13

Sections of Solids

13.1 INTRODUCTION

In the engineering practice, it is often required to make the drawing showing the interior details of the object. If the object is simple in its construction, the interior portion of the object can be easily interpreted by dotted lines in the orthographic projections. When the dotted lines of hidden parts are too many, the views become more confusing and hard to read. In such cases, views can be drawn by cutting the object by an imaginary cutting plane so as to expose its interior or hidden details. The part of the object between the cutting plane and the observer is assumed to be removed so as to show the internal constructional features or details of the invisible surface. The exposed interior details are drawn in continuous thin lines instead of dotted lines. Such views are known as sectional views or views in section. The section surfaces are indicated by section lines, evenly spaced and inclined at 45° to the reference line.

13.2 SECTION PLANES

These are generally perpendicular planes. These may be perpendicular or parallel to one of the principal planes and either perpendicular, parallel or inclined to the other plane. These planes are usually described by their traces.

13.3 SECTIONS

Basically, sections are of two types :

(*i*) Apparent Section

(*ii*) True Section

(*i*) **Apparent Section.** The projection of the section on the principal plane to which the section plane is perpendicular, a straight line coinciding with the trace of the section plane on it. Its projection on the other plane to which it is inclined is called apparent section.

(*ii*) **True Section.** The projection of the section on a plane parallel to the section plane shows the true shape of the section. When the section plane is parallel to the HP or ground plane, the true shape of the section is seen in the sectional top view. When it is parallel to the VP, the true shape is projected in the sectional front view.

But when the section plane is inclined to one of the principal planes, the section has to be projected on an auxiliary plane parallel to the section plane, to obtain its true shape.

When the section plane is perpendicular to both the principal planes, the sectional side view shows the true shape of the section.

13.4 FRUSTUM OF A SOLID AND A TRUNCATED SOLID

When a cone or a pyramid is cut by a plane parallel to its base, thus removing the top portion, the remaining lower portion is called its frustum of a solid as shown in the Fig. 13.1. The section obtained is called the true section of a solid.

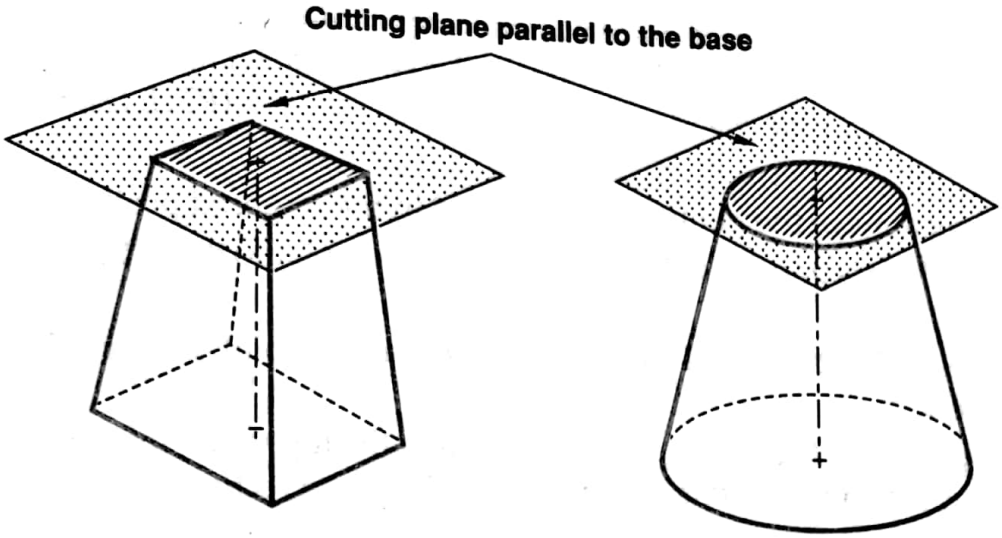

Fig. 13.1 Frustum of a solid

When a solid is cut by a plane inclined to its base, thus removing the top portion, the remaining lower portion is called its truncated of a solid as shown in the Fig. 13.2. The section obtained is called the apparent section of a solid.

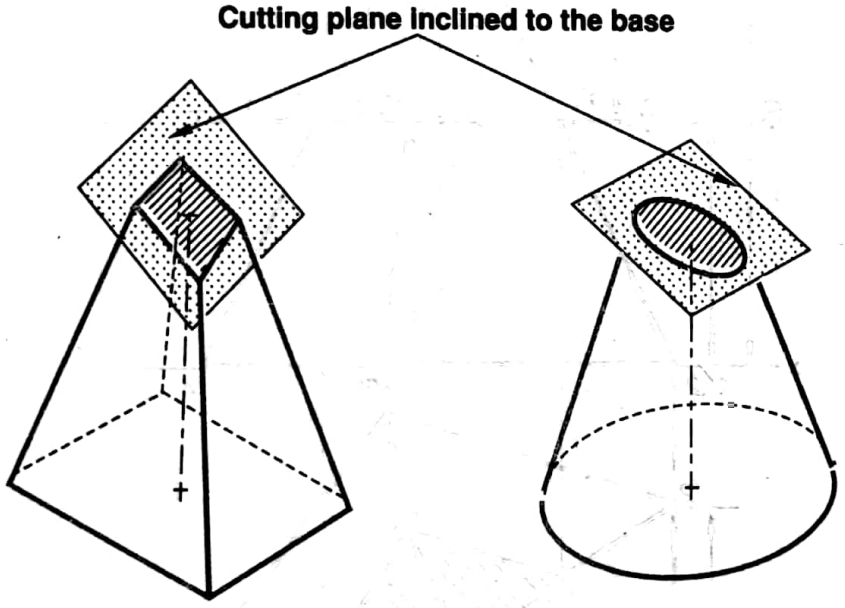

Fig. 13.2 Truncated of a solid

13.5 CLASSIFICATION OF SECTIONS OF SOLIDS

The solids may be assumed to be cut by the section planes in many ways to obtain the sectional views. These are as follows :

- Section plane parallel to the HP
- Section plane parallel to the VP
- Section plane perpendicular to the VP and inclined to the HP
- Section plane perpendicular to the HP and inclined to the VP
- Section plane perpendicular to both HP and VP

13.6 SECTION PLANE PARALLEL TO THE HP

As the section plane is perpendicular to the VP and parallel to the HP, therefore its VT will be a straight line parallel to *xy* and has no HT. As the section plane is parallel to the HP, projection of the section on the HP is true shape and size. Its projection on the VP is a line and coincides with VT of the plane.

PROBLEM 13.1 *A right regular pentagonal pyramid, edge of base 30 mm and height 50 mm, rests on its base on HP with one of its base edges perpendicular to VP. A section plane parallel to the HP cuts the pyramid bisecting its axis. Draw its front view and sectional top view.* (PTU, Jalandhar December 2003)

SOLUTION.

(*i*) Draw the projections of the pentagonal pyramid in the required position and label it.

(*ii*) As the section plane is parallel to the HP and perpendicular to the VP. Hence it is represented by its VT.

(*iii*) The slant edges 0'1', 0'2', 0'3', 0'4' and 0'5' intersect at the points *a'*, *b'*, *c'*, *d'* and *e'* respectively in the front view.

(*iv*) Project these points on the corresponding edges in the top view. Join these points in proper order and draw section lines in it. It will give the required sectional top view as shown in Fig. 13.3.

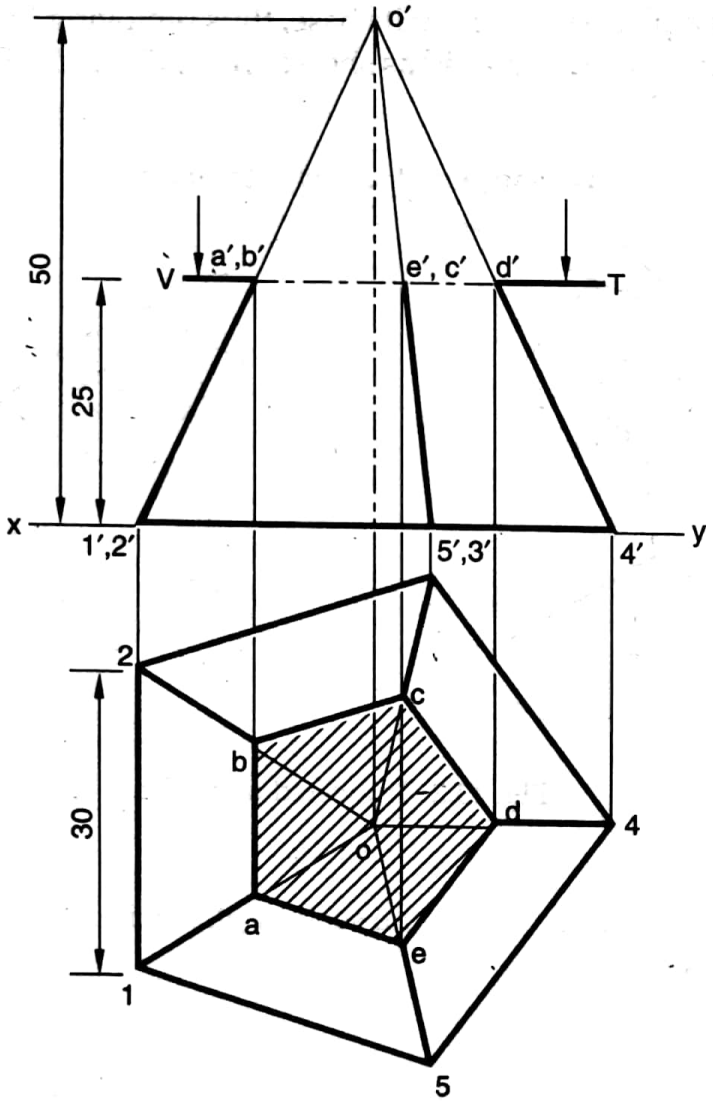

Fig. 13.3 Solution to problem 13.1

PROBLEM 13.2 *A right regular hexagonal pyramid, edge of base 30 mm and height 50 mm, rests on its base on ground plane with one of its base edges parallel to VP. A section plane parallel to the HP cuts the pyramid bisecting its axis Draw its front view and sectional top view.*

SOLUTION.

(*i*) Draw two lines *xy* ang *gl* by a suitable distance apart. Draw the projections of the hexagonal pyramid in the required position and label it.

(*ii*) Draw the VT to represent the section plane at a distance of 25 mm from *gl* and parallel to it.

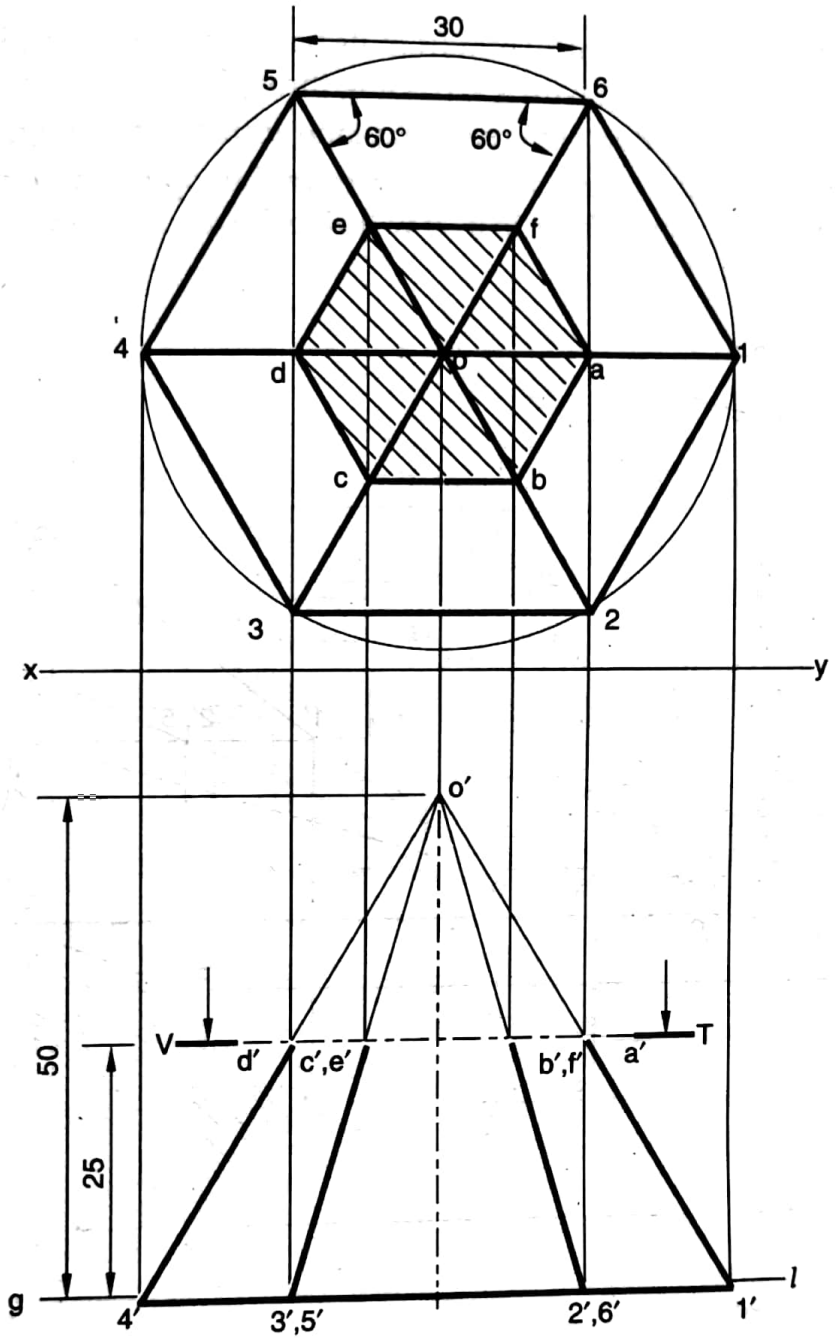

Fig. 13.4 Solution to problem 13.2

(*iii*) The slant edges 0′1′, 0′2′, 0′3′, 0′4′, 0′5′, 0′6′ cut the points *a′*, *b′*, *c′*, *d′*, *e′*, *f′* respectively in the front view.

(*iv*) Project these points of intersection on the corresponding edges in the top view. Join these points in proper order and draw section lines in it. It will give the required sectional top view as shown in Fig. 13.4.

PROBLEM 13.3 *A right regular pentagonal pyramid, side of base 30 mm and height 65 mm, lies on one of its triangular faces in HP such that its axis is parallel to VP. A section plane parallel to HP, cuts the axis at a point 10 mm away from its base. Draw its front view and sectional top view.*

(PTU, Jalandhar May 2004)

SOLUTION.

(*i*) Draw the projections of the given pyramid in the required position and label it.

(*ii*) As the section plane is parallel to HP and perpendicular to the VP. Hence it is represented by its VT.

(*iii*) In the front view, at a distance of 10 mm from its base, find the point along its axis and draw a cutting plane line coinciding with VT, passing through the above mentioned point.

(*iv*) Mark the points of intersection of the section plane with different edges of the pyramid.

(*v*) Project these points on the corresponding edges in the top view. Join these points in their proper order and draw section lines in it. It will give the required sectional top view as shown in Fig. 13.5.

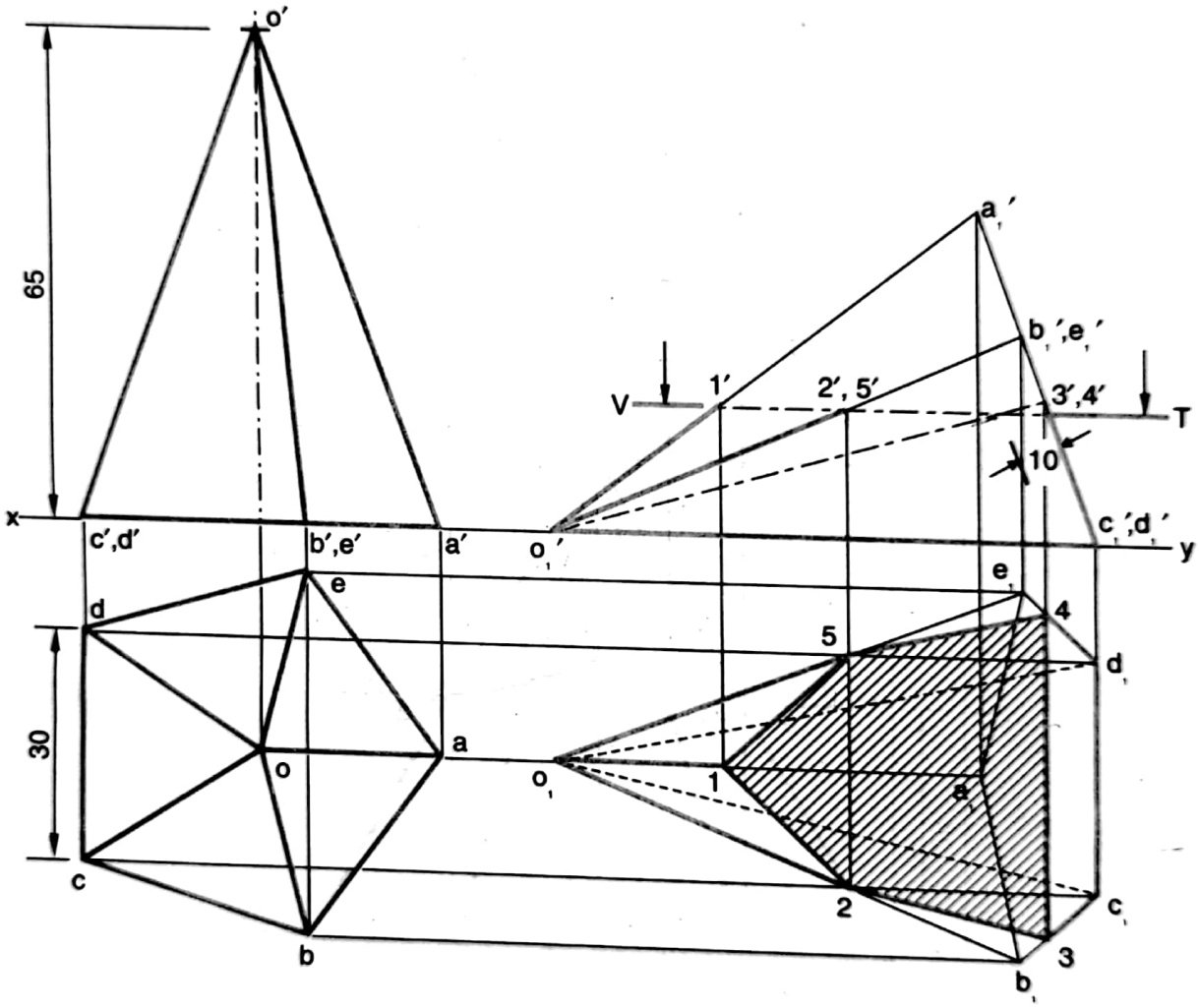

Fig. 13.5 Solution to problem 13.3

PROBLEM 13.4 *A right circular cone, diameter of base 50 mm and height 60 mm, lies on one of its elements in HP, such that its axis is parallel to VP. A section plane parallel to the HP and perpendicular to the VP cuts the cone, meeting the axis at a distance of 15 mm from the base. Draw its front view and sectional top view.*

SOLUTION.

(*i*) Draw the projections of the given cone in the required position and label it.

(*ii*) As discussed above, in the front view, at a distance of 15 mm from its base, find the point along its axis and draw a cutting plane line coinciding with VT, passing through the given point.

(*iii*) Mark the points of intersection of the section plane with different elements or base of the cone.

(*iv*) Project these points on the corresponding elements or base in the top view. Join these points in their proper order and draw section lines in it. It will give the required sectional top view as shown in Fig. 13.6.

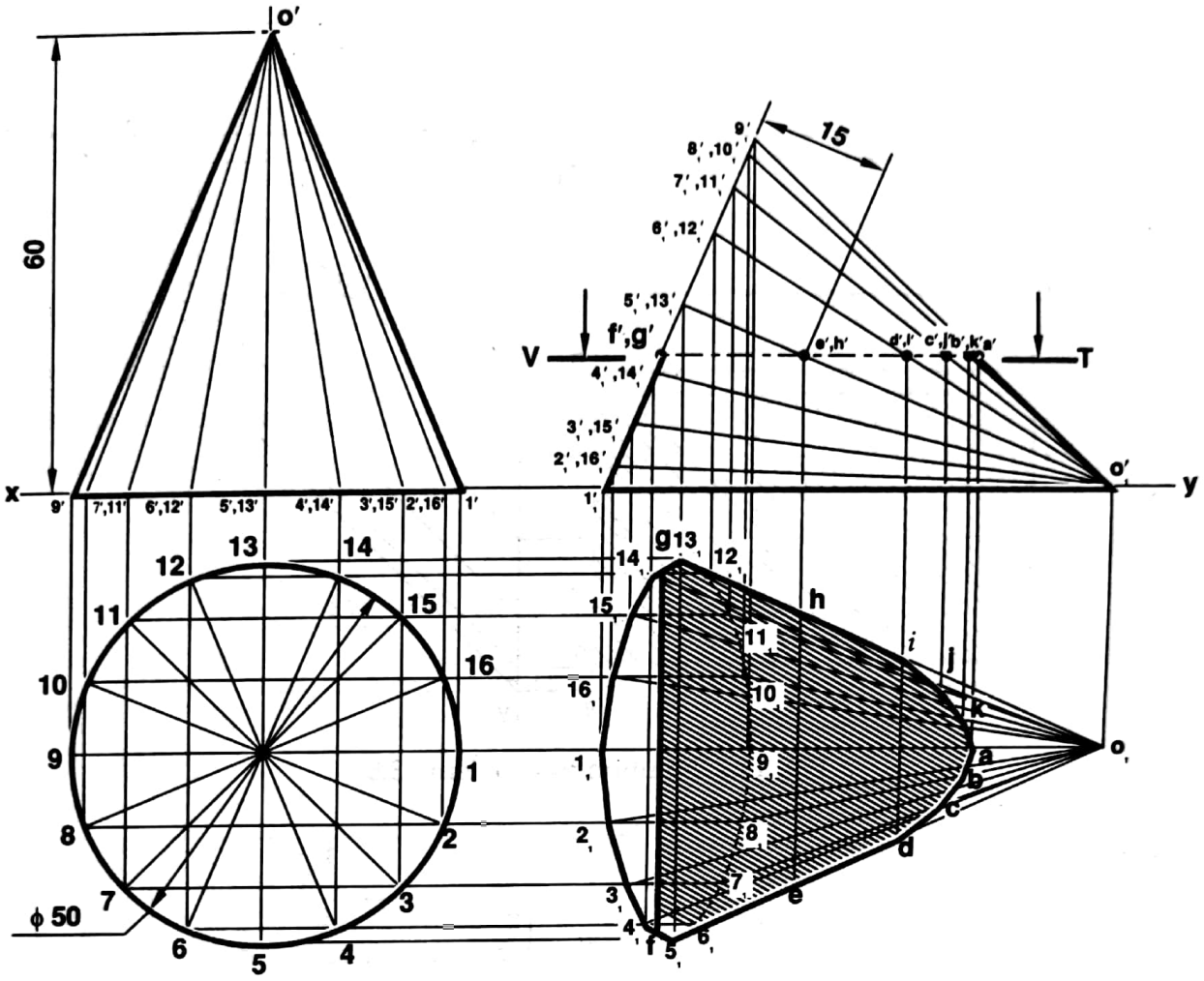

Fig. 13.6 Solution to problem 13.4

PROBLEM 13.5 *A right regular hexagonal prism, side of base 20 mm and length of axis 55 mm, is lying on one of its rectangular faces in HP. Its axis is parallel to both HP and VP. It is cut by a section plane parallel to and at a distance of 20 mm from the HP. Draw its front view and sectional top view.*

SOLUTION.

(*i*) Draw the projections of the given prism in the required position and label it. Here in this case, the projections will be started from the side view and then project the front and top views from it.

(*ii*) Draw a cutting plane coinciding with VT parallel to *xy* and 20 mm away from it.

(*iii*) Mark the points of intersection of the section plane with different elements of the prism.

(*iv*) Project these points on the corresponding elements in the top view. Join these points in their proper order and draw section lines in it. It will give the required front and sectional top views as shown in Fig. 13.7.

PROBLEM 13.6 *A triangular prism, side of base 45 mm and length of axis 60 mm, is lying on one of its rectangular faces in HP. Its axis is parallel to both HP and VP. It is cut by a section plane parallel to and at a distance of 20 mm from the HP. Draw its front view and sectional top view.*

(PTU, Jalandhar December 2006, December 2007)

SOLUTION. The procedure followed to solve this problem is same as explained in problem 13.5. The interpretation of the solution is left to the student. See Fig. 13.8.

