

# Development of Surfaces 3-2

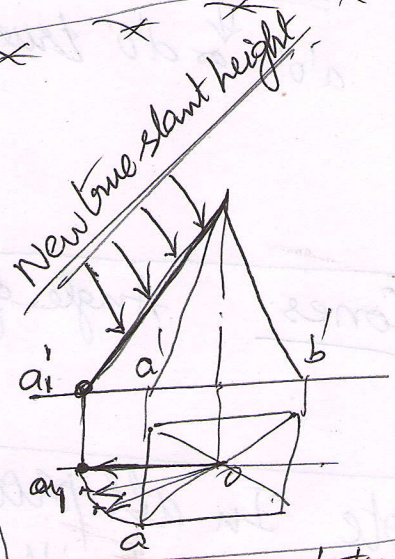
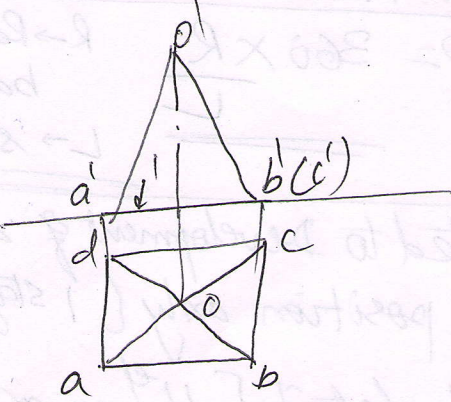
In pyramids, development is obtained by radial line method. Here, the true length is to be drawn first.

To determine the true length, the slant height is taken for consideration:

Rule: \* A slant height ( $a'o'$ ) <sup>in FV</sup> will represent the true slant height if its top view ( $ao$ ) is parallel to  $xy$

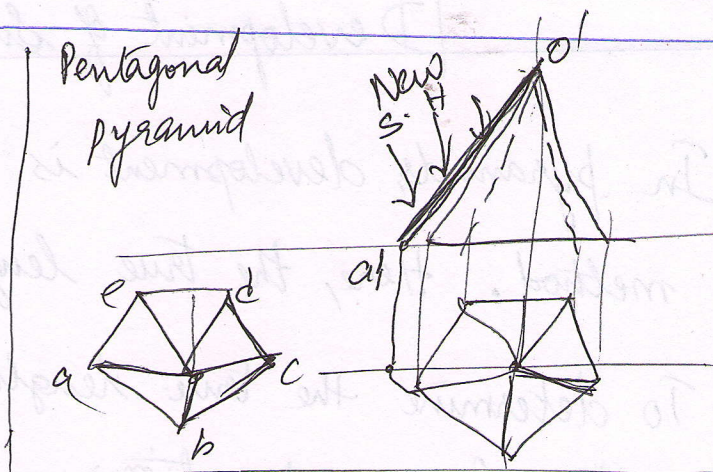
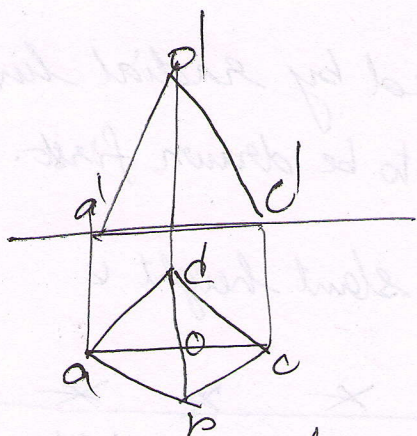
If any one line joining corner of polygon to its center in top view [ie  $ao, bo, co, do, eo$ ] is not parallel to  $xy$ , then none of ( $a'o', b'o', c'o', d'o', e'o'$ ) will represent the true slant height.

In such case, a new true slant height ( $a_1'o'$ ) is to be created by drawing  $a_1o$  in such a way that  $a_1o \parallel xy$

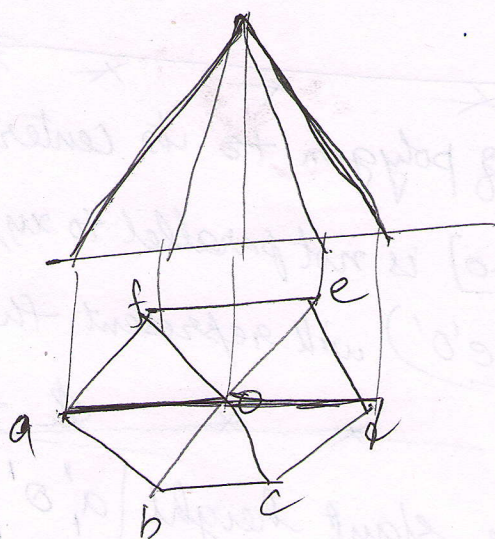


observe that  $ao, bo, co, do$  are not  $\parallel$  to  $xy$ .  
Hence  $a'o'$  or  $b'o'$  is not true slant height

To get  $oa_1$ , take  $o$  as center,  $(oa)$  as radius draw arcs till  $oa_1$  is  $\parallel$  to  $xy$

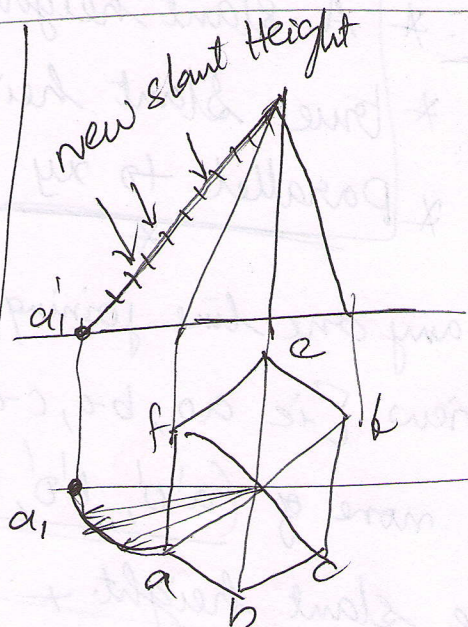


Here as  $ao \parallel xy$ ;  $a'o'$  is true slant Ht



$ao, do \parallel xy$

$a'o'$  or  $d'o'$  true sl. Ht.



$ao/fo/do/co$  not  $\parallel xy$ .

