Rao Badhur Y Mahabaleshwarappa Engineering College (RYMEC)

(Formerly , Vijayanagara Engineering College (VEC), Ballari)

Welcome to RYMEC Family.

Rao Badhur Y Mahabaleshwarappa Engineering College (RYMEC), BALLARI.

Dr. CHITRIKI THOTAPPA (MECH – 1987-1991)

PROFESSOR & M.Tech Co-Ordinator, Dept. of Mech.

SECRETARY - RYMEC, Alumni Association

QUALIFICATION:

BE (Mech) 1991 - (Gulbarga University)

ME (PM) 1994 - (Karnataka University)

Ph.D (SCM) 2012 - (Sree Venkateshwara University)

EXPERIENCE : 26 yrs Teaching, 1 yr Industry, 8 yrs Research.

PRESENTATION

on

ENGINEERING GRAPHICS (EG) : (18EGDL15/25)

ENGINEERING GRAPHICS

Semester	**: I/II**	**CIE Marks**	**: 40**
Course Code	**: 18EGDL15/25**	**SEE Marks**	**: 60**
Teaching Hours/week (L:T:P)	**: 2:0:2**	**Exam Hours**	**: 03**
	Credits : 03		

Course Learning Objectives:

This course will enable students to

CLO1 To expose the students to standards and conventions followed in preparation of engineering drawings.

CLO2 To make them understand the concepts of orthographic and isometric projections.

CLO3 Develop the ability of conveying the engineering information through drawings.

CLO4 To make them understand the relevance of engineering drawing to different engineering domains.

CLO5 To develop the ability of producing engineering drawings using drawing instruments.

CLO6 To enable them to use computer aided drafting packages for the generation of drawings.

Question paper pattern:

- Module -1 is only for practice and CIE and not for examination.
- Question paper for each batch of students will be sent online by VTU and has to be downloaded before the commencement of Examination of each batch. The answer sheets will have to be jointly evaluated by the Internal & External examiners.
- A maximum of THREE questions will be set as per the following pattern (No mixing of questions from different Modules).

Textbooks:

1. **Engineering Drawing** – N.D. Bhatt & V.M. Panchal, 48th edition, 2005-Charotar Publishing House, Gujarat.
2. **Engineering Graphics** – K.R. Gopalakrishna, 32nd edition, 2005-Subash Publishers Bangalore.
3. **Computer Aided Engineering Drawing -** by Dr. M H Annaiah, Dr C N Chandrappa and Dr. B Sudheer Premkumar, Fifth edition, New Age International Publishers.

Reference Books:

1. **Computer Aided Engineering Drawing** – S. Trymbaka Murthy, – I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition-2006.
2. **Engineering Drawing-**by N.S.Parthasarathy & Vela Murali, Oxford University Press, 2015
3. **Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-** Luzadder Warren J., Duff John M., Eastern Economy Edition, 2005- Prentice-Hall of India Pvt. Ltd., New Delhi.
4. **A Primer on Computer Aided Engineering Drawing-**2006, Published by VTU, Belgaum.

MODULE-I

Introduction to Computer Aided Sketching:

Introduction, Drawing Instruments and their uses, relevant BIS conventions and standards. Lettering, line conventions, dimensioning, material conventions, and free hand practicing.

Computer screen, layout of the software, standard tool bar / menu and description of most commonly used tool bars, and navigational tools.

Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale.

Commands and creation of Lines, coordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz., tangency, parallelism, inclination and perpendicularity.

MODULE-II

Orthographic projections of points, straight lines and planes:

Introduction, Definitions - Planes of projection, reference line and conventions employed. First angle and Third angle projection.

Projections of straight lines (located in first quadrant/first angle only), true and apparent lengths, true and apparent inclinations to reference planes (No application problems and midpoint problems).

Orthographic projections of plane surfaces (First angle projection only):

Projections of regular plane surfaces–triangle, square, rectangle, pentagon, hexagon and circle-in simple positions inclined to both the planes; planes in different positions by change of position method only. (No problems on punched plates and composite plates).

MODULE – III

Projections of solids:

Introduction, definitions – projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, and cones with axis inclined to both the planes. (Solids resting on HP only and no problems on octahedrons, and freely suspended solids.)

MODULE IV

Development of Lateral Surfaces of Solids:

Introduction to section planes and sectional views.

Development of lateral surfaces of right regular prisms, cylinders, pyramids, and cones resting with base on HP only. Development of their frustums and truncations. (No problems on lateral surfaces of trays, tetrahedrons, spheres and transition pieces).

MODULE-V

Isometric Projection (using isometric scale only)

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron(cube), right regular prisms, pyramids, cylinders, cones, and spheres. Isometric projection of combination of two simple solids. Conversion of given isometric/ pictorial views to orthographic views of simple objects.

LIST OF ENGINEERING DRAWING MATERIALS

Following Engineering Graphic materials required for the class work.

(All materials should be of good quality).

1. **200 pages un-ruled long note book.**
2. **Soft rubber/Eraser .**
3. **2 No. Micro tip pencil 1 No. HB and 1 No. 2H .**
4. **Compass.**
5. **Protractor.**
6. **Long plastic scale.**
7. **Sketch book.**
8. **Engineering Drawing question bank with solutions by VTU.**

ORTHOGRAPHIC PROJECTION OF LINES

(Here Line is an Object)

Line: It is a Locus of a point which moves linearly . (OR)
It is the shortest distance between any 2 given points.

Orthographic Projection of a Line: It is defined as obtaining the views of a line (Object) on Different POP's using the principles of Orthographic projections.

Position/Location of a Line:

Line can be positioned in the 1st Quadrant in infinite number of ways. All these infinite (∞) positions of line may be classified into following 4 cases based on how the line is held with reference to POP's (i.e. HP & VP) (Parallel, Perpendicular, Inclined)

ORTHOGRAPHIC PROJECTION OF LINES

NOTE:

1. If line is parallel to POP, then its view length on that POP is a true length.

   (- If line is parallel to HP, then the TV will be true length.

   - Similarly, if line is parallel to VP, then the FV will be true length.

   - If line is parallel to PP, then PV/SV will be true length.)

2. If line is Perpendicular to POP, then its view length (View) on that POP is a zero (Point).

   (- If line is Perpendicular to HP, then its TV will be a Point.

   - Similarly, if line is Perpendicular to VP, then its FV will be a Point.

   - If line is Perpendicular to PP, then its PV/SV will be a Point.)

ORTHOGRAPHIC PROJECTION OF LINES

3. If line is Inclined to POP, then its view length that POP is a Apparent length.

   (i.e. Apparent length will be always less than the true length. (AL < TL)

   If view length of the line is a true length, then it will with true inclination.

4. If view length of the line is Apparent length, then it will with Apparent inclination. (i.e. Apparent inclinations will be always greater than the true inclination. (i.e. AI > TI) ($\alpha, \beta > \theta, \phi$)

ORTHOGRAPHIC PROJECTION OF LINES

CASE -1: If Line is Parallel to both POP's (i.e. HP & VP), then it is always Perpendicular to PP.

NOTE: In CASE -1 Always Both FV and TV will be true length and Parallel to XY line.

CASE - 1

Line is Parallel to both HP & VP

ORTHOGRAPHIC PROJECTION OF LINES

CASE -2: Line is Parallel to one POP and Perpendicular to other POP (i.e. HP & VP), then it is always Parallel to PP.

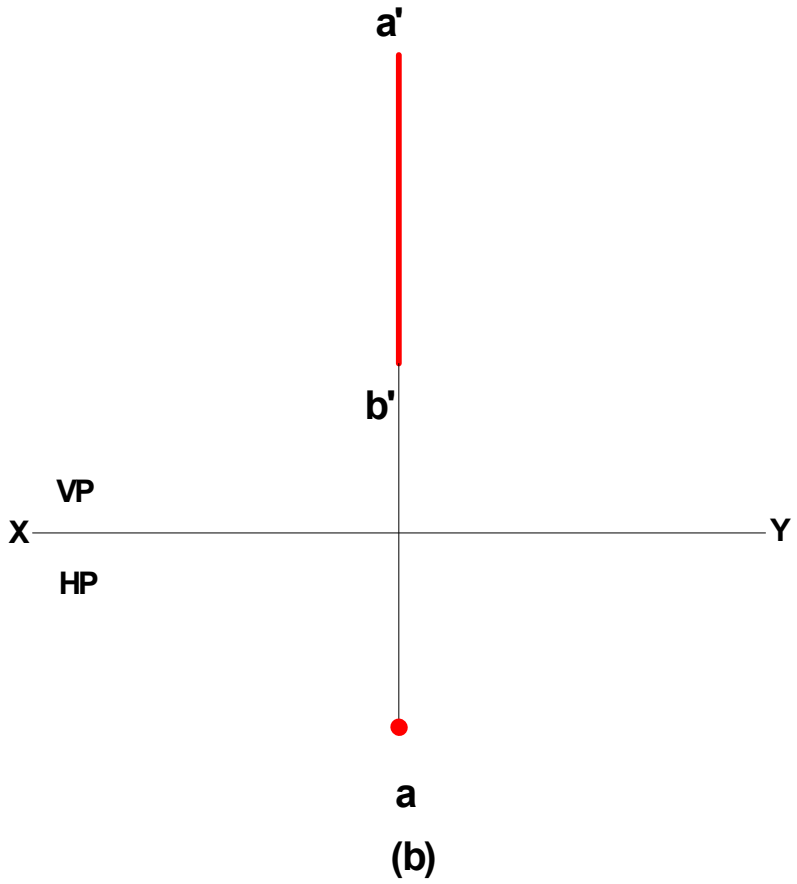
- **If Line is Parallel to HP and Perpendicular to VP, then TV will be true length and perpendicular to XY line and FV will be a Point.**
- **If line is Parallel to VP and Perpendicular to HP, then FV will be true length and perpendicular to XY line and TV will be a Point.**

NOTE: In CASE 2 always one view will be true length and that view will be perpendicular to XY line, And other view will be a Point.

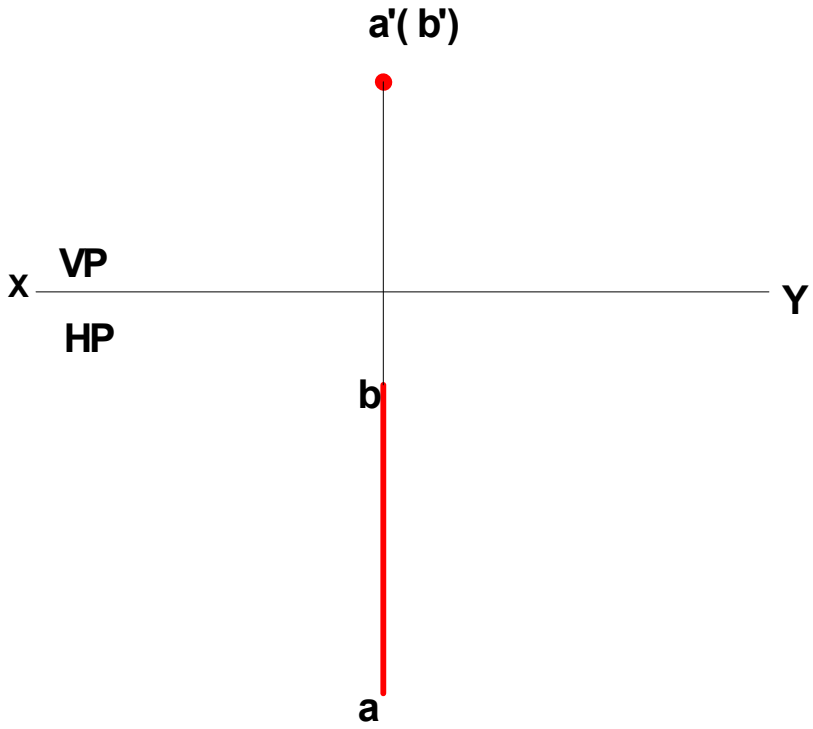
ORTHOGRAPHIC PROJECTION OF LINES

CASE - 2

Line Parallel to VP &
Perpendicular to HP



Line Parallel to HP &
Perpendicular to VP



ORTHOGRAPHIC PROJECTION OF LINES

CASE-3: Line is Parallel to one POP and Inclined to other POP (i.e. HP & VP), then it is always inclined to PP.

Note:

One view will true length and that view will be inclined to XY line at true inclination and other view will be apparent length and parallel to XY line.

If line is Parallel to HP and inclined to VP, then it is inclined to PP.

- TV will be true length and inclined to XY line at true Inclination and FV will apparent length and parallel to XY line.

If line is Parallel to VP and inclined to HP, then it is inclined to PP.

- FV will be true length and inclined to XY line at true Inclination and TV will be apparent length and parallel to XY line.

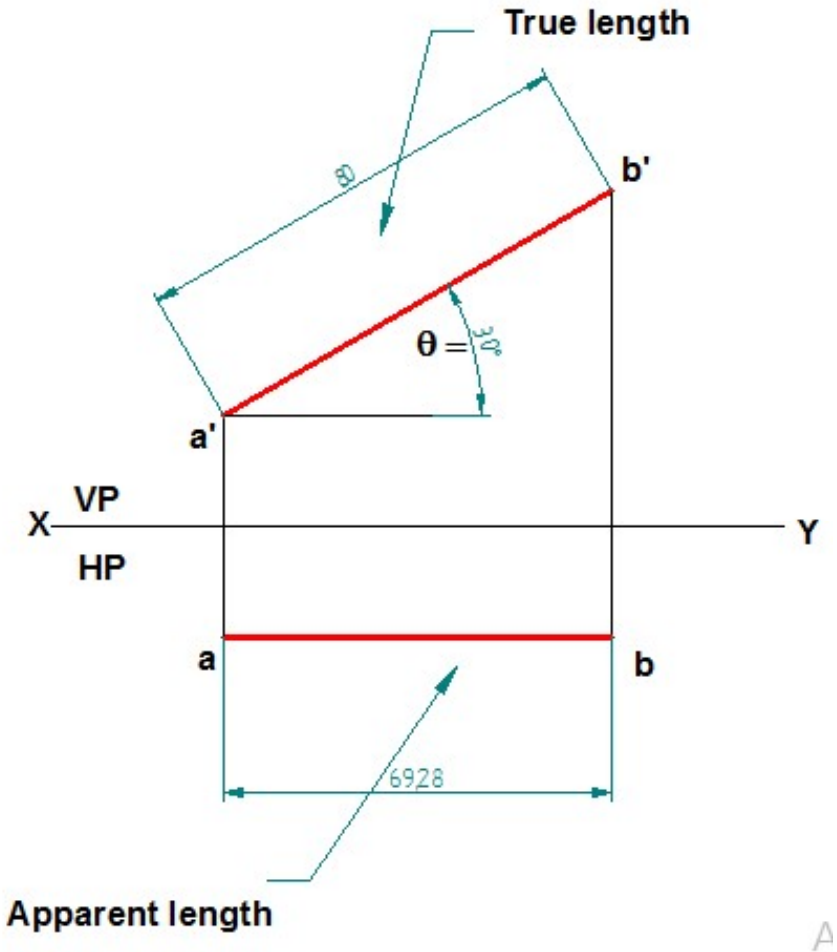
True length of a Line & Apparent length of a Line.