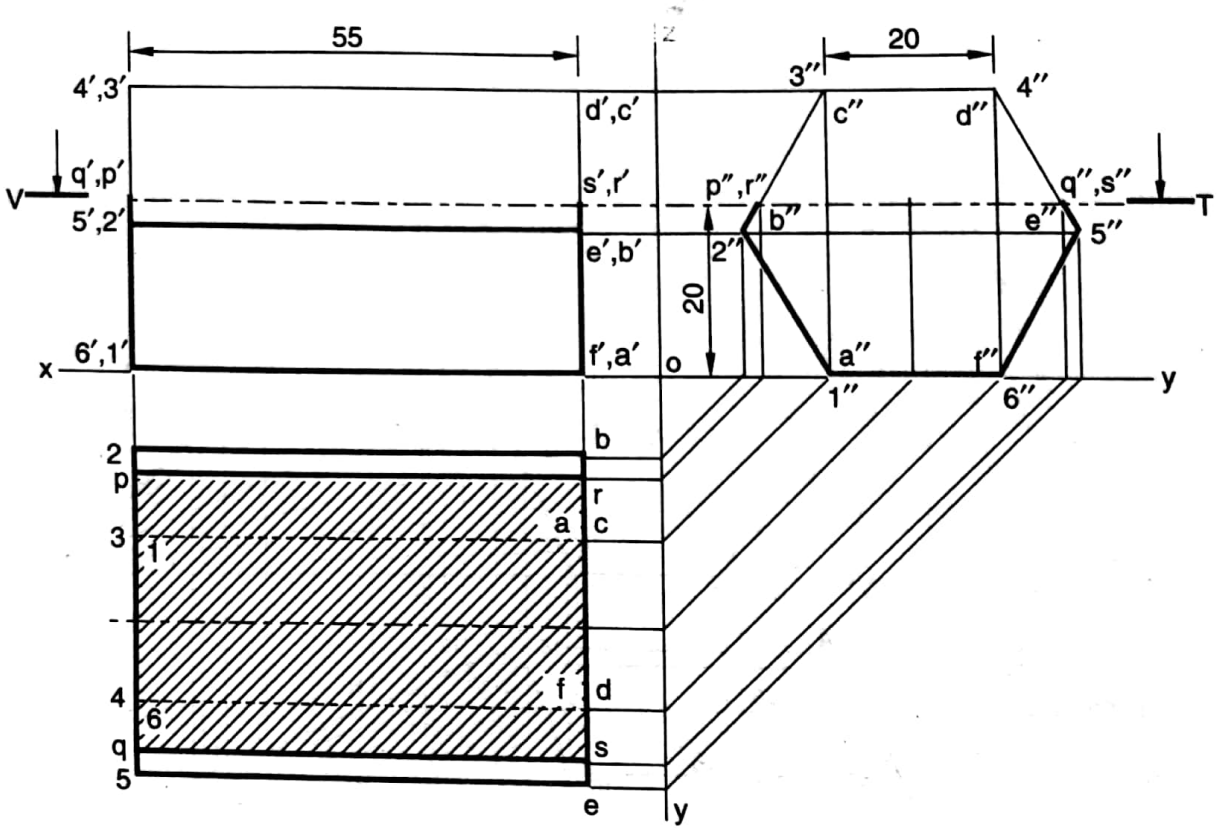

Fig. 13.7 Solution to problem 13.5

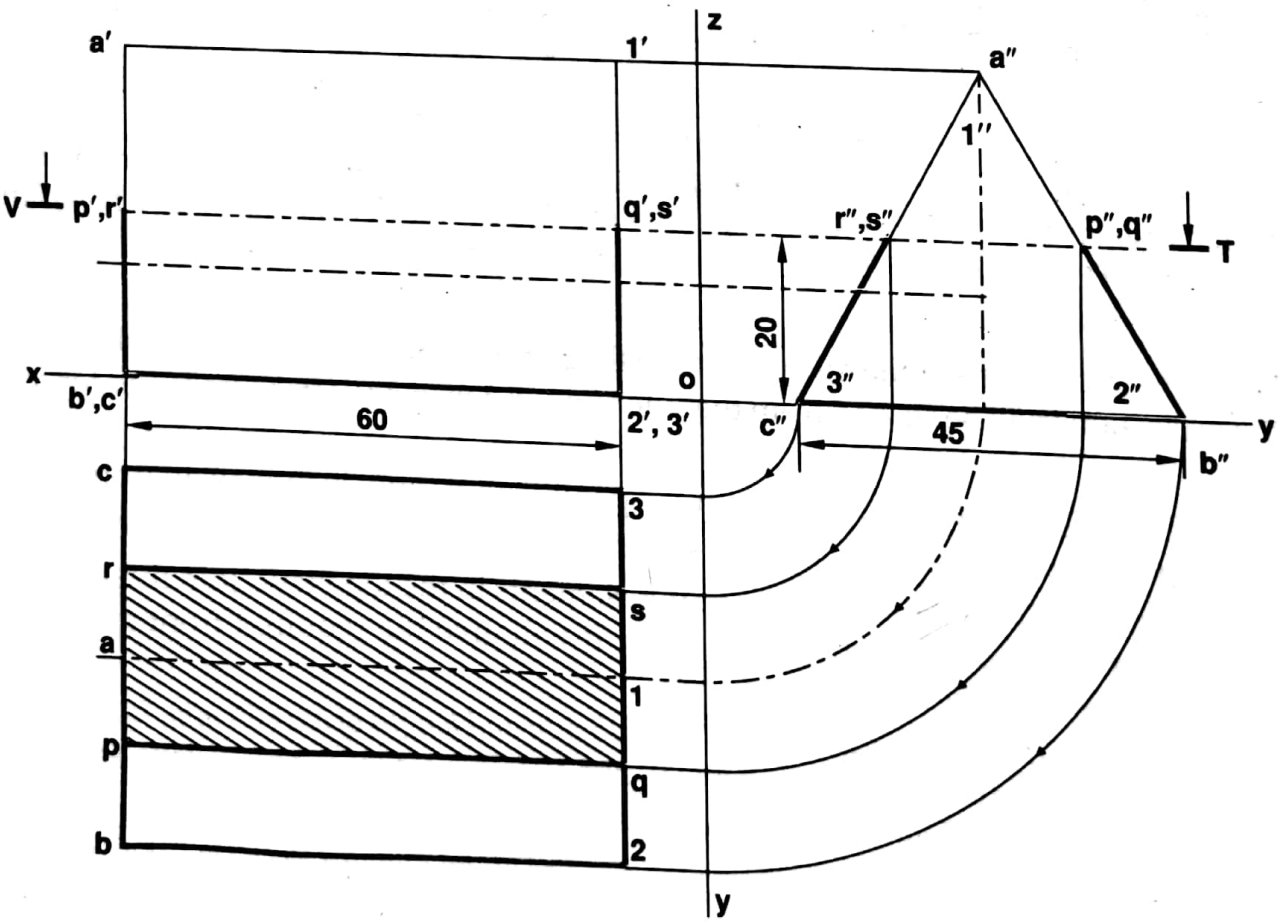

Fig. 13.8 Solution to problem 13.6

PROBLEM 13.7 *A right circular cylinder diameter of base 50 mm and height 60 mm, rests on its base rim on ground plane such that its axis is inclined at 45° to the ground plane and is parallel to the VP. A section plane parallel to the HP cuts the cylinder bisecting its axis. Draw its front view and sectional top view.*

(PTU, Jalandhar December 2014)

SOLUTION.

(*i*) Draw two lines *xy* and *gl* by a suitable distance apart. Draw the projections of the cylinder in the required position and label it.

(*ii*) Draw the VT to represent the section plane at a distance of 30 mm from base and parallel to it.

(*iii*) The section plane line cuts the elements $1_1'a_1'$, $2_1'b_1'$, so on, at points I', H' and so on. Project these points on the corresponding elements in the top view. Join these points in proper order and draw section lines in it. It will give the required sectional top view as shown in Fig. 13.9.

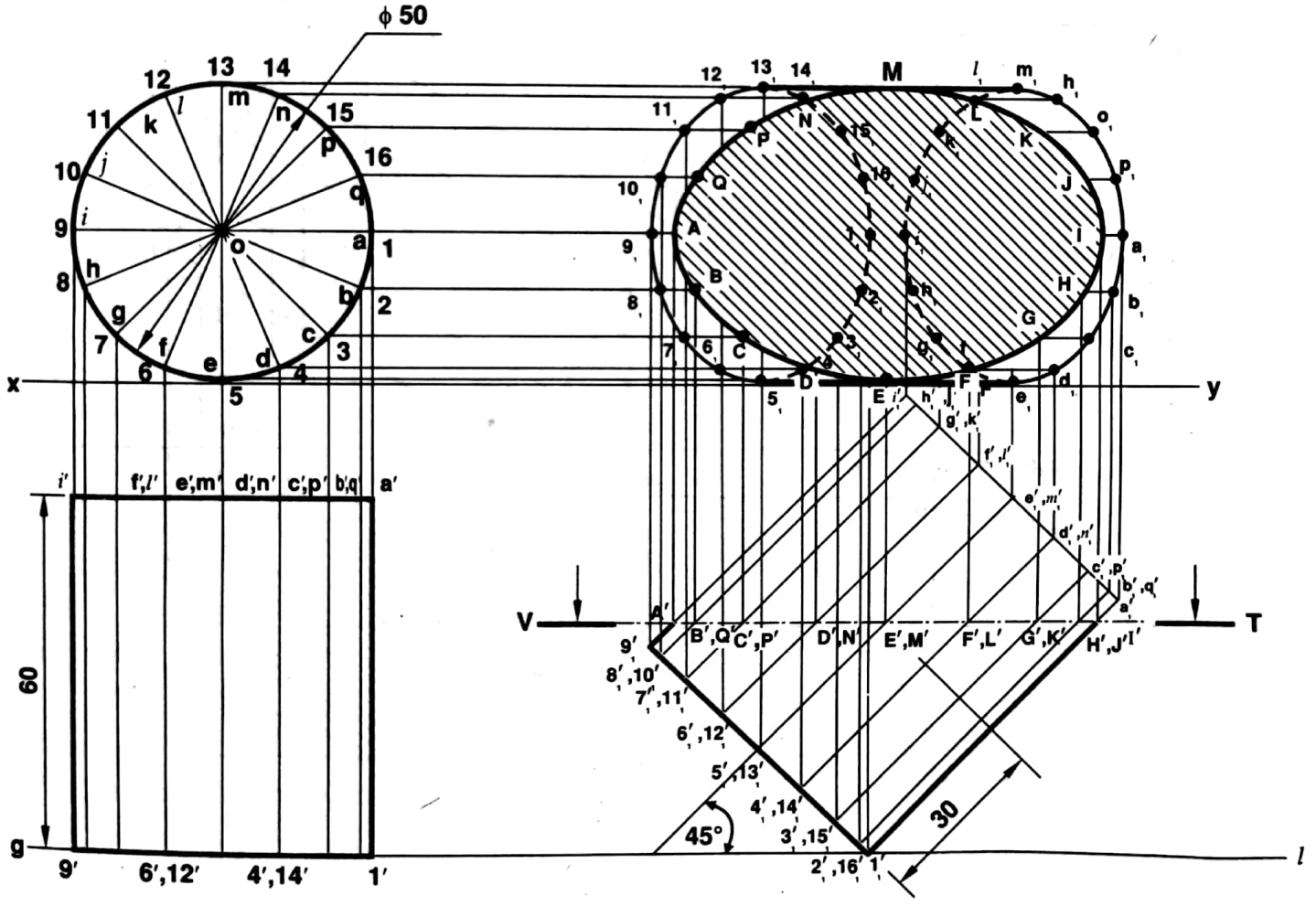

Fig. 13.9 Solution to problem 13.7

PROBLEM 13.8 *A hexagonal prism of base edge 20 mm long and height 60 mm is resting on one of its corners on HP with the base making 60° to HP. Axis is parallel to the VP. A section plane parallel to HP and perpendicular to VP cuts the object such that it is 15 mm away from the base measured along its axis. Draw the front view and sectional top view of the solid.* (*PTU, Jalandhar December 2002*)

SOLUTION.

(*i*) Draw the projections of the prism in the given position and label it.

(*ii*) Draw the section plane line VT parallel to the *xy* and 15 mm away from the base along its axis.

(*iii*) Mark the points of intersection of the section plane with different elements of the prism.

(*iv*) Project these points of intersection say e_1, g_1, i_1, h_1, c_1 in the top view to their corresponding elements of the prism. Join these points in their proper order and draw section lines in it. It will give the required sectional top view as shown in Fig. 13.10.

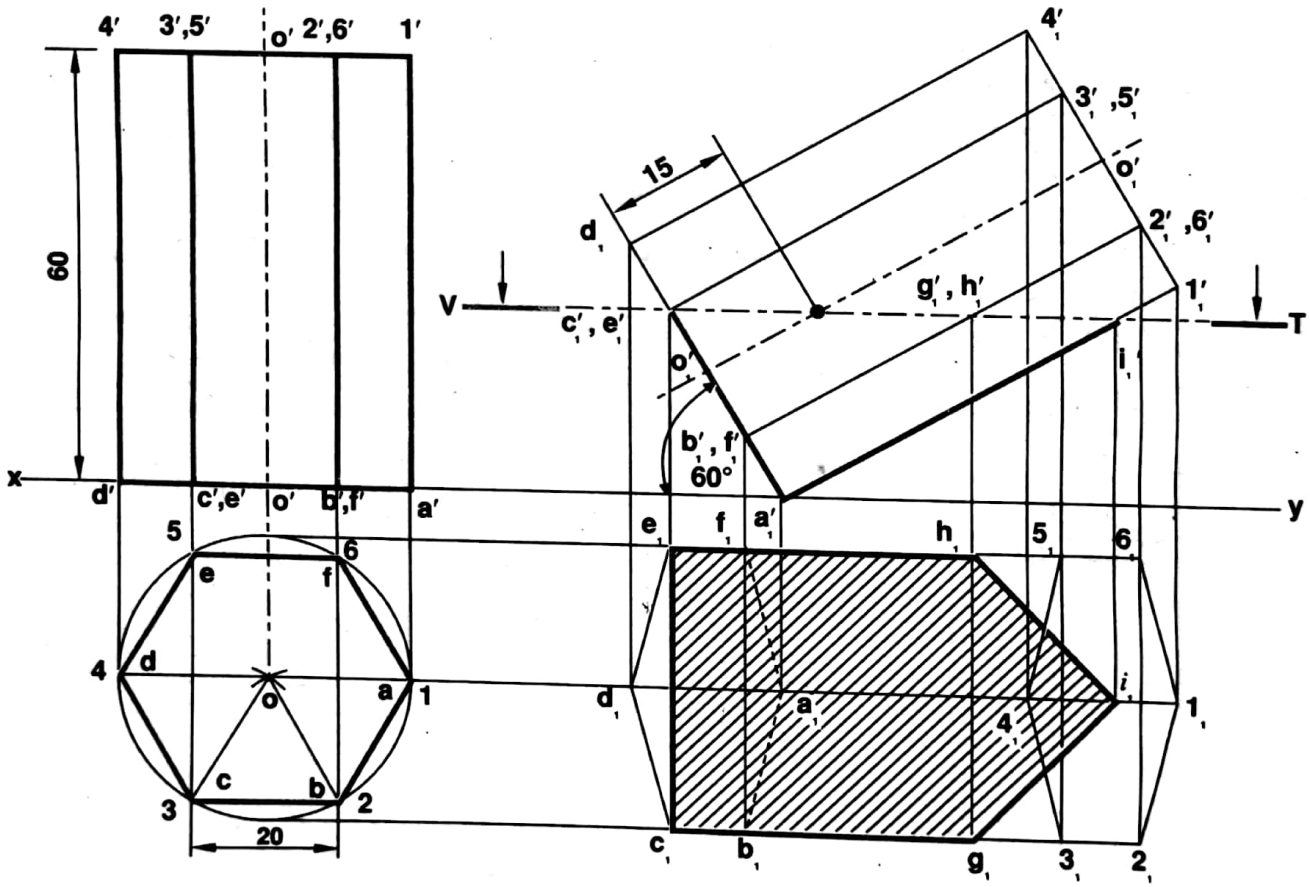

Fig. 13.10 Solution to problem 13.8

PROBLEM 13.9 *A right regular hexagonal prism, side of base 20 mm and height 45 mm rests on a corner of its base on the HP with the longer edge passing through this corner making an angle of 30° to the HP. A section plane parallel to the HP cuts the axis at a distance of 15 mm from top base. Draw its sectional top view and front view.*

SOLUTION. The interpretation of the solution is left to the reader. See Fig. 13.11.

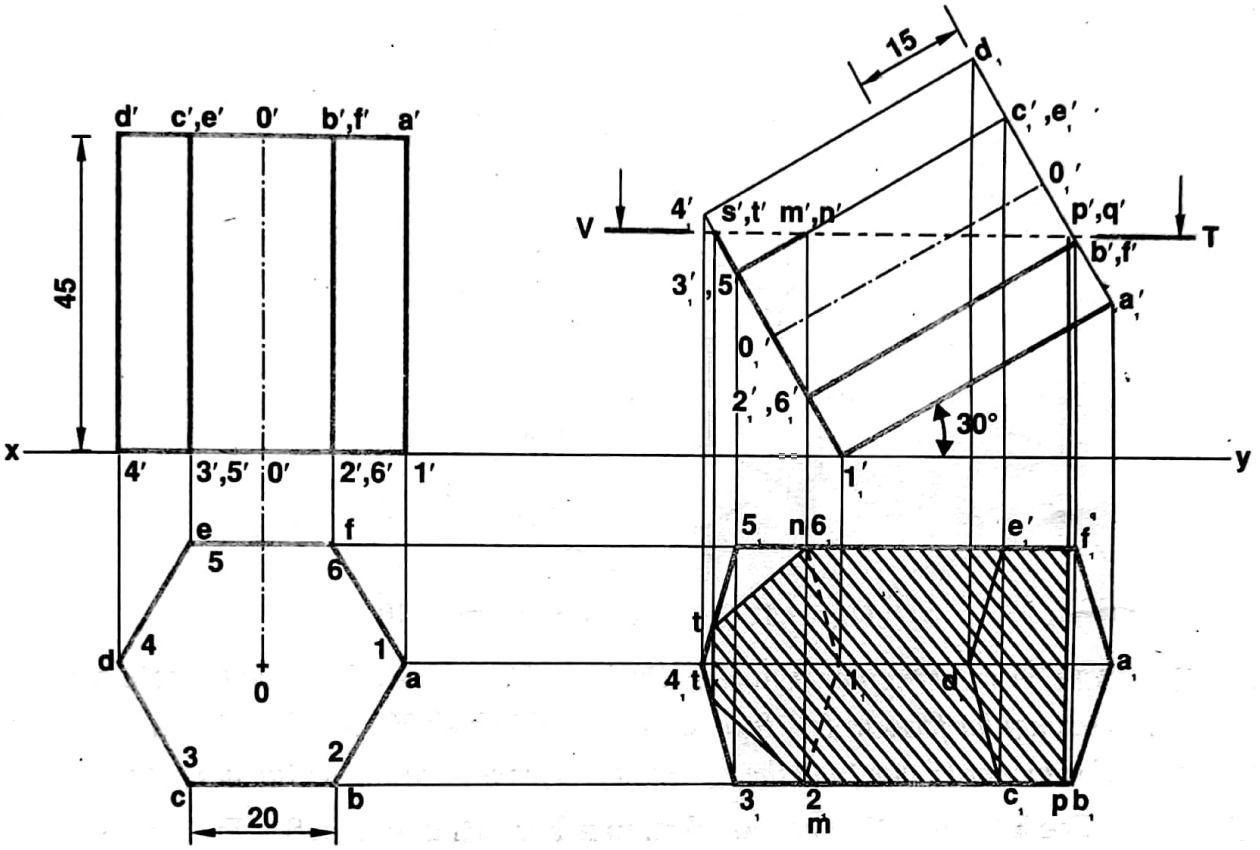

Fig. 13.11 Solution to problem 13.9

PROBLEM 13.10 *A right regular hexagonal pyramid, edge of base 30 mm and height 60 mm, rests on its base in HP with one of its base edges perpendicular to VP. A section plane parallel to the HP cuts the pyramid bisecting its axis. Draw its front view and sectional top view.*

SOLUTION. (*i*) Draw the projections of the pyramid in the given position and name the corner points on it.

(*ii*) Draw the cutting plane line VT parallel to *xy* and bisecting its axis.

(*iii*) The cutting plane live VT cuts the various edges as shown in Fig. 13.12.

(*iv*) Project these points in the top view. The projections *c*, *f* of *c'*, *f'* in the top view are to lie on 03 and 06. By direct intersection these points cannot be plotted. Project *c'*, *f'* horizontally on a slant edge (which gives true length) or $0'1'_1(0'2'_1)$ and then project point of intersection vertically into in the top view. With 0 as centre, rotate these points to lie on 03 and 06 at *c* and *f* respectively.

(*v*) Join the points in proper order and draw section lines in it.

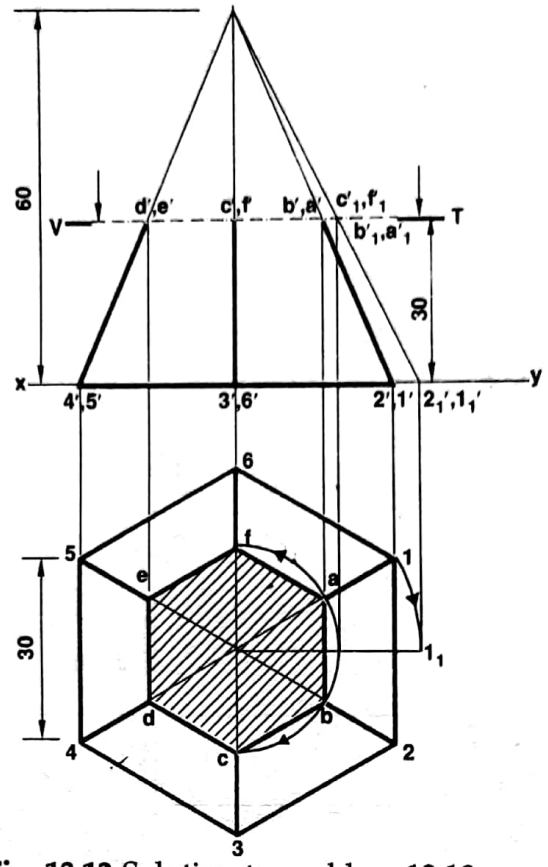

Fig. 13.12 Solution to problem 13.10

PROBLEM 13.11 *A right regular pentagonal prism, side of base 25 mm and length of axis 60 mm, is lying on one of its rectangular faces in HP. Its axis is parallel to both HP and VP. It is cut by a section plane parallel to and at a distance of 15 mm from the HP. Draw its front view and sectional top view.*

SOLUTION. The interpretation of the solution is left to the reader. See Fig. 13.13.

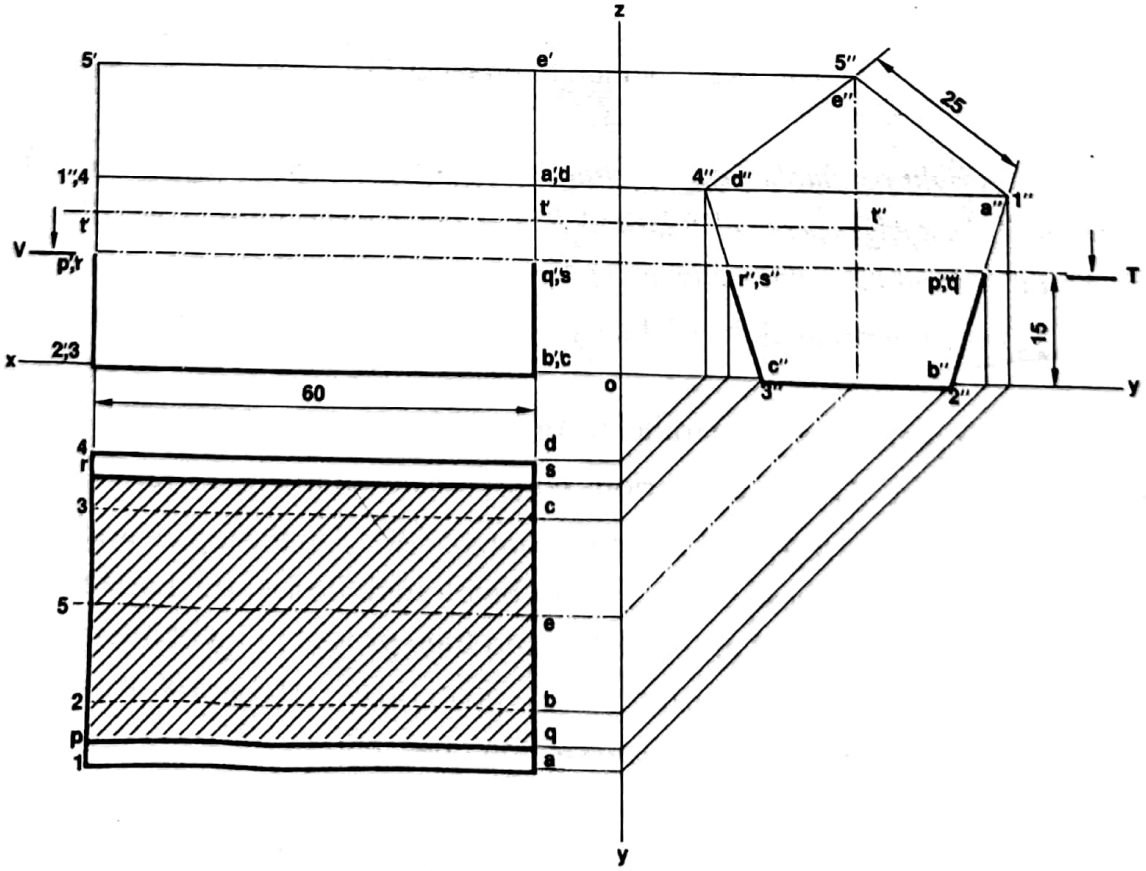

Fig. 13.13 Solution to problem 13.11

PROBLEM 13.12 *A right regular pentagonal pyramid, edge of base 30 mm and height 60 mm, rests on its base on HP with one of its base edges parallel to VP. A section plane parallel to the HP cuts the pyramid bisecting its axis. Draw its front view and sectional top view.* *(PTU, Jalandhar May 2009)*

SOLUTION. All the construction lines are retained to make the solution self–explanatory. See Fig. 13.14.

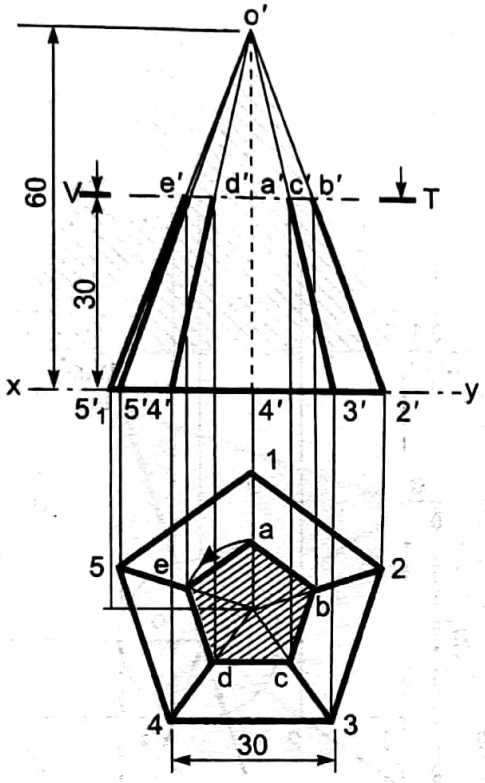

Fig. 13.14 Solution to problem 13.12

13.7 SECTION PLANE PARALLEL TO THE VP

As the section plane is perpendicular to the HP and parallel to the VP, therefore its HT will be a straight line parallel to *xy* and has no VT. As the section plane is parallel to the VP, projection of the section on the VP is true shape and size. Its projection on the HP is a line, coinciding with the HT of the plane.

PROBLEM 13.13 *A right regular pentagonal pyramid, edge of base 30 mm and height 55 mm, rests on its base on HP, such that one of its base edges is perpendicular to the VP. A section plane parallel to the VP cuts the pyramid at a distance of 10 mm from the axis. Draw its top view and sectional front view.*

(PTU, Jalandhar June 2003, May 2004)

SOLUTION.

(*i*) Draw the projections of the given pyramid in the required position and label it.

(*ii*) As the section plane is parallel to VP and perpendicular to the HP, hence it is represented by its HT. In the top view, cut a distance of 10 mm from its axis, coinciding with HT.

(*iii*) Mark the points of intersection of the section plane with different edges of the pyramid.

(*iv*) Project these points on the corresponding edges in the front view. Join these points in proper order and draw section lines in it. It will give the required sectional front view as shown in Fig. 13.15.

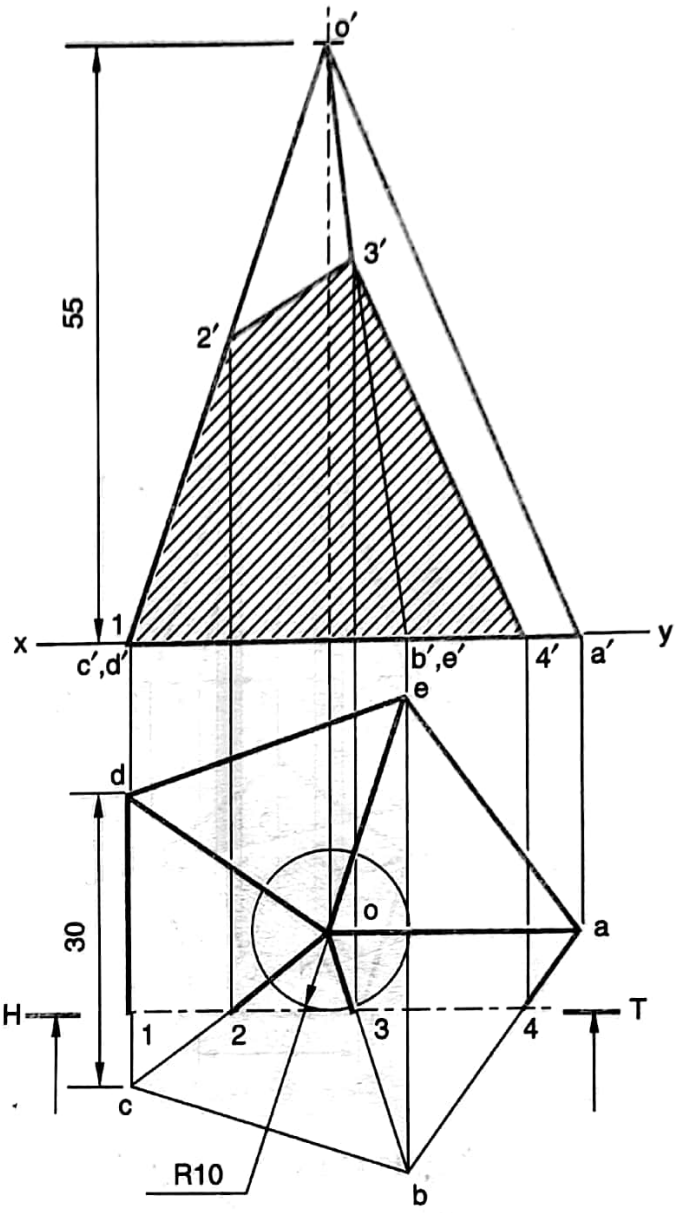

Fig. 13.15 Solution to problem 13.13

PROBLEM 13.14 *A right regular pentagonal pyramid, edge of base 30 mm and height 50 mm, rests on its base on ground plane, such that one of its base edges perpendicular to VP. A section plane parallel to the VP cuts the pyramid at a distance of 10 mm from the axis. Draw its top view and sectional front view.*

SOLUTION. The interpretation of the solution is left to the student. See Fig. 13.16.

