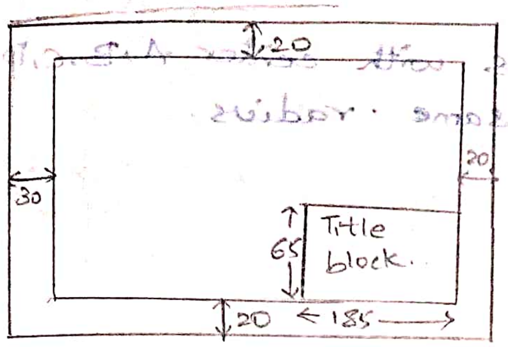
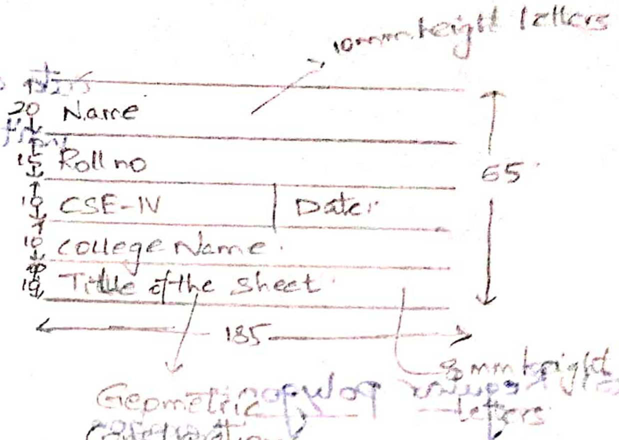
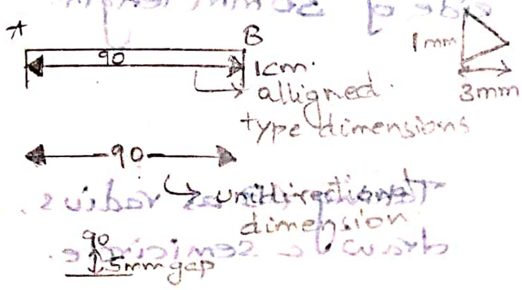
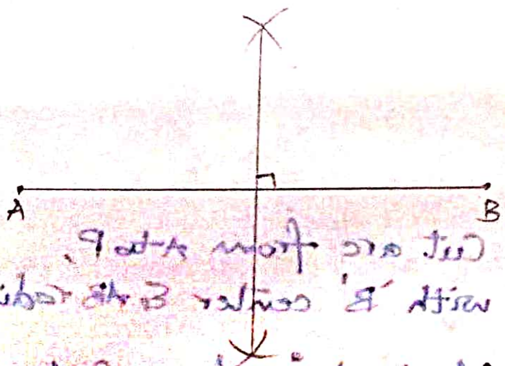
Geometric Constructions





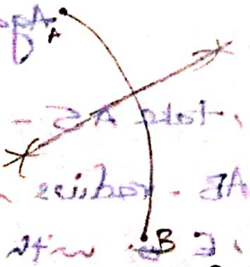


(1). Bisecting a line:-



Taking 'A' as center and more than radius draw arcs and similar with B and then join.

(2). Bisecting an arc:-

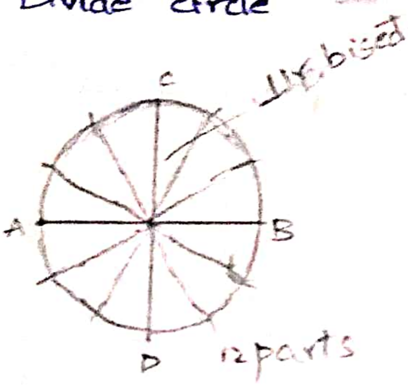


(3) Division of line in 'n' no. of divisions (6)

cut arcs with center 'A' on acutte line with any same radius.
draw 'B' to last arc.

draw parallel lines to last line

(4) Divide circle

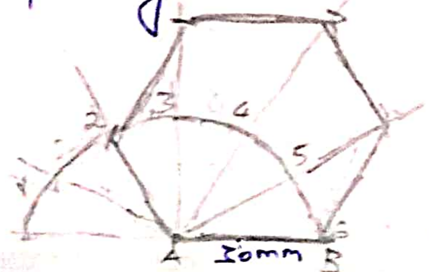


cut arcs with center A, B, C, D with same radius.

for 8 parts - draw only 1 arcs

(5) Regular polygon:-

Draw a regular ~~pentagon~~ hexagon with side of 30 mm length.

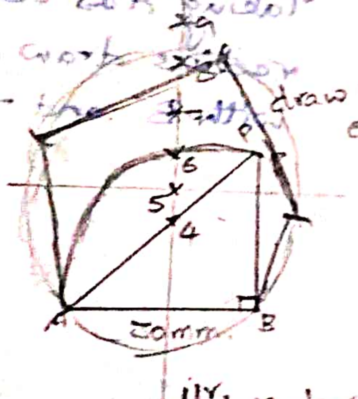


$\frac{180}{6} = 30°$

Taking AB as radius, draw a semicircle.

~~To~~ Cut arcs ~~on A~~ from A to 2 & 2 to 3, 3 to 4 .... with AB radius

General method:-



BP = AB

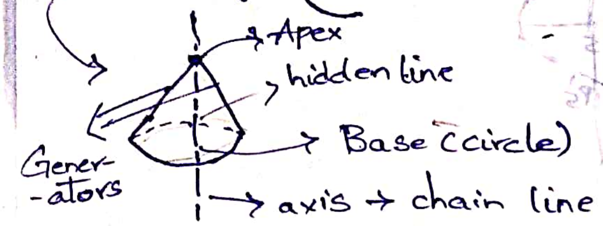
Cut arc from A to P, with 'B' center & AB radius

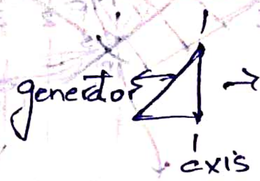
Again bisect 6 & 4

for drawing pentagon, take A5 - radius & B center as 5 draw a circle, taking AB - radius, center B draw arcs, again from C, D, E ~~or~~ with same radius.

CONIC SECTIONS:- Ellipse, Parabola, Hyperbola, rectangular hyperbola.

General method.



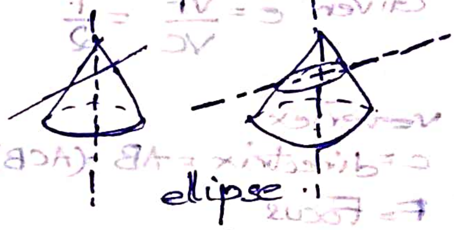


→ is rotated about axis to get cone.

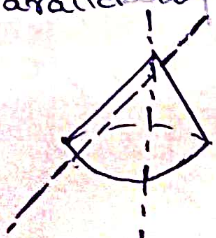
Section:- 2-D, no thickness H [L]

Section plane is used to cut cone at different angles.
→ then at 4 different angles → 4 different shapes
→ Conic sections.

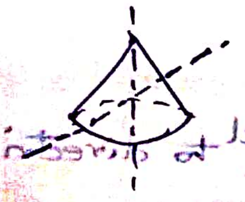
cut inclined to the base → ellipse



cut parallel to one of the generators → parabola.