True length of a Line : If view of a line length is equal to the Actual (True) length of a line, then it is called **True length of a line.**

Note: If a line is parallel to POP then its projection (view) on that POP will be always **True length.**

For Eg. If line is parallel to VP then its front view (FV) will be **true length.**

Line Parallel to VP & Inclined to HP

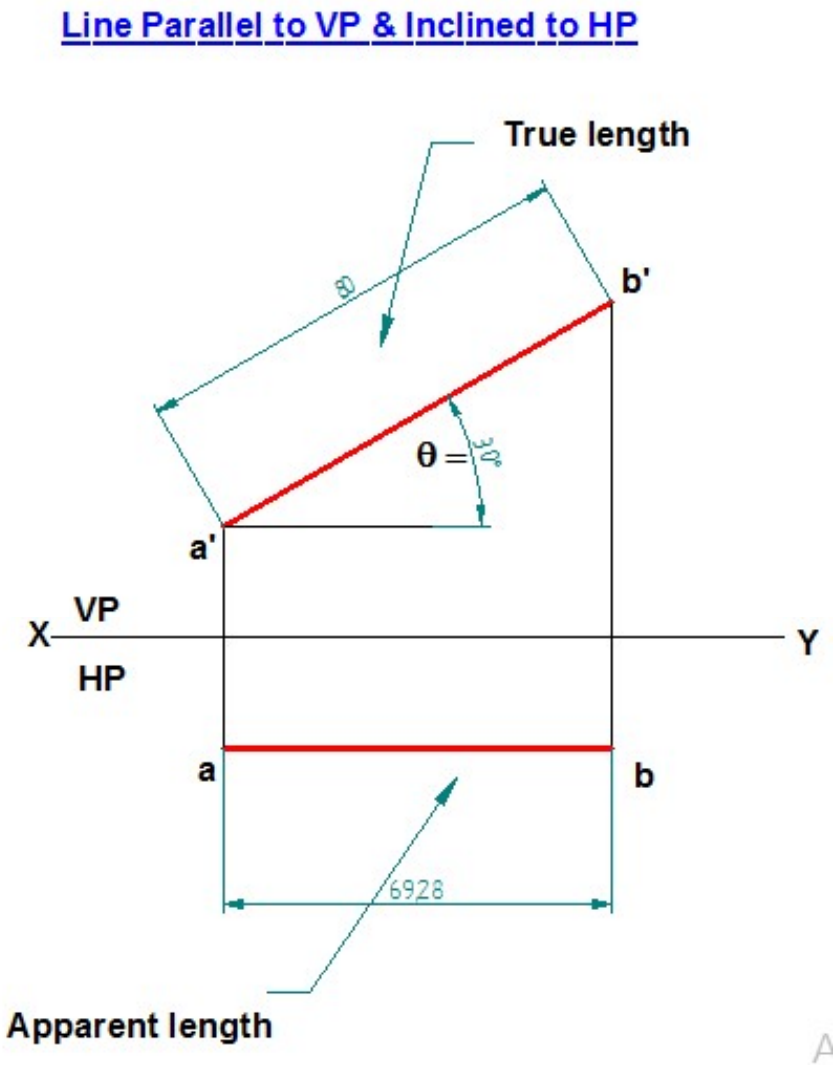


Apparent length of a Line. If view of a line length is less than the Actual length, then it is called Apparent length of a line.

Note: If a line is inclined to POP then its projection (view) on that POP will be always Apparent length.

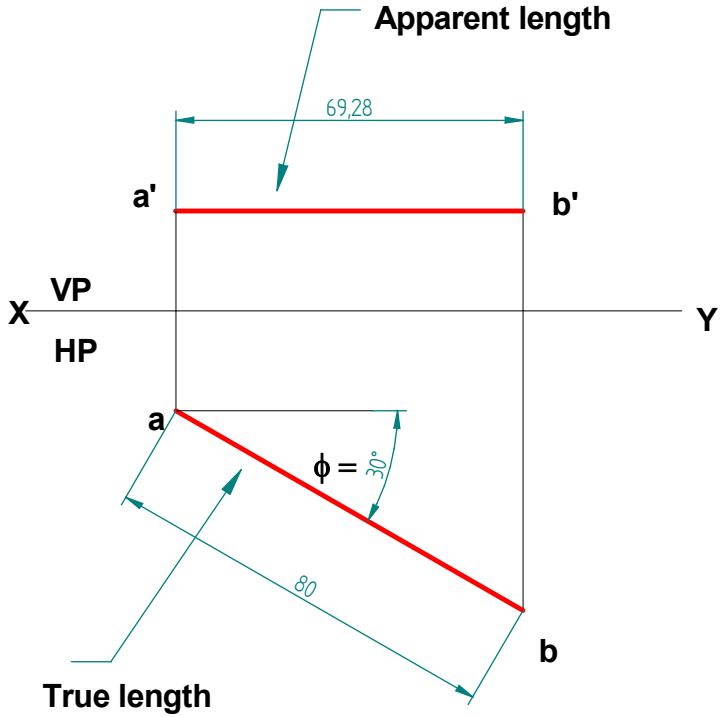
Always Apparent Length (AL) will be less than the True Length (TL). (i.e. AL < TL)

For Eg. If line is inclined to HP then its Top view (TV) will be Apparent length.

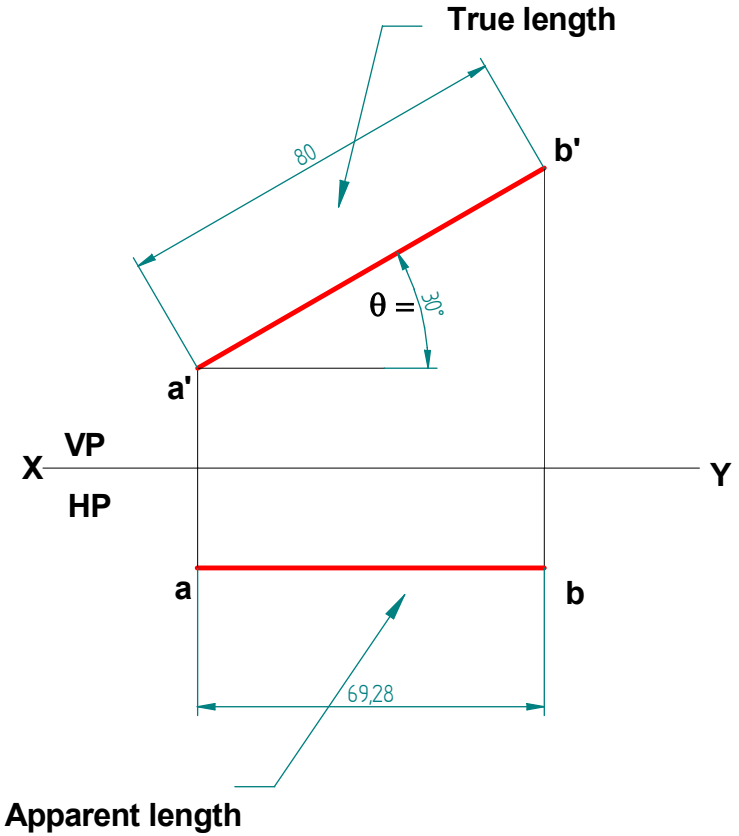


True length of a Line & Apparent length of a Line.

Line Parallel to HP & Inclined to VP



Line Parallel to VP & Inclined to HP

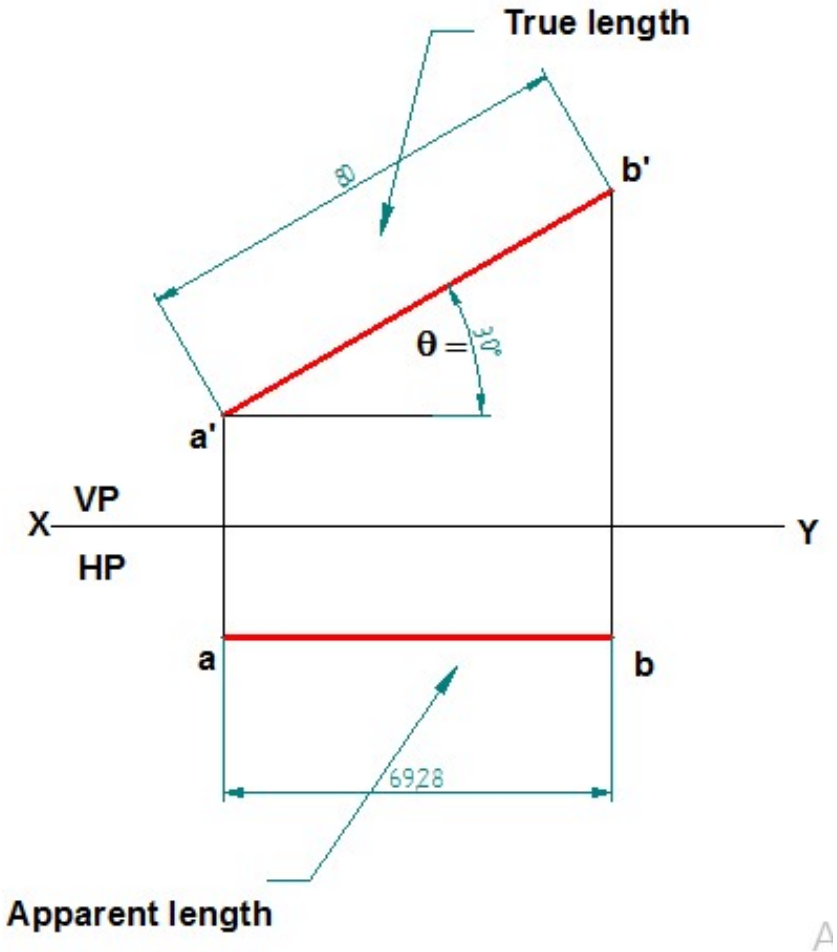


True Inclination of a Line & Apparent Inclination of a Line.

True Inclination of a Line : It is the angle between **True length of a line** and **line parallel to XY line.**

For Eg: If a line is parallel to VP and inclined to HP at a angle of θ, then its **FV will be true length** and at **True inclination 'θ '**

Line Parallel to VP & Inclined to HP



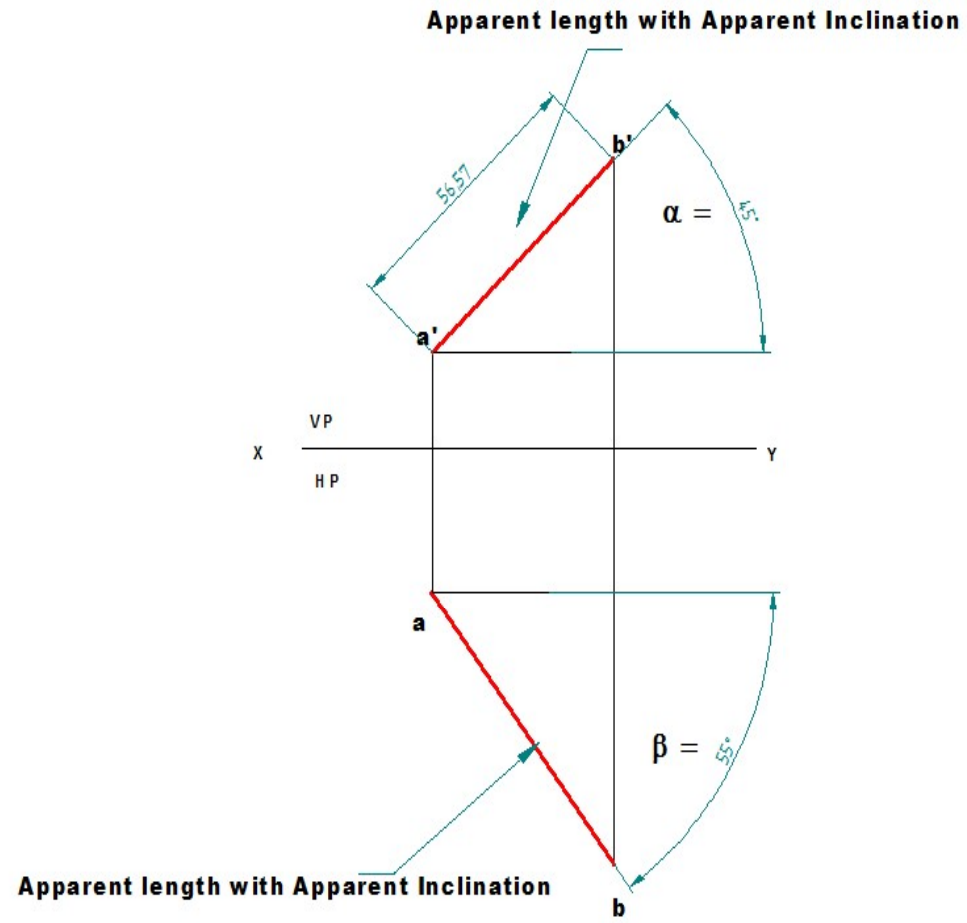
Note: Always

- **Line inclined to HP** is denoted as θ and its Apparent inclination is denoted by α
- **Line inclined to VP** is denoted as ϕ and its Apparent inclination is denoted by β

True Inclination of a Line & Apparent Inclination of a Line.

Apparent Inclination of a Line : It is the angle between Apparent length of a line and line parallel to XY line.

