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GLOBAL ACADEMY OF TECHNOLOGY

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DEPARTMENT OF MECHANICAL ENGINEERING

I/II SEM

Computer Aided Engineering Drawing

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Contents

CHAPTER 1: INTR0DUCTION TO GRAPHICS ----------1 to 9

CHAPTER 2: INTR0DUCTION TO SOLID EDGE ST9 ---------- 10 to 35

CHAPTER 3: PROJECTION OF POINTS----------36 to 43

CHAPTER 4: PROJECTION OF LINES----------44 to 48

CHAPTER 5: PROJECTION OF PLANES----------49 to 59

CHAPTER 6: PROJECTION OF SOLIDS----------60 to 79

CHAPTER 7: ISOMETRIC PROJECTION----------80 to 87

INTRODUCTION

Drawing

The graphical representation of any object or idea can be termed as drawing. A drawing can be prepared either using free hand or using engineering instruments or using computer software.

Types of Drawing

- Artistic Drawing
- Engineering Drawing

Artistic Drawing

The drawing representing any object or idea which is sketched in free hand using imagination of artist and in which proper scaling and dimensioning is not maintained is called an artistic drawing. Example: Painting, Posters, arts etc.

Engineering Drawing

- Engineering drawing can be defined as a graphical language used by engineers and other technical personnel associated with the engineering profession which fully and clearly defines the requirements for engineered items. It is a two dimensional representation of a three dimensional object.
- In other words, The art of representing a real or imaginary object precisely using some graphics, symbols, letters and numbers with the help of engineering drawing instruments is called engineering drawing.
- The art of representing engineering objects such as buildings, roads, machines, circuits etc. on a paper is called engineering drawing. It is used by engineers and technologists.
- An engineering drawing provides all information about size, shape, surface type, materials etc. of the object. Example: Building drawing for civil engineers, Machine drawing for mechanical engineers, Circuit diagrams for electrical and electronics engineers, computer graphics for one and all etc.

Difference between Artistic and Engineering Drawing

Artistic Drawing	Engineering Drawing
Purpose of artistic drawing is to convey emotion or artistic sensitivity in some way.	Purpose of engineering drawing is to convey information about engineering object or idea.
Can be understood by all.	Need some specific knowledge or training to understand.
Scale maintaining is not necessary	Scale maintaining is necessary
No special requirement of engineering instruments.	Engineering drawing instruments is used to make the drawing precise.
An artistic drawing may not be numerically specific and informative.	An engineering drawing must be numerically specific and informative.
Standard drawing code need not to be followed.	Standard drawing code (like ISO, ANSI, JIS, BS etc,) must be maintained.

Purpose of Engineering

- Drawing it is very difficult and complex to explain some certain engineering requirements in word.
- In such cases well dimensioned and properly scaled graphics can make it easy to understand that for technical personnel. Engineering drawing serves this purpose.
- Any product that is to be manufactured, fabricated, assembled, constructed, built, or subjected to any other types of conversion process must first be designed. To make the outcome from the design understandable to any third party engineering drawing is the best way.

Applications of Engineering Drawing

Engineering Drawing is an essential part of almost all engineering projects. Some important uses of engineering drawing are mentioned below:

- It is used in ships for Navigation.
- For Manufacturing of Machines, automobiles etc.
- For construction of buildings, roads, bridges, dams, electrical and telecommunication structures etc.
- For manufacturing of electric appliances like TV, phone, computers etc.

Types of Engineering Drawing

Drawing can be grouped into following 4 major categories:

1. Geometrical Drawing
    - Plane geometrical drawing
    - Solid geometrical drawing

2. Mechanical Engineering Drawing

3. Civil Engineering Drawing

4. Electrical & Electronics Engineering drawing etc.

1. Geometric Drawing

The art of representing geometric objects such as rectangles, squares, cubes, cones, cylinders, spheres etc. on a paper is called geometric drawing. If the object has only 2 dimensions i.e. length and breadth (as rectangles, squares, triangles etc.), it is called Plane geometrical drawing and if it has 3 dimensions i.e. length, breadth and thickness/depth (as cube, prism, sphere, cylinder etc.), it is called Solid geometrical drawing.

2. Mechanical Engineering Drawing

The art of representing mechanical engineering objects such as machines, machine parts etc. on a paper are called mechanical engineering drawing or machine drawing. It is used by mechanical engineers to express mechanical engineering works and projects for actual execution.

3. Civil Engineering Drawing

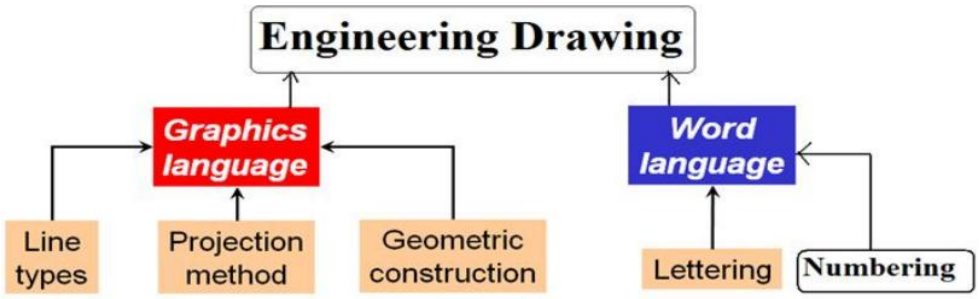
The art of representing civil engineering objects such as buildings, roads, bridges, dams etc. on a paper are called civil engineering drawing. It is used by civil engineers to express civil engineering works and projects for actual execution

4. Electrical Engineering Drawing

The art of representing electrical engineering objects such as motors, generators, transformers, wiring diagrams etc. on a paper are called electrical engineering drawing. It is used by electrical engineers to express electrical engineering works and projects for actual execution.

The art of representing electronic circuits of TV, Phones, computers etc. on a paper are called electronic engineering drawing or electronic drawing. It is used by electronic engineers to express electronic engineering works and projects for actual execution.

Elements of Engineering Drawing



Drawing Standards

An engineering drawing should be well specified and universally acceptable. That's why there are some specified rules for engineering drawing. These rules may vary slightly for different regions. There are some drawing standards or drawing codes that accumulates the rules of engineering drawing for a certain region.

Well-known drawing codes and their application region is expressed below:

Country/Region	Code/Standard	Full Meaning
Worldwide	**ISO**	International Organization for Standardization
USA	ANSI	American National Standards Institute
JAPAN	JIS	Japanese Industrial Standards
UK	BS	British Standards

In most of the cases, it is usual practice to follow ISO code for engineering drawing. However, in some instances ANSI and BS standards are also followed.

What is Projection?

- The light rays passes through on an object at any angle, then the image of the object is formed on reference planes, that image is called Projection
- If the light rays passes through on an object at 90^0 on an object, then the image formed of the object is perpendicular or straight then that perpendicular image is called Orthographic Projections.

Orthographic Projection:

"It is a technical drawing in which different views of an object are projected on different reference planes observing perpendicular to respective reference plane"

Different Reference planes

- Horizontal Plane (HP),
- Vertical Plane (VP)
- Side or Profile Plane (SV/PP)

Different orthographic views

Front view (FV) is a view projected on VP.

- Top View (TV) is a view projected on HP.
- Side View /Profile View (SV/PV) is a view projected on PP.

IMPORTANT TERMS FOR UNDERSTANDING OF ORTHOGRAPHIC PROJECTIONS:

- Quadrant System
- Planes.
- Pattern of planes & Pattern of views
- Methods of drawing Orthographic Projections

Projection of Points

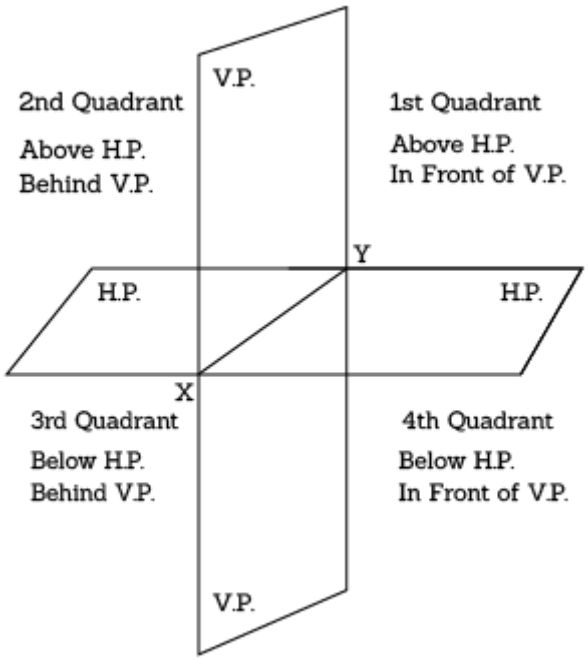
There are basically **nine** type of projections of point is space :

1. In FIRST Quadrant (Above H.P. , In front of V.P.)
2. In SECOND Quadrant (Above H.P. , Behind V.P.)
3. In THIRD Quadrant (Below H.P. , Behind V.P.)
4. In FOURTH Quadrant (Below H.P. , In front of V.P.)
5. In PLANE (On V.P. , Above H.P.)
6. In PLANE (On H.P. , Behind V.P.)
7. In PLANE (On V.P. , Below H.P.)
8. In PLANE (On H.P. In front of V.P.)
9. In PLANE (On both H.P. & V.P.)

Following notations should be followed while representing different views in orthographic projections.

OBJECT	POINT A
IT'S TOP VIEW	a
IT'S FRONT VIEW	a'
IT'S SIDE VIEW	a"

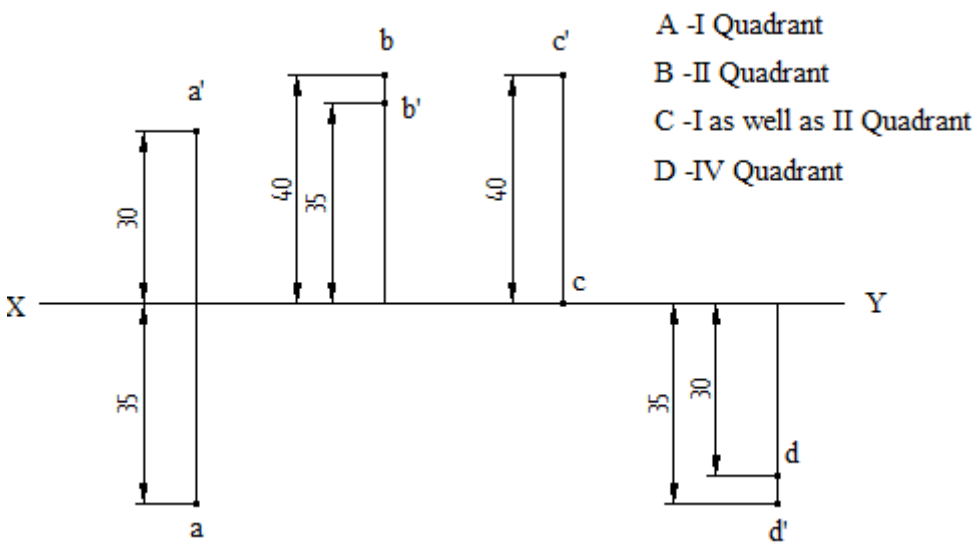
Projection of Points



1) Draw the projections of the following points on the same XY line, keeping convenient Distance between each projectors. Name the quadrants in which they lie.

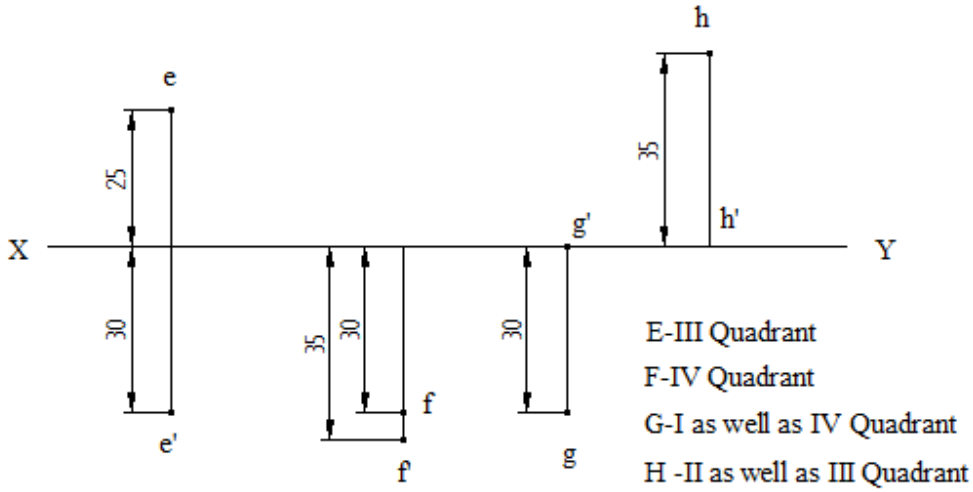
A - 30 mm above HP and 35 mm in front of VP.
B - 35 mm above HP and 40 mm behind VP.
C - 40 mm above HP and on VP.
D - 35 mm below HP and 30 mm in front of VP.

Solution



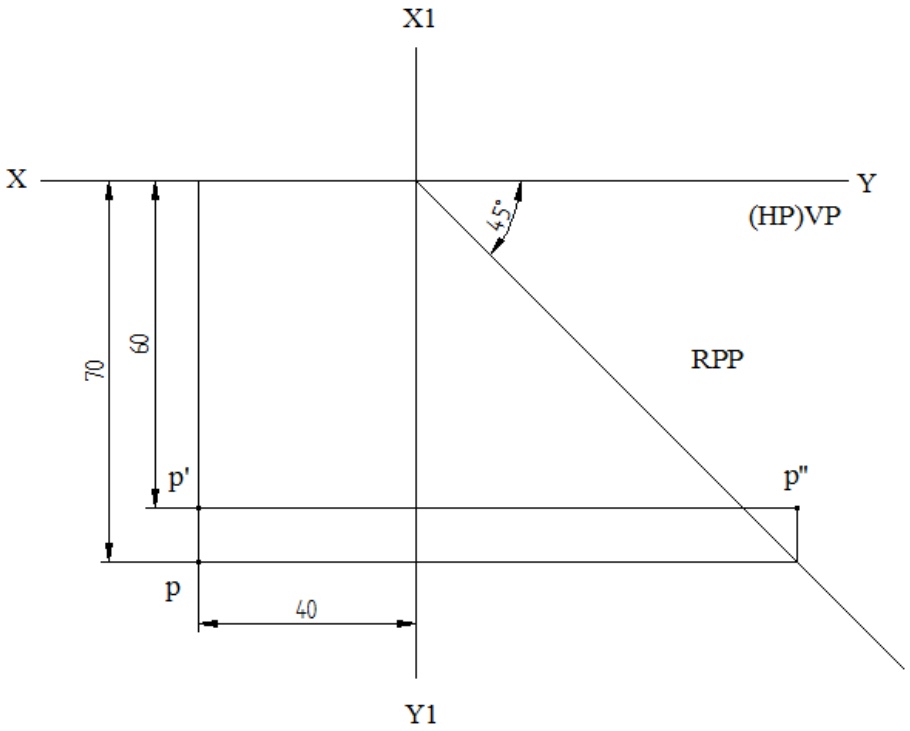
2) Draw the projections of the following points on the same XY line, keeping convenient Distance between each projectors. Name the quadrants in which they lie.
E - 30 mm below HP and 25 mm behind VP.
F - 35 mm below HP and 30 mm in front of VP.
G - On HP and 30 mm in front of VP.
H - On HP and 35 mm behind VP.

Solution



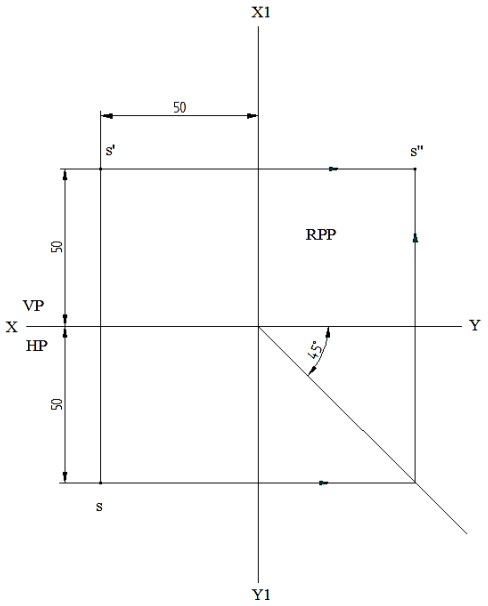
3) Draw all the three views of a point P lying 60mm below HP,70 mm infront of VP and 40mmfrom RPP. Also state the quadrant in which it lies.

Solution



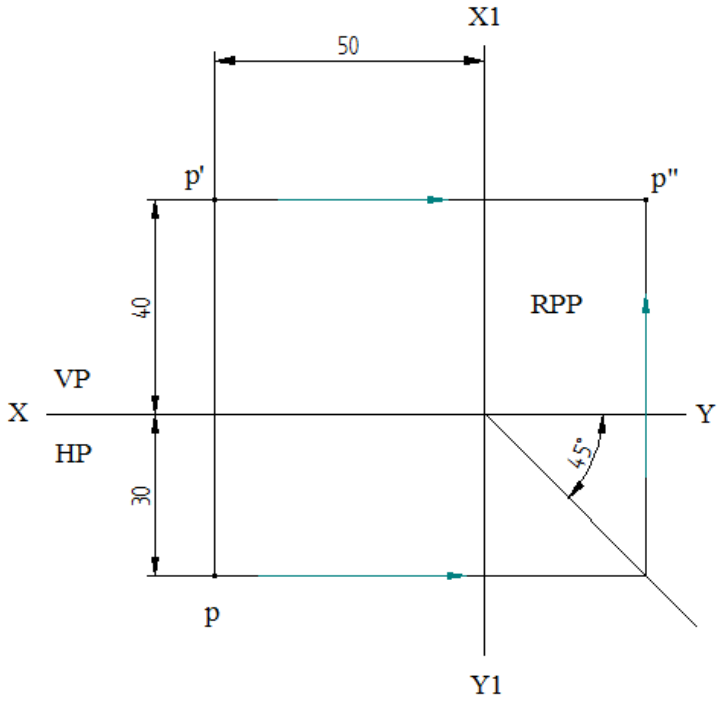
4) A point S is in first quadrant and equidistant of 50 mm from all the three principal planes. Draw the projections of the point. Draw all the three views of the point.

Solution



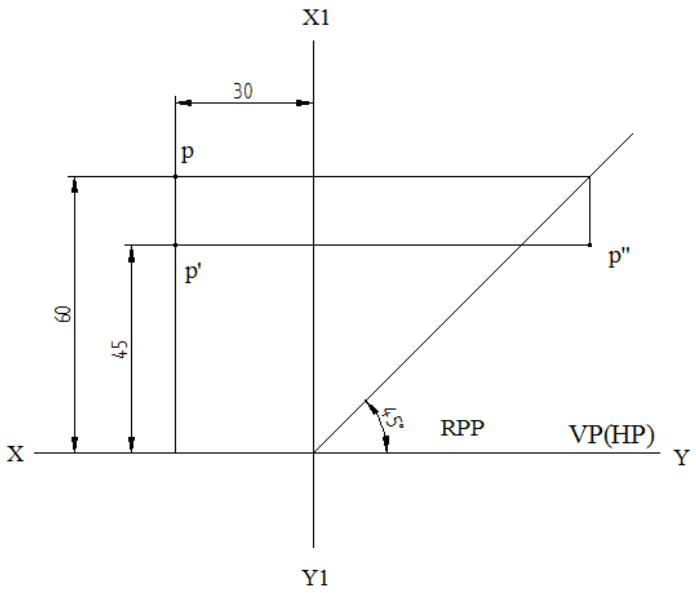
5) Point P is 30 mm infront of VP, 40 mm above HP and 50 mm from RPP. Draw its projections.

Solution: I Quadrant



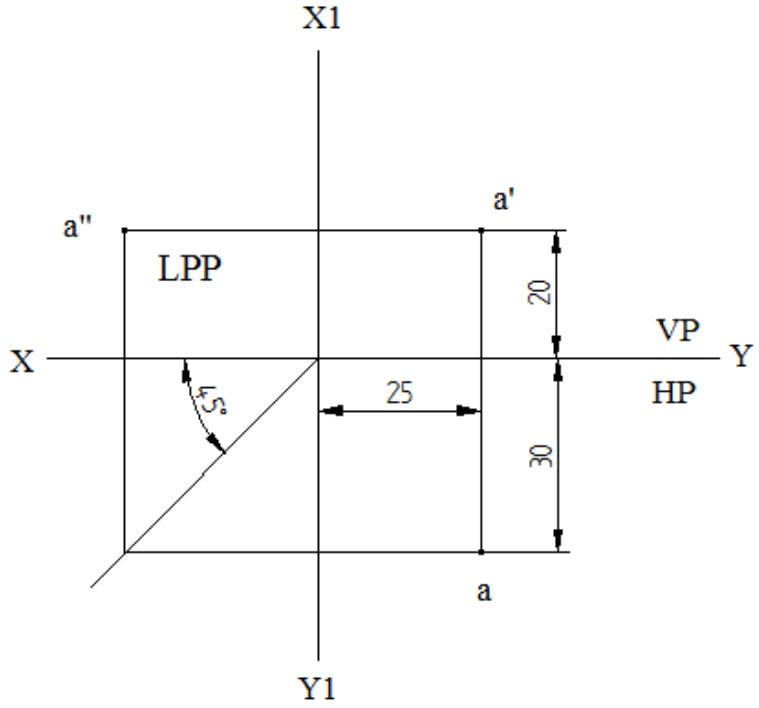
6) A point P is 45 mm above HP, 60 mm behind VP and 30 mm from RPP. Draw the three Principles view of the point. Also state the quadrant in which it lies.

Solution: II Quadrant



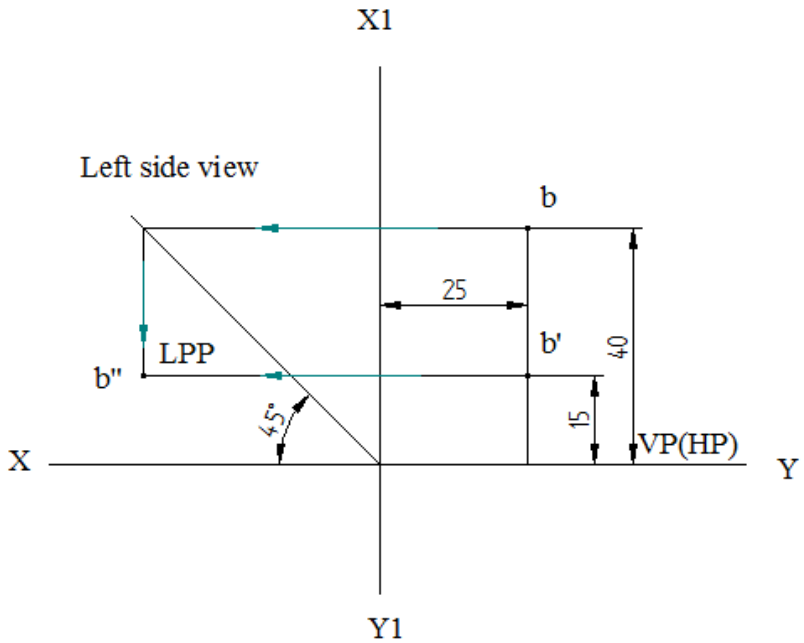
7) A point is 30 mm in front of VP, 20 mm above HP and 25 mm in front / behind / from LPP. Draw its projects and name the side view.

