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## 1.0 Lettering

- 1) *Prepare Drawing sheet*
- 2) *Write freehand, in single stroke vertical capital letters, small letters and numerals, using the ratio 7:5.*

## 2.0 Applied Geometry

### 2.1 Geometrical construction

- 1) *Trisect 70mm long straight line.*
- 2) *Divide 70mm long straight line in to 8 equal parts.*
- 3) *Divide 70mm long straight line in to 2:3:4 ratio.*
- 4) *Trisect an acute angle.*
- 5) *Trisect an obtuse angle.*
- 6) *Construct a regular pentagon, inscribed in a circle of diameter 50mm.*
- 7) *Construct a regular pentagon having sides 30mm.*
- 8) *Construct a regular hexagon having sides 30 mm, by using T- scale and 30°-60° set square.*
- 9) *Construct a regular octagon having sides 25 mm, by using T-scale and 45° set square.*

### 2.2 Tangents

- 1) *Construct an external (uncrossed) common tangent between two circles of same diameters (40mm) and center to center distance of circles is 60mm.*
- 2) *Construct an internal (crossed) common tangent between two circles of diameters 40mm and center to center distance of circles is 60mm.*
- 3) *Construct an external (uncrossed) common tangent between two different circles of diameters 60mm and 30mm respectively, where center to center distance of circles is 70mm.*
- 4) *Construct an internal (crossed) common tangent between two different circles of diameter 60 mm and 30mm respectively, where center to center distance of circles is 70.*

### 2.3 Conic section

- 1) *Construct an ellipse when the distance of the focus from directrix is 35mm and eccentricity is  $\frac{2}{3}$ . (Definition /eccentricity method)*
- 2) *Construct an ellipse by using rectangle/oblong method, where the major axis is 100mm and minor axis is 70mm.*
- 3) *Construct an ellipse by using concentric circle method, where the major axis is 100mm and minor axis is 70 mm.*

- 4) Construct an ellipse by using four center methods, where the major axis is 100mm and minor axis is 70 mm.
- 5) Draw a parabola, given the distance of the focus from directrix is 40mm.
- 6) Draw a parabola by using rectangle method where base of parabola is 70mm and height of axis is 60mm.
- 7) Draw a parabola by using triangular/tangent method where base of parabola is 70mm and height of axis is 60mm.
- 8) Construct a hyperbola when the distance of the focus from directrix is 35mm and eccentricity is  $3/2$ . (Definition /eccentricity method)

## 2.4 Curves and helix

- 1) Draw a cycloid of circle of diameter 40mm.
- 2) Draw epicycloids from the given generating circle of diameter 30mm and directing circle of diameter 90mm.
- 3) Draw hypocycloids from the given generating circle of diameter 30mm and directing circle of diameter 90mm.
- 4) Draw an inferior trochoid from the given rolling circle of diameter 40mm and the fixed point is 8mm away from the center of the circle.
- 5) Draw a superior trochoid from the given rolling circle of diameter 40mm and the fixed point is 8mm away from the center of the circle.
- 6) Draw an Archimedean's spiral of one convolution, where the radius of circle is 40mm.
- 7) Draw an Archimedean's spiral of one convolution, where the radius of circle is 40mm and the point is 10mm away from the center.
- 8) Draw involutes of equilateral triangle of sides 30mm.
- 9) Draw involutes of regular pentagon of sides 20mm.
- 10) Draw involutes of circle of diameter 30mm.
- 11) Draw a cylindrical helix of one convolution, where the diameter of cylinder is 60mm and height is 90mm.
- 12) Draw a cylindrical helix of two convolutions, where the diameter of cylinder is 60mm and height is 90mm.
- 13) Draw a conical helix of one convolution, where the base diameter of cone is 60mm and axial height is 90mm; also show the top view of the helix.

## 2.5 Basic Descriptive Geometry

### 2.51 Projection of Points

*Draw the projections of the following points*

- 1) Point A, 30mm in front of VP and 35mm above HP
- 2) Point B, 40mm in front of VP and in the HP.
- 3) Point C, 20mm behind VP and 25mm above HP.
- 4) Point D, 35mm behind VP and in the HP.
- 5) Point E, 20mm behind VP and 30mm below HP
- 6) Point F, in the VP and 50mm below HP.
- 7) Point G, in the HP and VP.

### 2.52 Projection of Lines.

*Draw the projection of the following lines.*

- 1) Line AB, 40mm long, parallel to HP and VP both, when the distance from HP and VP is 20mm and 30mm respectively.
- 2) Line CD, 45mm long contained by HP, and perpendicular to VP, when one of its end is 20mm away from the VP.
- 3) Line EF, 50mm long, contained by HP and inclined to VP at  $45^\circ$ , when one of its end is 15mm from the VP.
- 4) Line KL, 40mm long, contained by both HP and VP.
- 5) Draw the projection of the line MN when its end M is 10mm from the HP and 15mm from the VP and end N is 30mm from the HP and 40mm from the VP. Its end projectors are 40mm apart.
- 6) The front view of line inclined at  $30^\circ$  to the VP is 60mm long. Draw the projection of the line, when it is parallel to and 40mm above the HP, its one end being 30mm in front of the VP.

### 2.52 Projection of Planes.

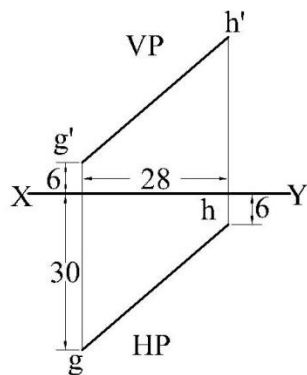
*Draw the projection of the following Planes.*

- 1) A square lamina ABCD, having 25mm side is parallel to HP and is 10mm from it. Its side nearer to VP is parallel to and 10mm from VP. Draw its projection.
- 2) A square plane ABCD of 40mm side is parallel to HP with one of its side inclined at  $60^\circ$  to VP and one corner of square close to the VP is 15mm in front of VP and 20mm above the HP. Draw its projections.
- 3) A  $60^\circ$  set square of 40mm longest side, is so kept, that the longest side is in the HP making an angle of  $30^\circ$  with XY line. Draw the projections of the set square if it is perpendicular with HP.
- 4) An equilateral triangle ABC, side 30 mm has its corner A in HP and side AC inclined at  $45^\circ$  to VP. The corners A and B are in VP. Draw its projections, if the plane is perpendicular with Hp.
- 5) A regular pentagon ABCDE, of 20mm sides has its one corner A in the HP and the side CD is parallel to HP. Draw its projections when its plane is parallel to and 10mm from the VP.

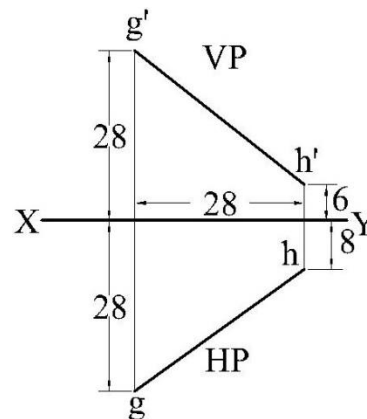
- 6) A regular hexagon of 25mm side has one side in HP. The plane is inclined at  $30^\circ$  to the VP and perpendicular to the HP. The nearest corner to the VP is 20mm in front of VP. Draw the projections of the plane.
- 7) A regular hexagonal plate having negligible thickness of sides 25mm is perpendicular to the HP and inclined with VP at  $45^\circ$ . One side of hexagon nearest to the HP is parallel to HP and 20mm above from it. The nearest corner to the VP is 20mm in front of it. Draw its projection.
- 8) Draw the projection of a thin circular sheet of 50mm diameter and negligible thickness, when its plane is inclined at  $45^\circ$  to the VP and is perpendicular to the HP. A point on its circumference and nearest to the VP is 40mm away from HP and 14mm from the VP.

## 2.53 True Length of line & Its Projection

**Reproduced the given views of the lines and determine the true length. (Using auxiliary plane method and rotation method).**



(Figure: 2.53-1)



(Figure: 2.53-2)

- a) A line AB 60 mm long has its end A in both VP and HP. It is inclined at  $45^\circ$  to the HP and  $30^\circ$  to the VP. Draw its projections.
- b) A line AB, 60mm long, is inclined at  $30^\circ$  to the HP. Its end A is 10mm above HP and 15mm in front of VP. Its front view measures 35mm long. Draw the top view of AB and determine the inclination with VP.
- c) A line AB 60mm long makes  $45^\circ$  and  $30^\circ$  with VP and HP respectively. Draw its projections when end A is 10mm in front of VP and 20 mm above HP.
- d) The top view of straight line AB 60 mm long, measures 42mm while front view is 49mm. Its end A is in the VP and 12 mm above HP. Draw its projection and determine the inclination with HP and VP.
- e) A line 70 mm long has its end A at 10mm above HP and 15mm in front of VP. Its front view and top view measure 50 mm and 60 mm respectively. Draw the projections of line and determine its inclination with VP and Hp.

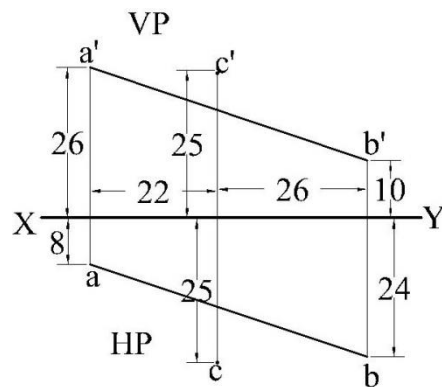
f) Distance between the end projectors of a straight line AB is 40 mm. End A is 40 mm behind VP and 20 mm below HP and end B is 5 mm behind VP. The line is inclined at  $30^\circ$  to the HP. Draw its projection and also find the true length.

g) A line AB, inclined at  $30^\circ$  to the VP has its ends 50mm and 20mm below HP. The length of its front view is 65mm and its VT is 10 mm below the HP. Find its TL and inclination with HP.

## 2.54 Shortest Distance

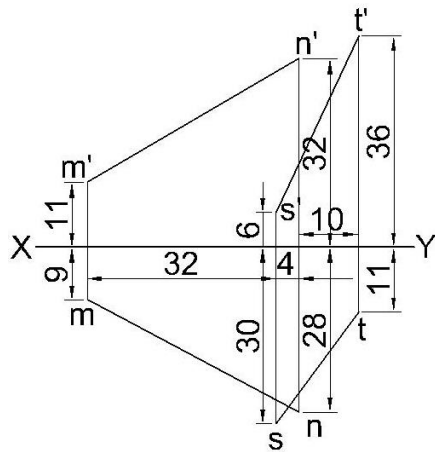
Reproduce the given views of line AB & point C and determine the shortest distance between line & point.

Figure 1.3



(Figure: 2.54-1)

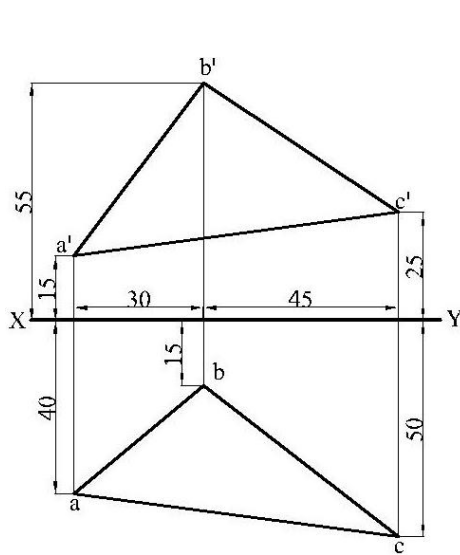
Reproduce the given views of line MN and ST, and find the shortest distance between lines.



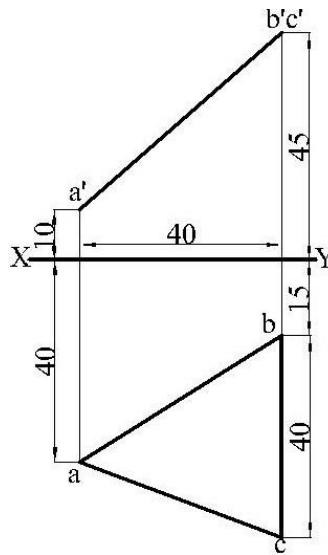
(Figure: 2.54-2)

## 2.55 True Shape of Planes

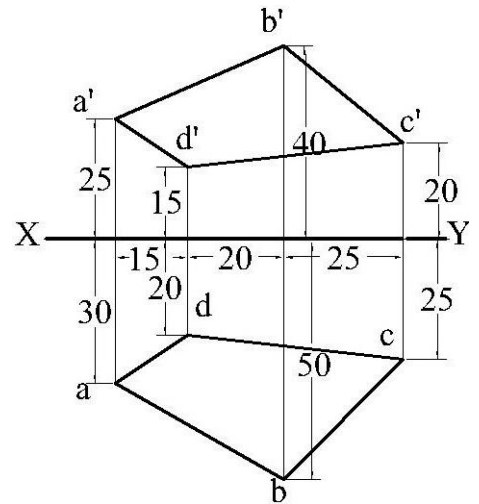
Reproduced the given views of plane and draw the true shape. (Using auxiliary plane method).



