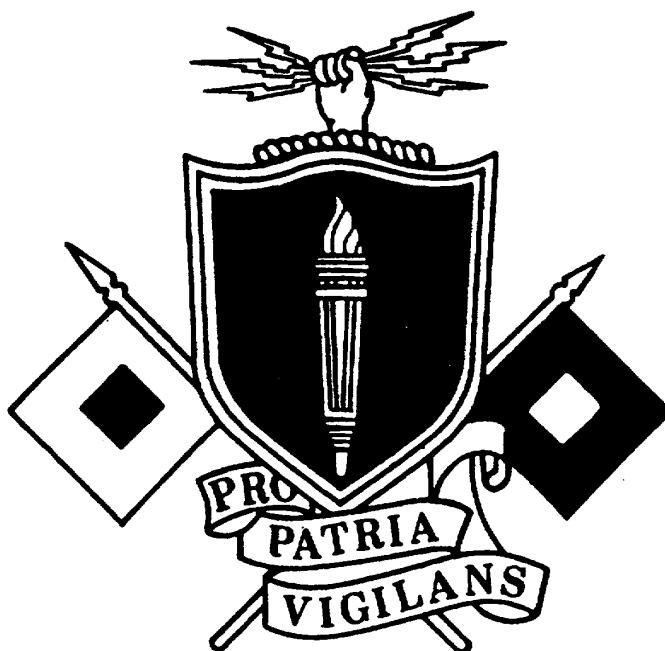# DRAW OBJECTS IN PERSPECTIVE

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US ARMY GRAPHICS DOCUMENTATION SPECIALIST
MOS 25Q SKILL LEVEL 1 AND 2 COURSE

DRAW OBJECTS IN PERSPECTIVE

SUBCOURSE NO. SS0526-5
(Development Date: 30 September 1985)

US ARMY SIGNAL CENTER AND FORT GORDON
FORT GORDON, GEORGIA

ONE CREDIT HOUR

GENERAL

Draw Objects in Perspective subcourse is designed to teach the knowledge necessary to perform tasks related to illustrating. Information is provided on one-, two-, and three-point perspective.

This subcourse is presented in three lessons. Each lesson corresponds to a terminal objective as indicated below.

Whenever pronouns or other references denoting gender appear in this document, they are written to refer to either male or female unless otherwise indicated.

Lesson 1: DRAW OBJECTS IN ONE-POINT PERSPECTIVE

TASK: Describe perspective and the components of one-point perspective.

CONDITIONS: Given information and examples about perspective, dimensions, and vanishing points.

STANDARDS: Demonstrate competency of the task skills and knowledge by correctly responding to 70 percent of the multiple-choice test covering one-point perspective.

(This objective supports SM Task 113-579-1026, Draw Subjects in Perspective.)

Lesson 2: DRAW OBJECTS IN TWO-POINT PERSPECTIVE

TASK: Describe the components of two-point perspective.

CONDITIONS: Given information and examples about perspective, dimensions, and vanishing points.

STANDARDS: Demonstrate competency of the task skills and knowledge by correctly responding to 70 percent of the multiple-choice test covering two-point perspective.

(This objective supports SM Task 113-579-1026, Draw Subjects in Perspective.)

Lesson 3. DRAW OBJECTS IN THREE-POINT PERSPECTIVE

TASK: Describe the components of three-point perspective.

CONDITIONS: Given information and examples about perspective, dimensions, and vanishing points.

STANDARDS: Demonstrate competency of the task skills and knowledge by correctly responding to 70 percent of the multiple choice test covering three-point perspective.

(This objective supports SM Task 113-579-1026, Draw Subjects in Perspective.)

TABLE OF CONTENTS

TABLE OF CONTENTS (cont)

iv

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INTRODUCTION

The three lessons on perspective drawing are designed to teach you the methods of drawing in perspective.

The world we live in is three-dimensional. Every object, regardless of size, has length, width, and depth. All forms exist in three dimensions. To do a drawing which looks real, you must show the differences between how forms look when they are near and how they look when they are far away. The place where forms exist is called "space." The artistic study of space is called perspective.

Your ability to draw in perspective can make the difference between work that presents a subject that seems real and a poor representation. In today's Army, your drawings are required in presenting plans, ideas, battlefield representations, and proposals to the commander. Your drawings could help or hinder his decisions.

After you have completed this subcourse, you will be able to draw illustrations using correct perspective.

This subcourse consists of three lessons which are all related to the following terminal learning objectives:

Performance-Oriented (Multiple-Choice) Terminal Learning Objective:

<u>TASK</u>: Describe perspective and the components of one-, two-, and three-point perspective.

<u>CONDITIONS</u>:   Given the lesson 1, 2, and 3 materials, pencil, and paper; and without supervision.

<u>STANDARDS</u>: Demonstrate competency of the task skills and knowledges by correctly responding to 70 percent of the multiple-choice test covering the drawing of objects in perspective.

LESSON 1
DRAW OBJECTS IN ONE-POINT PERSPECTIVE

TASK

Describe perspective and the components of one-point perspective.

CONDITIONS

Given information and examples about perspective, dimensions and vanishing points.

STANDARDS

Demonstrate competency of the task skills and knowledge by responding to the multiple-choice test covering one-point perspective.

REFERENCES

None

Learning Event 1:
DEFINE PERSPECTIVE

1. In the following section you will be shown how to construct various types of perspective projections. A thorough understanding of perspective will equip you with a more acute sense of observation and feeling for form and will help you in making your drawings more convincing and realistic.

2. Perspective drawings are pictorial one-view representations which depict a scene as it might appear to the eye. Thus, they are easier to comprehend at a glance than drawings made in orthographic projection. When constructing these drawings, imagine a vertical plane placed between the eye and the object to be drawn. This imaginary plane is the plane of projection and in perspective is known as the "picture plane".

3. The simplest method of making a perspective drawing is to make a tracing on a piece of glass. That is, you place a pane of glass between you and the object and trace all visible edges of the object. The pane of glass in this case is your picture plane. Even though this method may be rather impractical, it does illustrate some of the principles of perspective. In a real situation your paper takes the place of the glass, and instead of tracing your drawing, you project it.

4. One of the most important items in perspective drawing is the "station point." Actually, the "station point" represents the position of the observer's eyes. Therefore, the position of the station point greatly influences the perspective. For example, a house would look much different to

an observer on the ground or street level than it would to the same observer on the fourth floor of a large building.

5. Perspective drawing is based on the fact that all lines extending from the observer appear to converge or come together at some distant point. For example, to a person sighting down a long stretch of railroad tracks, the tracks will appear to merge or vanish at a single point in the distance. In perspective projection, the point at which these parallel horizontal lines seem to meet is known as the "vanishing point." Like the railroad tracks, all horizontal and vertical lines and planes, except for those parallel to the picture plane, appear to vanish or merge at the vanishing points which are located on the horizon line (fig 1-1).

6. Think of the object to be drawn as resting on a horizontal ground plane which is perpendicular to the "picture plane." The limits of the "ground plane" may be indicated on the picture plane as two separate lines: the ground line and the horizon line. The ground line intersects the picture plane at the bottom, and defines the lower limit of your drawing. The position of the horizon, or eye level line, which may or may not be visible on the picture plane, depends upon your angle of sight.
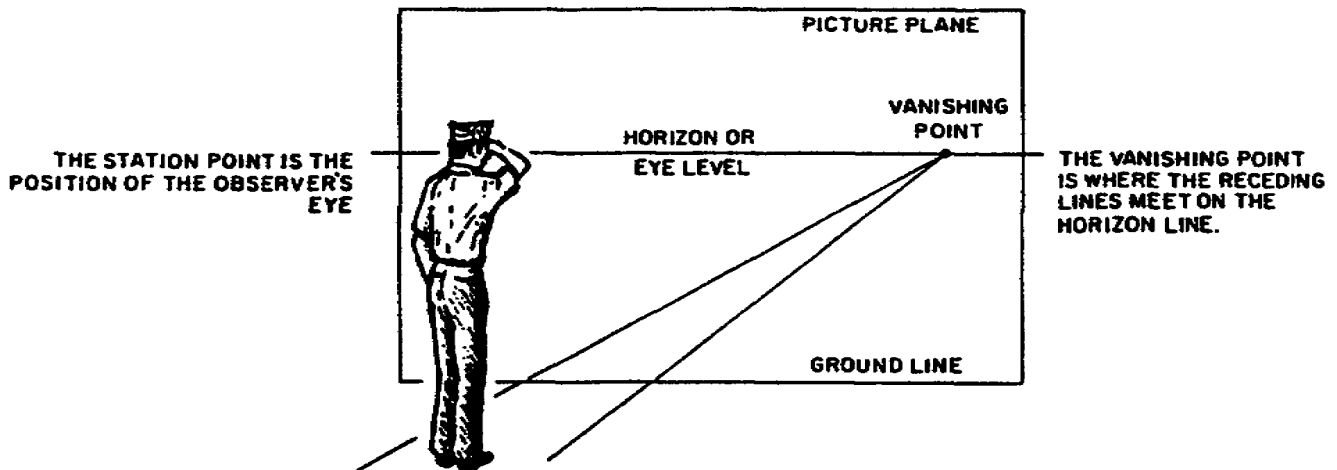

Figure 1-1. Perspective nomenclature

Learning Event 2:
DEFINE ONE-POINT PERSPECTIVE

1. One-point perspective exists when two dimensions of an object (height and width) are parallel to the picture plane. This occurs when the object being observed is straight in front of the observer. In such a view there is only one dimension, depth, that is left to be accounted for. This dimension must have a vanishing point. Figure 1-2 shows how a one-point perspective can occur in two ways. If you look at cube straight on, the vanishing point is out of sight behind it. If you were standing inside the cube, as in a room, you would have the same situation that you have when you are looking down the middle of a street. The right and left walls of the enclosure correspond to the flat fronts of the buildings on the side of the street. In such a view all receding parallel lines appear to run to one vanishing point.
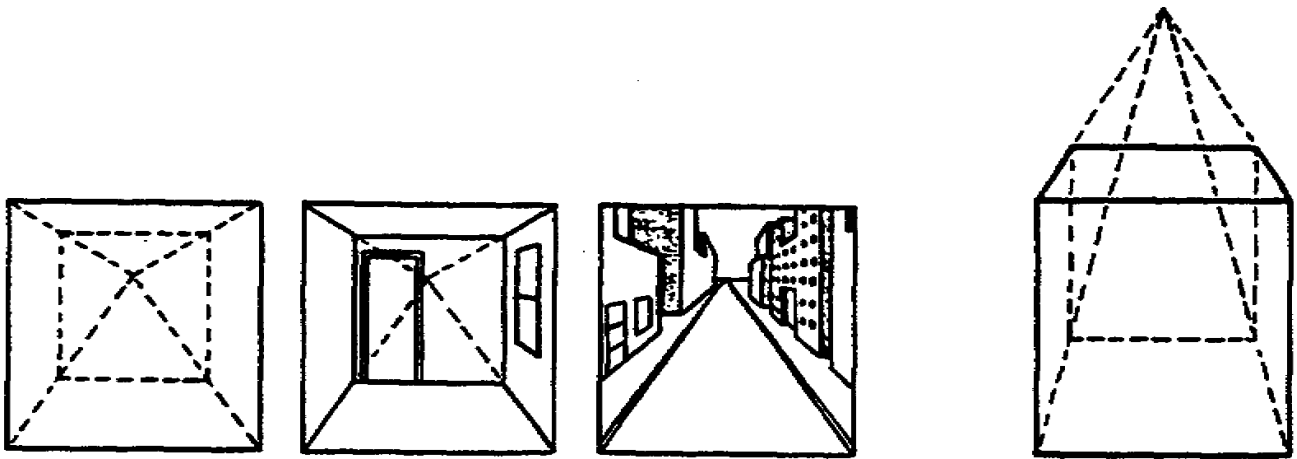

Figure 1-2. One-point perspective

2. To draw a cube in accurate perspective in relation to a definite view point, a plan view is used as shown in Figure 1-3. Application of this method enables you to draw an object as it may appear at any distance and viewpoint you desire. The sources of information necessary for this type of drawing are scaled drawings of the top and side views of the object. In regard to drawing a cube, all sides are of equal length and a side view is not necessary. If a box of unequal sides were used, you would need an elevation view of the box to find its height. This is covered later in the chapter.

3. In Figure 1-3 one-point perspective is used since two dimensions (height and width) are parallel to the picture plane. Draw a square representing the top of the cube in orthographic projection, and establish a station point at a distance no less than three times the length of one

3

side of the cube away from the center of the cube. Remember the station
point is the spot from which you ill view the cube. Now place a line that
represents the picture plane between the station point and the square so
that it touches the front of the cube. It is not essential to place it
here; it may be placed at some other distance from the cube. However, the
farther away you place in picture plane, the smaller the cube will appear.
In any perspective drawing, the comparative sizes will be reduced
proportionately as the distance is increased between the picture plane and
the object.