For Eg: If line is inclined to HP at an angle of 'θ' , and inclined to VP at an angle of 'ϕ' then its FV and TV will be Apparent length and with Apparent inclination 'α' and 'β'



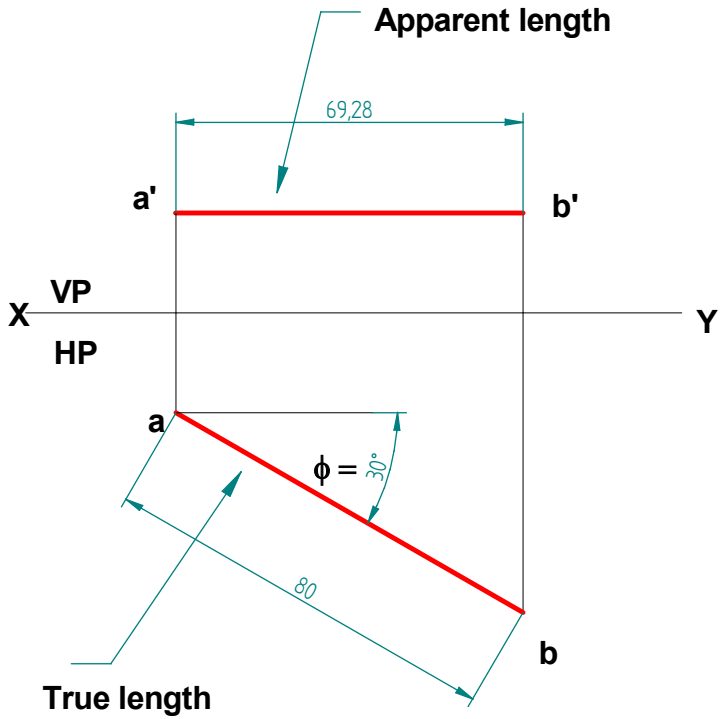
Note: Always Apparent Inclination will be greater than True inclination.

i.e. $\alpha , \beta > \theta , \phi$

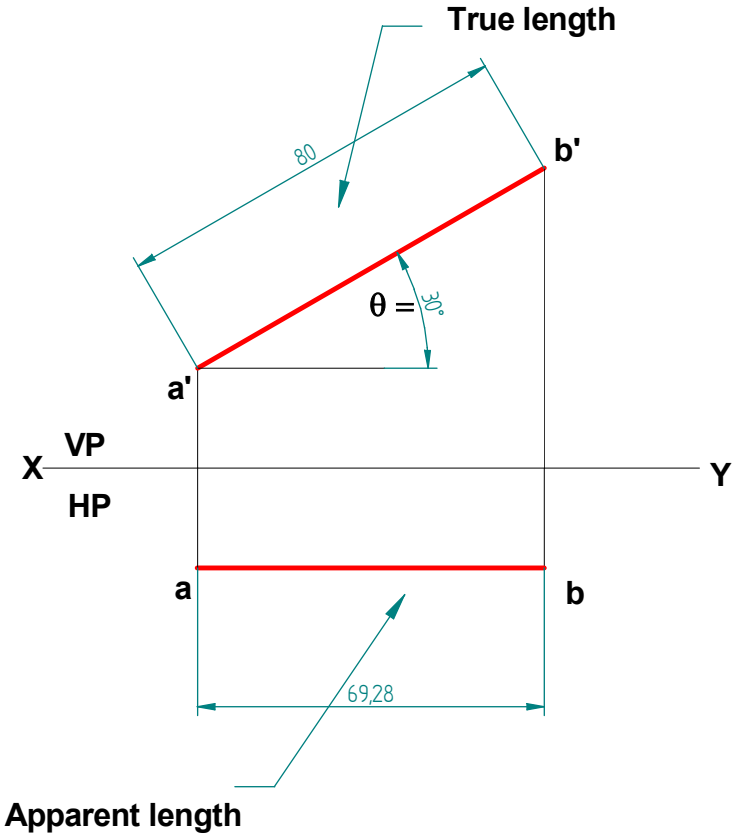
ORTHOGRAPHIC PROJECTION OF LINES

CASE - 3

Line Parallel to HP & Inclined to VP



Line Parallel to VP & Inclined to HP



ORTHOGRAPHIC PROJECTION OF LINES

CASE-4: **Line is inclined to both the POP's (i.e. HP & VP), then it is inclined to PP.**

If line is inclined to HP at an angle θ and inclined to VP at an angle ϕ, then it is inclined to PP at an angle τ.

Note: In case-4 both FV & TV will be apparent length, inclined to XY line with apparent inclinations. (α & β)

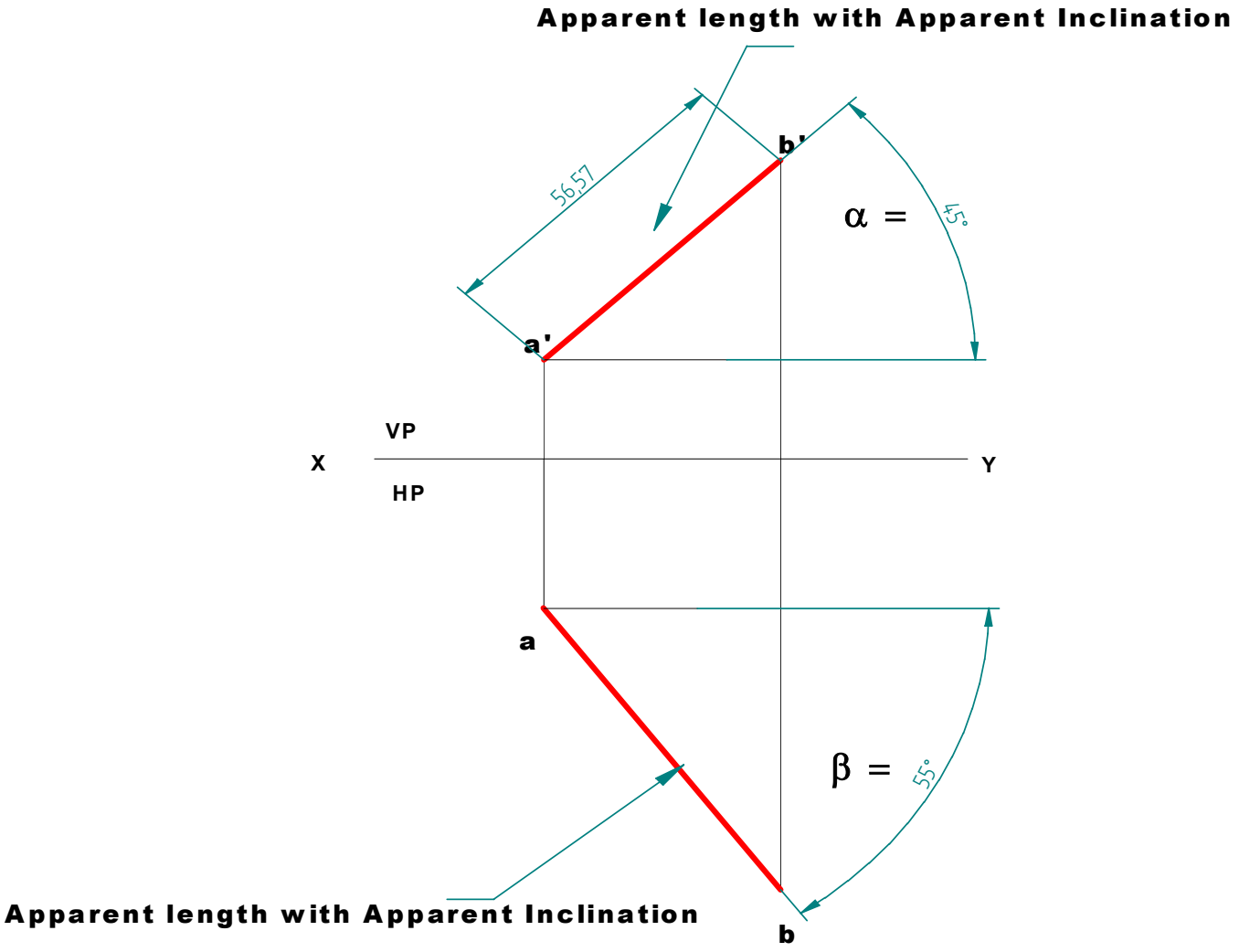
CASE-4 (Special Case): Line is inclined to HP at an angle θ and inclined to VP at angle ϕ and if $\theta + \phi = 90$, then it is Parallel to PP.

This is possible only when summation $(\theta + \phi = 90)$

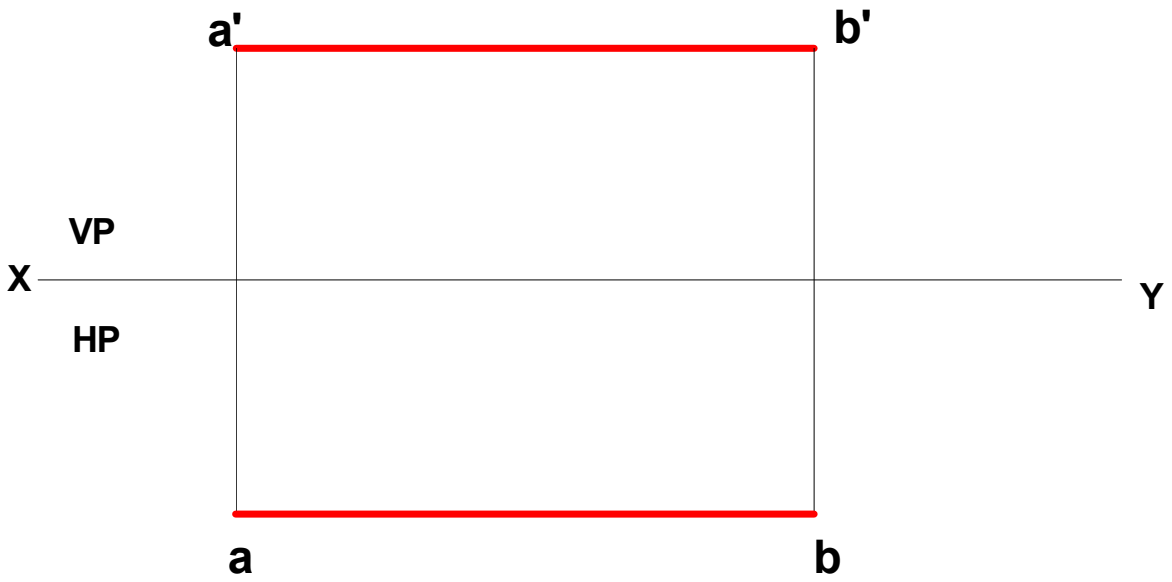
Note: In Special case both FV & TV will be apparent length, But Perpendicular to XY line and side view will be true length with true inclinations.

