Chapter 2 – Part 2
Multiview Drawing

Chapter Objectives

• Explain what multiview drawings are and their importance to the field of technical
drawing.
• Explain how views are chosen and aligned in a multiview drawing.
• Visualize and interpret the multiviews of an object.
• Describe projection planes
• Describe normal, inclined and oblique surfaces
• Describe line types
• Describe line weights
• Interpret the multiviews of graphic primitives
• Describe orthographic projection including the miter line technique
• Describe the line types and line weights used in technical drawings as defined by
the ASME Y14.2M standard.
• Explain the difference between drawings created with First Angle and Third Angle
projection techniques.
• Use a miter line to project information between top and side views.
• Create multiview sketches of objects including the correct placement and depiction
of visible, hidden and center lines.

Supplemental Files

Supplemental files are available for download inside the Chapter 2 folder
of the book’s file downloads. Please see the inside front cover for further
details.
2.4 MULTIVIEW DRAWINGS

Multiview drawing is a technique used by drafters and designers to depict a three-dimensional object (an object having height, width and depth) as a group of related two-dimensional (having only width and height, or width and depth) views. A person trained in interpreting multiview drawings, can visualize an object’s three-dimensional shape by studying the two-dimensional multiview drawings of the object.

For example, Figure 2.15 provides a three-dimensional (3D) image of a school bus, and while a 3D view of the bus is very helpful in visualizing its overall shape, it doesn’t show the viewer all of the sides of the bus, or the true length, width, or height of the bus.

Figure 2.15 A Three-Dimensional Image of a School Bus.
A better way to fully describe the bus graphically would be to create a multiview drawing as shown in Figure 2.16. The multiview drawing of the bus is represented by six views, the front, top, sides, back and bottom. These views represent the six “regular” views of the bus.

Figure 2.16
The multiviews of the bus depicting the six regular views-front, top, bottom, right, left and rear.
2.5 VIEW SELECTION AND ALIGNMENT OF MULTIVIEW DRAWINGS

In creating the multi-view drawing of the bus, the front, or principal, view was drawn first. The bus was then “rotated” at 90 degree intervals relative to the front view to create the top, bottom, right and left side views. The left side view was then rotated 90 degrees to the left to create the rear view. While a total of six views are possible using this technique, drafters creating a multiview drawing of an object only draw the views necessary to describe the object.

F.Y.I

When choosing the front, or principal, view of an object, select the view you would choose if you could only show the viewer one view to describe the object.
If a house were placed inside a glass box as in Figure 2.17, the glass sides of the box would create **projection planes** (also referred to as **viewing planes**). If the 3D geometry of the front, side, and top of the house were projected onto the corresponding 2D projection plane, the resulting 2D image would represent a front, top, or side view as shown in Figures 2.18, 2.19, and 2.20, respectively.

In Figure 2.18 the front of the house is shown as it would appear if projected onto a **frontal projection plane** that is placed between the viewer and the house.

Likewise, in Figures 2.19 and 2.20, the right and top views are shown as they would appear if projected onto the **profile** and **horizontal projection planes** respectively.

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**Figure 2.17**
The view through the **projection plane** shows the **front view** of the house. This view furnishes the width and height of the house.

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**Figure 2.18**
The view through the **frontal projection plane** shows the **front view** of the house. This view furnishes the width and height of the house.

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**Figure 2.19**
The view through the **horizontal projection plane** shows the **top view** or **roof plan**. This view reveals the width and depth of the house.

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**Figure 2.20**
The view through the **profile projection plane** reveals the **right side view** of the house. This view furnishes the depth and height of the house.
In **Figure 2.21**, notice how a feature like the peak of the roof in the front view, is exactly in line with the top of the roof in both the left and right views. Observe how the features of the chimney are depicted in each of the views.

The planes representing the roof in the right, left, and top views appear as rectangles in the multiviews, but by studying them in relation to the front view, you will see that they actually represent the sloping planes of the roof. Since the planes of the roof, as projected through the top and side projection planes are slanted, they are not drawn actual, or true size. In technical drawing, this phenomenon is referred to as “foreshortening”.