Solution: I Quadrant



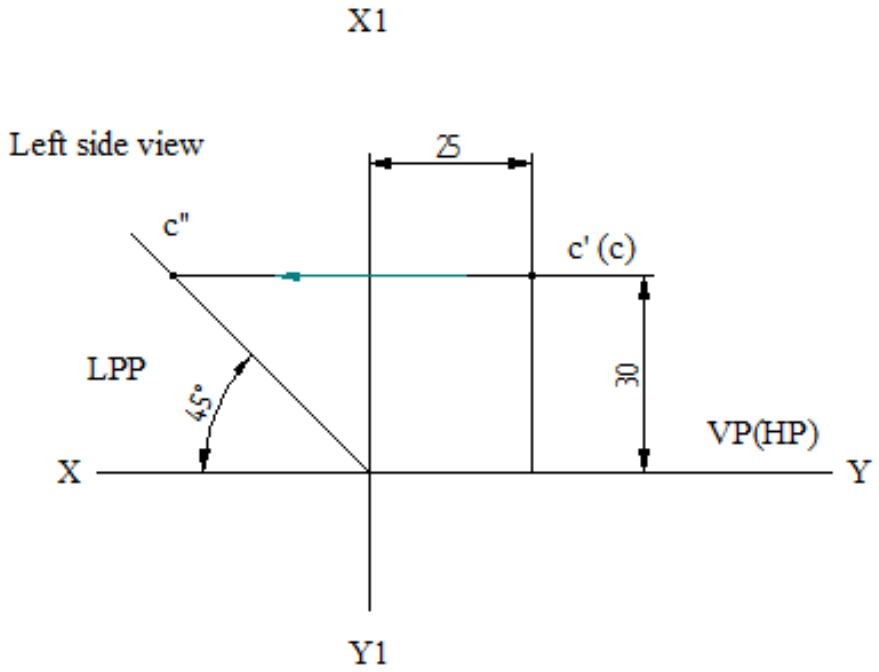
8) A point is 40 mm behind VP, 15 mm above HP and 25 mm infront / behind / from LPP. Draw its projections and name the side view.

Solution: II Quadrant



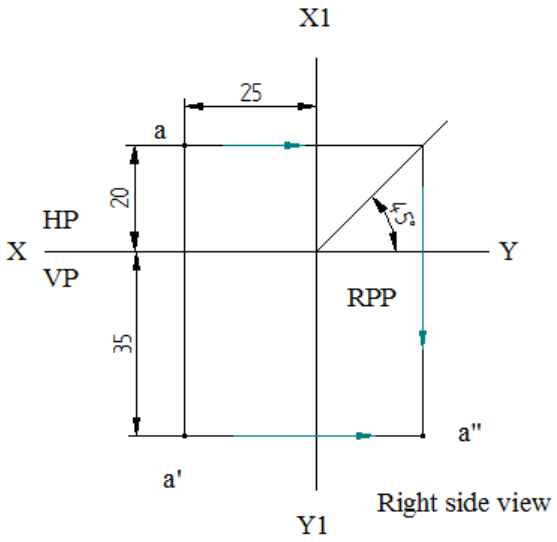
9) A point is 30 mm behind VP, 30 mm above HP and 25 mm infront / behind / from LPP. Draw its projections and name the side view.

Solution: II Quadrant



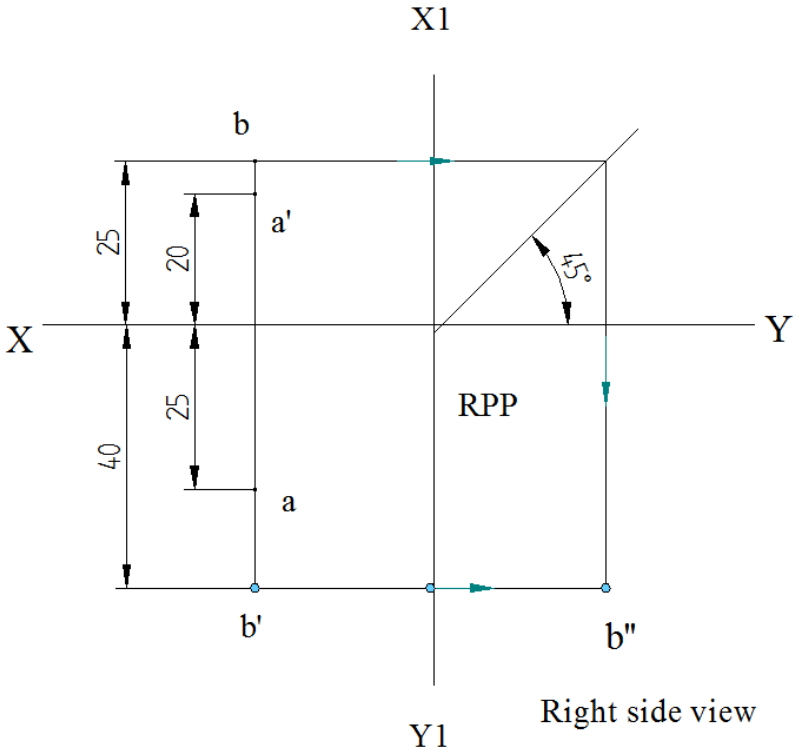
10) A point is 35 mm below HP, 20 mm behind VP and 25 mm behind / in front / from RPP. Draw its projections and name the side view.

Solution: III Quadrant



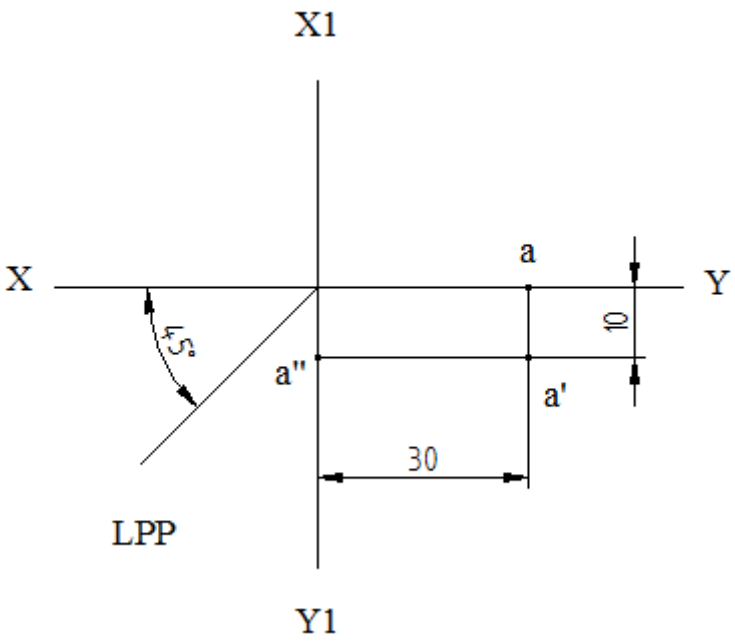
11) A point A is 20 mm above HP and 25 mm infront of VP. Another point B is 25 mm behind VP and 40 mm below HP. Draw their projections when the distance between their projectors parallel to XY line is zero mm. Add the right side view only to point B.

Solution



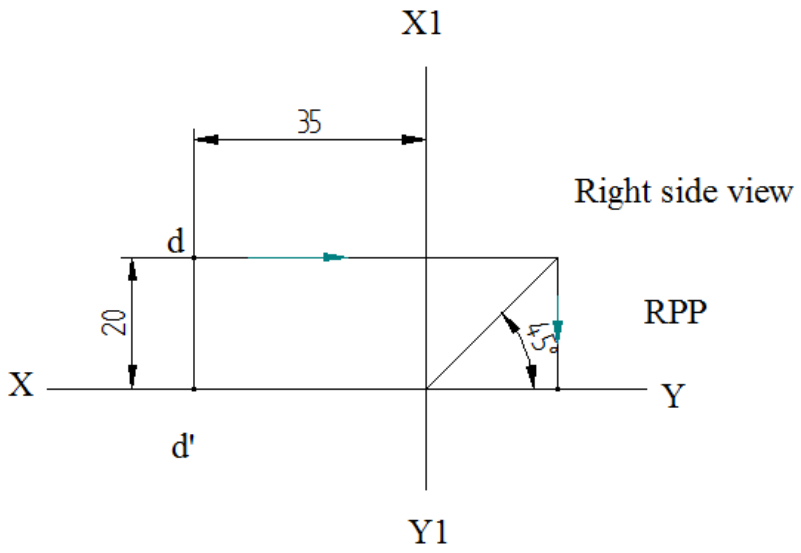
12) A point is lying on VP, 10 mm below HP and 30 mm behind / in front / from LPP. Draw its Projections and name the side view.

Solution



13) A point is lying on HP, 20 mm behind VP and 35 mm behind / in front / from RPP. Draw its Projections and name the side view.

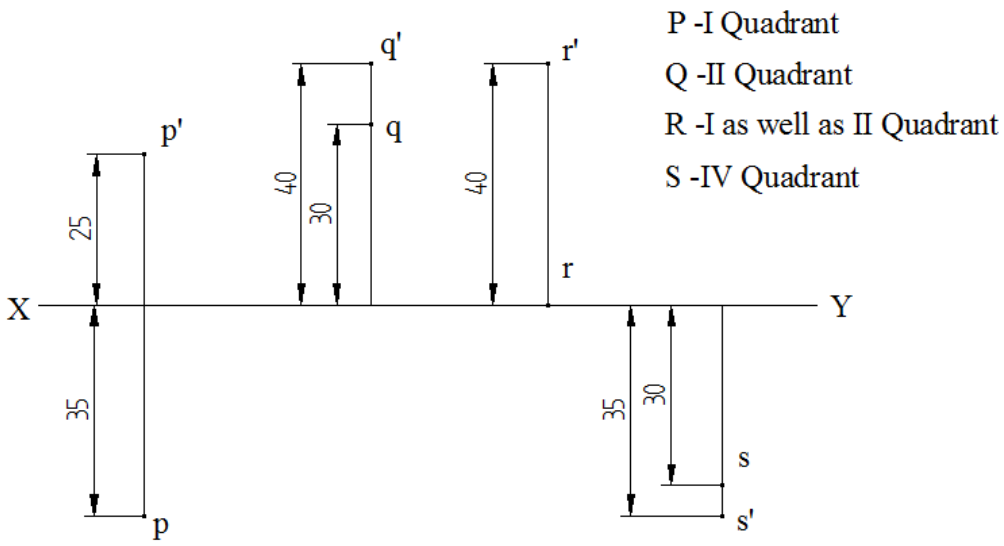
Solution



14) Draw the projections of the following points on the same XY line, keeping convenient distance between each projector. Also state the quadrants in which they lie.

P - 25 mm above HP and 35 mm in front of VP.
Q - 30 mm above HP and 40 mm behind VP.
R - 40 mm above HP and on VP.
S - 35 mm below HP and 30 mm in front of VP.

Solution



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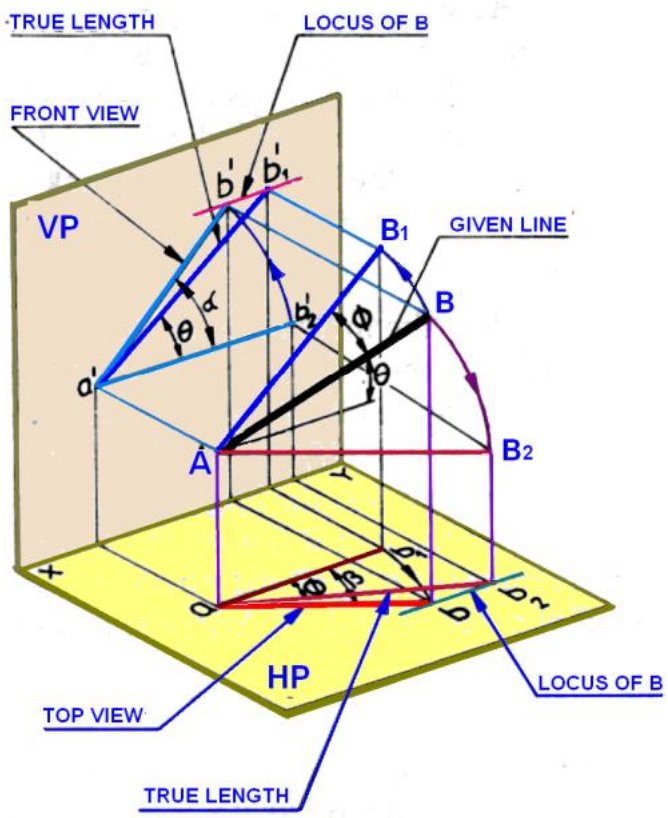
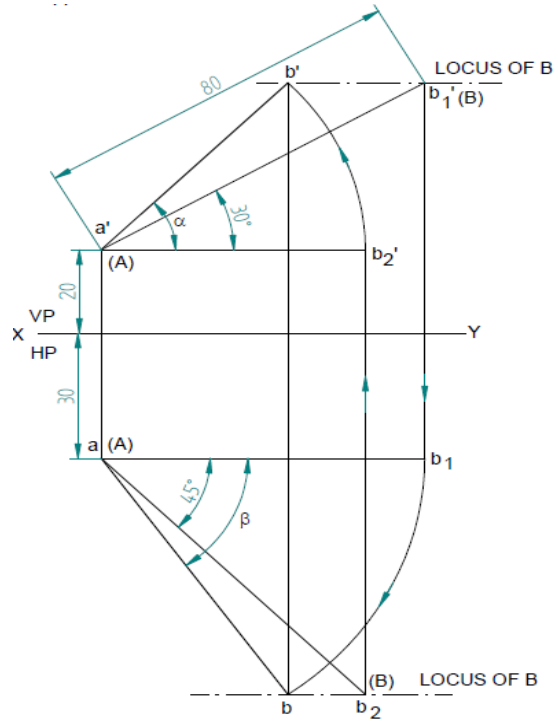
Projection of Lines



LINE INCLINED BOTH HP & VP

1. A line AB 80 mm long has its end A 20 mm above HP and 30 mm in front of VP. It is inclined at 30 deg. to HP and 45 deg. to VP. Draw the projections of the line and find apparent lengths and apparent inclinations.

Solution

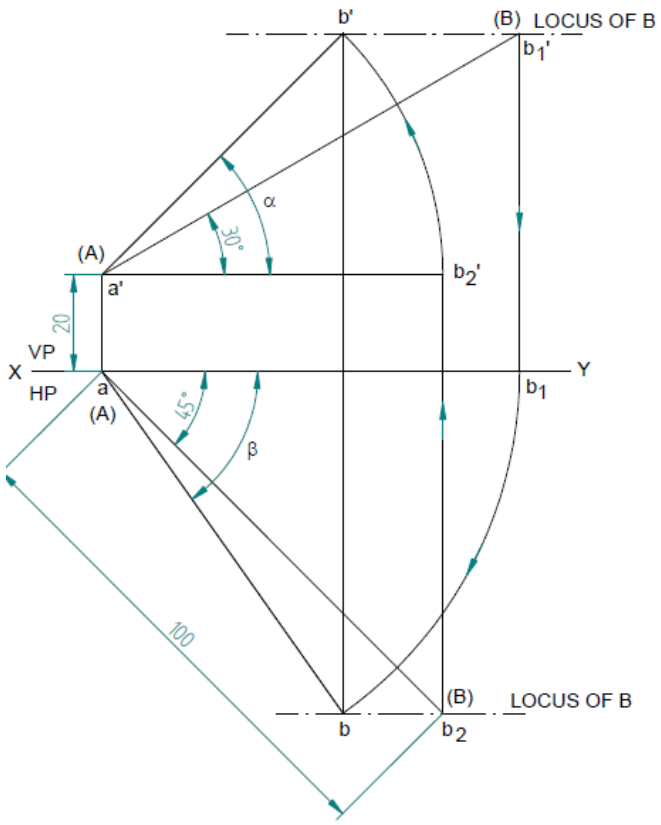


ANSWERS

α = 45°
β = 54.74°
a'b' = 56.57 mm
ab = 69.28 mm

2.Draw the projections of a line AB 100 mm long inclined at 45 deg. to VP and 30 deg. to HP. One end of the line is 20 mm above HP and in VP. Determine apparent lengths and inclinations.

Solution

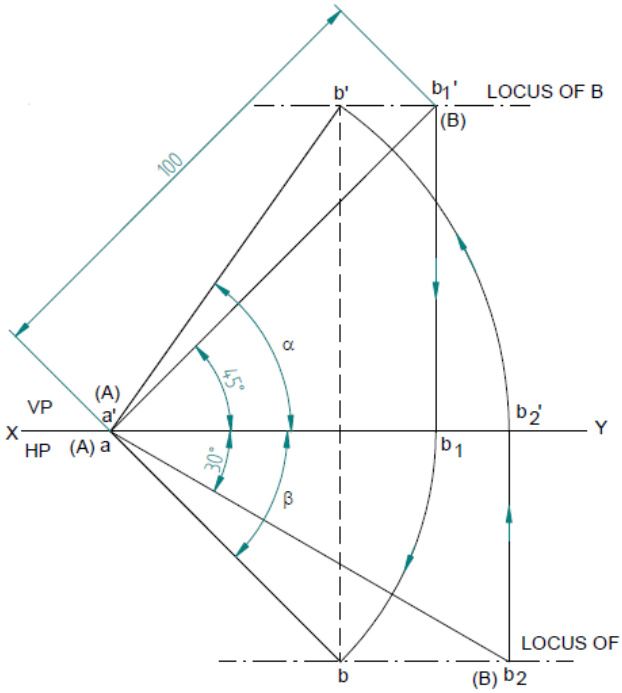


ANSWERS

α = 45.00°
β = 54.74°
a'b' = 70.71 mm
ab = 86.60 mm

3. A line AB 100 mm long is inclined to HP at 45 deg. and inclined to VP at 30 deg. Draw front and top views of line and determine their lengths .Also determine the perpendicular distance of end B from both HP and VP.

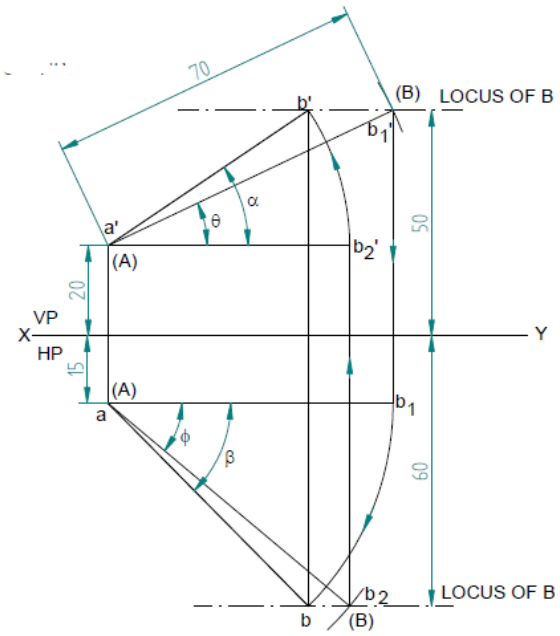
Solution



ANSWERS	
α = 54.74°	
β = 45.00°	
a'b' = 86.60 mm	
ab = 70.71 mm	
Perpendicular distance of end B from HP	$b_1'b_1$ = 70.71 mm
Perpendicular distance of end B from VP	$b_2'b_2$ = 50.00 mm

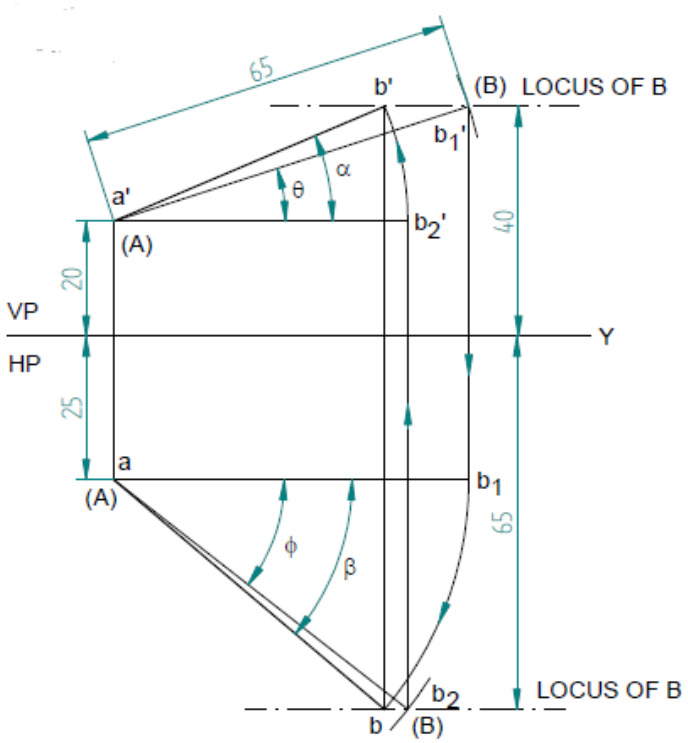
4. A line AB measuring 70 mm has its end A 15 mm in front of VP and 20 mm above HP and the other end B 60 mm in front of VP and 50 mm above HP. Draw the projections of the line and find the inclinations of the line with the both the reference planes of projection.

Solution



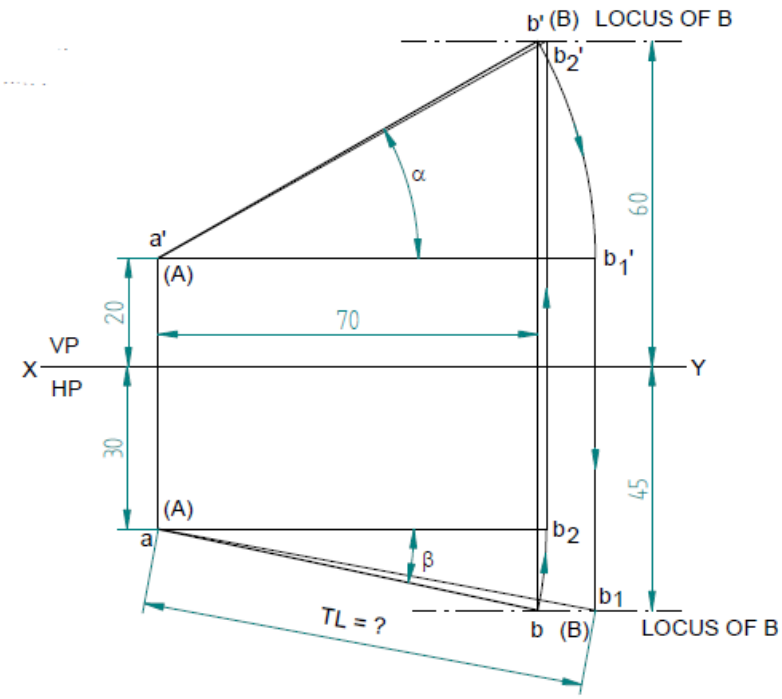
5. A line AB 65 mm long, has its end A 20 mm above HP and 25 mm in front of VP. The end B is 40 mm above HP and 65 mm infront of VP. Draw the projections of AB and shows its inclination with HP and VP.

Solution



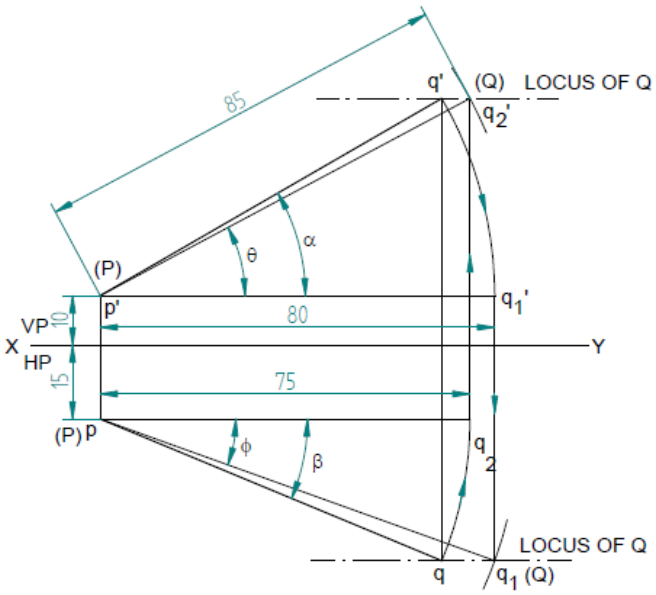
6. A line AB has its end A 20 mm above HP and 30 mm infront of VP. The other end B is 60 mm above HP and 45 mm infront of VP. The distance between end projectors is 70 mm. Draw its projections. Determine the true length and apparent inclinations.

