13 Types of Engineering Drawing

Free eBook

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Excerpt: This free 40-page eBook contains a list and definitions of 13 types of engineering drawing that can be individually produced from any one of the two major types or systems of projection (parallel and perspective) and their respective subtypes which are usually employed in developing different types of engineering drawing views.

13 Types of Engineering Drawing

Today's engineering products and projects originate from engineering drawings that are produced from any of the two main types of projection: parallel projection and perspective projection.

Parallel projection is of two types: orthographic projection and oblique projection; orthographic projection is of two types: multi-view projection or axonometric projection. On the other hand, perspective projection is also of two types: aerial perspective projection and linear perspective projection.

In engineering practice, the two main types of projection (parallel and perspective) are used respectively via six subtypes (orthographic projection, oblique projection, multi-view projection, axonometric projection, aerial perspective projection, and linear perspective projection) when producing the 13 types of engineering drawing that have been defined in this article.

But before we list and define each of the 13 types of engineering drawing, it's important to keep the following points/definitions in mind because they are crucial to clearly understanding the 13 types of engineering drawing:

- You have to make a projection (either parallel or perspective) and subtype of projection (orthographic, oblique, multi-view, axonometric, aerial perspective, or linear perspective) to produce any of the 13 different types of engineering drawing views.

- Parallel projection and its subtypes can be used to produce nine different types of engineering drawing, while perspective projection and its subtypes can be used to produce four other different types of engineering drawing; the total types and subtypes of projection result in 13 types of engineering drawing.

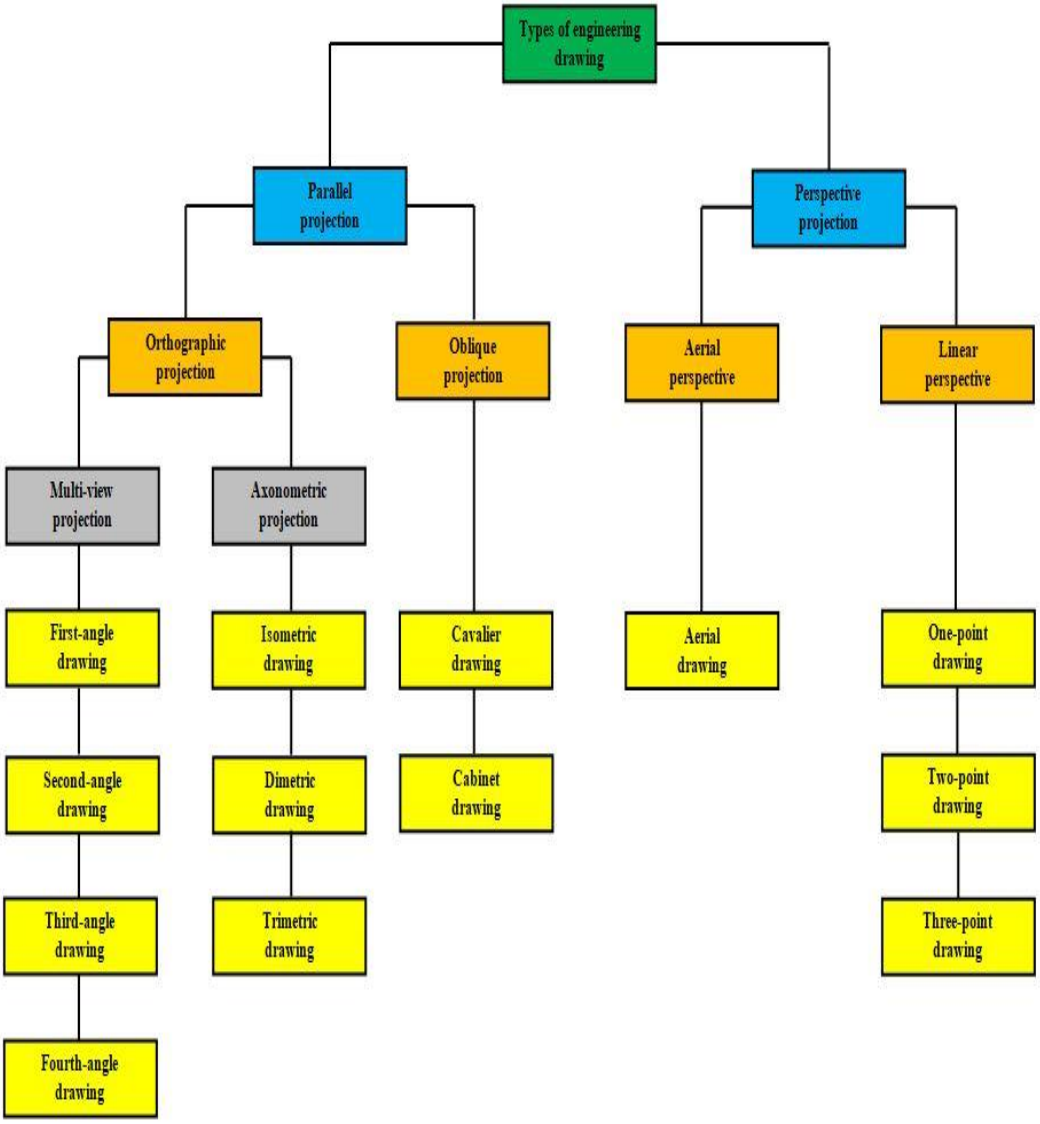


Figure 1: 13 types of engineering drawing (yellow rectangles)

- Parallel projection is the type of projection in which projectors (also known as "lines of sight" or "imaginary lines") are projected from a position (the eye of a viewer, or something) in such a way that they are parallel to each other and at the same time perpendicular to the planes of

the object(s) they are projected upon. The projectors or lines of sight are projected to touch very important points on various planes of any object which an engineering drawing can be produced for. There are two types of parallel projection: orthographic projection and oblique projection; orthographic projection can be expressed either as multiview (or multiview projection which displays as many important views as necessary) and axonometric projection (which can display a single important axonometric view).

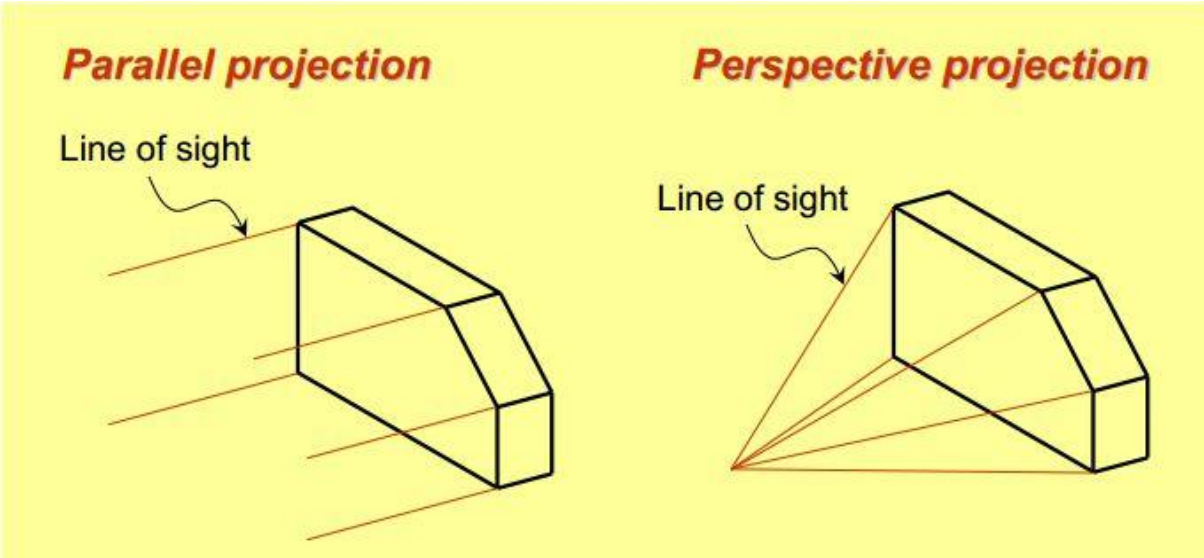
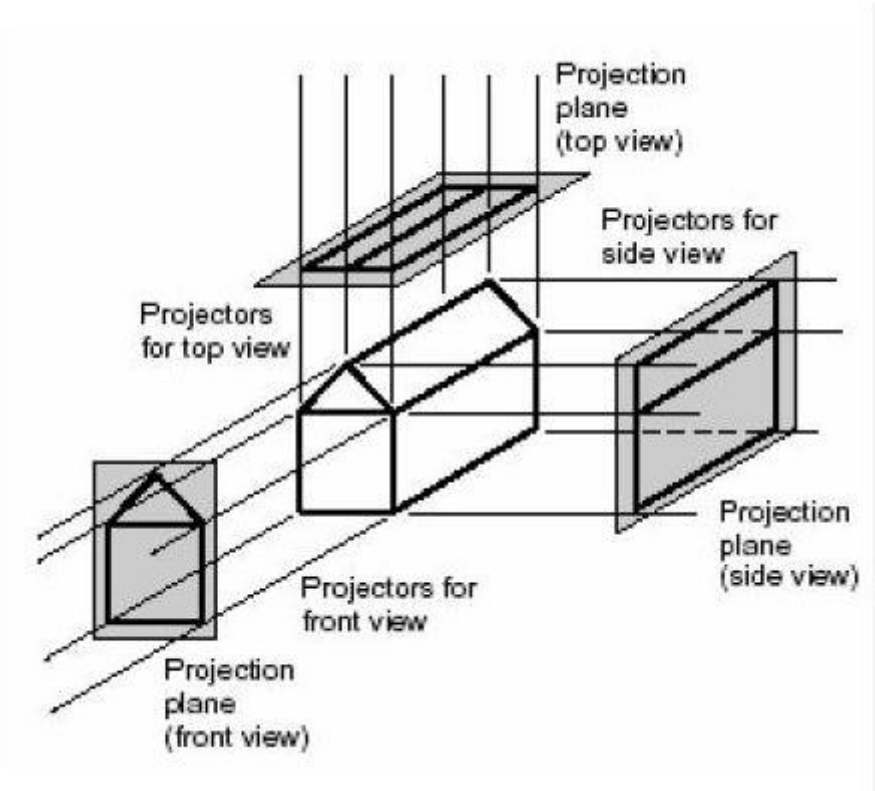


Figure 2: Lines of sight in parallel and perspective projections, respectively

- Orthographic projection is a type of parallel projection in which projectors are projected perpendicularly (in a

perpendicular direction) on the major planes of a 3-D object, and the corresponding 2-D (2-dimensional) representations of the object are drawn on media such as paper and computer screen.



