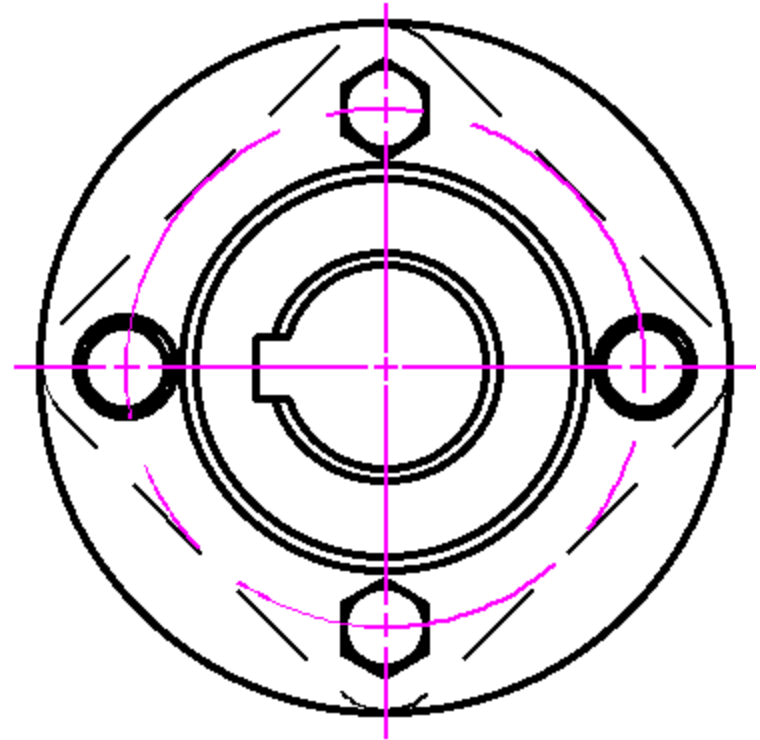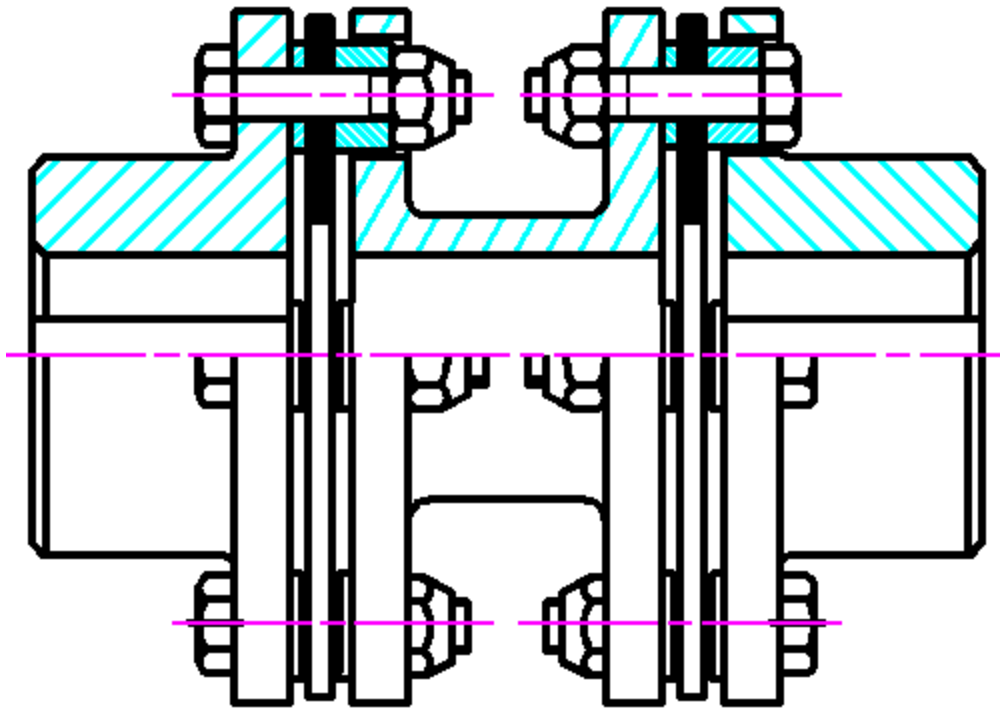# Sections through assemblies
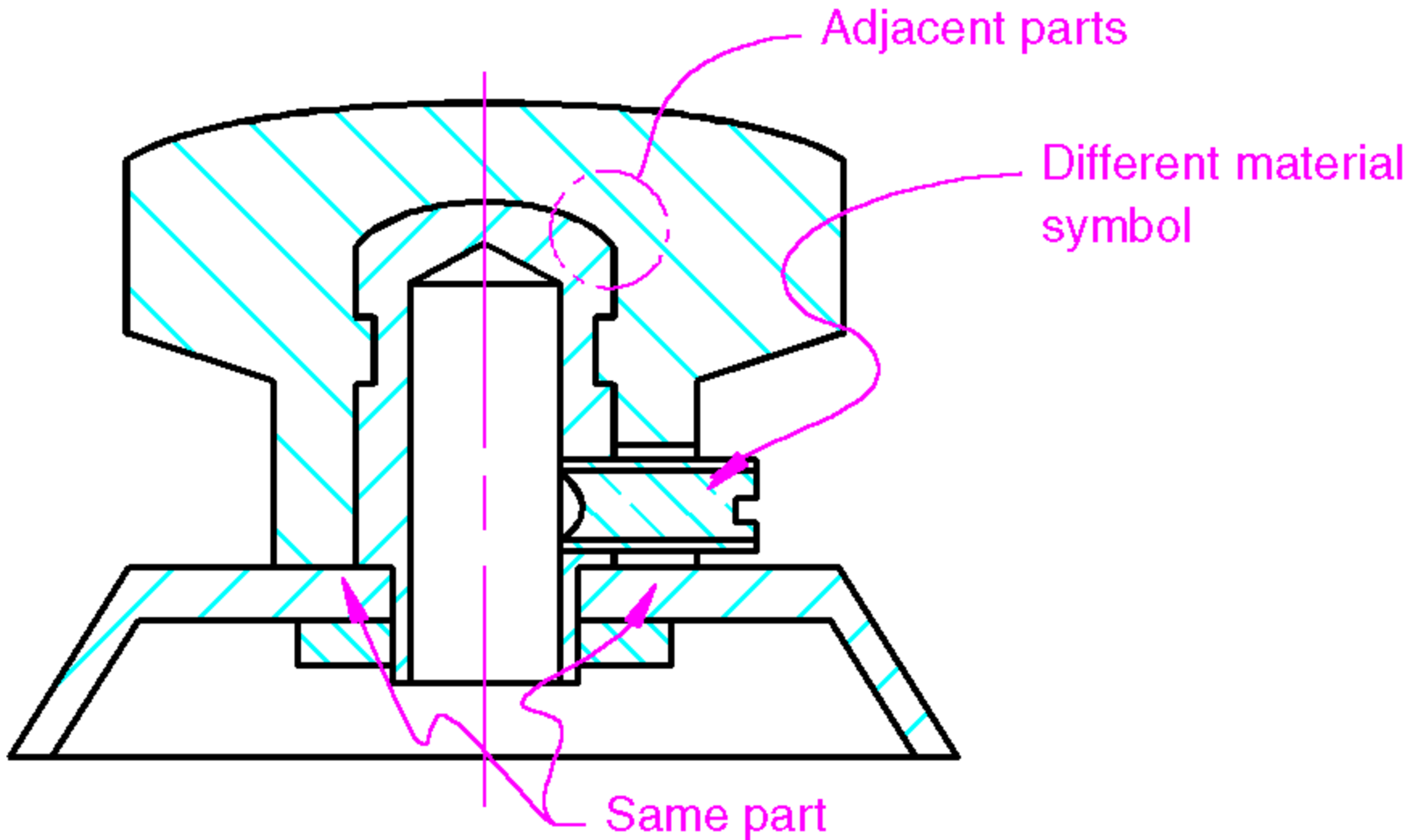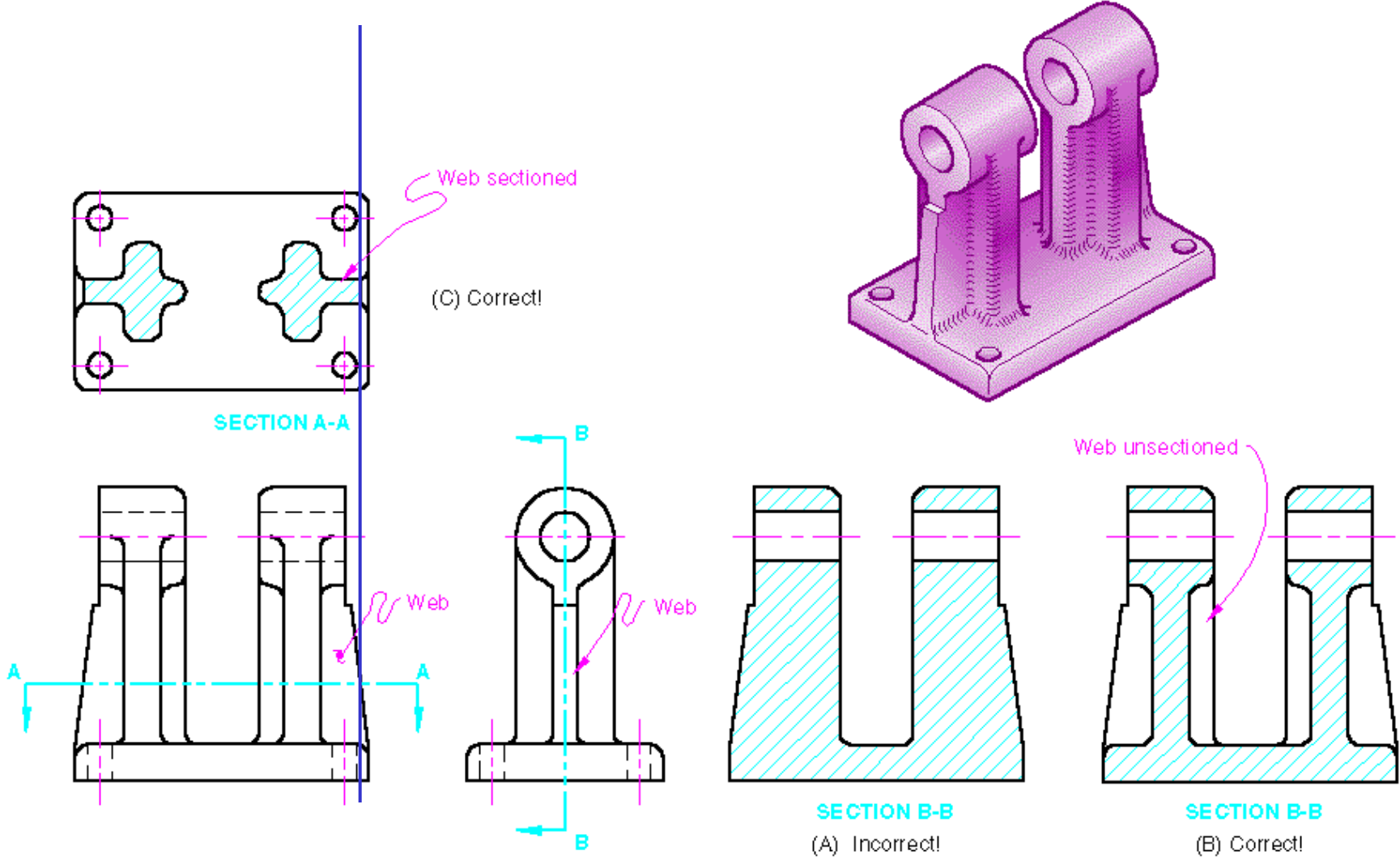
Pay attention to lining

Adjacent parts

Different material symbol

Same part

Pay attention to representation

Web sectioned

(C) Correct!

SECTION A-A

Web

Web

Web unsectioned

SECTION B-B
(A) Incorrect!

SECTION B-B
(B) Correct!

Pay attention to representation
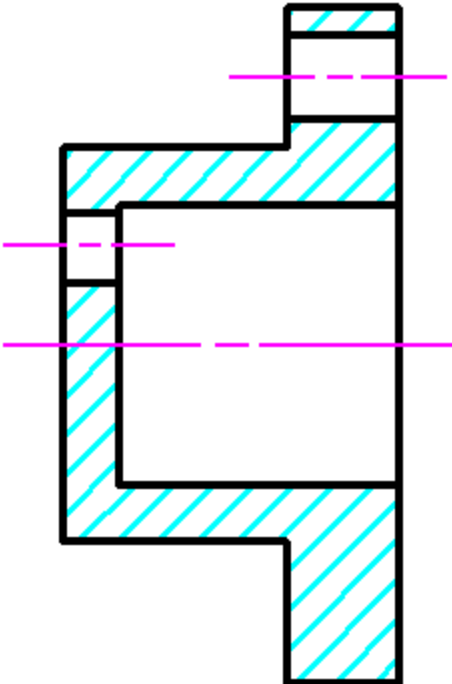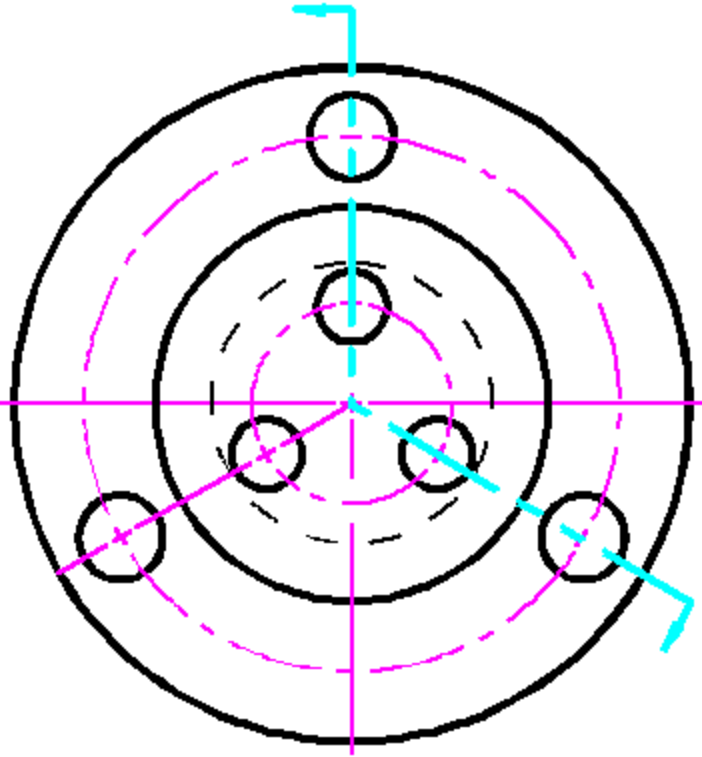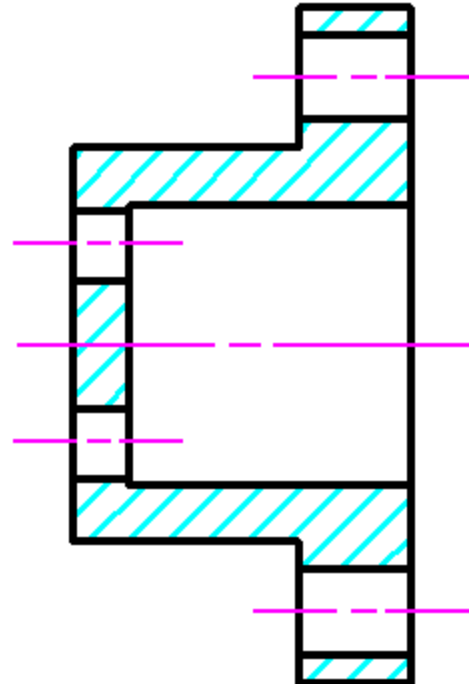
(A) True projection   (B) Preferred
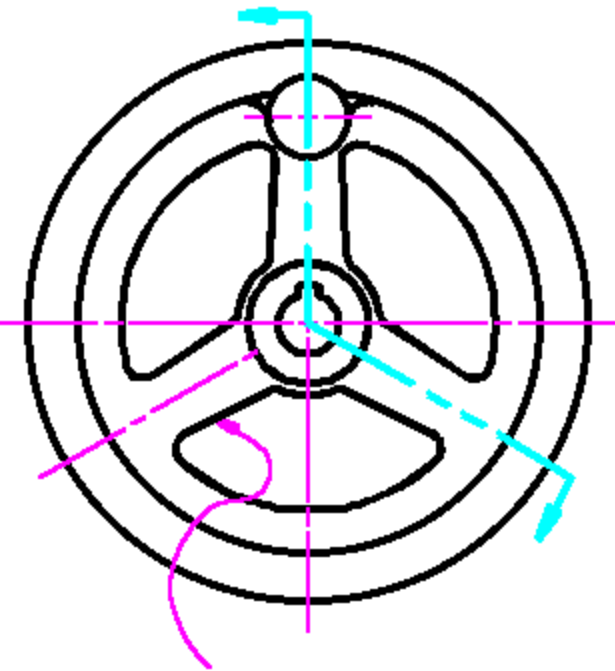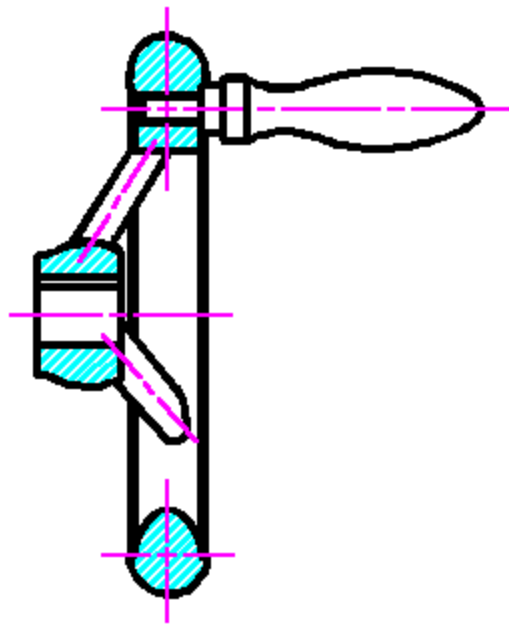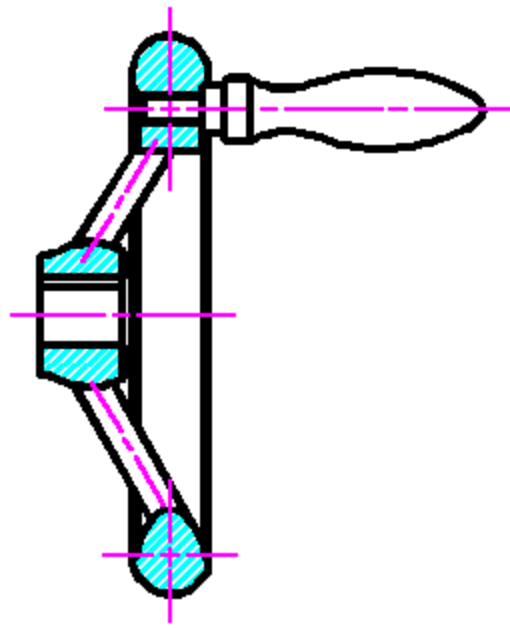
Pay attention to representation

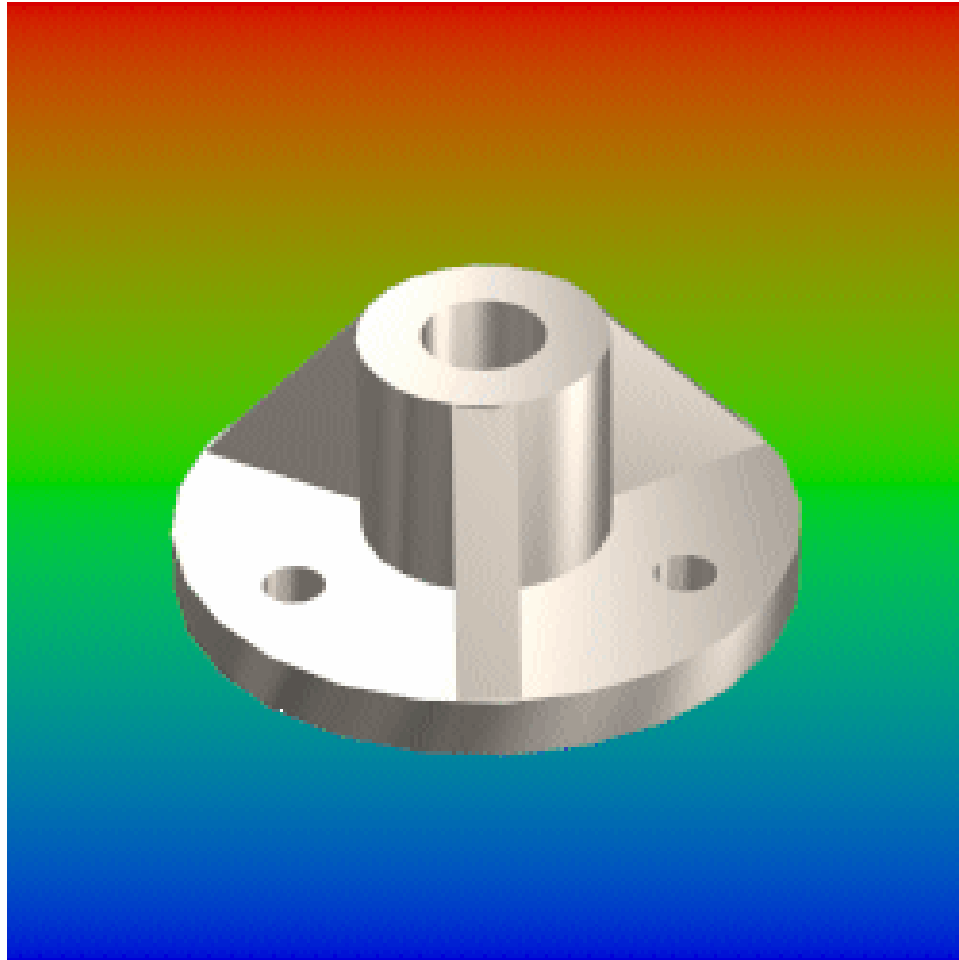Spoke A omitted in the "preferred" section view

True Projection

Preferred

Section in a flange

AUXILIARY VIEWS

Definitions

- Any view obtained by a projection on a plane other than the horizontal (H), frontal (F) and profile (P) is an auxiliary view.

- Primary auxiliary is projected to a plane that is perpendicular to one of the principal planes

- Secondary auxiliary is projected from a primary auxiliary to a plane that is inclined to all three principal views

Candidates for auxiliary views

Isometric lines

Non-isometric lines

Isometric axis
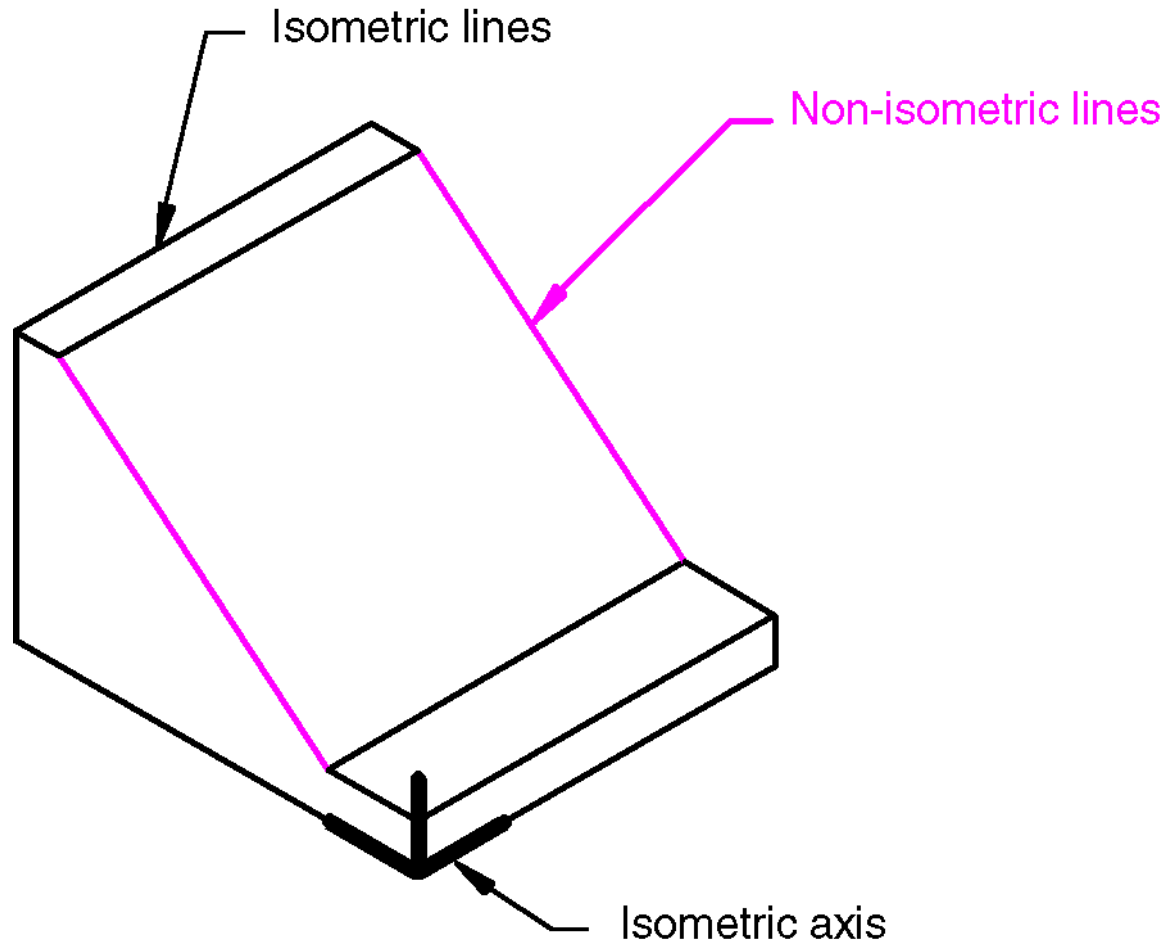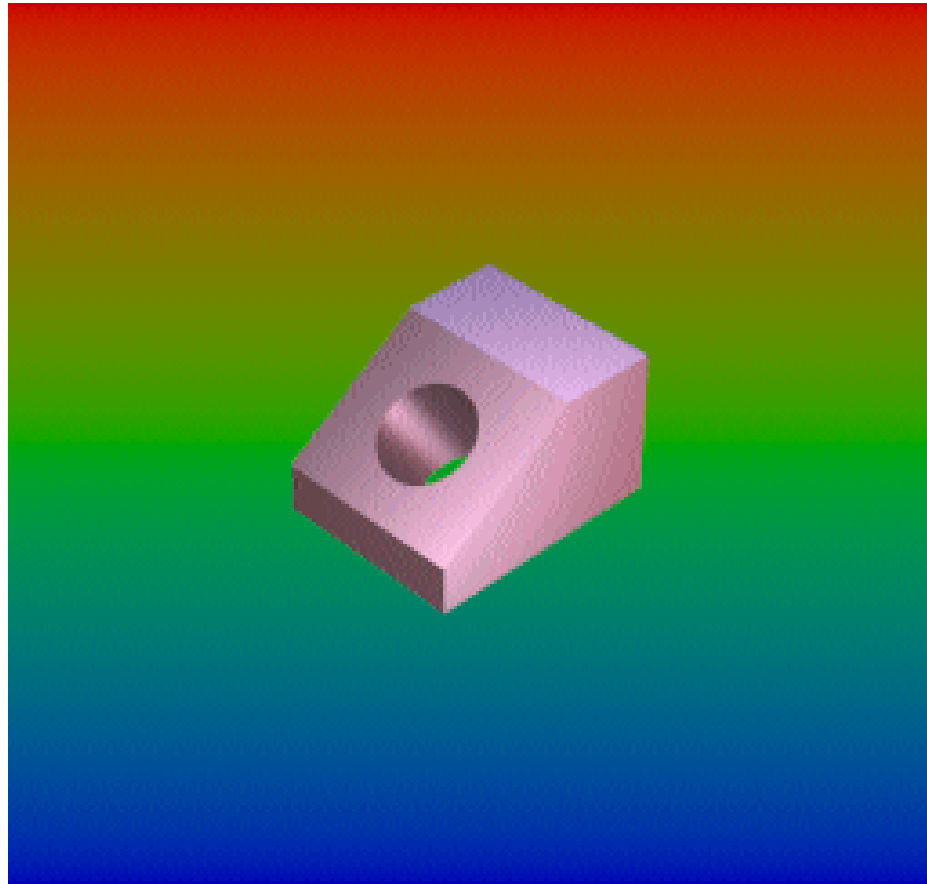
Auxiliary view

