

Unit-3: Solutions. [Projections of Solids]

(14) Draw the projections of a pentagonal prism, edge of base 30mm and axis 50mm long, having one of its base edges perpendicular to VP.

Soln: (i) Shape of Solid: Pentagonal Prism - 5/108°

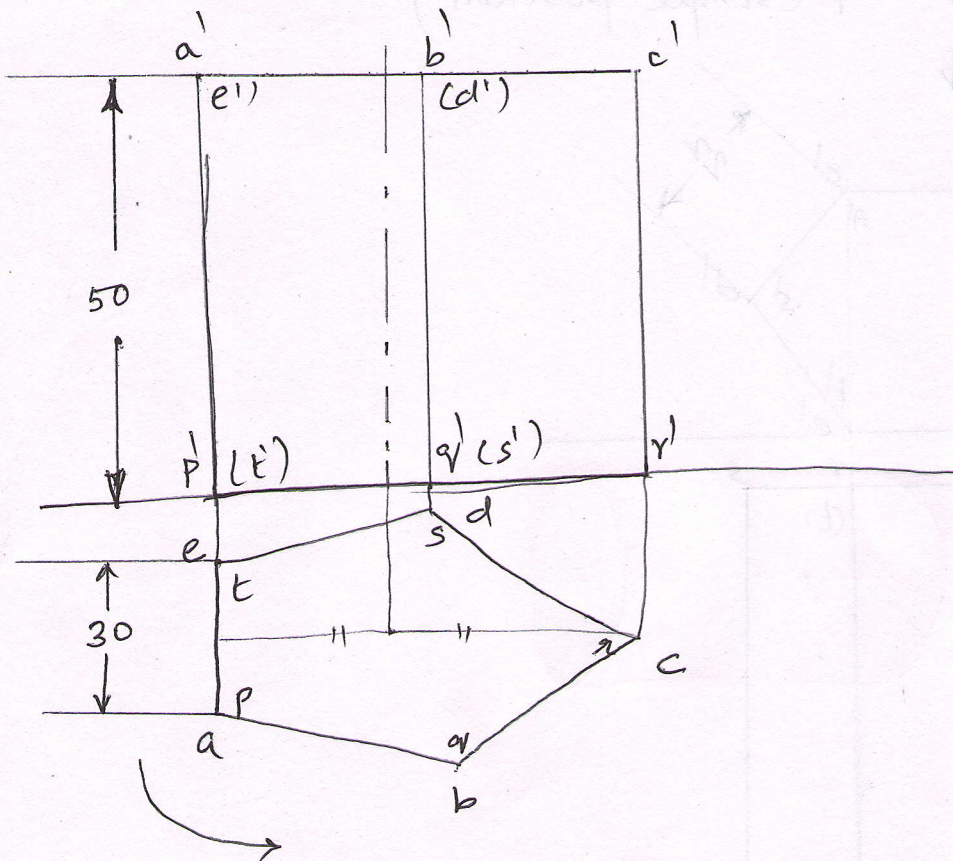
(ii) Dimensions (B, H): (30, 50)

(iii) Base or Axis position: Not mentioned.

Assumption: Base is on HP or Axis \perp to HP. (start in Topview)

(iv) Side of Base details: base edge \perp to VP [$\Rightarrow \perp$ to xy in TV]
 [This data gives the starting side details].

\therefore Start the shape of pentagon in topview with a side \perp to xy.



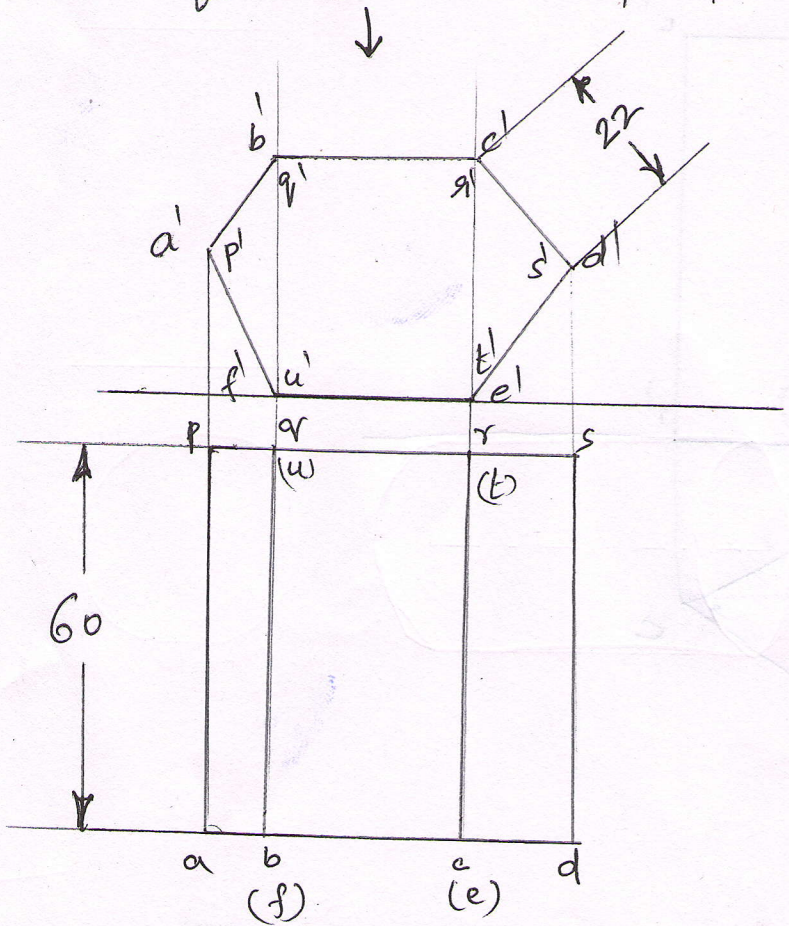
PENTAGONAL PRISM

15) A right regular hexagonal prism, edge of base 22mm and 60mm long axis lies on its rectangular face on the ground plane with the axis perpendicular to VP. Draw its projections.

Soln: Given data:

- (i) Shape - Hexagonal prism - 6/120°
 - (ii) Dimensions : (B, H) → (22, 60)
 - (iii) Base/Axis details: Axis ⊥ to VP (→ True shape of Base seen in FV)
 - (iv) Face/side of base details: face on ground → side on HP.
- * For prisms, face can be treated as side*

∴ Start in FV; starting side ||^{el} to xy.
 NO. of stages: 1 (simple position)



HEXAGONAL PRISM

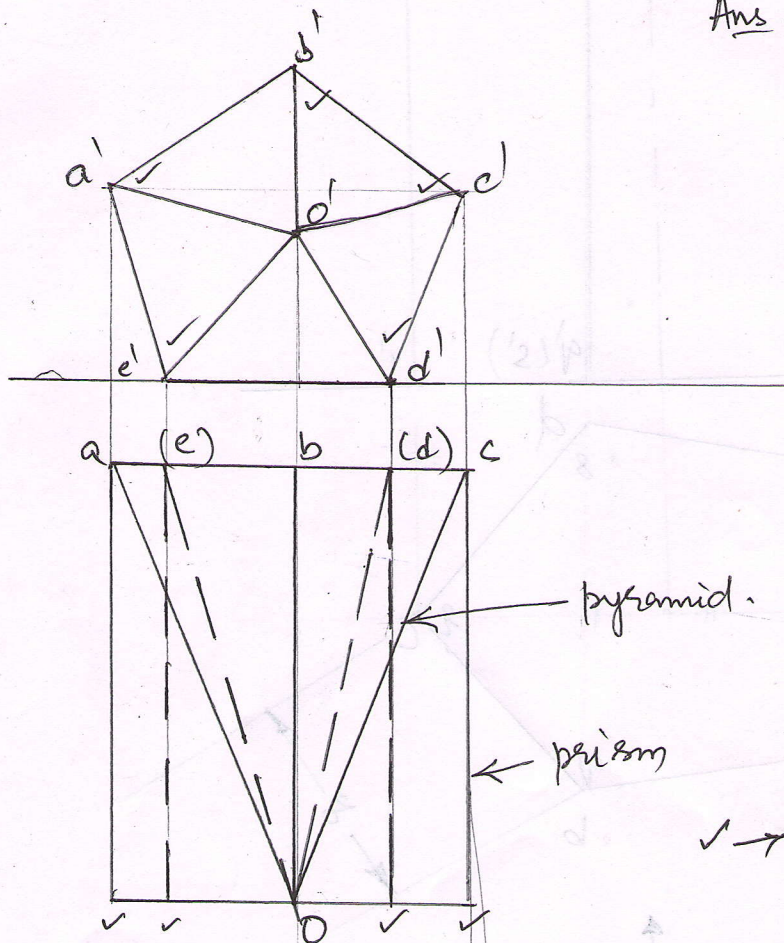
16) A right regular pentagonal pyramid, ^{prism} edge of base 20mm and height 45mm (h), has its base parallel to VP, with one of its base edges in HP. Draw its projections.

Soln:

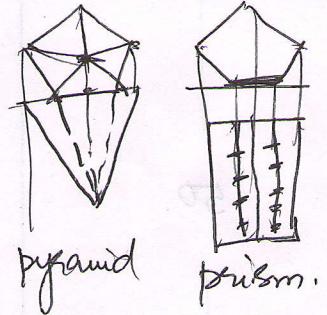
Given Data:

- (i) shape: pentagonal pyramid (5, 108°) - Triangle faces
- (ii) Dimensions (B, H) = (20, 45).
- (iii) Base/Axis condition: Base parallel to VP (\Rightarrow Axis \perp to VP)
 \therefore The Base shape is visible in FV; start in FV.
- (iv) Base/edge details: Base edge in HP (\Rightarrow on xy; \parallel xy)
 (Starting side is on xy).