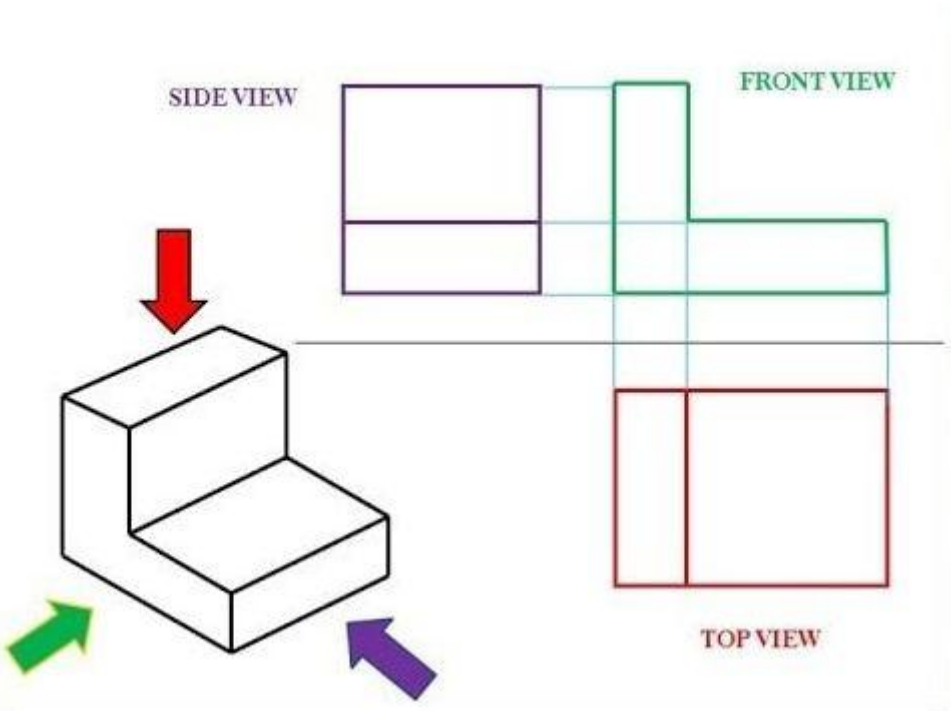
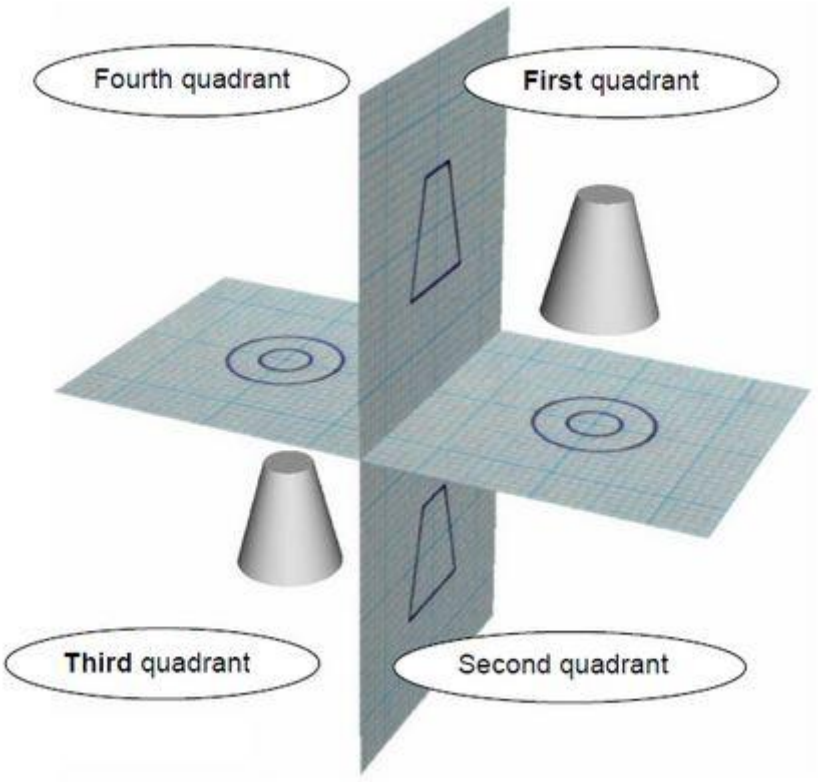


Figure 3: Orthographic projections of objects (Image credits: Google.com and Dreamcivil.com.)

- Multi-view projection is actually a projection of many orthographic projections or views all on one place or media such as paper or computer screen: in multi-view projection, the parallel projectors are directed perpendicularly to the major planes or important parts of an object such as the top, front, and side views (and may include other important sides) of an object which are all drawn or represented in 2-D. Multi-view projection is used in creating the first-angle, second-angle, third-angle, and fourth-angle types of engineering drawing, depending on the quadrant (either

first—for first-angle, second—second-angle, third—third-angle, or fourth quadrant—for fourth-angle) in which the object is placed for the parallel projectors or observer's eyesight to make a perpendicular projection on before drawing the individual projected planes.



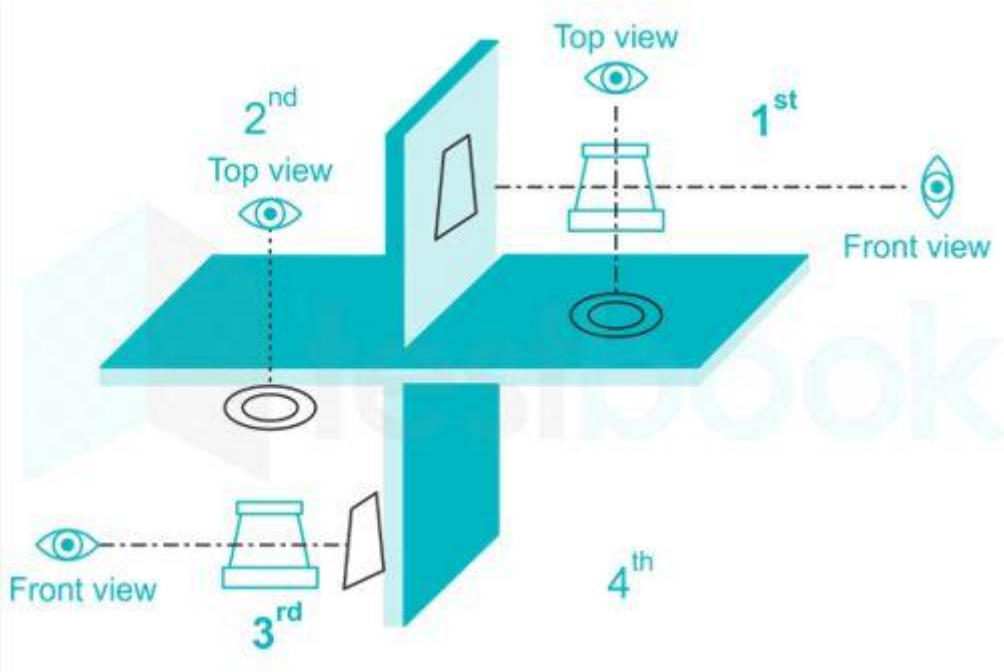


Figure 4: Quadrants used during multi-view projection to produce first-, second-, third-, and fourth-angle projections, respectively (Image credit: Google.com.)

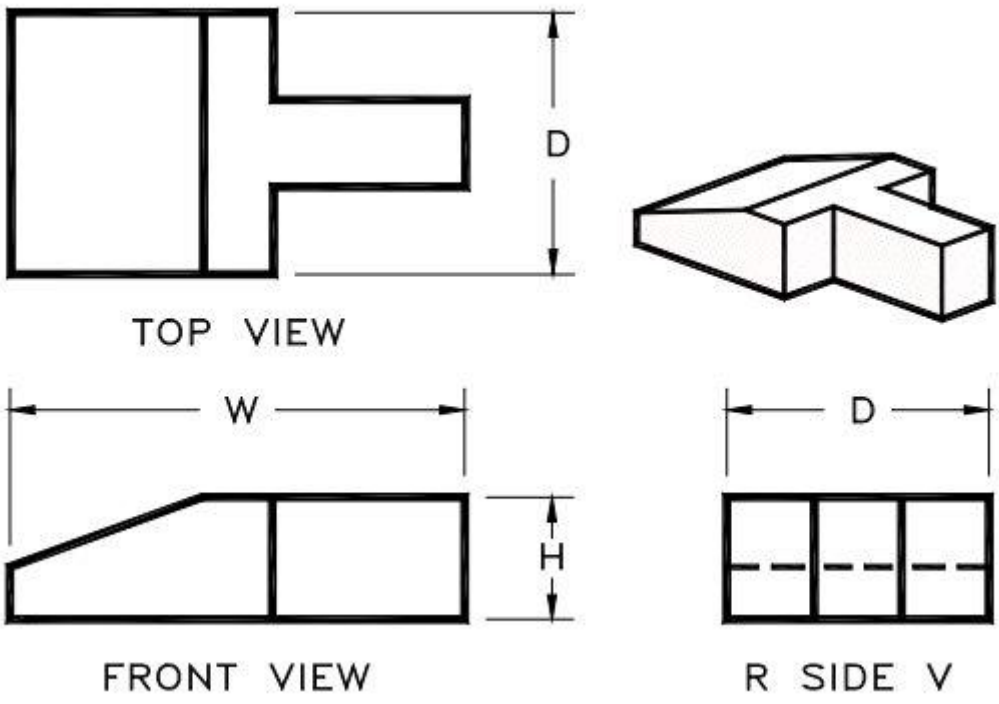


Figure 5: Multiview (3 major views) for 3 orthographic projections

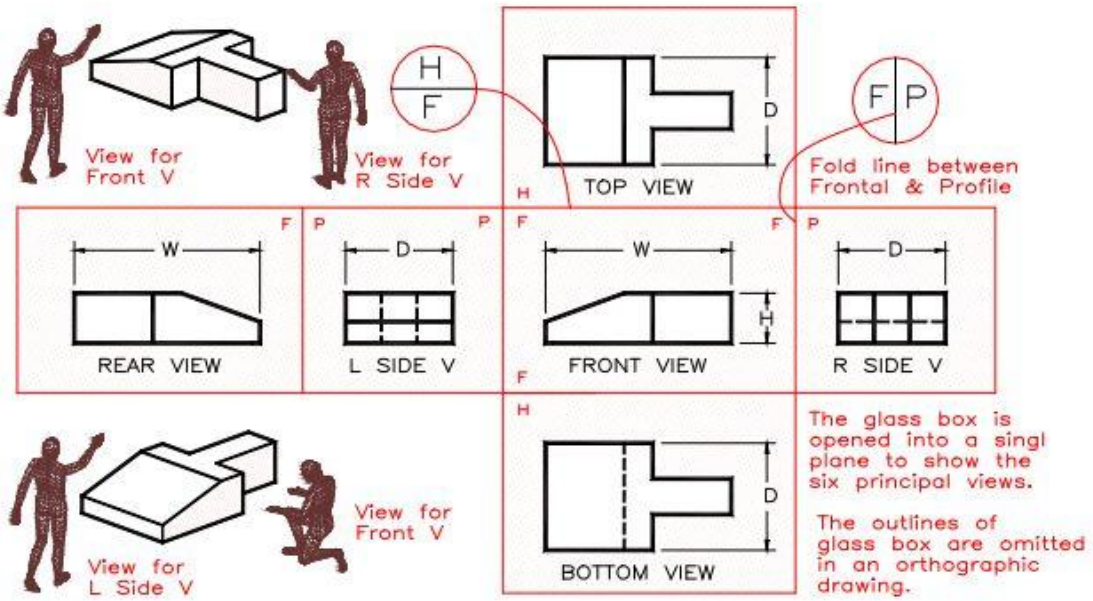


Figure 6: Multi-view (6 major views) for 6 orthographic projections

- Axonometric projection is another but different expression of orthographic projection, well suited for illustration purposes: parallel projectors are directed perpendicularly towards any plane of a 3-D object that is tipped/rotated about one or more of its major axes (*x*, *y*, and *z*) to show different sides (top, side, and front views), and the projection is usually expressed in a single view with some foreshortened dimensions that are easy to visualize.

Axonometric projection is used in producing three different types of engineering drawing: isometric, dimetric, and trimetric drawing, respectively.