Principal planes
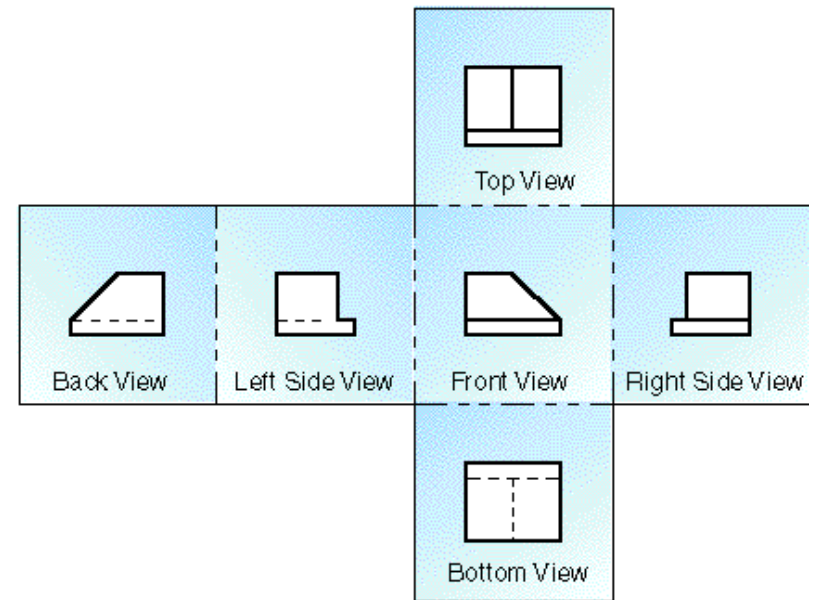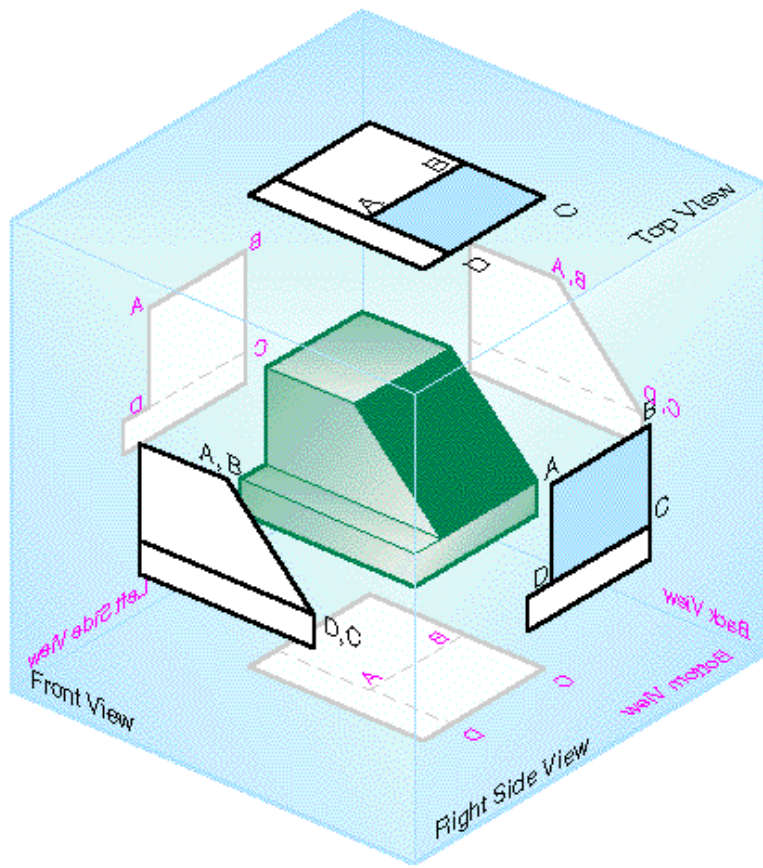
Auxiliary plane

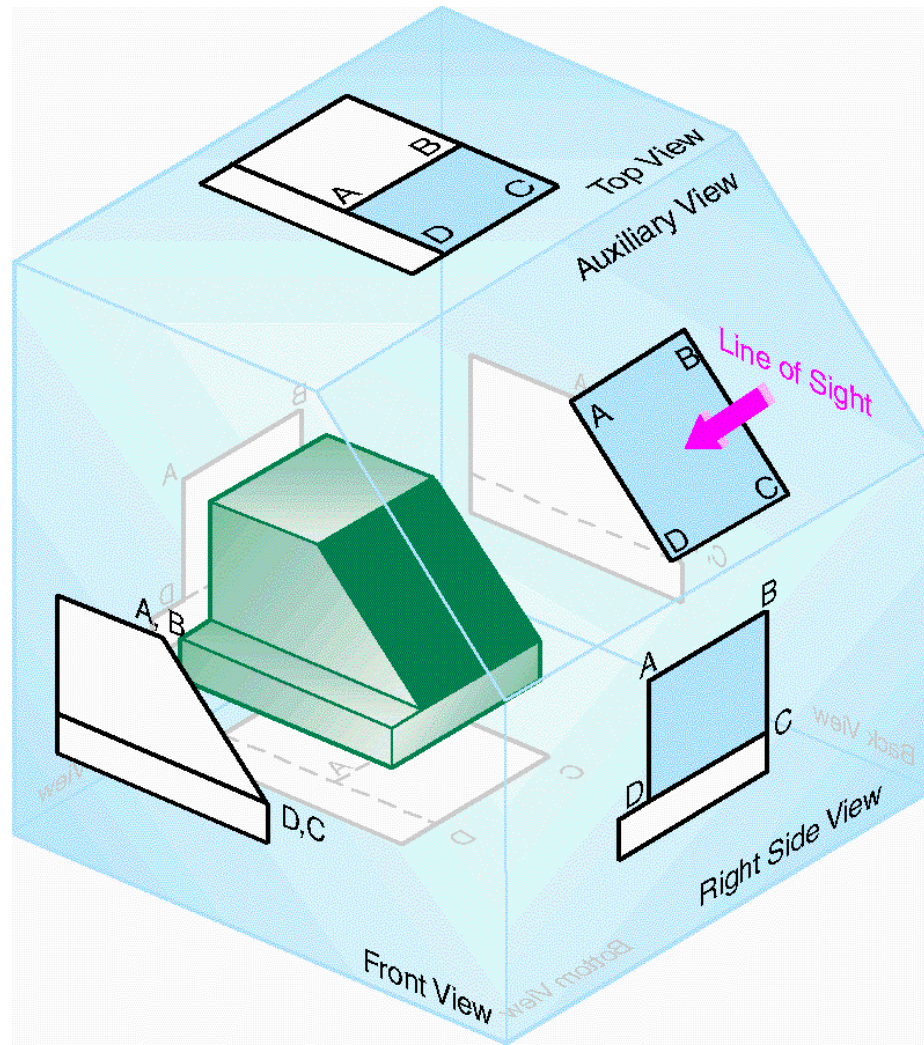# Primary auxiliary view
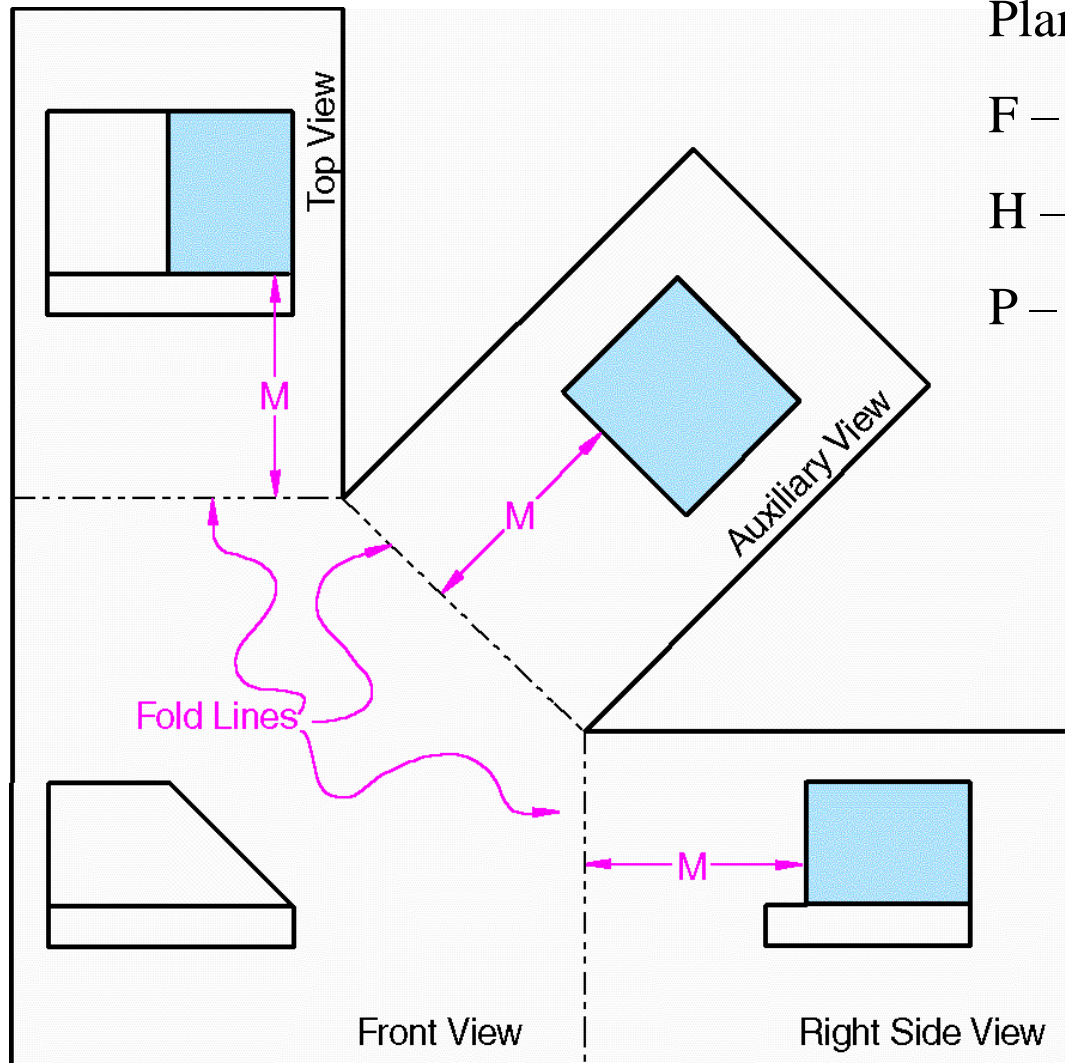
Plane   True Dim.

F – Width, Height

H – Width, Depth

P – Depth, Height

Primary auxiliary view

B   C
Inclined plane

A

A   D

AUXILIARY VIEW

B

TRUE SHAPE AND SIZE

C

D

Line of sight

Edge view of inclined plane

A, B

D, C

Inclined plane

A   B

D   C

(B)
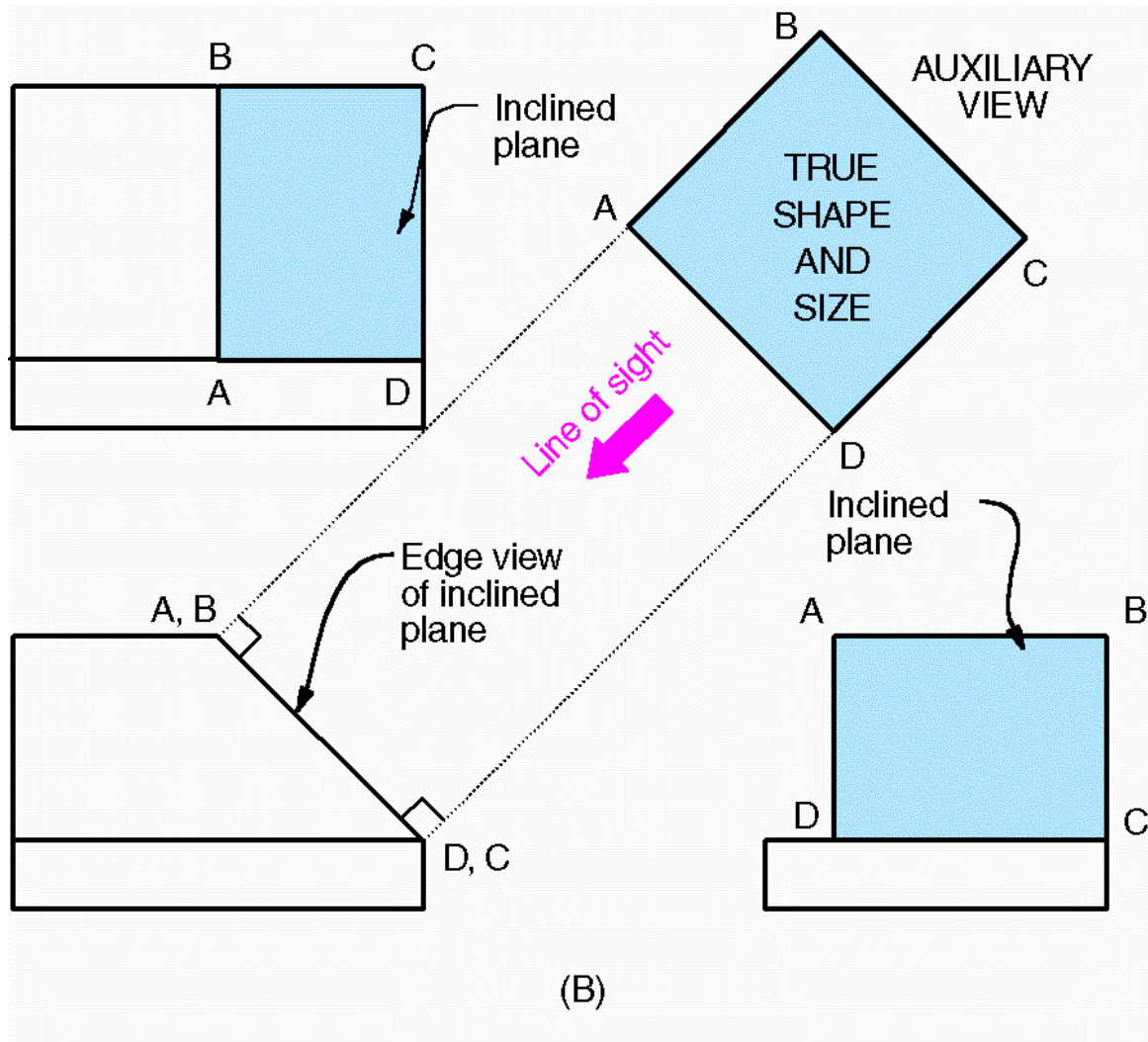
DEPTH AUXILIARY VIEWS

- A projection plane is perpendicular to the frontal view, and oblique to the top (or side) view. The auxiliary view is based on the frontal view.

- Depth in Auxiliary View = Depth in Top (Side) View
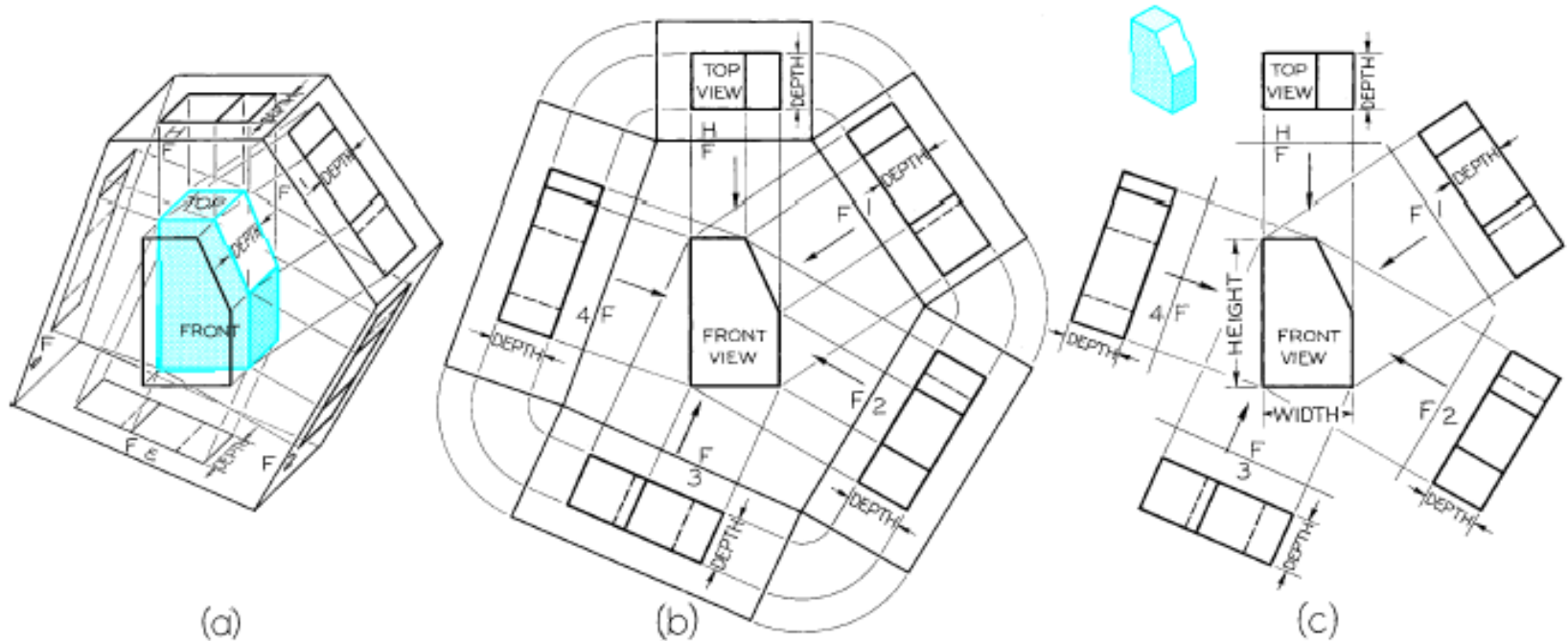
HEIGHT AUXILIARY VIEWS

- A projection plane is perpendicular to the top view, and oblique to the frontal (side) view. The auxiliary view is based on the top view.

- Height in Auxiliary View = Height in Frontal (Side) View
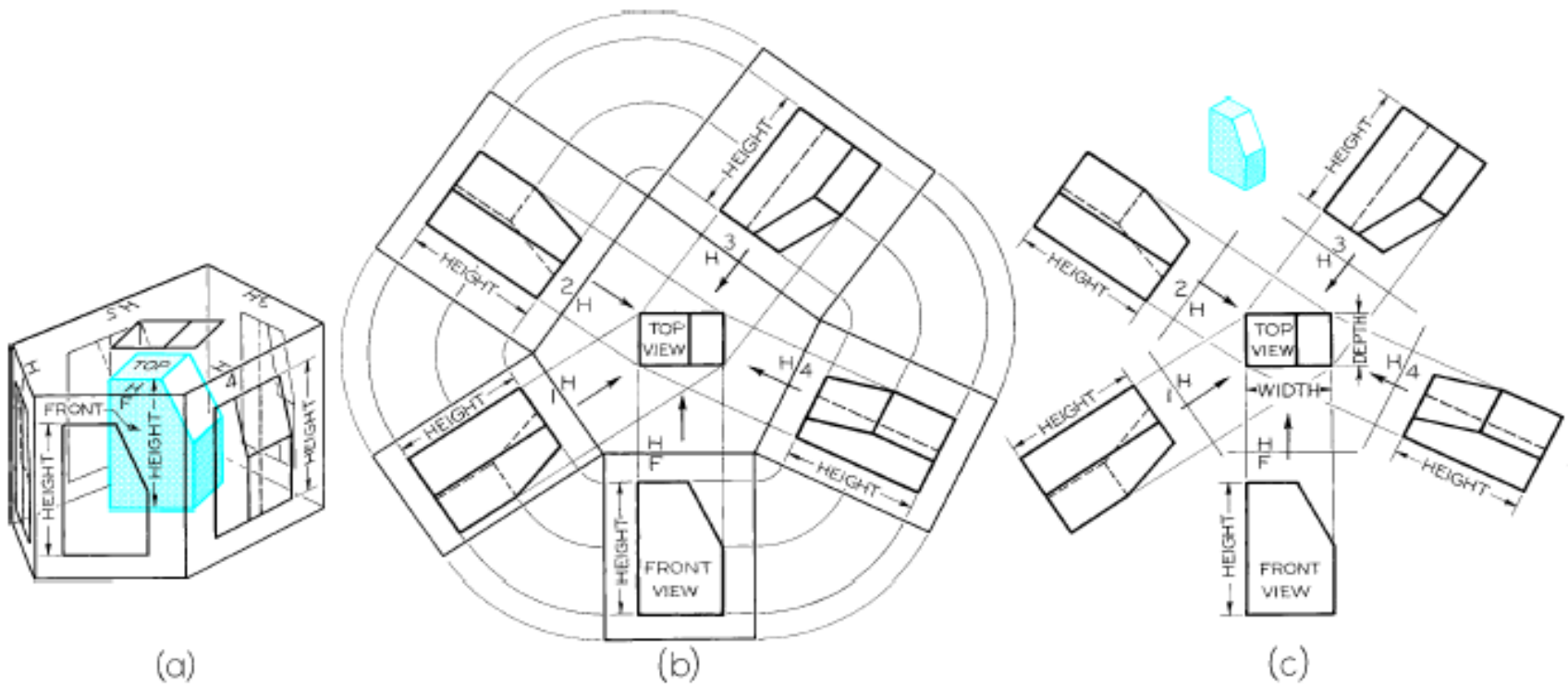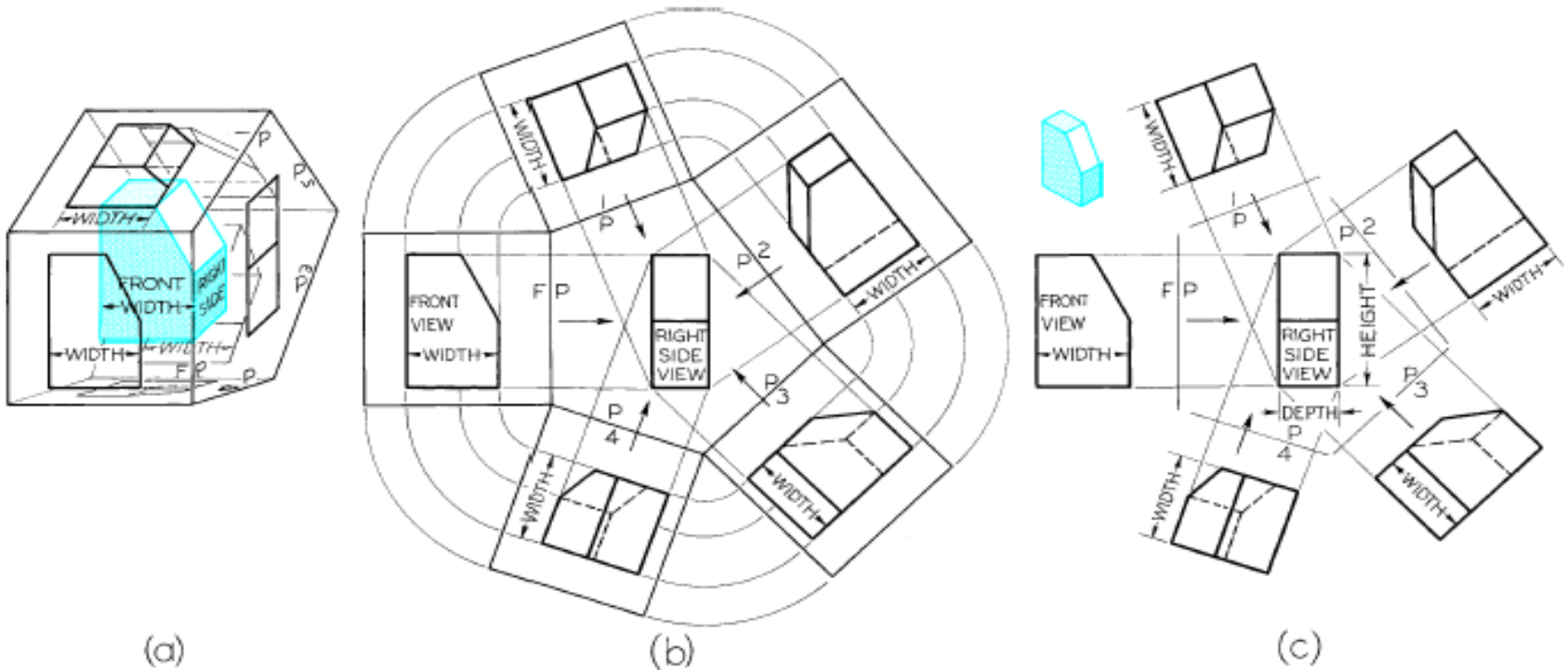

(a)   (b)   (c)

WIDTH AUXILIARY VIEWS
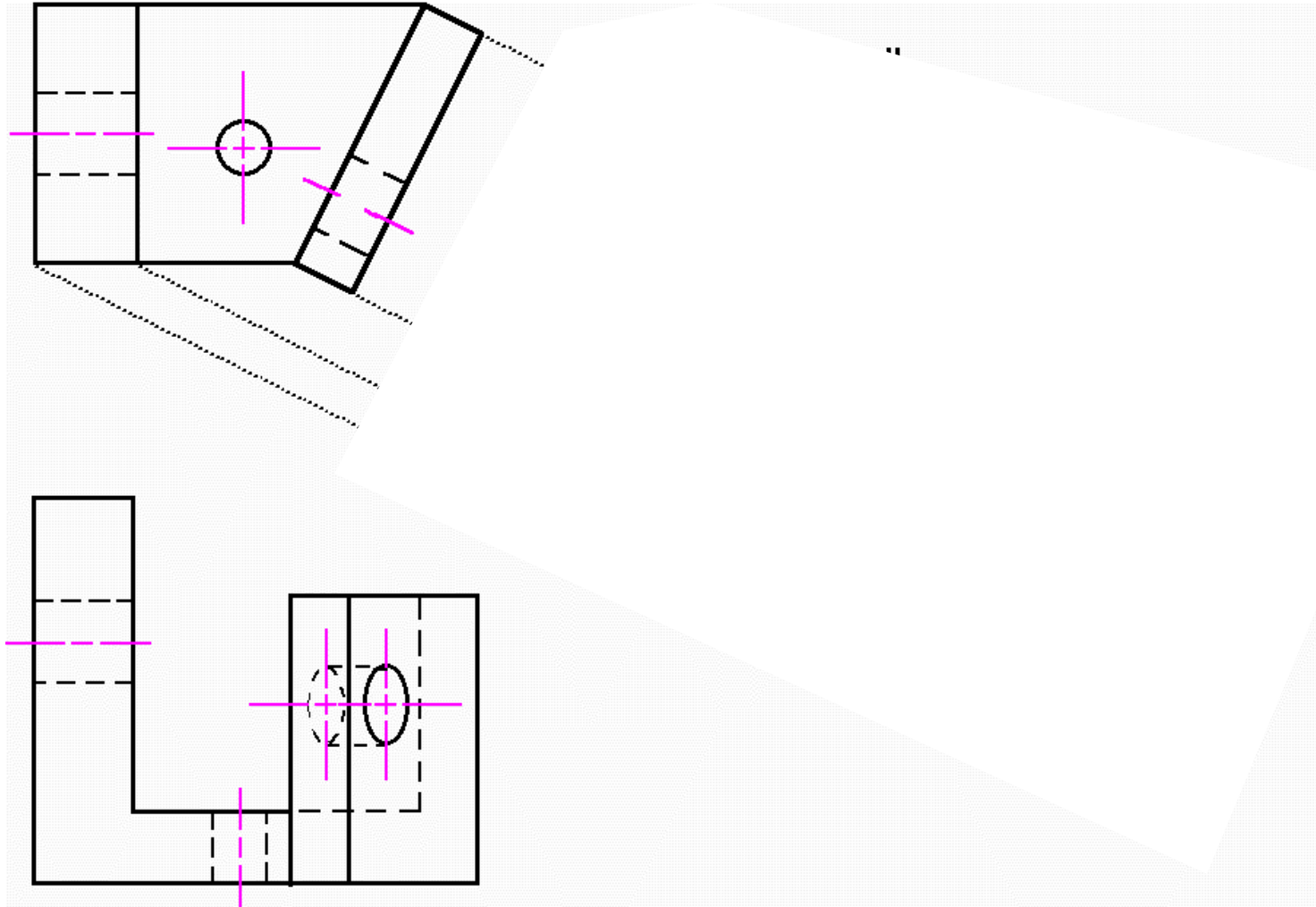
- A projection plane is perpendicular to the side view, and oblique to the frontal (or top) view. The auxiliary view is based on the side view.