4. Locate the corners of the cube on the picture plane by drawing lines B
(fig 1-3) from each corner of the square to the station point. (Each corner
of the cube represents the positions of a vertical corner of the cube.) The
positions of tie verticals on the picture plane are determined by the points
of intersection of these lines with the picture plane. In order to
determine the width of each side of the cube, drop vertical lines A and C
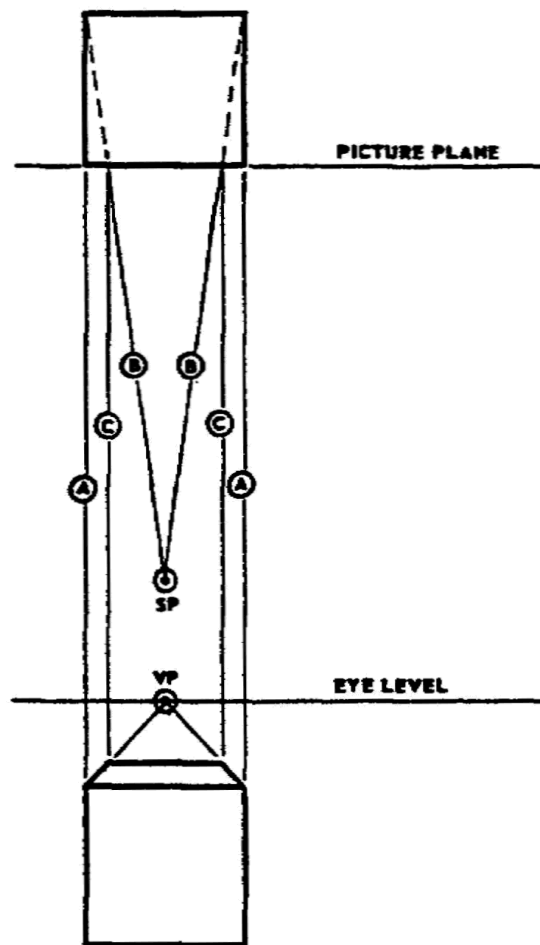from the points where the lines A and B intersect the picture plane.

Figure 1-3. Use a plan view to construct a
one-point perspective drawing

4

5. Construct a square representing the front face of the cube, using the length between lines A as the measurement. Determine the vertical height of the station point in relation to the level that you are viewing the cube from, and draw a horizontal eye level line. Vertically under the station point locate a vanishing point (VP) on the eye level line. Draw lines from the corners of the square to the vanishing point. At the intersections of these lines with lines C, draw the horizontal line representing the back of the cube. Darken the visual outlines to complete the cube in one-point perspective.

6. To draw an object in one-point perspective using a plan and elevation view follow the method shown in Figure 1-4. Notice the picture plane becomes a line in both the top and side orthographic views.

PLAN VIEW

PICTURE PLANE (PP)
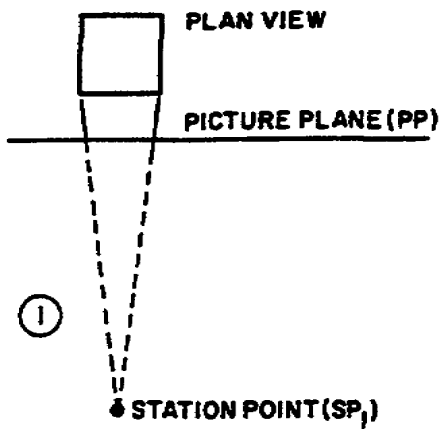
① ▼ STATION POINT (SP₁)

1. DRAW THE PLAN VIEW.

2. ESTABLISH ITS STATION POINT (SP₁).

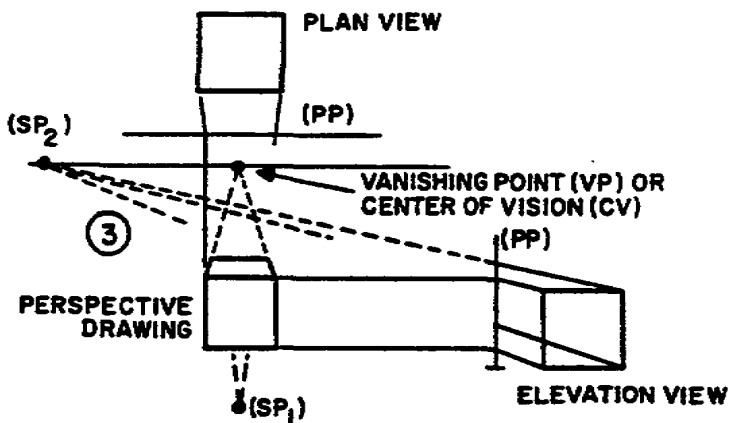3. DRAW A LINE REPRESENTING THE PICTURE PLANE FOR THE PLAN VIEW.

4. DRAW LINES FROM THE (SP₁) TO EACH CORNER OF THE OBJECT SO THAT THEY INTERSECT THE PICTURE PLANE.

PLAN VIEW

(SP₂)   (PP)
              HORIZON OR EYE LEVEL

(PP)

②   ▼(SP₁)
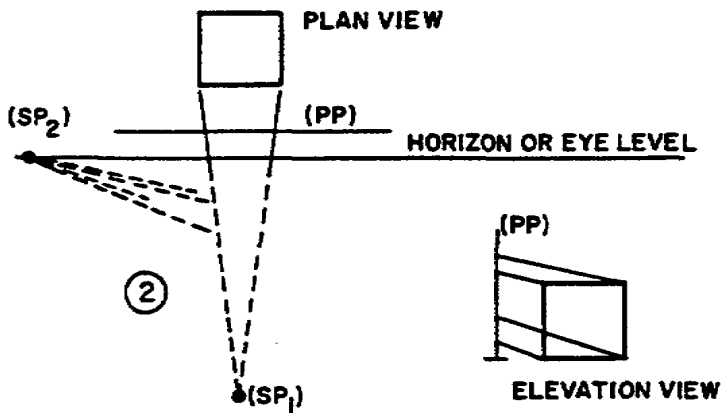
ELEVATION VIEW

5. DRAW THE ELEVATION VIEW.

6. ESTABLISH THE STATION POINT FOR THE ELEVATION VIEW (SP₂). THIS LOCATES THE HORIZON OR EYE LEVEL LINE.

7. DRAW A LINE REPRESENTING THE PICTURE PLANE FOR THE ELEVATION VIEW.

8. DRAW LINES FROM (SP₂) TO EACH CORNER OF THE ELEVATION VIEW SO THAT INTERSECT THE PICTURE PLANE.

PLAN VIEW

(SP₂)   (PP)

                VANISHING POINT (VP) OR CENTER OF VISION (CV)

③   (PP)

PERSPECTIVE DRAWING

         ▼(SP₁)   ELEVATION VIEW

9. DRAW PERPENDICULAR PROJECTORS FROM BOTH PP'S TO LOCATE CORNER PLOTS OF THE OBJECT.

10. CONNECT CORNER PLOTS TO COMPLETE PERSPECTIVE DRAWING.

Figure 4. One-point perspective drawing
obtained from orthographic views

6

Learning Event 3:
DEFINE PICTURE PLANE, STATION POINT AND VANISHING POINT

1. The station point for the plan view was located as described earlier.
As was stated, the station point is the observer's eye. Therefore, the
station point for the side view is actually the same station point as that
shown for the top view. Thus, it is the same horizontal distance from the
cube, but its elevation shows the height of the station point above the
level of the cube. The picture plane in the side view is also the same
distance from the cube as in the top view, and the ground line in this view,
on which the picture plane rests, defines the ground line of the picture
plane in the perspective drawing.

2. Notice that the vanishing point and center of vision in this drawing are
located directly above the station point in the perspective drawing and on
the same line with the station point for the side view of the cube. This
line is the eye level line. It is also the horizon line for the drawing.
The intersection point of a projector from a corner of the cube in the top
view with the projector from the same corner in the side view locates the
corner in the perspective drawing.

3. The vanishing point defines the point at which all lines perpendicular
to the picture plane in the perspective drawing converge. The fact that
there is only one vanishing point in this type of perspective drawing gives
it its name. It is also called parallel perspective because the front face
of the object is parallel to the picture plane.

4. In parallel perspective drawings, the center of vision is not
necessarily centered on the object. It may fall to one side or the other as
shown in Figure 1-5. When the front face is parallel to the picture plane
and the center of vision is at one side of the drawing, there will be
distortion. Actually, the drawing becomes an oblique projection which may
be know as fake perspective and is not a true perspective drawing. Notice
that in order to make such drawing, the object must be considered as resting
with its front face against the picture plane. If this were not so,
converging projection lines from the corners of the front face would alter
its appearance so that it would no longer appear to be parallel with the
picture plane. In fact, as you will see, it would then become a two-point,
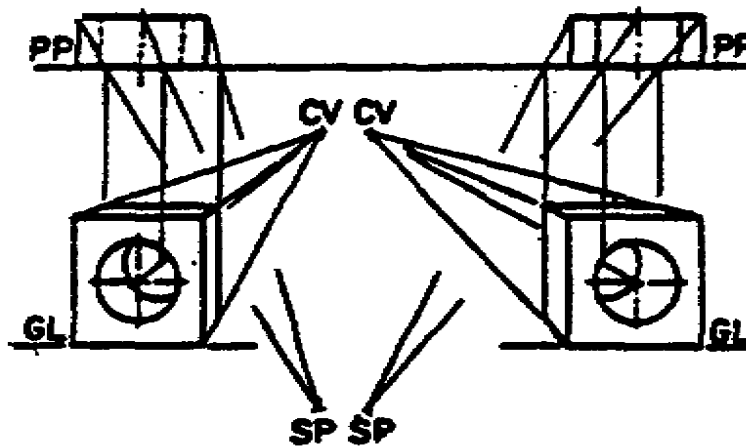rather than a one-point, perspective drawing.

Figure 1-5. Position of the station point at right
or left of center in parallel perspective drawings

6. Circular shapes, which may prove to be time consuming if drawn in true perspective, can be drawn with ease if they are drawn parallel with the picture plane. Therefore, this type of projection is ideal for items such as machine parts that have circular shapes.

PRACTICE EXERCISE

1.   What is a perspective drawing? _____

_____

2.   What is a "picture plane"? _____

_____

3.   What is a station point? _____

_____

4.   What is a vanishing point? _____

_____

5.   What is one-point perspective? _____

_____

ANSWERS TO PRACTICE EXERCISE

1.   Pictorial one-view representation which depicts a scene as it appears to the eye.

2.   An imaginary plane is the plane of projection.

3.   The position of the observer's eyes.

4.   In perspective projection, the point at which parallel horizontal lines appear to vanish or merge.

5.   Exists when two dimensions of an object height and width are parallel to the picture plane.

LESSON 2
DRAW OBJECTS IN TWO-POINT PERSPECTIVE

TASK

Describe the components of two-point perspective.

CONDITIONS

Given information and examples about perspective dimensions and vanishing points.

STANDARDS

Demonstrate competency of the task skills and knowledge by responding to the multiple choice test covering two-point perspective.

REFERENCES

Learning Event 1:
DEFINE TWO-POINT PERSPECTIVE

1. Two-point perspective is most commonly used in perspective drawings. Two-point, or angular perspective, exists when the object is sitting at an angle to the picture plane. In the perspective drawing of such an object, there are two sets of horizontal lines or planes converging toward two different vanishing points on the eye level or horizon line. The parallel lines which slop to the right will vanish at a point in the distance called the right vanishing point (VPR) and those that slope to the left at a point called the left vanishing point (VPL) (fig 2-1).

2. If there are a number of objects in the drawing which are sitting at different angles to the picture plane, each will have its own set of vanishing points (fig 2-1).

3. To draw an object in two-point perspective in relation to a definite viewpoint, plan and elevation views are used as shown in Figure 2-2. In the figure, the plan view of the block was drawn first at the desired angle to the picture plane. The position of the picture plane was then determined.
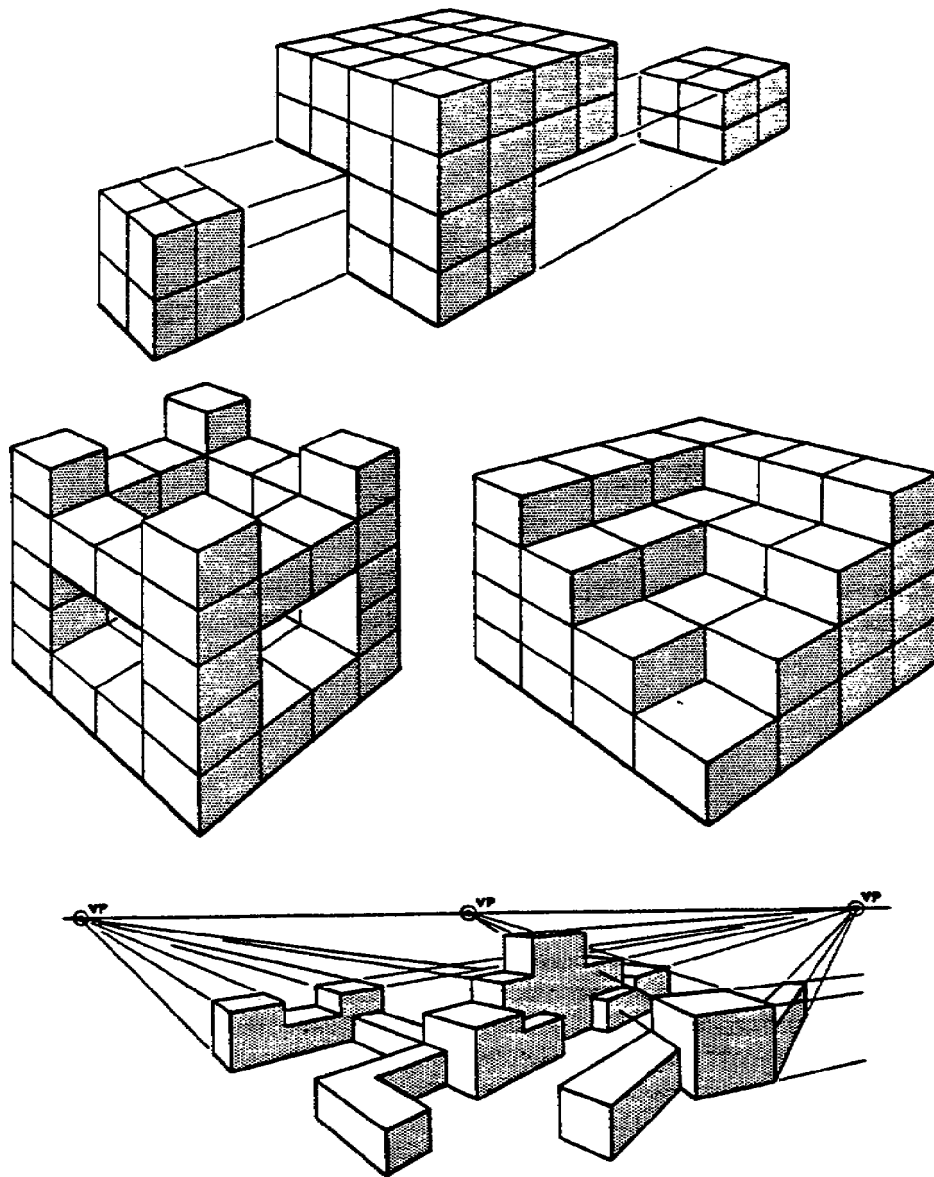
Figure 2-1. Cube construction