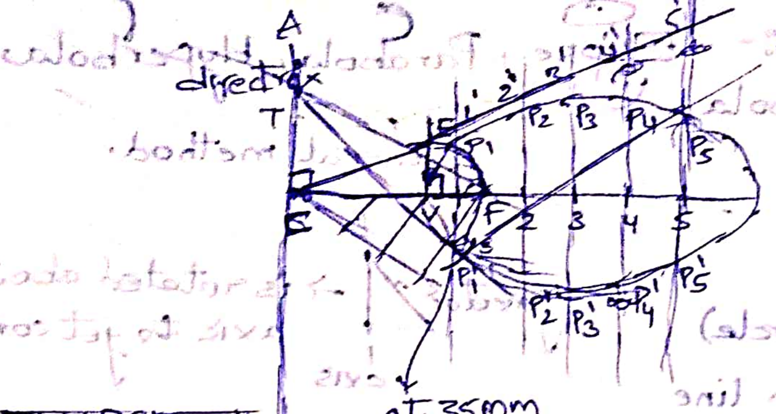
cut inclined to one of the generator → Hyperbola.



cut ⊥'ly on one side of the circle → Rectangular hyperbola.

General Method:- focus, eccentricity, directrix, vertex.

(1) Draw an ellipse when the distance b/n the focus and directrix is equal to 40mm & eccentricity is 1/2. Also draw a tangent and normal to the ellipse at a point 35mm from the focus.



at 35mm
draw tangent & Normal.

ELLIPSE $e=\frac{1}{2}$

ST - Tangent B.
SN - Normal.

Draw a ~~vertical~~ line. / CF

Given $e = \frac{VF}{VC} = \frac{1}{2}$ 1+2 = 3 parts,
Divide CF into 3 parts.
VF = 1 part, VC = 2 parts

V = vertex.
C = directrix = AB = (ACB)
F = Focus

Eccentricity = distance from vertex to focus divided by vertex to directric.

Draw a $\perp^r$ line to VF from V.
Draw an arc such that VF = EV

Join C with E.

Mark 1, 2, 3, 4, ..., 8 (min 8 to 12) randomly after vertex & should not coincide with focus

Mark 1 b/n V & F

Draw a line passing through '1', $\parallel^{el}$ to directrix.
Mark 1' along the line CE.
Taking 11' as radius and center F, cut an arc above and below the 'CF'
Taking radius - 22', 33', 44', 55' ... & center F cut arcs above & below the 'CF'

Only final diagram - ellipse and also namings A, B, C, 1, 2, 3, ... all markings - HB (continuous thick line)
- remaining - 2H (continuous thin line).

Draw an arc from F, and radius - 35mm, which cuts at S'. Join S' with F.

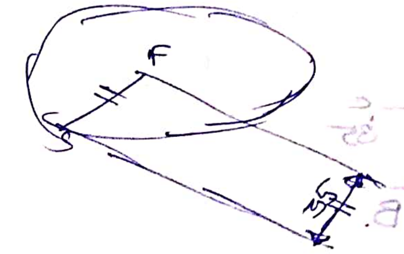
Draw a $\perp^{r}$ line from F to directrix at T.

Join T with S, ST → Tangent

$\perp^{r}$ to ST is SN → Normal.

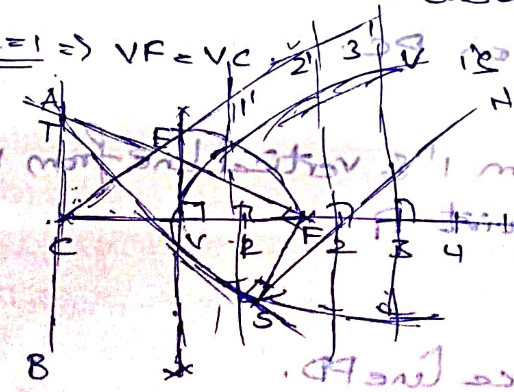
Dimension & Extension line – 2H.

40 → 2HB.



(2) Draw a parabola that has a distance 50 mm b/n the focus and the directrix. Draw a tangent and normal ~~to~~ at a distance of 40 mm to the focus.

$\underline{e=1}$ ⇒ VF = VC, V is $\perp^{r}$ bisector to CF



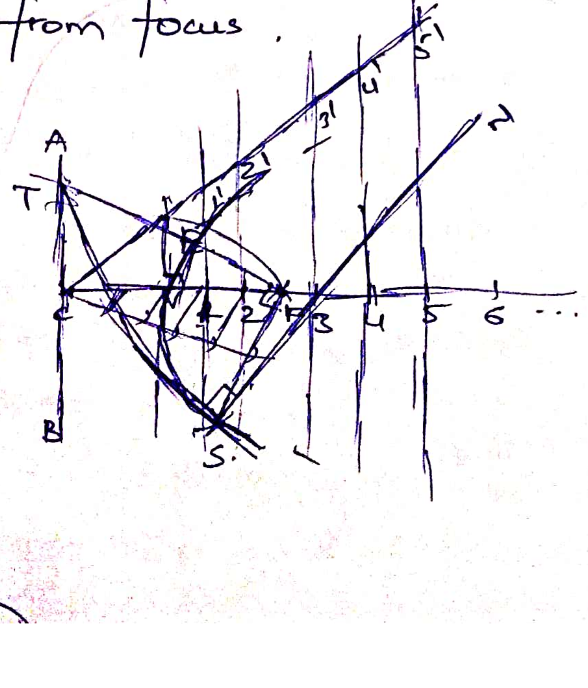
(3) Draw a hyperbola with distance b/n its focus & directrix equal to 75 mm and eccentricity = 3/2. Draw ~~to~~ a tangent and normal to the curve at a distance of 65 mm from focus.

CF = 75mm

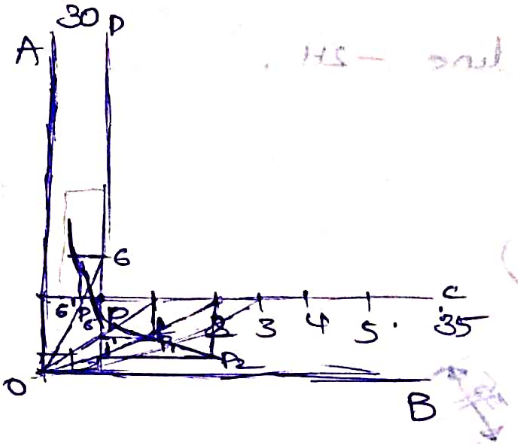
$e = \frac{3}{2}$ = '5' parts = $\frac{VF}{VC}$.

VF = 3parts

VC = 2 parts



Draw a rectangular hyperbola having its two lines inclined at 90° to each other and passing through a point at a distance of 30 mm from one line and 35 mm from other



Draw OA $\perp^r$ OB.

Draw C & D lines at distances 35 & 30 mm resp.

Mark P (intersection)

Mark 1, 2, 3 randomly on PC.

Join O1 and marks 1'.

