

# **ORTHOGRAPHIC DRAWING: DEFINITION, TYPES, VIEWS, TUTORIAL & PRACTICE**

**MARCH 2020**

**Definition of orthographic drawing; Types of orthographic drawing (First angle projection, and Third angle projection); Orthographic drawing views; Orthographic drawing tutorial & practice (Tools required for orthographic drawing practice; General procedure; Applications of orthographic drawing practice; Orthographic drawing shapes/objects for practice); and Conclusion**

## **EDITED**

**BY IHAGH GODWIN**

## **Motivation & Environment Presents**

### Orthographic Drawing: Definition, Types, Views, Tutorial & Practice

Content: Definition of orthographic drawing; Types of orthographic drawing (First angle projection, and Third angle projection); Orthographic drawing views; Orthographic drawing tutorial & practice (Tools required for orthographic drawing practice; General procedure; Applications of orthographic drawing practice; Orthographic drawing shapes/objects for practice); and Conclusion

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# 1. Introduction

This eBook defines orthographic drawing (drafting or projection) and uses 21 images to illustrate the meaning and types of orthographic drawing. At the end of this eBook, there is a link to hundreds of images of two- and three-dimensional (2D & 3D) objects that can be used to practice, and enhance your orthographic drawing skills. Generally, this eBook elaborates on the following:

- Definition of orthographic drawing
- Types of orthographic drawing
  - First angle projection
  - Third angle projection
- Orthographic drawing views
- Orthographic drawing tutorial & practice
  - Tools required for orthographic drawing practice
  - General procedure
  - Applications of orthographic drawing practice
  - Orthographic drawing shapes/objects for practice
- Conclusion

## 2. Definition of orthographic drawing

Orthographic drawing, which is one of the three types of parallel projections (orthographic, oblique, and axonometric), can be defined as a type of technical drawing in which 3-dimensional objects are represented in 2 dimensions by projecting planes (consisting of 2 major axes) of objects so that they are parallel with the plane of the media (paper, or computer) they are projected upon.

Any type of orthographic drawing uses two-dimensional (2D) views (obtained from two different lines of sight) to represent different parts of three-dimensional objects, or planes of objects viewed from/along different axes—typically, the  $x$ ,  $y$ , and  $z$  axes.

Generally, the best way to fully express all the most important visible parts of any 3D object in 2D views—either by first angle orthographic projection or third angle orthographic projection—is by using a maximum number of views, which in most cases is six—or at least four or three.

However, in practice, most people or organizations use three or four views to illustrate how the shapes and sizes of various parts

of an object look. Generally speaking, the number of views used in an orthographic drawing or projection depends on the purpose and objective of a drawing.

### **3. Types of orthographic drawing**

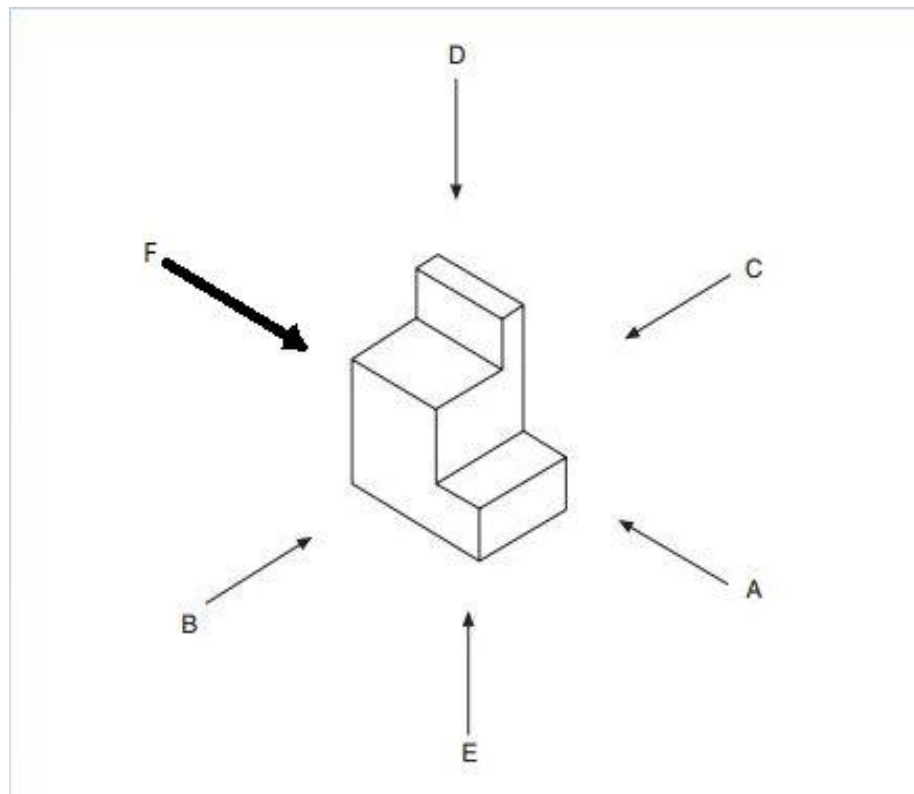
Orthographic drawing (also known as orthographic projection) consists of two types: first angle projection, and third angle projection.

