

# Alphabet of Lines

**Unit:** Orthographic and Multi-View Projection

**Problem Area:** Orthographic and Multi-View Projection

**Lesson:** Alphabet of Lines

- **Student Learning Objectives.** Instruction in this lesson should result in students achieving the following objectives:

- 1 Identify the principal lines utilized from the Alphabet of Lines.**
- 2 Apply the principal lines utilized from the Alphabet of Lines.**

- **List of Resources.** The following resources may be useful in teaching this lesson:

Curran, Kelly. *Print Reading: An Alphabet of Lines in Print Reading*. Accessed April 13, 2008 from Wisc-Online, the Wisconsin On-line Resource Center Web site. <[http://www.wisc-online.com/objects/index\\_tj.asp?objID=MTL17903](http://www.wisc-online.com/objects/index_tj.asp?objID=MTL17903)>.

Giesecke, Frederick E., et al. *Technical Drawing*, 12th ed. Prentice Hall, 2003.

Spencer, Henry Cecil, John Thomas Dygdon, and James E. Novak. *Basic Technical Drawing*, 8th ed. Glencoe/McGraw-Hill, 2004.

Walker, John R., and Bernard D. Mathis. *Exploring Drafting*. Goodheart-Willcox, 2007.



## ■ List of Equipment, Tools, Supplies, and Facilities

- ✓ Overhead or PowerPoint projector
- ✓ Visual(s) from accompanying master(s)
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials

## ■ Terms. The following terms are presented in this lesson (shown in bold italics):

- ▶ centerlines
- ▶ dimension lines
- ▶ extension lines
- ▶ hidden lines
- ▶ leader
- ▶ object lines
- ▶ visible lines

## ■ Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situation. A possible approach is included here.

*Tell students to think of the greatest moments in their lives. Then ask them to imagine trying to tell that story to the person next to them in one word. They could whisper that word or shout it 100 times at the top of their lungs, but without using vocabulary, no one would ever hear that story. In technical drawing, the Alphabet of Lines is the vocabulary. A line is nothing more than a line unless meaning is assigned to it.*

# SUMMARY OF CONTENT AND TEACHING STRATEGIES

**Objective 1:** Identify the principal lines utilized from the Alphabet of Lines.

**Anticipated Problem:** What do these different types of lines mean in a technical drawing?

- I. Common line types
  - A. In technical drawing, many line types are used to illustrate key features of an object. Being able to readily identify what they mean enables users to read almost

any print easily to determine an object's appearance. The most common line types are visible, hidden, center, dimension, and extension. (Other line types are used in more advanced technical drawing applications.) Some line styles are used to draw the object; others are used to clarify the object's appearance; and others are used to define specific details about the object.

1. **Visible lines (object lines** or visible object lines) illustrate the features of an object that define its shape; they are clearly visible in the view in which they are drawn. They often illustrate the overall size and shape of an object as well as intersections and edges of specific features. The visible lines are shown in black ink and are drawn approximately .024 inches thick, putting them among the thickest of lines used in technical drawing. Because the visible lines describe the key details of an object, their thick appearance makes the visible features stand out when compared to the other aspects illustrated with the different line types.
2. **Hidden lines** (invisible object lines) are thin dashed lines that represent where key features exist below or behind what is visible in a given view. Hidden lines are shown in black ink, are typically 0.014 inches thick, and are represented as a series of dashes 0.125 inches long with 0.06-inch spaces between each dash. These hidden lines are used to further define an object's shape. For instance, when showing a hole drilled into the top of any part, the primary view of the hole (that view which shows that the hole is round) would be the top view, yet the hidden lines in the front or right-side view help to show how deep the hole is drilled.
3. **Centerlines** show the center of round objects. The centerline is drawn 0.014 inches thick, which is the same thickness as hidden lines. Instead of using the same size dashes as those in hidden lines, centerlines use alternating dashes of 0.75 inches in width and 0.125 inches in length. The centerlines, when representing a cylindrical or round shape in the primary view, create cross hairs in the center with the smaller 0.125-inch lines. Centerlines are shown in green ink and should extend beyond the edge of the feature to avoid confusion with other lines and to clearly identify them as centerlines. Secondary centerlines are used to show that an object or feature is round in the secondary views of that feature. If a hole is drilled into an object, the cylindrical feature appears as a rectangle in the secondary view but a secondary centerline tells the viewer/reader that it is a round feature.
4. **Dimension lines** provide details about a drawing that the geometry itself may not accurately display. Dimension lines are shown in red ink and are generally 0.014 inches thick—the same thickness as hidden and centerlines—and end with a leader. A **leader** is used to connect the dimension to the extension lines. In mechanical design, the common leader is an arrow. In architectural drafting, however, the common leaders are tick marks or slashes.
5. **Extension lines** are the same thickness as dimension lines and are used to show specifically which points a linear dimension is referencing. If dimensions were placed directly on the object, the drawing would be cluttered and difficult to read. To avoid confusion, extension lines are shown in red ink, provide the