PROBLEM 13.15 *A right pentagonal pyramid of base side 25 mm and height 50 mm rests on the HP with one edge of the base at 45° to the VP. Draw the sectional elevation of the solid is cut by a plane parallel to the VP containing the apex.* *(PTU, Jalandhar December 2004)*

SOLUTION.

(*i*) Draw the projections of the given pyramid in the required position and label it.

(*ii*) As the section plane is parallel to the VP, hence it is represented by its HT. In the top view, draw a cutting plane line passing through the apex coinciding with the HT.

(*iii*) Mark the points of intersection of the section plane with different edges of the pyramid.

(*iv*) Project these points on the corresponding front view. Join these points in the proper sequence and draw section lines in it as shown in Fig. 13.17 .

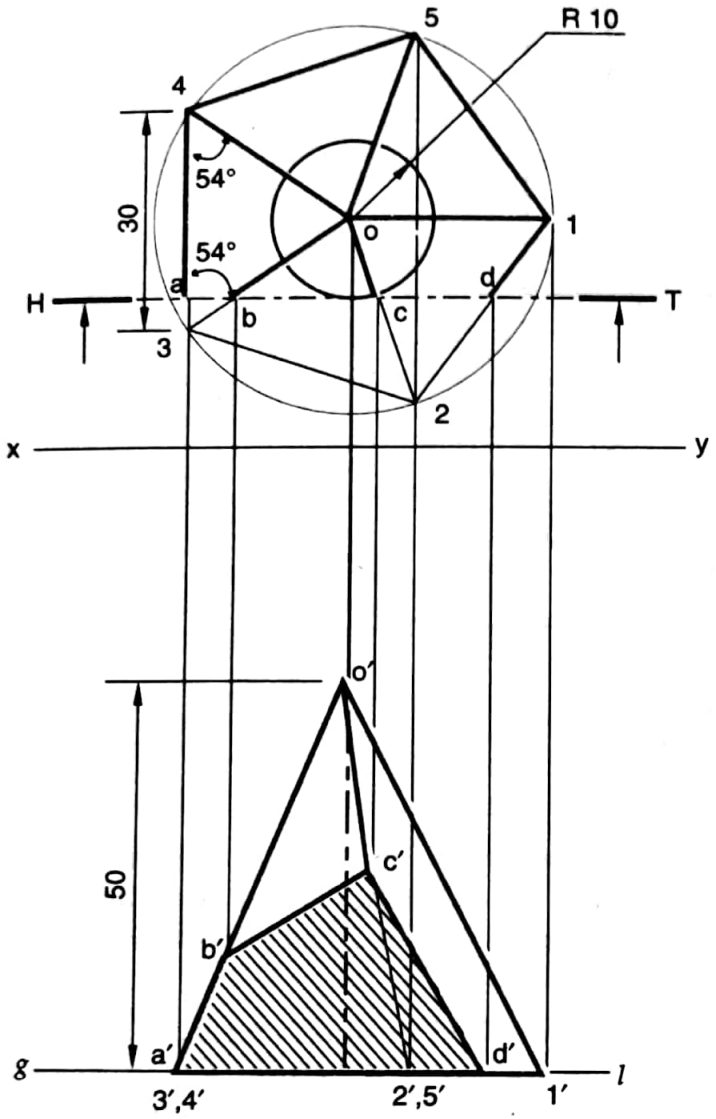

Fig. 13.16 Solution to problem 13.14

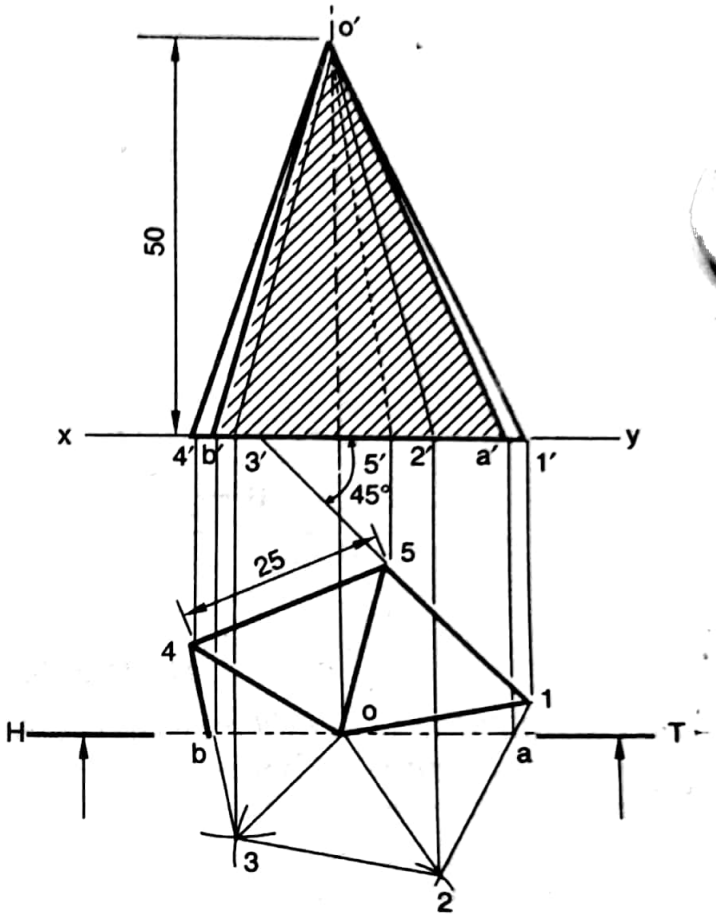

Fig. 13.17 Solution to problem 13.15

PROBLEM 13.16 *A cube of 35 mm long edge is resting on the HP on one of its faces with a vertical face inclined at 30° to the VP. It is cut by a section plane parallel to the VP and 10 mm away from the axis and further away from the VP. Draw its sectional front view and top view.*

(PTU, Jalandhar December 2007, May, 2008, May 2013)

SOLUTION.

(*i*) Draw the projections of the cube in the required position and label it.

(*ii*) As the section plane is parallel to the VP and is perpendicular to the HP, hence the section plane is represented by its HT. Draw a line HT in the top view parallel to *xy* and 10 mm from its axis.

(*iii*) Mark the points of intersection of the section plane with different edges of the cube.

(*iv*) Project these points on the corresponding edges in the front view and join these points in the correct sequence and draw section lines in it as shown in Fig. 13.18.

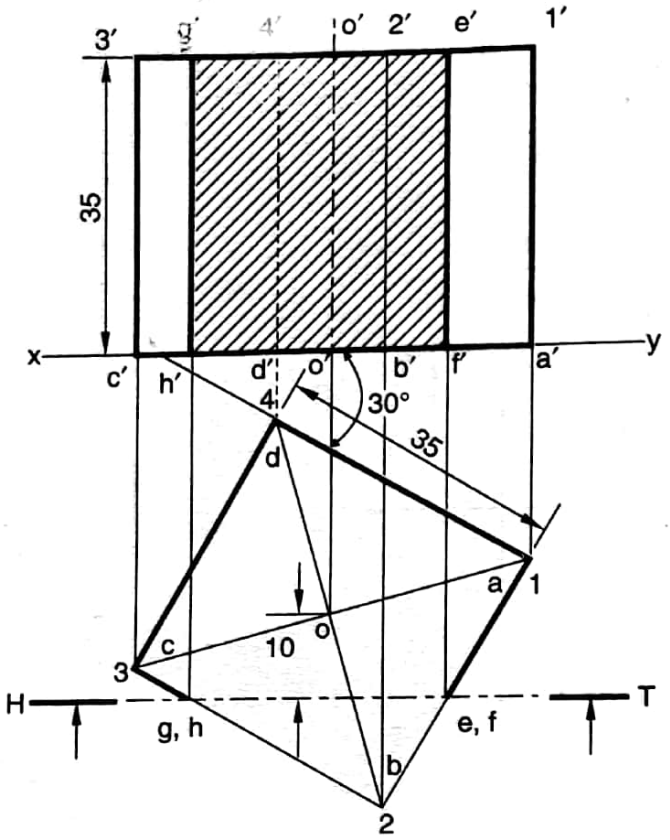

Fig. 13.18 Solution to problem 13.16

PROBLEM 13.17 *A right regular pentagonal pyramid, edge of base 30 mm and height 60 mm, rests on HP on one of its corners. Its base is inclined at 45° to HP and axis is parallel to the VP. A section plane parallel to the VP cuts the pyramid at a distance of 10 mm from its axis. Draw its top view and sectional front view.*

SOLUTION.

(*i*) Draw the projections of the given pyramid in the required position and label the corner points.

(*ii*) Draw the section plane line HT, to represent the section plane in top view, coinciding with HT and passing through a distance of 10 mm from its axis as shown in Fig. 13.19.

(*iii*) Project these points of intersection on the corresponding front view. Join these points in proper order and draw section lines in it. Complete the required top view and sectional front view.

PROBLEM 13.18 *A right circular cylinder diameter of base 40 mm and height 60 mm, is lying on HP on one of its elements, such that its axis is inclined at 30° to the VP. A section plane parallel to VP, cuts the cylinder at a distance of 10 mm from its end face meeting its axis. Draw its sectional front view and top view.*

SOLUTION.

(*i*) Draw the projections of the given cylinder in the required position and label it.

(*ii*) Draw the section plane line HT, to represent the section plane in top view, at a distance of 10 mm from its end face and parallel to the *xy*.

(*iii*) Mark the points of intersection of the section plane with different elements of the cylinder.

(*iv*) Project these points on the corresponding elements in the front view. Join these points in proper order and draw section lines in it. The required sectional front view and top view is as shown in Fig. 13.20.

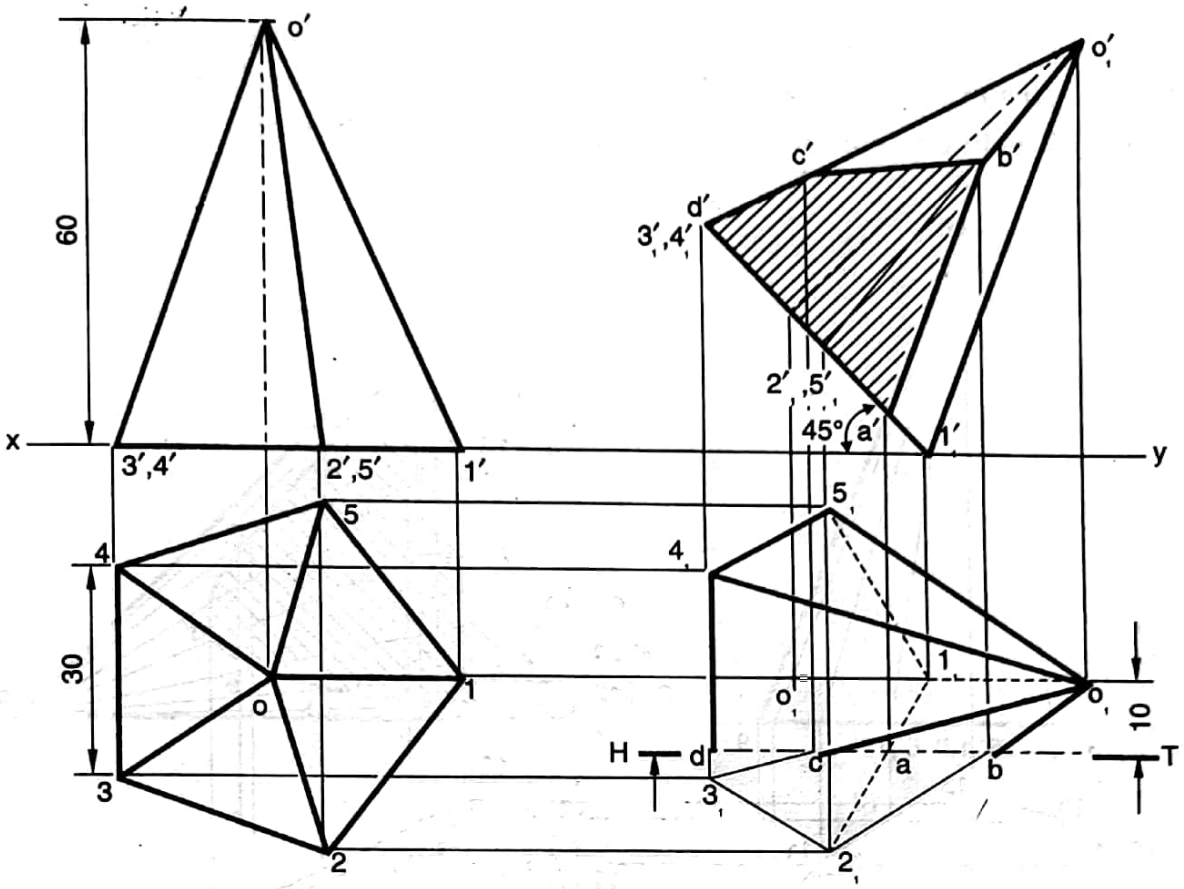

Fig. 13.19 Solution to problem 13.17

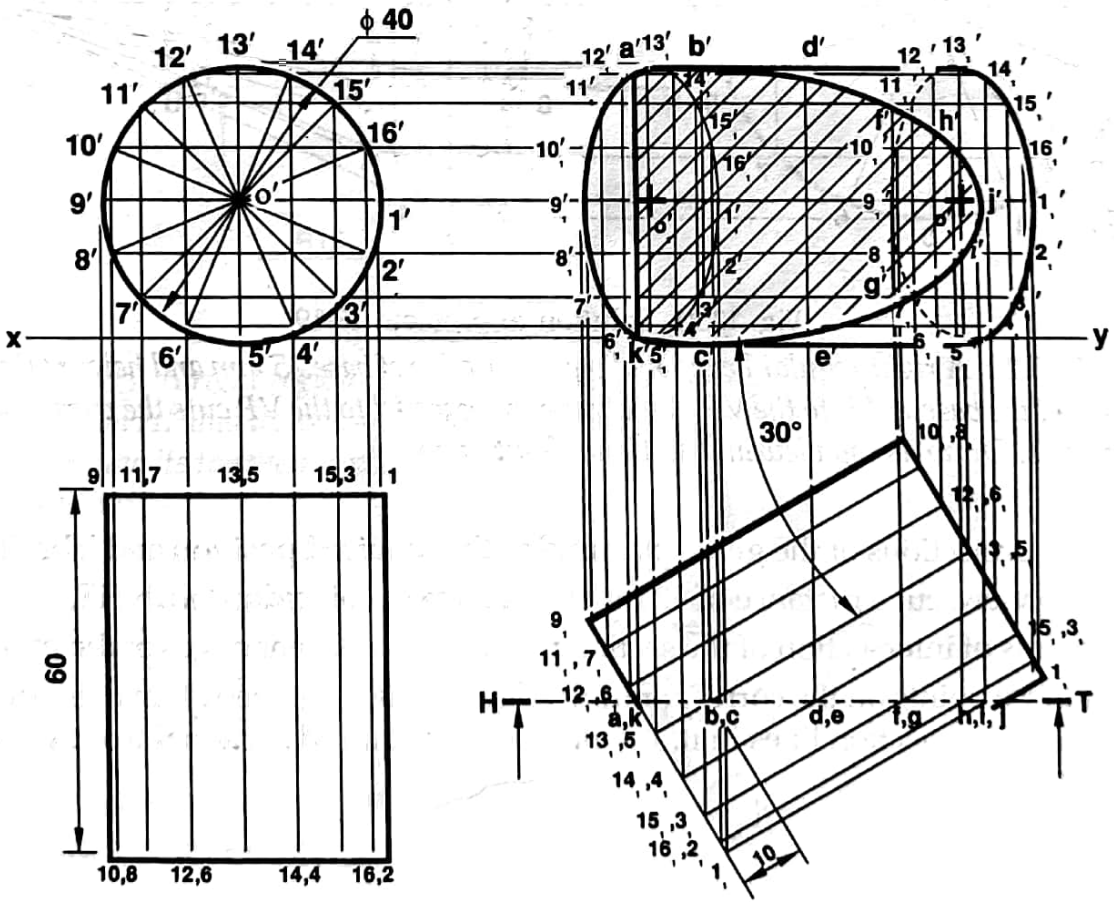

Fig. 13.20 Solution to problem 13.18

PROBLEM 13.19 *A right circular cone diameter of base 50 mm and height 60 mm, lies on one of its elements in HP with its axis parallel to the VP. A section plane perpendicular to the HP and parallel to the VP cuts the cone and is 10 mm away from the axis. Draw its top view and sectional front view.*

SOLUTION. The interpretation of the solution is left to the students. See Fig. 13.21.

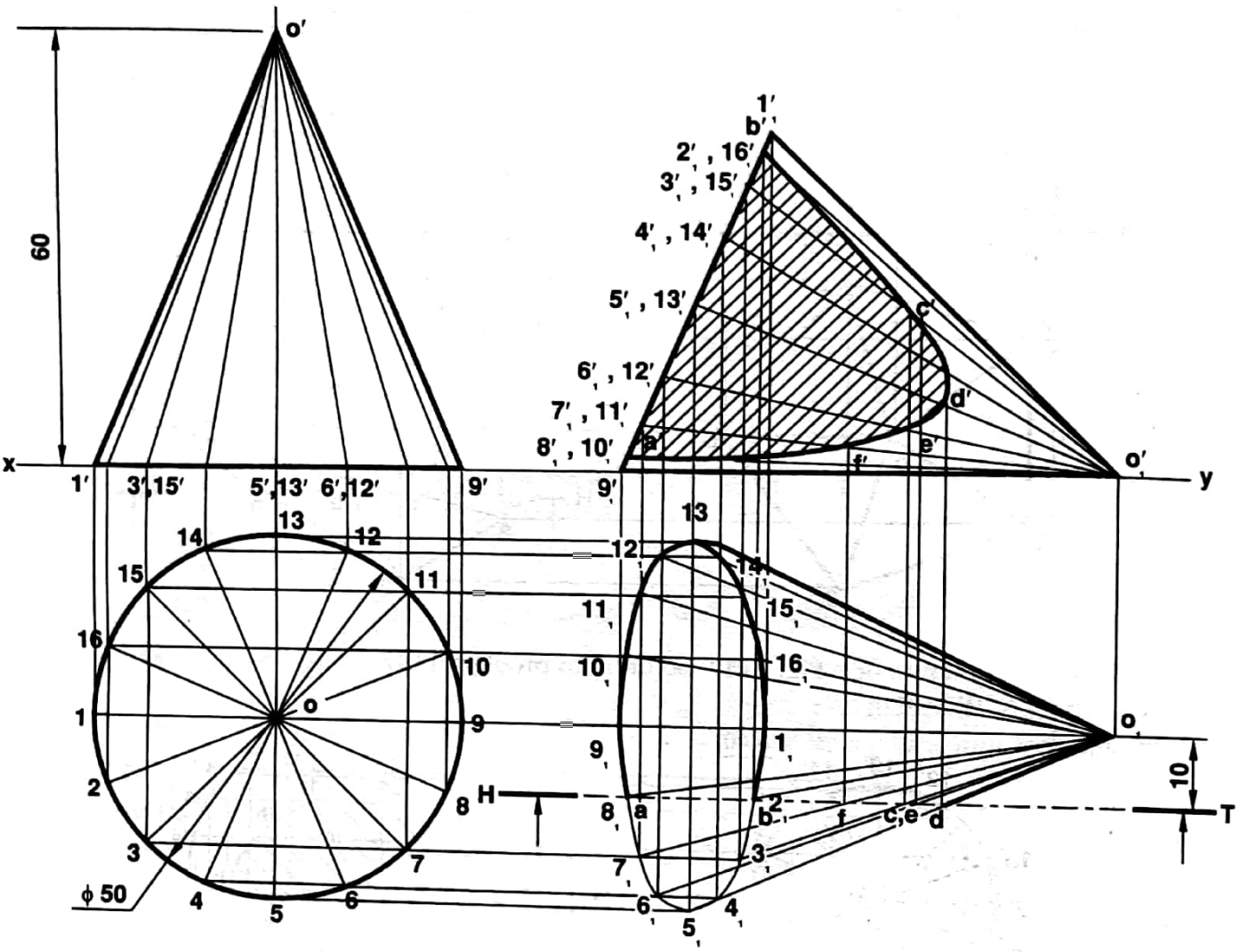

Fig. 13.21 Solution to problem 13.19

PROBLEM 13.20 *A right regular hexagonal pyramid, edge of base 25 mm and height 60 mm rests on the HP with one edge of the base at 45° to the VP. A section plane parallel to the VP cuts the pyramid at a distance of 12 mm from the axis. Draw its top view and sectional front view.*

SOLUTION.

(*i*) Draw the projections of the given pyramid in the required position and label it.

(*ii*) In the top view, cut a distance of 12 mm from its axis, coinciding with HT.

(*iii*) Mark points of intersection of the section plane with different edges of the pyramid.

(*iv*) Project these points on the corresponding edges in the front view. Join these points in proper order and draw section lines in it. It will give the required sectional front view as shown in Fig. 13.22.

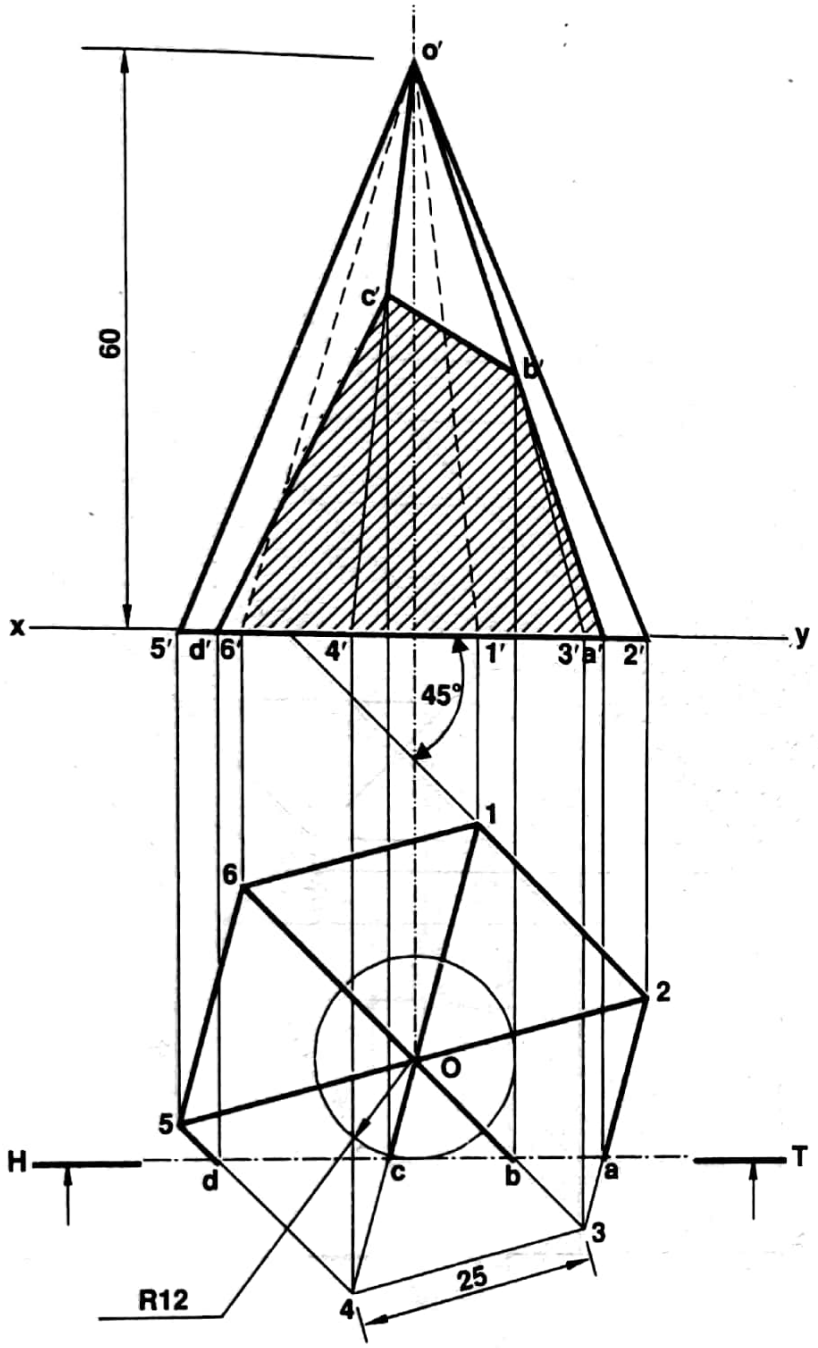

Fig. 13.22 Solution to problem 13.20

PROBLEM 13.21 *A right regular hexagonal prism, side of base 25 mm and height 60 mm, lies on one of its rectangular faces on HP and its axis inclined at 45° to the VP. A section plane parallel to the VP cuts the prism bisecting its axis. Draw its top view and sectional front view.*

SOLUTION. All the construction lines are retained to make the solution self–explanatory. See Fig. 13.22.

13.8 SECTION PLANE PERPENDICULAR TO THE VP AND INCLINED TO THE HP

When a section plane passing through a solid is perpendicular to the VP and inclined to the HP, its VT is inclined to the *xy* and HT which is perpendicular to the *xy* serves no purpose in drawing the section views, so it is omitted. The projection of such a section in front view is a line, coincident with the cutting plane line VT. As the section plane is inclined to HP, its projection on the HP does not show its true shape and size and is called apparent section.

The true shape of section may be obtained on an auxiliary inclined plane (AIP) parallel to the given section plane.