Solution

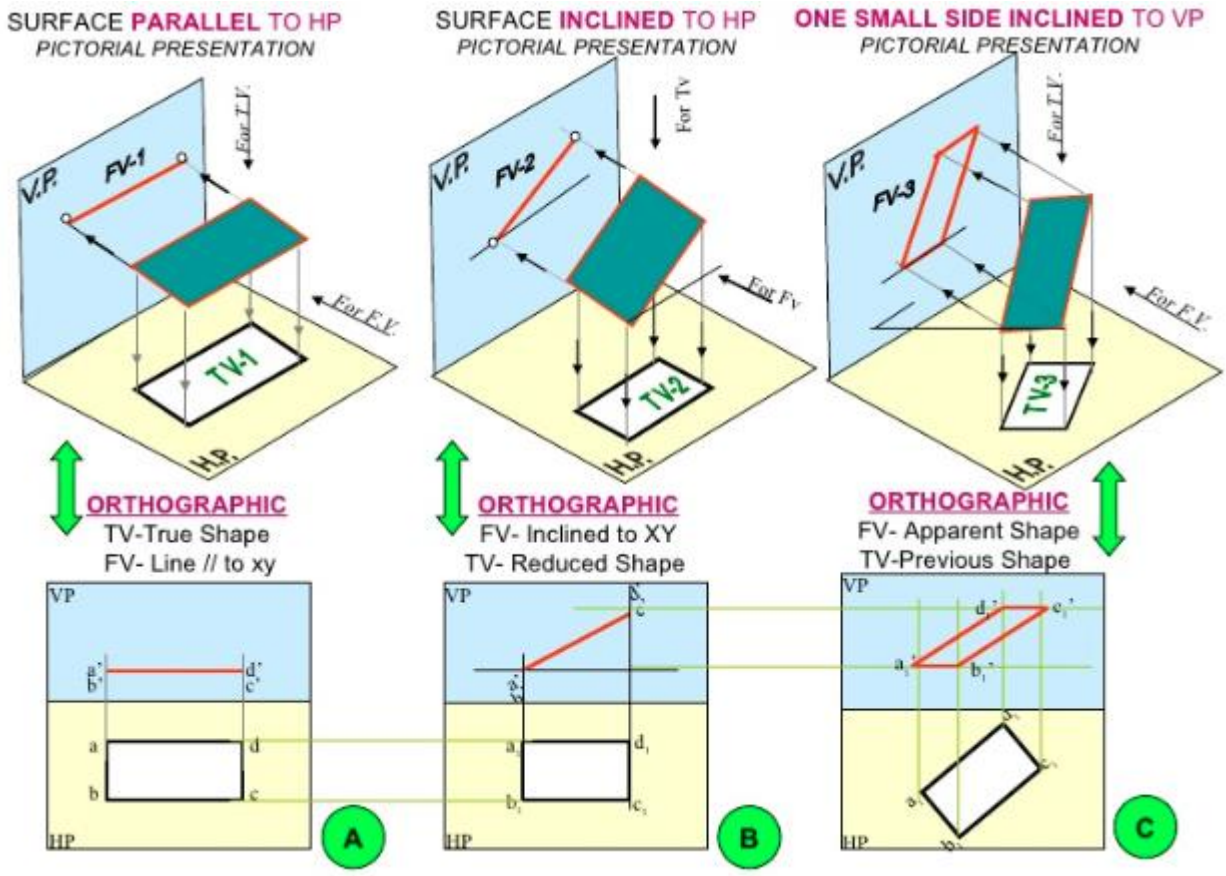


7. A line PQ 85 mm long has its end P 10 mm above HP and 15 mm in front of VP. The top view and front view of line PQ are 75 mm and 80 mm respectively. Draw its projections. Also determine the true and apparent inclinations of the line.

Solution

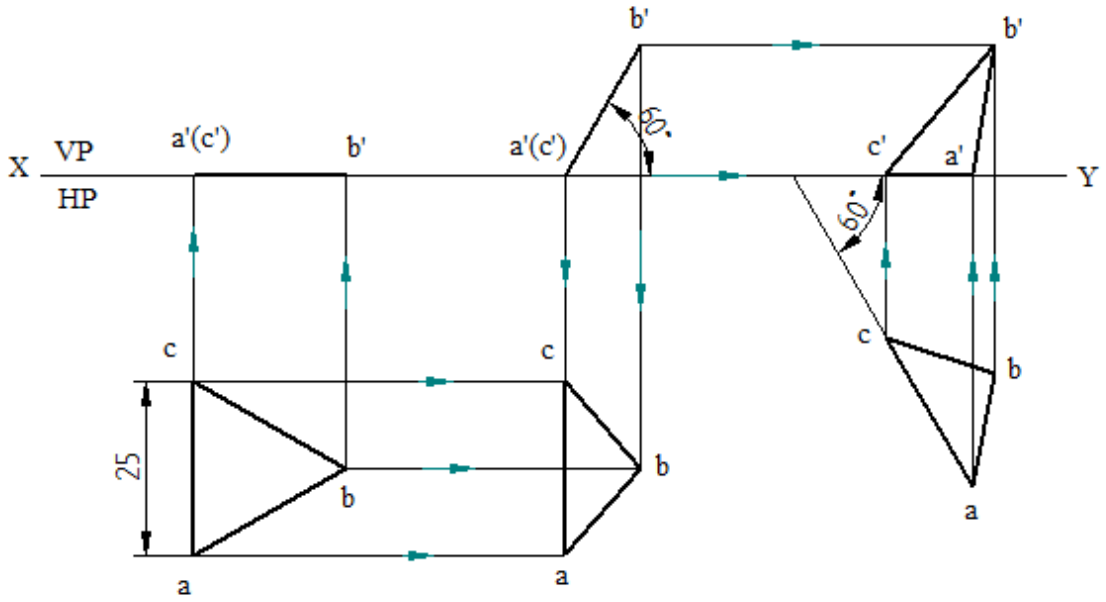


Projection of Planes



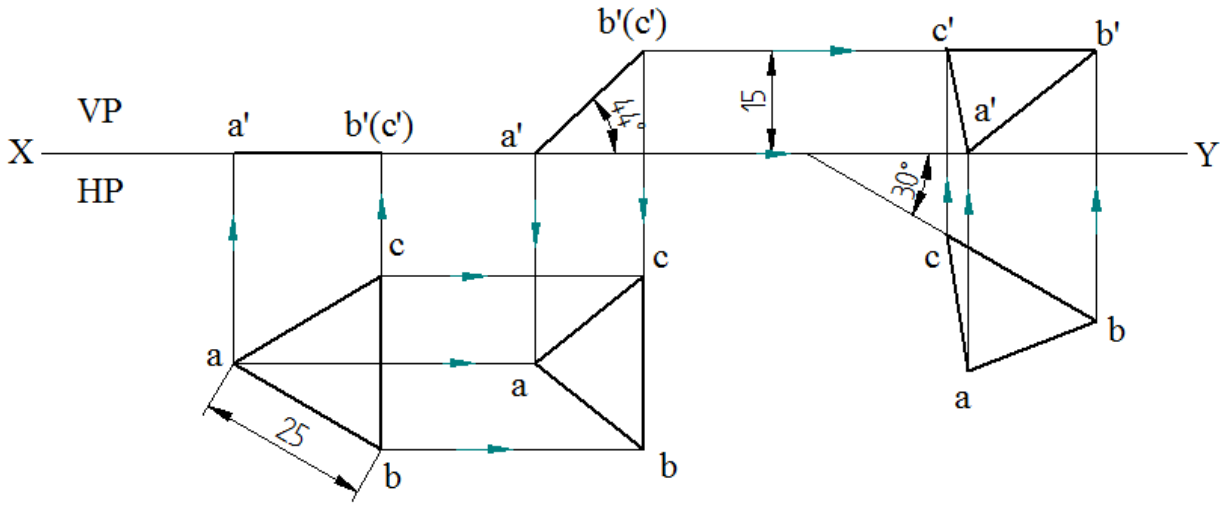
1) An equilateral triangular lamina of 25 mm sides lies with one of its edges on HP such that the surface of the lamina is inclined to HP at 60 deg. The edge on which it rests is inclined to VP at 60deg. Draw its projections.

Solution



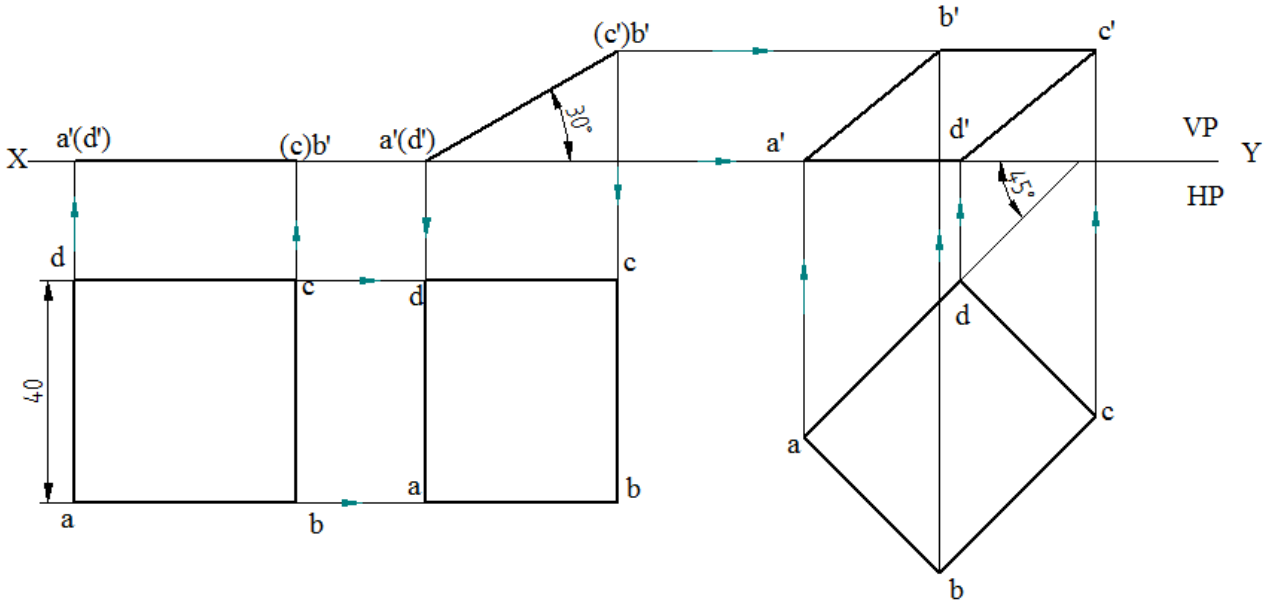
2) A triangular plane lamina of sides 25 mm is resting on HP with one of its corners touching it, such that the side opposite to the corner on which it rests is 15 mm above HP and make an angle of 30 deg. with VP. Draw the top and front views in this position. Also determine the inclination of the lamina to the reference plane.

Solution



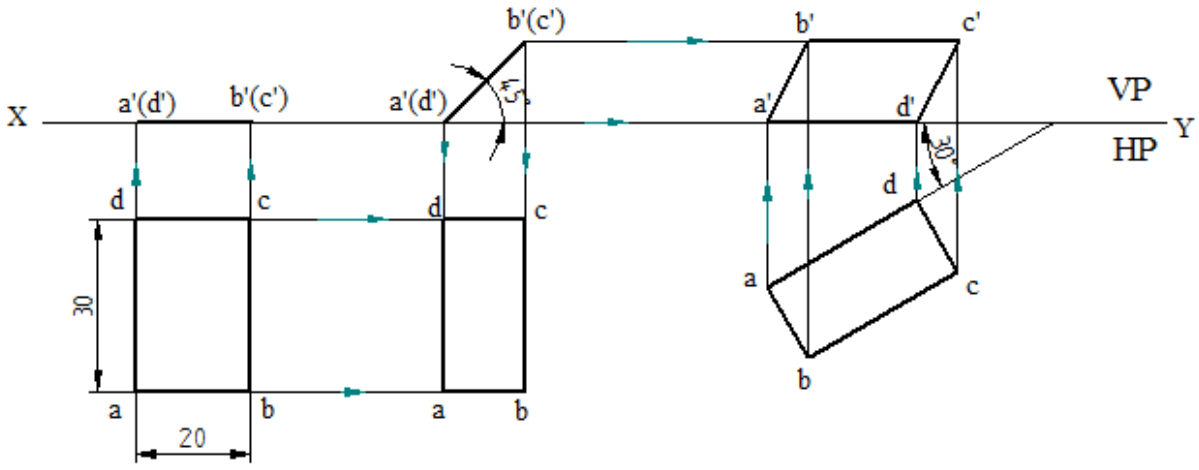
3) A square lamina of 40 mm side rests on one of its sides on HP. The lamina makes 30° to HP and the side on which it rests makes 45 deg. to VP. Draw its projections.

Solution



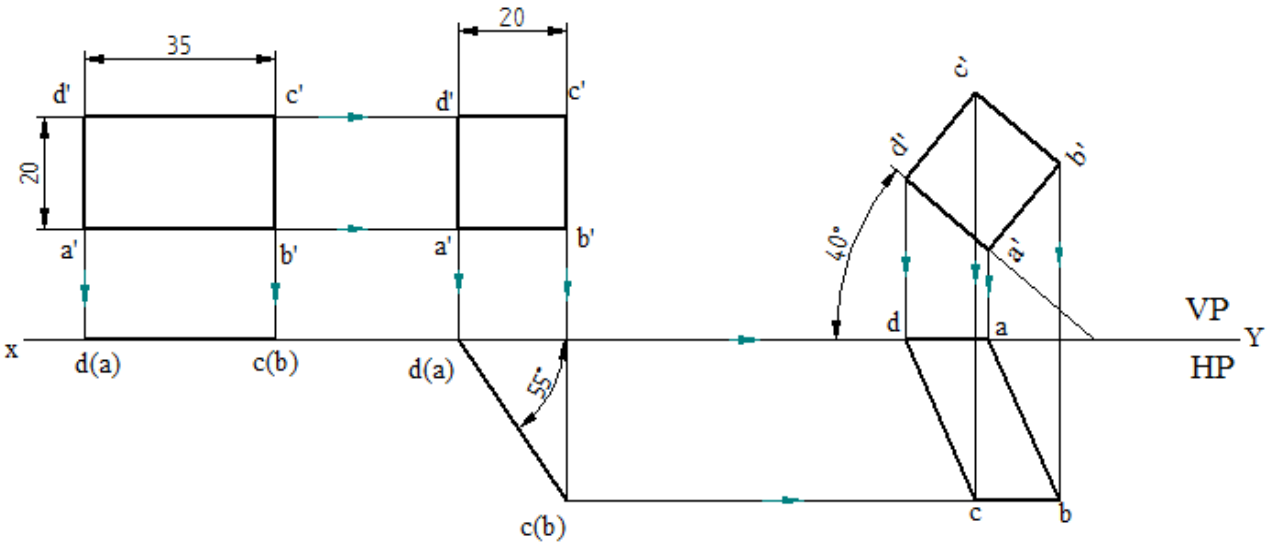
4) A rectangular lamina of sides 20 mm X 30 mm rests on HP on one of its longer edges. The lamina is tilted about the edge on which it rests till its plane surface is inclined to HP at 45 deg. The edge on which it rests is inclined at 30deg. to VP. Draw its projections of the lamina.

Solution



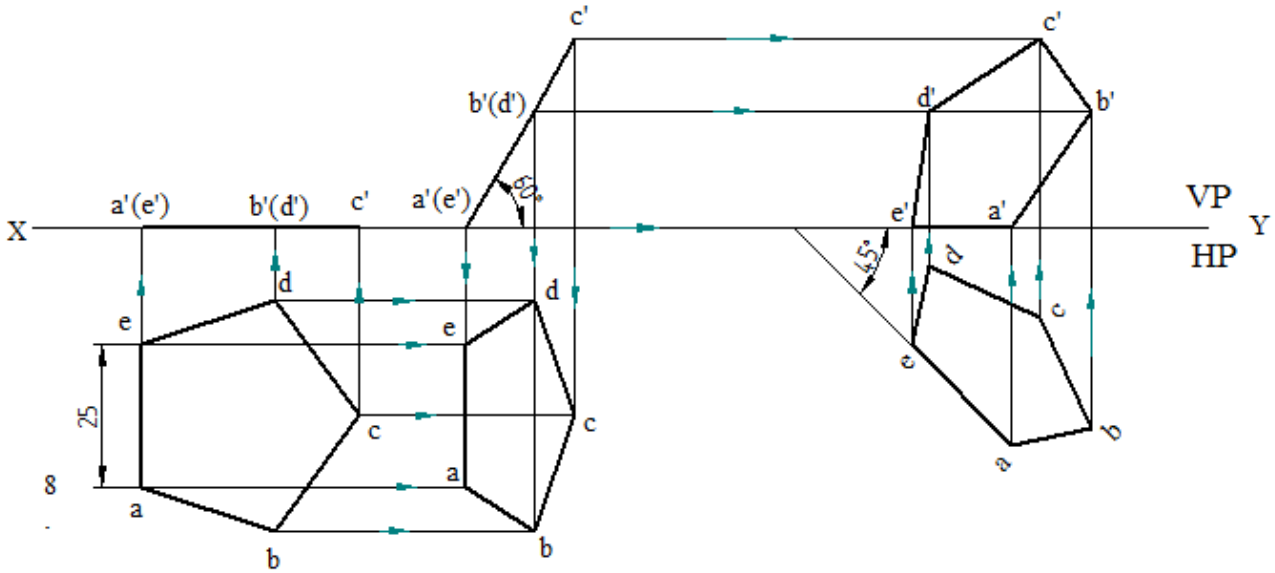
5) A rectangular plate of negligible thickness of size 35 X 20 mm has one of its shorter edges in VP with that edge inclined at 40 deg. to HP. Draw the top view if its front view is a square of side 20 mm.

Solution



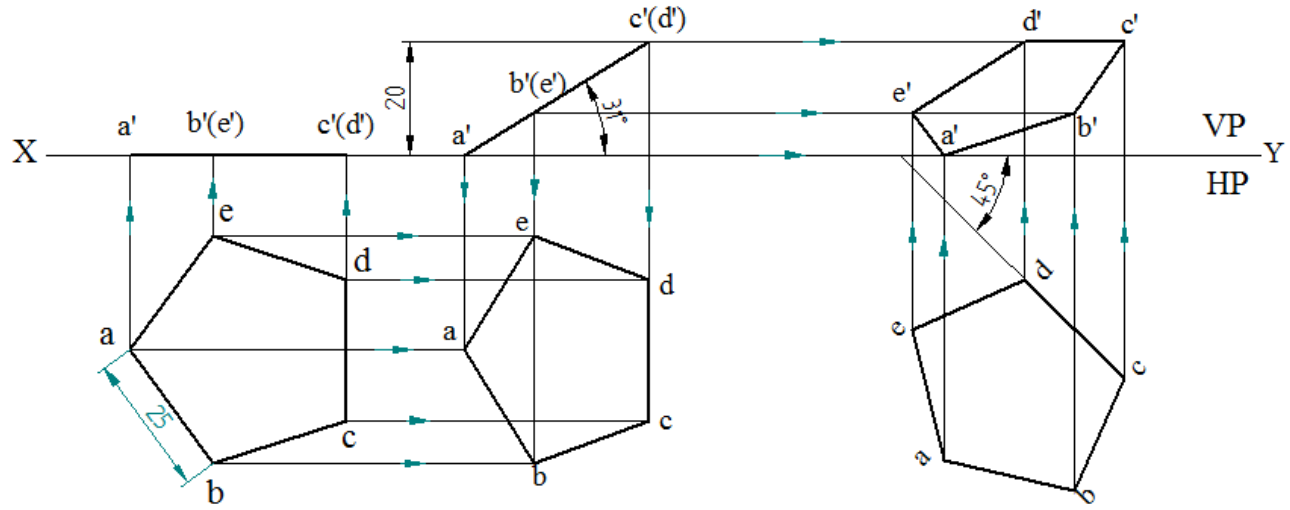
6) A pentagonal lamina of edges 25 mm is resting on HP with one of its sides such that the Surface makes an angle of 60 deg. with HP. The edge on which it rests is inclined at 45 deg. to VP. Draw its projections.

Solution



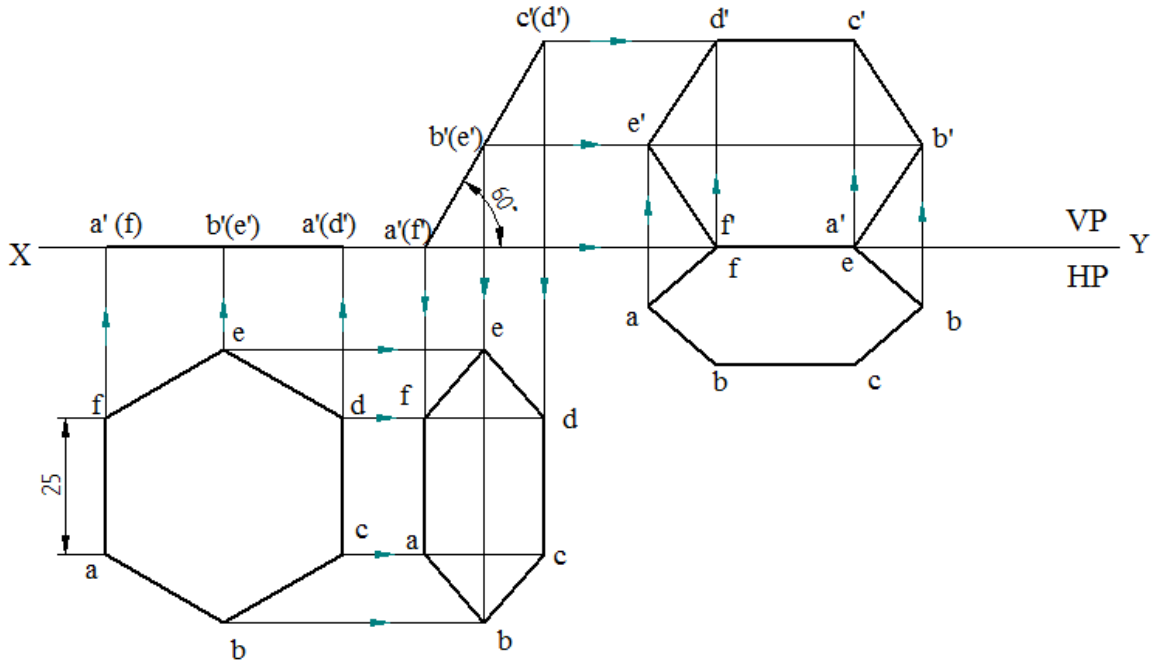
7) A pentagonal lamina of edges 25 mm is resting on HP with one of its corner such that the Edge opposite to this corner is 20 mm above HP & makes an angle of 45 deg. with VP. Draw the top and front views of the plane lamina in this position. Determine the inclination of the lamina with HP.

Solution



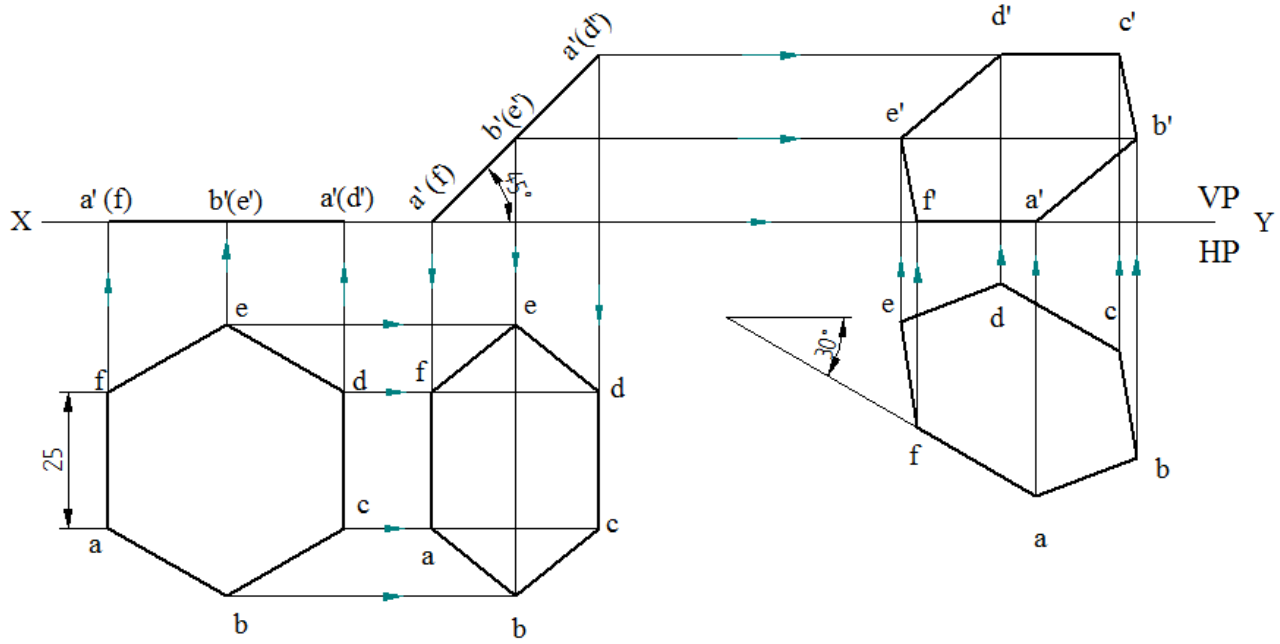
8) A regular hexagonal lamina of sides 25 mm is lying in such a way that one of its sides on HP while the side opposite to the side on which it rests on VP. If the lamina makes 60 deg. to HP. Draw the projections of the lamina.