$\therefore a'o', f'o', d'o', c'o'$   
does not represent true slant Ht  
 $\therefore$  New slant Ht to be created

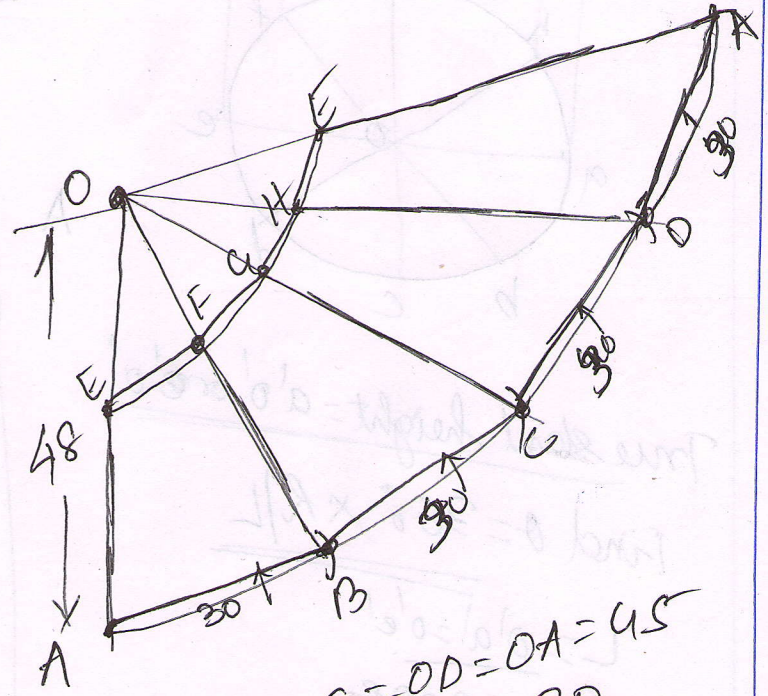
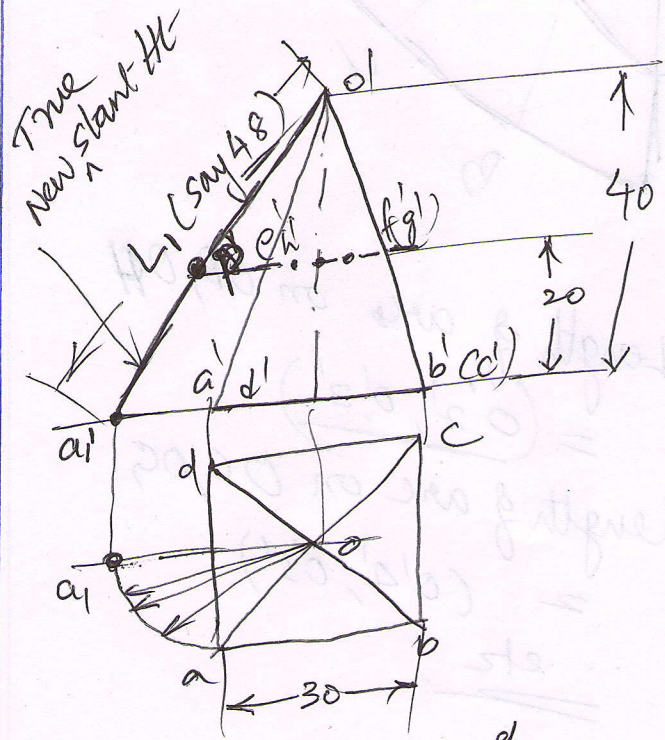
Cones: Angle of sector =  $\theta = \frac{360 \times R}{L}$

$R \rightarrow$  Radius of base circle  
 $L \rightarrow$  slant height

Note In all problems related to Development of surfaces, the solid will be in simple position only (1 stage problem)  
 $\therefore$  Focus only on starting side detail [ $\parallel xy$  or  $\perp$  to  $xy$ ]

15) A square pyramid of base 30 mm sides and axis 40 mm long has its base on HP such that an edge of its base is perpendicular to VP. It is cut by a section plane (horizontal) bisecting the axis. Draw the development of the frustum of the square pyramid.

Shape: Square pyramid,  $(B, H) = (30, 40)$   
 Condition: Base on HP (start in TV; 1 stage)  
 Starting side:  $\perp$  to VP  $\Rightarrow \perp$  to xy.  
 Section plane:  $\parallel$  to xy.  
 Position on axis: bisecting axis ( $\frac{40}{2} = 20$  mm)

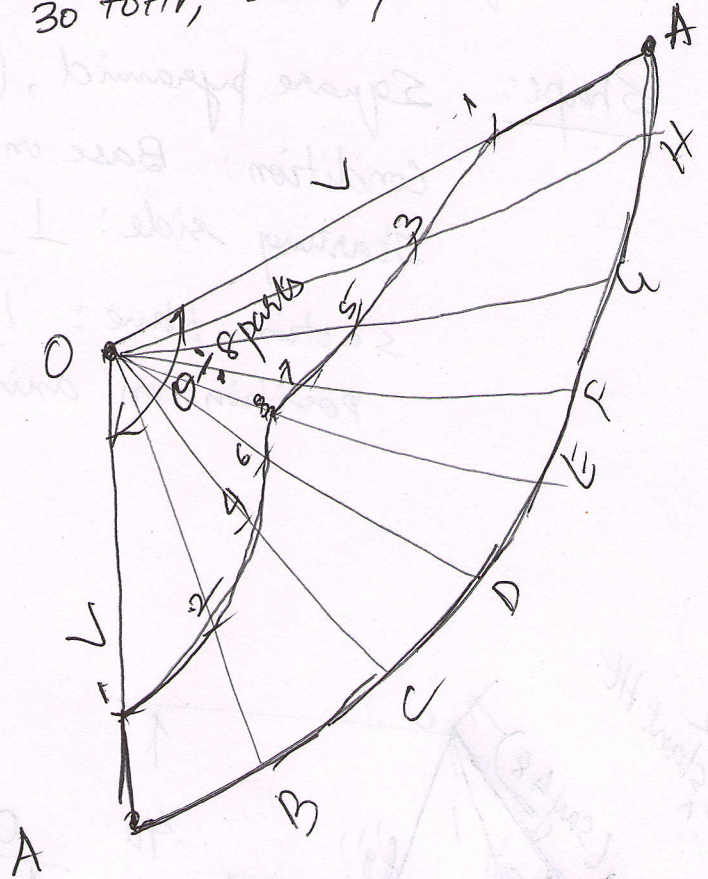
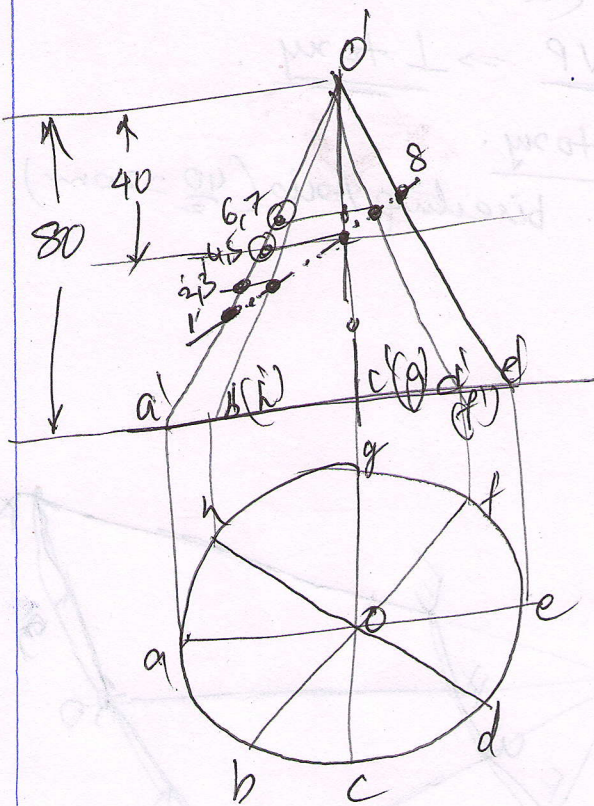


As  $ao/bo/co/do$  not  $\parallel$  to xy;  
 Create  $a_1o_1$  & get  $a_1o_1'$

$OA = OB = OC = OD = OA = 48$   
 $AB = BC = CD = DA = 30$   
 $OE = OF = OG = OH = OP$  (on  $o_1a_1'$ )

16) Draw the development of lateral surface of a truncated cone obtained as per data given here: diameter = 50 mm; Axis = 80 mm; resting on base on HP is cut by a plane  $30^\circ$  to HP and passing through mid point of axis.