\therefore Start in FV; starting side \parallel to xy.



Ans:



$\checkmark \rightarrow$ labellings for prism

If pentagonal prism is asked, a rectangle is to be drawn; shown in same fig.

17) A right regular pentagonal prism of base 20mm sides and axis 50mm rests on its base on HP with one of its base edges perpendicular to VP. Draw its projections.

Soln

Given data:

(i) shape: Pentagonal Prism \rightarrow 5-108-Rectangle faces

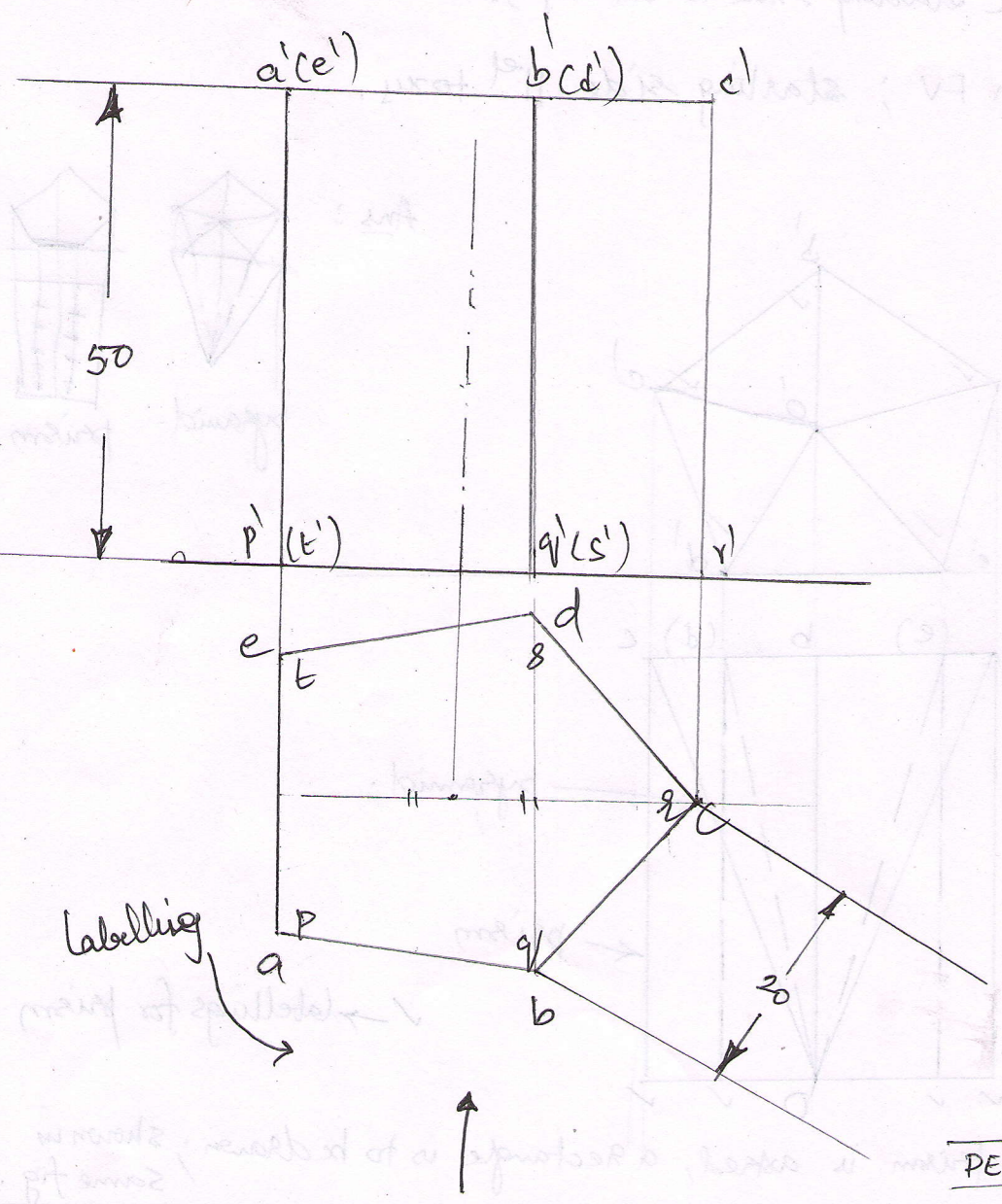
(ii) Dimensions: $(B, H) = (20, 50)$

(iii) Base/Axis details: Base on HP \Rightarrow start in T.V

(iv) Side details: edge \perp to VP \Rightarrow start \perp xy.

\therefore start pentagon in TV; starting side of pentagon \perp xy;

FV should have rectangular faces as it is a prism.



LONG ANSWER QUESTIONS & SOLUTIONS

2- stage Problems

Case 1: Axis Inclined to HP/VP

- Steps involved:
- (i) Find where the axis is inclined to. [HP/VP]
 - (ii) Make the axis \perp to HP/VP & draw 1st stage. check for starting side/details $\rightarrow (1^{st} \perp xy)$
 - (iii) Tilt the axis by given angle & redraw @ ^{face}
 - (iv) Match projections to get final reduced shape.

A square prism of base 40mm is resting on HP with its base sides equally inclined to both HP and VP. Its axis is inclined at 45° to HP. Draw its projections.

Soln

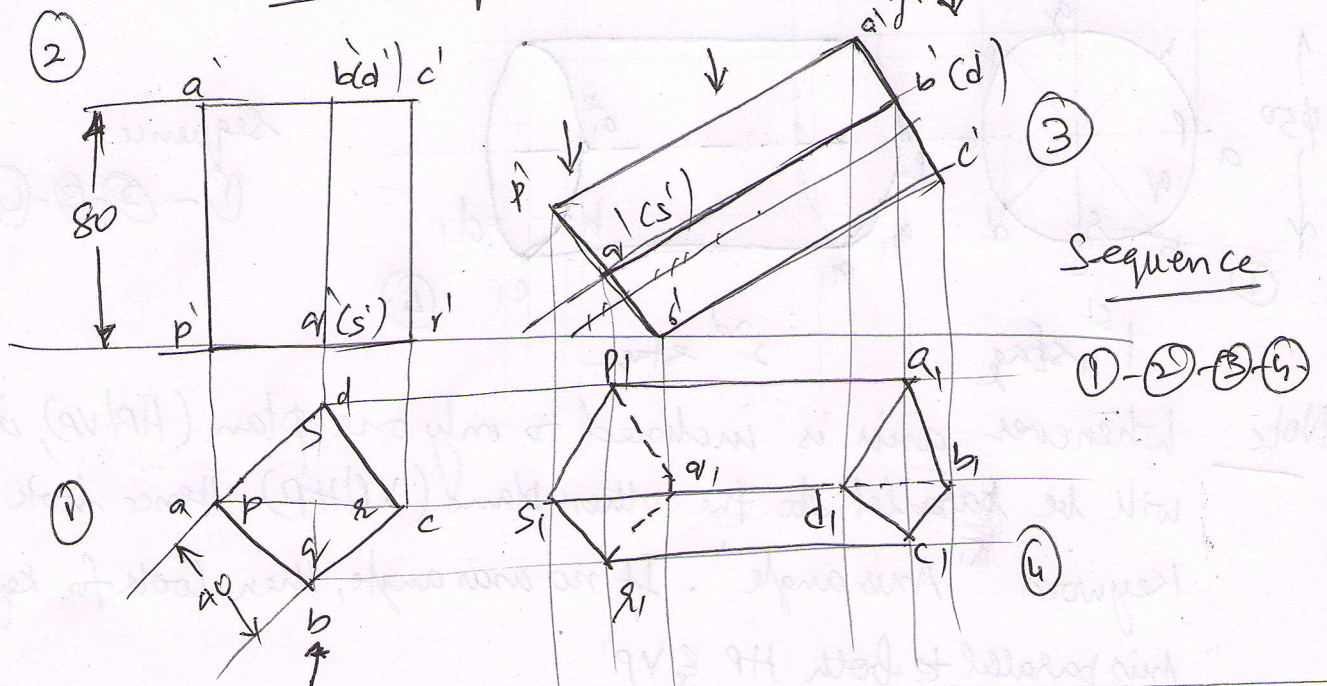
Given data:

Shape: Square prism [4, 90; Rectangular faces]

Dimensions: (B, H) \rightarrow (40, 80) [H not mentioned; Hence assume suitable axis]

Axis \perp : 45° to HP [2 stages: 1st stage \perp to HP. (\rightarrow start in TV) 2nd stage $\rightarrow \perp 45^\circ$ HP]

Side \perp : Eq. Inclined $\rightarrow 45^\circ$ to xy.