**Figure 2.21** The “Elevations” of a House as they would Appear in a Multiview Drawing.
2.7 PROJECTION PLANES

The projection plane technique of visualizing multiviews can also be applied to visualizing machine parts like the one shown in Figure 2.22. The arrows indicate the desired viewing position for the front, top and side views.

Visualizing the Front View

In Figure 2.23, a frontal projection plane has been placed between the viewer and the object and the **front view** of the object has been projected onto the projection plane. The viewer’s line of sight is perpendicular to the projection plane in this example.

2.23 Projecting the Front View of an Object to a Frontal Projection Plane
Visualizing the Top View

In Figure 2.24, a horizontal projection plane has been placed between the viewer and the object and the top view of the object has been projected onto the projection plane. The viewer’s line of sight is perpendicular to the projection plane in this example.

2.24 Projecting the Top View of an Object to a Horizontal Projection Plane
Visualizing the Side View

In Figure 2.25, a profile projection plane has been placed between the viewer and the object and the **right side view** of the object has been projected onto the projection plane. The viewer’s line of sight is perpendicular to the projection plane in this example.

2.25 Projecting the Side View of an Object to a Profile Projection Plane
2.8 NORMAL, INCLINED, AND OBLIQUE SURFACES

**Normal** surfaces are parallel to the projection plane – as a result, these surfaces appear **true size** and **true shape** on the projection plane that they are parallel with.

The viewer’s line of sight is perpendicular to the surface when the surface is normal. See Figure 2.26.
In Figure 2.27, the object has two surfaces that are parallel (normal) to the Horizontal Projection Plane. These surfaces appear true size and shape on the horizontal projection plane.

2.27 Projecting Normal Surfaces to a Horizontal Projection Plane
Inclined Surfaces

_Inclined_ surfaces are slanted, or inclined, relative to the projection plane – as a result, these surfaces appear *foreshortened* on the projection plane and are not true size. See Figure 2.28.

2.28 Projecting Inclined Surfaces to a Frontal Projection Plane
Inclined Surfaces

In Figure 2.29, the object's two inclined surfaces project to the top view as edges that are **true length**.

2.28 Projecting Inclined Surfaces to a Frontal Projection Plane
Oblique Surfaces

Oblique surfaces are both inclined and rotated relative to the frontal, horizontal, and profile projection planes— as a result, these surfaces never appear true size or shape in any of these views.

In Figure 2.30, the object’s two oblique surfaces project to the front view as oblique planes that are not true size.

2.30 Projecting Oblique Surfaces to a Frontal Projection Plane
Projecting Oblique Surfaces to Projection Planes

In Figure 2.31, the object's two oblique surfaces project to the top view as oblique planes that are not true size.
Projecting Oblique Surfaces to Projection Planes

In Figure 2.32, the object's normal, inclined, and oblique planes are projected to the profile projection plane.

2.32 Normal, Inclined, and Oblique Surfaces Projected to a Profile Projection Plane
Visualizing the True Size and Shape of an Oblique Surface

In order to create a true shape view of an oblique surface the surface must be projected onto a projection plane that is parallel to the oblique surface. When the viewer’s line of sight is perpendicular to the projection plane, the surface will appear as true size and shape. See Figure 2.33. These types of drawings are known as auxiliary views. Creation of Auxiliary Views is presented in Chapter 9.

2.33 Oblique Surface Projected to a Parallel Projection Plane to Reveal Its True Size and Shape
Normal, Inclined, and Oblique Surfaces in Multiview Drawings

Can you identify the Normal, Inclined, and Oblique surfaces on the object below?
Labeling Points and Vertices to Aid in Visualizing in Multiview Drawings

Sometimes it is helpful to number the corresponding point or vertex of a feature in its regular views to assist with visualizing the object. In Figure 2.34 a number has been assigned to each vertex and each plane has been labeled as normal, inclined or oblique.