Shape: Cone ( $\phi 50, 80$ ); position: Base on HP (TV)  
Section plane:  $30^\circ$  to HP, Bisecting Axis



True slant height =  $a'o'$  or  $e'o'$

Find  $\theta = 36^\circ \times R/L$

$L = o'a' = o'e'$

$R = ao = oe$

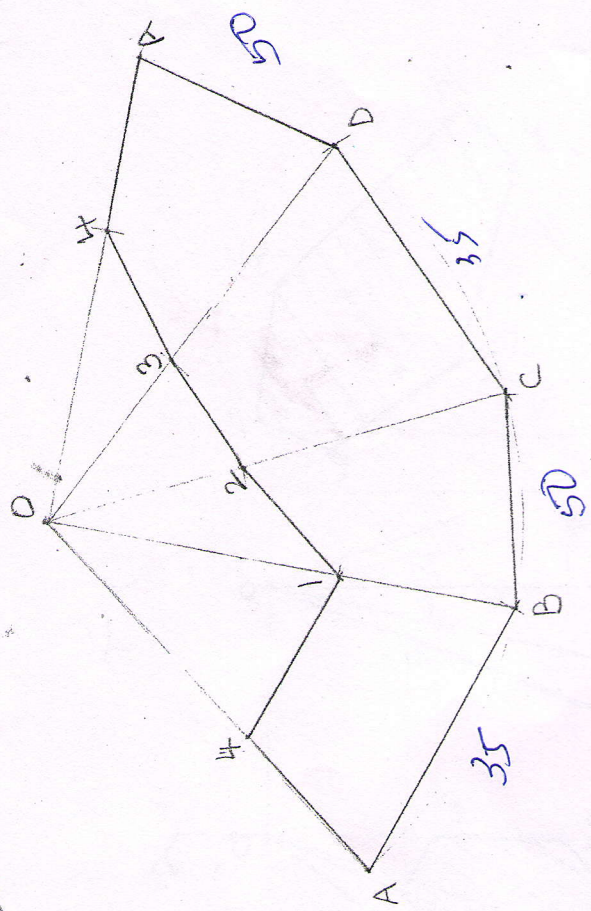
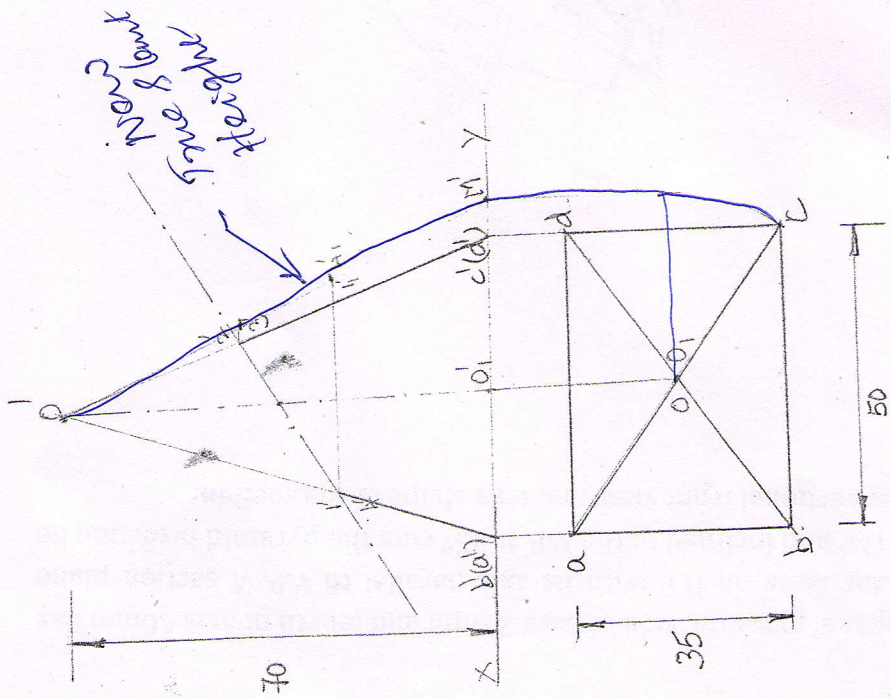
$\theta \rightarrow 8$  parts

Length of arc on  $OB, OH$   
 =  $(o'2', o'3')$

Length of arc on  $OC, OG$   
 =  $(o'4', o'5')$

... etc

$OA = O'M'$



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Q. A right regular rectangular pyramid of base 50 X 35 mm and height 70 mm, rests on its base in H.P with one of its base sides parallel to V.P. A section plane perpendicular to the V.P and inclined at 30° to the H.P cuts the pyramid, bisecting its axis. Develop the lateral surface of the truncated pyramid. (June 2013)

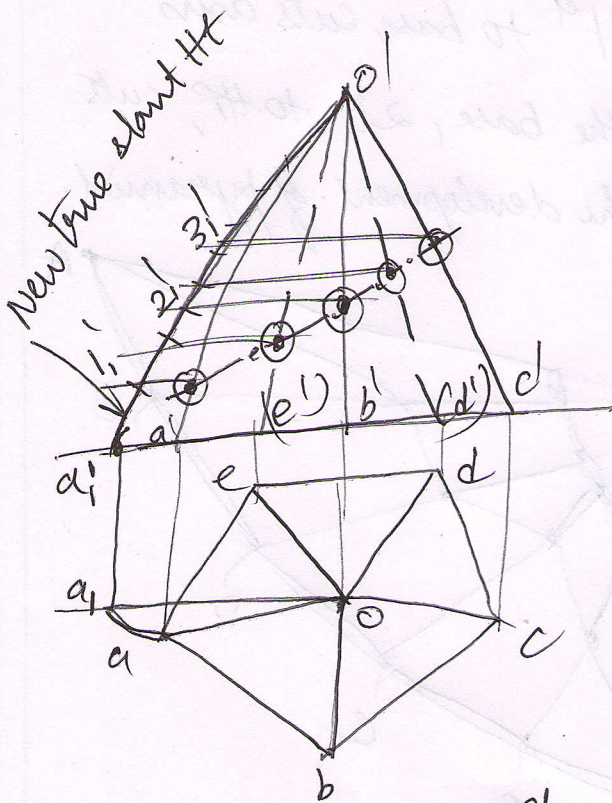
(17) A pentagonal pyramid of base 30mm side and height 50mm stands on Base on HP such that an edge of base is parallel to VP. It is cut by a plane at  $45^\circ$  to HP & cutting axis at 30mm above the base. Draw its development.

shape: Pentagonal pyramid (30, 50)

Base on HP (start in TV)