- Width in Auxiliary View = Width in Frontal (Top) View

(a)　　　　　(b)　　　　　(c)

The features in auxiliary planes are seen deformed in the principal views

The features in auxiliary planes are seen deformed in the principal views
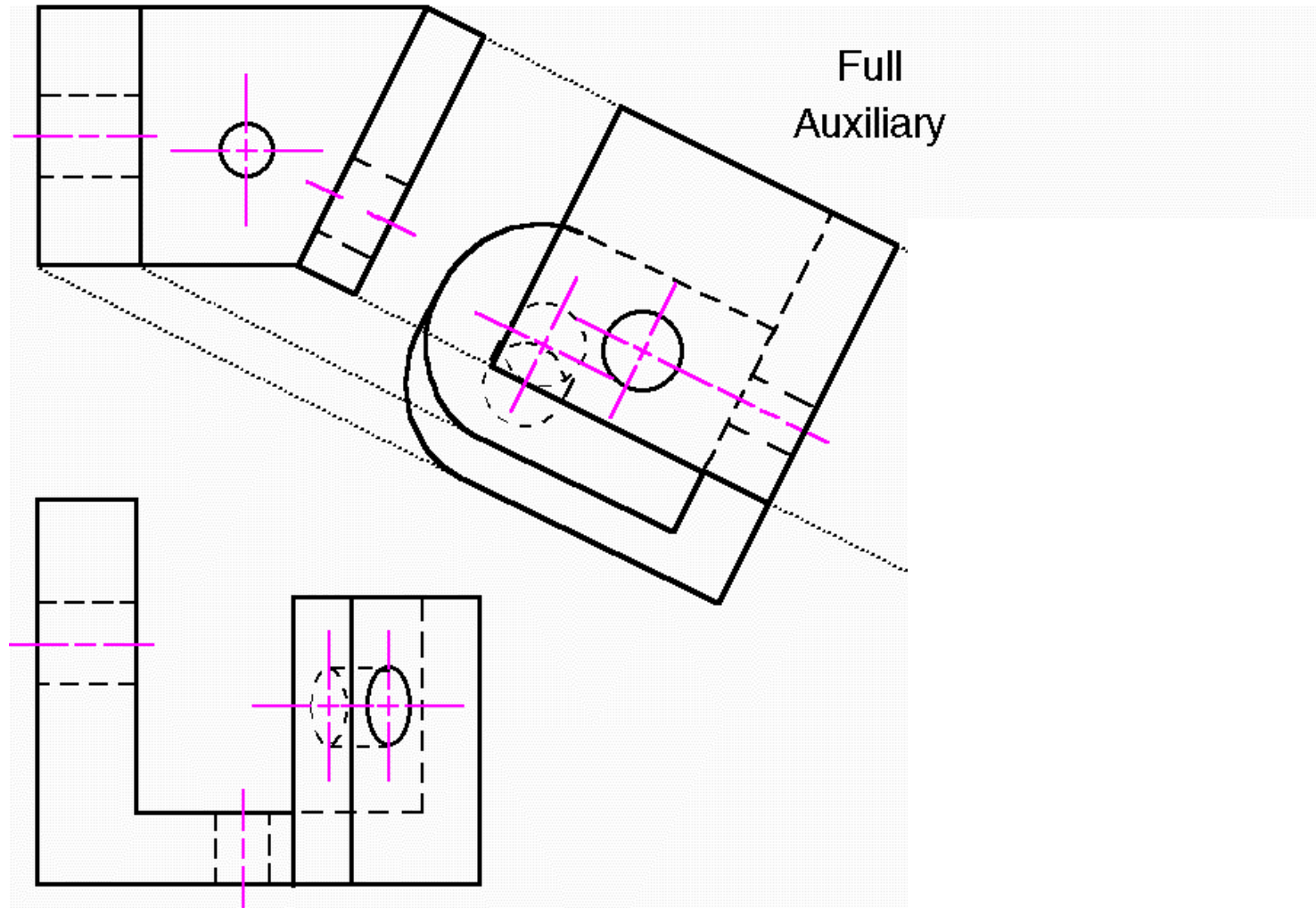
Full
Auxiliary

The features in auxiliary planes are seen deformed in the principal views

Full
Auxiliary

Partial
Auxiliary

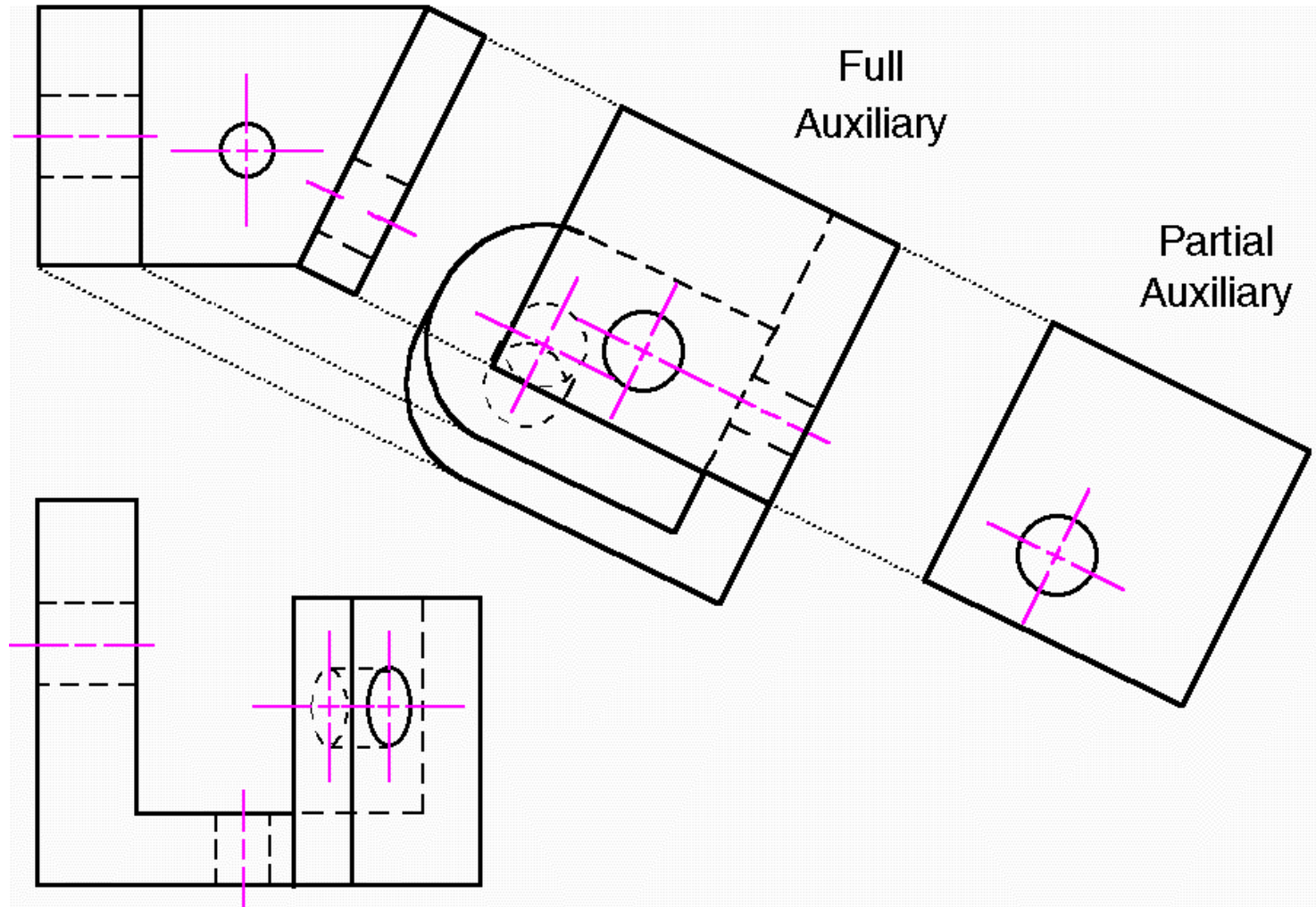# How to represent a full auxiliary view?
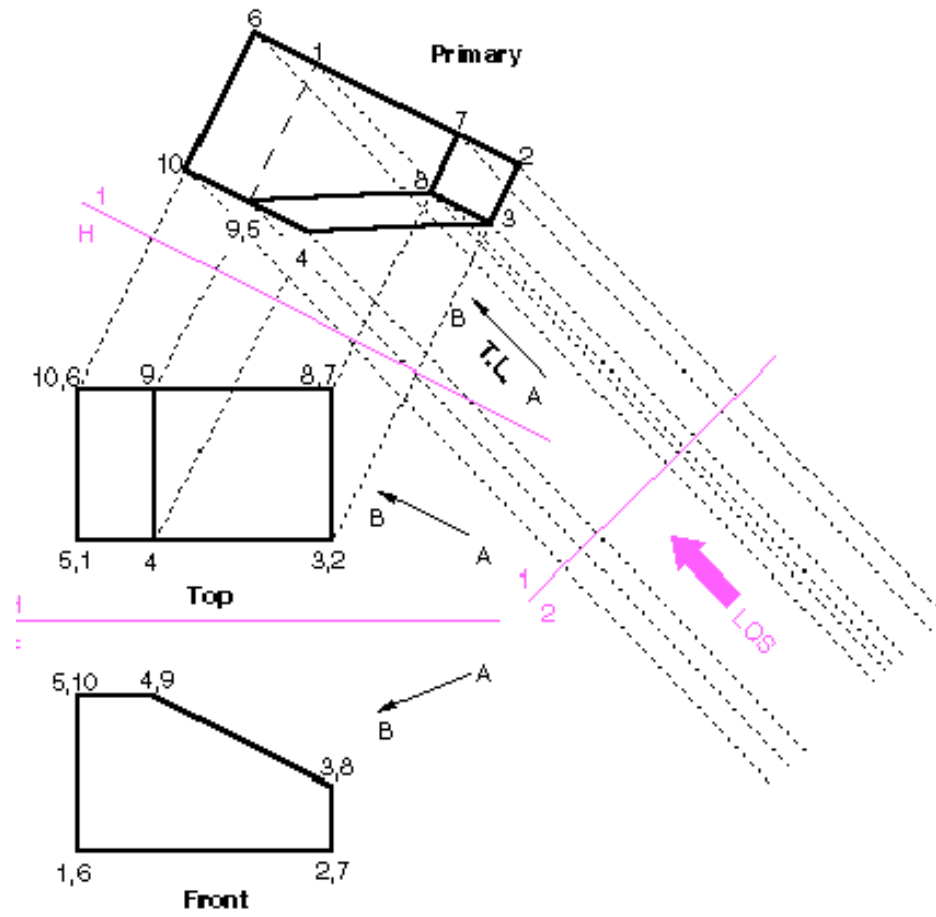## Folding-Line Method

Step 1

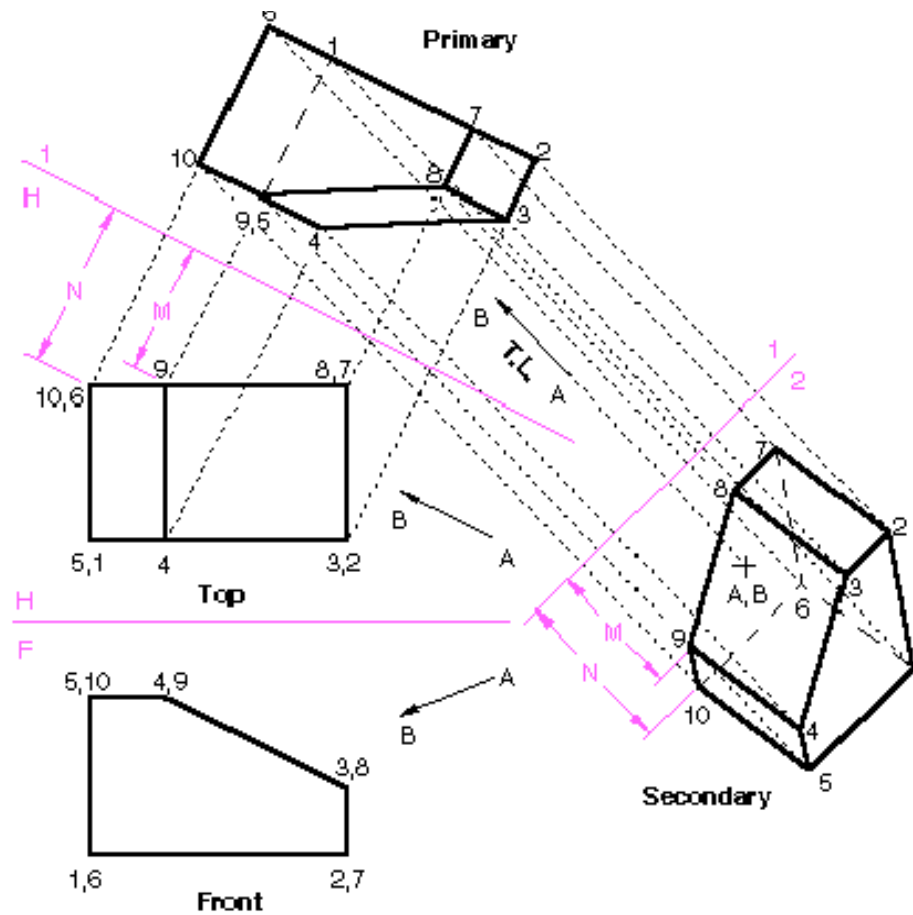# How to represent a full auxiliary view?
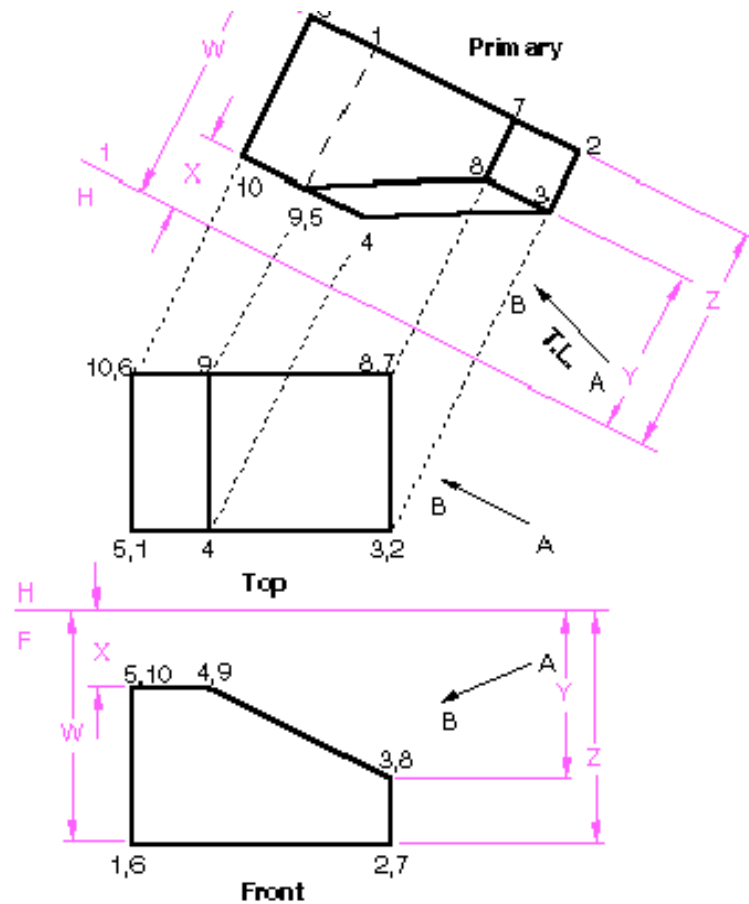
Step 2

How to represent a full auxiliary view?

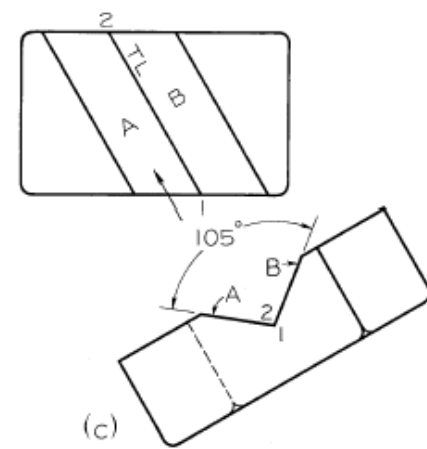
Step 3

How to represent a full auxiliary view?

Step 4

DIHEDRAL ANGLES
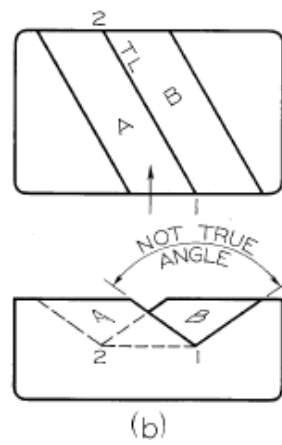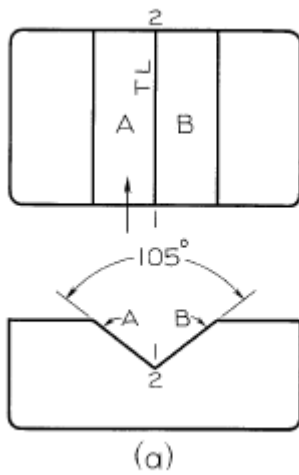
A practical problem
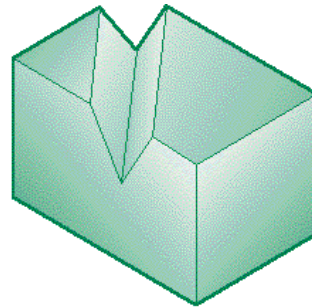
Find the angle of the V-cut
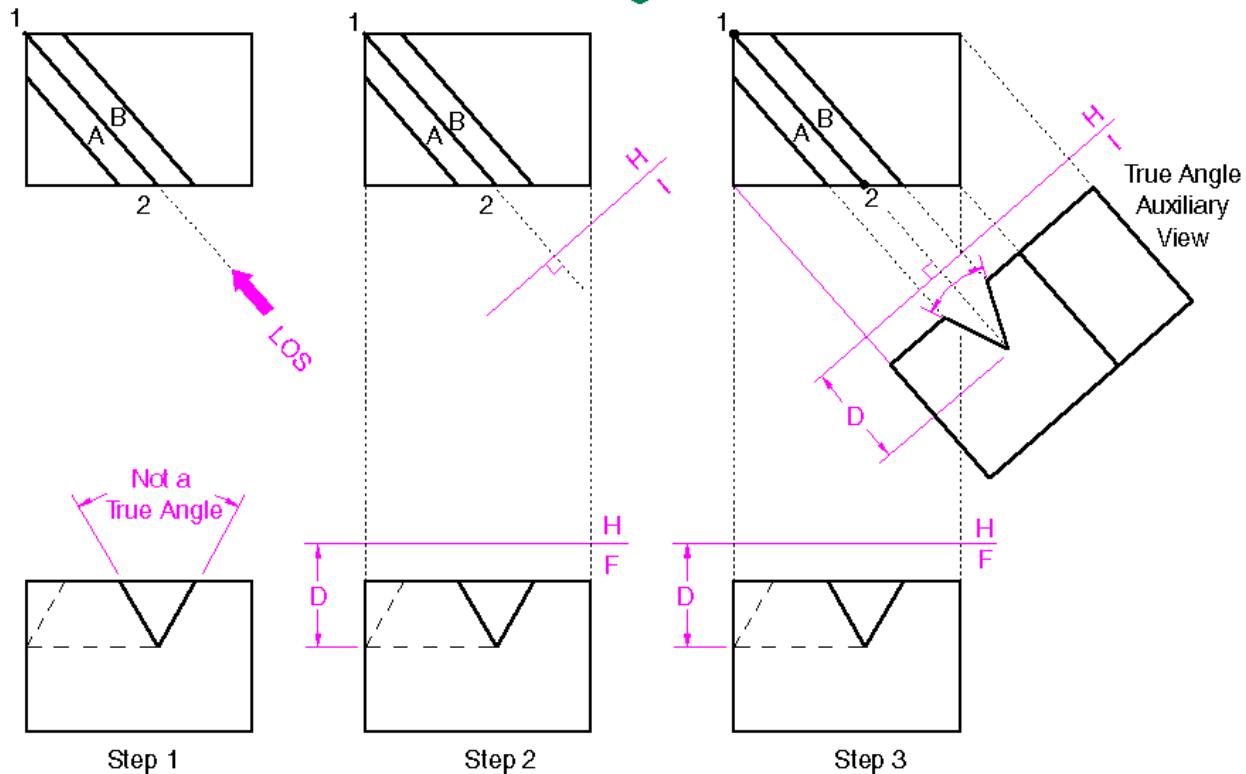
SOLUTION: TURE SIZE OF AN OBLIQUE SURFACE
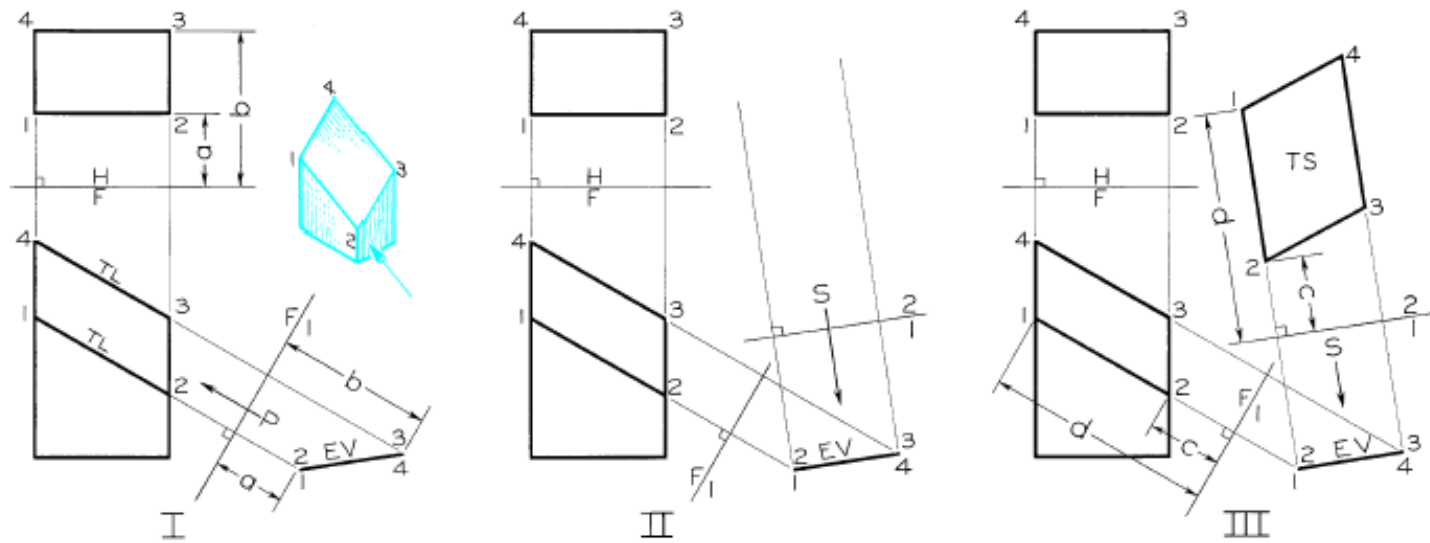
Another practical problem

Find the true shape of the section (triangle)
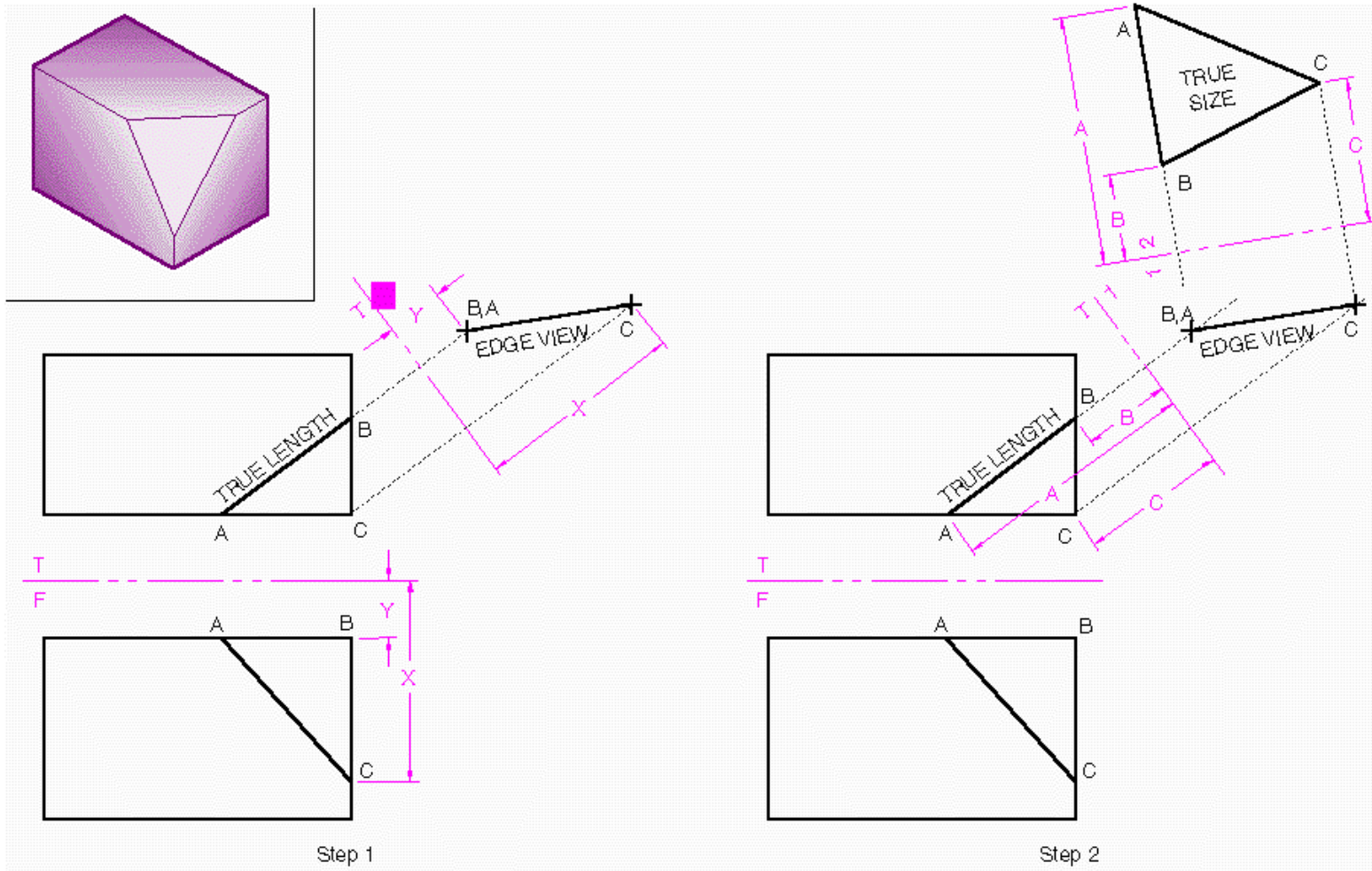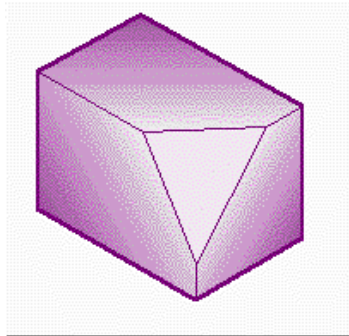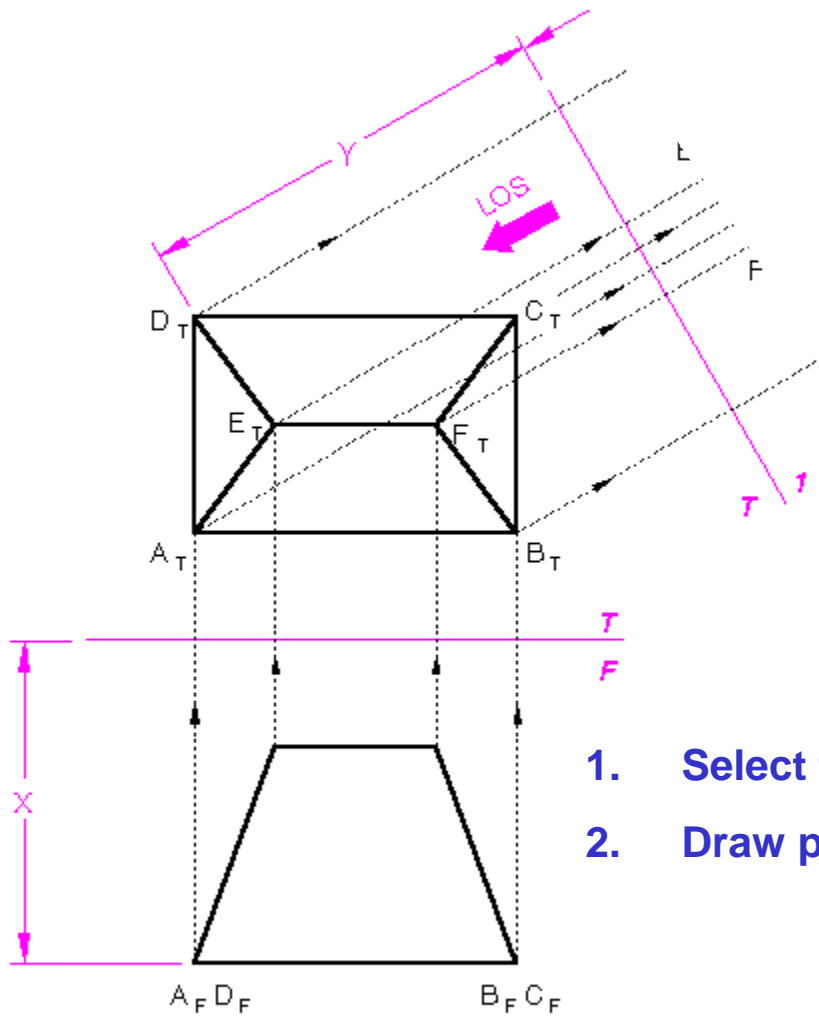
1. **Select fold line**
2. **Draw perp. To F/L**