(Figure:2.55-1)

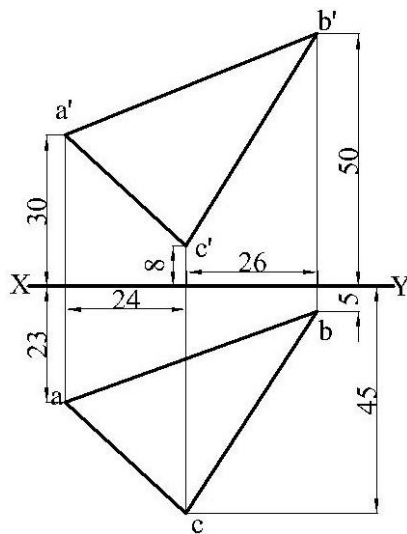


(Figure: 2.55-2)



(Figure: 2.55-3)

Reproduced the given views of plane and find its true shape ( rotation method).



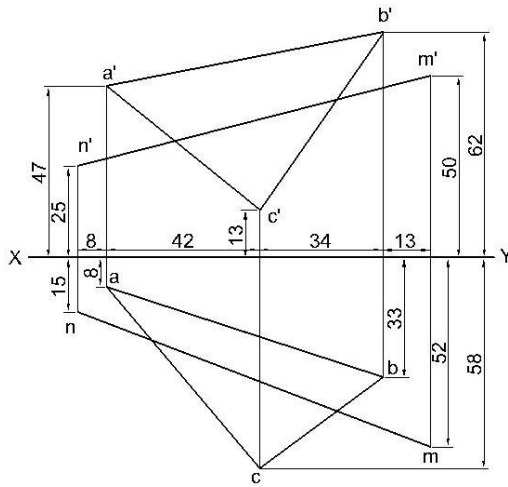
(Figure: 2.55-4)

Draw the true shape of given triangular plane from the given co-ordinates.

	X	Y	Z
A	75	20	10
B	40	10	45
C	0	50	20

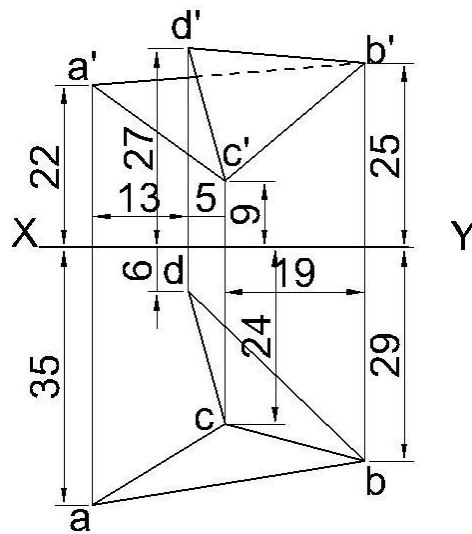
## 2.56 Inclination

*Reproduce the given views of plane ABC and line MN and determine the angle between plane and line.*



(Figure: 2.56-1)

*Reproduce the given views of plane ABC and BCD, and find the angle between them.*



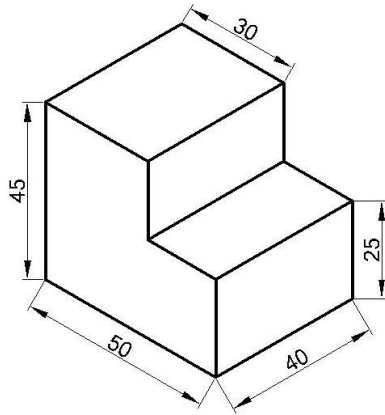
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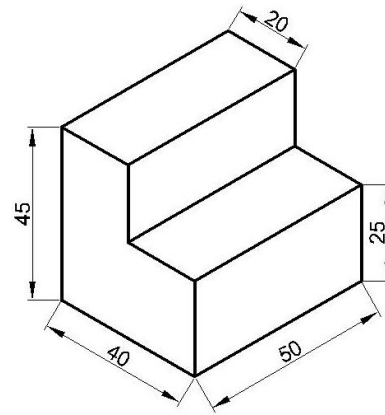
## 3.0 Theory of Projection Drawing

### 3.1 Orthographic Projection

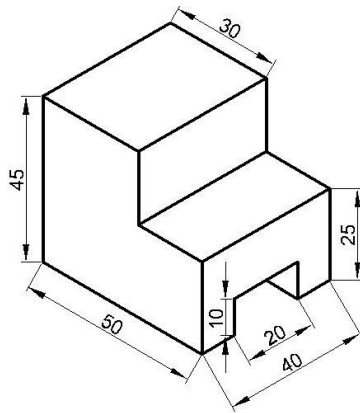
Draw complete orthographic views (Top, Side & Front) of the given solid figures.



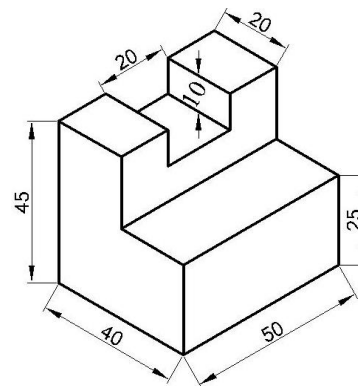
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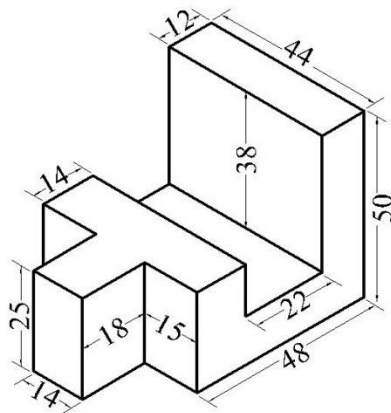
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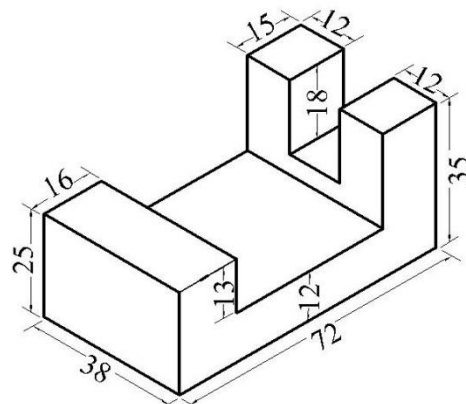
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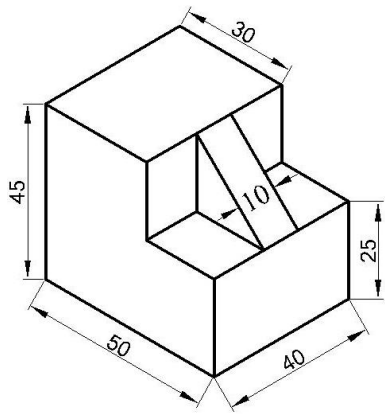
(Figure: 3.1-4)