Solution



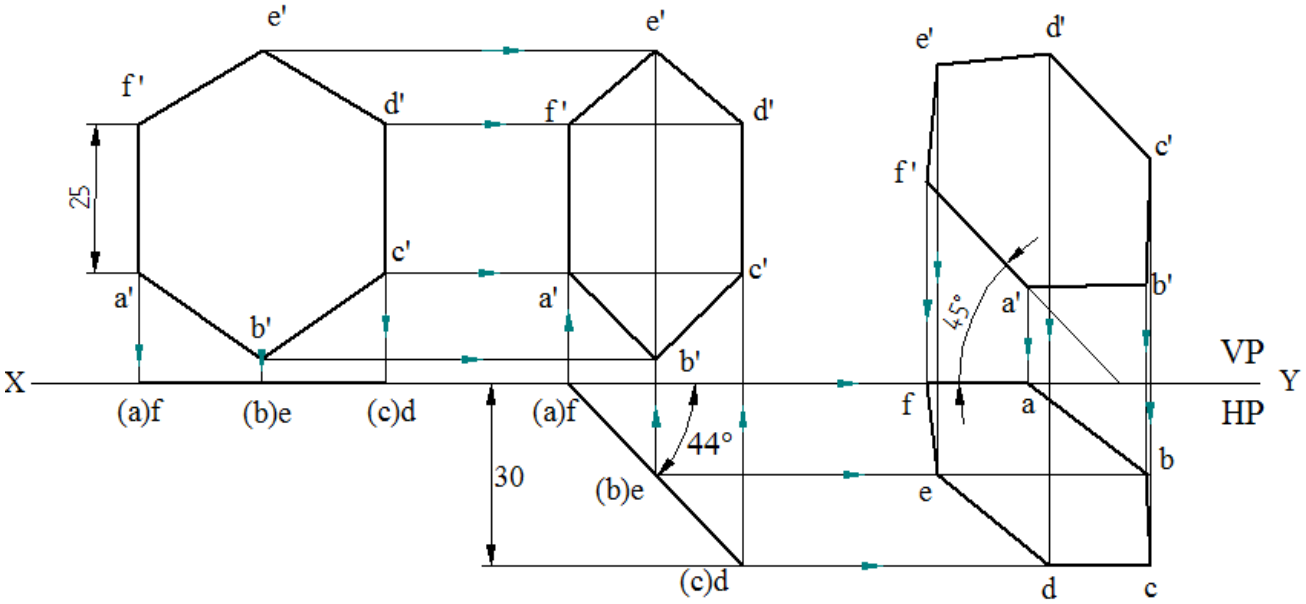
9) A hexagonal lamina of sides 25 mm rests on one of its sides on HP. The lamina makes 45deg. to HP and side on which it rests makes 30 deg. to VP. Draw its projections.

Solution



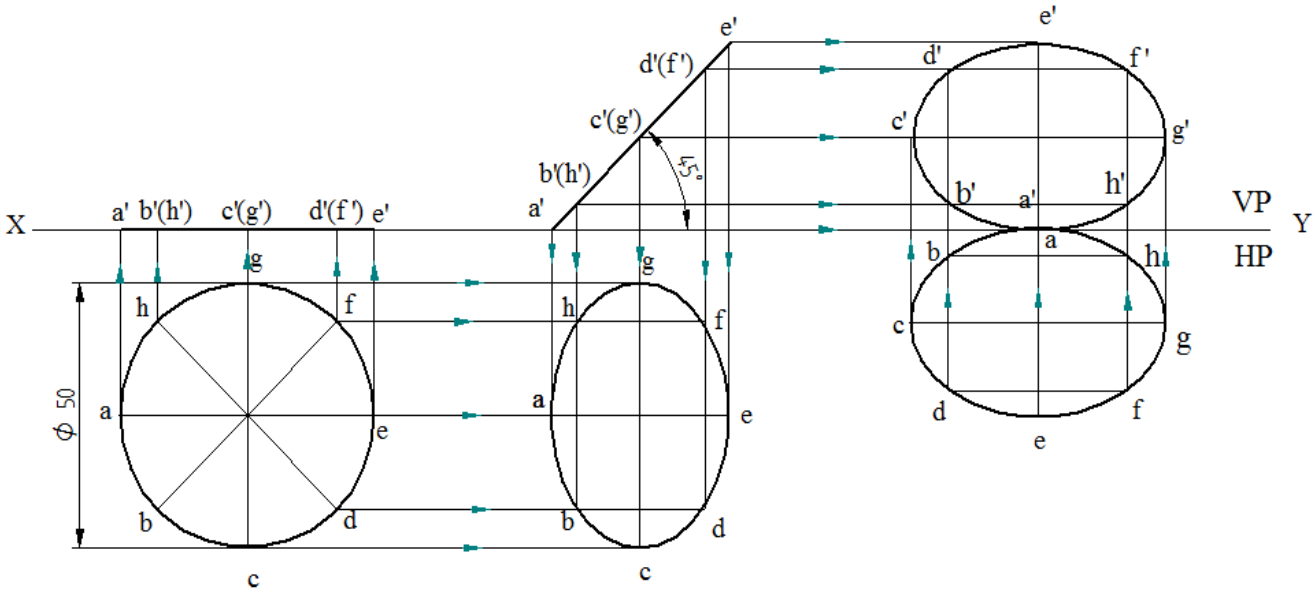
10) Hexagonal lamina of sides 25 mm rests on one of its sides on VP. The side opposite to the Side on which it rests is 30 mm in front of VP and the side on which it rests makes 45 deg. to HP. Draw its projections. Also determine the inclination of the lamina with the reference plane.

Solution



11) A circular lamina of 50 mm diameter is standing with one of its points on the rim on HP and the lamina inclined at 45 deg. to HP. The diameter at right angle to the diameter which is passing through the point on which the lamina rests is parallel to VP. Draw its projections.

Solution



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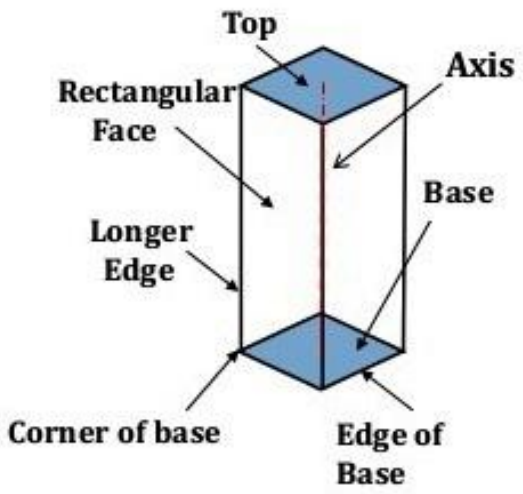
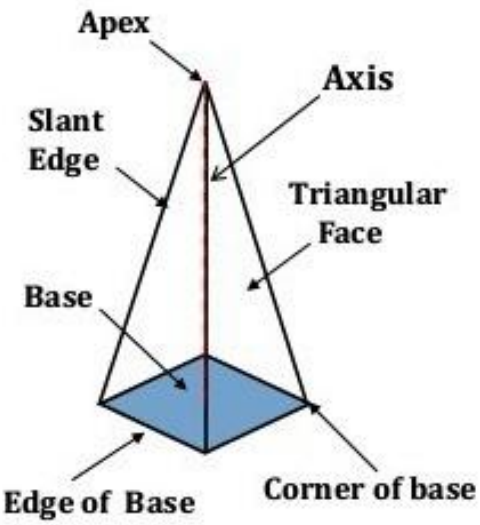
Projection of Solids

Square Prism

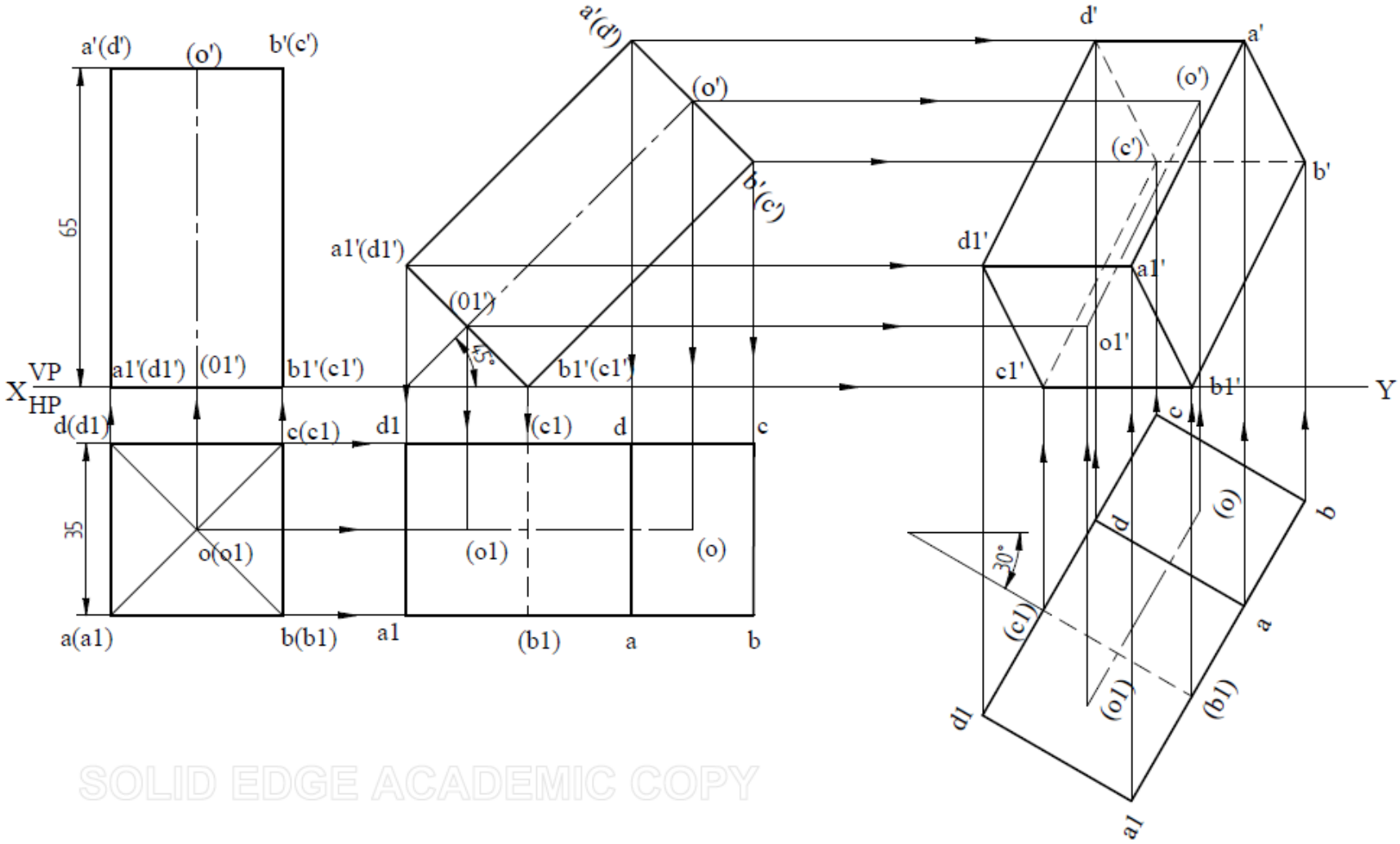


Square Pyramid



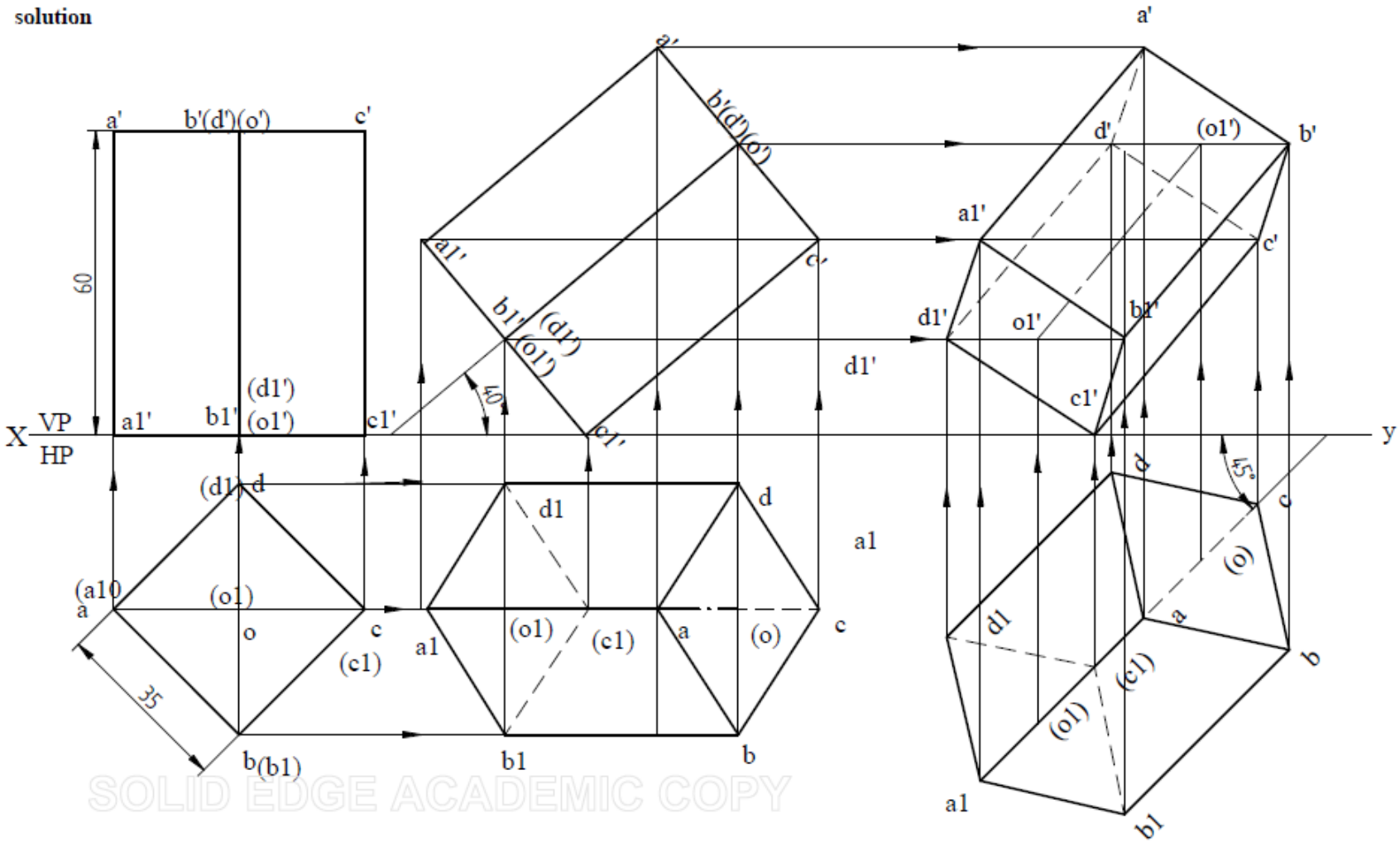
1. A square prism 35mm sides of base and 60mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30° draw the projections of the prism when the axis is inclined to HP at 45°.

Solution



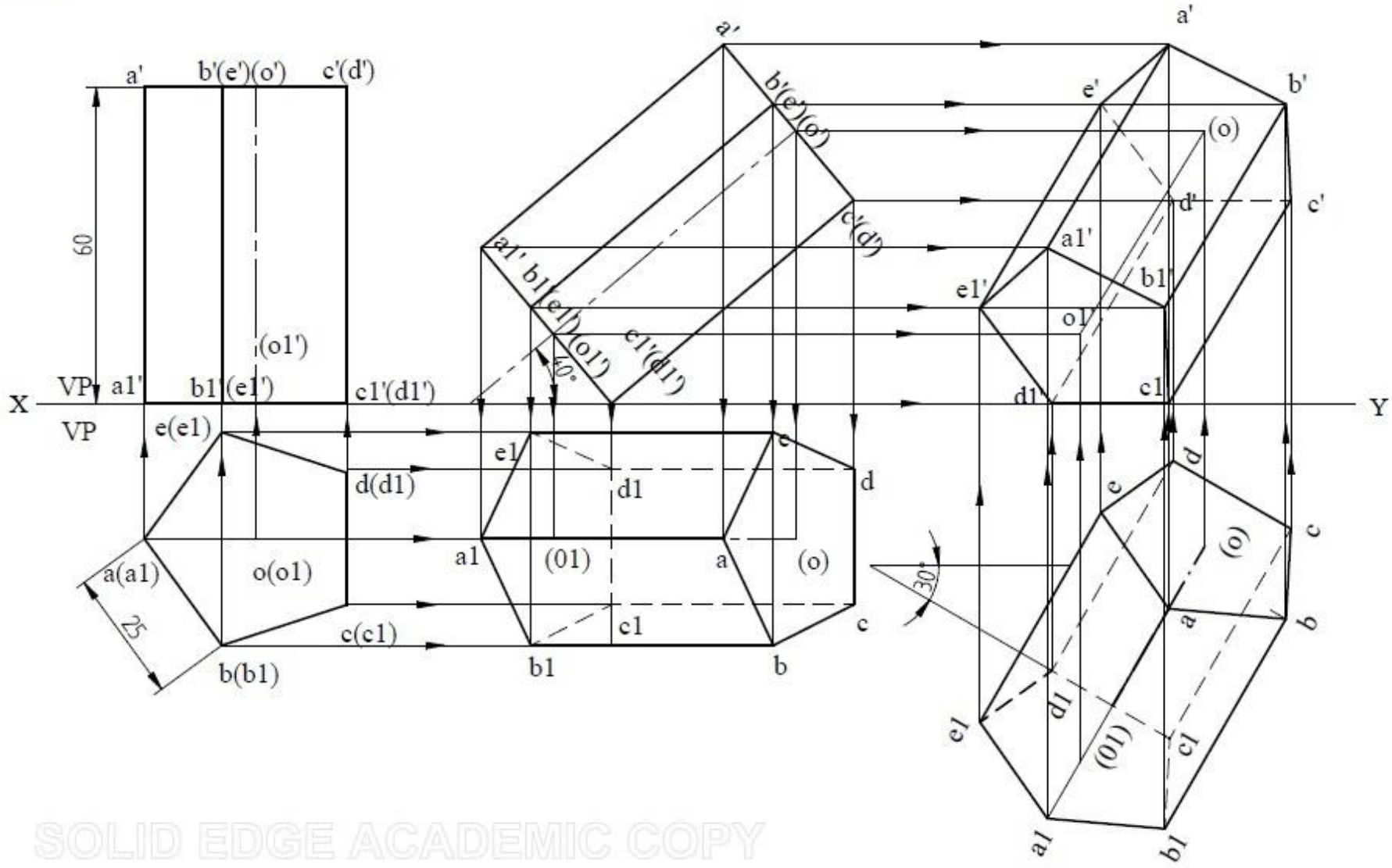
2) A square prism 35mm sides of base and 60mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP Draw the projections of the prism when the axis of the prism is inclined to HPat 40° and appears to be inclined to VP at 45°.

solution



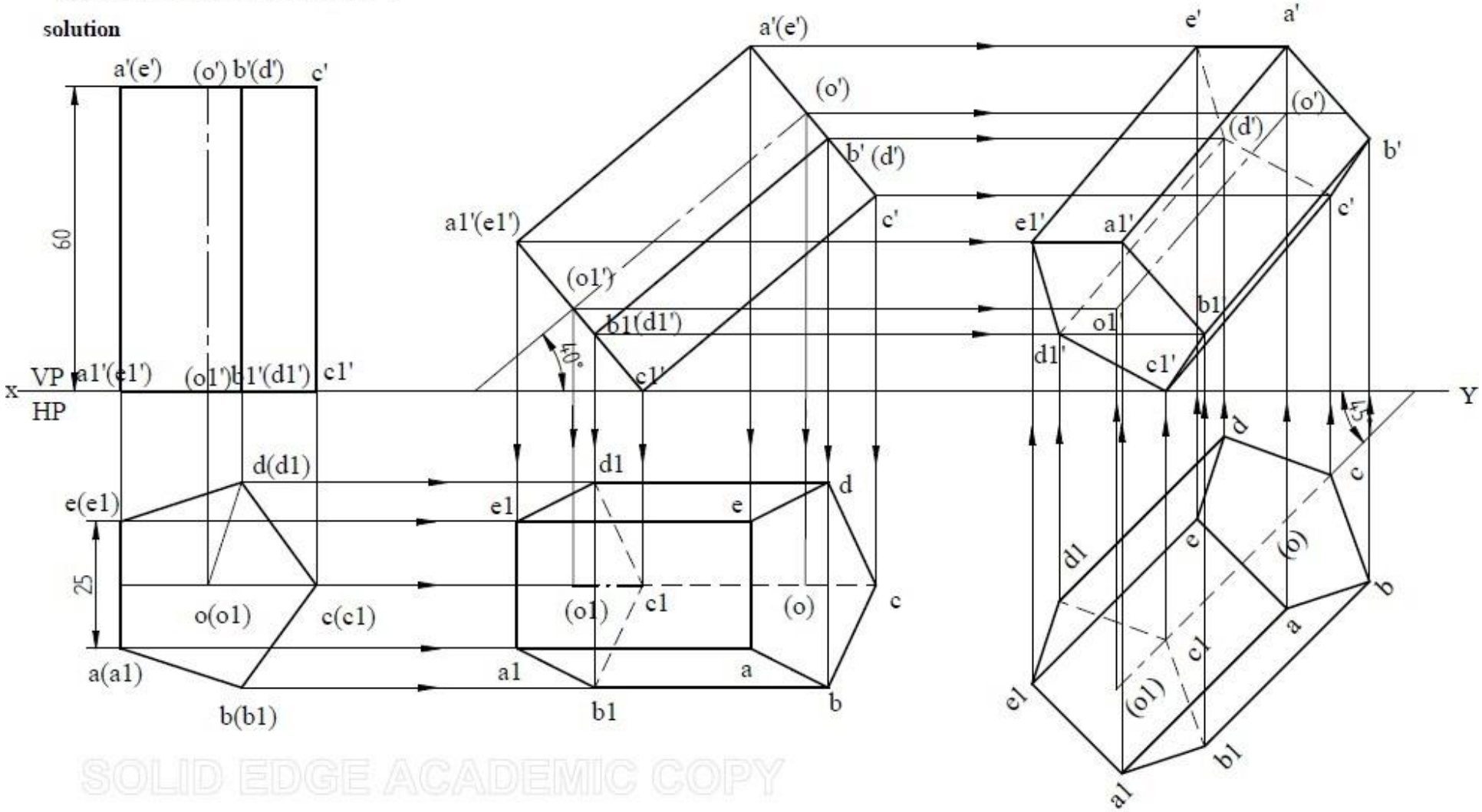
3) A pentagonal prism 25mm sides of base and 60mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30°. Draw the projections of the prism when the axis is inclined to HP at 40°.

solution



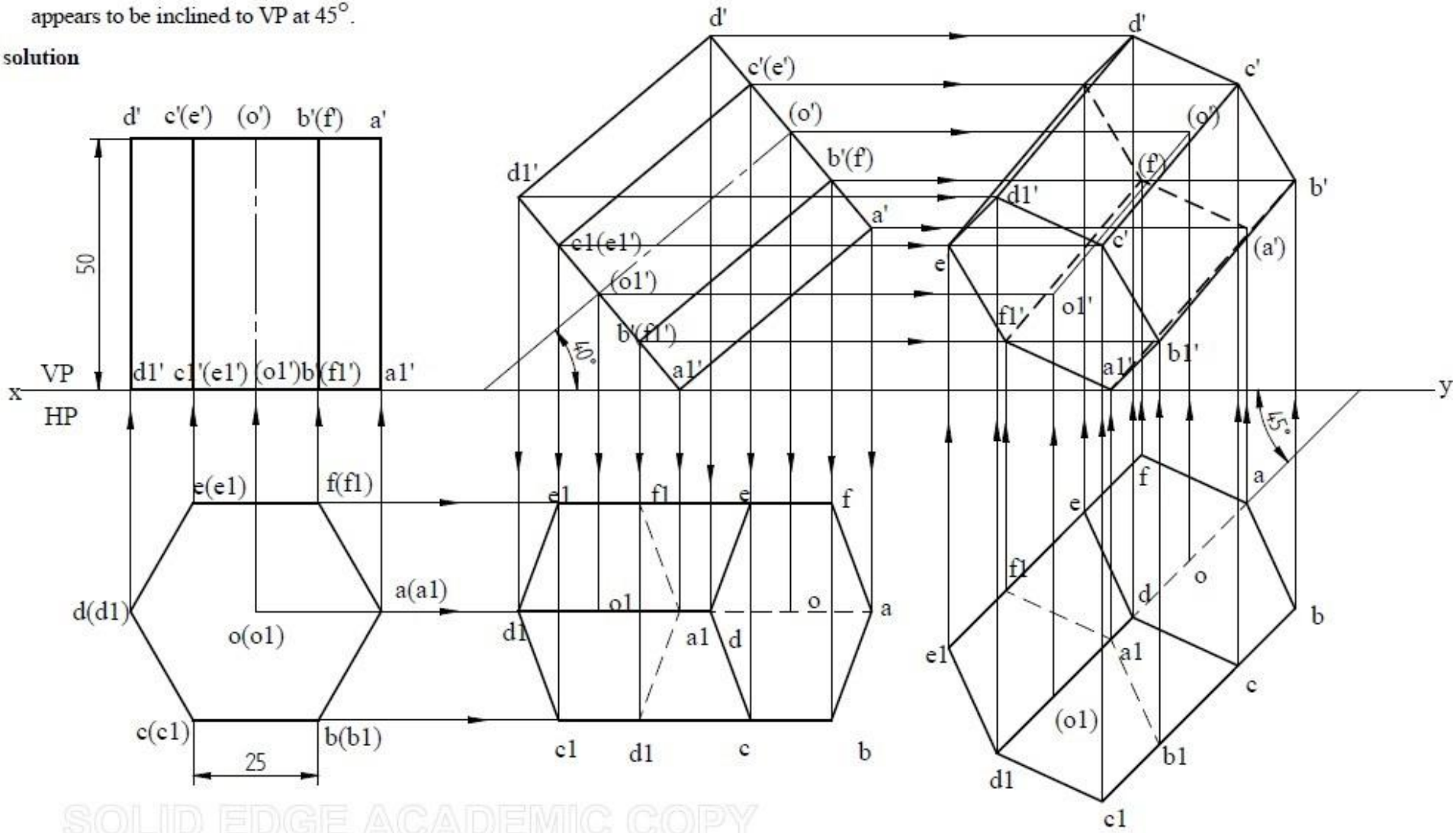
4) A pentagonal prism 25mm sides of base and 60mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP Draw the projections of the prism when the axis of the prism is inclined to HP at 40° and appears to be inclined to VP at 45°.

solution



5) A hexagonal prism 25mm sides of base and 50mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP Draw the projections of the prism when the axis of the prism is inclined to HP at 40° and appears to be inclined to VP at 45°.

