ME 111: Engineering Drawing

Lecture 6
16-08-2011

Projection of Points and Projection of Lines

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Projection of Points

(Orthographic)
A POINT

Define its position with respect to the coordinates.

With respect to the VP, HP, & PP
Direction of rotation of the HP
Convention

• **Top views are represented by only small letters eg.** *a*.

• **Their front views are conventionally represented by small letters with dashes eg.** *a’*

• **Profile or side views are represented by small letters with double dashes eg.** *a’’*
The line of intersection of HP and VP is denoted as XY.

The line of intersection of VP and PP is denoted as $X_1Y_1$. 
• Projectors and the lines of the intersection of planes of projections are shown as thin lines.
Point in the First quadrant

Point P is 40 mm in front of VP, 50 mm above HP, 30 mm in front of left profile plane (PP)
Point in the First quadrant
Point in the First quadrant

HP & PP Completely rotated
Point in the First quadrant

Procedure

• Draw a thin horizontal line, XY, to represent the line of intersection of HP and VP.
• Draw X1Y1 line to represent the line of intersection of VP and PP.
• Draw the Top View (p).
• Draw the projector line
• Draw the Front View (p')
Point in the First quadrant

Procedure

• To project the right view on the left PP, draw a horizontal projector through \( p \) to intersect the 45 degree line at \( m \).

• through \( m \) draw a vertical projector to intersect the horizontal projector drawn through \( p' \) at \( p'' \).

• \( p'' \) is the right view of point \( P \)
Point in the Second quadrant

Point P is 30 mm above HP, 50 mm behind VP and 45 mm in front of left PP.

Since point P is located behind VP, the VP is assumed transparent.
Direction of rotation of the HP

HP & PP Completely Rotated
Point in the Second quadrant

Point in the II Quadrant

HP & PP Partly Rotated

HP & PP Completely Rotated

Orthographic Projection
**Point in the Third quadrant**

Point P is 40 mm behind VP, 60 mm below HP and 30 mm behind the right PP.

Since the three planes of projections lie in between the observer and the point P, they are assumed as transparent planes.
Point in 3rd quadrant

Point in the III Quadrant

HP & PP Completely Rotated

HP & PP Partly Rotated

Orthographic Projection
Point in the Fourth quadrant

point P is 60 mm below HP, 50 mm in front of VP, 45 mm in front of the left PP.
Point in the Fourth quadrant

Point P in the IV Quadrant

HP & PP Partly Rotated

HP & PP Completely Rotated

Orthographic Projection
First Angle Projection

Object in the first quadrant
• THIRD Angle Projection
  - Object behind plane
Placing the object in the third quadrant puts the projection planes between the viewer and the object.

When placed in the first quadrant, the object is between the viewer and the projection planes.
### Difference between first- and third-angle projections

<table>
<thead>
<tr>
<th>First angle projection</th>
<th>Third-angle projection</th>
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<tbody>
<tr>
<td>Object is kept in the first quadrant.</td>
<td>Object is assumed to be kept in the third quadrant.</td>
</tr>
<tr>
<td>Object lies between observer and the plane of projection.</td>
<td>Plane of projection lies between the observer and the object.</td>
</tr>
<tr>
<td>The plane of projection is assumed to be non-transparent.</td>
<td>The plane of projection is assumed to be transparent.</td>
</tr>
<tr>
<td>Front (elevation) view is drawn above the XY line</td>
<td>Front (elevation) view is drawn below the XY line</td>
</tr>
<tr>
<td>Top (plan) view is drawn below the XY line</td>
<td>Top (plan) view is drawn above the XY line</td>
</tr>
<tr>
<td>Left view is projected on the right plane and vise versa</td>
<td>Left view is projected on the left plane itself.</td>
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<tr>
<td>Followed in India, European countries</td>
<td>Followed in USA</td>
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</tbody>
</table>
Symbol of projection

The method of projection used should be indicated in the space provided for the purpose in the title box of the drawing sheet. The symbol recommended by BIS is to draw the two sides of a frustum of a cone placed with its axis horizontal.
Projections of Lines
Straight line

Locus of a point, which moves linearly the shortest distance between any two given points.

Location of a line

The location of a line in projection quadrants is described by specifying the distances of its end points from the VP, HP and PP.

- Parallel to both the planes.
- Parallel to one plane and perpendicular to the other.
- Parallel to one plane and inclined to the other.
- Inclined to both the planes.
Projection of a line

• Obtained by projecting its end points on planes of projections and then connecting the points of projections.

• The projected length and inclination of a line, can be different compared to its true length and inclination.
Line parallel to a plane

PLANE OF PROJECTION

TRUE LENGTH

PROJECTORS

VIEW

PROJECTION OF A LINE

GIVEN LINE
Line inclined to a plane
Line parallel to both HP & VP

Line of 80 mm length is placed parallel to both HP and VP.

The line is 70 mm above HP, 60 mm in front of VP.

end B is 30 mm in front of right PP.
Line parallel to both HP & VP...

Since the line is parallel to both HP and VP, both the front view a'b' and the top view ab are in true lengths.

Since the line is perpendicular to the right PP, the left side view of the line will be a point a''(b'').
Line perpendicular to HP & parallel to VP

Line of 80 mm length placed parallel to VP and perpendicular to HP.

The line is 60 mm in front of VP and 70 mm in front of right PP.

The lower end of the line is 30 mm above HP.
Line perpendicular to HP & parallel to VP...

Draw the front view \(a'b' = 80\) mm perpendicular to the \(XY\) line, with the lower end \(b'\) lying 30 mm above the \(XY\) line.

Project the top view of the line which will be a point \(a(b)\) at a distance of 60 mm below \(XY\) line.

Since the line is 70 mm in front of the right PP draw the \(X1Y1\) line at a distance of 70 mm on the right-side of the front view.

Through 0 the point of intersection of \(XY\) and \(X1Y1\), lines draw a \(45^\circ\) line.

Draw the horizontal projector through \(a(b)\) to cut the 45 degree line at \(m\).

Draw the horizontal projectors through \(a'\) and \(b'\) to intersect the vertical projector drawn through \(m\) at \(a''\) and \(b''\). \(a''b''\) is the left view of the line \(AB\).
Line parallel to one plane and inclined to the other
Line parallel to VP and inclined to HP.

A line AB, 90 mm long is inclined at 30 degrees to HP and is parallel to VP.

The line is 80 mm in front of VP.

The lower end A is 30 mm above HP.

The upper end B is 50 mm in front of the right PP.
Line parallel to VP and inclined to HP....

Mark a', the front view of the end A, 30 mm above HP.

Draw the front view a'\(b'\) = 90 mm inclined at 30° to XY line.

Project the top view ab parallel to XY line. The top view is 80 mm in front of VP.

Draw the \(X_1Y_1\) line at a distance of 50 mm from a'.

Draw a 45° line through o. Draw the horizontal projector through the top view ab to cut the 45° line at m. Draw a vertical projector through m.

Draw the horizontal projectors through a' and b' to intersect the vertical projector drawn through m at a'' and b''. Connect a''b'' which is the left side view.
Line inclined to HP and VP

Apparent Inclinations: $\alpha$ and $\beta$

Apparent Lengths: $ab$, $a'b'$
Line inclined to HP and VP……

Draw the projections of a line AB inclined to both HP and VP, whose true length and true inclinations and locations of one of the end points, say A are given.

Since the line AB is inclined at $\theta$ to HP and $\phi$ to VP – its top view ab and the front view $a'\,b'$ are not in true lengths and they are also not inclined at angles $\theta$ to HP and $\phi$ to VP.
Have a nice Day