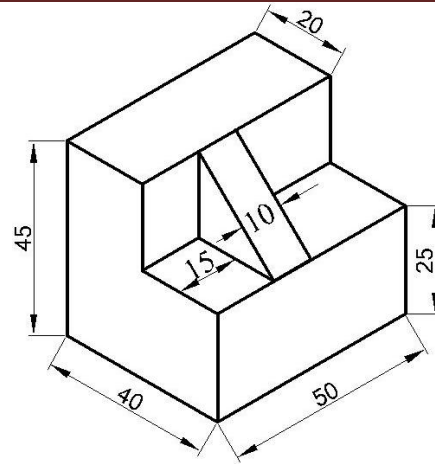
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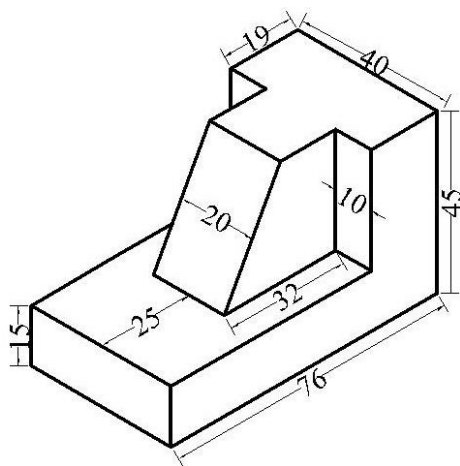
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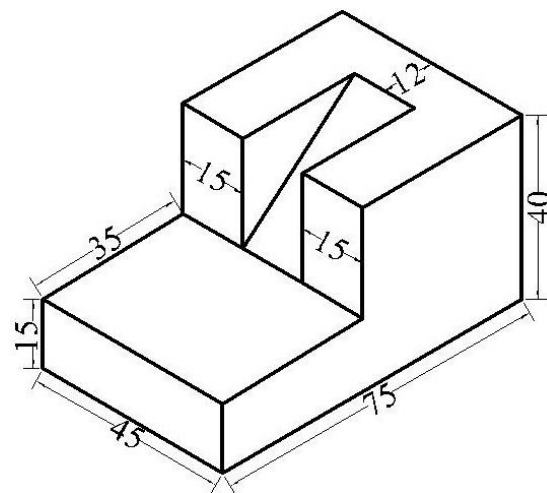
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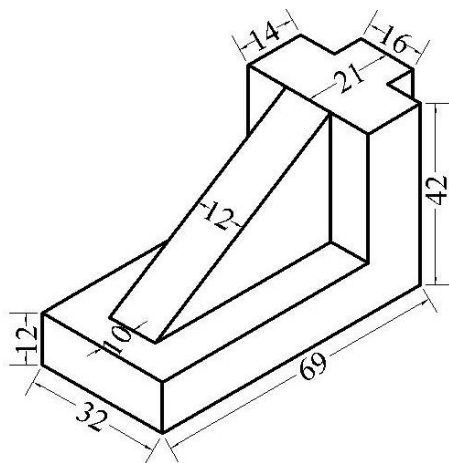
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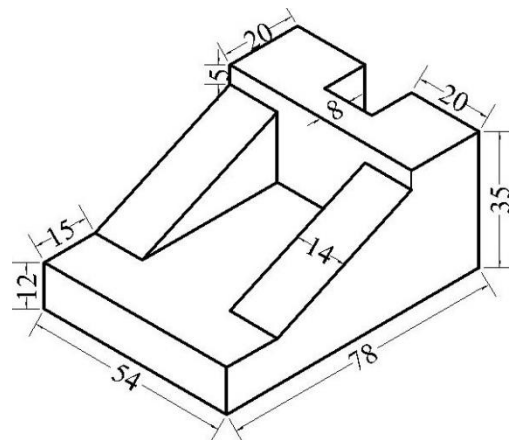
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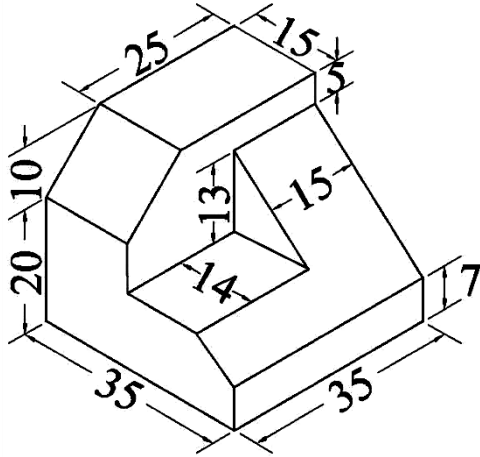
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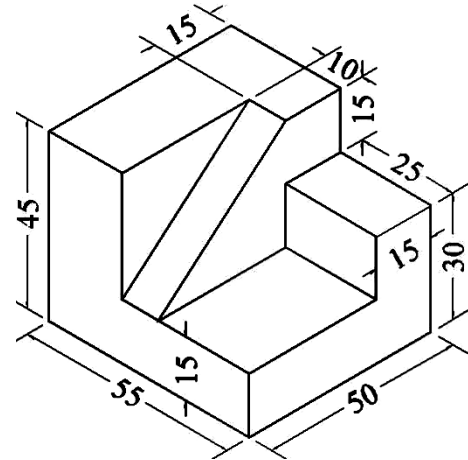
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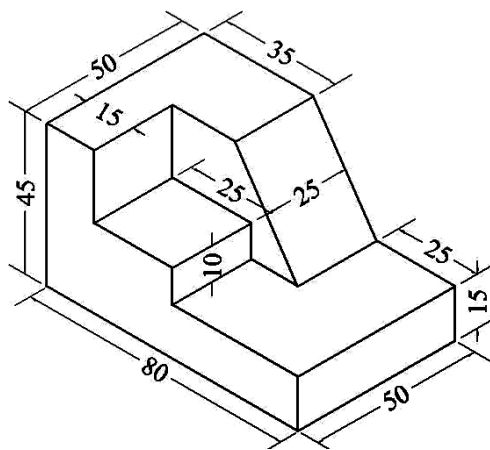
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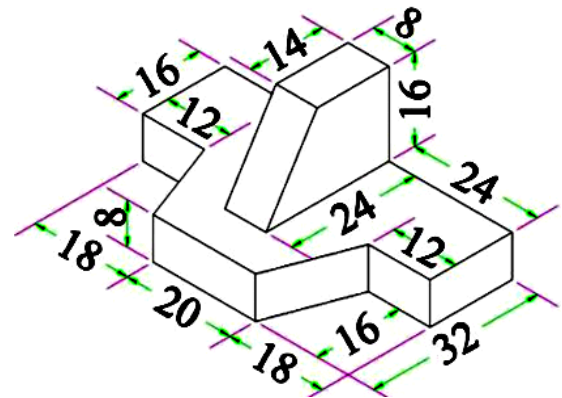
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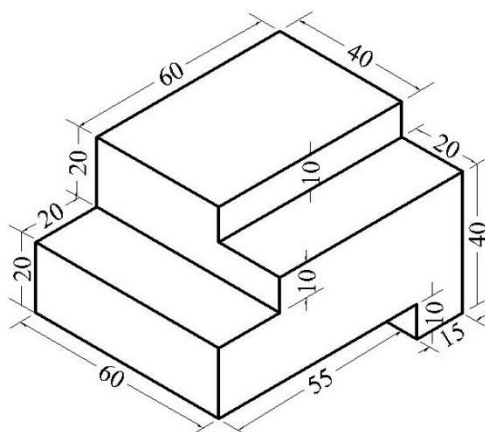
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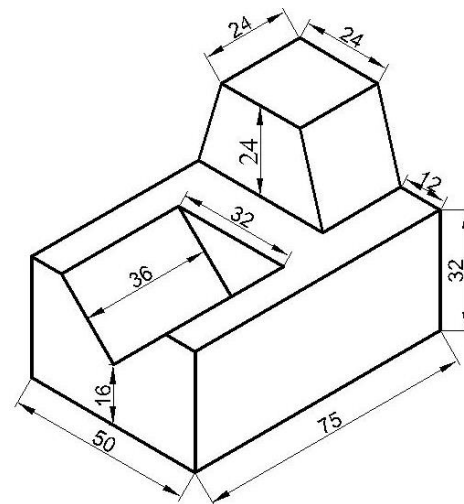
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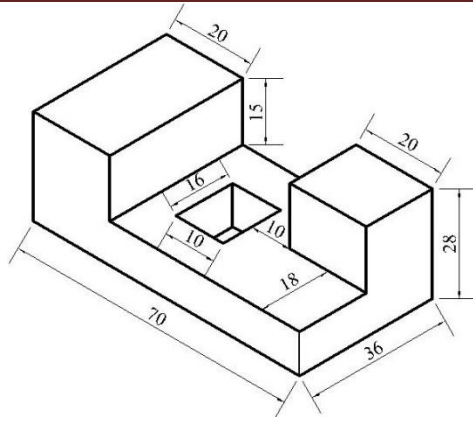
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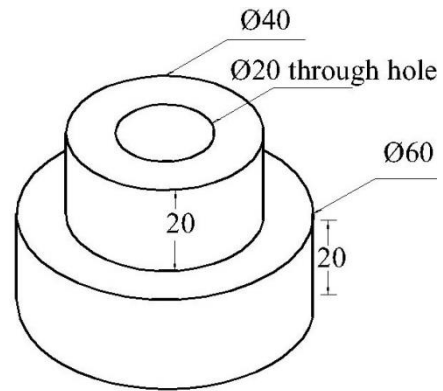
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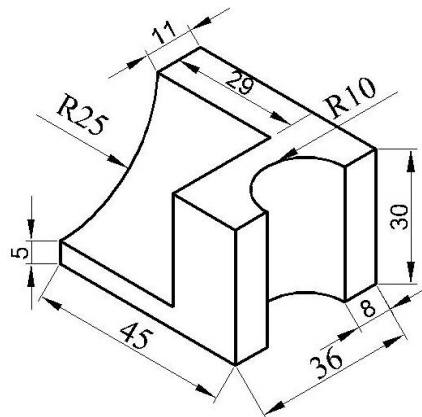
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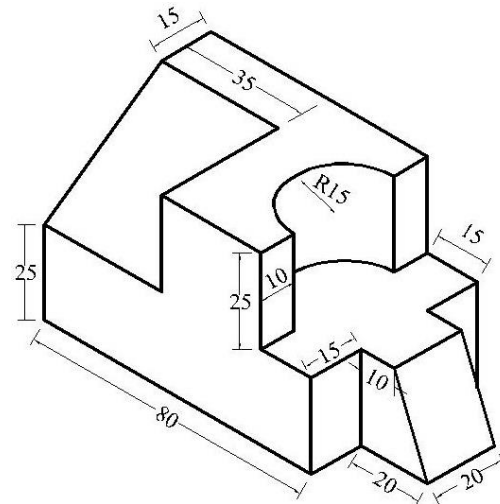
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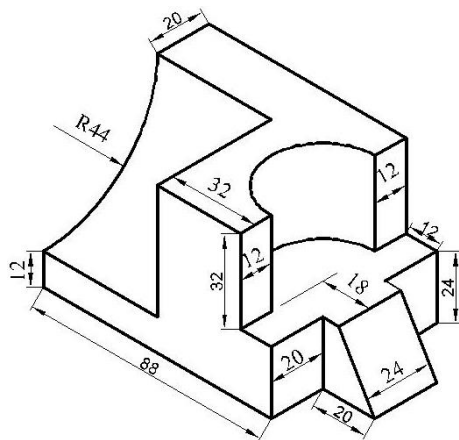
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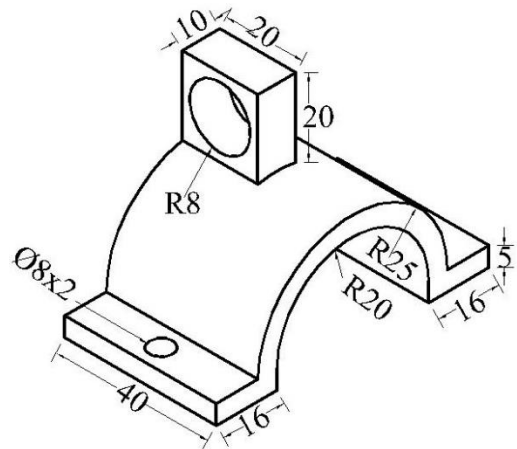
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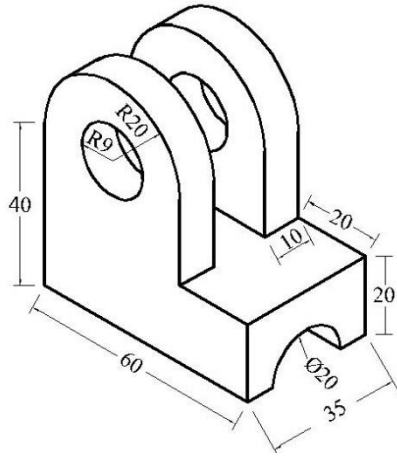
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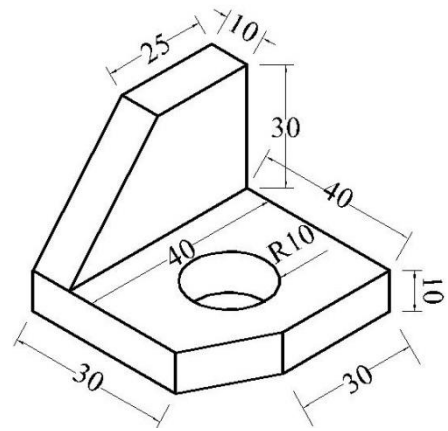
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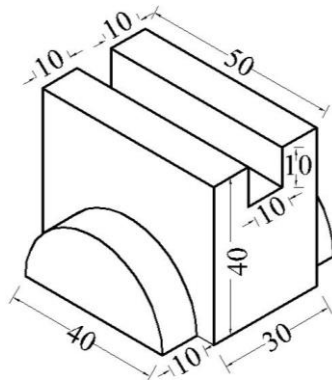
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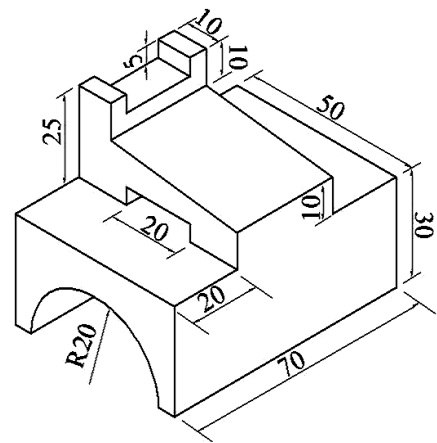
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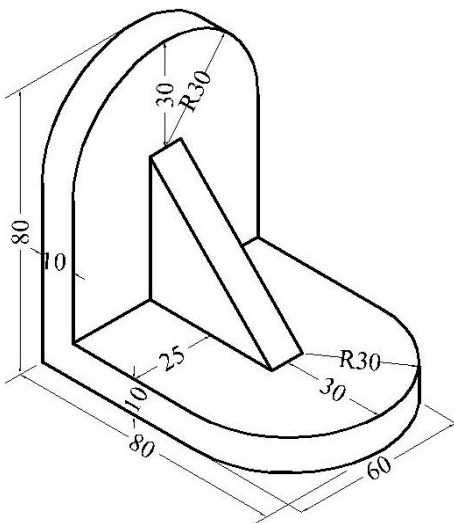
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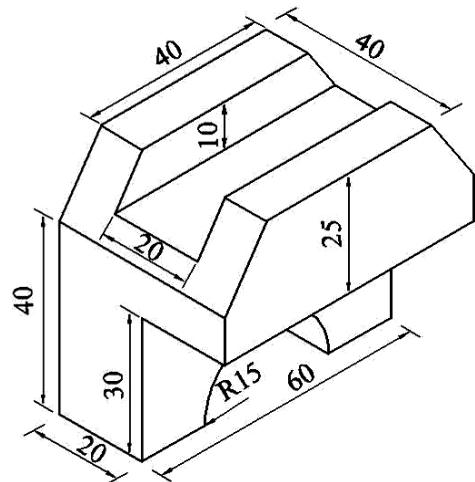
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(Figure: 3.1-28)

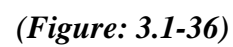
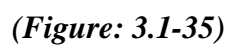
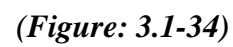
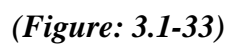
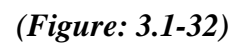
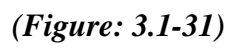


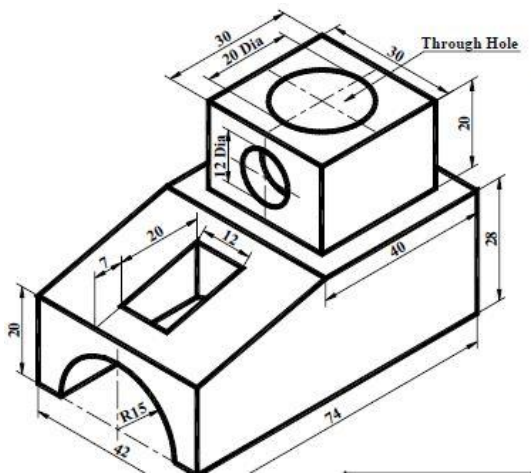
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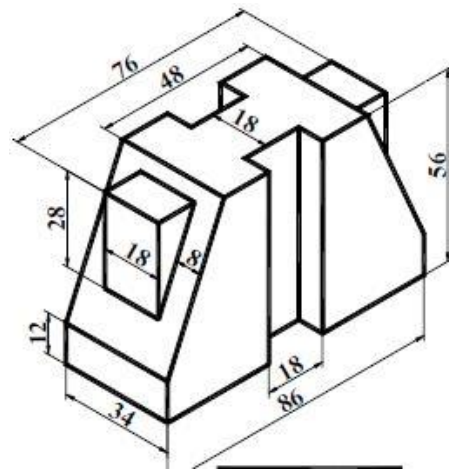
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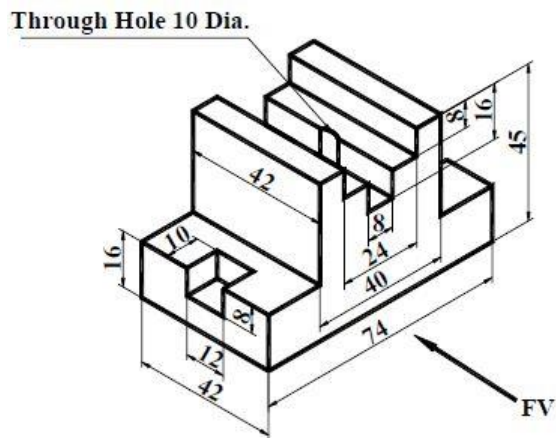