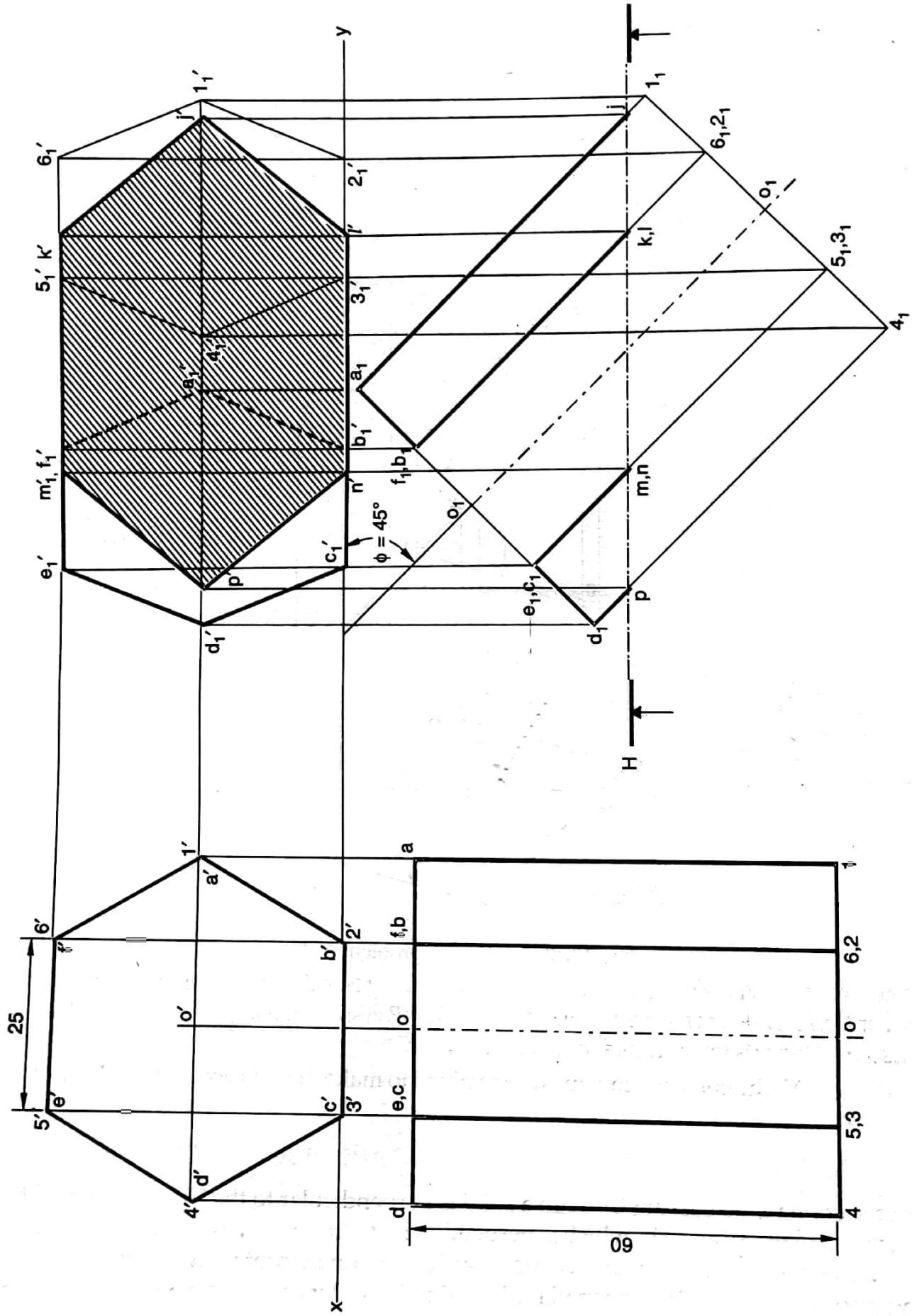

Fig. 13.23 Solution fo problem 13.21

PROBLEM 13.22 *A cylinder of 45 mm diameter and 60 mm long is resting on one of its bases on HP. It is cut by a section plane inclined at 60° with HP and perpendicular to VP passing through a point on the axis 15 mm from it top end. Draw its front view, sectional top view and true shape of the section.*

(PTU, Jalandhar December 2009)

SOLUTION. The interpretation of the solution is left to the reader. See Fig. 13.24.

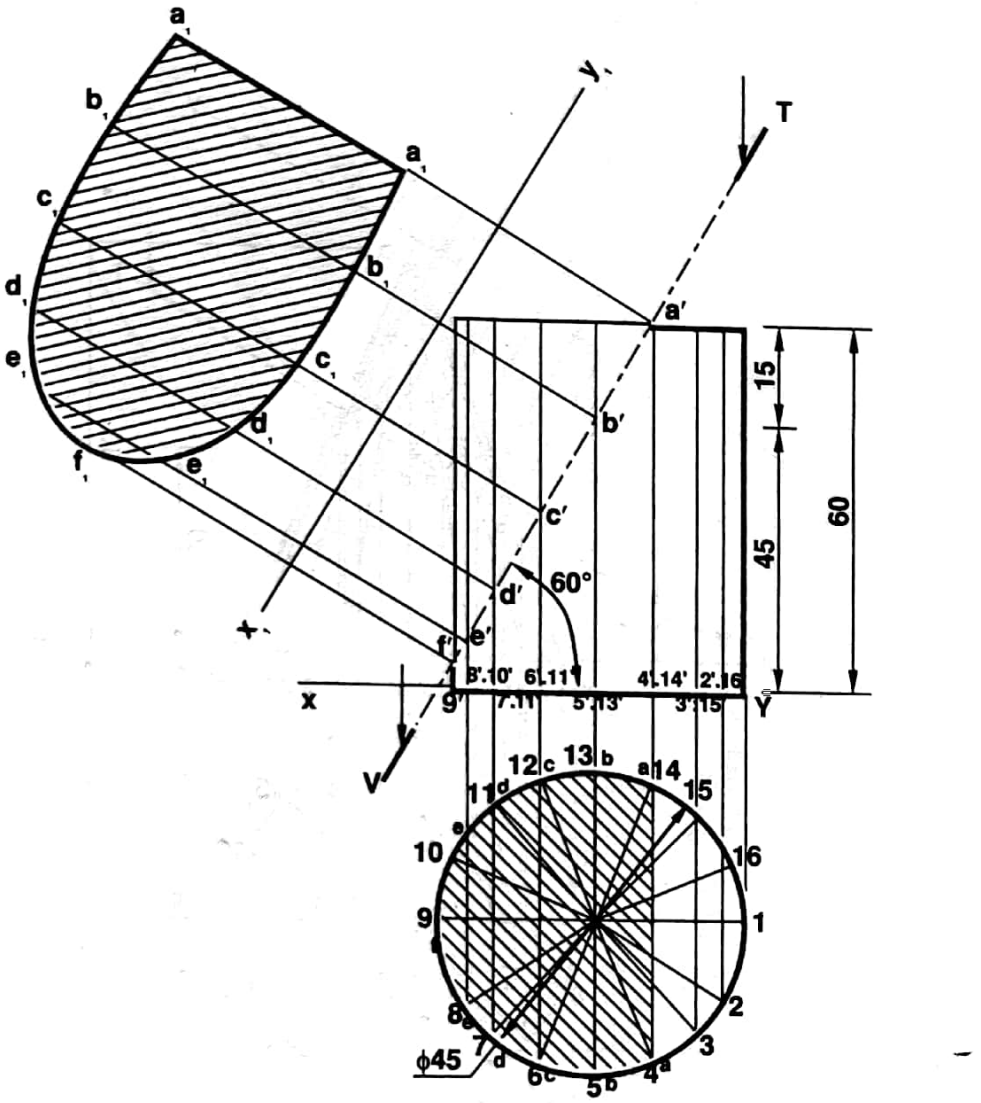

Fig. 13.24 Solution to problem 13.22

PROBLEM 13.23 *A right circular cone, diameter of base 50 mm, height 60 mm, rests on its base on HP. A section plane perpendicular to VP and inclined to HP at 30°, cuts the cone bisecting its axis. Draw its front view, sectional top view and true shape of the section.* *(PTU, Jalandhar May 2006)*

SOLUTION.

(*i*) Draw the projections of the cone in the given position and name the points on it.

(*ii*) Draw the cutting plane line VT inclined at 30° to *xy* and bisecting its axis.

(*iii*) The cutting plane line VT cuts the various elements as shown in Fig. 13.25.

(*iv*) Project all the points on the corresponding elements in the top view. Join these points by a smooth curve and draw section lines in it.

(*v*) To draw the true shape of the section, draw a new reference line x_1y_1 at a convenient distance and parallel to the cutting plane line.

(*vi*) Through the points on the section in front view, draw perpendicular projectors to x_1y_1. On the perpendicular projector through 1′, from x_1y_1 cut the distance of point 1 in the top view from xy.

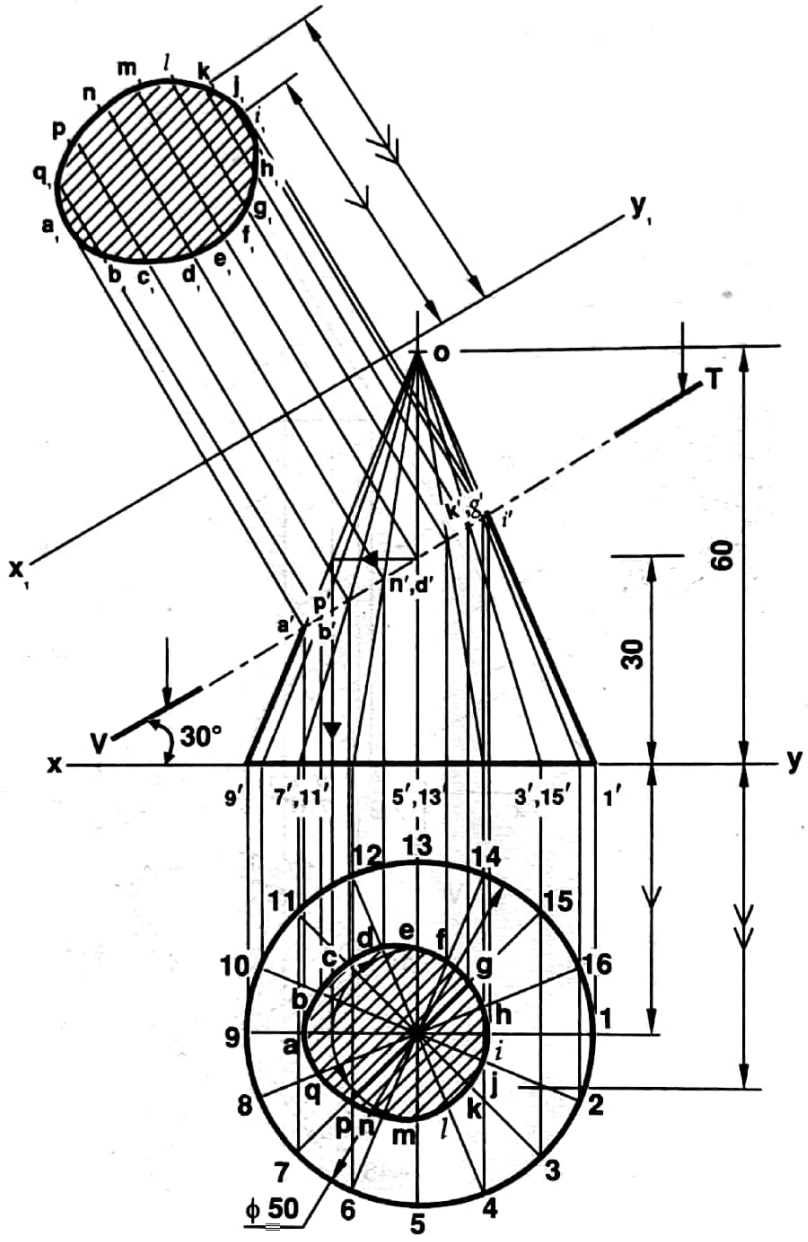

Fig. 13.25 Solution to problem 13.23

Similarly plot the other points. Join these points by a smooth curve and draw section lines in it. The required figure is called the true shape of the section.

PROBLEM 13.24 *A right regular hexagonal pyramid, edge of base 25 mm, height 50 mm, rests on its base on HP, with one of its base edges parallel to VP. A section plane perpendicular to VP and inclined to HP at 30°, cuts the pyramid, bisecting its axis. Draw its front view, sectional top view and true shape of the section.*

SOLUTION.

(*i*) Draw the projections of the pyramid in the given position and name all the corner points on it.

(*ii*) Draw the cutting plane line VT inclined at 30° the xy and bisecting its axis.

(*iii*) The cutting plane line VT cuts the various edges as shown in Fig. 13.26.

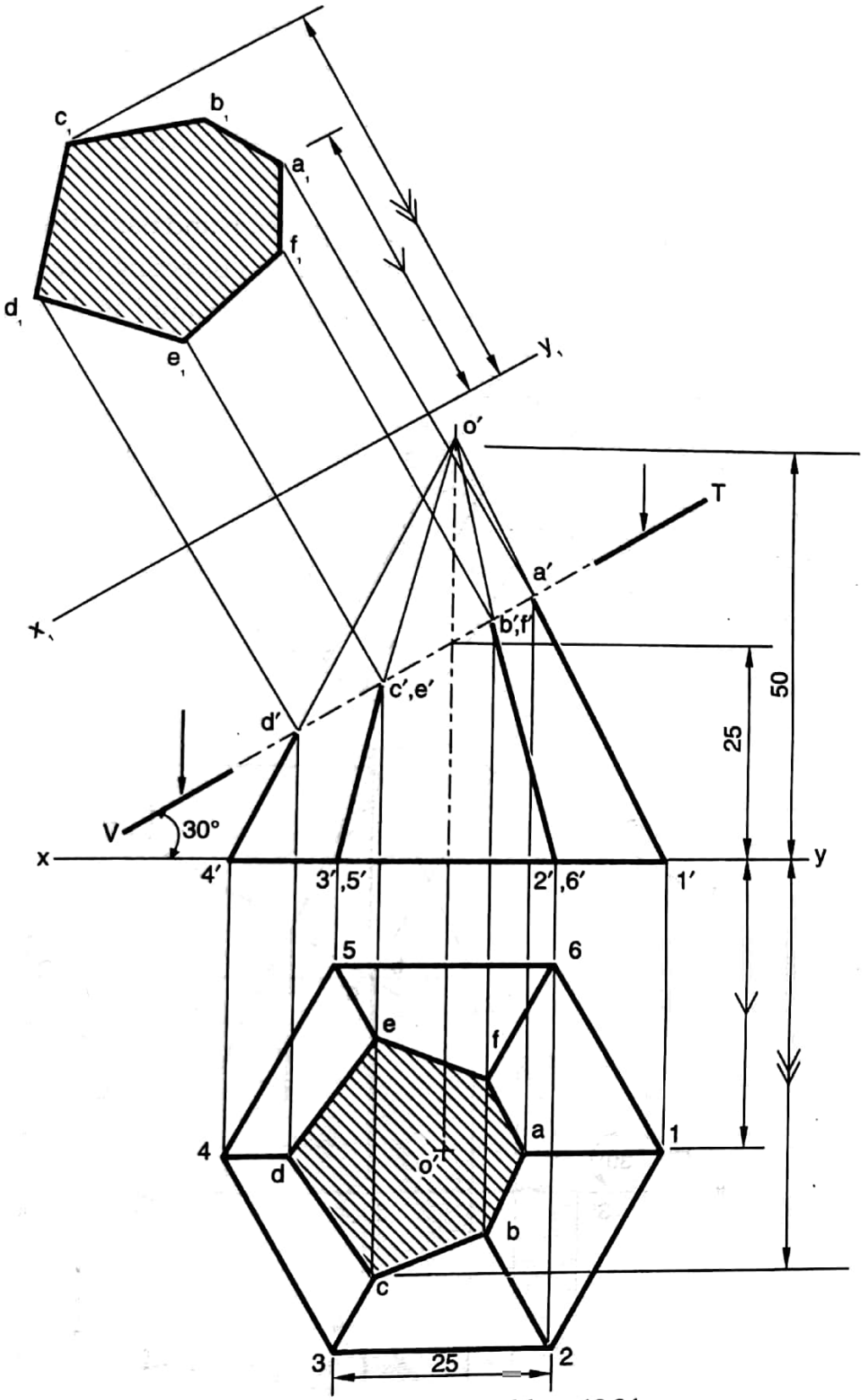

Fig. 13.26 Solution to problem 13.24

(*iv*) Project all these points on the corresponding edges in the top view. Join these points in proper order and draw section lines in it.

(*v*) To draw the true shape and size of the section, draw a new reference line x_1y_1, at a convenient position and parallel to the cutting plane line.

(*vi*) Through the points on the section in front view, draw perpendicular projectors to x_1y_1. On the perpendicular projectors cut the distances of the points from xy in the top view. Join these points in proper order and draw section lines in it. This is the required true shape of the section.

PROBLEM 13.25 *A square pyramid, edge of base 35 mm, height 50 mm rests on its base on HP with its base edges equally inclined to VP. A section plane perpendicular to the VP and inclined to the HP at 30°, cuts the pyramid bisecting its axis. Draw its front view, sectional top view and true shape of the section.*

(PTU, Jalandhar December 2013)

SOLUTION.

(*i*) Draw the projections of the pyramid in the given position and name the corners points on it.

(*ii*) Draw the cutting plane line VT inclined at 30° to *xy* and bisecting its axis.

(*iii*) The cutting plane line VT cuts the various edges of the pyramid as shown in Fig. 13.27.

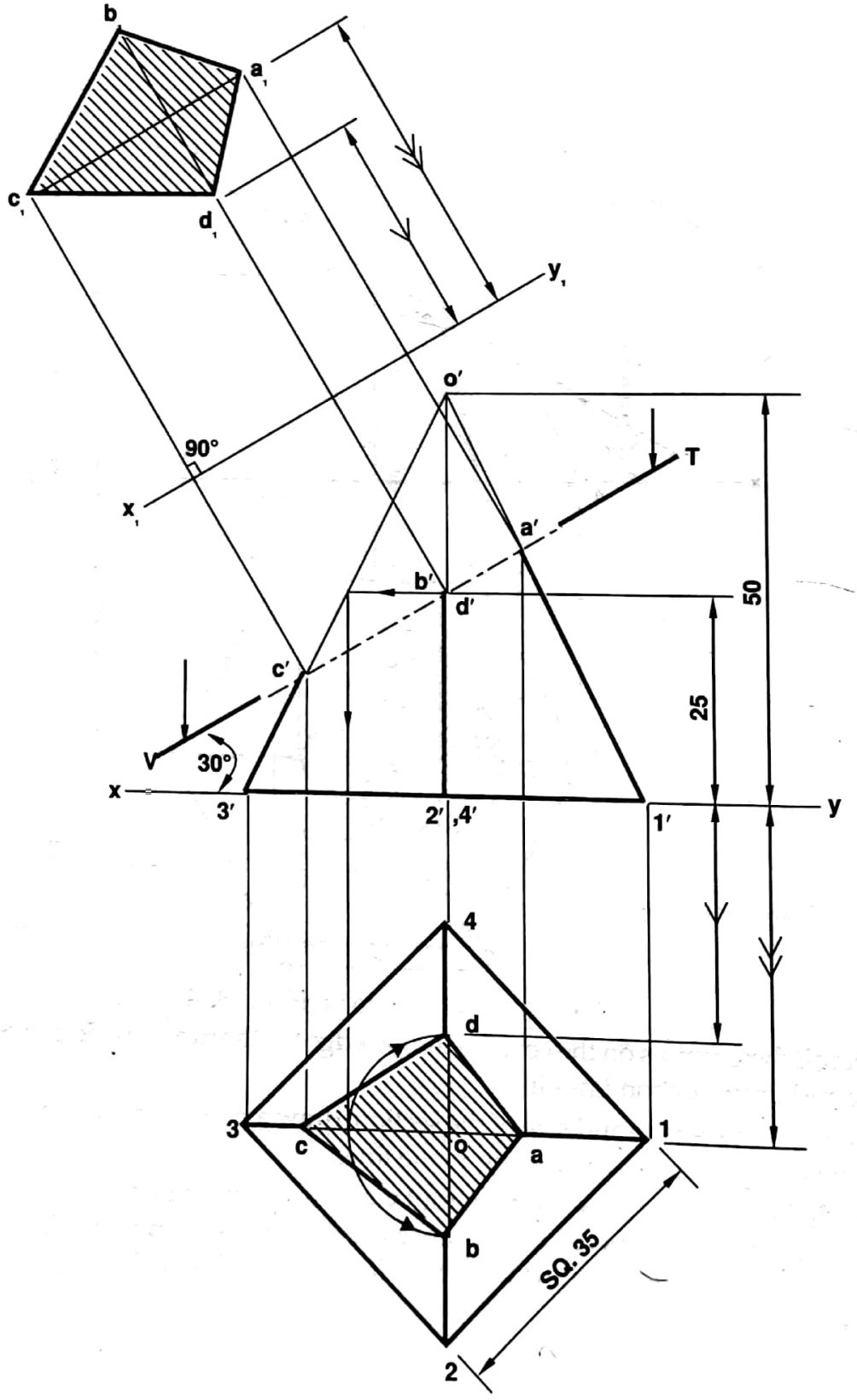

Fig. 13.27 Solution to problem 13.25

(*iv*) Project these points in the top view. The projections b, d of b', d' in the top view are to lie on 02 and 04. By direct intersection these points cannot be plotted. Project b', d' horizontally on a slant edge (which gives true length) 0'1' or 0'3' and then project the point of intersection vertically into 01 or 03 in the top view. With o as centre, rotate these points to lie on 02 and 04 at b and d respectively.

(*v*) Join these points in proper order and draw section lines in it.

(*vi*) To draw the true shape of the section, draw a new reference line x_1y_1 at a convenient position and parallel to the cutting plane line.

(*vii*) Project all the points as discussed in the earlier problems. Repeat the same procedure here to get the true shape of the section.

PROBLEM 13.26 *A square pyramid, edge of base 30 mm, height 45 mm rests on its base on HP with its base edges equally inclined to the VP. A section plane perpendicular to the VP and inclined to the HP at 30°, cuts the pyramid bisecting its axis. Draw its front view, sectional top view, sectional left side view and true shape of the section.* (PTU, Jalandhar May 2006, December 2015)

SOLUTION. The interpretation of the solution is left to the student. See Fig. 13.28.

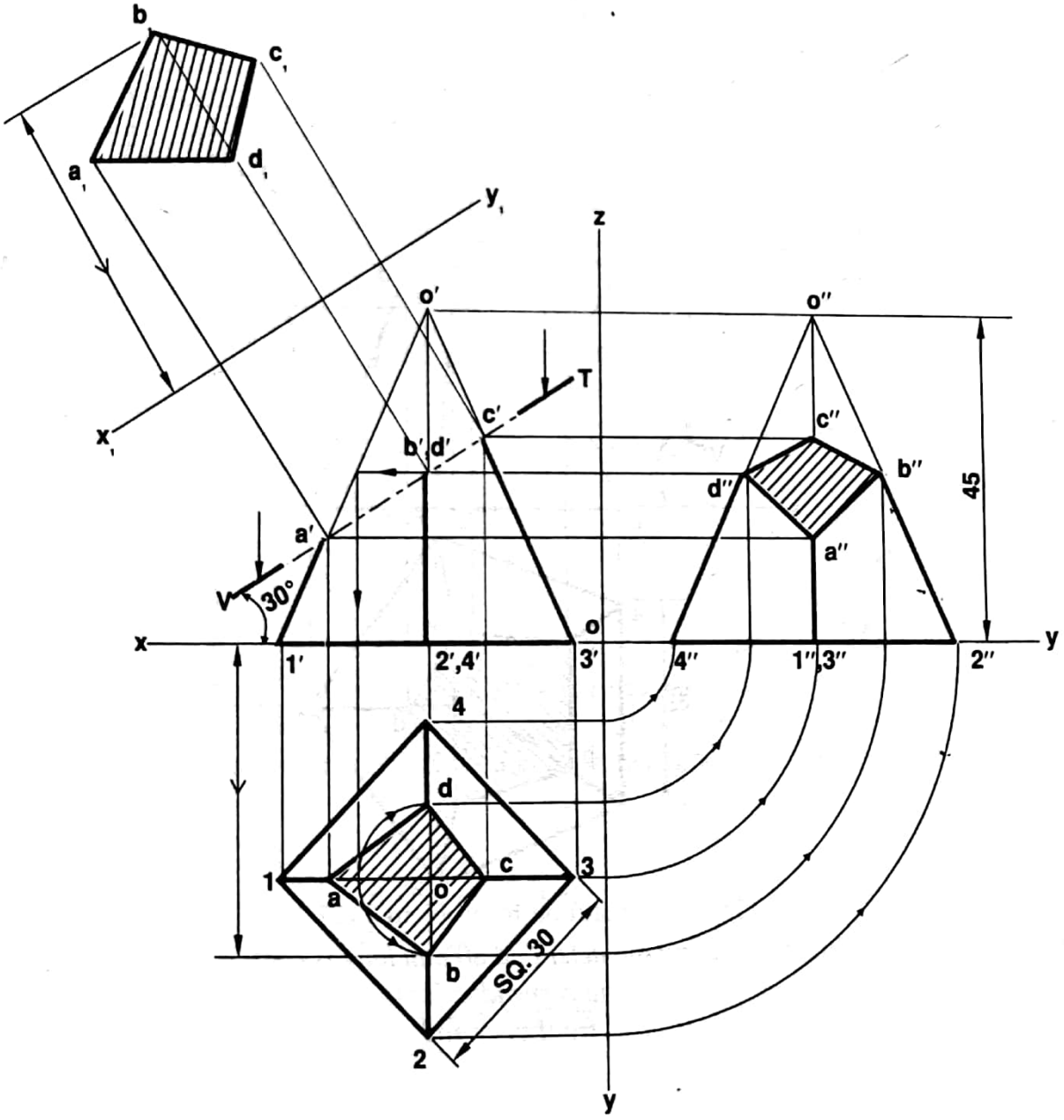

Fig. 13.28 Solution to problem 13.26

PROBLEM 13.27 *A right regular pentagonal pyramid, edge of base 25 mm and height 50 mm, rests on its base on HP such that one of its base edges to be perpendicular to VP. A section plane perpendicular to the VP and inclined to the HP at 30° cuts the pyramid bisecting its axis. Draw its front view, sectional top view and true shape of the section.* (PTU, Jalandhar May 2010)

SOLUTION.

(*i*) Draw the projections of the pyramid in the given position and label it.

(*ii*) Draw the cutting plane line VT inclined at 30° to *xy* and bisecting its axis.

(*iii*) The cutting plane line VT cuts the various edges of the pyramid as shown in Fig. 13.29.

(*iv*) Project all the points of intersection in the top view. Join these point in proper order and draw section lines in it.

(*v*) To draw the true shape of the section, draw a new reference line x_1y_1 at a convenient distance and parallel to the section plane line.

(*vi*) Project all the points as discussed in earlier problems. Repeat the same procedure to get the true shape of the section.

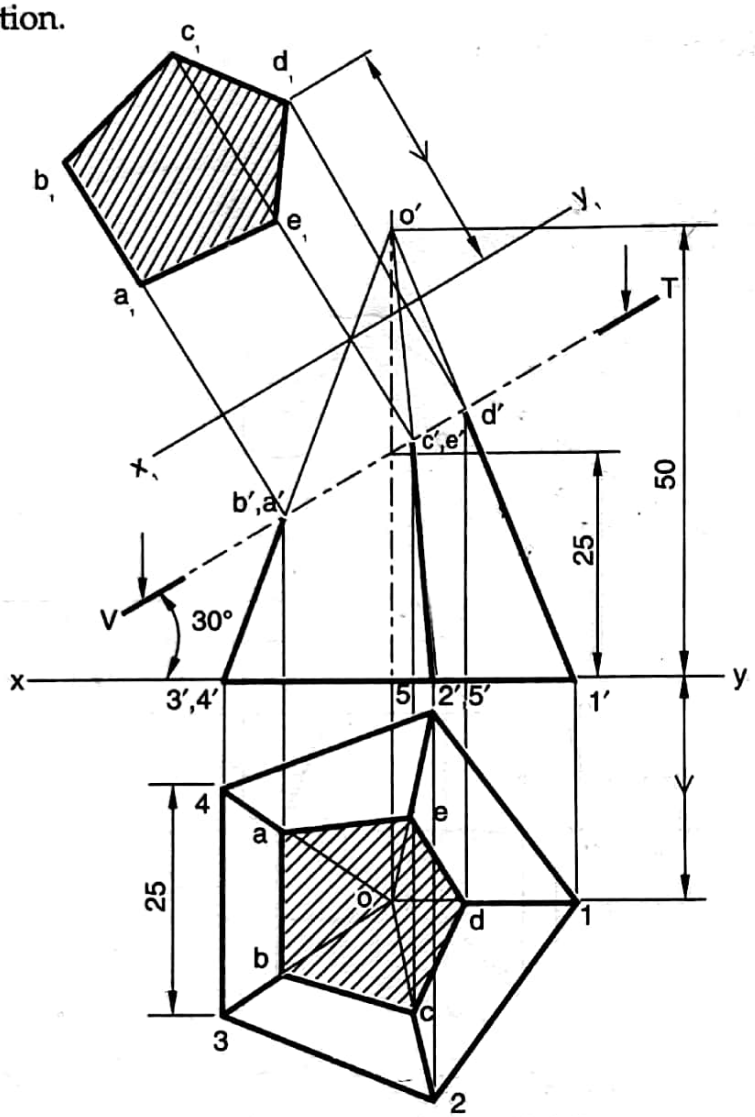

Fig. 13.29 Solution to problem 13.27

PROBLEM 13.28 *A cylinder of 45 mm diameter and 60 mm long is resting on one of its bases on HP. It is cut by a section plane inclined at 60° with HP and perpendicular to VP passing through a point on the axis 15 mm from its top end. Draw its sectional top view, front view and sectional end view.*

(PTU, Jalandhar May 2001)

SOLUTION.