ORTHOGRAPHIC PROJECTION OF LINES

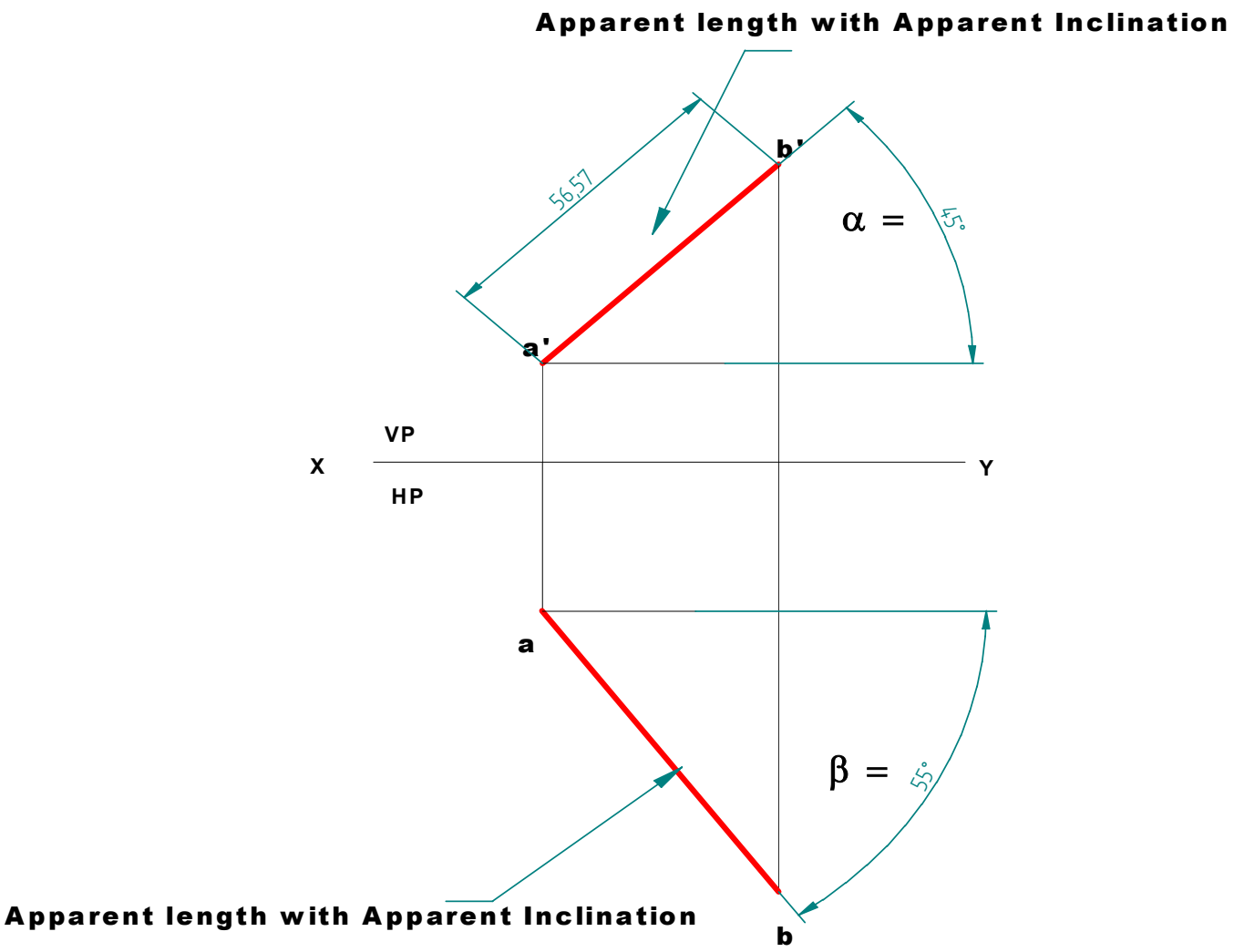
CASE - 4



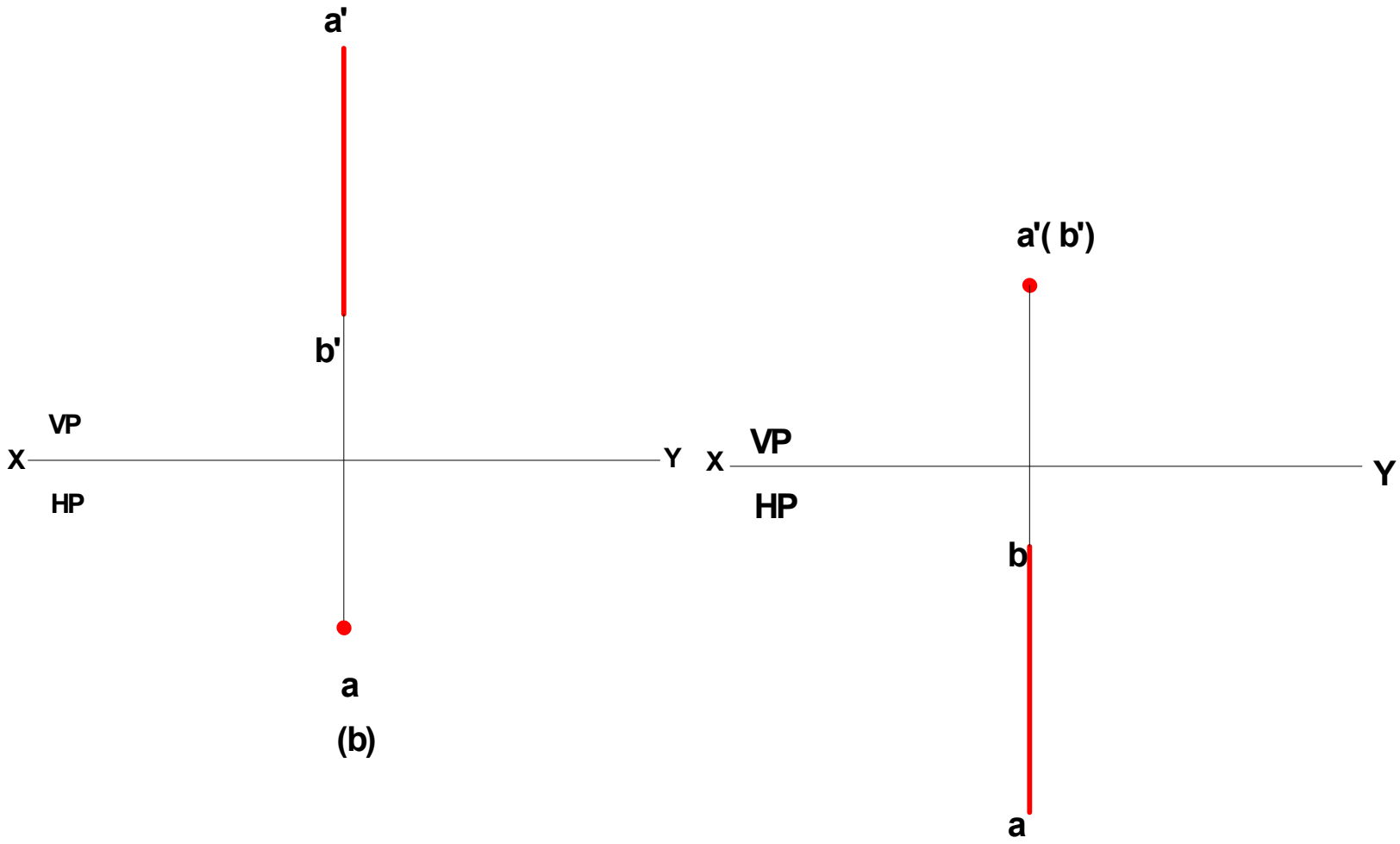
ORTHOGRAPHIC PROJECTION OF LINES



ORTHOGRAPHIC PROJECTION OF LINES



ORTHOGRAPHIC PROJECTION OF LINES



P1: A line AB 80mm long has its end A 20mm above HP and 30mm infront of VP. It is inclined at 30* to HP and 45* to VP. Draw the projetions of the line and find apparent lengths and apparent inclinations.

Data Given:

AB = TL = a'b1' = ab2 = 80

a' = 20

a = 30

$\theta = 45^*$

$\phi = 30^*$

Draw: FV = a'b', TV = ab

Find: Apparent Inclination

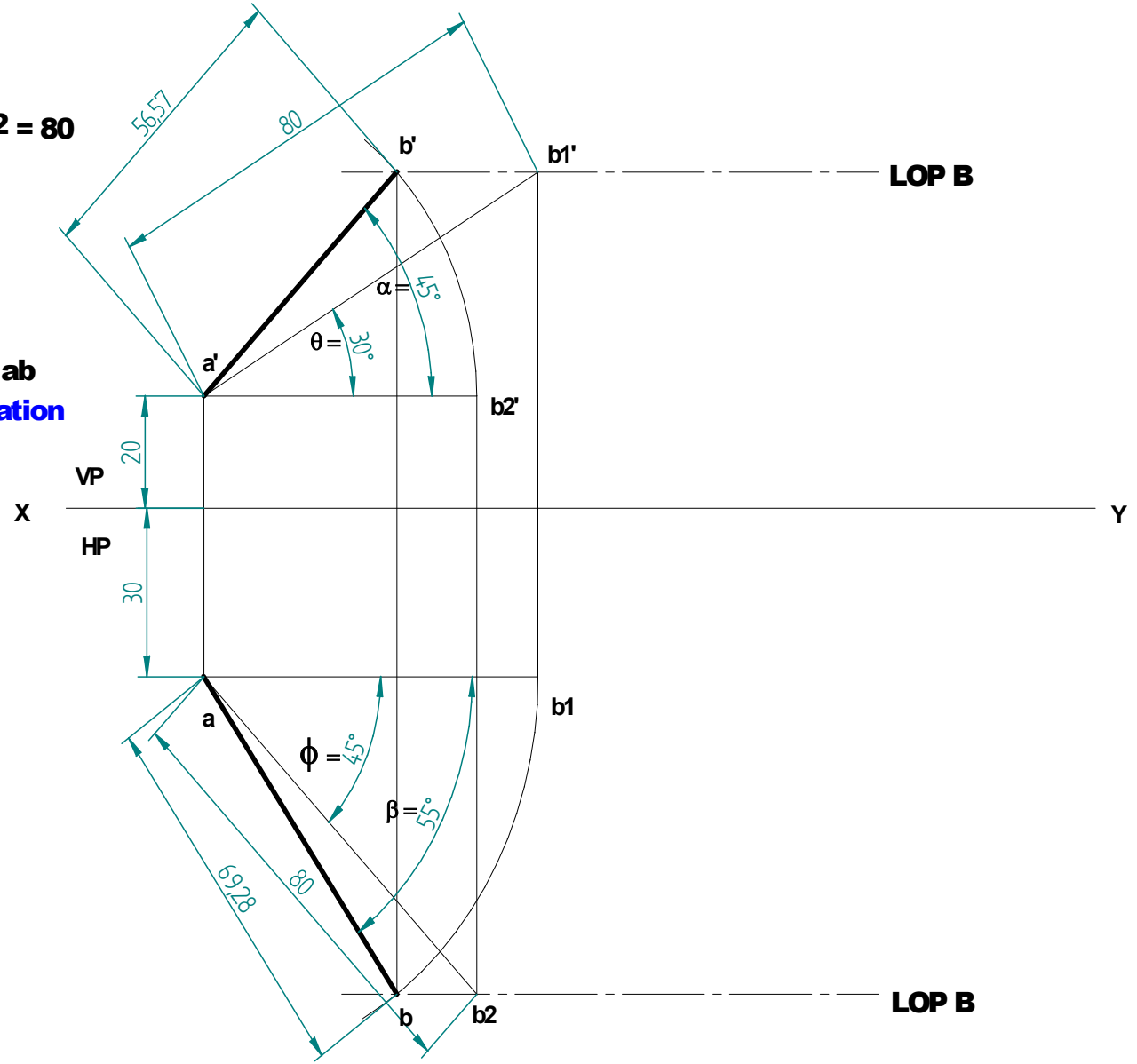
$\alpha = ?\ 45^*$

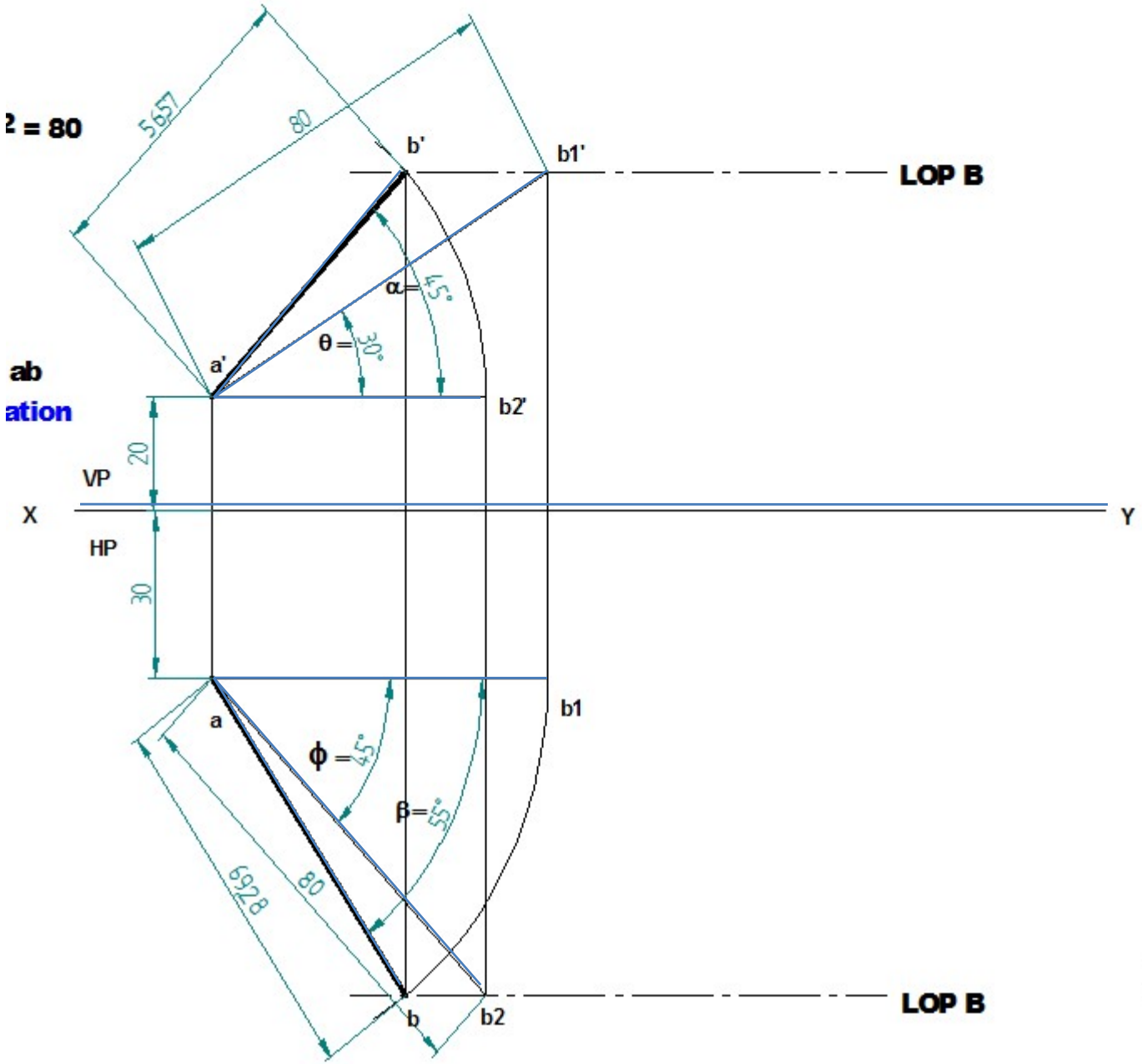
$\beta = ?\ 55^*$

Apparent length

FV = a'b' = 56.57

TV = ab = 69.28




2 = 80
5657
80
b'
b1'
LOP B
α = 45°
θ = 30°
a'
ab
ation
b2'
20
VP
X
Y
HP
30
b1
a
ϕ = 45°
β = 55°
6928
80
b
b2
LOP B

