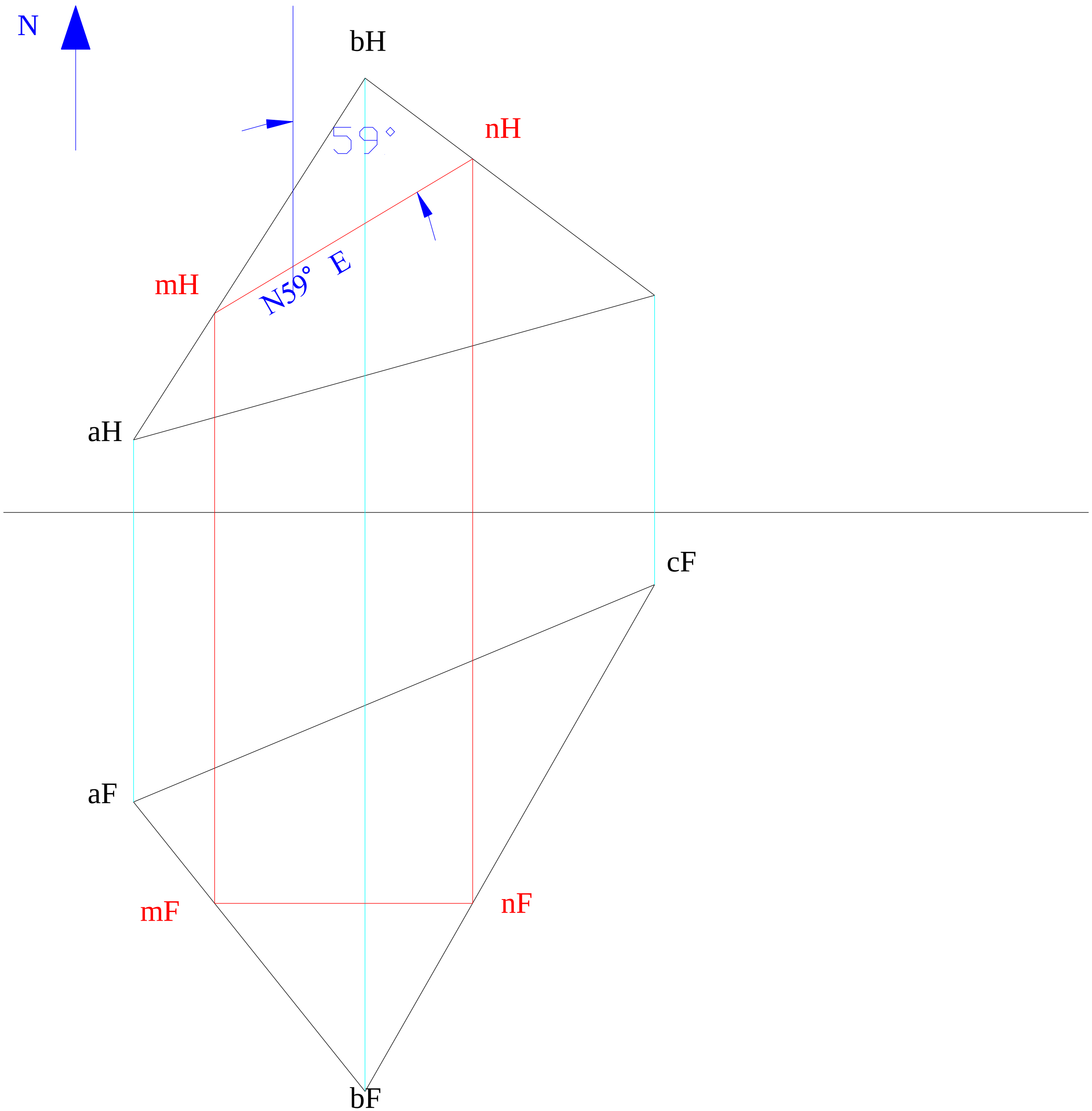
Line MN is a horizontal line. mHnH is the true length of the line MN.

Line IJ is a front line iFjF is the true length of the. line IJ.