(*i*) Draw the projections of the cylinder in the given position and label it.

(*ii*) Draw the cutting plane line VT inclined at 60° to *xy* and passing through a point on the axis 15 mm from the top end of the cylinder.

(*iii*) The cutting plane line VT cuts the various edges as shown in Fig. 13.30.

(*iv*) Project the points of intersection in the top view and end view to their corresponding edges. Join these points in proper order and draw section lines in it.

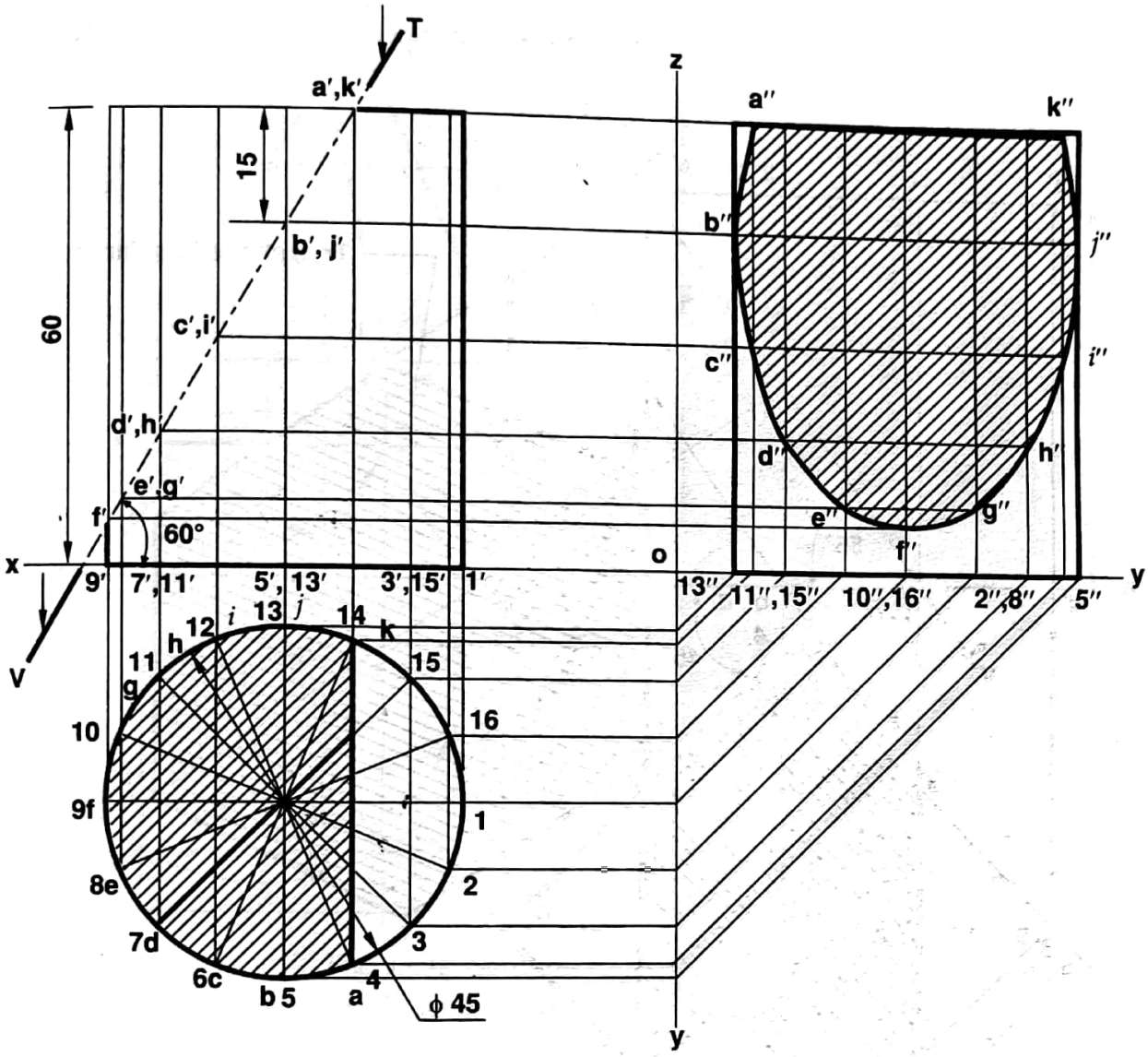

Fig. 13.30 Solution to problem 13.28

PROBLEM 13.29 *A cube of 65 mm long edges has its vertical faces equally inclined to the VP. It is cut by a section plane, perpendicular to the VP, so that the true shape of the section is a regular hexagon. Determine the inclination of the cutting plane with the HP and draw the sectional top view and true shape of the section.*

(PTU, Jalandhar June 2003)

SOLUTION.

(*i*) The true shape of the section is a regular hexagon, as all the edges of the cube are equal, therefore the section plane should pass through the mid-points of all the six edges, which are cut by a section plane.

(*ii*) The cube must be kept in such a way that its vertical faces make equal angles with the VP. Therefore draw the top and front views of the cube in this position.

(*iii*) The cutting plane now passes through the points *f, g, e* and *h* which are the mid-points of the edges in the top view. Project these points in the front view to get the section plane through *f'g'* and *e'h'*.

(*iv*) Join the points *e, b, f, g, j, h* in the top view by straight lines to obtain the sectional top view and draw the section lines in it.

(*v*) Then draw x_1y_1 line parallel to the section plane line at any convenient distance, the true shape of the section can be drawn on an auxiliary top view as shown in Fig. 13.31.

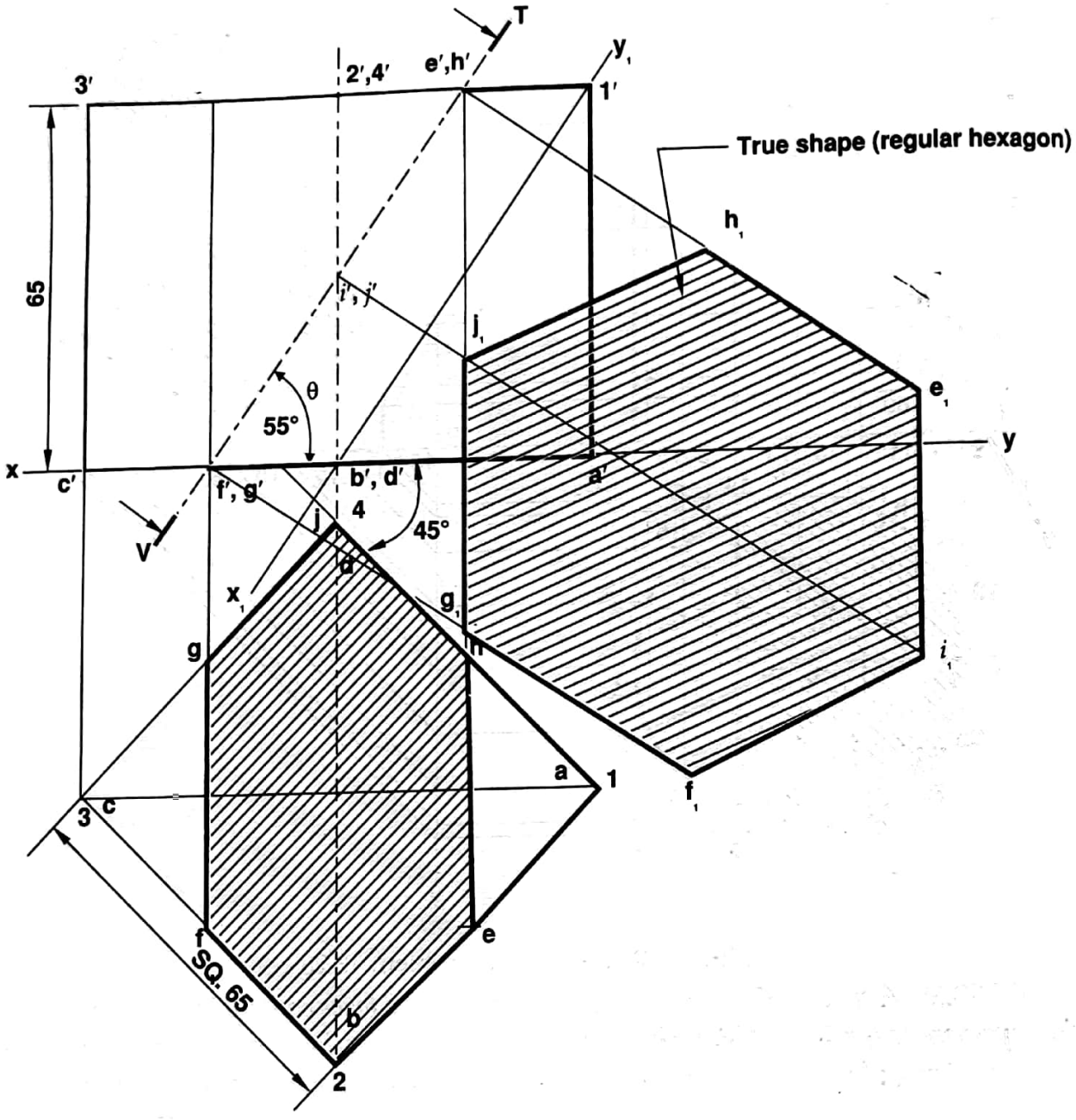

Fig. 13.31 Solution to problem 13.29

PROBLEM 13.30 *A right regular hexagonal pyramid, base 30 mm side and axis 65 mm long, is resting on its base on the HP with one of its base edges parallel to the VP. It is cut by a section plane, perpendicular to the VP and inclined to the HP at 60° and intersecting the axis at a point 25 mm above the base. Draw the front view, sectional top view and sectional left side view.*

SOLUTION. The interpretation of the solution is left to the reader. See Fig. 13.32.

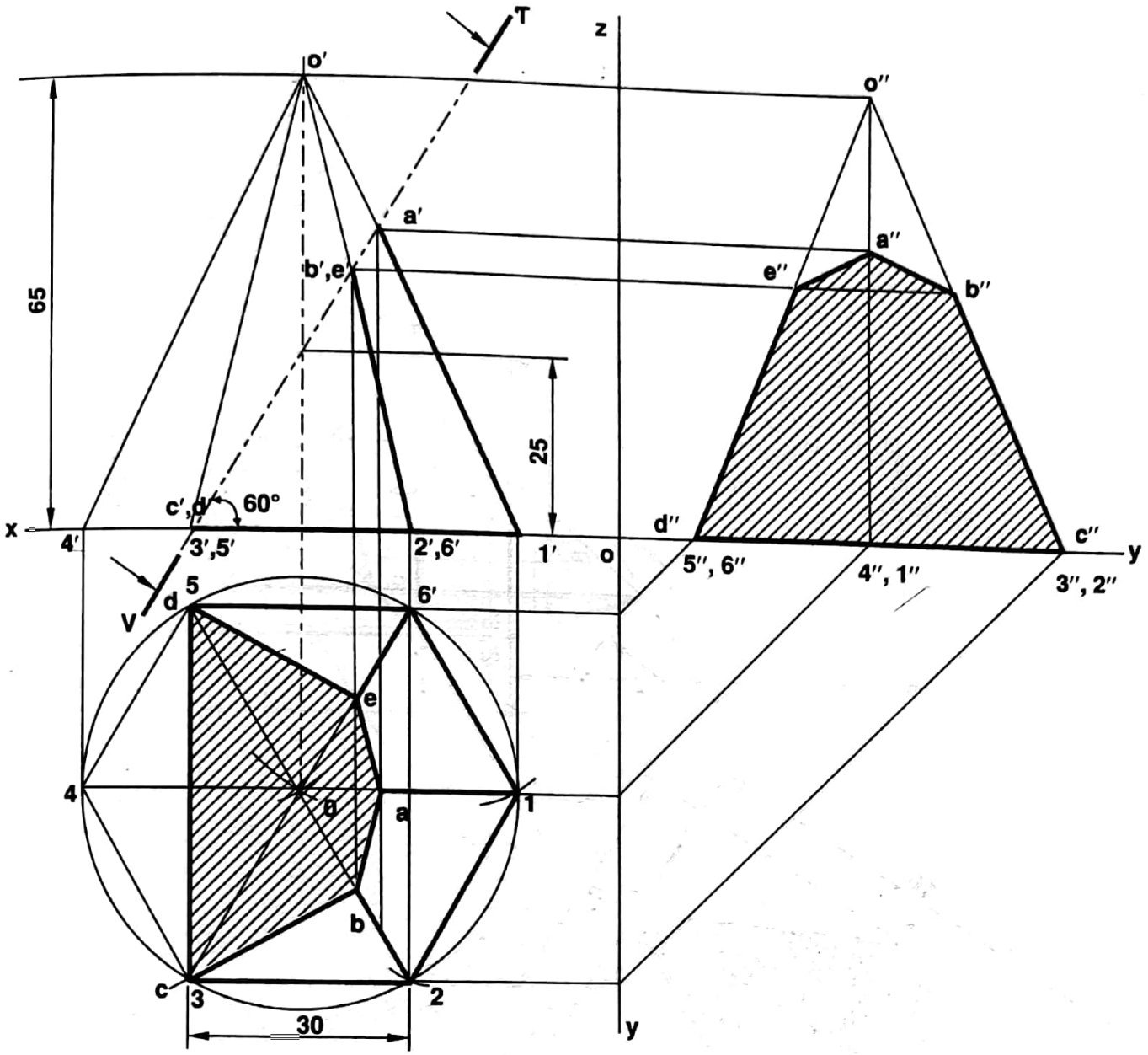

Fig. 13.31 Solution to problem 13.29

PROBLEM 13.30 *A square pyramid, edge of base 40 mm and height 60 mm, is resting on its base in HP with one of its base edges perpendicular to VP. A section plane perpendicular to the VP and inclined to the HP cuts the pyramid in such a way that the true shape of the section is a trapezium where parallel sides measure 30 mm and 15 mm. Draw the front view, sectional top view and true shape of the section. Also determine the inclination of the section plane with HP.*

SOLUTION. The interpretation of the solution is left to the student. See Fig. 13.32.

PROBLEM 13.31 *A square prism edge of base 25 mm and 70 mm long axis is resting on its base in HP. The edges of the base are equally inclined to the VP. It is cut by a plane inclined to the HP and perpendicular to the VP passing through the mid-point of the axis in such a way that the true shape of the section is rhombus having diagonals of 70 mm and 35 mm. Draw the projections and determine the inclination with HP.*

SOLUTION.

(*i*) Draw the projections of the square prism in the given position and name it.

(*ii*) Mark the mid-point of the axis in the front view. With the mid-point of the axis as centre and radius equal to 35 mm, draw an arc cutting the two opposite sides of the prism as shown in Fig. 13.33.

(*iii*) Project these points in the top view and complete the true shape of the section. Draw the section lines in it.

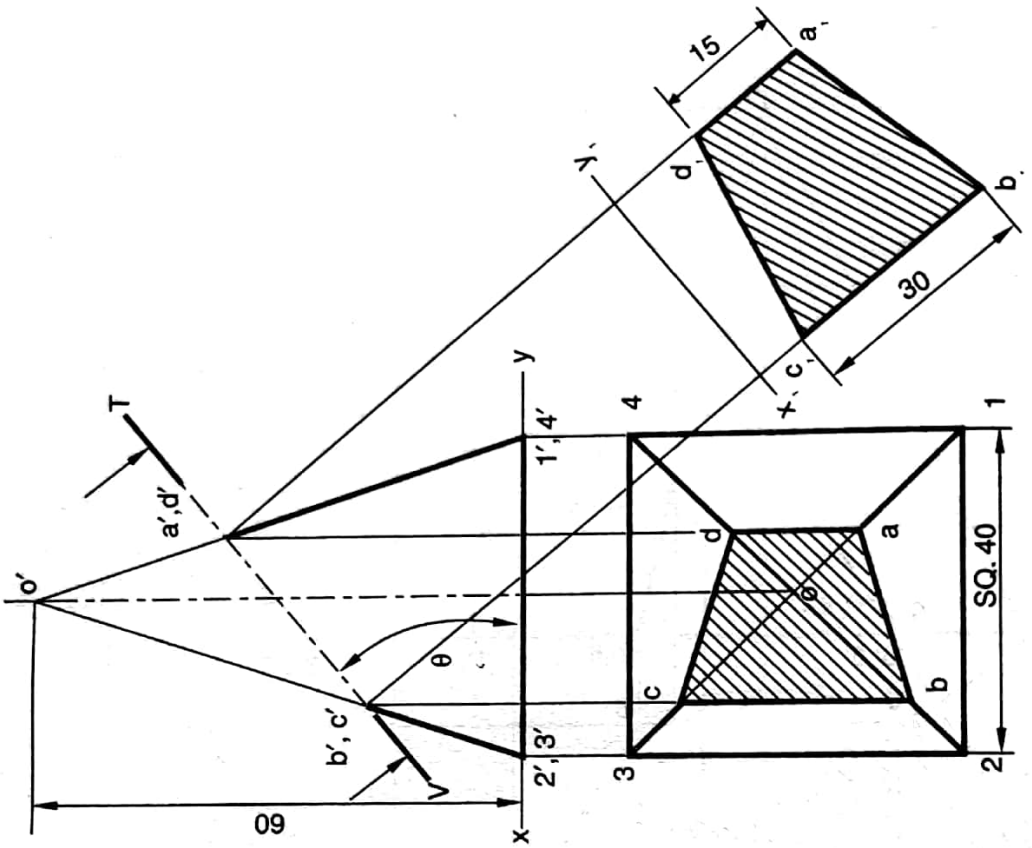

Fig. 13.32 Solution to problem 13.30

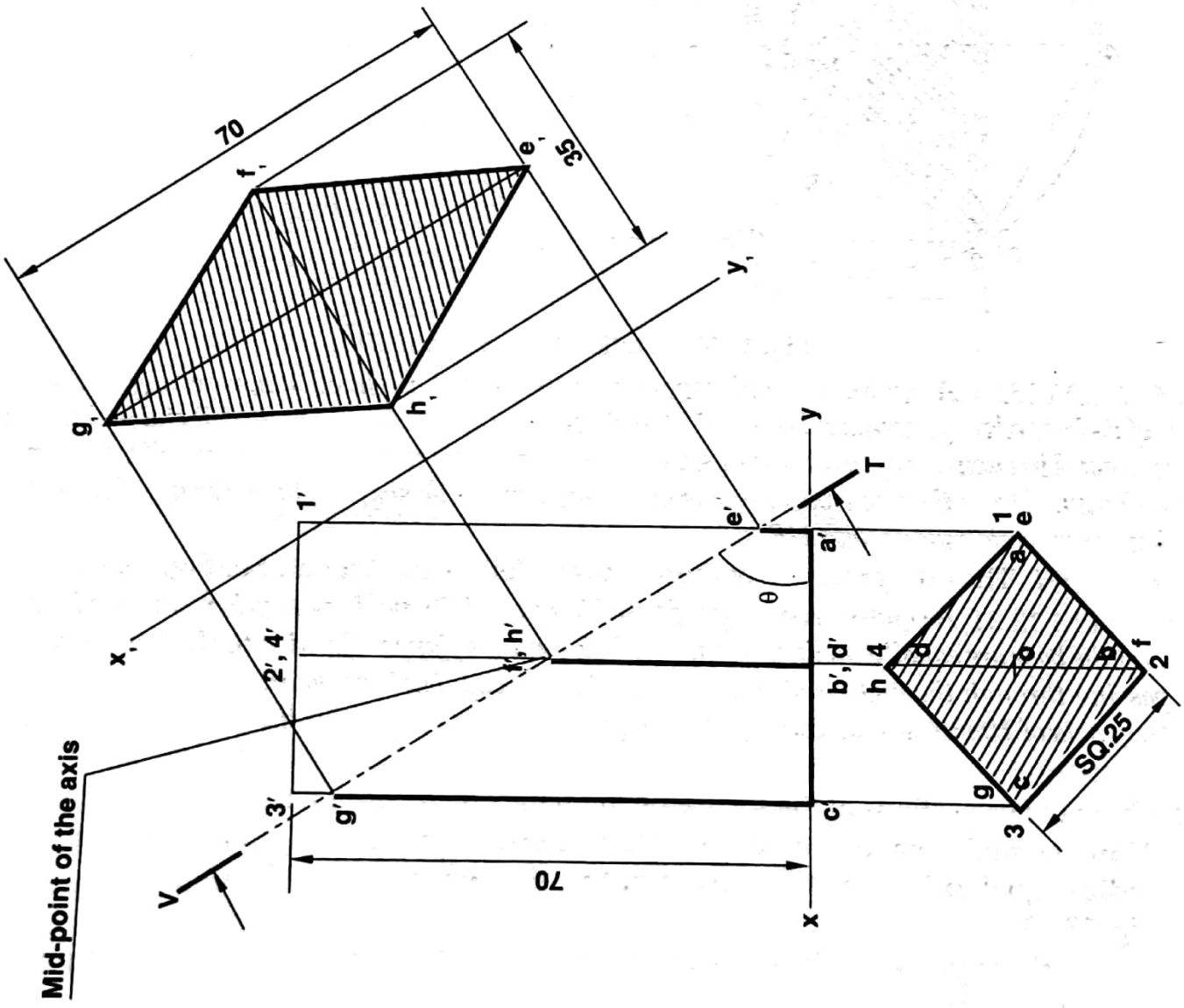

Fig. 13.33 Solution to problem 13.31

PROBLEM 13.33 *A right circular cylinder diameter of base 60 mm and axis 60 mm long, rests on its base in HP. It is cut by a section plane, which is perpendicular to the VP and inclined to the HP at 30° cuts the cylinder bisecting its axis. Draw the front view, sectional top view, sectional left side view and true shape of the section.*

(PTU, Jalandhar December 2009)

SOLUTION. The interpretation of the solution is left to the reader. See Fig. 13.35.

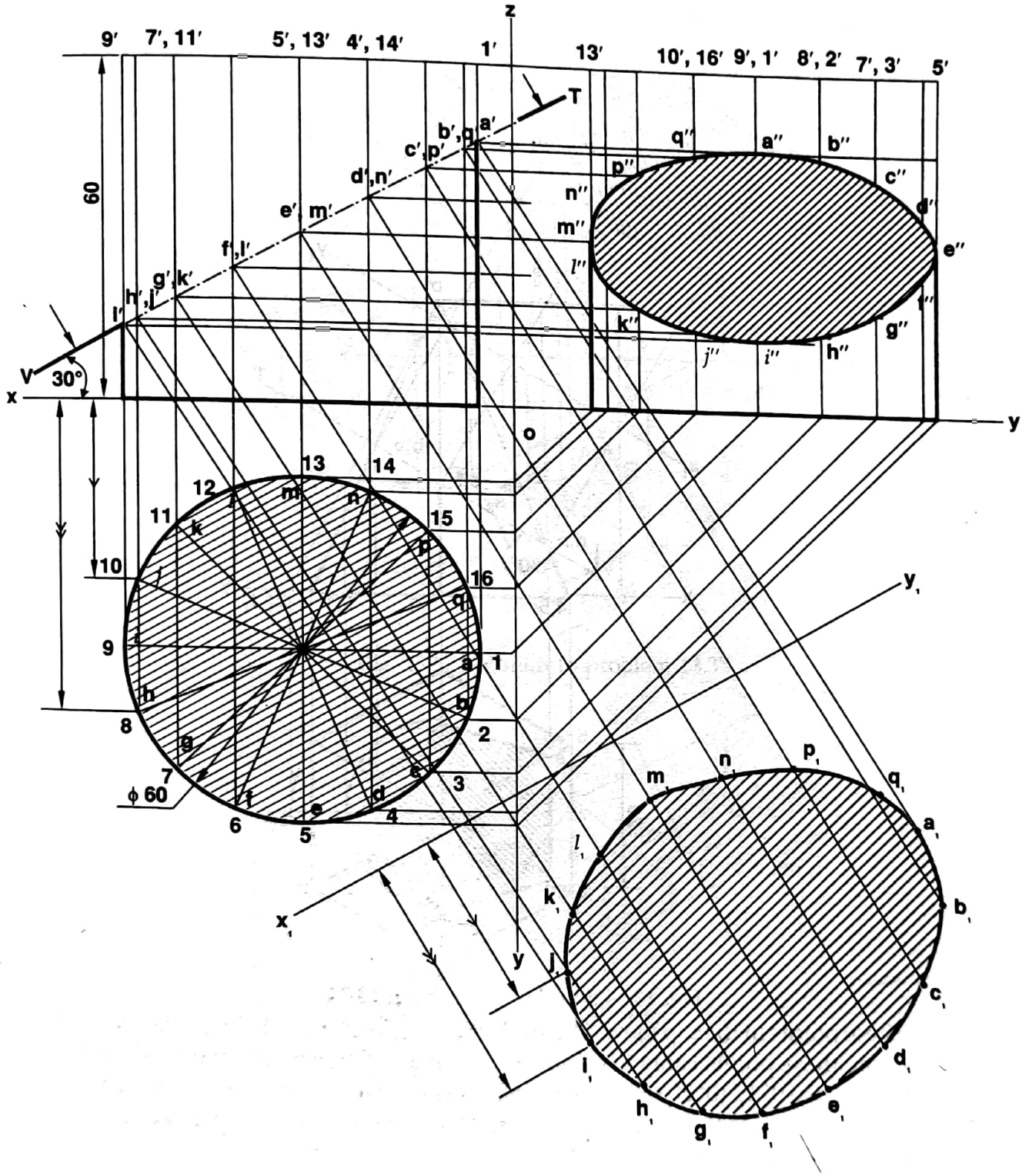

Fig. 13.35 Solution to problem 13.33

PROBLEM 13.34 *A right regular hexagonal pyramid, edge of base 20 mm and height 40 mm, rests on its base in HP, with one of its base edges perpendicular to VP. A section plane inclined to HP at 30° and perpendicular to VP cuts the pyramid, bisecting its axis. Draw its front view, sectional top view and true shape of the section.* (PTU, Jalandhar May 2014)

SOLUTION.

(*i*) Draw the projections of the pyramid in the given position and name the corner points on it.

(*ii*) Draw the cutting plane line *VT* inclined at 30° to *xy* and bisecting its axis.

(*iii*) The cutting plane line *VT* cuts the various edges of the pyramid as shown in Fig. 13.36.