P1: Data Given

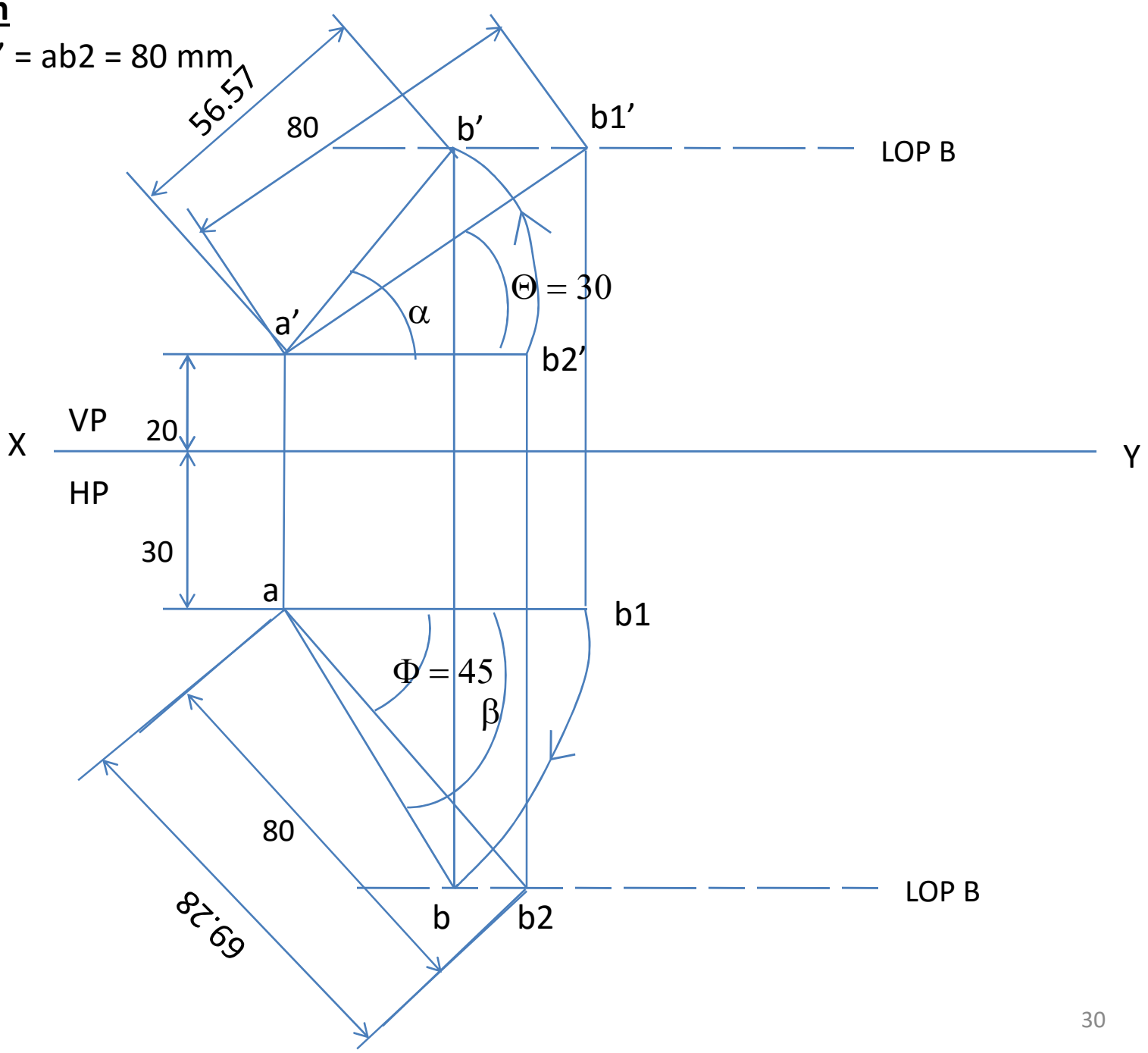
AB = TL = a'b1' = ab2 = 80 mm

a' = 20

a = 30

$\Theta = 30*$

$\Phi = 45*$



Find:

a'b' = ?

ab = ?

$\alpha = ?$

$\beta = ?$

P1: Data Given

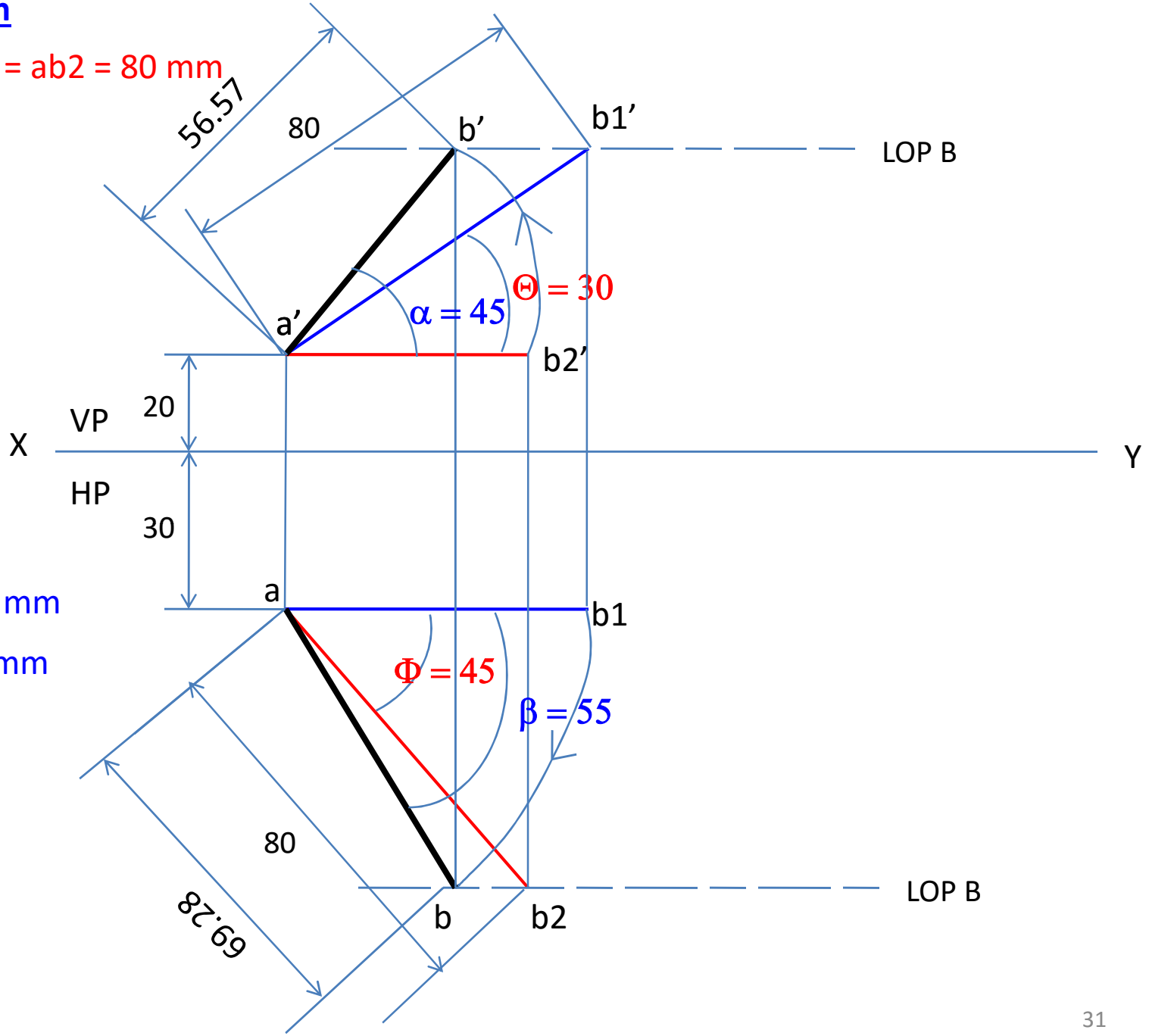
AB = TL = a'b1' = ab2 = 80 mm

a' = 20

a = 30

$\Theta = 30^*$

$\Phi = 45$



Find:

a'b' = ? 56.57 mm

ab = ? 69.28 mm

$\alpha = ?$ 45*

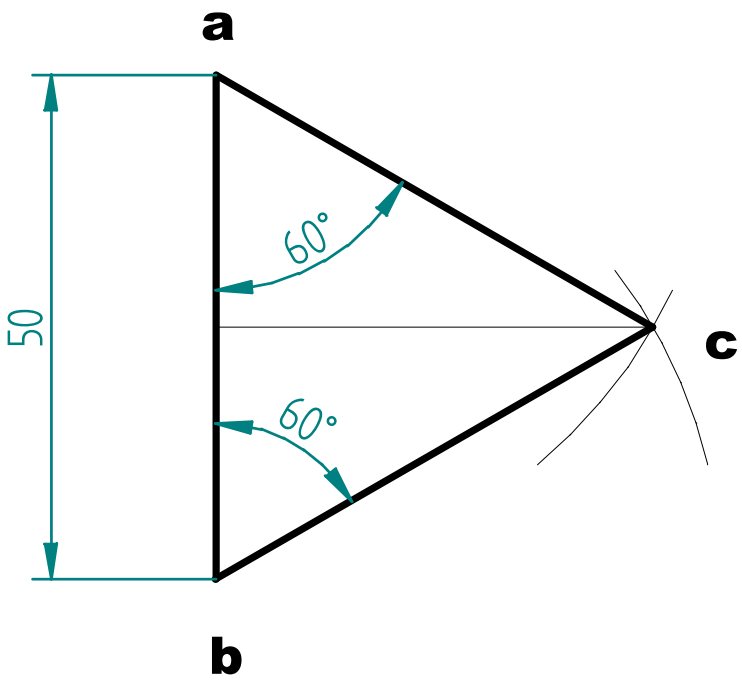
$\beta = ?$ 55*

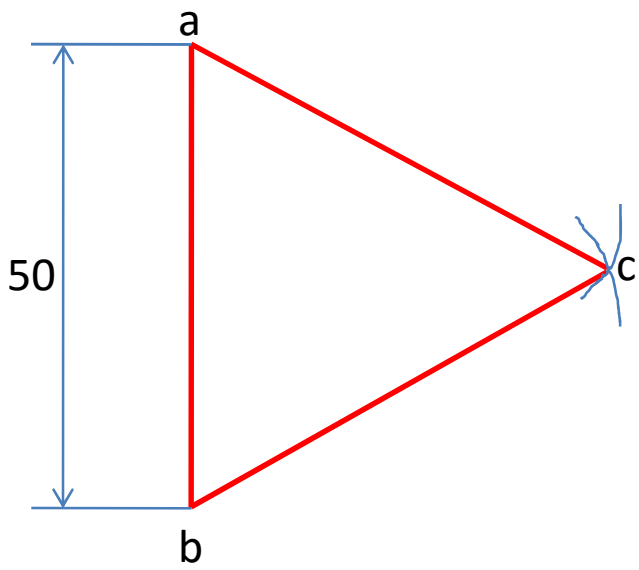
FOR ALL CASE – 4 PROBLEMS THE FOLLOWING CONDITIONS SHOULD SATISFY
(Assuming Point A is sationary and Point B is rotating)

1. Always a'b' (Inclined to XY line) = a'b2' (Parallel to XY line)
2. Always ab (Inclined to XY line) = ab1 (Parallel to XY line)
3. a'b1' = ab2 = True length.
4. α = Apparent Inclination with ref. to FV = a'b' and XY line.
5. β = Apparent inclination with ref. to TV = ab and XY line.
6. θ = True Inclination with ref. to a'b1' and XY line.
7. Φ = True inclination with ref. to ab2 and XY line.
8. Always α & $\beta > \theta$ & ϕ.
9. Always points b' & b1' lie on locus of Point line (LOP) B in the FV.
10. Always pints b & b2 lie on locus of Point line (LOP) B in the TV.

ORTHOGRAPHIC PROJECTION OF PLANES

ORTHOGRAPHIC PROJECTION OF PLANES





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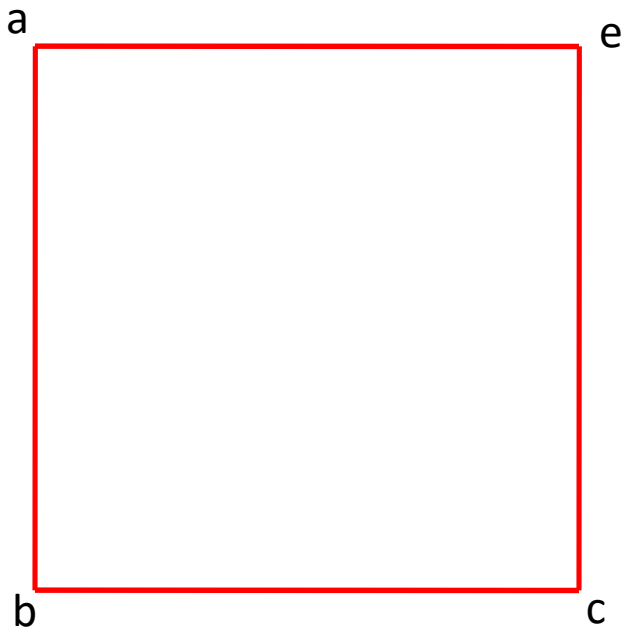

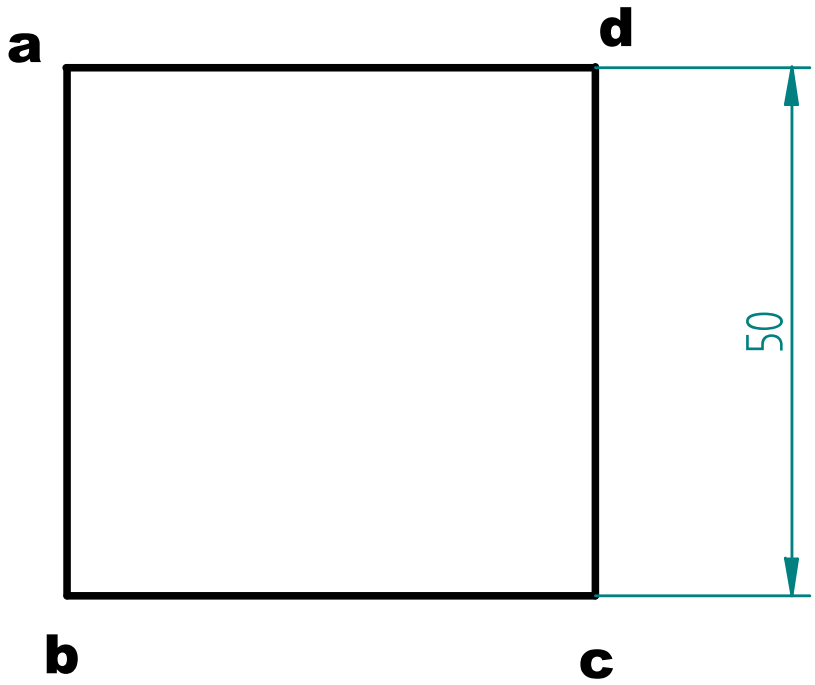

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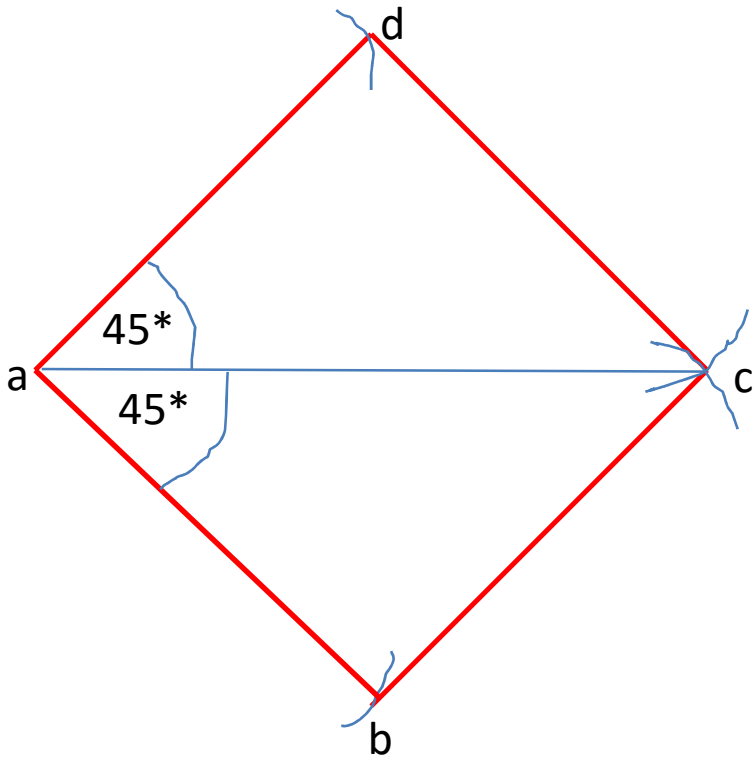