2.34 Labeling Points and Vertices of Features to Assist in Visualizing Views
Applying the “Glass Box” Technique to Multiview Projection

Placing an object inside a glass box to assist with visualizing its multiviews is known as the “Glass Box” technique. In this technique, the viewer’s lines of sight are assumed to be perpendicular to the transparent glass projection planes. The following steps detail the process of using the glass box technique to visualize the multiviews of the object in Figure 2.35.

**Step 1.** Imagine the object shown in Figure 2.35 is centered inside a glass box and the sides of the box represent six possible projection planes for viewing the features of the object. The six regular views of this object are its front, top, bottom, right side, left side, and back views.

In Figure 2.36, the six regular views of the object have been projected onto the projection planes created by the glass box. The front view is projected onto the frontal projection plane, the top view is projected onto a horizontal projection plane, and the right side view is projected onto a profile projection plane. 

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Step 2. Unfold the glass box as if the four sides of the frontal projection plane were hinged as shown in Figures 2.38.

When Step 2 is completed, the sides of the glass box will be coplanar as shown in Figure 2.38 revealing the six regular views of the object.
Step 3.
The six regular multiviews of the object (front, top, bottom, right, left, and rear) are displayed in their “projected” positions in Figure 2.39.

Note that the front, right, left and rear views are aligned horizontally, and the front, top, and bottom views are aligned vertically.
2.9 Line Types and Lineweights in Multiview Drawings

The features of an object are shown with differing “line types”.

Commonly used line types include visible lines which show the visible edges and features of an object, hidden lines which represent features that would not be visible, and center lines which locate the centers of features such as holes and arcs. The terminology used for the various line types is shown in Figure 2.40.

Figure 2.40 Line Type Terminology.
Line Weight

Line weight refers to the relative widths of the lines in a technical drawing.

Standard line types and line weights have been established by the American Society of Mechanical Engineers (ASME). The ASME standard for Line Conventions and Lettering is ASME Y14.2-2014. The line-weights for lines specified by this standard for use on technical drawings is shown in Table 2.1.

<table>
<thead>
<tr>
<th>Line Type</th>
<th>Line Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible Line</td>
<td>.6mm thick</td>
</tr>
<tr>
<td>Hidden Line</td>
<td>.3mm thick</td>
</tr>
<tr>
<td>Center Line</td>
<td>.3mm thick</td>
</tr>
<tr>
<td>Dimension Line</td>
<td>.3mm thick</td>
</tr>
<tr>
<td>Extension Line</td>
<td>.3mm thick</td>
</tr>
<tr>
<td>Cutting Plane Line</td>
<td>.6mm thick</td>
</tr>
<tr>
<td>Section Line</td>
<td>.3mm thick</td>
</tr>
</tbody>
</table>

ASME describes these line thicknesses as the approximate widths.
2.10 Hidden Features and Center Lines in Multiviews Drawings

Figure 2.42 shows the six regular views of the object shown in Figure 2.41. Study these examples and note how features that would otherwise be invisible in a view, such as the edges of the hole and slot in the side views, are depicted with hidden lines. Also, note the different ways that the centerlines representing the center of the hole are drawn in each view.
2.11 Use Your Imagination!

As a drafter-in-training, you should develop the ability to use your imagination to visualize the multiviews of an object. Engineering and architecture are fields in which a powerful imagination is an important tool for success because most of the objects being designed exist first only in the imagination of the designer(s). The challenge for the design team is to take the design from the imagination stage and turn it into a set of drawings that can be used to make the design a reality.

The following steps document the process of creating a multiview drawing of the object shown in Figure 2.43 from the initial visualization through the dimensioned technical drawing.

**Figure 2.43**
The designer’s two-dimensional sketch of the object to be visualized.

**Figure 2.44**
The object visualized as a three-dimensional part.
Step 1. The Imagination Process:

The drafter studies the object in Figure 2.43 and imagines it as a 3D object as in Figure 2.44. Next, the drafter determines the front, or principal, view of the object and imagines it positioned as shown in Figure 2.45.