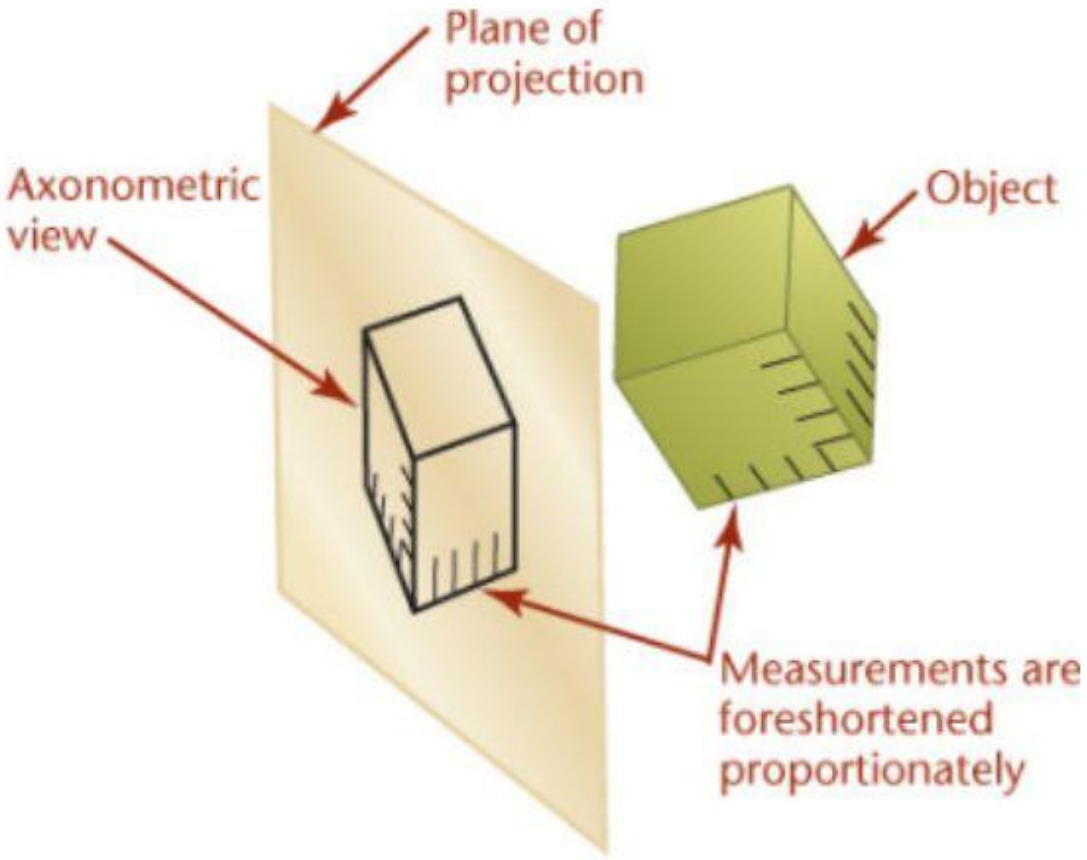
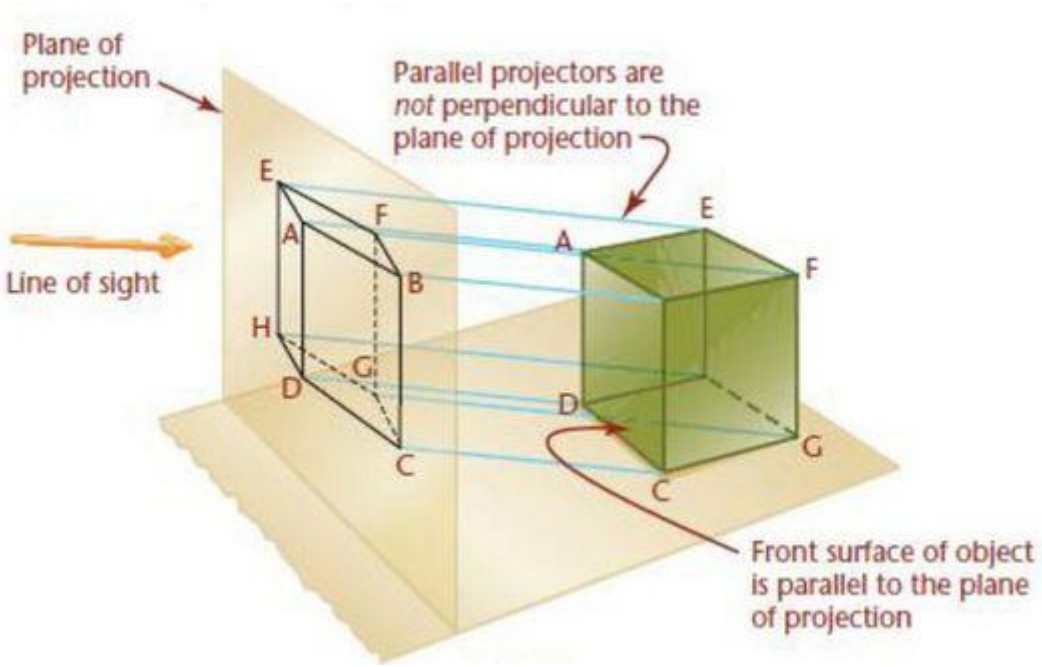


Figure 7: Axonometric projection and view of an object (Image credit: Peachpit.com.)

- Oblique projection is another type of parallel projection (the other is orthographic) in which the projectors are parallel to each other but not perpendicular to any planes of the 3-D object they are projected on, and one of the three planes of

the object is projected at either 30°, 45°, or 60° to the *x*-axis. Angle 45° is used in most oblique projections. The parallel projectors are not projected perpendicularly on any 3-D object's plane; this would result in an engineering drawing that has true shapes and sizes on only one or two planes/faces. Oblique projection is used in creating two types of engineering drawing: cavalier drawing and cabinet drawing, respectively.



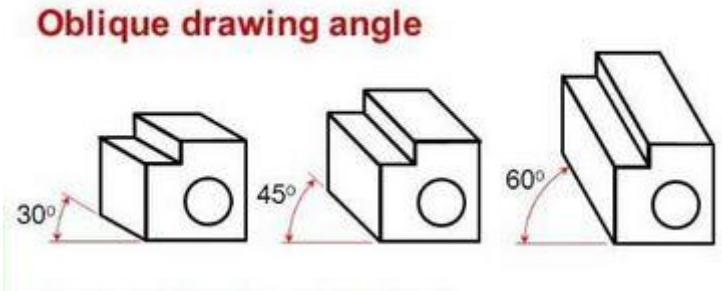


Figure 8: Oblique projection of an object (Image credit: Slideplayer.com.)

- Perspective projection is the type of projection in which the parallel projectors or lines of sight originate from the same point (called "point of convergence") and increasingly diverge away the more they approach an object's plane of projection; the projectors converge or come together at a fixed point(s) (called vanishing or convergence point(s)), away from the object's plane of projection—illustrated by the shape of a cone, thereby making objects appear smaller the more their distance increases away from an observer. There are two types of perspective projection: aerial perspective projection and linear perspective projection, respectively. Perspective projection is sometimes called perspective view or perspective drawing or simply perspective.

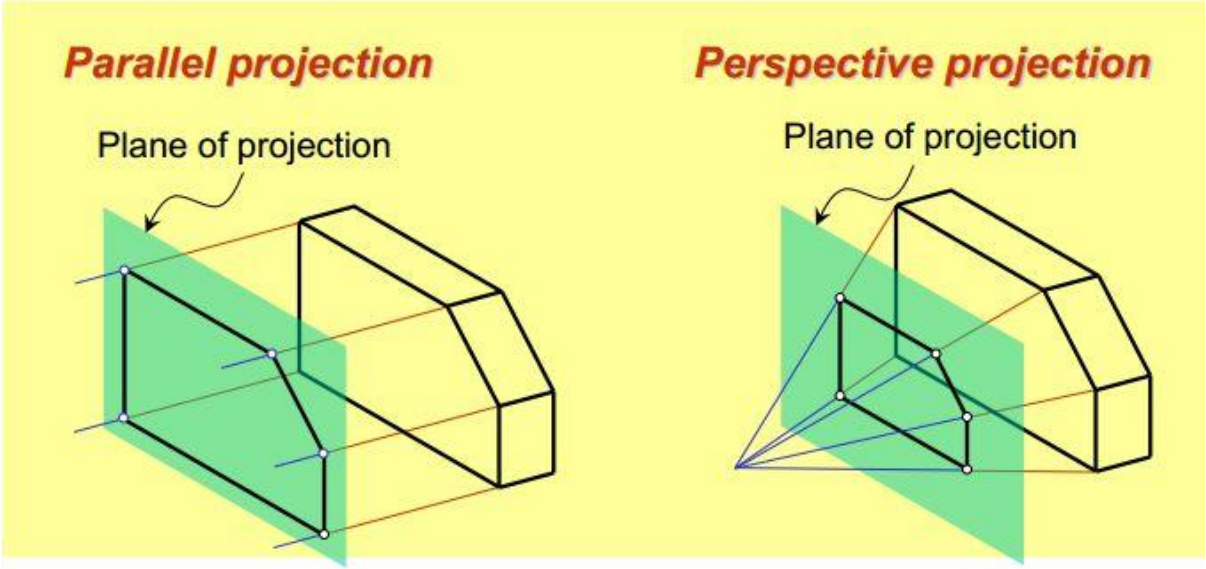
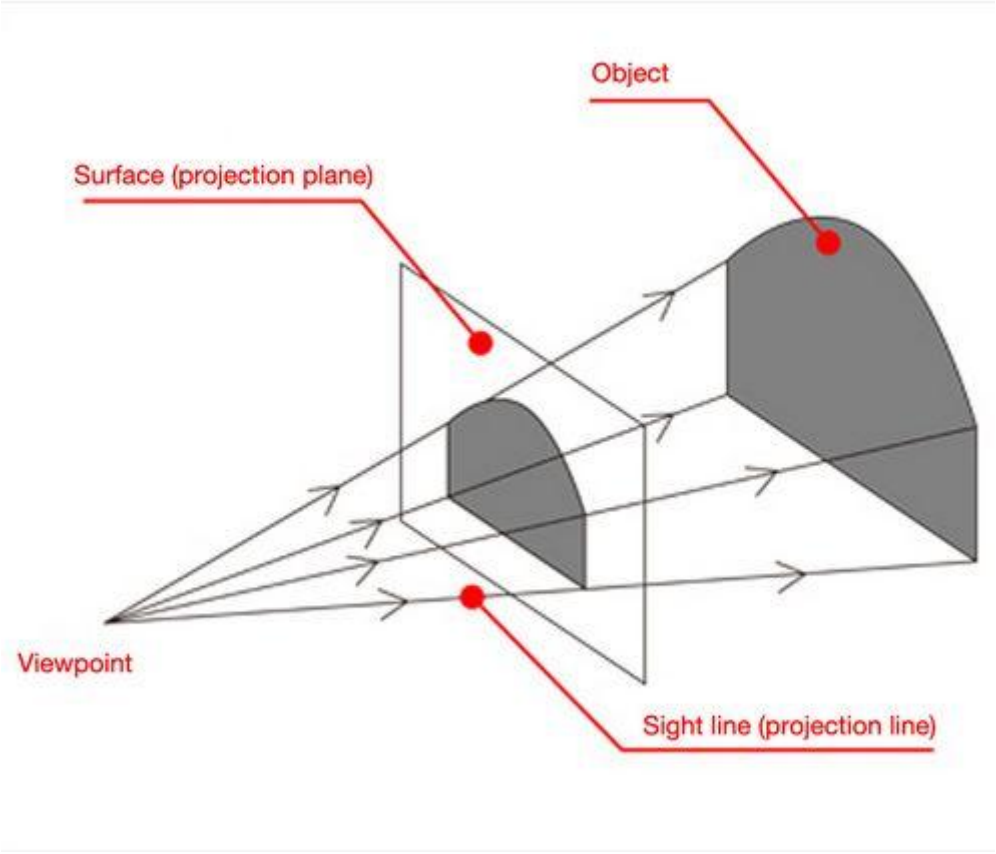


Figure 9: Difference in the orientation of projectors in perspective and parallel projections, respectively



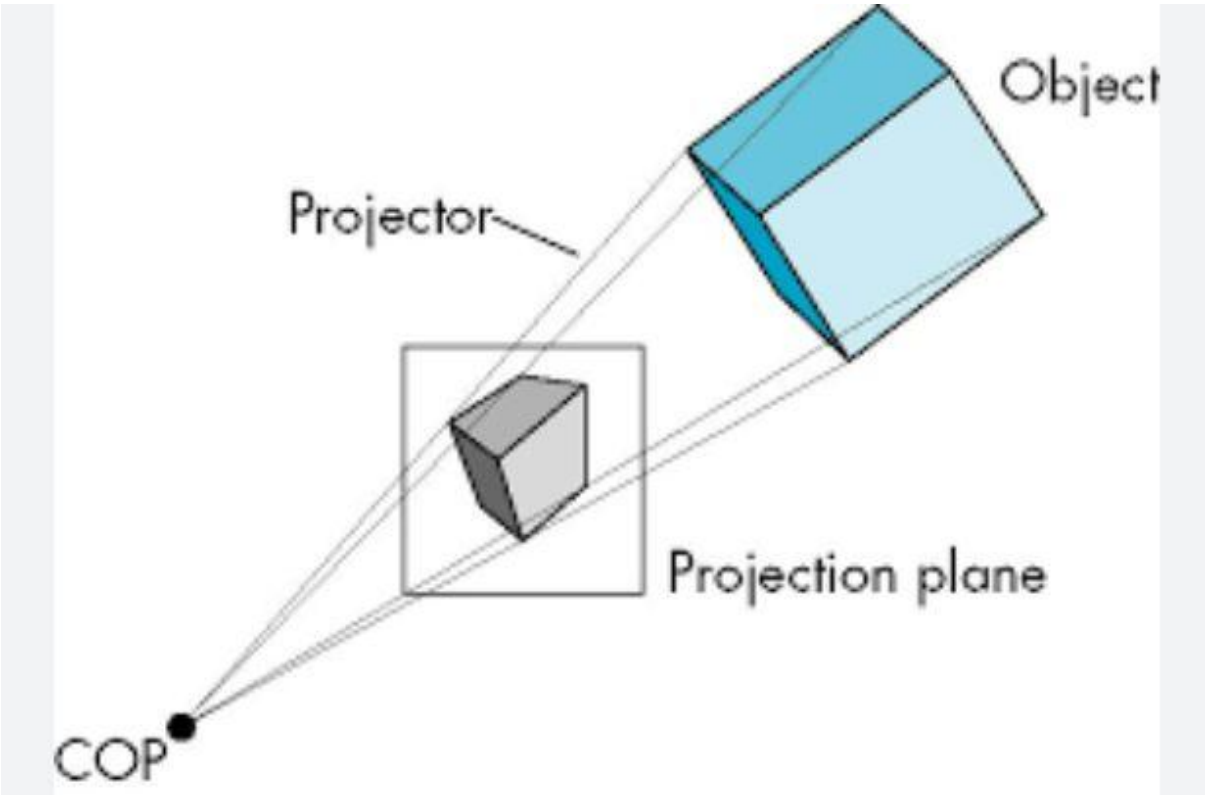


Figure 10: Center of projection (viewpoint, vanishing point, or convergence point) in perspective projection (Image credits: Art-Design-Glossary and Google.com.)