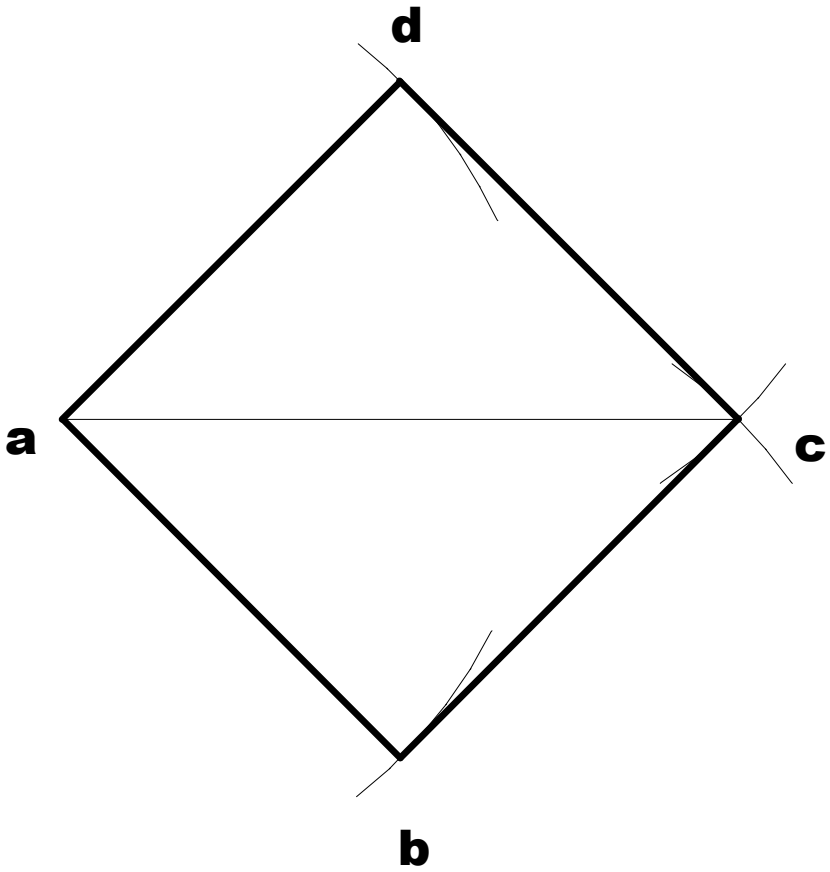

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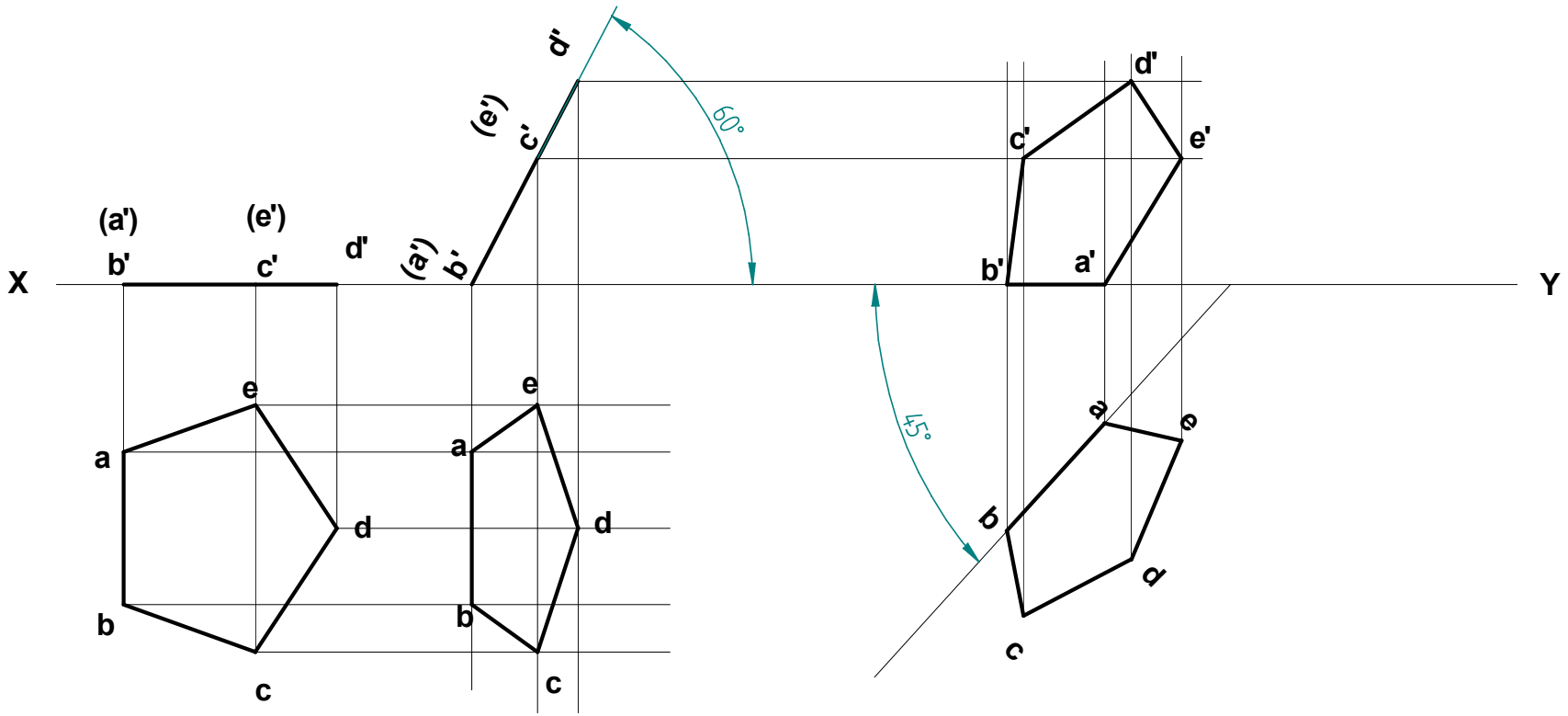

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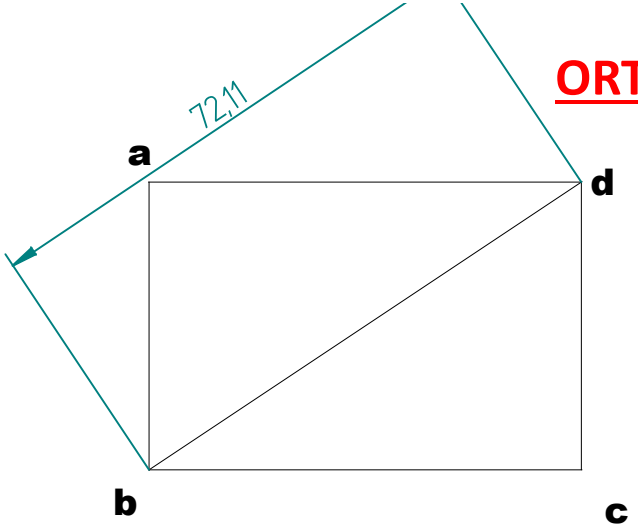
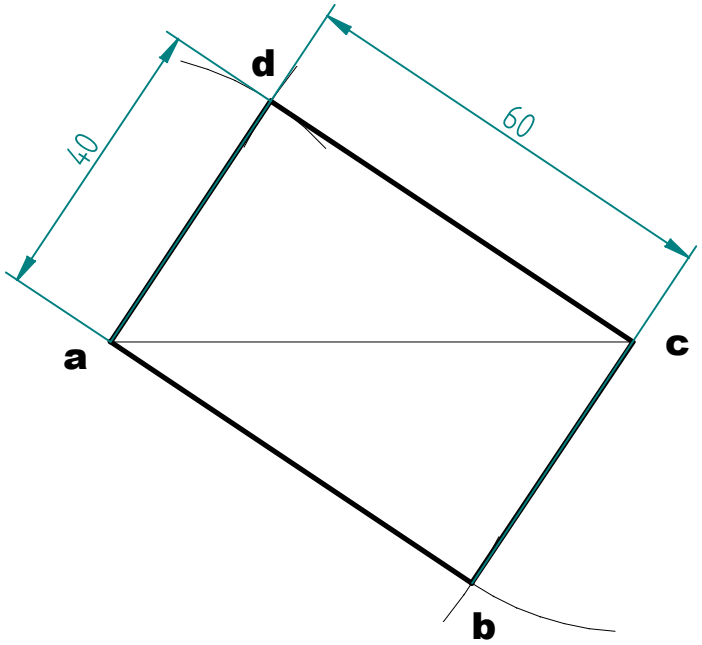
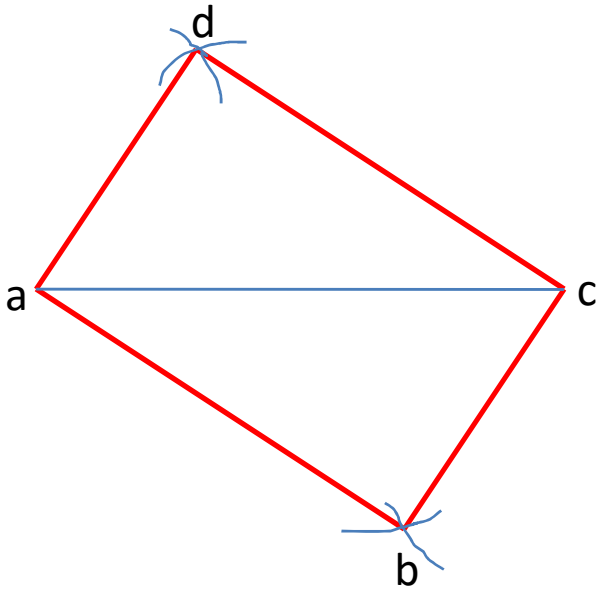
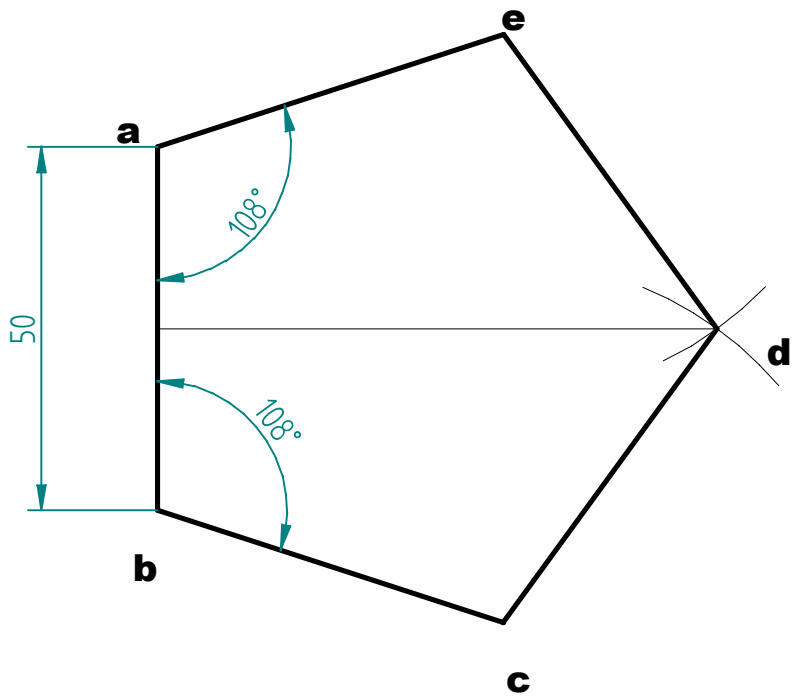