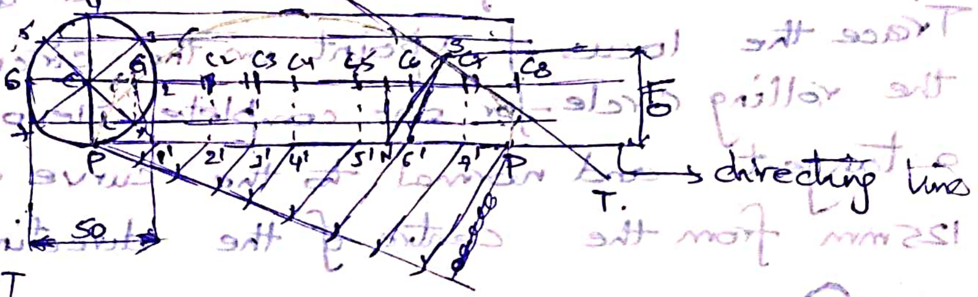
Draw horizontal line from 1' & vertical line from 1 and mark intersection point P_1

Join O & 2 and mark 2'

Draw similarly on vertice line PD.

Cycloid:-

Q) A circle of ~~150~~ 50 mm diameter rolls along a straight line without slipping. Draw the curve traced out by a point 'P' ~~from~~ on the circumference for ~~one~~ one complete revolution of the circle. Name the curve, draw a tangent to the curve at a point ~~of~~ on it at 40mm from the line.



CYCLOID

ST - TANGENT

SN - NORMAL

Draw a circle of diameter 50mm.

- Mark P.

Take a straight line of $2\pi r$ length.

$PP' = 2\pi r$
$= 2 \times 3.14 \times 25$
$= 157$ mm.

Divide the circle into '8' equal parts and also line into '8' equal parts.

For circle the point right to P touches the ground first. So mark it as '1'.

Extend G_2 ∥el to PP.

Marks points $C_1, C_2, C_3 \ldots$ ∥el to CP.

This circle is called as ~~directing~~ generating circle.

Draw a line ∥el to PP' passing through '1', so it also passes through '7'.

Draw a line ∥el to PP' passing through 3, 5 and also line through 4.

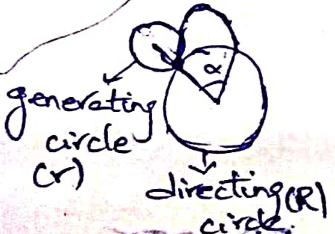
Taking radius - CP, and centre as $C_1, C_2, C_3, \ldots, C_8$, cut along line passing through 1, 2, ..., 8.

Set the drafter along PP and check the vertical distance to the semicircle, the point where the curve is cut at 40mm, draw a tangent at 'S'.

Taking CP = radius, draw an arc from 'S' to the line $C_1, C_2 \ldots C_8$. Drop a line ||el to CP on 'PP'. Mark it as N. Join SN - Normal.

Epicycloid:-

Q:- A circle of 50mm diameter rolls on the circumference of another circle of 175 mm diameter and outside it. Trace the locus of a point on the circumference of the rolling circle for one complete revolution. Draw a tangent and normal to the curve at a point 125mm from the centre of the directing circle.

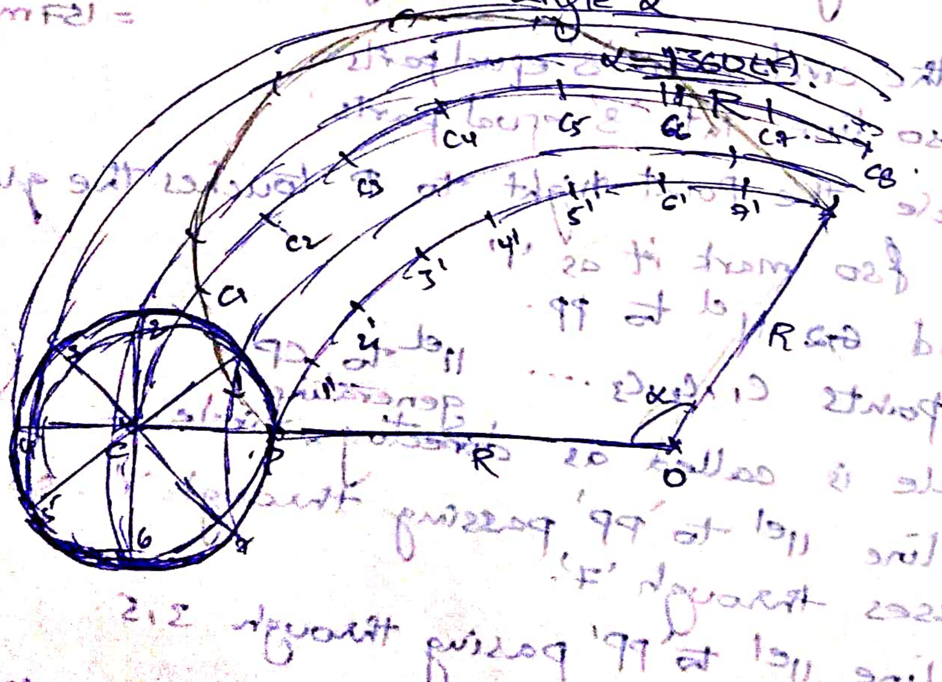


generating → the circle responsible for generation of a curve

directing →

It covers some angle 'α'

$\alpha = 360 \times \frac{r}{R}$



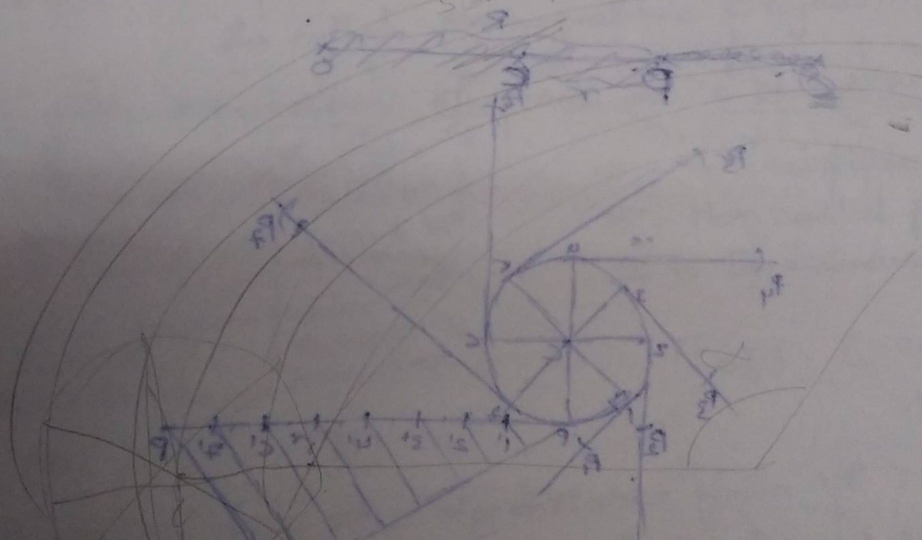
e vertical
where the
at S,
s' to the
to CP on PP'

circumference
and outside it.
cumference of
olution. Draw
at a point
ting circle.

sponsible for
f a curve

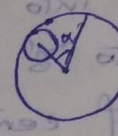
$\alpha = 360 \times \frac{r}{R}$.

Draw a line of 175/2 length (R). = OP.
Extend OP to C such that CP = r
Draw the circle, centre 'C' & radius 'CP'
Draw the arc of angle 'α'.
Divide circle into '8' equal parts.
Divide 'α' into '8' equal parts.
Plot line of centers.
Taking CP radius, center $C_1, C_2, \ldots, C_8$
cut arcs on line passing through ~~1 2~~ 17, 26, ...