4. Once the picture plane was established, the station point for the top view in Figure 2-2 was located. The rule for locating this station point is to position it approximately opposite the center of the block, at a distance from the object so-the angle at the SP is no greater than 30 degrees. If this rule is neglected, a distorted appearance may result in the perspective drawing because there is a cone of about 30 degrees in which the human eye sees clearly. For this reason, the angle formed by the lines of sight from the sides of the object to the station point should not exceed 30°. In no case, even when the perspective drawing depicts a panoramic scene, should it exceed 45°.
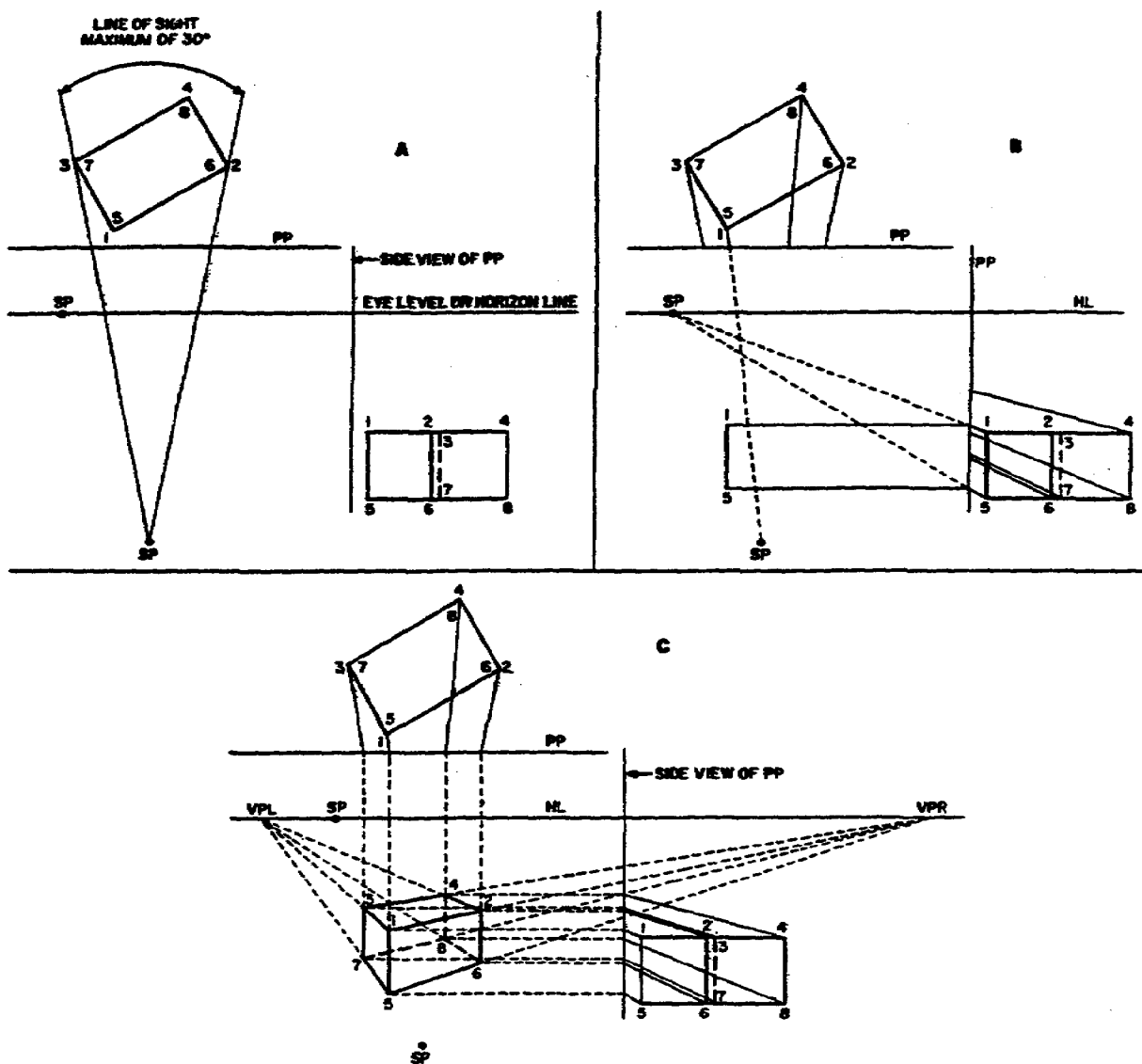
Figure 2-2. Two-point or angular perspective

5. Next, the picture plane for the side view was established. Then the side view was drawn. (Points may be projected from the top view to the side view if necessary). Remember that the picture plane in the side view or elevation is the same picture plane shown in the top view and thus, it is the same horizontal distance from the object.

6. The station point for the side view was located next. Remember this station point is the same point seen in the top view and, therefore, it is the same horizontal distance from the object. However, its angle to the object can vary. This variation of the station point in the side view determines the height of the eye level or horizon line. Note that the station point for the side view always falls on the horizon line.

13

7. This horizon line is a very important one. If it is high, objects in the perspective view will appear as if they were viewed from a height. If it is low, objects will appear as if they were viewed from directly in front or below.

8. Generally, it is best to select a station point approximating that from which a real observer might view the object.

9. Project the corner points of the object to the picture planes by constructing lines that converge toward their respective station points from each corner of the top and side views. For example, to establish line 1-5, in the perspective view, construct vertical and horizontal intersecting lines from the respective points on the picture planes (fig 2-3).
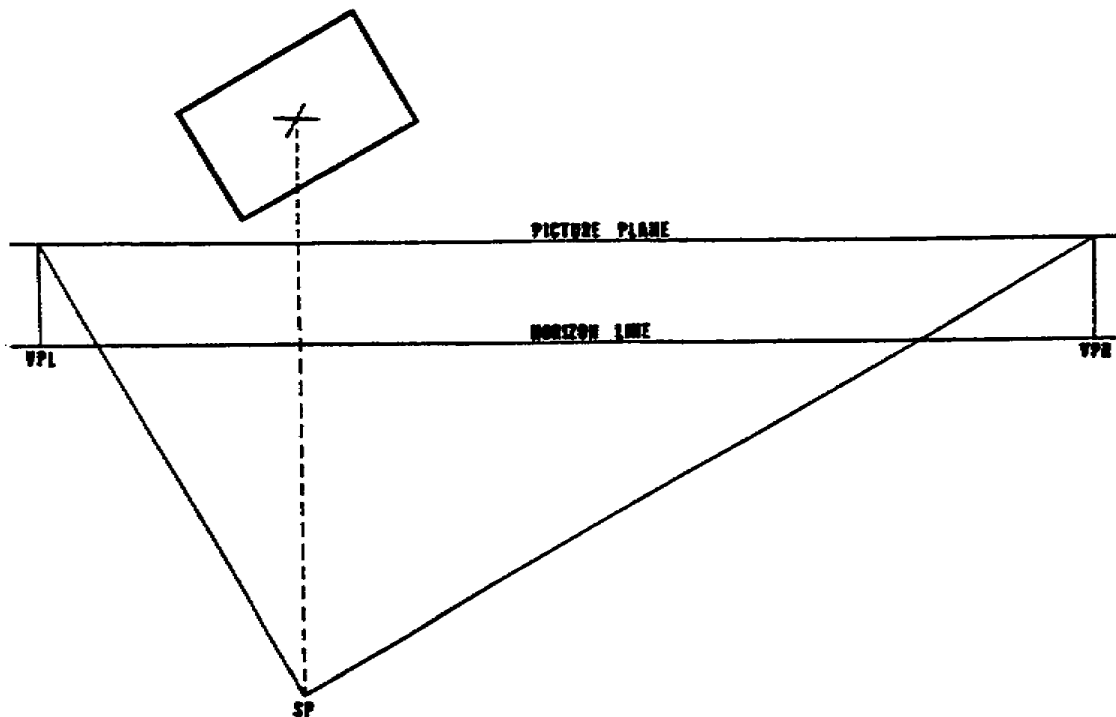

Figure 2-3. Locating vanishing points for two-point
perspective drawn from the plan view

10. Figure 2-4 shows the remainder of the points projected and all lines constructed. In this type of perspective the construction of the vanishing points is not essential. However, if you were to continue any or all of the receding lines such as lines 1-2, 5-6, 3-4, and 7-8 you will find they converge on the VPR. Also the VPL may be located by extending the lines 1-3, 7-5, 4-2, and 8-6. Locating the vanishing points will serve as a check to see if you have projected all points correctly.
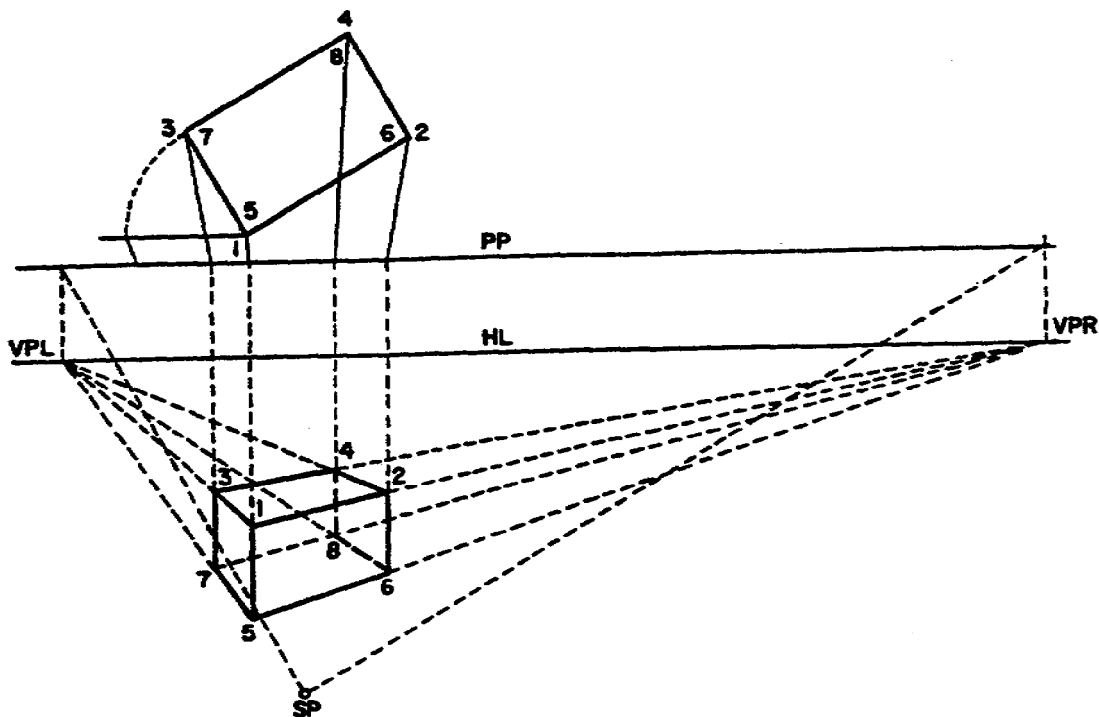
Figure 2-4. Two-point perspective drawing made
without using an elevation of the object

11. This method is usually used when architectural drawings are made in two-point perspective. However, two-point perspective may be drawn from the plan view of the object alone, without the elevation. When this is done, the vanishing points are first projected on the picture plane and then located on the horizon line (fig 2-3). In order to do this, first locate the station point for the constructed plan view. Second, draw lines from the station point to the picture plane that are parallel to the lines in the plan view, as shown by lines 1-2, and 1-3 in Figure 2-3. The points at which the lines intersect the picture plane are then projected vertically to the horizon line to locate the VPL and VPR.

12. In Figure 2-4 lines are drawn converging toward the station point from the corners of the block in the plan view. From the points where these lines pierce the picture plane, verticals are dropped to give the apparent width of the block in the perspective view. Since an elevation is not used, the various heights cannot be found directly. However, the bottom of the block may be located by drawing lines to the vanishing points from the point i.e., (5) selected as the near corner (fig 2-4).