reference point, and allow the draftsman to move the dimension details outside of the object—or at least away from the feature he or she is describing. Extension lines should start 0.06 inches off of the reference point and extend 0.125 inches beyond the dimension line.

Use VM–A, VM–B, VM–C, VM–D, and VM–E to help students identify five common lines from the Alphabet of Lines. Give a pre-test on the vocabulary terms in this objective.

## **Objective 2:** Apply the principal lines utilized from the Alphabet of Lines.

**Anticipated Problem:** How are the five common types of lines applied in a technical drawing?

- II. Apply line types: After students have been introduced to the common line types utilized from the Alphabet of Lines, provide examples of the importance of the different representations and what the lines mean. These examples could be from a text, an online resource, or actual drawings.

Use LS–A and LS–B to reinforce the concepts in this lesson.

- **Review/Summary.** Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which line types need to be reviewed or taught from a different angle. The anticipated problems in this lesson and textbook questions may be used in the review/summary.
- **Application.** Use the included visual masters and lab sheets to apply the information presented in the lesson.
- **Evaluation.** Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

## ■ **Answers to Sample Test:**

### **Part One: Matching**

1. f
2. d
3. a
4. b
5. e
6. c

## **Part Two: Short Answer**

1. The Alphabet of Lines is used to clarify the details of an object when drawn in orthographic projection. Each line type has a specific meaning and purpose to aid in the overall clarity of the drawing.
2. Primary centerlines create a cross hair at the center point of a round object and are used to define the center point of a cylindrical or circular detail. Secondary centerlines are straight lines that illustrate an object is round, although the view that it is in does not illustrate that fact.

## **Part Three: Completion**

1. Visible
2. Hidden
3. Dimension
4. leader
5. Extension

# Alphabet of Lines

## ► Part One: Matching

**Instructions:** Match the term with the correct definition.

- |              |            |
|--------------|------------|
| a. center    | d. hidden  |
| b. dimension | e. leader  |
| c. extension | f. visible |

- \_\_\_\_\_ 1. Lines that illustrate the overall size and shape as well as intersections and edges of an object
- \_\_\_\_\_ 2. Thin, dashed lines that represent where key features exist below or behind what is visible in a given view
- \_\_\_\_\_ 3. Lines that represent a cylindrical or round shape
- \_\_\_\_\_ 4. Lines that provide specific details about a drawing that the geometry itself may not accurately display
- \_\_\_\_\_ 5. Common types are arrows, tick marks, or slashes
- \_\_\_\_\_ 6. Lines that provide reference points and allow the draftsman to move the dimension outside of the object

## ► Part Two: Short Answer

**Instructions:** Complete the following.

1. What is the purpose of the Alphabet of Lines?



2. Describe the differences between primary and secondary centerlines.

► **Part Three: Completion**

**Instructions:** Provide the word or words to complete the following statements.

1. \_\_\_\_\_ lines are solid and are among the thickest of the line styles used in technical drawing, typically 0.024 inches thick.
2. \_\_\_\_\_ lines are drawn as 0.125-inch dashes and are typically 0.012 inches thick.
3. \_\_\_\_\_ lines are drawn as solid lines, are typically 0.012 inches thick, and end with arrows, tick marks, or slashes.
4. Arrows and tick marks are commonly referred to as \_\_\_\_\_.
5. \_\_\_\_\_ lines define the ending points of linear dimensions.