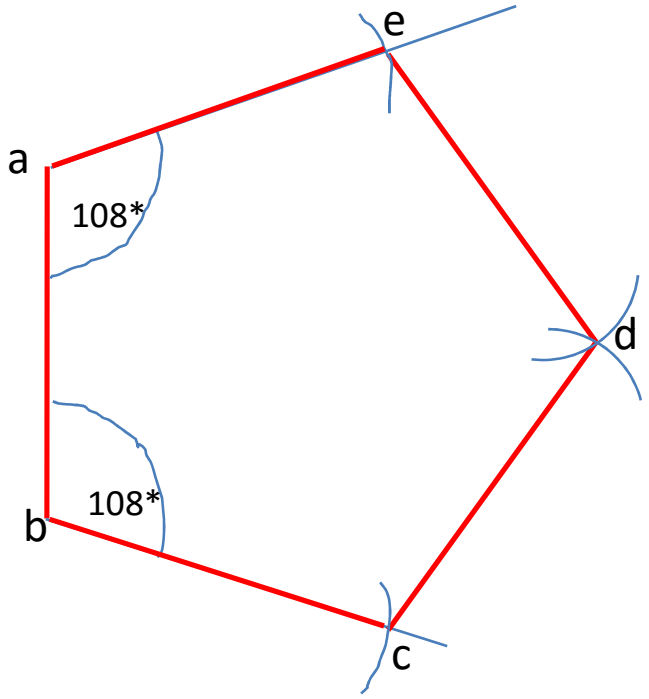


ORTHOGRAPHIC PROJECTION OF PLANES

Edge Position Pentagon

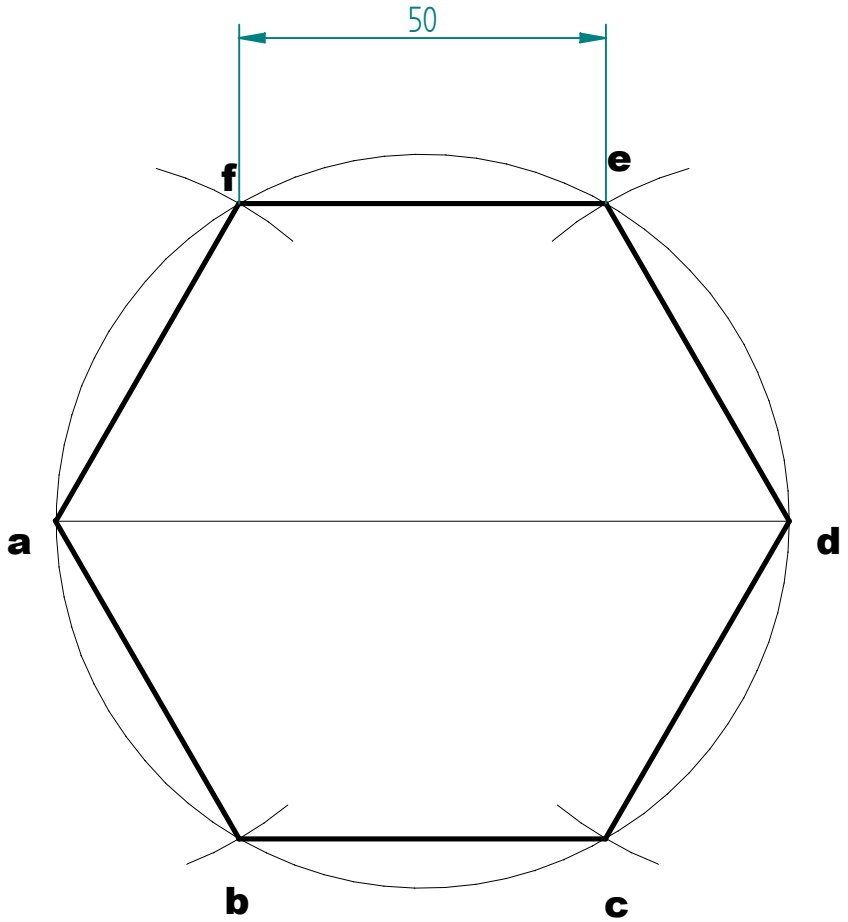


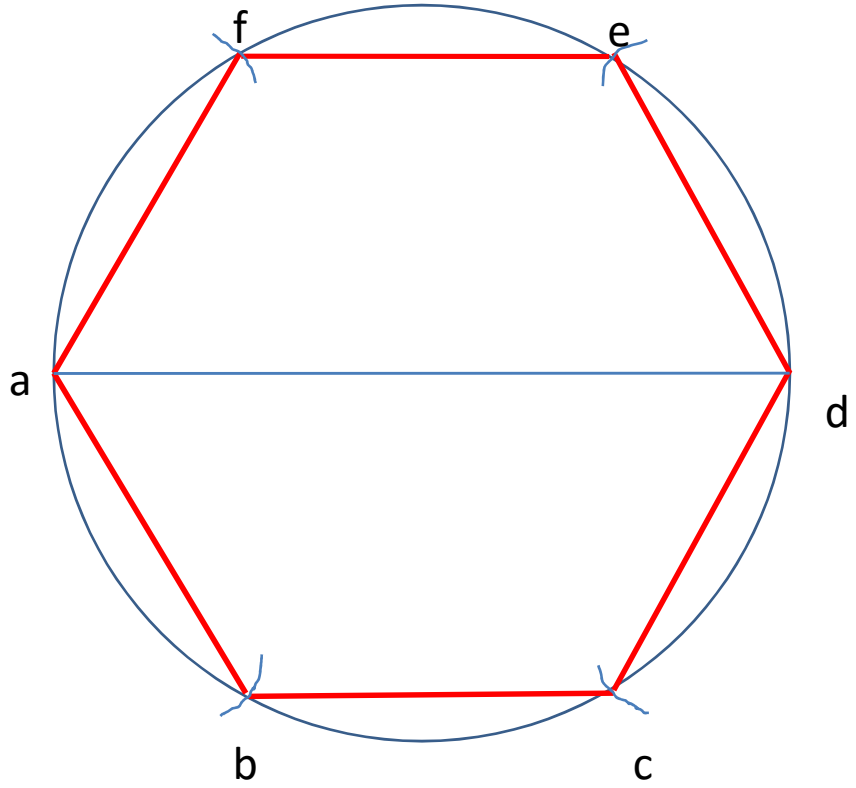
Corner Position Pentagon



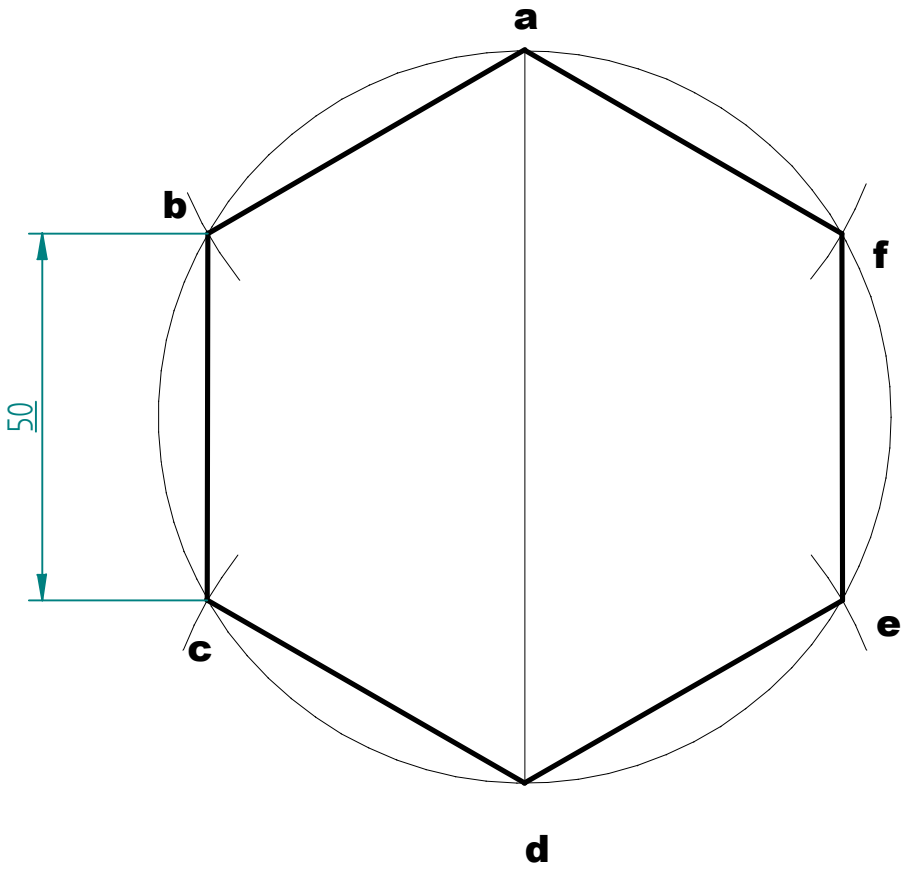
ORTHOGRAPHIC PROJECTION OF PLANES

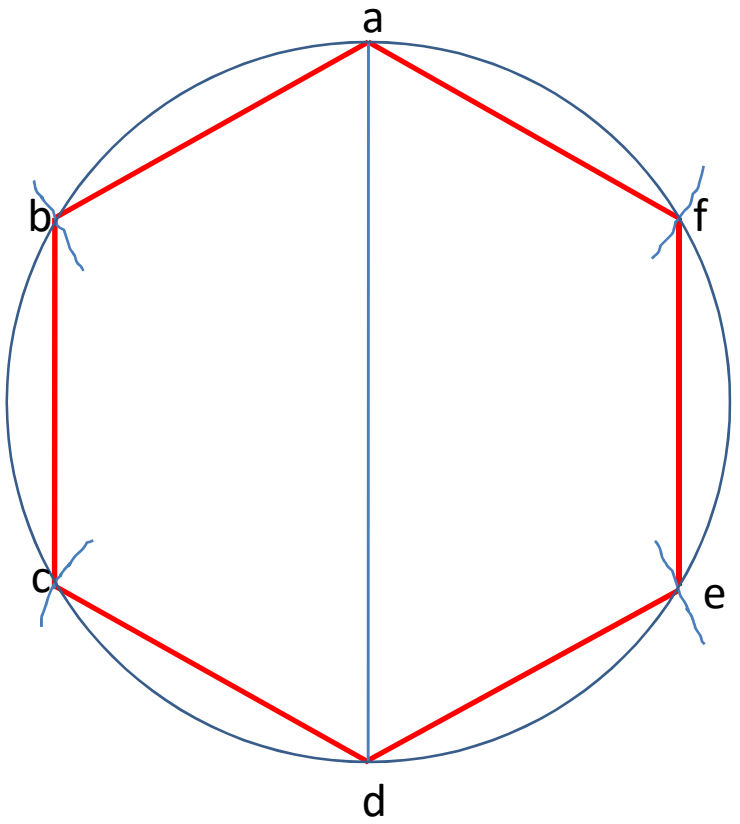
Corner Position Hexagon



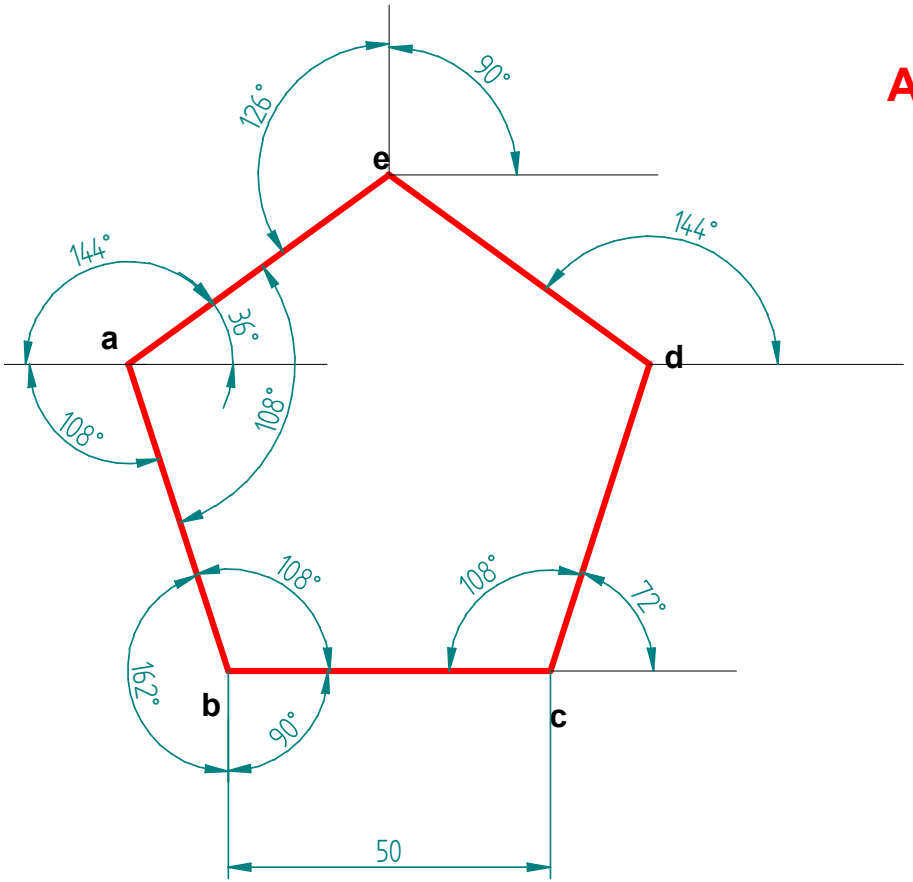


Edge Position Hexagon of side 50 mm





PENTAGON

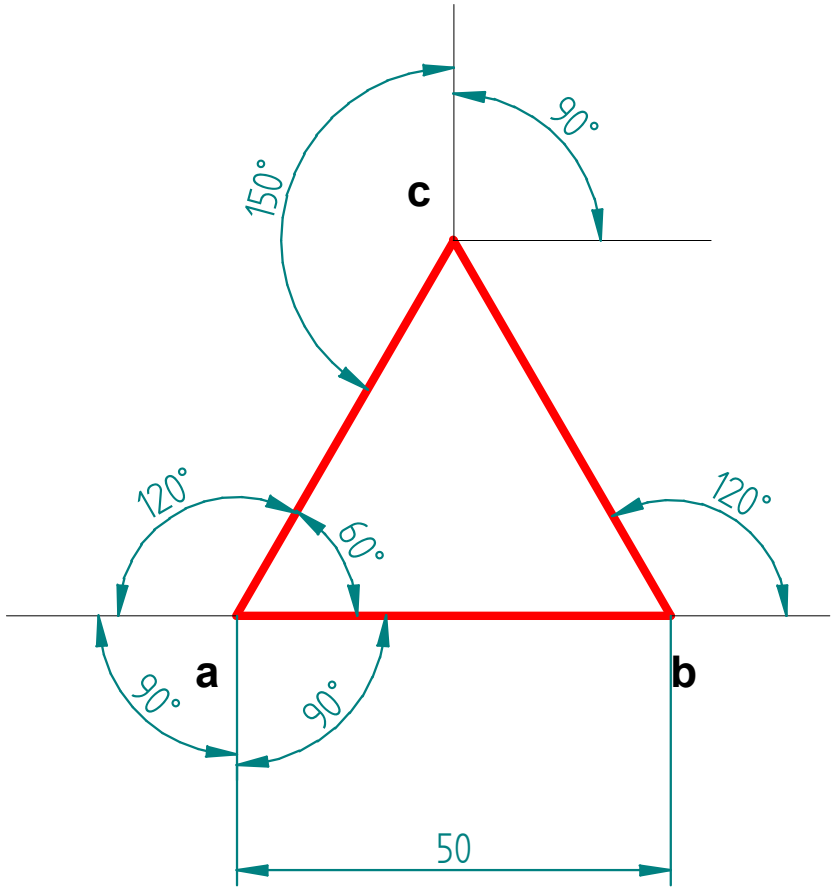


Length = 50 mm

Angles = 360/5 = 72 (72 , 144, 216, 288, 360)

1. **72**
2. **72 + 72 = 144**
3. **72 + 72+72 = 216**
4. **72 + 72 + 72 + 72 = 288**
5. **72 + 72 + 72 + 72 + 72 = 360**