Then, the drafter rotates the object in his “mind’s eye” toward the top (Figure 2.46) until the top, or “bird’s eye”, view of the principal view is visible as shown in Figure 2.47.

Next, the drafter imagines the front view of the object rotated toward the right (Figure 2.48) until the right-side view is visible (Figure 2.49).

This process could be likened to creating a 3D movie of the object in one’s imagination to facilitate the visualization of the desired views.

Note that the top and right views (Figures 2.47 and 2.49) are drawn at right angles (90 degrees), or perpendicular, to the front view (Figure 2.45).
Step 2.
The drafter continues the process begun in Step 1, rotating the object until the six regular views of the object have been visualized as shown in Figure 2.50.

Figure 2.50  The Six Regular Views of the 3D Object
Step 3.
The drafter visualizes the visible lines of the object as shown in Figure 2.51

Figure 2.51  The Six Regular Views of the Object with Visible Lines Shown
Step 4.
Next, the drafter visualizes the location of the object's hidden and center lines as shown in Figure 2.52.

Figure 2.52 The Six Regular Views of the Object with Hidden and Center Lines Shown
Step 5.
In the last step, the drafter determines which of the six views will be necessary to describe the object and places dimensions on the part as shown in Figure 2.53.

Figure 2.53
The views necessary to describe the object including dimensions.

NOTES: 1.
MATERIAL: ALUMINUM 6061
2.12 Visualizing the Multiviews of Basic Geometric Shapes

Shown in **Figures 2.54 through 2.67** are the multiview representations of some basic geometric shapes.

Shapes like boxes, cylinders, cones, spheres, wedges, and prisms are often referred to as **Graphic Primitives** because by combining, or “unioning” these shapes, or in some cases “subtracting” the geometry of one shape from another shape, more complicated shapes can be formed.

Graphic primitives could be considered the building blocks used to construct more complex objects. Students who learn to correctly visualize the multiviews of these basic shapes will find it easier to visualize the multiviews of the more complicated shapes formed when they are combined.

Study the figures below, and on the next page, and familiarize yourself with how the multi-views for the graphic primitives, and their combinations, are depicted including the placement of hidden and center lines.

**Figure 2.54** Front, Top, and Right Views of a Box

**Figure 2.55** Front, Top, and Right Views of a Shape Formed by Unioning and Subtracting Boxes
Visualizing the Multiviews of Basic Geometric Shapes

**Figure 2.56** Front, Top, and Right Views of a Cylinder

**Figure 2.57** Front, Top, and Right Views of a Shape Formed by Subtracting a Cylinder from a Box
Visualizing the Multiviews of Basic Geometric Shapes

**Figure 2.58** Front, Top, and Left Views of a Cylinder with a Smaller cylinder Subtracted from its Center

**Figure 2.59** Front, Top, and Right Views of a Shape Formed by the Intersection of Two Cylinders of Equal Diameter
Figure 2.60  Front, Top, and Right Views of the Shape resulting from the Intersection of Two Cylinders with Unequal Diameters.

Figure 2.61  Front, Top, and Right Views of a Quarter-Round Shape
Visualizing the Multiviews of Basic Geometric Shapes (continued)

**Figure 2.62** Front, Top, and Right Views of a Half-Round Shape

**Figure 2.63** Front, Top, and Right Views of a *Stadium* Shape resulting from the Union a Box and Two Half-Rounds
Visualizing the Multiviews of Basic Geometric Shapes (continued)

**Figure 2.64** Front, Top, and Right Views of a Wedge

**Figure 2.65** Front, Top, and Right Views of a Prism
Visualizing the Multiviews of Basic Geometric Shapes (continued)

**Figure 2.66** Front, Top, and Left Views of a Cone

**Figure 2.67** Front, Top, and Right Views of a Sphere
2.13 Orthographic Projection

Orthographic projection is the technique employed in the creation of multiview drawings to project geometric information (points, lines, planes or other features) from one view to another. Light construction lines are usually drawn between views to project the information from one view to another.