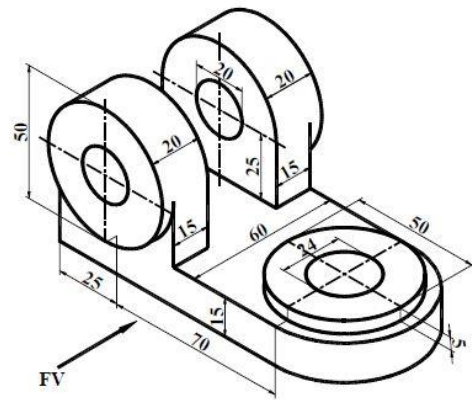
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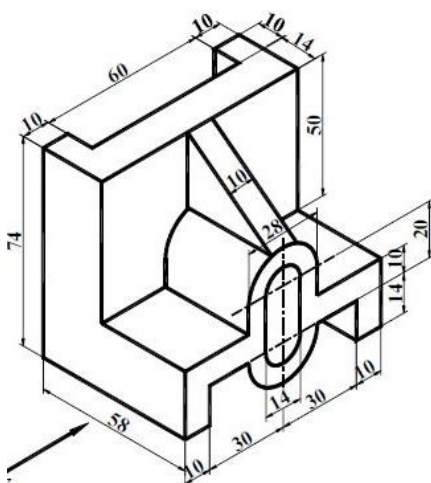
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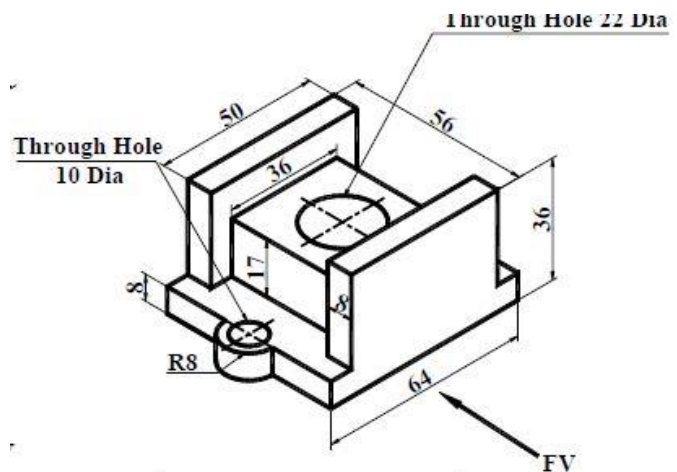
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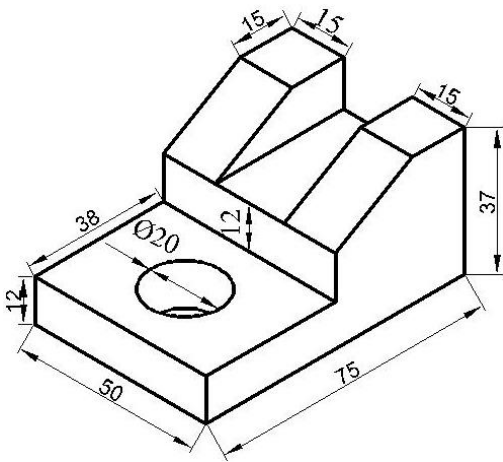
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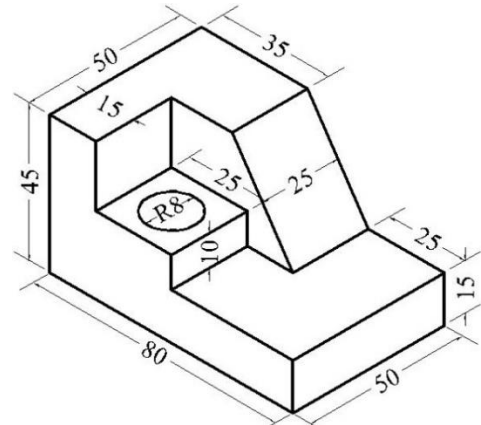
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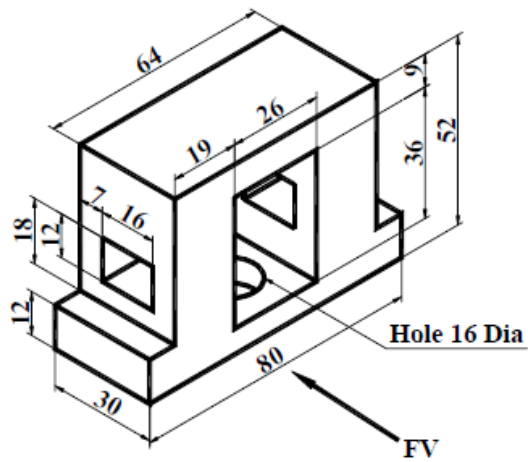
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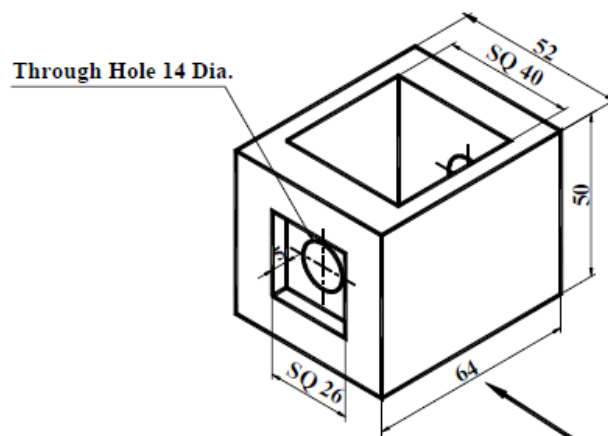
(Figure: 3.1-43)



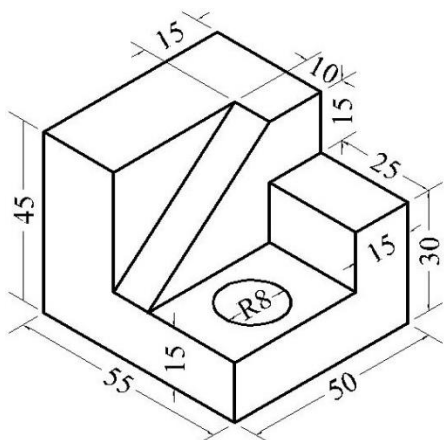
(Figure: 3.1-44)



(Figure: 3.1-45)



(Figure: 3.1-46)

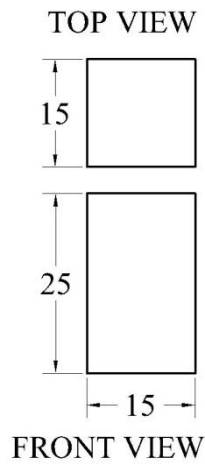


(Figure: 3.1-47)

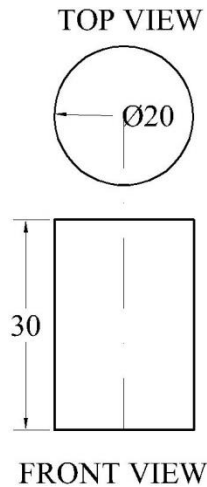


### 3.2 Isometric Projection

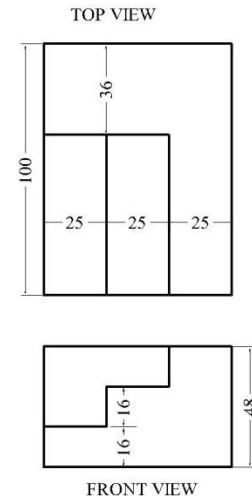
Draw an isometric view from the given orthographic views.



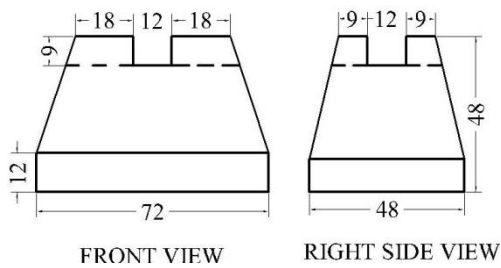
(Figure: 3.2-1)



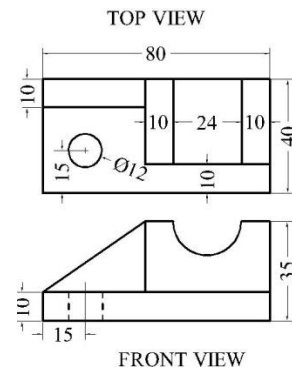
(Figure: 3.2-2)



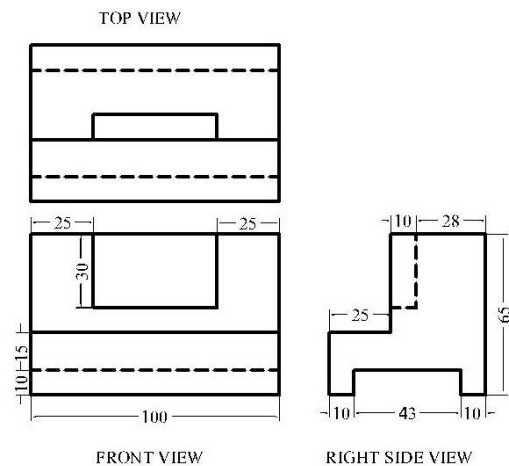
(Figure: 3.2-3)



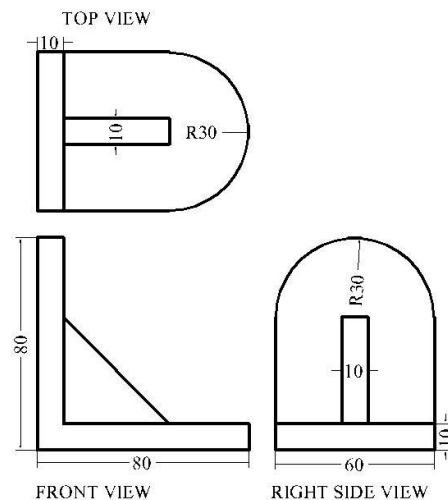
(Figure: 3.2-4)



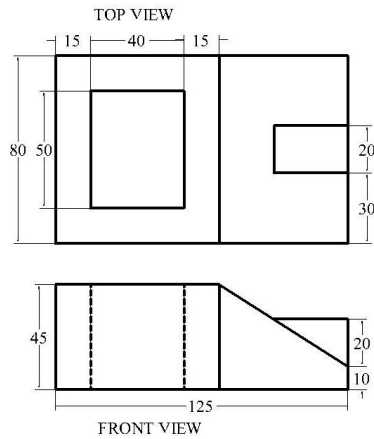
(Figure: 3.2-5)



(Figure: 3.2-6)



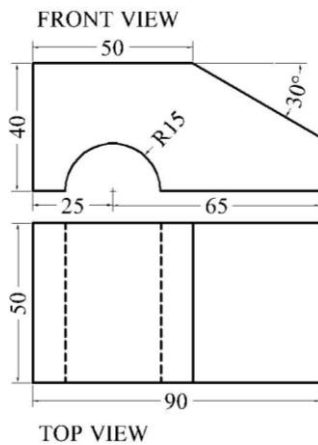
(Figure: 3.2-7)



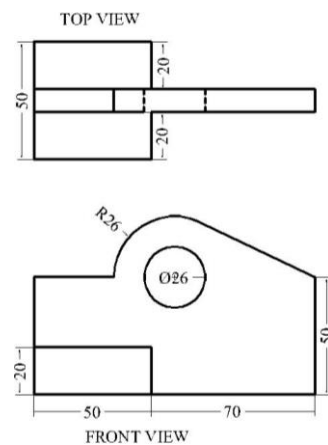
(Figure: 3.2-8)