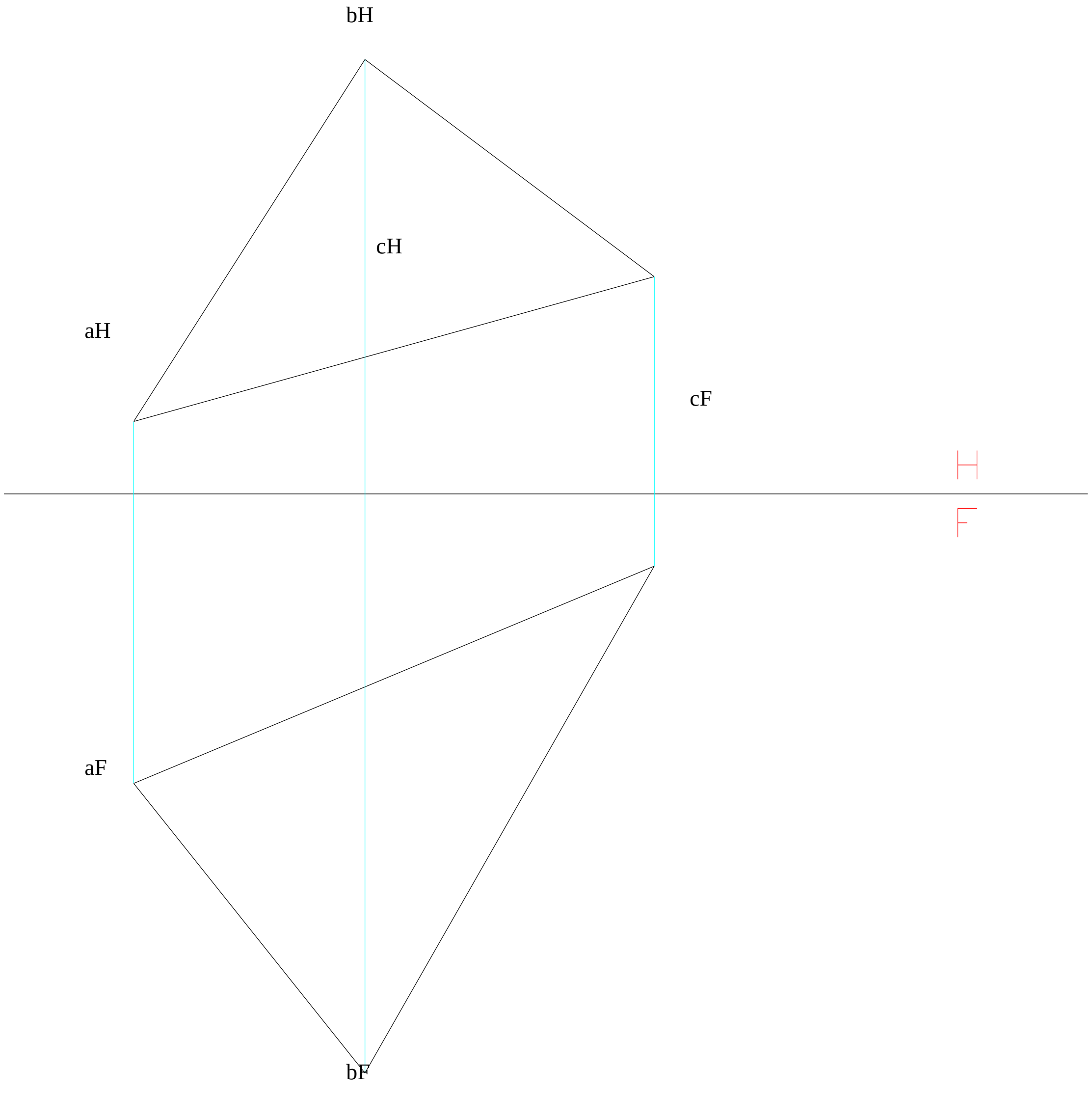
Strike of a plane

Line MN is a horizontal line. mHnH is the true length of the line MN.