Orthographic Projection utilizes a **Miter Line** drawn at 45 degrees which enables information to be projected from the top view to the side view, and from the side view to the top view.

Figure 2.68 shows an example of this technique. Phantom lines have been used to show how information is projected from view to view. Note how the 45 degree miter line allows the drafter to efficiently project information between the top and side views.

![Figure 2.68](image)

The American Society of Mechanical Engineers Standard for creating multiview drawings is **ASME Y14.3-2012**.
Utilizing Orthographic Projection techniques to create Multi-view Sketches

**Step 1.**
Study the sketch of the part shown in Figure 2.69 and try to imagine it as a three dimensional object. With the 3D image of the object in mind, visualize the front, top, and right side views.

**Step 2.**
Sketch the front view of the object. Try to sketch the part proportionally to the dimensions specified on the sketch. Extend light construction lines out from the features of the front view to the top and right sides and place a 45 degree miter line as shown in Figure 2.70.

**Figure 2.69**
Extending construction lines from the features of the front view to the side and top.

**Figure 2.70**
Extending construction lines from the features of the front view to the side and top.
Step 3.

Sketch the top and right-side views of the object as shown in Figure 2.71. Use the construction lines projected from the front view, and construction lines projected through the miter line, to locate the features of each view. Darken the visible, hidden, and centerlines as needed. Erase construction lines that appear too dark.

Figure 2.71 Completed Sketch of the Front, Top, and Right Side Views
2.14 Drawing Objects to Scale:

In technical drawings, objects are often drawn to scale. This term refers to the relationship between the size of the object in the drawing and the actual size of the object after it is manufactured. Below are four of the scales most commonly used in the creation of mechanical drawings:

Full Scale - this means that the size of the object in the drawing will be the same size as the object after it is manufactured. This is usually only feasible on smaller objects like machine parts (to draw an average size house at full scale you might need a sheet of paper that is 136 feet long by 88 feet wide). When noting on a drawing that the object is drawn full scale, the drafter could write 1=1, 1/1, or 1:1.

Half Scale - this means that the size of the object in the drawing is half the size of the object after it is manufactured. The drafter will still place the full size dimensions on the views of the object so that even though the drawing is half size, the part will be manufactured full size. When noting on a drawing that the object is drawn half scale, the drafter could write 1=2, 1/2, .5X, or 1:2.

Quarter Scale - this means that the size of the object in the drawing is one fourth the size of the object after it is manufactured. The drafter will still place the full size dimensions on the views of the object so that even though the drawing is one fourth size, the part will be manufactured full size. When noting on a drawing that the object is drawn quarter scale, the drafter could write 1=4, 1/4, .25X, or 1:4.

Double Scale - this means that the size of the object in the drawing is twice the size of the object after it is manufactured. The drafter will still place the full size dimensions on the views of the object so that even though the drawing is twice size, the part will be manufactured full size. This scale is used for smaller objects that would be difficult to dimension if drawn at actual size. When noting on a drawing that the object is drawn double scale, the drafter could write 2=1, 2/1, 2:1, or 2X.
2.15 Drawing Architectural Plans to Scale:

Below are two of the scales most commonly used in the creation of architectural drawings:

1/4 Inch Equals 1 Foot—this means that every 1/4 of an inch on the plotted drawing will represent a measurement of one foot on the actual construction project. For example a wall that is to be built 16 feet in length, will measure 4 inches on the drawing. This allows a drafter to fit a house that is 100 feet long and 50 feet wide on a sheet of paper measuring only 34 inches by 22 inches. The distance of 100 feet will measure only 25 inches on the drawing sheet (100 X ¼”=25”) and 50 feet will measure 12.5 inches on the sheet (50 X ¼”= 12.5”). The dimensions on the drawing will be labeled at the actual distance (in feet and inches) required to construct the building full size. When noted on a drawing that the object is drawn to this scale, the drafter would write 1/4”=1'-0”.