13. Now if the perspective height of any one vertical line can be determined, the height of the other verticals can be found automatically. This is easy to do when one edge of the object rests against the picture plane. This edge will then appear in its true height in the perspective view. If you have the dimension for this height in the orthographic projection, you can transfer that dimension directly to the perspective view. Lines drawn to the vanishing

15

points from this top corner will locate the top of the two sides, and lines drawn to the vanishing points from the far corners on these sides will complete the drawing of the block.

Learning Event 2:
DEFINE OBJECTS AT, ABOVE, AND BELOW EYE LEVEL

1. When the front edge of the subject does not rest against the picture
plane, it is necessary to use some other dimension. Since the end of the
block is square it is possible to find the perspective length of a
horizontal line and use this dimension for the edge of 1-5. This is done by
drawing a line parallel to the picture plane from 1, measuring a length of
this line equal to 1-3, and drawing a line converging on the station point
to the picture plane from the end of this line.

2. This length can then be transferred to the front edge of the perspective
view and the view completed as shown in Figure 2-4. To check the accuracy
of this method, compare Figure 2-4 with 2-2. You will find that, since the
station point, horizon level, and the bottom of the cube correspond, the two
perspective views are similar. It is possible to make them correspond
exactly.

3. In Figure 2-4, the bottom of the front edge of the block has been placed
at a certain point, to correspond with the same point in Figure 2-2.
Actually it could have been placed as any desired point. Thus, the
perspective view may be drawn below the eye level, at eye level or above it,
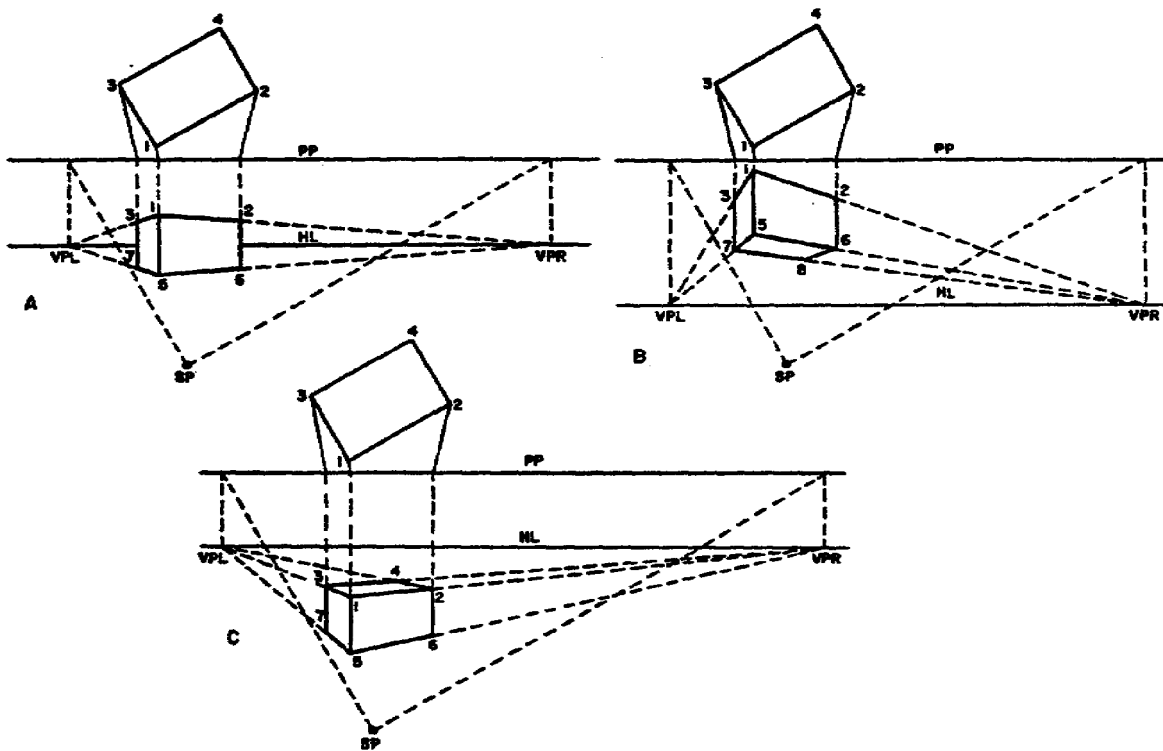as shown in Figure 2-5.

Figure 2-5. A. Object on eye level B. Object above eye
level C. Object below eye level

17

4. However, if the object is placed too high above the eye level or too low below it, the effect will be one of distortion. A block drawn in these positions will cease to look right as shown in Figure 11. (When the station point is too close to the object, there will be a similar distortion.) The angle indicated in the figure should never be less than 90° and preferably not less than 100°.
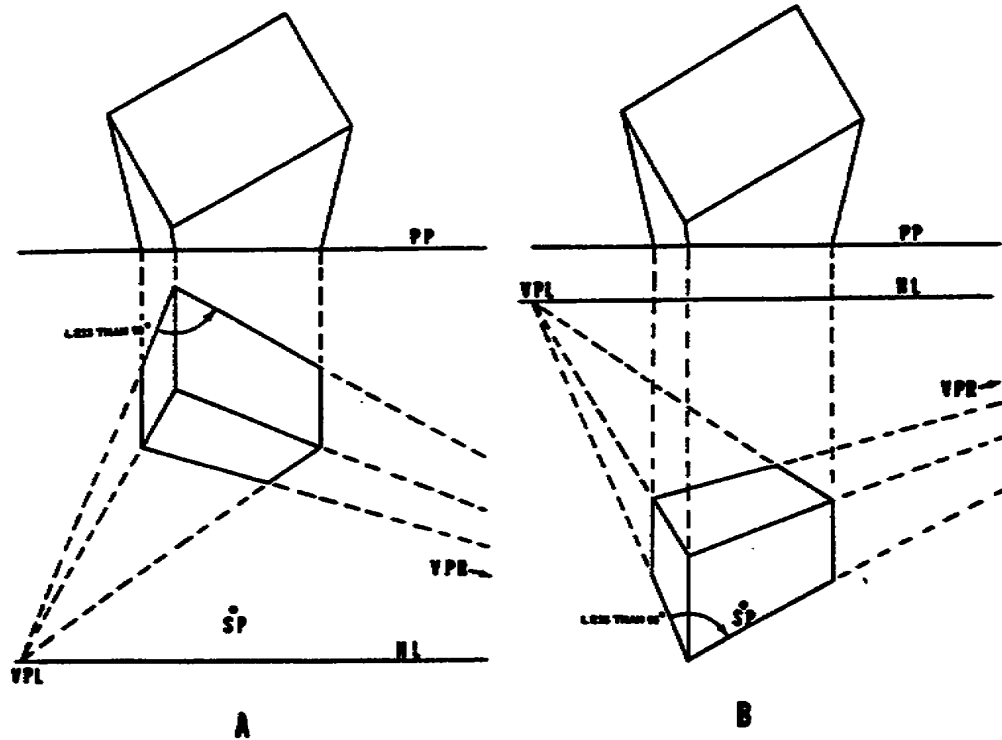

Figure 2-6. A. Object placed too high above eye level
             B. Object placed too low below eye level

5. To overcome distortion such as that illustrated in Figure 2-6, the station point may be moved further from the object, or the picture plane and object may be considered tilted at an angle to each other so that a third vanishing point is needed for the third set of parallel lines in the drawing.

6. Inclined lines and planes have vanishing points similar to horizontal vanishing points. If you are constructing a perspective from plan and elevation views, locating the vanishing points for the inclined lines will involve further preliminary projection.

    a. Figure 2-7 shows an object being constructed in a manner similar to the previously discussed perspective drawings. However, the object contains three pairs of parallel lines defining three inclined planes. One accurate method of constructing the perspective view is to project it without using vanishing points similar to Figure 2-2. To construct this object using only the plan view and elevation for measuring purposes, you must also locate vanishing points for the inclined lines.
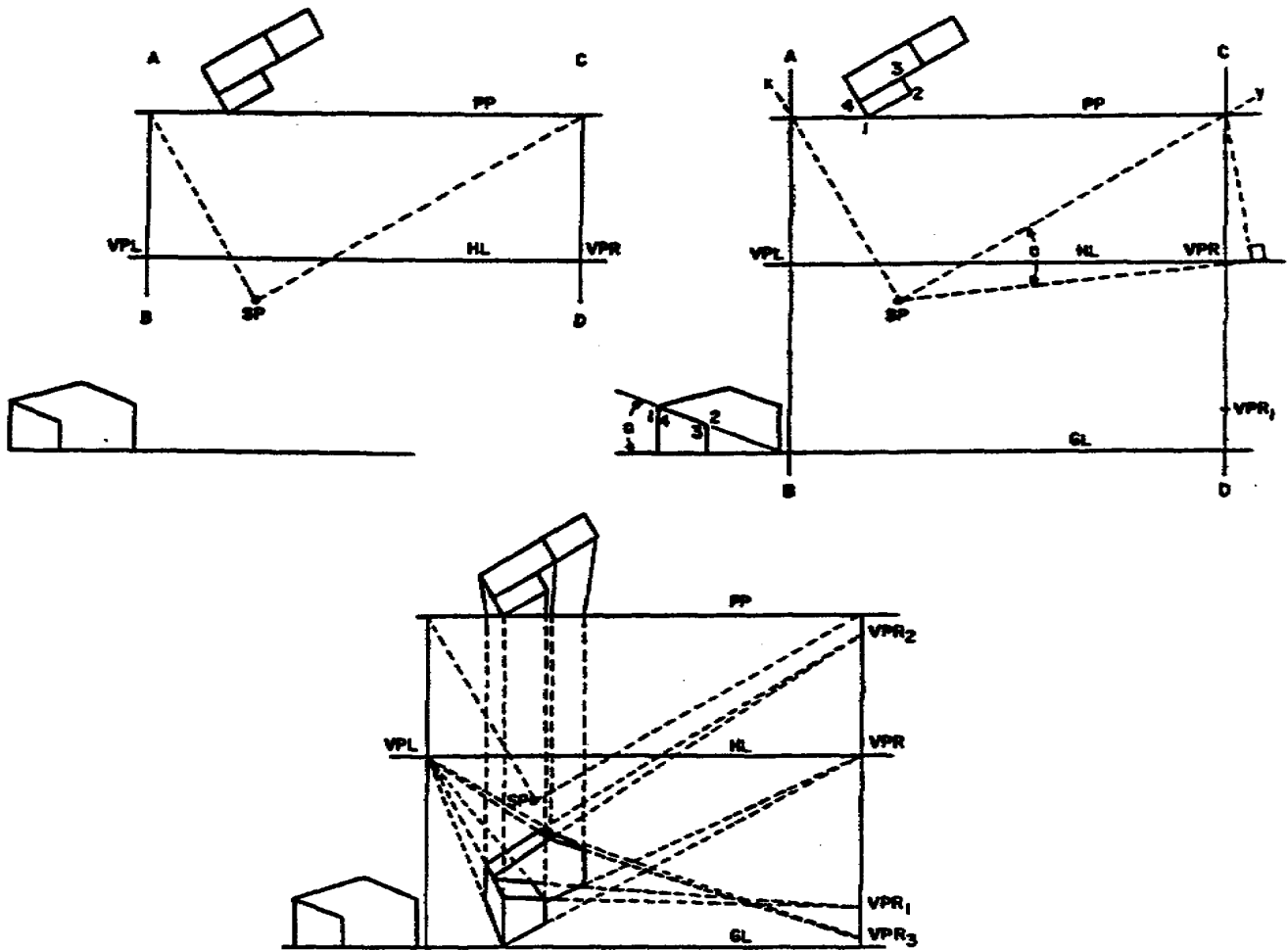
18

Figure 2-7. Finding the vanishing points for incline lines

    b. To locate the inclined vanishing points, extend if necessary the
vertical lines A-B, C-D as shown in Figure 2-7 through the horizontal right
and left vanishing points. Along these vertical lines will fall all the
vanishing points for the inclined lines and planes. Our problem now is to
find where the VPs fall on the vertical lines. As we view the object all of
the planes are inclined to the right; thus their vanishing points will fall
on the right vertical line C-D. From line SP-Y, construct angle "a" equal
to the inclined plane 1-2-3-4 in the elevation view. Extend the line
defining this angle beyond line C-D. Construct a perpendicular to this line
intersection C-D at Y. Using a compass, lay off this perpendicular distance
on C-D from the VPR. This now is the VPR 1 for the inclined plane 1-2-3-4.
Proceed with this method on the remaining inclined planes. Finish the
perspective projection as shown in Figure 2-7.

7. Circles seen in perspective appear as ellipses. The ellipse may be sized and placed in perspective by constructing it within a square. The reason the circle in perspective is drawn with the aid of the square is that while there are no direct measurements on a curve, vanishing points are easily determined for the square, and proportions of the curves can easily be seen with the square.

STEP 1.
DRAW A CIRCLE WITH THE DIMENSIONS DESIRED.

STEP 2.
DRAW A SQUARE AROUND THE CIRCLE. CONSTRUCT CENTER LINES AND DIAGONALS IN THE FIGURE.