- Aerial perspective projection (a.k.a. atmospheric perspective) is the type of perspective projection in which the projectors diverge away from their point of convergence (or vanishing point) unto the planes of projection, and colors, tones, and atmospheric effects are used to give the object its shape—a shape that would appear smaller the more the object's distance increases away from the observer or vanishing point. The use of colors and tones usually creates the

illusion of depth on a 2-D surface such as paper or computer screen. Aerial perspective projection is used in producing aerial drawing which is one type of engineering drawing:

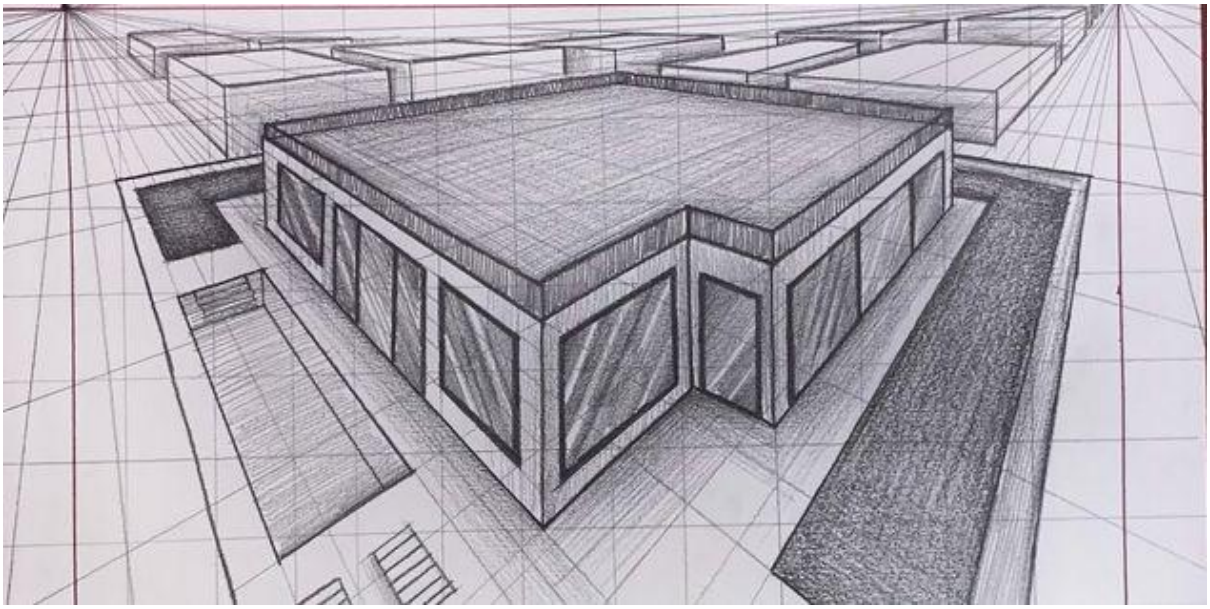
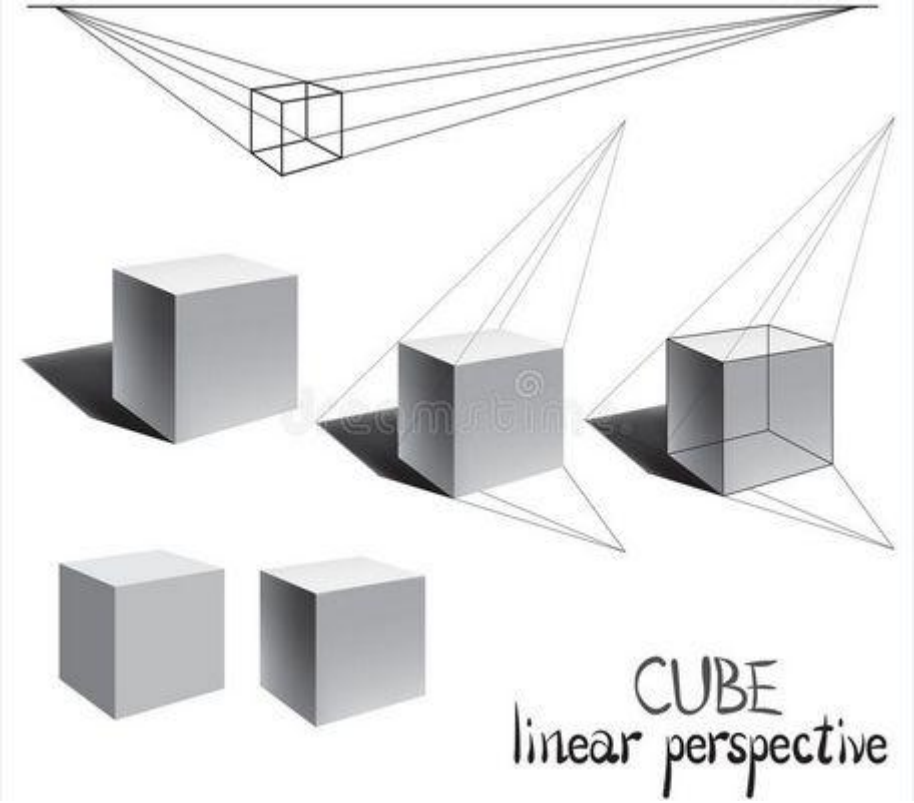


Figure 11: Aerial perspective projection of an area (Image credits: GenesisStudios and YouTube.)

- Linear perspective projection (often referred to as "geometric perspective") is the type of perspective projection in which a set of construction rules are employed in such a way that the projectors or imaginary lines of projection converge/meet at one or more vanishing point(s) and give the illusion of a depth that is not real. Linear perspective projection is used in creating three types of engineering

drawing: one-point, two-point, and three-point drawing, respectively.



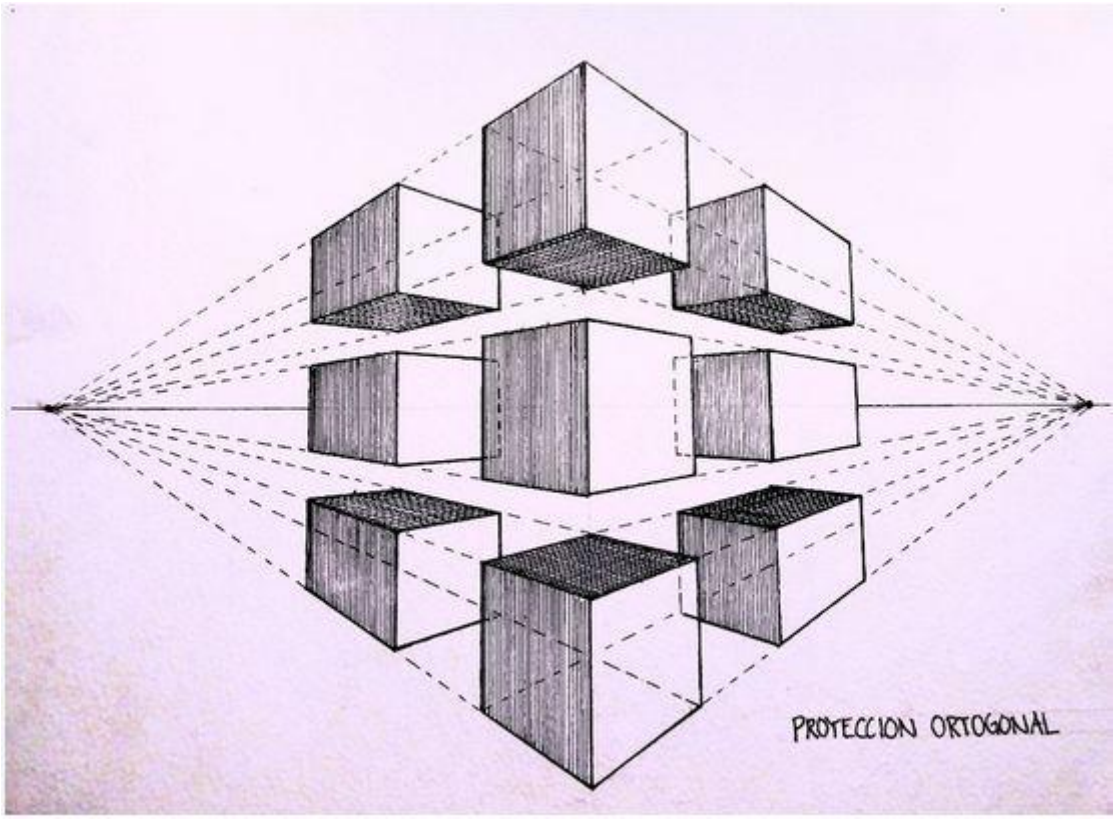


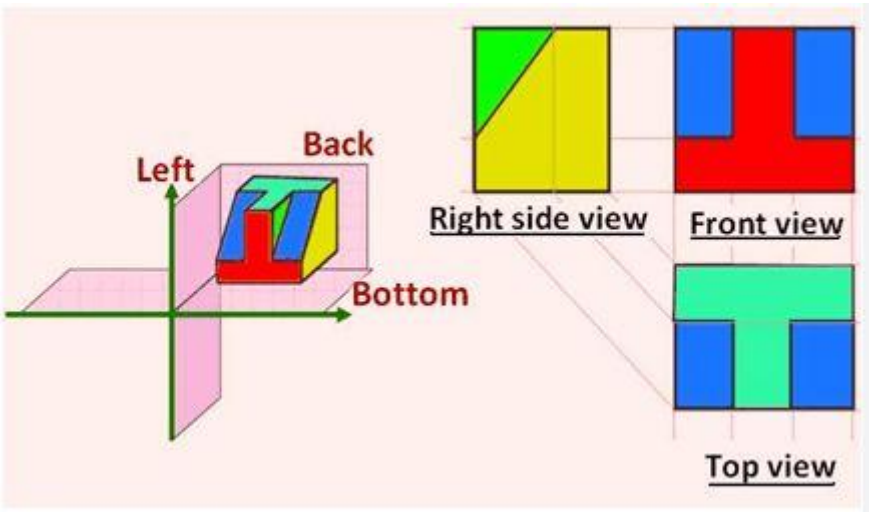
Figure 12: Linear perspective projection of some cubes (Image credits: Dreamstime.com and Pinterest.com.)