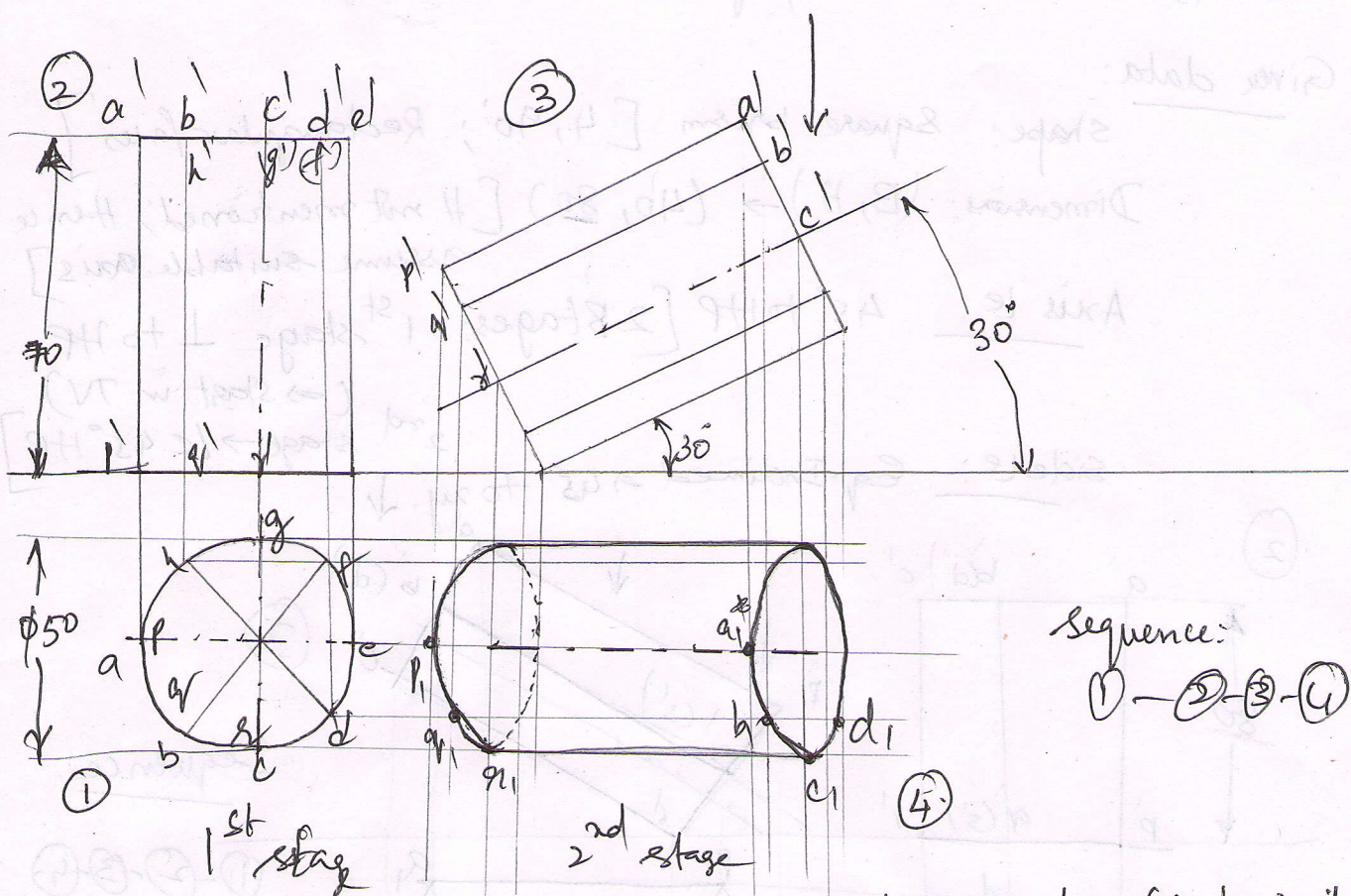
19

A cylinder of diameter 50mm base, axis 70mm long rests on one of its points of the base in the HP and its axis is parallel to VP and inclined at 30° to HP. Draw its projections

Solu

Given data:

- (i) Shape: Cylinder → Circle; Rectangular face.
 - (ii) Dimensions: (B, H) = (φ 50, 70).
 - (iii) Base/Axis details: Axis inclined at 30° to HP.
- ∴ Two stage problem; start in TV with Axis ⊥ to HP.



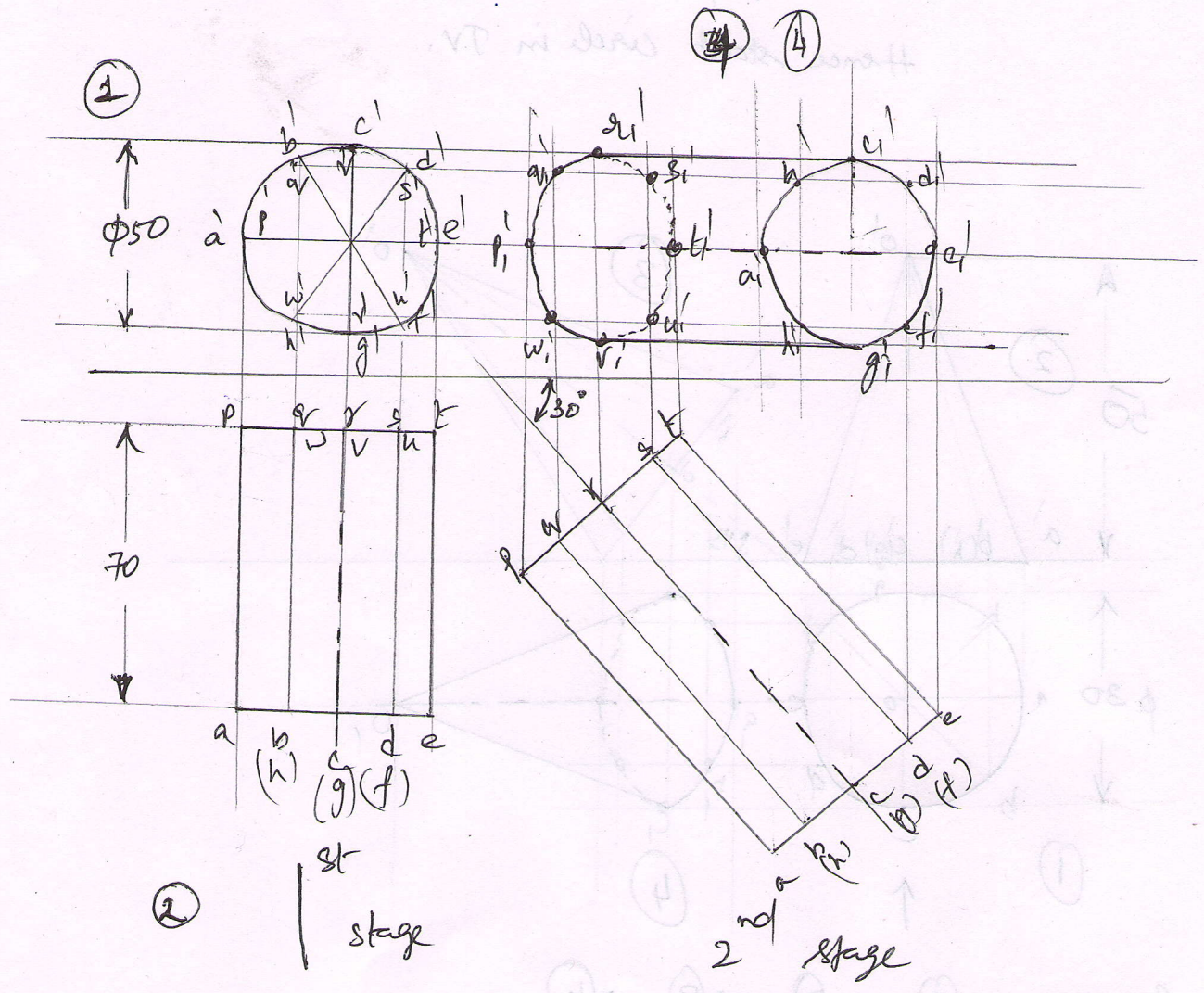
Sequence: ①-②-③-④

Note: Whenever axis is inclined to only one plane (HP/VP), it will be parallel to the other plane (VP/HP). Hence look for keyword "Axis angle". If no axis angle, then look for keyword "Axis parallel to both HP & VP"

(20) A cylindrical prism of 50 mm diameter and axis 70 mm long has its axis parallel to HP and inclined at 30° to VP. Draw its projections

Given data:

- (i) shape: Cylinder [circle base, rectangular face]
- (ii) Dimensions: $(B, H) = (\phi 50, 70)$.
- (iii) Axis details: Axis 30° to VP \rightarrow 2 stage problems.
start in FV with axis \perp to VP & then get 2nd stage.