Primary
Auxiliary View
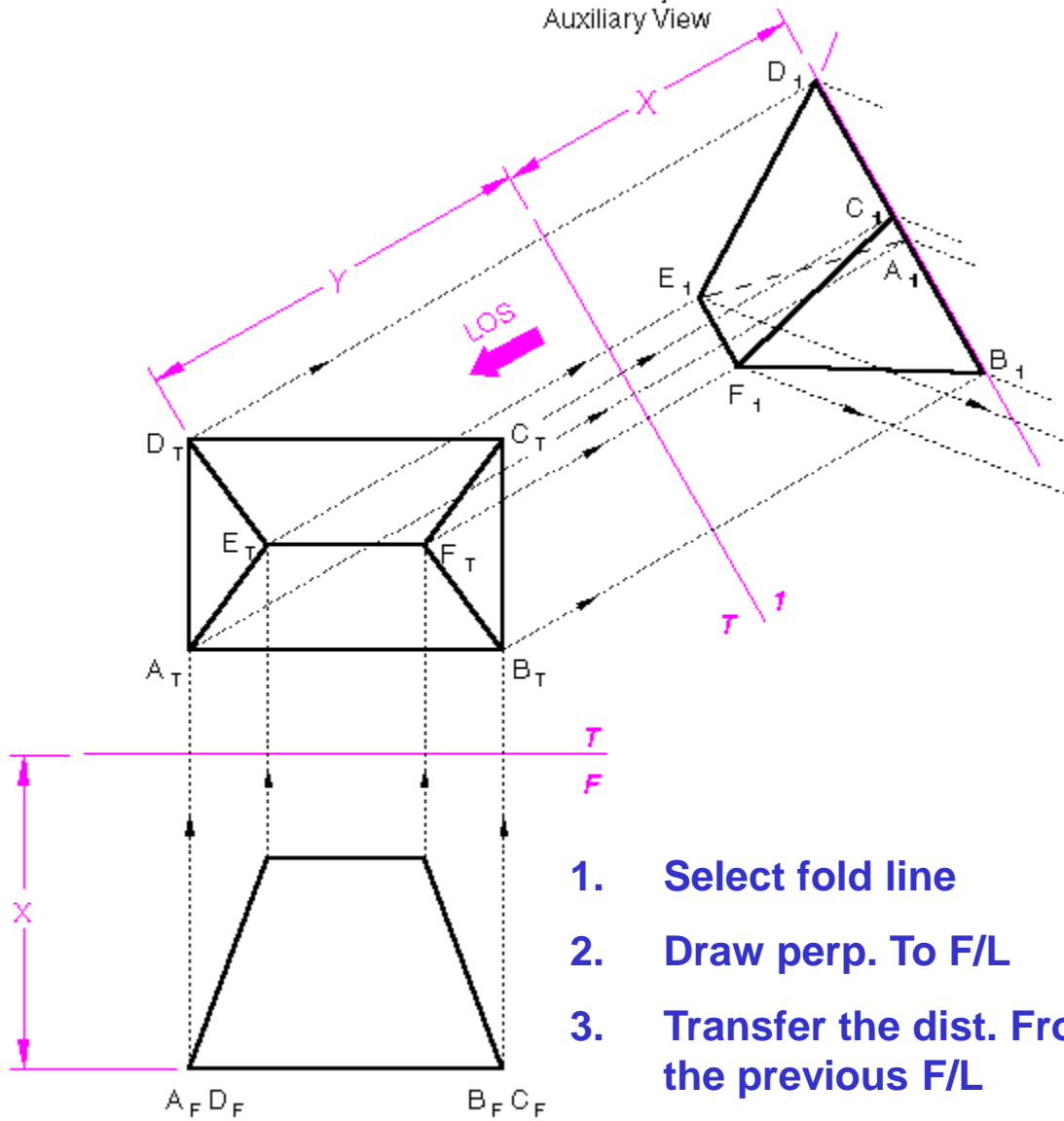
D_1

C_1

E_1

A_1

B_1

F_1

LOS

X

Y

D_T

C_T

E_T

F_T

T

1

A_T

B_T

T

F

X

$A_F D_F$

$B_F C_F$

1. Select fold line

2. Draw perp. To F/L

3. Transfer the dist. From the previous F/L

4. Check the visibility

Primary
Auxiliary View

Secondary
Auxiliary View

D_1

C_1

E_1

A_1

B_1

F_1

C_2

D_2

B_2

A_2

F_2

E_2

X

Z

Y

Y

LOS

LOS

T

1

1

2

D_T

C_T

E_T

F_T

A_T

B_T

T
F

X

$A_F D_F$

$B_F C_F$

1.   **Select fold line**

2.   **Draw perp. To F/L**

3.   **Transfer the dist. From
     the previous F/L**

4.   **Check the visibility**

Primary Auxiliary View

Secondary Auxiliary View

Tertiary Auxiliary View

1. **Select fold line**

2. **Draw perp. To F/L**

3. **Transfer the dist. From the previous F/L**

4. **Check the visibility**

Primary Auxiliary View

Secondary Auxiliary View

Tertiary Auxiliary View

1. **Select fold line**
2. **Draw perp. To F/L**
3. **Transfer the dist. From the previous F/L**
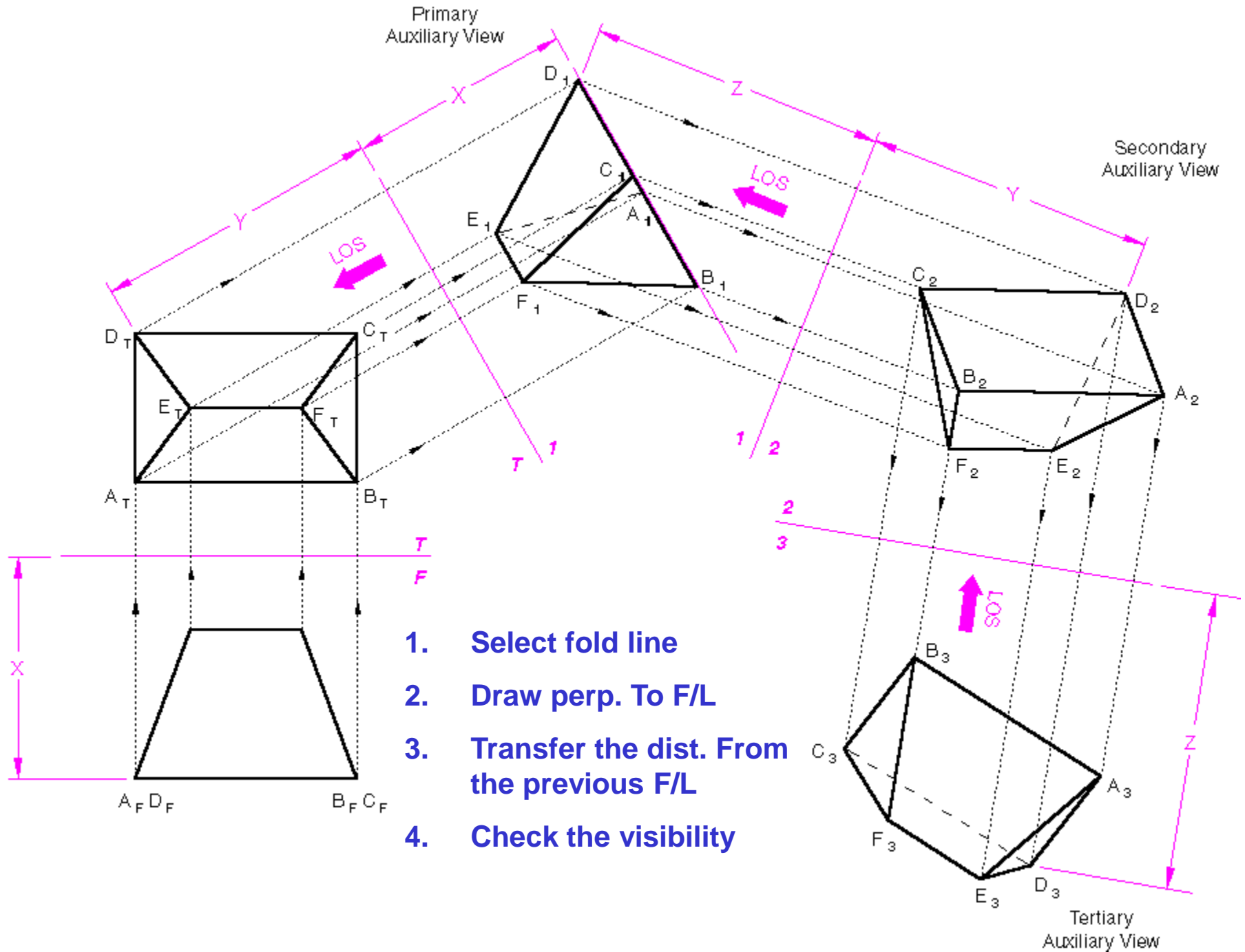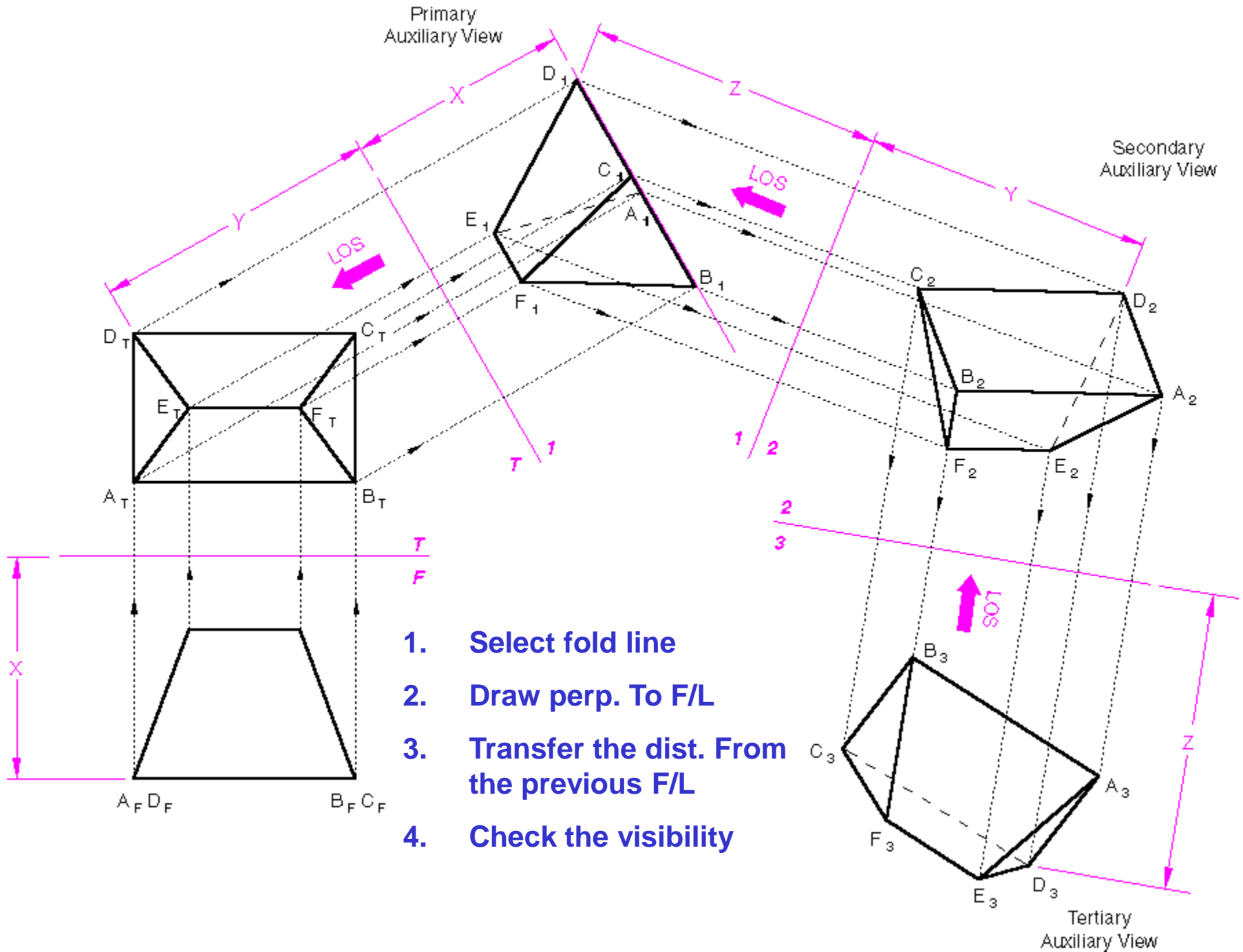4. **Check the visibility**

Auxiliary Views:

To draw

TL of line, point view of line, Edge view of the plane and true size of plane.

To View TL : Draw Aux View parallel to any view

To view point view: Draw Aux View perp. To TL

To view Edge View : Draw Aux View perp. To TL of any edge/line

To view full surface : Draw Aux View Parallel to Edge view

Mechanical Engineering Drawing

MECH 211

## LECTURE 4

Content of the lecture

1. Point – location, particular positions (on the principal planes)
2. Multiple points – lines
3. Location of a line – the basic views
4. Particular positions of a line – horizontal, frontal or profile
5. True length of a line – selected auxiliary views
6. Bearing of a line (in the top view, N(S) nn E(W)
7. Slope of a line (from the top view, draw a TL in aux view – *elevation view*
8. Point view of a line – second aux. View
9. Relative position of a point vs. a line (location of a point vs. a line)

Content of the lecture

10. Relative position of two lines (//, X or skew)

11. Parallel lines; rule of parallel lines (exceptions)

12. Location of a line through a point parallel to another line (construction)

13. True distance between two parallel lines

14. Intersecting lines – identification through inspection

15. Perpendicular lines – rule of perpendicular lines

16. Distance form a point to a line

17. Location of a perpendicular line at a given pint on a line

1. Point - location

- How to represent single point on space

- Three views H, F, and P

- Similar to objects, look for distance of points from the folding line in the adjacent views
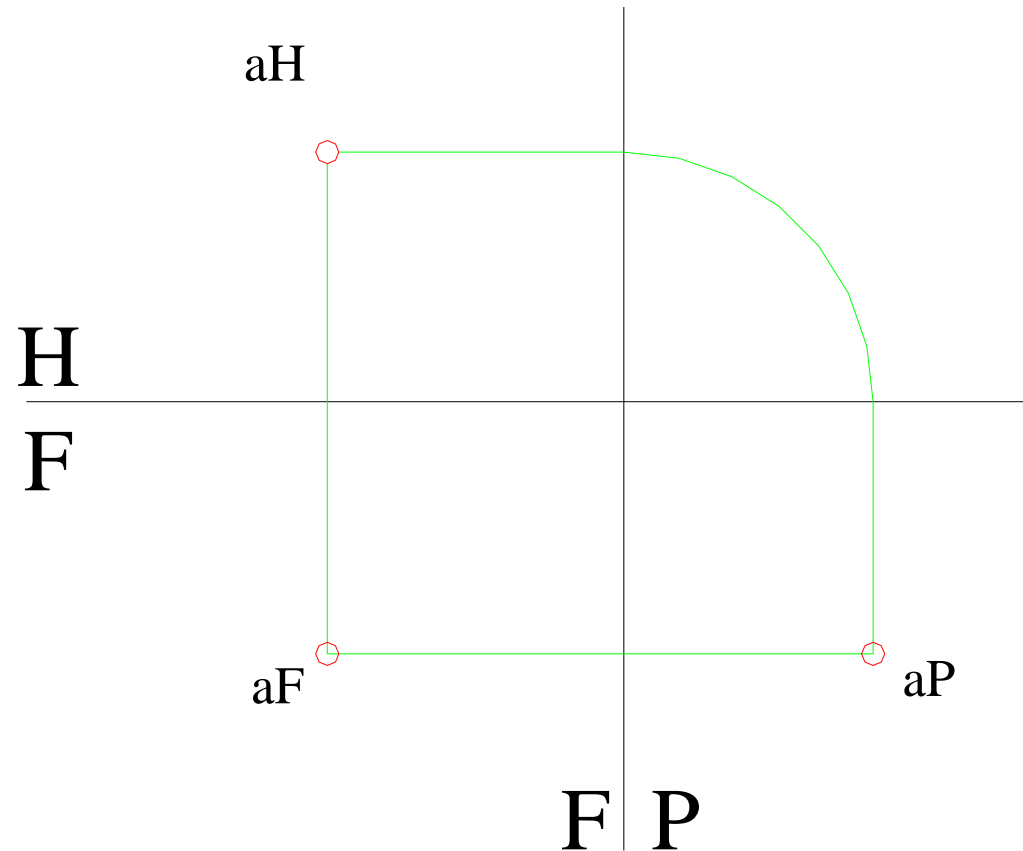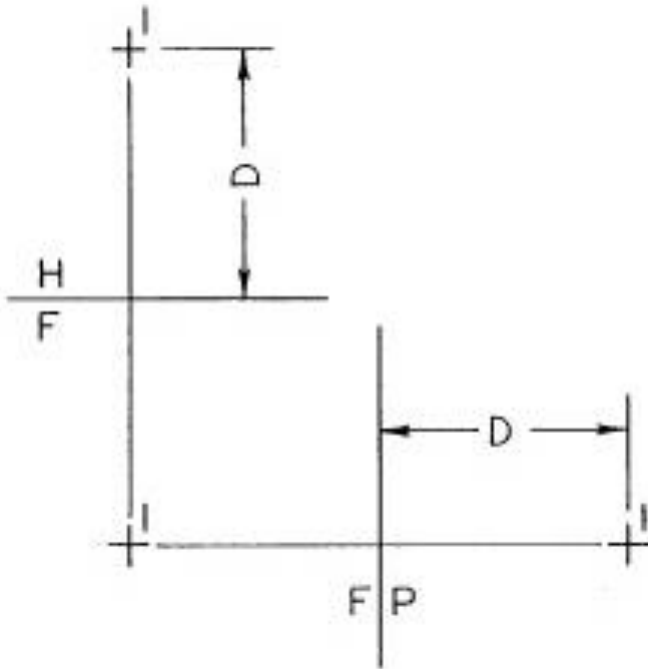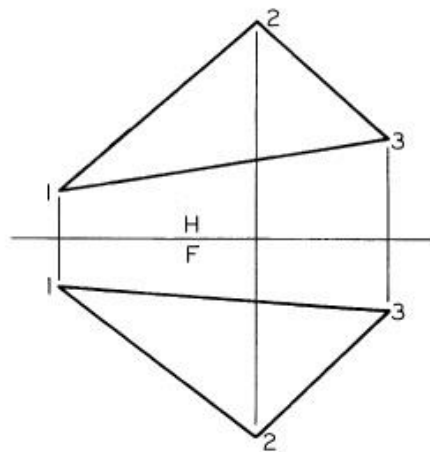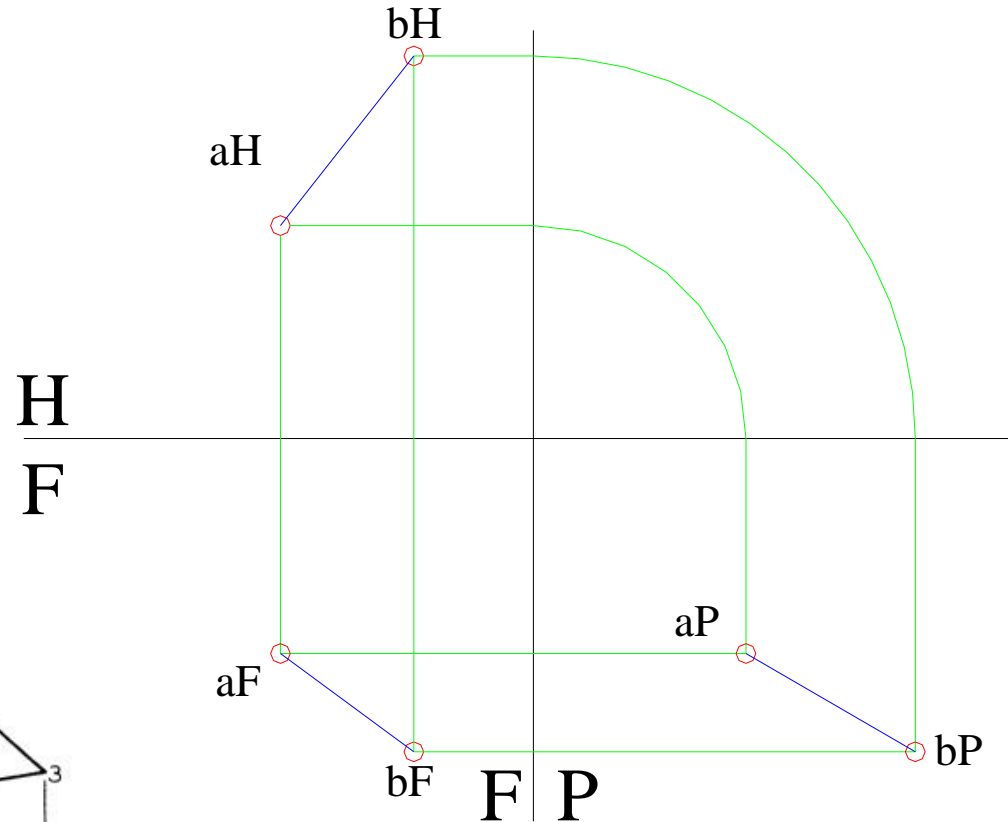
2. Multiple points - lines

- How to represent multiple points on space

- Three views H, F, and P

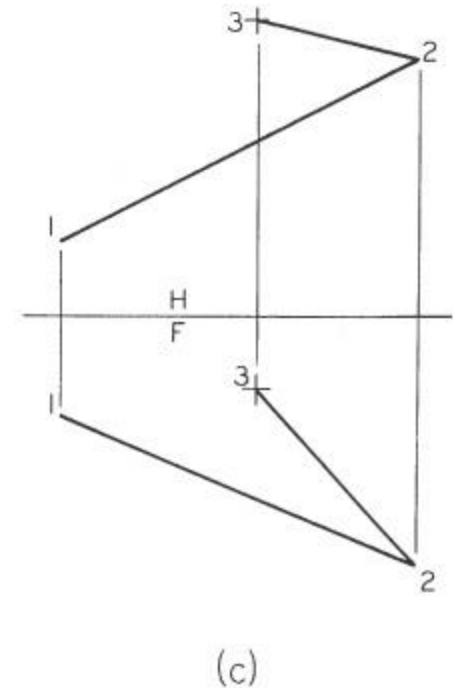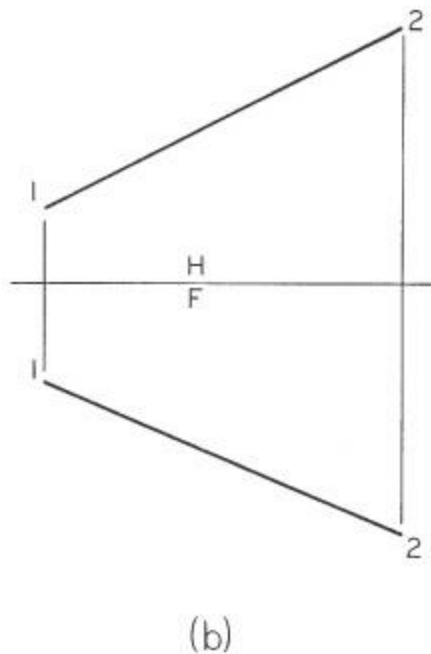- Locating multiple points become important in describing a line
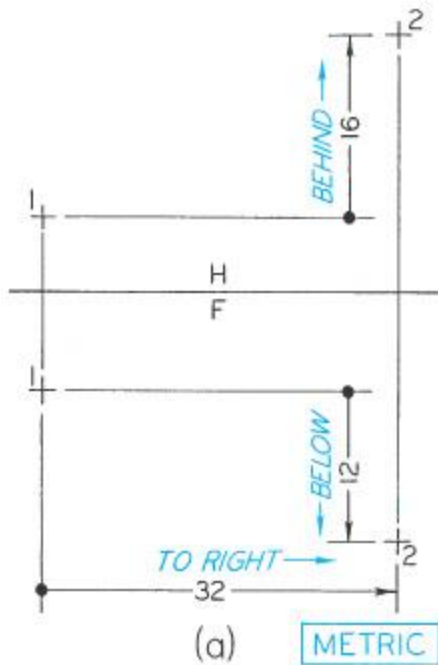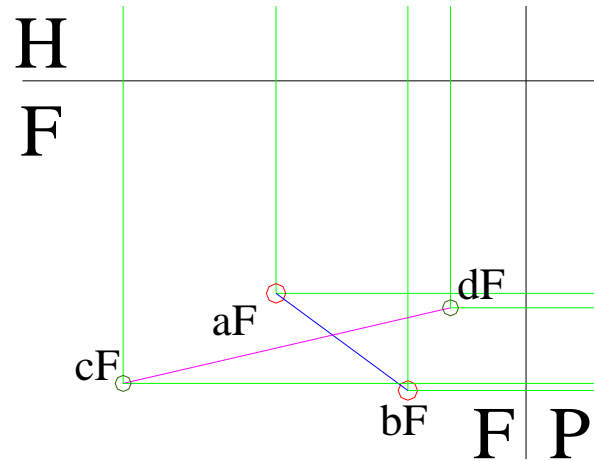