# ALPHABET OF LINES

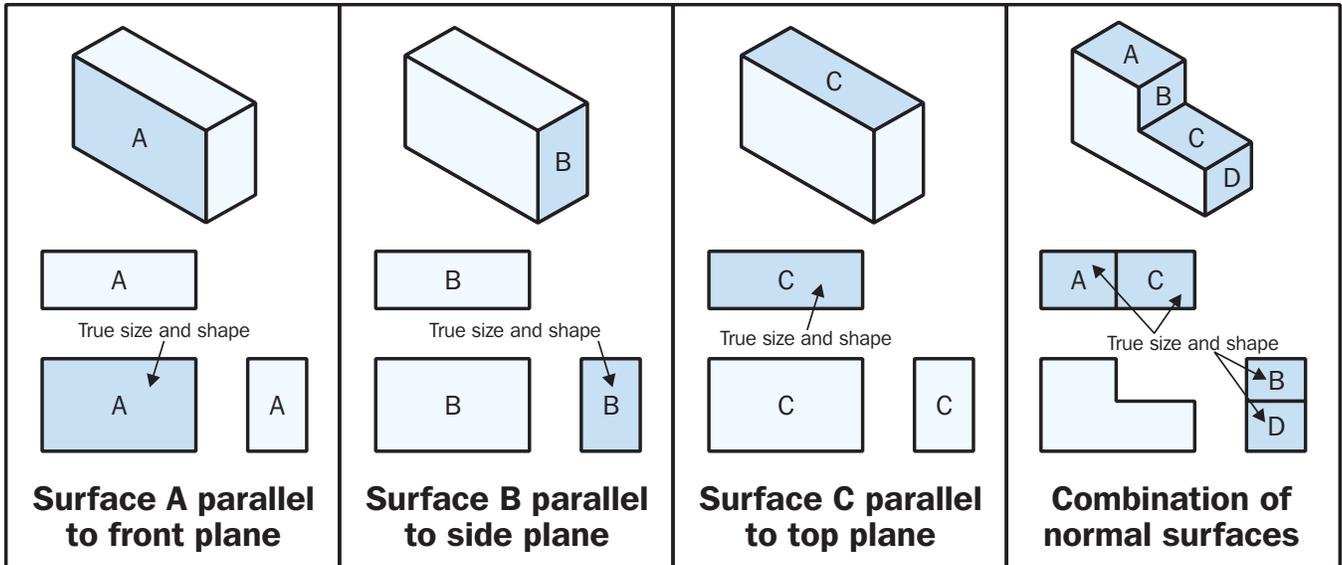
## Color Codes\*

Line	Weight	Color	Appearance
Construction	Very thin .012"	Blue	
Guideline	Very thin .012"	Blue	
Border	Very thick .047"	Black	
Object	Thick .024"	Black	
Hidden	Thin .014"	Black	
Dimension	Thin .014"	Red	
Extension	Thin .014"	Red	
Centerline	Thin .014"	Green	
Cutting-plane	Thick .024"	Black	
Section	Thin .014"	Black	
Phantom	Thin .014"	Black	

\*Note: In manual drafting and technical sketching, the lines are drawn in pencil. The line weights or thicknesses and the style of line (solid, dashed, long dash, short dash, etc.) are what matters. When working in a CAD program, the line types are established with layers. The layers are often color coded for ease of differentiation on the screen and advanced program set ups that allow the administrator to establish the line weights by color. (This dates back to old pen plotters in the early days of CAD.)