TRIANGLE

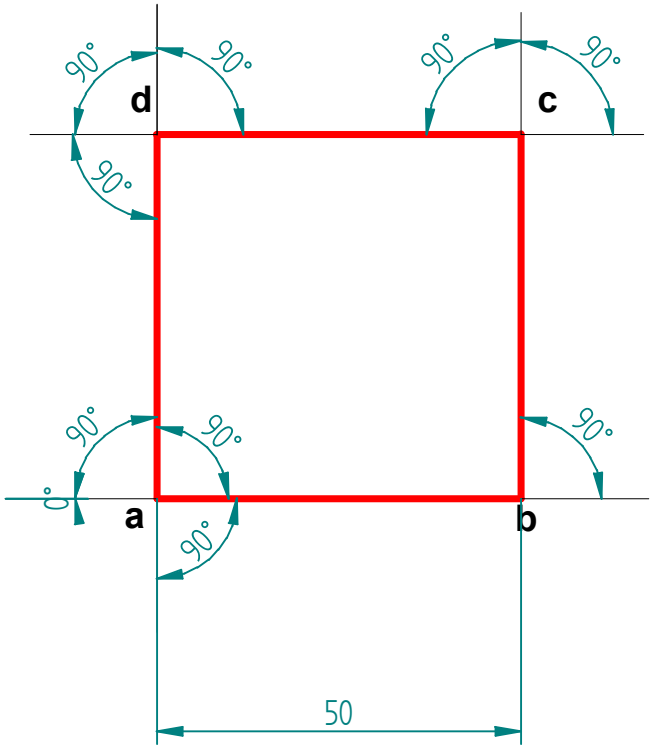


Length = 50 mm

Angles = 360/3 =120 (120, 240, 360)

1. **120**
2. **120 + 120 = 240**
3. **120 + 120 + 120 = 360**

SQUARE



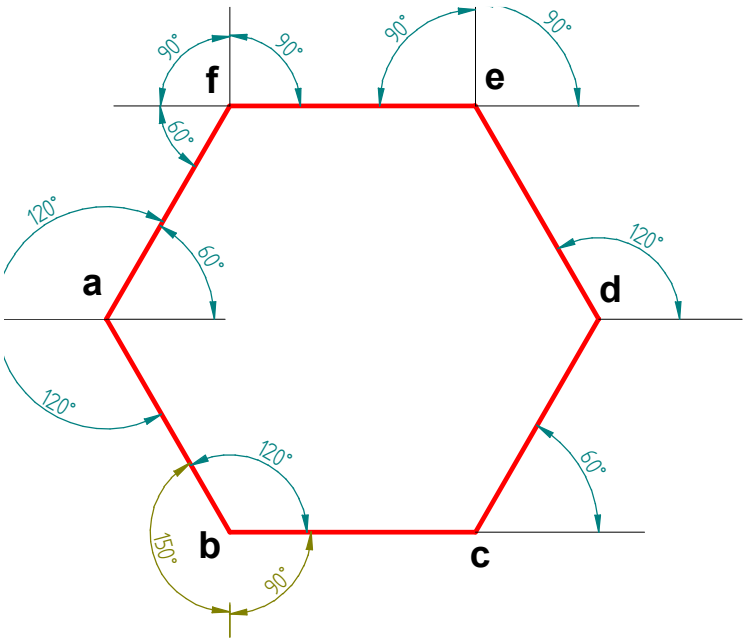
Length = 50 mm

Angles = 360/4 =90 (90, 180, 270, 360)

1. **90**
2. **90 + 90 = 180**
3. **90 + 90 + 90 = 270**
4. **90 + 90 + 90 + 90 = 360**

ORTHOGRAPHIC PROJECTION OF PLANES

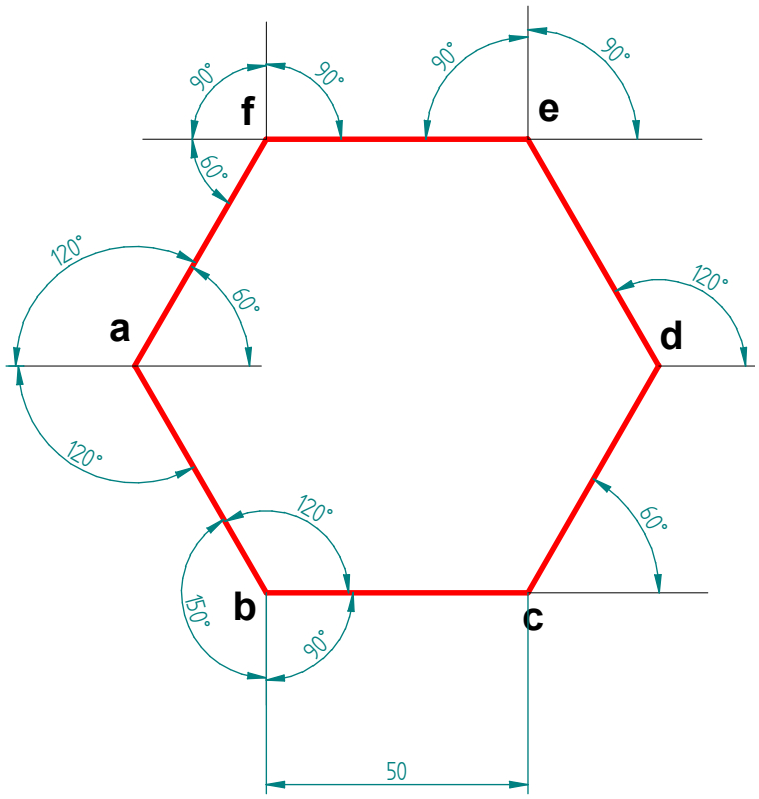
HEXAGON



Length = 50 mm
Angles = 360/6 =60 (60 , 120, 180, 240, 300, 360)

1. 60
2. 60 + 60 = 120
3. 60 + 60 + 60 = 180
4. 60 + 60 + 60 + 60 = 240
5. 60 + 60 + 60 + 60 + 60 = 300
6. 60 + 60 + 60 + 60 + 60 + 60 = 360

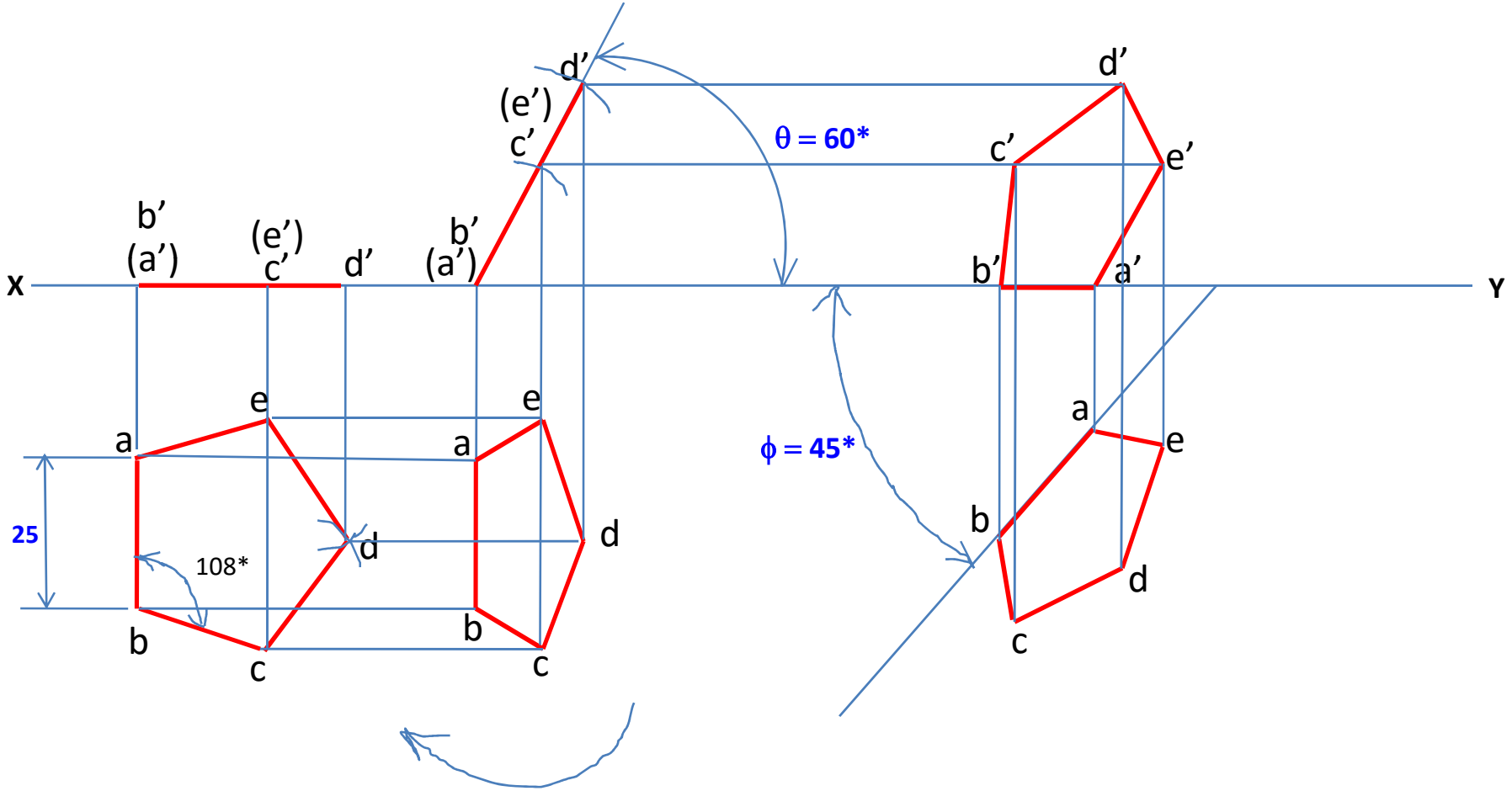
HEXAGON

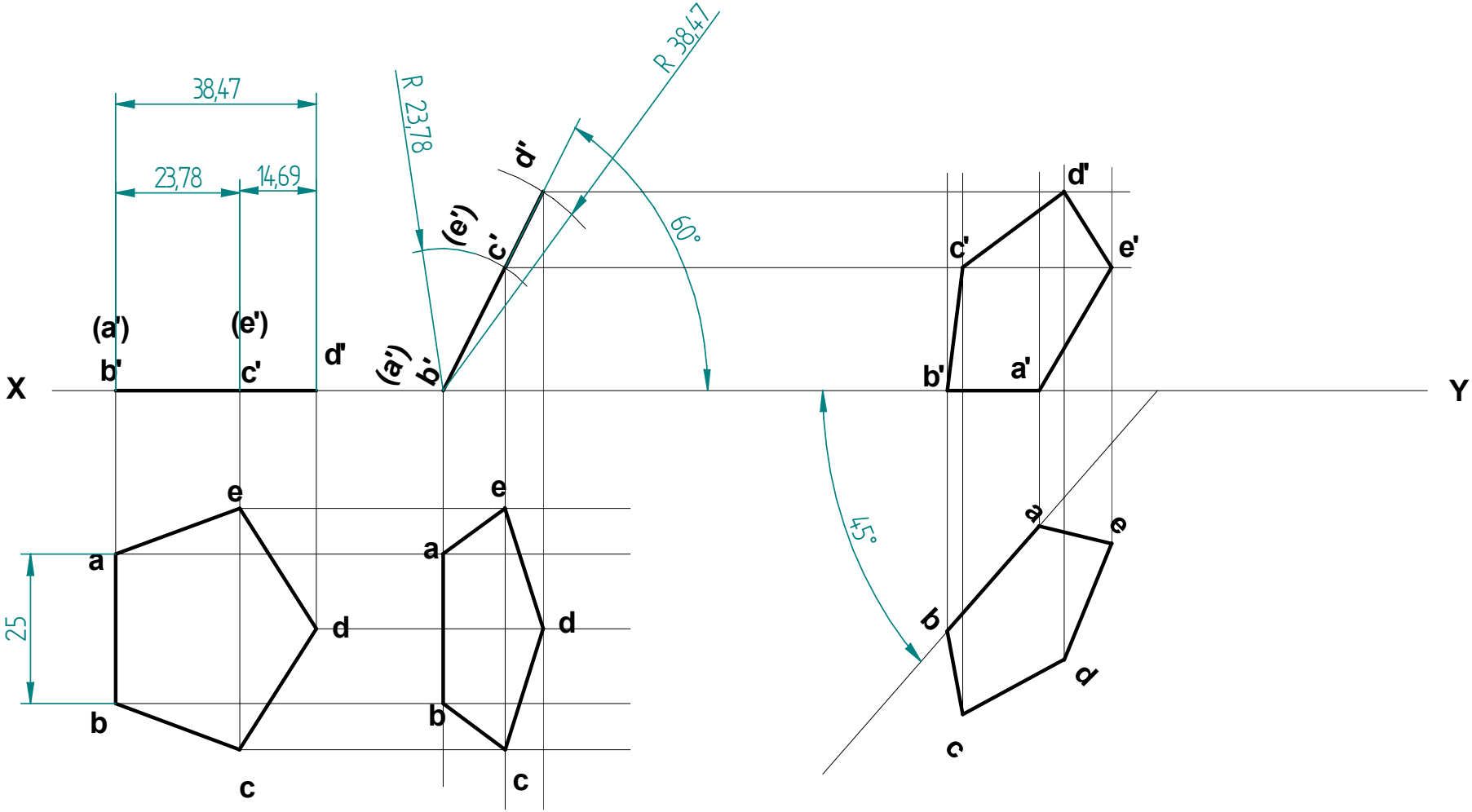


Length = 50 mm

Angles = 360/6 =60 (60 , 120, 180, 240, 300, 360)

1. 60
2. 60 + 60 = 120
3. 60 + 60 + 60 = 180
4. 60 + 60 + 60 + 60 = 240
5. 60 + 60 + 60 + 60 + 60 = 300
6. 60 + 60 + 60 + 60 + 60 + 60 = 360


X
Y
b'
(a')
(e')
c'
d'
b'
(a')
d'
(e')
c'
θ = 60*
d'
c'
e'
b'
a'
e
a
e
a
25
108*
d
d
b
c
b
c
ϕ = 45*
a
e
b
d
c


38,47
23,78
14,69
(a')
(e')
d'
b'
c'
X
Y
R 23,78
R 38,47
60°
45°
25
a
b
c
d
e