H
―――
F

bH

aH

aF

bF
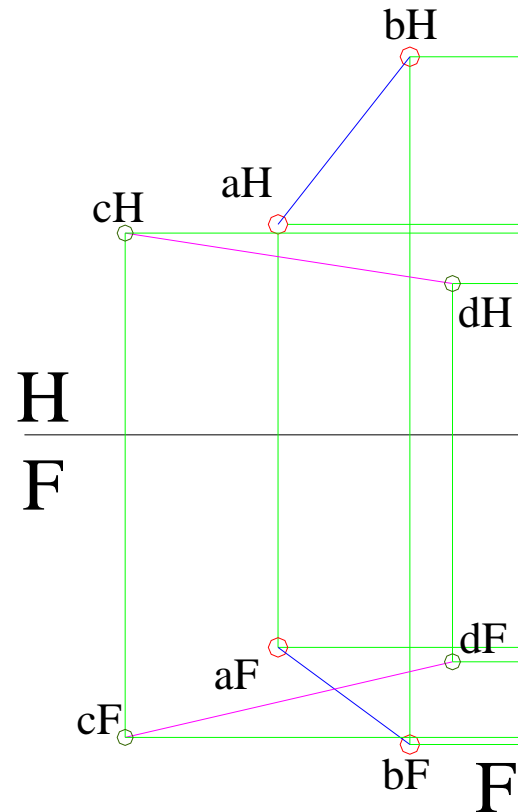
F | P

aP

bP
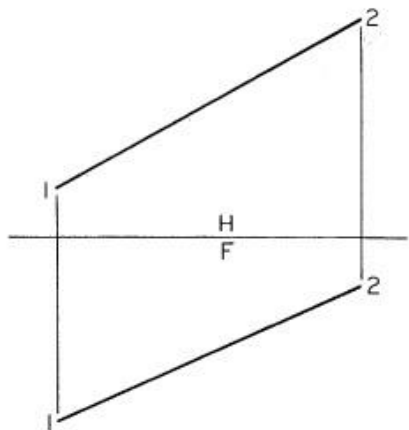
(b)

(c)

2. Multiple points - lines

- To describe object, relative positions of 2 > points are needed

- Point 2 is 32mm to the right of and 12mm below and 16mm behind point 1

- The points are placed at specific distance – connected to get line

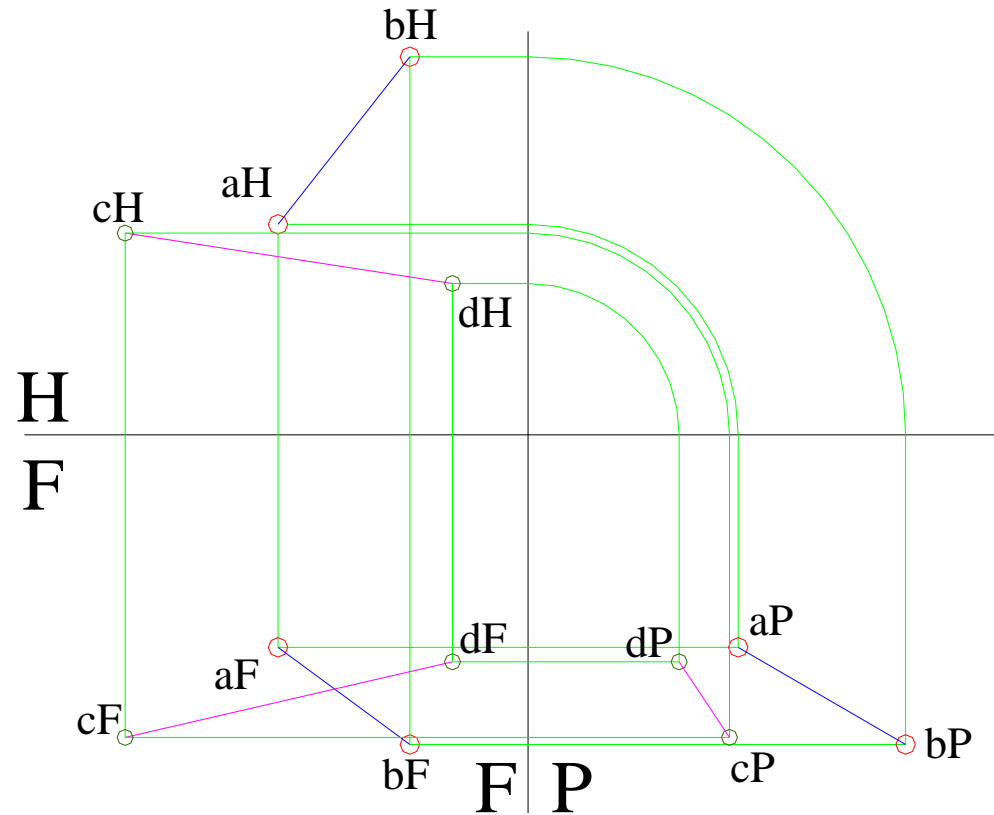# 3. Location of a line

# 3. Location of a line

3. Location of a line
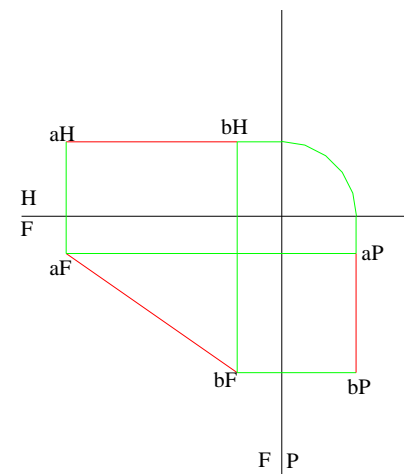
4. Particular positions of a line

- Inclined line appears as TL on the plane to which it is parallel

- They are termed as Frontal, Horizontal and Profile

- TL view is always inclined while the other views are foreshortened

- TL view gives more info like TA of the line to the plane of projection

- In frontal line, ∠H and ∠P can be found as the line is TL and planes are in EV
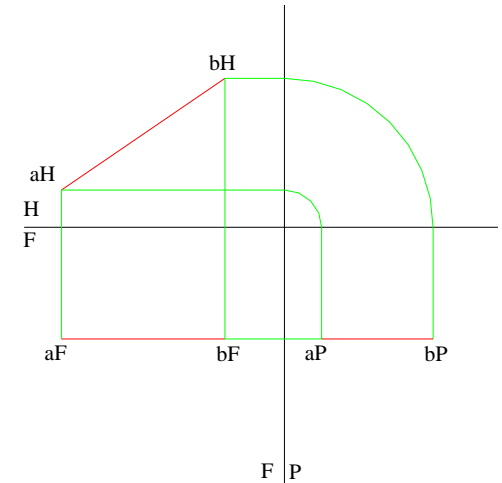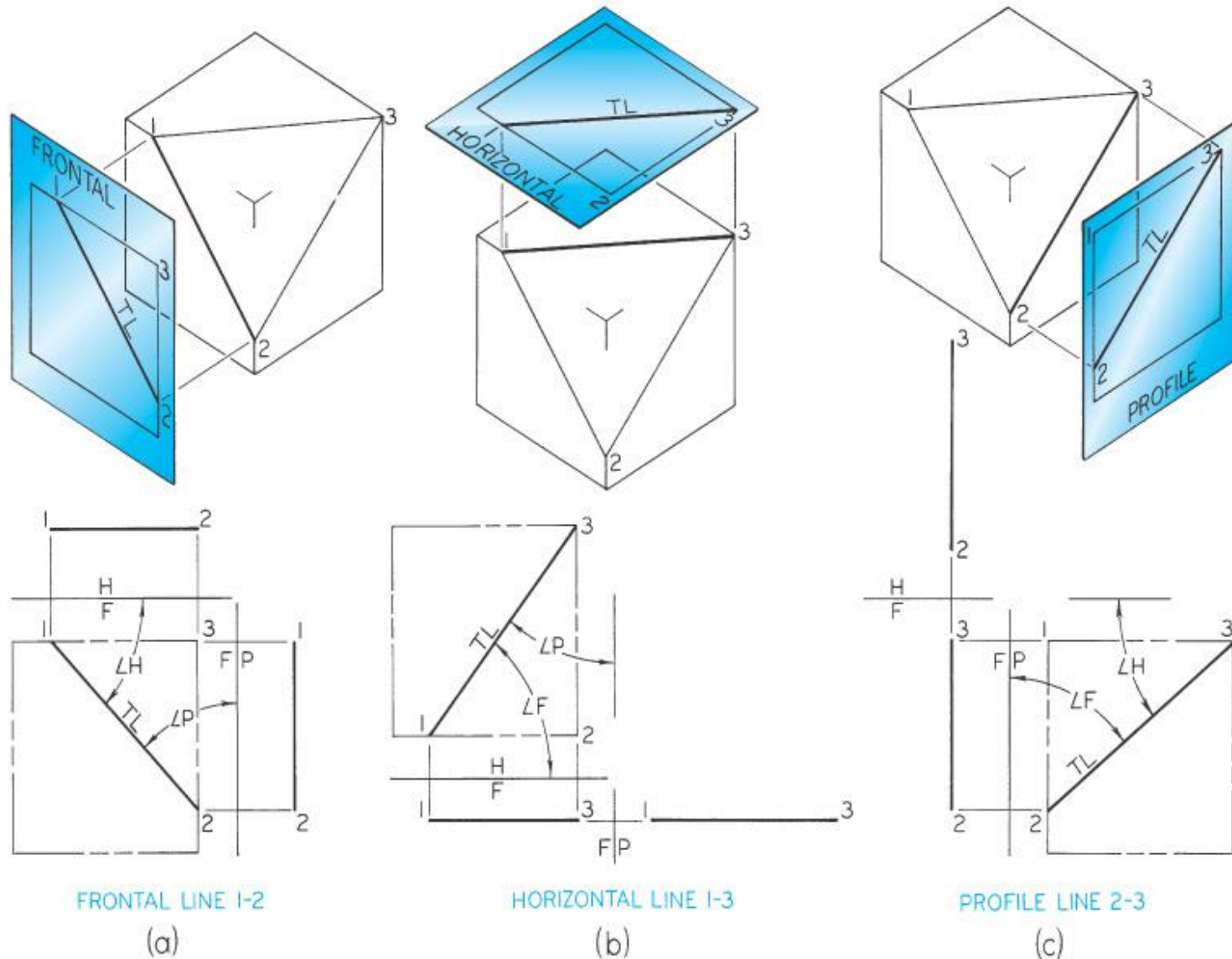

HORIZONTAL LINE
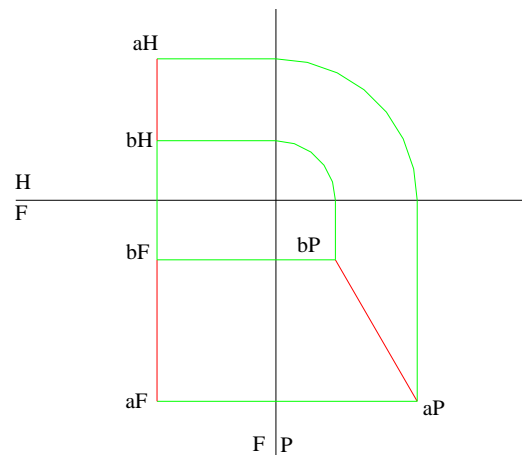
PROFILE LINE

FRONTAL LINE

4. Particular positions of a line

FRONTAL LINE 1-2
(a)

HORIZONTAL LINE 1-3
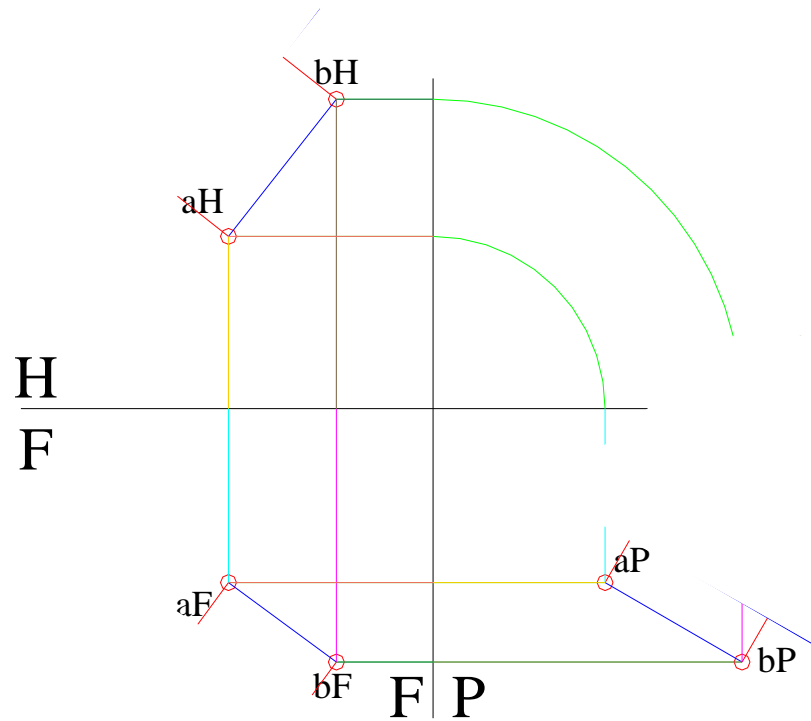(b)

PROFILE LINE 2-3
(c)

5. True length of a <u>oblique</u> line

- Oblique line does not appear TL in any principal views

- So aux view is needed. Here depth aux view wrt front view is created to find the TL of the line 1-2

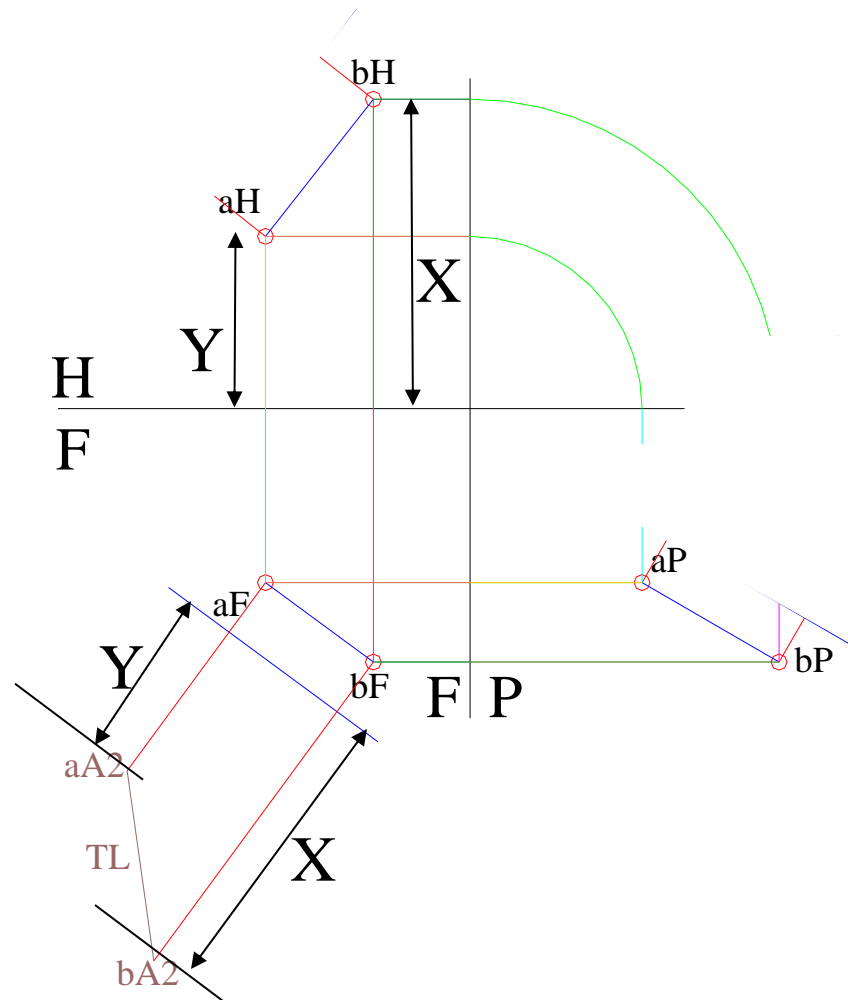- ∠F can also be found as the plane of projection (the wall) all points are at distance D in the top view
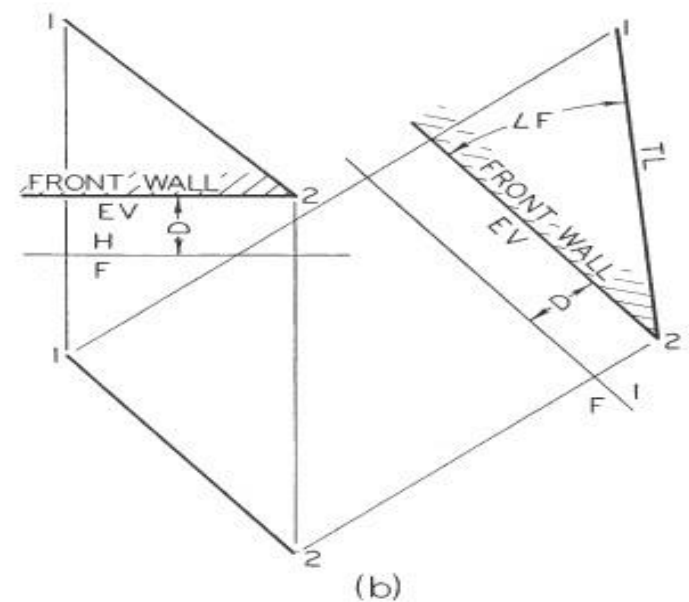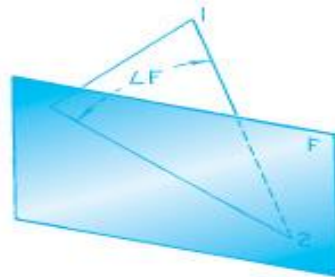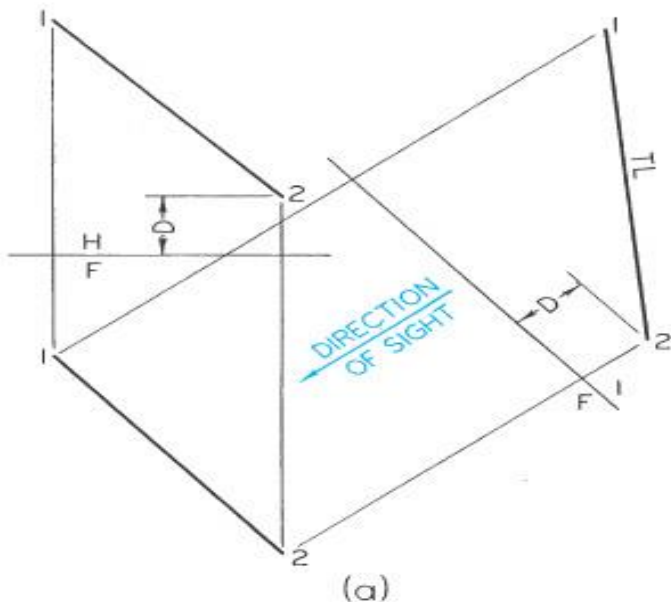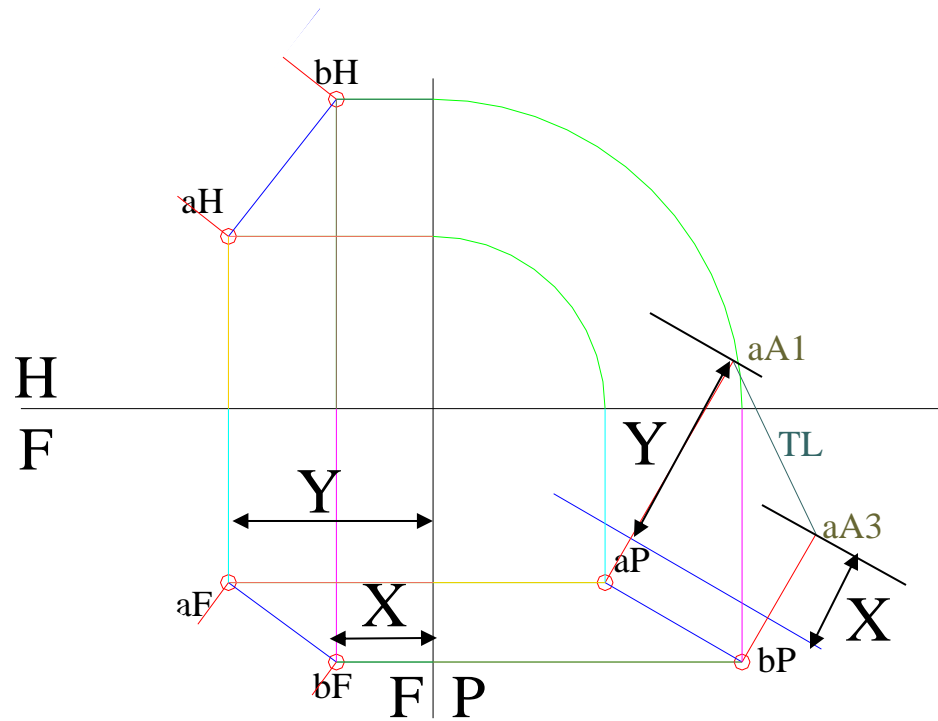
5. True length of a line

5. True length of a line

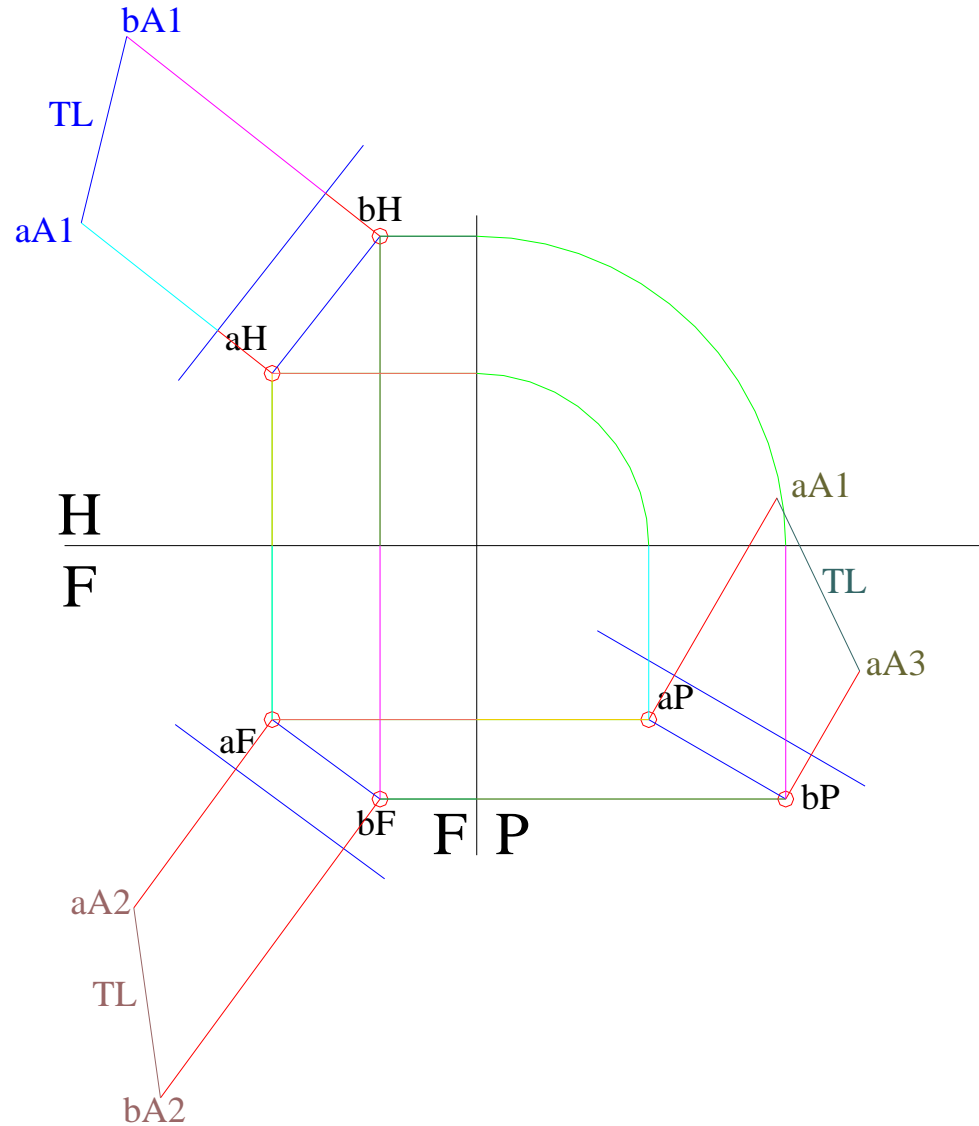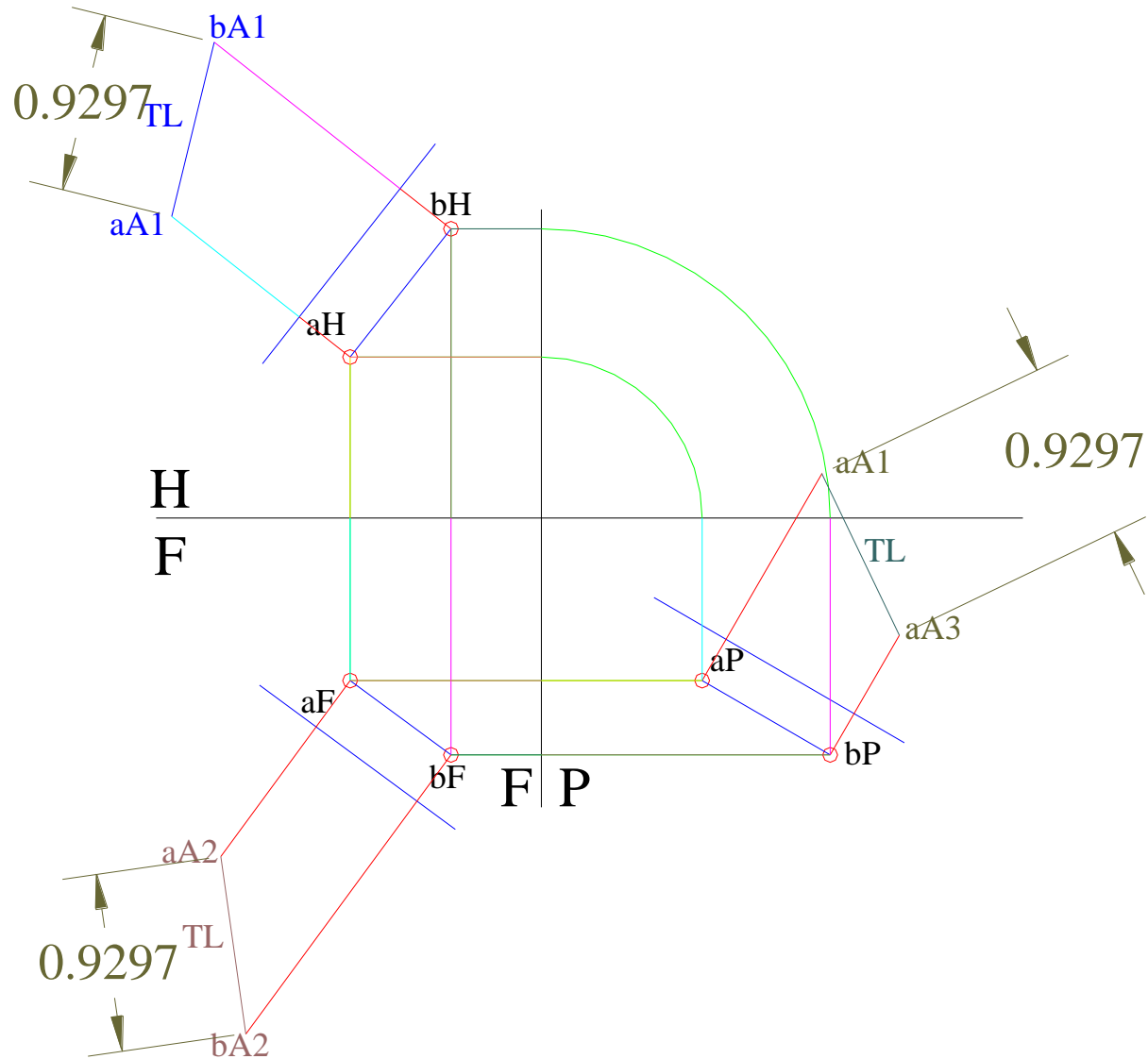# 5. True length of a line