#### **First angle projection**

In first angle projection, which is popularly practiced in Europe, whenever six views are used to illustrate how the sides of a 3D object look from six directions (as shown in Figure 1 below), they are usually arranged in the following manner (as shown in Figure 2 below):

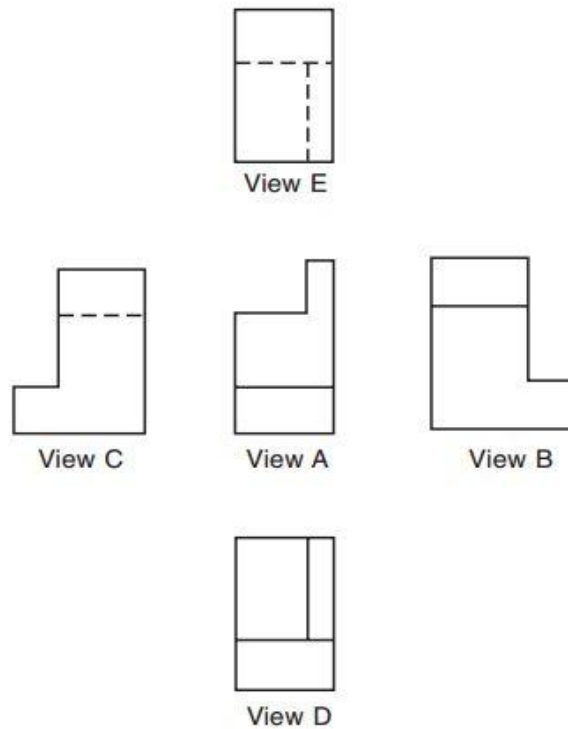
- The bottom view E is placed at the top of the paper or computer screen.
- The front view A is placed beneath the bottom view E.
- The top view D is placed beneath front view A (i.e., at the bottom of the paper or computer screen.
- The right view C is placed on the left side of front view A.

- The left view B is placed on the right side of front view A.
- The back/rear view F (which is not shown in Figure 2) is usually placed at the extreme left or right—whichever position is convenient.



**Figure 1: Six directions for six views**

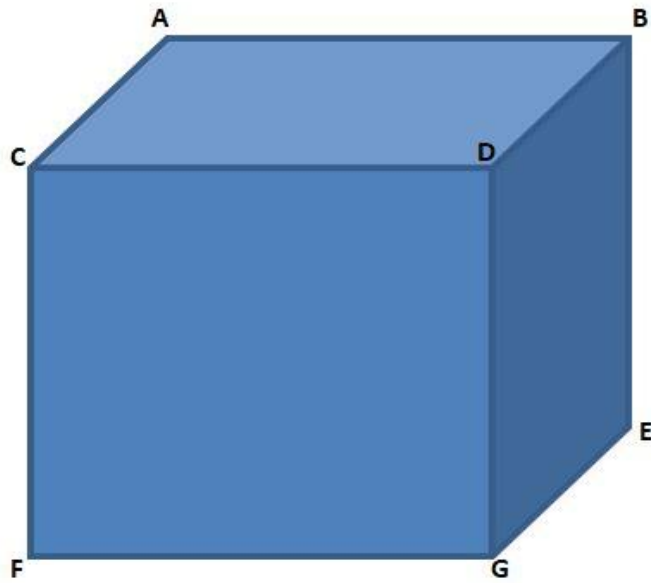




**Figure 2: Five views of first angle projection (A sixth View F would depend on the shape of the back/rear view of the object.)**

Whenever four views are used, the front view is usually placed at the top of a medium (paper, computer screen, etc.) along with the right side view which is placed at the left side of the front view, while the left side view is placed at the right side of the front view, and the top view (T) is placed alone beneath the front view.

It has to be noted that in many first angle orthographic drawing practices, three views could be sufficient enough to describe the shapes and dimensions of various sides of an object which actually exist in 3D as shown in Figure 3 below:



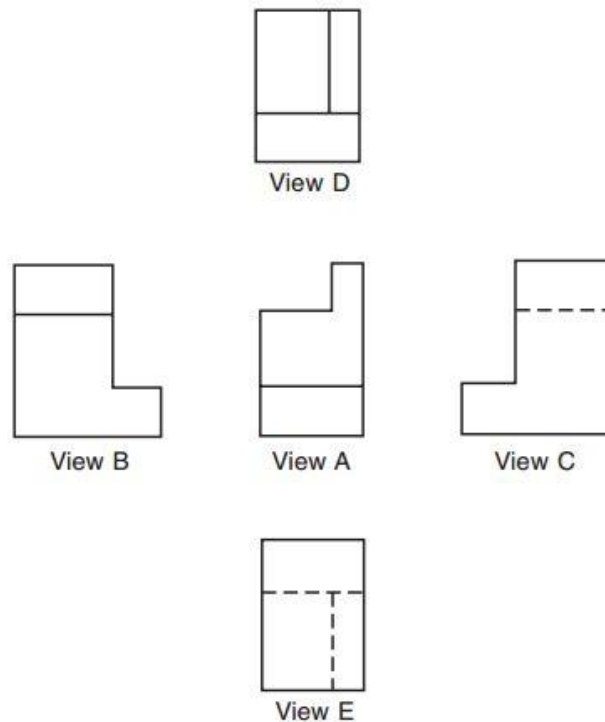
**Figure 3: A three-dimensional object with 7 visible edges (A, B, C, D, E, F, and G)**

### **Third Angle Projection**

In third angle projection, which is mostly practiced in North America, whenever six views are used to describe the sides of a 3D object from six different directions (as shown in Figure 1 above), they are usually arranged in the following manner (as shown in Figure 4 below):

- The top view D is placed at the top of the paper or computer screen.
- The front view A is placed beneath the top view D.

- The bottom view E is placed beneath front view A (i.e., at the bottom of the paper or computer screen).
- The right view C is placed on the right side of front view A.
- The left view B is placed on the left side of front view A.
- The back/rear view F (which is not shown in Figure 2) is usually placed at the extreme left or right—whichever position is convenient.