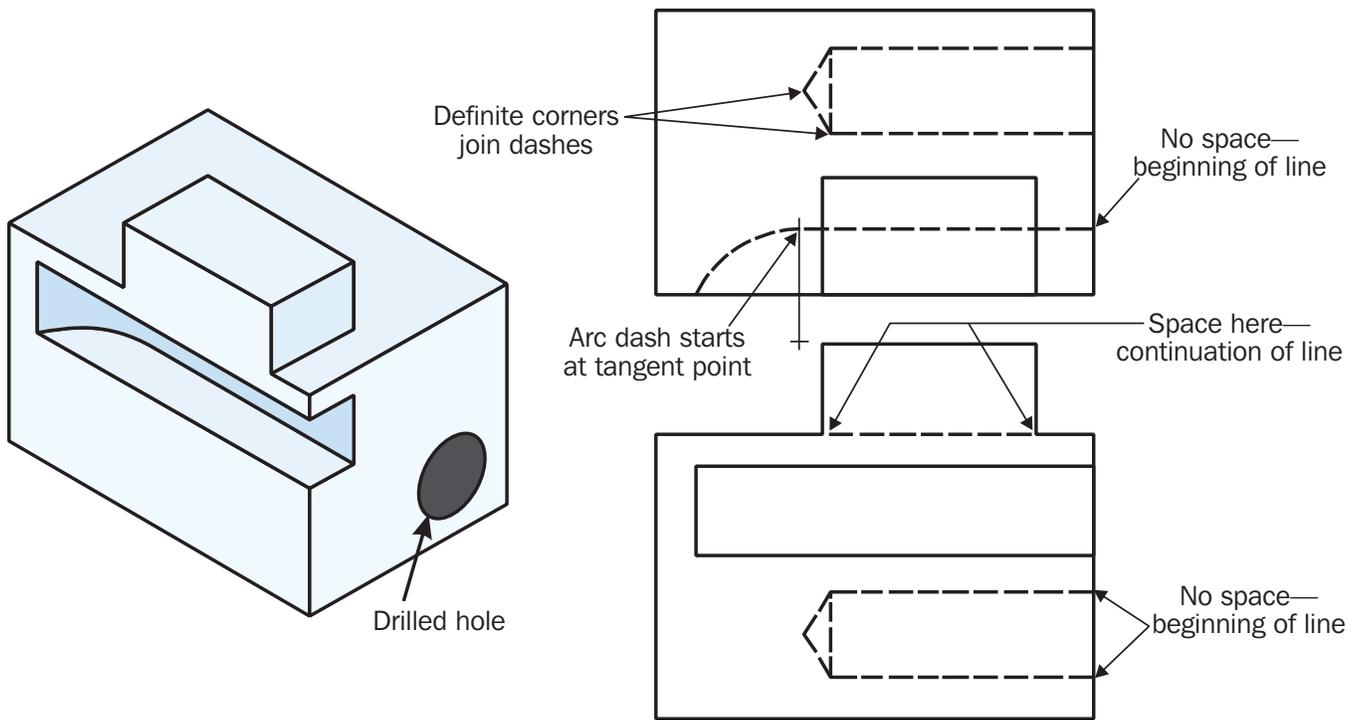
# VISIBLE OR OBJECT LINES

In this drawing, all lines are visible or object lines