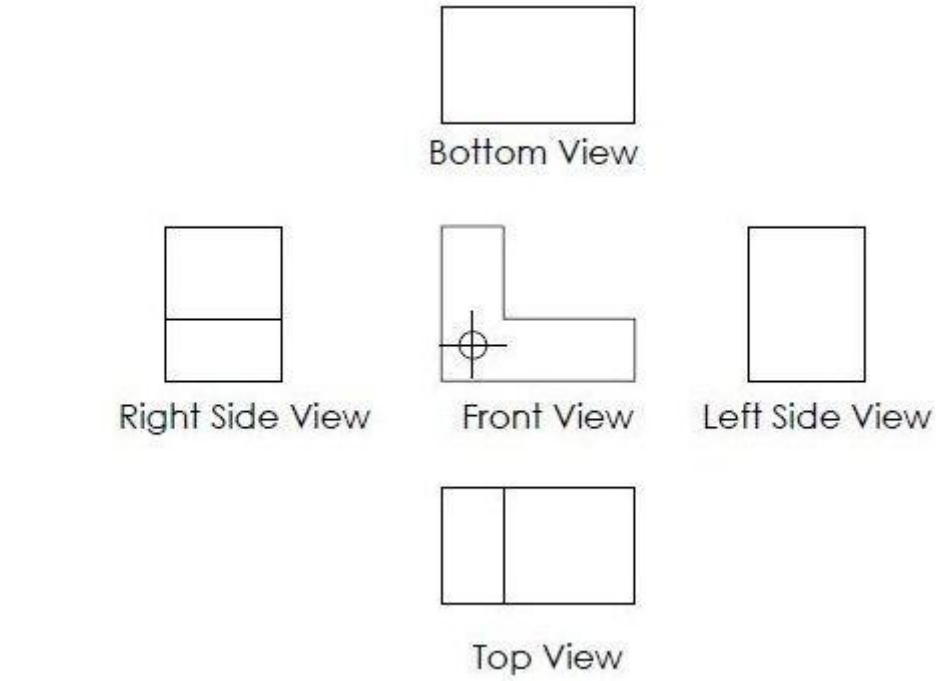
With the above important points/definitions in mind, we now define the following 13 types of engineering drawing:

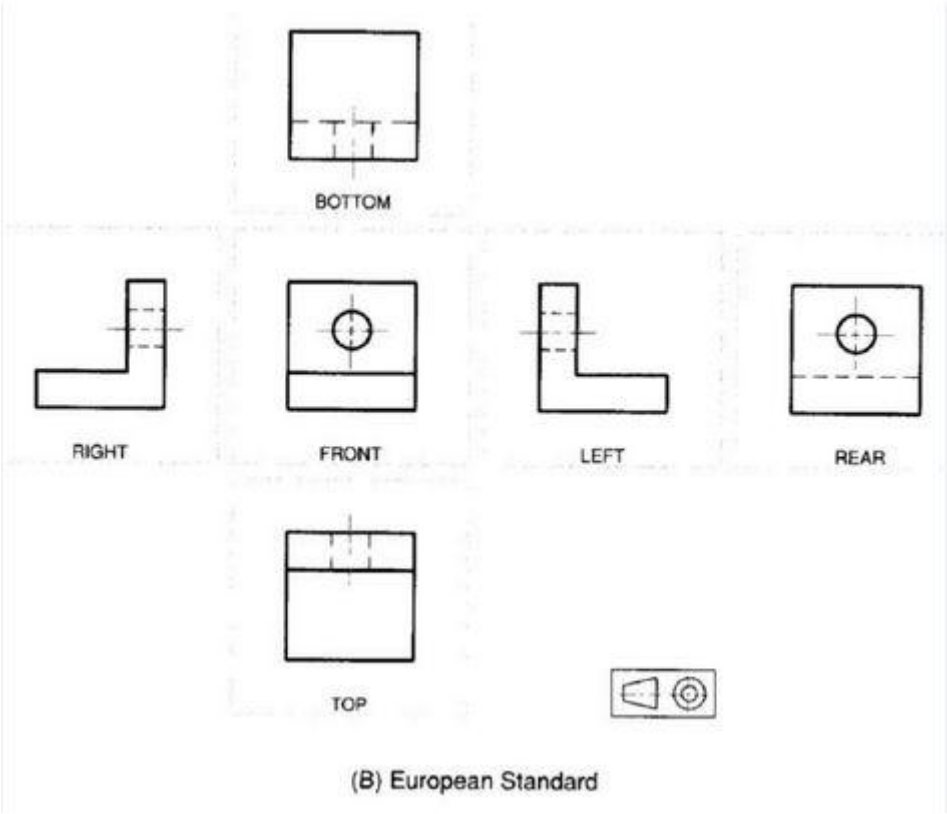
1. First-angle drawing

First-angle drawing is the type of engineering drawing that contains multi/multiple (i.e., at least 3) 2-dimensional projections or multi-view produced from the resulting parallel projections that are perpendicular (orthographic projection) to different/multiple planes of projection of an object; after making

projections on the planes of an object in the first quadrant, the projection of the front view (F)—which is one of the planes of the object—is drawn on the middle area of a medium (paper, computer screen, etc.) along with the right side view (R) of the object which is drawn on the left side of the front view, while the left side view (L) of the object is drawn on the right side of the front view, and the top view (T) or plan of the object is drawn alone/by itself beneath the front view. In some other cases, the bottom view (B) of the object is included/drawn on top of (but spaced a bit away from) the front view, and the rear view (R) of the object is included/drawn on either the right side of the left view or left side of the right view. First-angle drawing is also known as the European/international system of projection or engineering drawing.







(B) European Standard

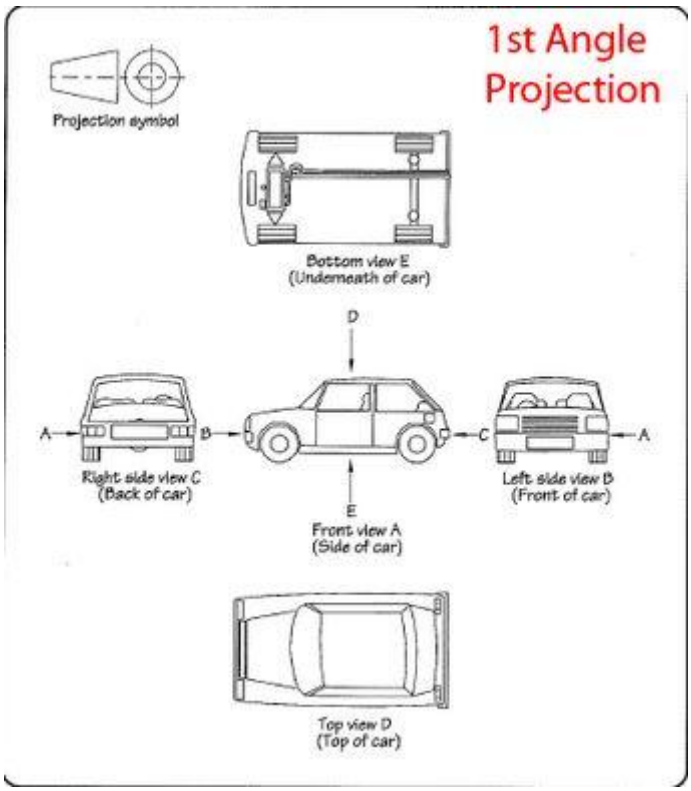


Figure 13: First-angle drawings of different objects (Image credit: Google.com.)

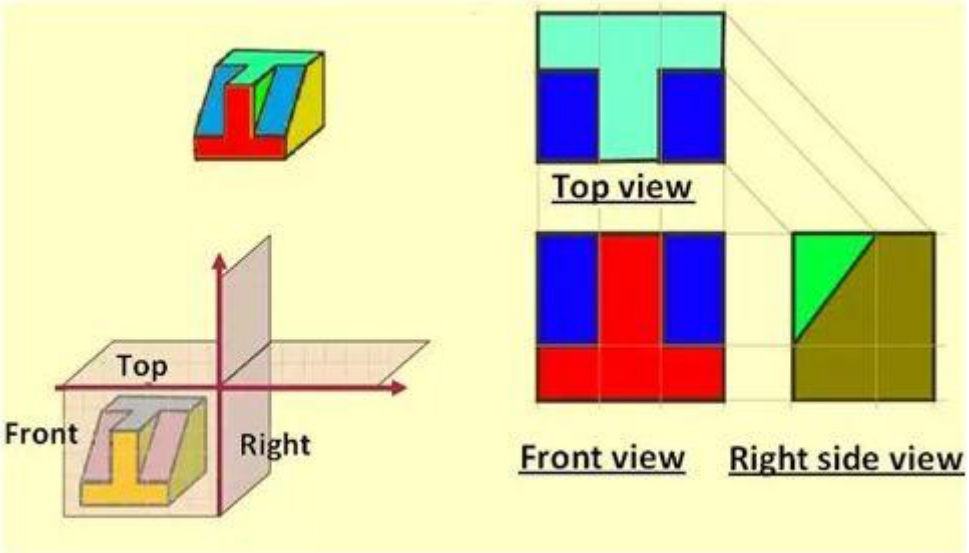
2. Second-angle drawing

Second-angle drawing is similar to first-, third-, and fourth-angle drawings, in that they also contain multi/multiple (i.e., at least 3) 2-dimensional projections or multi-view produced from the resulting parallel projections that are perpendicular (orthographic projection) to different/multiple planes of projection of an object; however, when making projections on different planes of an object in the second quadrant where the view is rotated downwards, it would be discovered that the resulting top view

and front view overlap each other, usually causing confusion in the drawing. The same happens in fourth-angle drawing where the top view and front view also overlap. But this overlap does not happen in first-angle and third-angle drawings, respectively. Therefore, first-angle and third-angle drawings are far more popular than second-angle and fourth-angle drawings which are not popular.

3. Third-angle drawing

In many cases (involving at least three 2-D projections: projections on three planes of an object), after projections are made on the planes of an object in the third quadrant, the projection of the top view (T) or plan of the object—which is one of the planes of an object—is drawn alone/by itself on the middle of a medium (paper, computer screen, etc.), while the front view (F) of the object is drawn beneath the top view, and the right side view (R) of the object is drawn on the right side of the front view; if four 2-D projections are made instead of three, then the extra 2-D projection would represent the left side view (L) of the object, usually drawn on the left side of the front view. Third-angle drawing is also known as "the American system" of projection or engineering drawing.



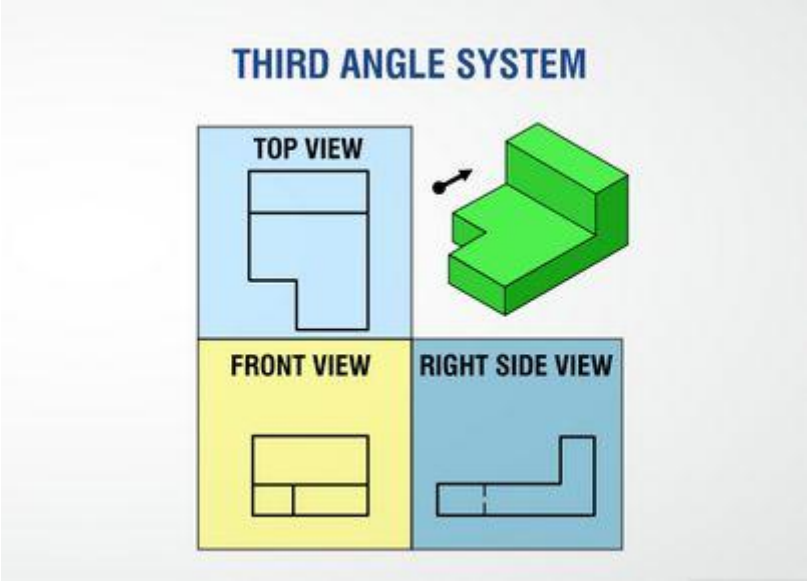


Figure 14: Third-angle drawings of objects (Image credit: Google.com.)

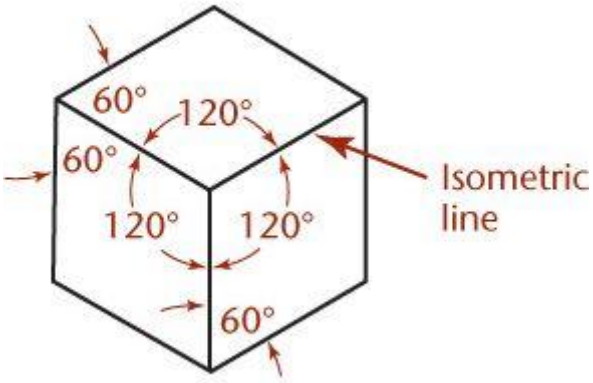
4. Fourth-angle drawing

In fourth-angle drawing, projections are made on different planes of an object placed in the fourth quadrant (where the view is now opposite the direction it was in second-angle drawing), but the

resulting top view and front view overlap each other, similar to second-angle projection. The top view and front view overlap in both second- and fourth-angle drawings, respectively. As earlier stated, this is the reason why second- and fourth-angle drawings are unpopular and not even used in engineering circles; first-angle and third-angle drawings, on the other hand, are widely used.

5. Isometric drawing

Isometric drawing is the type of engineering drawing that is produced from the resulting parallel projectors that are projected perpendicularly on the planes of any 3-D object that is tipped/rotated about one of its own major axes (*x*, *y*, and *z*). Isometric drawings are drawn in such a way that an object's axes are inclined to each other by 120°—i.e., the angle between each axis is the same; furthermore, 2 of the 3 axes are at either 30°, 45°, or 60° to the imaginary *x*-axis on any 2-D medium.