### 3.3 Oblique projection

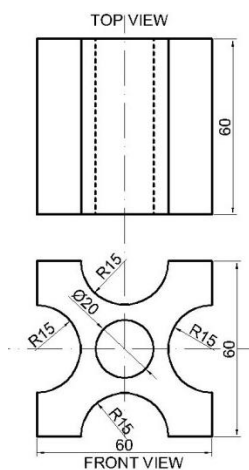
*Draw an oblique view from the given orthographic views.*



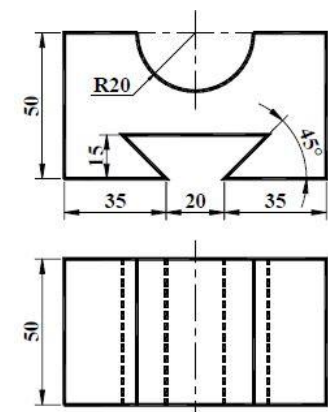
(Figure: 3.3-1)



(Figure: 3.3-2)



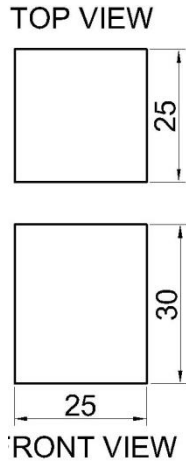
(Figure: 3.3-3)



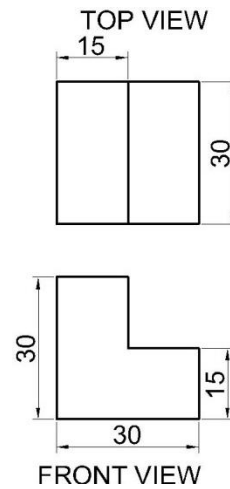
(Figure: 3.3-4)

### 3.4 Perspective Projection

*Draw the perspective projection from the given orthographic views.*



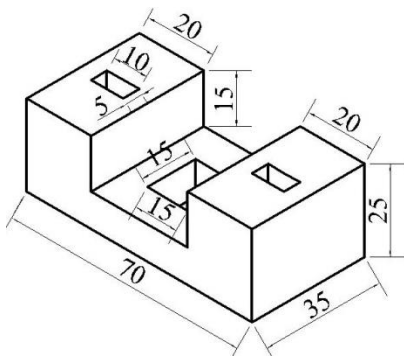
*(Figure: 3.4-1)*



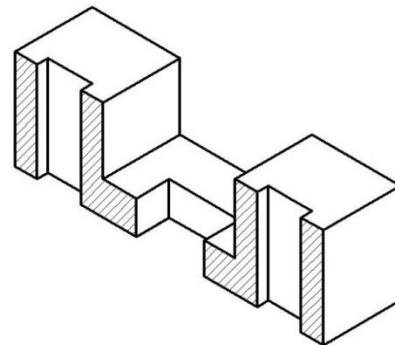
*(Figure: 3.4-2)*

### 3.5 Sectional Views

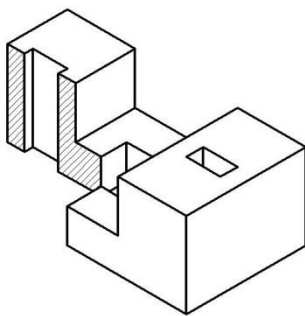
*Draw Full sectional and Half sectional front view of the given solid figures*



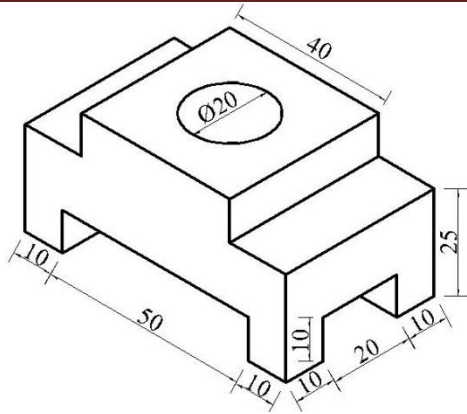
*(Figure: 3.5-1)*



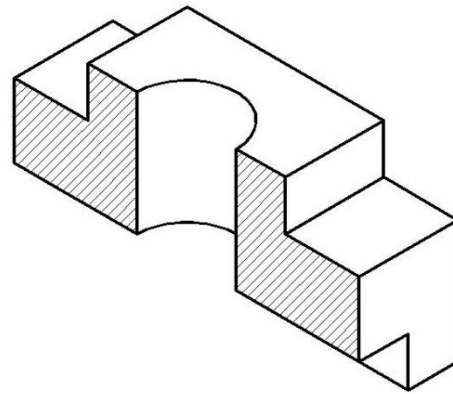
*Full section (Figure: 3.5-1)*



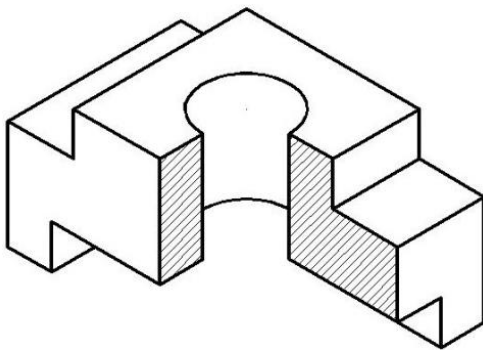
*Half section (Figure: 3.5-1)*



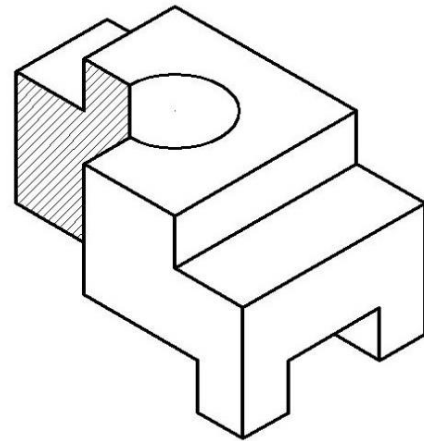
(Figure: 3.5-2)



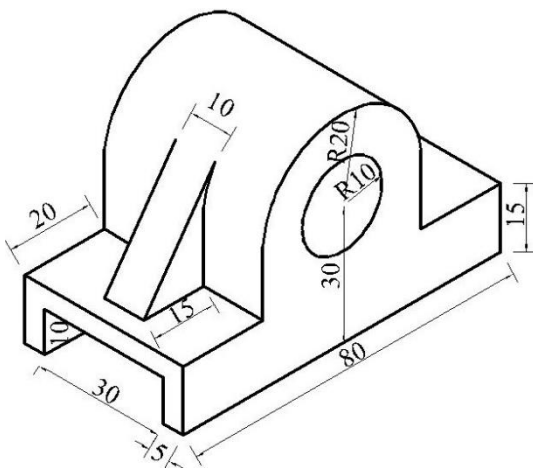
Full section (Figure: 3.5-2)



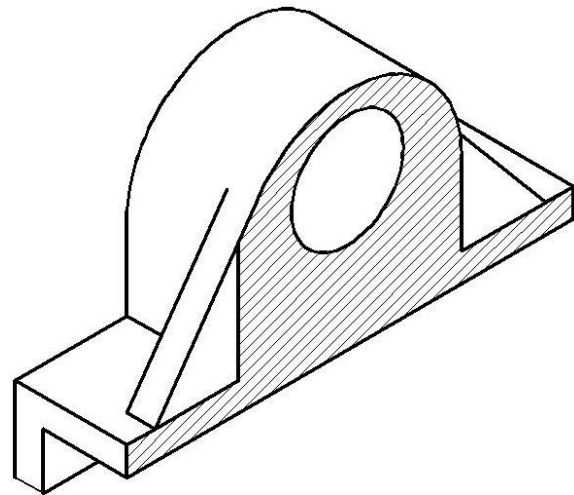
Half section (Figure: 3.5-2)



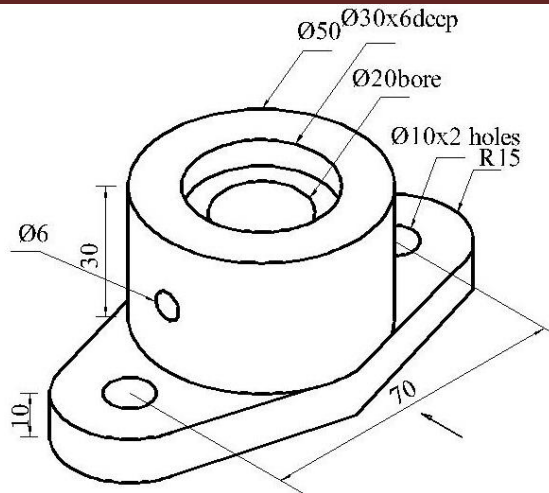
Half section (Figure: 3.5-2)



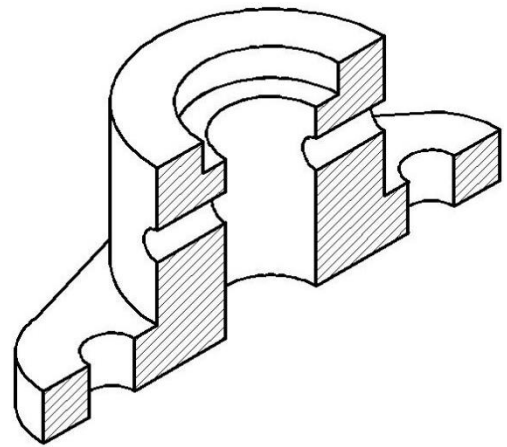
(Figure: 3.5-3)



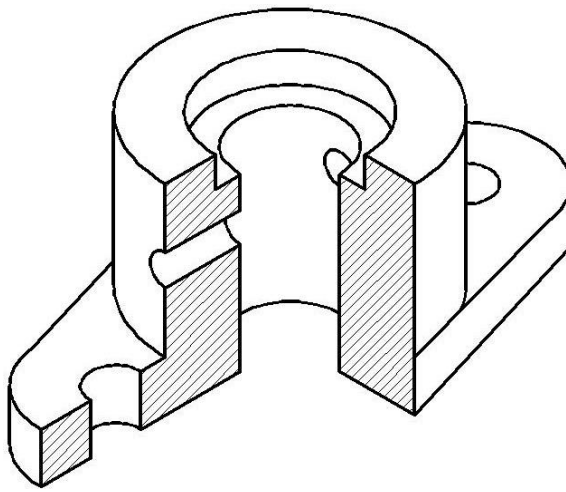
Full section (Figure: 3.5-3)



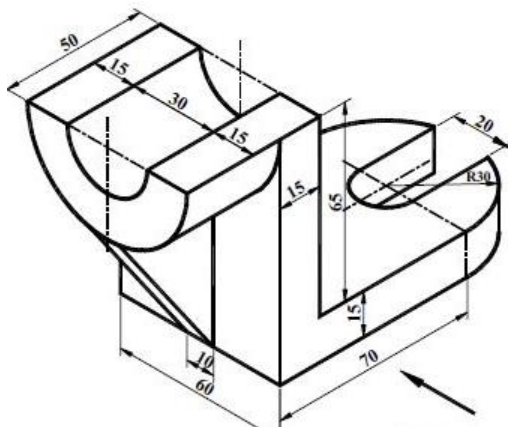
(Figure: 3.5-4)



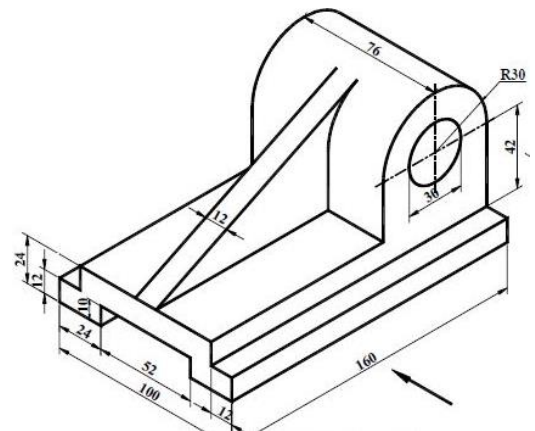
Full section (Figure: 3.5-4)



Half section (Figure: 3.5-4)



(Figure: 3.5-5)

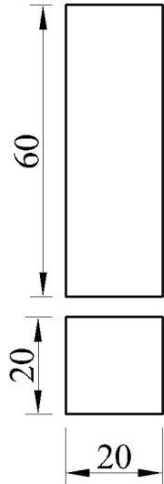


(Figure: 3.5-6)