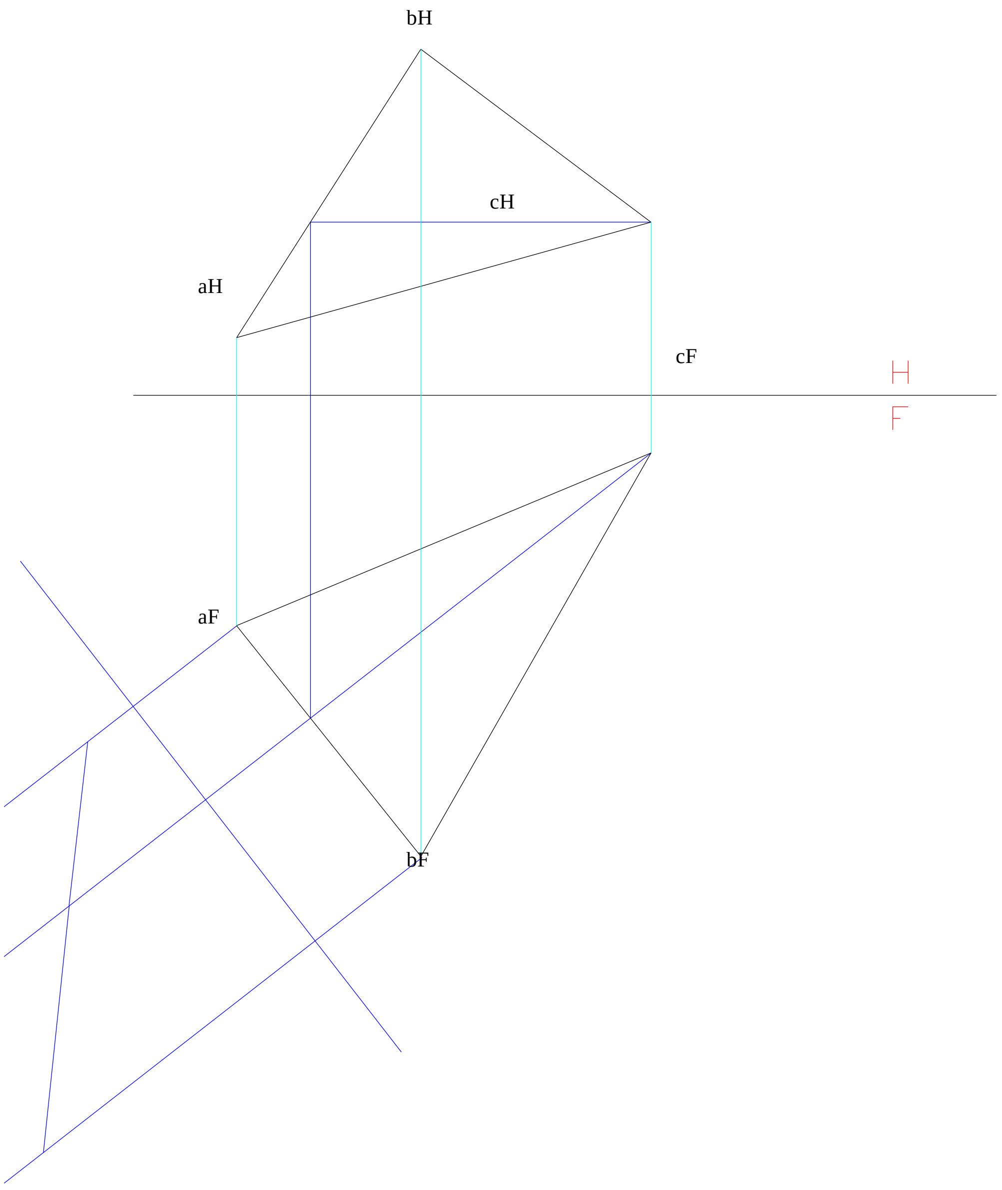
The bearing of this line represents the strike of the plane. cH