**Figure 4: Five views of third angle projection (A sixth View F would depend on the shape of the back/rear view of the object.)**

Whenever four views are used, the top view is usually placed alone at the top of a medium (paper, computer screen, etc.), while

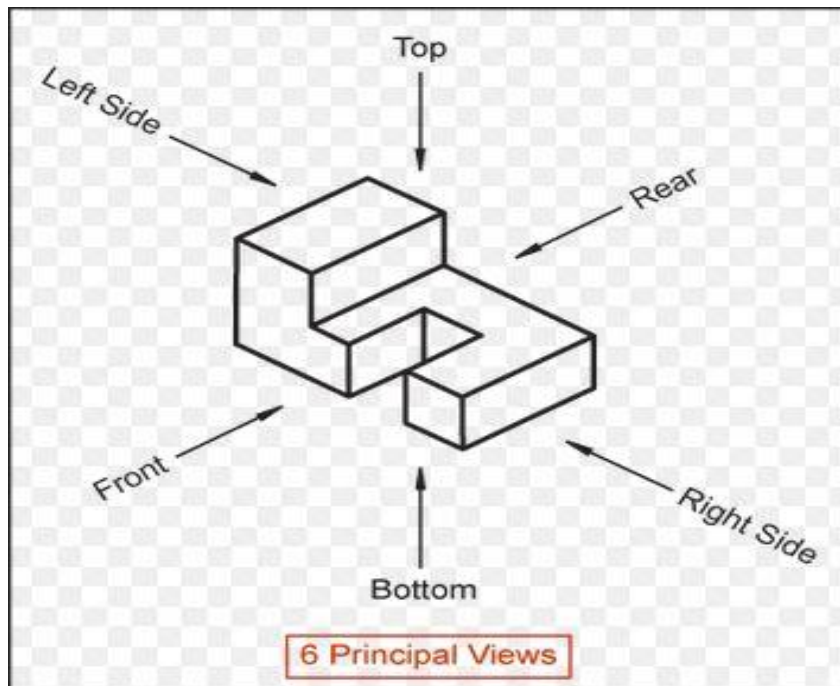
the front view is placed beneath the top view, and the right side view is placed at the right side of the front view, while the left side view is placed at the left side of the front view. (Note that third angle projection is the most popular type of orthographic drawing or projection.)

Generally speaking, the difference between first angle projection and third angle projection depends on where each view is placed on paper or computer screen according to the universally accepted requirements of the two main types of orthographic drawing/projection.

## **4. Orthographic drawing views**

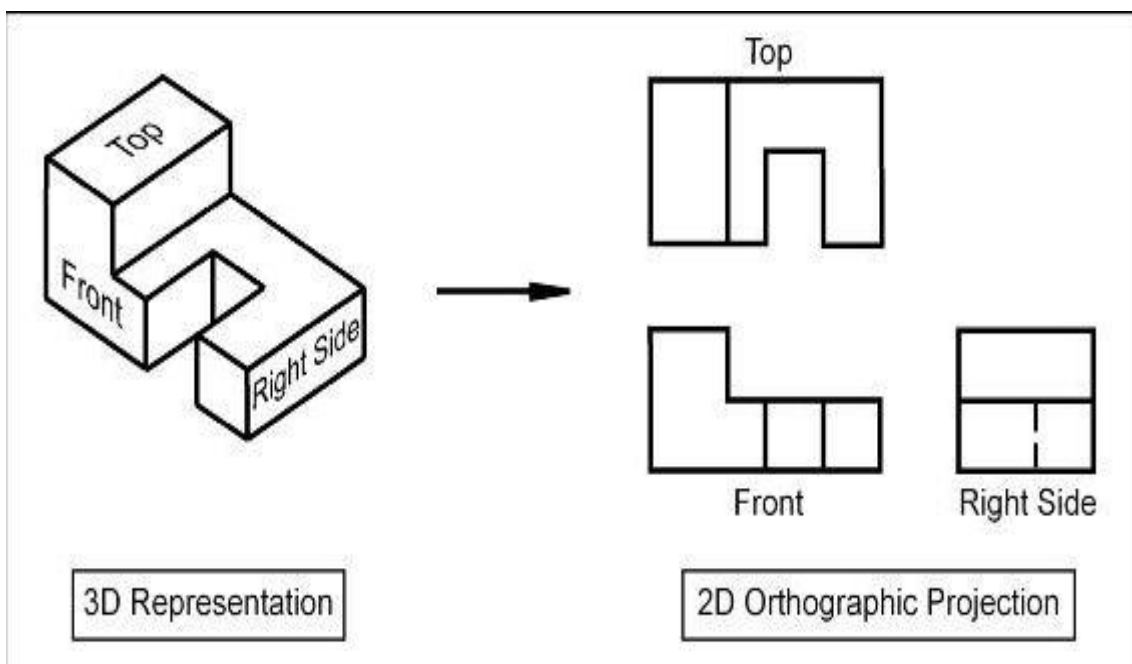
There is no general rule per se, but the best or most recommendable way to fully express the important visible and hidden parts of any 3D object in 2D views, is by using as many views as possible: probably between three and six views.

Unlike in Figure 1 above, whenever six views are used, different directions (lines of sight projected on the sides of an object) can be chosen to illustrate the top, bottom, front, rear/back, left and right views, respectively, as can be seen in Figure 5 below:



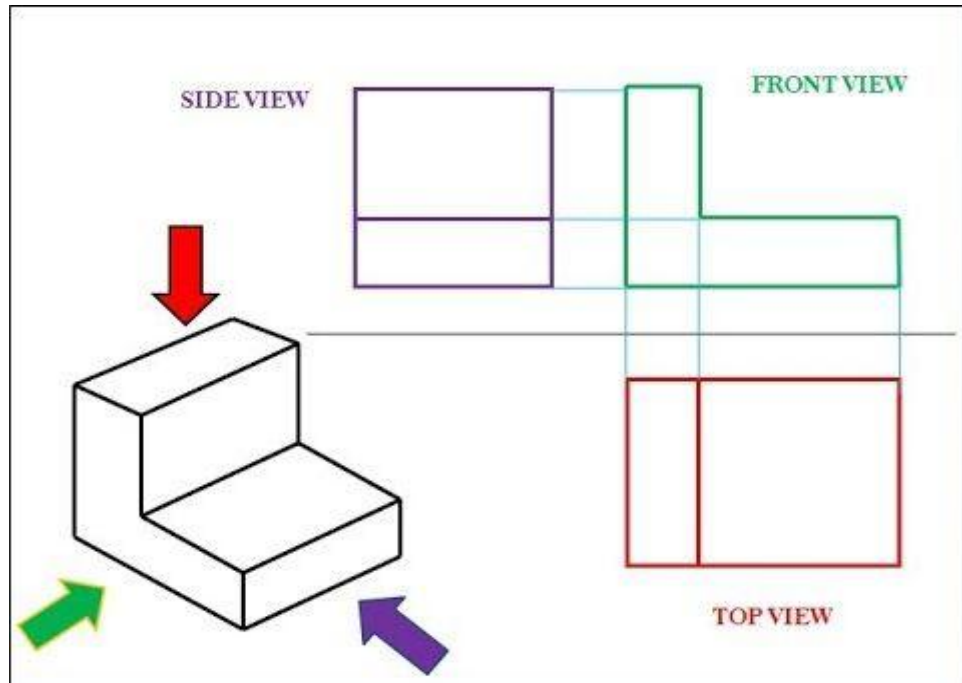
**Figure 5: Six different directions for six views**