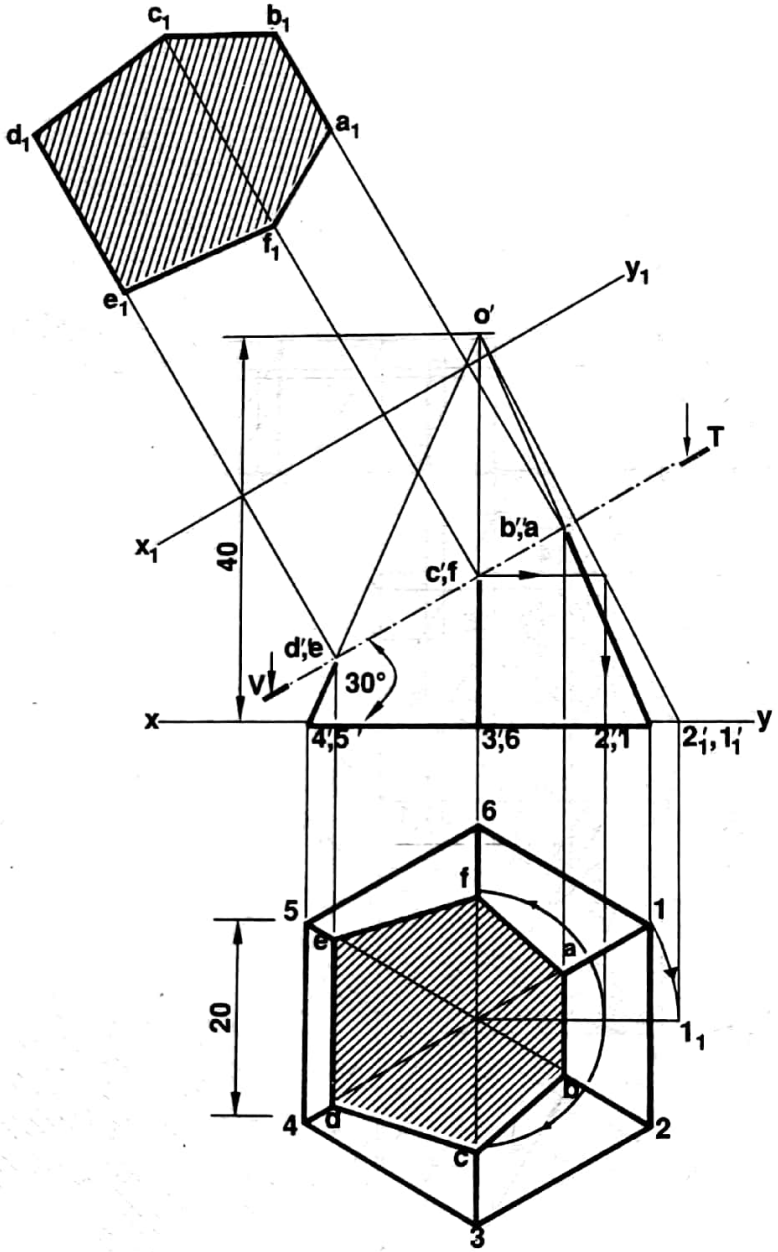

Fig. 13.36 Solution to problem 13.34

(*iv*) Project these points in the top view. The projections *c*, *f* of *c'*, *f'* are to lie on 03 and 06. By directg intersection, these points cannot be plotted. Project *c'*, *f'* horizontally on a slant edge (which gives true length) $0'1_1'$ $(0'2_1')$ and then project point of intersection vertically in the top view. With 0 as centre, rotate there points to lie on 03 and 06 at *c* and *f* respectively.

(*v*) Join these points in proper order and draw section lines in it.

(*vi*) To draw the true shape of the section, draw a new reference $x_1\ y_1$ at a convenient position and parallel to the cutting plane line.

(*vii*) Project all these points as discussed in the previous problems. Repeat the same procedure to get the true shape of the section.

PROBLEM 13.35 *A square pyramid, edge of base 30 mm, height 60 mm rests on its base on HP with one of its base edge inclined at 30° to the VP. A section plane perpendicular to the VP and inclined to the HP at 45° cuts the pyramid at a distance of 25 mm from its apex on the axis. Draw its front view, sectional top view and true shape of the section.*

SOLUTION. All the construction lines are retained to make the solution self–explanatory. See Fig. 13.37

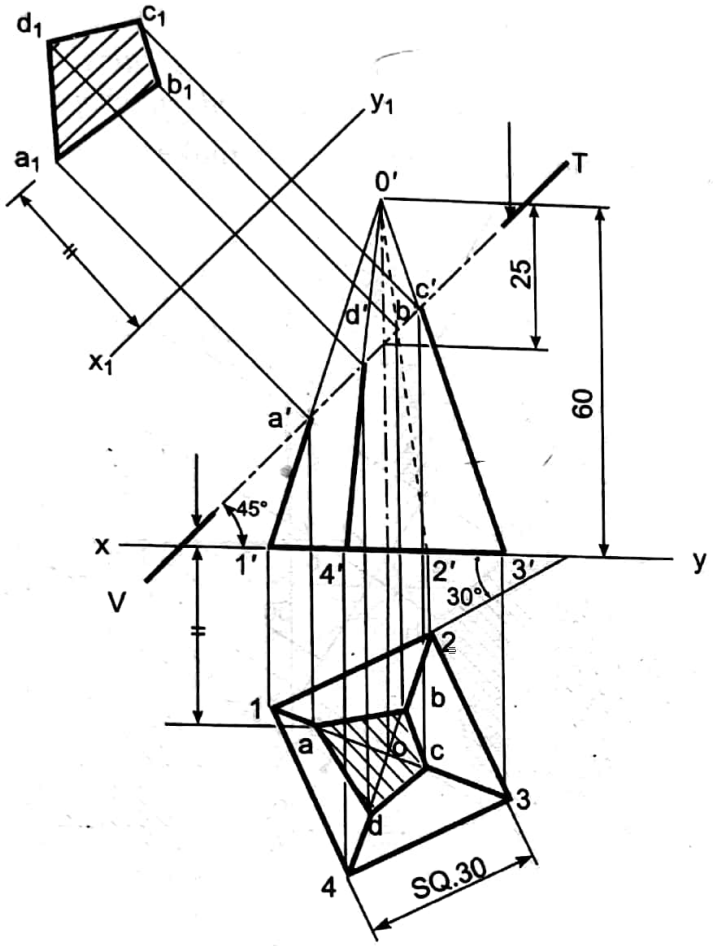

Fig. 13.37 Solution to problem 13.35

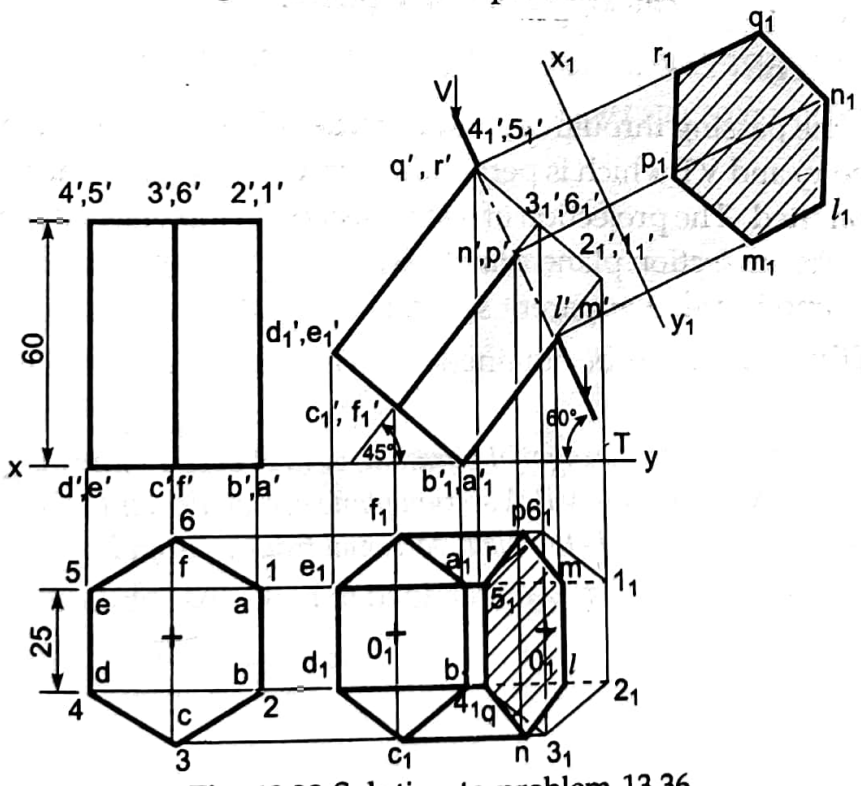

Fig. 13.38 Solution to problem 13.36

PROBLEM 13.36 *A right regular hexagonal prism of base 30 mm and axis 60 mm long is resting on HP on one of its base edge with its axis inclined at 45° to HP and parallel to the VP. A section plane inclined to the HP at 60° and perpendicular to the VP is passing through the topmost edges of the prism. Draw its front view, sectional top view and true shape of the section.*

SOLUTION. All the construction lines are retained to make the solution self-explanatory. See Fig. 13.38.

PROBLEM 13.37 *A cube of 55 mm edge rests on HP with one of its vertical faces inclined at 30° to the VP. A section plane inclined to the HP at 60° and perpendicular to the VP cuts the solid at a distance of 48 mm from the base along its axis. Draw its front view, sectional top view and true shape of the section.*

SOLUTION. All the construction lines are retained to make the solution self-explanatory. See Fig. 13.39.

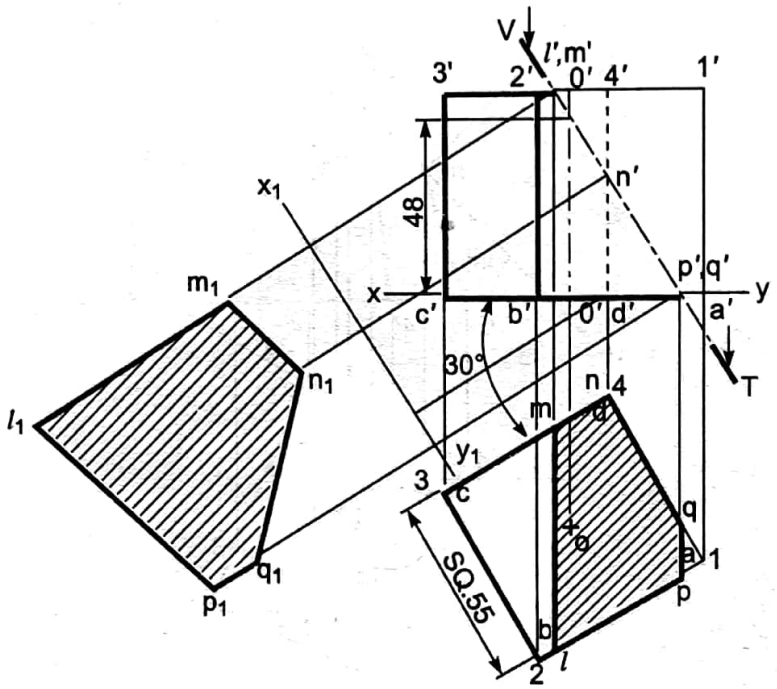

Fig. 13.39 Solution to problem 13.37

13.9 SECTION PLANE PERPENDICULAR TO THE HP AND INCLINED TO THE VP

When a section plane passing through a solid is perpendicular to the HP and inclined to the VP, its HT is inclined to the *xy* and VT which is perpendicular to the *xy* serves no purpose in drawing the section views, so it is omitted. The projection of such a section in top view is a line, coincident with the cutting plane line HT. As the section plane is inclined to VP, its projections on the VP does not show its true shape and size and is called apparent section.

The true shape of the section may be obtained on an auxiliary vertical plane (AVP) parallel to the given plane.

PROBLEM 13.38. *A right regular hexagonal pyramid, edge of base 25 mm, height 50 mm lies on one of its slant edges on HP with its axis parallel to VP. A section plane perpendicular to HP and inclined to VP at 30° cuts the pyramid bisecting its axis. Draw its top view, sectional front view and true shape of the section.*

SOLUTION. All the construction lines are retained to make the solution self-explanatory. See Fig 13.40.

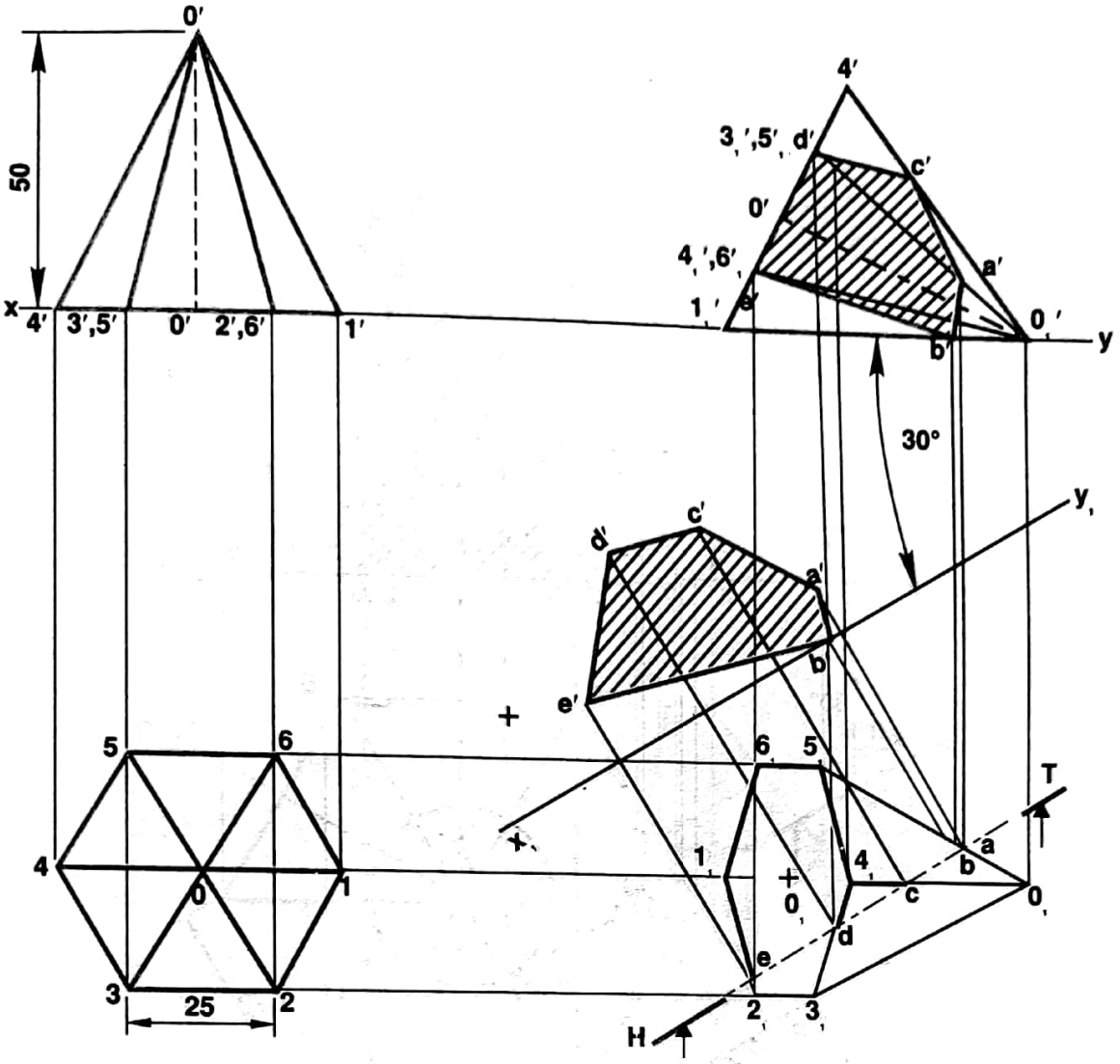

Fig. 13.40 Solution to problem 13.38

PROBLEM 13.39 *A right regular hexagonal pyramid, edge of base 25 mm, height 60 mm, rests on its base on HP with one of its base edges parallel to VP. A section plane perpendicular to HP and inclined to the VP at 30° cuts the pyramid and is 10 mm away from the axis. Draw its top view, sectional front view and true shape of the section.*

SOLUTION.

(*i*) Draw the projections of the pyramid in the given position and name the corner points on it.

(*ii*) Draw the cutting plane line HT inclined at 30° to *xy* and 10 mm away from the axis. This can be done by drawing a circular arc of 10 mm radius with o as centre and draw the cutting plane line HT tangential to the arc.

(*iii*) The points *a, b, c, d, e* of the cutting plane line intersect with various edges of the pyramid in the top view.

(*iv*) Project these points in the front view to their corresponding edges. Join these points in proper order and draw section lines in it. As the section plane is inclined to the VP, projections of the section in the front view is an apparent section.

(*v*) To draw true shape of the section, draw an auxiliary plane parallel to the section plane, as shown in the Fig. 13.41 by the method already explained.

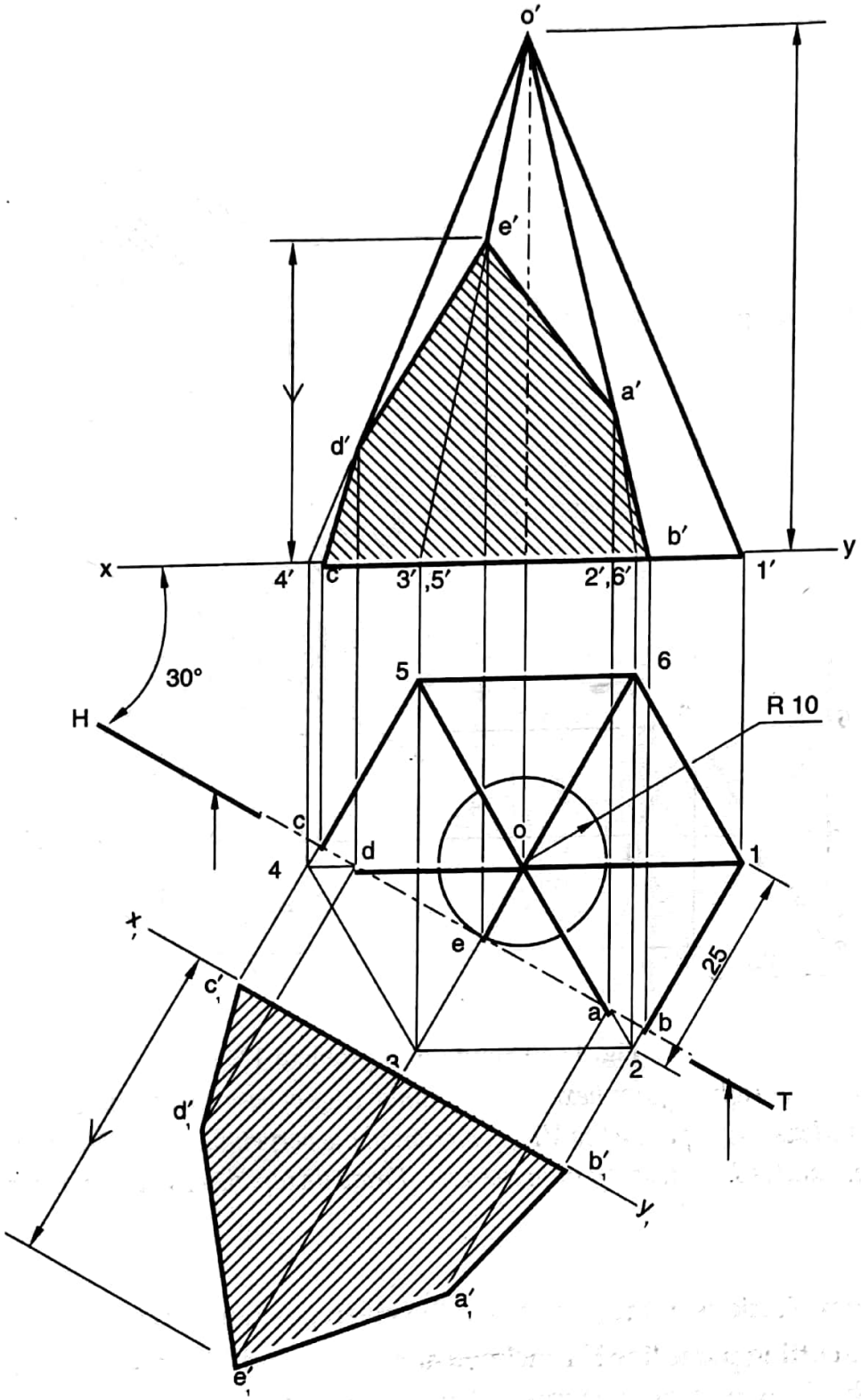

Fig. 13.41 Solution to problem 13.39

PROBLEM 13.40 *A right regular pentagonal pyramid, edge of base 25 mm and height 50 mm, rests on its base on HP such that one of its base edges to be perpendicular to VP. A section plane perpendicular to the HP and inclined to the VP at 30° cuts the pyramid and is 10 mm away from the axis. Draw its top view, sectional front view and true shape of the section.* *(PTU, Jalandhar December 2008)*

SOLUTION.

(*i*) Draw the projections of the pyramid in the given position and label it.

(*ii*) Draw the cutting plane line HT inclined at 30° to *xy* and 10 mm away from the axis. This can be done by drawing a circular arc of 10 mm radius with 0 as centre and draw the cutting plane line HT tangential to it.

(*iii*) The points of intersection *a, b, c, d* of the cutting plane line with various elements of the pyramid in the top view are shown in Fig. 13.42.

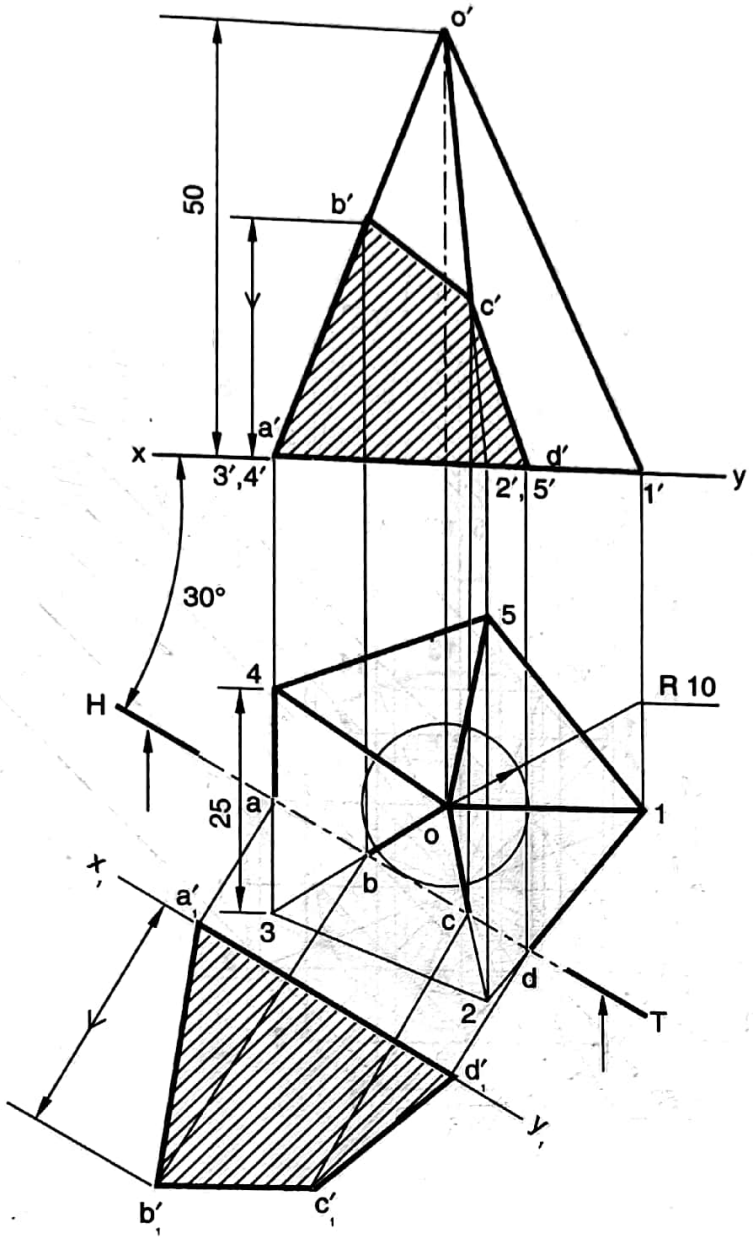

Fig. 13.42 Solution to problem 13.40

(*iv*) Project these points in the front view to their corresponding elements. Join these points in proper order and draw section lines in it.

(*v*) To get the true shape of the section, draw an auxiliary plane parallel to the section plane, project all the points as discussed in the previous problems.

PROBLEM 13.41 *A right circular cone, diameter of base 50 mm and height 65 mm, rests on its base in HP. A section plane perpendicular to the HP and inclined to the VP at 45° cuts the cone and is 12 mm away from the axis. Draw its top view, sectional front view and true shape of the section.* (*PTU, Jalandhar December 2004*)

SOLUTION.

(*i*) Draw the projections of the cone in the given position and label it.

(*ii*) Draw the section plane line HT inclined at 45° to *xy* and 12 mm away from the axis. This can be done by drawing a circular arc of 12 mm radius with o as centre and draw the section plane line HT tangential to it.

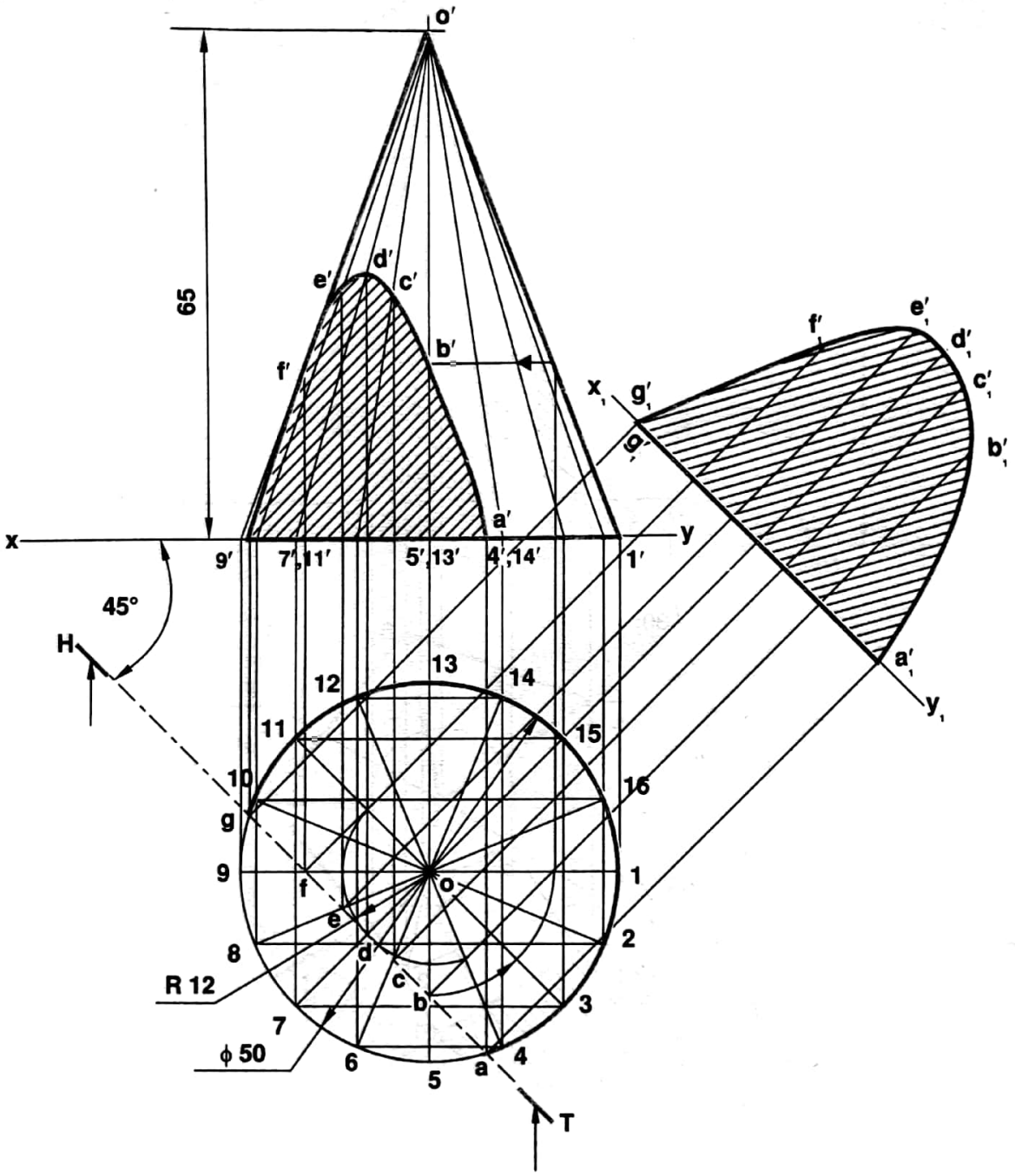

Fig. 13.43 Solution to problem 13.41

(*iii*) The points of intersection *a, b, c, d, e, f, g* of the cutting plane line makes with various elements of the cone in the top view. Project these points in the front view. The projection of point *b* of *b'* in the front view are to lie on 0'5'. This point cannot be plotted by direct intersection. Rotate the point *b*, either on 01 or on 09 (which gives the true length 0'1' or 0'9') and then project the point of intersection vertically into 0'1' or 0'9' in the front view and *b'* horizontally on the 0'5' or 0'13'.