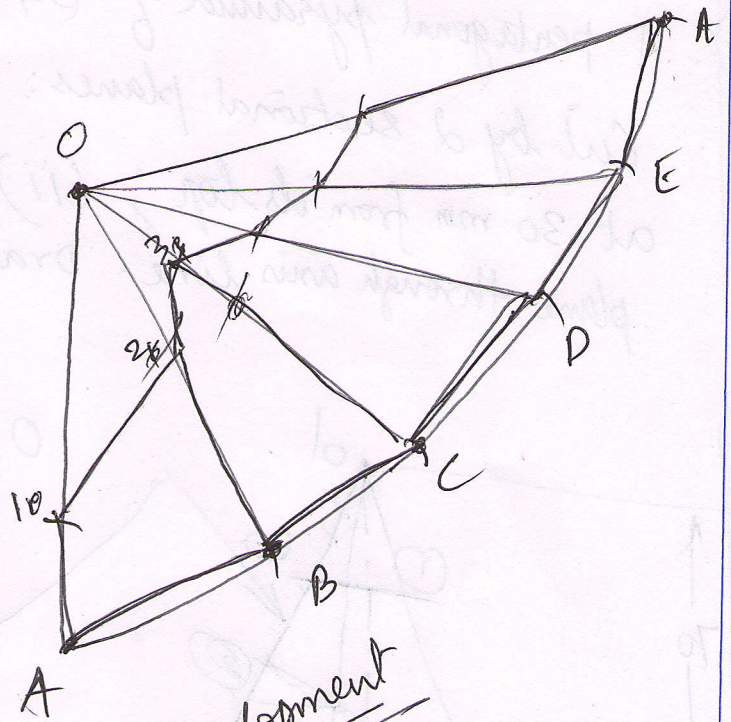
starting side:  $\parallel^e xy$  [∵ edge  $\parallel^e VP$ ]

Section plane:  $45^\circ$  HP; 30mm on axis above Base.



As  $oa$  or  $oc$  not  $\parallel^e xy$   
create new true slant height

$oa_1$  &  $o'a_1$

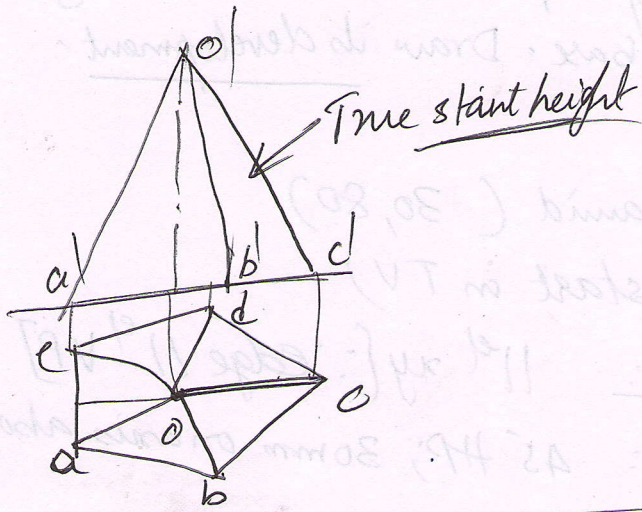


Development

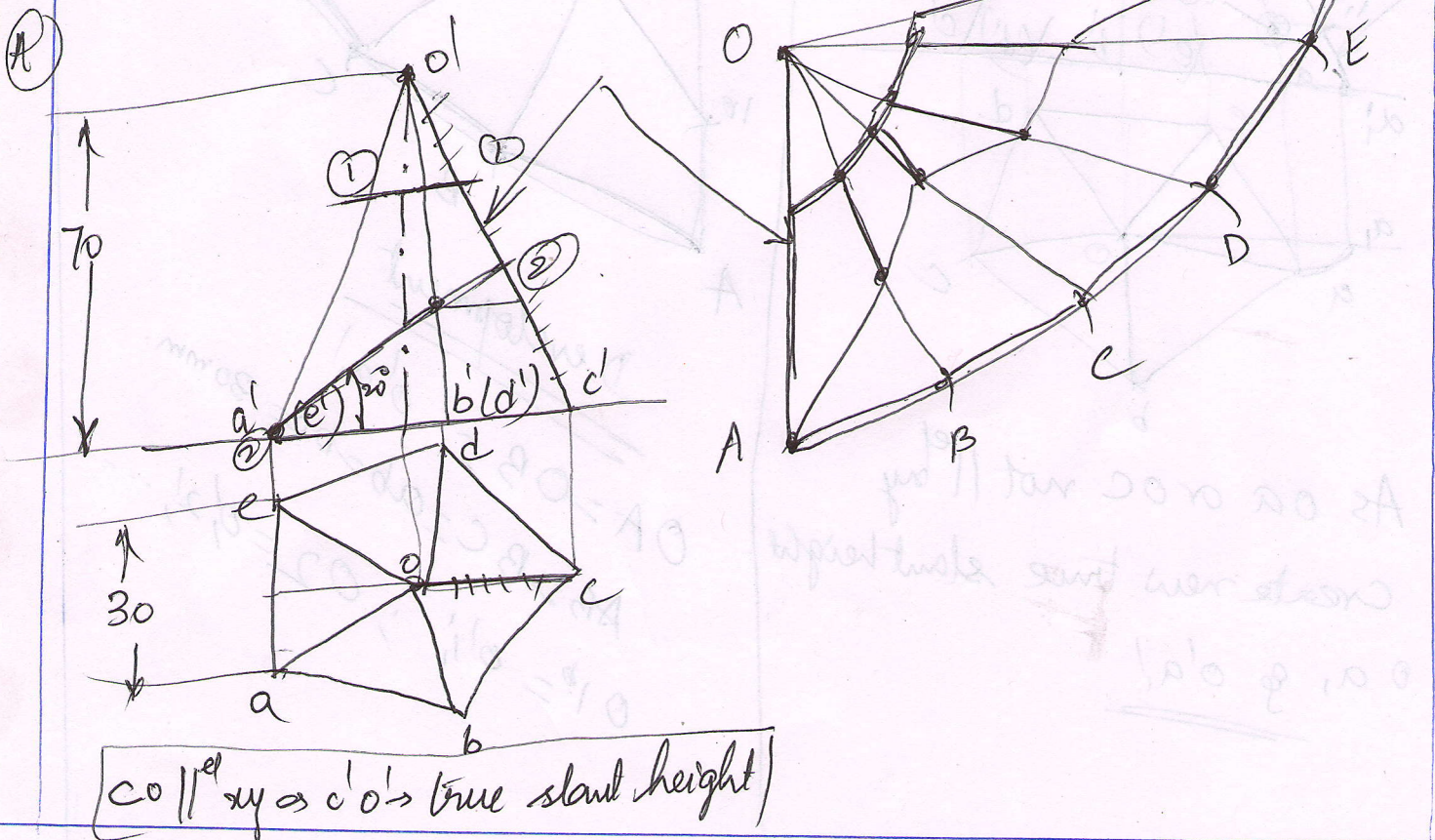
$OA = OB = o'a_1$   
 $AB = BC = cd = de = 30\text{mm}$

$o_1p = o_1q$ ;  $o_2 = o_1r_1, \dots$

(18) Assignment : Edge of base  $\perp$  to VP:  
 $\therefore O^p c^p$  is  $\parallel^{el}$  to  $xy$   $\therefore O^p c^p$  is True slant height



(19) A pentagonal pyramid of (30, 70), base on HP, edge  $\perp$  VP.  
 Cut by 2 sectional planes: (i)  $\parallel^{el}$  to base, cuts axis at 30 mm from its top; (ii) at the base,  $20^\circ$  to HP, cuts plane through axis line. Draw the development of pyramid.