The third angle projection of Figure 5 is shown in Figure 6 below:

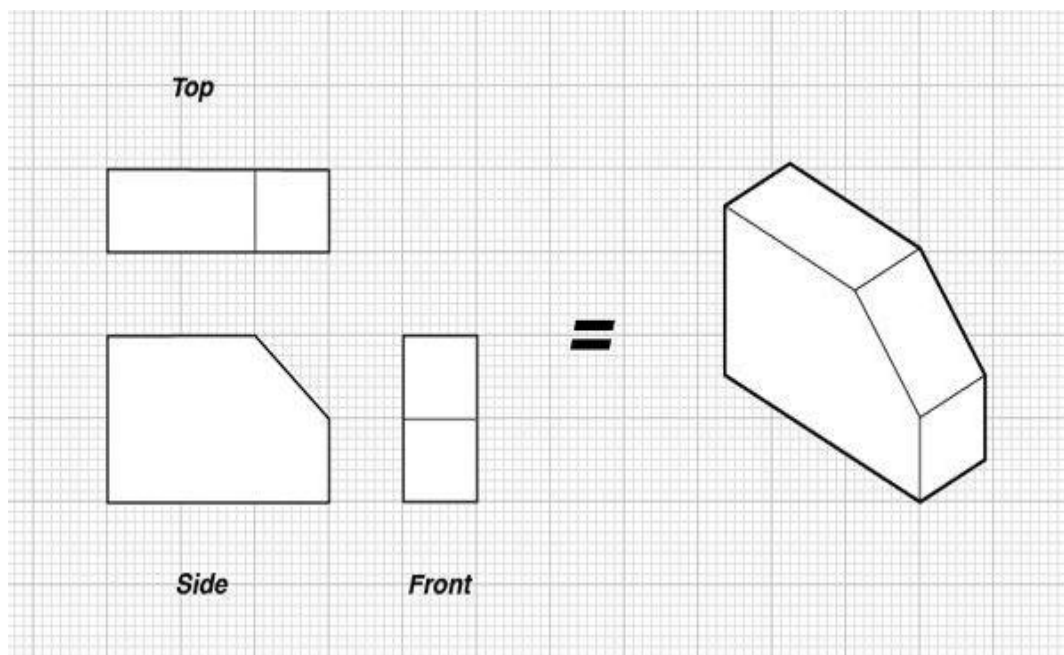


**Figure 6: Third angle projection of the object in Figure 5**

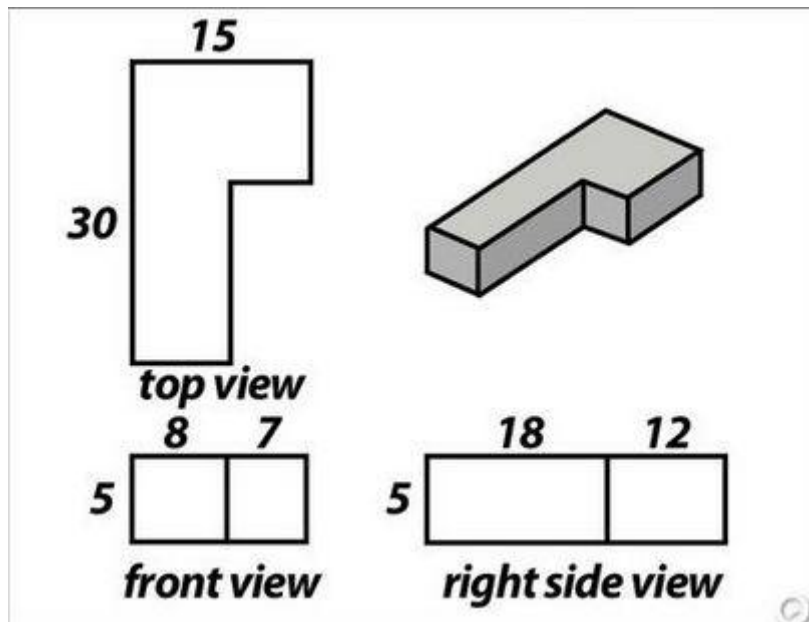
The orthographic drawings or projections of some other objects/shapes can be viewed in Figures 7, 8, and 9 below:



**Figure 7: First angle projection of an object**



**Figure 8: Projection of an object**



**Figure 9: Third angle projection of an object that has dimensions in millimeters**

Always remember that in many orthographic drawing practices across the world, the number of views chosen or used usually depends on the number of views required or needed.