Sequence: (1) \rightarrow (2) \rightarrow (3) \rightarrow (4)

(2)

A cone of 30mm diameter base and axis 50mm long is resting on a point of base circle on HP with axis inclined at 45° to HP & 11° to VP. Draw its projections

ESN

Given data:

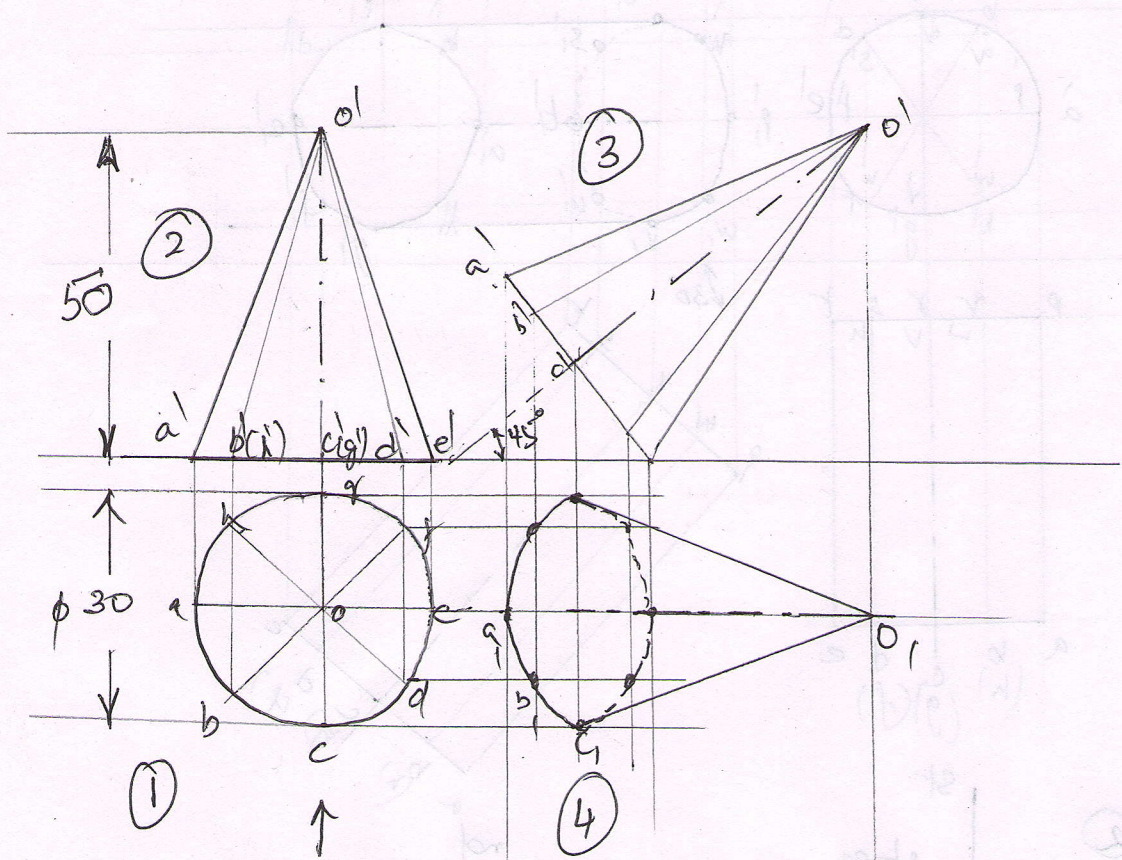
Shape: Cone (Circle base; triangular face)

Dimensions: (B, H) = ($\phi 30, 50$) \rightarrow (30, 50)

Axis orientation: 45° to HP & 11° to VP.

\therefore 2 stage problem with 1st stage Axis \perp to HP.

Hence start circle in TV.



Sequence: ① \rightarrow ② \rightarrow ③ \rightarrow ④.

22

A hexagonal prism of base 30mm sides and axis 50mm has a rectangular face on the HP and its axis makes an angle of 60° with the VP. Draw its projections.

Soln

Given data:

(i) Shape → Hexagonal prism [6-120°-Hex(Base) & Rect. face]

(ii) Dimensions → (B, H) → (30, 50).

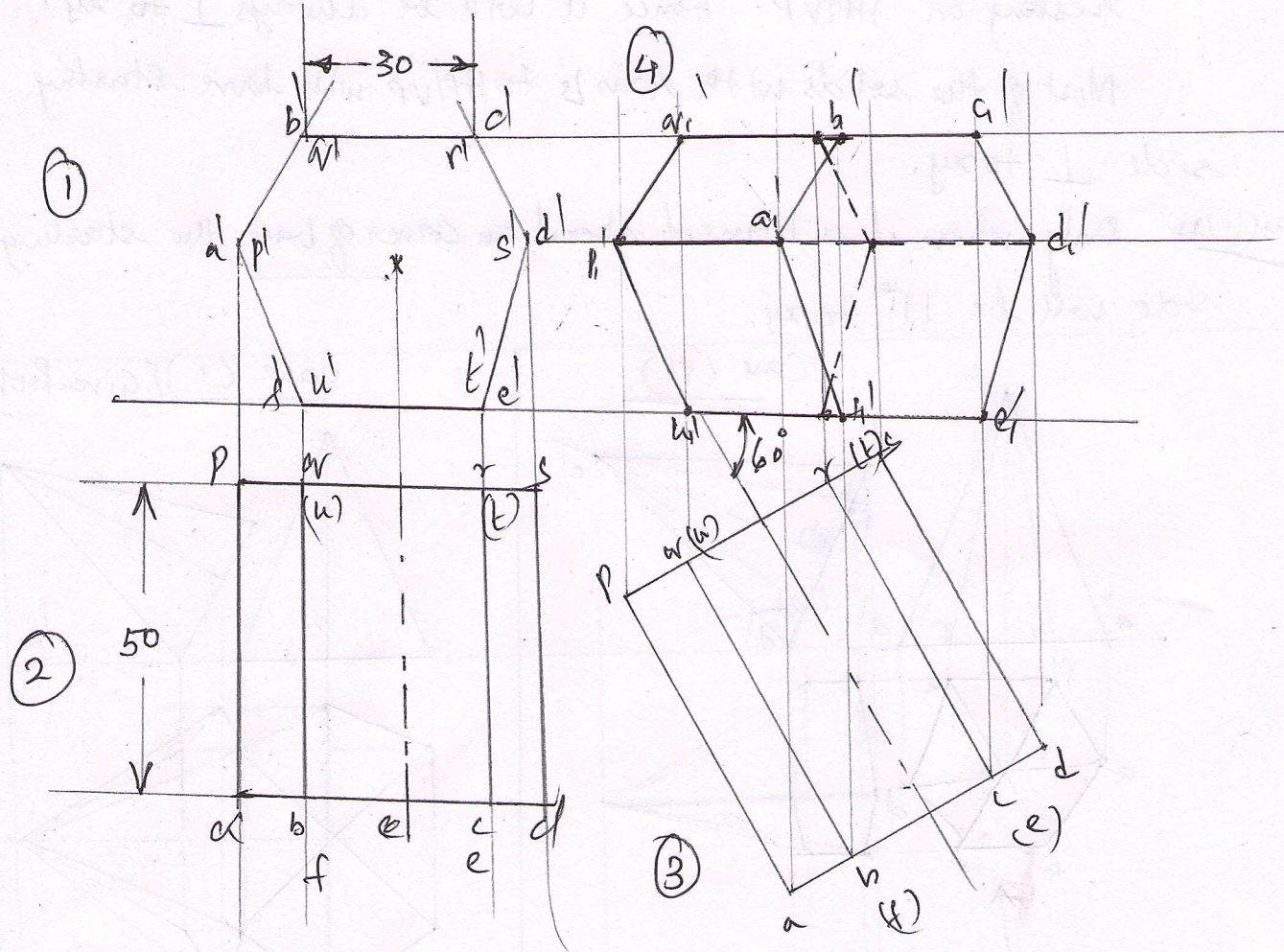
(iii) Axis orientation: 60° w.r.t. VP.

∴ Two stage problem; 1st stage → Axis ⊥ to VP.

Hence start in FV.

(iv) Starting side details: Face on HP ⇒ Side on HP.

∴ Side is ||^{el} to xy & on xy.

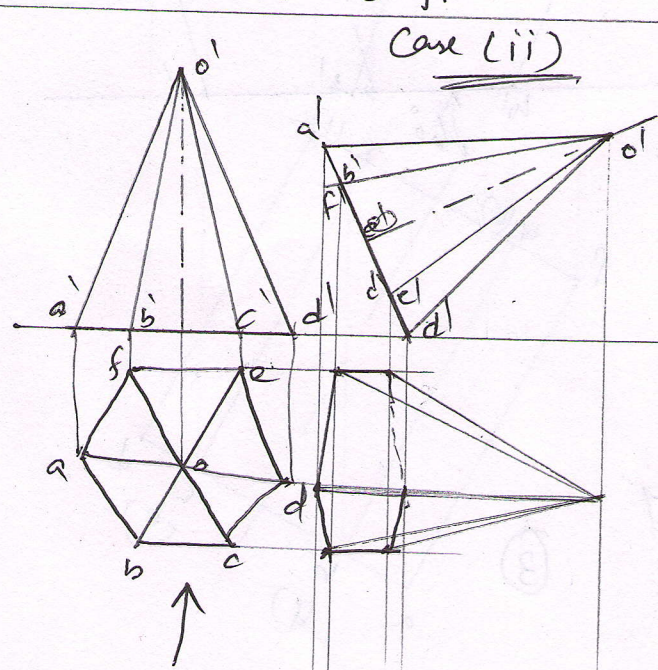


23) A hexagonal pyramid of base 30mm sides and axis 70mm long is resting on HP on one of its base edges. Its axis is inclined at 30° with HP and parallel to VP. Draw its projections [Refer Prob NO: 13.12 in Text Book]