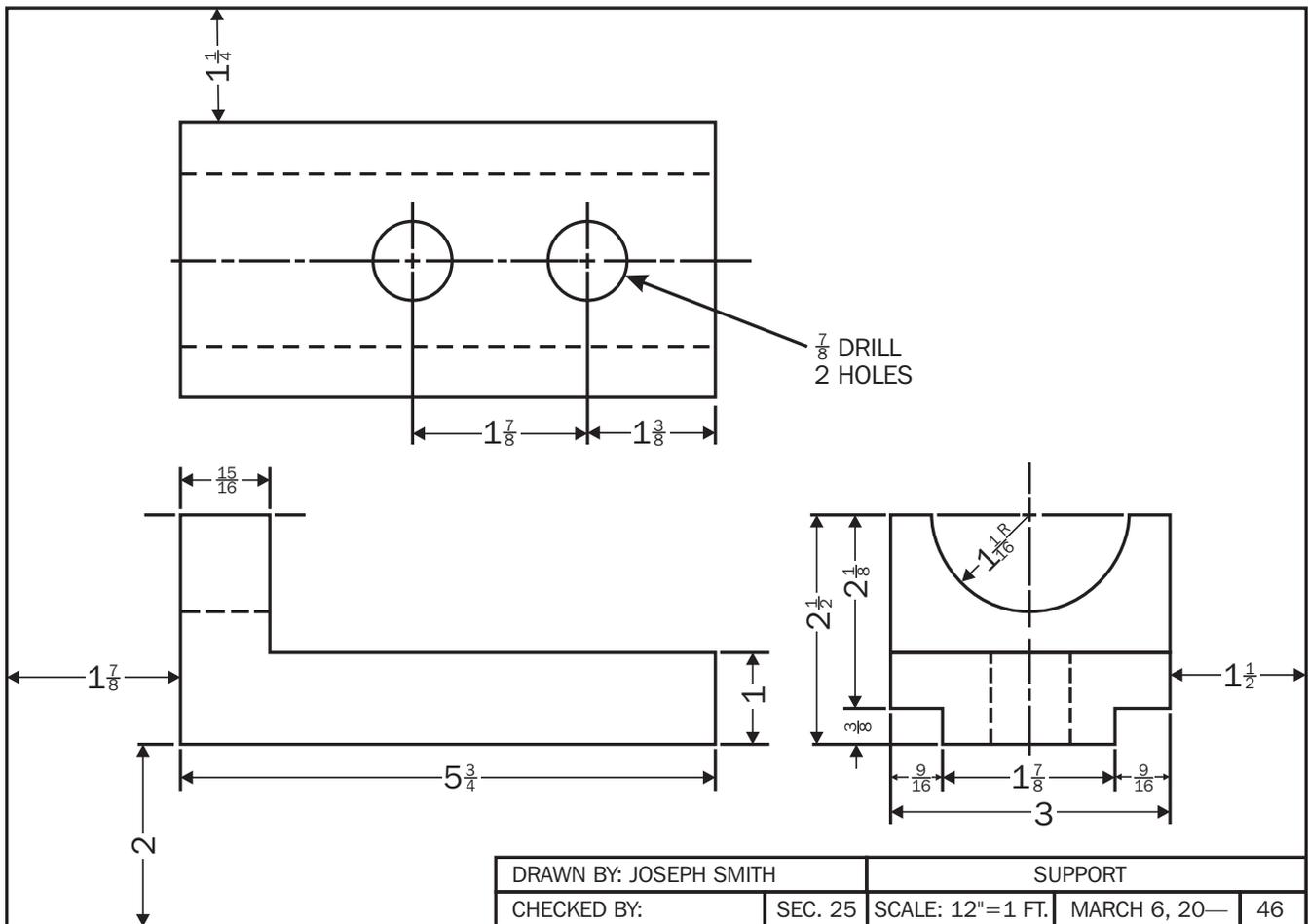
# HIDDEN LINES

In this drawing, identify the hidden lines and highlight the notes.