1/8 Inch Equals 1 Foot—this means that every 1/8 of an inch on the plotted drawing will represent a measurement of one foot on the actual construction project. For example a wall that is to be built 16 feet in length, will measure 2 inches on the drawing. This allows a drafter to fit a house that is 200 feet long and 100 feet wide on a sheet of paper measuring only 34 inches by 22 inches. The distance of 200 feet will measure only 25 inches on the drawing sheet (200 X 1/8”=25”) and 100 feet will measure 12.5 inches on the sheet (100 X 1/8”= 12.5”). The dimensions on the drawing will be labeled at the actual distance (in feet and inches) required to construct the building full size. When noted on a drawing that the object is drawn to this scale, the drafter would write 1/8”=1'-0”.

2.16 Drawing Sheet Sizes

Drafters create drawings on standardized sheet sizes. Sheet size varies with the type of drawing and/or the unit of measurement used to create the drawing.

For Mechanical drawings, where inches are used as the unit of measurement, the standard sheet sizes begin with an A size sheet which is 11 X 8.5 inches. A B size sheet’s dimensions are 17 X 11 which is the equivalent of two A sheets laid side by side. A C size sheet is 22 X 17 which is the equivalent of two B sheets laid side by side. A D size sheet is 34 X 22 which is the equivalent of two C sheets laid side by side. The American Society of Mechanical Engineers standard for Decimal Inch Drawing Sheet Size and Format is ASME Y14.1 – 2012. Figure 2.72 illustrates the sheet sizes used in mechanical drawings employing the decimal inch sheet format.

For Mechanical drawings where millimeters are used as the unit of measurement, an A4 sheet measures 297 X 210, an A3 sheet measures 420 X 297, an A2 sheet measures 594 X 420, and an A1 sheet measures 841 X 594. The American Society of Mechanical Engineers standard for Metric Drawing Sheet Size and Format is ASME Y14.1M - 2012.

For Architectural drawings where inches are used as the unit of measurement, an A sheet measures 12 X 9 inches, a B sheet is 18 X 12, a C sheet is 24 X 18, and a D sheet is 36 X 24.

A high-quality paper known as vellum, or tracing paper, is used to plot drawings that are intended to be reproduced using the blueprinting process (more accurately known as blueline prints). Vellum is a strong, thin paper that allows light to pass through it relatively easily. In order to reproduce a drawing using the blueline process, light must be able to pass through the paper the original is drawn on.

Vellum can be purchased in rolls 24” to 36” in width, or in standard sheet sizes. Vellum can also be purchased with pre-printed title blocks.
2.17 Third Angle Projection versus First Angle Projection

Third Angle Projection
The method of arranging multiviews shown in Figure 2.73, with the top view drawn above the front view and the right side drawn to the right of the front view, is called Third Angle Projection. This method is widely used in technical drawings created in the United States.

First Angle Projection
In many parts of the world, multi-views are prepared using First Angle Projection (see Figure 2.74).

When a drawing is created with First Angle Projection, the right side view is drawn to the left of the front view and the top view is placed below the front view, and so on.

The standard arrangement for First and Third angle projections are defined in the ASME Y14.3-2012 standard covering multiview drawing.
To avoid confusion between drawings created with third angle and first angle projection, it is very helpful to the person interpreting the views to know which method of projection was used when the drawing was created.

For this reason, symbols have been developed that can be placed on the drawing to indicate which projection method was used.

Third Angle Projection can be noted on drawings by placing the symbol shown in Figure 2.75 in, or near, the title block.

Figure 2.75 Third Angle Projection Symbol

First Angle Projection can be noted on drawings with the symbol shown in Figure 2.76. The letters SI (Metric International System of Units) shown in Figure 2.76 indicate that the drawing was prepared using metric units. The unit of measurement commonly used in the creation of mechanical engineering drawings is the millimeter.

Figure 2.76 First Angle Projection Symbol-SI Indicates Metric Units.