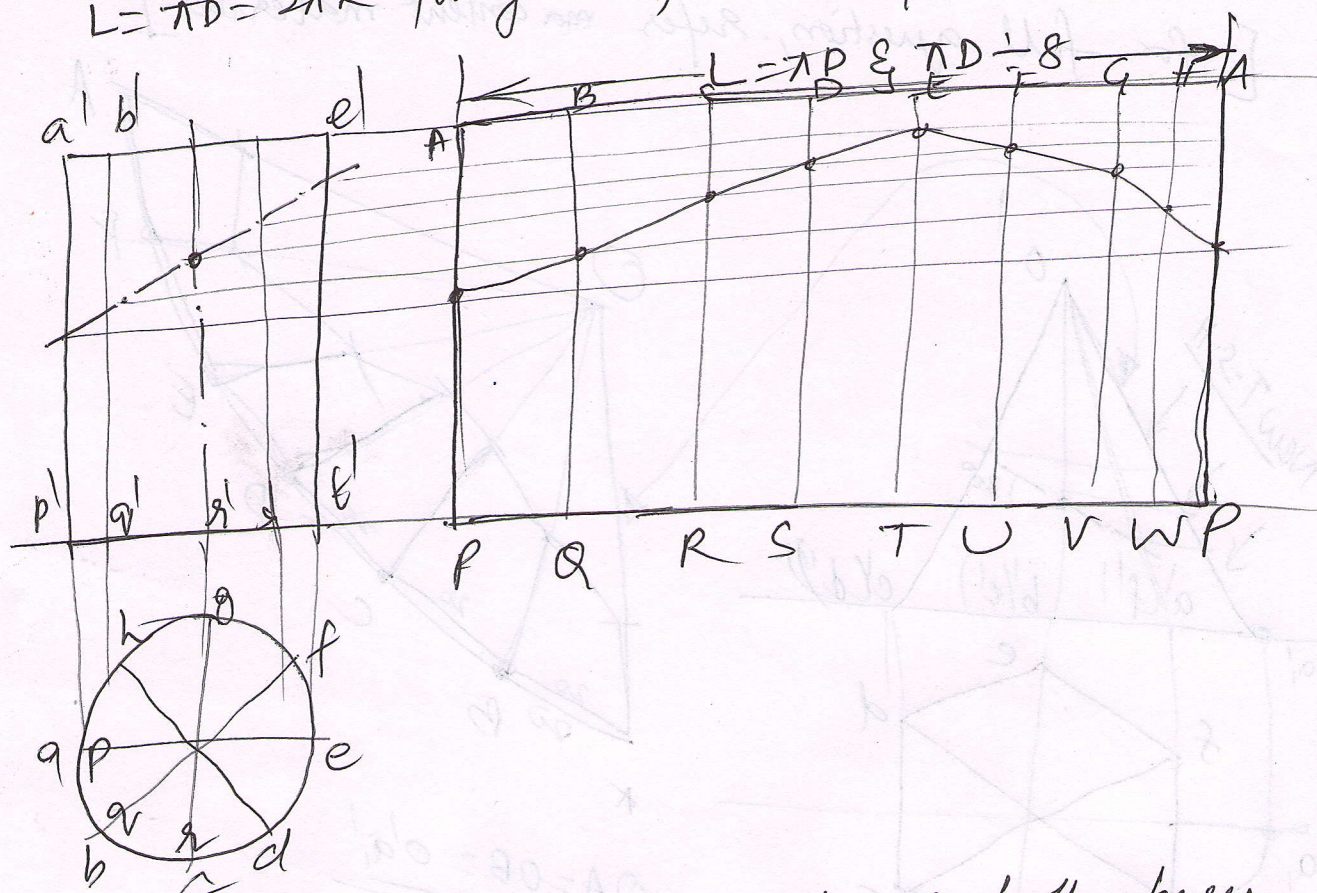


(21)

Cylinder  $\rightarrow$  ( $\phi 50, 100$ ); Base on HP;  
Section plane  $\rightarrow 45^\circ$  HP; Axis  $\rightarrow$  30 mm from top.  
Develop the truncated solid.

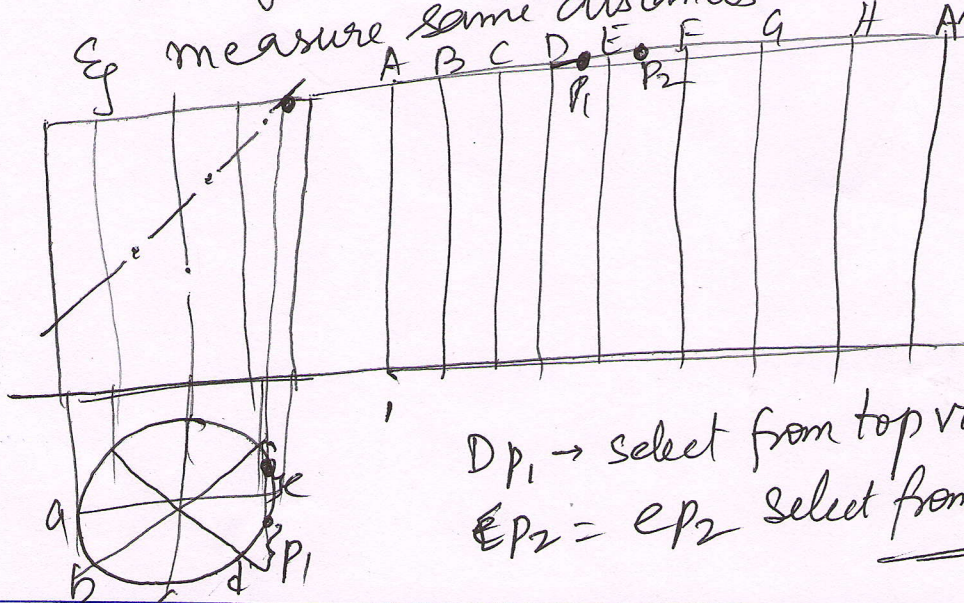
$L = \pi D = \pi R$  for cylinder;  $L \div 8 \text{ parts} \rightarrow \frac{\pi D}{8}$

(A)



Note: If section plane cuts the top or bottom bases, then to get the development points, project onto top view