bH

aH

X

Y

H
F

aP

aF

bF F P bP

Y

aA2

TL

X

bA2

5. True length of a line

5. True length of a line

bA1

TL

aA1

bH

aH

H
F

aA1

TL

aA3

aP

aF

bP

bF

F | P

aA2

TL

bA2
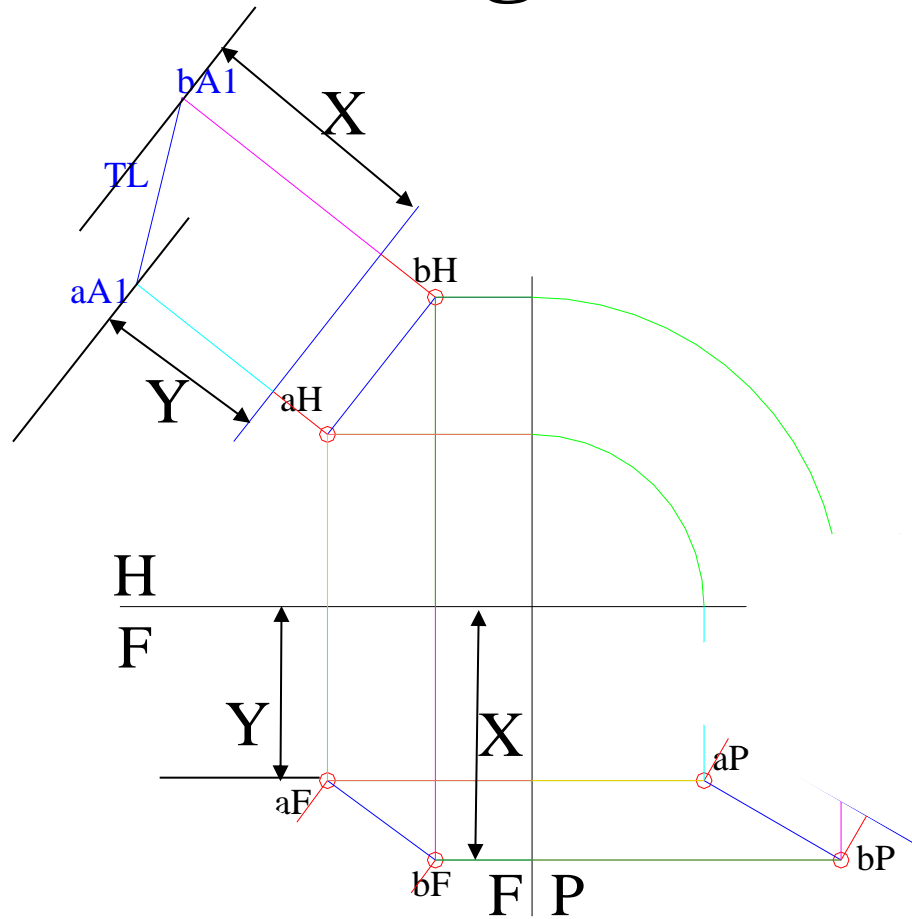
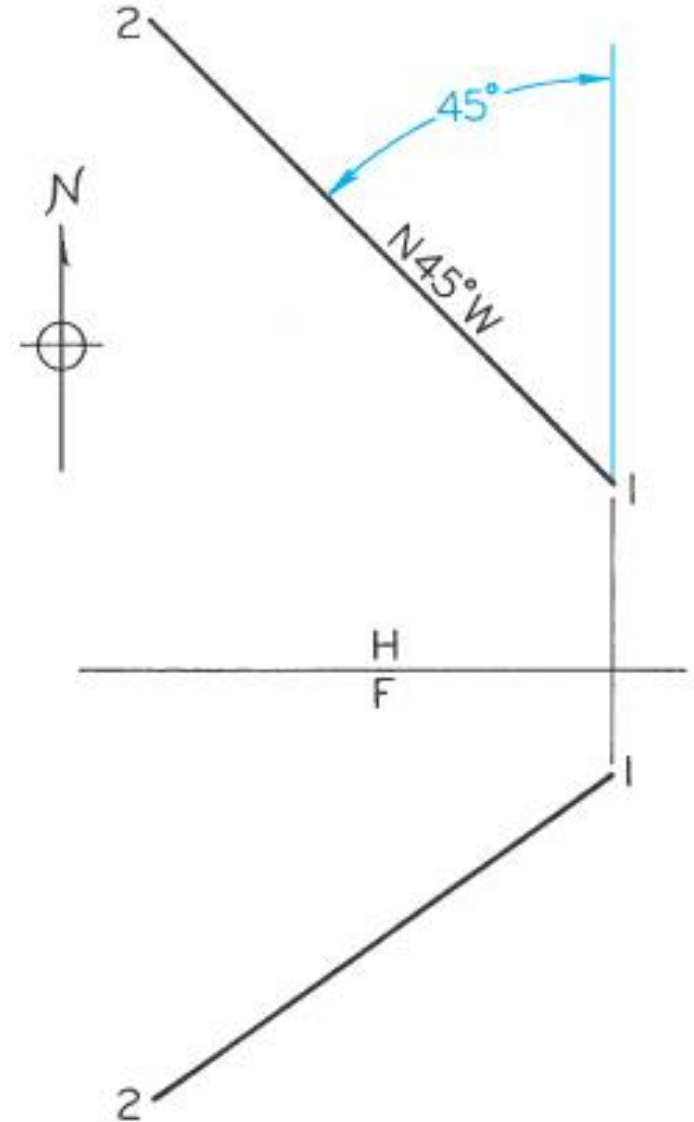# 5'. True length of a line

6. Bearing of a line

- Position of line in space is also described by bearing and slope of the line

- If earth is considered as flat, then a map is a top view

- Thus the bearing of a line is measured with respect to North or south in the **top view** of the line

- Generally upward is N, and generally N and S are used together with E and W to keep the ∠ less than 90°

6. Bearing of a line

bH

N38E

aH

38°

Bearing of a line is the
direction an oriented line
is doing with an
established direction NS

Bearing of line AB is
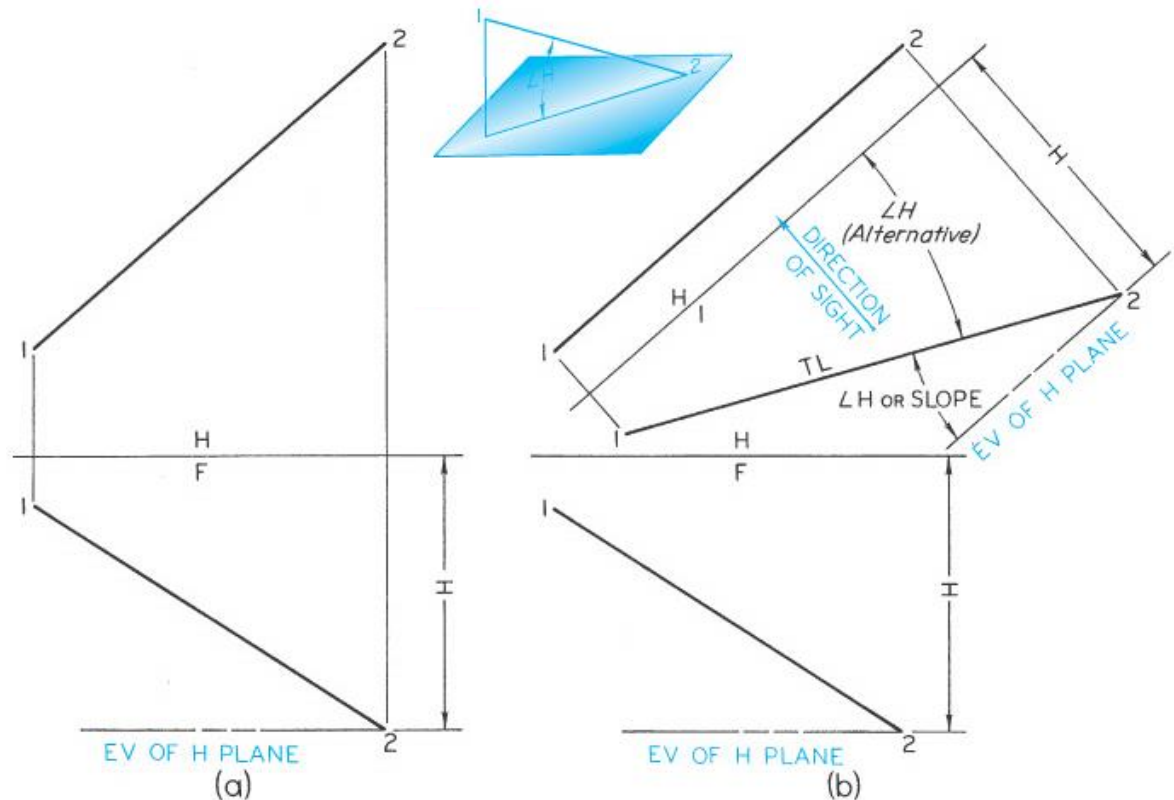N38E

H
F

aP

aF

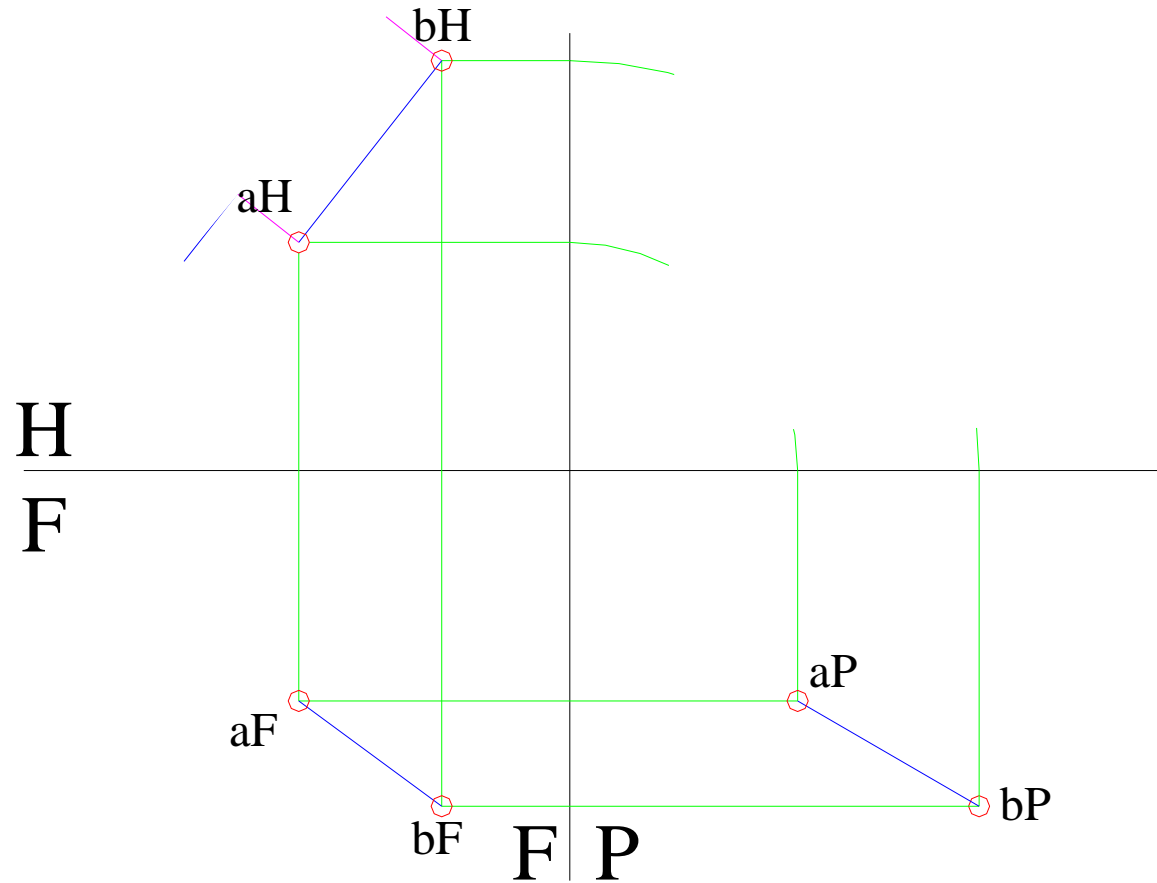bF F P bP
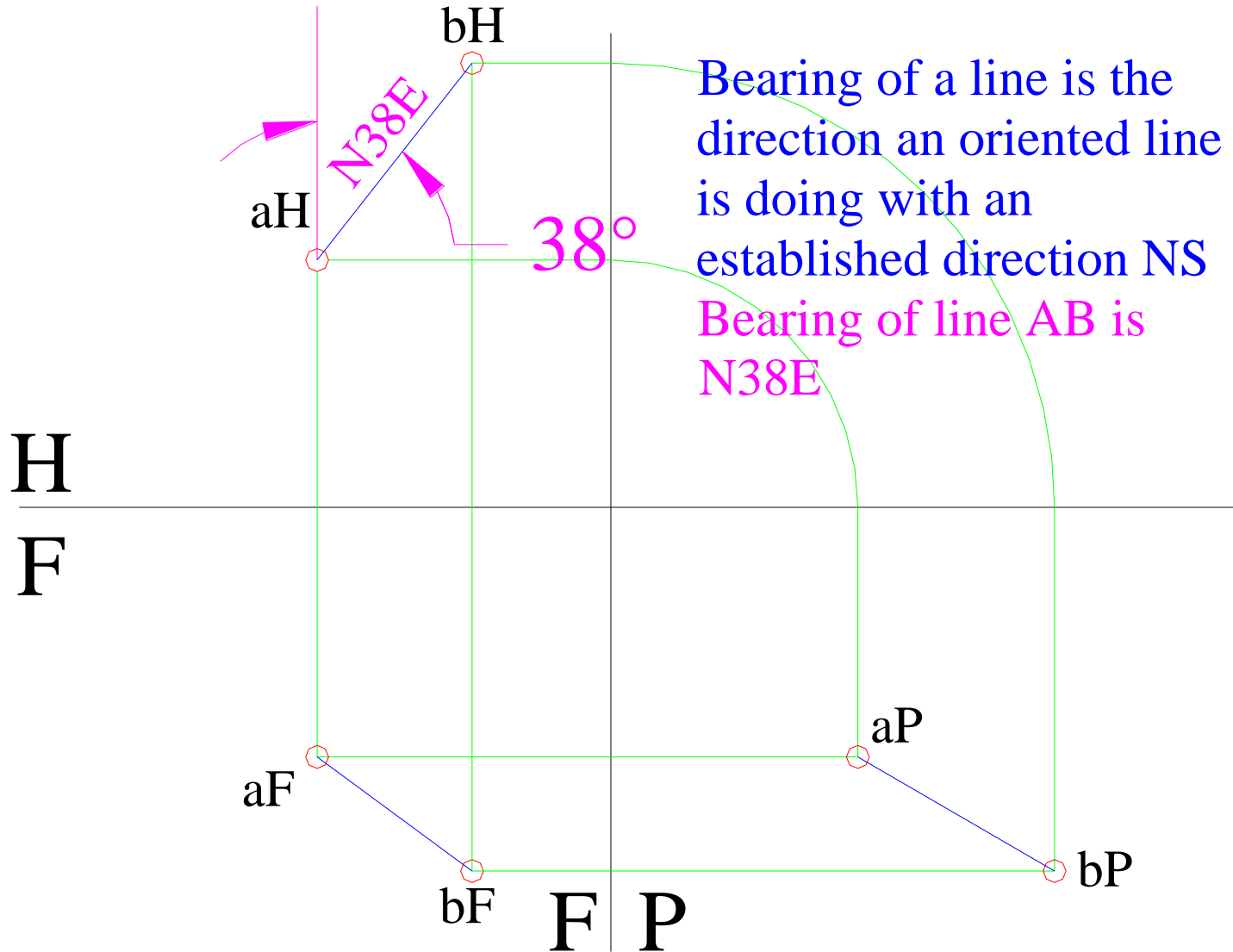
7. Slope of a line

- If earth is considered as flat, then a map is a top view, Horizontal plane is the most important plane

- Angle between a line (eg. Road) and horizontal plane is the slope (important to describe)

- To measure slope of 1-2, a view must be got where the line is in TL and horizontal plane in EV

- Horizontal plane is in EV in the front view and is // to HF

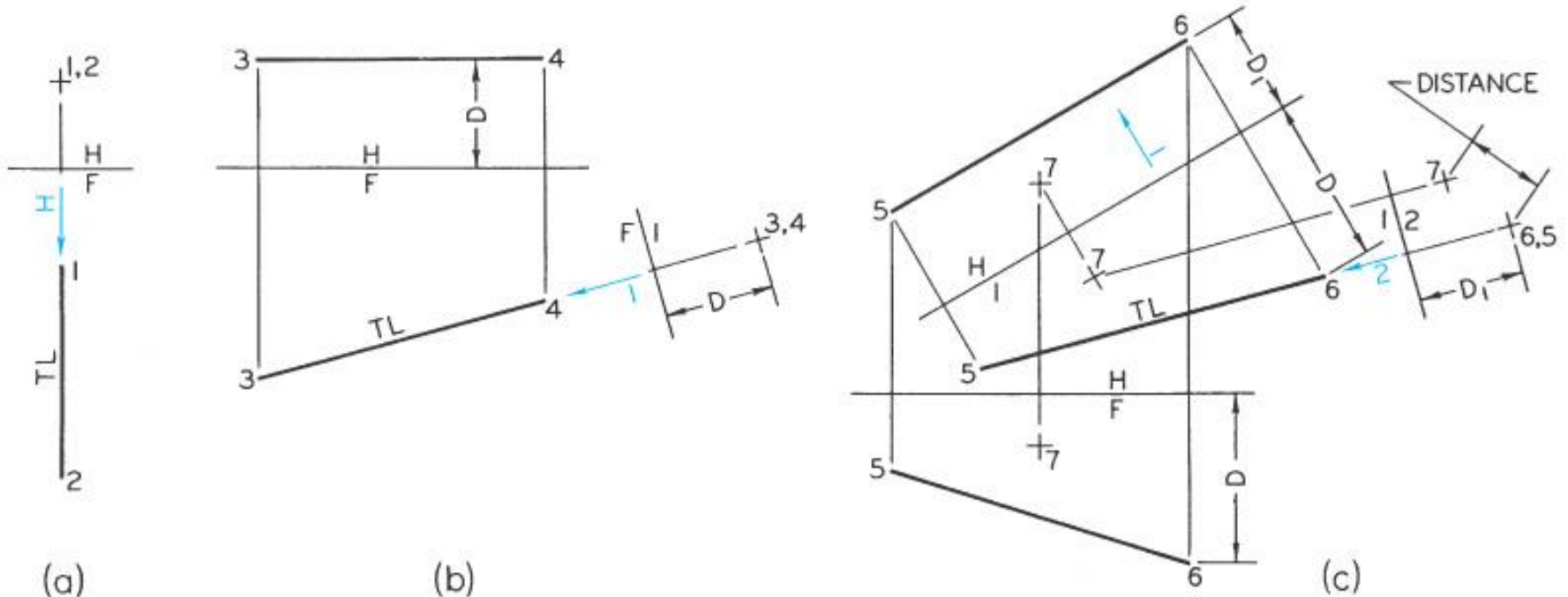# 7. Slope of a line

7. Slope of a line

bA1

aA1

TL

24°

Horizontal plane direction

bH

aH

Elevation view - ajacent to the top view

Slope of the line AB is -24° since the line descendes from A to B (the distance form the point of the line to the horizontal plane direction increases
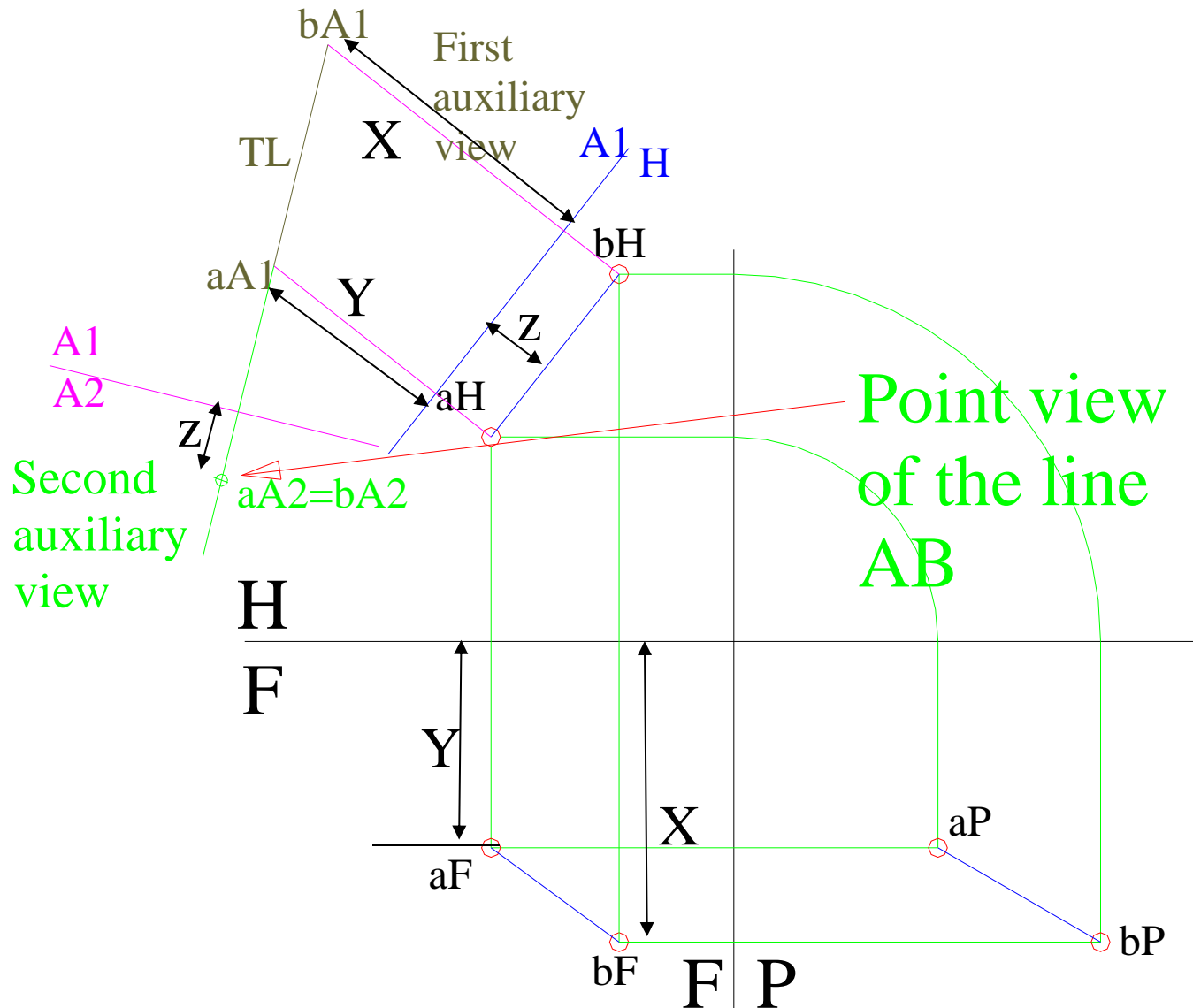
H
F

aF

bF

F | P
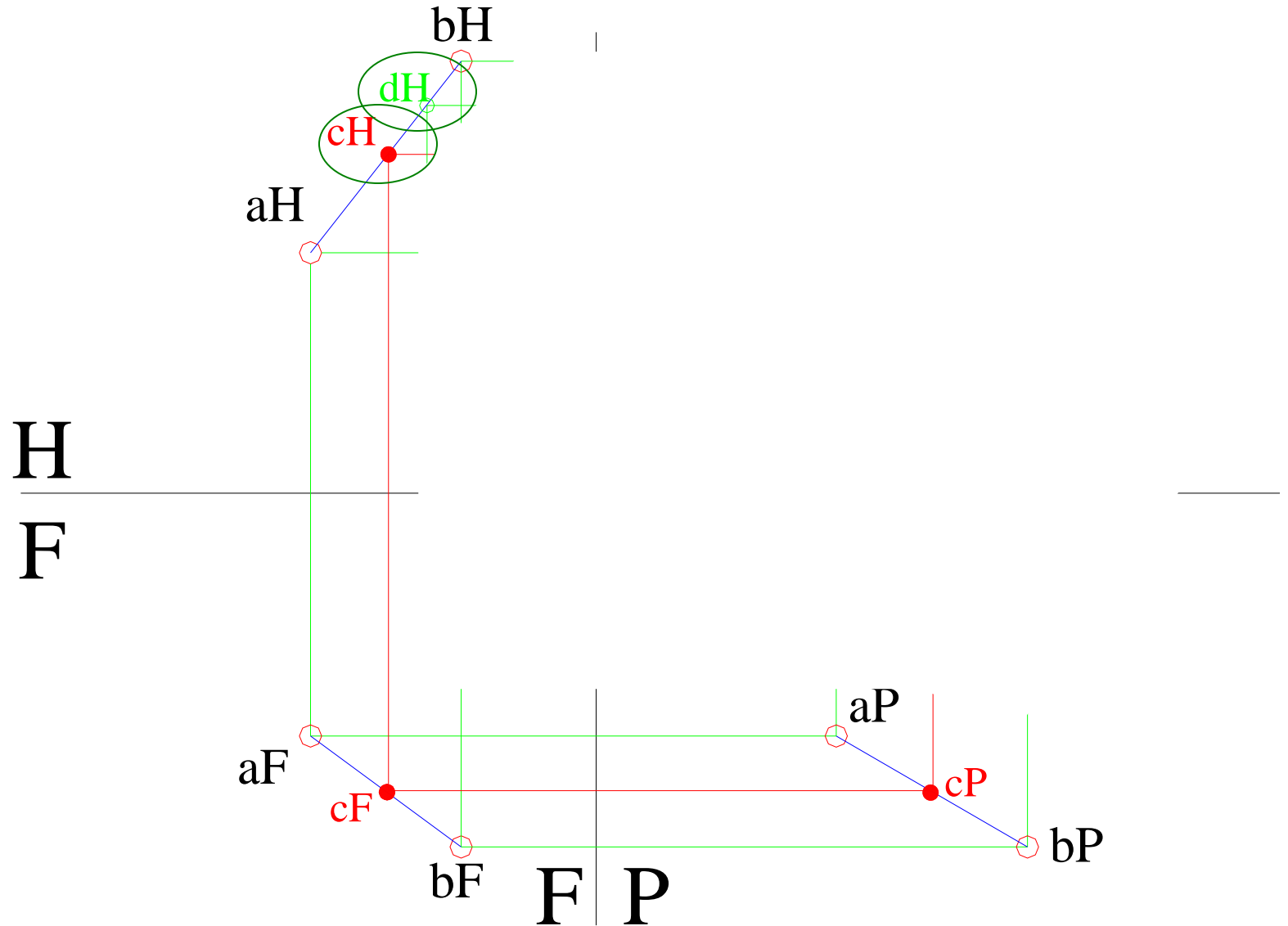
aP

bP

8. Point view of a line

- If a direction of sight is **//** to the TL view of the line, the line will appear as point