60°
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Isometric
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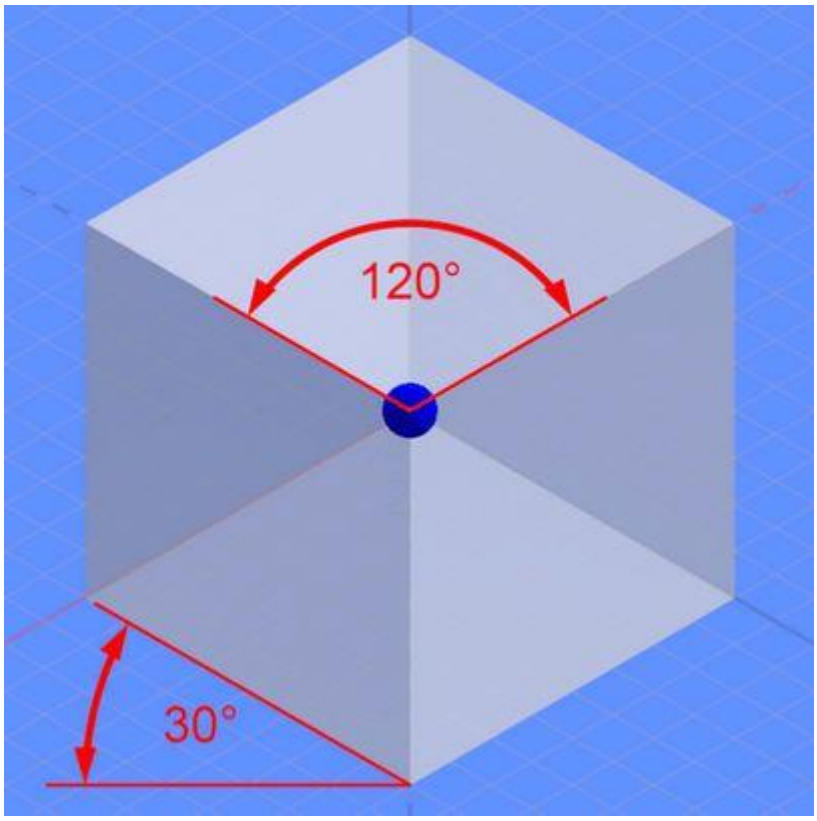
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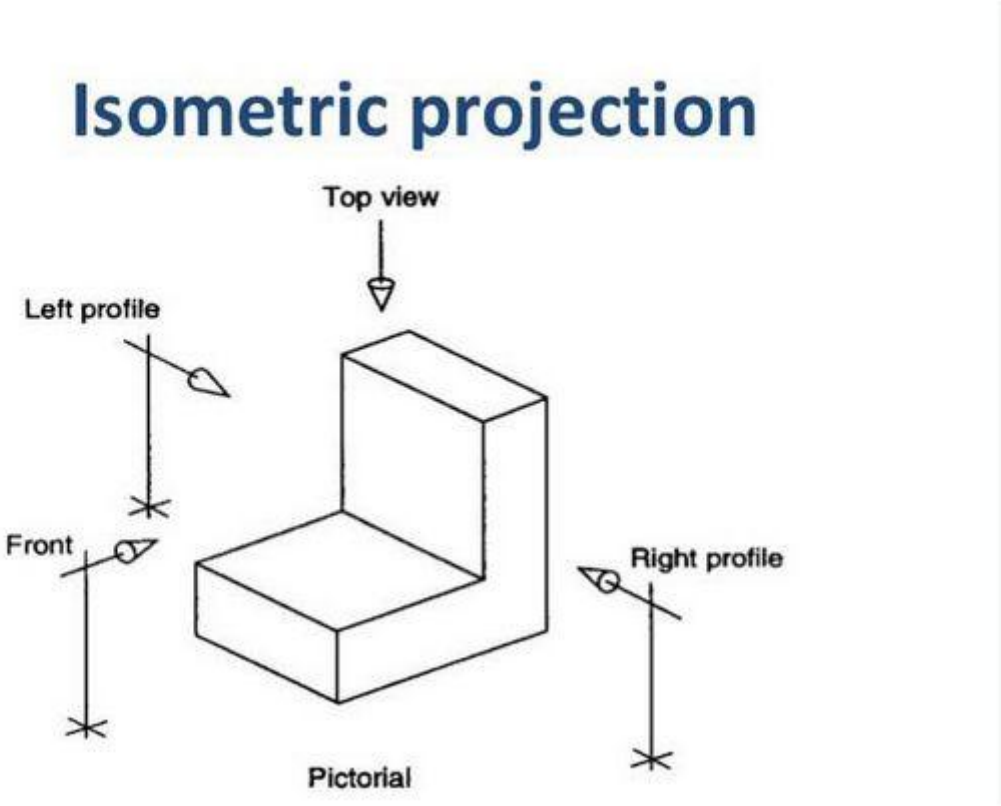


Figure 15: Isometric drawings of different objects (Image credit: Google.com.)

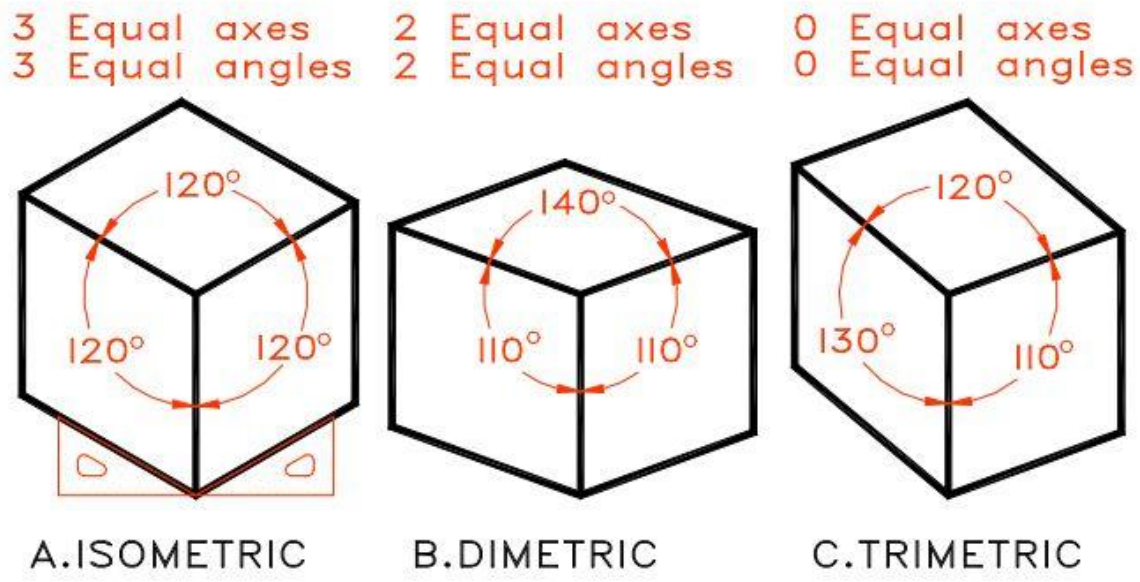


Figure 16: Isometric drawing in comparison with dimetric and trimetric drawings of an object

6. Dimetric drawing

Dimetric drawing is similar to isometric and trimetric drawings, in that, it is also the type of engineering drawing that is produced from the resulting parallel projectors that are projected perpendicularly on the planes of a 3-D object that is tipped/rotated about one of its major axes (*x*, *y*, and *z*). However, unlike in isometric drawing, only two faces of the object are equally inclined to the plane of projection—i.e., only 2 angles between any 2 major axes are unequal. Generally, two different angles are required to construct 2 planes of objects in dimetric projections.

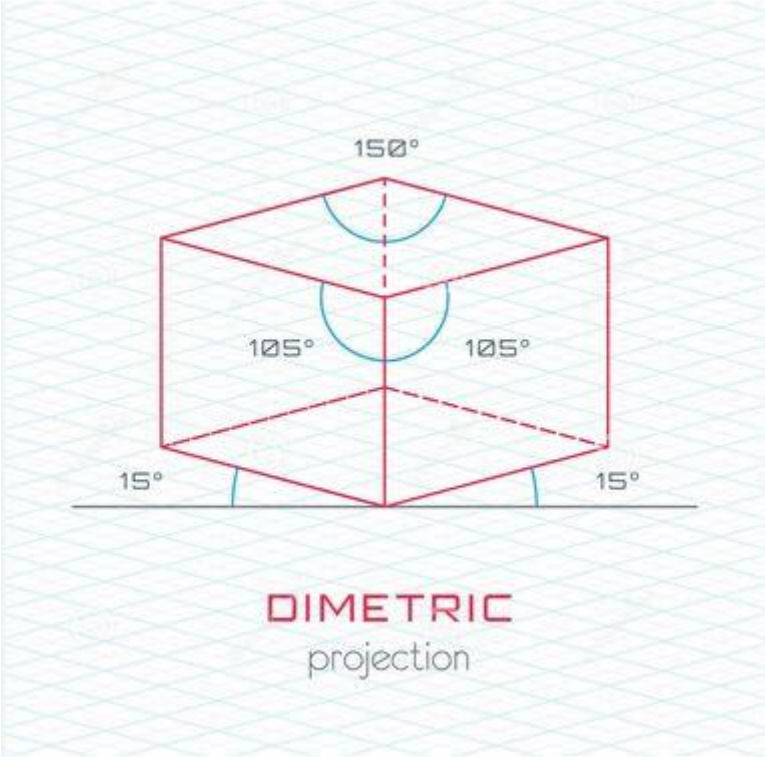


Figure 17: Dimetric drawing of an object (Image credit: Google.com.)

7. Trimetric drawing

In trimetric drawing, the three major axes of an object are inclined to each other by three different angles, respectively: three different angles are required to construct 3 planes of any objects, and the 3 angles between the 3 major axes are unequal.

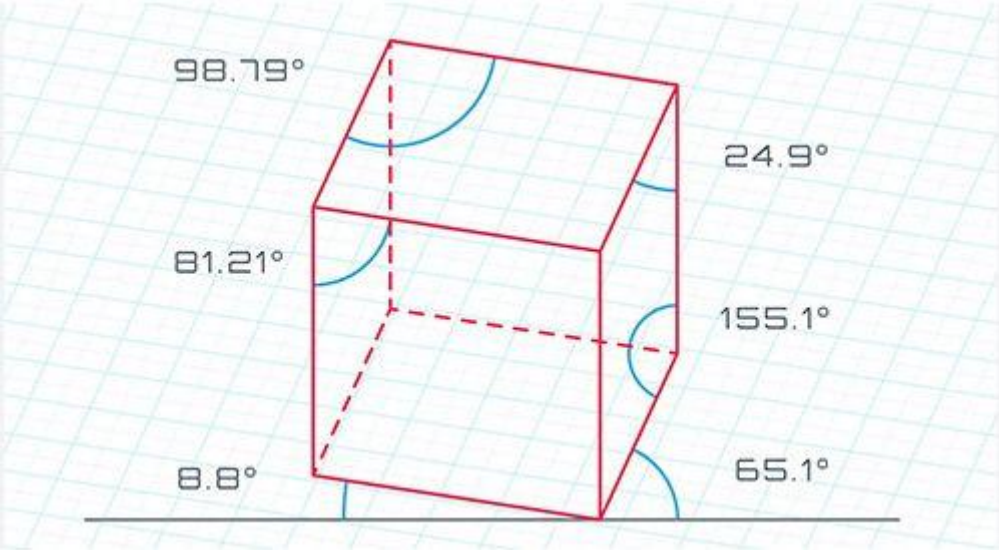
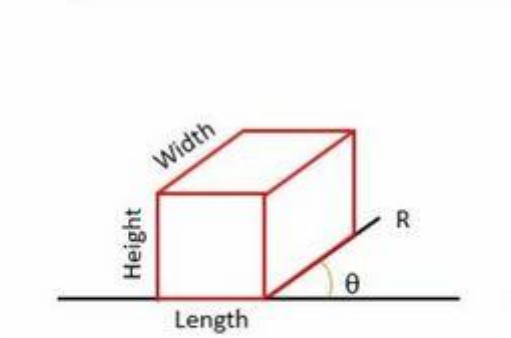


Figure 18: Trimetric drawing of an object (Image credit: Xamou-Art.com.)