Hypocycloid:- a circle rotates inside another circle.

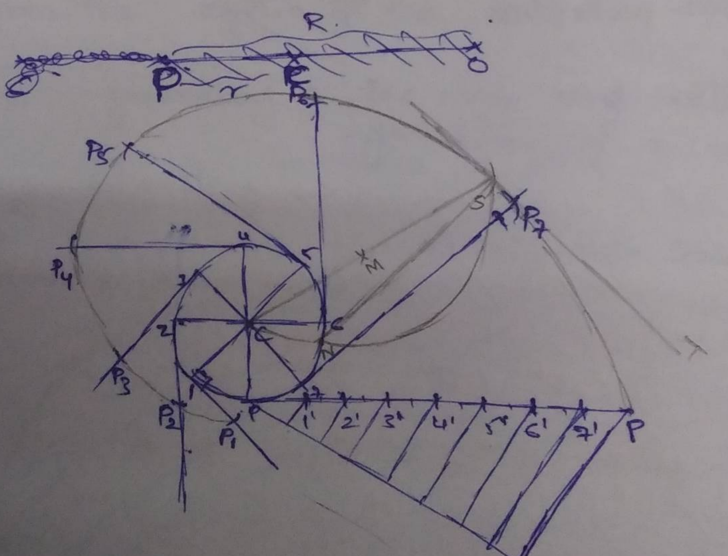
Q:- Construct a hypocycloid, rolling circle 50mm diameter and directing circle 175 mm diameter. Draw a tangent to it at a point 50mm to the center of directing circle.



$r = 25mm$, $R = 87.5mm$

Involute:-

Q:- Draw an involute of a circle of 40mm diameter. Also draw a normal and tangent to it at a point 100mm from the center of the circle.



Draw a circle of diameter 40mm

Divide it into '8' equal parts.

the point left to 'P' open first, mark it '1'.

Draw a line $= 2\pi r$ length, draw a line $\perp^{lr}$ to C1

Taking radius P1', ~~draw~~. centre 1, draw an arc on '1' line and mark P_1

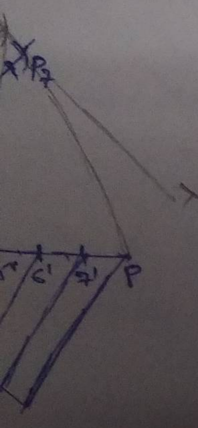
Continue with 1, 2, 3, ...

Draw arc from C to curve & mark 's'. mark centre of CS.

Taking radius 'CM', centre 'M' draw a semicircle, it touches circle at 'N'.

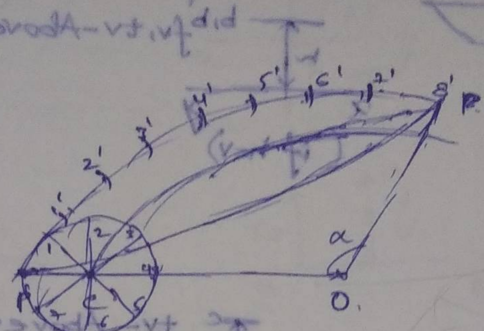
another circle.
g circle 50mm diameter
er, Draw a tangent to
nter of directing

of 40mm diameter.
nt to it at a point
circle.



, mark it '1'.
line $\perp^{lr}$ to C1
1, draw an arc

mark 's'. mark
w a semicircle, it touches circle at 'N'.

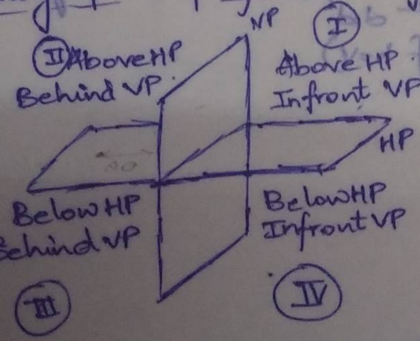


Projection of points :-

Orthographic projection :-

line used to project (object) body on plane - projectors
angle b/n projector & plane - 90°.
So called Orthographic projection.

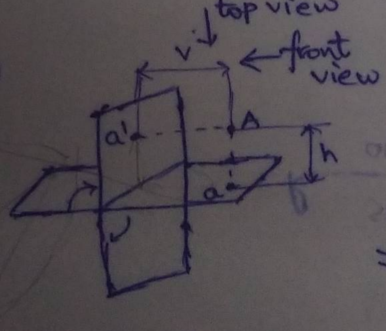
Orthographic projection of point on 4 Quadrants :-



VP - Vertical plane
HP - Horizontal plane
I to IV - Quadrants

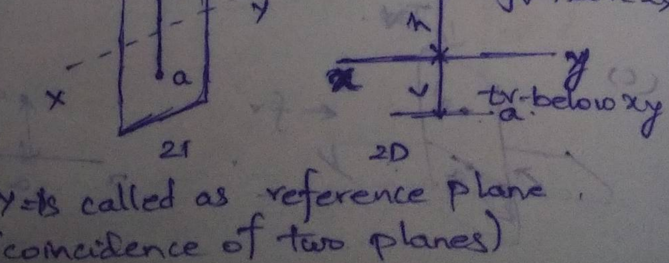
H - distance from HP, V - distance from VP.
A, B, C, D - points in I, II, III, IV Quadrants.

I



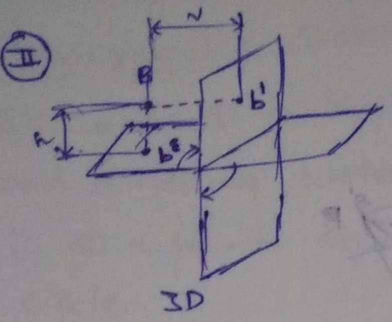
3D
HP rotated clockwise.

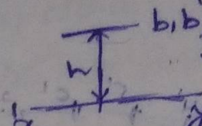
a' - front view of A → distance 'h'
a - top view of A. 'v'



XY - is called as reference plane.
(coincidence of two planes)

(II)



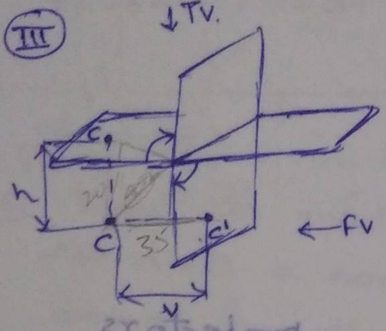


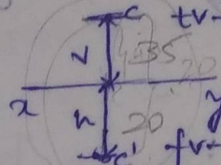
b,b' fv, tv - Above xy

(if h=v)

(III)

↓Tv.

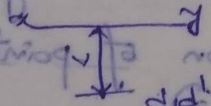




tv - Above xy.

fv - below xy.