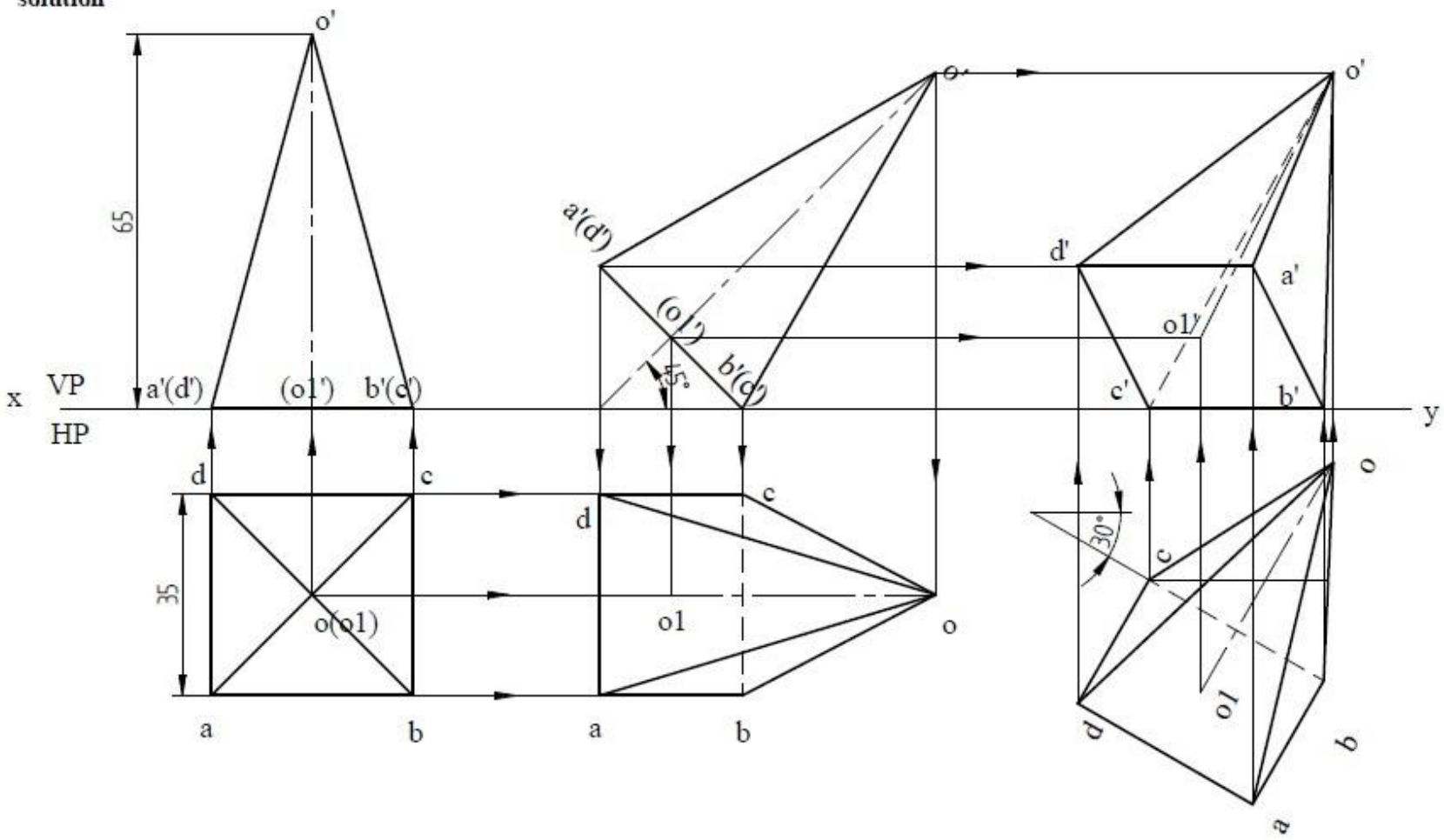
solution



PYRAMIDS

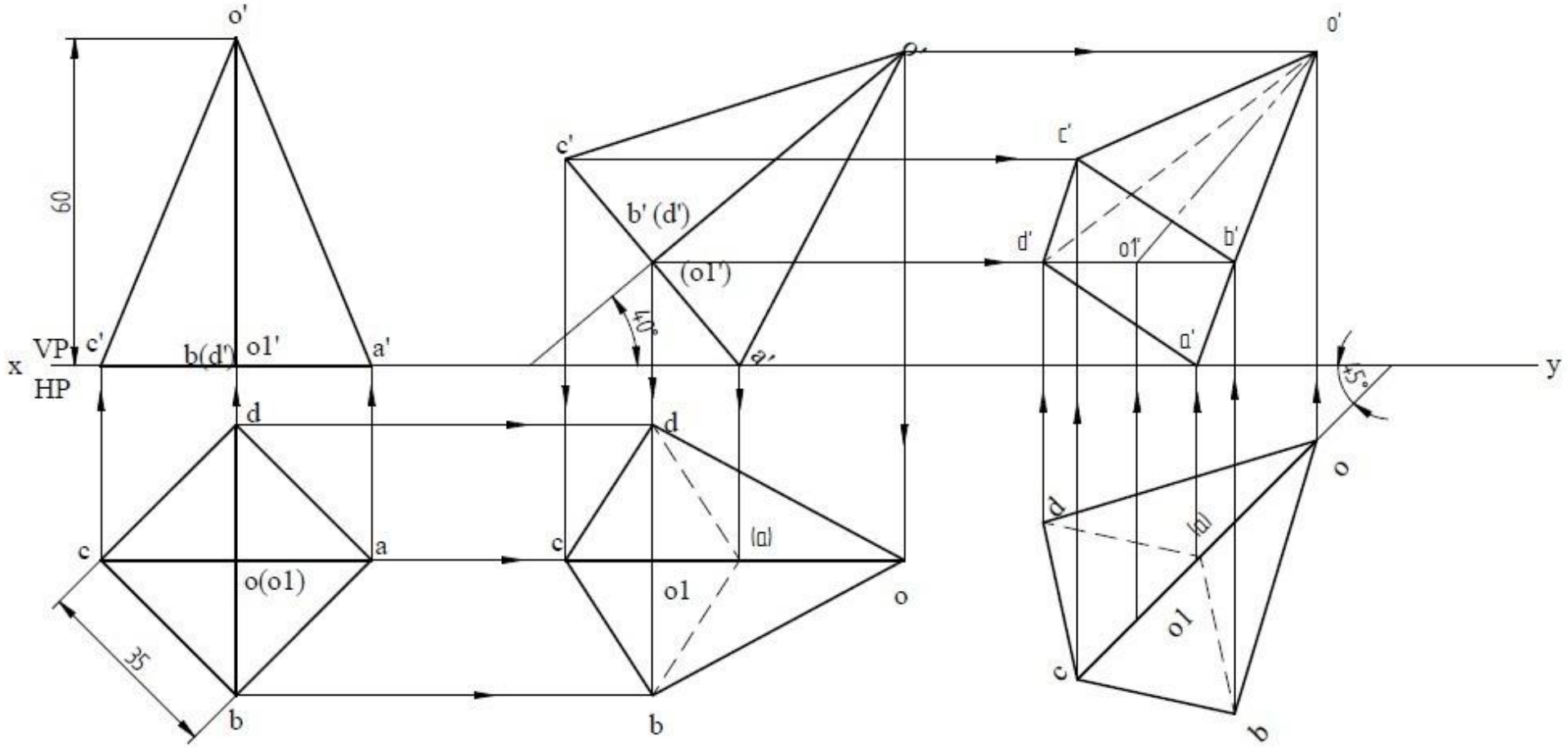
6) A square pyramid 35mm sides of base and 65mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30° Draw the projections of the pyramid when the axis is inclined to HP at 45° .

solution



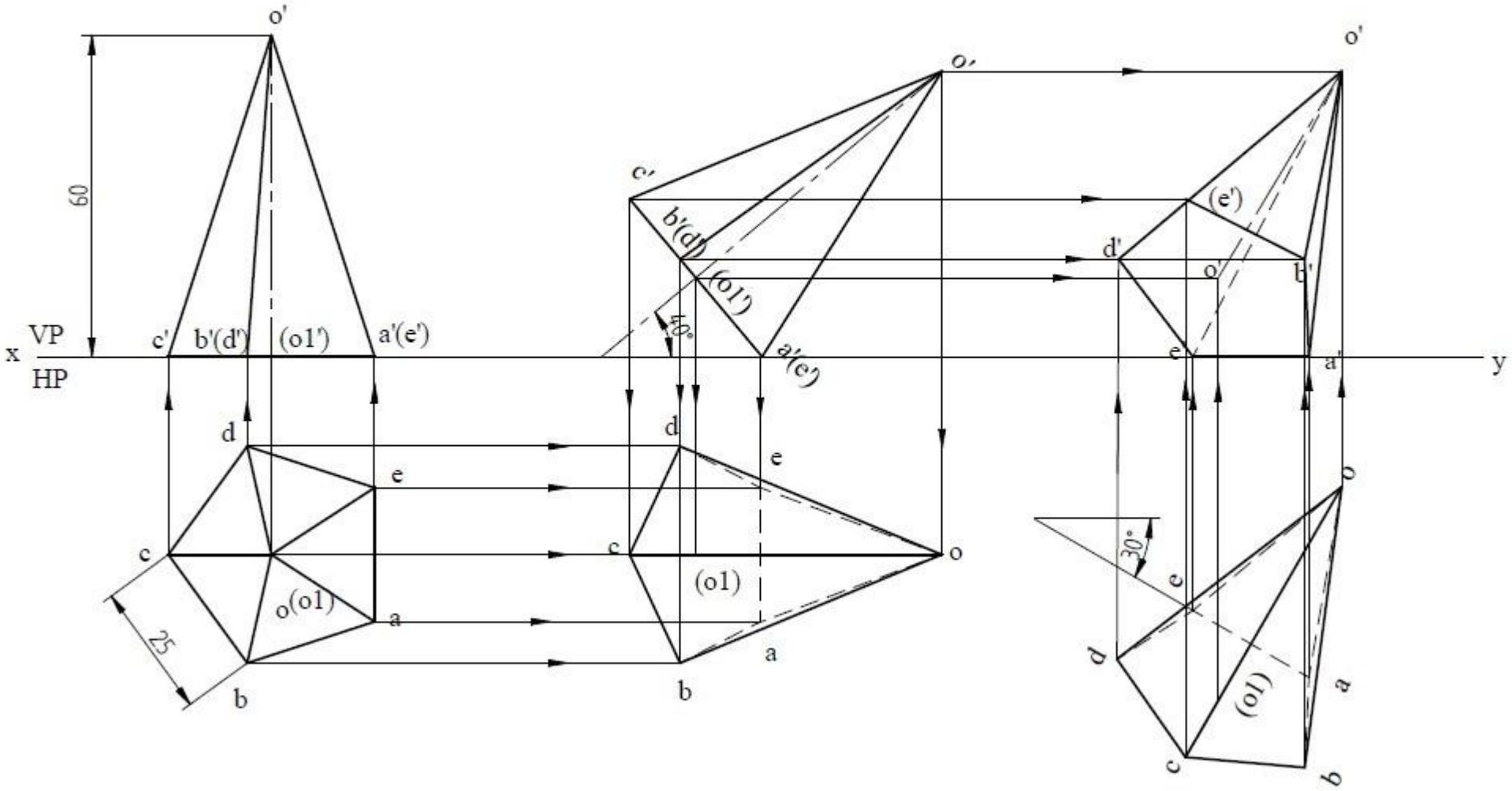
7) A square pyramid 35mm sides of base and 60mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP Draw the projections of the pyramid when the axis of the pyramid is inclined to HP at 40° and appears to be inclined to VP at 45°.

solution



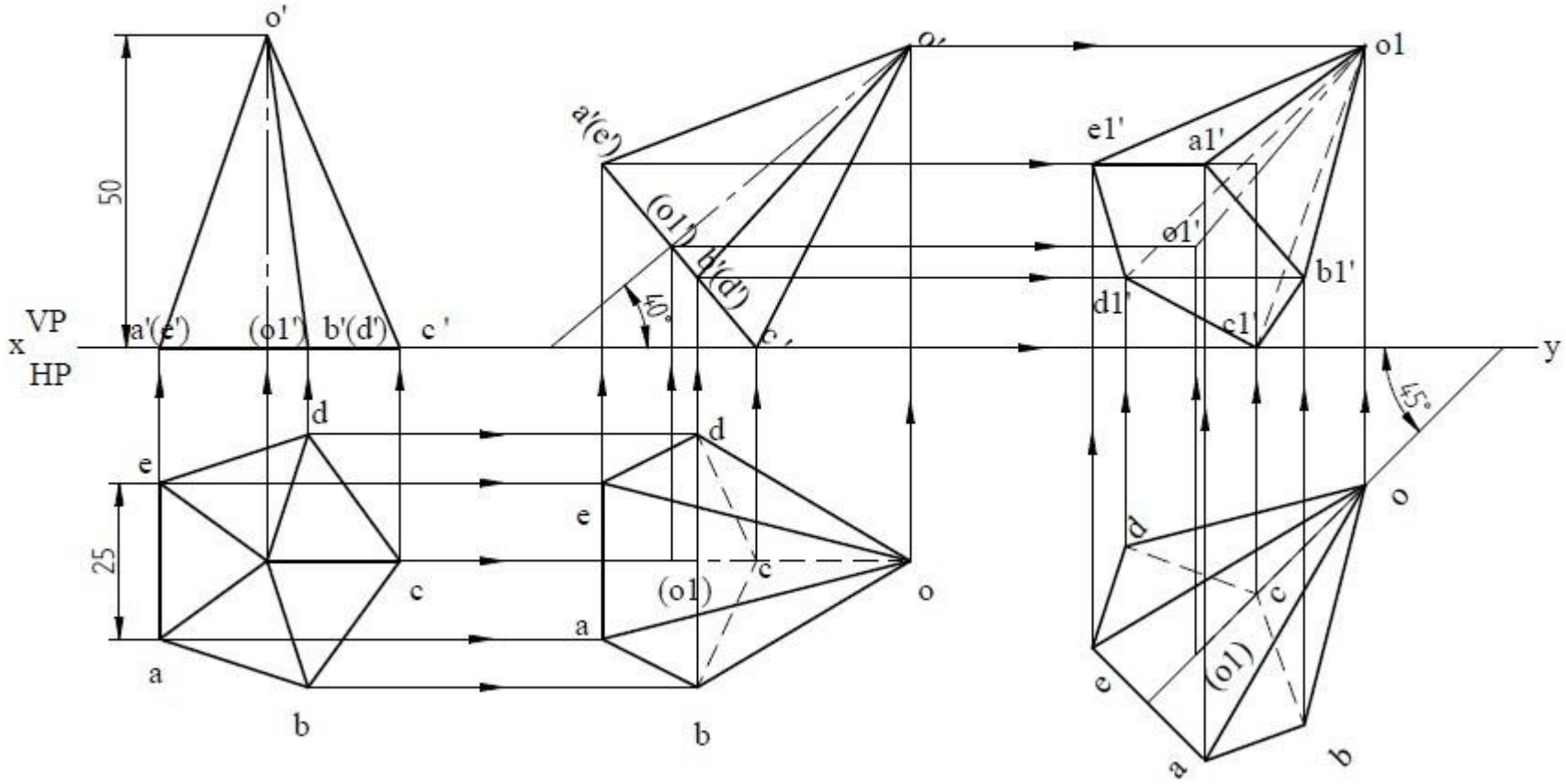
8) A pentagonal pyramid 25mm sides of base and 60mm axis length rests on HP on one of its edges of the base which is inclined to VP at 30° Draw the projections of the pyramid when the axis is inclined to HP at 40°.

solution



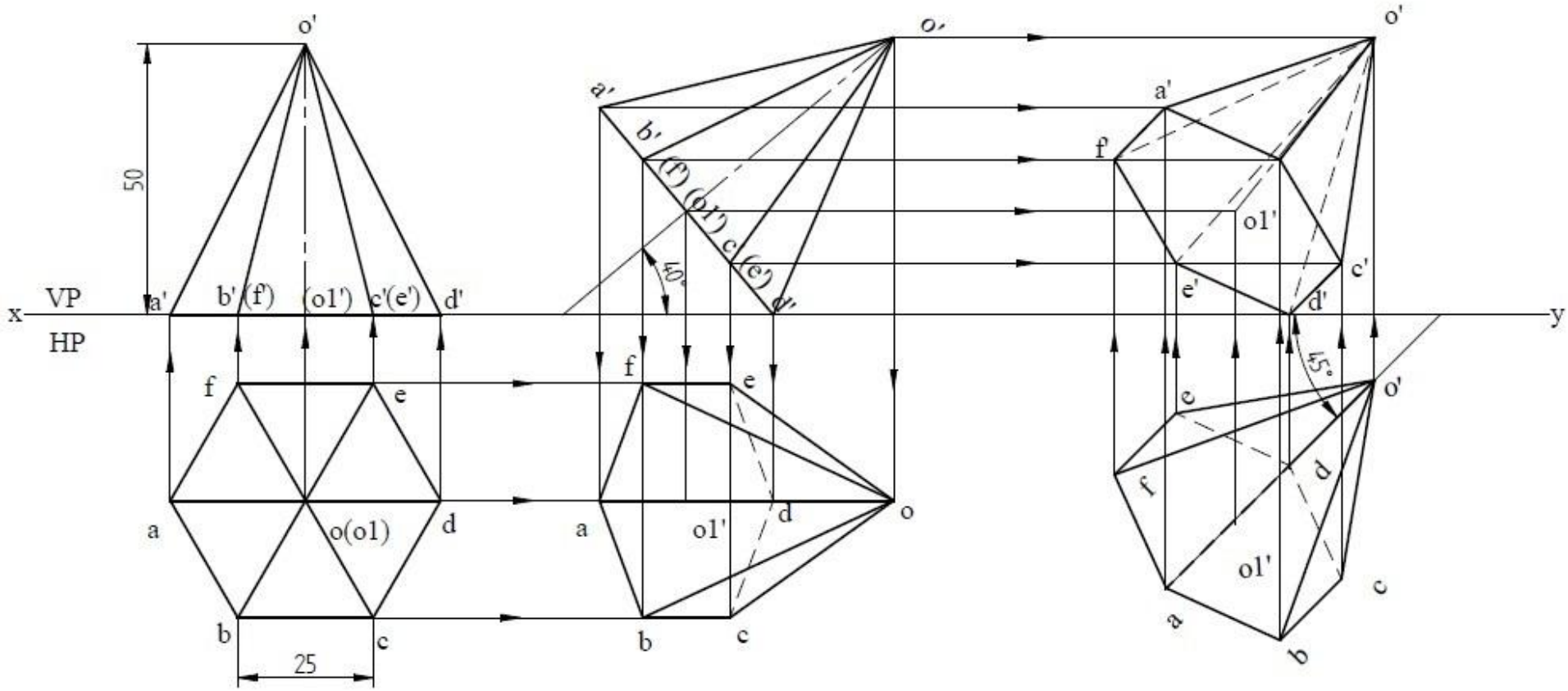
9) A pentagonal pyramid 25mm sides of base and 50mm axis length rests on HP on one of its corners of the base such that the two base edges containing the corner on which it rests make equal inclinations with HP Draw the projections of the pyramid when the axis of the pyramid is inclined to at 40° and appears to be inclined to VP at 45°.