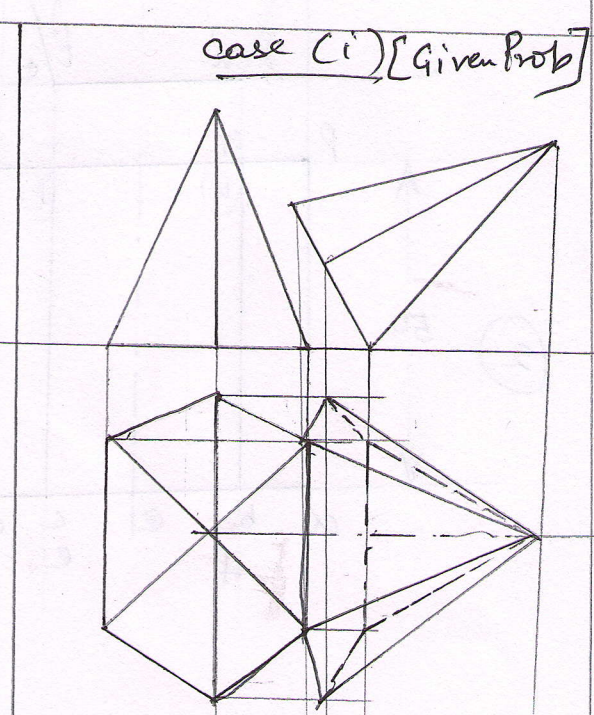
- (A) Given data:
- Case (i) (i) shape \rightarrow Hex. Pyramid [6- 120° -Triangular faces]
 - (ii) Dimensions \rightarrow (B, H) \rightarrow (30, 70)
 - (iii) Axis Orientation : 30° to HP [2 stages; 1st \rightarrow \perp to HP]
 \therefore start in TV as Axis \perp to HP.
 - (iv) Side orientation : Base Edges on HP \Rightarrow side \perp to xy.

*** Note: Whenever a solid is inclined, it is turned usually about its base edge. Hence that base edge will be resting on HP/VP. Hence it will be always \perp to xy.
 \therefore Most of the solids with Axis \perp to HP/VP will have starting side \perp to xy.

Case (ii) *** Only when it is turned about an corner of base, the starting side will be \parallel to xy.



Tilted about a corner



Tilted about base edge

(24) A pentagonal prism of base 25mm side and axis 50mm long is resting on one of its rectangular faces on the HP with axis inclined at 45° to the VP. Draw its projections. [Refer Prob No 13.10 in Text Book].

Soln

Given data:

→ Shape: Pentagonal Prism [5-108°-Rectangular faces]

→ Dimensions: (B, H) = (25, 50)

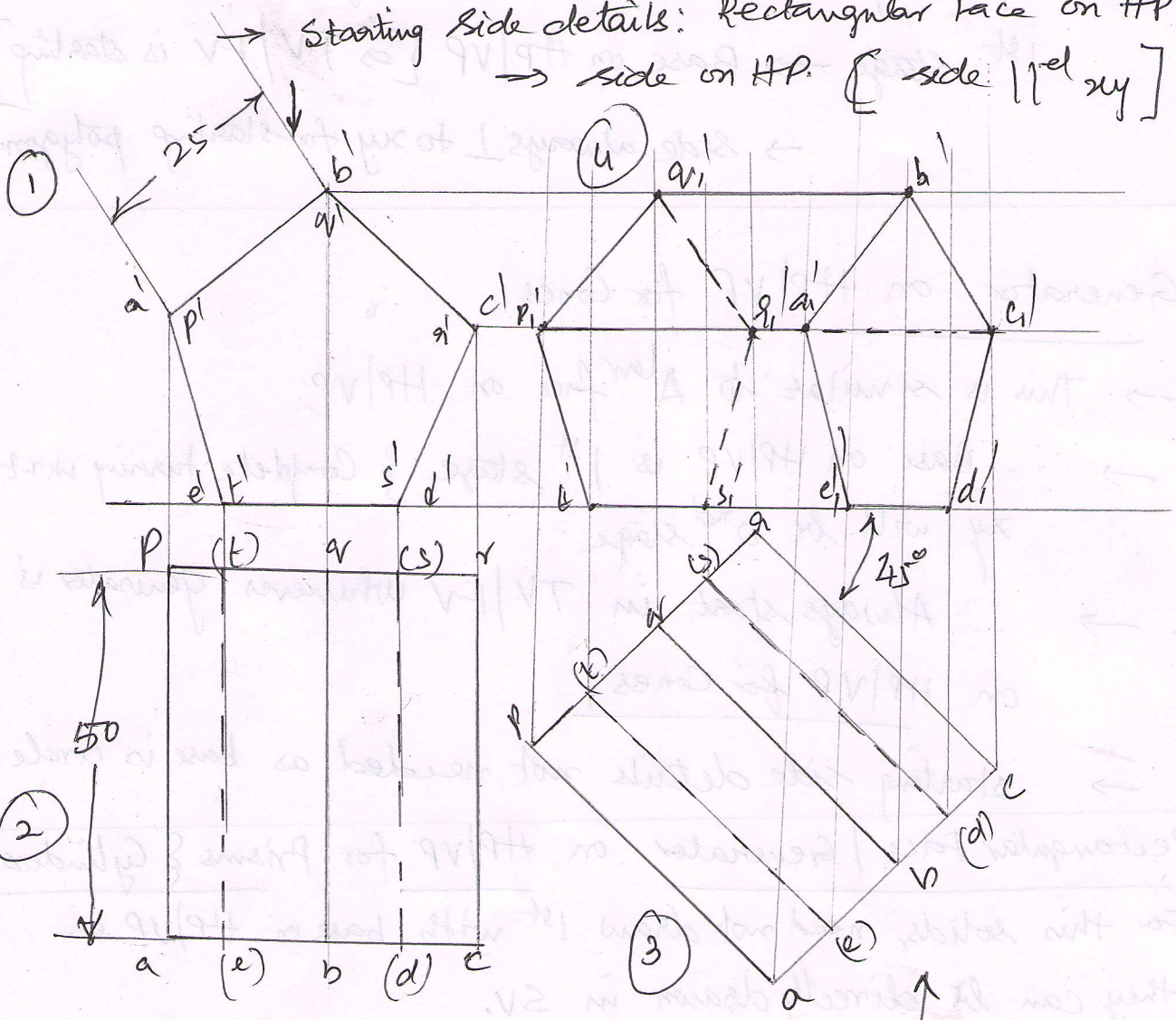
→ Axis orientation: Axis 45° to VP [Two stage Problems]

1st stage → Axis \perp to VP

∴ start in FV.

Starting Side details: Rectangular face on HP

→ side on HP. [side \parallel to xy]



Sequence: ① → ② → ③ → ④.

25

Faces / Generators lying on HP/VP:

→ For pyramids, whenever a triangular face is on HP/VP; it has to be first kept with base on HP/VP for 1st stage

→ The starting side of base will always be \perp to xy in all these cases whenever a Δ^{lar} face is on HP/VP since the turning is about a side of base, containing the Δ^{lar} face.

∴ Triangular face on HP/VP \Rightarrow 2 stages.

1st stage \rightarrow Base on HP/VP [\Rightarrow TV/FV is starting]
 \rightarrow side always \perp to xy for starting polygon.

Generator on HP/VP for Cones:

→ This is similar to Δ^{lar} face on HP/VP;

→ ∴ Base on HP/VP is 1st stage & Complete turning w.r.t. xy will be 2nd stage.

→ ∴ Always start in TV/FV whenever generator is on HP/VP for Cones.

→ starting side details not needed as base is circle.

Rectangular Face / Generator on HP/VP for Prisms & Cylinders

For this solids, need not draw 1st with base on HP/VP as they can be directly drawn in SV.

Only the axis condition is to be checked.

If Axis \perp to HP/VP \rightarrow directly 1 stage problems.

If Axis \parallel to HP/VP \rightarrow directly siderview based 1 stage.

Q5) A right pentagonal pyramid, edge of base 30mm and 68mm high is lying on one of its triangular faces on the ground plane such that its axis is parallel to VP. Draw its projections.

Given data:

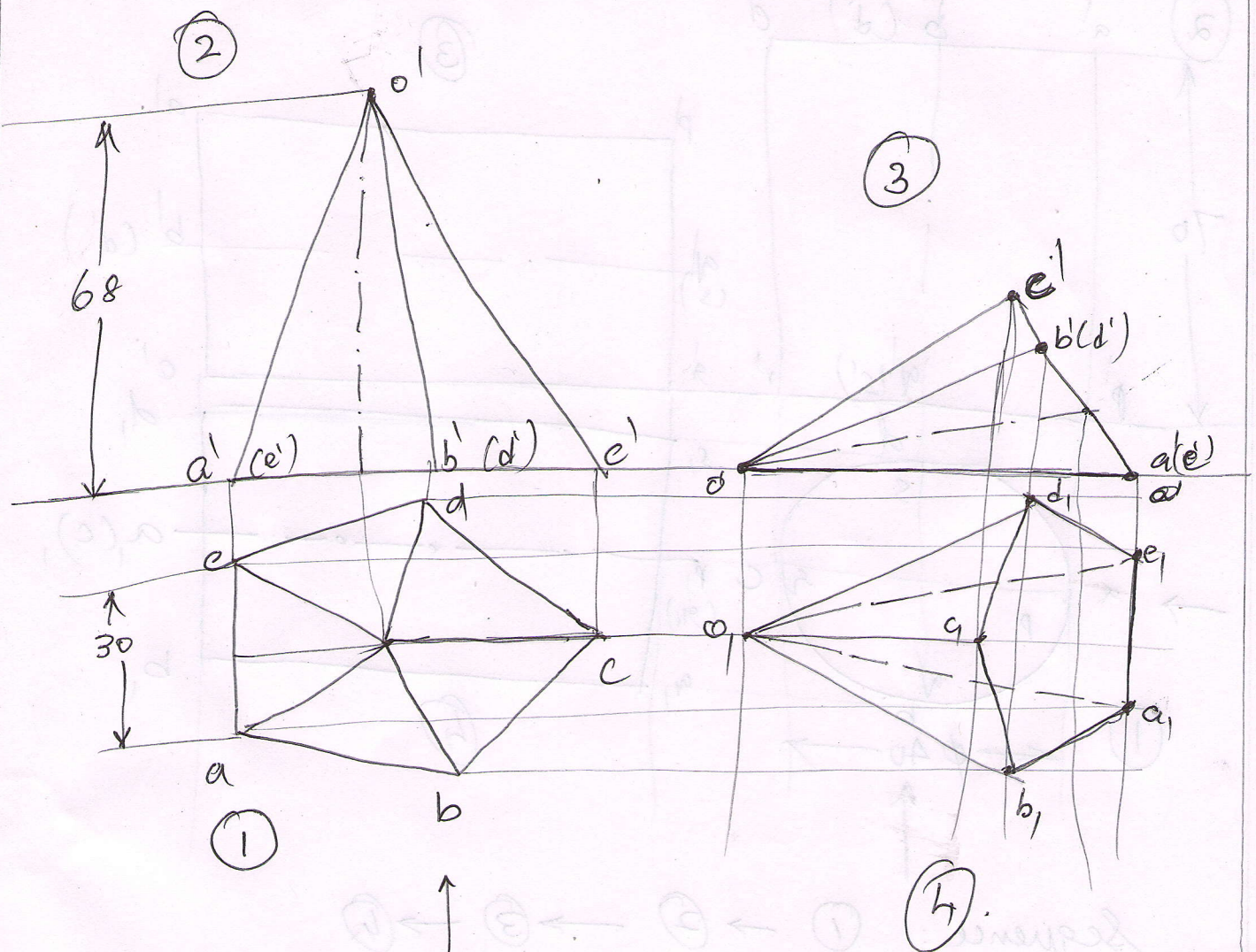
Shape \rightarrow pentagonal pyramid [5-108 - Triangular face]

Dimensions: (B, H) = (30, 68)

Base/Axis/Face orientation: Δ face on HP.

\therefore make it 1st as base on HP & start in TV.

Starting side position: \perp to xy [whenever face is resting \rightarrow side \perp]



(3) \rightarrow [$a'e'o'$ & $a_eo \rightarrow \Delta$ face; $a'e'o'$ on xy]

26

A cylinder of base diameter 40 mm and axis 70 mm long is resting on HP on one of its generators with the axis \parallel^a HP & VP. Draw its projections.

Soln

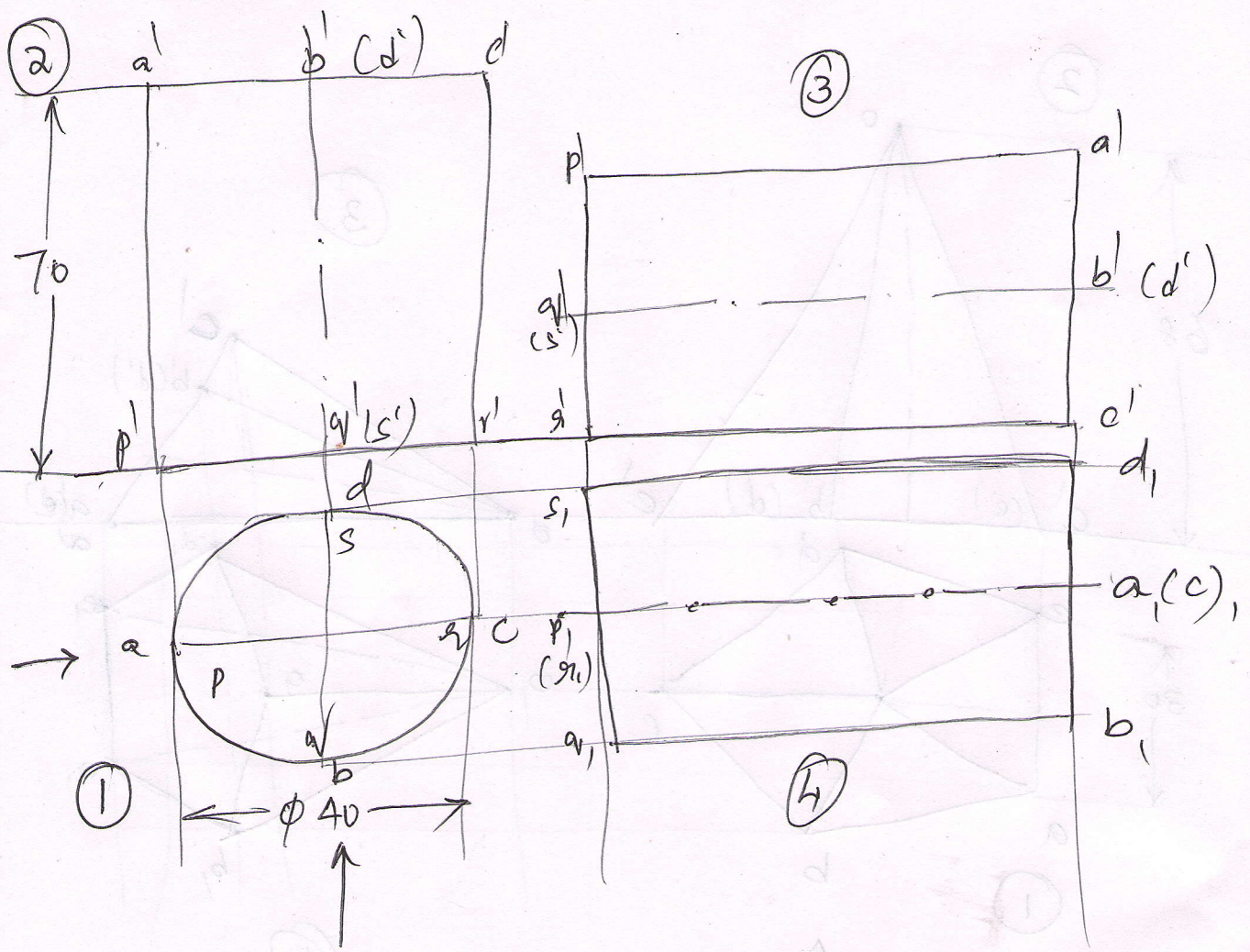
Given data:

Shape \rightarrow Cylinder

Dimensions $\rightarrow (B, H) \rightarrow (\phi 40, 70)$

Axis/Generator position: Generators on HP.

\therefore Can be drawn in single stage from side view or
can draw in two stages by using base on HP as the initial condition.



Sequence: (1) \rightarrow (2) \rightarrow (3) \rightarrow (4)

27

A pentagonal pyramid, edge of base 30mm and 68mm high is lying on one of its triangular faces on VP such that its axis is parallel to HP. Draw its projections.

Soln

Given data:

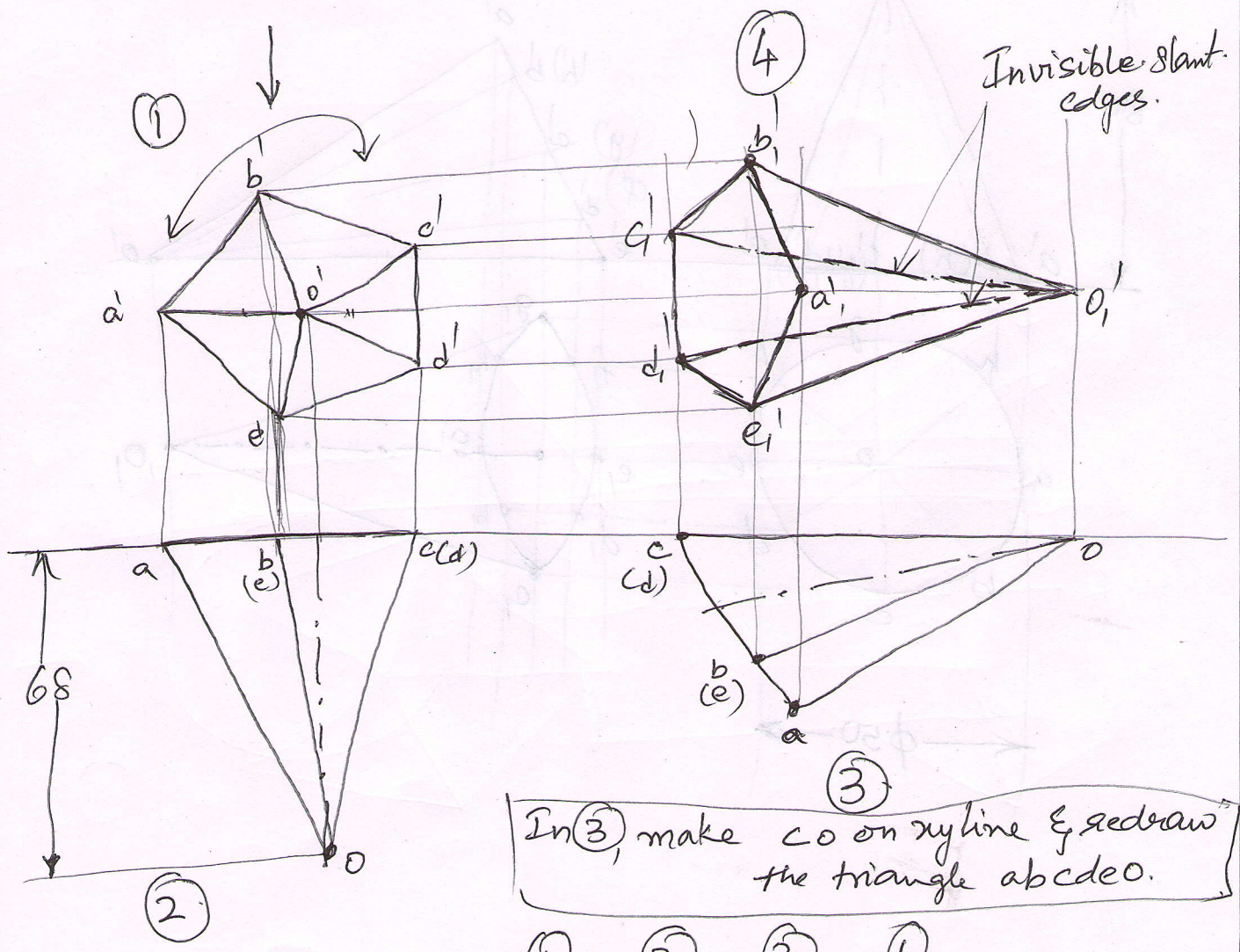
Shape: Pentagonal Pyramid - (5, 108°); Δ^{lar} faces.