The symbols used for signifying First and Third angle projection are defined in the ASME Y14.1-2012 standard covering sheet size and format.
Summary

The ability to visualize and create multiview drawings, as well as the ability to interpret multiview drawings produced by others, is an essential job skill that every successful architect, engineer, designer, and drafter must possess.

Some students may find that in order to develop this skill, they will need to put in a significant amount of time practicing the visualization and sketching techniques presented in this unit.

Developing a solid understanding of the multiview drawing techniques presented in this unit is essential to mastering the concepts and drawing assignments you will encounter later in this course.
Multiview Sketching Exercises

The sketching exercises on the following sheets are designed to help you develop multiview sketching and visualization skills.

Directions:

1. On the grid sheets located at the back of the text, sketch the front, top, and side views of the objects in Exercises 2.1 through 2.6. The black arrows on each sketching exercise identify the view of the object to sketch as the front view.

2. Begin each sketch by counting the number of grids that define the features of the front view and transfer these distances to the grid sheet. Start the front view in the darkened corner located in the lower left corner of each numbered grid box (see the example shown on the Exercise 2.1 grid sheet). Begin the top and right views in the darkened corners above, or to the right, of the front view.

3. Take advantage of the miter line drawn in each grid box to transfer information between the top and right views whenever possible.

If you have trouble with a sketching problem, you may find referring to Figures 2.54 through 2.67 helpful. Also, do not hesitate to ask your instructor for assistance. This activity may seem difficult at first, but keep working at it, because through practice it is possible for you to develop this important drafting skill.
Multiview Sketching-Exercise 2-1  On the grid sheet located at the back of the text, sketch the front, top, and right-side views of the objects shown below. Begin views in the dark corners shown in the grid.
On the grid sheet located at the back of the text, sketch the front, top, and right-side views of the objects shown below. Begin views in the dark corners shown in the grid.

Press *Enter* to advance through the solutions.
Solutions to Sheet 2-1 Multiview Sketching Problems

Press Enter to advance through the solutions.
Multiview Sketching-Exercise 2-2  On the grid sheet located at the back of the text, sketch the front, top, and right-side views of the objects shown below. Begin views in the dark corners shown in the grid.
Solutions to Sheet 2-2 Multiview Sketching Problems

Press Enter to advance through the solutions.
Multiview Sketching-Exercise 2-3

On the grid sheet located at the back of the text, sketch the front, top, and right-side views of the objects shown below. Begin views in the dark corners shown in the grid.
Press Enter to advance through the solutions.
Multiview Sketching-Exercise 2-4

On the grid sheet located at the back of the text, sketch the front, top, and right-side views of the objects shown below. Begin views in the dark corners shown in the grid.
Solutions to Sheet 2-4 Multiview Sketching Problems

Press Enter to advance through the solutions.
Multiview Sketching-Exercise 2-5

On the grid sheet located at the back of the text, sketch the front, top, and right-side views of the objects shown below. Begin views in the dark corners shown in the grid.
On the grid sheet located at the back of the text, sketch the front, top, and right-side views of the objects shown below. Begin views in the dark corners shown in the grid.
Press *Enter* to advance through the solutions.
FILE DOWNLOADS AVAILABLE FOR THIS CHAPTER

Additional multiview sketching, assignments and quizzes are available to faculty for downloading in the Syllabus, Tests, and Quizzes folder of the book's file downloads. These downloads are available to faculty who have adopted this book.
On the grid sheet furnished by your instructor (MV Quiz Grid Sheet.pdf located in Instructor Resources SDC website for Technical Drawing 101), sketch the front, top, and right-side views of the objects shown below. Begin views in the dark corners shown in the grid.
On the grid sheet furnished by your instructor (MV Quiz Grid Sheet.pdf located in Instructor Resources at the SDC Faculty website for Technical Drawing 101), sketch the front, top, and right-side views of the objects shown below. Begin views in the dark corners shown in the grid.
Unit 1 and 2 Quiz

1. What does the acronym “CAD” stand for?
2. Name the 6 “regular” views of an object.
3. How is the front view of an object chosen?
4. What do the terms Solidworks and ProE refer to?
5. How many views of an object should a drafter draw?
6. What is the angle of the Miter Line used in an orthographic projection?
7. What does the acronym “ASME” stand for?
8. According to the ASME standard, what is the correct lineweight for a visible line?
9. Which symbol below, A or B, indicates that a drawing was created using First Angle Projection?