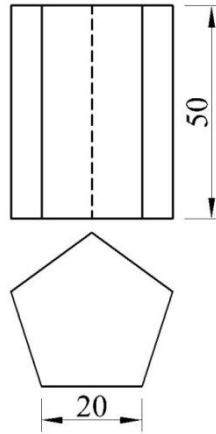
## 4.0 Surface Development and Intersection

### 4.1 Surface Development

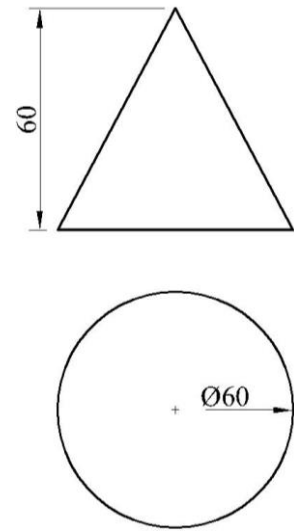
*Reproduced the given views of the right prism, pyramid and cone, and draw complete surface development.*



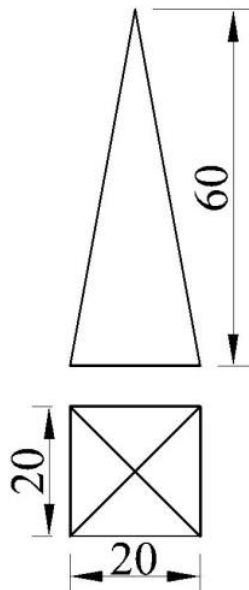
(Figure: 4.1-1)



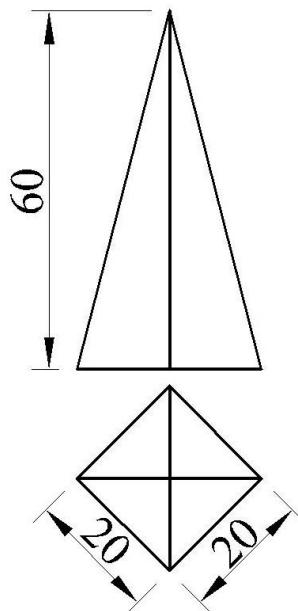
(Figure: 4.1-2)



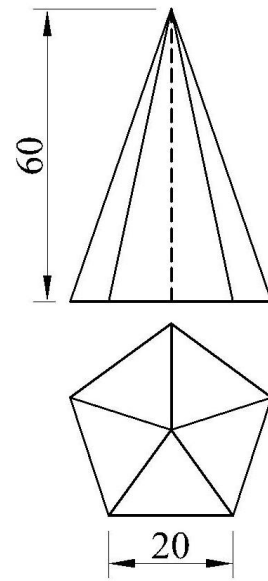
(Figure: 4.1-3)



(Figure: 4.1-4)

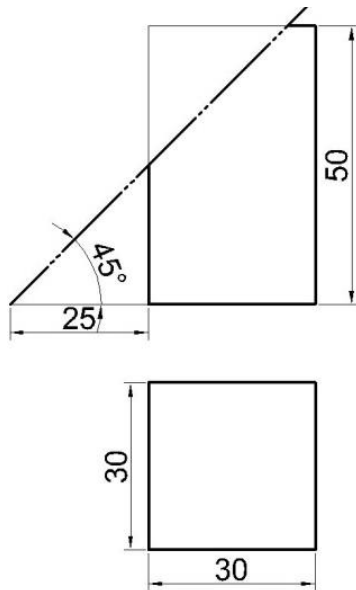


(Figure: 4.1-5)

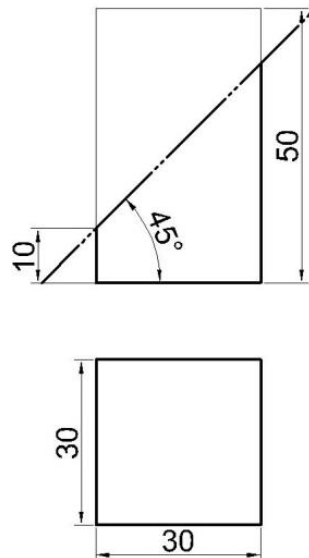


(Figure: 4.1-6)

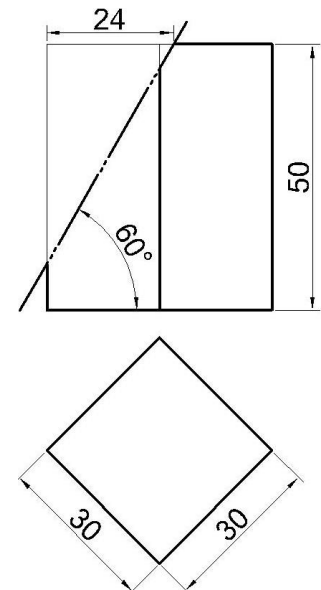
*If a cutting plane cuts the given objects in to given position, as shown in figures. Reproduced the given views of the objects and draw complete surface development and also draw the true shape of the section.*



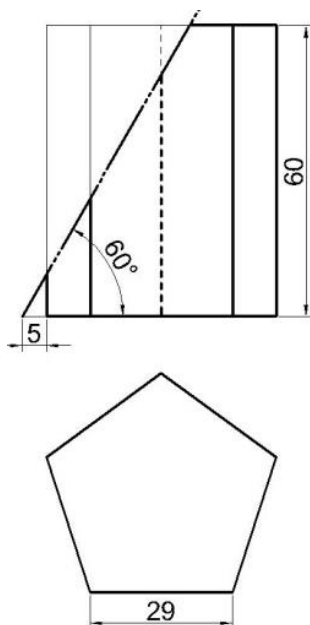
(Figure: 4.1-7)



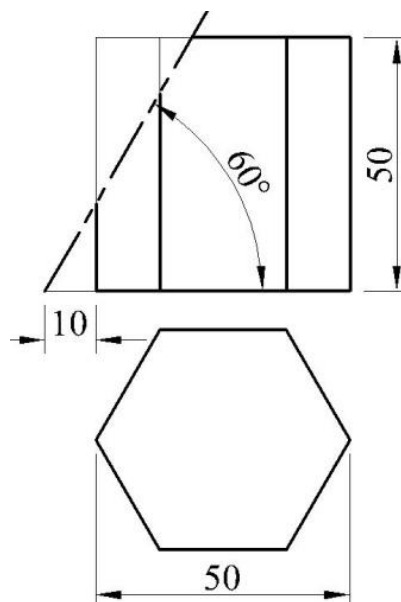
(Figure: 4.1-8)



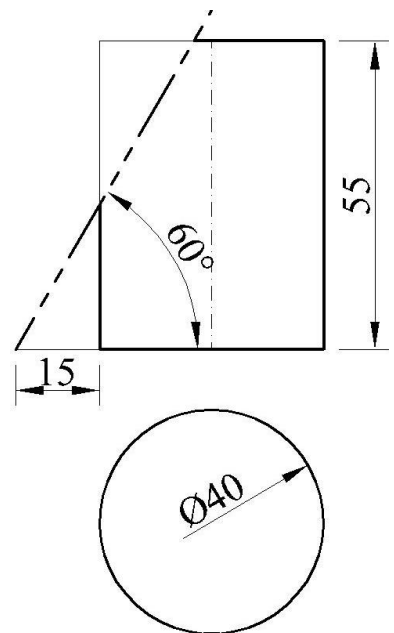
(Figure: 4.1-9)



(Figure: 4.1-10)

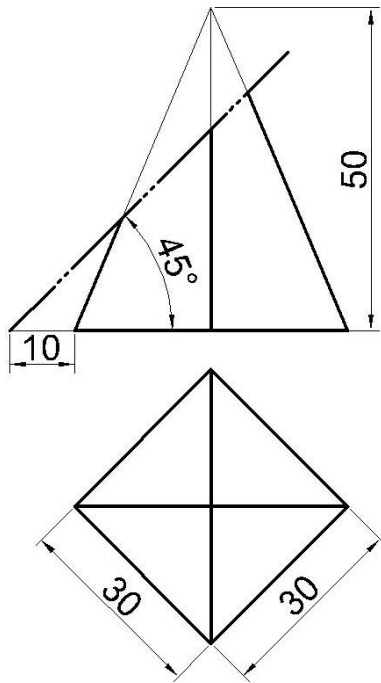


(Figure: 4.1-11)

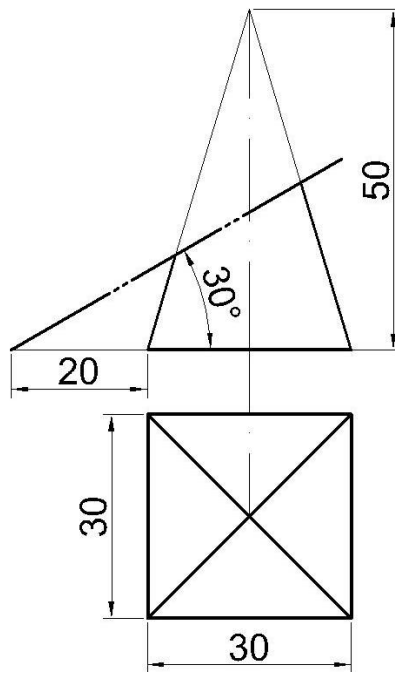


(Figure: 4.1-12)

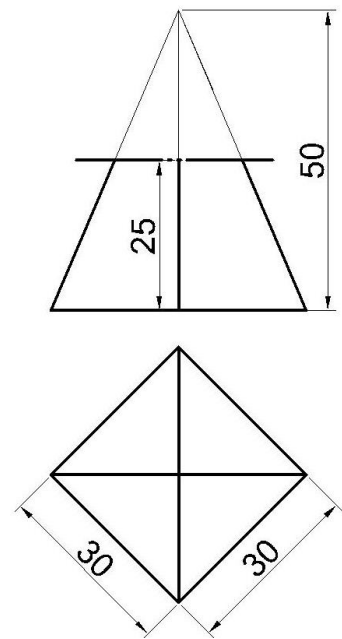




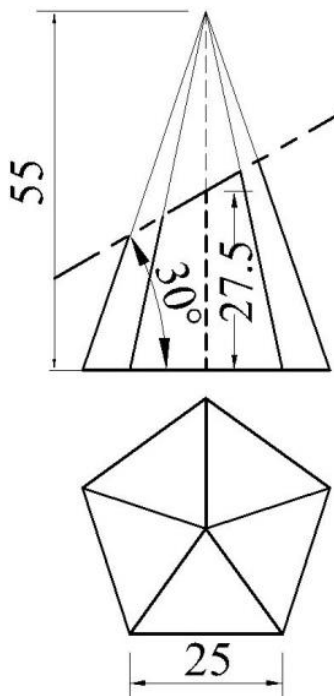
(Figure: 4.1-13)



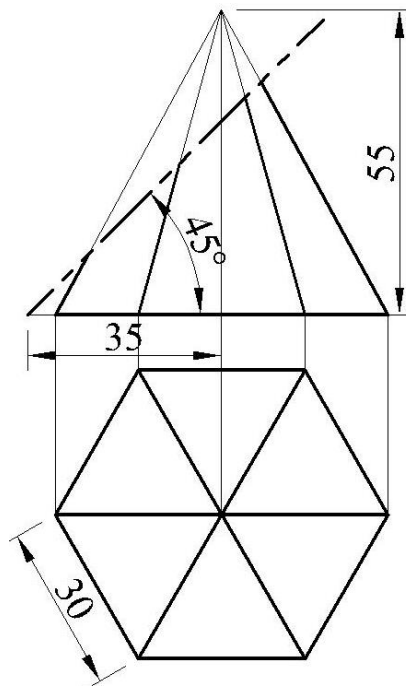
(Figure: 4.1-14)



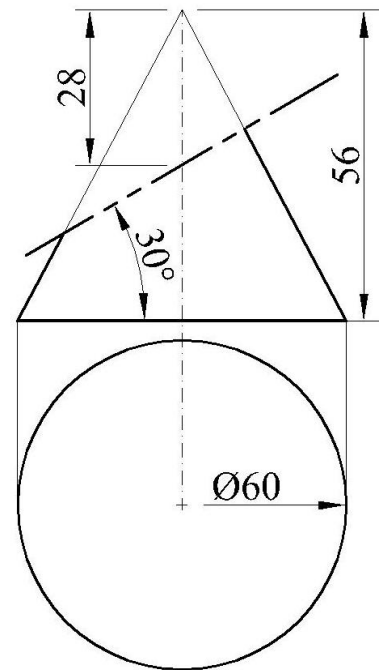
(Figure: 4.1-15)



(Figure: 4.1-16)