## 5. Orthographic Drawing Tutorial & Practice

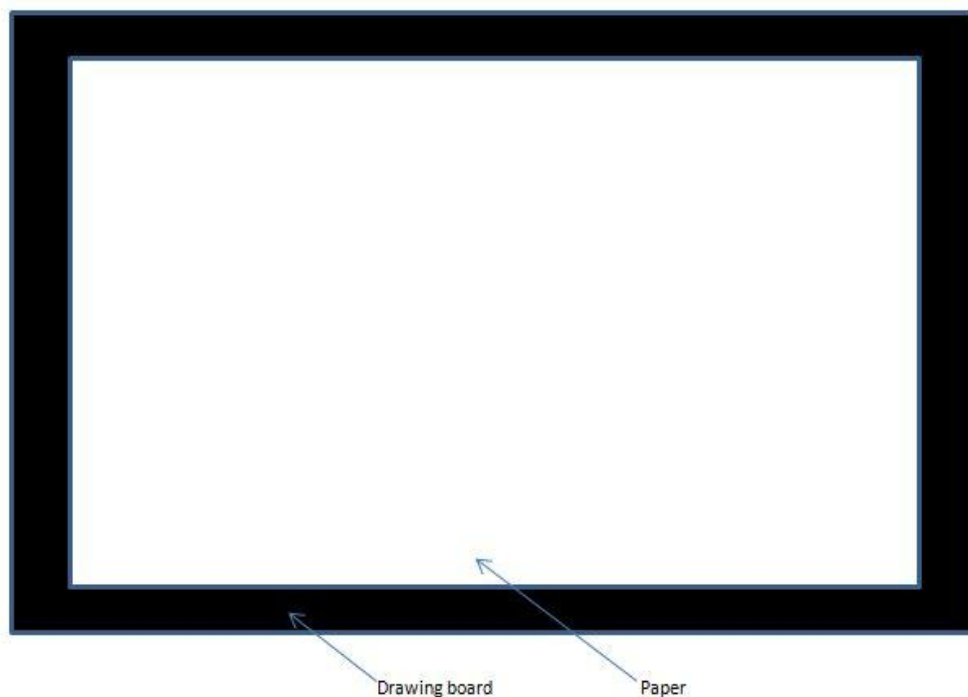
### Tools required for orthographic drawing practice

With regular drawing practice, it is very easy to learn and perfect orthographic drawing skills. The tools usually required for practicing orthographic drawing are quite the same as the ones

used in technical and engineering drawing, respectively.

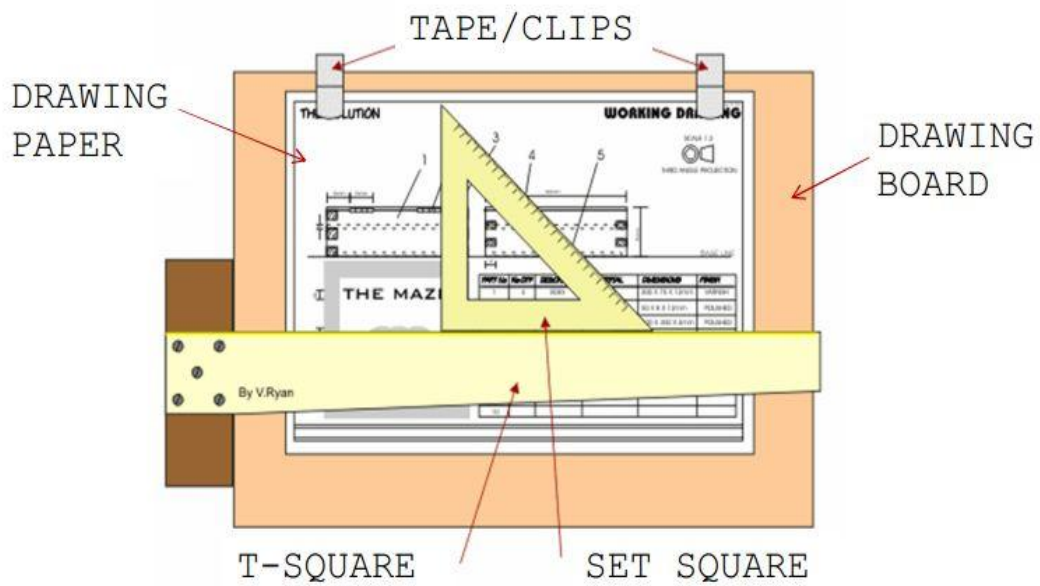
Generally, the tools could include:

- Drawing board.
- Drawing paper: either A<sub>0</sub>, A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub>, and A<sub>4</sub>.
- Drawing pencil.
- Eraser.
- 30° × 60° and 45° × 45° set squares.
- 300 mm (30 cm) ruler.
- T-square.
- Drawing compasses