![A](image1.png)  ![B](image2.png)

10. How many views would be necessary to describe the cylinder shown at right?

11. What does signify if an architect has the letters “AIA” following her name on her business card?
12. According to the US Department of Labor, which field of drafting has the highest median salary (Mechanical, Architectural or Electronics)?
13. What do hidden lines represent on multiview drawings?
14. What does the term “SI” indicate when noted on a technical drawing?
15. How would “half scale” be indicated on a technical drawing?
16. What are the dimensions for an A size drawing sheet?
17. The front view of an objects shows the object’s Width and ___________________________.
18. The side view of an object shows the object’s Height and ___________________________.
19. Which set of views shown below, A or B, employs Third Angle Projection?

![A](image3.png)  ![B](image4.png)

20. Is the following statement True or False? Humans have been creating CAD drawings for thousands of years.
Unit 1 and 2 Quiz

1. What does the acronym “CAD” stand for?  
   Computer Aided Design

2. Name the 6 “regular” views of an object.  
   Front, Top, Bottom, Right, Left, Rear

3. How is the front view of an object chosen?  
   The most descriptive view of the object is chosen.

4. What do the terms Solidworks and ProE refer to?  
   They are both CAD software programs

5. How many views of an object should a drafter draw?  
   As many as are needed to describe the object.

6. What is the angle of the Miter Line used in an orthographic projection?  
   Forty-five degrees

7. What does the acronym “ASME” stand for?  
   American Society of Mechanical Engineers

8. According to the ASME standard, what is the correct linewidth for a visible line?  
   .6mm

9. Which symbol below, A or B, indicates that a drawing was created using First Angle Projection?  
   B.

   ![A and B symbols]

10. How many views would be necessary to describe the cylinder shown at right?  
    Two, the front and side, or front and top.

11. What does signify if an architect has the letters “AIA” following her name on her business card?  
    That she has passed the licensing exams of the American Institute of Architects

12. According to the US Department of Labor, which field of drafting has the highest median salary (Mechanical, Architectural or Electronics)?  
    Architecture

13. What do hidden lines represent on multiview drawings?  
    An object’s features that are invisible in the view.

14. What does the term “SI” indicate when noted on a technical drawing?  
    That the drawing’s units of measurement employ the Metric system.

15. How would “half scale” be indicated on a technical drawing?  
    1=2, or 1:2, or ½, or .5X

16. What are the dimensions for an A size drawing sheet?  
    11 X 8.5 (mechanical) or 12 X 9 (architectural)

17. The front view of an object’s shows the object’s Width and Height?  

18. The side view of an object shows the object’s Height and Depth?  

19. Which set of views shown below, A or B, employs Third Angle Projection?  
    A.

   ![A and B views]

20. Is the following statement True or False?  
    Humans have been creating CAD drawings for thousands of years.  
    False
Home Work Assignment: Read up through the Chapter Summary of Chapter 3.

Chapter 3.
Traditional Drafting Tools and Techniques

Chapter Objectives:

- Describe the tools and techniques used in traditional drafting.
- Use technical pencils, straightedges, triangles, scales, protractors, and templates to construct the geometry of technical drawings.
- Read a conversion table to convert between decimal, fractional, and metric units.
- Use traditional drafting tools to create multiview drawings of objects including the correct placement and depiction of visible, hidden, and center lines.
- Hand-letter notes and dimensions on technical drawings that are clear and legible.
Optional Sketching Assignments

Make freehand sketches of the front, top, and right views of these objects.

MATERIAL:  CAST IRON

MATERIAL:  MOLYBDENUM ALLOY STEEL
Make freehand sketches of the front, top, and right views of these objects.