8. Cavalier drawing

Cavalier drawing is the type of engineering drawing that is produced from the resulting parallel projectors that are not projected perpendicularly on the planes of any 3-D object that has one of its three planes projected at either 30°, 45°, or 60° to the *x*-axis; but all the dimensions (width, breadth, and height) of the 3-D object are all drawn to full scale.



(1) Cavalier Projection
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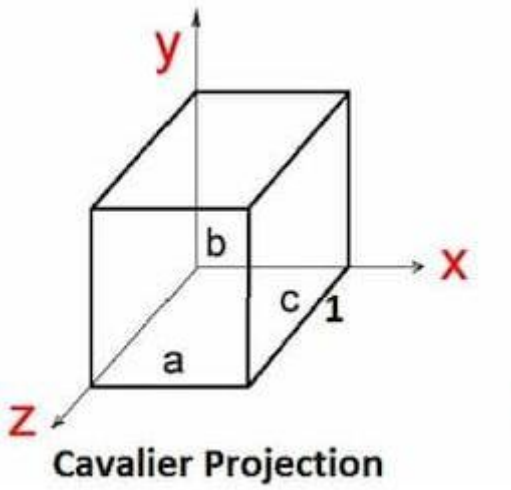


Cavalier Projection

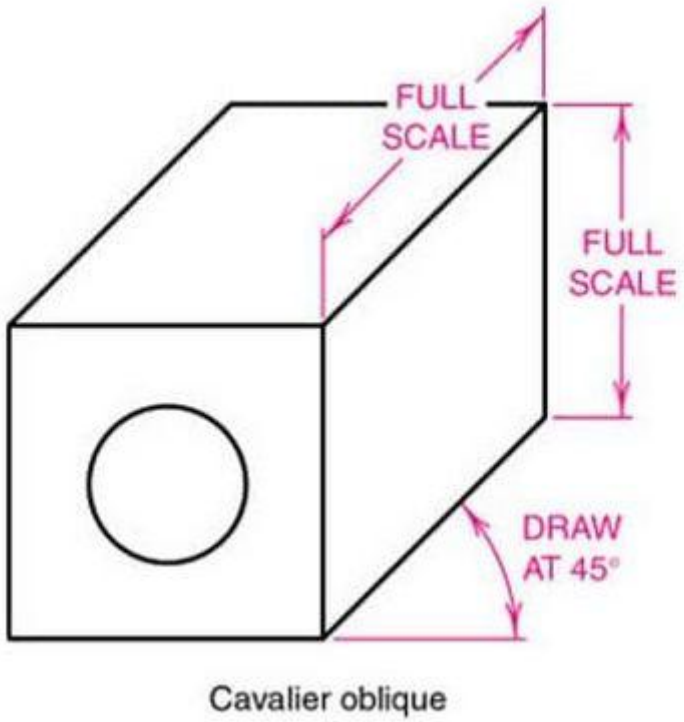
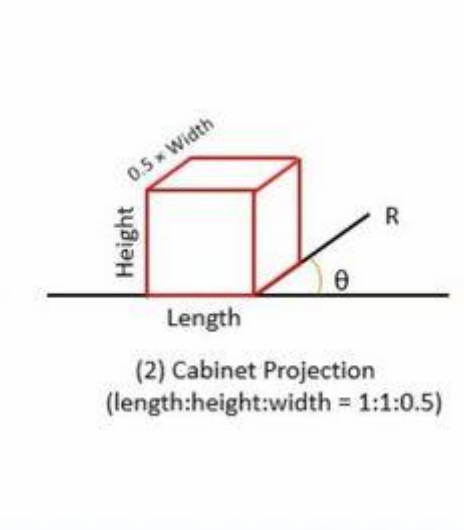


Figure 19: Cavalier drawing of different objects (Image credit: Google.com.)

9. Cabinet drawing

Cabinet drawing is similar to cabinet drawing, in that, it is also the type of engineering drawing that is produced from the resulting parallel projectors that are not projected perpendicularly on the planes of any 3-D object that has one of its three planes projected at either 30°, 45°, or 60° to the *x*-axis; however, unlike cavalier drawing, the width or breadth (whichever you designate to a particular dimension) is only drawn

to half scale instead of full scale; but the height is drawn to full scale just as is applicable to cavalier drawing.



(2) Cabinet Projection
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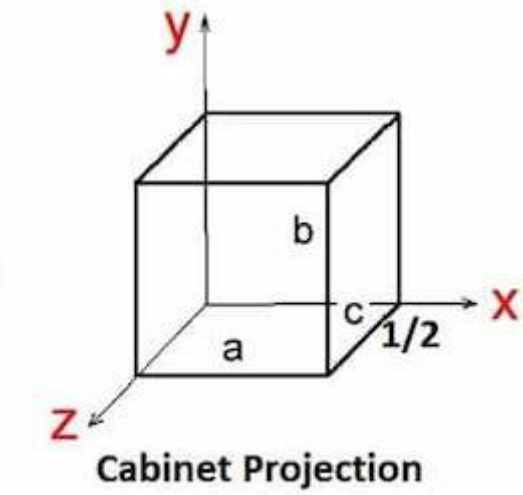


Cabinet Projection

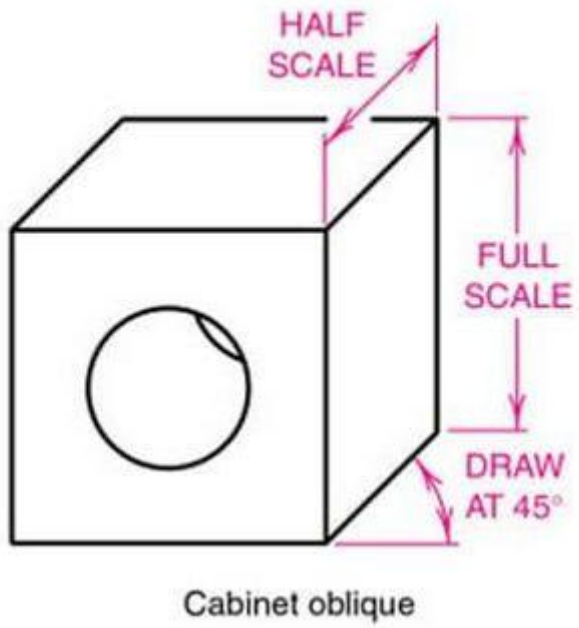


Figure 20: Cabinet drawings of different objects (Image credit: Google.com.)

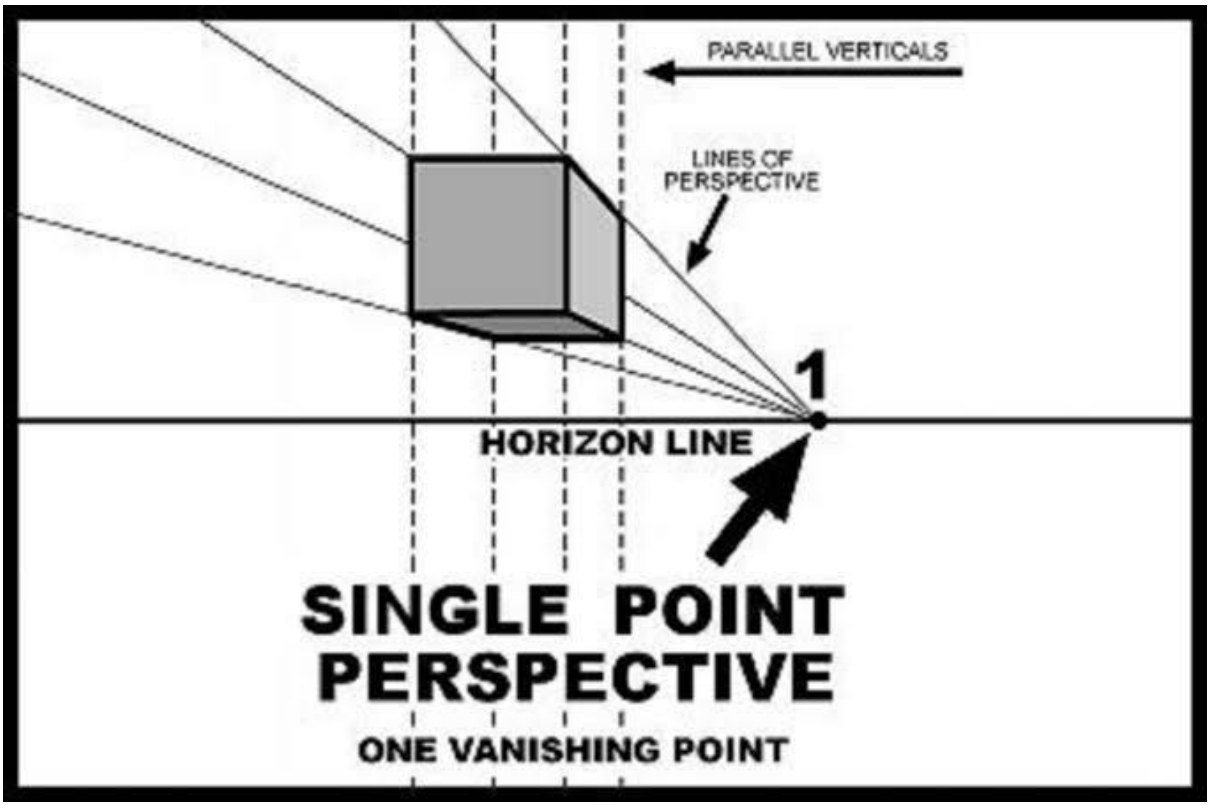
10. Aerial drawing

Aerial drawing is the type of engineering drawing that is produced from aerial perspective projection in which the projectors diverge away from their point of convergence (or vanishing point) unto the planes of projection, then and colors, tones, and atmospheric effects are used to give the object its shape—a shape that would appear smaller the more the object's distance increases away from the observer or vanishing point.

Figure 21: Aerial drawing of a building and environment (Image credit: Google.com.)

11. One-point drawing

One-point drawing is the type of engineering drawing that is produced from linear perspective projection in which a set of construction rules are used to ensure that the projectors diverge away from their point of convergence (or vanishing point) as they approach an object's plane of projection; but the same projectors (or imaginary lines) converge/meet at only one vanishing point. As a result, one-point drawings consist of only one vanishing point.