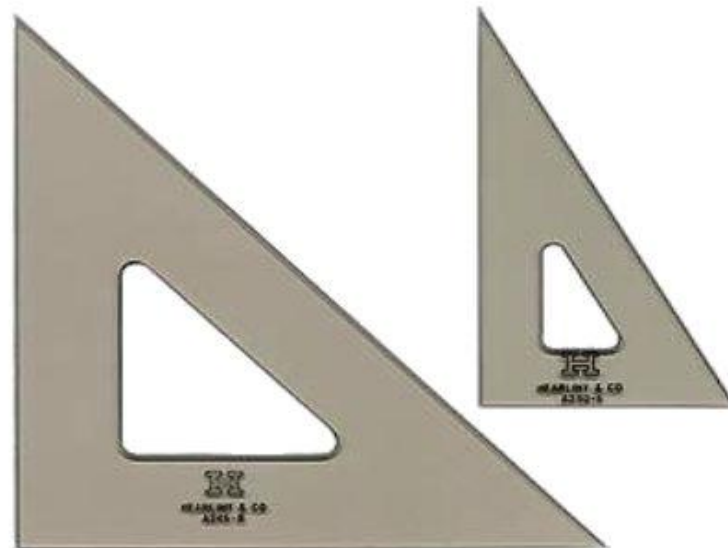


**Figure 10: Drawing board and drawing paper**

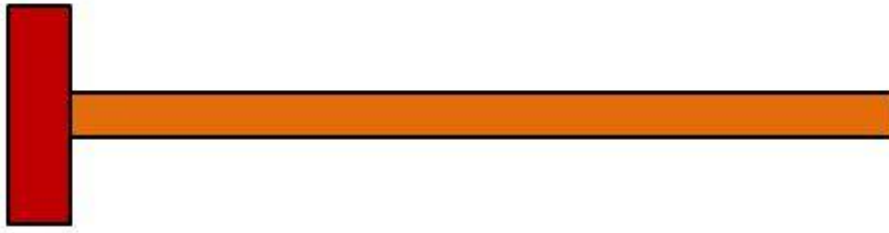




**Figure 11: Complete set of drawing board, drawing paper, tape/clips, set square, and T-square**



**Figure 12: 45° x 45° (bigger: on the left), and 30° x 60° (smaller: on the right) set-squares**



**Figure 13: T-square**



**Figure 14: Drawing compasses (for drawing circular or elliptical shapes)**

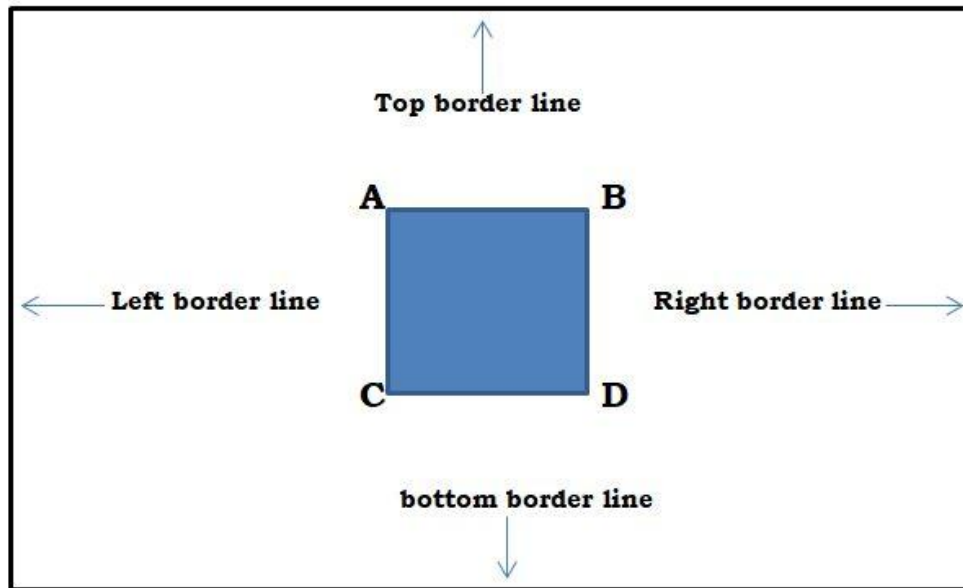
T-squares and set squares must be aligned perfectly on the pure/true  $x$  and  $y$  axes before perfect vertical or horizontal lines can be produced. It will be difficult to produce good orthographic drawings without drawing or projecting perfect vertical and horizontal lines.

### **General Procedure**

Generally, when projecting sides or different views of 3D objects in 2D, a certain degree of concentration will be needed to ensure that shapes, sizes, or dimensions are consistent and accurate. The following are important when making orthographic projections:

- Estimate the area of paper that would be enough to draw all necessary and important views. In addition, determine an appropriate scale for your drawings. A scale is any ratio (examples: 1:10, 1:100, 1:1000, etc.) of the size of an object on paper, to the actual size of the same object in real life. Common scales for “enlargement of objects” include: 2:1, 5:1, 10:1, etc. On the other hand, common scales for “reduction of objects”, include 1:2, 1:5, 1:10, etc.

- Put equal distances (which should also be considered in the total area that would be enough to accommodate all views) between views, vertically (for example, top, front, and bottom views), and horizontally (for example, left, right, and back/rear views).
- When drawing any view—whether square-, rectangular-, or circular-shaped—mark the center lines of each shape and the center/centroid of each shape. Center lines are very important, not just because they are center lines, but because they serve other purposes, one of them being that they help in establishing other points and lines in drawings.
- Draw the top view, and project the most visible and important lines into the front view, or vice versa.
- After drawing the front view, the right and left side views can be projected and drawn; in addition, the bottom and back/rear view can be also be drawn or constructed if required.



**Figure 15: Top view of an object drawn on drawing paper**

As an example, in order to draw perfectly straight vertical and horizontal lines for the two dimensional (2D) top view ABCD of a 3D object on paper (as shown in Figure 15 above), the following steps should be taken:

- Points A and B should be the same distance away from the top border line on the drawing paper.
- Points C and D should be the same distance away from the bottom border line on the paper.
- Points A and C should be the same distance away from the left border line on the paper.

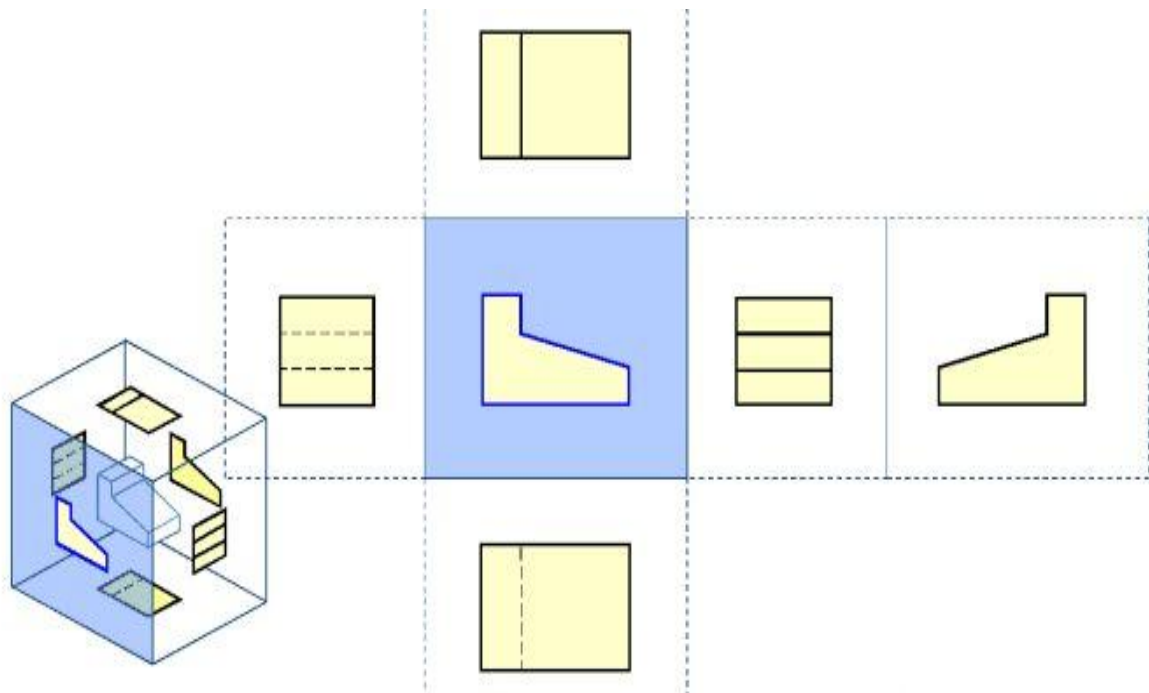
- Points and B and D should be the same distance away from the right border line on the paper.