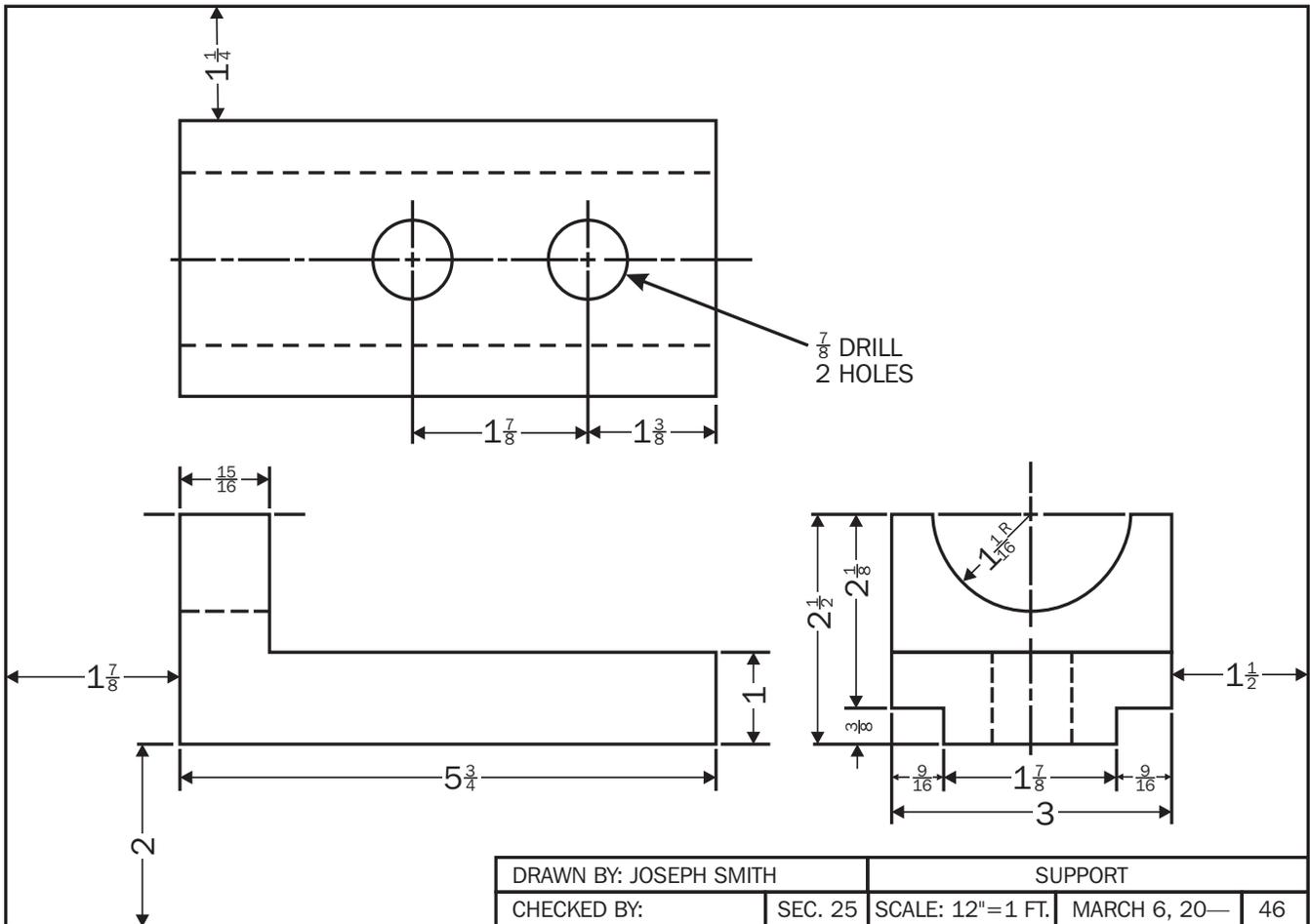
# CENTERLINES

In this drawing, identify the primary and secondary centerlines and highlight how the lines extend beyond the feature.



# LEADERS, DIMENSION, AND EXTENSION LINES

In this drawing, identify the leaders (arrows) and the dimension and extension lines.



# Identify the Alphabet of Lines in Action

## Purpose

The purpose of this activity is to identify the Alphabet of Lines in technical drawing samples.

## Objective

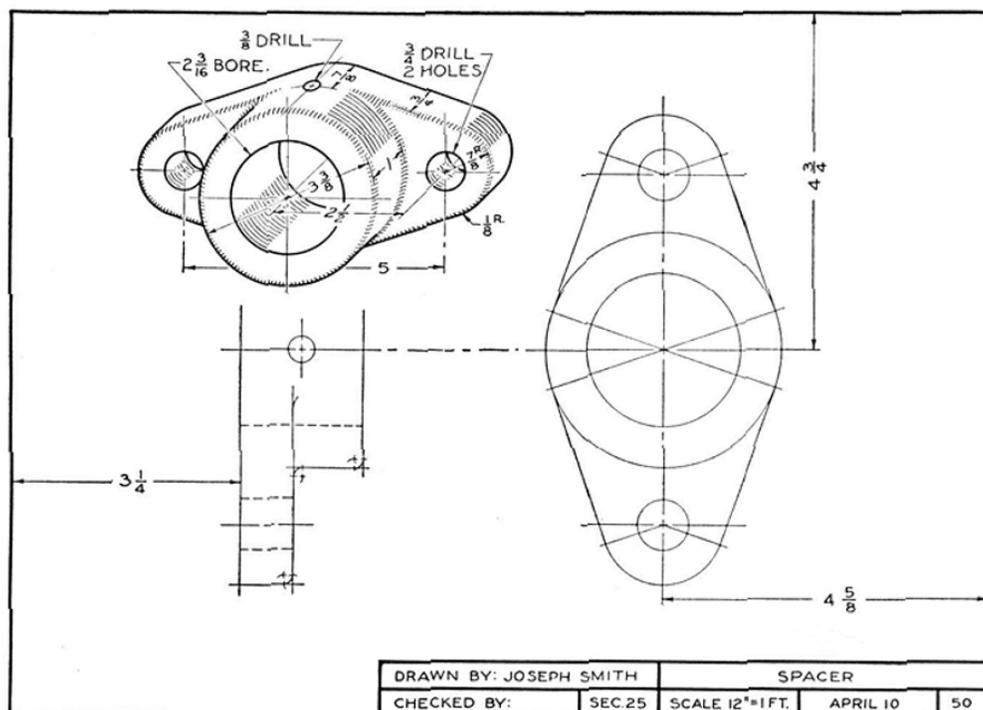
Identify and apply the common line types from the Alphabet of Lines.