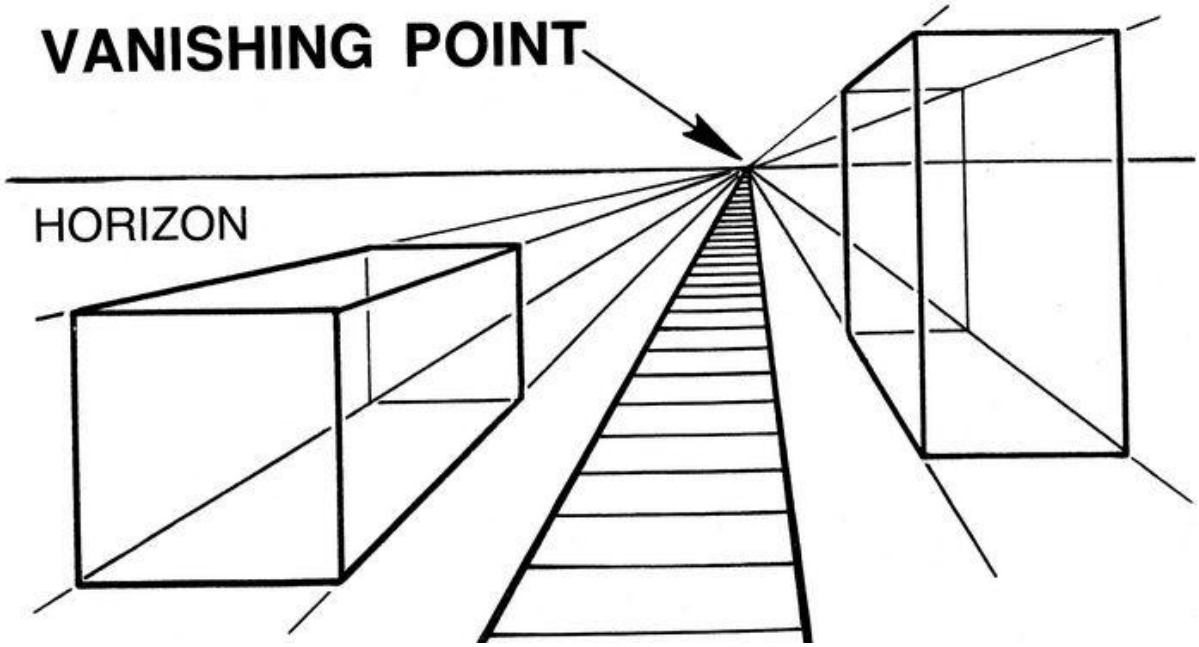
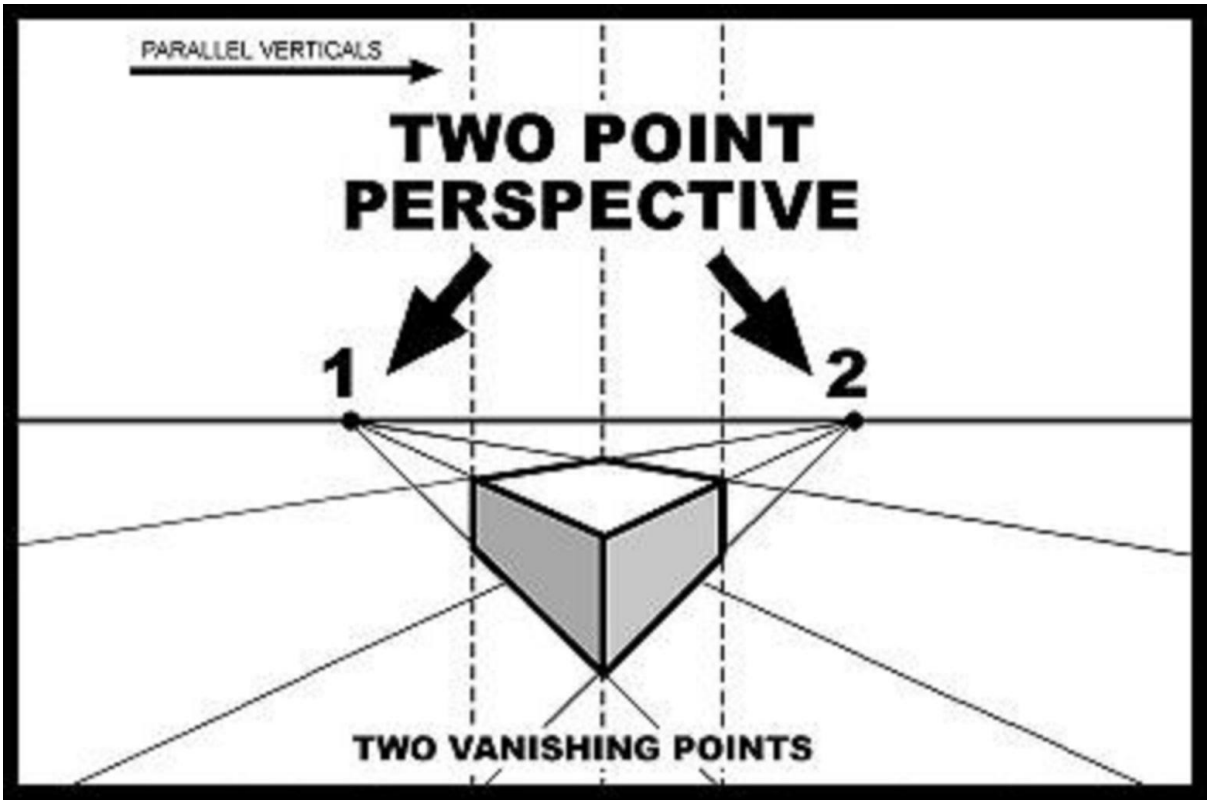


Figure 22: One-point drawings of different objects (Image credit: Google.com.)

12. Two-point drawing

Two-point drawing is similar to one-point and three-point drawings, in that, it is also the type of engineering drawing that is produced from linear perspective projection in which a set of construction rules are used to ensure that the projectors diverge away from their point of convergence (or vanishing point) as they approach an object's plane of projection; however, the projectors (or imaginary lines) converge/meet at two different vanishing points. As a result, two-point drawings consist of two vanishing points.


PARALLEL VERTICALS
TWO POINT PERSPECTIVE
1
2
TWO VANISHING POINTS

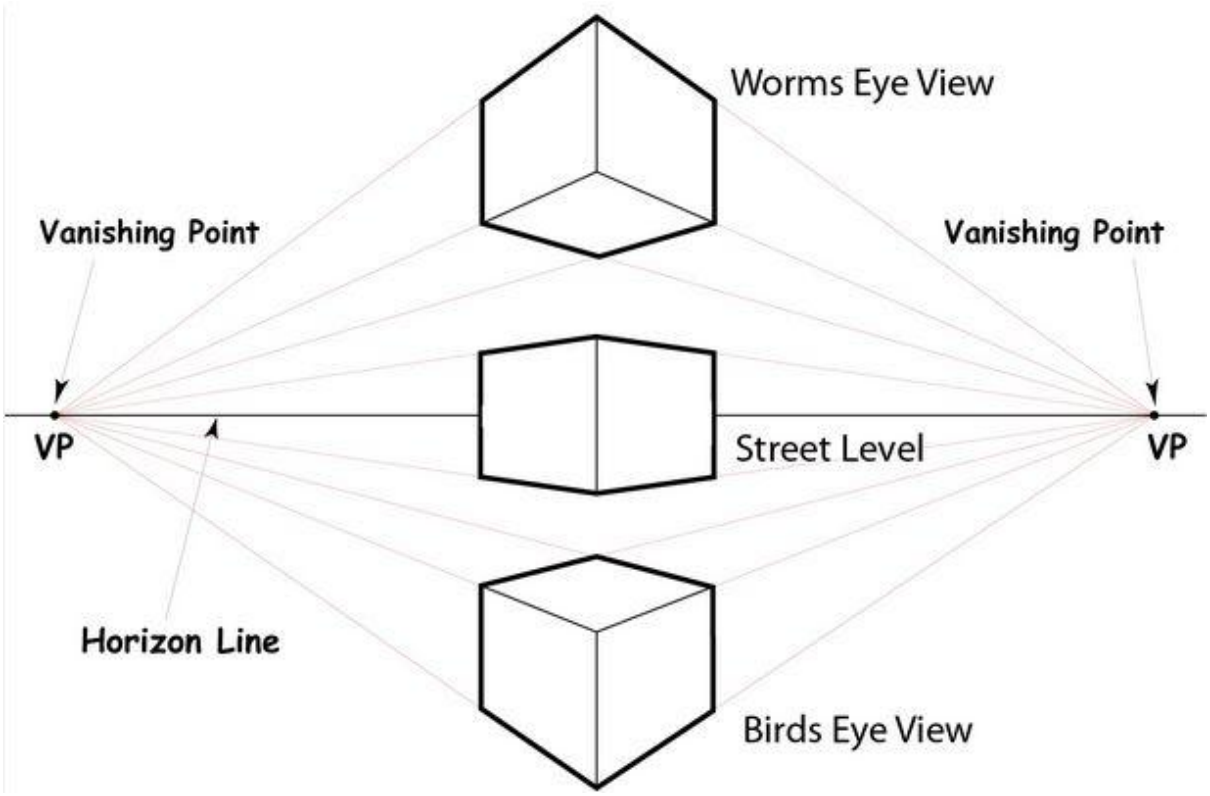
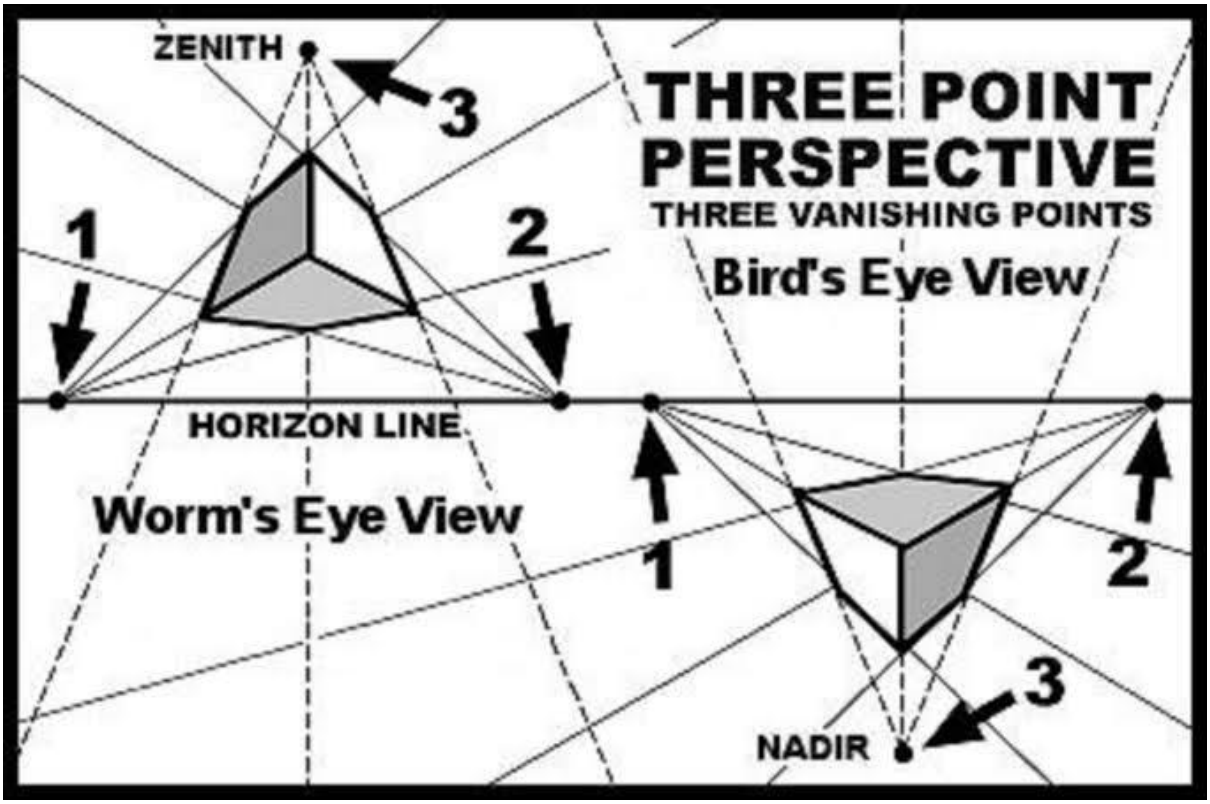

Worms Eye View
Vanishing Point
Vanishing Point
VP
Street Level
VP
Horizon Line
Birds Eye View

Figure 23: Two-point drawings of different objects (Image credit: Google.com.)

13. Three-point drawing

In three-point drawing, the projectors (or imaginary lines) converge/meet at three different vanishing points. As a result, three-point drawings consist of three vanishing points.



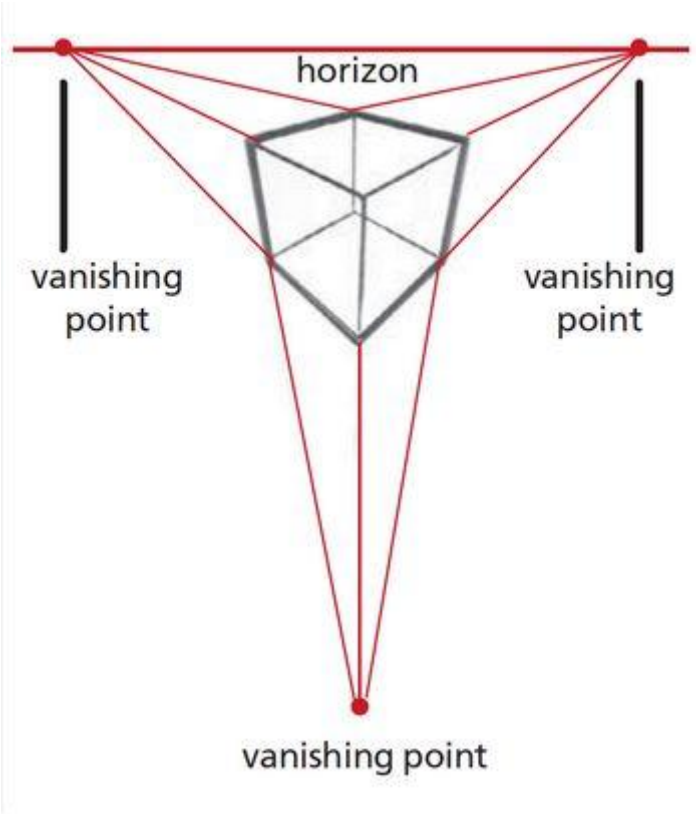


Figure 24: Three-point drawings of different objects (Image credit: Google.com.)