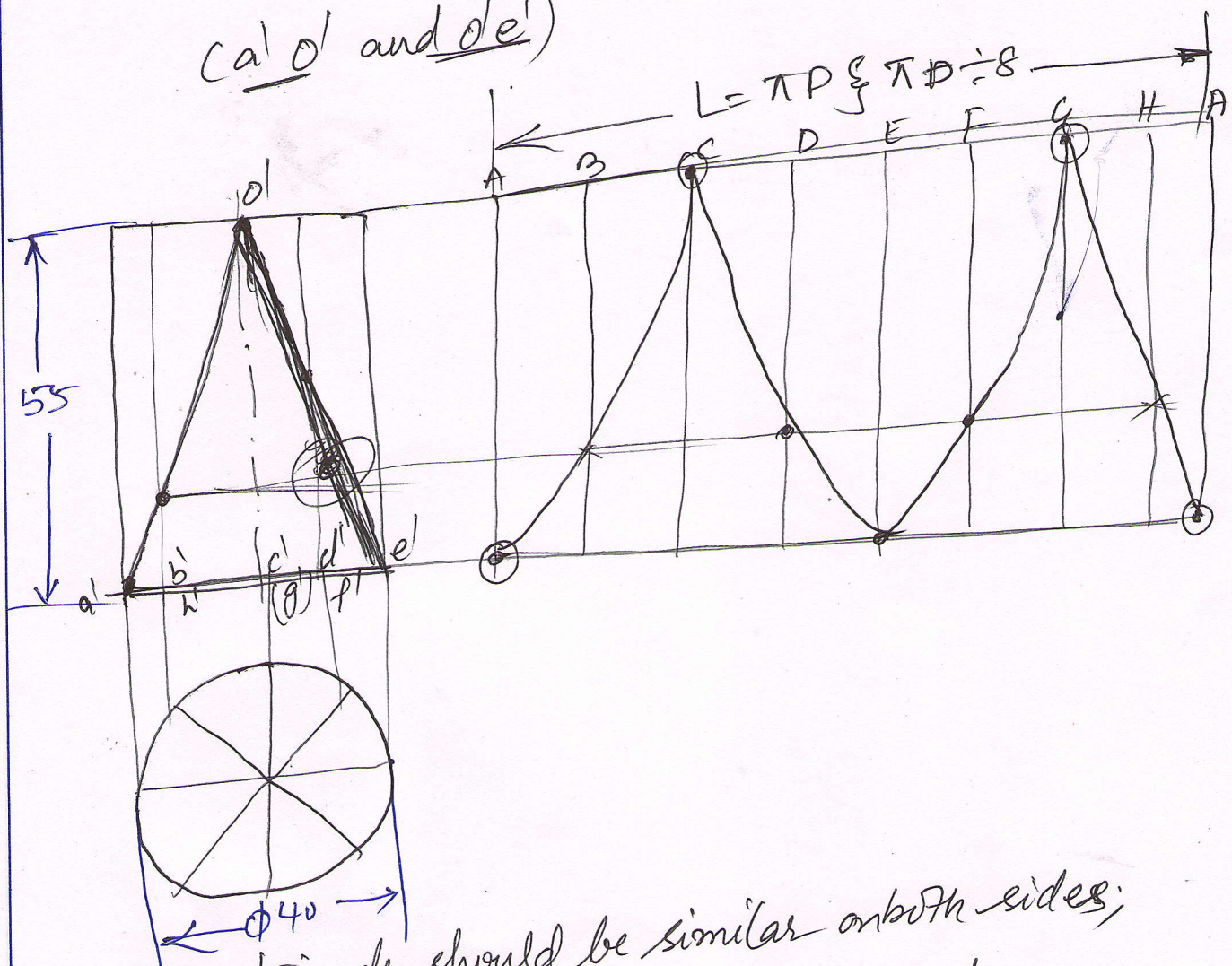
eg measure same distances in development.



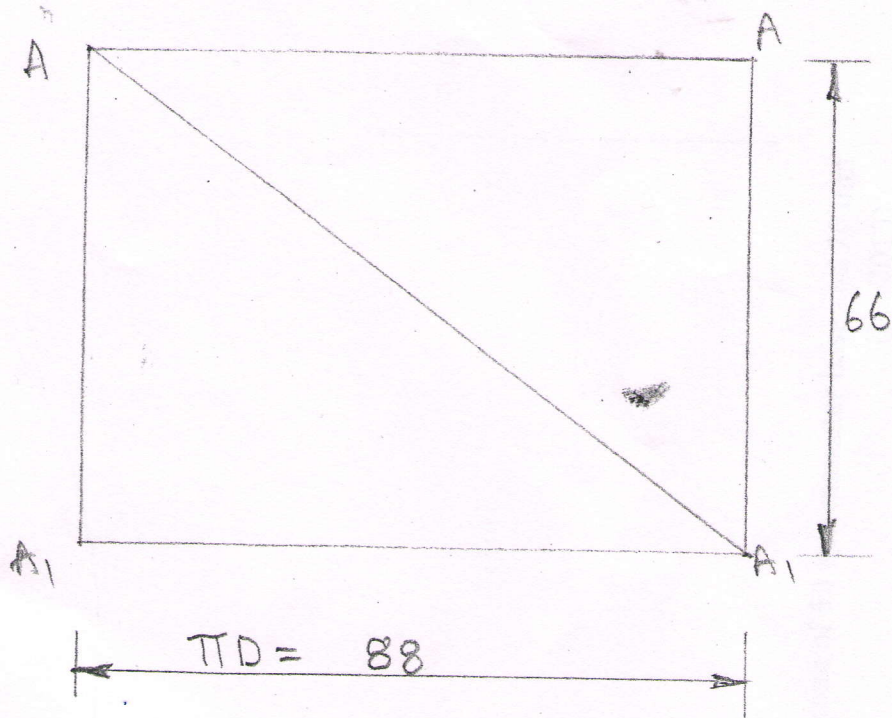
$D_{P1} \rightarrow$  select from top view  
 $E_{P2} = e_{P2}$  select from top view

22) A cylinder of base diameter 40 mm and axis 55 mm long rests with its base on HP. It is so sectioned that its elevation appears as an isosceles triangle of base 40 mm and height 55 mm. Develop its surface.

(A) Sectioned elevation is an isosceles  $\Delta^e$  of (40, 55).  
 It means there are 2 section planes  
 (a)  $d'$  and  $d'e'$

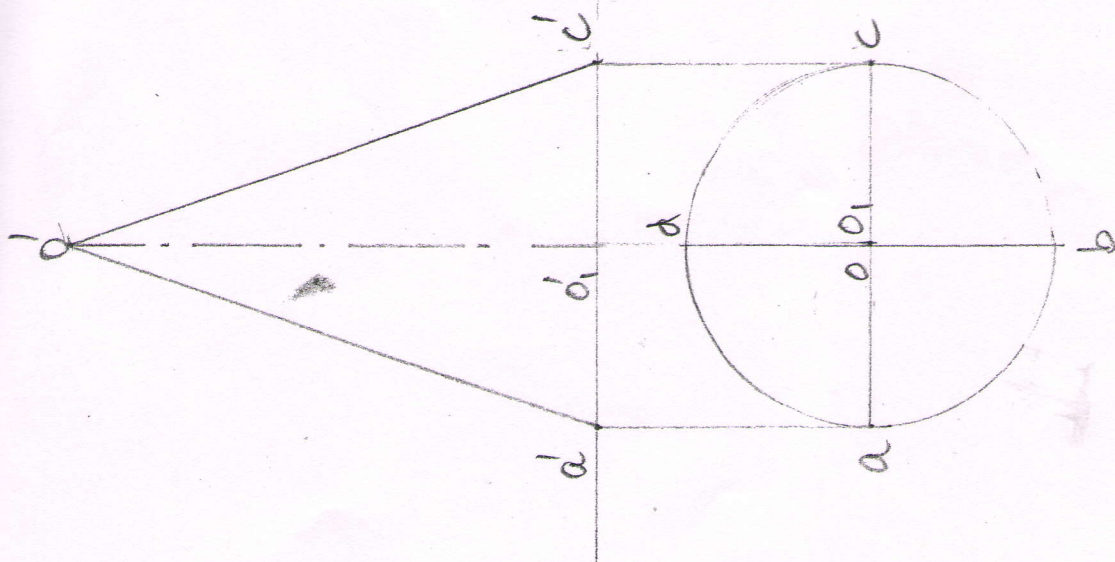


The triangle should be similar on both sides;  
Drawing errors may be neglected.