(IV)

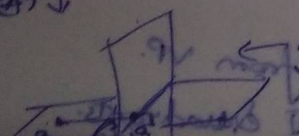


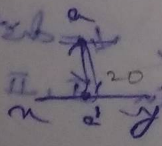
fv, tv - below xy

(if h=v)

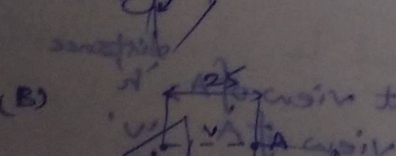
Exercise-9 pg-193

(1) (A) ↓ T.V



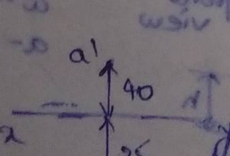


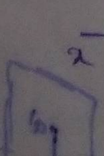
(B)

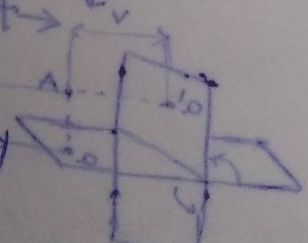


a' - front view

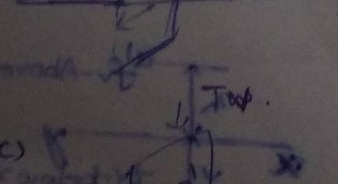
a - top view

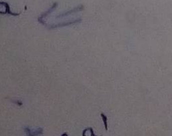




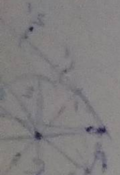


(C)





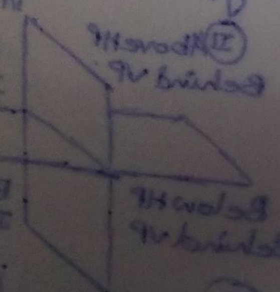
tv-Above xy

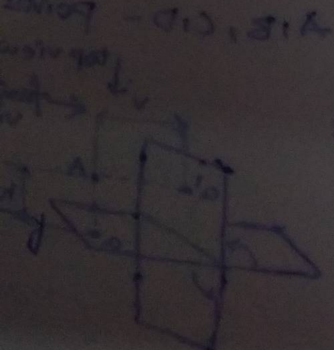


Above xy.

below xy.

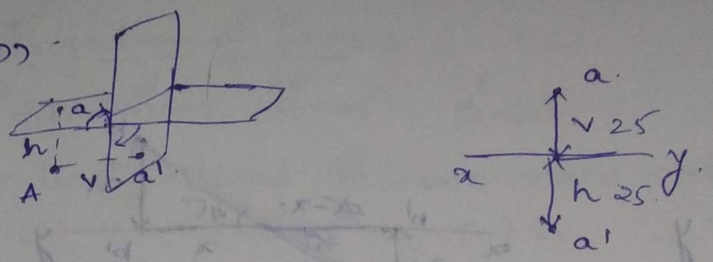
fv,tv-below xy



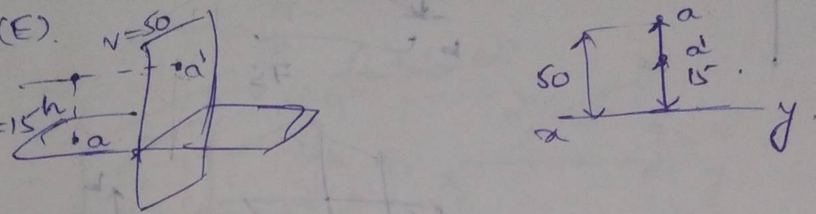


y

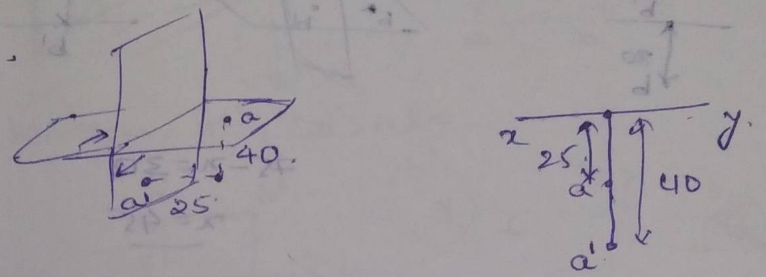
(D)



(E).

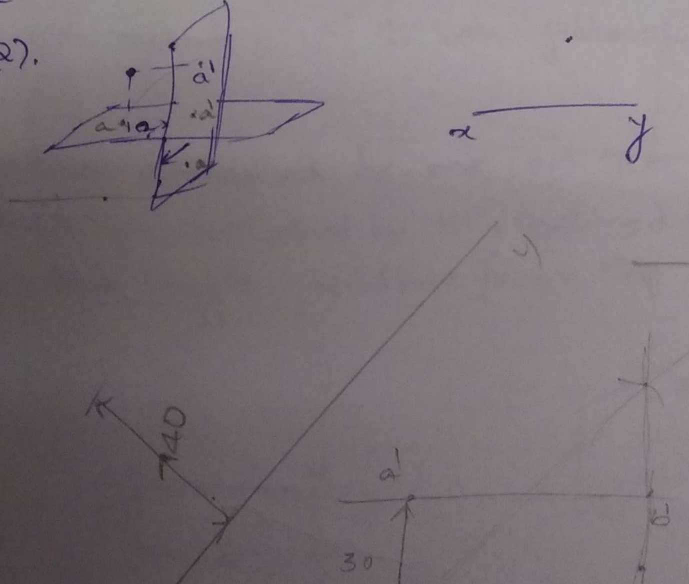


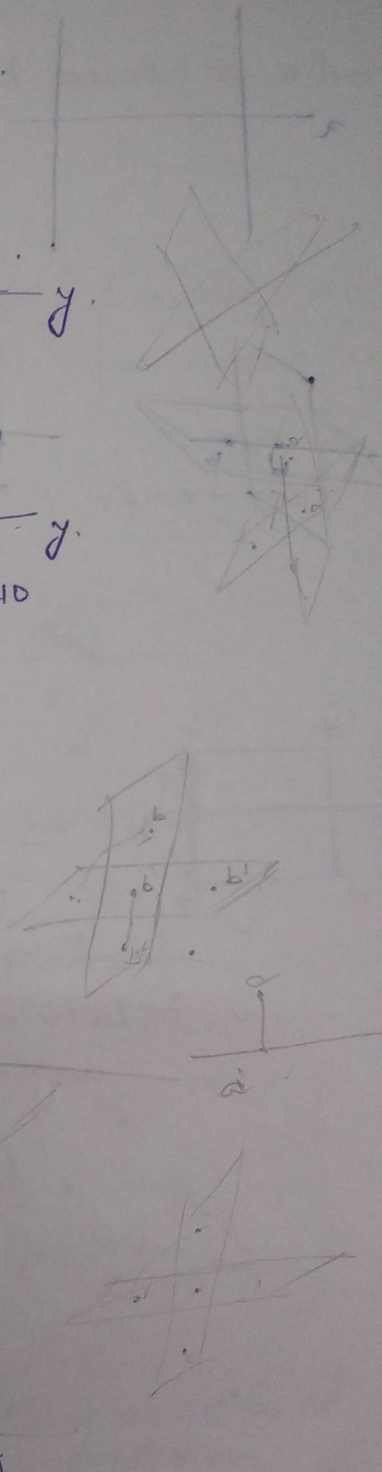
(F).