solution



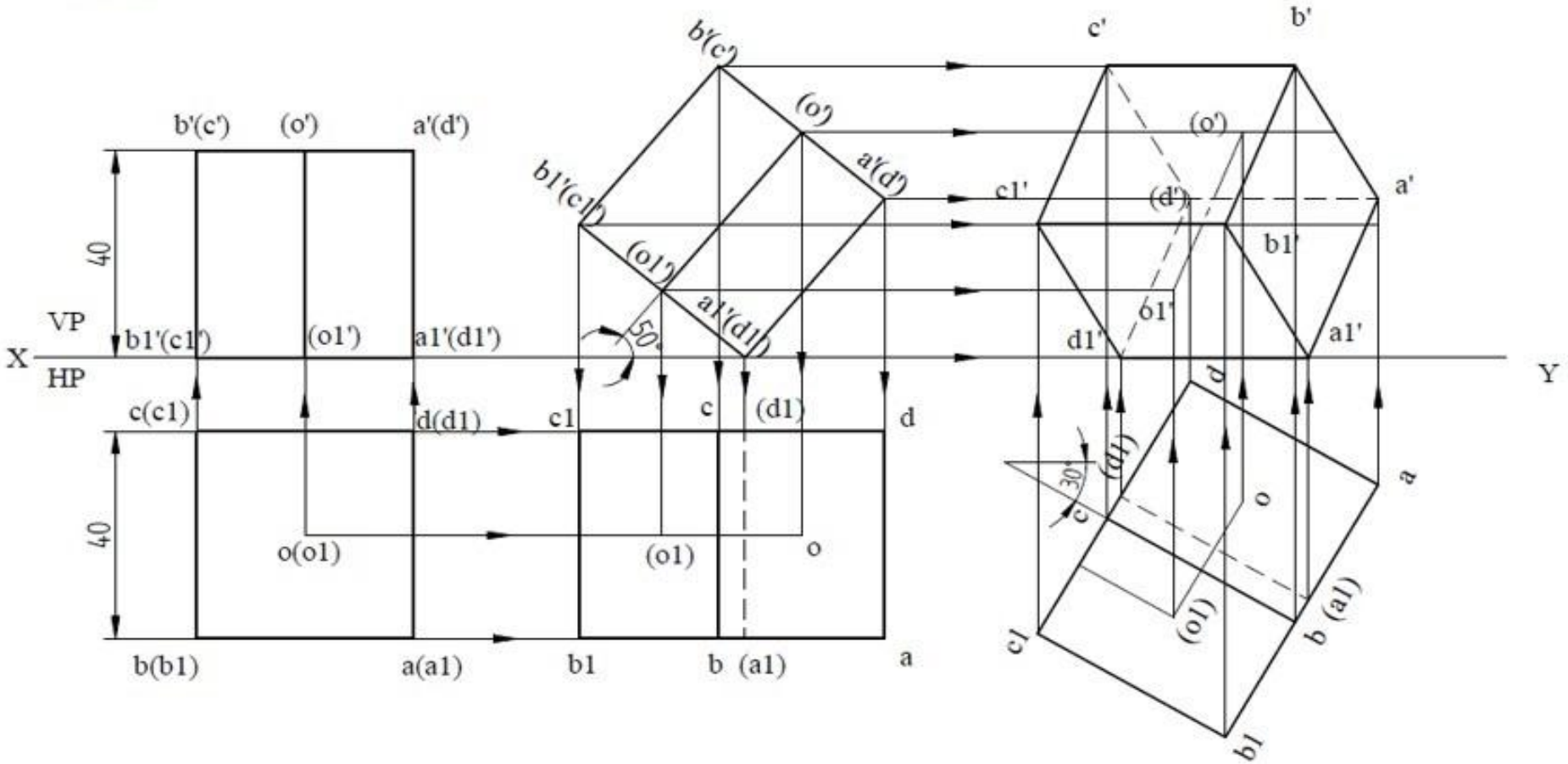
10) A hexagonal pyramid 25 mm sides of the and 50 mm axis length rests on HP on one of its corner of the base such that the two base edges containing the corner on which it rests make equal inclination with HP. Draw the projection of the pyramid inclined to HP 40° and appears to be inclined to VP at 45°.

solution

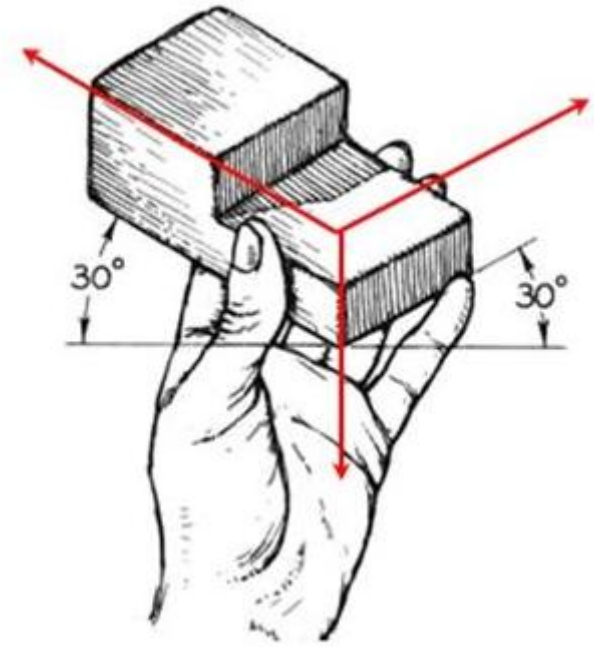


11) A cube of 40mm sides rests on HP on an edge which is inclined to VP at 30° Draw the projections when the lateral square face containing the edge on which it rests makes an angle of 50° to HP.

solution

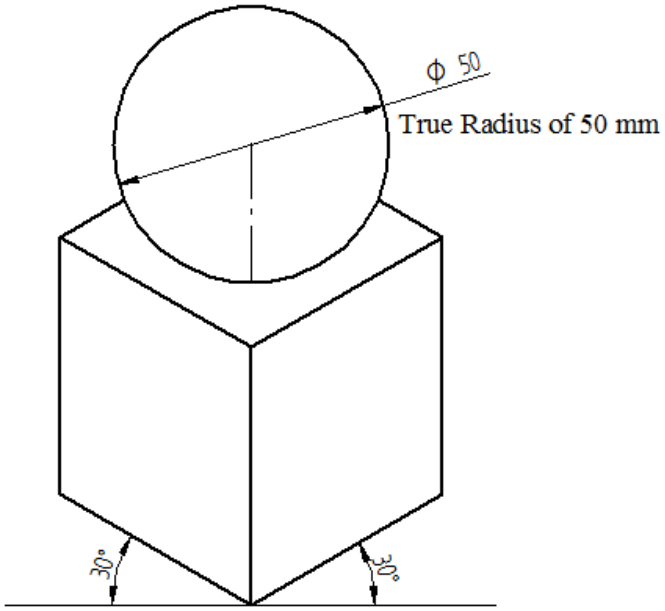


Isometric projection



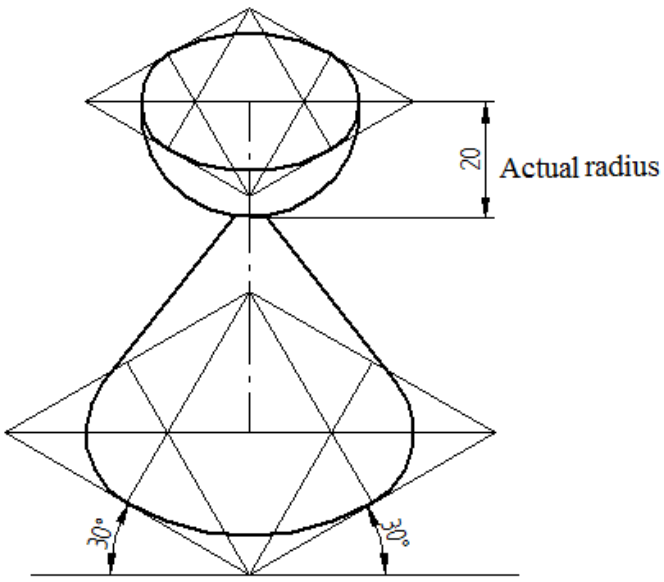
1) A sphere of diameter 50 mm rests centrally on top of a cube of sides 50 mm. Draw the Isometric projections of the combination of solids.

Solution



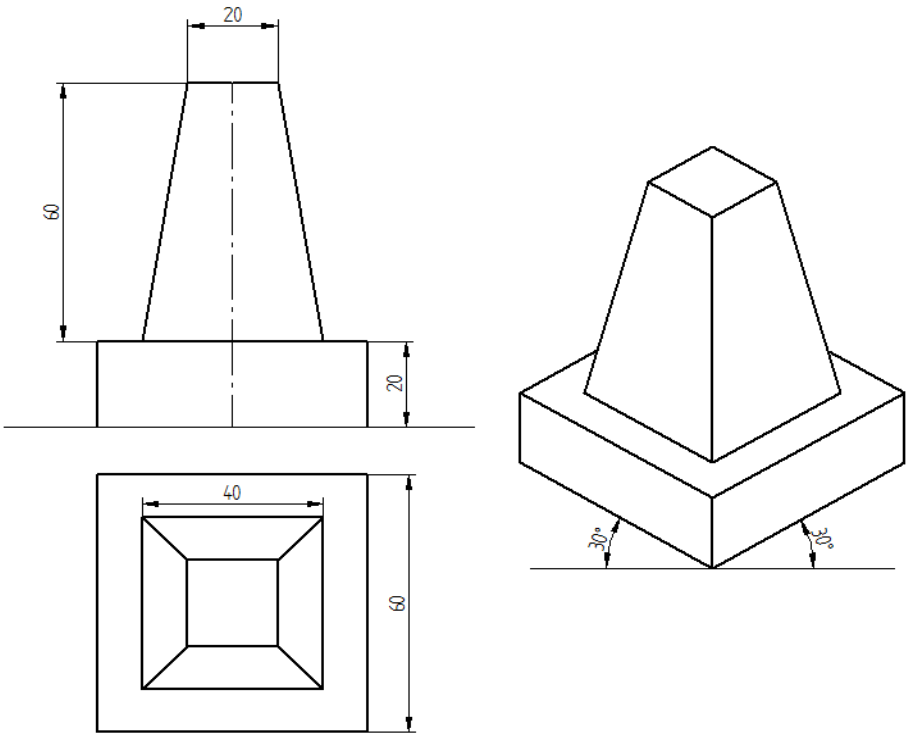
2) A hemisphere of 40 mm diameter is supported co-axially on the vertex of a cone of base diameter 60 mm and axis length 50 mm. The flat circular face of the hemisphere is facing upside. Draw the isometric projection of the combination of solids.

Solution



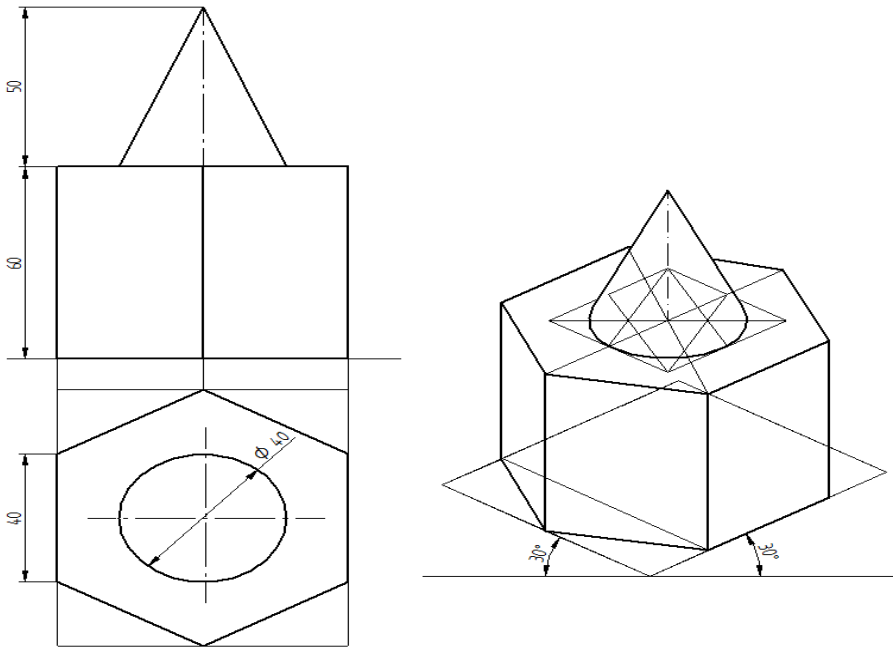
3) The frustum of a square pyramid of base 40 mm, top face 20 mm and height 60 mm rest on the center of the top of a square block of sides 60 mm and height 20 mm. The base edges of the pyramid are parallel to the top edges of the square block. Draw the isometric projection of the combination of the solids.

Solution

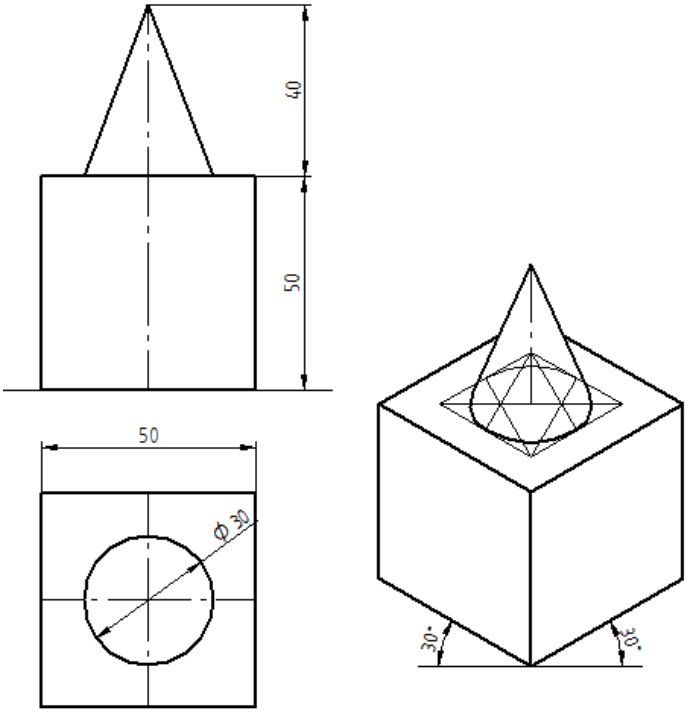


4) Draw isometric projection of a hexagonal prism of side of base 40 mm and height 60 mm with a right circular cone of base 40 mm as diameter altitude 50 mm, resting on its top such that the axes of both the solids are collinear.

Solution

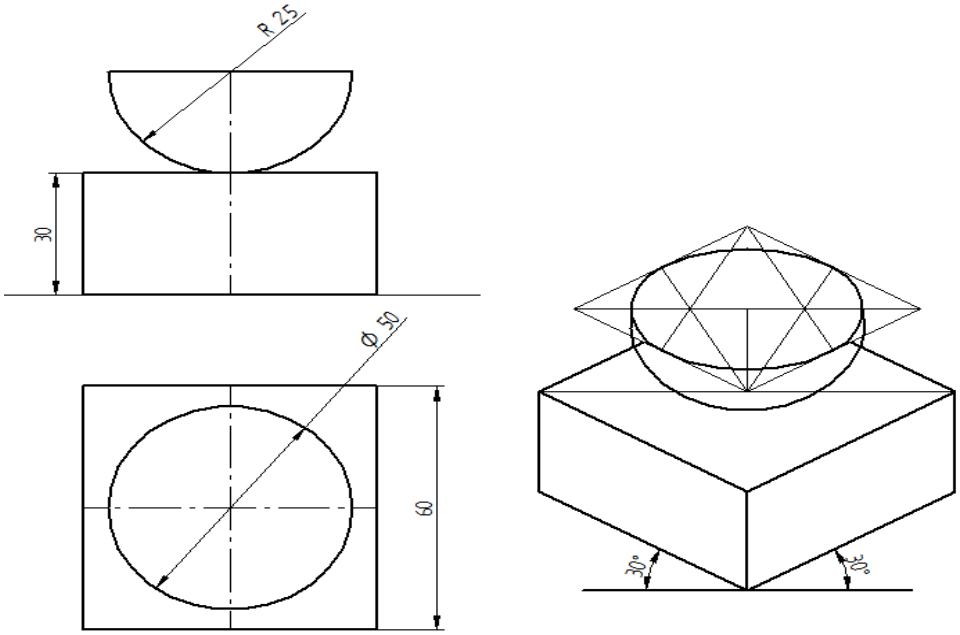


5) A cone of base diameter 30 mm and height 40 mm rests centrally over a cube of side 50 mm. draw the isometric projection of the combination of solids.
Solution



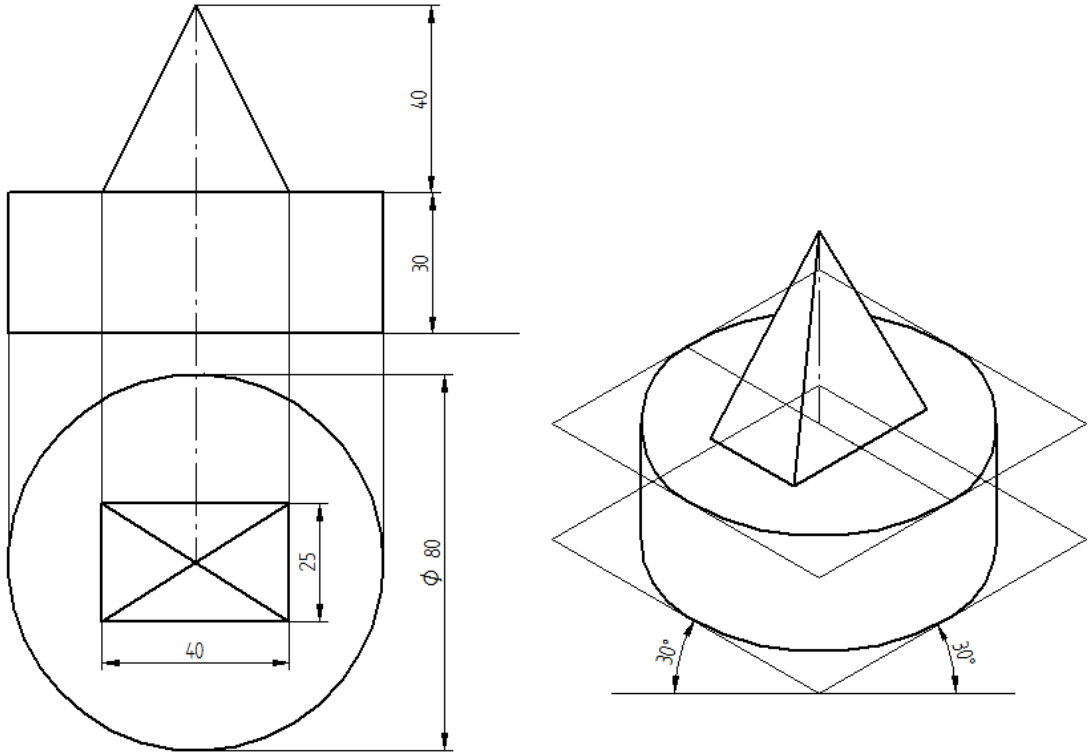
6) A hemisphere of diameter 50 mm is centrally resting on top of a square prism of base side 60 mm and height 30 mm such that the curved surface of hemisphere is touching top face of the prism. Draw its isometric projections.

Solution



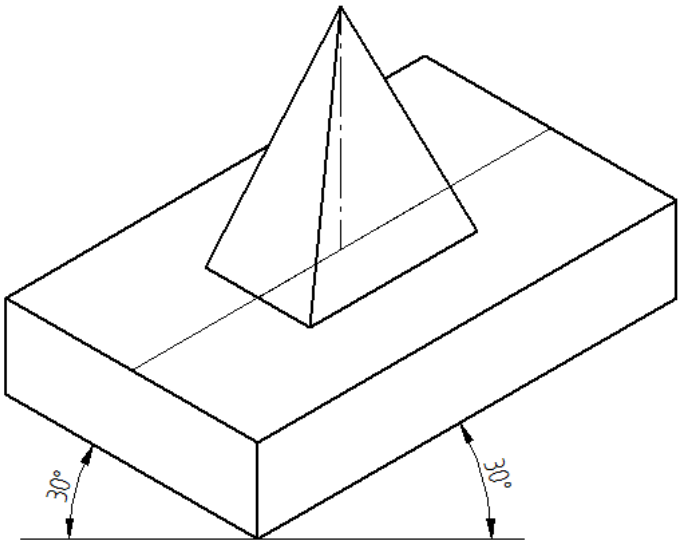
7) A rectangular pyramid of base - 40 mm X 25 mm and height 50 mm is placed centrally on a cylindrical slab of diameter 100 mm and thickness - 30 mm. Draw the isometric projection of the combination.

Solution



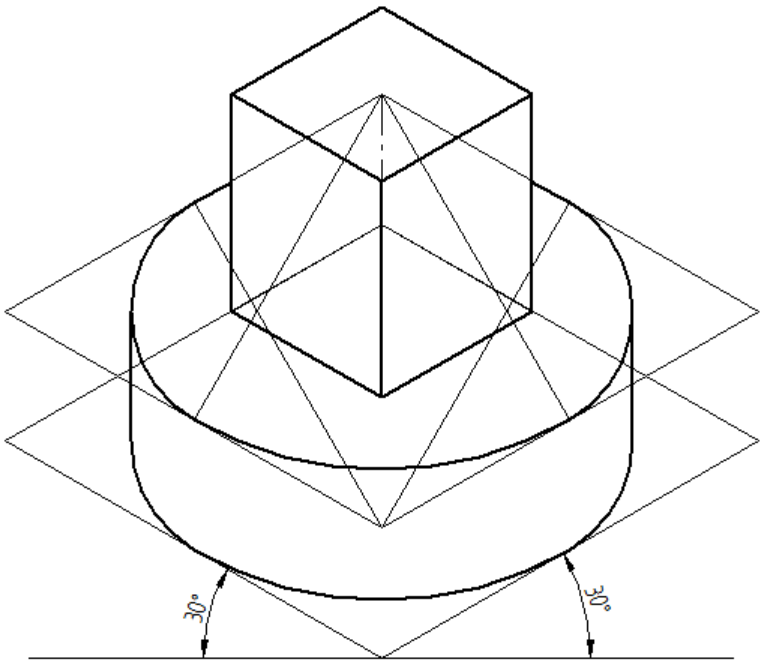
8) A rectangular pyramid of base - 40 mm X 25 mm and height 50 mm is placed centrally on a rectangular slab sides - 100 mm X 60 mm and thickness 20 mm. draw the isometric projections of the combination.

Solution



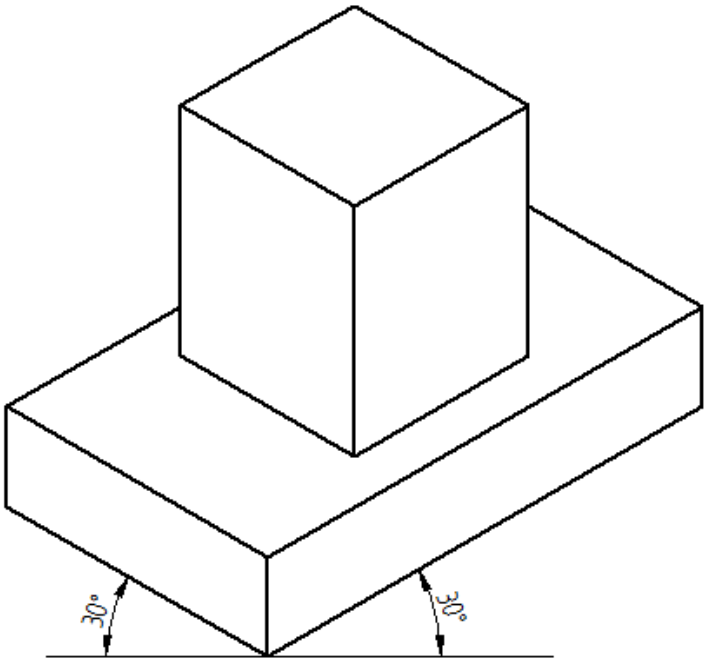
9) A square prism base side - 40 mm, height 50 mm is placed centrally on a cylindrical slab of diameter 100 mm and thickness 30 mm. Draw the isometric projection of the combination.

Solution

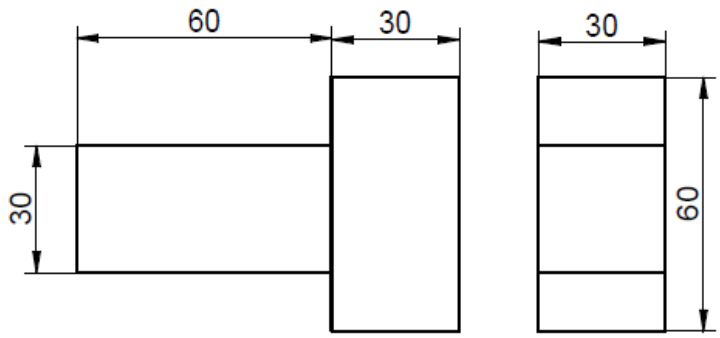


10) A square prism base side - 40 mm, height 50 mm is placed centrally on a rectangular slab sides - 100 mm X 60 mm and thickness 20 mm. Draw the isometric projection of the combination.

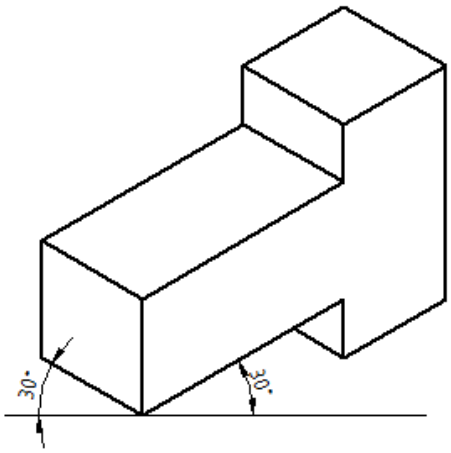
Solution



11) Following figures shows the front and side views of solid. Draw the isometric projection of the solid.