Dimensions: (B, H) = (30, 68).

Axis / Face orientation: Δ^{lar} face on VP.

∴ Make base on VP as 1st stage, start in FV.
Starting side: \perp to xy as turning is about edge.

It is 2 stage problem.



In (3), make co on xy line & redraw the triangle $abcdeo$.

Sequence: (1) → (2) → (3) → (4)
 $a'b' = 30$;

28

A cone of base 50 mm diameter and axis 80mm long is lying on one of its generators on the HP with the axis parallel to VP. Draw its projections.

Soln

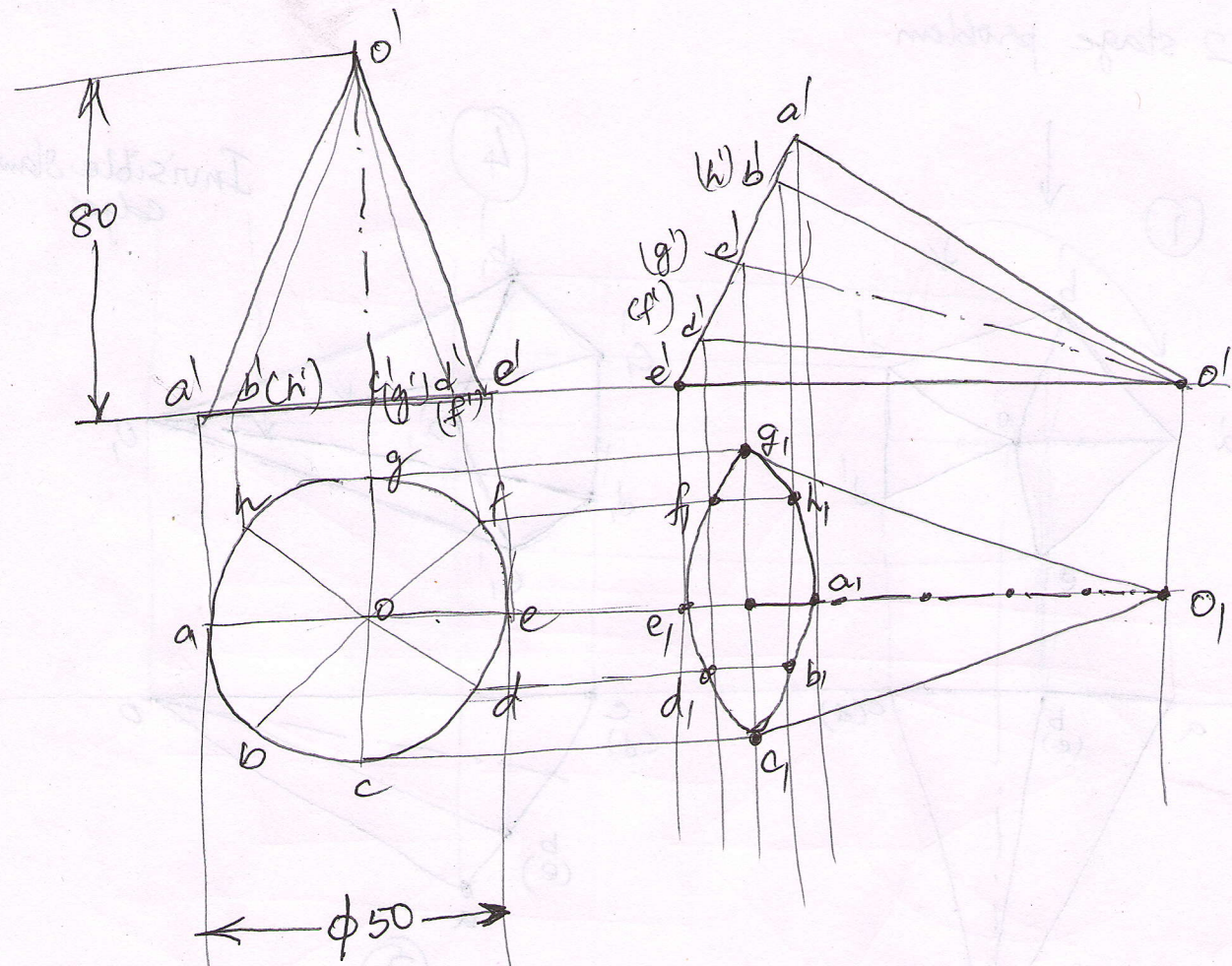
Given data:

Shape: Cone [circle base; Δ lar faces/generators]

Dimensions: (B, H) = (ϕ 50, 80).

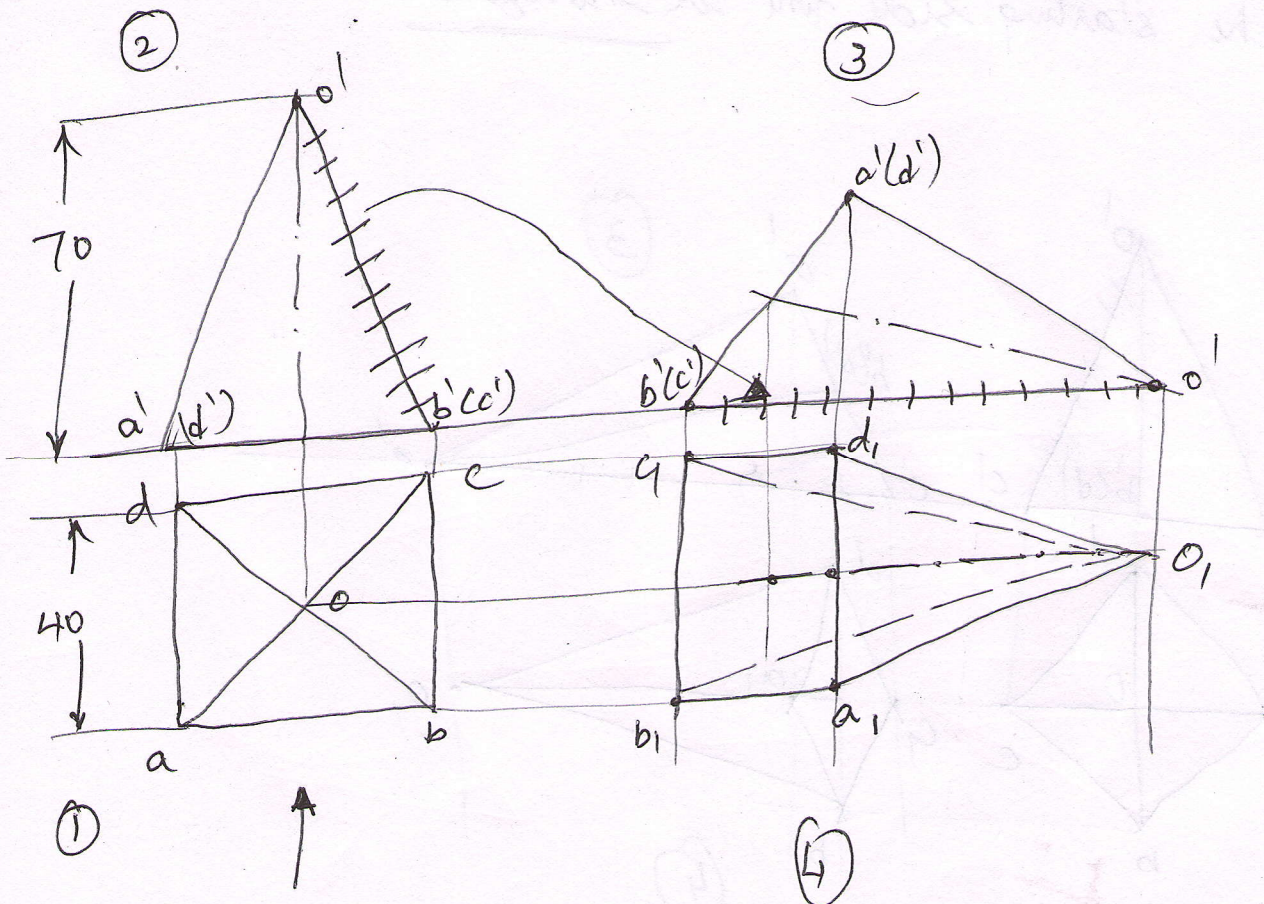
Axis/Generator position: Generator on HP.