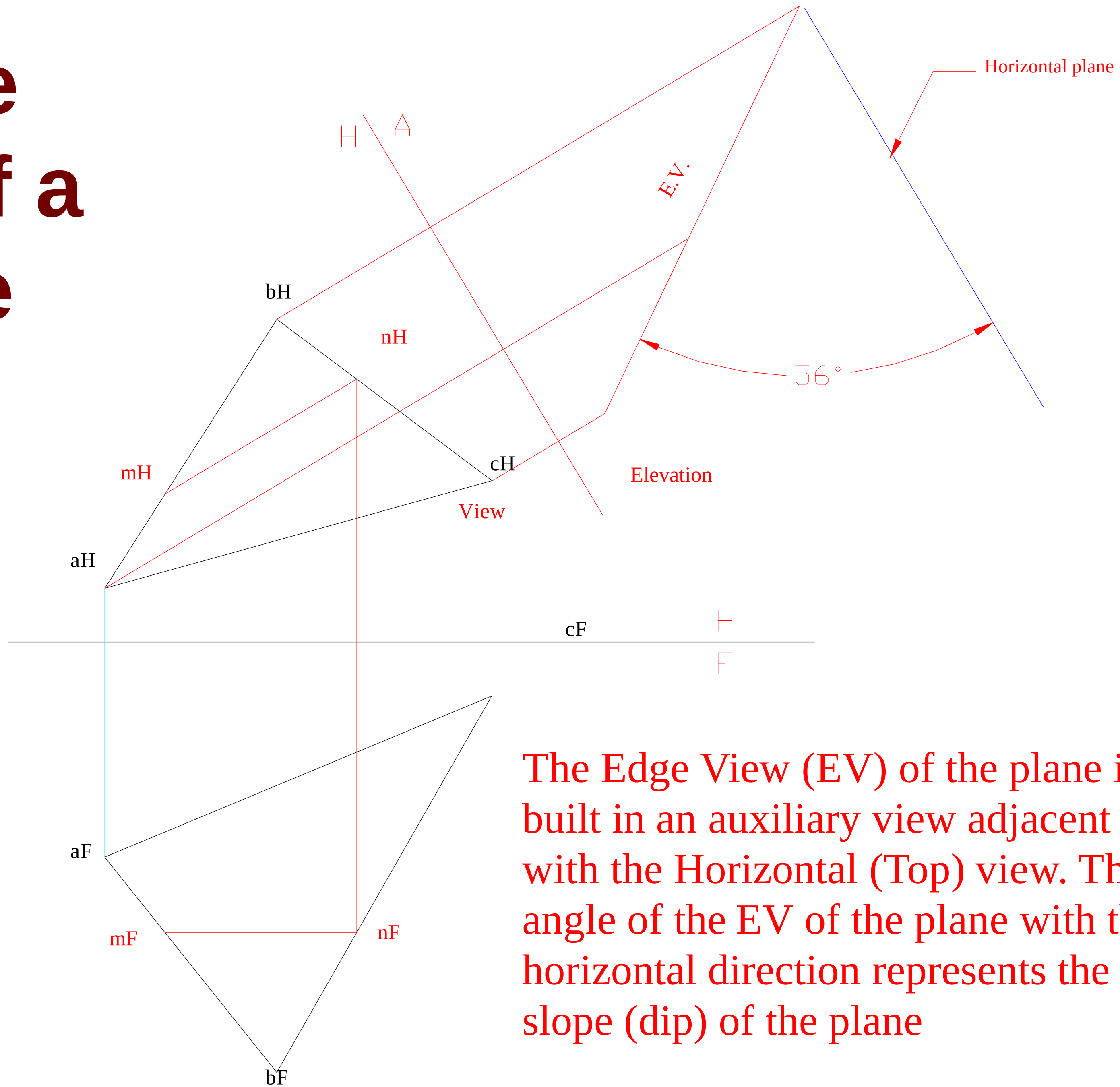
Edge View of a plane



Edge View of a plane



Slope (dip) of a plane

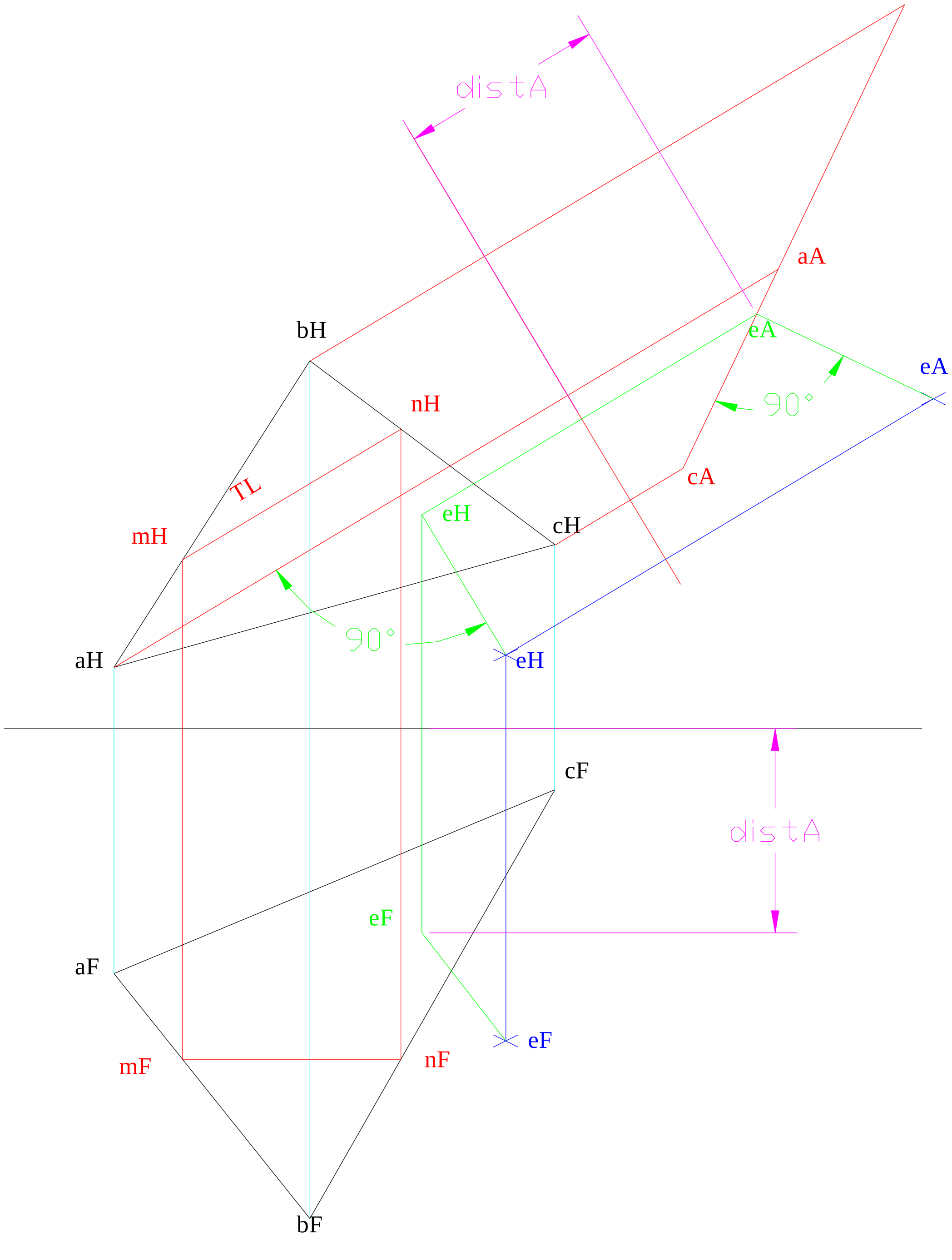


The Edge View (EV) of the plane is built in an auxiliary view adjacent with the Horizontal (Top) view. The angle of the EV of the plane with the horizontal direction represents the slope (dip) of the plane