- If line is inclined, one auxiliary view required

- If line is oblique, two auxiliary view required

- Important to find the shortest distance between a line and a point
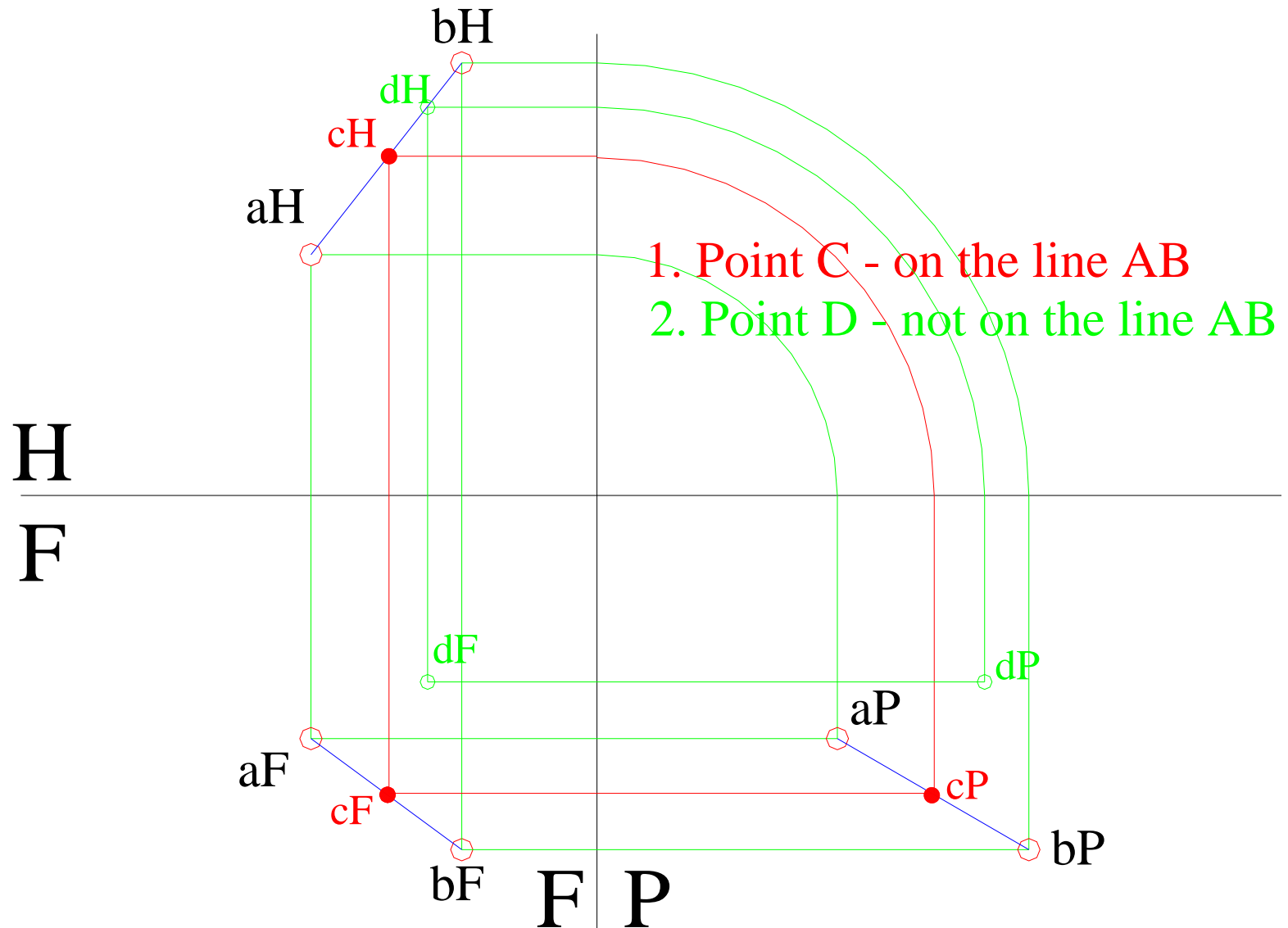

(a)   (b)   (c)

8. Point view of a line

bA1

First
auxiliary
view

TL

X

A1 H

bH

aA1

Y

Z

A1
A2

aH

z

Second
auxiliary
view

aA2=bA2

Point view
of the line
AB

H
F

Y

X

aF

bF

F P

Y

X

aP

bP

9. Relative position of point vs. line

9. Relative position of point vs. line

1. Point C - on the line AB
2. Point D - not on the line AB
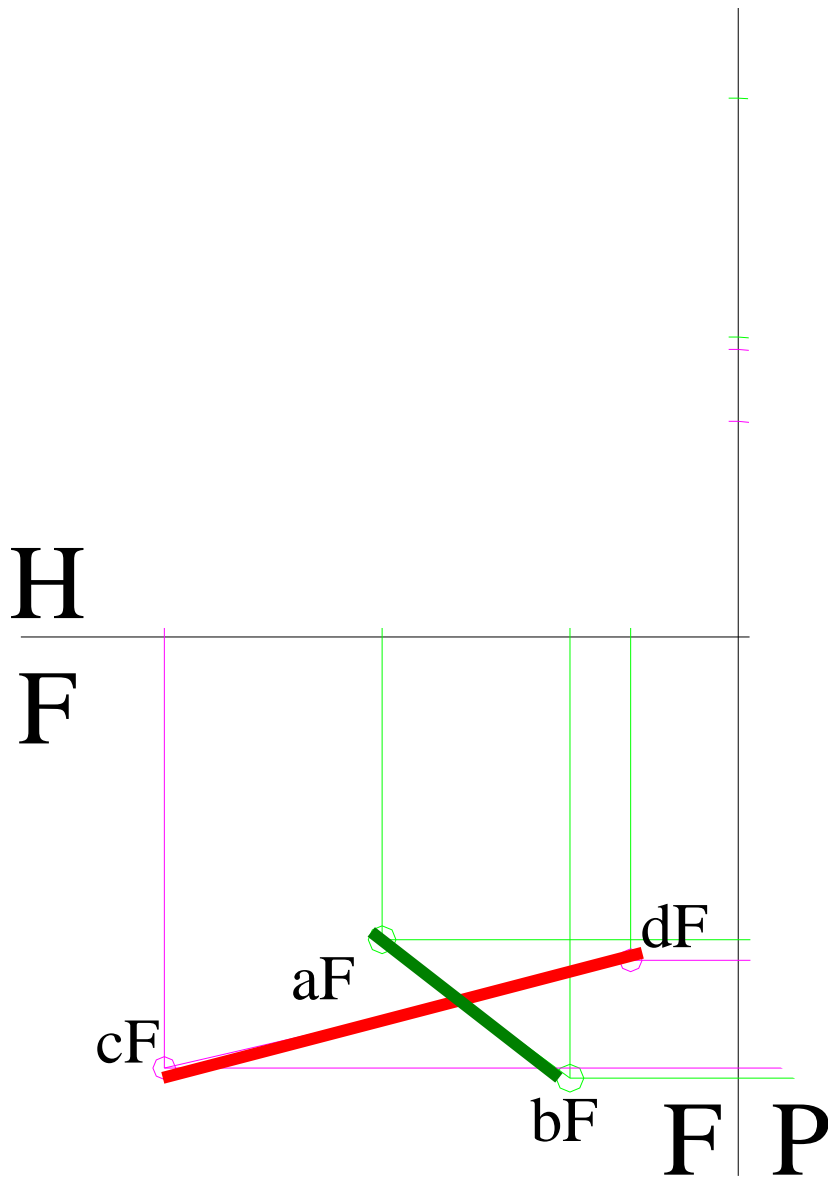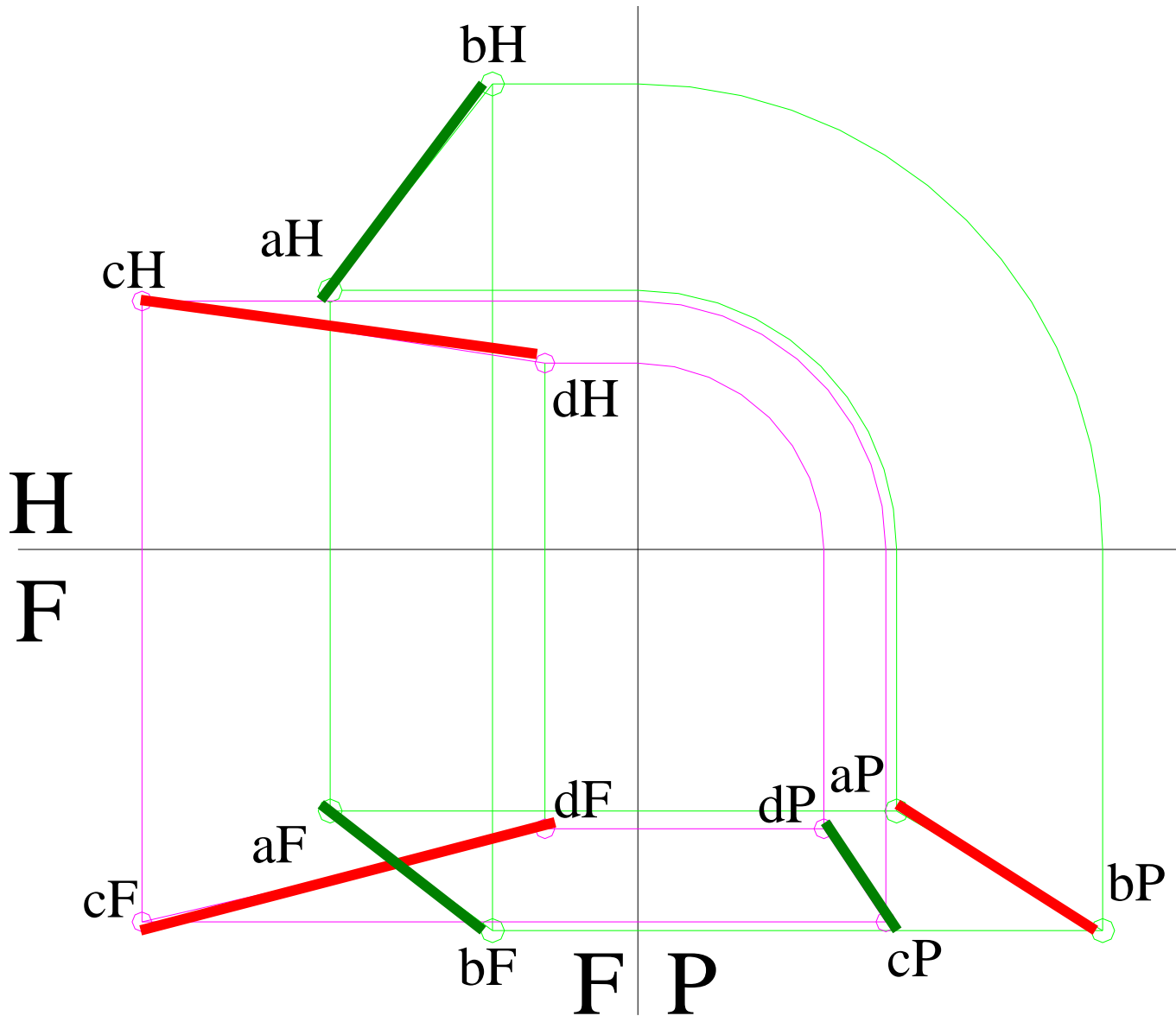
10. Relative position of two lines

- Skew lines – non intersecting, non-parallel and not coincident

- Intersecting lines (one common point)

- Parallel lines (no common point)

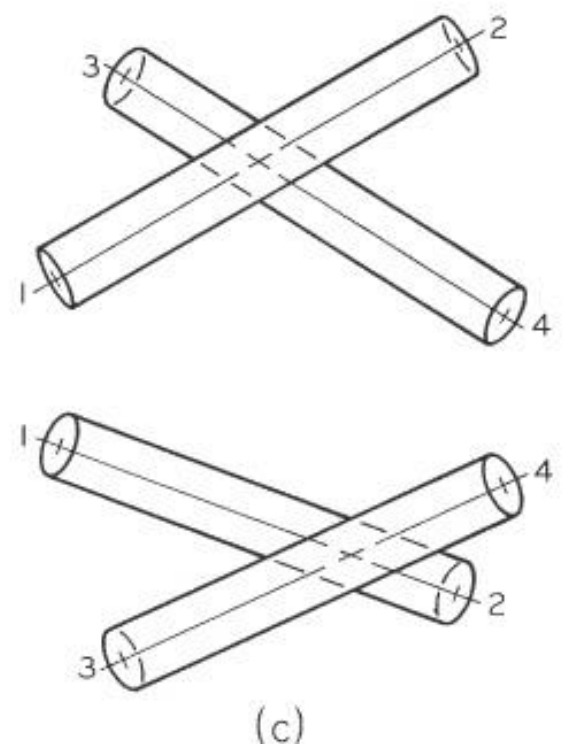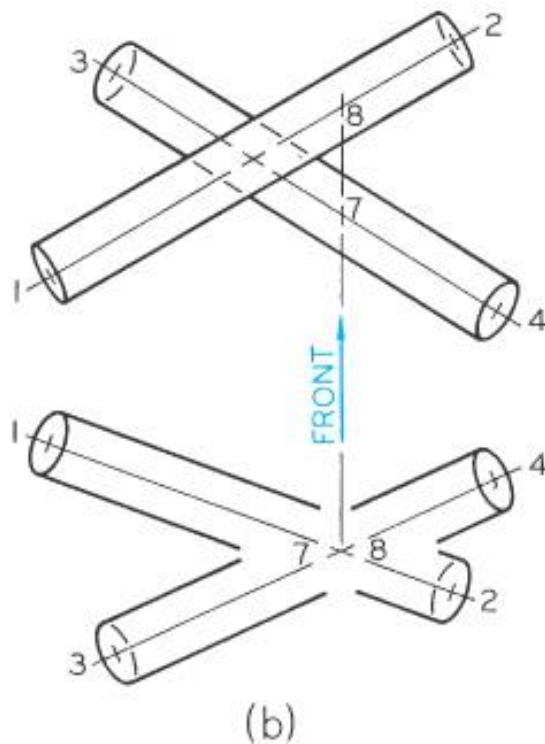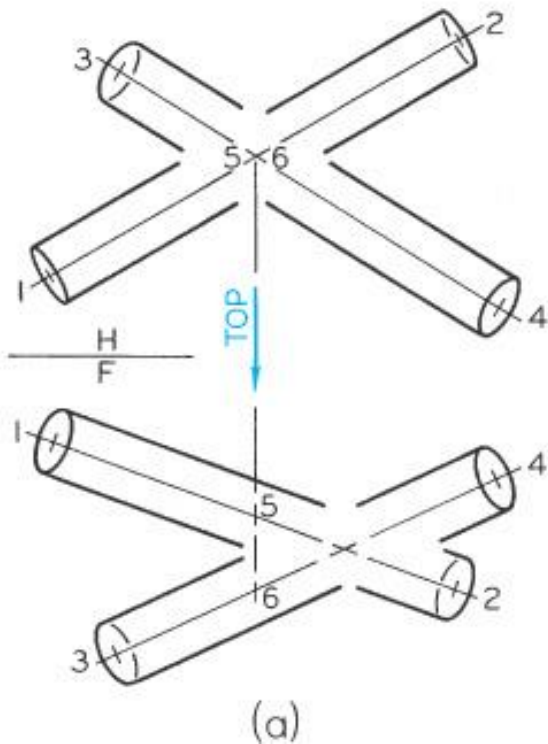- Coincident lines (overlapping – all points are common)

10a. Skew Lines

H

F

aF

cF

dF

bF

F | P

10a. Skew Lines

10a. Skew Lines

- Since lines don't intersect, they must go one over another. This can help to find out which one goes over the other

- If you plot 5,6 (arbitrarily one point to one line) on TV and project it to FV – we can see which line is passing above the other line

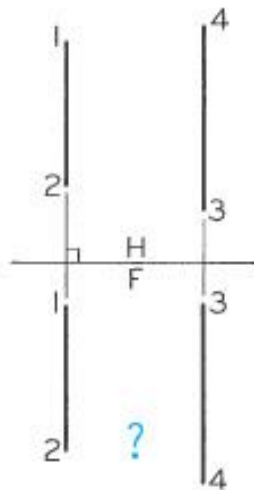(a)   (b)   (c)
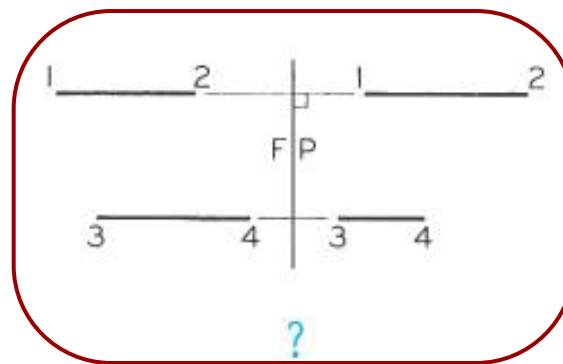
10b. Parallel Lines

- Parallel lines do not have any common point between them

- Parallel lines are seen as parallel in adjacent views, exception to this when the lines are perpendicular to the FL, the lines may or may not be parallel
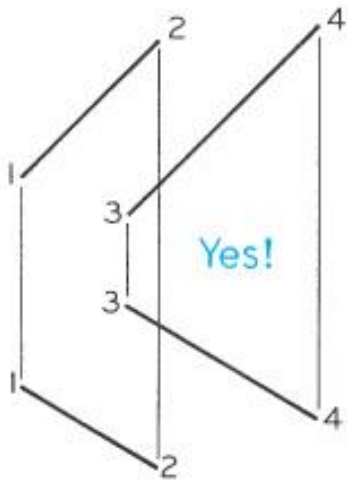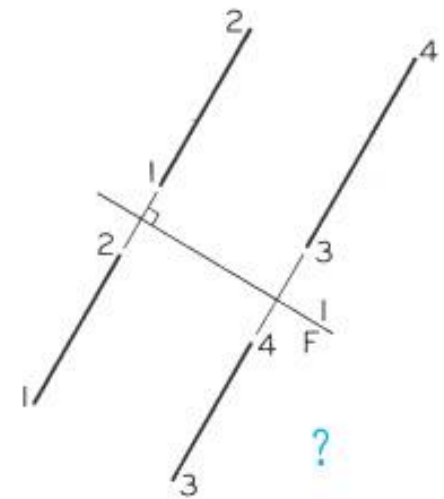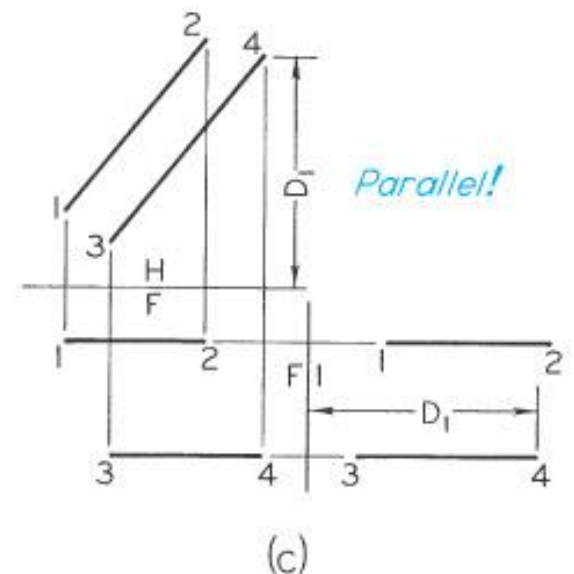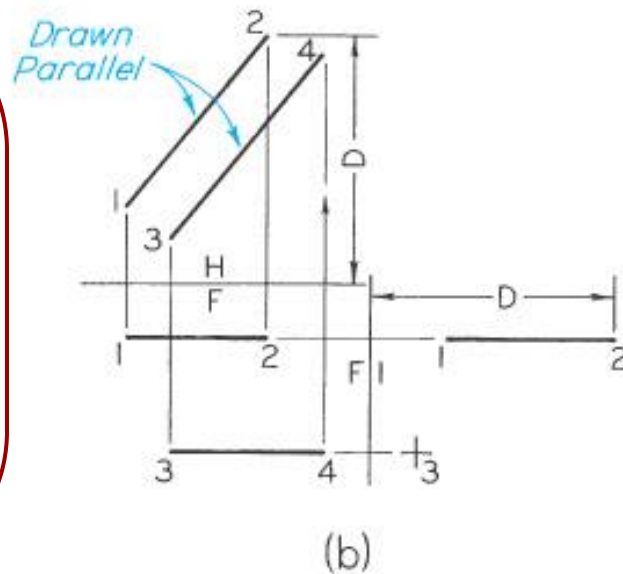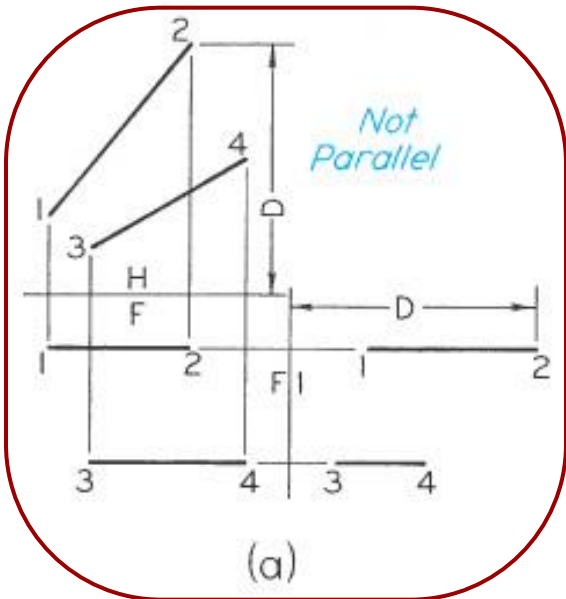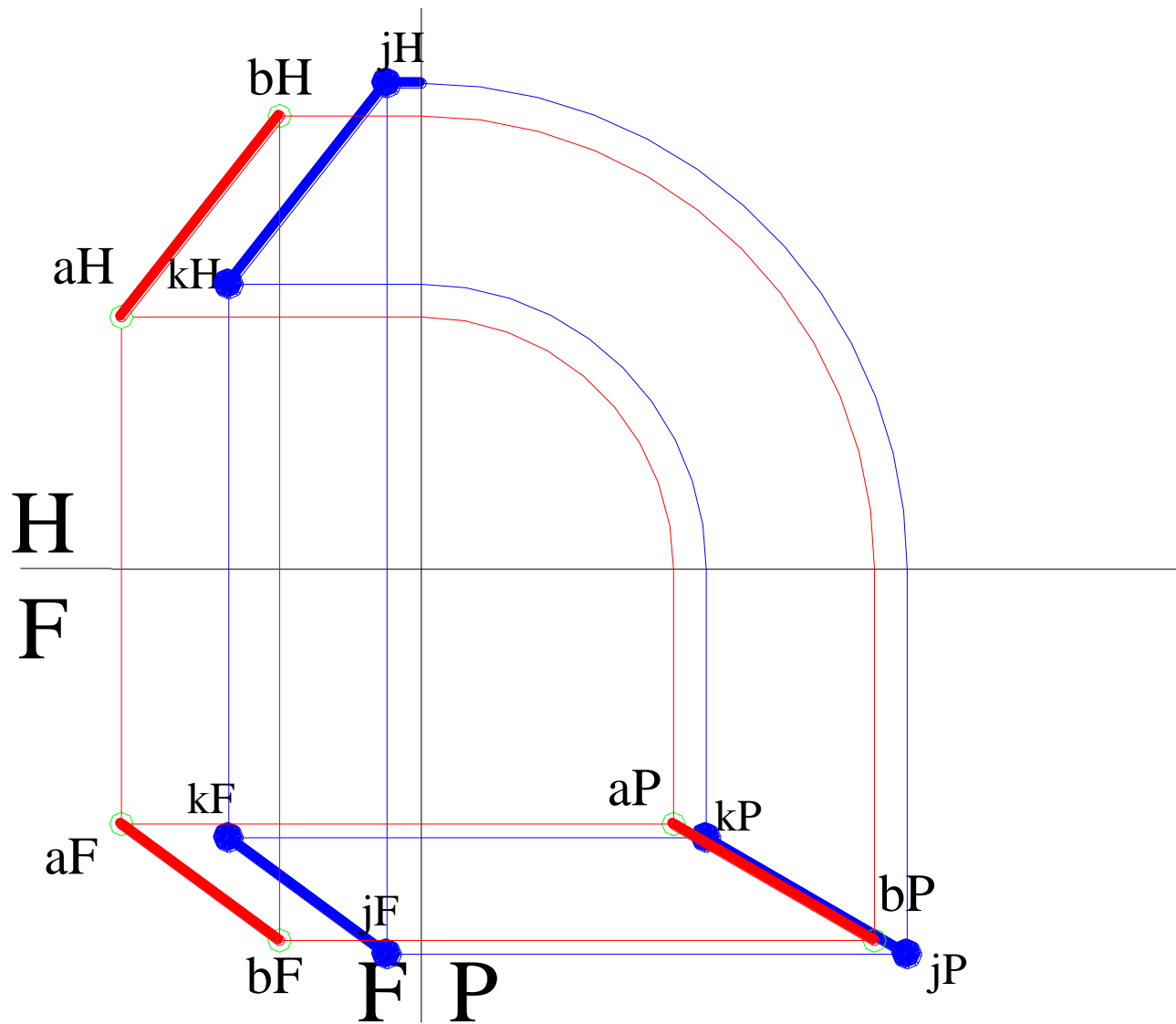

(a)   (b)   (c)   (d)

10b. Parallel Lines

- To find out if the lines are parallel, even if the lines are perpendicular to the FL, it is best to draw the 3rd view

- If it is required to get the lines parallel, then use one view, draw the lines parallel and complete the 3rd view
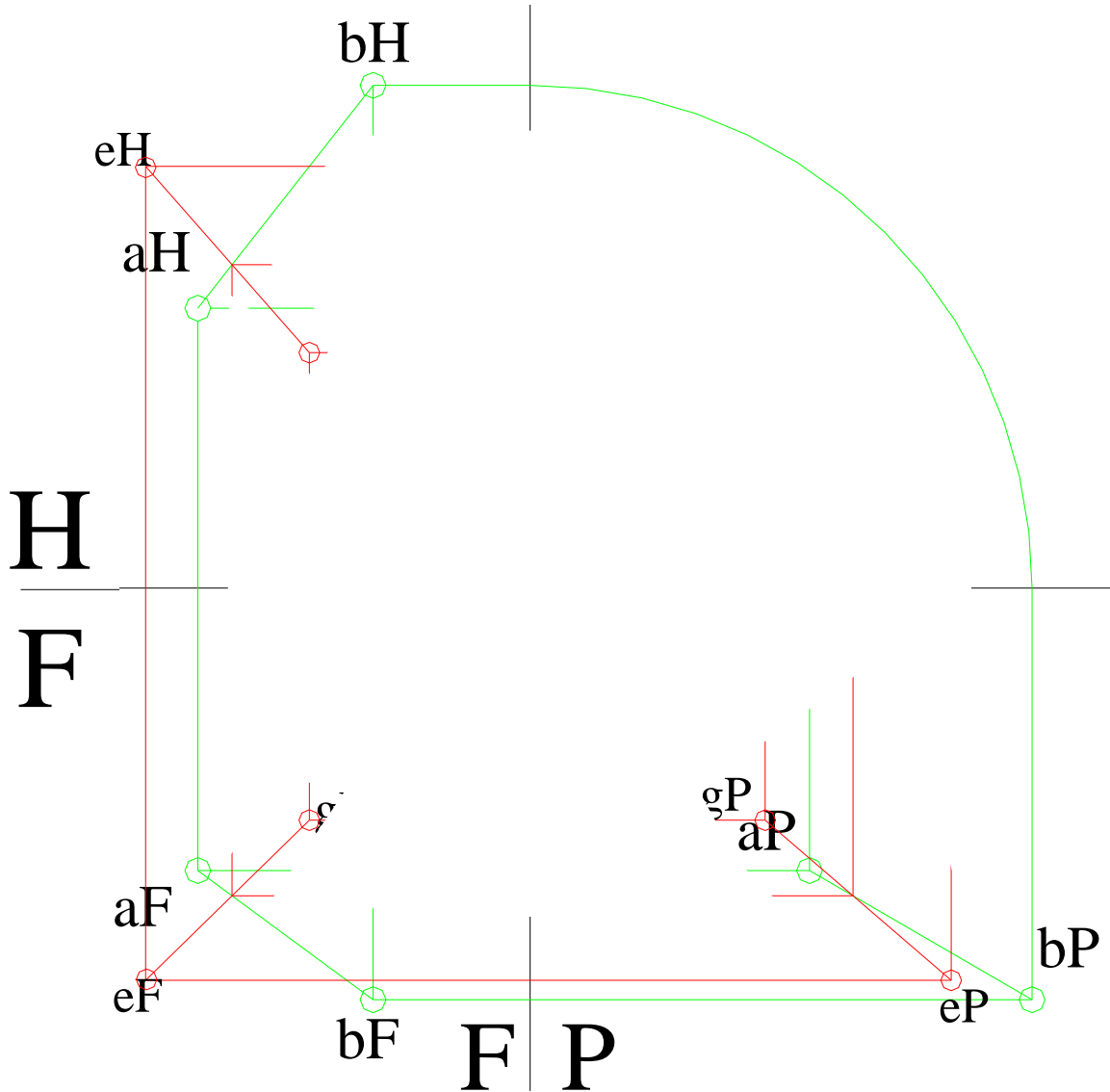