STEP 3.
CONSTRUCT THE DESIRED PERSPECTIVE VIEW, AND WITH AN IRREGULAR CURVE, CONNECT THE PLOTTED CHECK POINTS ON THE DIAGONALS AND CENTER LINES.
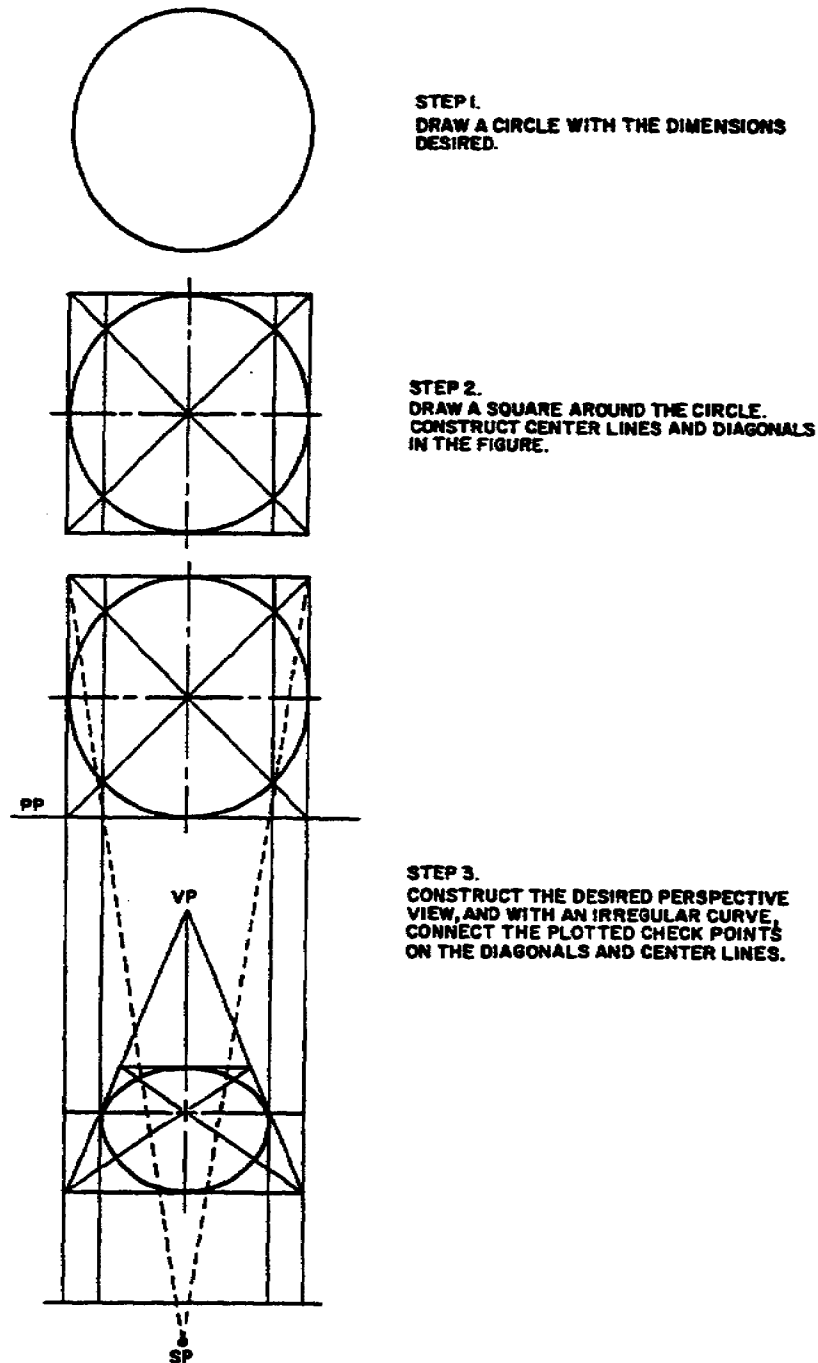
Figure 2-8. Layout for a circle in perspective

a. Figure 2-8 shows the proper layout of a circle drawn in perspective. The first step in the layout is to draw a circle with the dimensions desired. Fit a square around the circle as shown in the second step and add the diagonals, center lines, and vertical lines shown in step two. The points at which the circle and square division lines intersect will give you eight checkpoints for drawing the circle in perspective. The third step is to draw the square in perspective including diagonal lines, center lines, and vertical lines. The points at which the circle lines cross the diagonal and other division lines in the perspective square are the points through which the curve of the ellipse is drawn.

b. When drawing ellipses it is often best to rough them in freehand and get the general shape desired, then relate the square in proper perspective superimposed on the freehand ellipse. This procedure is down in Figure 2-9. When the square is proportionally correct, cross the center with two diagonal lines and cross these with a vertical line through the intersection of the diagonal lines. Draw a horizontal line through the center to determine the perspective center. Use the vanishing point to have the direction of the receding lines correct.
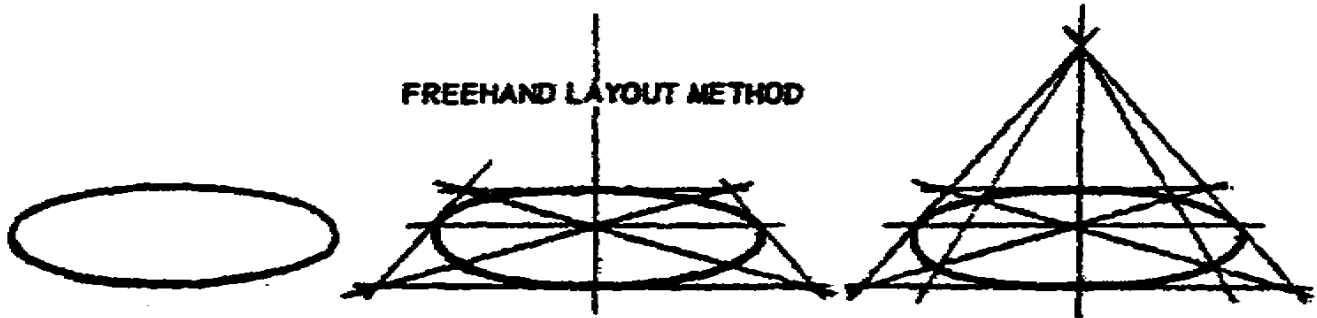

FREEHAND LAYOUT METHOD

Figure 2-9. Drawing the circle in perspective

c. Figure 2-10 shows a circular cylinder constructed in two-point perspective.

d. Figure 2-11 shows some of the applications of the circle in perspective when it is associated with the right circular cylinder. At the eye level the circular section line appears as a straight line. Above and below the eye level the circular sections appear as ellipses that become progressively more open as their distance above and below the eye level increases. The proportion of the ellipses, the proportion of short to long diameters, also depends upon the distance of the cylinder from the eye. The nearer the eye, the more open the ellipse; the farther the eye, the thinner the ellipse. When seen at a considerable distance the ellipses appear as nearly straight lines.
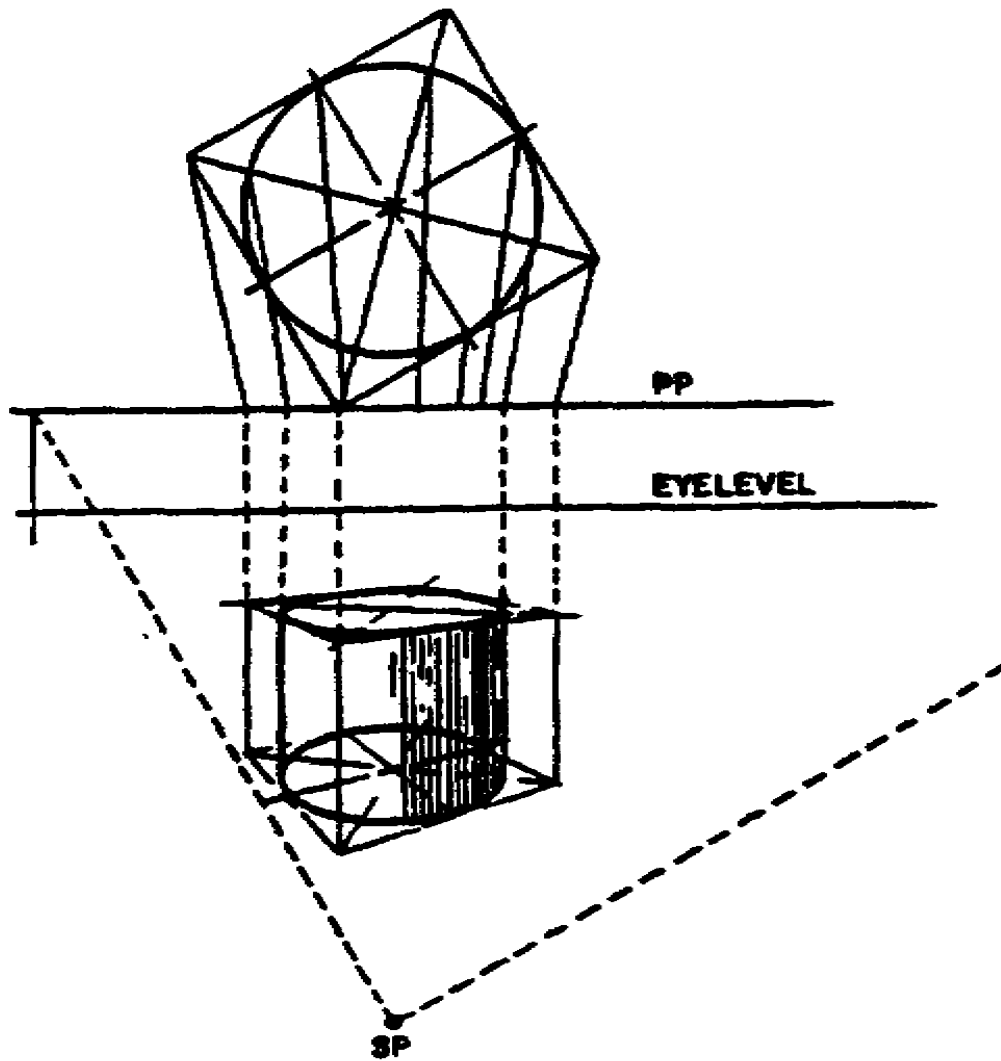
Figure 2-10. Circular cylinder in perspective

e. Think of the right circular cone as being enclosed within a cylinder, both having the same base and the same axis. Figure 2-11 shows the cone first on its side, then resting on its sloping side. Notice that the long diameter of the ellipse representing the cone's circular base has been drawn at right angles to the cone's axis, a relationship that is constant in the cone as it is with the cylinder. Figure 2-11 shows several examples of circular construction based on the shape of the cone.
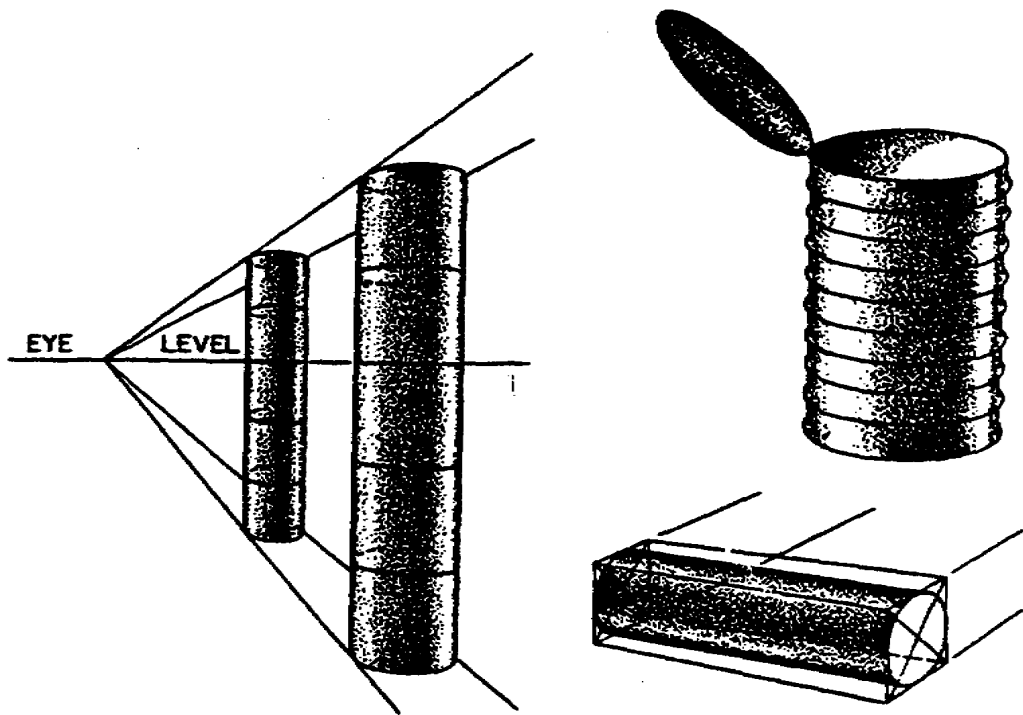
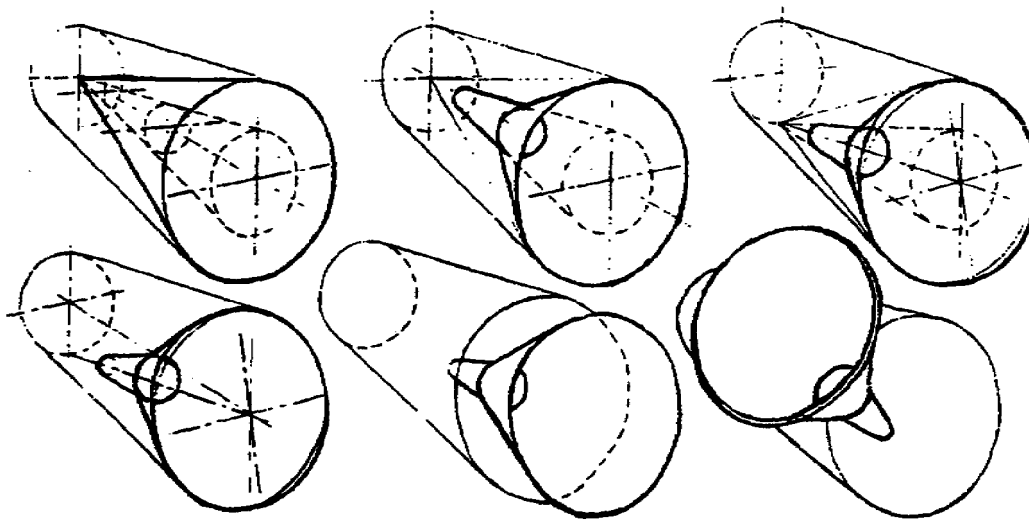Figure 2-11. Perspective circles when in relation to cylinders