Length of the diagonal of the development  
 $AA_1 = 110\text{mm}$ .

8. From the development of the surface of a cylinder of diameter 28mm and axis 66mm. Find the length of the diagonal of the development.

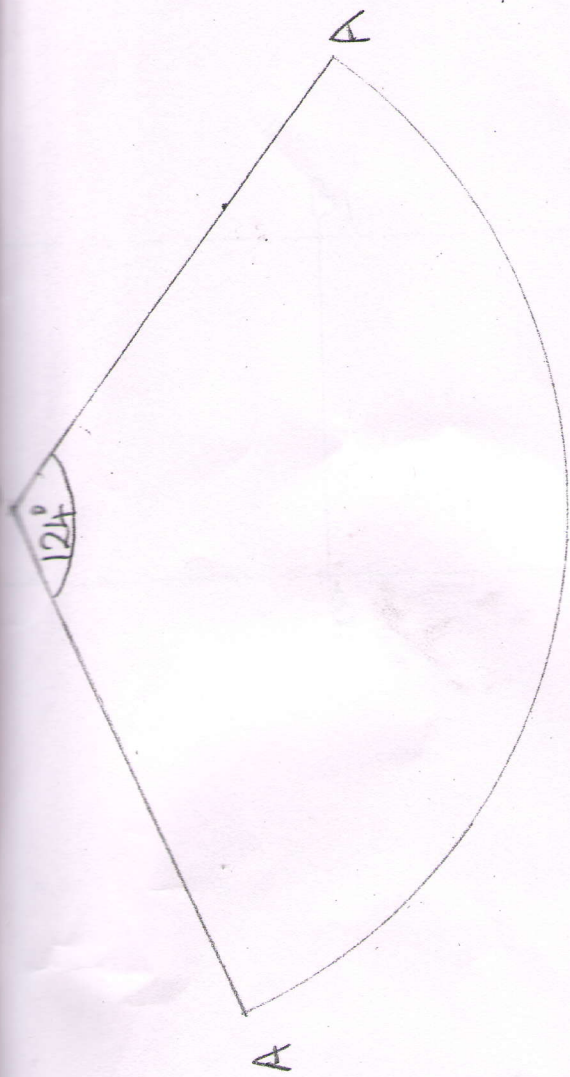


$$R = o'c' = 73 \text{ mm}$$

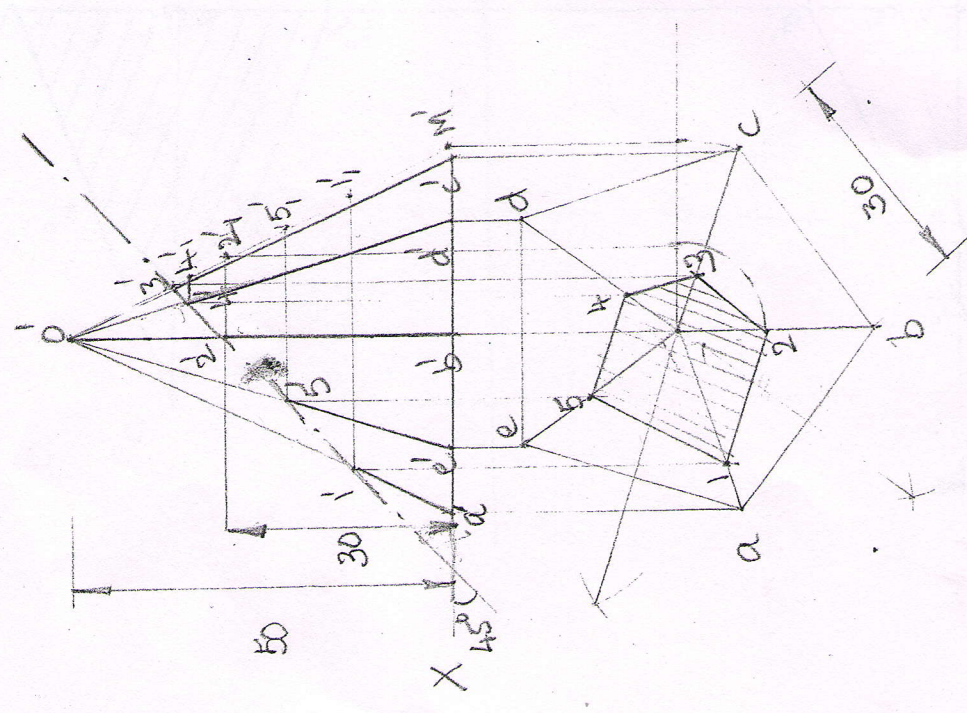
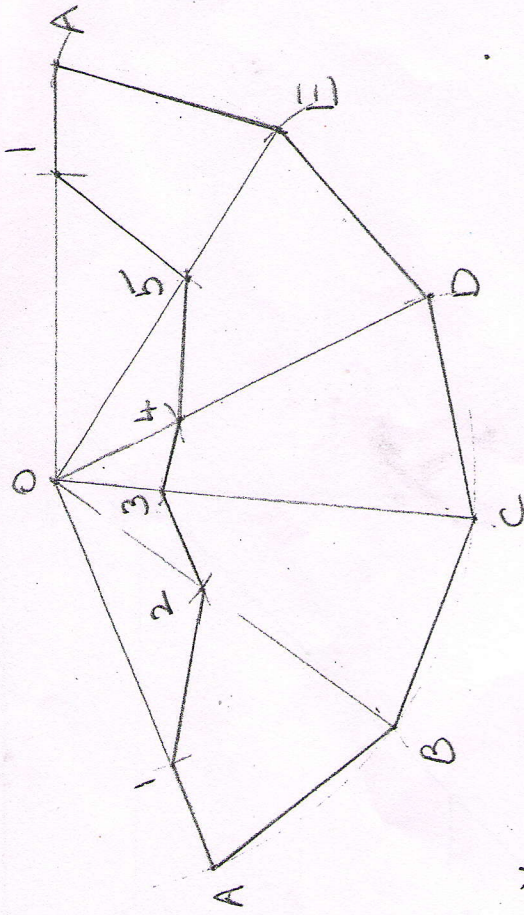
$$\theta = 360 \times \frac{x}{R}$$