(a)   (b)   (c)

10b. Parallel Lines

10c. Intersecting Lines

- Intersecting lines have one common point between them

- The projection of the points must be aligned in adjacent views

- If they are, then the lines are intersecting

- If not, they are skewed

10c. Intersecting Lines

- Intersecting lines have one common point between them

- The projection of the points must be aligned in adjacent views

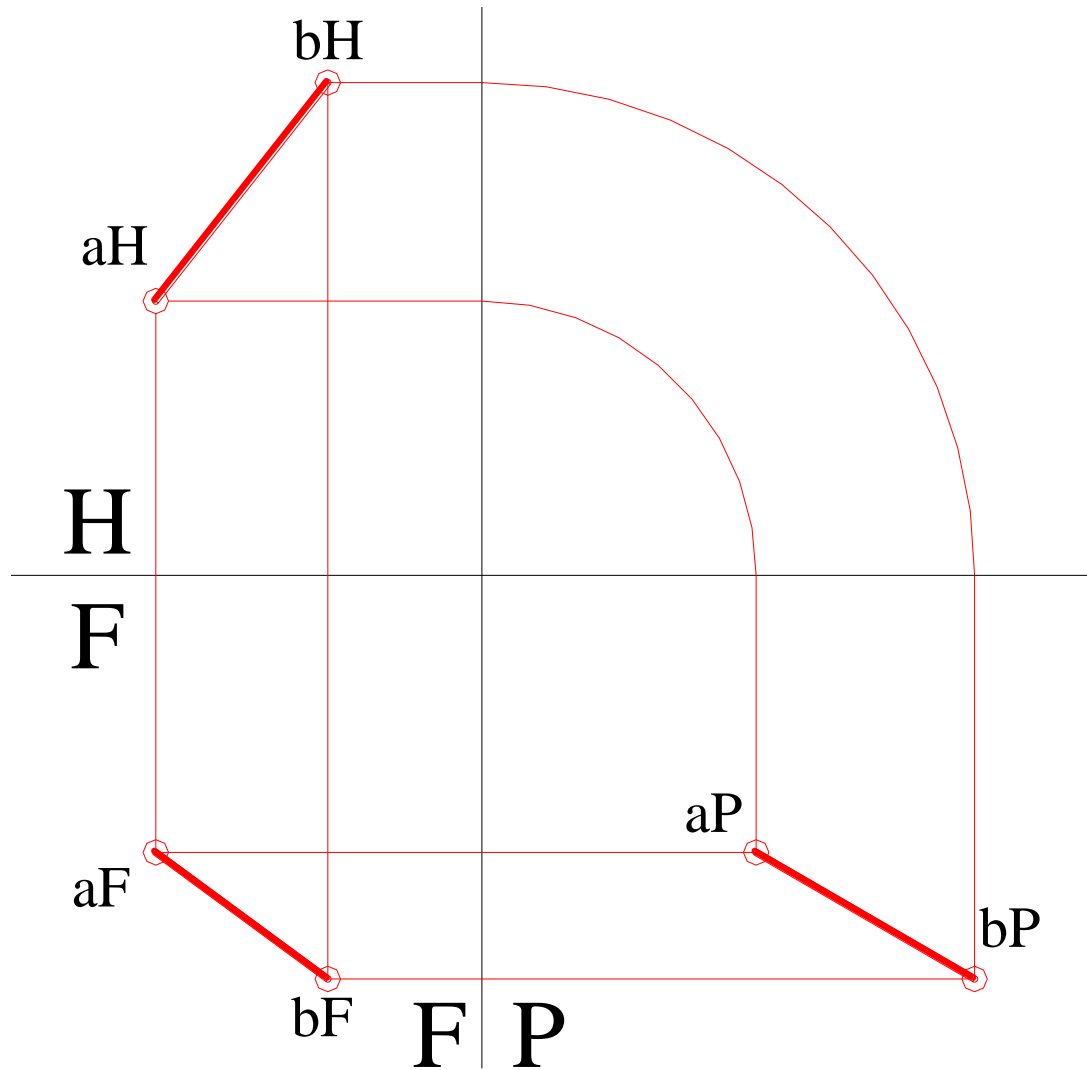- If they are, then the lines are intersecting

- If not, they are skewed

10c. Intersecting Lines

- Intersecting lines have one common point between them

- The projection of the points must be aligned in adjacent views

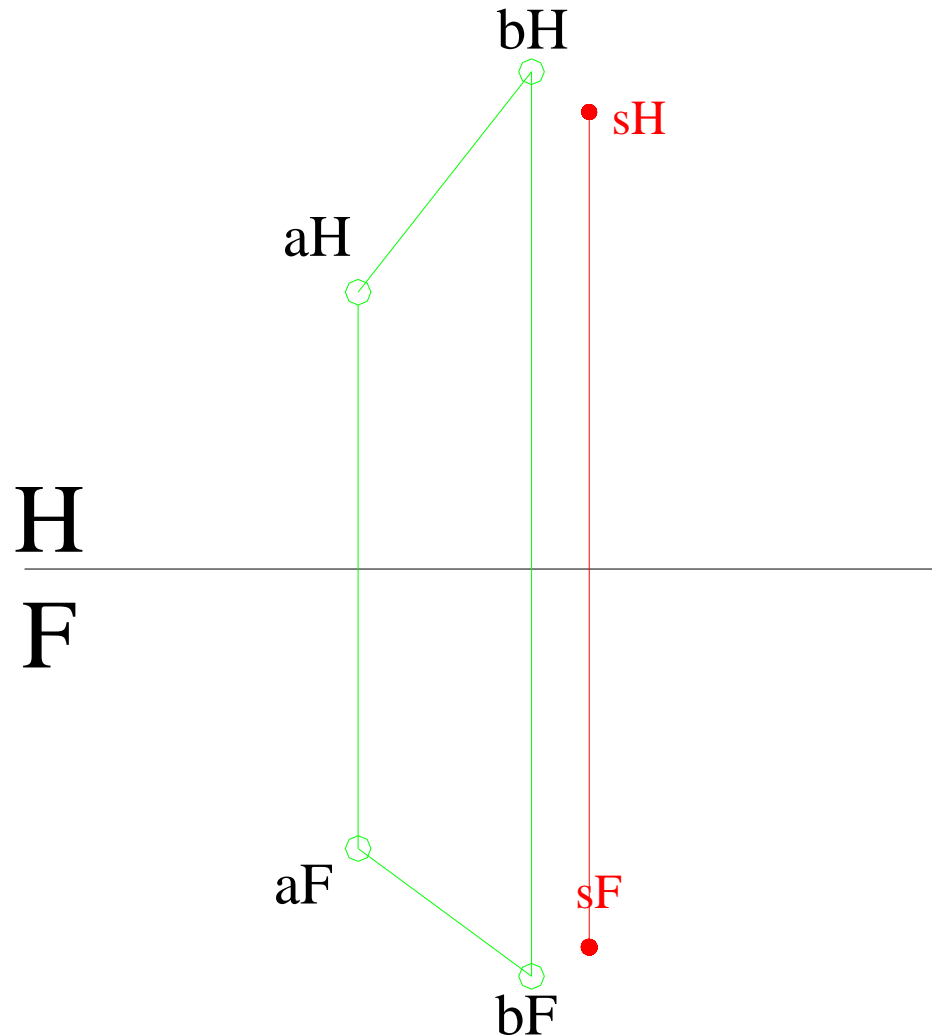- If they are, then the lines are intersecting

- If not, they are skewed
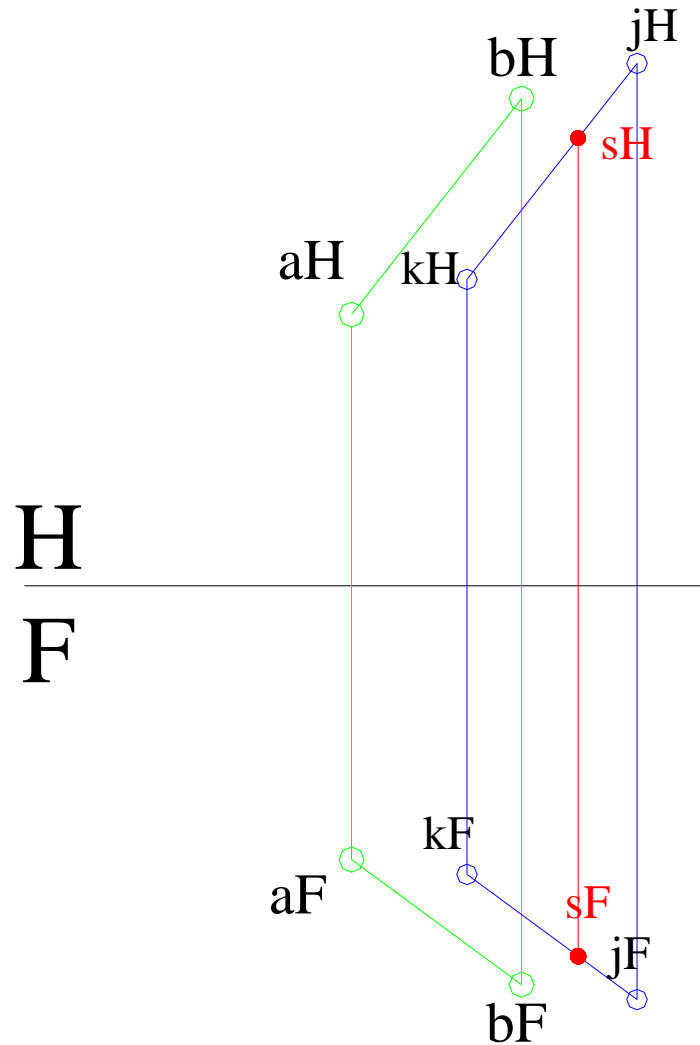
10c. Coincident lines
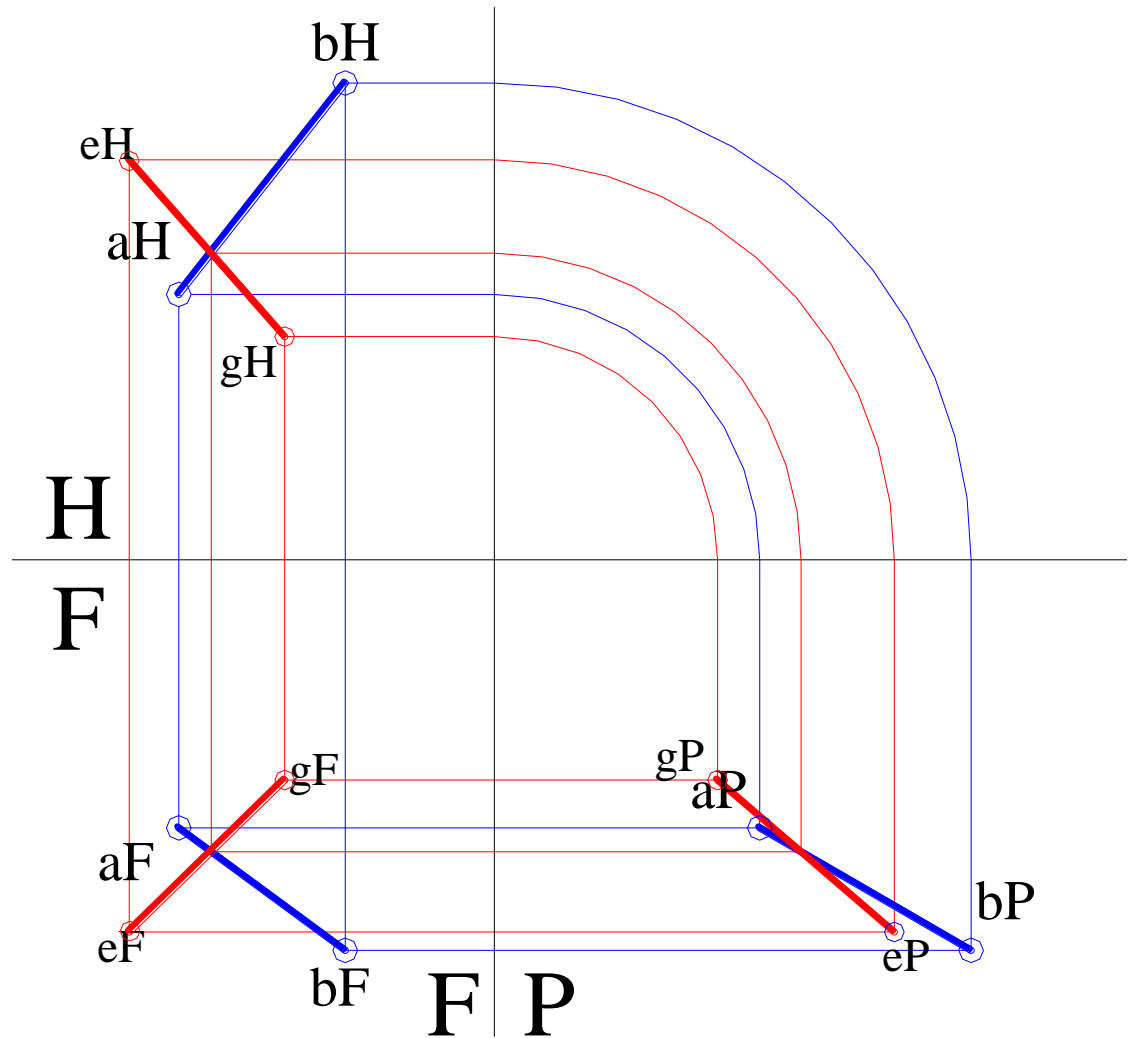
10c. Coincident lines

11. Location of a line

Locate a line // to a given line passing through a point
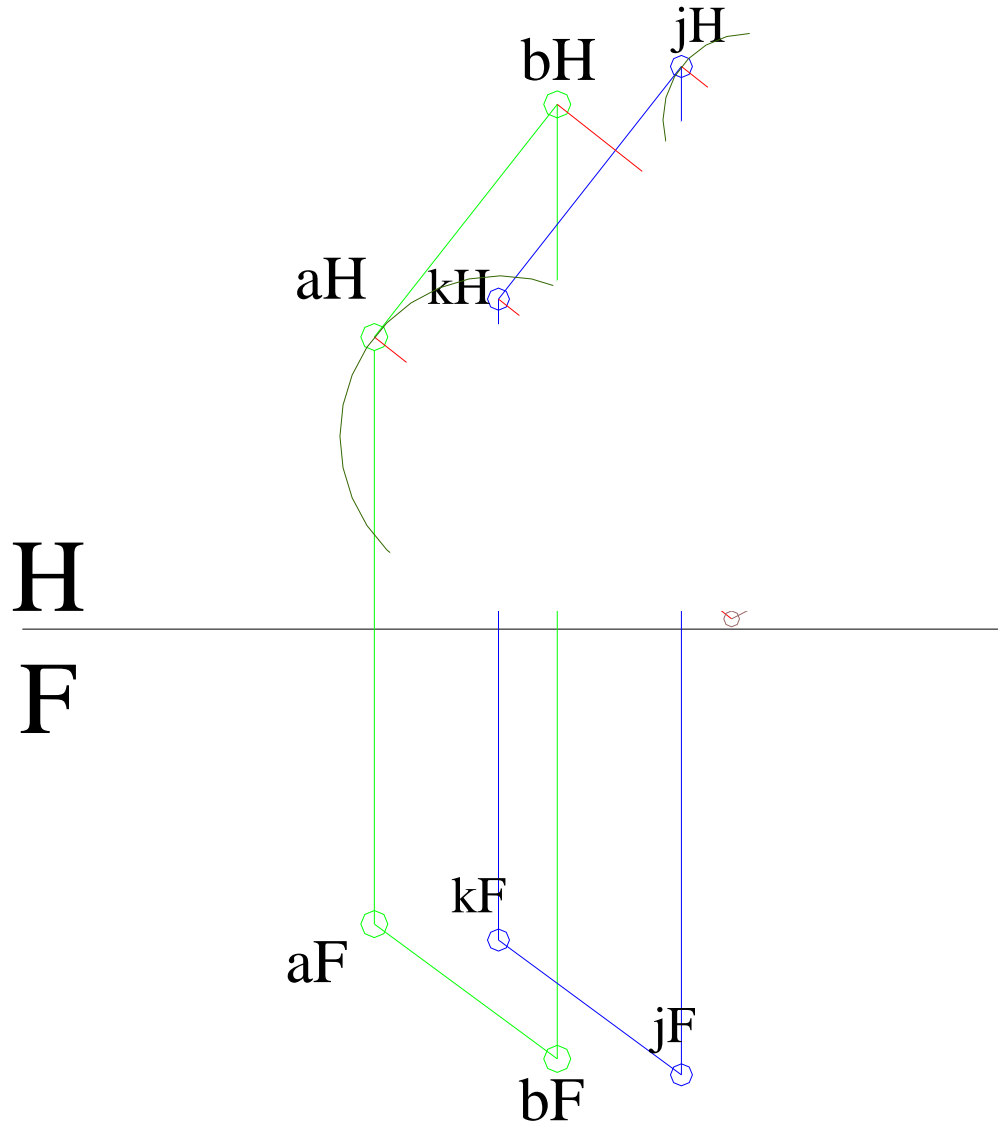
bH

sH

aH

H

F

aF
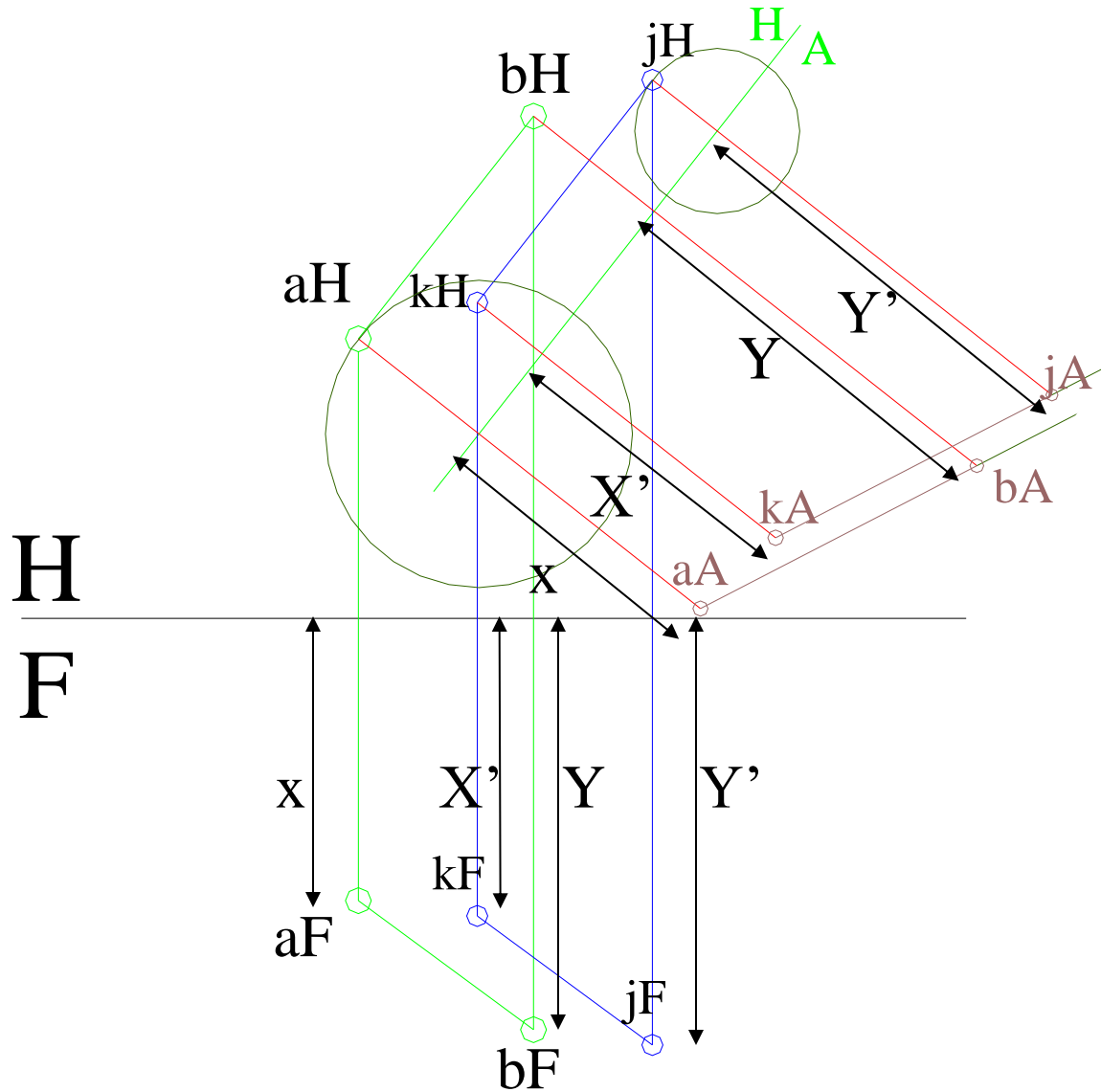
sF

bF

11. Location of a line

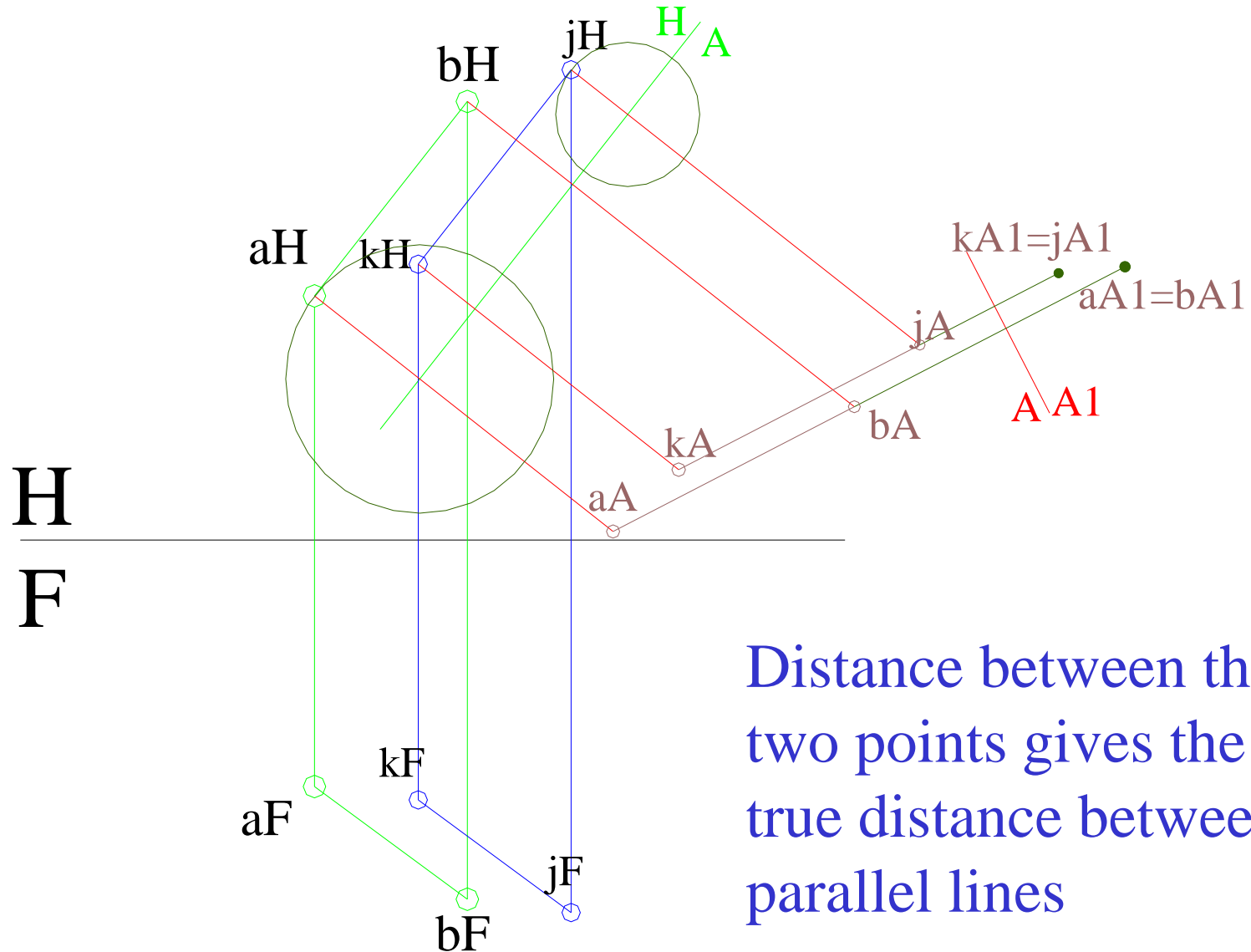Locate a line // to a given line passing through a point

12. True distance between 2 // lines

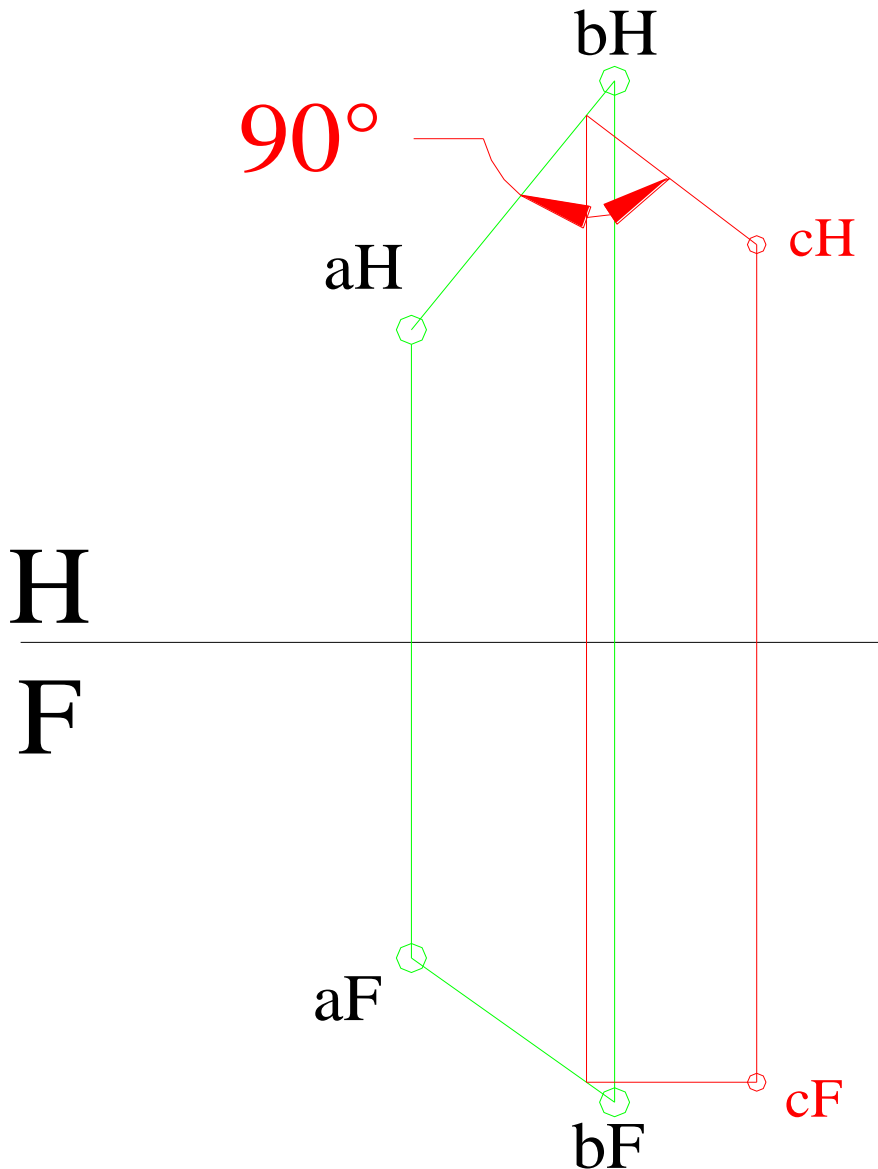# 12. True distance between 2 // lines

12. True distance between 2 // lines

Distance between the two points gives the true distance between parallel lines

13. Perpendicular lines

- A 90° angle appears in true size in any view showing one leg in TL provided the other leg does not appear as point view

- Two intersecting lines are perpendicular if the TL projection is making 90° with the other line

13. Perpendicular lines