## Materials

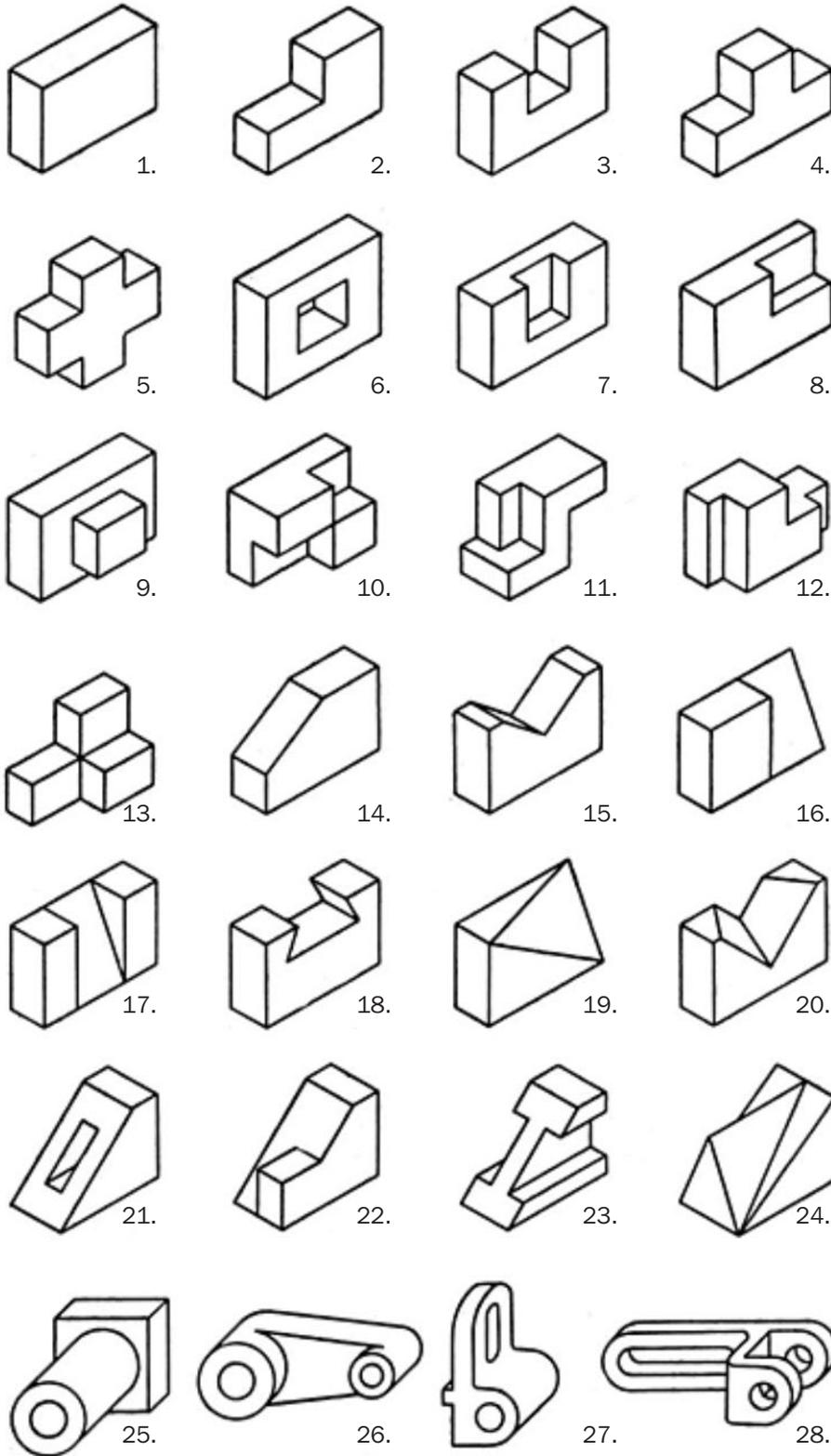
- ◆ writing utensil
- ◆ six different colored highlighters (if possible)

## Procedure

1. In examining the drawing below, use the highlighters to identify the visible, hidden, (primary and secondary) centerlines, dimension, and extension lines used in the drawing.



2. Choose one item from each row and create the appropriate views. Apply the Alphabet of Lines.



# Working with the Alphabet of Lines

## Purpose

The purpose of this activity is to apply the Alphabet of Lines through sketching practice.

## Objective

Identify and apply the common line types from the Alphabet of Lines.

## Materials

- ◆ writing utensil
- ◆ ruler or straight edge

## Procedure

1. Complete the drawing below.
2. Show your sketch to a classmate for feedback.
3. Turn in your completed sketch (to your teacher) for additional feedback.