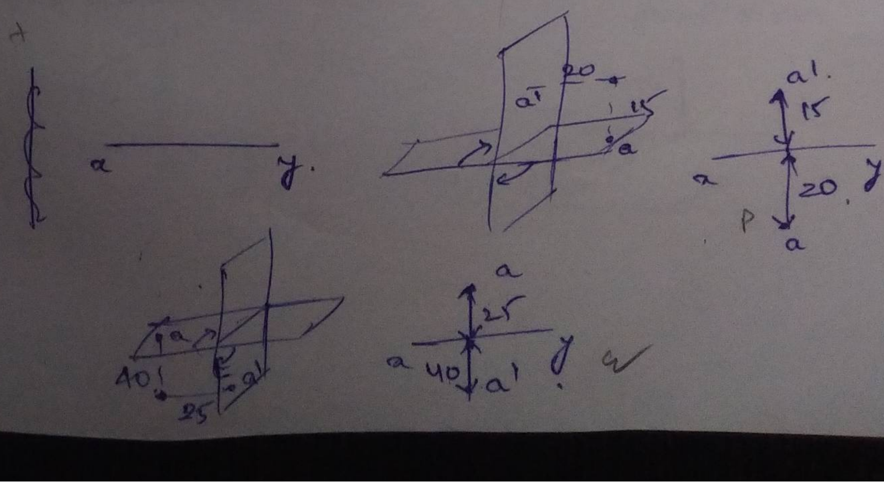
(G).

(2).

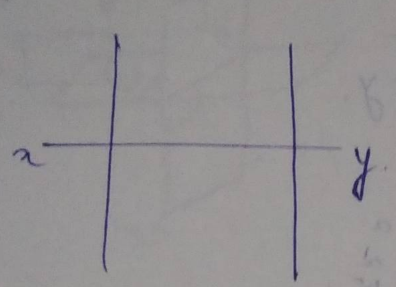


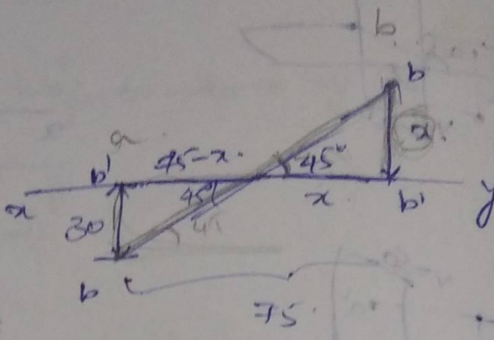


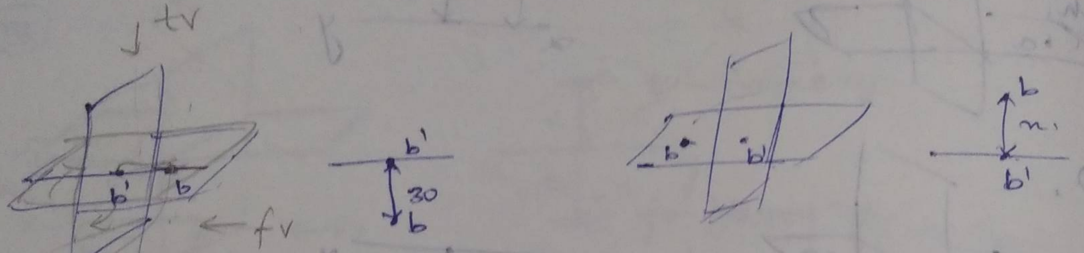
(4).



(6).

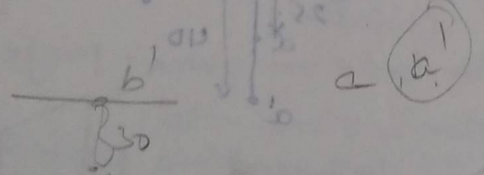


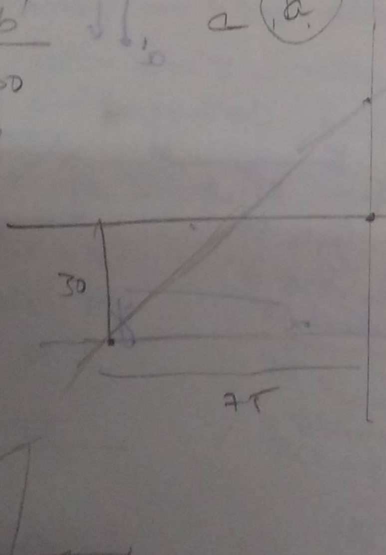


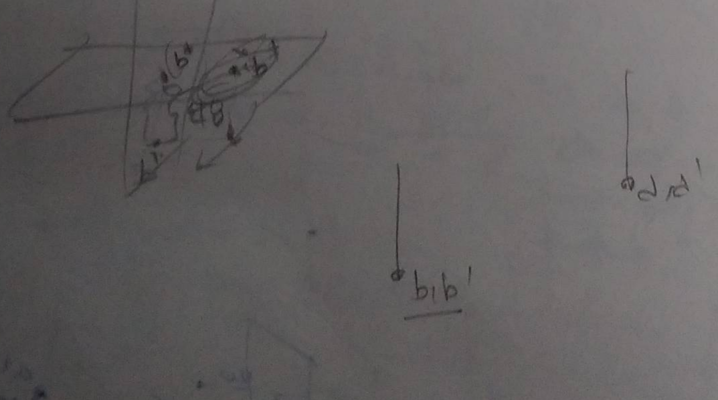


$75 - x = 30$

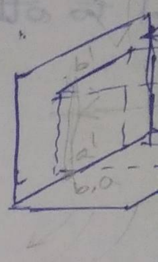
$x = 45$



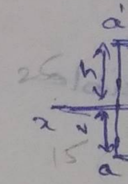




Projection...
Let AB = 75mm...
(1) line inc...
(a) 75mm...

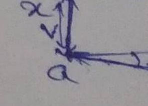


(b) 75m...

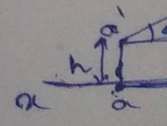


(c) 75m...

(2) line cont...
(a) 75mm, c...
true len...



(b) 75mm, ...

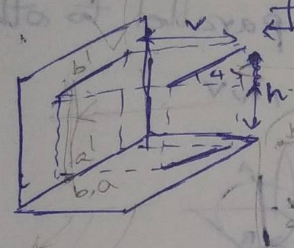


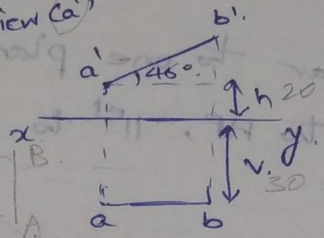
Projection of lines :-

Let AB = 75mm, H.P $\theta = 45^\circ$, VP $\phi = 30^\circ$.

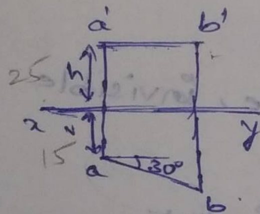
(1) line inclined to one plane and parallel to other.

(a) 75mm, 45°, ||el to VP, h&v

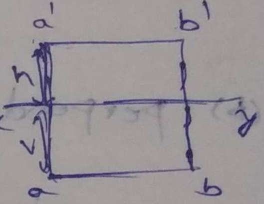




(b) 75m, ||el, 30°, h&v.