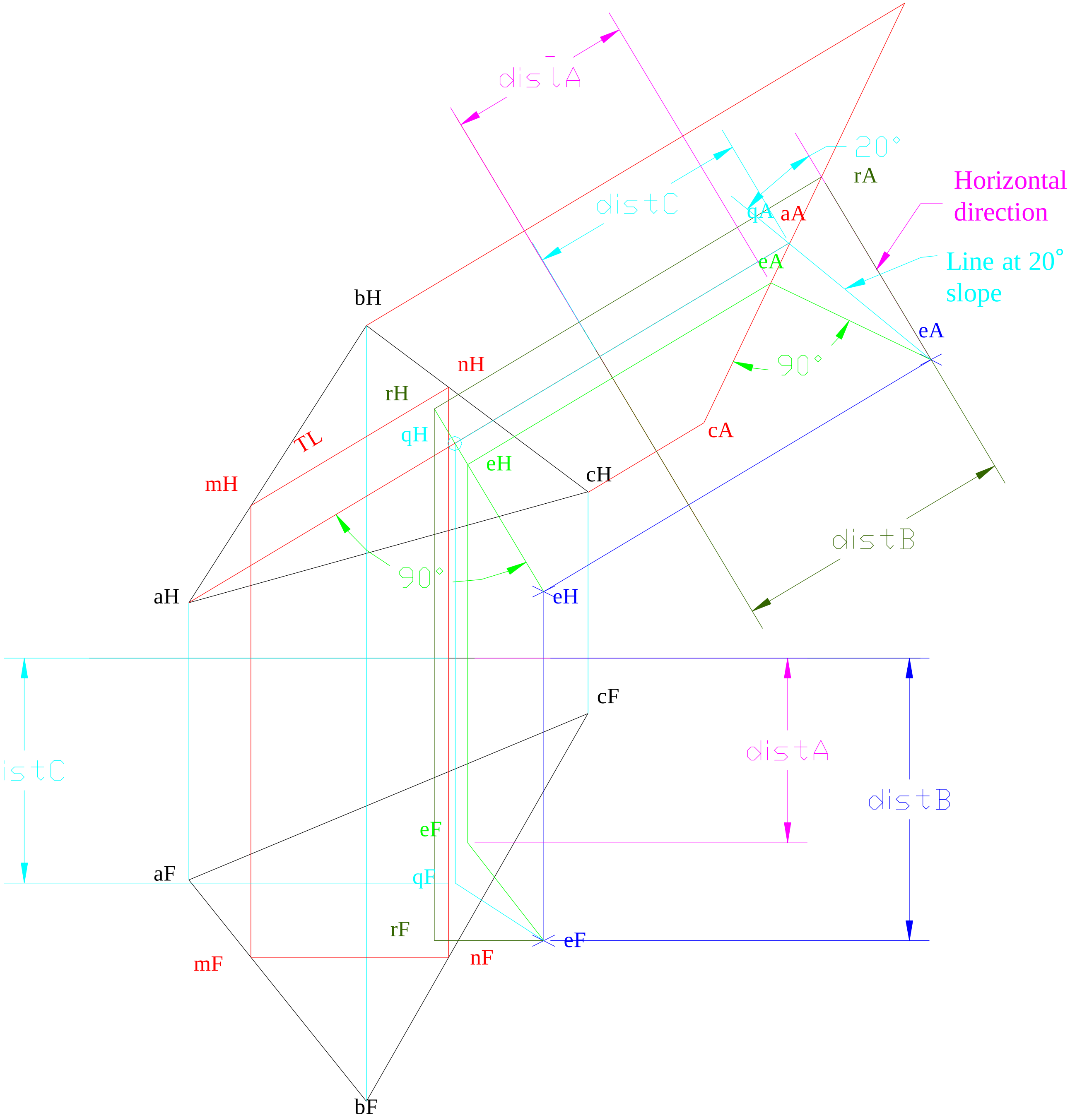
MECH211

NEXT LECTURE

Shortest line from a point to a plane: bA



Shortest grade line from a point to a plane: bA



The slope could be shown ONLY IN AN ELEVATION VIEW