Figure 2-12. The cone in perspective

23

Learning Event 3:
IDENTIFY MEASUREMENTS IN TWO-POINT PERSPECTIVE

In drawing objects with compound shapes, a series of cubes may be used. If
you draw a cube in two-point perspective you can easily divide the
perspective views of the sides of the cube into halves and again into
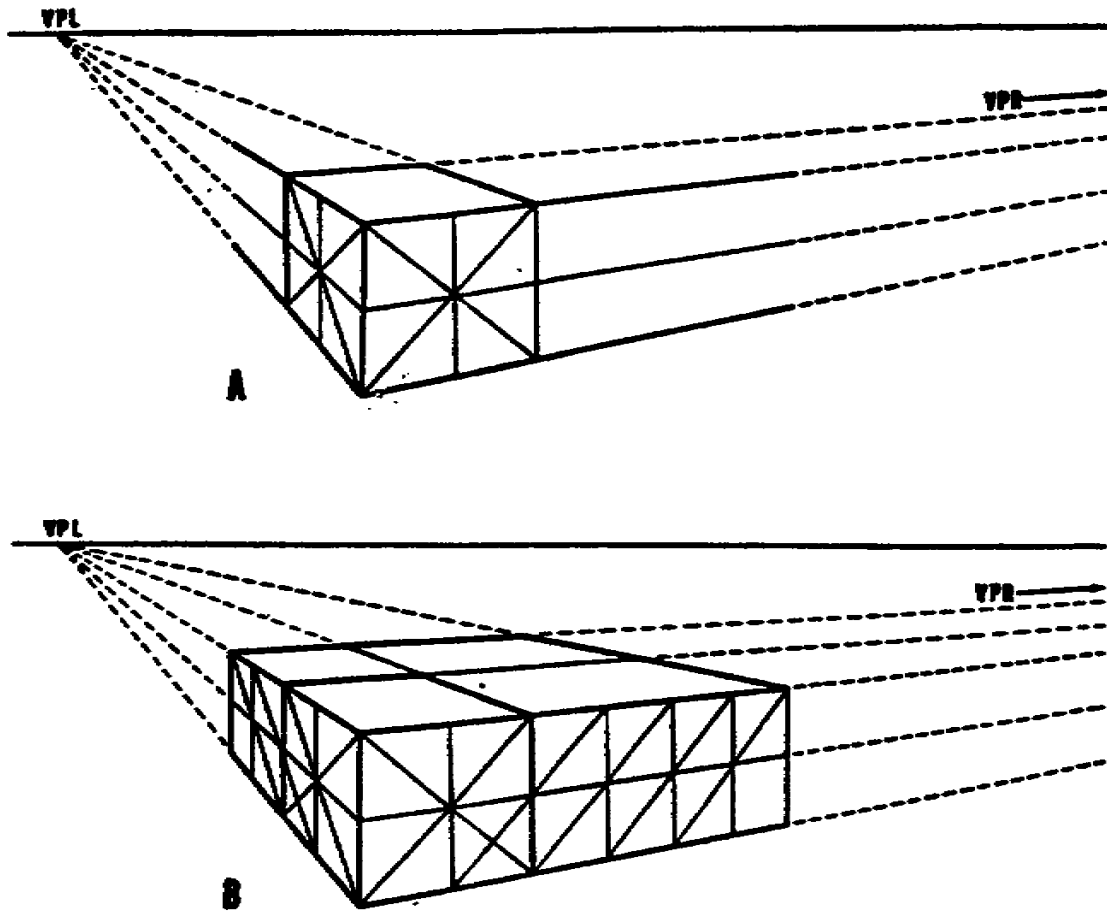quarters by using diagonals as shown in Figure 2-13.

Figure 2-13. Using diagonals to establish divisions on
a line or a plane in perspective

Learning Event 4:
IDENTIFY THE USE OF DIAGONALS

1. The diagonals of the square sides establish the centers of these sides.
Verticals erected through each center, divide the side into halves. In
order to divide the squares into quarters, find the center of a vertical
side and draw lines from this point receding toward the vanishing points.
This establishes the centers of the vertical edges. Now draw a diagonal in
one of the quarters so established. This diagonal will cross the diagonal
of the large square. Finally erect a vertical through the point established
by the intersection of these two diagonals. As you can see, this process of
division can be carried on as far as necessary to establish the required
division points on a horizontal edge or within the square itself.

2. It is also possible by using diagonals to add to the sides of the cube
in multiples of 2, 4, 8, etc., as shown in Figure 2-14. First, the center
of the square side is found and a vertical and horizontal are drawn through
this center. The horizontal is extended beyond the side of the cube toward
the vanishing point and the horizontal edges of the side are also extended
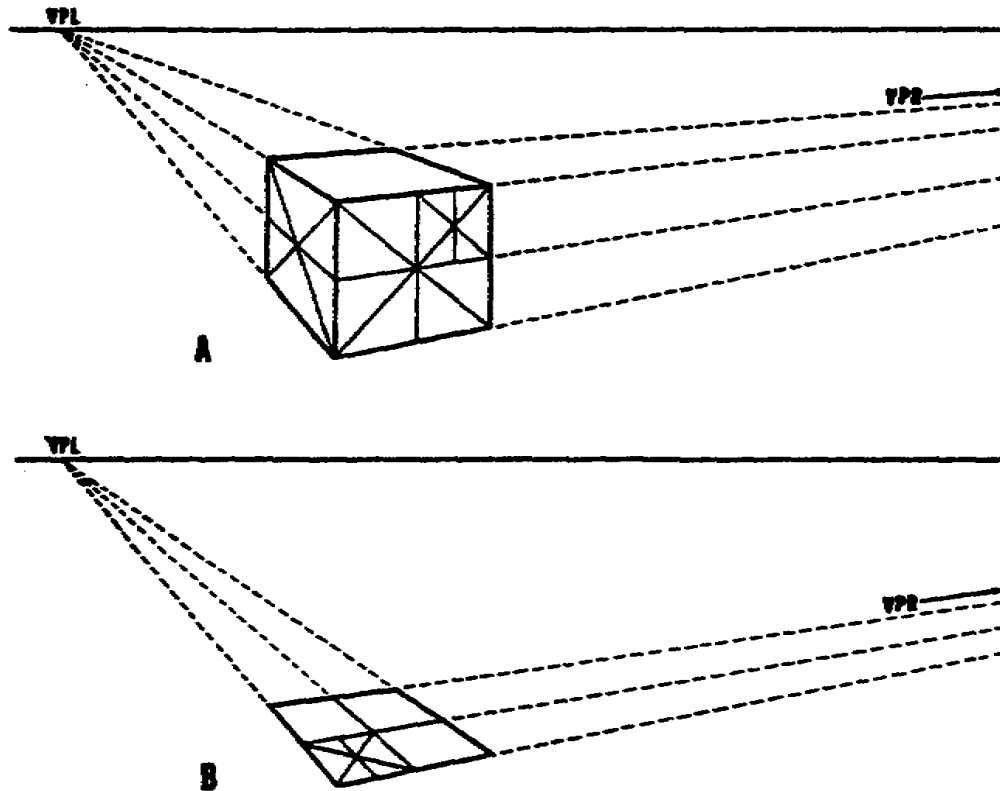toward this point, as shown in Figure 2-14.

Figure 2-14. Using diagonals to multiply areas

3. A diagonal drawn from the center point on the lower horizontal edge of the square through the center point on the far edge will intersect the extension of the top edge as shown in Figure 2-14. A vertical dropped from this intersection will add the equivalent of a half to that side. As you can see, this process can be continued as many times as necessary, and the sections so established can be divided in turn.

4. Now suppose you are asked to draw in perspective a bookcase 36 inches high, 24 inches wide, and 12 inches deep. Since the 36 inches can be divided into 18 inches or 9 inches but not into 24 or 12, it will be better to make the basic cube 24 inches, which can easily be divided into 12 inches and to which 12 inches can be added. In Figure 2-15, these dimensions have been established. Note that the same method used for multiplying areas in a horizontal direction, shown in Figure 2-14, may be applied to multiplying them in a vertical direction.
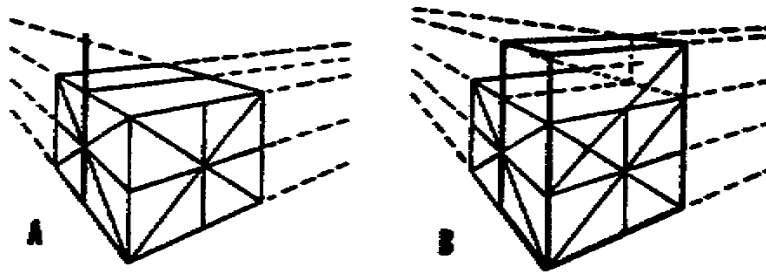

Figure 2-15. Finding the outside dimensions
of a bookcase in perspective.

5. Suppose that the bookcase is constructed of boards which are 1 inch thick. The top shelf is 8 inches high; that is, the upper front edge is 9 inches from the top of the bookcase, and the lower shelves are 12 inches high, that is, 13 inches including the width of one shelf, with the lowest 1 inch shelf resting on the floor. Notice that 9 inches is one-fourth of the total height of the bookcase, which should make it easy to find this dimension. A diagonal may be used to create a 36-inch square, as shown in Figure 2-6, and diagonals may be used to locate the top shelf, as shown in Figure 2-16.
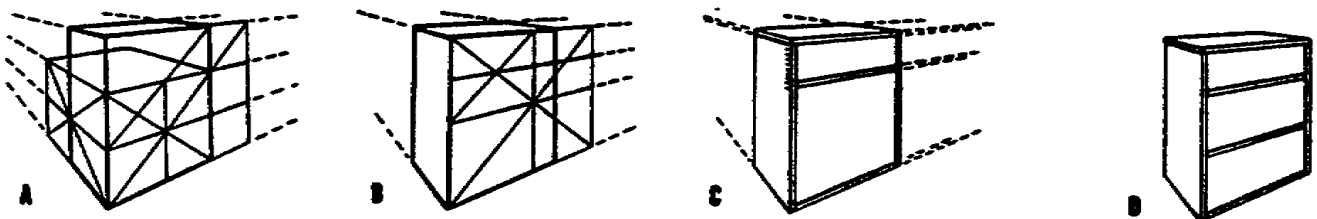
Figure 2-16. Locating the shelves of the bookcase

PRACTICE EXERCISE

1.   What is two-point perspective? _____

_____

2.   If there are two objects in the two-point perspective drawing sitting
at different angles to the picture plane, how many sets of vanishing points
will there be? _____

_____

3.   Once the picture plane is established, what is the rule for locating
the station point? _____

_____

4.   What do circles seen in perspective appear as? _____

_____

ANSWERS TO PRACTICE EXERCISE

1.   Two-point, or angular perspective, exists when the object is sitting at an angle to the picture plane. There are two sets of horizontal lines or planes converging toward two different vanishing points on the eye level or horizon line.

2.   2

3.   Position the station point approximately opposite the center of the block, at a distance from the object so the angle at the station point is no greater than 30 degrees.