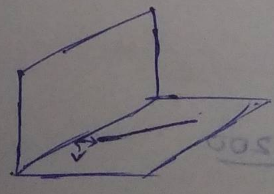


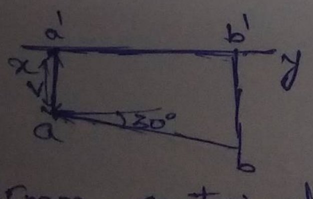
(c) 75mm, ||el to both planes, h&v.



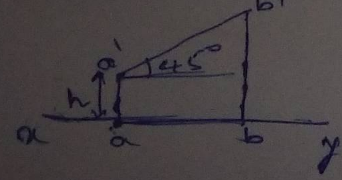
(2) line contained by one (or) two planes

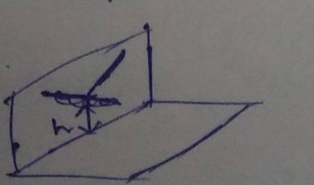
(a) 75mm, contained by HP, inclined to VP at 30°, v
true length visible from top view.



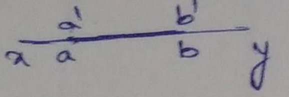


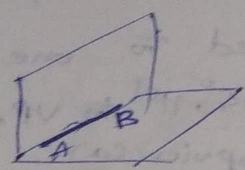
(b) 75mm, contained by VP, h, & inclined at 45° to HP.
front view





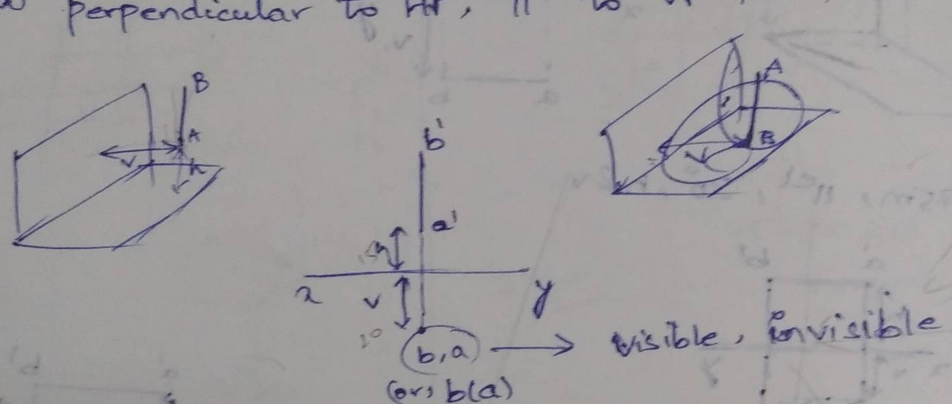
(c) 75mm, contained by both planes.



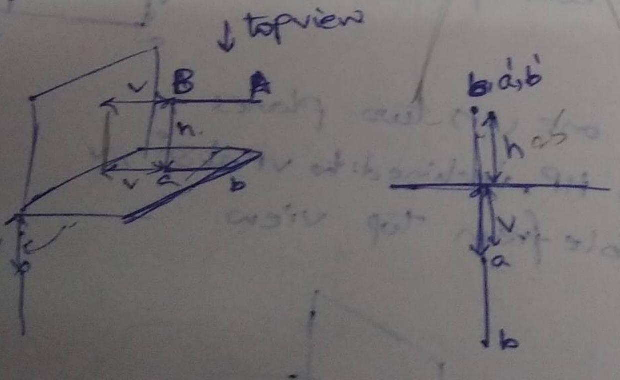


(8) line perpendicular to one plane, parallel to other

(a) perpendicular to HP, $||^{el}$ to VP, h, V.



(b) perpendicular to VP, $||^{el}$ to HP, h, V.



Ex-10(a) pg-200

(1) (a) (i).

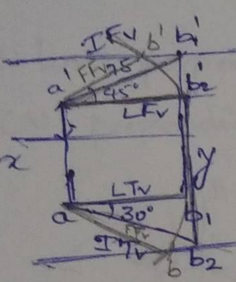
lines inclined to both planes

Pg-216 (10.11) :- AB = 75mm, ab = 65mm, a'b' = 50mm

A → in H.P & 12 mm infront of VP

Find θ & φ

75mm, θ = 45°, φ = 30°



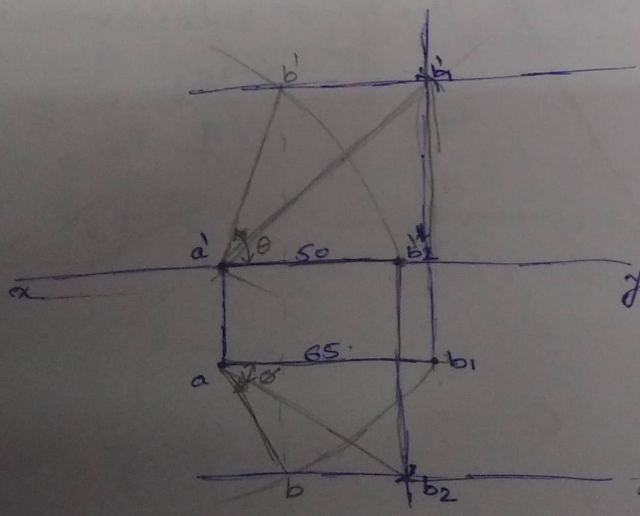
locus of b_1'
$a'b_2'$ radius
a' centre

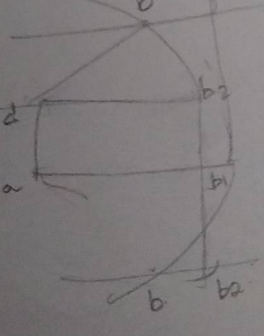
x ——— y

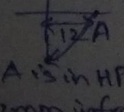
locus of b_2
ab_1 radius
a centre

IFv - initial Front view
LTv - length of Top view.
ITv - initial Top view
LTv - length of Front view

FFv - Final front view
FTv - Final Top view







A is in HP
12mm infront of VP

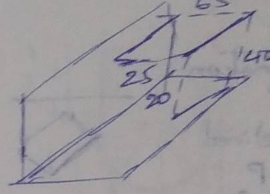
L.Tv - ab_1
L.Fv - $a'b_2'$

Extend b_1' and from a' draw an arc length AB = 75mm. ($a'b_1'$)

Similarly with b_2, a to b_2 - 75mm.

Now draw lo...
draw arcs f...
bb' must be...

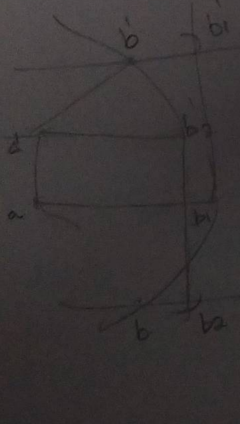
Pg-217 (10.12)
A → 20mm a...
B → 40mm a...
Find θ & φ



draw, a', a, ...
cut arc from...