(*iv*) Join these points in proper order and draw section lines in it.

(*v*) To draw the true shape of the section, draw a new reference line x_1y_1 at a convenient distance and parallel to the section plane line. Project all the points as discussed in the earlier problems. Repeat the same procedure to get the true shape of the section as shown in Fig. 13.43.

PROBLEM 13.42 *A right circular cone 45 mm diameter axis 65 mm long is resting on its base on HP, it is cut by a plane, the HT of which makes an angle 45° with the VP and is passing 15 mm from the top view axis. Draw the sectional front view and true shape of the section.* (*PTU, Jalandhar December 2003*)

SOLUTION. The interpretation of the solution is left to the student. See Fig. 13.44.

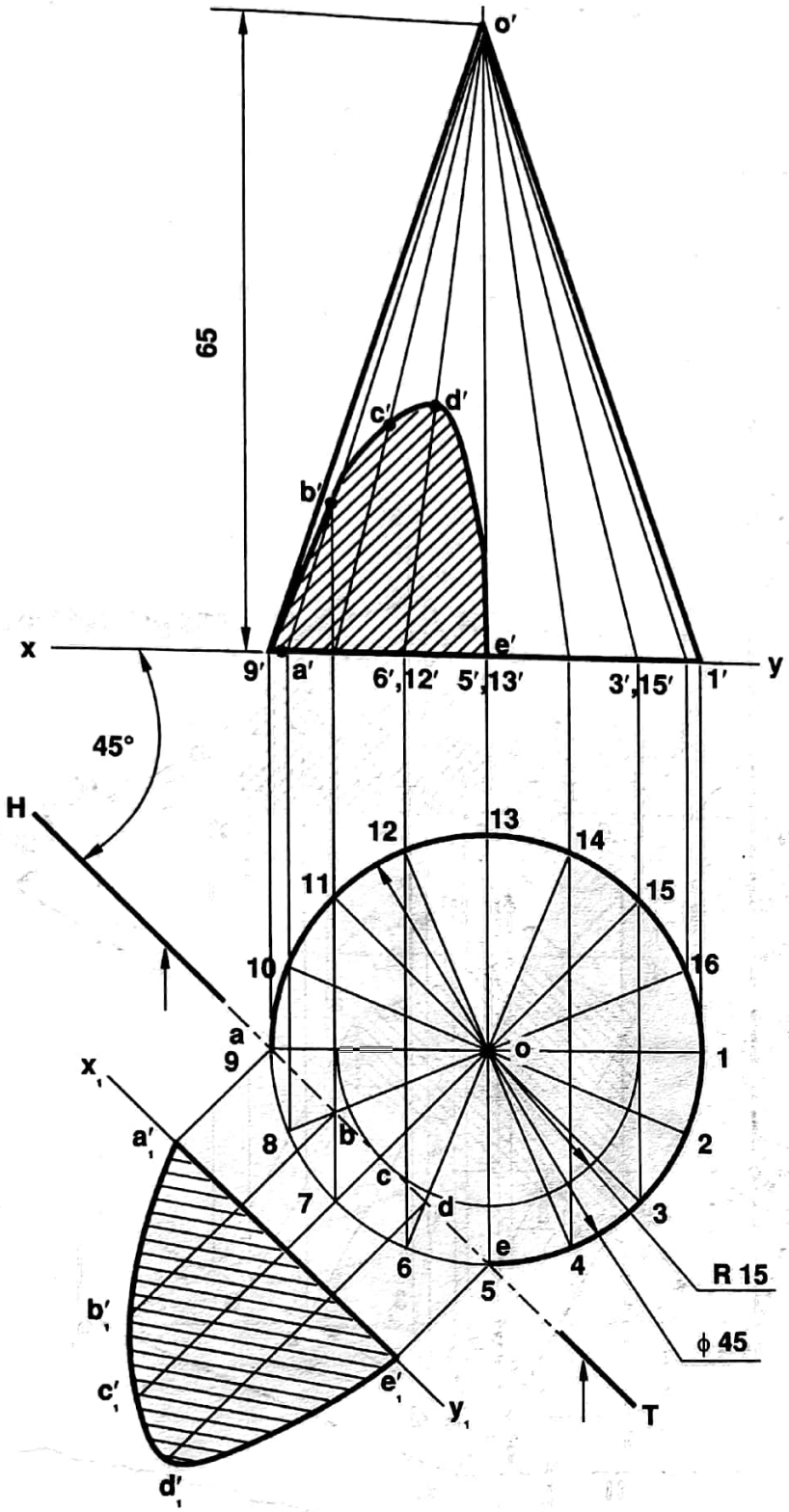

Fig. 13.44 Solution to problem 13.42

PROBLEM 13.43 *A right regular pentagonal pyramid, edge of base 25 mm, height 50 mm, lies on one of its triangular faces on HP with its axis parallel to VP. A section plane perpendicular to the HP and inclined to the VP at 30° cut the pyramid bisecting its axis. Draw its top view, sectional front view and true shape of the section.*

SOLUTION.

(*i*) Draw the projections of the pyramid in the given position and label it.

(*ii*) Mark the mid-point of the axis in the front view and project it in the top view.

(*iii*) Draw the cutting plane line HT inclined at 30° the *xy* and passing through the centre of the axis.

(*iv*) The cutting plane line HT cuts the various edges as shown in Fig. 13.45.

(*v*) Project the points of intersection in the front view of their corresponding edges. Join these points in proper order and draw section lines in it. As the section plane is inclined to the VP, projections of the section in the front view is an apparent section.

(*vi*) To draw true shape of the section, draw an auxiliary plane parallel to the section plane by the method already explained.

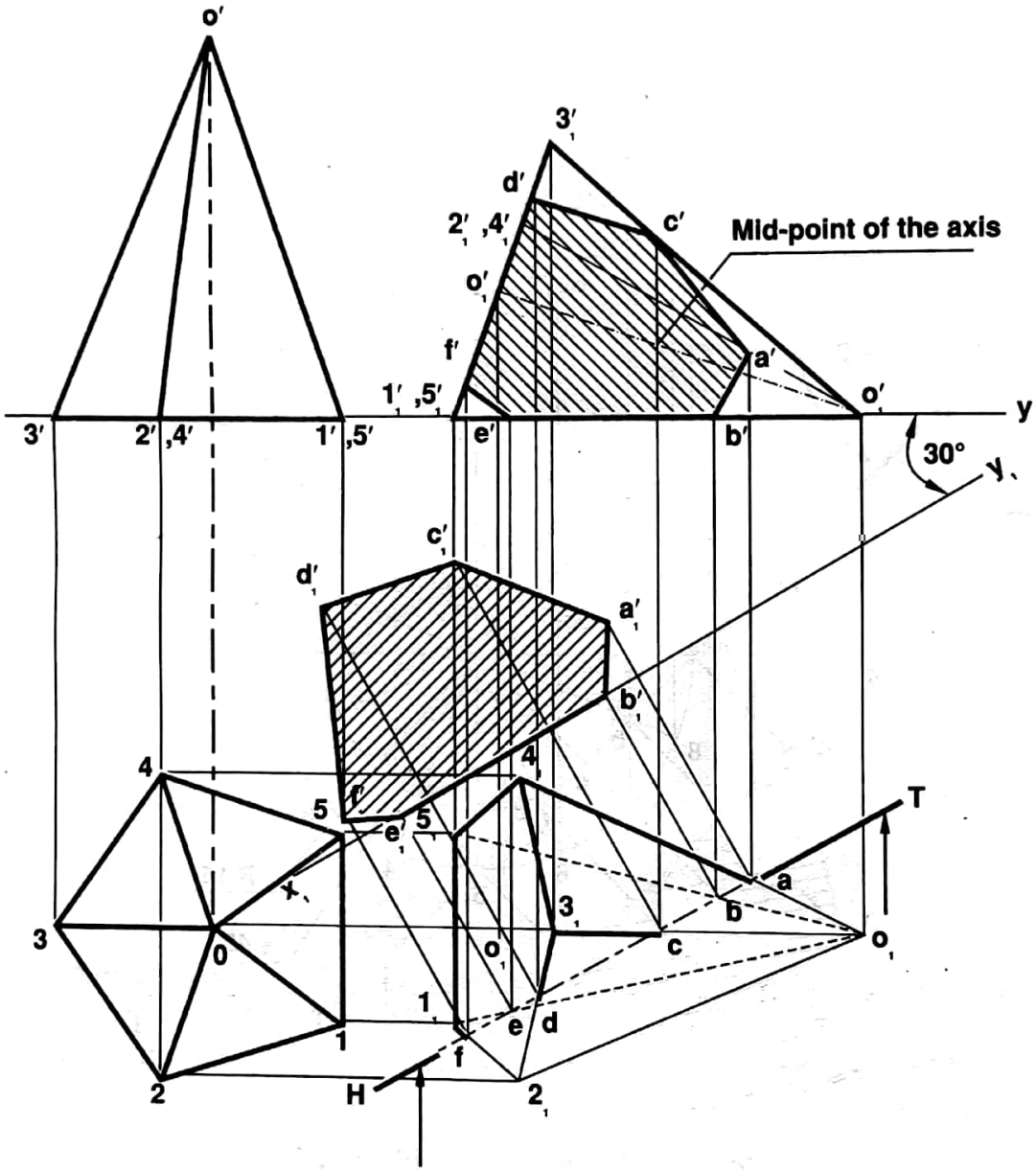

Fig. 13.45 Solution to problem 13.43

PROBLEM 13.44 *A right regular pentagonal prism, side of base 25 mm and height 60 mm, rests on an edge of its base on HP, such that one of its base corners lies on HP and its axis is inclined at 45° to the HP and parallel to the VP. A section plane perpendicular to the HP and inclined to the VP at 45° cuts the prism bisecting its axis. Draw its top view and sectional front view.*

SOLUTION.

(*i*) Draw the projections of the prism in the given position and name it.

(*ii*) Mark the mid-point of the axis in the front view and project it in the top view.

(*iii*) Draw the cutting plane line HT inclined at 45° to *xy* and passing through the centre of the axis.

(*iv*) The cutting plane line HT cuts the various edges as shown in Fig. 13.46.

(*v*) Project the points of intersection in the front view to their corresponding edges. Join these points in proper order and draw section lines in it. As the section plane is inclined to the VP, the projections of the section in the front view is an apparent section.

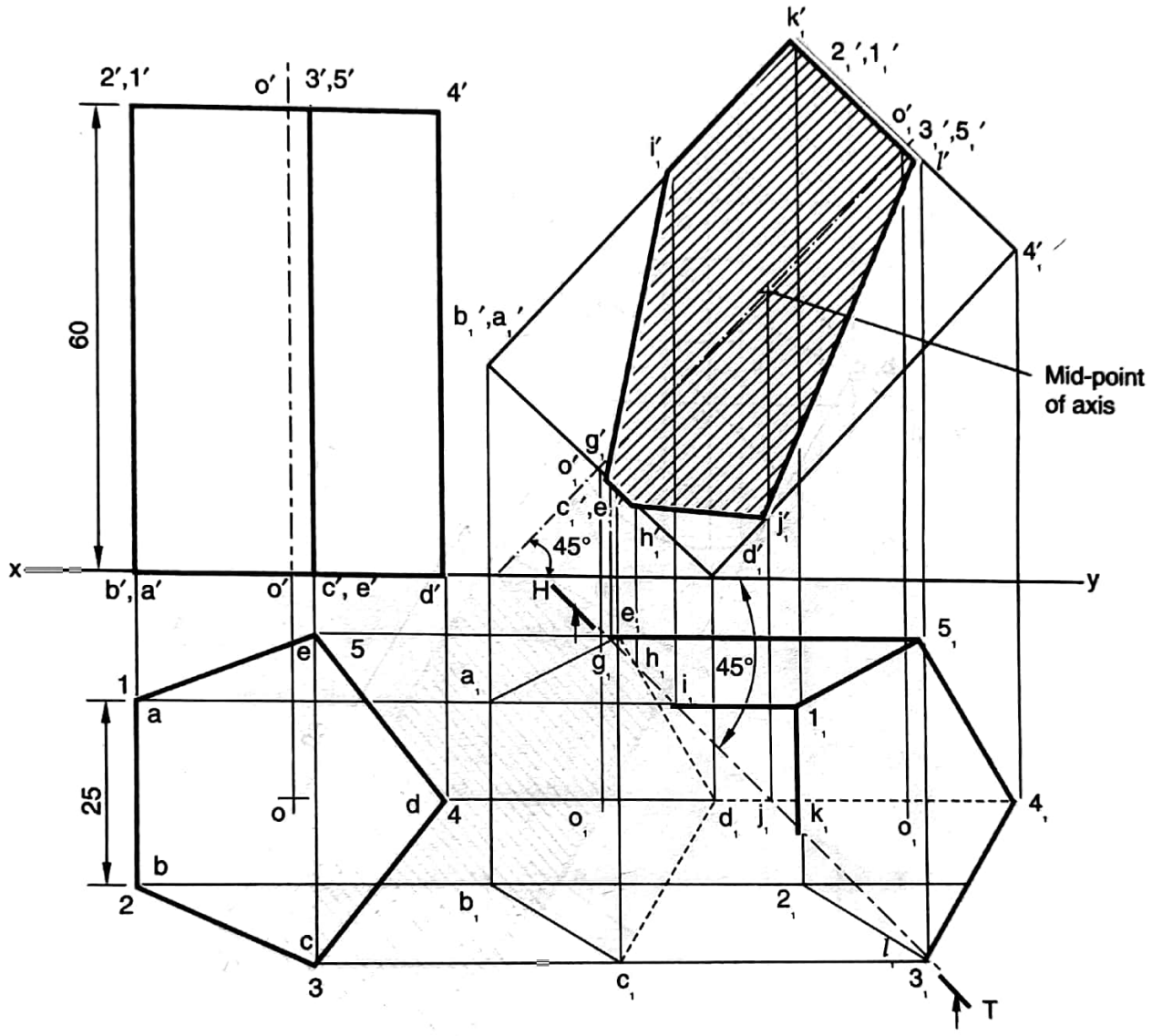

Fig. 13.46 Solution to problem 13.44

PROBLEM 13.45 *A vertical cylinder of 40 mm diameter is resting on its base in HP. It is cut by a section plane, which is perpendicular to the HP and inclined to the VP at 30° such that the true shape of the section is a rectangle of 30 mm × 60 mm. Draw the front view, sectional top view and true shape of the section.*

SOLUTION.

(*i*) Draw the projections of the cylinder in the given position and name it.

(*ii*) Draw a line x_1y_1 in such a way that the chord length in the top view is 30 mm at 30° to *xy* line.

(*iii*) Project the points of intersection and draw the rectangle of 30 mm × 60 mm as shown in Fig. 13.47.

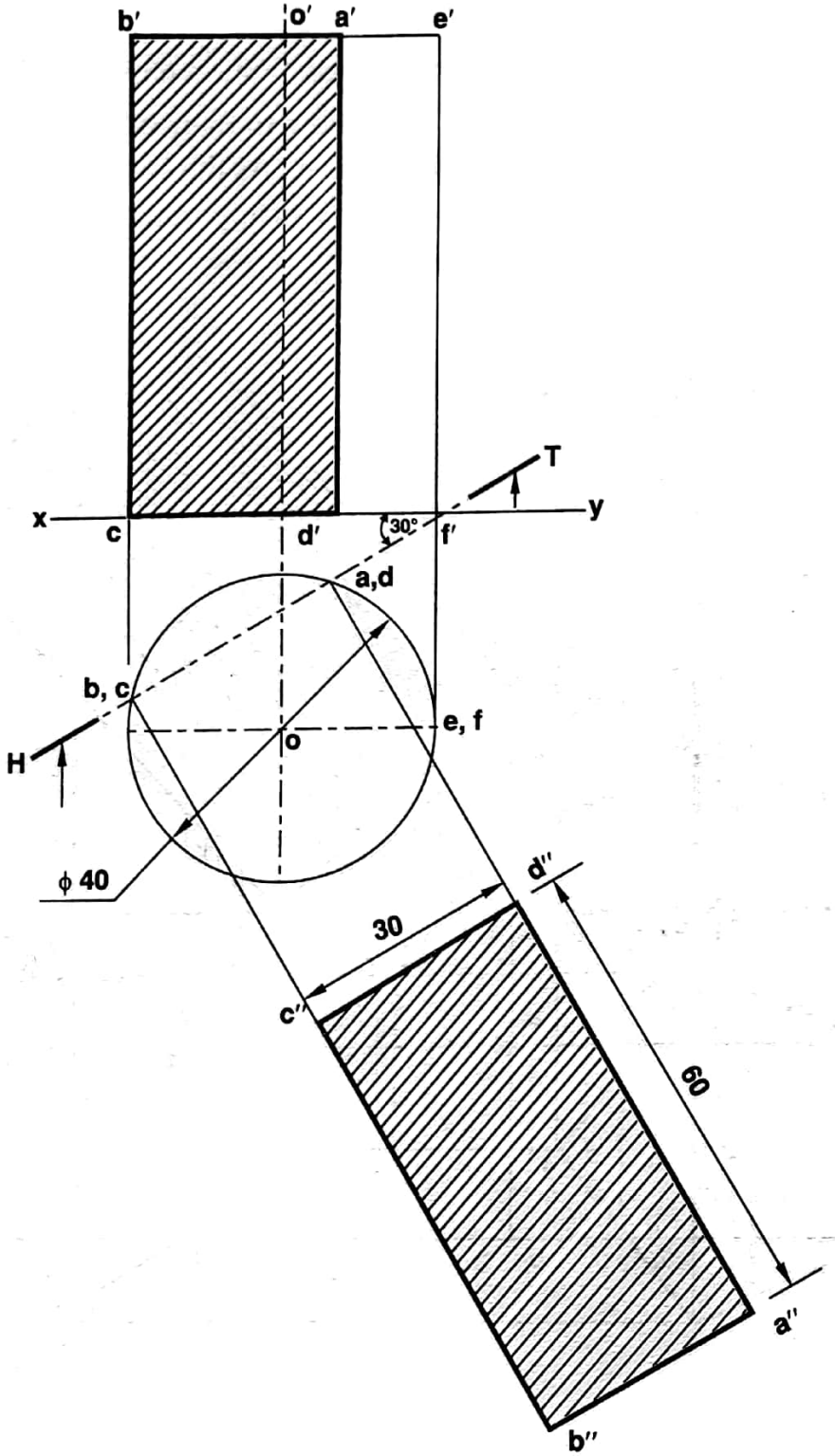

Fig. 13.47 Solution to problem 13.45

PROBLEM 13.46 *A right egular entagonal pyraid, edge of base 25 mm and height 60 mm, rests on its base on HP such that one of its base edges parallel to the VP. A section plane perpendicular to the HP and inclined to the VP at 30° cuts the pyramid and is 12 mm away from the axis. Draw its top view, sectional front view and true shape of the section.*

SOLUTION. The interpretation of the solution is left to the student. See Fig. 13.48.

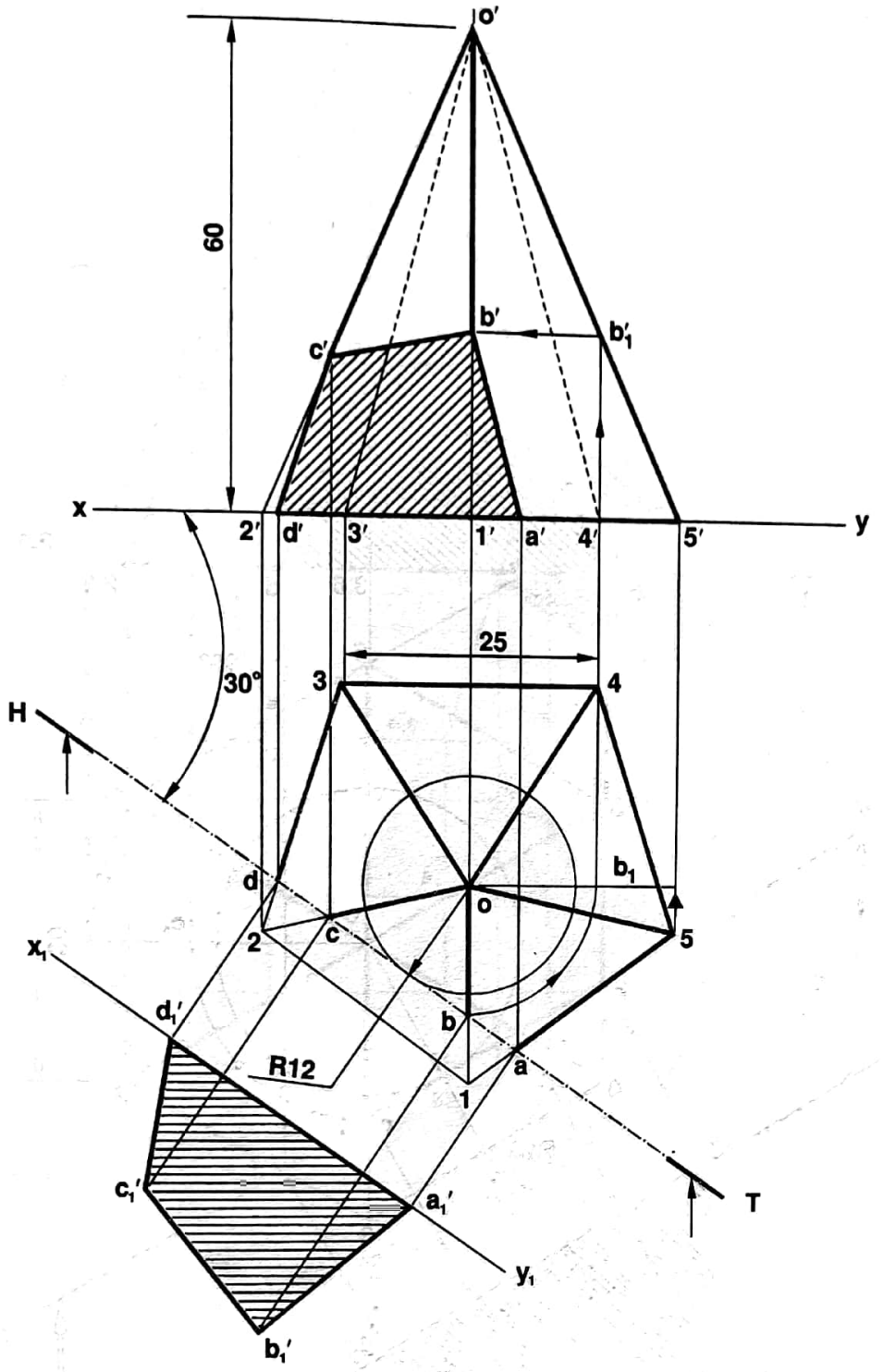

Fig. 13.48 Solution to problem 13.46

PROBLEM 13.47 *A hexagonal pyramid, side of base 30 mm and height 60 mm, has its base on the HP and an edge of the base makes an angle of 30° to the VP. It is cut by a plane perpendicular to the HP and inclined at 30° to VP at a distance of 18 mm from the base along the axis. Draw the sectional elevation and true shape of the section.*

Or

A right regular hexagonal pyramid, edge of base 30 mm and height 60 mm, rests on its base in HP, with one of its base edges perpendicular to VP. A section plane inclined to VP at 30° and perpendicular to HP and is 18 mm away from the axis. Draw its top view, sectional front view and true shape of the section.

(PTU, Jalandhar December 2005)

SOLUTION. The interpretation of the solution is left to the reader. See Fig. 13.49.

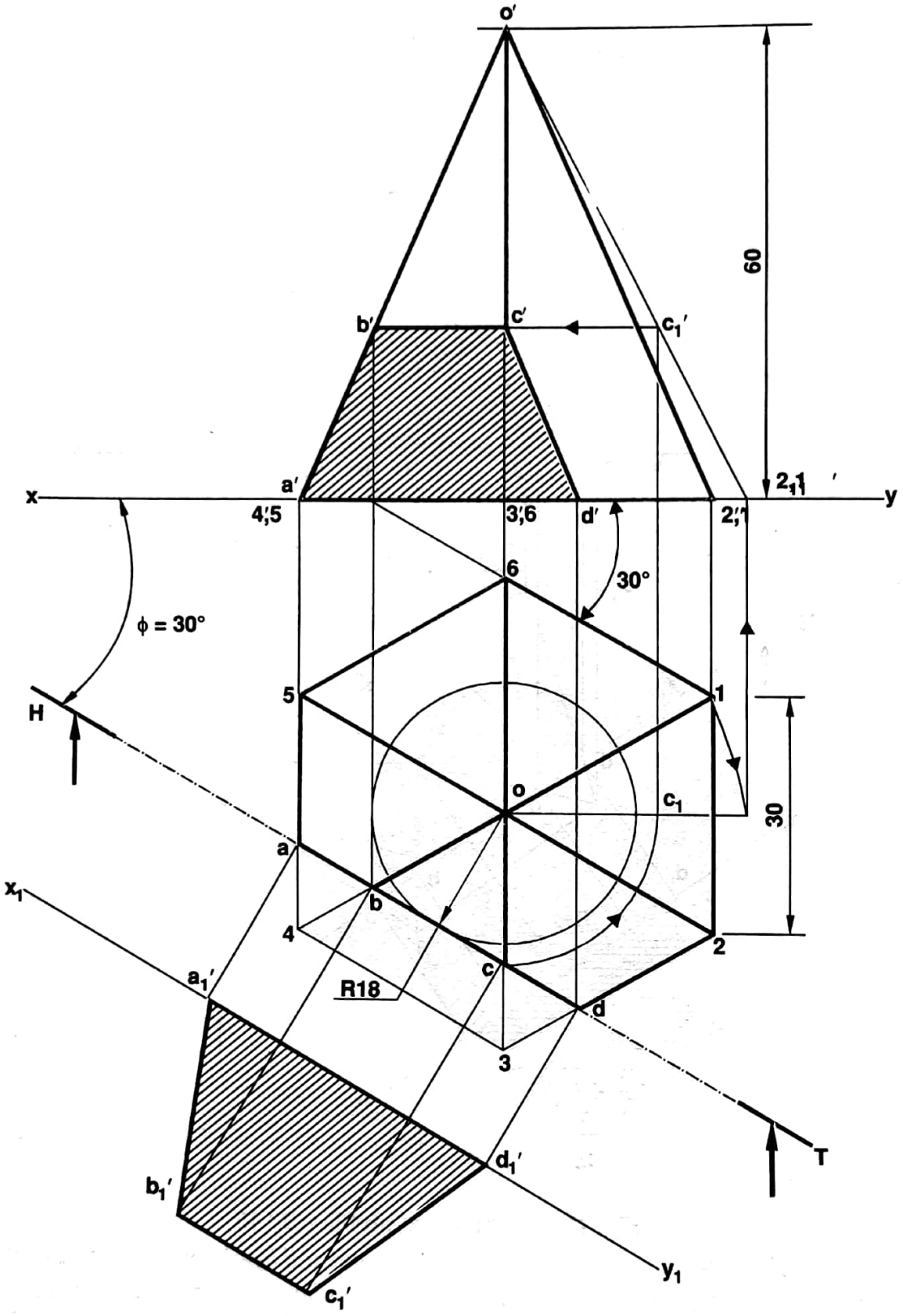

Fig. 13.49 Solution to problem 13.47

PROBLEM 13.48 *A hexagonal pyramid, side of base 25 mm and height 65 mm is lying on HP on one of its triangular faces, with its axis parallel to VP. It is cut by an auxiliary vertical plane (AVP) inclined to VP by 30° and passing though a point on the axis, 20 mm from the apex. Draw its projections and true shape of the section.* (PTU, Jalandhar December 2005, 2010)

SOLUTION. The solution of this problem is self-explanatory. See Fig. 13.50.