4.   Ellipses.

```
                            LESSON 3
              DRAW OBJECTS IN THREE-POINT PERSPECTIVE
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TASK

Describe the components of three-point perspective.

CONDITIONS

Given information and examples about perspective, dimensions and vanishing points.

STANDARDS

Demonstrate competency of the task skills and knowledge by responding to the multiple choice test covering three-point perspective.

REFERENCES

None

Learning Event 1:
DEFINE THREE-POINT PERSPECTIVE

1. Three-point perspective occurs when none of the object's surfaces (height, width, and depth) are parallel to the picture plane (fig 3-1). Three-point is usually needed when the station point is close to a large object, such as when you are looking up at a nearby ship or tall building. The horizon in this case is usually very low, or entirely below the object. If you were looking down from above, the horizon may not appear in the view at all.

     a. When constructing this type of perspective, use your artistic ability to place the vanishing points, particularly the VP for the vertical lines. A good rule to follow says that <u>small</u> objects will usually look better if the three vanishing points are well separated. However, to emphasize the <u>bigness</u> of an object, sharp diagonal lines are important. Here the closeness of the vanishing points strengthens the bigness effect.

     b. Horizontal diagonal lines must end at the eye level line. One line cannot be higher or lower than the other. Regardless of their distance apart, they must be established on the same eye level.
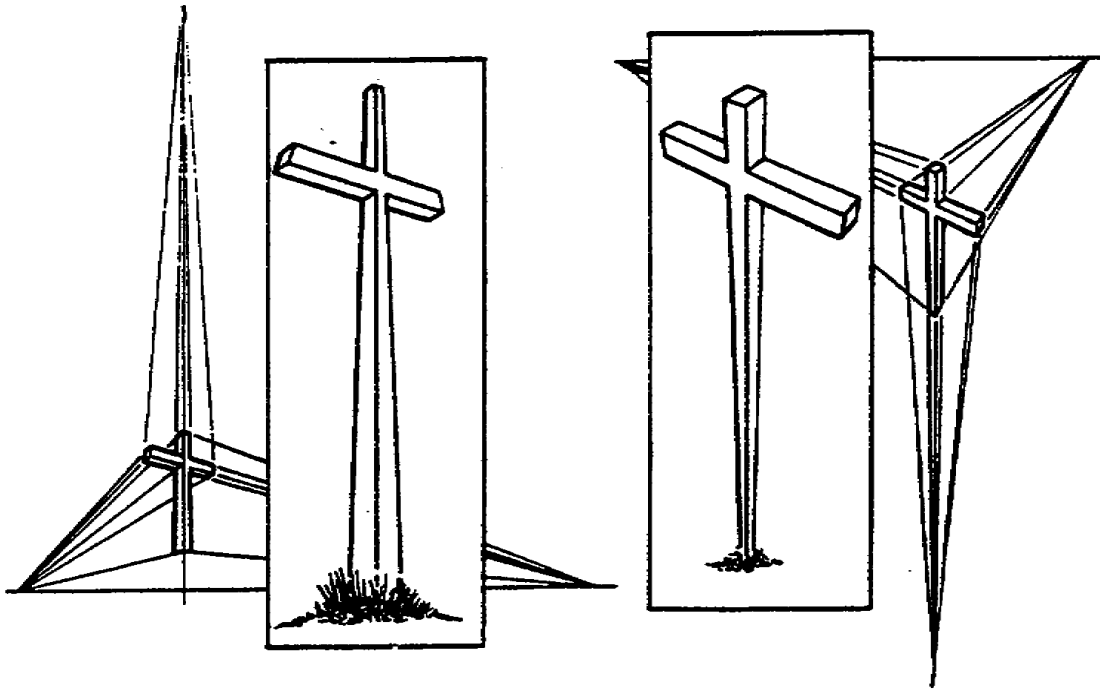
Figure 3-1. Three-point perspective

2. A general rule to follow in this case is small objects look better if
the three vanishing points are well separated. The perspective angle should
not be acute. To emphasize the bigness of an object, sharp diagonal lines
are important. Here the closeness of the vanishing points strengthens the
bigness effect.

     a. Be sure that the horizontal lines end at the eye level line, be
cause one cannot be higher or lower than the other. Regardless of their
distance apart, they must be established on the same eye level. In any
perspective drawing, it is a good idea to use the sketching method and
lightly sketch the object before finding the horizon line and vanishing
points.

     b. In drawing any form, the proportions should be correct. This is
especially true when drawing form in perspective. At the beginning of this
chapter, we introduced into our discussion the cube, the basis for all good
drawing. In order to solve many practical problems in art, you must become
acquainted with methods of measurement as they apply to this geometric
solid.

3. Before making measurements of any kind, establish the needed vanishing
points and station point. Next, correctly sketch in the overall shape of
the object. If you do not, you may wind up making endless corrections, and
the drawing will never be quite right artistically. To divide a rectangle
or a square, draw a diagonal line from corner to corner as shown in Figure
3-2. The

point where the diagonals cross is the center of the rectangle or square. This simple rule is invaluable, it enables you to solve problems that are seemingly unsolvable.
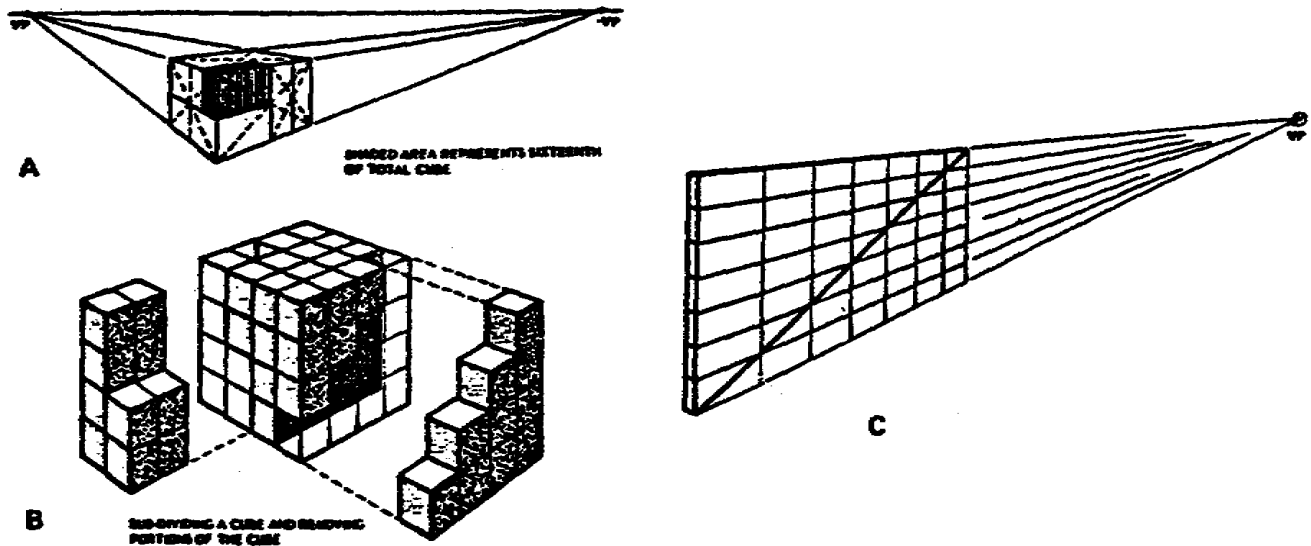

Figure 3-2. Division

a. At other times it is necessary to divide an area, or a diagonal, into a number of parts. Here a ruler alone will not suffice. As with most division of space, the vertical (fig 3-2) or horizontal line (not shown) parallel to the picture plane is the key. Aspect B of Figure 3-2 shows the subdivision of a cube, portions removed. For example, to divide a receding plane into any number of units, divide the left vertical height into the desired number of parts with a ruler as shown in Figure 3-2. Draw lines from the points of division on the vertical line out to the vanishing point. Then draw a line from corner to corner as shown, and the intersections of the diagonal and the horizontal lines drawn to the vanishing point are the correct points to add the other vertical lines.

b. Figure 3-3 shows the correct method of dividing a rectangular area into uniform rectangular patterns, such as floor tiles. The width of the squares are first measured on a horizontal line (A). Two vanishing points are established and lines are drawn from the divided horizontal line to the left vanishing point, then the depth is established by drawing lines to the right vanishing point. A diagonal line is drawn from corner to corner, points 1 and 2. Where the diagonal intersects the lines drawn to the left vanishing point are-the correct points for the receding lines to be drawn to the right vanishing point. Notice that the lower drawing is a one-point perspective.
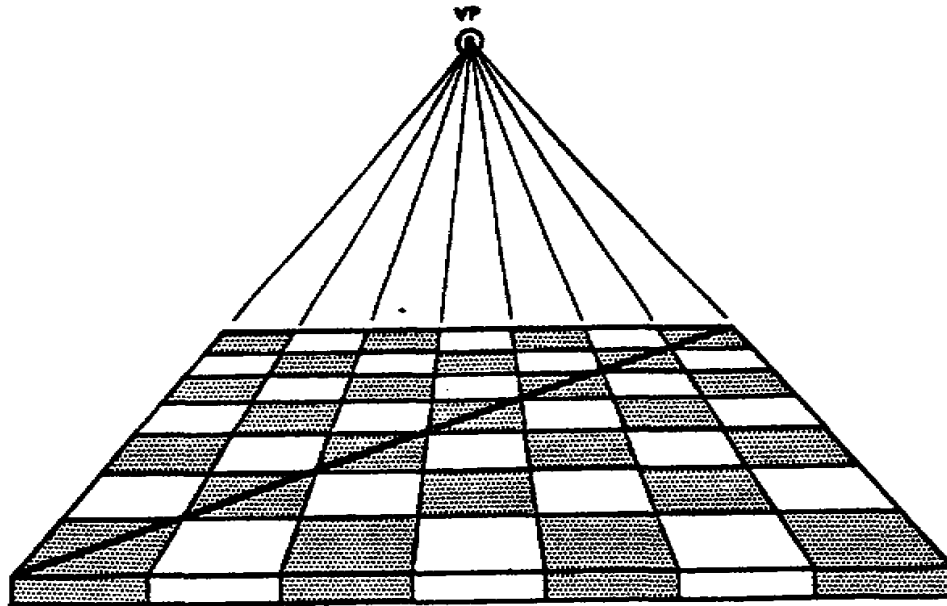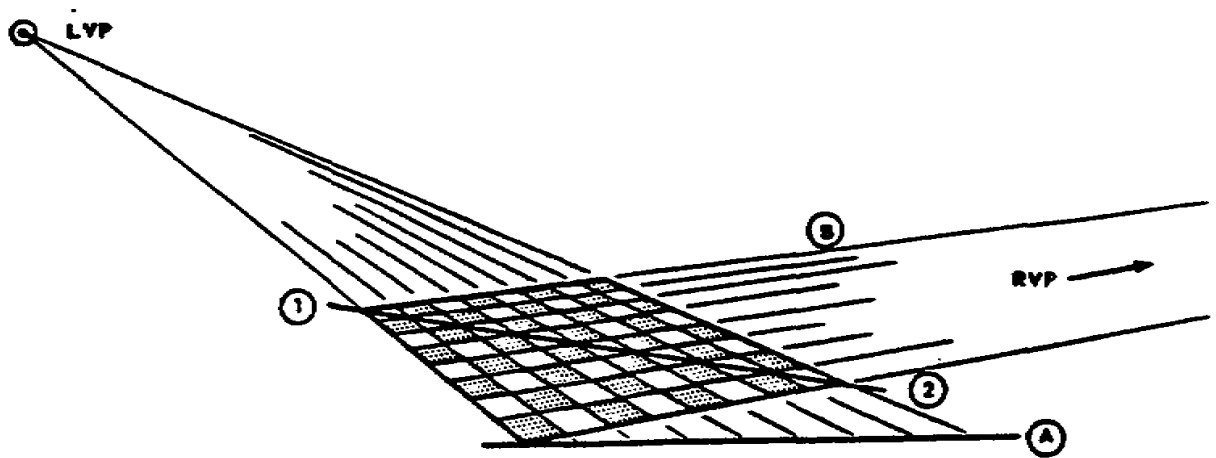
31

Figure 3-3. Division of a rectangular area

   c. Figure 3-4 shows the method for drawing vertical divisions of posts, telephone poles, or any object with evenly spaced units. First draw two posts any distance apart. Locate the vanishing point by drawing lines (A) and (B) from the two original posts. At no time should any posts extend above or below the receding lines. Locate the center of the first post, then draw a line through the center point of the first post to the vanishing point on the horizon. From the top of the first post, draw a line through the center of the second post, the third post will be located where the diagonal line touches line (B). Repeat this procedure as many times as you desire, doing one at a time.
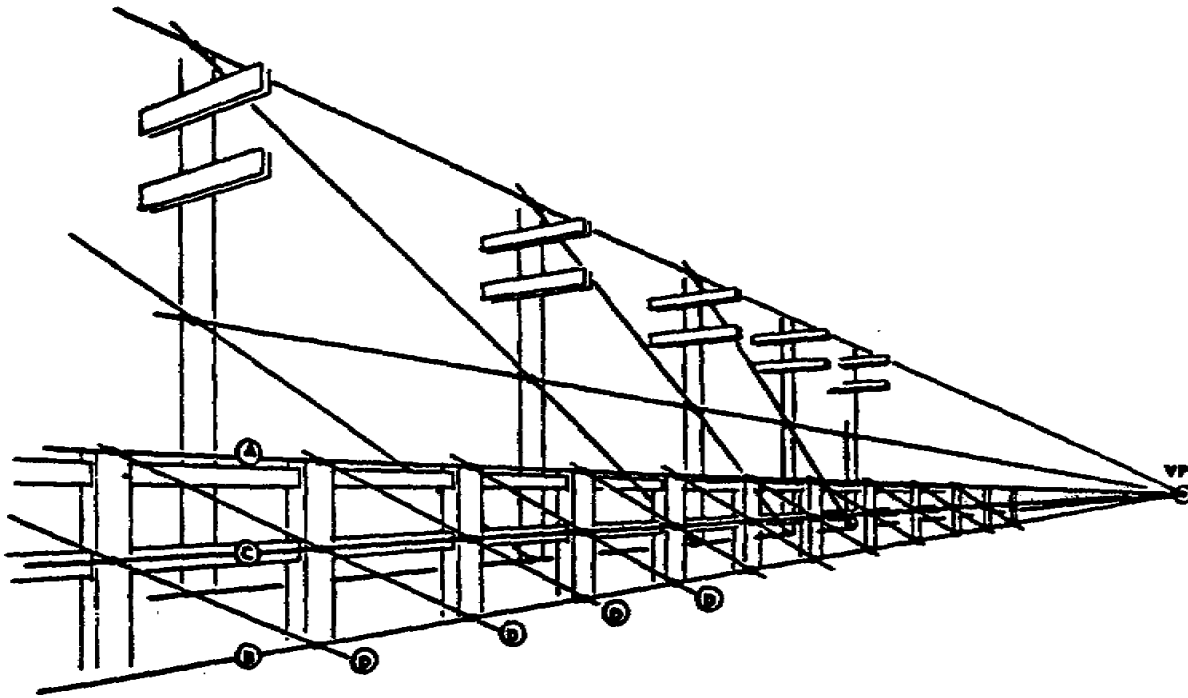
Figure 3-4. Vertical division

4. The cube is in many ways the most important single shape you will study in your art career. Both simple and complex structural development can be illustrated by this one geometric form. Its importance will become increasingly evident as you work with three-dimensional forms and measurement, especially when you draw objects in perspective. As the preceding text segment pointed out, in order to solve many practical problems in perspective, you will use the cube or some portion of it as a medium of measurement. This may be a tedious business because you may make several sketches before you get an acceptable drawing. But it is time and effort well spent. Some artists who make cubes too wide or too narrow have never really learned what a square, hence a cube, looks like in perspective.