$$= 360 \times \frac{25}{73} = 123.28^\circ$$

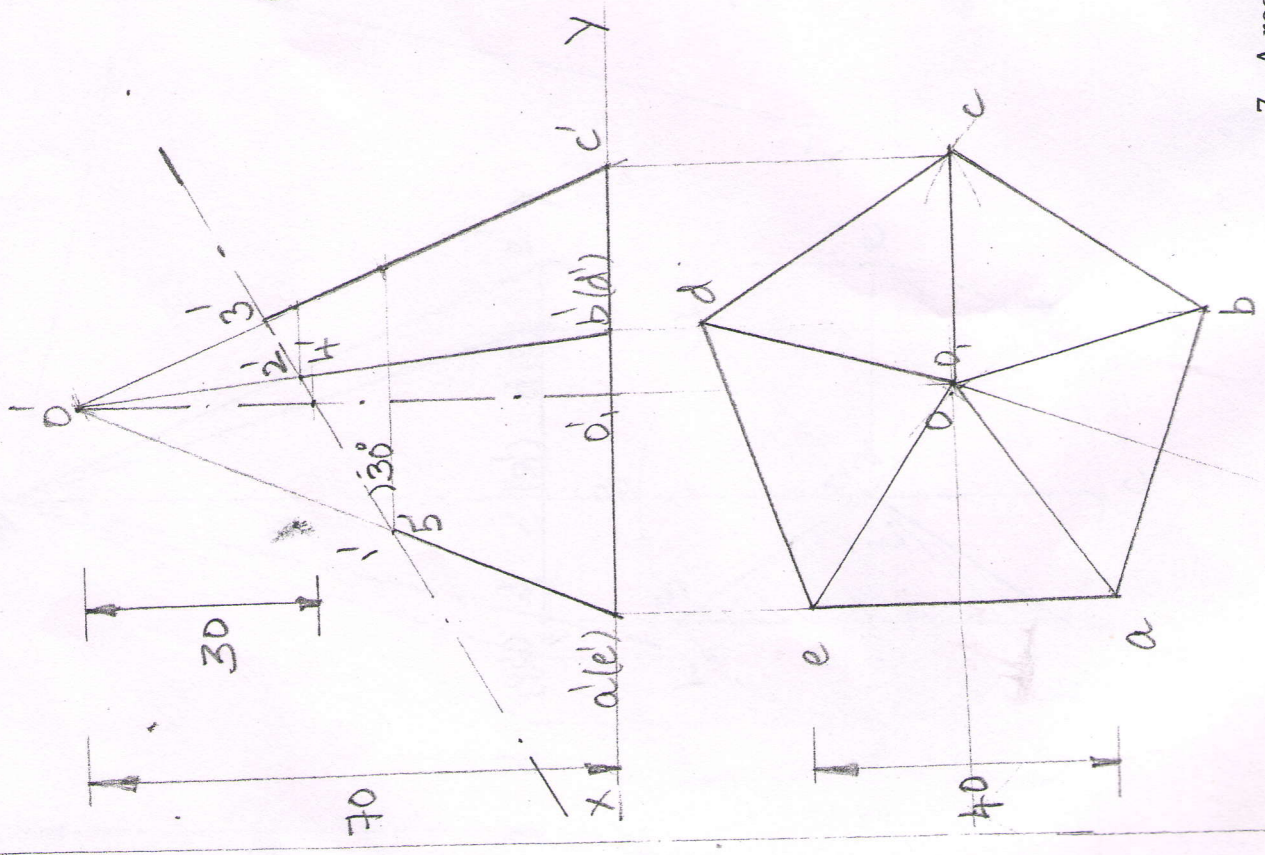
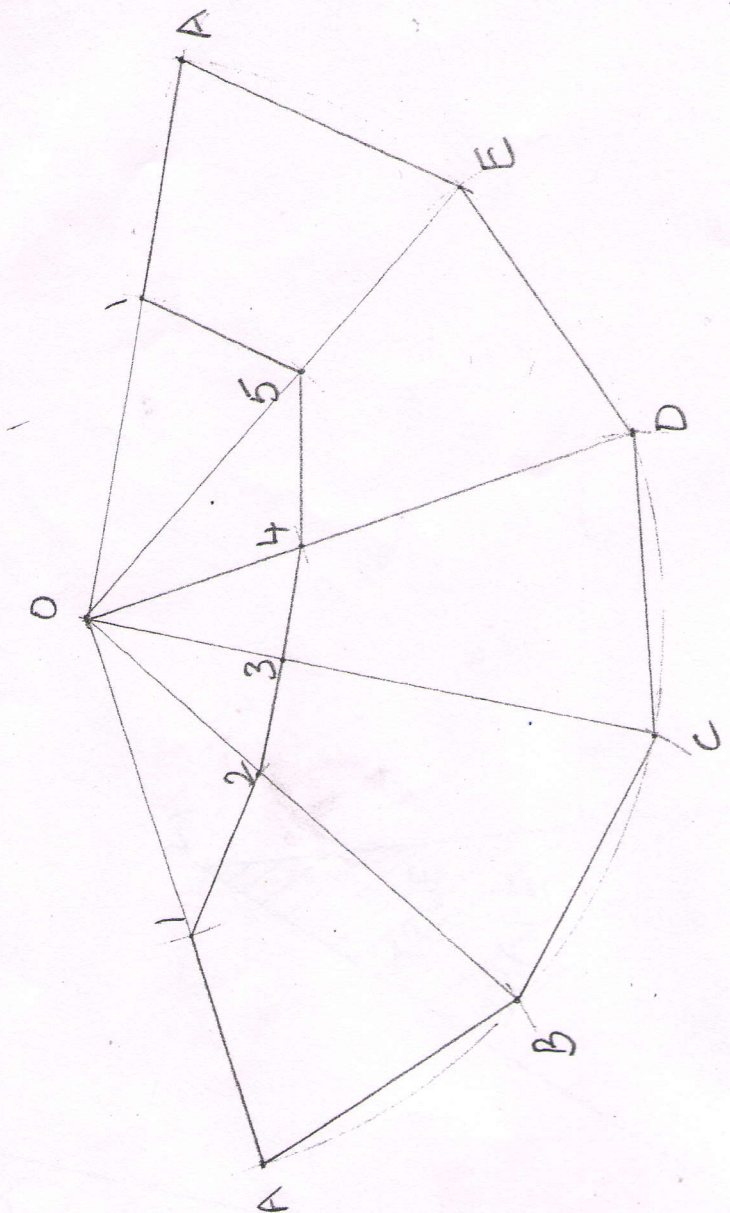
$$\approx 124^\circ$$



9. Draw the development of a right circular cone of 50 mm diameter base and 70 mm height. (Jan 2013)



5. A pentagonal pyramid of base 30mm side and height 50mm stands with its base on H.P. such that an edge of the base is parallel to V.P it is cut by a plane perpendicular to V.P inclined at  $45^\circ$  to H.P and passing through a point on the axis 30 mm above the base. Draw the sectional top view and development of the lateral surface of the truncated solid.



7. A regular pentagonal pyramid of 40mm side and 70 mm long axis is resting on its base on H.P. It is cut by an AIP normal to V.P and inclined to H.P at  $30^\circ$  passing through a point 30mm below the apex. Draw the development of lateral surface of lower part of the pyramid