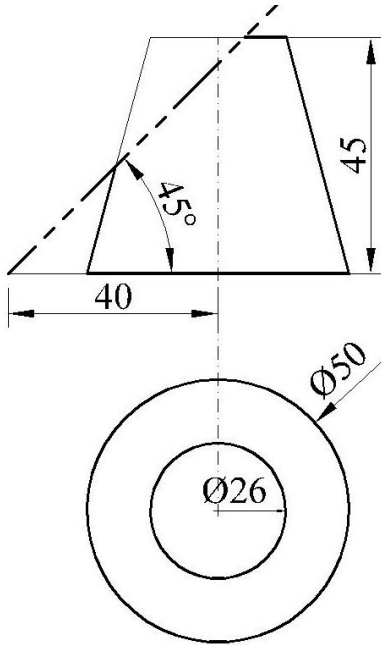


(Figure: 4.1-17)

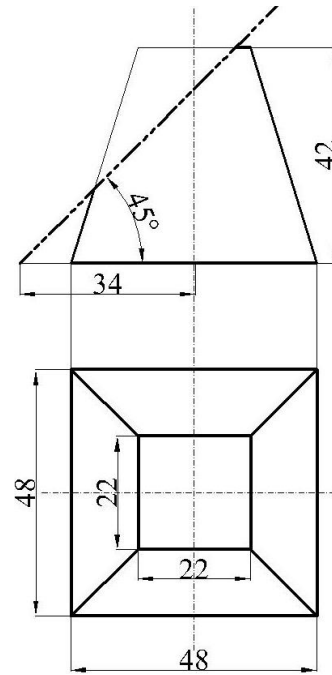


(Figure: 4.1-18)





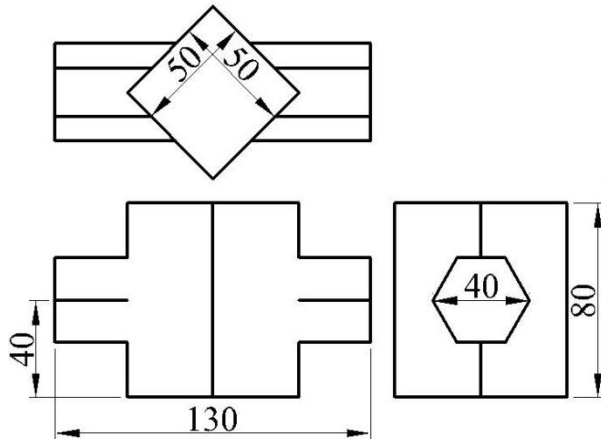
(Figure: 4.1-19)



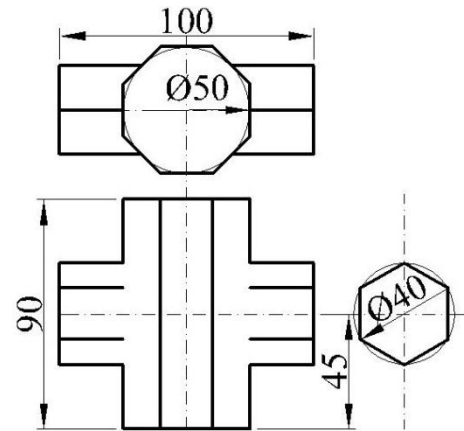
(Figure: 4.1-20)

## 4.2 Intersection

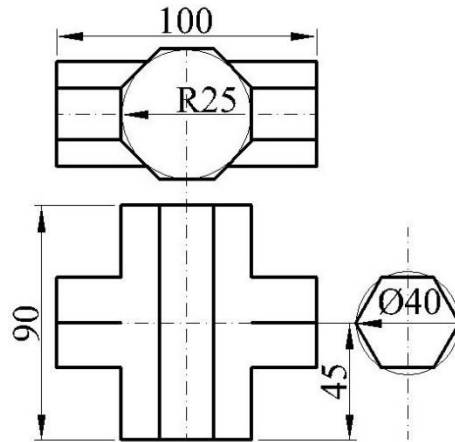
Reproduced the given views of objects and draw the curves /lines of intersection.



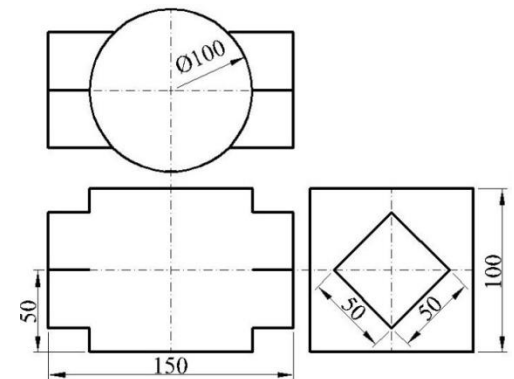
(Figure: 4.2-1)



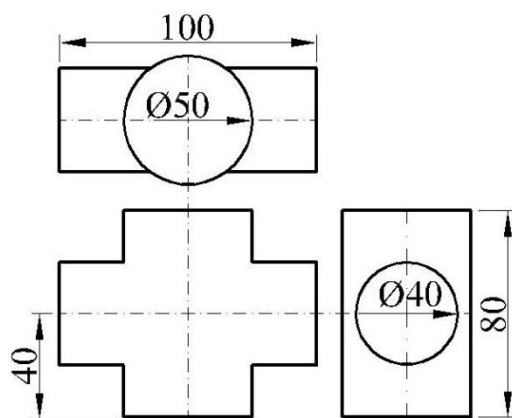
(Figure: 4.2-2)



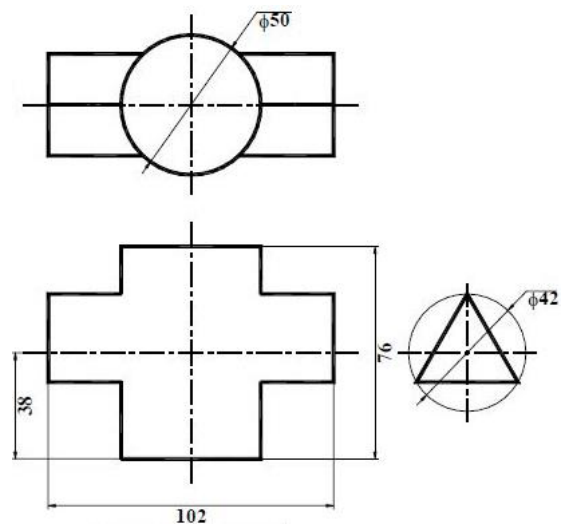
(Figure: 4.1-3)



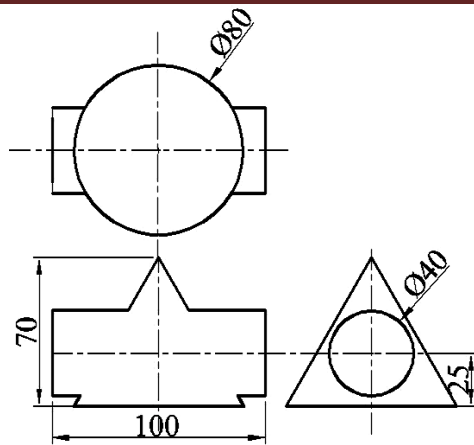
(Figure: 4.1-4)



(Figure: 4.2-5)



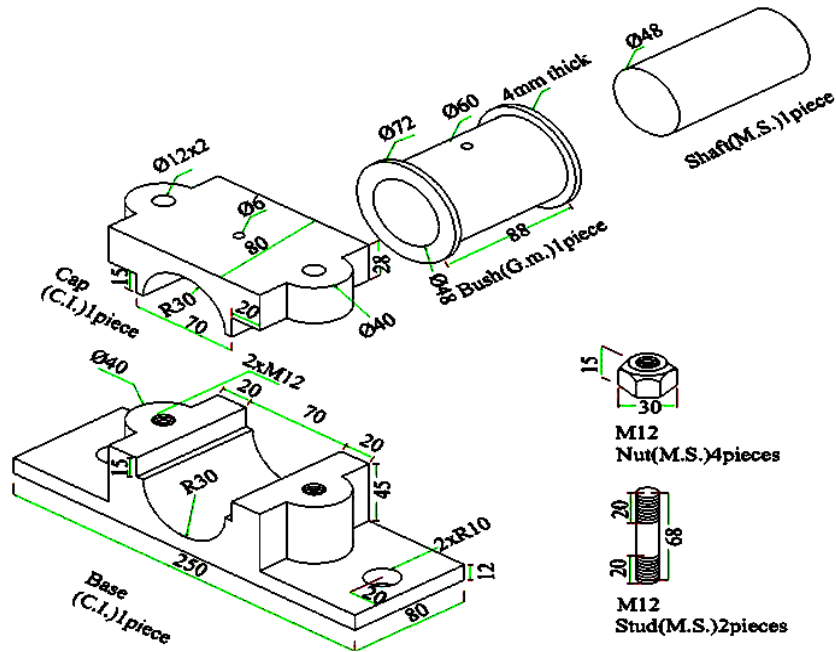
(Figure: 4.2-6)



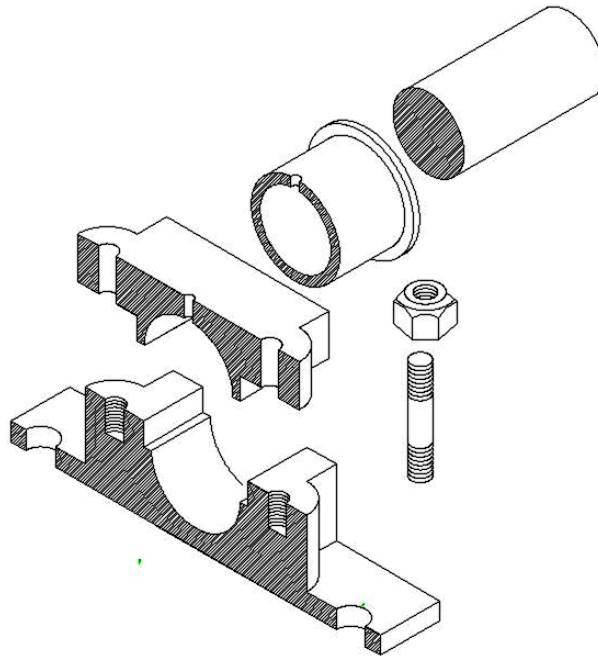
(Figure: 4.2-7)

## 5.0 Machine Drawing

Assembled the given parts of Split Bearing and draw full lsectional front view. (Fig:5.1 & 5.2)