, a'b'=50mm

y



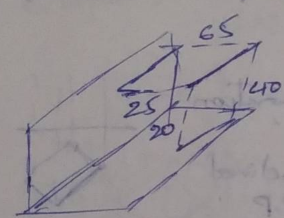
draw an arc length

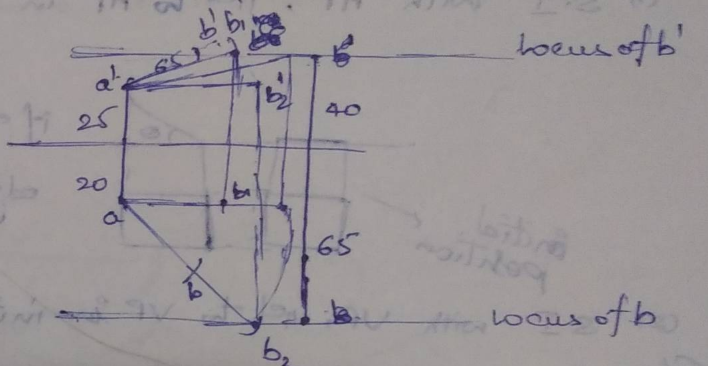
b_2 - 75mm.

Now draw locus of b_1 & b_2
draw arcs from a' & radius $a'b_2'$
a & radius ab_1.
bb' must be on same line.

Pg - 217 (10.12)

A → 20mm above HP, 25mm infront of VP. AB=65m.
B → 40mm above HP, 65mm infront of VP.
Find θ & Ø





draw, a', a, b', b, locus of b' & locus of b.
cut arc from a' & radius 65
a & radius 65

Projection of planes :-

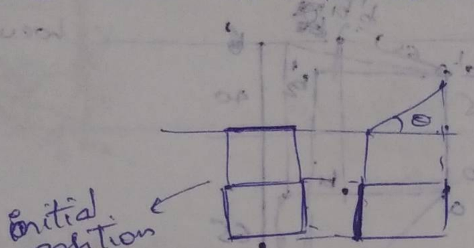
Surface inclination , edge inclination.

→ plane inclined to horizontal plane.

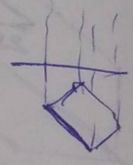
True length not known in top & front view.

Now, put it ||el to H.P and project (T.P - True length) and then incline it.

(1) S.I with HP, ||el to HP in initial position (F.V)



if edge inclination 'α' edge is inclined with V.P then →



(2) S.I with VP, ||el to VP in initial position.

Edge :-

(1) when edge inclination with HP, Edge $\perp^{r}$ to HP in initial position

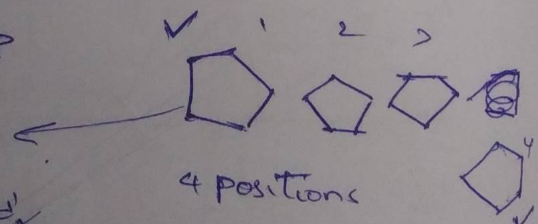
(2) when ~~ed~~ E.I with VP, Edge $\perp^{r}$ to VP in initial position.

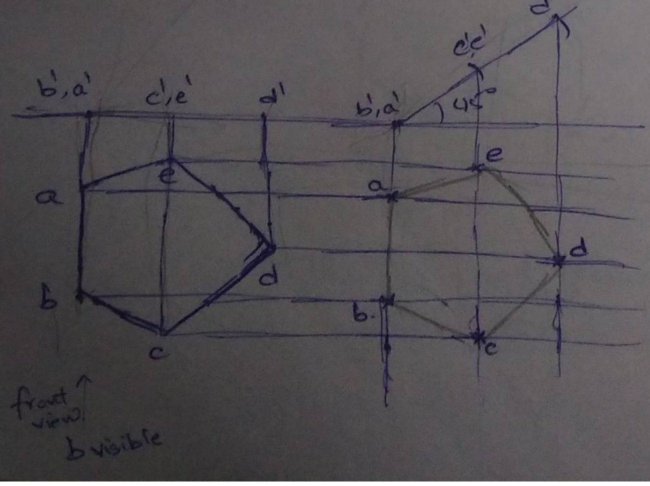
Pg-260 problem 12-4

regular pentagon - 25mm. one side is on ground
one side on HP.

S.I with H.P = 45°.

Initial position :- ||el to HP



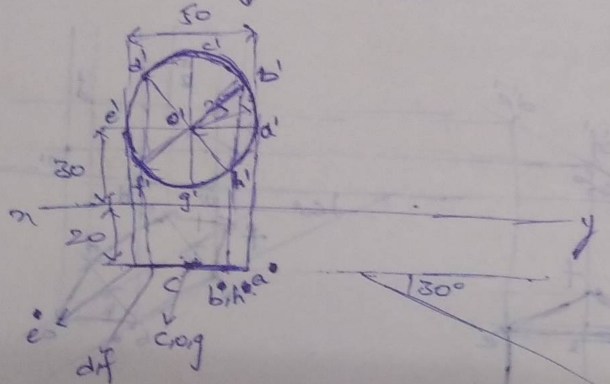


Take radius c'e' and centre b'a' and cut arcs.
d' and centre b'a'

Now, project lines from b'a', c'e', d'.
and also from a, b, c, d, e, and mark the intersection points.

pg-261 problem 12.5

circle - 50mm diameter, SI 30° to VP
centre :- 30mm above HP and 20mm infront VP.
↓T.V - line.

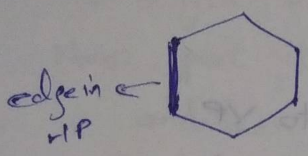


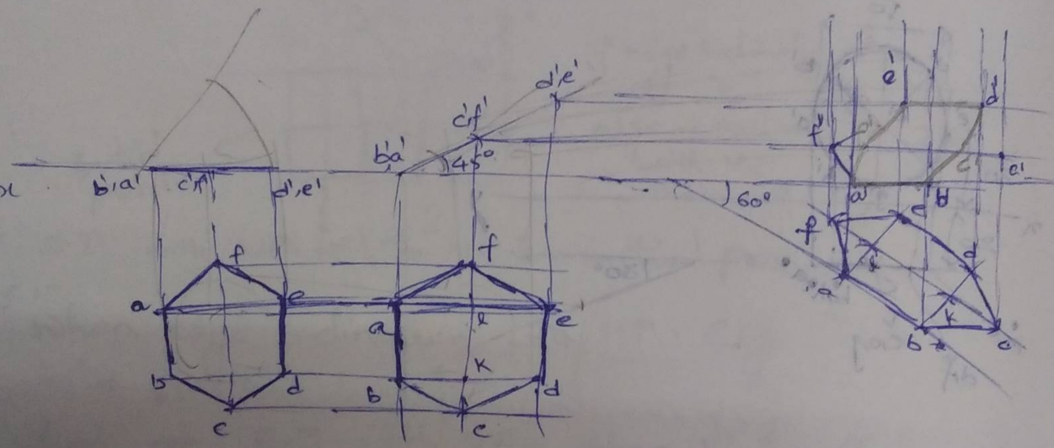
Divide the circle into 8 equal parts.
front view - circle, top view - line.
Take radius .

Pg-263 problem - 12.8

Hexagon, 25mm side, S.I with HP = 45°

one of its sides in HP E.I with VP = 60°.





S.I with HP
= 45°.

∠ b/n ab & ae = 90°. arc from a to line radius ae

ab & bd = 90° arc from b to line radius bd

from b to k - distance

arc from b to line radius bk

cut arc from k and radius kc.

l and radius lf

12.6, 12.9

Total - 5 - 12.4, 12.5, 12.8, 12.6, 12.9