### **Applications of orthographic drawing practice**

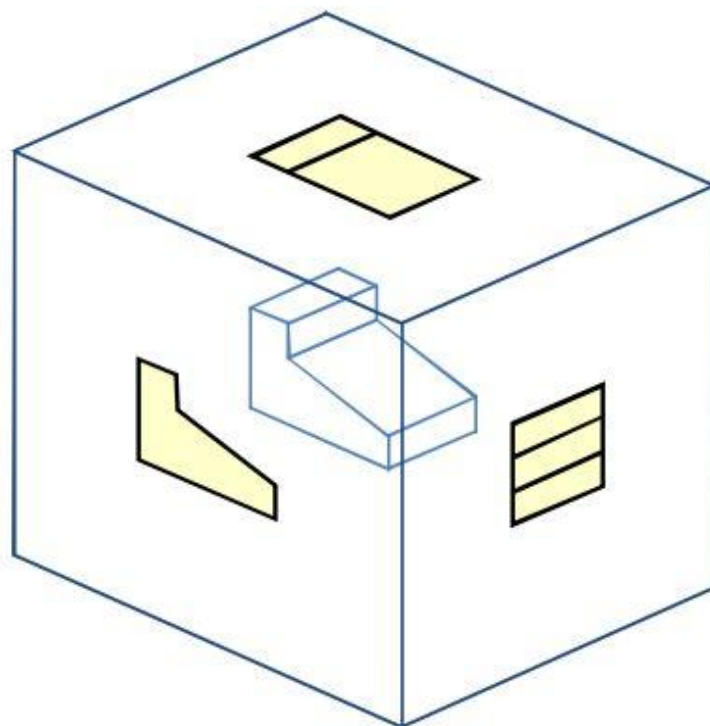
Orthographic drawings have many applications scattered across various fields that require planning and designing such as architecture, construction, design, engineering, environment, estate management, manufacturing, surveying, etc. Orthographic drawings are usually produced according to precision and requirements. It is possible for an orthographic drawing that has been produced in one country, to be used to manufacture an object in another country.

### **Orthographic drawing shapes/objects for practice**

Like we said earlier: “practice makes perfect”. In order to strengthen your orthographic drawing skills, you may practice how to draw the views of the following objects:

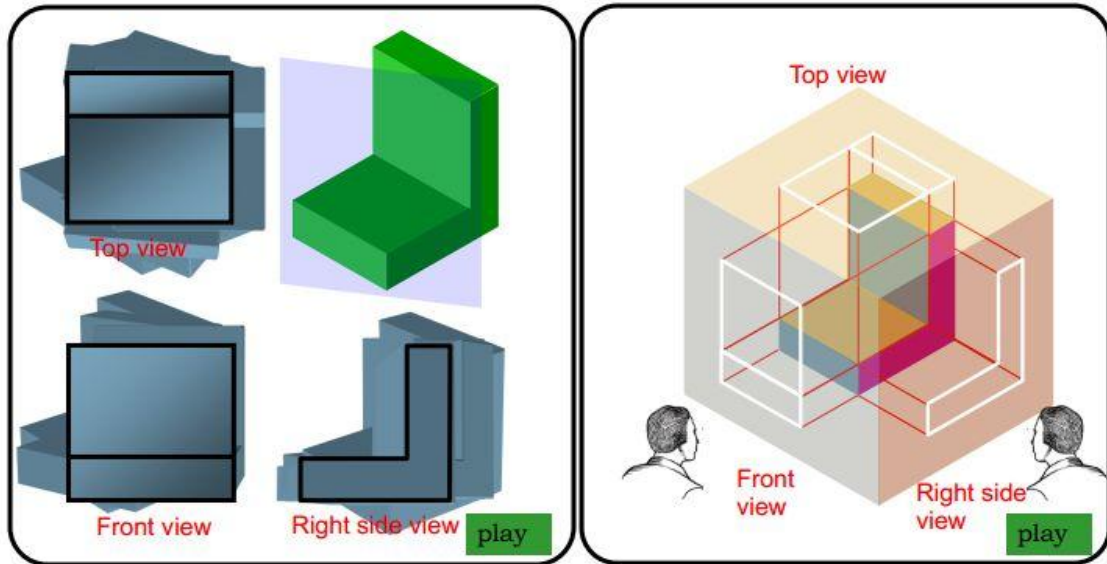


**Figure 16: Third angle projection of an object with six views**

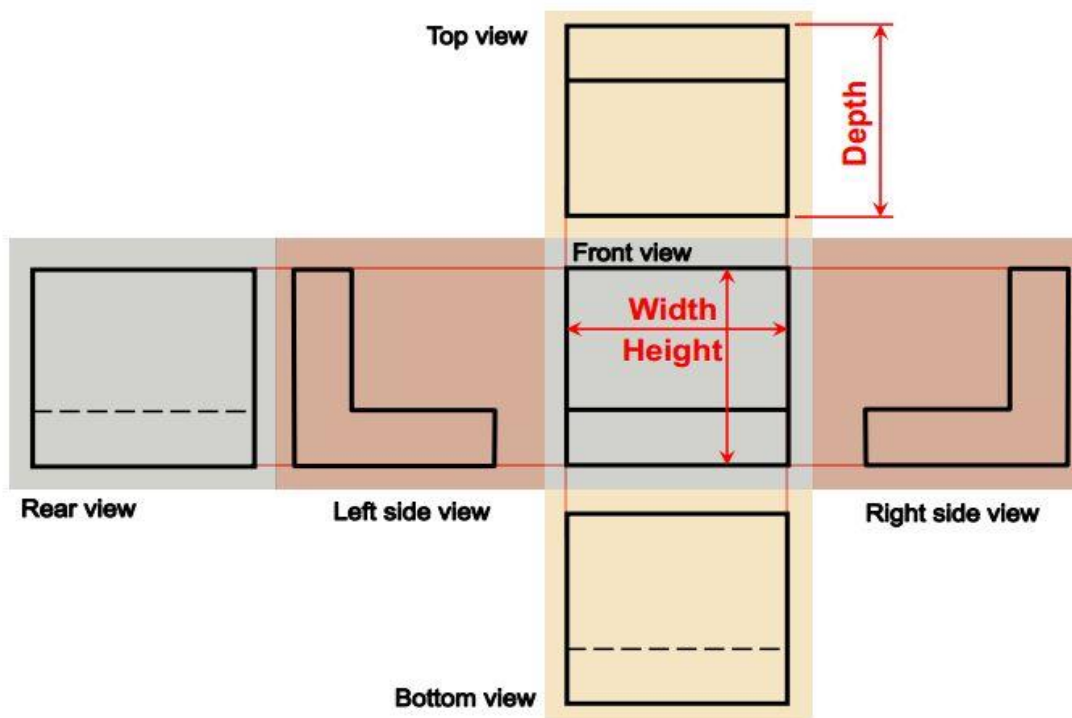


**Figure 17: Three commonly practiced orthographic views**

The three main 2D views and six general 2D views of an L-shaped object can be seen in Figures 18 and 19, respectively.



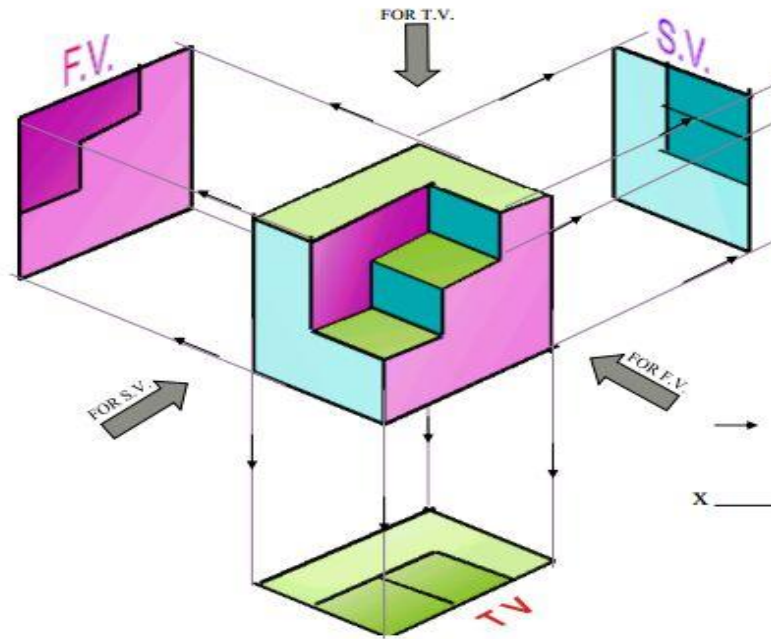
**Figure 18: Three popular 2D views**



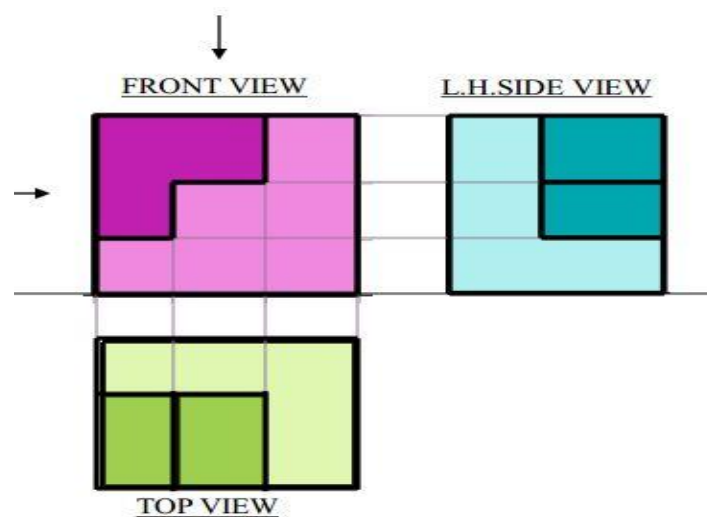
**Figure 19: Six views of the object shown in Figure 18 above**



The use of colors makes it easier to understand, locate, and draw 2D views of 3D objects. With the aid of colors on objects, you can study and practice how to draw Figures 20 and 21, respectively:



**Figure 20: Figure 20\_The use of colors in orthographic projection**



**Figure 21: Three third angle projection views with colors**

## Conclusion

Anyone who is interested in succeeding with orthographic drawing or projection must practice consistently; there is no other easy or painless way out. The more anyone practices, the more proficient they will become, and develop newer and more efficient ways to draw better.

If you are interested in viewing, studying, and drawing various shapes/types of objects, click the following link: [Hundreds of images of objects projected in 2 and 3 dimensions](#). For regular updates on technical & engineering drawing topics, subscribe with your email address for new articles at the top or bottom of the right sidebar of any web page on [Motivation & Environment](#).

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