\therefore Make Base on HP & start in TV.



29) A square pyramid, edge of base 40mm and axis 70mm long is resting on HP on one of its triangular faces with axis (axis) parallel to VP. Draw its projections.

A) Given data:
 shape: square pyramid (4, 90°)
 Dimensions: (B, H) = (40, 70).
 Axis/Face position: Triangular face on HP.
 ∴ Start with base on HP in T.V.
Start-side-details: \perp to xy as Δ^{lar} face is on HP/VP.



Sequence: ① → ② → ③ → ④.

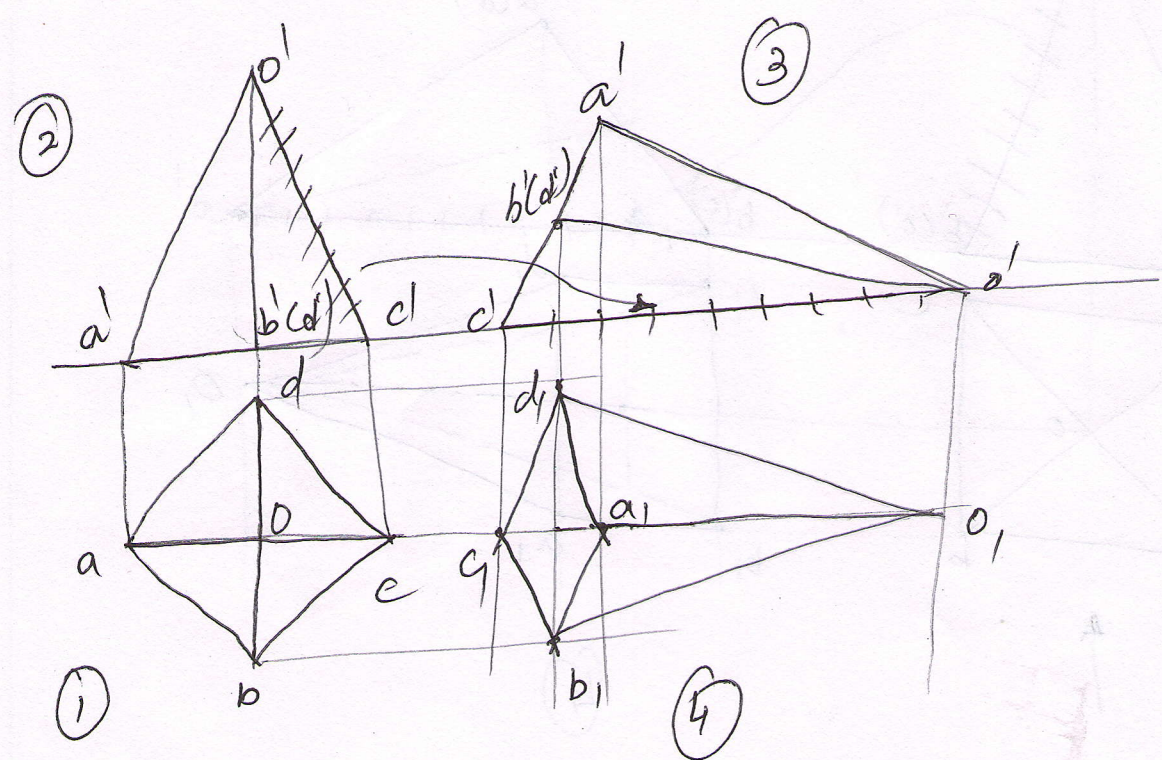
30. A square pyramid, edge of base 40mm and axis 70mm long is resting on HP on one of its slant edges with the axis parallel to VP. Draw its projections.

A. Given data: shape: Square pyramid (Square Base; 4 faces)
 Dimensions: (B, H) = (40, 70).

Axis/Face/Edge position: slant Edges on HP

∴ Start with Base on HP. only difference is that the starting side will be equally inclined (45°) to xy for a square.

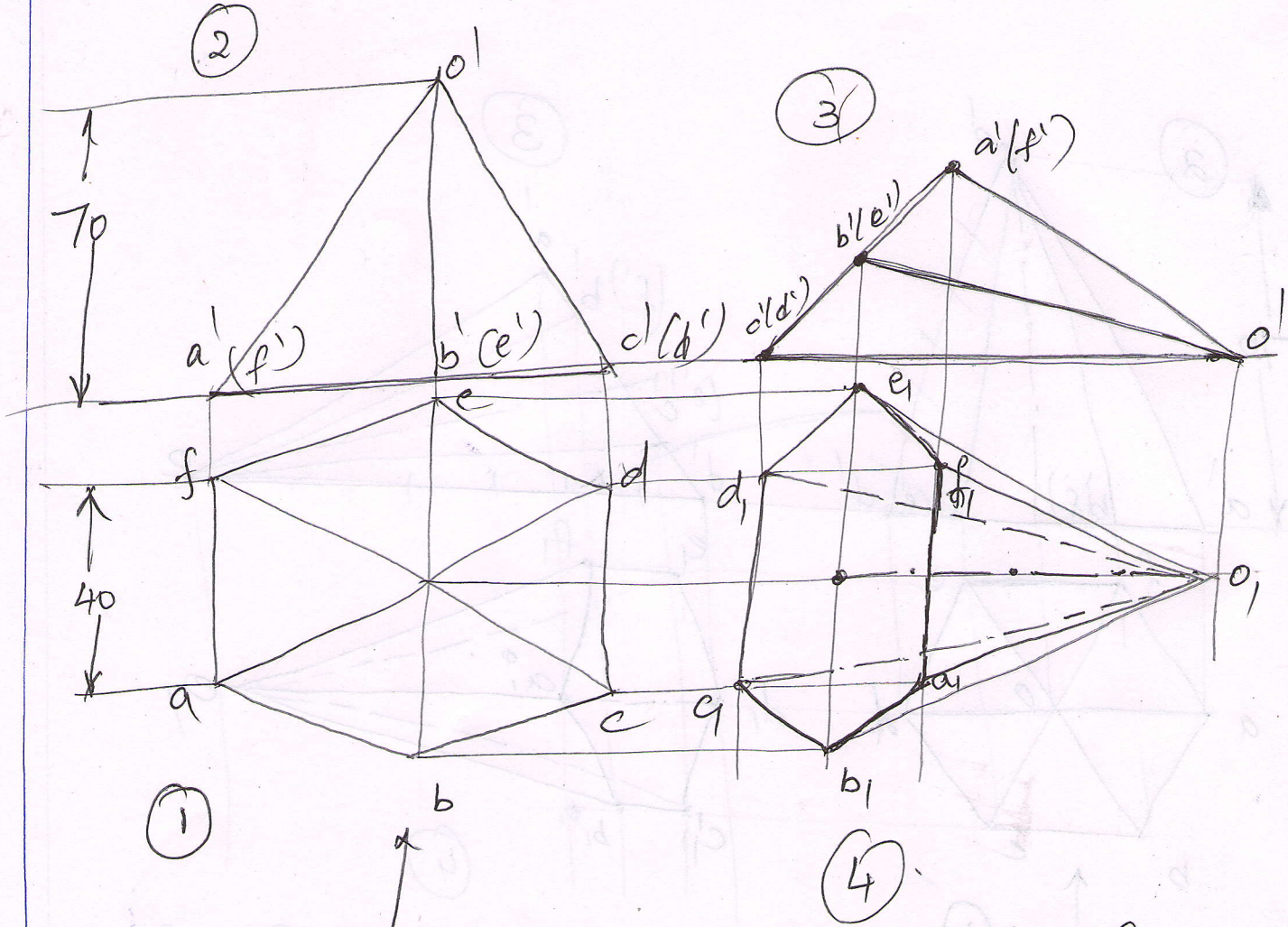
For non square objects like Δ, pentagon & hexagon, the starting side will be horizontal.



Sequence: ① → ② → ③ → ④

(31) A hexagonal pyramid, edge of base 40mm and axis 70mm long is resting on HP on one of its triangular faces with its axis parallel to VP. Draw its projections.

(A) Given data:
 Base shape: Hexagonal Pyramid [6-iso]
 Dimensions: (B, H) = (40, 70)
Axis/Face/Slant edge details: Triangular face on HP.
 ∴ Start with base on HP in TV.
Starting side details: Δ^{lar} face on HP
 ∴ Side is always ⊥ to xy.



Sequence: (1) → (2) → (3) → (4)

32) A hexagonal pyramid, edge of base 40mm and axis 70mm long is resting on the HP on one of its slant edges with the axis parallel to VP. Draw its projections.

- (A) Given data :
- Shape: Hexagonal pyramid
 - Dimensions: $(B, H) = (40, 70)$.
 - Axis/face/slant edge details: Slant Edge on HP.
 - ∴ Start with base on HP.
 - Starting side details: Side \parallel^{el} to xy as slant edge condition
- $ab=bc=40$.