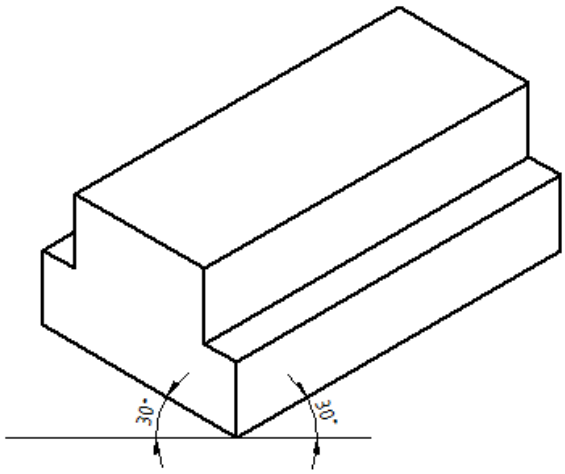


Solution



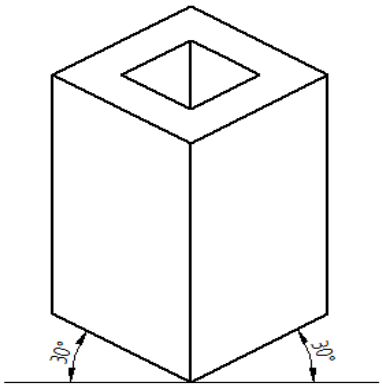
12) Two rectangular plats are placed centrally with dimensions (l x b x h) 100 mm X 60 mm X 20 mm and 100 mm X 40 mm X 20 mm such that longer edges are parallel. Draw the isometric projection of the combination.

Solution



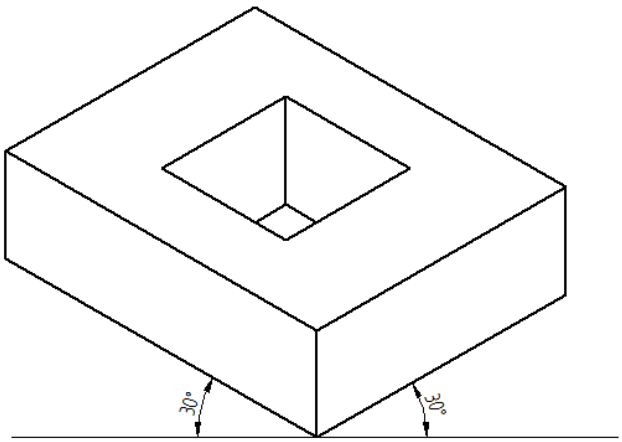
13) A square prism side - 40 mm and height 70 mm has a full depth co-axial square hole side - 20 mm, such that edges of both the squares are parallel. Draw the isometric projection of the combination.

Solution

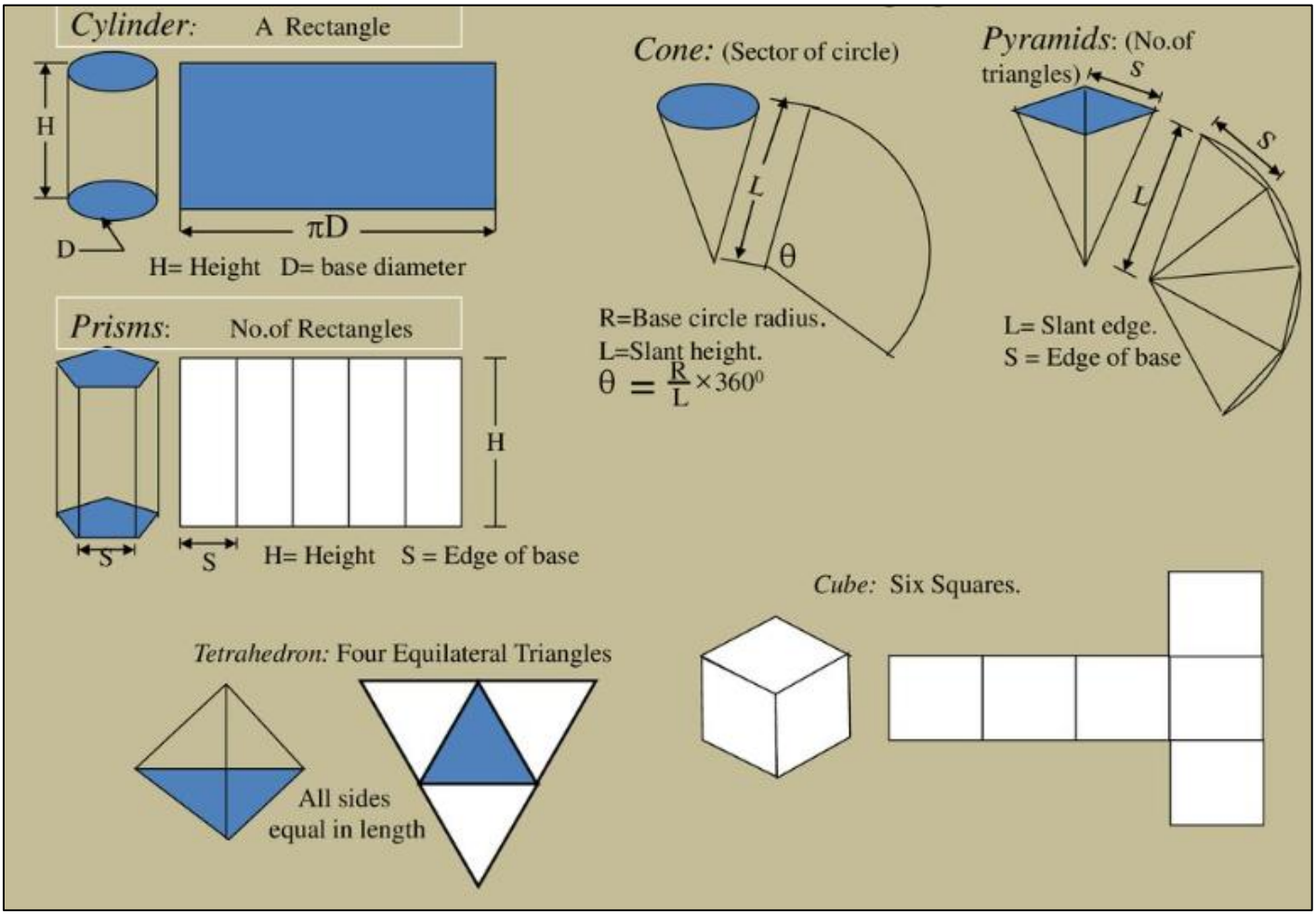


14) A rectangular slab base - 100 mm X 80 mm and height 30 mm has a full depth co-axial square hole side - 40 mm, such that one of the sides of the square is parallel to one of the sides of the rectangle. Draw the isometric projection of the combination.

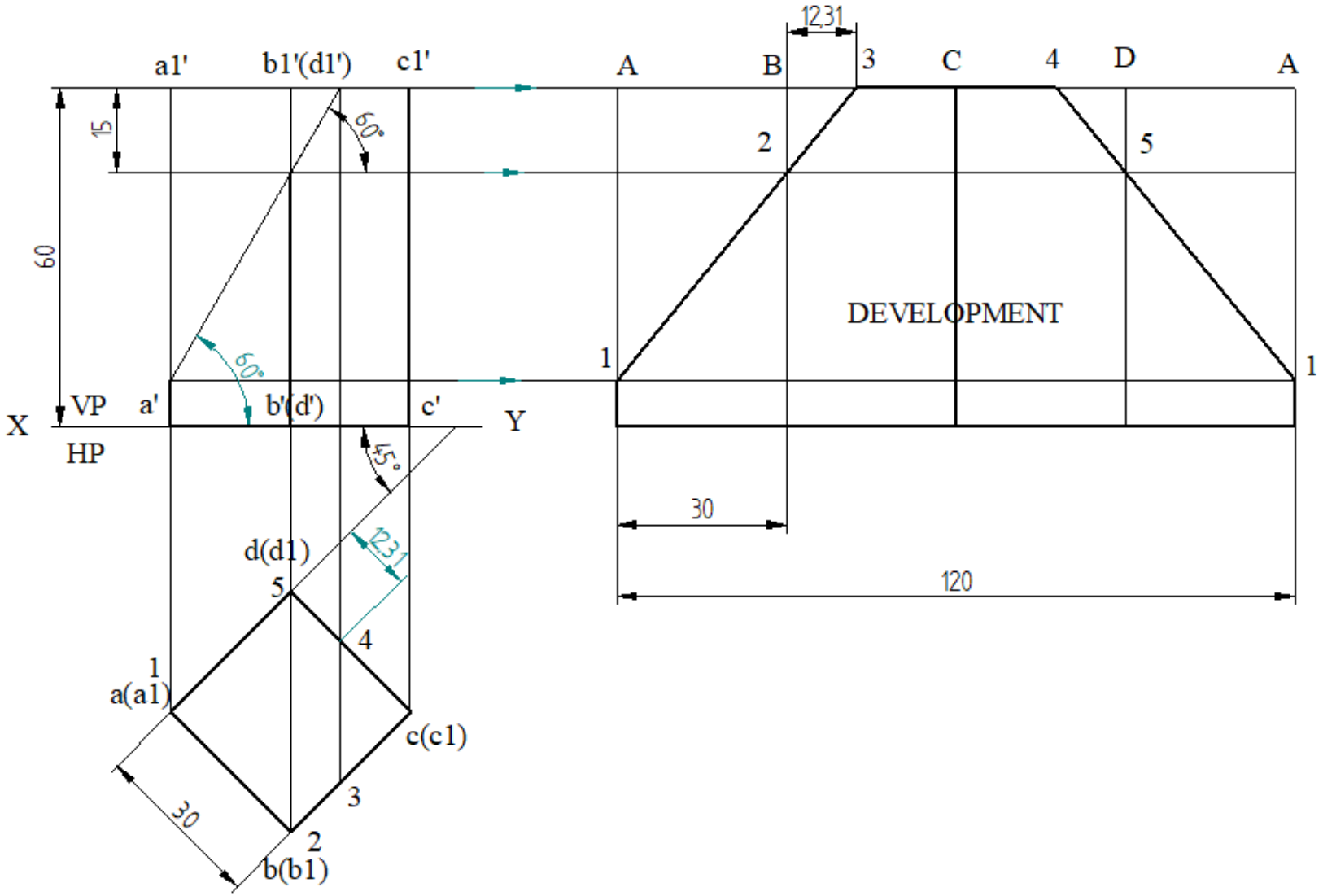
Solution



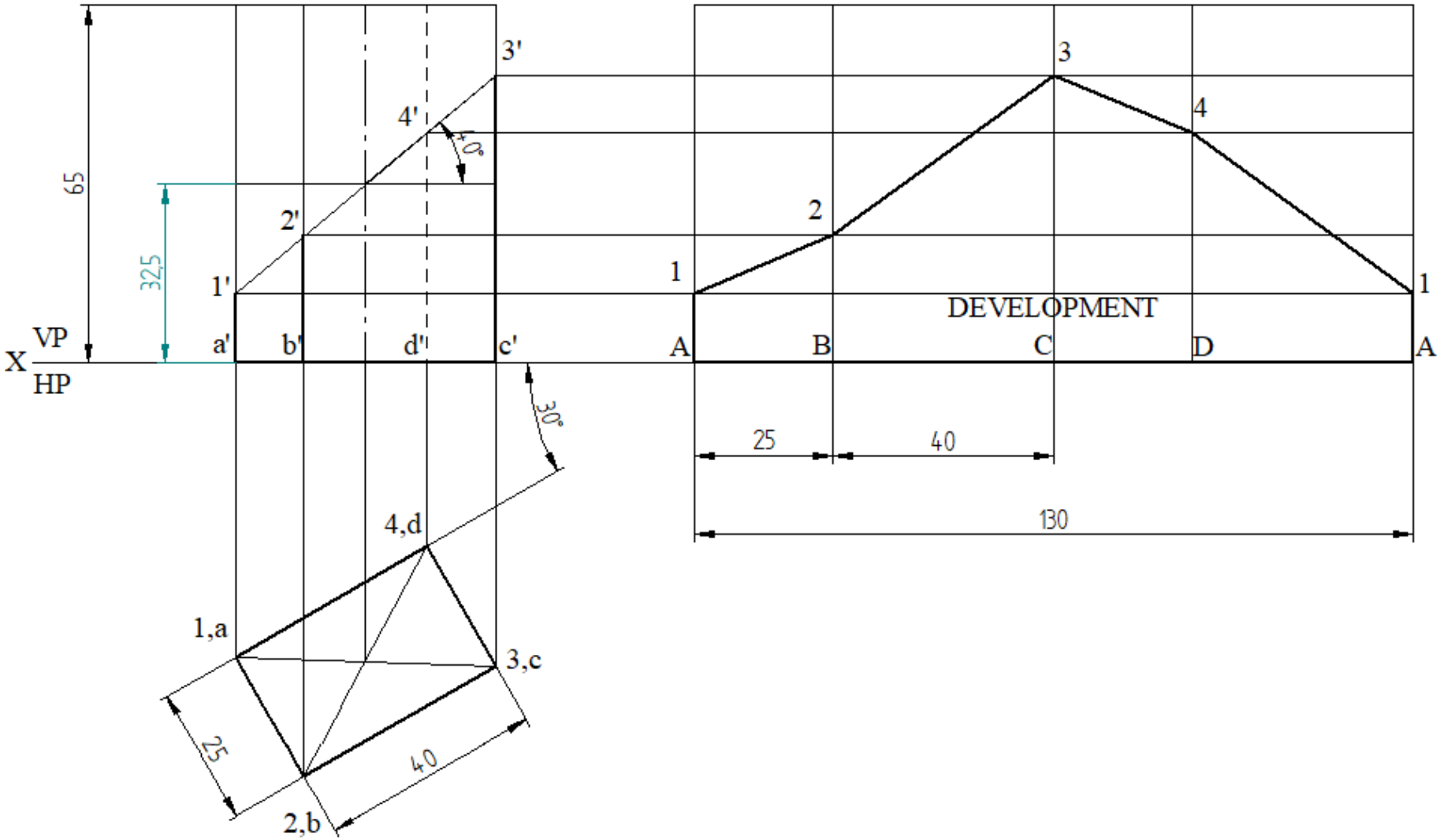
Development of Lateral Surfaces of Solids



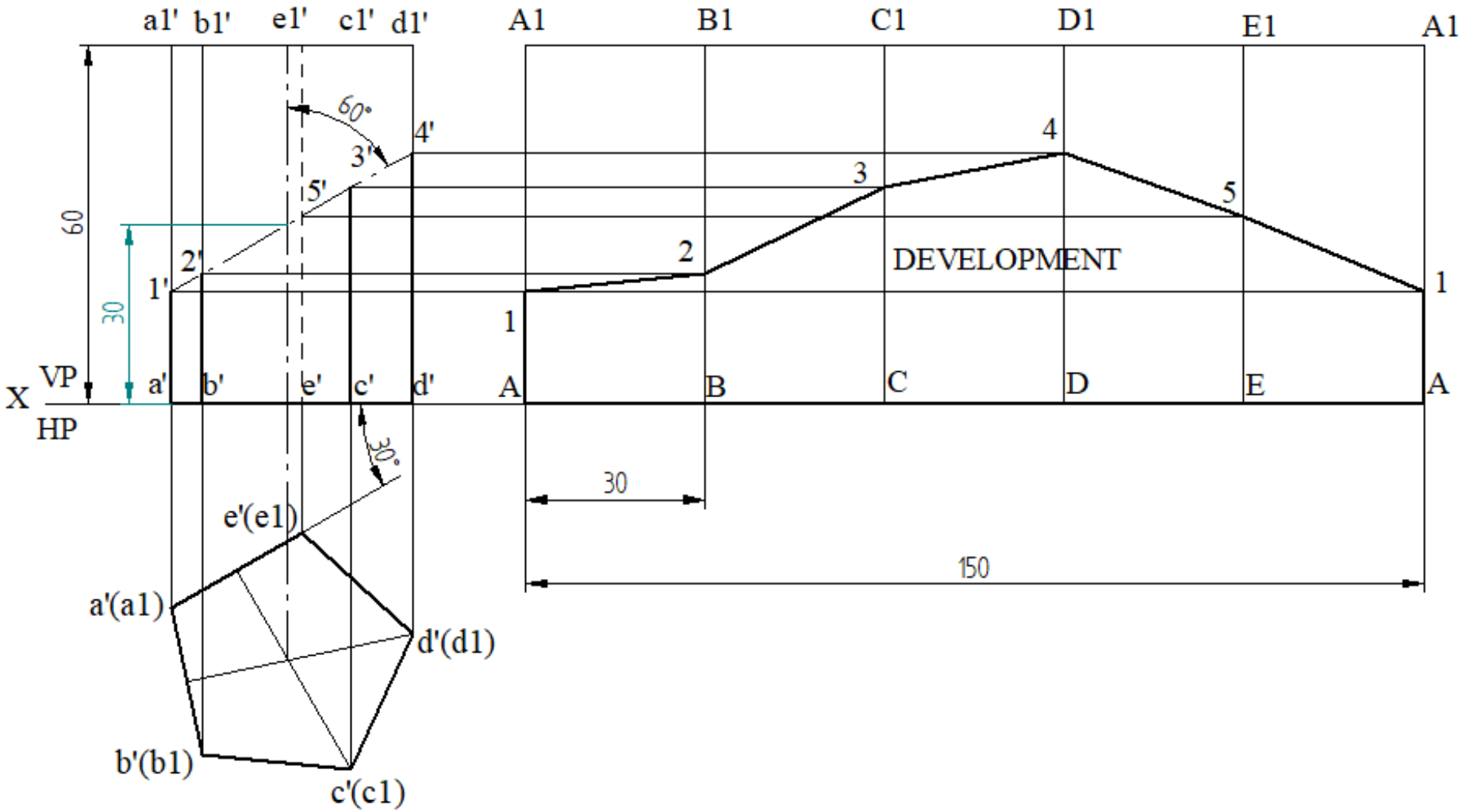
1) A square prism of base side 30 mm and axis length 60 mm is resting on HP on its base with all the vertical faces being equally inclined to VP. It is cut by an inclined plane 60° to HP and perpendicular to VP and is passing through a point on the axis at a distance 50 mm from the base. Draw the development of the lower portion of the prism.



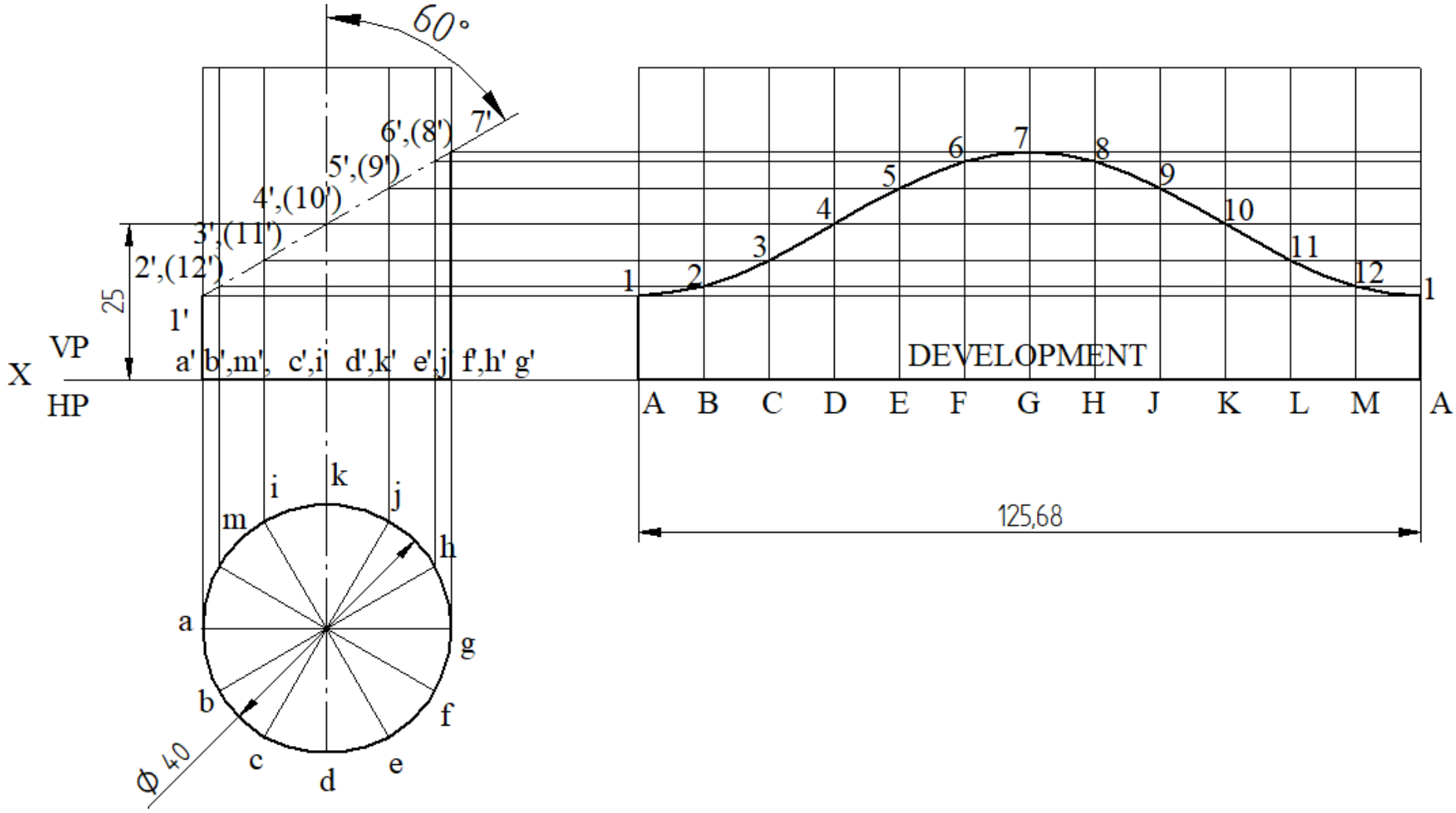
2) A rectangular prism of base 40mm x 25 mm and height 65 mm rests on HP on its base with the longer base side inclined at 30° to VP. It is cut by a plane inclined at 40° to HP, perpendicular to VP cuts the axis at its mid height. Draw the development of the remining portion of the prism.