a. Although the cube is perhaps the most important shape, the circle is the guide for drawing all two-dimensional curves, ellipses and ovals in perspective. Even so, its basis is the square, or one surface of the cube. The square is used because there are no direct measurements on a curve in perspective. Vanishing points are determined from the square, and proportions of the curve can easily be seen within the square. Figure 3-5 shows the proper layout of a circle in perspective. The first step in the instrument layout is to draw a circle with the desired dimensions. Second, draw the square around the circle and add the diagonal and centerlines as shown in step 2. This will give you eight checkpoints for drawing the circle in perspective. Next, draw the perspective lines back to the desired vanishing point to establish the square in perspective.

33

STEP 1

STEP 2

MAJOR AXIS

PERSPECTIVE CENTER

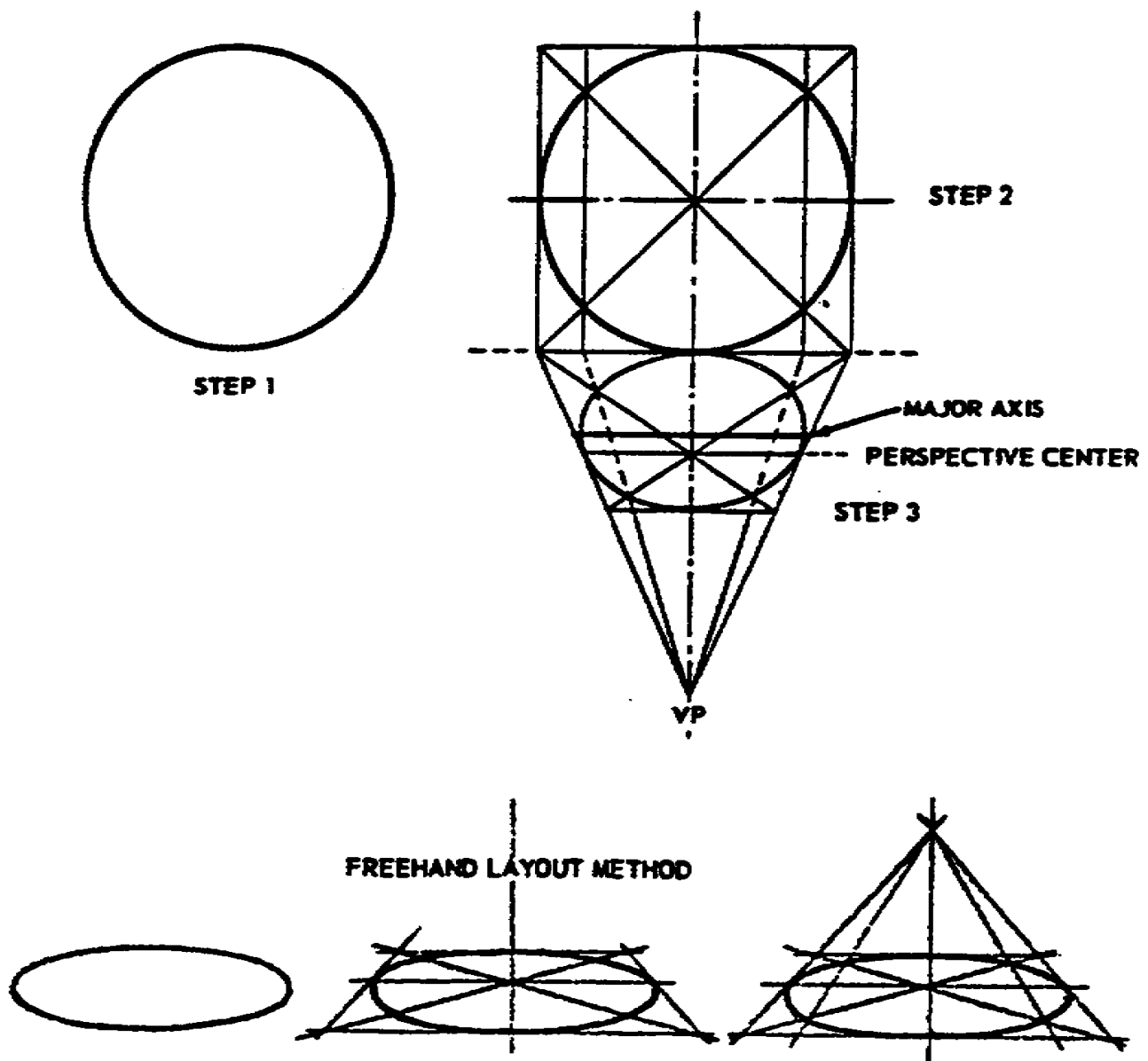STEP 3

VP

FREEHAND LAYOUT METHOD

Figure 3-5. Mechanical tool and freehand layout methods

    b. The back line of the new square is determined by the method
presented in Figure 3-5. Now diagonal lines are drawn from corner to corner
in the perspective square. Within the original square, short vertical lines
are drawn downward to the picture plane from the points where the circle
line and the diagonal lines intersect.   From these two points, draw lines
back to the vanishing point.   The points at which these lines cross the
diagonal lines in the perspective square are the points through which the
curve is drawn.

34

c. The center of the circle shifts from the center of the square when the circle is in perspective. The intersection of the diagonals is the perspective center; the intersections of the horizontal centerline with the lines drawn back to the vanishing point does not indicate the widest part of the circle in perspective.

d. When drawing circles in perspective, it is often best to rough them in freehand and get the general shape desired. When the square is proportion ally correct, cross the center with two diagonal lines and cross these with a vertical line through the intersection of the diagonal lines. Draw a horizontal line through the center to determine the perspective center. Use the vanishing point to have the direction of the receding lines correct.

Learning Event 2:
IDENTIFY COMPOUND FORMS

1. Compound Form. Most objects consist of compound forms that can be reduced to a basic form, as you've just seen. You can solve most of your perspective problems if you understand the cube and its relationship to perspective. The three most important things to remember are: the horizon, the station point, and the vanishing points. These are the only elements that affect the appearance of your drawings. If these elements are poorly selected but definitely established, your drawing is correct although it may be unattractive.

        a. Remember, keep the vanishing points as far apart as possible; this gives the final picture a more pleasant appearance. Also keep all vertical lines truly vertical, except for special effects. If special effects are necessary, a third vanishing point may be needed.

        b. Drawing a cube or a rectangle in perspective is a simple operation if you understand measurement. A rectangle in perspective can be thought of as two cubes placed end to end. If you can draw a cube and measure it, you can divide it into halves, thirds, or any number of divisions found in compound form. Compound forms need not be complex if they are thought of as cube-upon-cube in perspective.

2. Making a plan and elevation view. Plan and elevation views can become very complex; compound forms are to be expected. When making such a plan and elevation view in perspective, the-first step is to draw a line to represent the picture plane. The plan view is arranged behind the picture plane with the nearest corner of the building just touching the picture plane (A) as shown in Figure 3-6. Next, select the station point. Make the station point approximately the center of the plan view at a 30° overall angle.

        a. Draw lines from the station point to the corners of the important parts of the building that you want to locate in your perspective drawing. Where the lines intersect the picture plane, draw vertical lines to establish accurately the width of the different parts of the structure. The most important of these lines is the line that is actually touching the picture plane (line A). It is the only line that is not foreshortened; therefore, it is the only line that can be used for vertical measurement from the elevation view.

        b. Now you must decide on the location of the horizon line. After you have located the horizon line, draw lines (B) and (C) parallel to lines (D) and (E) in the plan view. From the points at which lines (B) and (C) intersect the picture plane, drop vertical lines to the horizon line to establish the right and left vanishing points.

        c. The next step is to carry across vertical measurement from the elevation view to line (A) and draw construction lines from the points on line (A) to the vanishing points using the same procedure already discussed. The vertical lines dropped from the picture plane will automatically establish the width of doors, windows, walls, etc., in the perspective drawing. Remember, you can make direct vertical measurement only on line (A); it is the only true length line in the whole drawing.
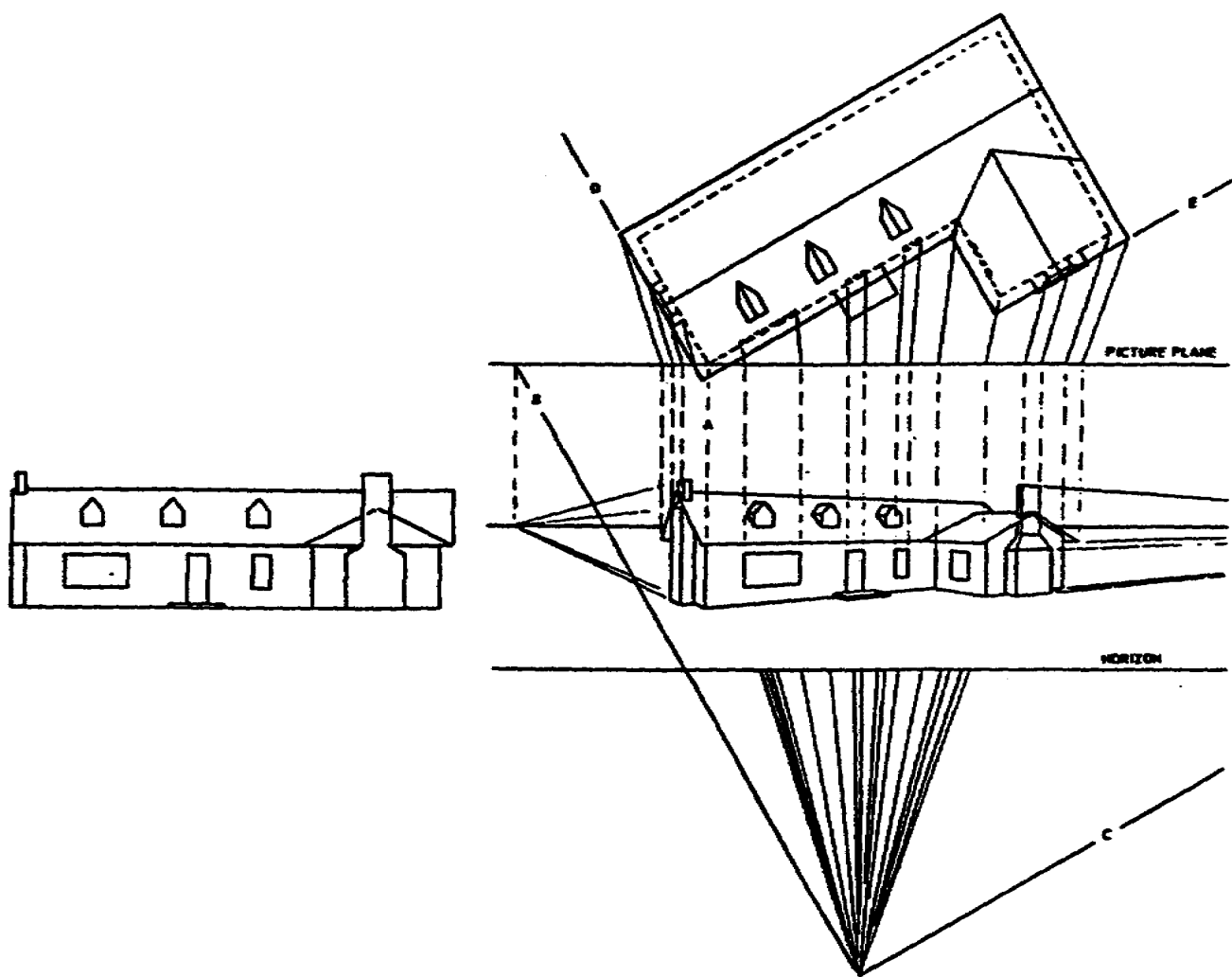
Figure 3-6. Plan and elevation views

PRACTICE EXERCISE

1.   Name and describe each of the three types of perspective?

     a.   _____

          _____

     b.   _____

          _____

     c.   _____

2.   What are the two steps necessary before making measurements? _____

     _____

3.   What are the three most important things to remember in perspective
     drawing?

     a.   _____

     b.   _____

     c.   _____

4.   What are the first two steps in drawing a plan and elevation view in
     perspective?

     _____

     _____

ANSWERS TO PRACTICE EXERCISE

1. a. One-point exists when two dimensions of an object height and
        width are parallel to the picture plane.

    b. Two-point exists when the object is sitting at an angle to the
        picture plane.

    c. Three-point exists when none of the object's surfaces are
        parallel to the picture plane.

2. To establish the needed station point and vanishing points.

3. a. The horizon.

    b. The station point.

    c. The vanishing point.

4. a. Step one is to draw a line to represent the picture plane.

    b. Step two is to select the station point (approximately the center
        of the plan view at a 30° overall angle).