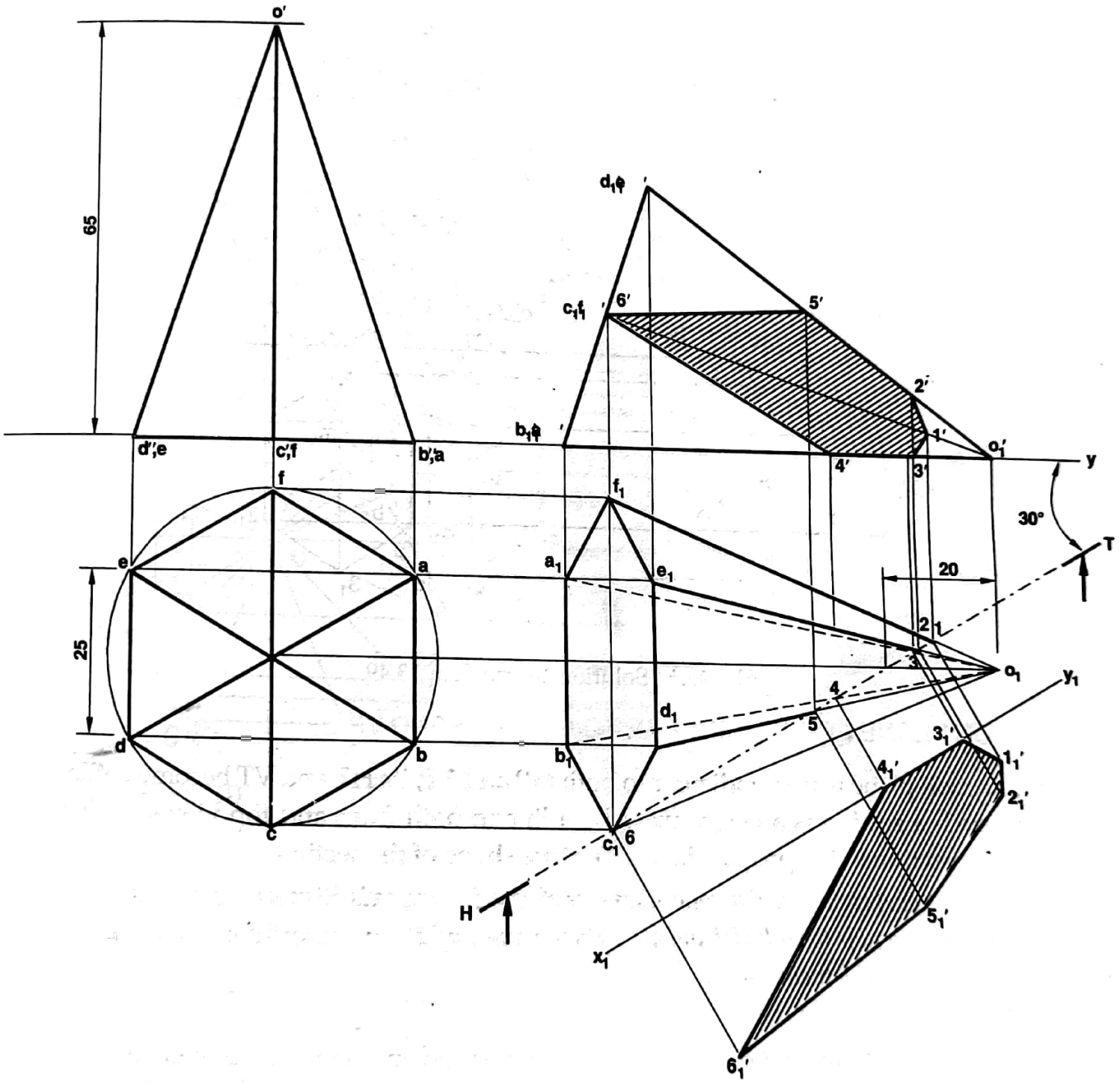

Fig. 13.50 Solution to problem 13.48

PROBLEM 13.49 *A right regular hexagonal prism, edge of base 30 mm and height 80 mm long has an edge of its base in HP with its axis inclined at 60° to the HP and parallel to the VP. A section plane inclined to the VP at 60° and perpendicular to the HP cuts the axis at a distance of 60 mm from its bottoms end. Draw its top view and sectional front view.*

SOLUTION. All the construction lines are retained to make the solution self-explanatory see Fig. 13.51.

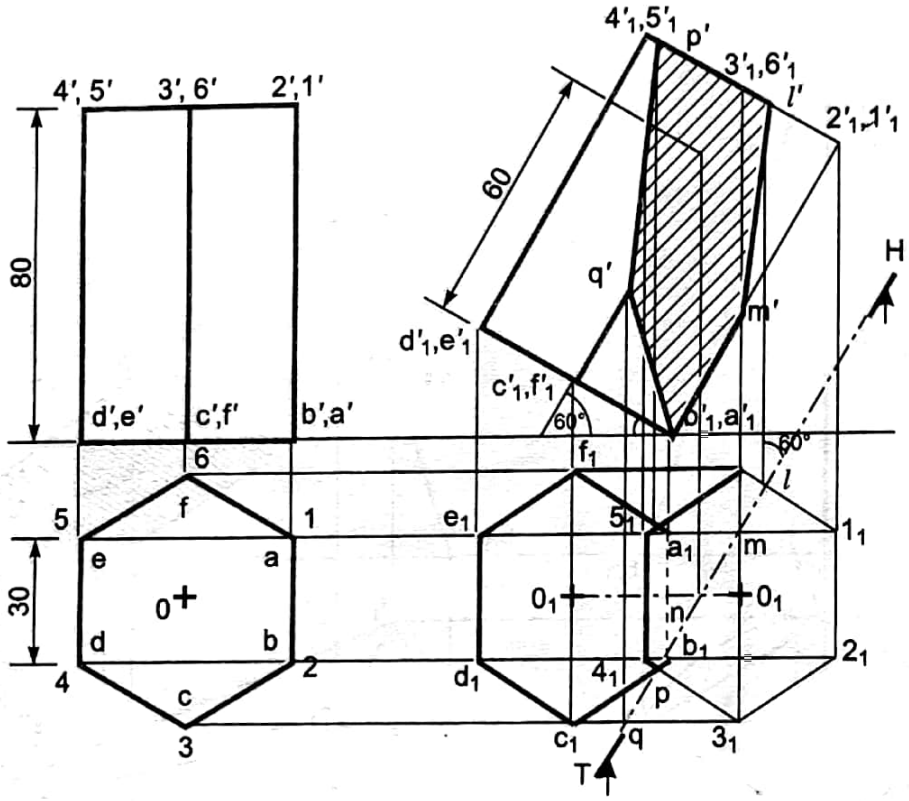

Fig. 13.51 Solution to problem 13.49

13.10 SECTION PLANE PERPENDICULAR TO BOTH HP AND VP

When a section plane is perpendicular to both HP and VP, its HT and VT become collinear. The projection of such a section is an edge view *i.e.* a line in both front and top views. Whereas, the projection of the section in the profile plane gives true shape of the section.

PROBLEM 13.50 *A right circular cone, diameter of base 50 mm, axis 50 mm long, rests on is base on HP. A section plane perpendicular to both HP and VP cuts the cone and 10 mm away from the axis. Draw its front view, top view and sectional left side view.*

SOLUTION.

(*i*) Draw the projections of the cone in the given position and name the points on it.

(*ii*) Since, the section plane is perpendicular to both HP and VP, so the section plane line is seen as an edge view or a line both in front and top views. The side view will show the true shape of the section.

(*iii*) The cutting plane line *i.e.* HT and VT both cuts the various elements as shown in Fig. 13.52.

(*iv*) Project all the points of intersection in the left side view to their corresponding elements. Join these points in proper order and draw section lines in it.

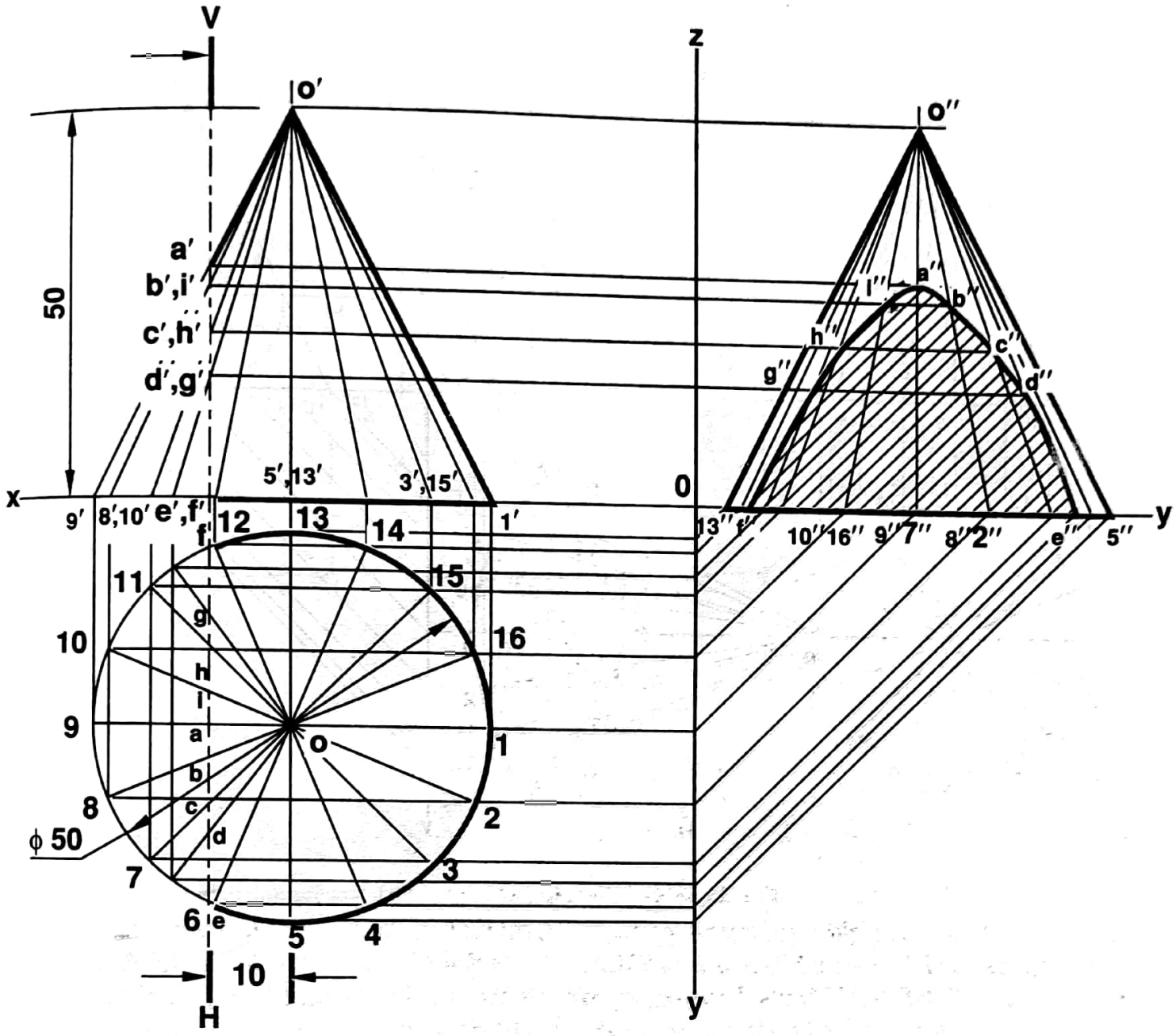

Fig. 13.52 Solution to problem 13.50

PROBLEM 13.51 *A right circular cone diameter of base 50 mm and height 60 mm, rests on its base rim on HP, such that its axis is parallel to VP and inclined at 45° to the HP. A section plane perpendicular to both HP and VP, cuts the axis of the cone at a distance of 25 mm from its vertex. Draw its front view, top view and sectional side view.*

SOLUTION. The interpretation of the solution is left to the student. See Fig. 13.53.

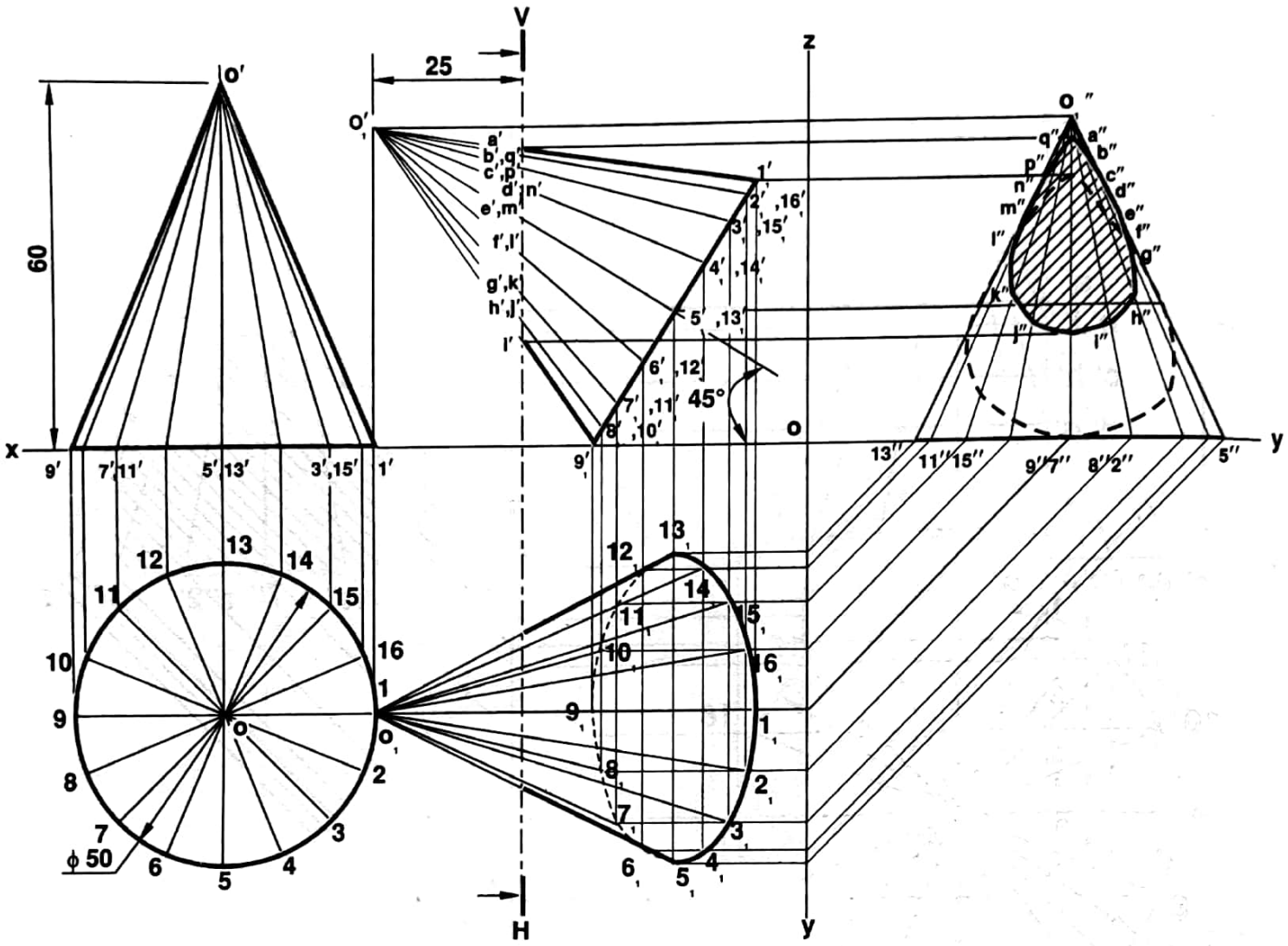

Fig. 13.53 Solution to problem 13.51

PROBLEM 13.52 *A right regular pentagonal prism, side of base 25 mm, height 50 mm, lies on one of its rectangular faces on HP, such that its axis is inclined at 30° to the VP and parallel to the HP. A section plane perpendicular to both HP and VP cuts the prism, meeting its axis at a distance of 10 mm from the base which is away from the VP. Draw its front view, top view and sectional side view.*

SOLUTION.

(*i*) Draw the projections of the prism in the given position and label it.

(*ii*) As the section plane is perpendicular to both HP and VP, so its section plane line is seen as an edge view or a line both in front and top views. The side view will show the true shape of the section.

(*iii*) The cutting plane line cuts the various elements as shown in Fig. 13.54.

(*iv*) Project all the points of intersection in the left side view to their corresponding edges (elements). Join these points in proper order and draw section lines in it.

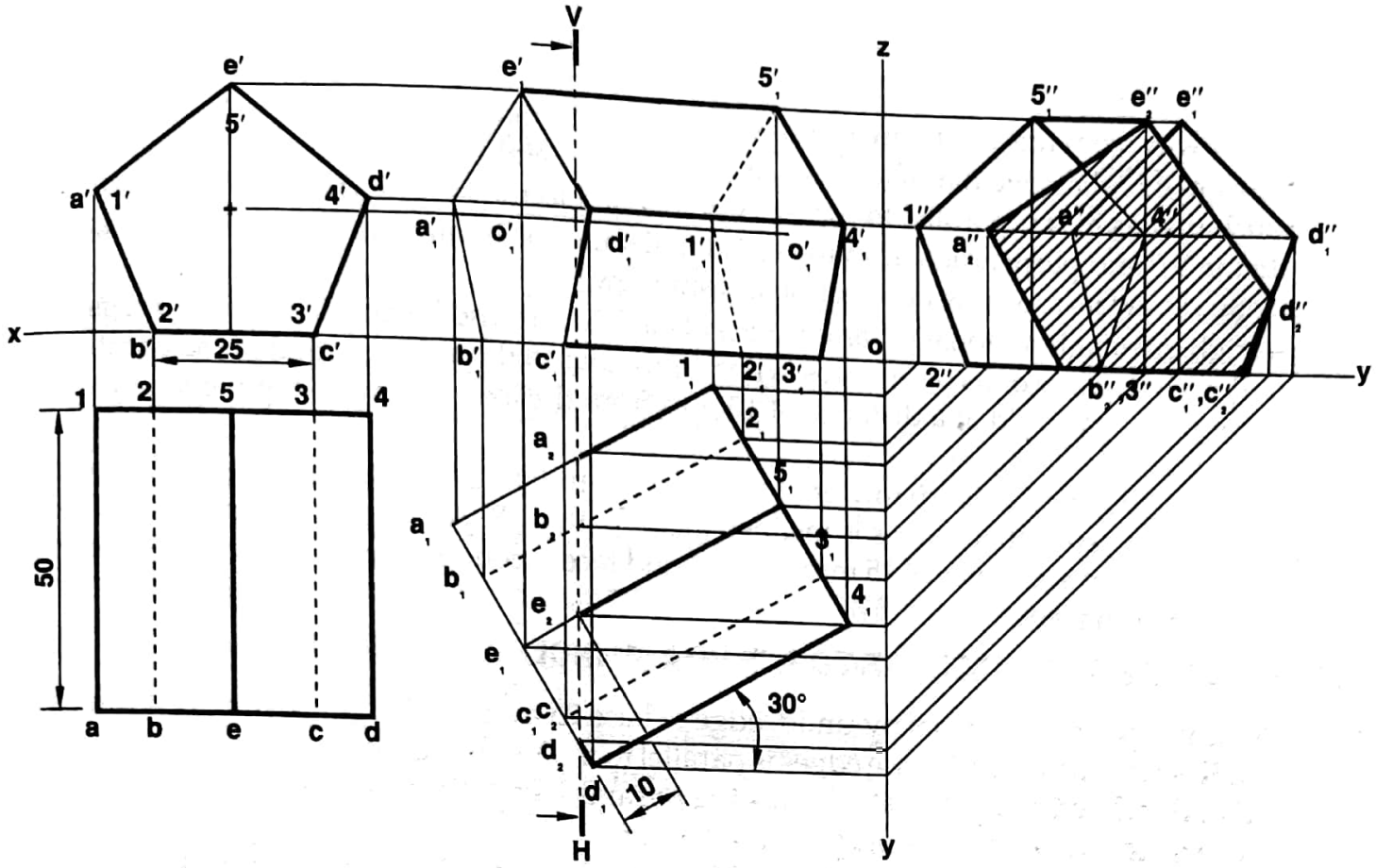

Fig. 13.54 Solution to problem 13.52

EXERCISES

SECTION PLANE PARALLEL TO THE HP

13.1 A right regular pentagonal pyramid, side of base 25 mm and height 50 mm, rests on its base on HP such that one of its base edges is parallel to the VP. A section plane parallel to the HP cuts the pyramid bisecting its axis. Draw its front view and sectional top view.

13.2 A square pyramid, edge of base 25 mm and height 50 mm rests on its base on HP such that one of its base edges makes an angle of 30° with the VP. A section plane parallel to the HP and perpendicular to the VP cuts the pyramid bisecting its axis. Draw its front view and sectional top view.

13.3 A right circular cone, diameter of base 50 mm and height 60 mm rests on HP on its base rim such that its axis is parallel to the VP and inclined to the HP at 45°. A section plane parallel to the HP and perpendicular to the VP cuts the cone bisecting its axis. Draw its front view and sectional top view.

13.4 A right regular pentagonal prism, side of base 25 mm and axis 50 mm, lies on one of its rectangular faces on HP such that its axis is parallel to the both HP and VP. A section plane parallel to and 15 mm above the HP cuts the prism. Draw its front view and sectional top view.

SECTION PLANE PARALLEL TO THE VP

13.5 A cube of 35 mm edge rests on its base on HP such that one of its faces is inclined at 30° to the VP. A section plane parallel to the VP cuts the cube at a distance of 10 mm from the axis. Draw its top view and sectional front view.

13.6 A right regular pentagonal prism, side of base 25 mm and length of the axis 60 mm, lies on one of its rectangular faces on HP with its axis inclined at 45° to VP. A section plane parallel to the VP and perpendicular to the HP, cuts the axis of the prism at a distance of 10 mm from the end face away from the VP. Draw its top view and sectional front view.

13.7 A right circular cone diameter of base 50 mm and height 60 mm rests on HP on its base rim such that its axis is parallel to the VP and inclined to the HP at 45°. A section plane parallel to the VP and perpendicular to the HP at a distance of 10 mm away from its vertex, cuts the cone. Draw its top view and sectional front view.

13.8 A right regular hexagonal pyramid, edge of base 30 mm and height 55 mm, rests on its base on HP, such that one of its base edges is perpendicular to the VP. A section plane parallel to the VP cuts the pyramid at a distance of 10 mm from the axis. Draw its top view and sectional front view.

13.9 A right circular cylinder diameter of base 40 mm and height 60 mm, is lying on HP on one of its elements, such that its axis is inclined at 30° to the VP. A section plane parallel to VP, cuts the cylinder at a distance of 15 mm from its end face meeting its axis. Draw its sectional front view and top view.

SECTION PLANE PERPENDICULAR TO THE VP AND INCLINED TO THE HP

13.10 A right regular pentagonal pyramid, edge of base 25 mm and height 50 mm, rests on its base on HP such that one of its base edges is parallel to the VP. A section plane perpendicular to the VP and inclined to the HP at 45° cuts the pyramid, bisecting its axis. Draw its front view, sectional top view and true shape of the section.

13.11 A right circular cone diameter of base 50 mm and height 60 mm, rests on its base on HP. A section plane perpendicular to the VP and inclined to the HP at 45°, cuts the cone bisecting its axis. Draw its front view, sectional top view and true shape of the section.

13.12 A right circular cylinder diameter of base 50 mm and height 60 mm rests on its base on HP. A section plane perpendicular to the VP and inclined to the HP at 45°, cuts the cylinder bisecting its axis. Draw its front view, sectional top view and true shape of the section.

13.13 A right circular cylinder, diameter of base 30 mm and height 60 mm long, lies on its base in HP. A section plane perpendicular to the VP and inclined at 45° to the HP cuts the axis at a point 20 mm from its top end. Draw its front view, sectional top view and true shape of the section.

SECTION PLANE PERPENDICULAR TO THE HP AND INCLINED TO THE VP

13.14 A right regular hexagonal pyramid, edge of base 25 mm and height 50 mm, lies on HP on one of its triangular faces such that its axis is parallel to the VP. A section plane perpendicular to the HP and inclined to the VP at 30° cuts the pyramid, bisecting its axis. Draw its top view, sectional front view and true shape of the section.

13.15 A right regular pentagonal pyramid, edge of base 25 mm and height 50 mm, rests on its base on HP such that one of its base edges is perpendicular to VP. A section plane perpendicular to the HP and inclined to the VP at 45° cuts the pyramid and is 10 mm infront of its axis. Draw its top view, sectional front view and true shape of the section.

13.16 A right circular cone, diameter of base 50 mm and height 65 mm, rests on its base in HP. A section plane perpendicular to the HP and inclined to the VP at 30° cuts the cone and is 15 mm away from the axis. Draw its top view, sectional front view and true shape of the section.

SECTION PLANE PERPENDICULAR TO BOTH HP AND VP

13.17 A right regular hexagonal pyramid, edge of base 25 mm and height 50 mm, rests on HP on one of its base edges such that the edge is perpendicular to the VP and its axis makes an angle of

45° to the HP. A section plane perpendicular to both HP and VP cuts the pyramid, bisecting its axis. Draw its front view, top view, sectional right side view and true shape of the section.

13.18 A right regular pentagonal prism, side of base 25 mm and height 50 mm, lies on one of its rectangular faces on HP, such that its axis is inclined to the VP at 45°. A section plane perpendicular to both HP and VP cuts the prism, meeting its axis at a distance of 10 mm from the end face which is away from the VP. Draw its front view, top view and true shape of the section.

13.19 A right circular cone, diameter of base 60 mm, axis 50 mm long, rests on is base on HP. A section plane perpendicular to both HP and VP cuts the cone and 12 mm away from the axis. Draw its front view, top view and sectional left side view.

13.20 A right circular cone diameter of base 60 mm and height 60 mm, rests on its base rim on HP, such that its axis is parallel to VP and inclined at 45° to the HP. A section plane perpendicular to both HP and VP, cuts the axis of the cone at a distance of 30 mm from its vertex. Draw its front view, top view and sectional side view.

OBJECTIVE QUESTIONS

13.1 Distinguish between frustum of a solid and truncated of a solid ?
13.2 Why the solids are sectioned ?
13.3 What is the difference between apparent section and true section ?
13.4 The sectional views are used to see the ..... details of the objects.
13.5 When a section plane is parallel to the HP, the true shape of the section is viewed in the ..... .
13.6 The projection obtained on a VP of a cut solid is called sectional .....
13.7 The true shape of the section is an ....., when a cylinder is cut by a section plane inclined to the axis.
13.8 The section planes are represented by its ..... on HP and VP.
13.9 What is a cutting plane ?
13.10 For obtaining a sectional view of a solid, the part of the object between the section plane and ..... is assumed to be removed.
13.11 What is the principle of sectioning ?
13.12 Name different types of sectioning methods.
13.13 What do you mean by sectional view ?
13.14 Where and why a cutting plane is drawn in a drawing ?
13.15 What is the true shape of the section obtained by cutting a cone parallel to one of the generators ?
13.16 A cone is cut by a plane in such a way that the cutting plane passes through the apex. What is the true shape of the section ?
13.17 Section portion is represented by ..... lines.
13.18 Explain the procedure for working out true shape of surface inclined to HP.
13.19 The true shape of a section will be seen in the front view of an object when the section plane is ..... to the VP.
13.20 Section lines are inclined at ..... angle to .....line.
13.21 What do you mean by VT and HT fo section plane ?

ANSWERS

13.4 Interior **13.5** Top view **13.6** Front view **13.7** Ellipse
13.8 Traces **13.10** Observer **13.17** Continuous thin **13.19** Parallel
13.20 45°, horizontal