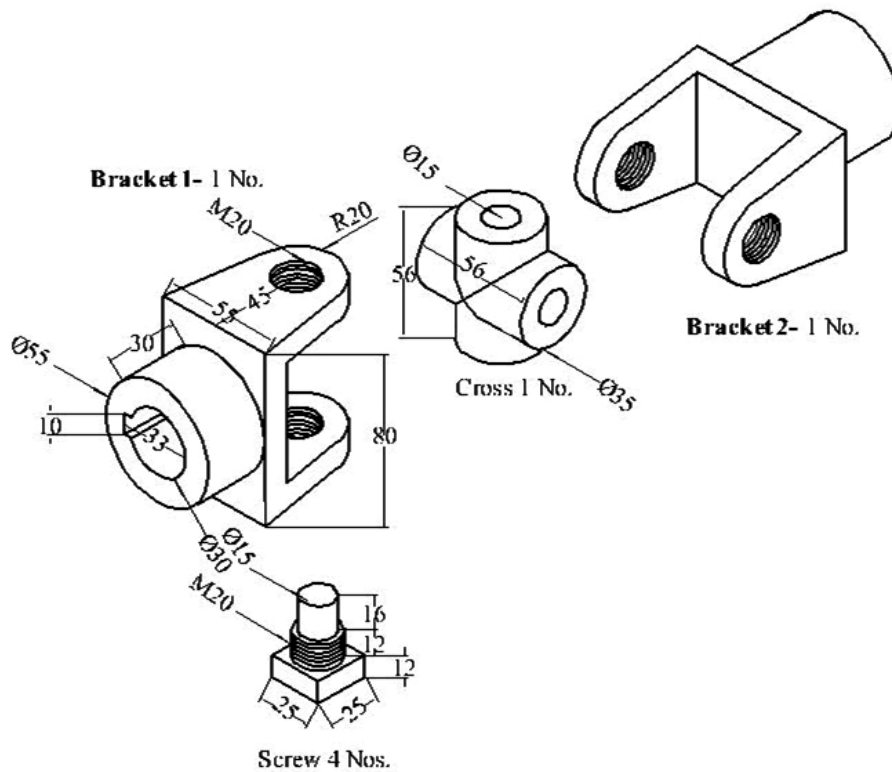


*Pictorial view (Figure: 5.1)*

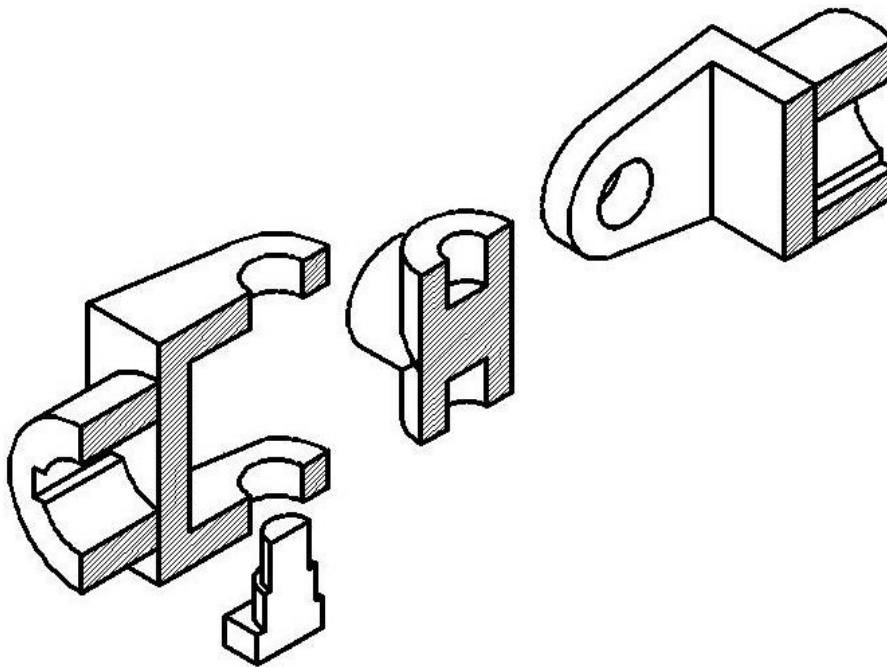


*Full sectional pictorial view (Figure: 5.2)*

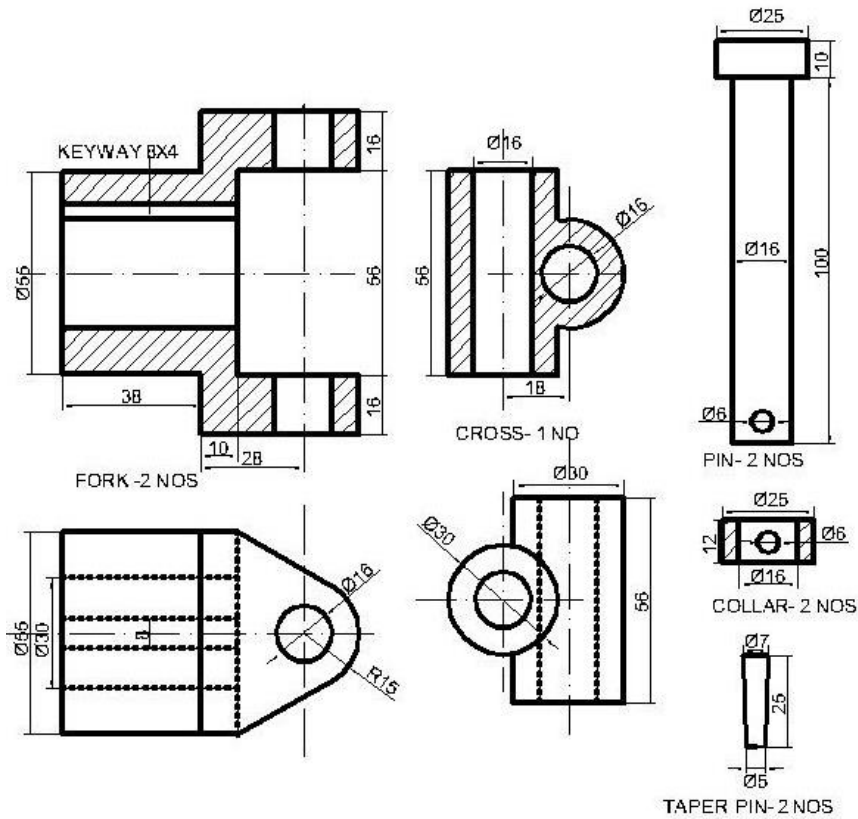
Assembled the given parts of Universal Coupling and draw its full sectional front view. (Fig: 5.3, 5.4 & 5.5)



*Pictorial view (Figure: 5.3)*

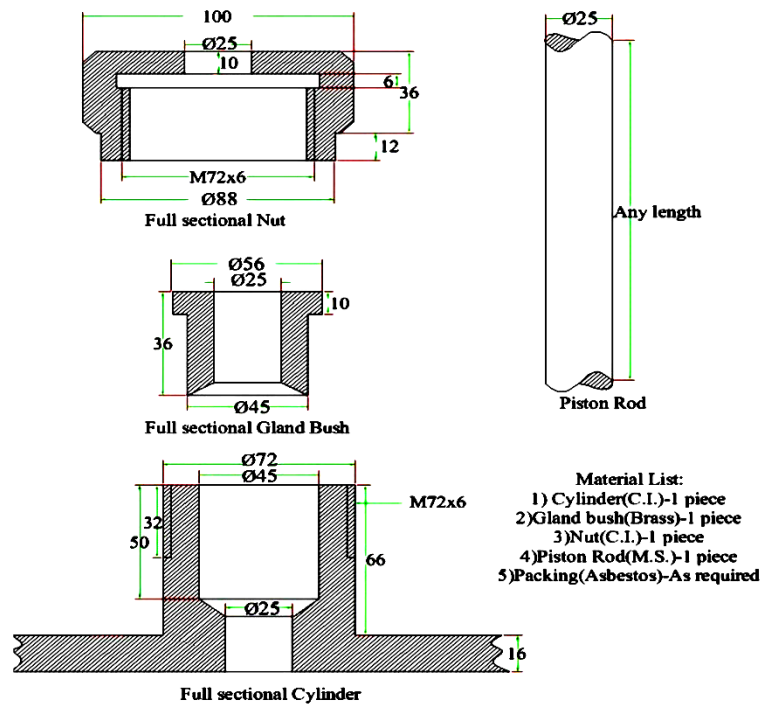


*Full sectional pictorial view (Figure: 5.4)*



*Full sectional front views (Figure: 5.5)*

*Assembled the given parts of Stuffing Box and draw fullsectional / half sectional front view. (Fig: 5.6 & 5.7)*



*Full sectional front view (Figure: 5.6)*

Engineering drawing of a piston and connecting rod assembly. The drawing includes five views: a top view of the piston (1), a side view of the piston (2), a front view of the piston (3), a side view of the connecting rod (4), and a front view of the connecting rod (5). Dimensions are given in mm. The piston has a crown diameter of 88 mm, a skirt diameter of 72 mm, and a skirt thickness of 16 mm. The connecting rod has a big end diameter of 45 mm and a small end diameter of 25 mm. The scale is 1:0.8.

ALL DIMENSIONS IN MM			
5	Packing	1	Asbestos
4	Piston rod	1	C-30
3	Gland bush	1	Brass
2	Nut	1	C.I.
1	Cylinder	1	C.I.

Scale: 1:0.8

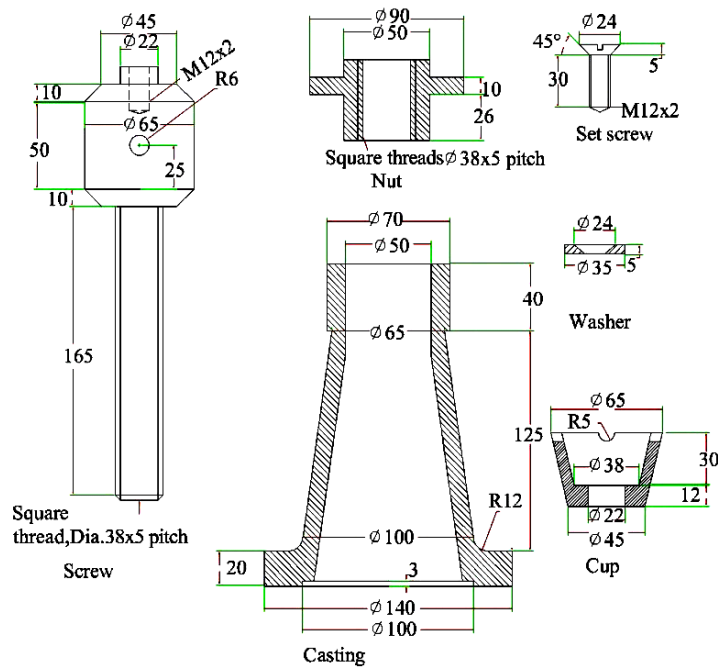
**Assembled the given parts of Knuckle Joints and draw full sectional front view. (Fig: 5.8 &5.9)**



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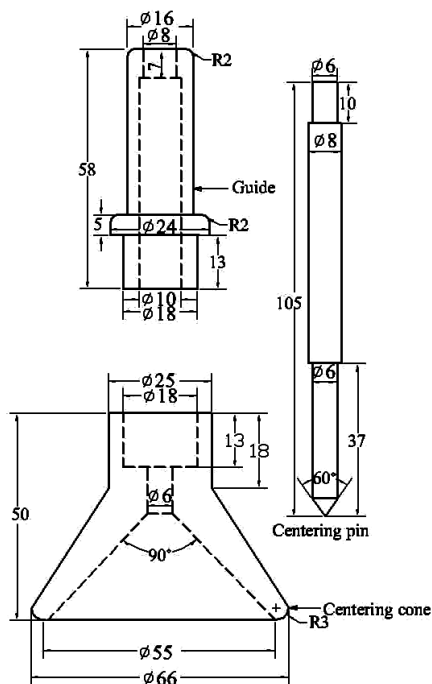
Prepared by: Bibek Pudasaini, Nepal College Of Information & Technology (NCIT), Lalitpur.

Assembled the given parts of Screw Jack and draw full sectional front view.(Fig: 5.10)

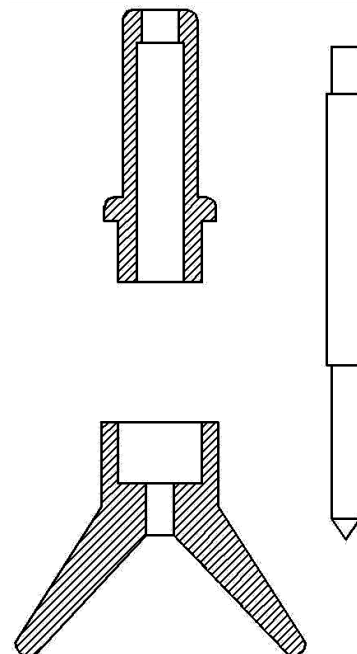


Full sectional views (Figure: 5.10)

Assembled the given parts of Centering Cone and draw full sectional / half sectional front view. (Fig: 5.11, 5.12 & 5.13)

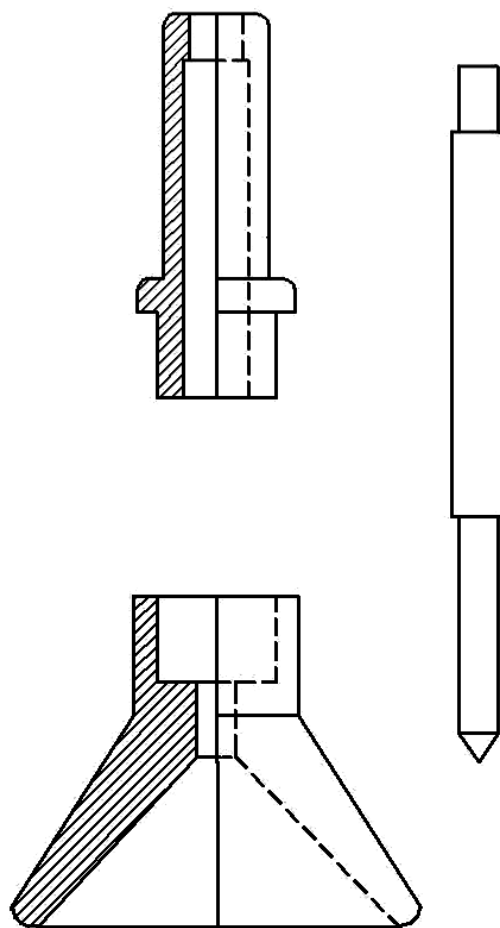


Orthographic views(Figure:5.11)



Full sectional views (Figure: 5.12)





*Half sectional view(Figure: 5.13)*