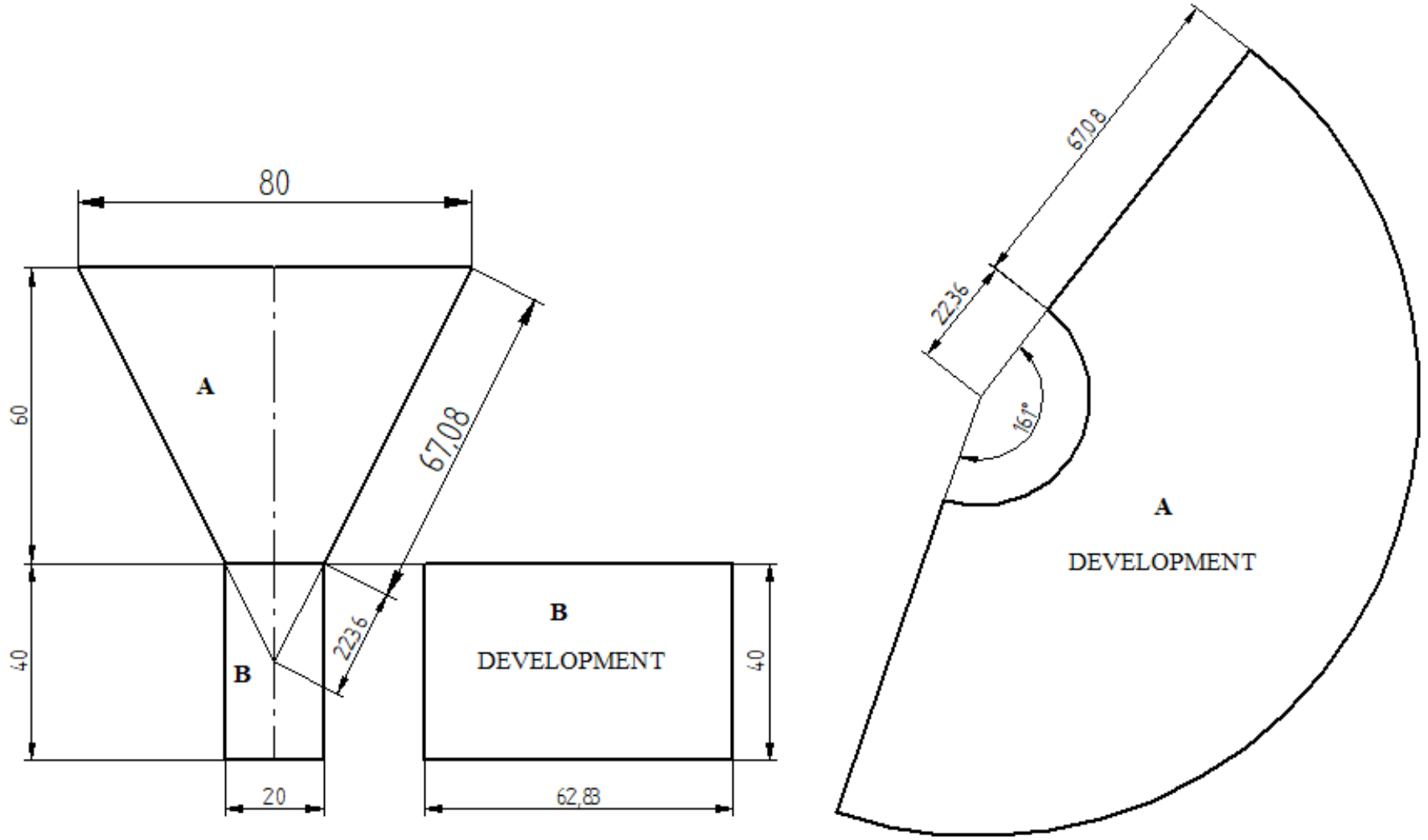
3) A regular pentagonal prism of height 60 mm and base edge 30 mm rests with its base on HP. The vertical face closest to VP is 30° to it. Draw the development of the truncated prism with its truncated surface inclined at 60° to its axis and bisecting it.



4) Draw the development of the lateral surface of a truncated vertical cylinder, 40 mm diameter of base and height 50 mm, the truncated flat surface of the cylinder bisects the axis at 60° to it.



5) Draw the development of the lateral surface of a funnel consisting of a cylinder and a frustum of a cone. The diameter of the cylinder is 20 mm, and the top face diameter of the funnel is 80 mm. The height of frustum and cylinder are equal to 60 mm and 40 mm respectively.

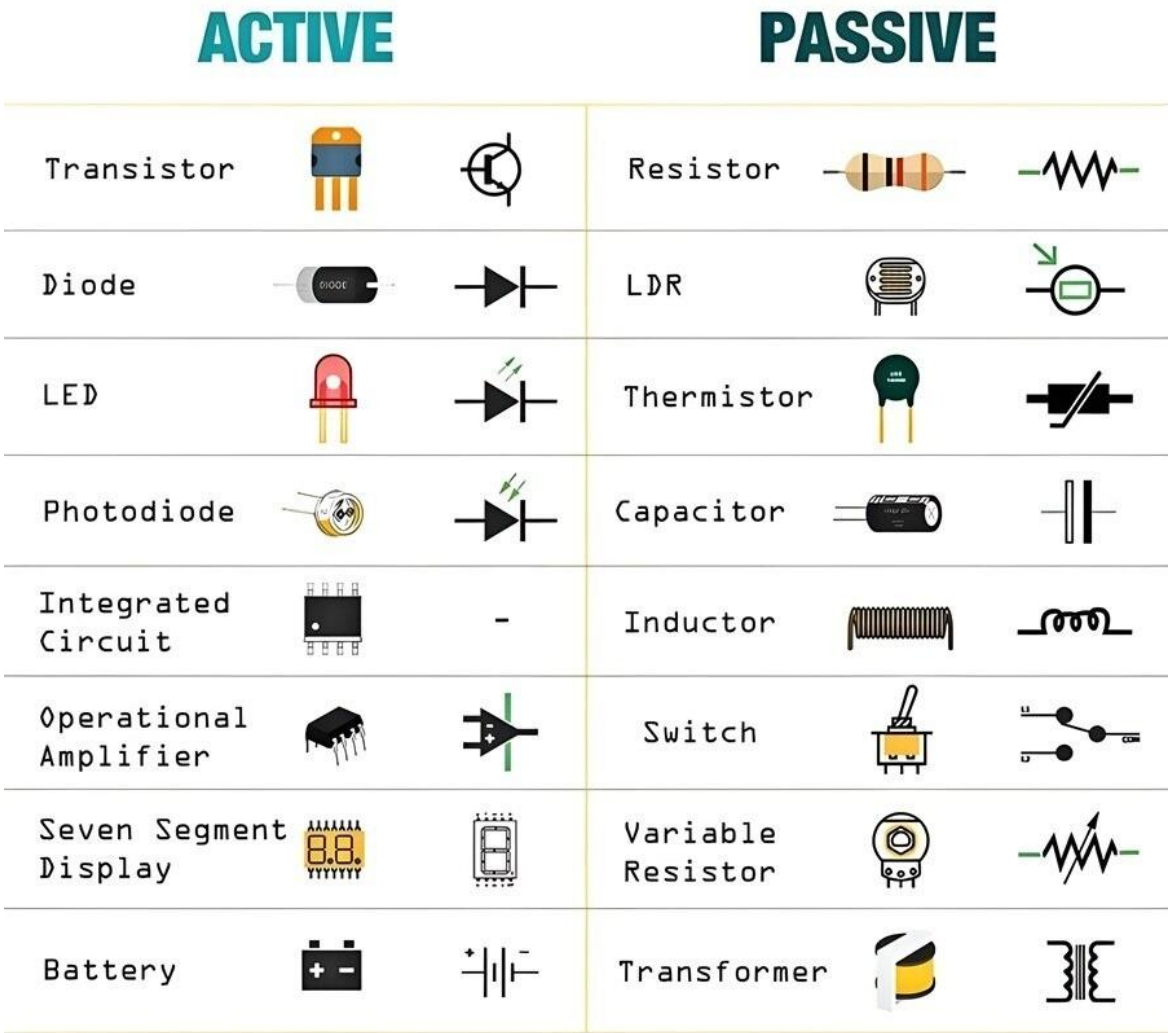


How to Create Circuit Diagram?

A circuit diagram (electrical diagram or electronic schematic) is a visualization of an electrical circuit. It shows the flow and relationships between components in an electrical circuit. Circuit diagrams also visualize the physical arrangement of wires and the components that connect them within different electronic systems.

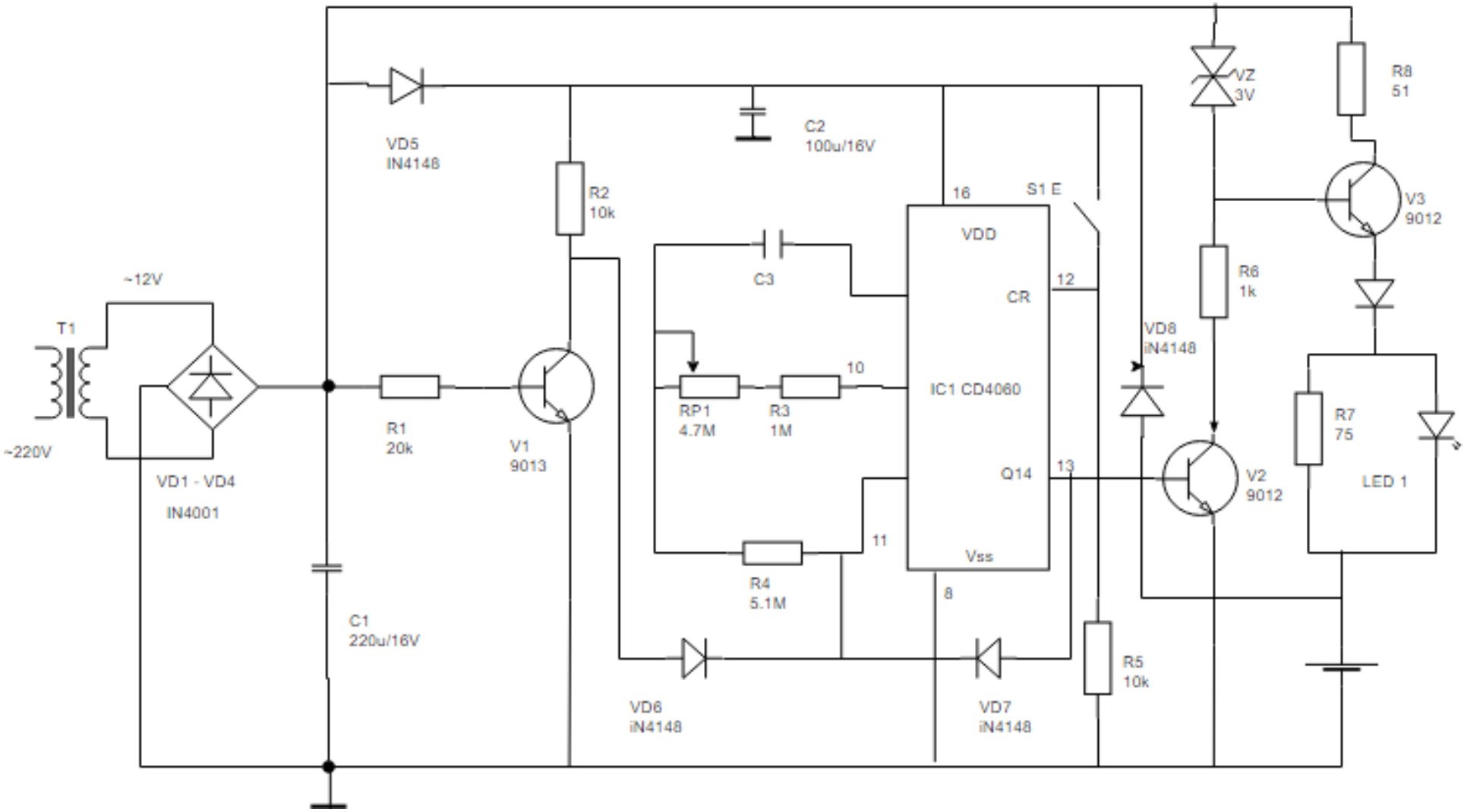
Circuit Symbols: Key to Understanding Electrical and Electronic Diagrams

Circuit symbols are essential in electrical and electronic diagrams for representing complex circuits and components in a standardized and simplified manner. These symbols are crucial for engineers, electricians, and technicians to understand circuit functions without documentation. Universal recognition of these symbols ensures consistent interpretation across languages and regions, aiding education and training.



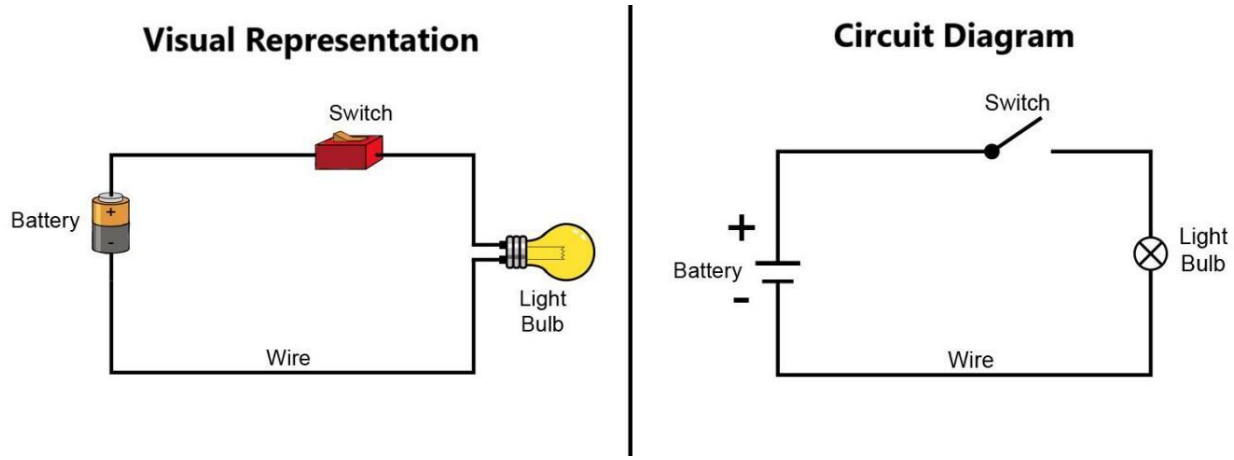
Circuit diagrams consist of various components like switches, capacitors, resistors, and batteries, connected by nets or trails. Each component has a unique symbol with specific characteristics. Understanding component operation is vital for effective circuit design and analysis. Knowledge of resistor, capacitor, and transistor properties enables engineers to predict component interactions, achieve desired outcomes, and troubleshoot issues.

Circuit diagram:



How do the Circuit Symbols form the Circuit Diagram?

Electronic circuit symbols are concise drawings or pictograms that depict various components in a circuit's schematic diagram. In such diagrams, electrical elements typically feature two or more terminals for connecting components. Fundamental electrical and electronic symbols include the ground electrode, battery, and resistor. These symbols facilitate the representation of even the most intricate circuits. With these essential symbols, anyone can sketch an electrical diagram. For instance, a basic circuit comprises a battery, a switch, and a bulb connected in a closed loop.



Representing a Circuit with Symbols v/s Words

Usually to define anything specific words are enough but the circuit diagram has its own advantages. Circuit diagrams become self-explanatory by utilizing symbols format. Representing the circuit by words is an easy process. For example, the above shown circuit can be explained as "the battery is connected to the switch and bulb in the series combination". This is very easy to understand, but when the diagrams become bigger and complex, you have to use circuit diagrams and symbols to represent them. It makes the person quickly analyze the circuit, that what is happening.In short, electronic symbols simplify our understanding of the circuit. It saves our time and makes it easy.

Advantages of the Circuit Symbols

A symbol's precise meaning is provided by the inclusion of a dot, line, letter, letter spacing, shading, and number. One has to be familiar with the basic structure of various symbols to comprehend circuits and their corresponding symbol meanings. Here are some main advantages of using symbols:

Reduces confusion in production - By using a defined set of electrical symbols, it is impossible to assign various symbols to similar components.

Lessens Rework - By developing and using a single, standardized set of electrical symbols, unnecessary and redundant schematic rework is eliminated.

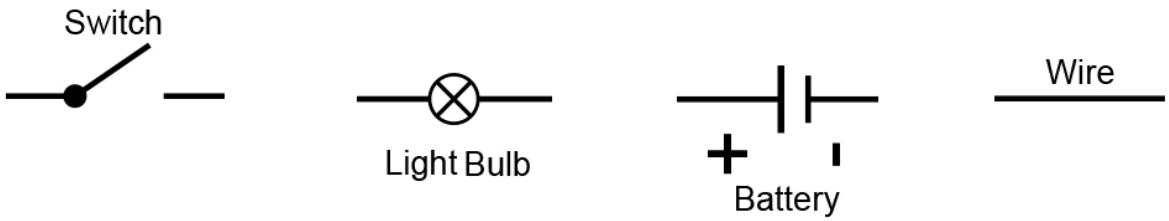
Greater Electrical and Mechanical Communication - The use of standardized electrical symbols reduces instances of misunderstanding between members of the MCAD and ECAD teams. The use of connections between 2D symbols and 3D modeled parts puts everyone on the same page.

Saves Time - Standardized electrical symbols not only save time on rework and misunderstandings.

Physics Behind Designing of Symbols

Symbols are used to indicate an electric/electronic component. As said above it is very important to have knowledge about how a component operates, that is the starting point from where the design concept of different symbols came from. Each symbol has a capability to explain the basic physics behind the actual component. Most of the symbol designs are based on different national and international standards. Instances include IEC standards, JIC standards, ANSI standards, IEEE standards, etc. Although electrical symbols are standardized, they might differ from engineering discipline to engineering field depending on previous traditions.

Example explaining the physics of circuit: The majority of electrical circuit symbols include switches and batteries, the symbols for them is shown below:



Switch: The above switch symbol represents the closed and open circuit connection in a circuit and hence the symbol is universally adapted as per that.

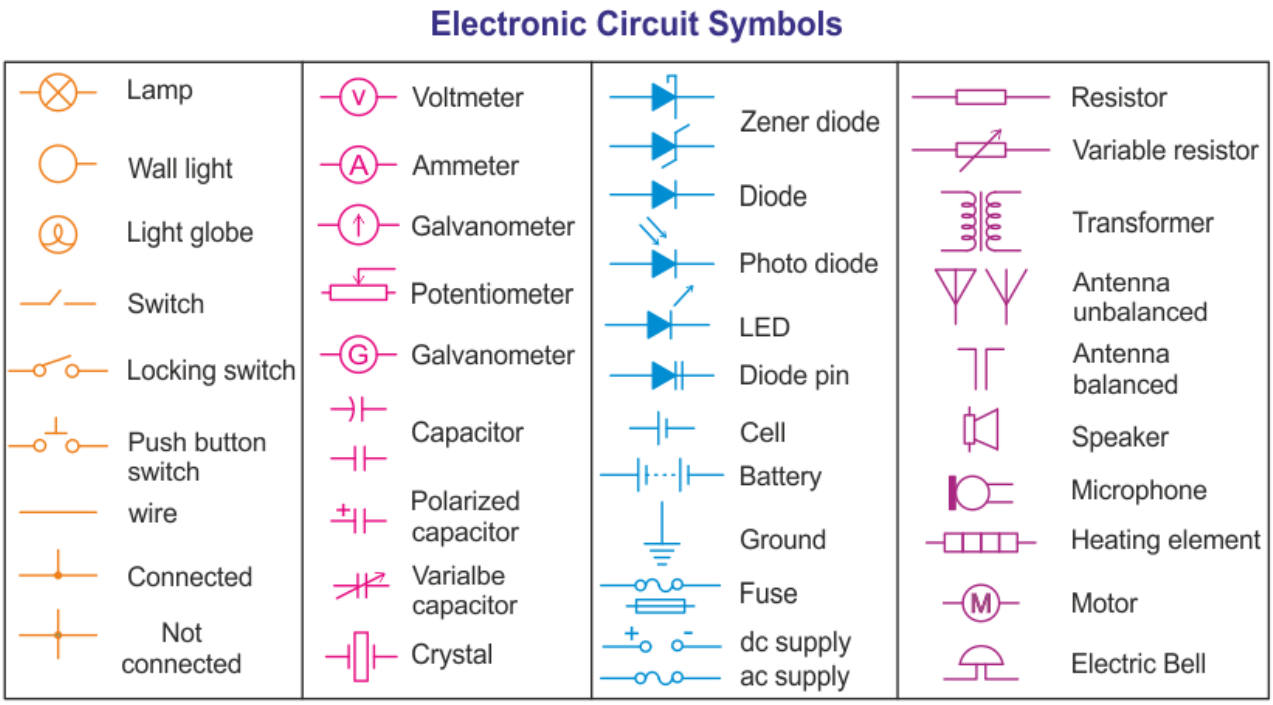
Light Bulb: Bulb has some resistance which is heated up to produce light. And here in the source the symbol shows a cross mark representing light coming from a resistive source.

Battery: It is an energy source made of cells, having a chemical electrolyte inside which provides polarity. The cells in the battery symbol are represented by two uneven lines in parallel with positive and negative polarity mentioned on them.

Wire: It is just a connection conductor between two devices, which has very low resistance and hence for connection it is just represented by a straight line.

There are some other complicated symbols too which are not that easy to explain without having component knowledge.

List of Circuit Diagram Symbols with Design Physics Behind it

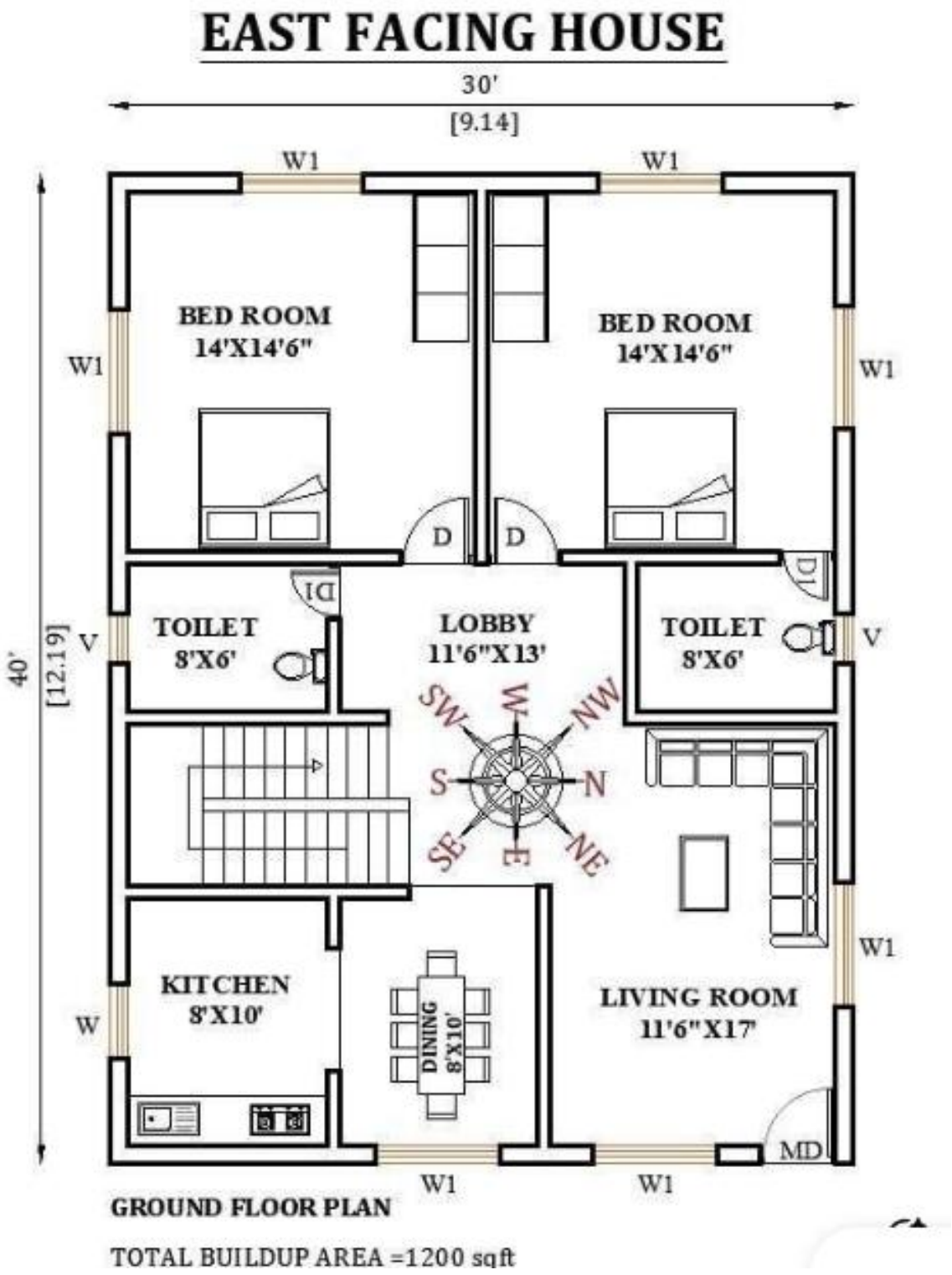


Circuit diagrams are used to portray the symbols used in electronic circuits virtually. Every circuit uses standardized symbols to represent the various parts. To represent fundamental electrical devices, several electronic circuit symbols are employed. There is a circuit symbol for each electrical device or component used in a circuit, such as passive components (resistors, capacitors and inductors), active components (diodes, transistors, amplifiers and transformers), measuring devices and logic gates.

References:

1. https://jlcpcb.com/blog/circuit-symbols-key-to-understanding-electrical-and-electronic-diagrams

- Analyze the functional and spatial requirements for a 30' x 40' residential site and design a top view plan. Your plan should include the Living Room, Two Bedrooms, Kitchen, Dining Area, One common bathroom, Staircase Provision. Critically evaluate the layout for effective space utilization, ventilation, and aesthetics. Compare your design choices with the given example plan.



**********ALL THE BEST**********